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Supporting Information

An efficient one-pot conversion of carboxylic acids into benzimidazoles via an HBTU-promoted methodology

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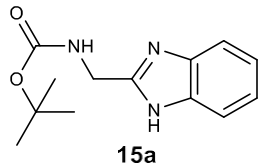
GENERAL PROCEDURE

All commercially available reagents were purchased and used without further purification, unless otherwise stated. Commercially available solvents (> 99.0% purity) were used for column chromatography without any further purification. Proton and carbon NMR spectra were recorded on a 400 MHz spectrometer. Proton chemical shifts are reported in ppm (δ) relative to residual DMSO-d_6 (2.49 ppm). Data are reported as follows: chemical shift (multiplicity [singlet (s), doublet (d), doublet of doublets (dd), doublet of doublets of doublets (ddd), triplet (t), quartet (q), quintet (p), sextet (h), multiplet (m)], coupling constants [Hz], integration). Carbon chemical shifts are reported in ppm with the respective solvent resonance as the internal standard (DMSO-d_6, 39.52 ppm). Unless otherwise noted, all NMR spectra were acquired at ambient temperature. Infrared spectra (thin film) were recorded on a FT-IR, v_{max} (cm^{-1}) and are partially reported. Analytical thin-layer chromatography (TLC) was performed using Silica Gel 60 Å F254 precoated plates (0.25 mm thickness). The following visualization methods were used for monitoring reactions and column chromatography: UV absorption by fluorescence quenching; Ninhydrin spray (Ninhydrin: acetic acid: *n*-butanol/ 0.6g: 6mL: 200mL) or PMA stain (phosphomolybdic acid, H_2SO_4). Flash column chromatography was performed using Flash Silica Gel (32-63 micron). Mass spectrometry data were collected on a UPLC/MS instrument equipped with a reverse-phase C18 column (1.7 µm particle size, 2.1 x 50 mm), dual atmospheric pressure chemical ionization (API)/electrospray (ESI) mass spectrometry detector, and photodiode array detector.

GENERAL PROCEDURE FOR THE SYNTHESIS OF BENZIMIDAZOLE ANALOGS

To a solution of commercially available carboxylic acid (1.0 equiv) in 30 mL of toluene or DMF was added N-ethyldiisopropylamine (1.9 equiv) and the solution was stirred for 10 min at room temperature. To the stirring solution, HBTU (2 equiv) was added and the reaction mixture stirred for another 10 min. To the stirring reaction mixture, O-phenylenediamine (1 equiv) was added and stirred for 3-4 hours. Thereafter, the reaction was heated under reflux for 3 hours. The reaction was cooled to room temperature, after which the solvent was removed *in vacuo* in the case of toluene, but for DMF, the reaction mixture was diluted with water and products were extracted using ethyl acetate (EtOAc). The organic layer was dried over anhydrous sodium sulfate, filtered and concentrated *in vacuo*. The crude product was purified using column chromatography using hexanes/EtOAc in an increasing polarity up to 1:1 mixture. The fractions containing the desired product were concentrated and recrystallized in hexanes/EtOAc (1:1) to yield the product as a white solid. All the compounds were characterized by 1D (^{1}H and ^{13}C) NMR, FT-IR, and LC/MS.

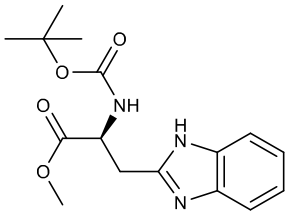
tert-butyl (1*H*-benzo[*d*]imidazol-2-yl)methylcarbamate (15a)



15a

White solid, 0.47 g, 91%; R_f 0.22 (9:1/CH_2Cl_2:MeOH); IR: 3343.8, 2923.9, 1939.1, 1738.9, 1683.4, 1527.6cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.21 (s, 1H, NH), 8.33 (s, 1H, NH), 7.48 (m, 2H, Ar-H), 7.14 (m, 2H, Ar-H), 4.37 (d, *J*=5.9Hz, 2H, CH_2), 1.35 (s, 9H, $C(CH_3)_3$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 156.2, 153.2, 79.7, 78.7, 28.7. LC-MS: (ESI) m/z calculated for $C_{13}H_{17}N_3O_2$ $[M+H]^+$ 248.14, observed 248.20.

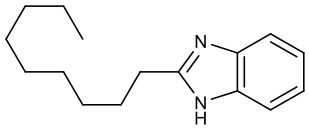
tert-butyl (S)-1-(methoxycarbonyl)-2-(1*H*-benzo[*d*]imidazol-2-yl)ethylcarbamate (15b)



15b

White solid, 0.40 g, 92%; R_f 0.41 (9:1/CH_2Cl_2:MeOH); IR: 3300.1, 2979.8, 2618.5, 1888.4, 1676.4, 1650.9cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.21 (s, 1H, NH), 8.33 (s, 1H, NH), 7.49 (m, 2H, Ar-H), 7.27 (d, *J*=8.3Hz, 1H, Ar-H), 7.13 (m, 2H, Ar-H), 5.20 (q, *J*=6.4Hz, 1H, CH), 3.11 (dd, *J*=6.4, 6.4Hz, 1H, CH_2), 3.06 (s, 3H, OCH_3), 2.91 (dd, *J*=6.4, 6.4Hz, 1H, CH_2), 1.39 (s, 9H, $C(CH_3)_3$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 169.8, 155.9, 155.4, 125.3, 122.1, 79.7, 78.7, 60.2, 46.7, 37.4, 37.1, 35.3, 28.7, 21.2. LC-MS: (ESI) m/z calculated for $C_{16}H_{22}N_3O_4$ $[M+H]^+$ 320.16, observed 320.20.

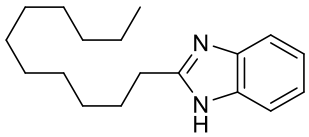
2-nonyl-1*H*-benzo[*d*]imidazole (15c)



15c

White solid, 0.24 g, 90%; R_f 0.47 (9:1/CH_2Cl_2:MeOH); IR: 2937.4, 2894.1, 2857.2, 2562.8, 1949.0, 1926.9, 1886.9, 1739.9cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.17 (s, 1H, NH), 7.45 (m, 2H, Ar-H), 7.10 (m, 2H, Ar-H), 2.79 (t, 2H, CH_2), 1.75 (t, 2H, CH_2), 1.24 (s, 12H, CH_2), 0.85 (t, 3H, CH_3); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 155.6, 121.4, 31.8, 29.4, 29.2, 29.1, 29.0, 28.0, 22.6, 14.4. LC-MS: (ESI) m/z calculated for $C_{16}H_{25}N_2$ $[M+H]^+$ 245.20, observed 245.20.

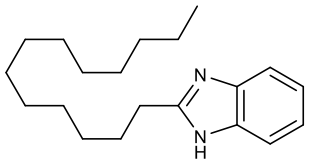
2-undecyl-1*H*-benzo[*d*]imidazole (15d)



15d

White solid, 0.449 g, 92%; R_f 0.24 (9:1/CH_2Cl_2:MeOH); IR: 3296.9, 2952.9, 2921.1, 2848.8, 2775.9, 1935.9, 1738.8cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.18 (s, 1H, NH), 7.45 (m, 2H, Ar-H), 7.09 (m, 2H, Ar-H), 2.79 (t, 2H, CH_2), 1.75 (t, 2H, CH_2), 1.22 (s, 16H, CH_2), 0.84 (t, 3H, CH_3); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 155.6, 122.1, 31.9, 29.7, 29.7, 29.7, 29.5, 29.4, 29.4, 29.4, 22.7, 14.1. LC-MS: (ESI) m/z calculated for $C_{18}H_{29}N_2$ $[M+H]^+$ 273.23, observed 273.20.

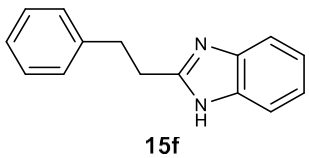
2-tridecyl-1*H*-benzo[*d*]imidazole (15e)



15e

White solid, 0.46 g, 90%; R_f 0.26 (9:1/CH_2Cl_2:MeOH); IR: 3048.6, 2952.9, 2919.5, 2849.0, 1897.4, 1778.9cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.15 (s, 1H, NH), 7.45 (m, 2H, Ar-H), 7.10 (m, 2H, Ar-H), 2.78 (t, 2H, CH_2), 1.75 (t, 2H, CH_2), 1.26 (s, 21H, CH_2), 0.85 (t, 3H, CH_3); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 155.6, 122.1, 31.9, 29.7, 29.7, 29.7, 29.5, 29.4, 29.4, 29.4, 22.7, 14.1. LC-MS: (ESI) m/z calculated for $C_{20}H_{33}N_2$ $[M+H]^+$ 301.26, observed 301.30.

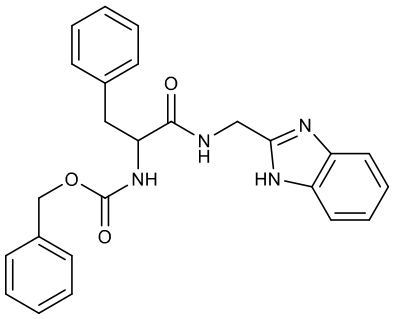
2-phenethyl-1*H*-benzo[*d*]imidazole (15f)



15f

White solid, 1.1 g, %; R_f 0.24 (9:1/CH_2Cl_2:MeOH); IR: 3028.9, 2677.1, 1928.2, 1644.1, 1623.9, 1591.2cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.26 (s, 1H, NH), 7.48 (m, 2H, Ar-H), 7.28 (m, 2H, Ar-H), 7.20 (m, 2H, Ar-H), 7.11 (m, 2H, Ar-H), 3.12 (s, 4H, $(-CH_2)_2$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 154.8, 141.5, 128.8, 128.8, 126.5, 33.8, 30.9. LC-MS: (ESI) m/z calculated for $C_{15}H_{15}N_2$ $[M+H]^+$ 223.12, observed 223.10.

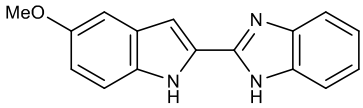
Benzyl 1-((1*H*-benzo[*d*]imidazol-2-yl)methylcarbamoyl)-2-phenylethylcarbamate (15g)



15g

White solid, 0.22 g, 68%; R_f 0.38 (9:1/CH_2Cl_2:MeOH); IR: 3280.7, 1691.9, 1648.3, 1539.5, 1439.8cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.21 (s, 1H, NH), 8.77 (d, *J*=5.0Hz, 1H, NH), 8.33 (s, 1H, NH), 7.52 (m, *J*=8.2, 3H, Ar-H), 7.22 (m, 14H, Ar-H), 4.93 (m, 2H, CH_2), 4.45 (s, 2H, CH_2), 4.33 (m, 1H, CH), 3.095 (dd, *J*=3.4, 3.8Hz, 1H, CH_2), 2.84 (dd, J=3.4, 3.8 Hz, 1H, -CH_2); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 172.3, 156.4, 152.3, 138.6, 137.5, 129.7, 128.7, 128.5, 127.9, 126.7, 122.0, 79.7, 65.7, 49.1, 37.9, 37.7. LC-MS: (ESI) m/z calculated for $C_{25}H_{25}N_4O_3$ $[M+H]^+$ 429.19, observed 429.20.

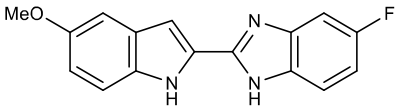
2-(5-methoxy-1*H*-indol-2-yl)-1H-benzo[*d*]imidazole (17a)



17a

White solid, 0.46 g, 92%; R_f 0.47 (9:1/CH_2Cl_2:MeOH); IR: 2991.5, 2829.5, 1705.8, 1674.6, 1623.9, 1602.3cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.93 (s, 1H, NH), 11.86 (s, 1H, NH), 7.67 (d, *J*=7.2Hz, 1H, Ar-H), 7.56 (d, 1H, Ar-H), 7.34 (dd, *J*=8.8, 8.8Hz, 1H, Ar-H), 7.23 (m, 2H, Ar-H), 6.83 (dd, *J*=8.8, 8.8Hz, 1H, Ar-H), 3.79 (s, 3H, OCH_3); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 154.3, 146.7, 144.2, 135.2, 132.9, 129.4, 128.7, 122.9, 122.1, 118.9, 114.9, 114.1, 113.3, 113.2, 111.6, 102.2, 101.9, 55.7. LC-MS: (ESI) m/z calculated for $C_{16}H_{14}N_3O$ $[M+H]^+$ 264.11, observed 264.10.

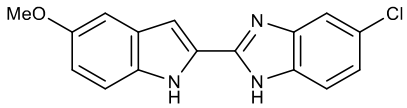
5-fluoro-2-(5-methoxy-1*H*-indol-2-yl)-1*H*-benzo[*d*]imidazole (17b)



17b

White solid, 0.19 g, 53%; R_f 0.38 (1:1/hexanes:EtOAc); IR: 3437.4, 3036.9, 1866.5, 1620.4, 1605.2, 1576.2cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 13.06 (s, 1H, NH), 11.86 (s, 1H, NH), 7.59 (s, 1H, Ar-H), 7.41 (s, 1H, Ar-H), 7.35 (d, *J*=8.8Hz, 1H, Ar-H), 7.15 (s, 1H, Ar-H), 7.06 (t, *J*=7.9Hz, 2H, Ar-H), 6.84 (dd, *J*=2.4, 2.4Hz, 1H, Ar-H), 3.78 (s, 3H, OCH3); ^{13}C NMR (DMSO-d6, 100 MHz) δ 154.3, 132.9, 129.1, 128.6, 114.2, 113.2, 102.2, 102.1, 55.7. LC-MS: (ESI) m/z calculated for $C_{16}H_{13}FN_3O$ $[M+H]^+$ 282.10, observed 282.10.

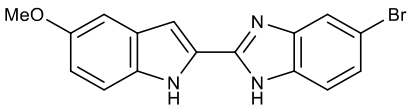
5-chloro-2-(5-methoxy-1*H*-indol-2-yl)-1*H*-benzo[*d*]imidazole (17c)



17c

White solid, 0.21 g, 59%; R_f 0.47 (1:1/hexanes:EtOAc); IR: 3445.4, 2993.3, 2836.7, 1870.7, 1618.2, 1576.3cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 13.14 (s, 1H, NH), 11.91 (s, 1H, NH), 7.69 (s, 1H, Ar-H), 7.65 (dd, J=8.6, 8.6Hz, 1H, Ar-H), 7.55 (dd, *J*=8.6, 8.6Hz, 1H, Ar-H), 7.34 (d, *J*=8.8Hz, 1H, Ar-H), 7.23 (m, 2H, Ar-H), 6.84 (dd, *J*=2.4, 2.4Hz, 1H, Ar-H), 3.78 (s, 3H, OCH_3); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 154.3, 133.0, 128.8, 128.6, 114.4, 113.2, 102.4, 102.2, 79.7, 55.7. LC-MS: (ESI) m/z calculated for $C_{16}H_{13}ClN_3O$ $[M+H]^+$ 298.07, observed 298.10.

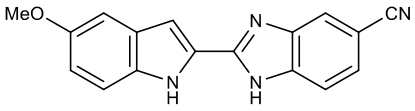
5-bromo-2-(5-methoxy-1*H*-indol-2-yl)-1*H*-benzo[*d*]imidazole (17d)



17d

White solid, 0.25 g, 70%; R_f 0.42 (1:1/hexanes:EtOAc); IR: 3315.3, 2938.2, 2832.4, 1738.1, 1628.0, 1569.4cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 13.14 (s, 1H, NH), 11.90 (s, 1H, NH), 7.8 (s, 1H, Ar-H), 7.71 (s, 1H, Ar-H), 7.60 (dd, J=8.6, 8.4Hz, 1H, Ar-H), 7.50 (dd, *J*=8.6, 8.4Hz, 1H, Ar-H), 7.35 (m, 2H, Ar-H), 7.15 (dd, *J*=2.4, 1.7Hz, 2H, Ar-H), 6.83 (dd, *J*=2.4, 2.4Hz, 1H, Ar-H), 3.79 (s, 3H, OCH_3); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 154.3, 148.0, 147.7, 145.7, 143.3, 136.5, 134,4, 133.0, 128.7,125.6, 125.1, 121.1, 120.4, 115.1, 114.4, 113.2, 102.4, 102.2, 55.7. LC-MS: (ESI) m/z calculated for $C_{16}H_{13}BrN_3O$ $[M+H]^+$ 342.02, observed 342.10.

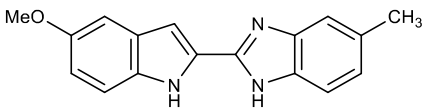
2-(5-methoxy-1*H*-indol-2-yl)-1*H*-benzo[*d*]imidazole-5-carbonitrile (17e)



17e

White solid, 0.25 g, 70%; R_f 0.40 (1:1/hexanes:EtOAc); IR: 3453.1, 3387.2, 3240.1, 2970.2, 2218.1, 1738.0, 1623.1, 1595.9cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 13.49 (s, 1H, NH), 11.97 (s, 1H, NH), 8.13 (s, 1H, Ar-H), 7.73 (d, *J*=7.1Hz, 1H, Ar-H), 7.61 (d, *J*=8.2Hz, 1H, Ar-H), 7.34 (d, *J*=8.8Hz, 1H, Ar-H), 7.23 (s, 1H, Ar-H), 7.15 (s, 1H, Ar-H), 6.85 (dd, *J*=2.4, 2.4Hz, 1H, Ar-H), 3.79 (s, 3H, OCH_3); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 154.3, 133.3, 128.6, 128.2, 120.5, 114.9, 113.4, 104.3, 103.4, 102.3, 55.7. LC-MS: (ESI) m/z calculated for $C_{17}H_{13}N_4O$ $[M+H]^+$ 289.11, observed 289.10.

2-(5-methoxy-1*H*-indol-2-yl)-5-methyl-1*H*-benzo[*d*]imidazole (17f)

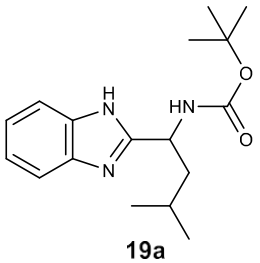


17f

White solid, 0.32 g, 89%; R_f 0.42 (9:1/CH_2Cl_2:MeOH); IR: 3461.6, 3009.7, 2970.5, 1738.0, 1626.7, 1572.2cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.75 (s, 1H, NH), 11.79 (s, 1H, NH), 7.52 (dd, *J*=8.2, 8.2Hz, 1H, Ar-H), 7.45 (s, 1H, Ar-H), 7.41 (dd, *J*=8.2, 8.2Hz, 1H, Ar-H), 7.33 (s, 1H, Ar-H), 7.13 (d, *J*=2.2Hz, 1H, Ar-H), 7.07 (s, 1H, Ar-H), 7.02 (m, 1H, Ar-H), 6.81 (dd,

J=2.4, 2.4Hz, 1H, Ar-H), 3.78 (s, 3H, OCH_3), 2.45 (s, 3H, $-CH_3$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 154.3, 146.6, 144.5, 133.2, 132.8, 131.0, 129.6, 124.4, 123.6, 118.6, 113.9, 111.3, 102.2, 101.6, 79.7, 55.7. LC-MS: (ESI) m/z calculated for $C_{17}H_{16}N_3O$ $[M+H]^+$ 278.13, observed 278.10.

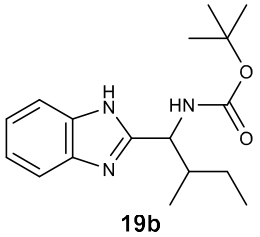
***Tert*-butyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-3-methylbutylcarbamate (19a)**



19a

White solid, 0.48 g, 96%; R_f 0.40 (1:1/hexanes:EtOAc); IR: 3345.2, 2958.5, 1680.1, 1524.6, 1443.6, 1365.3, 1316.2cm^{-1}; ^1H NMR (DMSO-d_6, 400 MHz): δ = 12.16 (s, 1H, NH), 7.50 (m, 2H, Ar-H), 7.30 (d, 1H, *J*=8.1Hz, Ar-H), 7.14 (m, 2H, Ar-H), 4.84 (m, 1H, CH), 3.37 (s, 1H, NH), 1.74 (m, 2H, CH_2), 1.60 (m, 1H, CH), 1.34 (s, 9H, $C(CH_3)_3$), 0.92 (s, 6H, $C(CH_3)_2$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 156.6, 155.8, 143.5, 134.5, 122.1, 121.4, 118.9, 111.7, 78.5, 48.1, 43.5, 28.7, 24.8, 23.2, 22.3. LC-MS: (ESI) m/z calculated for $C_{17}H_{26}N_3O_2$ $[M+H]^+$ 304.20, observed 304.20.

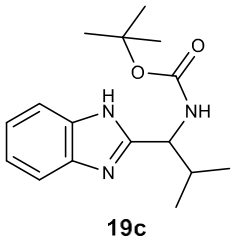
***Tert*-butyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-methylbutylcarbamate (19b)**



19b

White solid, 0.48 g, 96%; R_f 0.56 (1:1/hexanes:EtOAc); IR: 3323.4, 2965.7, 1681.3, 1526.9, 1443.3, 1364.9, 1331.9cm^{-1}; ^1H NMR (DMSO-d_6, 400 MHz): δ = 12.17 (s, 1H, NH), 7.51 (m, 2H, Ar-H), 7.21 (d, 1H, *J*=8.8Hz, Ar-H), 7.15 (m, 2H, Ar-H), 4.64 (t, 1H, *J*=8.2Hz, CH), 3.39 (s, 1H, NH), 1.74 (m, 2H, CH_2), 1.60 (m, 1H, CH), 1.34 (s, 9H, $C(CH_3)_3$), 0.86 (d, 3H, *J*=2.2Hz, $C(CH_3)$), 0.74 (d, 3H, *J*=6.7Hz, $C(CH_3)$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 156.0, 155.8, 155.5, 121.9, 118.9,111.8, 78.5, 54.4, 53.8, 38.8, 28.6, 26.2, 25.3, 16.0, 15.4, 11.8, 11.5. LC-MS: (ESI) m/z calculated for $C_{17}H_{26}N_3O_2$ $[M+H]^+$304.20, observed 304.20.

***Tert*-butyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-methylpropylcarbamate (19c)**

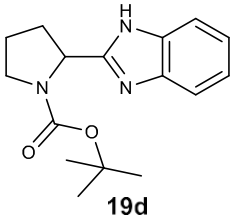


19c

White solid, 0.48 g, 94%; R_f 0.56 (1:1/hexanes:EtOAc); IR: 3325.7, 2964.0, 1681.4, 1529.7, 1443.3, 1365.3, 1302.5cm^{-1}; ^1H NMR (DMSO-d_6, 400 MHz): δ = 12.16 (s, 1H, NH), 7.51 (m, 2H, Ar-H), 7.19 (d, 1H, *J*=8.8Hz, Ar-H), 7.14 (m, 2H, Ar-H), 4.57 (t, 1H, *J*=7.8Hz, CH), 3.37 (s, 1H, NH), 2.21 (m, 1H, C(CH)), 1.38 (s, 9H, $C(CH_3)_3$), 0.92 (d, 3H, *J*=5.4Hz, $C(CH_3)$), 0.79 (d,

3H, *J*=5.2Hz, C(CH_3); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 155.9, 155.5, 121.6, 118.9, 111.7, 78.5, 55.7, 32.6, 28.6, 19.7, 19.1. LC-MS: (ESI) m/z calculated for $C_{16}H_{24}N_3O_2$ $[M+H]^+$ 290.19, observed 290.20.

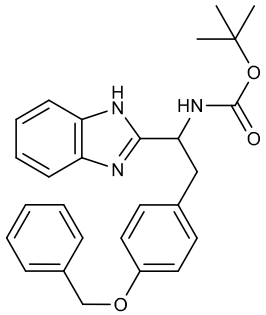
Tert-butyl 2-(1*H*-benzo[*d*]imidazol-2-yl)pyrrolidine-1-carboxylate (19d)



19d

White solid, 1.0 g, 98%; R_f 0.38 (1:1/hexanes:EtOAc); IR: 2976.3, 1696.1, 1660.9, 1428.3, 1383.9, 1360.1, 1322.9, 1307.7cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 8.34 (s, 1H, NH), 7.49 (m, 2H, Ar-H), 7.13 (m, 2H, Ar-H), 4.95 (dd, 1H, *J*=6.7, 3.6Hz, CH), 3.61 (m, 1H, CH_2), 3.41 (m, 1H, CH_2), 2.29 (m, 2H, CH_2), 1.94 (m, 2H, CH_2), 1.39 (s, 9H, C(CH_3)$_3$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 157.5, 156.9, 154.3, 153.8, 121.7, 115.2, 79.7, 79.2, 78.8, 56.2, 55.7, 47.2, 46.9, 38.7, 33.7, 32.4, 28.6, 28.2, 24.3, 23.6. LC-MS: (ESI) m/z calculated for $C_{16}H_{22}N_3O_2$ $[M+H]^+$ 288.17, observed 288.20.

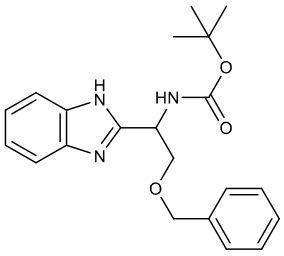
Tert-butyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-(4-(benzyloxy)phenyl) ethylcarbamate (19e)



19e

White solid, 0.42 g, 84%; R_f 0.40 (1:1/hexanes:EtOAc); IR: 3325.7, 2982.9, 1676.9, 1511.5, 1447.4, 1367.3, 1309.9, 1277.7, 1240.9, 1170.7, 1071.1, 1017.7, 962.1, 863.3, 813.8, 738.6cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.22 (s, 1H, NH), 7.41 (m, 8H, Ar-H), 7.16 (m, 4H, Ar-H), 6.90 (d, 2H, *J*=7.7Hz, Ar-H), 5.04 (s, 2H, CH_2), 4.95 (q, 1H, *J*=6.4Hz, CH_2), 3.40 (s, 1H, NH), 3.29 (m, 1H, CH2), 3.02 (t, 1H, J=12.9Hz, CH), 1.32 (s, 9H, C(CH_3)$_3$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 157.4, 155.8, 155.6, 137.7, 130.7, 128.9, 128.2, 128.1, 114.9, 78.5, 69.6, 51.5, 28.6. LC-MS: (ESI) m/z calculated for $C_{27}H_{30}N_3O_3$ $[M+H]^+$ 444.23, observed 444.20.

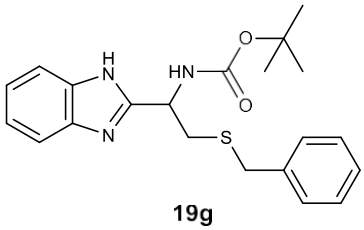
Tert-butyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-(benzyloxy) ethylcarbamate (19f)



19f

White solid, 0.42 g, 84%; R_f 0.34 (1:1/hexanes:EtOAc); IR: 3295.8, 2869.7, 1687.7, 1532.4, 1454.2, 1366.6, 1309.5cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.29 (s, 1H, NH), 7.52 (m, 2H, Ar-H), 7.37 (d, 2H, *J*=8.2Hz, Ar-H), 7.29 (m, 4H, 7.4Hz, Ar-H), 7.16 (m, 2H, Ar-H), 5.08 (m, 1H, CH), 4.53 (s, 1H, NH), 3.86 (m, 2H, CH_2), 3.38 (s, 2H, CH_2), 1.41 (s, 9H, $C(CH_3)_3$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 155.8, 153.8, 138.7, 128.6, 127.9, 78.8, 72.4, 71.4, 49.7, 28.7. LC-MS: (ESI) m/z calculated for $C_{21}H_{26}N_3O_3$ $[M+H]^+$ 368.20, observed 368.20.

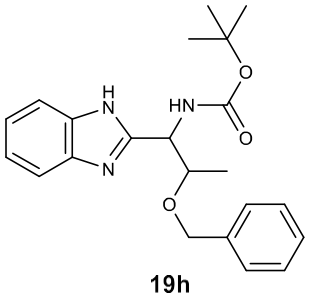
Tert-butyl 1-(1_H_-benzo[_d_]imidazol-2-yl)-2-(benzylthio) ethylcarbamate (19g)



19g

White solid, 1.0 g, 98 %; R_f 0.45 (1:1/hexanes:EtOAc); IR: 3316.1, 2980.9, 1672.6, 1515.4, 1441.1cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.32 (s, 1H, NH), 7.58 (d, 1H, *J*=7.4Hz, Ar-H), 7.48 (m, 2H, Ar-H), 7.44 (m, 4H, Ar-H), 7.22 (m, 1H, Ar-H), 7.18 (m, 2H, Ar-H), 5.01 (q, 1H, *J*=6.6Hz, CH), 3.75 (s, 2H, CH_2), 3.11 (dd, 1H, *J*=6.2, 6.1Hz, CH_2), 2.85 (dd, 1H, J=8.3, 8.3Hz, CH_2), 1.43 (s, 9H, $C(CH_3)_3$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 155.8, 154.7, 143.4, 138.8, 134.6,129.4, 128.8, 127.3, 122.5, 121.7, 119.1, 111.9, 78.9, 49.4, 35.7, 35.4, 28.7. LC-MS: (ESI) m/z calculated for $C_{21}H_{26}N_3O_2S$ $[M+H]^+$ 384.17, observed 384.20.

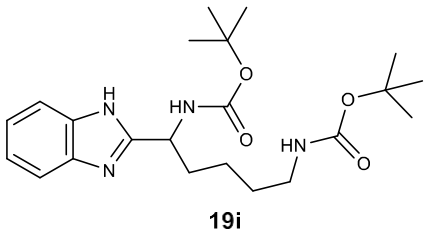
Tert-butyl 1-(1_H_-benzo[_d_]imidazol-2-yl)-3-(benzyloxy) butylcarbamate (19h)



19h

White solid, 0.47 g, 94%; R_f 0.40 (1:1/hexanes:EtOAc); IR: 3324.3, 2977.1, 1678.7, 1528.7cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.25 (s, 1H, NH), 7.49 (m, 2H, Ar-H), 7.30 (d, 1H, *J*=9.4Hz, Ar-H), 7.18 (m, 6H, Ar-H), 7.03 (d, 1H, *J*=8.9Hz, Ar-H), 5.02 (m, 1H, CH), 4.94 (m, 1H, CH), 4.47 (m, 2H, CH_2), 4.01 (m, 1H, NH), 3.37 (m, 2H, CH_2), 1.34 (s, 9H, $C(CH_3)_3$), 1.13 (d, 3H, *J*=5.6Hz, CH_3); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 155.9, 154.1, 139.1, 138.9, 128.5, 127.9, 127.8, 127.7, 79.6, 78.9, 76.5, 76.4, 70.7, 70.5, 53.4, 28.6, 17.0, 16.6. LC-MS: (ESI) m/z calculated for $C_{22}H_{28}N_3O_3$ $[M+H]^+$ 382.21, observed 382.20.

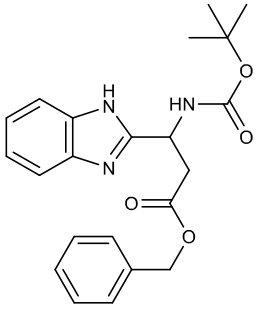
_N_^{a,e}-bis-_tert_-butyloxycarbonyl-lysine-benzimidazole (19i)



19i

White solid, 1.00 g, 96%; R_f 0.29 (1:1/hexanes:EtOAc); IR: 3317.9, 1693.9, 1677.2, 1530.9, 1439.8, 1393.0, 1364.3cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.15 (s, 1H, NH), 7.50 (m, 2H, Ar-H), 7.28 (d, 1H, *J*=7.3Hz, Ar-H), 7.14 (m, 2H, Ar-H), 6.79 (s, 1H, NH), 4.73 (m, 1H, CH), 3.37 (s, 1H, NH), 2.90 (m, 2H, CH_2), 1.84, (m, 2H, CH_2), 1.38 (s, 9H, $C(CH_3)_3$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 156.3, 156.0, 155.8, 121.8, 78.6, 77.8, 49.9, 34.1, 29.6, 28.7, 28.7, 23.3. LC-MS: (ESI) m/z calculated for $C_{22}H_{35}N_4O_4$ $[M+H]^+$ 419.27, observed 419.30.

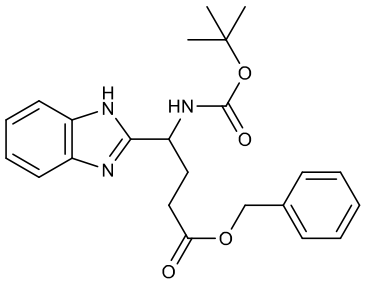
Tert-butyl 2-(phenoxycarbonyl)-1-(1_H_-benzo[_d_]imidazol-2-yl)ethylcarbamate (19j)



19j

White solid, 0.45 g, 90%; R_f 0.46 (1:1/hexanes:EtOAc); IR: 3320.1, 2980.3, 1737.4, 1679.4, 1524.8, 1440.8, 1391.5, 1367.3, 1337.2cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.30 (s, 1H, NH), 7.56 (d, 1H, *J*=8.00Hz, Ar-H), 7.47 (m, 2H, Ar-H), 7.31 (m, 5H, Ar-H), 7.16 (m, 2H, Ar-H), 5.21 (q, 1H, *J*=7.4Hz, CH), 5.10 (s, 2H, CH_2), 3.40 (s, 1H, NH), 3.22 (m, 1H, CH_2), 2.95 (m, 1H, CH_2), 1.41 (s, 9H, $C(CH_3)_3$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 170.6, 155.5, 154.6, 136.6, 134.9, 128.8, 128.3, 128.1, 121.6, 119.1, 111.9, 79.7, 78.9, 65.9, 46.6, 38.6, 28.7. LC-MS: (ESI) m/z calculated for $C_{22}H_{26}N_3O_4$ $[M+H]$+ 396.19, observed 396.20.

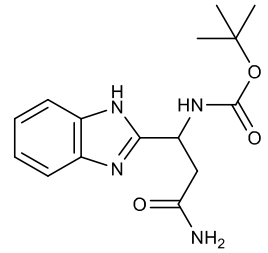
Tert-butyl 3-((benzyloxy)carbonyl)-1-(1_H_-benzo[_d_]imidazol-2-yl)propylcarbamate (19k)



19k

White solid, 0.40 g, 80%; R_f 0.33 (1:1/hexanes:EtOAc); IR: 3312.3, 2977.1, 1737.5, 1677.3, 1525.8, 1453.8, 1391.4, 1366.9cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.22 (s, 1H, NH), 7.57 (dd, 1H, *J*=6.9, 6.9Hz, Ar-H), 7.46 (dd, 1H, *J*=6.9, 6.9Hz, Ar-H), 7.39 (m, 5H, Ar-H), 7.15 (m, 2H, Ar-H), 5.08 (s, 2H, CH_2), 4.85 (m, 1H, CH), 3.38 (s, 1H, NH), 2.49 (d, 2H, *J*=12.0Hz, CH_2), 2.29 (m, 1H, CH_2), 2.09 (m, 1H, CH_2), 1.40 (s, 9H, $C(CH_3)_3$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 172.7, 155.8, 155.5, 143.4, 136.6, 134.7, 128.9, 128.4, 128.4, 122.3, 121.5, 119.0, 111.8, 79.7, 78.7, 65.9, 49.0, 30.6, 29.3, 28.7. LC-MS: (ESI) m/z calculated for $C_{23}H_{28}N_3O_4$ $[M+H]^+$ 410.21, observed 410.20.

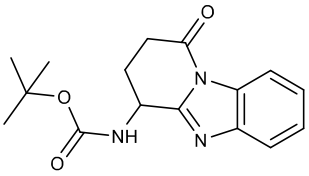
***Tert*-butyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-carbamoylethylcarbamate (19l)**



19l

White solid, 0.48 g, 96%; R_f 0.41 (1:1/hexanes:EtOAc); IR: 3296.2, 2983.9, 1728.0, 1676.4, 1526.9, 1446.2, 1394.7, 1371.1, 1303.5cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.43 (s, 1H, NH), 8.32 (d, 1H, *J*=1.2Hz, NH), 7.79 (d, 1H, *J*=8.3Hz, Ar-H), 7.60 (dd, 1H, *J*=7.2, 7.4Hz, Ar-H), 7.48 (dd, 1H, *J*=7.2, 7.4Hz, Ar-H), 7.19 (t, 1H, *J*=7.6Hz, Ar-H), 5.19 (m, 1H, CH), 3.39 (s, 2H, NH_2), 3.13 (m, 1H, CH_2), 1.44 (s, 9H, $C(CH_3)_3$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 155.5, 152.9, 143.1, 134.9, 122.8, 121.8, 119.2, 118.8, 112.0, 79.6, 79.3, 46.5, 28.6, 22.5. LC-MS: (ESI) m/z calculated for $C_{15}H_{21}N_4O_3$ $[M+H]^+$ 305.16, observed 305.20.

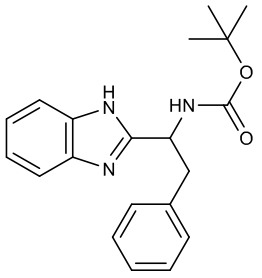
1,2,3,4-Tetrahydro-1-oxo-pyrido[1,2a]benzimidazole (19m)



19m

White solid, 0.48 g, 96%; R_f 0.53 (1:1/hexanes:EtOAc); IR: 3376.1, 2973.6, 1738.1, 1682.0, 1610.6, 1548.1, 1514.3, 1445.9, 1356.8, 1330.4, 1303.4cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 8.14 (m, 1H, Ar-H), 7.71 (m, 1H, Ar-H), 7.56 (d, 1H, *J*=8.5Hz, Ar-H), 7.39 (m, 2H, Ar-H), 5.12 (m, 1H, CH), 3.04 (m, 1H, NH), 2.88 (m, 1H, CH), 2.17 (m, 2H, CH_2), 1.45 (s, 9H, $C(CH_3)_3$), 0.92 (s, 6H, $C(CH_3)_2$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 169.6, 155.6, 155.5, 142.7, 131.6, 125.4, 125.3, 119.9, 115.2, 78.9, 45.9, 31.8, 28.7, 27.6. LC-MS: (ESI) m/z calculated for $C_{16}H_{19}N_3O_3$ $[M+H]^+$ 302.15, observed 302.18.

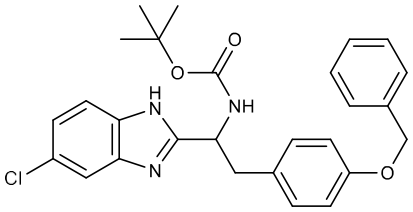
***Tert*-butyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-phenylethylcarbamate (19n)**



19n

White solid, 1.0 g, 99%; R_f 0.40 (1:1/hexanes:EtOAc); IR: 3307.6, 1681.9, 1531.8, 1457.6, 1433.8, 1367.1, 1335.5, 1311.8cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.22 (s, 1H, NH), 7.51 (m, 1H, Ar-H), 7.40 (d, 1H, *J*=8.3Hz, Ar-H), 7.20 (m, 7H, Ar-H), 4.99 (m, 1H, CH), 3.36 (s, 1H, NH), 3.07 (t, 1H, J=11.6Hz, CH_2), 1.21 (s, 9H, $C(CH_3)_3$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 155.8, 155.6, 138.6, 138.9, 129.7, 128.5, 126.7, 78.5, 51.3, 28.6. LC-MS: (ESI) m/z calculated for $C_{20}H_{24}N_3O_2$ $[M+H]^+$ 338.19, observed 338.20.

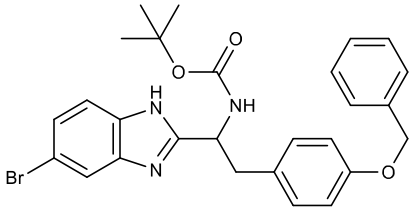
***Tert*-butyl 2-(4-(benzyloxy)phenyl)-1-(5-chloro-1*H*-benzo[*d*] imidazol-2-yl)ethylcarbamate (20)**



20

White solid, 0.45 g, 90%; R_f 0.47 (7:3/hexanes:EtOAc); IR: 3318.2, 2930.1, 1675.5, 1607.9, 1510.4, 1445.3, 1371.1cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.41 (s, 1H, NH), 8.15 (s, 1H, Ar-H), 7.82 (m, 1H, Ar-H), 7.71 (m, 1H, Ar-H), 7.48 (m, 9H, Ar-H), 7.11 (m, 4H, Ar-H), 5.05 (m, 1H, CH), 3.37 (s, 2H, CH_2), 3.27 (m, 1H, CH_2), 3.01 (m, 1H, CH_2), 1.31 (s, 9H, $C(CH_3)_3$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 157.4, 137.7, 130.7, 128.9, 128.2, 128.1, 118.4, 114.9, 78.6, 69.6, 28.6. LC-MS: (ESI) m/z calculated for $C_{27}H_{29}ClN_3O_3$ $[M+H]^+$ 478.19, observed 478.20.

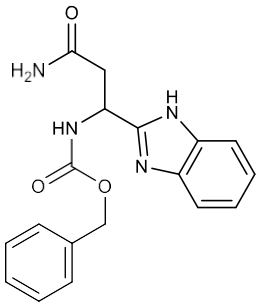
***Tert*-butyl 2-(4-(benzyloxy)phenyl)-1-(5-bromo-1*H*-benzo[*d*] imidazol-2-yl)ethylcarbamate (21)**



21

White solid, 0.46 g, 92%; R_f 0.47 (7:3/hexanes:EtOAc); IR: 3314.6, 2914.3, 1675.6, 1613.5, 1512.9, 1443.4, 1371.9cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.44 (s, 1H, NH), 7.77 (s, 1H, Ar-H), 7.60 (d, *J*=8.3Hz, 1H, Ar-H), 7.48 (m, 7H, Ar-H), 7.15 (dd, *J*=8.1, 8.2Hz, 2H, Ar-H), 6.89 (dd, *J*=8.1, 8.2Hz, 2H, Ar-H), 5.05 (m, 1H, CH), 3.37 (s, 2H, CH_2), 3.27 (m, 1H, CH_2), 3.01 (m, 1H, CH_2), 1.31 (s, 9H, $C(CH_3)_3$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 157.4, 155.7, 144.9, 137.7, 130.7, 133.7, 129.4, 128.9, 128.2, 128.1, 124.9, 121.4, 120.7, 114.9, 114.5, 78.6, 69.6, 51.5, 38.9, 28.6. LC-MS: (ESI) m/z calculated for $C_{27}H_{29}BrN_3O_3$ $[M+H]^+$ 522.14, observed 522.10.

Benzyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-carbamoylethylcarbamate (22)

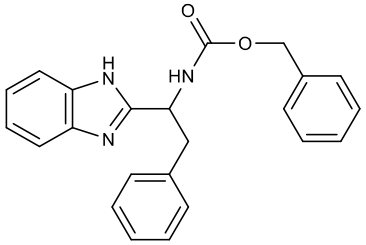


22

White solid, 0.41 g, 82%; R_f 0.40 (1:1/hexanes:EtOAc); IR: 3303.1, 1693.3, 1528.7, 1440.3, 1328.9cm^{-1}; ^{1}H NMR (DMSO-d_6, 400 MHz): δ = 12.52 (s, 1H, NH), 8.31 (d, 1H, *J*=9.2Hz, NH), 7.61 (dd, 1H, *J*=7.6, 7.6Hz, Ar-H), 7.49 (dd, 1H, *J*=7.6, 7.6Hz, Ar-H), 7.33 (m, 5H, Ar-H), 7.23 (m, 1H, Ar-H), 7.18(m, 2H, Ar-H), 5.27 (q, 1H, *J*=7.4Hz, CH), 5.13 (q, 2H, *J*=12.7Hz, CH_2), 3.38 (s, 4H, NH_2, CH_2), 3.33 (d, 1H, J=5.0Hz, CH), 3.18 (m, 1H); ^{13}C NMR (DMSO-d_6, 100

MHz) δ 156.3, 152.6, 143.0, 137.2, 135.0, 128.9, 128.4, 128.3, 122.9, 121.9, 119.2, 118.8, 112.0, 66.4, 47.0, 22.4. LC-MS: (ESI) m/z calculated for $C_{18}H_{19}N_4O_3$ $[M+H]^+$ 339.15, observed 339.12.

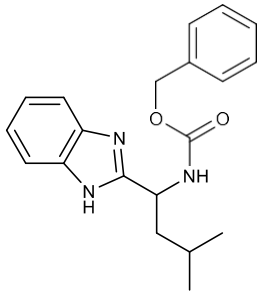
Benzyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-phenylethylcarbamate (23)



23

White solid, 1.0 g, 98%; R_f 0.54 (1:1/hexanes:EtOAc); IR: 3303.2, 1685.8, 1524.9, 1454.9, 1429.8, 1335.8cm^{-1}; ^1H NMR (DMSO-d_6, 400 MHz): δ = 12.33 (s, 1H, NH), 7.99 (d, 1H, *J*=8.2Hz, Ar-H), 7.53 (m, 2H, Ar-H), 7.25 (m, 13H, Ar-H), 5.00 (q, 2H, *J*=12.7Hz, CH), 3.40 (s, 4H, CH_2), 3.11 (t, 1H, *J*=12.0Hz, NH); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 156.3, 155.5, 138.6, 137.5, 129.7, 128.8, 128.6, 128.1, 127.9, 126.8, 65.7, 51.9. LC-MS: (ESI) m/z calculated for $C_{23}H_{22}N_3O_2$ $[M+H]^+$ 372.17, observed 372.20.

Benzyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-3-methylbutylcarbamate (24)



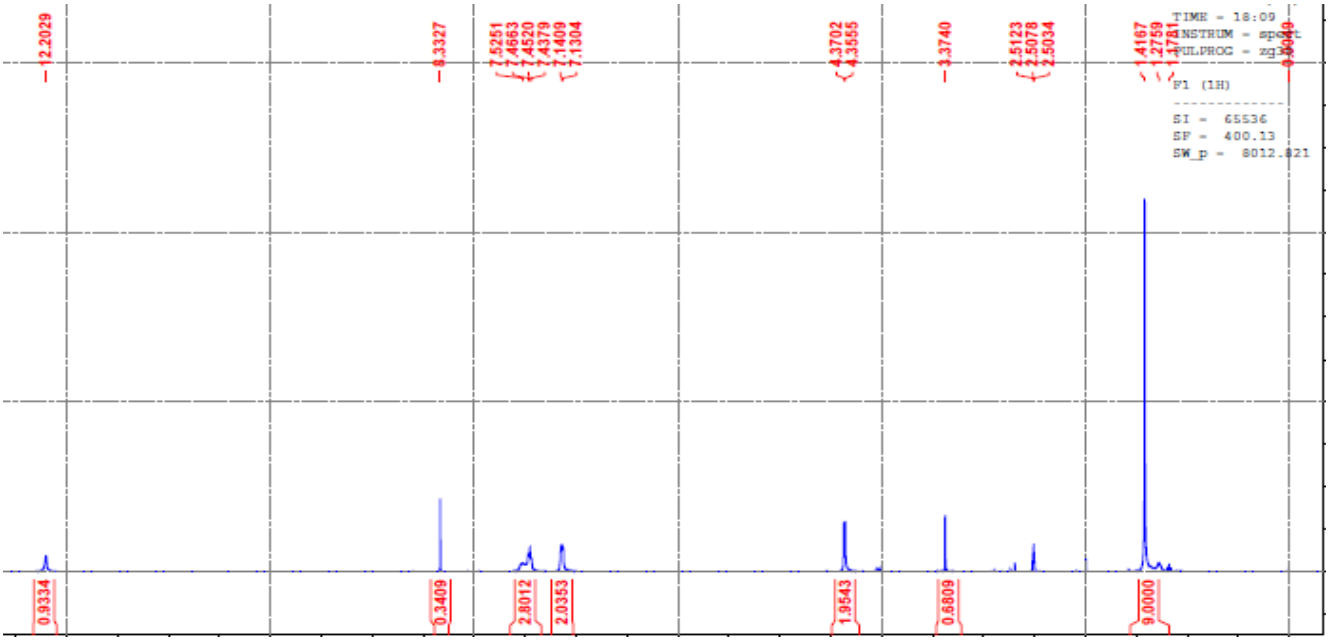
24

White solid, 0.45 g, 90%; R_f 0.40 (1:1/hexanes:EtOAc); IR: 3255.3, 1693.1, 1530.7, 1326.9cm^{-1}; ^1H NMR (DMSO-d_6, 400 MHz): δ = 12.25 (s, 1H, NH), 7.83 (d, 1H, *J*=8.2Hz, Ar-H), 7.41 (m, 6H, Ar-H), 7.15 (m, 2H, Ar-H), 5.06 (q, 2H, *J*=12.6Hz, CH_2), 4.89 (q, 1H, *J*=7.7Hz, NH), 3.37 (s, 2H, CH_2), 1.79 (m, 1H, CH), 1.63 (m, 1H, CH), 0.92 (s, 6H, $C(CH_3)_2$); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 156.5, 156.4, 137.5, 128.8, 128.3, 128.2, 66.0, 48.6, 43.1, 24.8, 23.2, 22.2. LC-MS: (ESI) m/z calculated for $C_{20}H_{24}N_3O_2$ $[M+H]^+$ 338.19, observed 338.20.

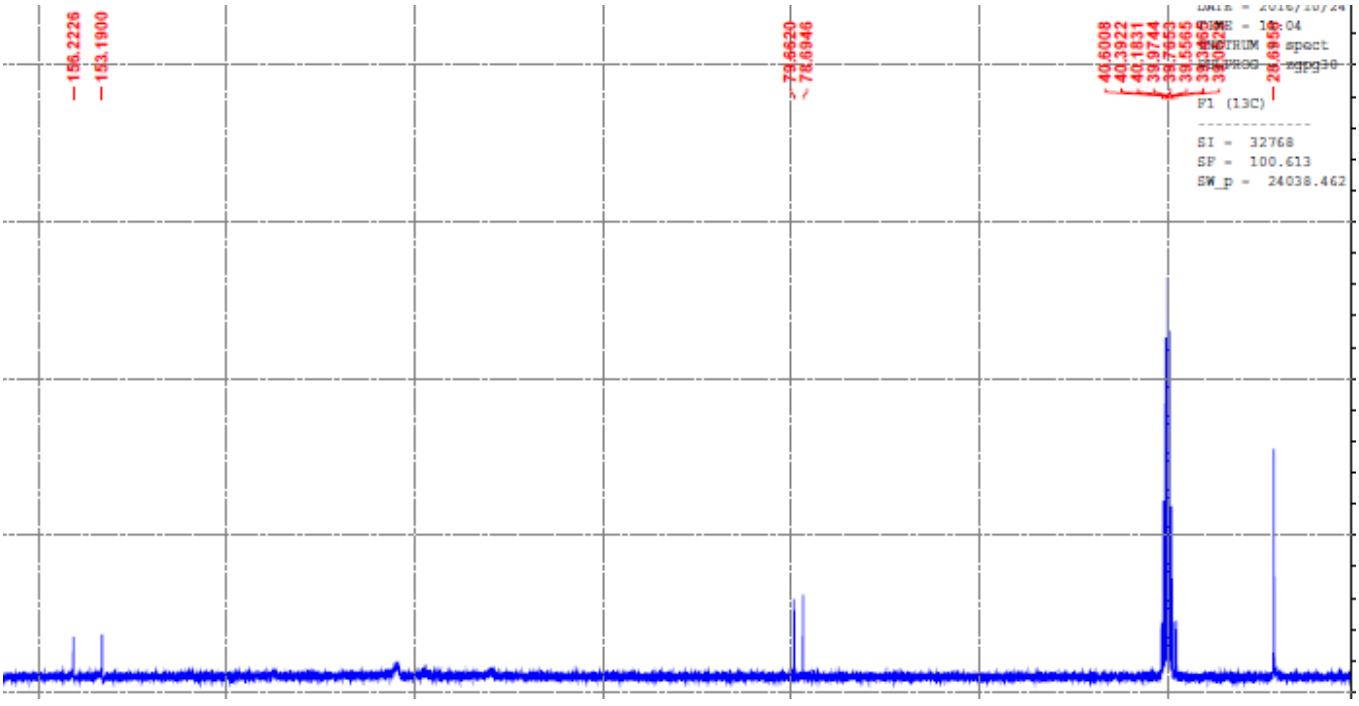
NMR SPECTRA

tert-butyl (1*H*-benzo[*d*]imidazol-2-yl)methylcarbamate (15a)

^{1}H NMR

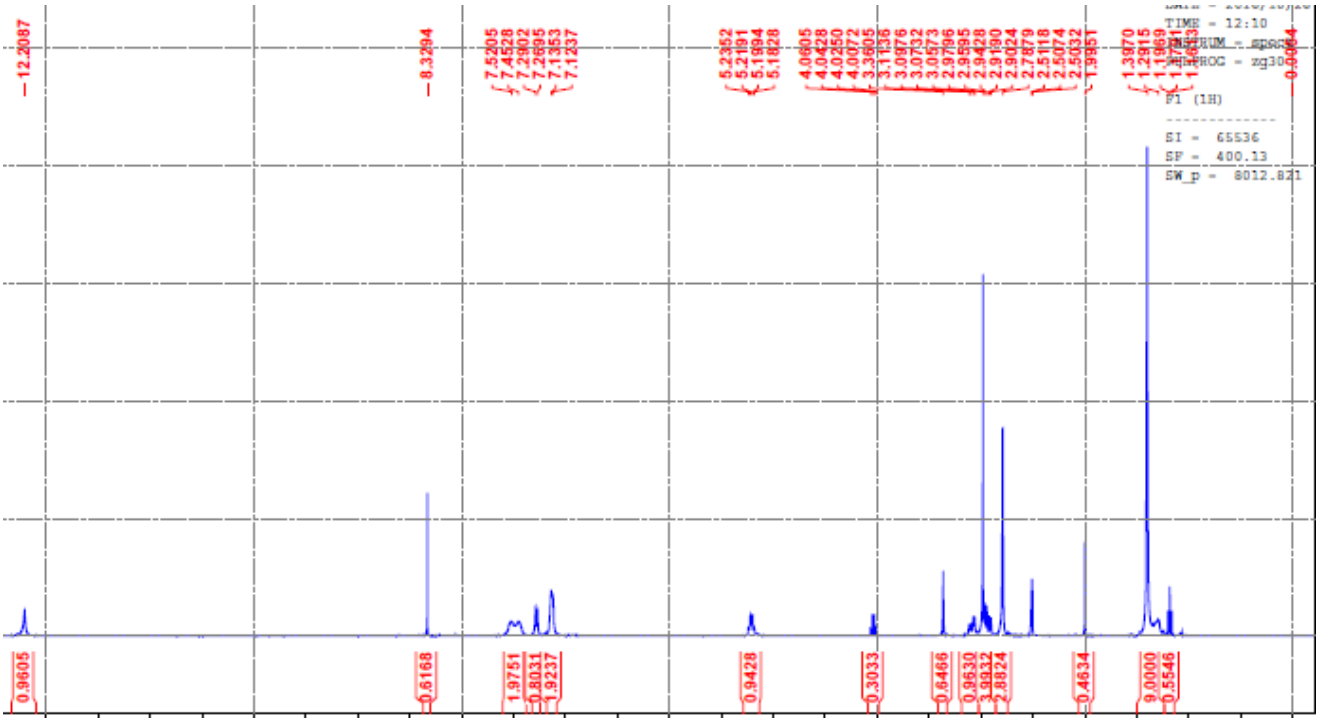


^{13}C NMR

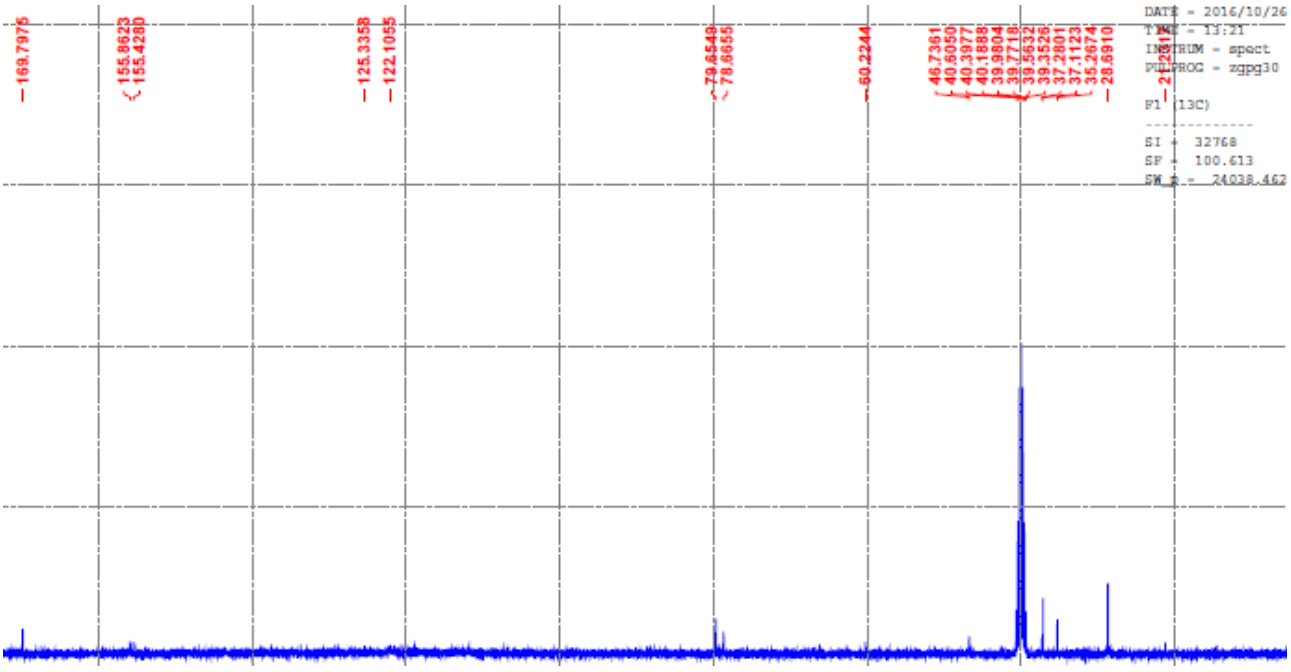


tert-butyl (S)-1-(methoxycarbonyl)-2-(1_H_-benzo[_d_]imidazol-2-yl)ethylcarbamate (15b)

^{1}H NMR

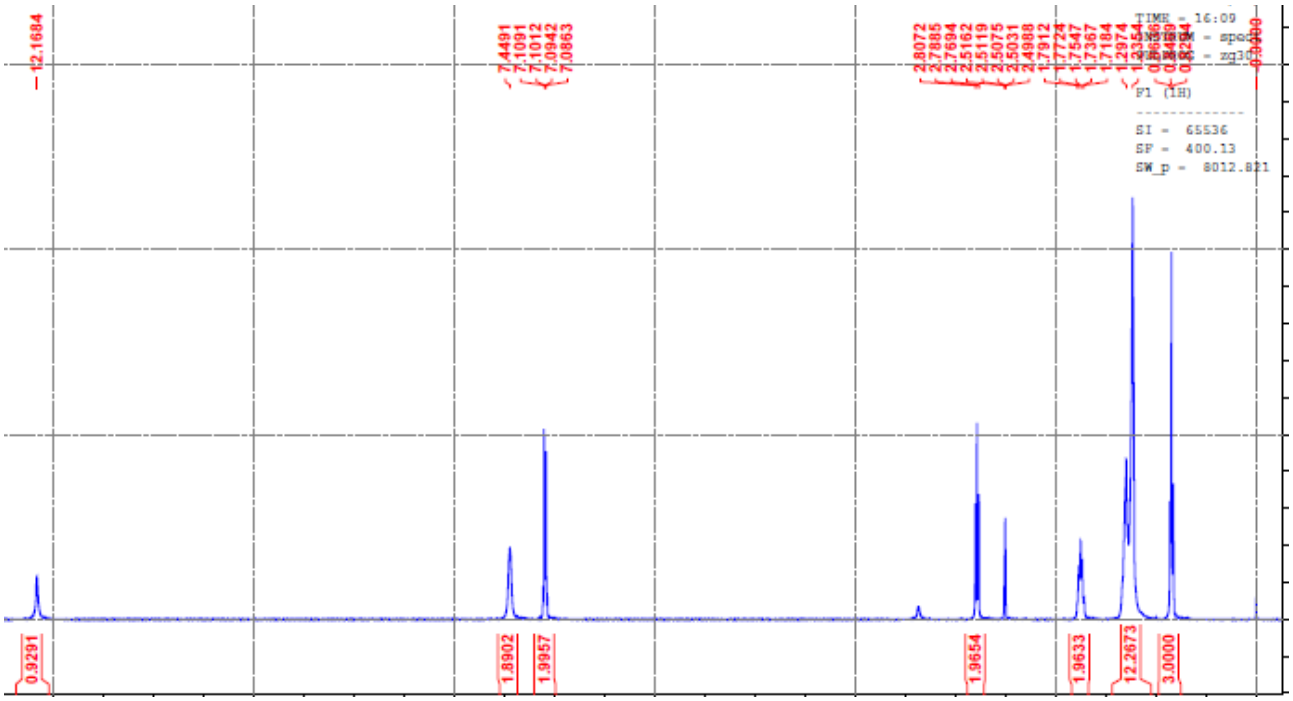


^{13}C NMR

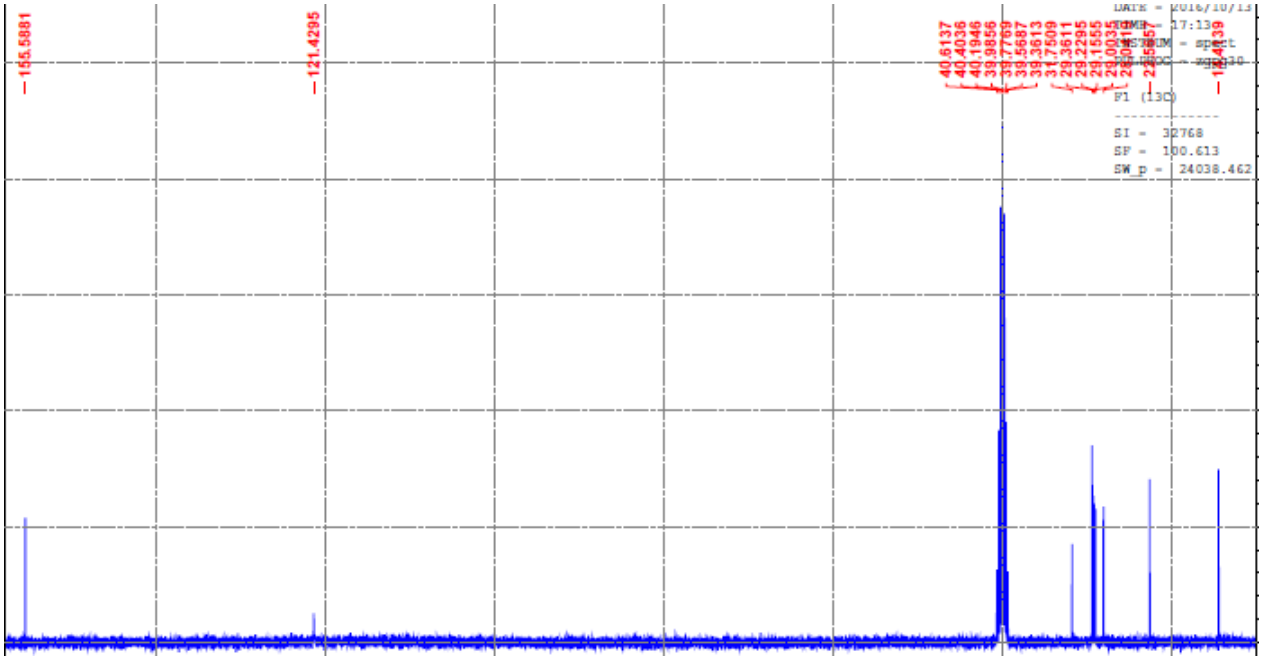


2-nonyl-1*H*-benzo[*d*]imidazole (15c)

^{1}H NMR

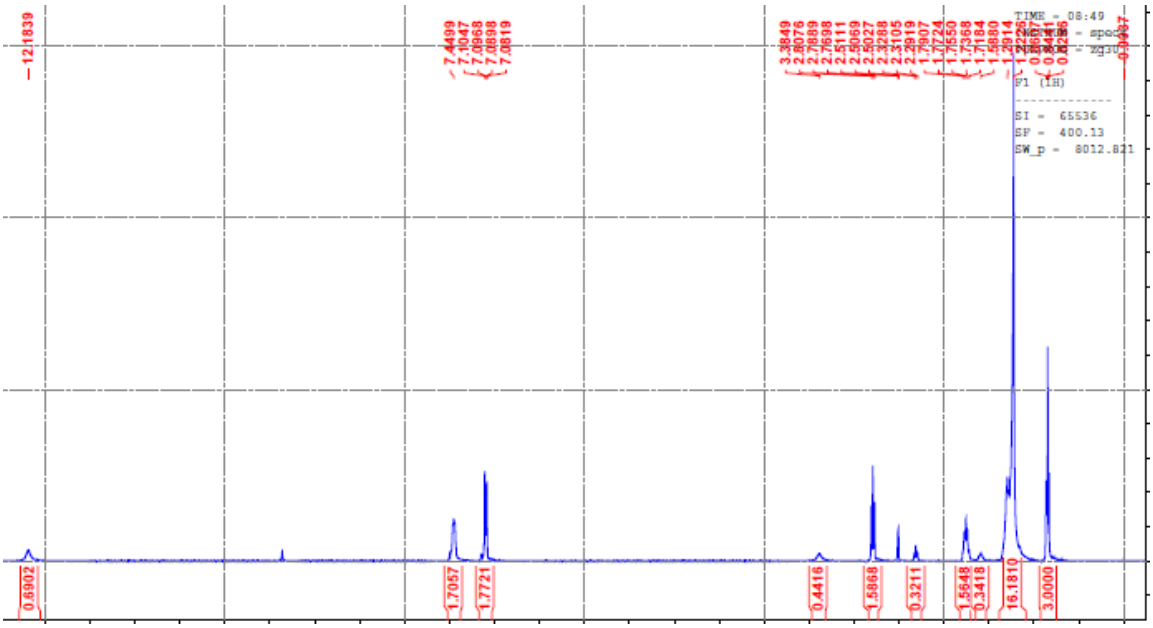


^{13}C NMR

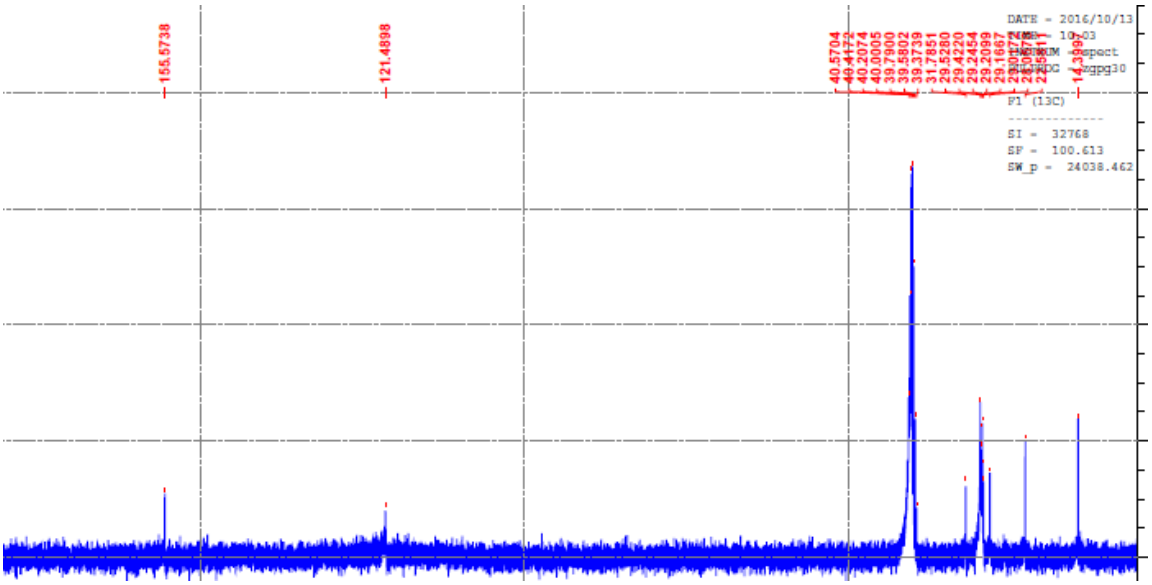


2-undecyl-1*H*-benzo[*d*]imidazole (15d)

^{1}H NMR

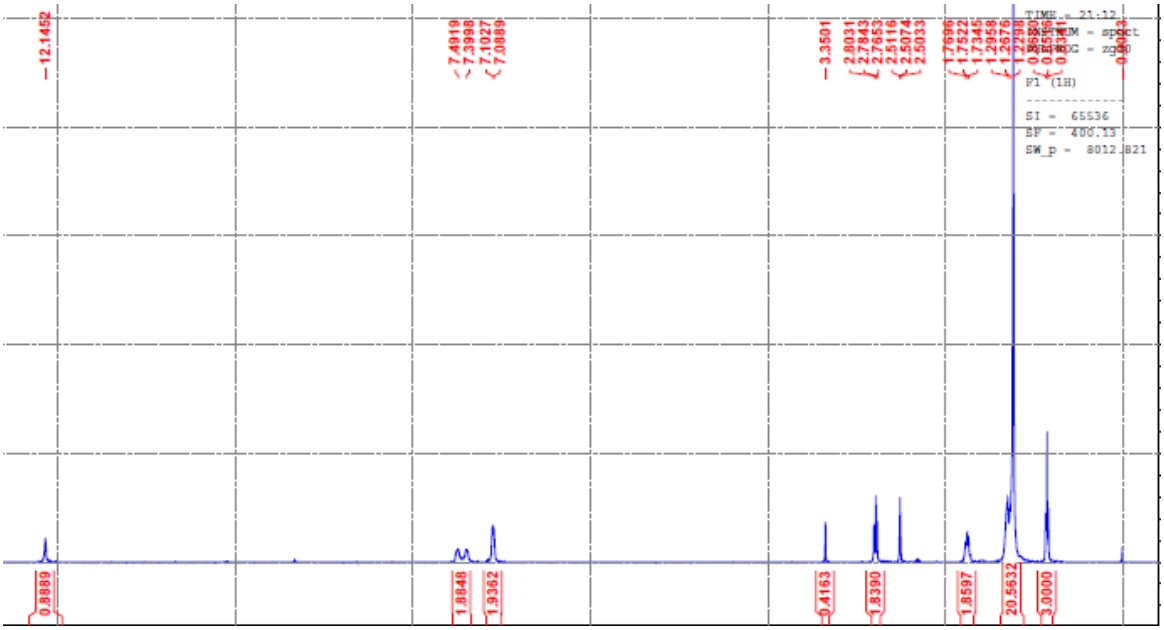


^{13}C NMR

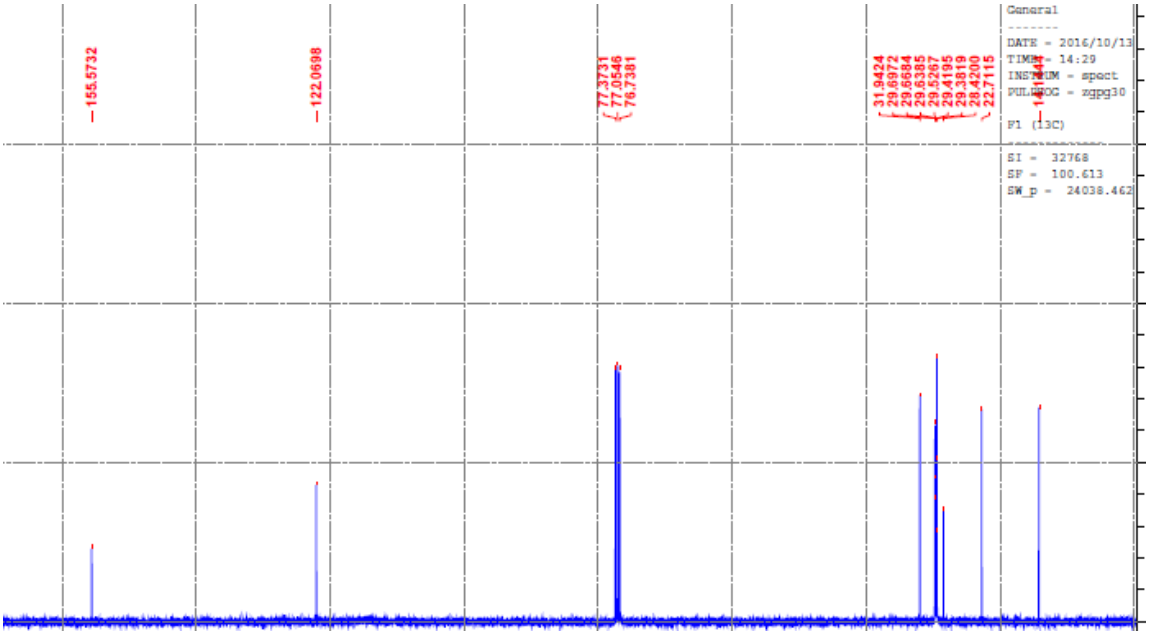


2-tridecyl-1*H*-benzo[*d*]imidazole (15e)

^{1}H NMR

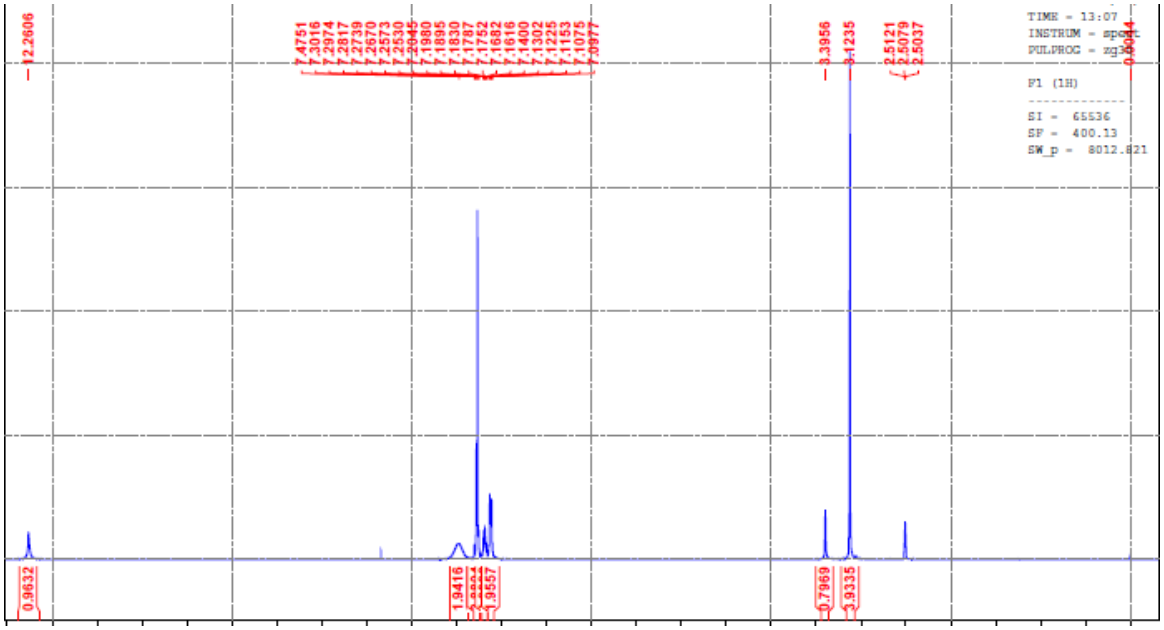


^{13}C NMR

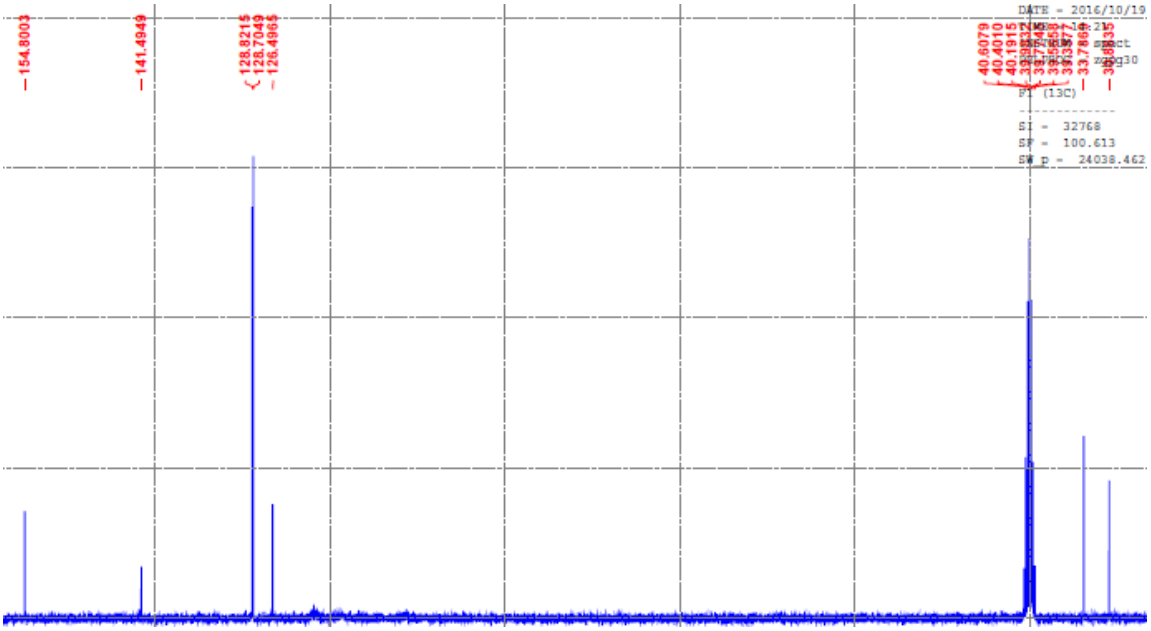


2-phenethyl-1*H*-benzo[*d*]imidazole (15f)

^{1}H NMR

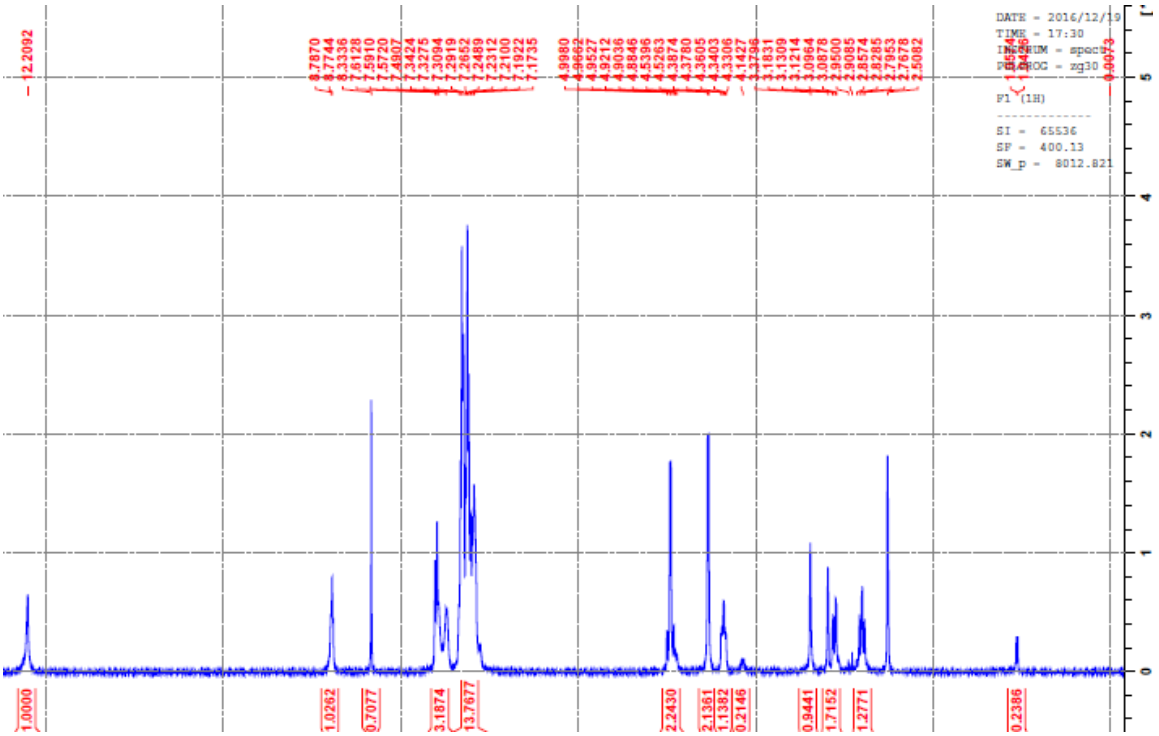


^{13}C NMR

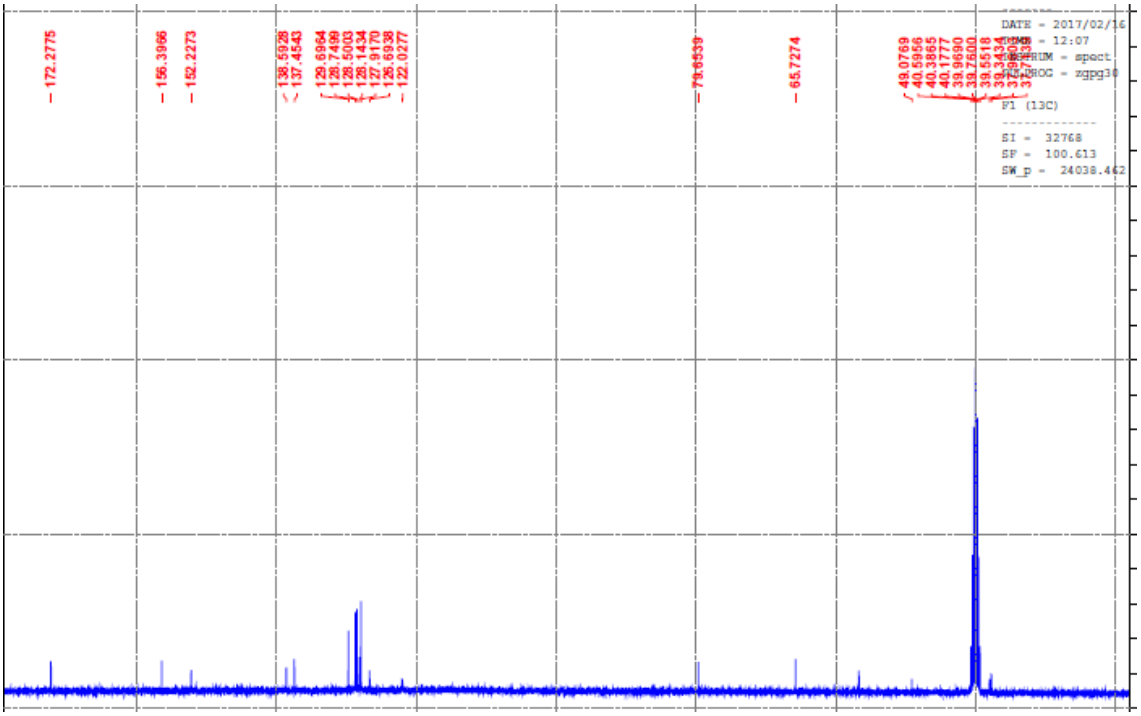


Benzyl 1-((1*H*-benzo[*d*]imidazol-2-yl)methylcarbamoyl)-2-phenylethylcarbamate (15g)

^{1}H NMR

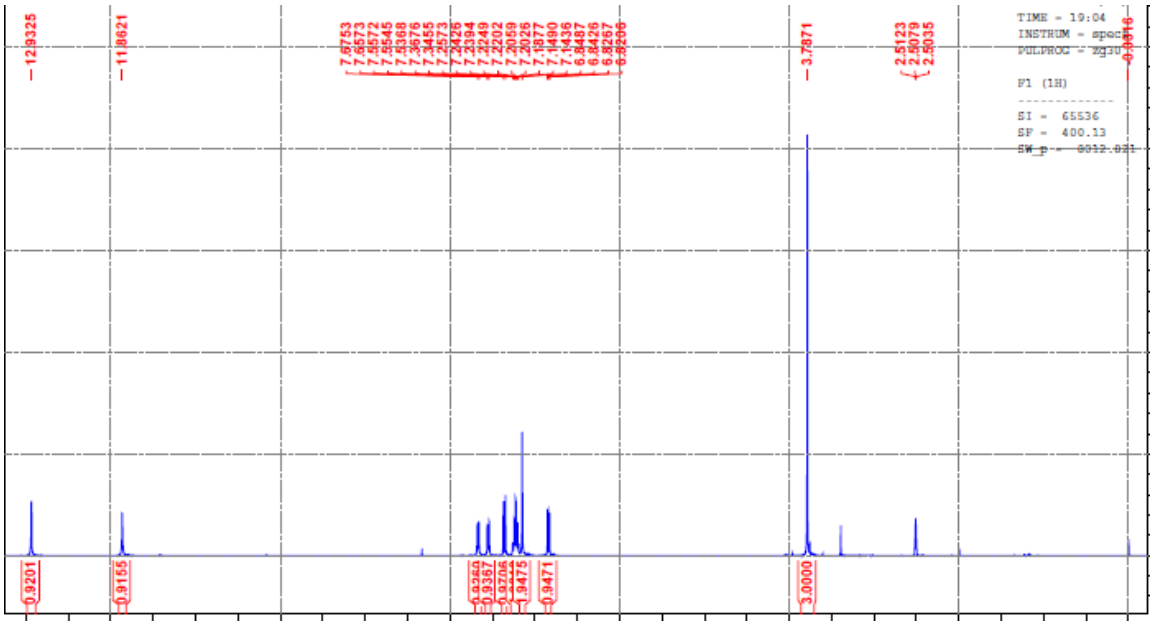


^{13}C NMR

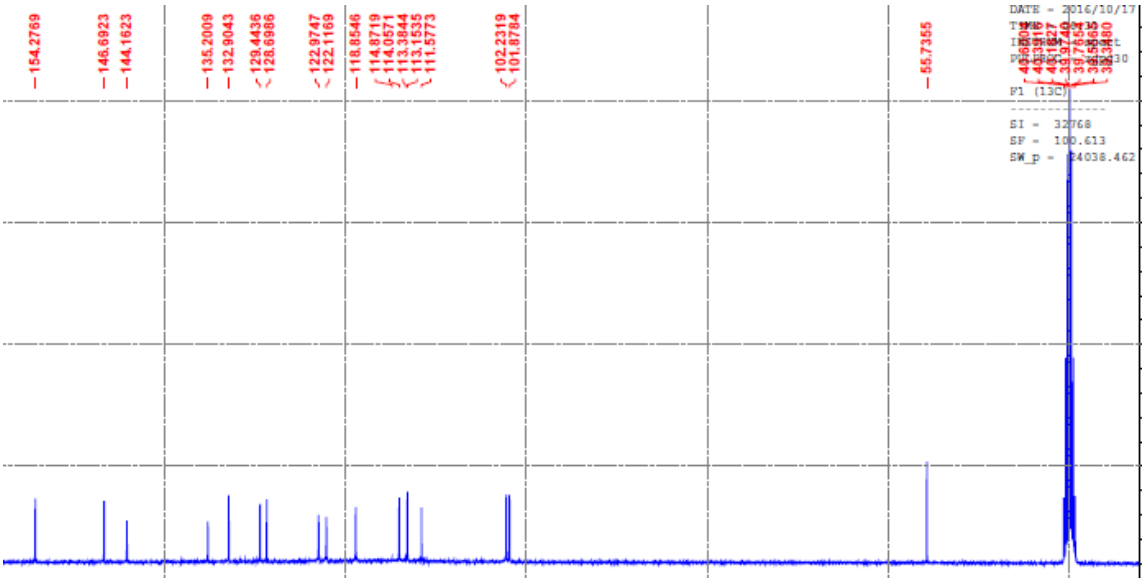


2-(5-methoxy-1*H*-indol-2-yl)-1H-benzo[*d*]imidazole (17a)

^{1}H NMR

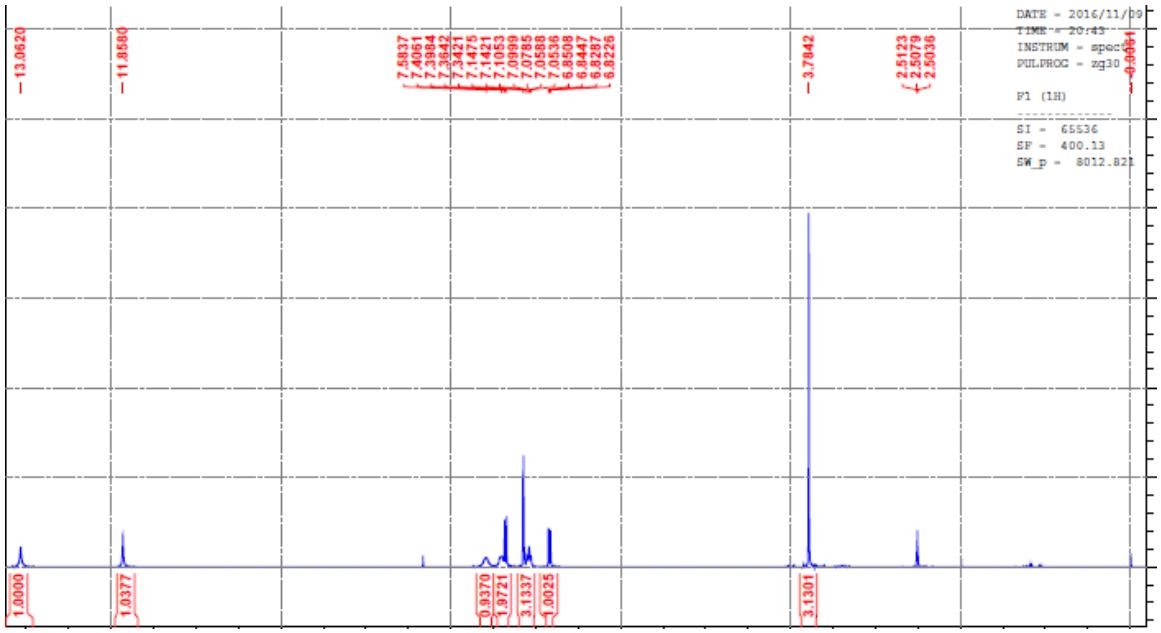


^{13}C NMR

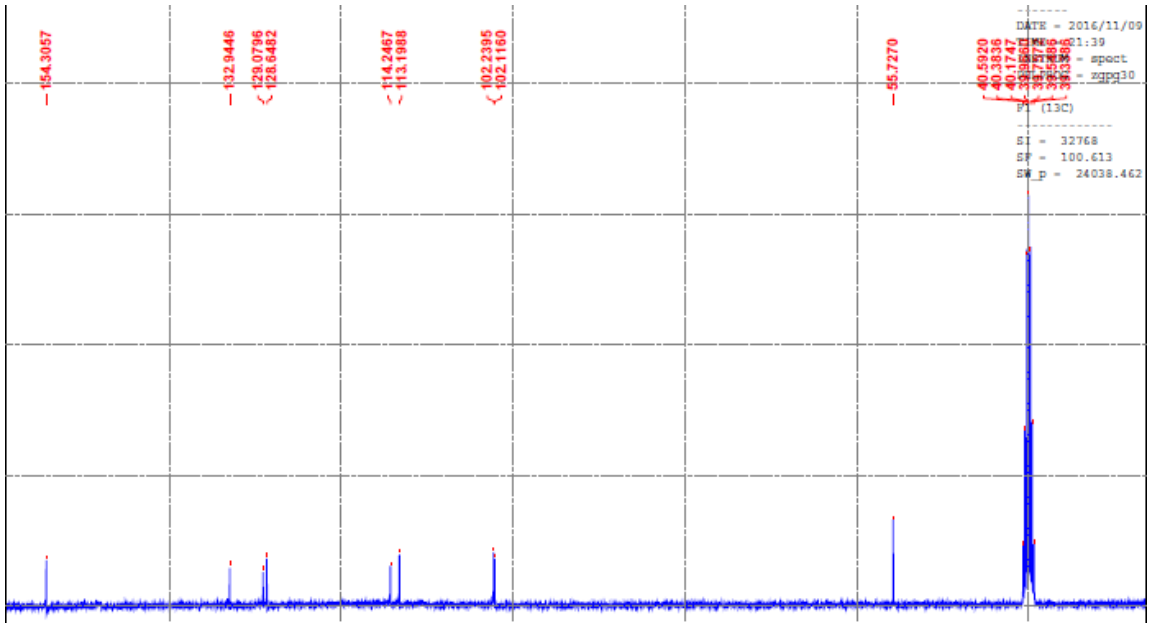


5-fluoro-2-(5-methoxy-1H-indol-2-yl)-1H-benzo[d]imidazole (17b)

^{1}H NMR

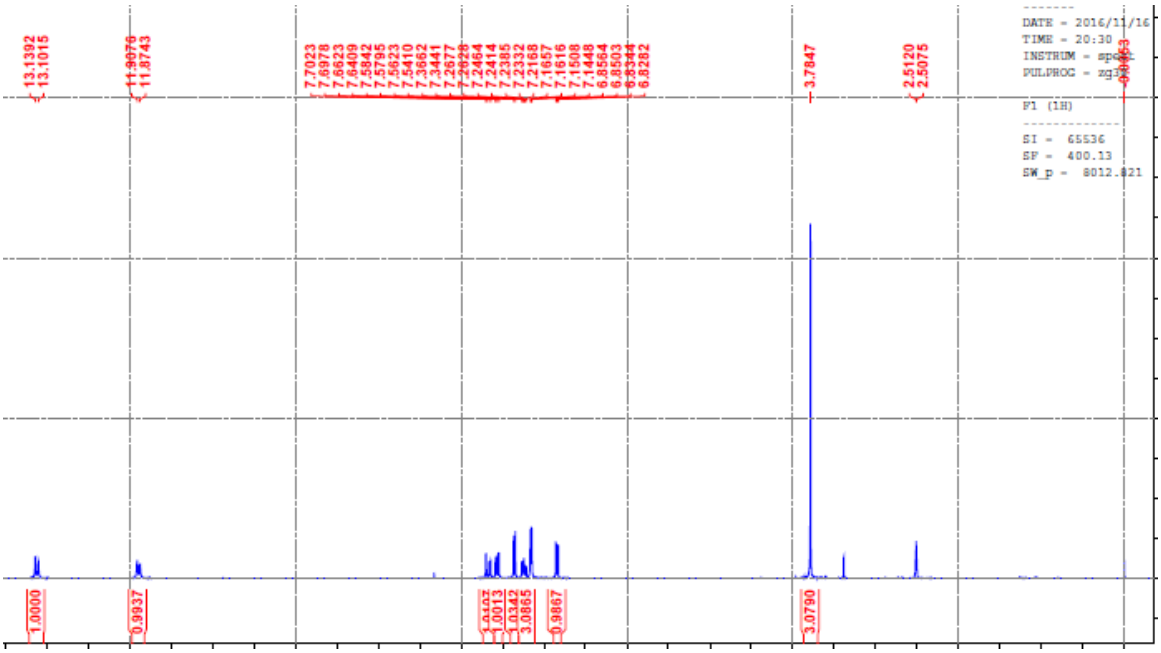


^{13}C NMR

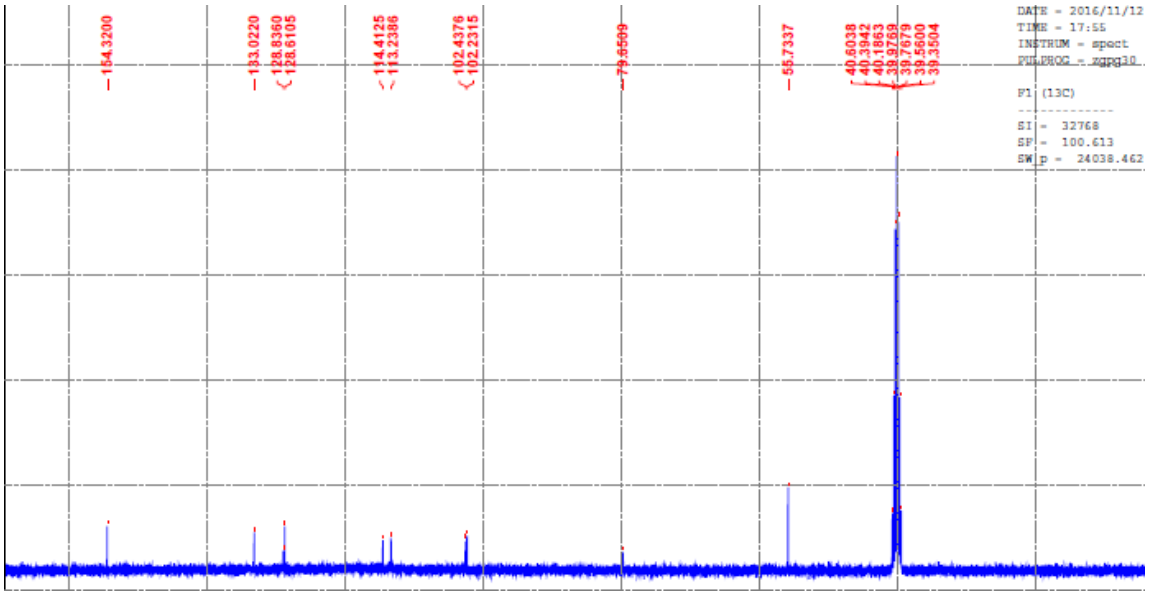


5-chloro-2-(5-methoxy-1H-indol-2-yl)-1H-benzo[d]imidazole (17c)

^{1}H NMR

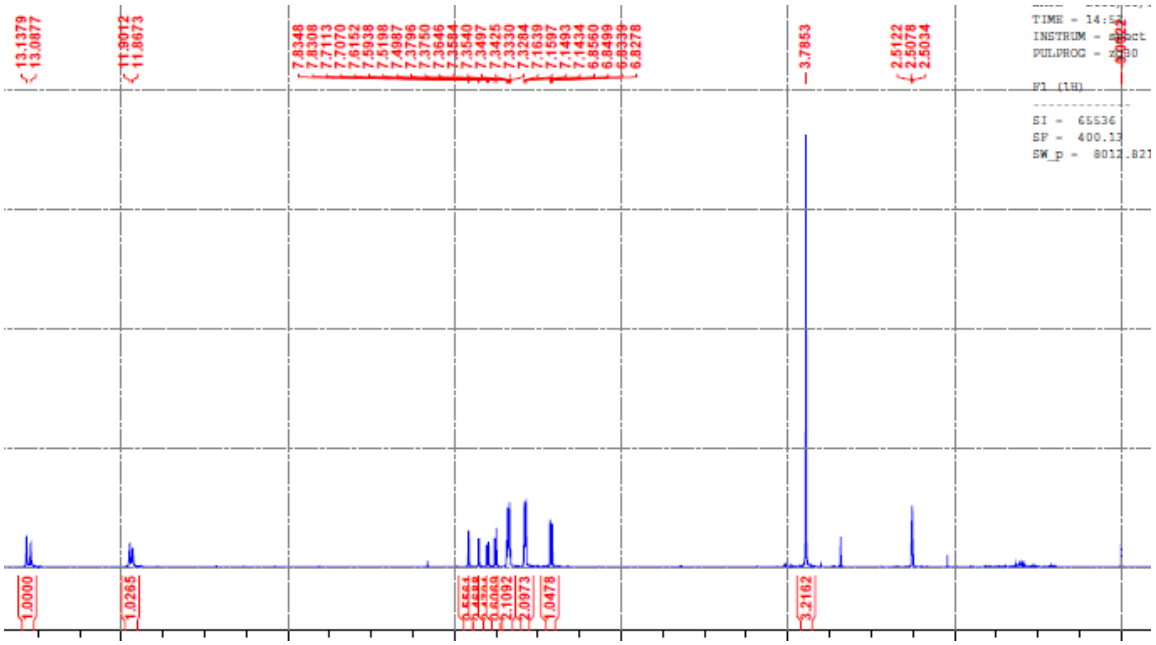


^{13}C NMR

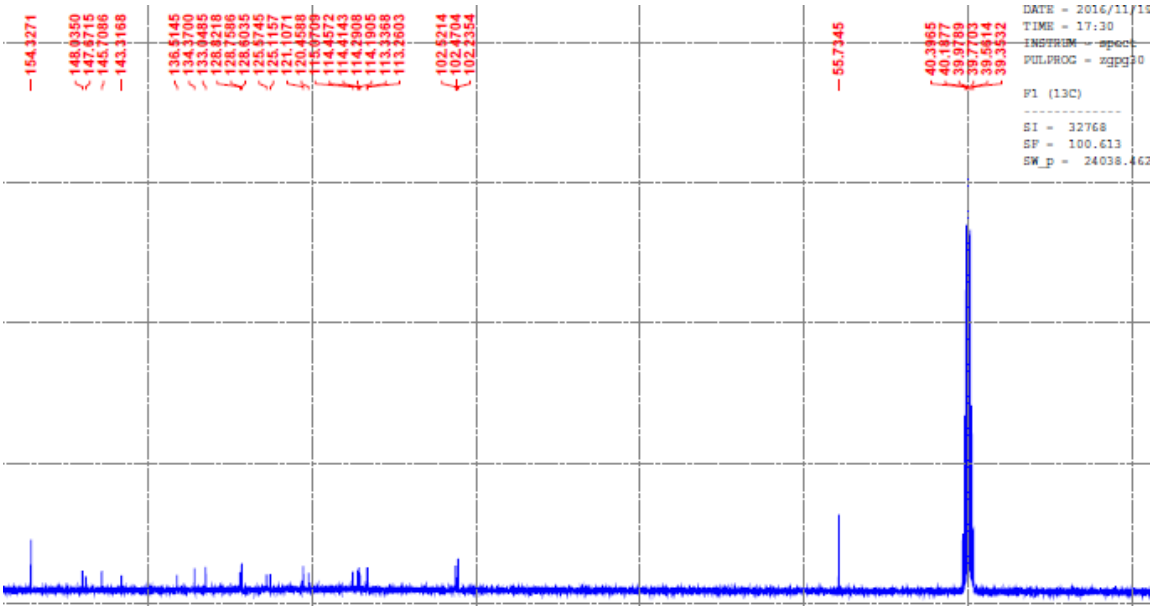


5-bromo-2-(5-methoxy-1H-indol-2-yl)-1H-benzo[d]imidazole (17d)

^{1}H NMR

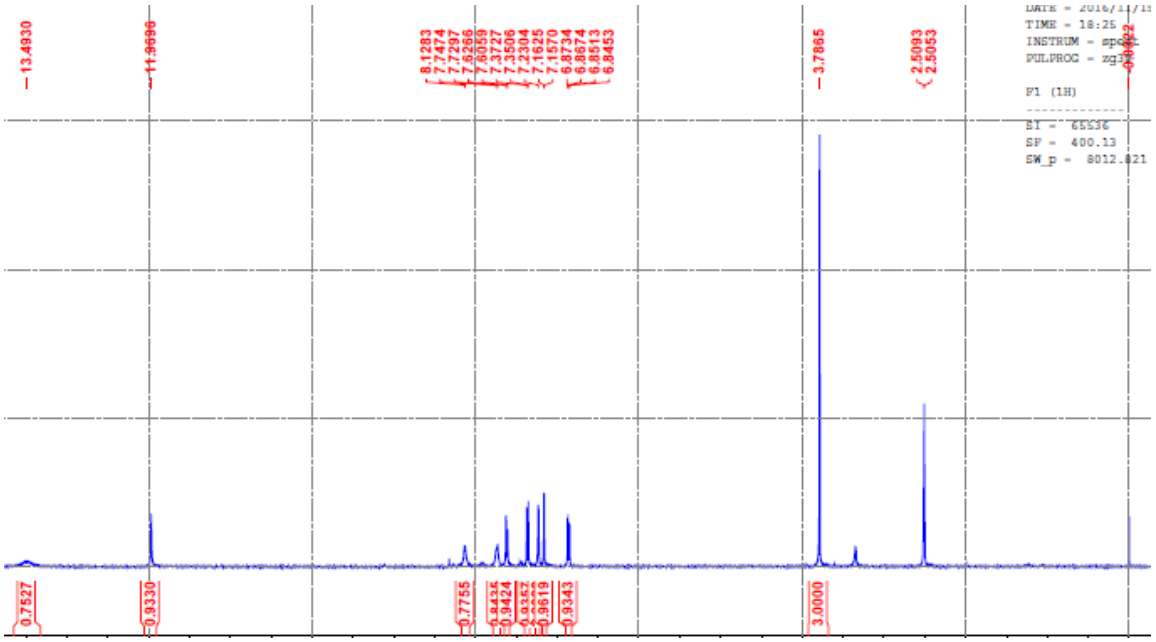


^{13}C NMR

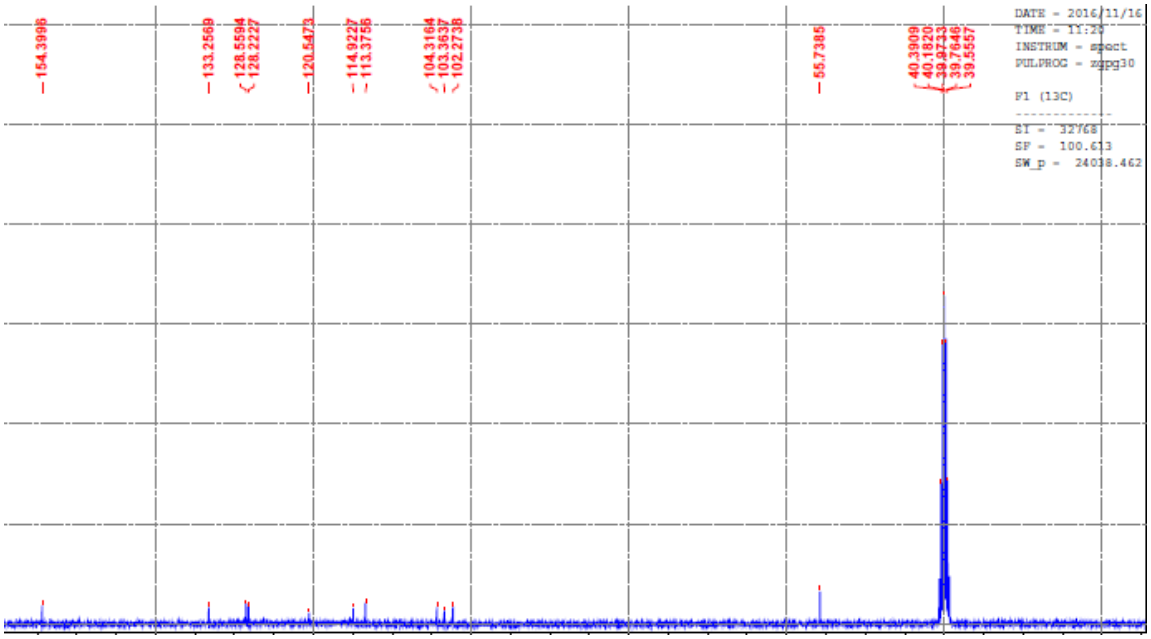


2-(5-methoxy-1H-indol-2-yl)-1H-benzo[d]imidazole-5-carbonitrile (17e)

^{1}H NMR

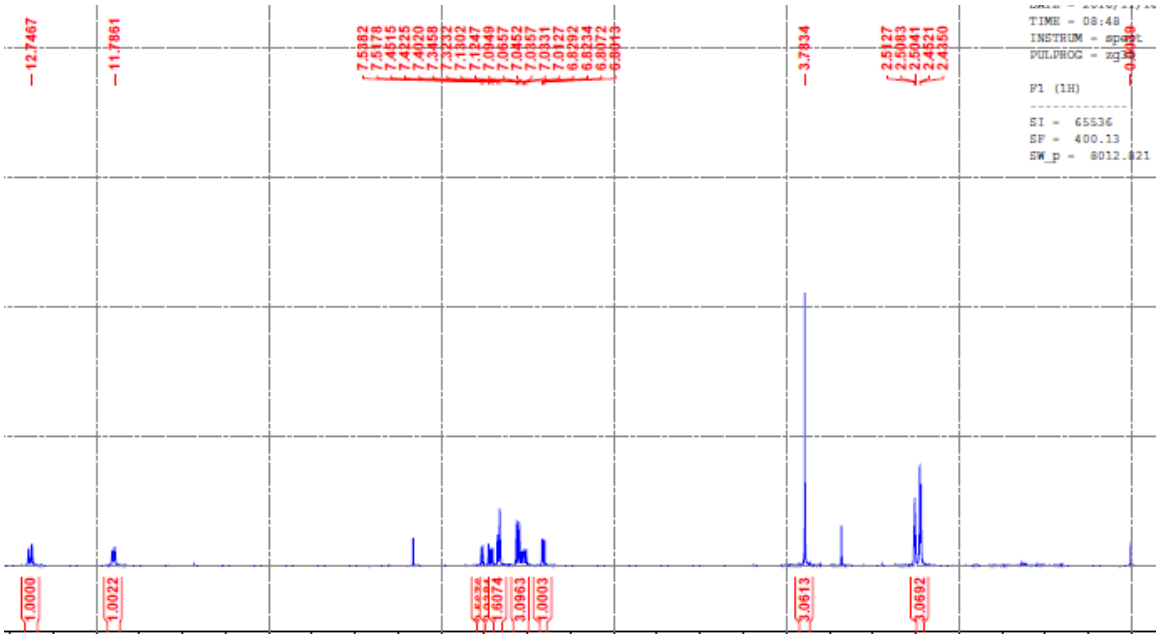


^{13}C NMR

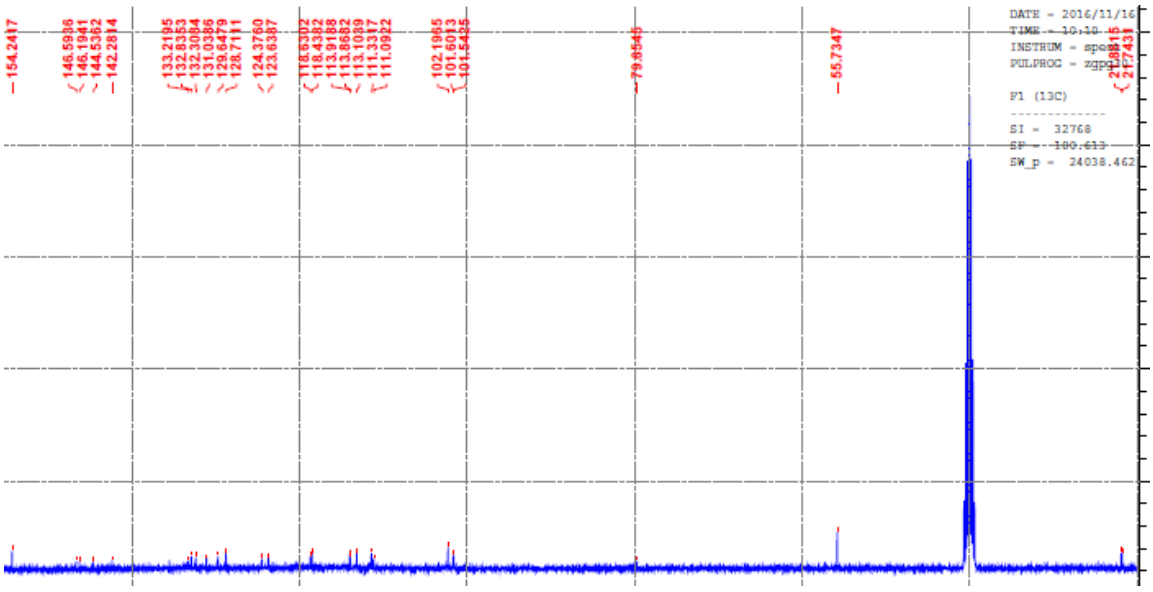


2-(5-methoxy-1H-indol-2-yl)-5-methyl-1H-benzo[d]imidazole (17f)

^{1}H NMR

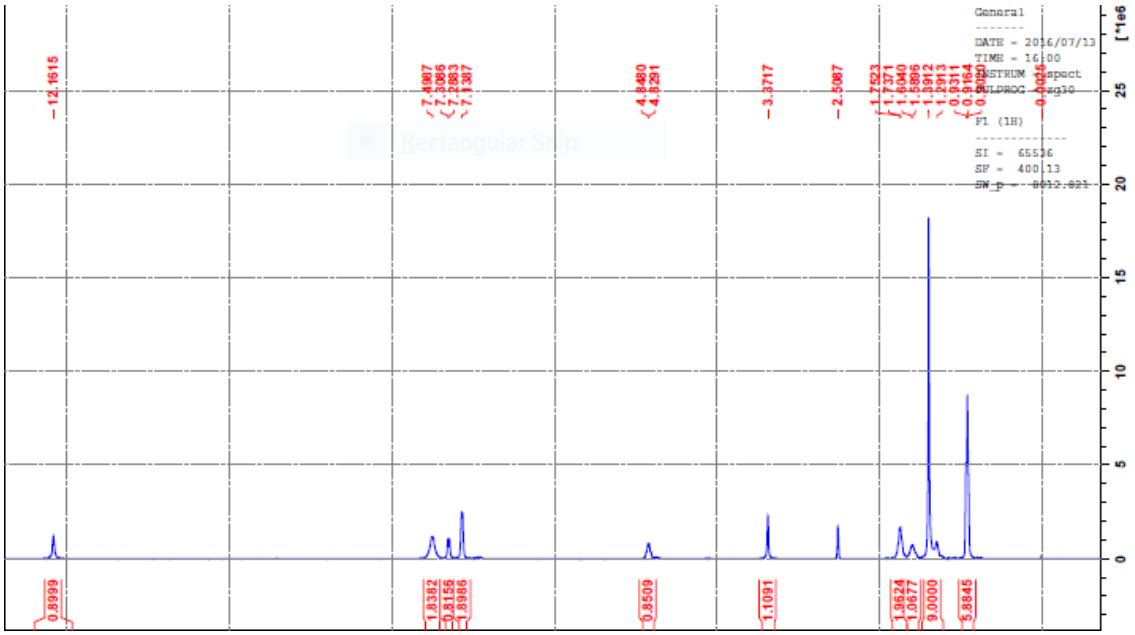


^{13}C NMR



Tert-butyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-3-methylbutylcarbamate (19a)

^{1}H NMR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7.4987
7.3866
7.2883
7.1387
4.8480
4.8291
3.3717
2.5087
1.7523
1.7371
1.6040
1.5896
1.3912
1.2913
0.9311
0.9164
0.0025
General
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TIME = 16:00
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SF = 400.13
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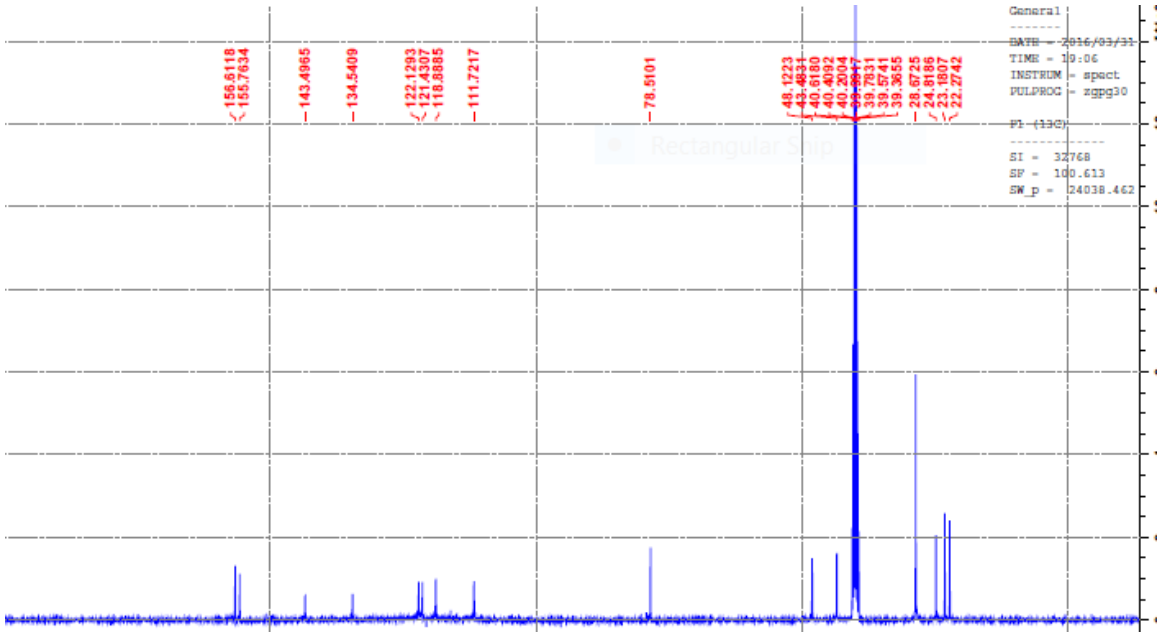
1.8986
0.8509
1.1091
1.9624
1.0677
9.0000
5.8845

^{13}C NMR


156.6118
155.7634
143.4985
134.5409
122.1293
121.4307
118.8885
111.7217
78.5101
48.1223
43.4831
40.6180
40.4092
40.2004
39.7831
39.5741
39.3655
28.6725
24.8186
23.1807
22.2742
General
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PULPROG = zgpg30
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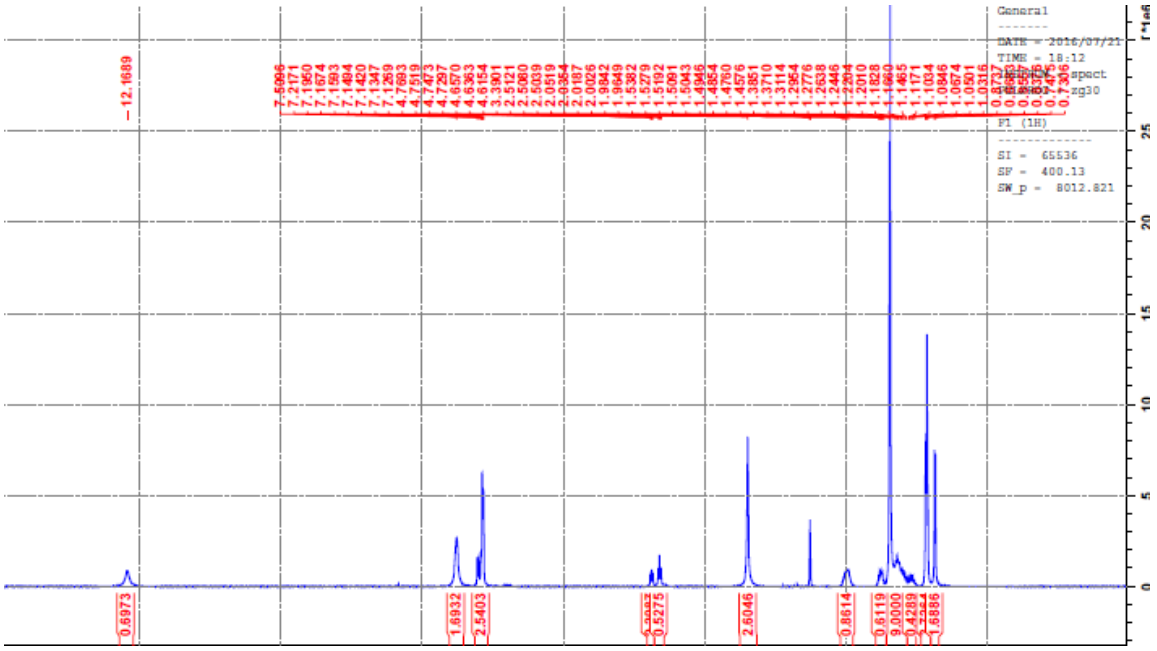
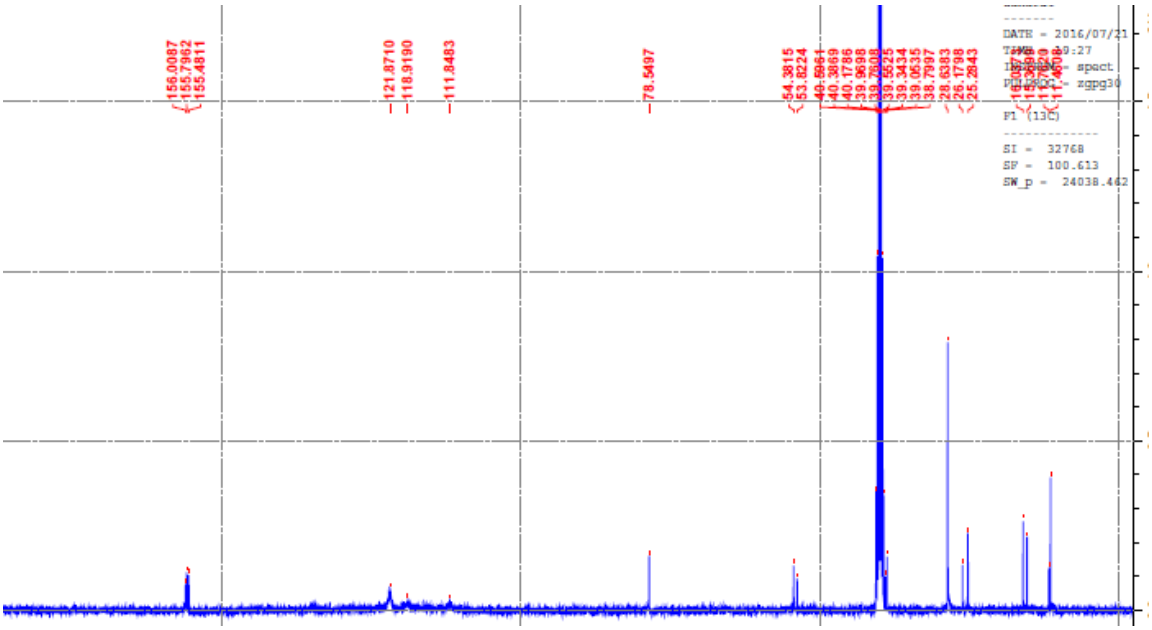
SF = 100.613
SW_p = 24038.462

Tert-butyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-methylbutylcarbamate (19b)

^{1}H NMR

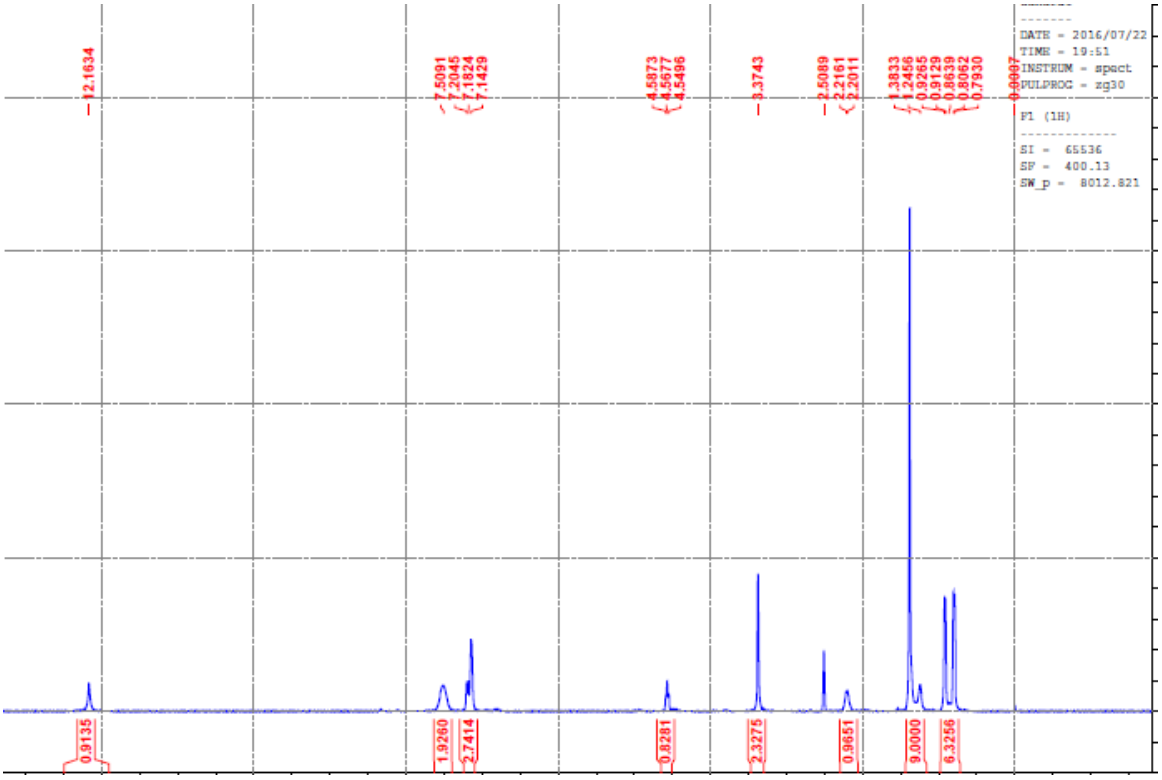


^{13}C NMR

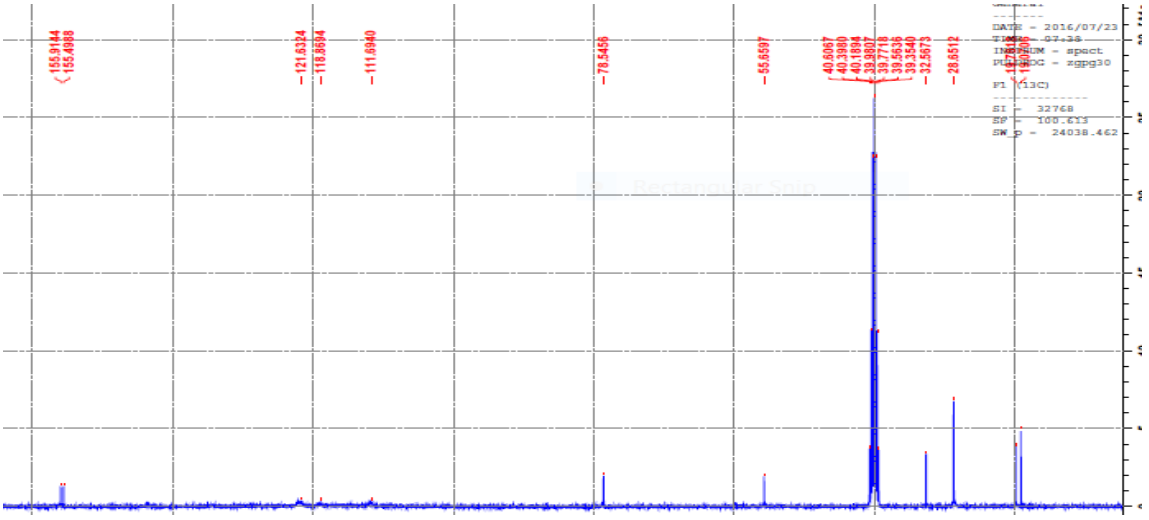


Tert-butyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-methylpropylcarbamate (19c)

^{1}H NMR

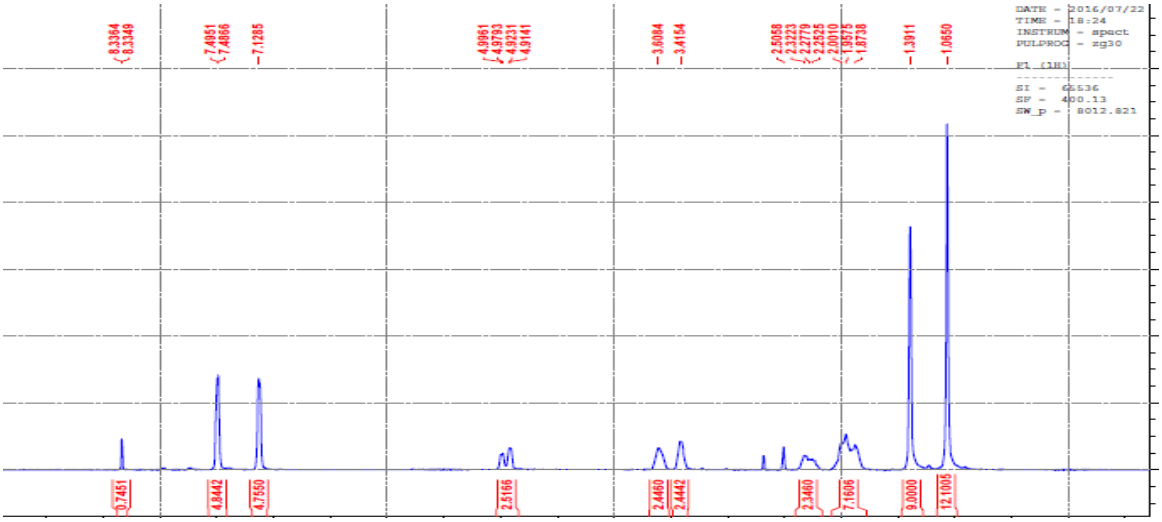


^{13}C NMR

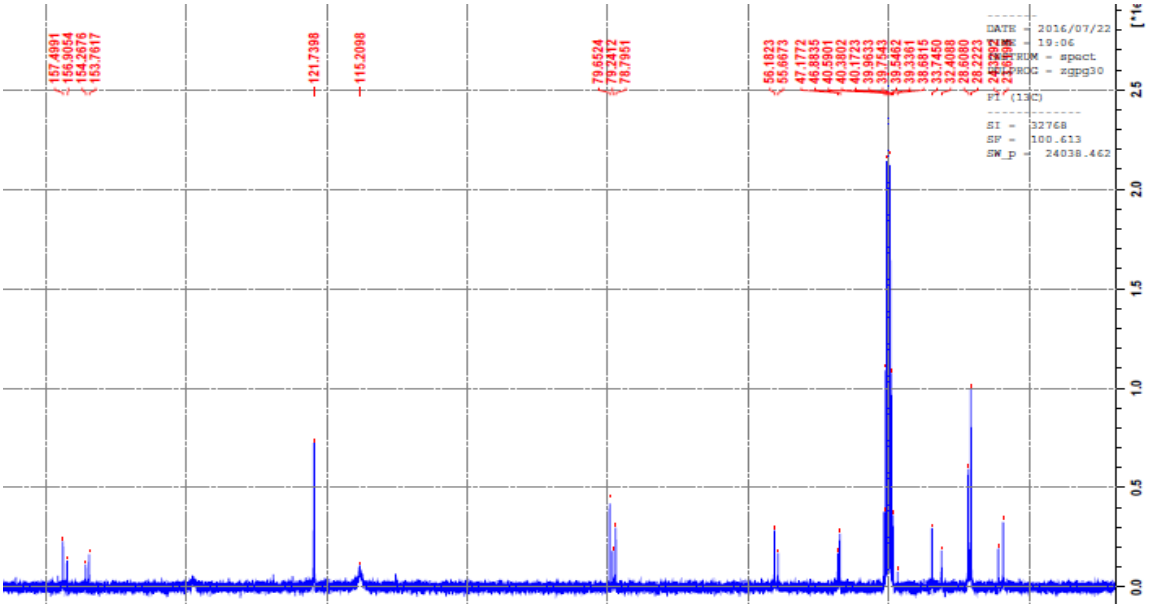


Tert-butyl 2-(1*H*-benzo[*d*]imidazol-2-yl)pyrrolidine-1-carboxylate (19d)

^{1}H NMR

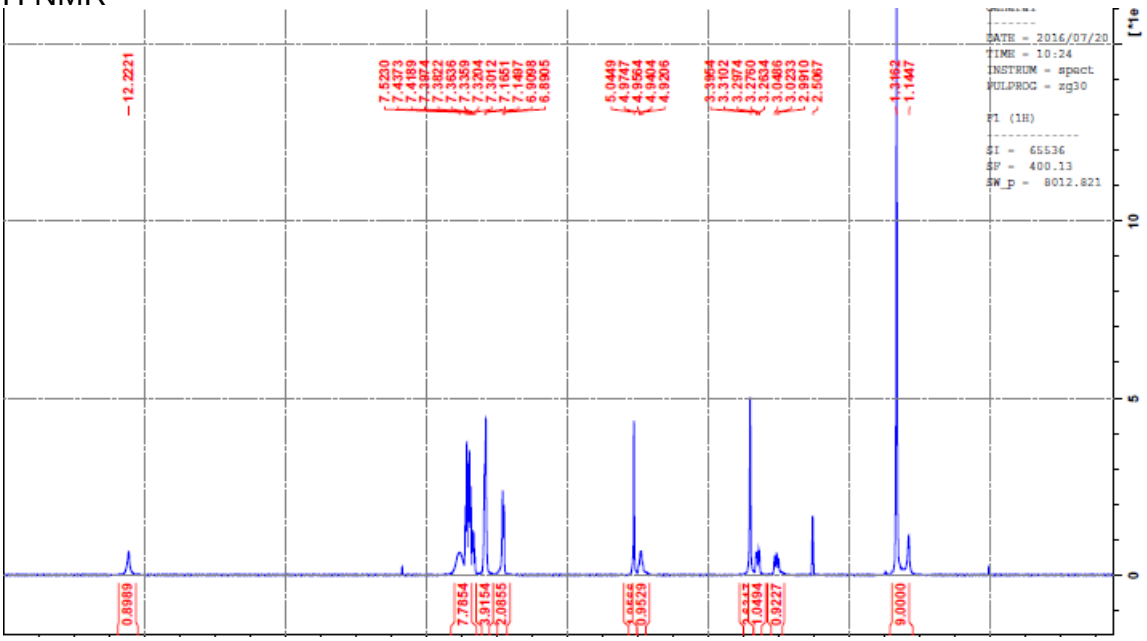


^{13}C NMR

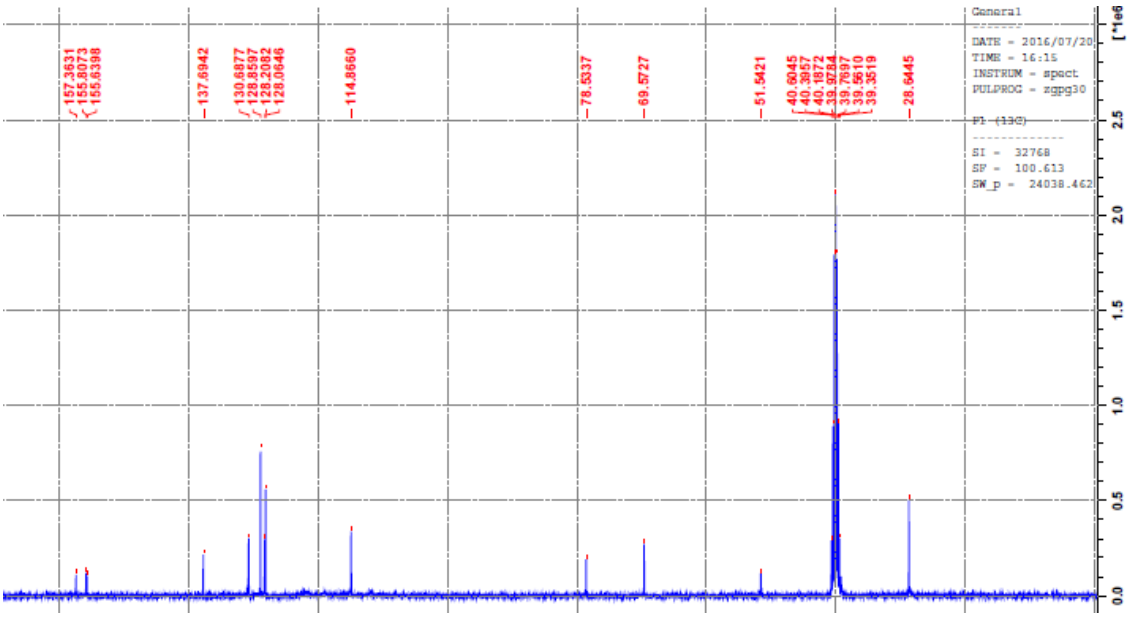


***Tert*-butyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-(4-(benzyloxy)phenyl)ethylcarbamate (19e)**

^{1}H NMR

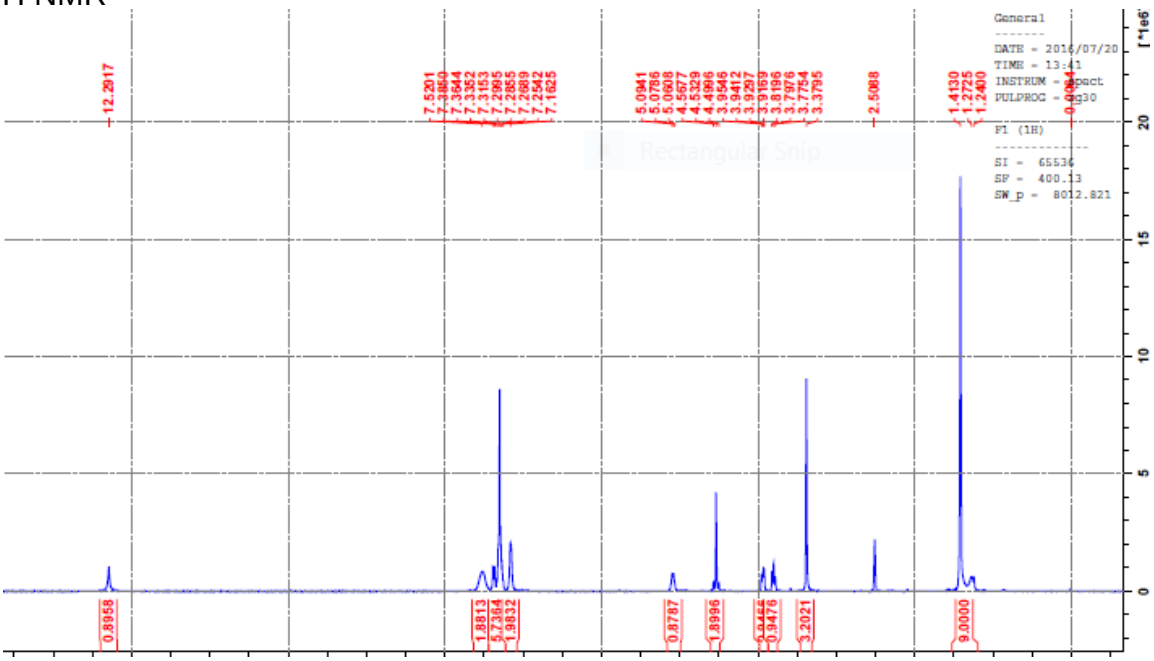


^{13}C NMR

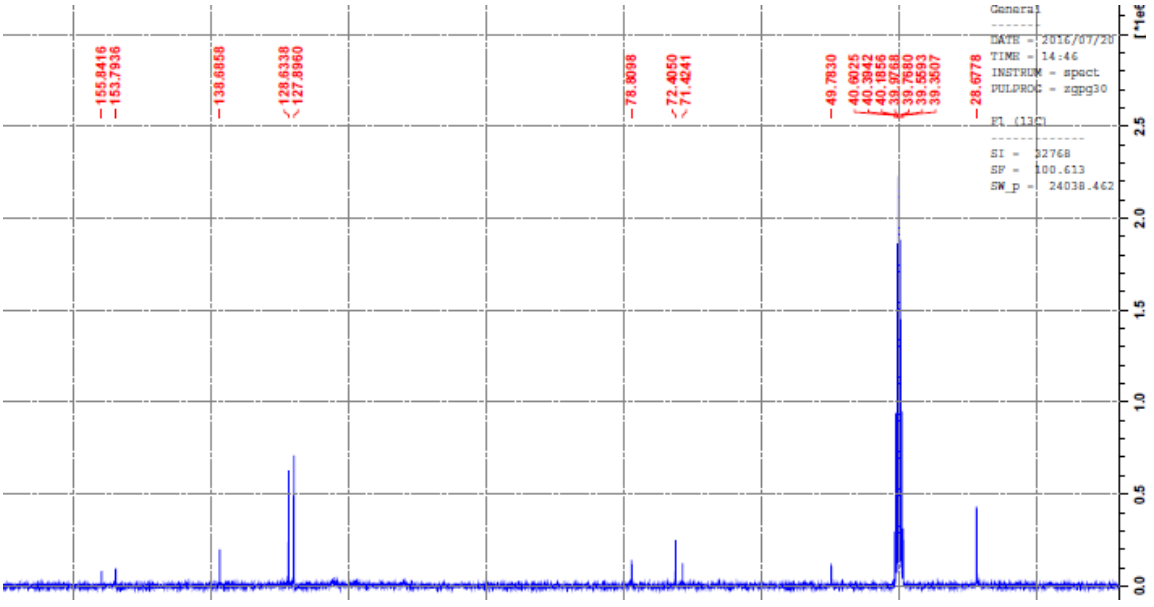


Tert-butyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-(benzyloxy)ethylcarbamate (19f)

^{1}H NMR

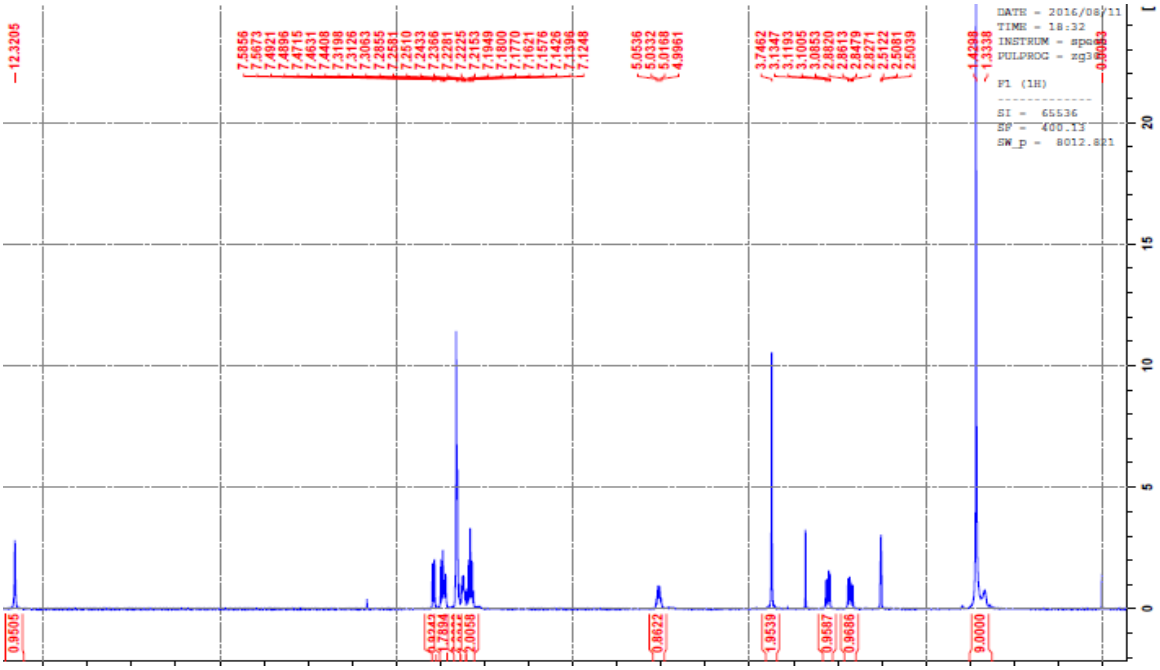


^{13}C NMR

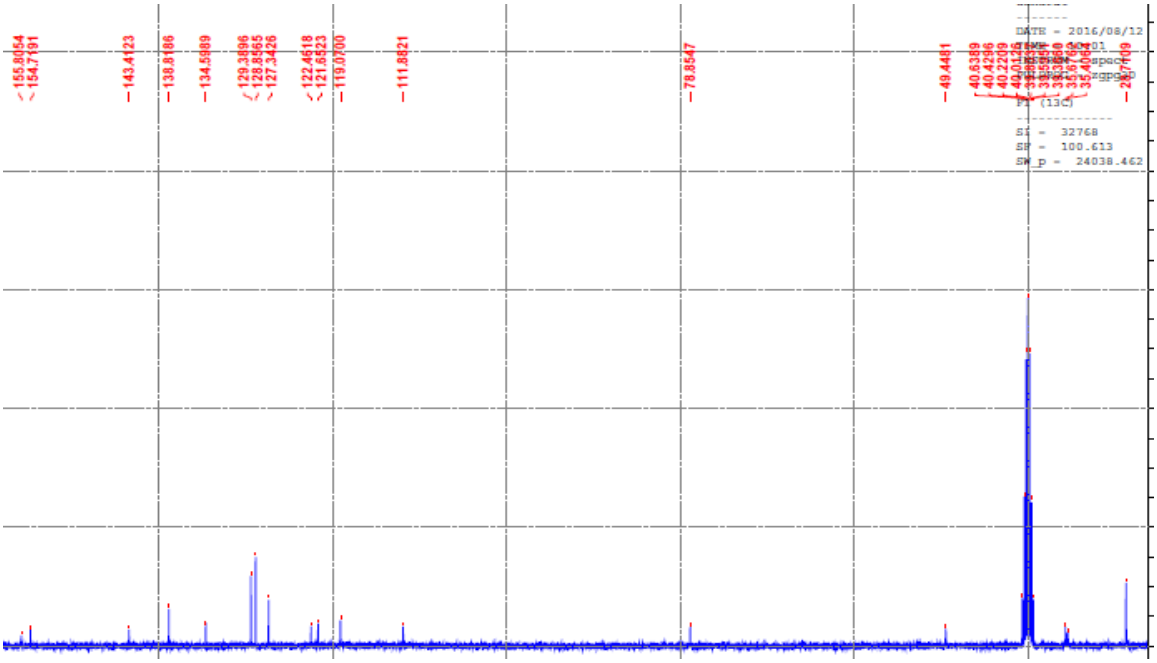


Tert-butyl 1-(1_H_-benzo[_d_]imidazol-2-yl)-2-(benzylthio)ethylcarbamate (19g)

^{1}H NMR

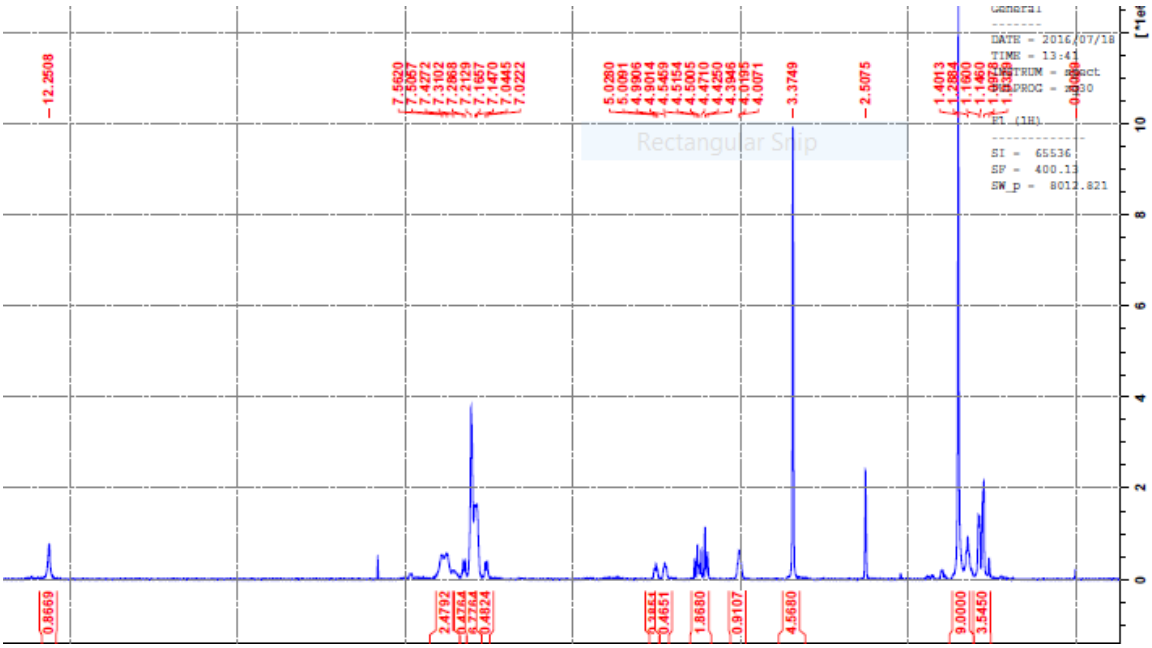


^{13}C NMR

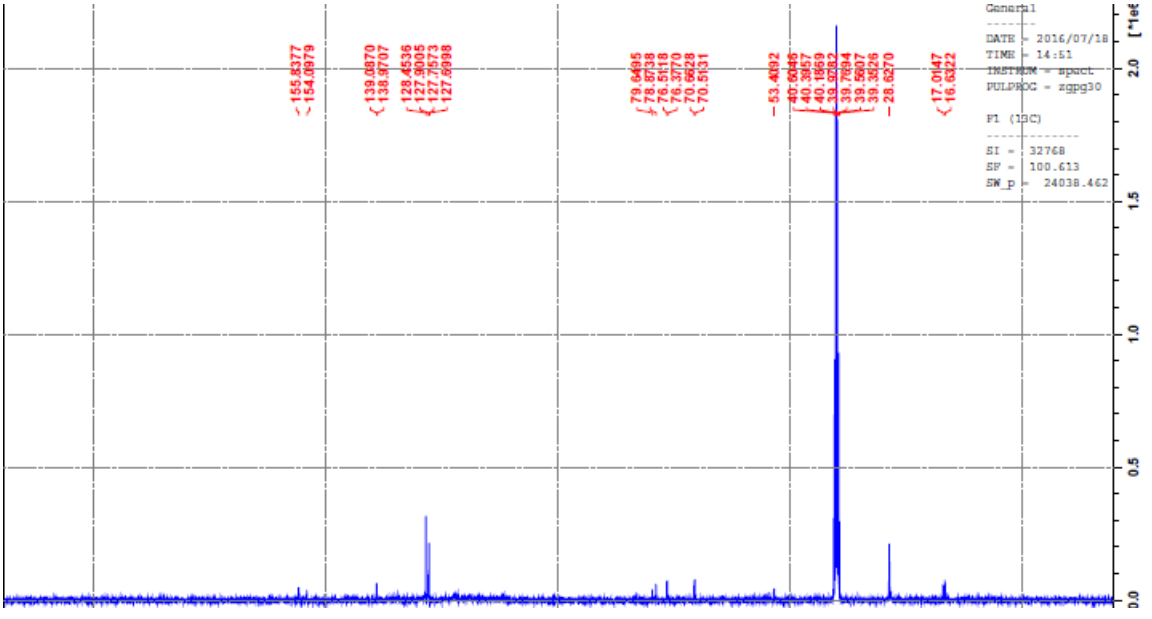


***Tert*-butyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-3-(benzyloxy)butylcarbamate (19h)**

^{1}H NMR

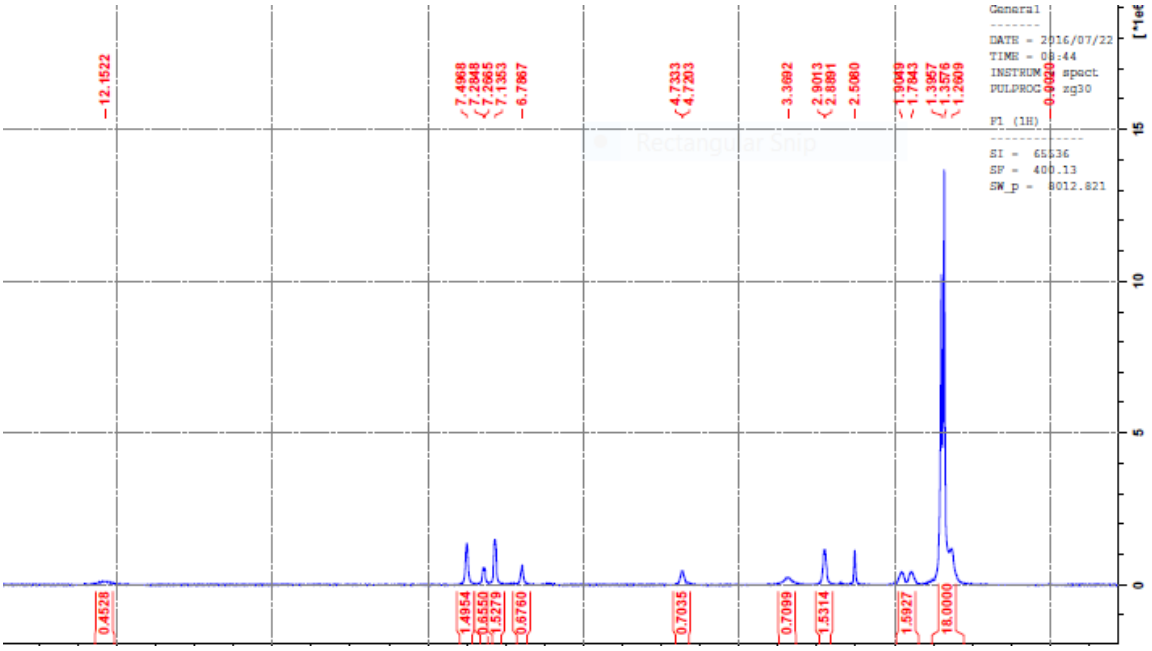


^{13}C-NMR

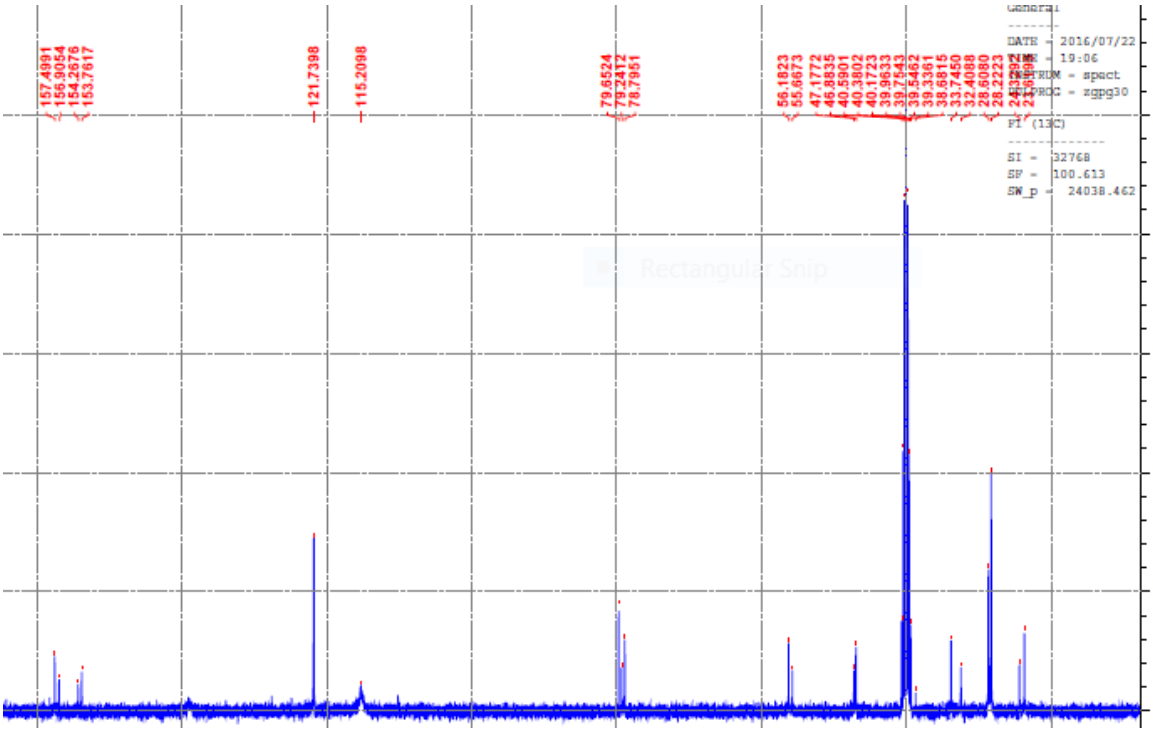


$N^{a,e}$-bis-butyloxycarbonyl-lysine-benzimidazole (19i)

^{1}H NMR

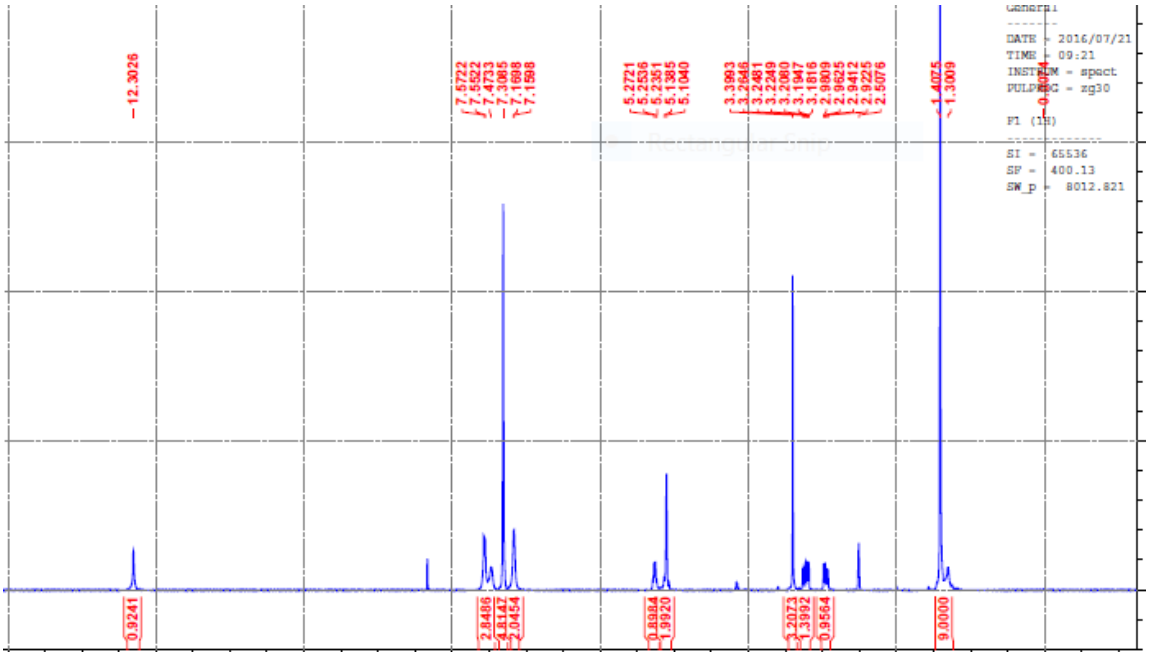


^{13}C NMR

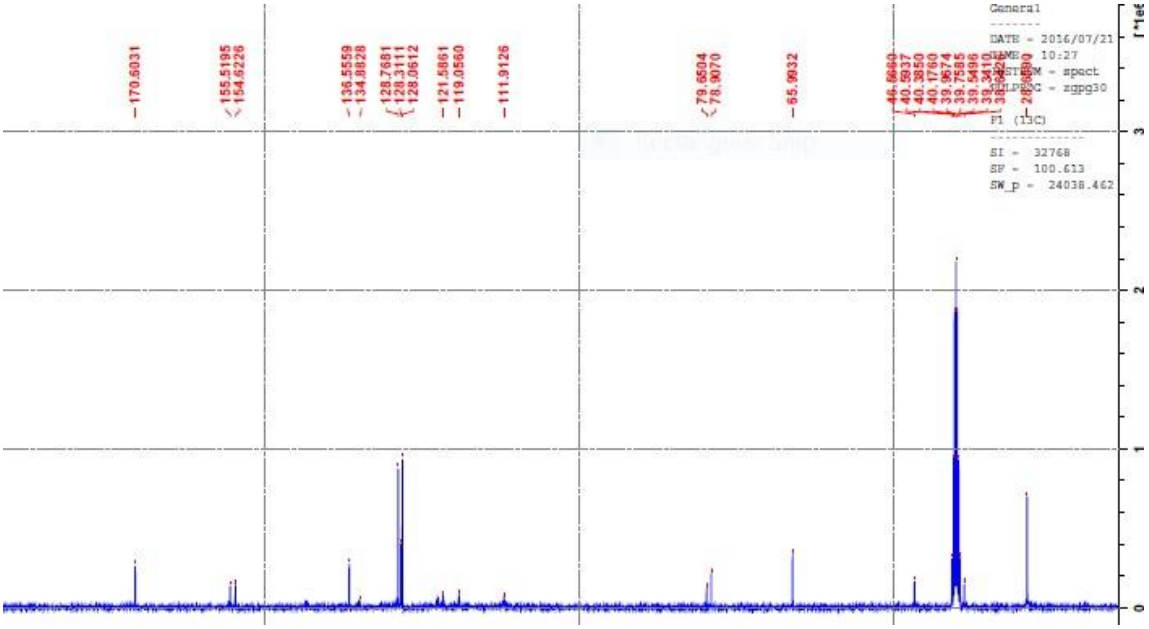


Tert-butyl 2-(phenoxycarbonyl)-1-(1*H*-benzo[*d*]imidazol-2-yl)ethylcarbamate (19j)

^{1}H NMR

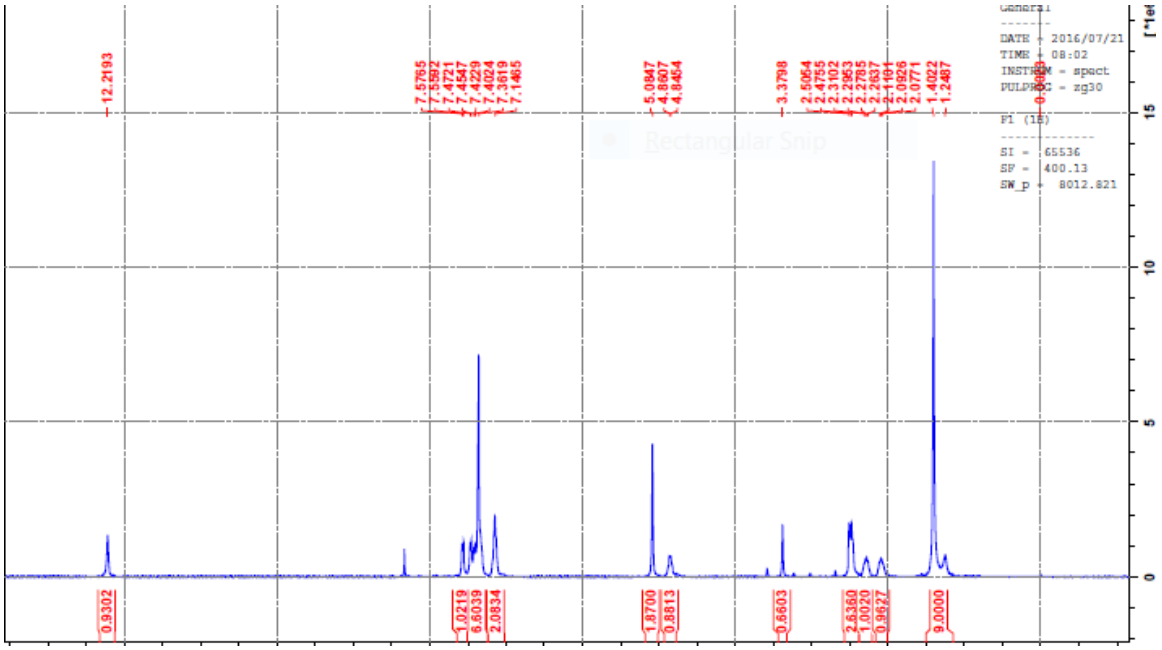


^{13}C NMR

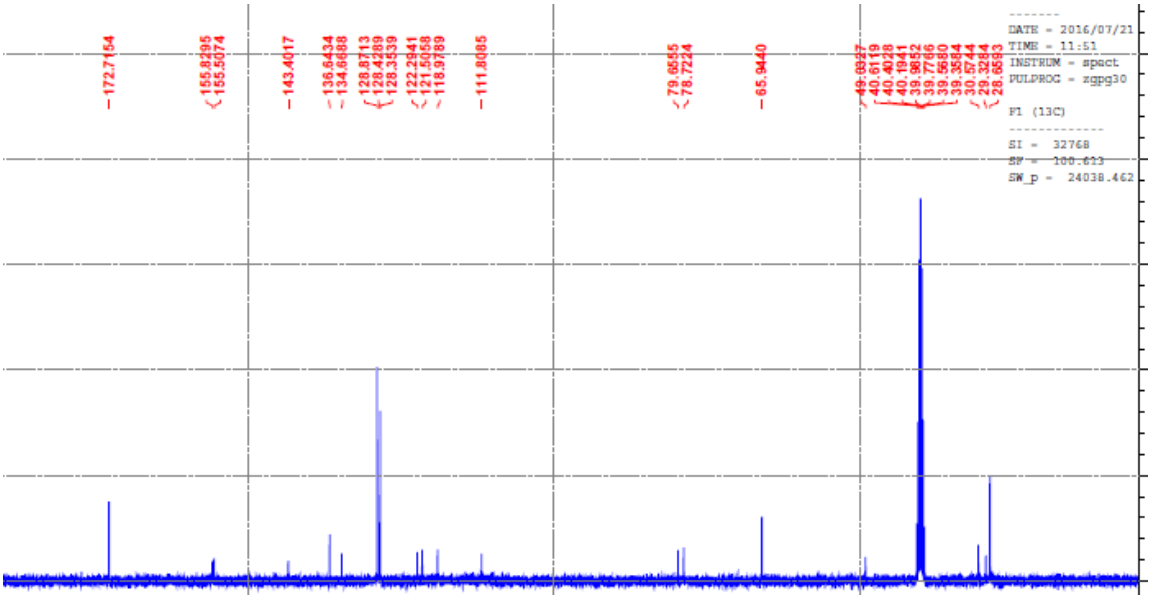


***Tert*-butyl 3-((benzyloxy)carbonyl)-1-(1*H*-benzo[*d*]imidazol-2-yl)propylcarbamate (19k)**

^{1}H NMR

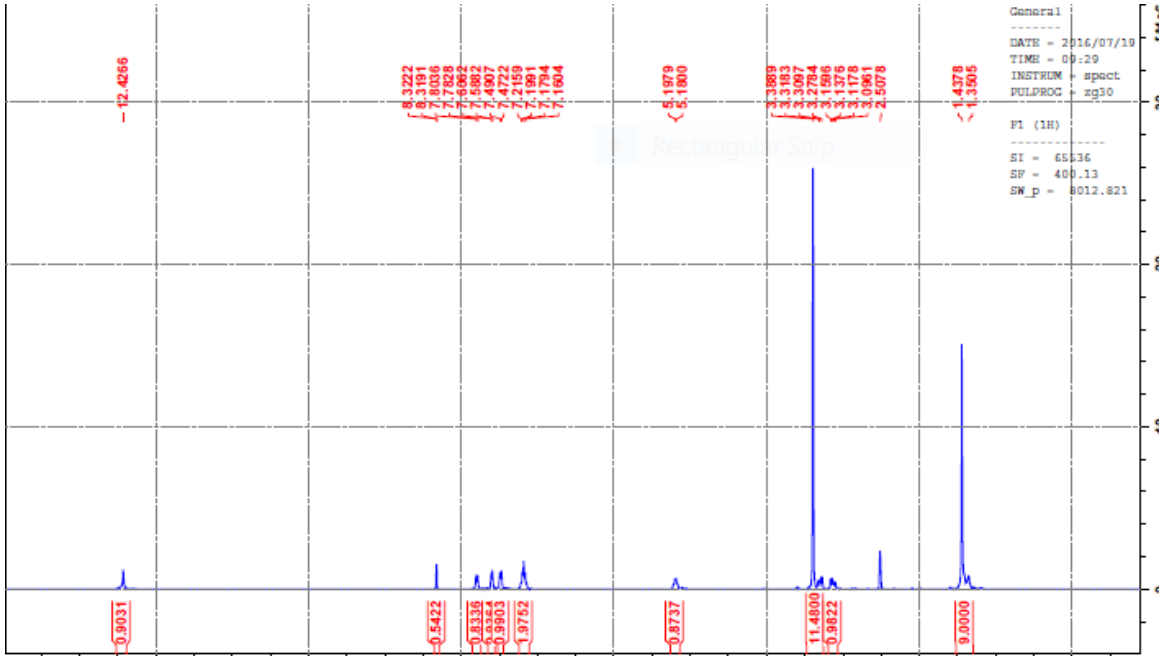


^{13}C NMR

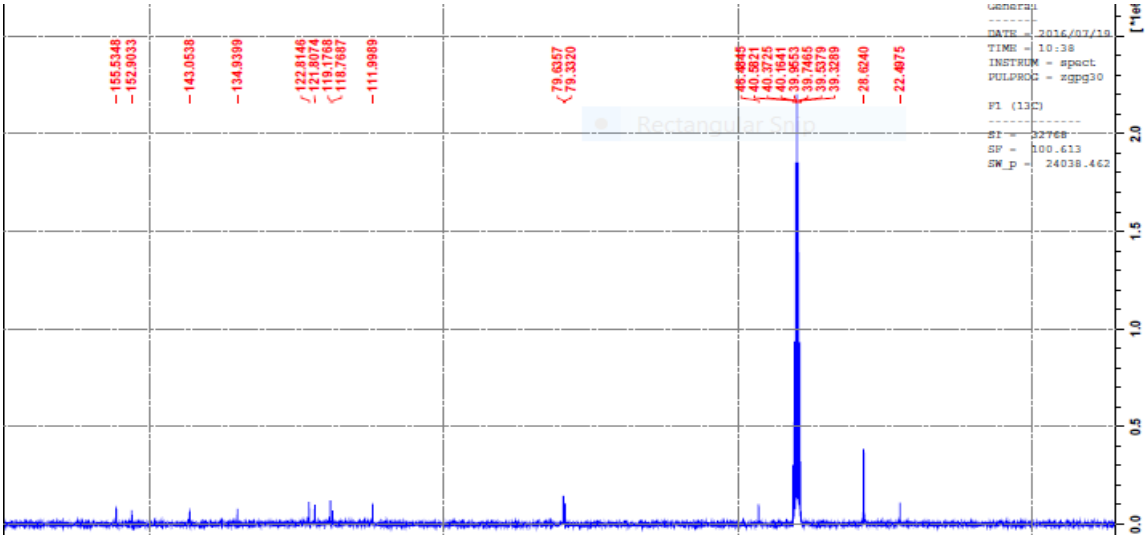


Tert-butyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-carbamoylethylcarbamate (19l)

^{1}H NMR

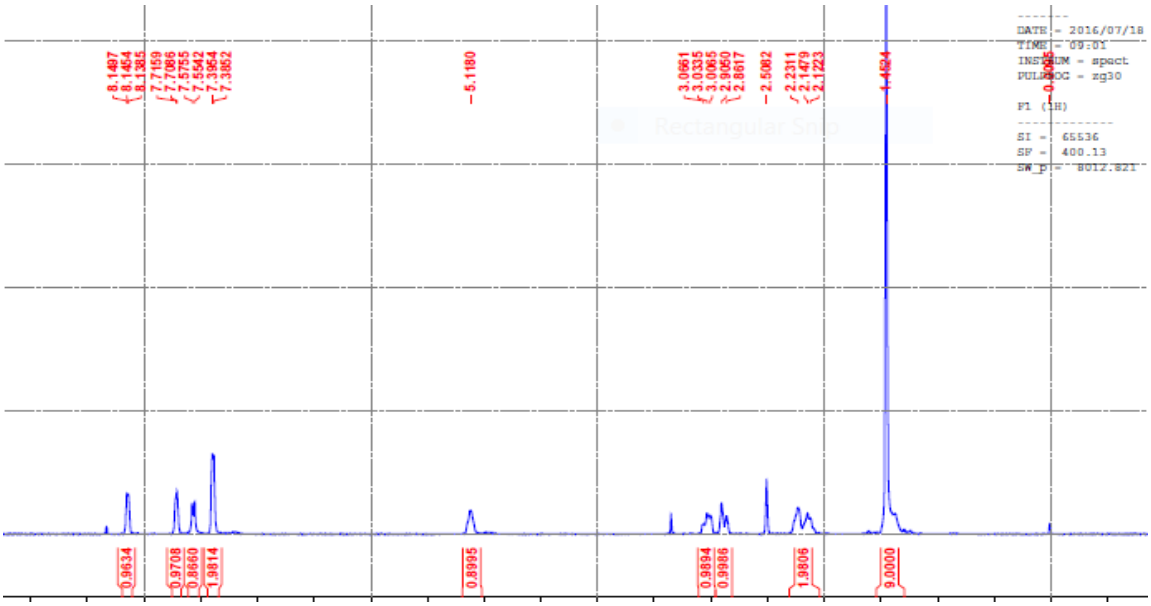


^{13}C NMR

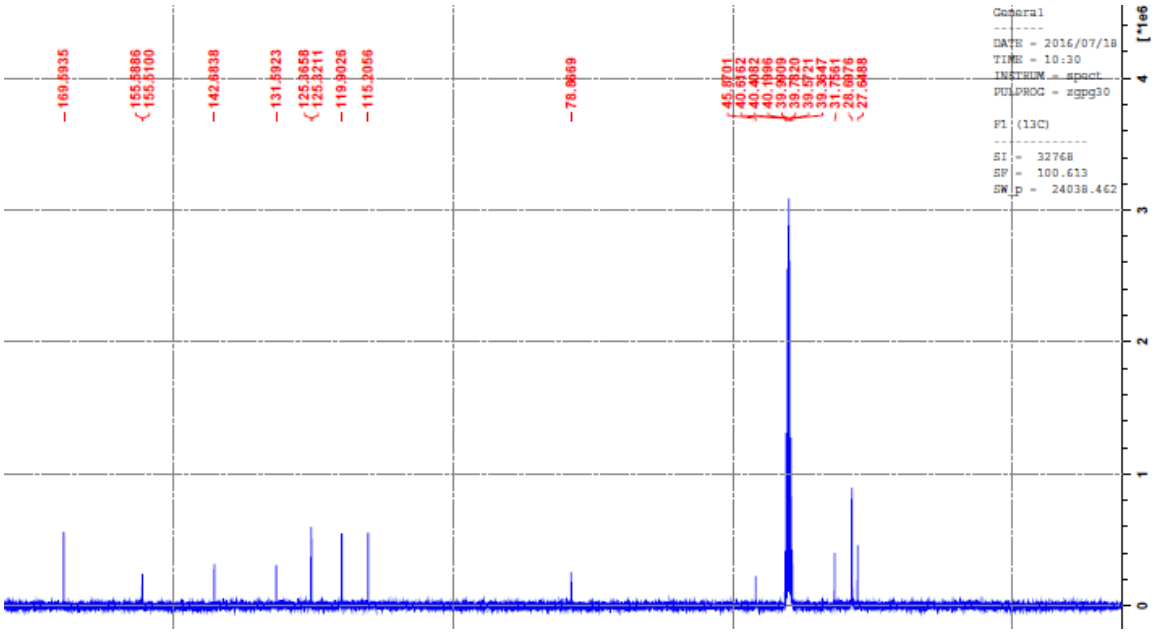


1,2,3,4-Tetrahydro-1-oxo-pyrido[1,2a]benzimidazole (19m)

^{1}H NMR

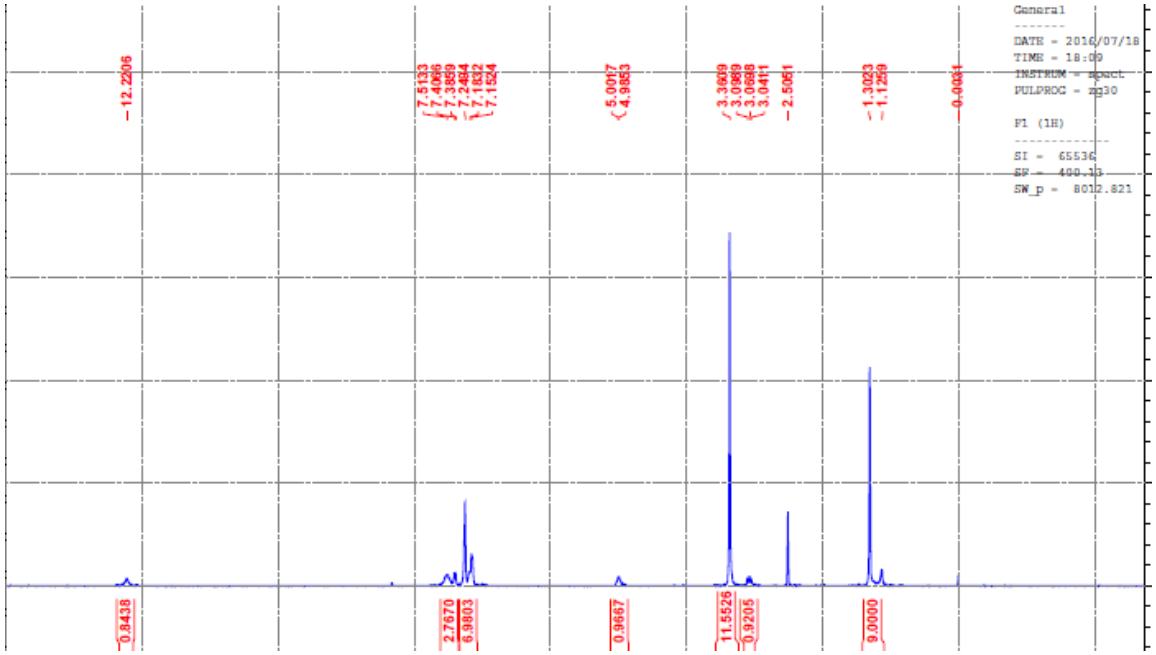


^{13}C NMR

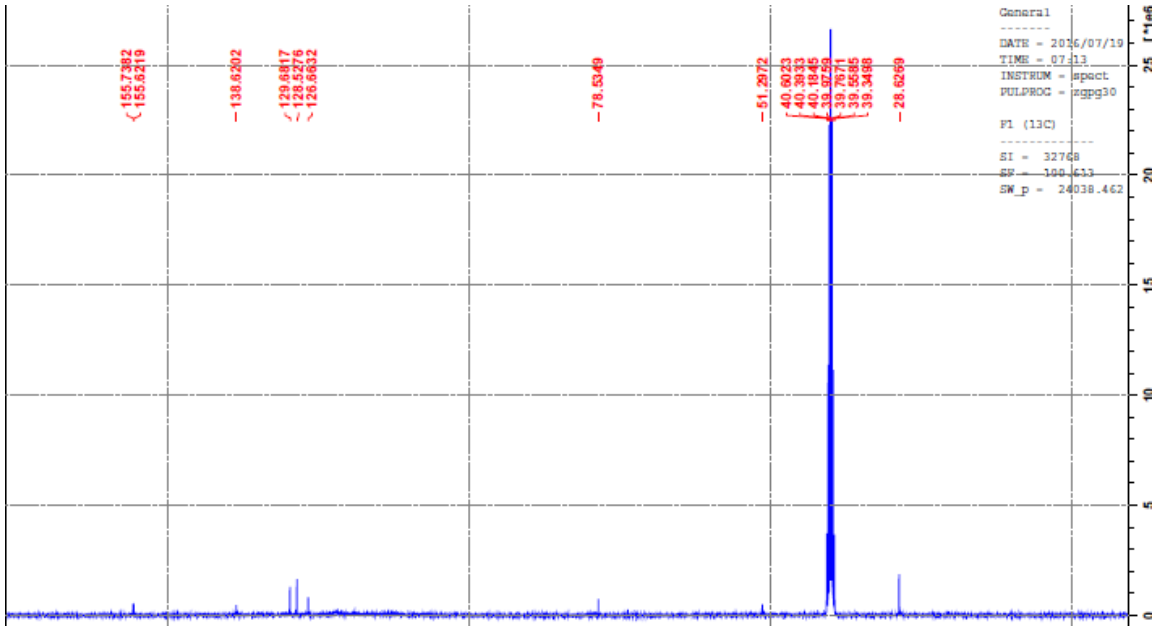


***Tert*-butyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-phenylethylcarbamate (19n)**

^{1}H NMR

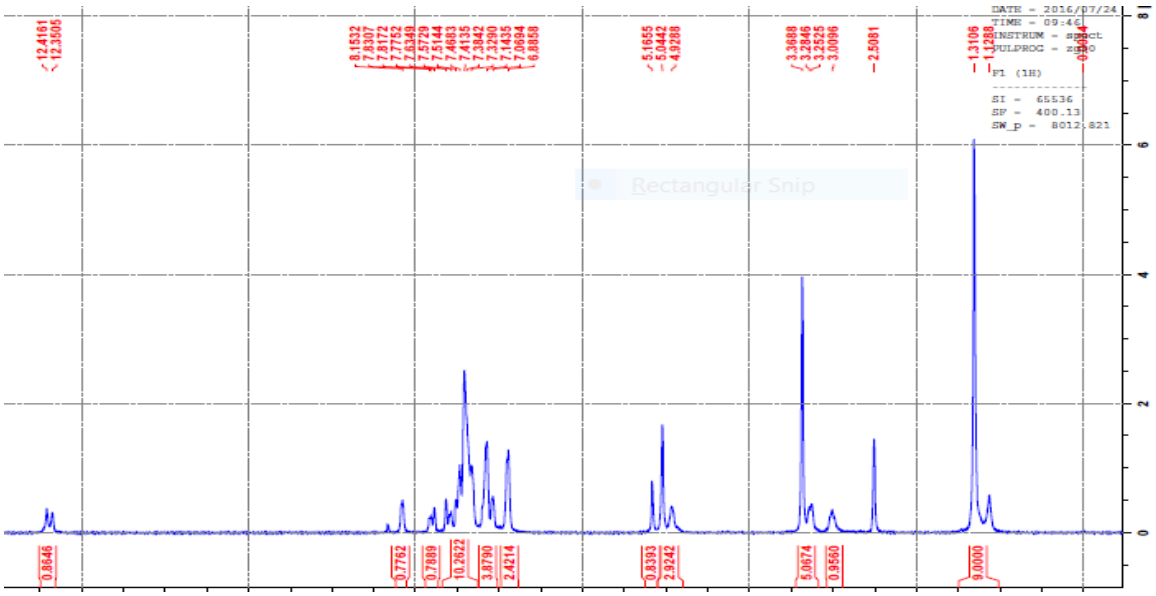


^{13}C NMR

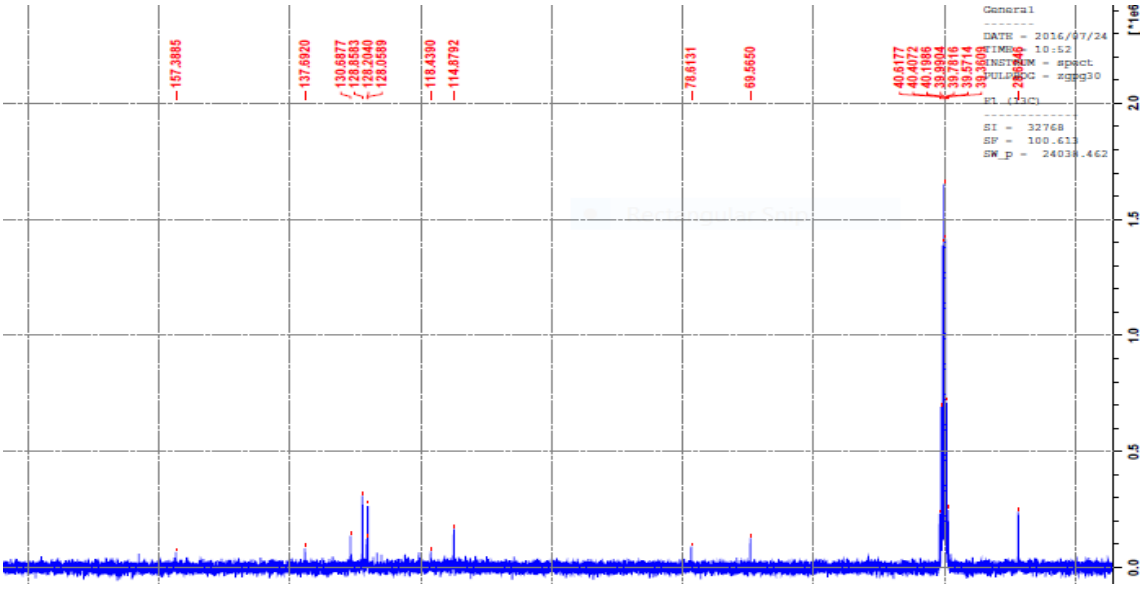


Tert-butyl 2-(4-(benzyloxy)phenyl)-1-(5-chloro-1_H_-benzo[_d_]imidazol-2-yl)ethylcarbamate (20)

^{1}H NMR

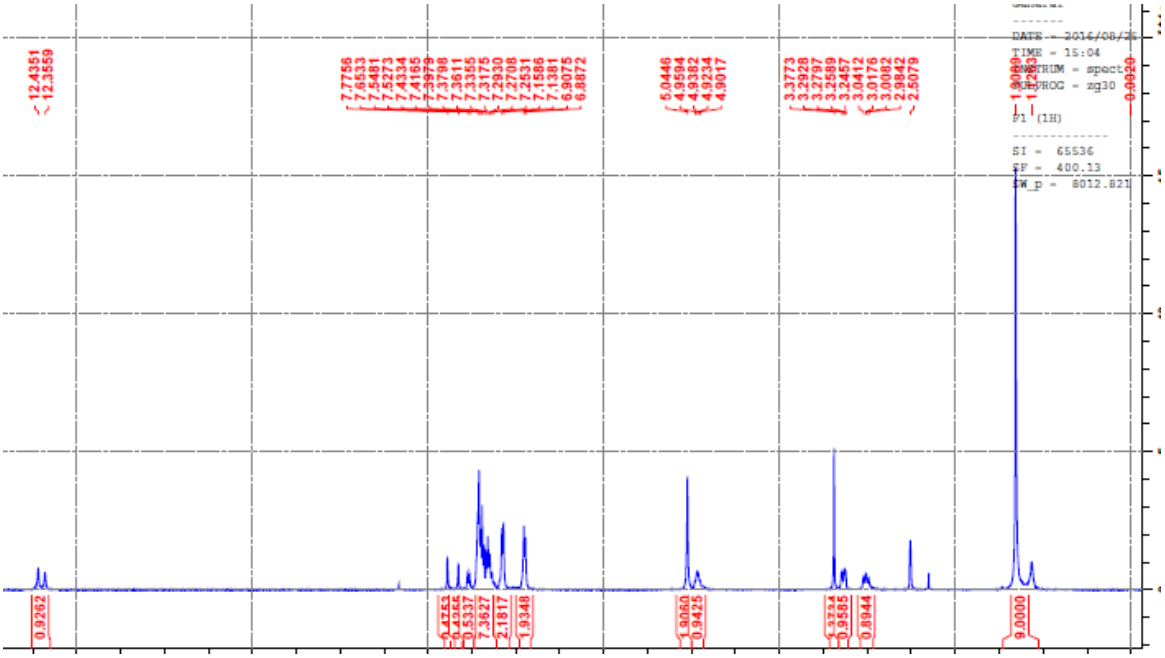


^{13}C NMR

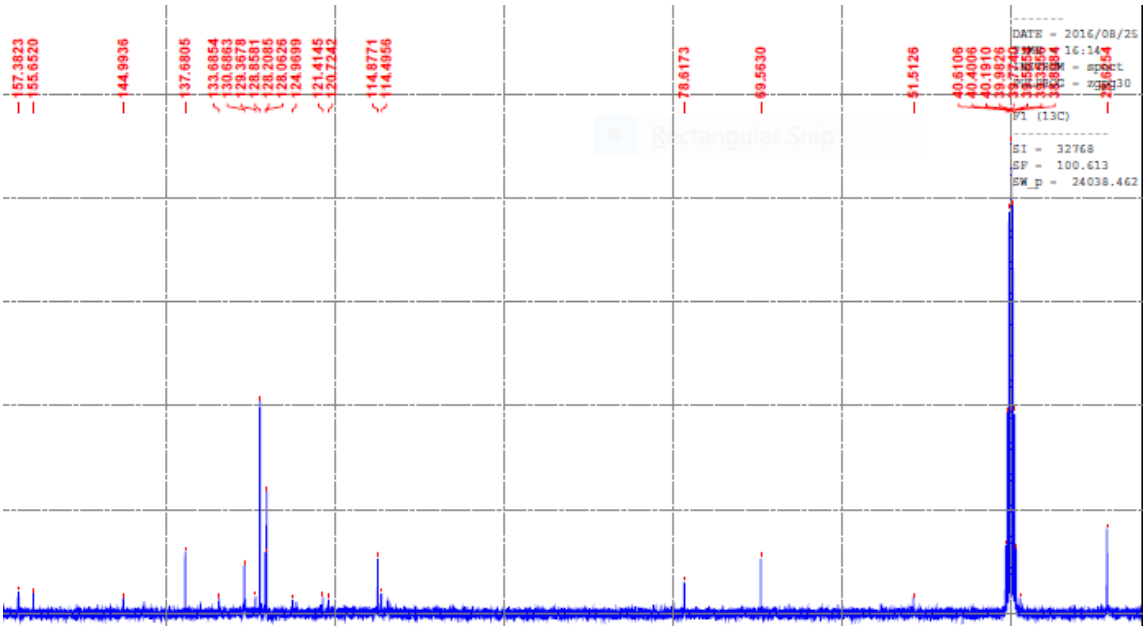


***Tert*-butyl 2-(4-(benzyloxy)phenyl)-1-(5-bromo-1*H*-benzo[*d*]imidazol-2-yl)ethylcarbamate (21)**

^{1}H NMR

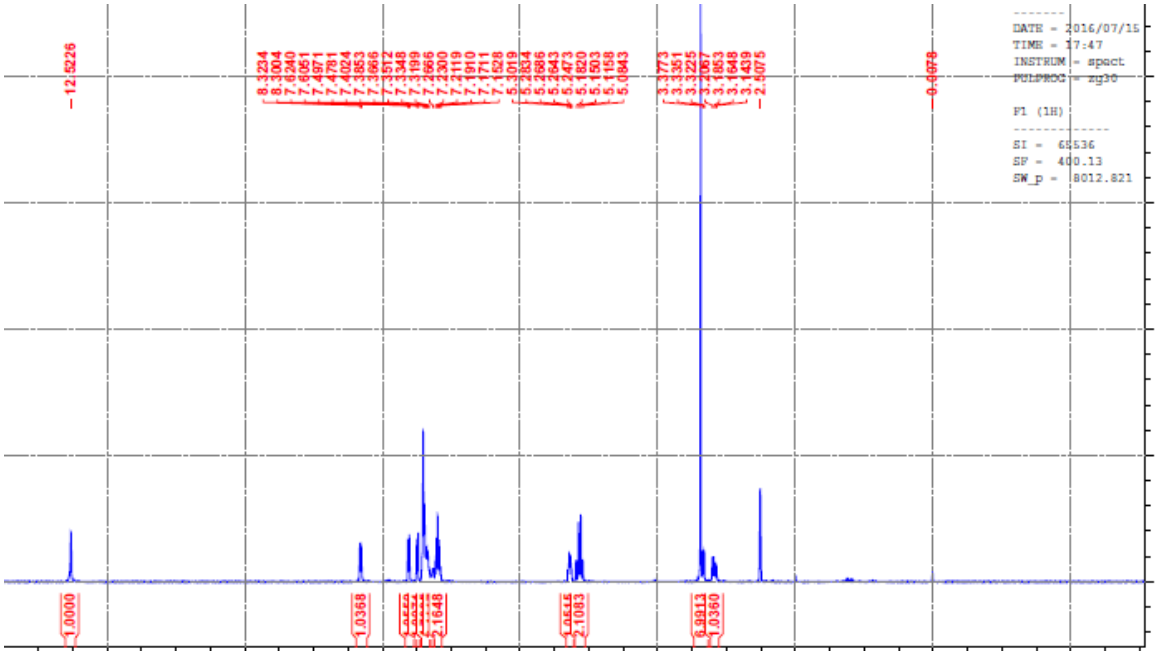


^{13}C NMR

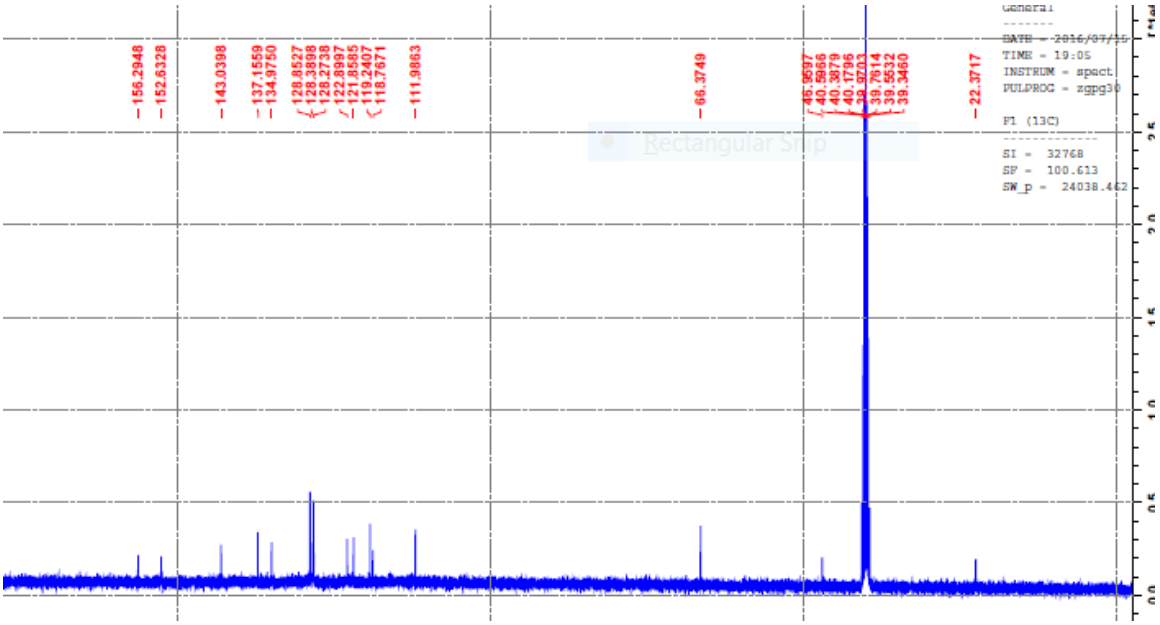


Benzyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-carbamoylethylcarbamate (22)

^{1}H NMR

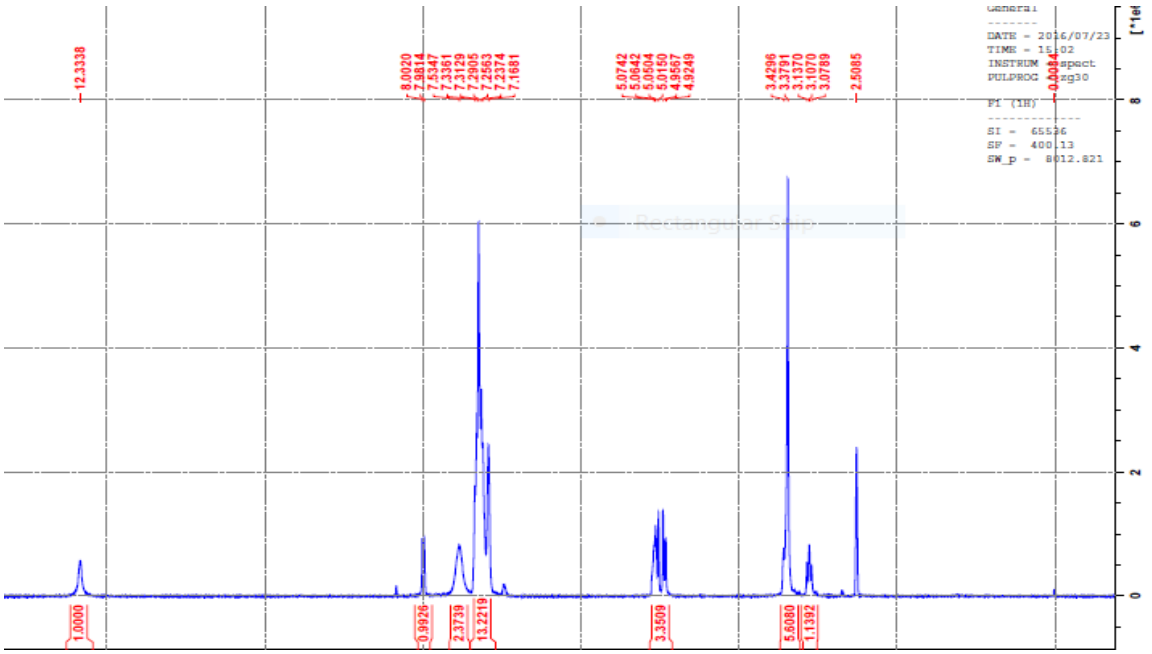


^{13}C NMR

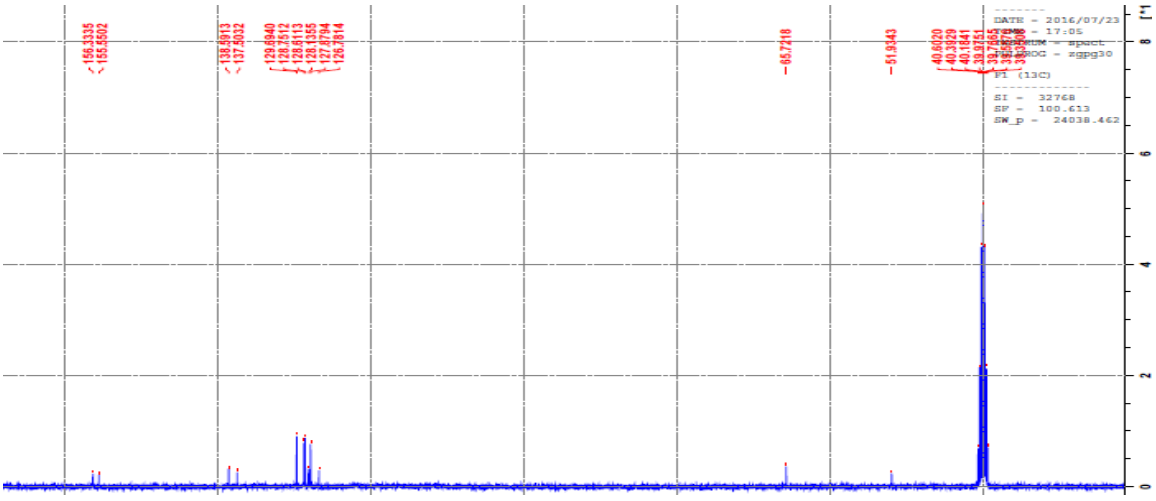


Benzyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-2-phenylethylcarbamate (23)

^{1}H NMR

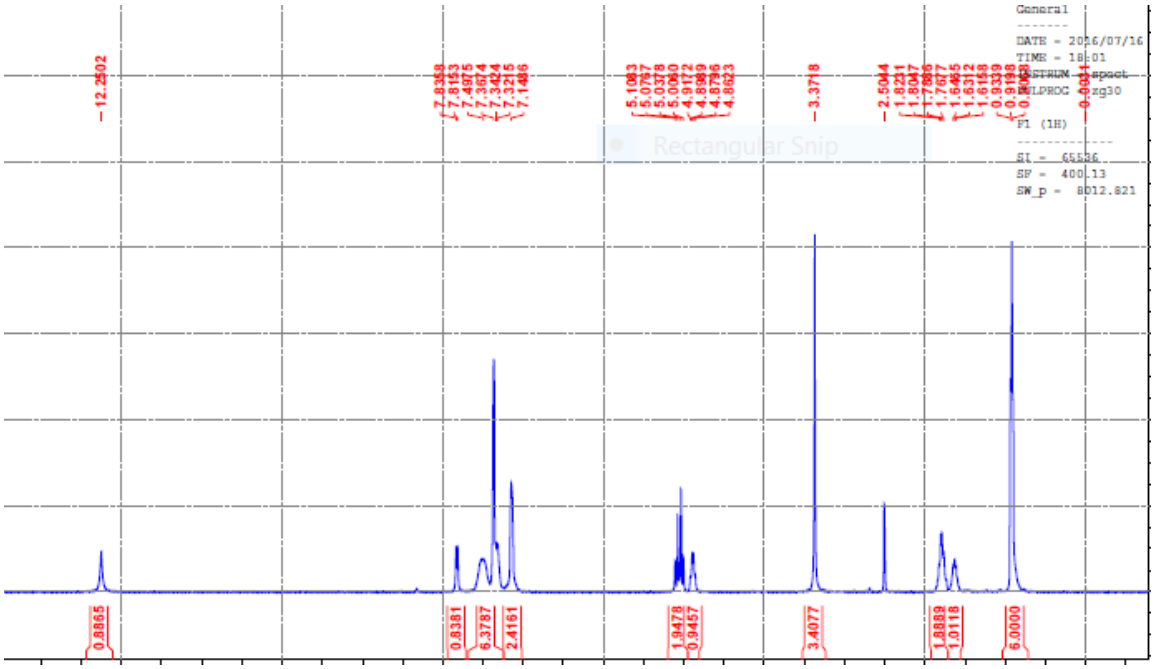


^{13}C NMR



Benzyl 1-(1*H*-benzo[*d*]imidazol-2-yl)-3-methylbutylcarbamate (24)

^{1}H NMR



^{13}C NMR