Supplementary Information

Acid-catalysed divergent synthesis of 2-substituted 1,3-benzazoles with antioxidant and mitochondrial protective effects

Kalleshappa Sheela, [a,c] Chikkappaiahnayaka Santhosh,[a] Kalleshappa Sharath,[a] Aishwarya Bharathi H M,[b] Prabitha Prabhakaran,*[b] and Maralinganadoddi P Sadashiva*[a]

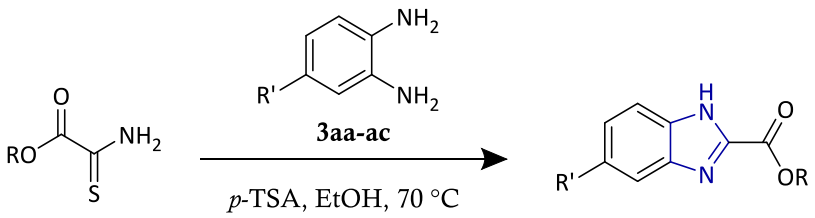
[a]Department of Studies in Chemistry, University of Mysore, Manasagangotri, Mysuru-570006, India.

[b]Department of Pharmaceutical Chemistry, JSS College of Pharmacy, JSS Academy of Higher Education & Research, Mysuru, India- 570015

[c]Department of Chemistry, IDSG Government First Grade College, Chikmagalur, Karnataka 577102, India.

E-mail: sadashivamp@chemistry.uni-mysore.ac.in; mpsadashiva@gmail.com

General Procedure for the Synthesis of Benzimidazole-2-carboxylates (4a–p)

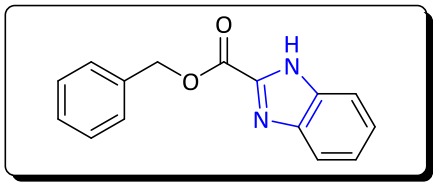


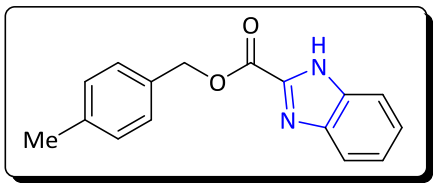
2a-m **4a-p**

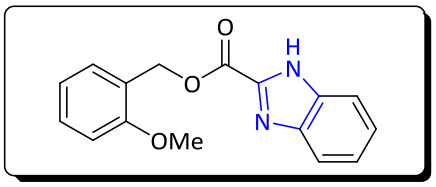
Reaction conditions: **2a**–**m** (1 mmol, 1 equiv.), **3aa**–**3ac** (1 mmol, 1 equiv.), *p*-TSA (0.1 mmol, 0.1 equiv.), EtOH (4 mL), 70 °C, 11 h.

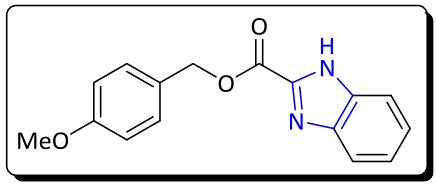
To a solution of *alkyl/arylmethyl thiooxamates* **2a**–**m** (1.0 mmol, 1.0 equiv.) and *ortho-phenylenediamines* **3aa**–**ac** (1.0 mmol, 1.0 equiv.) in ethanol (4 mL), *para-toluenesulfonic acid* (*p*-TSA) (0.1 mmol, 0.1 equiv.) was added. The resulting mixture was stirred at 70 °C in oil bath for 11 hours with continuous magnetic stirring. The reaction progress was monitored by thin-layer chromatography (TLC). Upon completion, the solvent was removed under reduced pressure and reaction mixture was extracted with ethyl acetate and water. The aqueous layer was further extracted twice with ethyl acetate. The combined organic extract was dried over anhydrous sodium sulfate (Na_2SO_4), filtered, and concentrated in vacuo to yield the crude product. The residue was then purified by silica gel column chromatography using a gradient of ethyl acetate and hexane as the eluent, affording the desired *benzimidazole-2-carboxylates* (**4a**–**p**)

Characterization details of Benzimidazole-2-carboxylates (4a–p)

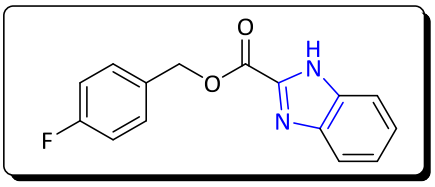
Benzyl 1H-benzo[d]imidazole-2-carboxylate (4a): Pale yellow solid; **Yield** 0.166 g (66%); mp 120-122 °C.  **^{1}H NMR** (600 MHz, DMSO-d_6): δ 13.47 (s, 1H, NH), 7.86 – 7.54 (m, 1H, Ar-H), 7.55 – 7.45 (m, 2H, Ar-H), 7.42 – 7.37 (m, 2H, Ar-H), 7.31 – 7.23 (m, 4H, Ar-H), 5.41 (s, 2H, Ar-CH_2).**^{13}C NMR** (151 MHz, DMSO-d_6): δ 159.7, 142.0, 137.9, 136.0, 129.1, 129.0, 128.9, 128.9, 128.2, 123.6, 121.3, 113.3, 67.5. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{13}N_2O_2$ 253.0977; found 253.0974

4-methylbenzyl 1H-benzo[d]imidazole-2-carboxylate (4b): Pale yellow solid; **Yield** 0.164 g (62%); mp 140-142 °C.  **^{1}H NMR** (600 MHz, DMSO-d_6): δ 13.47 (s, 1H, NH), 7.72 (d, *J* = 8.2 Hz, 1H, Ar-H), 7.53 (d, *J* = 8.2 Hz, 1H, Ar-H), 7.36 (d, *J* = 7.8 Hz, 2H, Ar-H), 7.33 (t, *J* = 7.8 Hz, 1H, Ar-H), 7.25 (t, *J* = 7.7 Hz, 1H, Ar-H), 7.19 (d, *J* = 7.6 Hz, 2H, Ar-H), 5.36 (s, 2H, Ar-CH_2), 2.27 (s, 3H, CH_3).**^{13}C NMR** (151 MHz, DMSO-d_6): δ 159.7, 143.4, 142.0, 138.3, 134.9, 133.0, 129.6, 129.2, 125.7, 123.5, 121.3, 113.3, 67.4, 21.3. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{16}H_{15}N_2O_2$ 267.1134; found 267.1130

2-methoxybenzyl 1H-benzo[d]imidazole-2-carboxylate (4c): Pale yellow solid; **Yield** 0.169 g (60%); mp 190-192 °C.  **^{1}H NMR** (400 MHz, DMSO-d_6): δ 13.50 (s, 1H, NH), 7.67 (s, 2H, Ar-H), 7.49 (dd, *J* = 7.5, 1.8 Hz, 1H, Ar-H), 7.43 – 7.21 (m, 3H, Ar-H), 7.09 (dd, *J* = 8.3, 1.0 Hz, 3H, Ar-H), 7.01 (td, *J* = 7.5, 1.1 Hz, 1H, Ar-H), 5.43 (s, 2H, Ar-CH_2), 3.83 (s, 3H, OCH_3). **^{13}C NMR** (101 MHz, DMSO-d_6): δ 159.7, 157.8, 153.4, 143.5, 141.9, 132.3, 130.6, 130.5, 125.6, 124.1, 123.5, 120.8, 113.4, 111.5, 63.0, 56.0. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{16}H_{15}N_2O_3$ 283.1083; found 283.1080

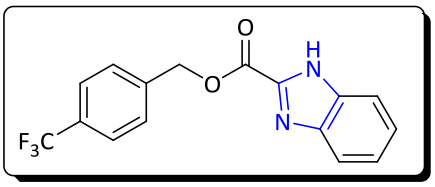
4-methoxybenzyl 1H-benzo[d]imidazole-2-carboxylate (4d): Pale yellow solid; **Yield** 0.163 g (58%); mp 185-187 °C.  **^{1}H NMR** (600 MHz, DMSO-d_6): δ 13.44 (s, 1H, 1NH), 7.71 (d, *J* = 8.2 Hz, 1H, Ar-H), 7.54 (dd, *J* = 16.6, 8.1 Hz, 1H, Ar-H), 7.42 (d, *J* = 8.4 Hz, 2H, Ar-H), 7.36 – 7.18 (m, 2H, Ar-H), 6.95 (d, *J* = 8.8 Hz, 2H, Ar-H), 5.33 (s, 2H, CH_2), 3.73 (s, 3H, OCH_3). **^{13}C NMR** (151 MHz, DMSO-d_6): δ 160.0, 159.7, 143.4, 142.1, 134.9, 131.1, 127.9, 125.7, 123.5, 121.3, 114.5, 113.3, 67.4, 55.7. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{16}H_{15}N_2O_3$ 283.1083; found 283.1081

4-fluorobenzyl 1H-benzo[d]imidazole-2-carboxylate (4e): Pale yellow solid; **Yield** 0.162 g (60%); mp 165-167 °C. **^{1}H NMR** (600 MHz, DMSO-d_6): δ 13.48 (s, 1H, NH), 7.75 – 7.70 (m, 1H, Ar-H), 7.55 (ddd, *J* = 11.7, 6.9, 4.1 Hz, 3H, Ar-H), 7.34 (s, 1H, Ar-H), 7.19 (dt, *J* = 47.2, 8.9

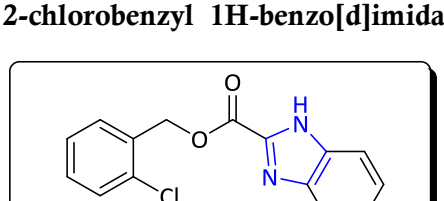


Hz, 3H, Ar-H), 5.39 (s, 2H, Ar-CH_2). **^{13}C NMR** (151 MHz, DMSO-d_6): δ 162.6 (d, *J* = 244.7 Hz), 159.6, 142.0, 132.3 (d, *J* = 3.2 Hz), 131.44 (d, *J* = 8.3 Hz), 130.57 (d, *J* = 8.2 Hz), 125.7, 123.5, 121.3, 115.93 (d, *J* = 21.4 Hz), 115.67 (d, *J* = 21.0 Hz), 113.3, 66.8. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{12}FN_2O_2$ 271.0883; found 271.0886

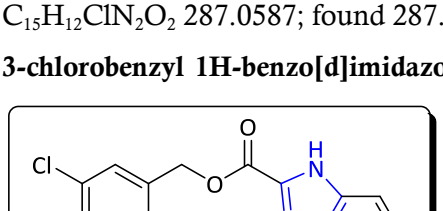
4-(trifluoromethyl)benzyl 1H-benzo[d]imidazole-2-carboxylate (4f): Pale yellow solid; **Yield** 0.188 g (59%); mp 173-175 °C. **^{1}H NMR** (400 MHz, DMSO-d_6): δ 13.40 (s, 1H, NH), 7.82-7.72 (m, 2H, Ar-H), 7.69 – 7.62 (m, 2H, Ar-H), 7.56-7.54 (m, 1H, Ar-H), 7.36 (dt, *J* = 6.1, 3.5 Hz, 2H, Ar-H), 5.55 (s, 2H, Ar-H).**^{13}C NMR** (101 MHz, DMSO-d_6): δ 159.4, 156.9, 142.8, 141.7, 140.7, 129.2, 128.3, 125.99, 125.90 (q, *J* = 3.7 Hz), 125.76, 125.72, 125.68, 123.3, 66.5. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{16}H_{12}F_3N_2O_2$ 321.0851; found 321.0855



2-chlorobenzyl 1H-benzo[d]imidazole-2-carboxylate (4g): Pale yellow solid; Yield 0.176 g (62%); mp 140-142 °C. **^{1}H NMR** (400 MHz, DMSO-d_6): δ 13.56 (s, 1H, NH), 7.81 – 7.74 (m, 1H, Ar-H), 7.73 – 7.64 (m, 1H, Ar-H), 7.62 – 7.49 (m, 2H, Ar-H), 7.49 – 7.39 (m, 2H, Ar-H), 7.39 – 7.28 (m, 2H, Ar-H), 5.52 (s, 2H, Ar-CH_2). **^{13}C NMR** (101 MHz, DMSO-d_6): δ 159.4, 149.3, 141.6, 133.4, 133.3, 131.3, 130.9, 130.0, 128.0, 125.8, 121.6, 119.6, 113.4, 64.8. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{12}ClN_2O_2$ 287.0587; found 287.0591



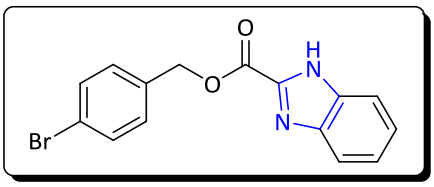
3-chlorobenzyl 1H-benzo[d]imidazole-2-carboxylate (4h): Pale yellow solid; **Yield** 0.179 g (63%); mp 130-132 °C. **^{1}H NMR** (400 MHz, DMSO-d_6): δ 13.55 (s, 1H, NH), 7.78 (d, *J* = 8.2 Hz, 1H, Ar-H), 7.64 – 7.56 (m, 2H, Ar-H), 7.53 – 7.42 (m, 3H, Ar-H), 7.46 – 7.36 (m, 1H, Ar-H), 7.33 – 7.27 (m, 1H, Ar-H), 5.45 (s, 2H, Ar-CH_2). **^{13}C NMR** (101 MHz, DMSO-d_6): δ 159.4, 153.4, 141.8, 138.4, 133.6, 131.0, 128.8, 128.5, 127.4, 125.8, 123.6, 121.2, 113.2, 66.5. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{12}ClN_2O_2$ 287.0587; found 287.0590



4-chlorobenzyl 1H-benzo[d]imidazole-2-carboxylate (4i): Pale yellow solid; **Yield** 0.182 g (64%); mp 135-137 °C. **^{1}H NMR** (400 MHz, DMSO-d_6): δ 13.53 (s, 1H, NH), 7.75 (t, 2H, Ar-H), 7.57 (d, *J* = 8.6 Hz, 2H, Ar-H), 7.51 (d, *J* = 8.4 Hz, 2H, Ar-H), 7.47 – 7.33 (m, 2H, Ar-H), 5.45 (s, 2H, Ar-CH_2). **^{13}C NMR** (151 MHz, DMSO-d_6): δ 159.5, 156.9, 144.3, 141.8, 136.9, 135.0, 133.5, 130.8, 130.0, 129.0, 128.8, 125.7,

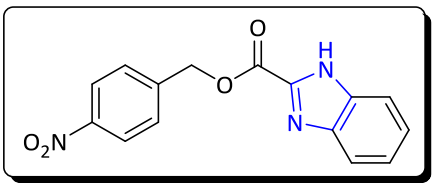
66.6. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{12}ClN_2O_2$ 287.0587; found 287.0592

4-bromobenzyl 1H-benzo[d]imidazole-2-carboxylate (4j): Pale yellow solid; **Yield** 0.207 g



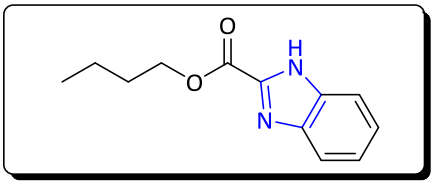
(63%); mp 155-157 °C. **^{1}H NMR** (400 MHz, DMSO-d_6): δ 13.48 (s, 1H, NH), 7.76 – 7.71 (m, 1H, Ar-H), 7.64 (d, *J* = 8.4 Hz, 3H, Ar-H), 7.49 (d, *J* = 8.2 Hz, 1H, Ar-H), 7.41 – 7.11 (m, 3H, Ar-H), 5.39 (s, 2H, Ar-CH_2). **^{13}C NMR** (151 MHz, DMSO-d_6): δ 159.5, 141.8, 135.4, 131.9, 131.7, 131.0, 130.3, 125.8, 123.5, 122.0, 121.4, 113.2, 66.6. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{12}BrN_2O_2$ 331.0082; found 331.0080

4-nitrobenzyl 1H-benzo[d]imidazole-2-carboxylate (4k): Pale yellow solid; **Yield** 0.163 g



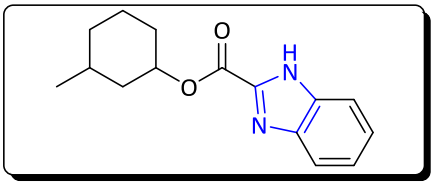
(55%); mp 197-198 °C. **^{1}H NMR** (600 MHz, DMSO-d_6): δ 13.50 (s, 1H, NH), 8.26 (d, *J* = 8.8 Hz, 2H, Ar-H), 7.77 (d, *J* = 8.8 Hz, 2H, Ar-H), 7.71 (d, *J* = 7.9 Hz, 1H, Ar-H), 7.53 (dd, *J* = 20.5, 8.4 Hz, 1H, Ar-H), 7.28 – 7.20 (m, 1H, Ar-H), 5.56 (s, 2H, Ar-CH_2). **^{13}C NMR** (151 MHz, DMSO-d_6): δ 160.6, 144.3, 144.0, 135.2, 129.7, 129.4, 129.2, 127.0, 126.9, 124.1, 113.3, 112.6, 67.7. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{12}N_3O_4$ 298.0828; found 298.0830

Butyl 1H-benzo[d]imidazole-2-carboxylate (4l): Pale yellow solid; **Yield** 0.131 g (62%); mp



127-129 °C. **^{1}H NMR** (400 MHz, DMSO-d_6): δ 13.45 (s, 1H, NH), 7.71 – 7.66 (m, 2H, Ar-H), 7.38 – 7.31 (m, 2H, Ar-H), 4.38 (t, *J* = 6.6 Hz, 2H, CH_2), 1.80 – 1.68 (m, 2H, CH_2), 1.45 (h, *J* = 7.3 Hz, 2H, CH_2), 0.95 (t, *J* = 7.3 Hz, 3H, CH_3). **^{13}C NMR** (101 MHz, DMSO-d_6): δ 159.8, 143.3, 142.1, 134.9, 125.3, 123.5, 121.1, 113.2, 65.7, 30.6, 19.1, 14.0. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{12}H_{15}N_2O_2$ 219.1134; found 219.1130

3-methylcyclohexyl 1H-benzo[d]imidazole-2-carboxylate (4m): Pale yellow solid; **Yield** 0.165 g



(64%); mp 120-122 °C. **^{1}H NMR** (600 MHz, DMSO-d_6): δ 13.41 (s, 1H, NH), 8.14 (dt, *J* = 7.9, 2.0 Hz, 1H, Ar-H), 7.85 (ddd, *J* = 8.5, 7.1, 1.6 Hz, 1H, Ar-H), 7.79 (ddd, *J* = 8.3, 5.4, 1.2 Hz, 1H, Ar-H), 7.61 (ddd, *J* = 8.2, 7.1, 1.3 Hz, 1H, Ar-H), 4.85 (td, *J* = 11.0, 5.5 Hz, 1H, CH), 2.04 – 1.80 (m, 3H, CH_2), 1.77 – 1.44 (m, 4H, CH_2), 1.41 – 1.23 (m, 2H, CH_2), 1.14 (q, *J* = 11.9 Hz, 1H, CH), 0.89 (d, *J* = 6.6 Hz, 3H, CH_3). **^{13}C NMR** (151 MHz, DMSO-d_6): δ 161.6, 160.1, 147.8, 144.2, 135.4, 129.0, 126.6, 123.5, 76.4, 33.9, 31.3, 31.2, 23.9, 22.6, 20.6. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{19}N_2O_2$ 259.1447; found 259.1443

2,6-dichlorobenzyl 1H-benzo[d]imidazole-2-carboxylate (4n): Pale yellow solid; **Yield** 0.185 g (61%); mp 170-172 °C. **^{1}H NMR** (400 MHz, DMSO-d_6): δ 13.55 (s, 1H, NH), 7.74 (d, *J* = 8.3 Hz, 1H, Ar-H), 7.67 – 7.58 (m, 2H, Ar-H), 7.55 – 7.43 (m, 2H, Ar-H), 7.40 – 7.28 (m, 2H, Ar-H), 5.64 (s, 2H, Ar-CH_2). **^{13}C NMR** (101 MHz, DMSO-d_6): δ 159.4, 143.3, 141.3, 136.7, 132.5, 130.8, 129.3, 129.0, 125.8, 123.6, 121.2, 113.2, 62.6. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{11}Cl_2N_2O_2$ 321.0198; found 321.0202

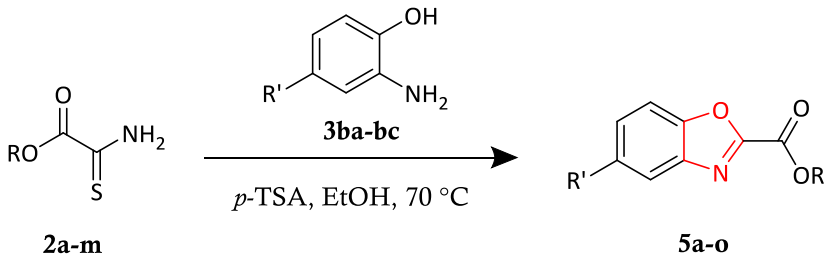
Benzyl 5-methyl-1H-benzo[d]imidazole-2-carboxylate (4o): Pale yellow solid; **Yield** 0.164 g (62%); mp 166-168 °C. **^{1}H NMR** (400 MHz, DMSO-d_6): δ 13.37 (s, 1H, NH), 8.17 – 8.09 (m, 1H, Ar-H), 7.75 (d, *J* = 8.9 Hz, 1H, Ar-H), 7.48 – 7.33 (m, 1H, Ar-H), 7.30 – 7.07 (m, 5H, Ar-H), 5.49 (s, 2H, Ar-CH_2), 2.29 (s, 3H, CH_3). **^{13}C NMR** (101 MHz, DMSO-d_6): δ 157.1, 143.1, 141.5, 137.4, 134.8, 130.2, 129.3, 128.3, 127.7, 127.4, 126.8, 118.4, 65.2, 21.2. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{16}H_{15}N_2O_2$ 267.1134; found 267.1132

Benzyl 5-nitro-1H-benzo[d]imidazole-2-carboxylate (4p): Pale yellow solid; **Yield** 0.154 g (52%); mp 173-175 °C. **^{1}H NMR** (400 MHz, DMSO-d_6): δ 13.60 (s, 1H, NH), 8.20 (dd, *J* = 9.0, 2.3 Hz, 1H, Ar-H), 7.81 (d, *J* = 9.0 Hz, 1H, Ar-H), 7.53 (d, *J* = 7.3 Hz, 2H, Ar-H), 7.48 – 7.24 (m, 2H, Ar-H), 5.47 (s, 2H, Ar-CH_2). **^{13}C NMR** (101 MHz, DMSO-d_6): δ 158.9, 157.1, 146.1, 144.4, 137.8, 135.6, 129.1, 129.0, 129.0, 128.8, 128.2, 128.1, 67.9. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{12}N_3O_4$ 298.0828; found 298.0833

Benzyl 2-(phenylamino)-2-thioxoacetate (7a): Yellow gummy solid; **Yield** 0.211 g (78%). **^{1}H NMR** (400 MHz, $CDCl_3$): δ 10.57 (s, 1H, NH), 8.08 – 7.91 (m, 2H, Ar-H), 7.56 – 7.36 (m, 7H, Ar-H), 7.36 – 7.30 (m, 1H, Ar-H), 5.42 (s, 2H, CH_2). **^{13}C NMR** (101 MHz, $CDCl_3$): δ 178.9, 159.5, 137.7, 134.5, 129.1, 128.8, 128.8, 128.4, 127.4, 122.0, 69.7. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{14}NO_2S$ 272.0745; found 272.0741

Benzyl 2-thioxo-2-(*o*-tolylamino)acetate (7b) Yellow gummy solid; **Yield** 0.230 g (81%). **^{1}H NMR** (400 MHz, $CDCl_3$): δ 10.39 (s, 1H, NH), 8.11 – 7.95 (m, 1H, Ar-H), 7.52 (dd, *J* = 8.0, 1.7 Hz, 1H, Ar-H), 7.49 – 7.37 (m, 4H, Ar-H), 7.34 – 7.30 (m, 2H, Ar-H), 7.14 – 6.97 (m, 1H, Ar-H), 5.44 (s, 2H, CH_2).**^{13}C NMR** (101 MHz, $CDCl_3$): δ 180.6, 159.4, 131.1, 130.5, 128.8, 128.4, 128.1, 1267.0, 126.8, 124.2, 118.7, 115.0, 69.6, 17.7. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{16}H_{16}NO_2S$ 286.0902; found 286.0906

General Procedure for the Synthesis of Benzoxazole-2-carboxylates (5a–o)



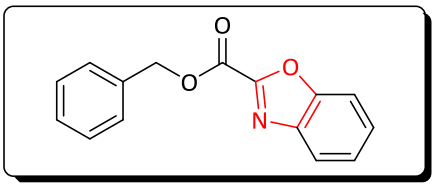
2a-m **5a-o**

Reaction condition: **2a–m** (1 mmol, 1 equiv.), **3ba–3bc** (1 mmol, 1 equiv.), *p*-TSA (0.1 mmol, 0.1 equiv.), EtOH (4 mL), 70 °C, 11 h.

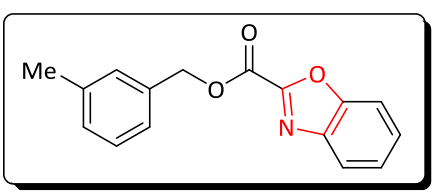
To a solution of *alkyl/arylmethyl thiooxamates* **2a–m** (1.0 mmol, 1.0 equiv.) and *ortho-aminophenols* **3ba–bc** (1.0 mmol, 1.0 equiv.) in ethanol (4 mL), *para-toluenesulfonic acid* (*p*-TSA) (0.1 mmol, 0.1 equiv.) was added. The resulting mixture was stirred at 70 °C in oil bath for 11 hours with continuous magnetic confrontation. The reaction progress was monitored by thin-layer chromatography (TLC). Upon completion, the solvent was removed under reduced pressure and reaction mixture was extracted with ethyl acetate and water. The aqueous layer was further extracted twice with ethyl acetate. The combined organic extract was dried over anhydrous sodium sulfate (Na_2SO_4), filtered, and concentrated in vacuo to yield the crude product. The residue was then purified by silica gel column chromatography using a gradient of ethyl acetate and hexane as the eluent, affording the desired *benzoxazole-2-carboxylates* (**5a–o**)

Characterization details of Benzoxazole-2-carboxylates (5a–o)

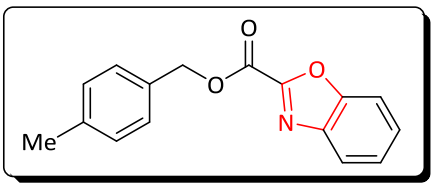
Benzyl benzo[d]oxazole-2-carboxylate (5a): Brown solid; **Yield** 0.177 g (70%); mp 73-75 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 7.87 (dt, *J* = 8.0, 1.0 Hz, 1H, Ar-H), 7.63 (dt, *J* = 8.3, 0.9 Hz, 1H, Ar-H), 7.54 – 7.47 (m, 3H, Ar-H), 7.46 – 7.33 (m, 4H, Ar-H), 5.50 (s, 2H, Ar-CH_2). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 156.5, 152.7, 151.0, 140.6, 134.5, 129.1, 129.0, 128.9, 128.3, 128.3, 125.9, 122.3, 122.2, 111.8, 68.7. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{12}NO_3$ 254.0817; found 254.0814



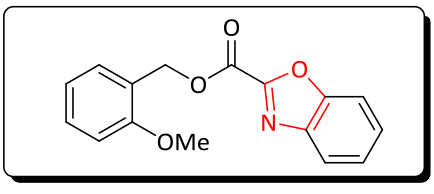
3-methylbenzyl benzo[d]oxazole-2-carboxylate (5b): Brown solid; **Yield** 0.178 g (67%); mp 90-92 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 7.88 (ddd, *J* = 8.1, 1.3, 0.7 Hz, 1H, Ar-H), 7.64 (dt, *J* = 8.3, 0.9 Hz, 1H, Ar-H), 7.51 (ddd, *J* = 8.4, 7.3, 1.3 Hz, 1H, Ar-H), 7.44 (ddd, *J* = 8.3, 7.3, 1.1 Hz, 1H, Ar-H), 7.25 (s, 3H, Ar-H), 7.17 (ddt, *J* = 7.1, 1.7, 0.9 Hz, 1H, Ar-H), 5.47 (s, 2H, Ar-CH_2), 2.36 (s, 3H, CH_3). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 156.5, 152.7, 151.0, 140.6, 138.6, 134.4, 129.8, 129.8, 128.8, 128.3, 126.2, 125.9, 122.3, 111.8, 68.8, 21.4. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{16}H_{14}NO_3$ 268.0974; found 268.0977

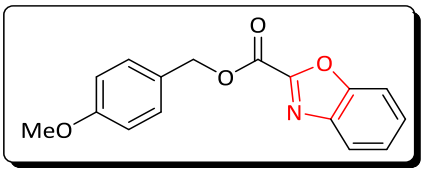


4-methylbenzyl benzo[d]oxazole-2-carboxylate (5c): Brown solid; **Yield** 0.181 g (68%); mp 95-97 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 7.87 (ddd, *J* = 8.0, 1.2, 0.7 Hz, 1H, Ar-H), 7.64 (dt, *J* = 8.3, 0.9 Hz, 1H, Ar-H), 7.51 (ddd, *J* = 8.4, 7.3, 1.3 Hz, 1H, Ar-H), 7.45 – 7.42 (m, 1H, Ar-H), 7.40 (d, *J* = 8.0 Hz, 2H, Ar-H), 7.19 (d, *J* = 7.6 Hz, 2H, Ar-H), 5.46 (s, 2H, Ar-CH_2), 2.35 (s, 3H, CH_3). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 156.5, 152.8, 151.0, 140.6, 139.0, 131.5, 129.5, 129.3, 128.3, 125.9, 122.3, 111.8, 68.7, 21.4. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{16}H_{14}NO_3$ 268.0974; found 268.0979

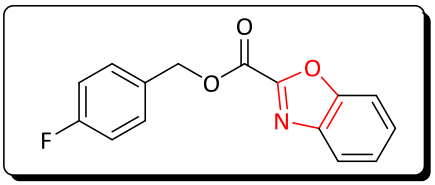


2-methoxybenzyl benzo[d]oxazole-2-carboxylate (5d): Gummy solid; **Yield** 0.189 g (67%); mp 110-112 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 7.87 (dt, *J* = 7.9, 0.9 Hz, 1H, Ar-H), 7.64 (dt, *J* = 8.4, 0.9 Hz, 1H, Ar-H), 7.54 – 7.48 (m, 1H, Ar-H), 7.47 – 7.42 (m, 2H, Ar-H), 7.34 (ddd, *J* = 8.3, 7.5, 1.8 Hz, 1H, Ar-H), 6.97 (td, *J* = 7.5, 1.0 Hz, 1H, Ar-H), 6.91 (dd, *J* = 8.3, 1.0 Hz, 1H, Ar-H), 5.56 (s, 2H, Ar-CH_2), 3.85 (s, 3H, OCH_3). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 158.0, 156.6, 152.9, 151.0, 140.7, 130.7, 130.4, 128.2, 125.8, 122.8, 122.2, 120.6, 111.8, 110.7, 64.4, 55.6. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{16}H_{14}NO_4$ 284.0923; found 284.0919

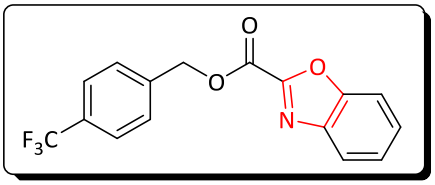


4-methoxybenzyl benzo[d]oxazole-2-carboxylate (5e): Brown solid; **Yield** 0.186 g (66%); mp 100-102 °C. 

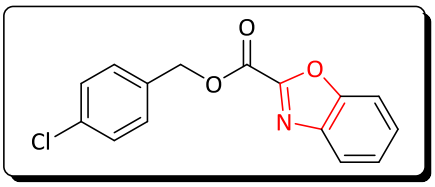
^{1}H NMR (600 MHz, $CDCl_3$): δ 7.42 (m, 1H, Ar-H), 7,35 (m, 1H, Ar-H), 7.30 (d, *J* = 7.6 Hz, 2H, Ar-H), 7.03-6.95 (m, 1H, Ar-H), 6.88 (m, 3H, Ar-H), 5.41 (s, 2H, Ar-CH_2), 3.80 (s, 3H, OCH_3). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 159.8, 156.8, 131.0, 130.9, 130.2, 128.4, 127.3, 127.0, 114.6, 114.4, 114.1, 114.0, 66.9, 55.5. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{16}H_{14}NO_4$ 284.0923; found 284.0921

4-fluorobenzyl benzo[d]oxazole-2-carboxylate (5f): Brown solid; **Yield** 0.176 g (65%); mp 85-87 °C. 

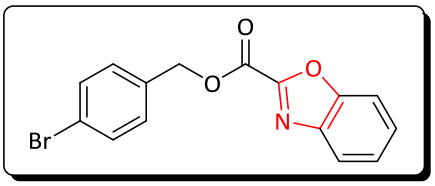
^{1}H NMR (600 MHz, $CDCl_3$): δ 7.88 (dt, *J* = 8.0, 1.0 Hz, 1H, Ar-H), 7.64 (dt, *J* = 8.2, 0.9 Hz, 1H, Ar-H), 7.55 – 7.41 (m, 4H, Ar-H), 7.08 (t, *J* = 8.7 Hz, 2H, Ar-H), 5.46 (s, 2H, Ar-CH_2). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 163.2 (d, *J*= 247.9 Hz), 156.4, 152.6, 151.0, 140.6, 131.2 (d, *J* = 8.3 Hz), 130.37 (d, *J* = 3.5 Hz), 128.4, 125.9, 122.3, 115.9 (d, *J* = 21.7 Hz), 111.9 68.0. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{11}FNO_3$ 272.0723; found 272.0725

4-(trifluoromethyl)benzyl benzo[d]oxazole-2-carboxylate (5g): Brown solid; **Yield** 0.202 g (63%); mp 90-92 °C. 

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.93 (dt, *J* = 7.9, 1.1 Hz, 1H, Ar-H), 7.73 – 7.63 (m, 5H, Ar-H), 7.57 (ddd, *J* = 8.4, 7.4, 1.3 Hz, 1H, Ar-H), 7.49 (td, *J* = 7.7, 1.2 Hz, 1H, Ar-H), 5.59 (s, 2H, Ar-CH_2). **^{13}C NMR** (101 MHz, $CDCl_3$): δ 156.2, 152.3, 151.0, 140.5, 138.3, 131.3, 128.9, 128.4, 125.9, 125.8 (d, *J* = 3.8 Hz), 122.3, 117.8, 111.8, 67.5. (The outer lines of the expected quartets and the large ^{1}J(C–F) coupling were not clearly observed, likely due to their low intensity). **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{16}H_{11}F_3NO_3$ 322.0691; found 322.0696.

4-chlorobenzyl benzo[d]oxazole-2-carboxylate (5h): Brown solid; Yield 0.185 g (65%); mp 97-100 °C. 

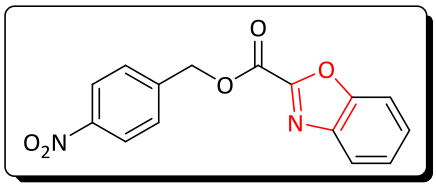
^{1}H NMR (600 MHz, $CDCl_3$): δ 7.88 (ddd, *J* = 8.1, 1.2, 0.7 Hz, 1H, Ar-H), 7.65 (dt, *J* = 8.3, 0.9 Hz, 1H, Ar-H), 7.55 – 7.49 (m, 3H, Ar-H), 7.45 (ddd, *J* = 8.3, 7.3, 1.1 Hz, 1H, Ar-H), 7.38 (d, *J* = 8.4 Hz, 2H, Ar-H), 5.45 (s, 2H, Ar-CH_2). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 156.4, 152.5, 151.0, 140.6, 133.5, 132.1, 130.7, 128.5, 126.0, 123.2, 122.3, 111.9, 67.9. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{11}ClNO_3$ 288.0427; found 288.0431



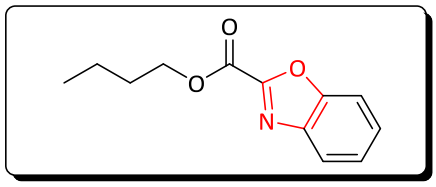
4-bromobenzyl benzo[d]oxazole-2-carboxylate (5i): Brown solid; **Yield** 0.217 g (66%); mp 100-102 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 7.88 (ddd, *J* = 8.1, 1.2, 0.7 Hz,

1H, Ar-H), 7.65 (dt, *J* = 8.3, 0.9 Hz, 1H, Ar-H), 7.57 – 7.48 (m, 3H, Ar-H), 7.45 (ddd, *J* = 8.3, 7.3, 1.1 Hz, 1H, Ar-H), 7.38 (d, *J* = 8.4 Hz, 2H, Ar-H), 5.45 (s, 2H, Ar-CH_2). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 156.4, 152.5, 151.0, 140.6, 133.5, 132.1, 130.7, 128.4, 126.0, 123.2, 122.3, 111.9, 67.9. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{11}BrNO_3$ 331.9922; found 331.9925

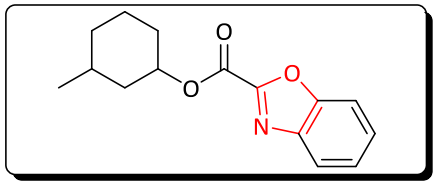
4-nitrobenzyl benzo[d]oxazole-2-carboxylate (5j): Brown solid; **Yield** 0.184 g (62%); mp 117-119 °C. **^{1}H NMR** (400 MHz, $CDCl_3$): δ 8.29 – 8.23 (m, 1H, Ar-H), 7.97 (dd, *J* = 7.8, 1.6 Hz, 1H, Ar-H), 7.65 (q, *J* = 8.4 Hz, 4H, Ar-H), 7.60 – 7.50 (m, 2H, Ar-H), 5.56 (s, 2H, Ar-CH_2). **^{13}C NMR** (101 MHz, $CDCl_3$): δ 160.4, 157.5, 153.2, 138.8, 136.8, 128.7, 127.8, 127.2, 125.7, 125.7, 125.6, 122.1, 67.3. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{11}N_2O_5$ 299.0668; found 299.0672



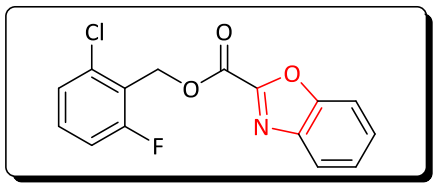
Butyl benzo[d]oxazole-2-carboxylate (5k): Brown solid; **Yield** 0.148 g (68%); mp 135-137 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 7.89 (ddd, *J* = 8.0, 1.2, 0.7 Hz, 1H, Ar-H), 7.65 (dt, *J* = 8.2, 1.0 Hz, 1H, Ar-H), 7.51 (ddd, *J* = 8.4, 7.3, 1.3 Hz, 1H, Ar-H), 7.44 (ddd, *J* = 8.3, 7.4, 1.1 Hz, 1H, Ar-H), 4.49 (t, *J* = 6.8 Hz, 2H, CH_2), 1.87 – 1.79 (m, 2H, CH_2), 1.49 (h, *J* = 7.4 Hz, 2H, CH_2), 0.98 (t, *J* = 7.4 Hz, 3H, CH_3). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 156.7, 152.9, 151.0, 140.6, 128.2, 125.8, 122.3, 111.8, 67.2, 30.6, 19.1, 13.7. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{12}H_{14}NO_3$ 220.0974; found 220.0970



3-methylcyclohexyl benzo[d]oxazole-2-carboxylate (5l): Brown gummy solid; **Yield** 0.173 g (67%); mp 110-112 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 7.88 (ddt, *J* = 8.1, 7.2, 1.1 Hz, 1H, Ar-H), 7.64 (dt, *J* = 8.3, 0.9 Hz, 1H, Ar-H), 7.49 (ddd, *J* = 8.3, 7.3, 1.2 Hz, 1H, Ar-H), 7.42 (ddd, *J* = 8.2, 7.4, 1.1 Hz, 1H, Ar-H), 5.44 (p, *J* = 3.6 Hz, 1H, CH), 2.26 – 1.89 (m, 2H, CH_2), 1.87 – 1.53 (m, 4H, CH_2), 1.52 – 1.19 (m, 2H, CH_2), 1.09 – 0.98 (m, 1H, CH), 0.91 (d, *J* = 6.8 Hz, 3H, CH_3). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 156.2, 153.3, 150.9, 140.8, 128.0, 125.7, 122.2, 111.8, 74.3, 38.2, 33.9, 29.9, 27.1, 22.0, 20.7. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{18}NO_3$ 260.1287; found 260.1290

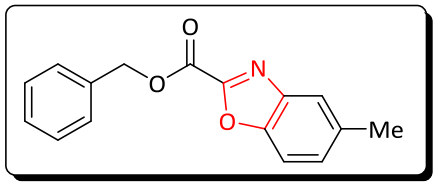


2-chloro-6-fluorobenzyl benzo[d]oxazole-2-carboxylate (5m): Brown solid; **Yield** 0.197 g (65%); mp 87-90 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 7.87 (ddd, *J* = 8.1, 1.2, 0.7 Hz, 1H, Ar-H), 7.64 (dt, *J* = 8.3, 0.9 Hz, 1H, Ar-H), 7.51 (ddd, *J* = 8.4, 7.3, 1.2 Hz, 1H, Ar-H), 7.43 (ddd, *J* = 8.2, 7.3, 1.0 Hz, 1H, Ar-H), 7.33 (td, *J* = 8.3, 6.0 Hz, 1H, Ar-H), 7.26 (t, *J* = 1.1 Hz, 1H, Ar-H), 7.06 (ddd, *J* = 9.4, 8.5, 1.2 Hz, 1H, Ar-H), 5.67 (d, *J* = 4.4 Hz, Ar-CH_2). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 162.4 (d, *J*= 253.0 Hz), 156.3, 152.4, 151.0, 140.6, 136.9 (d, *J* = 4.6 Hz), 131.6 (d, *J* = 9.8 Hz), 128.4, 125.9, 125.7 (d, *J* = 3.5

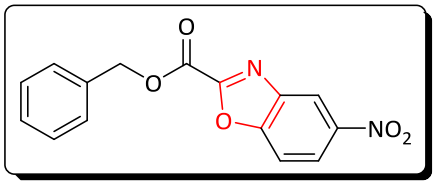


Hz), 122.3, 120.4 (d, J = 16.6 Hz), 114.6 (d, J = 22.4 Hz), 111.9, 59.6 (d, J = 4.7 Hz). **HRMS** (ESI-TOF) m/z: $[M + H]^+$ calcd for $C_{15}H_{10}ClFNO_3$ 306.0333; found 306.0337

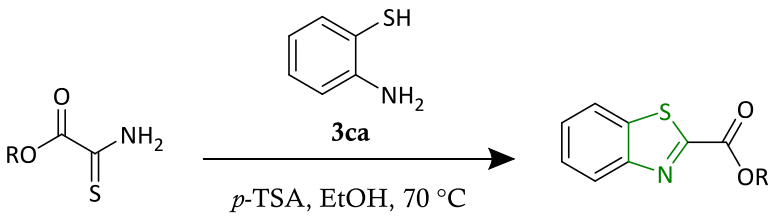
Benzyl 5-methylbenzo[d]oxazole-2-carboxylate (5n): Brown solid; Yield 0.170 g (64%); mp 110-112 °C. **^{1}H NMR** (400 MHz, $CDCl_3$): δ 7.70 – 7.65 (m, 1H, Ar-H), 7.54 (d, J = 8.4 Hz, 3H, Ar-H), 7.46 – 7.38 (m, 3H, Ar-H), 7.35 (dd, J = 8.5, 1.7 Hz, 1H, Ar-H), 5.53 (s, 2H, Ar-CH_2), 2.52 (s, 3H, CH_3). **^{13}C NMR** (101 MHz, $CDCl_3$): δ 156.5, 152.6, 149.2, 140.8, 135.9, 134.5, 129.7, 129.0, 128.9, 128.8, 121.7, 111.1, 68.6, 21.5. **HRMS** (ESI-TOF) m/z: $[M + H]^+$ calcd for $C_{16}H_{14}NO_3$ 268.0974; found 268.0979



Benzyl 5-nitrobenzo[d]oxazole-2-carboxylate (5o): Brown solid; **Yield** 0.178 g (60%); mp 130-132 °C. **^{1}H NMR** (400 MHz, $CDCl_3$): δ 8.81 (d, J = 2.3 Hz, 1H, Ar-H), 8.50 (dd, J = 9.1, 2.3 Hz, 1H, Ar-H), 7.82 (d, J = 9.0 Hz, 1H, Ar-H), 7.58 – 7.50 (m, 2H, Ar-H), 7.50 – 7.33 (m, 3H, Ar-H), 5.57 (s, 2H, Ar-CH_2). **^{13}C NMR** (101 MHz, $CDCl_3$): δ 155.5, 155.2, 154.0, 146.2, 140.8, 133.9, 129.2, 129.1, 128.9, 123.8, 118.7, 112.3, 69.3. **HRMS** (ESI-TOF) m/z: $[M + H]^+$ calcd for $C_{15}H_{11}N_2O_5$ 299.0668; found 299.0672



General Procedure for the Synthesis of Benzothiazole-2-carboxylates (6a–m)



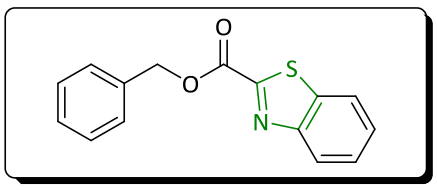
2a-m **5a-m**

Reaction condition: **2a–m** (1 mmol, 1 equiv.), **3ca** (1 mmol, 1 equiv.), *p*-TSA (0.1 mmol, 0.1 equiv.), EtOH (4 mL), 70 °C, 11 h.

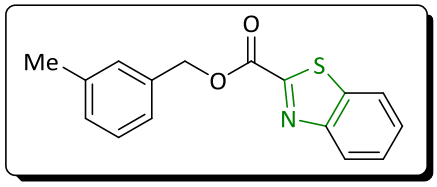
To a solution of *alkyl/arylmethyl thiooxamates* **2a–m** (1.0 mmol, 1.0 equiv.) and *ortho-aminothiophenol* **3ca** (1.0 mmol, 1.0 equiv.) in ethanol (4 mL), *para-toluenesulfonic acid* (*p*-TSA) (0.1 mmol, 0.1 equiv.) was added. The resulting mixture was stirred at 70 °C in oil bath for 11 hours with continuous magnetic confrontation. The reaction progress was monitored by thin-layer chromatography (TLC). Upon completion, the solvent was removed under reduced pressure and reaction mixture was extracted with ethyl acetate and water. The aqueous layer was further extracted twice with ethyl acetate. The combined organic extract was dried over anhydrous sodium sulfate (Na_2SO_4), filtered, and concentrated in vacuo to yield the crude product. The residue was then purified by silica gel column chromatography using a gradient of ethyl acetate and hexane as the eluent, affording the desired *benzothiazole-2-carboxylates* (**6a–m**)

Characterization details of Benzothiazole-2-carboxylates (6a–m)

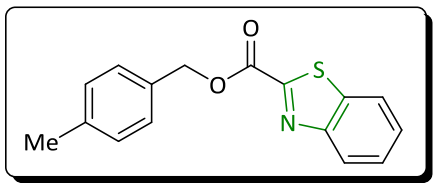
Benzyl benzo[d]thiazole-2-carboxylate (6a): White solid; **Yield** 0.196 g (73%); mp 65-67 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 8.26 – 8.21 (m, 1H, Ar-H), 7.95 (td, *J* = 7.9, 0.7 Hz, 1H, Ar-H), 7.61 – 7.49 (m, 4H, Ar-H), 7.42 – 7.32 (m, 3H, Ar-H), 5.50 (s, 2H, Ar-CH_2). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 160.6, 158.1, 153.3, 136.9, 134.9, 128.9, 128.9, 128.8, 127.7, 127.2, 125.7, 122.2, 68.6. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{12}NO_2S$ 270.0589; found 270.0593



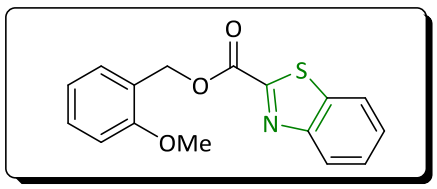
3-methylbenzyl benzo[d]thiazole-2-carboxylate (6b): White solid; **Yield** 0.192 g (68%); mp 83-85 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 8.24 (ddd, *J* = 8.2, 1.3, 0.7 Hz, 1H, Ar-H), 7.95 (ddd, *J* = 7.9, 1.4, 0.7 Hz, 1H, Ar-H), 7.60 – 7.50 (m, 2H, Ar-H), 7.33 – 7.25 (m, 3H, Ar-H), 7.19 – 7.14 (m, 1H, Ar-H), 5.47 (s, 2H, Ar-CH_2), 2.36 (s, 3H, CH_3). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 160.6, 158.2, 153.3, 138.5, 136.9, 134.8, 129.6, 128.7, 127.7, 127.2, 126.0, 125.7, 122.2, 68.7, 21.5. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{16}H_{14}NO_2S$ 284.0745; found 284.0747



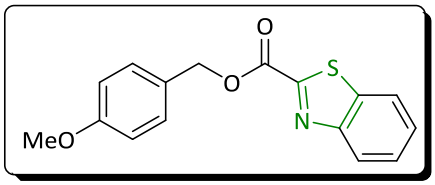
4-methylbenzyl benzo[d]thiazole-2-carboxylate (6c): White solid; **Yield** 0.198 g (70%); mp 69-71 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 8.23 (ddd, *J* = 8.2, 1.3, 0.7 Hz, 1H, Ar-H), 7.94 (ddd, *J* = 8.0, 1.4, 0.7 Hz, 1H, Ar-H), 7.54 (dddd, *J* = 24.7, 8.3, 7.2, 1.3 Hz, 2H, Ar-H), 7.39 (d, *J* = 8.1 Hz, 2H, Ar-H), 7.19 (d, *J* = 7.6 Hz, 2H, Ar-H), 5.46 (s, 2H, Ar-CH_2), 2.35 (s, 3H, CH_3). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 160.6, 158.3, 153.3, 138.8, 136.9, 131.9, 129.5, 129.1, 127.7, 127.2, 125.6, 122.2, 68.6, 21.3. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{16}H_{14}NO_2S$ 284.0745; found 284.0749



2-methoxybenzyl benzo[d]thiazole-2-carboxylate (6d): White solid; **Yield** 0.197 g (66%); mp 100-101 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 8.24 (ddd, *J* = 8.2, 1.4, 0.7 Hz, 1H, Ar-H), 7.95 (ddd, *J* = 7.9, 1.4, 0.7 Hz, 1H, Ar-H), 7.54 (dddd, *J* = 24.3, 8.3, 7.1, 1.3 Hz, 2H, Ar-H), 7.45 (dd, *J* = 7.5, 1.7 Hz, 1H, Ar-H), 7.33 (ddd, *J* = 8.2, 7.5, 1.8 Hz, 1H, Ar-H), 6.97 (td, *J* = 7.5, 1.0 Hz, 1H, Ar-H), 6.90 (dd, *J* = 8.4, 1.0 Hz, 1H, Ar-H), 5.56 (s, 2H, Ar-CH_2), 3.85 (s, 3H, OCH_3). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 160.6, 158.4, 157.8, 153.3, 136.9, 130.2, 130.2, 127.6, 127.1, 125.7, 123.3, 122.1, 120.6, 110.6, 64.2, 55.6. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{16}H_{14}NO_3S$ 300.0694; found 300.0699

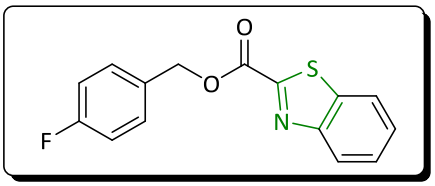


4-methoxybenzyl benzo[d]thiazole-2-carboxylate (6e): Gummy solid; **Yield** 0.188 g (63%); mp 110-112 °C. **^{1}H NMR** (400 MHz, $CDCl_3$): δ 8.30 – 8.23 (m, 1H, Ar-H), 8.01 – 7.95 (m, 1H, Ar-

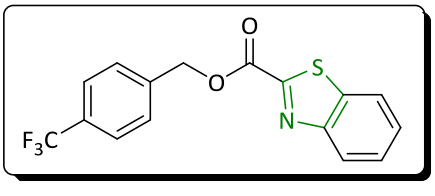


H), 7.64 – 7.51 (m, 2H, Ar-H), 7.48 (d, *J* = 8.7 Hz, 2H, Ar-H), 6.94 (d, *J* = 8.7 Hz, 2H, Ar-H), 5.48 (s, 2H, Ar-CH_2), 3.84 (s, 3H, OCH_3). **^{13}C NMR** (101 MHz, $CDCl_3$): δ 160.6, 160.1, 158.3, 153.2, 136.8, 130.8, 127.6, 127.1, 127.0, 125.6, 122.1, 114.1, 68.4, 55.3. **HRMS** (ESI-TOF) *m/z*: [M + H]$^+$ calcd for $C_{16}H_{14}NO_3S$ 300.0694; found 300.0698

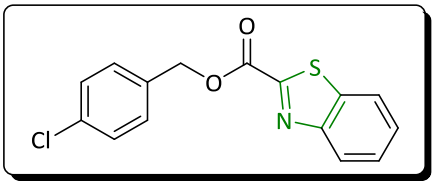
4-fluorobenzyl benzo[d]thiazole-2-carboxylate (6f): White solid; **Yield** 0.192 g (67%); mp 63-65 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 8.25 – 8.20 (m, 1H, Ar-H), 7.95 (ddd, *J* = 7.9, 1.4, 0.7 Hz, 1H, Ar-H), 7.59 – 7.45 (m, 4H, Ar-H), 7.06 (t, *J* = 8.7 Hz, 2H, Ar-H), 5.46 (s, 2H, Ar-CH_2). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 163.1 (d, *J* = 247.8 Hz), 160.6, 158.1, 153.3, 136.9, 131.1 (d, *J* = 8.2 Hz), 130.8 (d, *J* = 3.3 Hz), 127.8, 127.3, 125.7, 122.2, 115.8 (d, *J* = 21.6 Hz), 67.9. **HRMS** (ESI-TOF) *m/z*: [M + H]$^+$ calcd for $C_{15}H_{11}FNO_2S$ 288.0495; found 288.0501



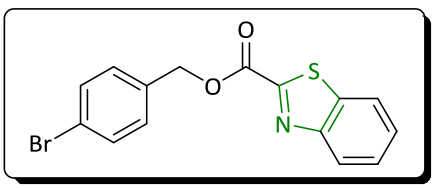
4-(trifluoromethyl)benzyl benzo[d]thiazole-2-carboxylate (6g): White solid; **Yield** 0.212 g (63%); mp 77-79 °C. **^{1}H NMR** (400 MHz, $CDCl_3$): δ 8.29 – 8.23 (m, 1H, Ar-H), 7.97 (dd, *J* = 7.8, 1.5 Hz, 1H, Ar-H), 7.65 (q, *J* = 8.4 Hz, 4H, Ar-H), 7.59 – 7.49 (m, 2H, Ar-H), 5.48 (s, 2H, Ar-CH_2). **^{13}C NMR** (101 MHz, $CDCl_3$): δ 160.4, 157.6, 153.2, 138.8, 136.8, 128.7, 127.8, 127.3, 125.8, 125.7, 125.7 (d, *J* = 3.7 Hz), 125.6, 122.1, 67.4. (The outer lines of the expected quartets and the large ^{1}J(C–F) coupling were not clearly observed, likely due to their low intensity). **HRMS** (ESI-TOF) *m/z*: [M + H]$^+$ calcd for $C_{16}H_{11}F_3NO_2S$ 338.0463; found 338.0466.



4-chlorobenzyl benzo[d]thiazole-2-carboxylate (6h): White solid; **Yield** 0.208 g (69%); mp 80-82 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 8.23 (ddd, *J* = 8.2, 1.3, 0.7 Hz, 1H, Ar-H), 7.95 (ddd, *J* = 7.9, 1.4, 0.7 Hz, 1H, Ar-H), 7.60 – 7.50 (m, 2H, Ar-H), 7.43 (d, *J* = 8.5 Hz, 2H, Ar-H), 7.35 (d, *J* = 8.4 Hz, 2H, Ar-H), 5.45 (s, 2H, Ar-CH_2). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 160.5, 157.9, 153.3, 136.9, 134.9, 133.4, 130.3, 129.0, 127.8, 127.3, 125.7, 122.2, 67.7. **HRMS** (ESI-TOF) m/z: [M + H]$^+$ calcd for $C_{15}H_{11}ClNO_2S$ 304.0199; found 304.0202

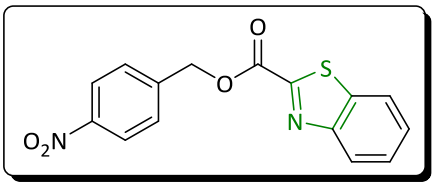


4-bromobenzyl benzo[d]oxazole-2-carboxylate (6i): White solid; **Yield** 0.242 g (70%); mp 87-89 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 8.26 (m, 1H, Ar-H), 7.98 (m, 1H, Ar-H), 7.62– 7.57 (m, 2H, Ar-H), 7.54 (d, *J* = 6.7 Hz, 2H, Ar-H), 7.40 (d, *J* = 6.8 Hz, 2H, Ar-H), 5.47 (s, 2H, Ar-CH_2). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 160.4, 157.8,

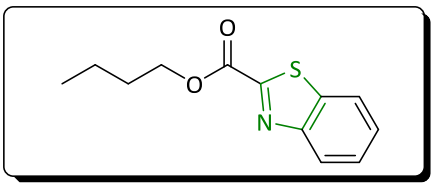


153.2, 136.8, 133.8, 131.9, 130.5, 127.7, 127.2, 125.6, 122.9, 122.1, 67.6. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{11}BrNO_2S$ 347.9694; found 347.9697

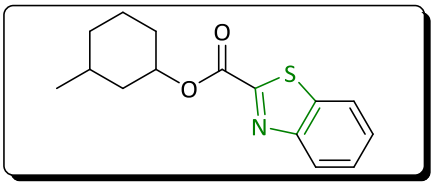
4-nitrobenzyl benzo[d]thiazole-2-carboxylate (6j): White solid; **Yield** 0.188 g (60%); mp 89-91 °C. **^{1}H NMR** (400 MHz, $CDCl_3$): δ 8.33 – 8.23 (m, 3H, Ar-H), 8.05 – 7.96 (m, 1H, Ar-H), 7.70 (d, *J* = 8.8 Hz, 2H, Ar-H), 7.74 – 7.53 (m, 2H, Ar-H), 5.63 (s, 2H, Ar-CH_2). **^{13}C NMR** (101 MHz, $CDCl_3$): δ 160.3, 157.3, 153.2, 148.1, 141.9, 136.9, 128.9, 128.0, 127.4, 125.7, 124.0, 122.2, 66.8. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{11}N_2O_4S$ 315.0440; found 315.0444



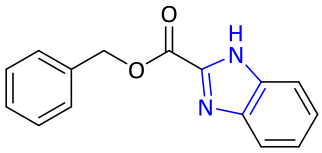
Butyl benzo[d]thiazole-2-carboxylate (6k): Brown gummy solid; **Yield** 0.164 g (70%); mp 110-112 °C. **^{1}H NMR** (400 MHz, $CDCl_3$): δ 8.23 (dd, *J* = 7.6, 1.4 Hz, 1H, Ar-H), 7.94 (dd, *J* = 8.2, 1.3 Hz, 1H, Ar-H), 7.60 – 7.46 (m, 2H, Ar-H), 4.48 (t, *J* = 6.8 Hz, 2H, CH_2), 1.88 – 1.77 (m, 2H, CH_2), 1.48 (h, *J* = 7.3 Hz, 2H, CH_2), 0.98 (t, *J* = 7.4 Hz, 3H, CH_3). **^{13}C NMR** (101 MHz, $CDCl_3$): δ 160.6, 158.4, 153.2, 136.7, 127.5, 127.1, 125.5, 122.0, 66.9, 30.6, 19.1, 13.7. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{12}H_{14}NO_2S$ 236.0745; found 236.0741



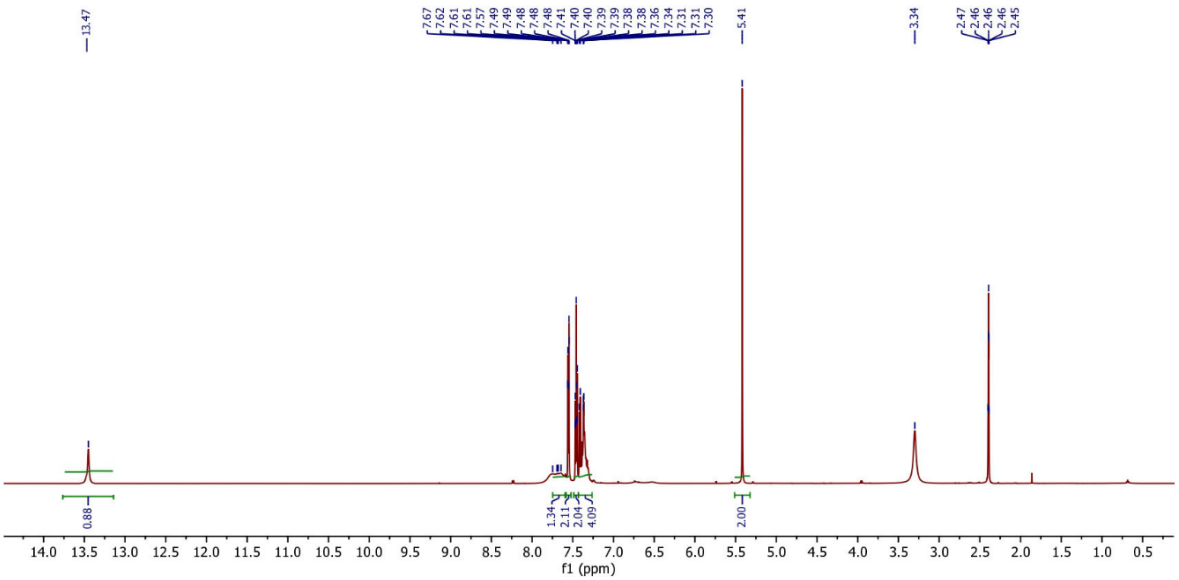
3-methylcyclohexyl benzo[d]thiazole-2-carboxylate (6l): White solid; **Yield** 0.186 g (68%); mp 78-80 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 8.24 (ddd, *J* = 8.1, 1.3, 0.7 Hz, 1H, Ar-H), 7.94 (ddd, *J* = 7.9, 1.4, 0.7 Hz, 1H, Ar-H), 7.73 – 7.43 (m, 2H, Ar-H), 5.38 – 5.01 (m, 1H, CH), 2.24 – 2.08 (m, 2H, CH_2), 1.84 (dt, *J* = 13.5, 3.3 Hz, 1H, CH), 1.73 – 1.62 (m, 1H, CH), 1.58 – 1.45 (m, 2H, CH_2), 1.43 – 1.35 (m, 1H, CH), 1.31 – 1.21 (m, 2H, CH_2), 0.96 (d, *J* = 6.5 Hz, 3H, CH_3). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 160.2, 159.1, 153.4, 136.8, 127.5, 127.1, 125.6, 122.1, 76.6, 40.3, 33.9, 31.5, 31.4, 24.0, 22.3. **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{18}NO_2S$ 276.1058; found 276.1061



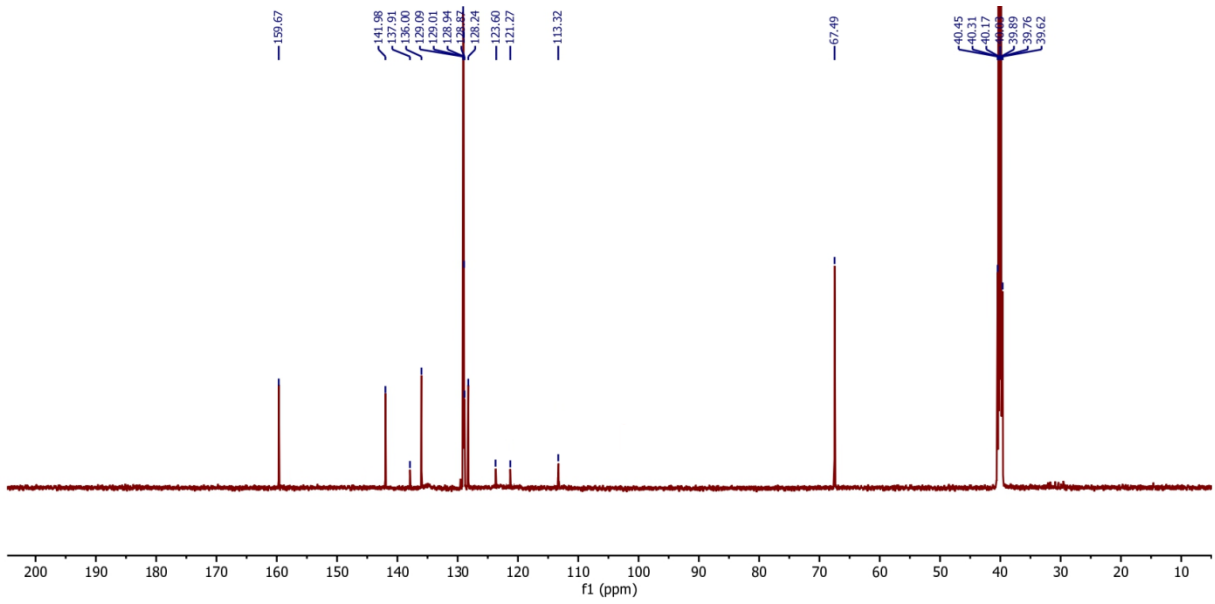
2-chloro-6-fluorobenzyl benzo[d]thiazole-2-carboxylate (6m): White solid; **Yield** 0.214 g (67%); mp 91-93 °C. **^{1}H NMR** (600 MHz, $CDCl_3$): δ 8.22 (ddd, *J* = 8.2, 1.4, 0.7 Hz, 1H, Ar-H), 7.93 (ddd, *J* = 7.9, 1.4, 0.7 Hz, 1H, Ar-H), 7.57 – 7.48 (m, 2H, Ar-H), 7.31 (td, *J* = 8.2, 5.9 Hz, 1H, Ar-H), 7.27 – 7.22 (m, 1H, Ar-H), 7.05 (ddd, *J* = 9.4, 8.3, 1.2 Hz, 1H, Ar-H), 5.65 (d, *J* = 1.7 Hz, 2H, Ar-CH_2). **^{13}C NMR** (151 MHz, $CDCl_3$): δ 162.3 (d, *J* = 252.9 Hz), 160.4, 157.7, 153.3, 136.9, 136.8 (d, *J* = 4.8 Hz), 131.4 (d, *J* = 9.6 Hz), 127.7, 127.2, 125.73, 125.71, 122.1, 120.8 (d, *J* = 17.3 Hz), 114.5 (d, *J* = 22.4 Hz), 59.5 (d, *J* = 4.4 Hz). **HRMS** (ESI-TOF) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{10}ClFNO_2S$ 322.0105; found 322.0111



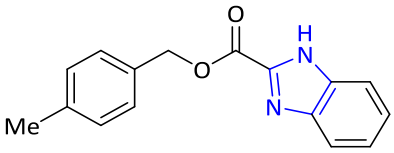
Benzyl 1H-benzo[d]imidazole-2-carboxylate (4a)



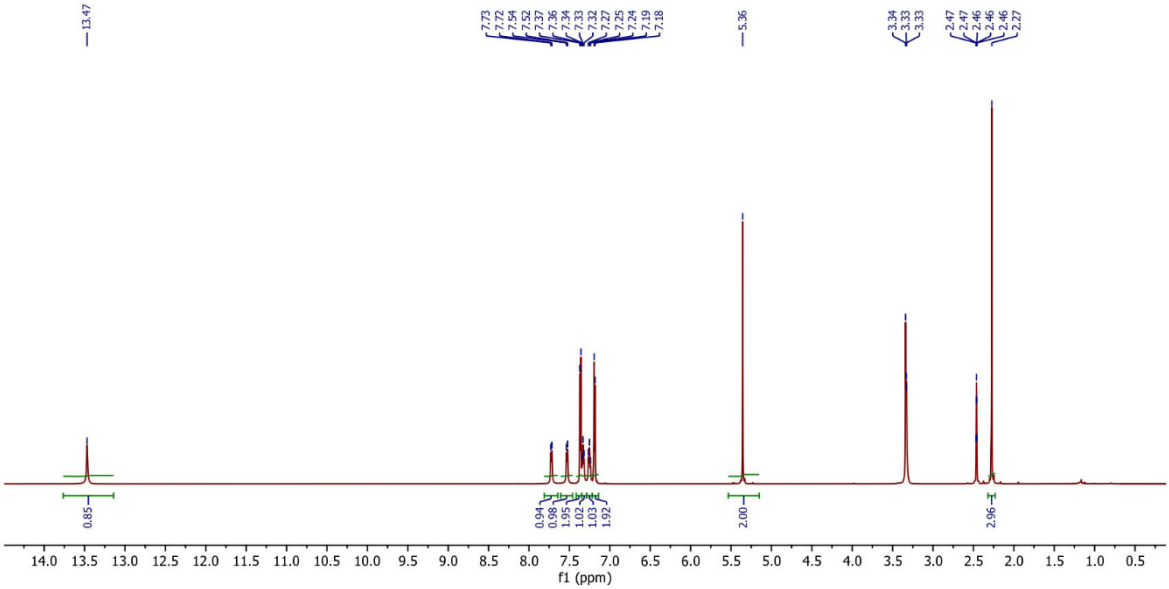
^{1}H NMR Spectrum of **4a** (600 MHz, DMSO-d_6)



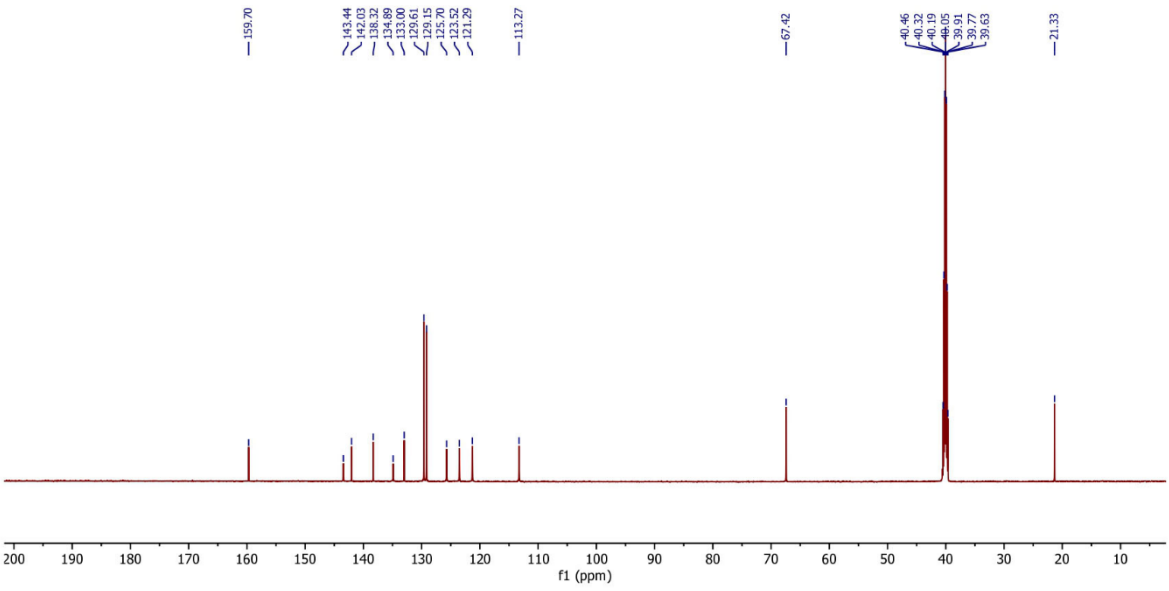
^{13}C NMR Spectrum of **4a** (151 MHz, DMSO-d_6)



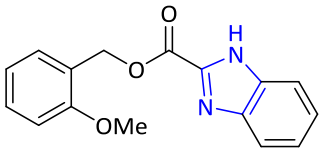
4-methylbenzyl 1H-benzo[d]imidazole-2-carboxylate (4b)



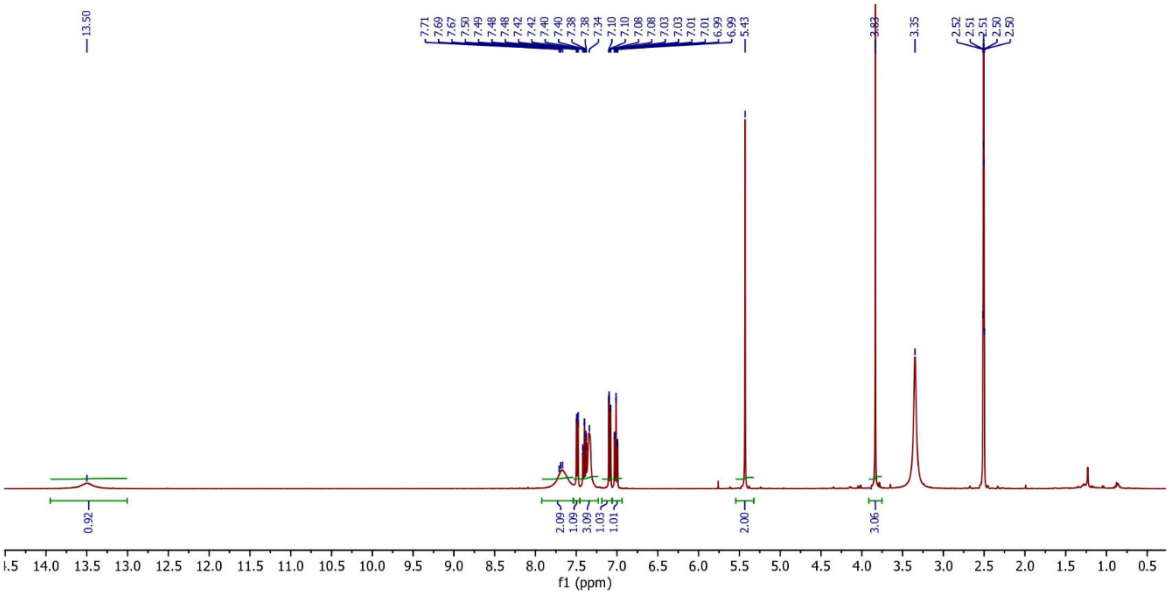
^{1}H NMR Spectrum of **4b** (600 MHz, DMSO-d_6)



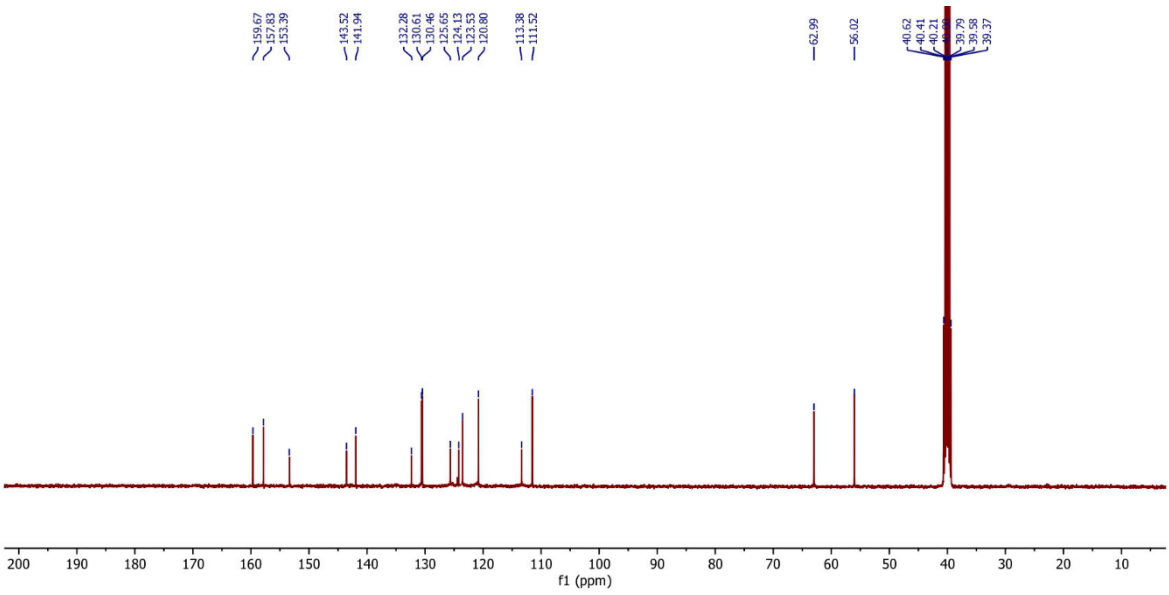
^{13}C NMR Spectrum of **4b** (151 MHz, DMSO-d_6)



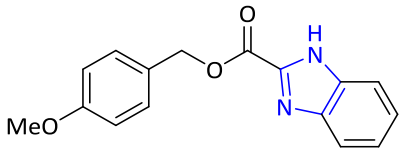
2-methoxybenzyl 1H-benzo[d]imidazole-2-carboxylate (4c)



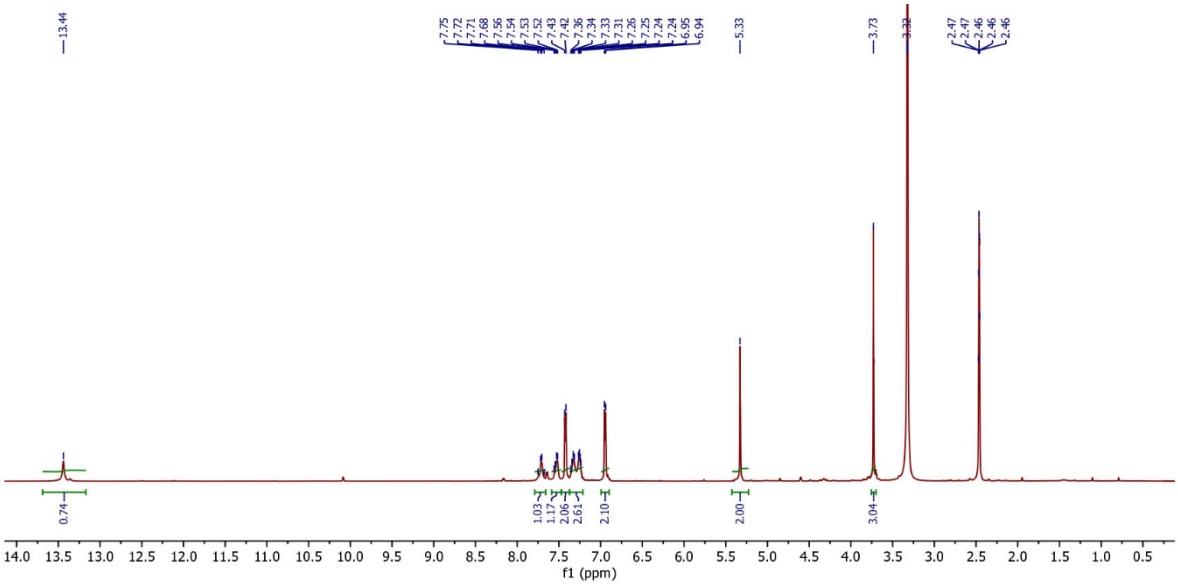
^{1}H NMR Spectrum of **4c** (400 MHz, DMSO-d_6)



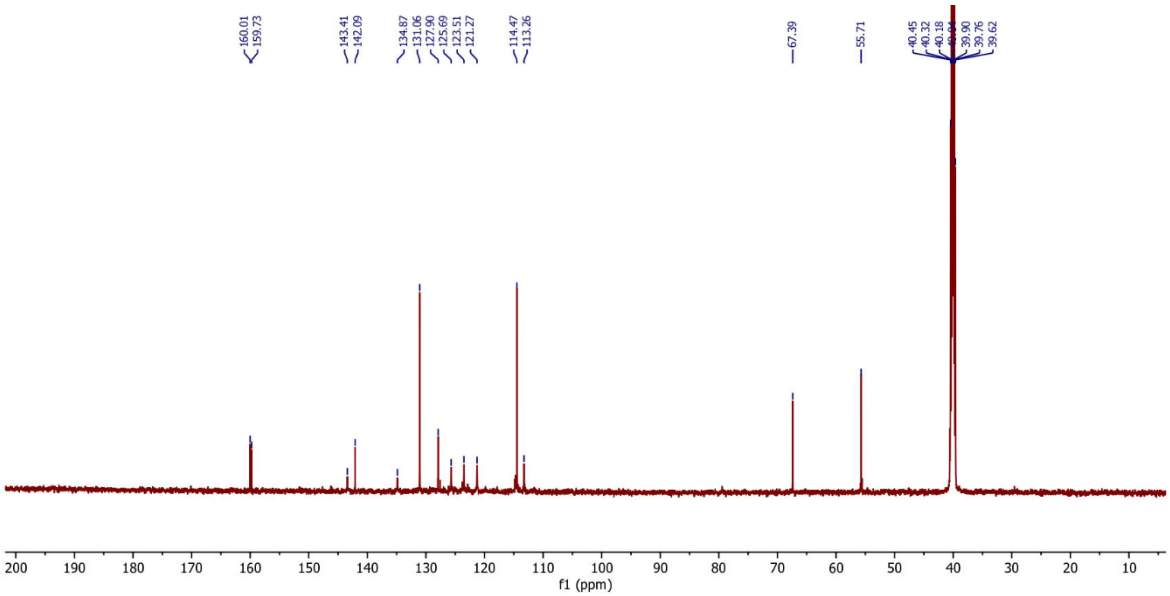
^{13}C NMR Spectrum of **4c** (101 MHz, DMSO-d_6)



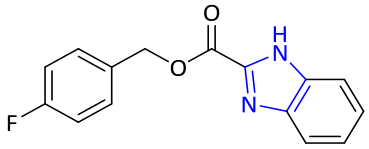
4-methoxybenzyl 1H-benzo[d]imidazole-2-carboxylate (4d)



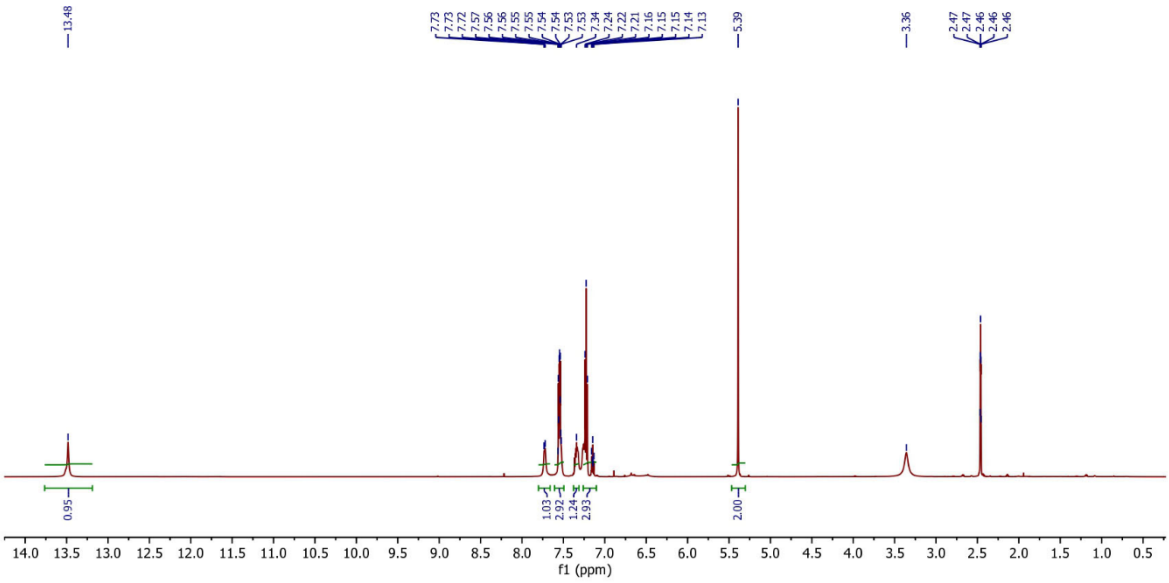
^{1}H NMR Spectrum of **4d** (600 MHz, DMSO-d_6)



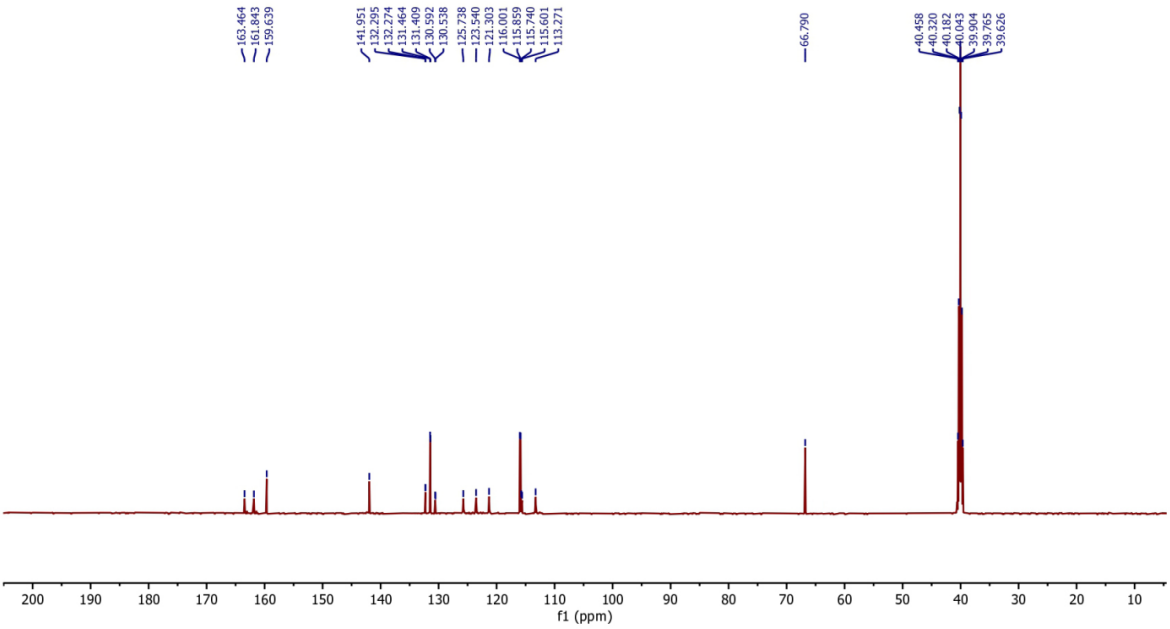
^{13}C NMR Spectrum of **4d** (151 MHz, DMSO-d_6)



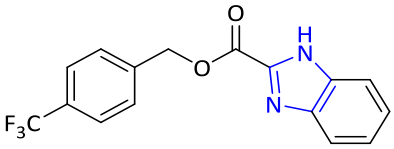
4-fluorobenzyl 1H-benzo[d]imidazole-2-carboxylate (4e)



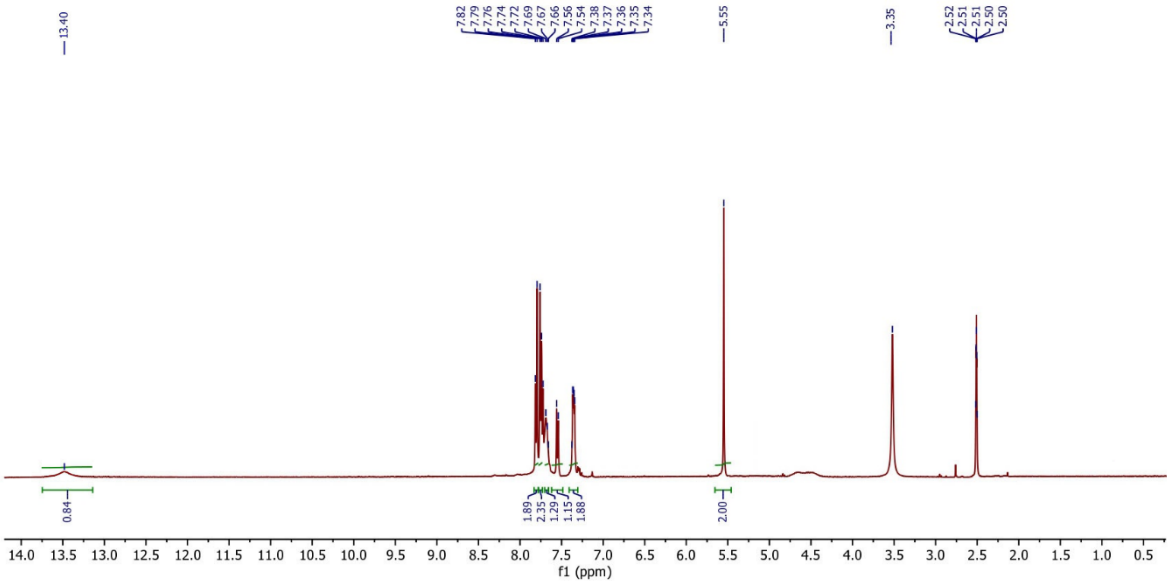
^{1}H NMR Spectrum of **4e** (600 MHz, DMSO-d_6)



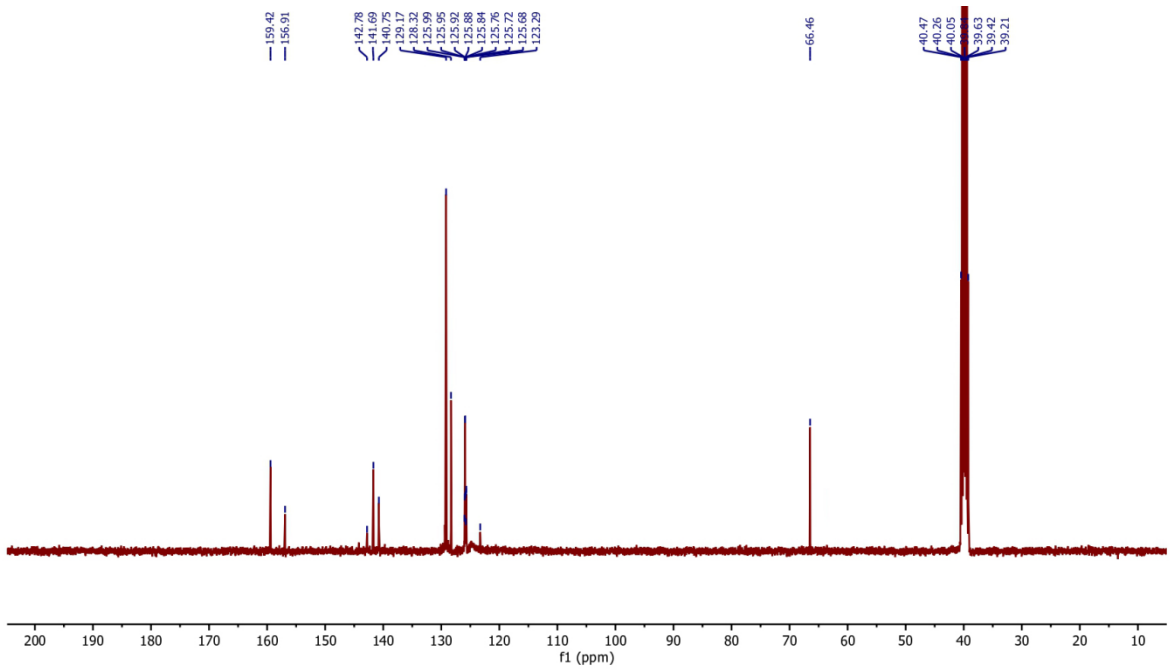
^{13}C NMR Spectrum of **4e** (151 MHz, DMSO-d_6)



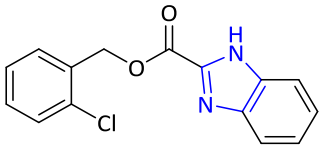
4-(trifluoromethyl)benzyl 1H-benzo[d]imidazole-2-carboxylate (4f)



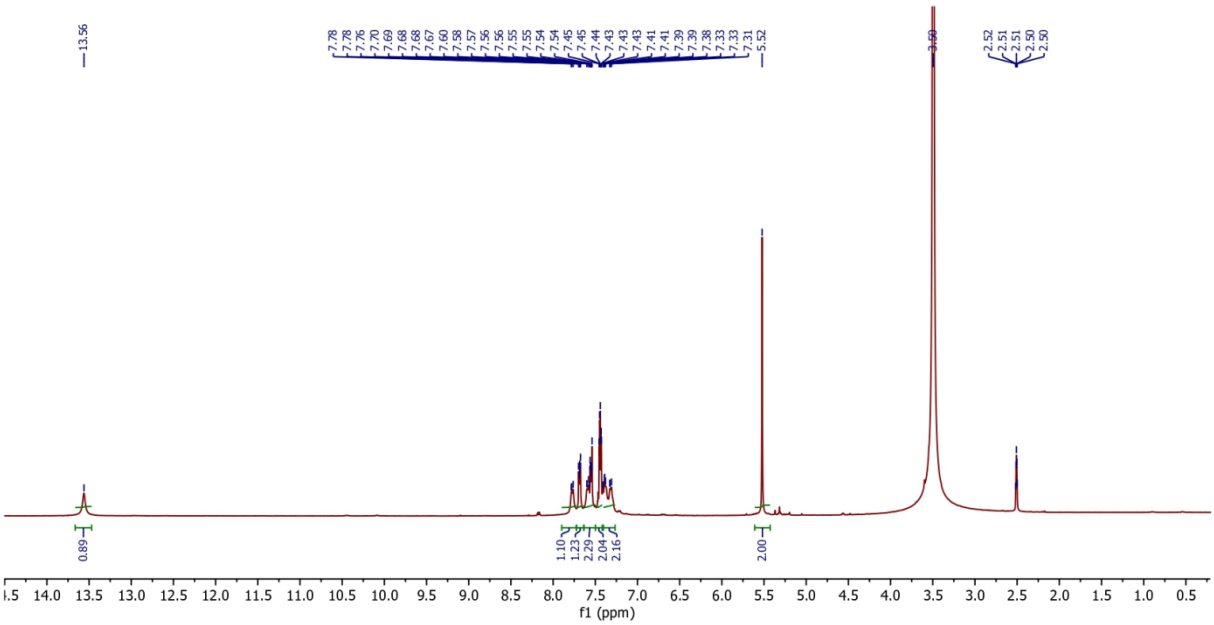
^{1}H NMR Spectrum of **4f** (400 MHz, DMSO-d_6)



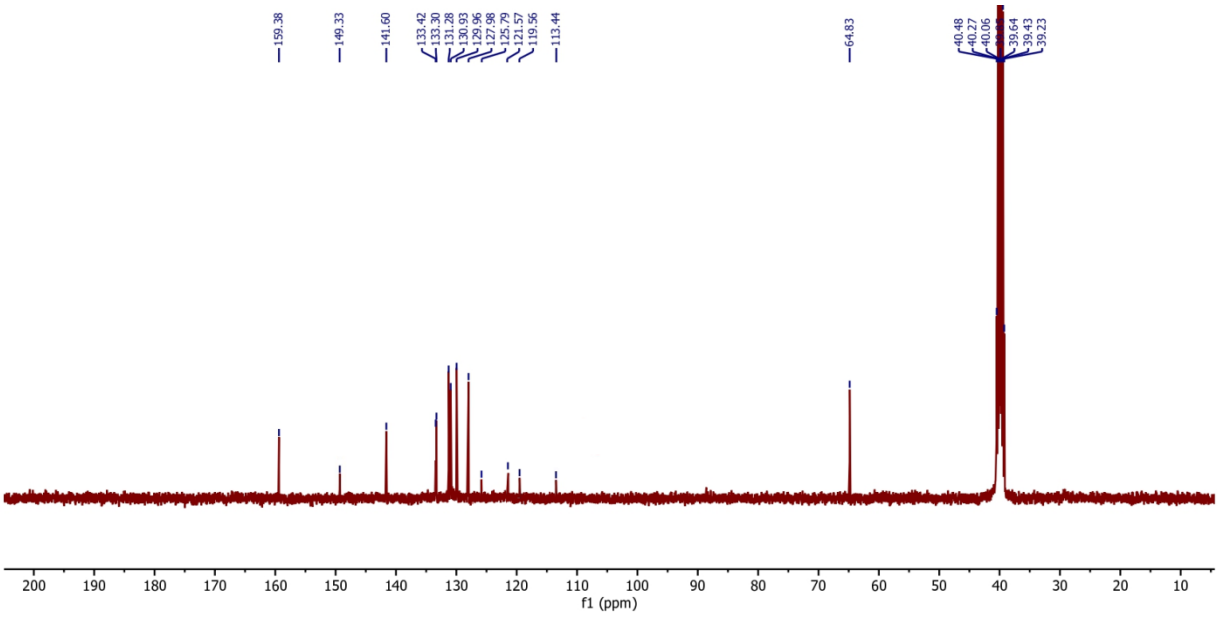
^{13}C NMR Spectrum of **4f** (101 MHz, DMSO-d_6)



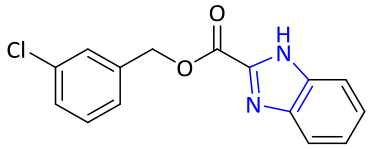
2-chlorobenzyl 1H-benzo[d]imidazole-2-carboxylate (4g)



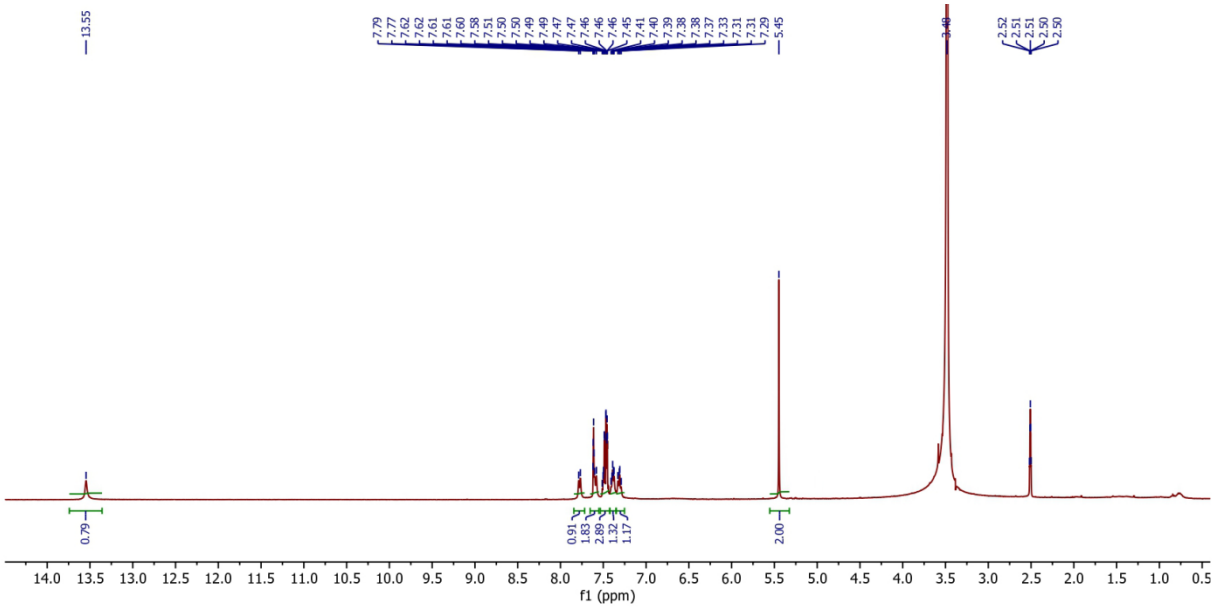
^{1}H NMR Spectrum of **4g** (400 MHz, DMSO-d_6)



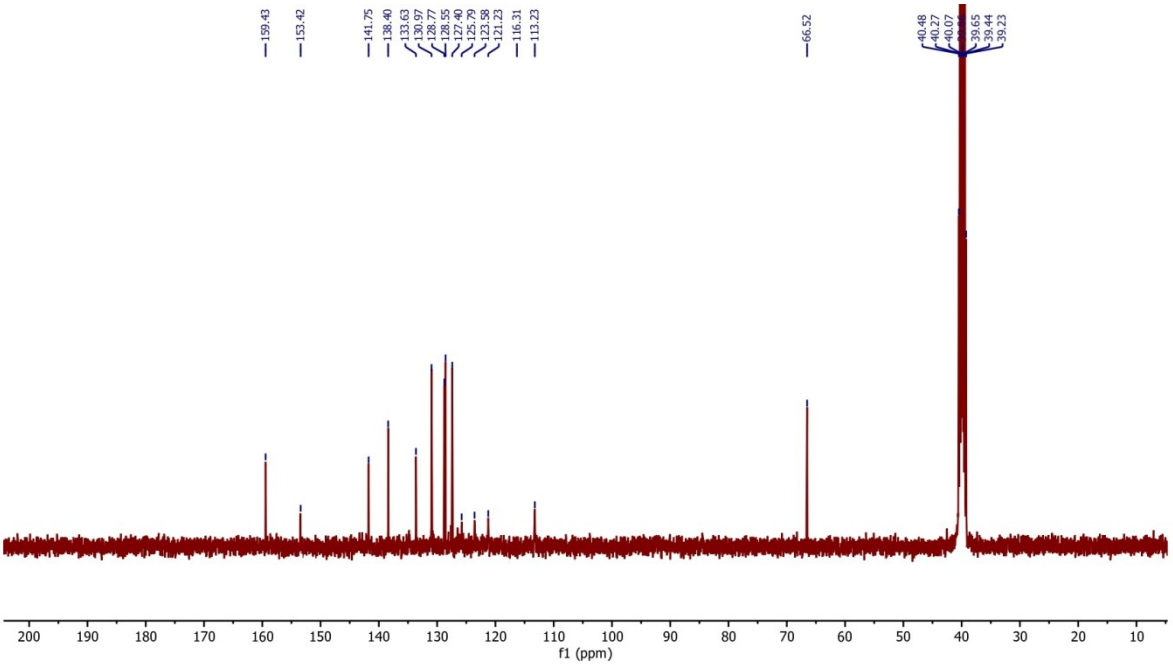
^{13}C NMR Spectrum of **4g** (101 MHz, DMSO-d_6)



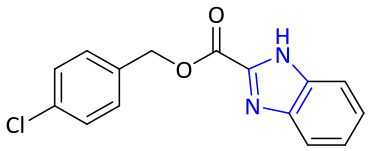
3-chlorobenzyl 1H-benzo[d]imidazole-2-carboxylate (4h)



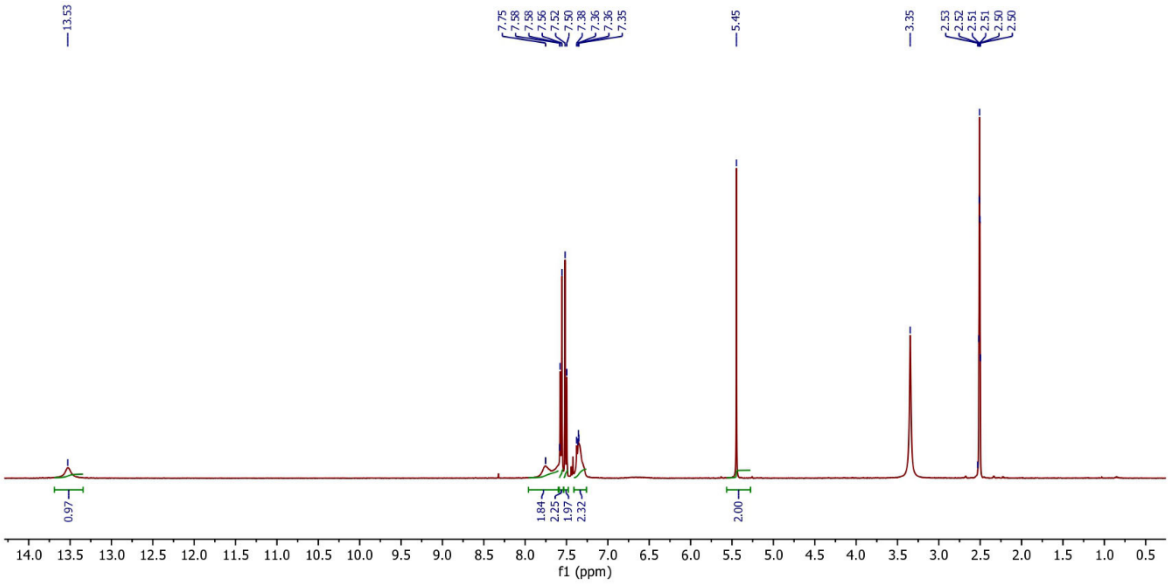
^{1}H NMR Spectrum of **4h** (400 MHz, DMSO-d_6)



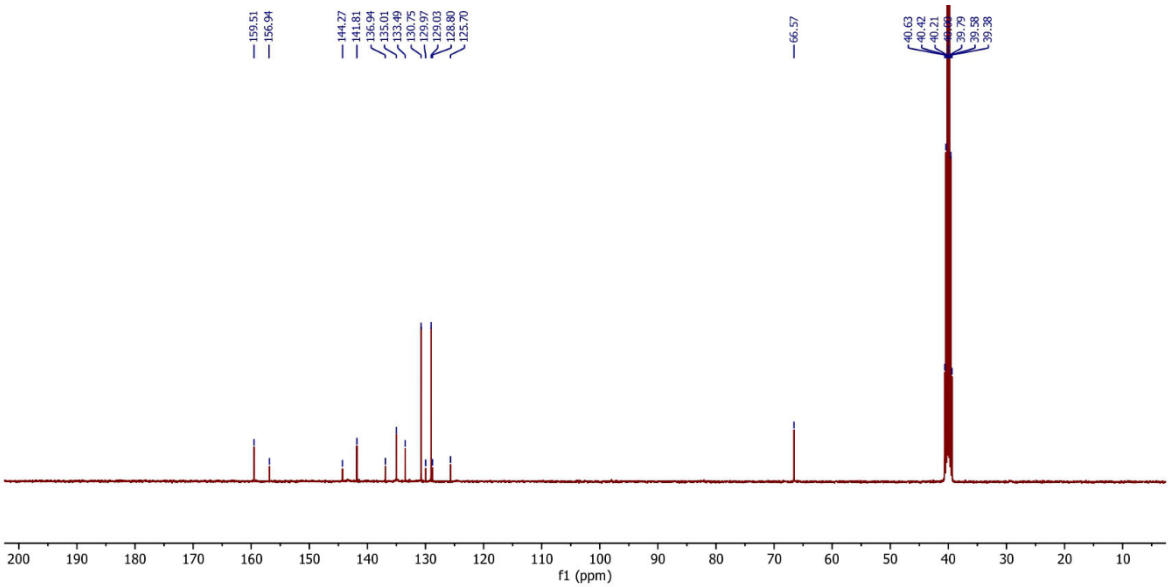
^{13}C NMR Spectrum of **4h** (101 MHz, DMSO-d_6)



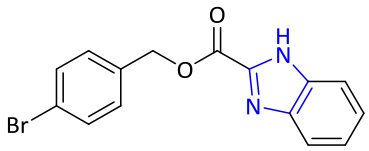
4-chlorobenzyl 1H-benzo[d]imidazole-2-carboxylate (4i)



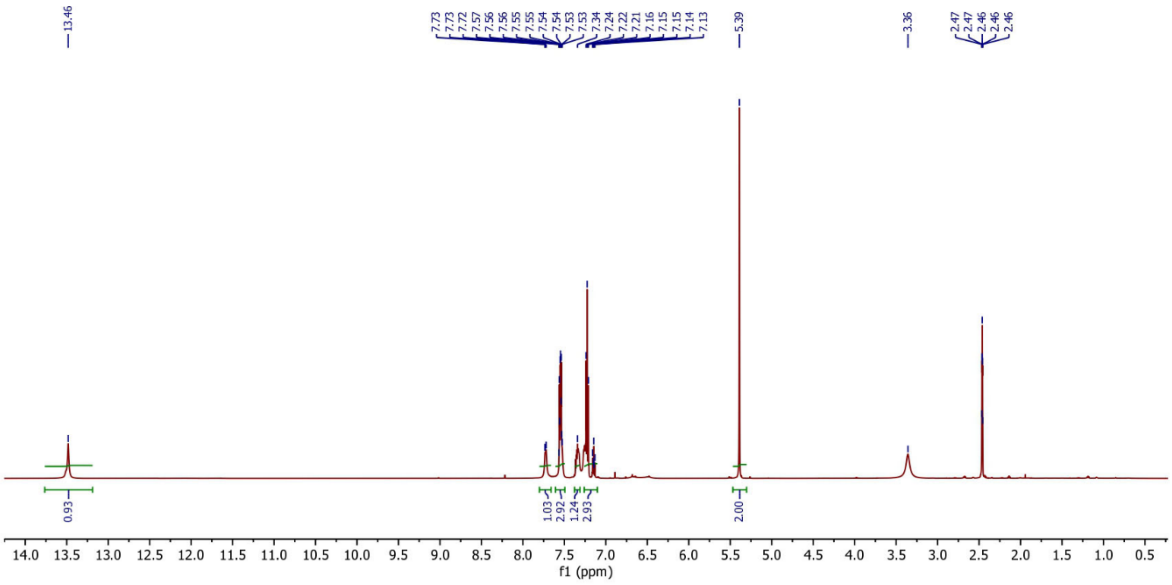
^{1}H NMR Spectrum of **4i** (400 MHz, DMSO-d_6)



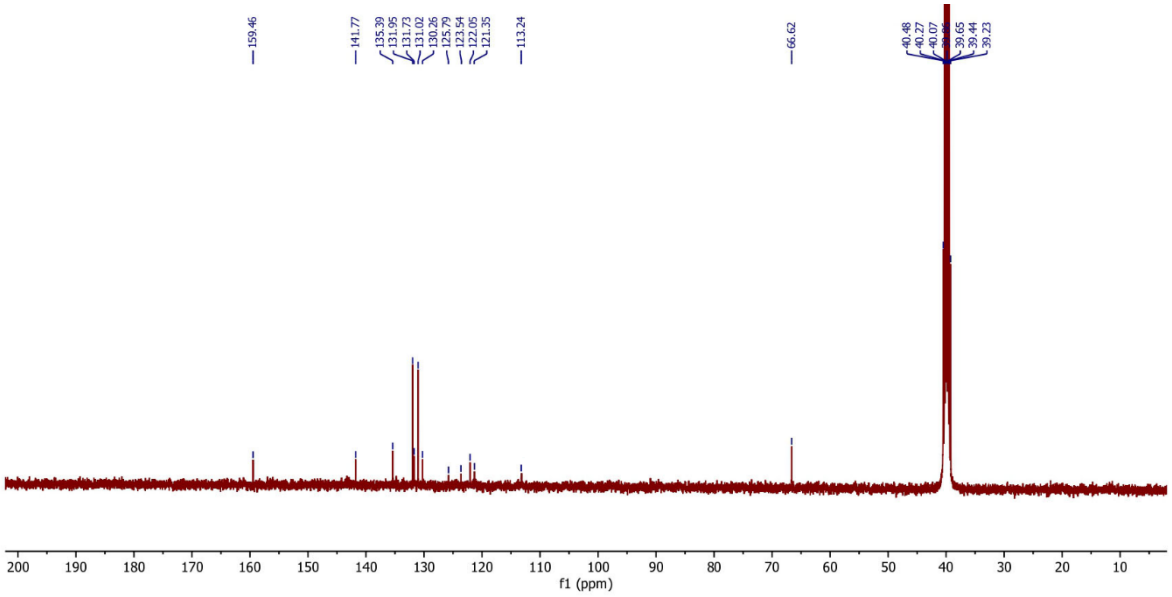
^{13}C NMR Spectrum of **4i** (101 MHz, DMSO-d_6)



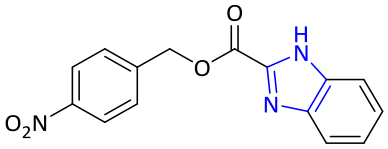
4-bromobenzyl 1H-benzo[d]imidazole-2-carboxylate (4j)



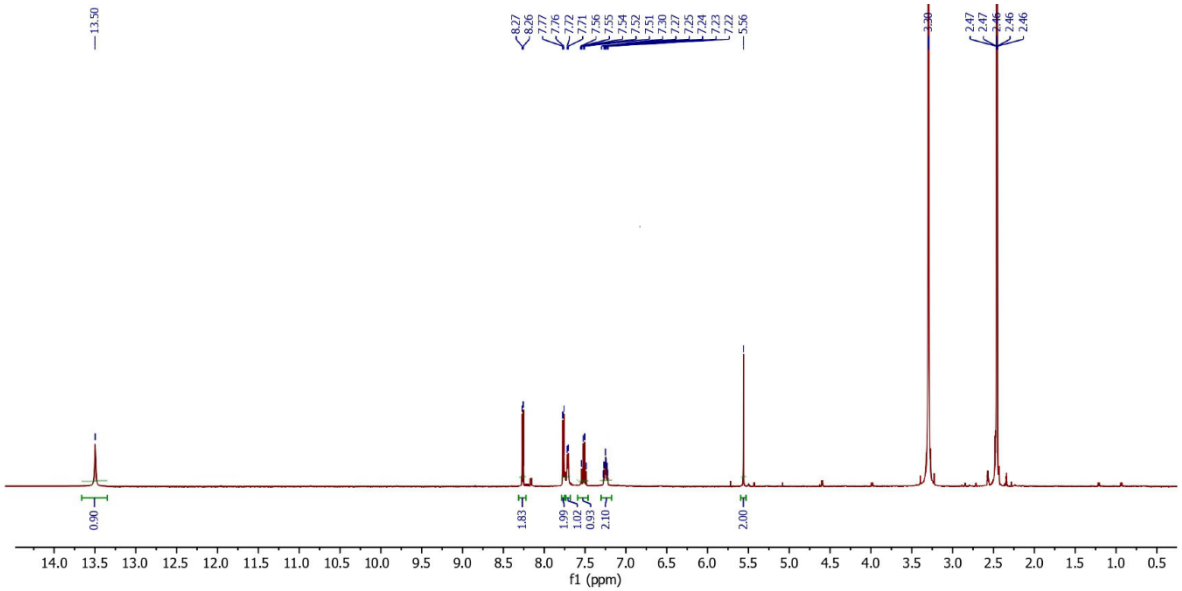
^{1}H NMR Spectrum of **4j** (400 MHz, DMSO-d_6)



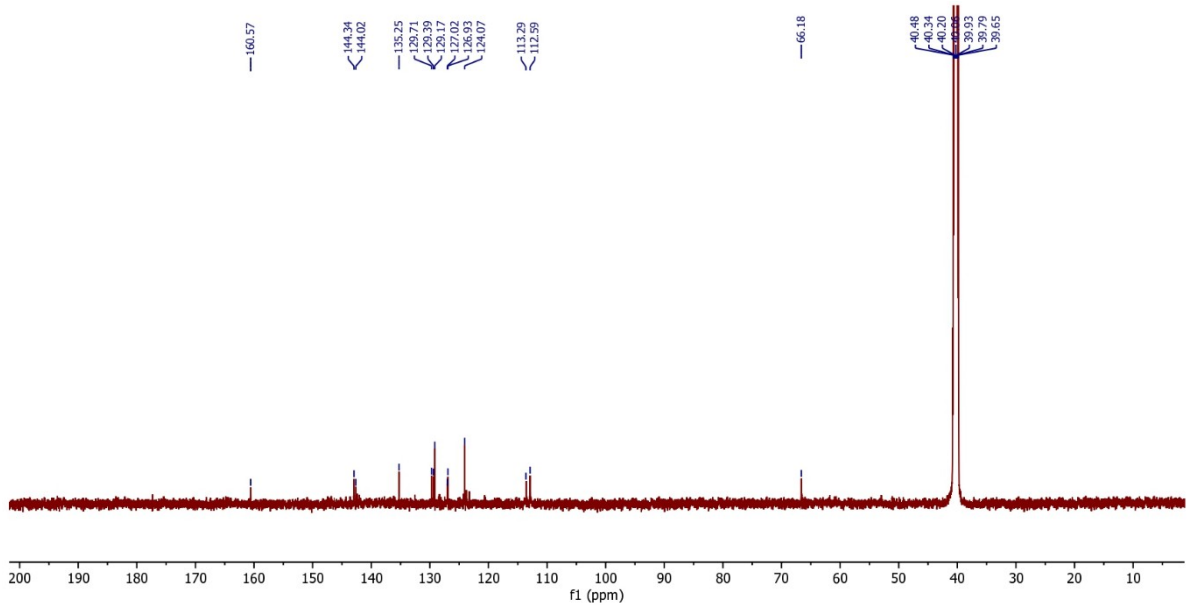
^{13}C NMR Spectrum of **4j** (151 MHz, DMSO-d_6)



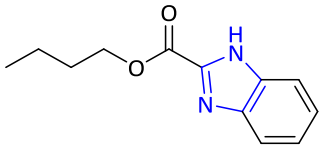
4-nitrobenzyl 1H-benzo[d]imidazole-2-carboxylate (4k)



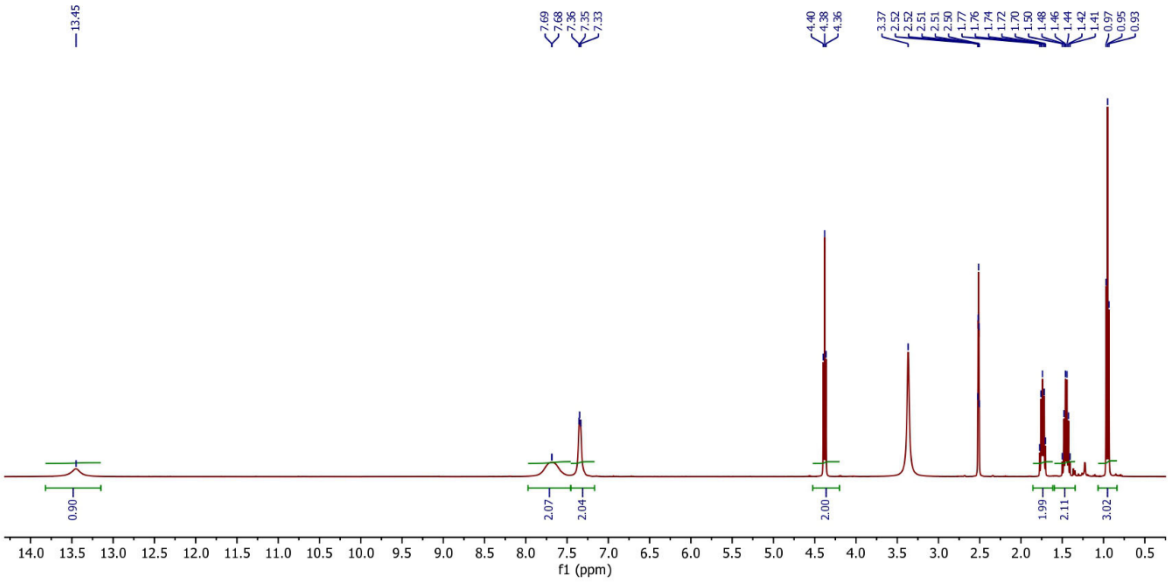
^{1}H NMR Spectrum of **4k** (600 MHz, DMSO-d_6)



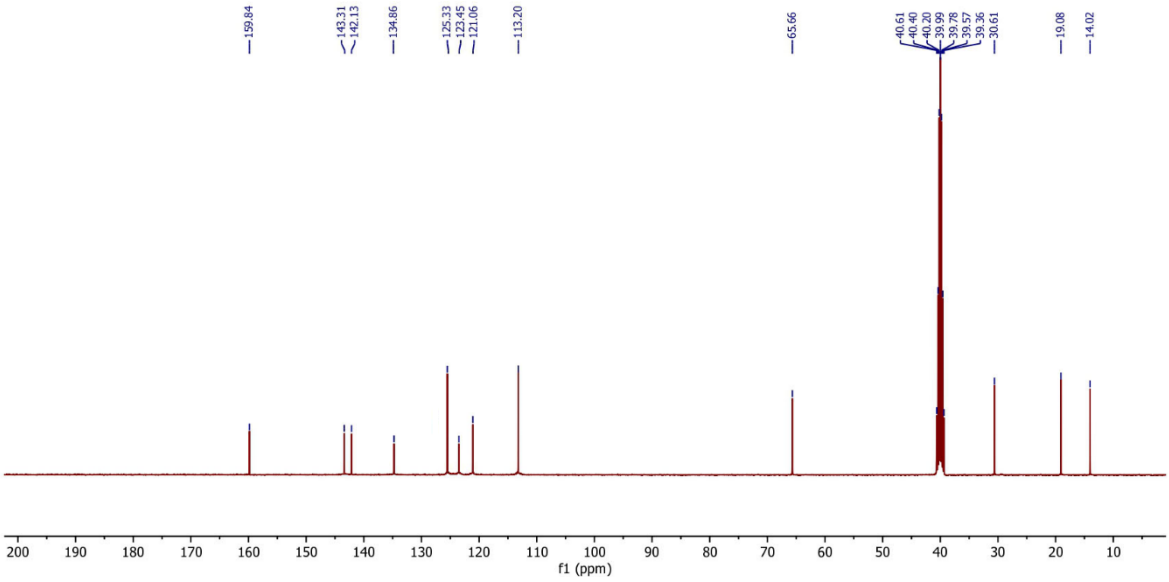
^{13}C NMR Spectrum of **4k** (151 MHz, DMSO-d_6)



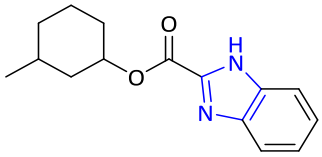
Butyl 1H-benzo[d]imidazole-2-carboxylate (4l)



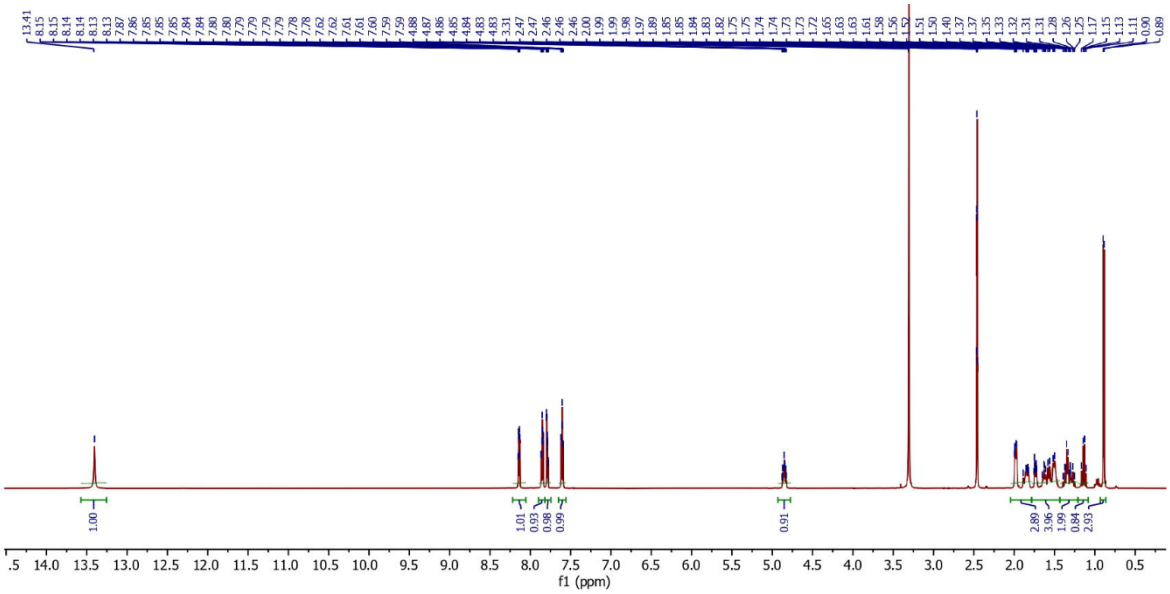
^{1}H NMR Spectrum of **4l** (400 MHz, DMSO-d_6)



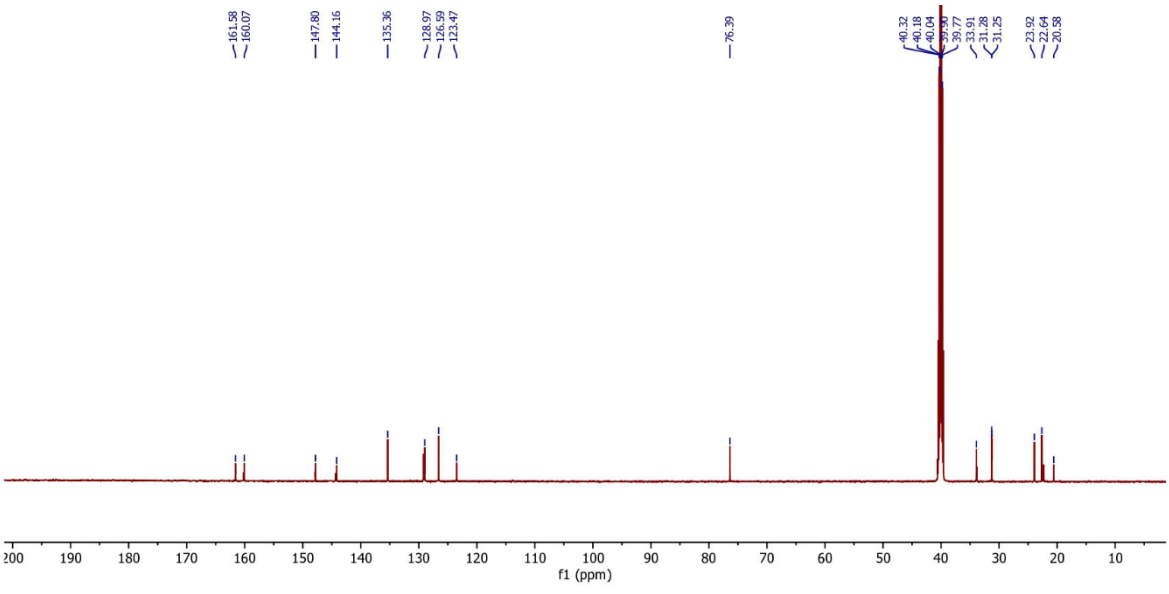
^{13}C NMR Spectrum of **4l** (101 MHz, DMSO-d_6)



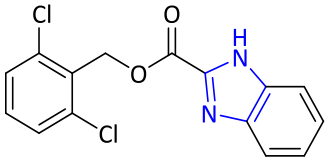
3-methylcyclohexyl 1H-benzo[d]imidazole-2-carboxylate (4m)



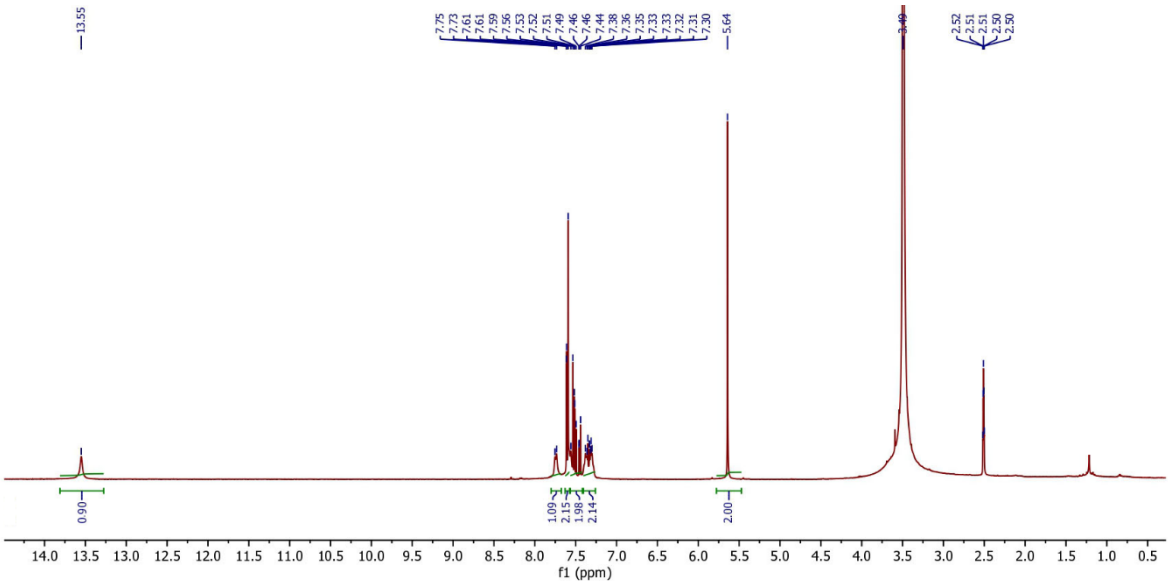
^{1}H NMR Spectrum of **4m** (600 MHz, DMSO-d_6)



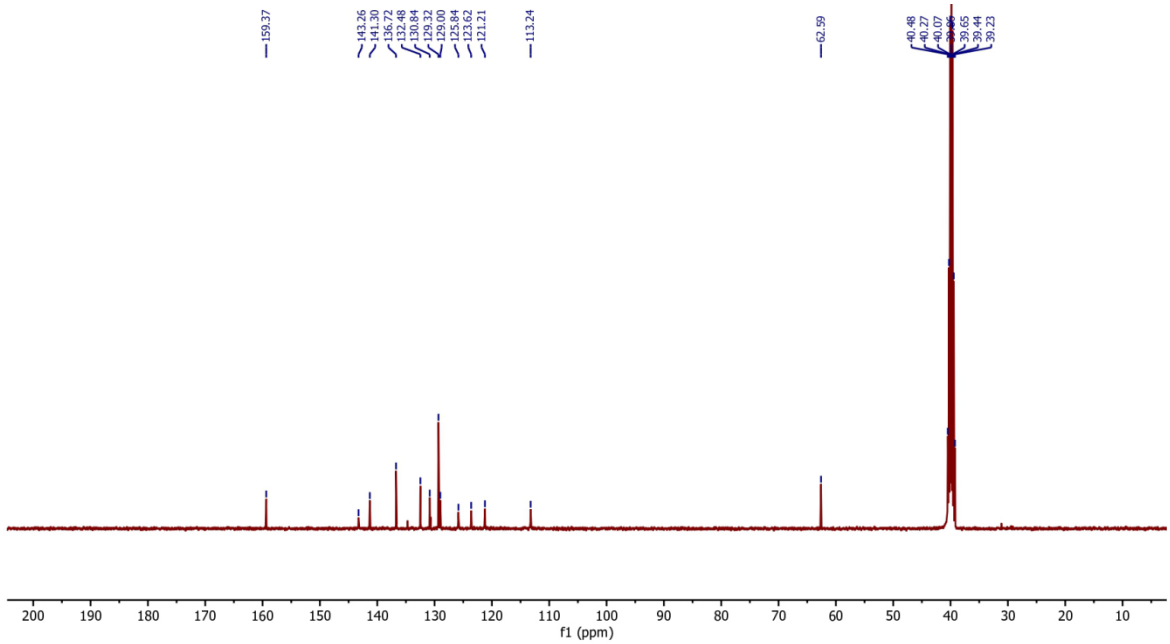
^{13}C NMR Spectrum of **4m** (151 MHz, DMSO-d_6)



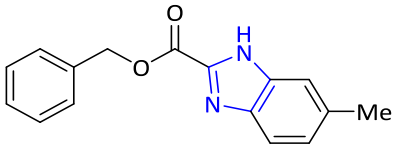
2,6-dichlorobenzyl 1H-benzo[d]imidazole-2-carboxylate (4n)



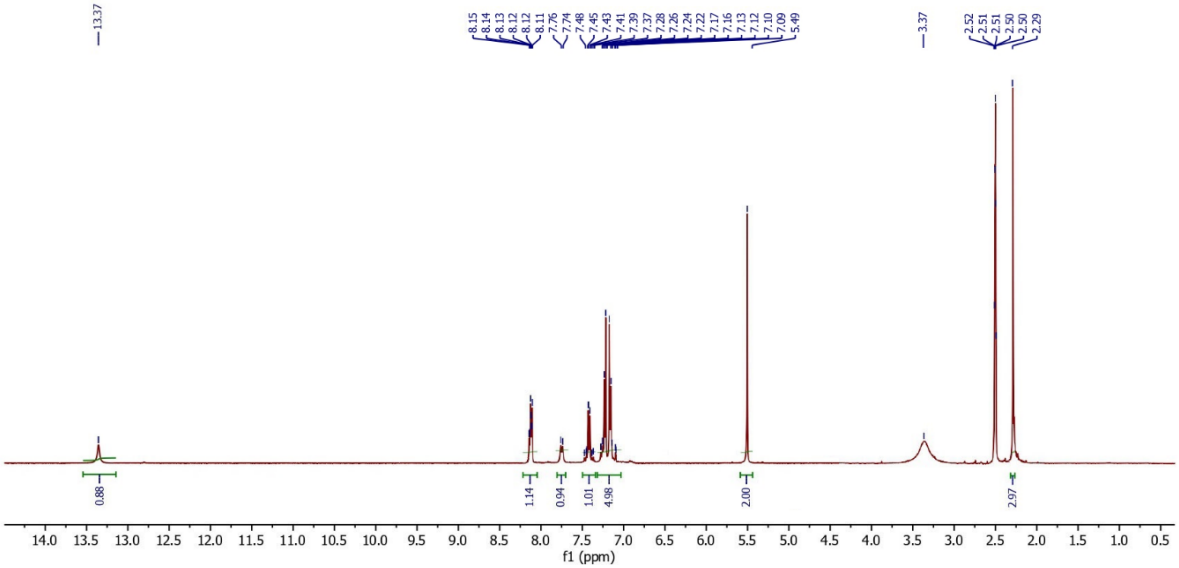
^{1}H NMR Spectrum of **4n** (400 MHz, DMSO-d_6)



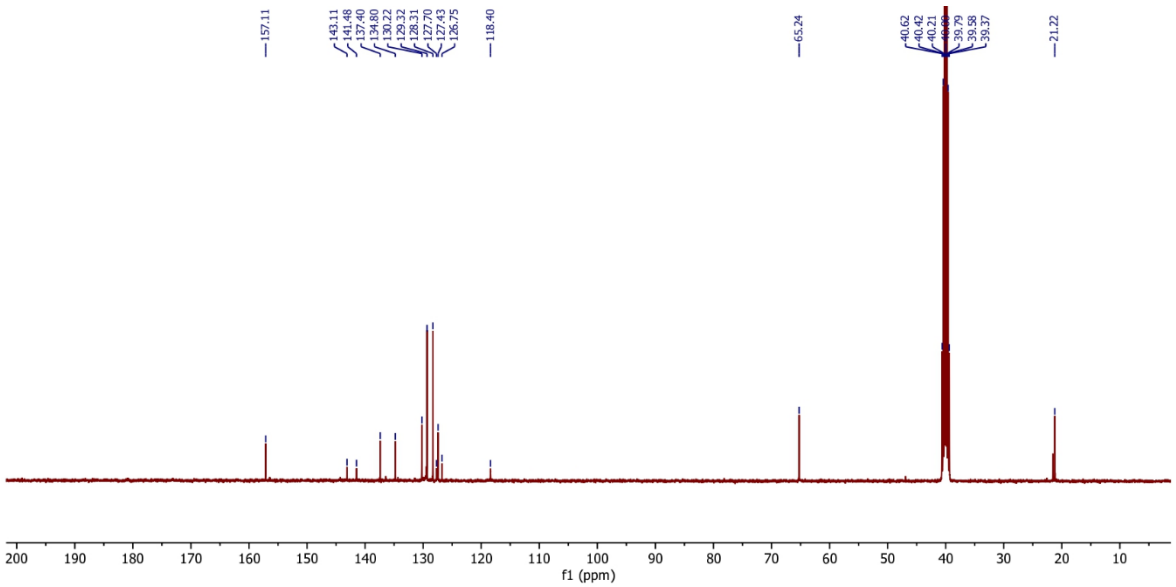
^{13}C NMR Spectrum of **4n** (101 MHz, DMSO-d_6)



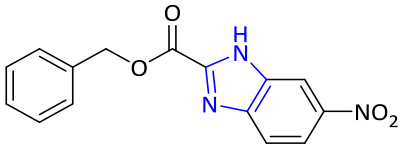
Benzyl 6-methyl-1H-benzo[d]imidazole-2-carboxylate (4o)



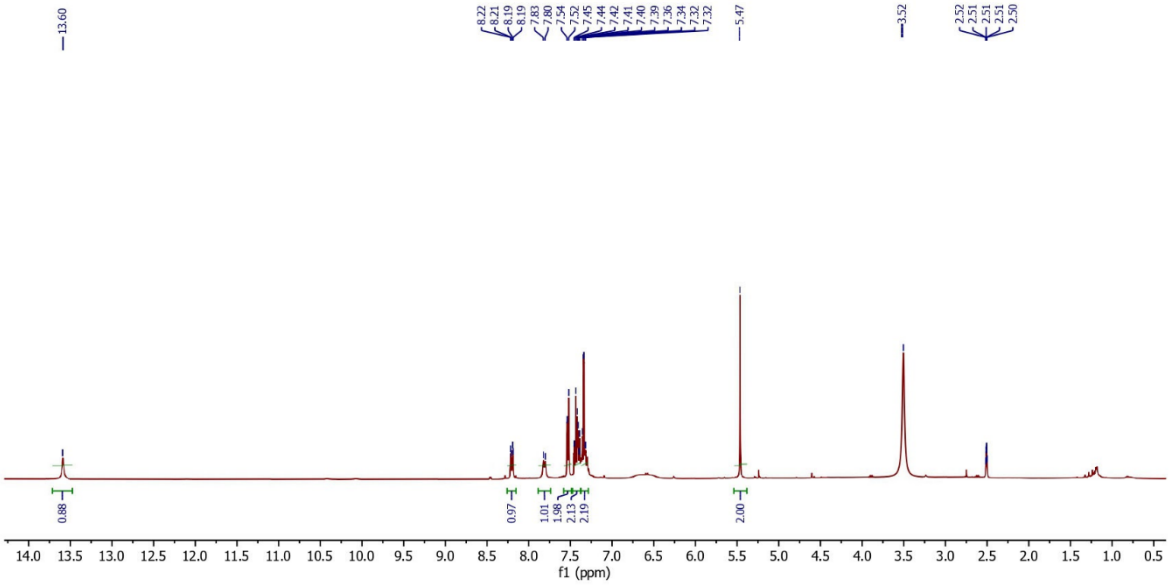
^{1}H NMR Spectrum of **4o** (400 MHz, DMSO-d_6)



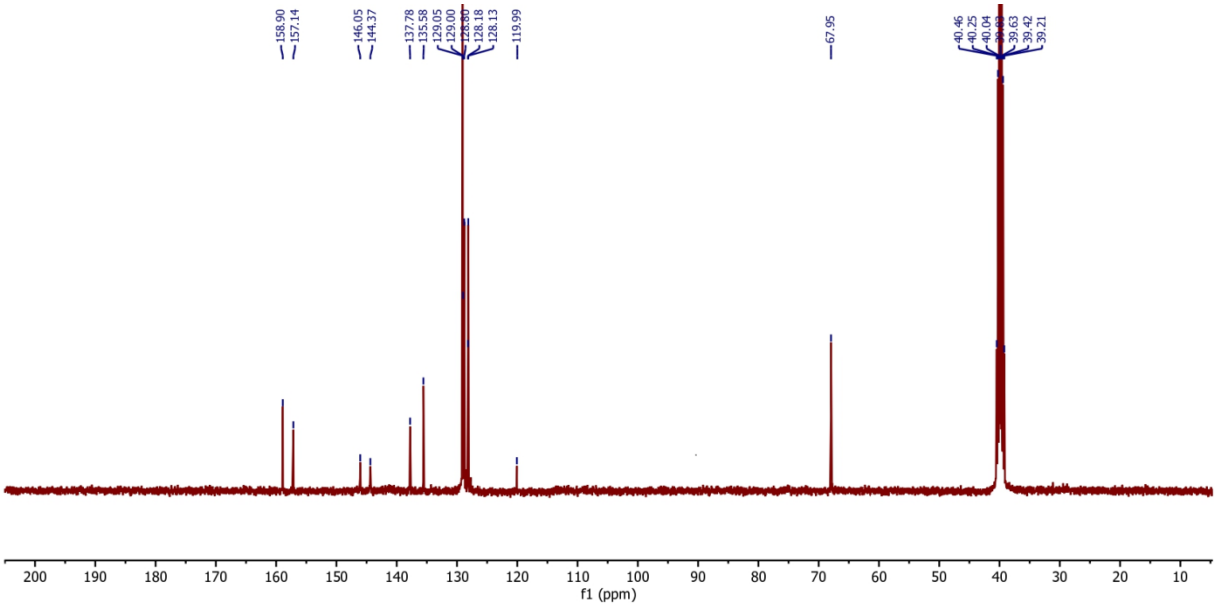
^{13}C NMR Spectrum of **4o** (101 MHz, DMSO-d_6)



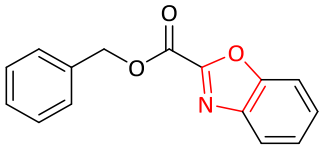
Benzyl 6-nitro-1H-benzo[d]imidazole-2-carboxylate (4p)



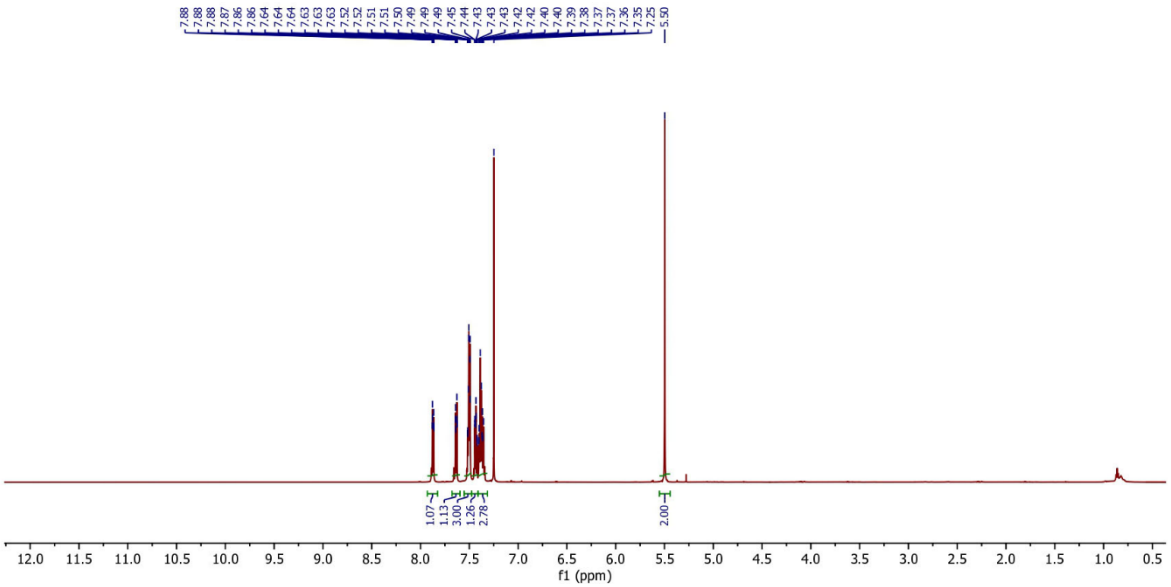
^{1}H NMR Spectrum of **4p** (400 MHz, DMSO-d_6)



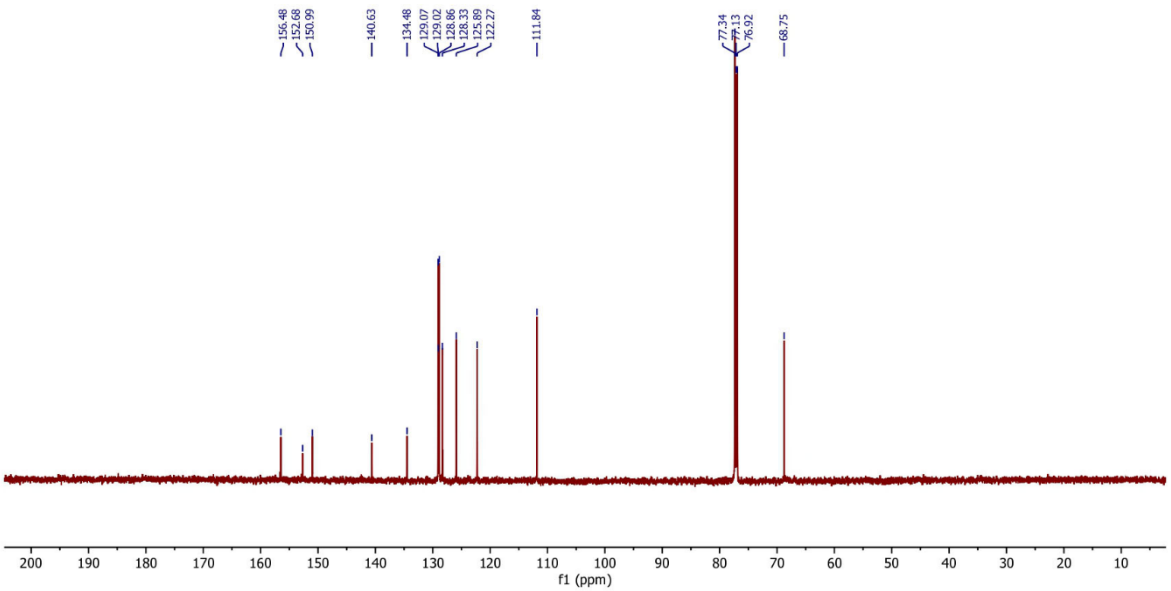
^{13}C NMR Spectrum of **4p** (101 MHz, DMSO-d_6)



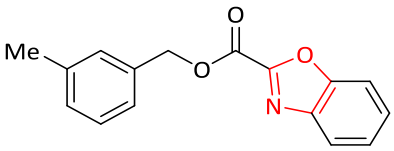
Benzyl benzo[d]oxazole-2-carboxylate (5a)



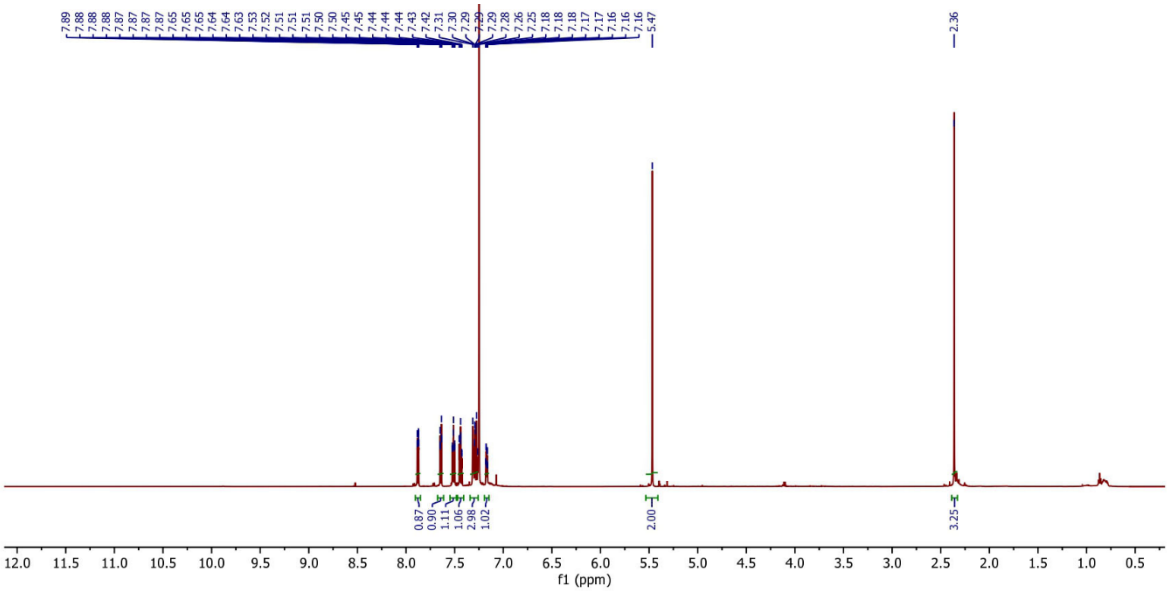
^{1}H NMR Spectrum of **5a** (600 MHz, $CDCl_3$)



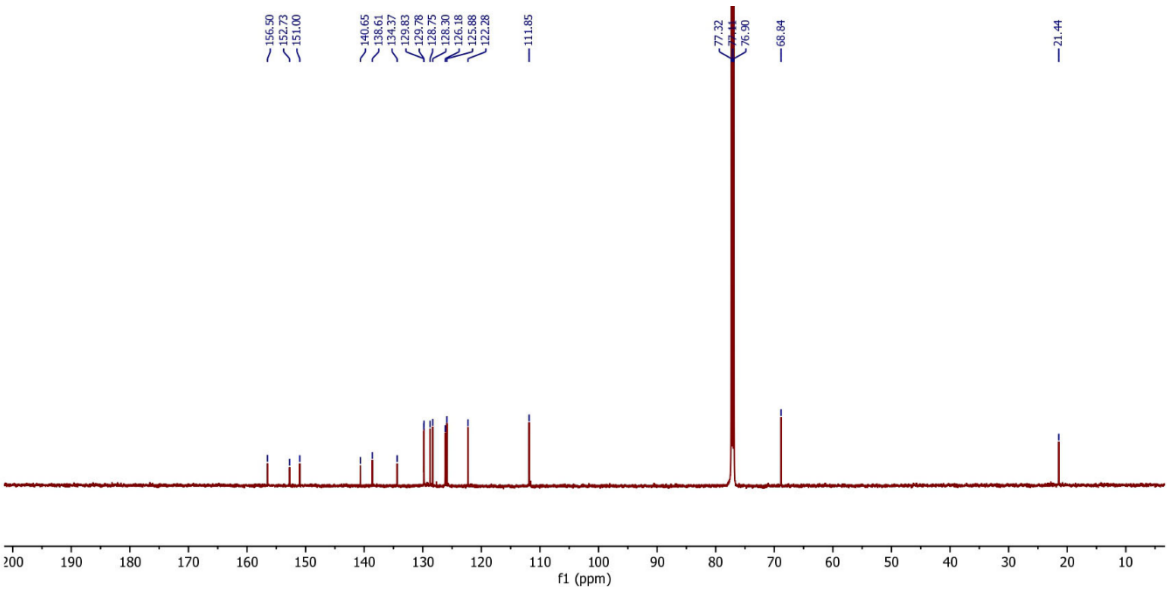
^{13}C NMR Spectrum of **5a** (151 MHz, $CDCl_3$)



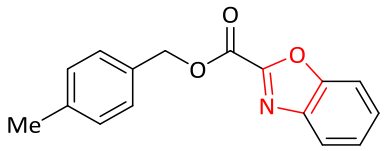
3-methylbenzyl benzo[d]oxazole-2-carboxylate (5b)



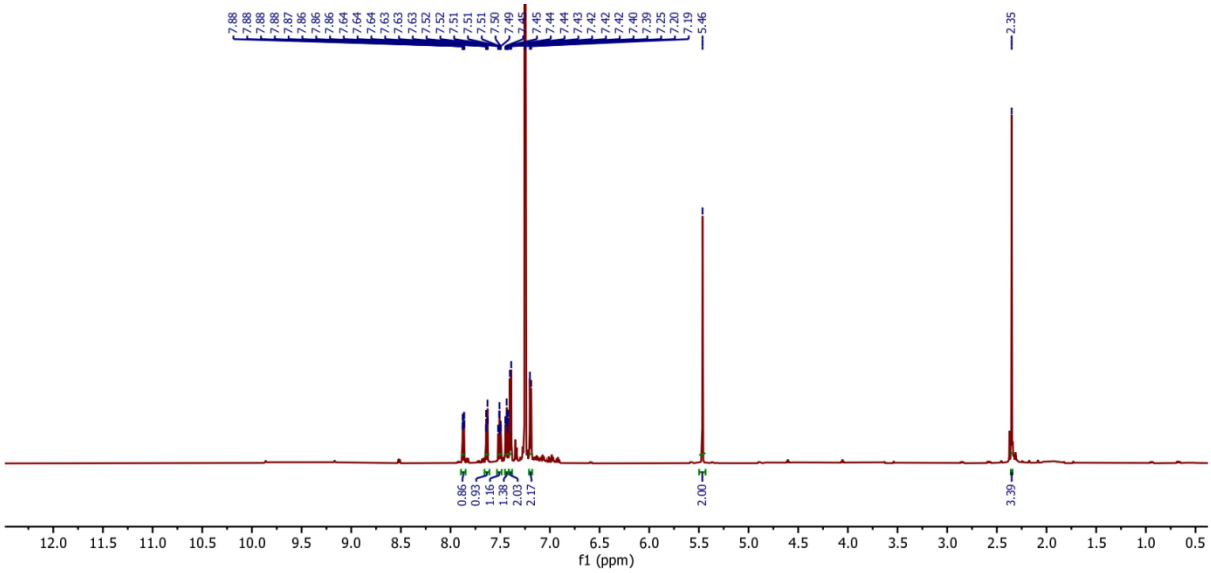
^{1}H NMR Spectrum of **5b** (600 MHz, $CDCl_3$)



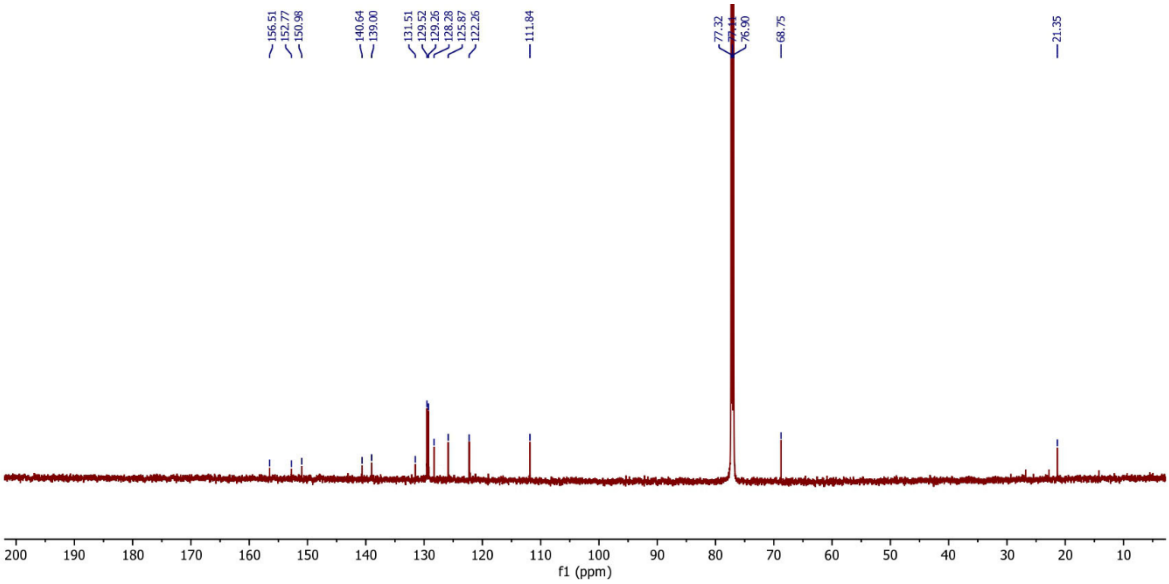
^{13}C NMR Spectrum of **5b** (151 MHz, $CDCl_3$)



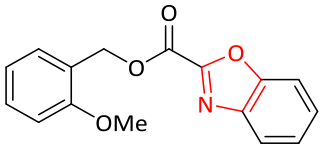
4-methylbenzyl benzo[d]oxazole-2-carboxylate (5c)



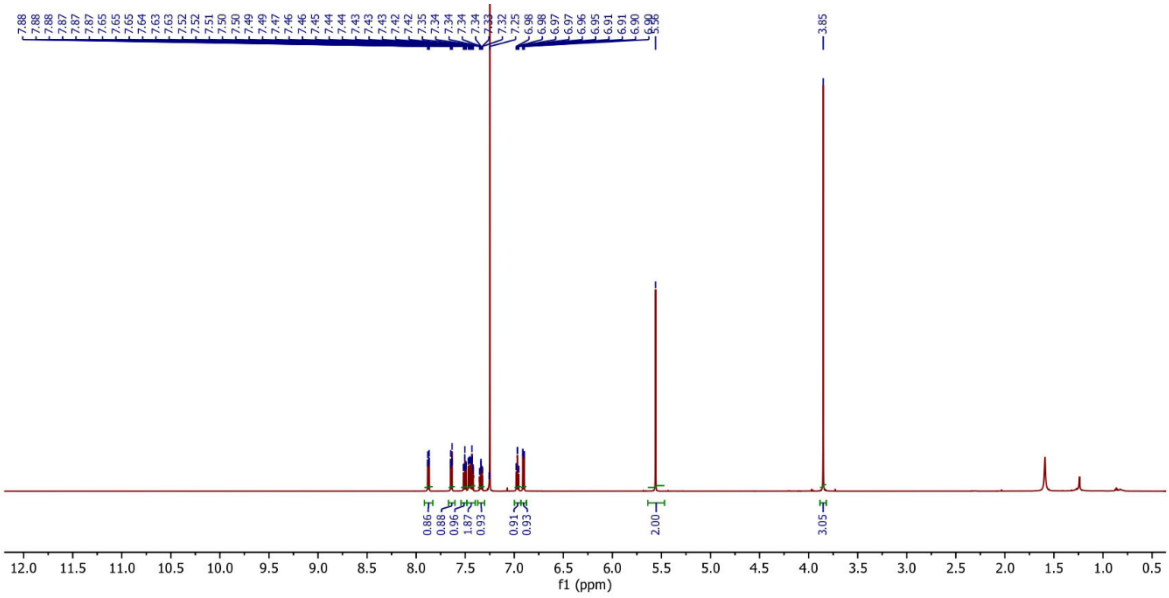
^{1}H NMR Spectrum of **5c** (600 MHz, $CDCl_3$)



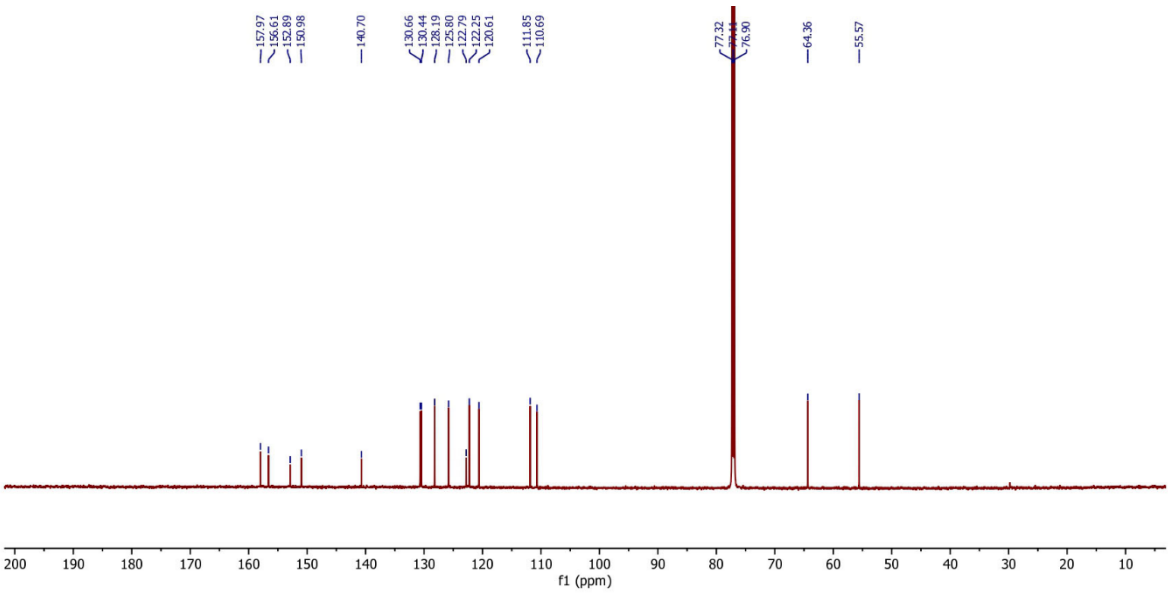
^{13}C NMR Spectrum of **5c** (151 MHz, $CDCl_3$)



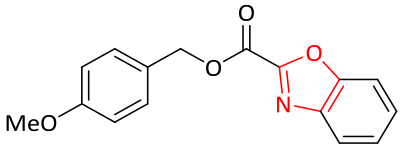
2-methoxybenzyl benzo[d]oxazole-2-carboxylate (5d)



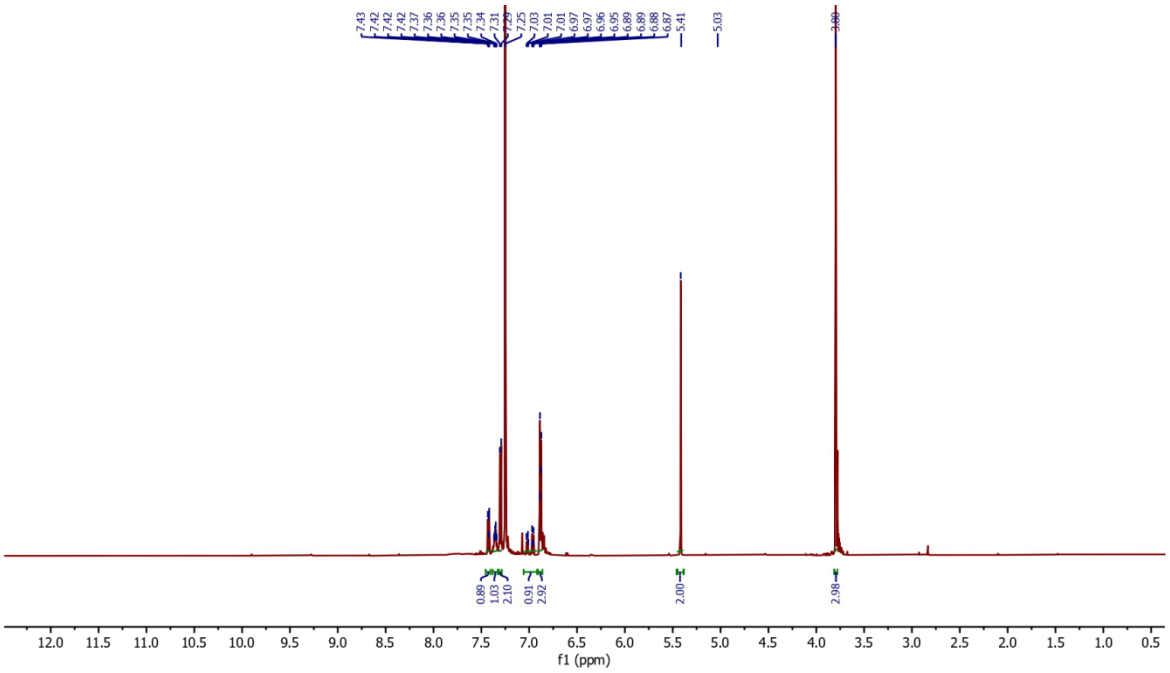
^{1}H NMR Spectrum of **5d** (600 MHz, $CDCl_3$)



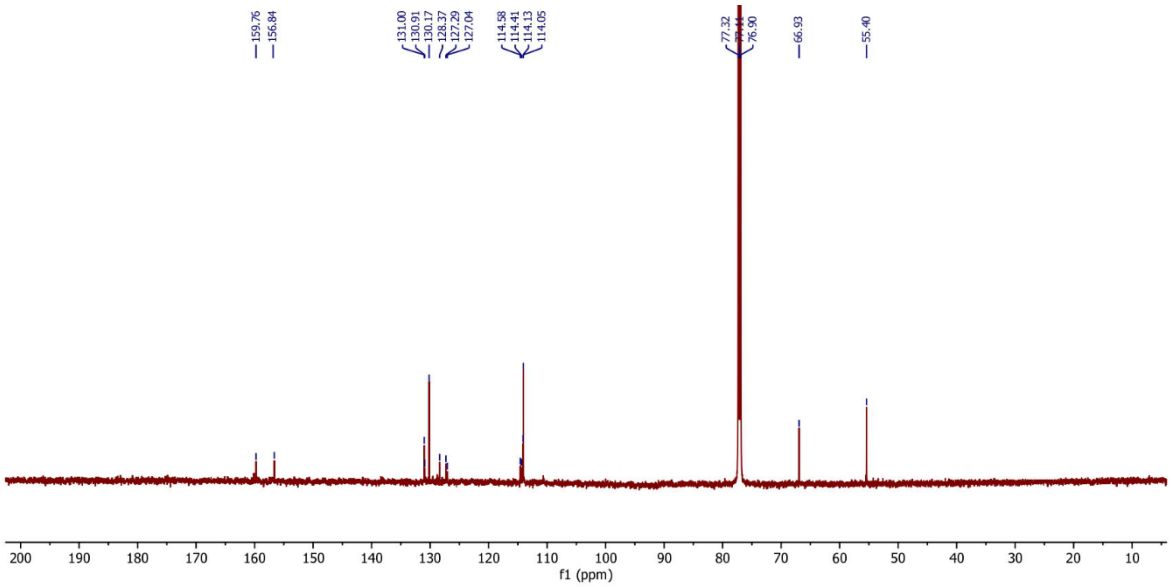
^{13}C NMR Spectrum of **5d** (151 MHz, $CDCl_3$)



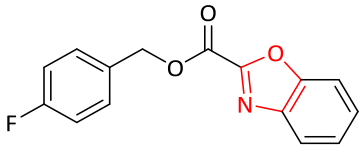
4-methoxybenzyl benzo[d]oxazole-2-carboxylate (5e)



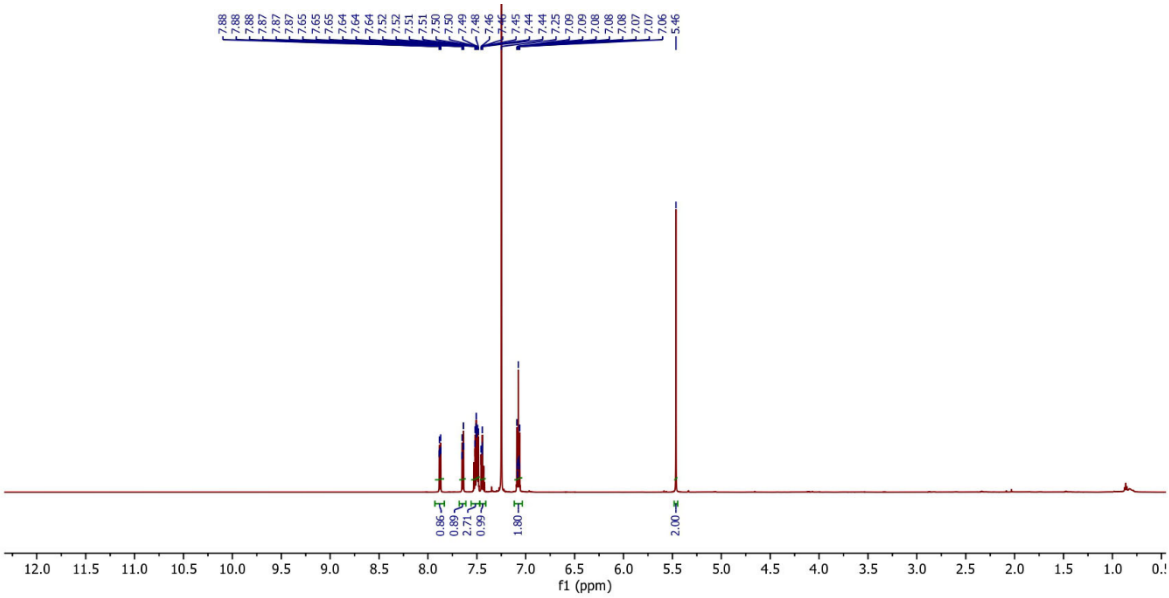
^{1}H NMR Spectrum of **5e** (600 MHz, $CDCl_3$)



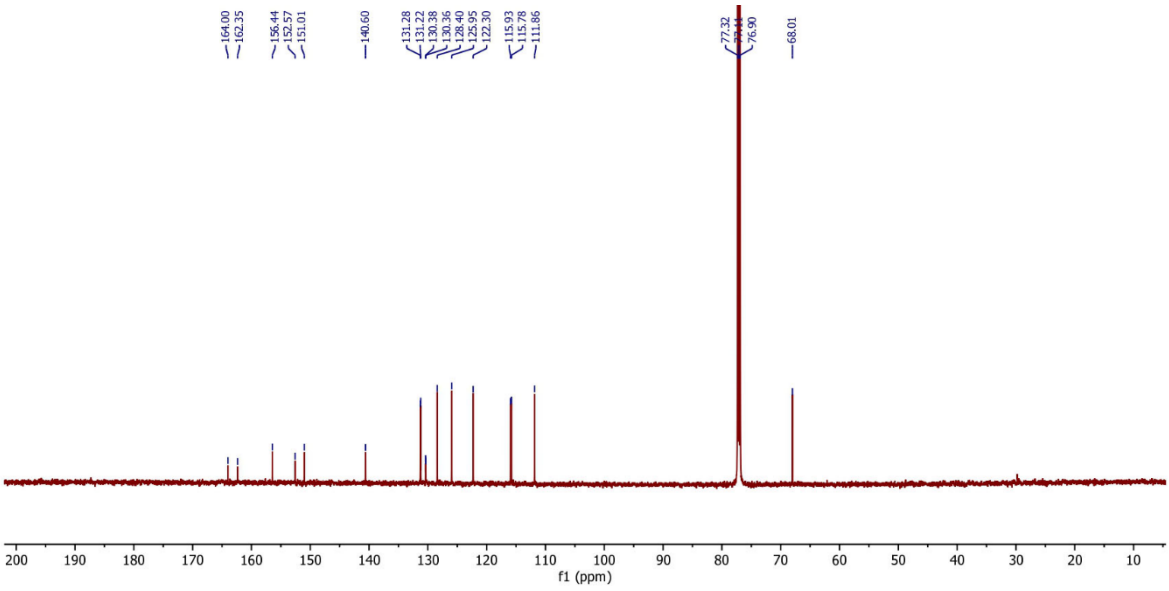
^{13}C NMR Spectrum of **5e** (151 MHz, $CDCl_3$)



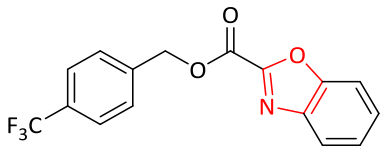
4-fluorobenzyl benzo[d]oxazole-2-carboxylate (5f)



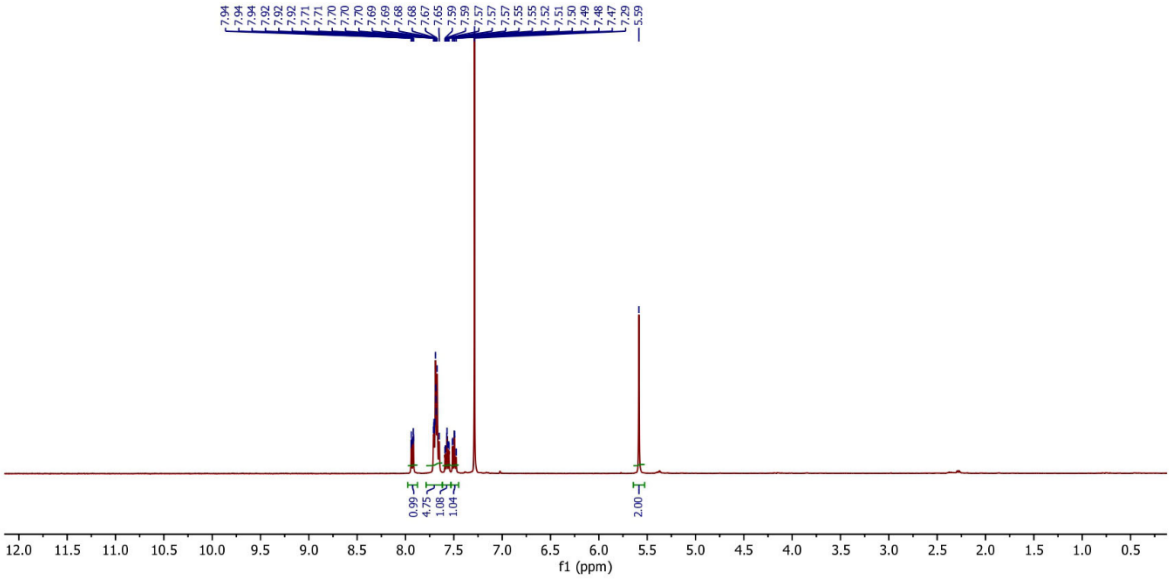
^{1}H NMR Spectrum of **5f** (600 MHz, $CDCl_3$)



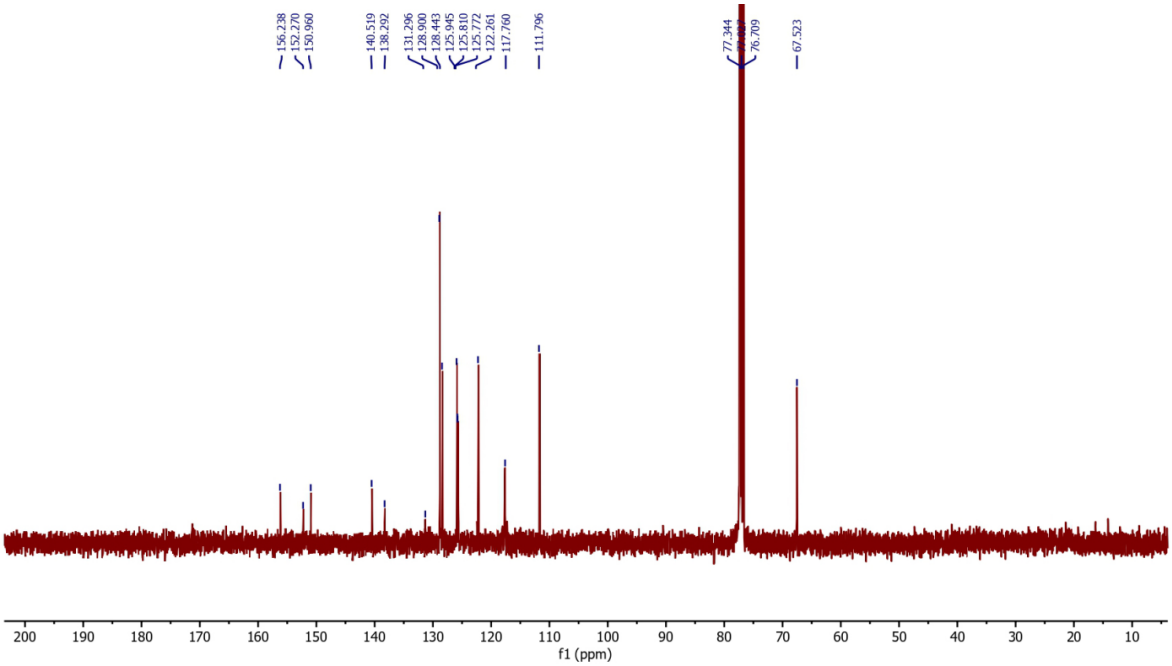
^{13}C NMR Spectrum of **5f** (151 MHz, $CDCl_3$)



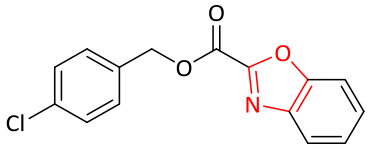
4-(trifluoromethyl)benzyl benzo[d]oxazole-2-carboxylate (5g)



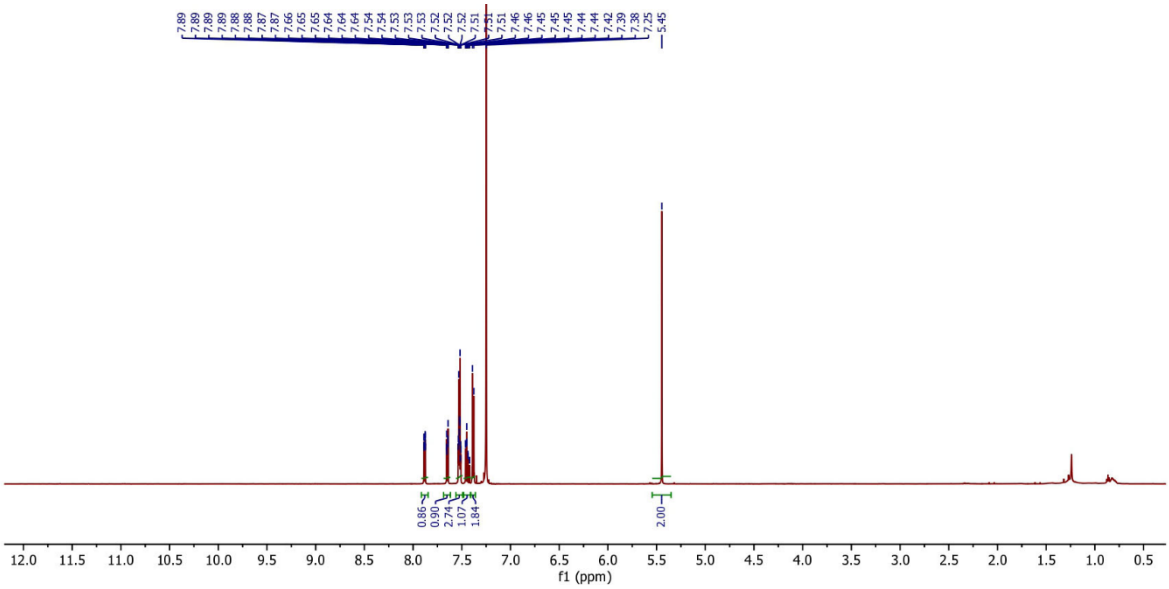
^{1}H NMR Spectrum of **5g** (400 MHz, $CDCl_3$)



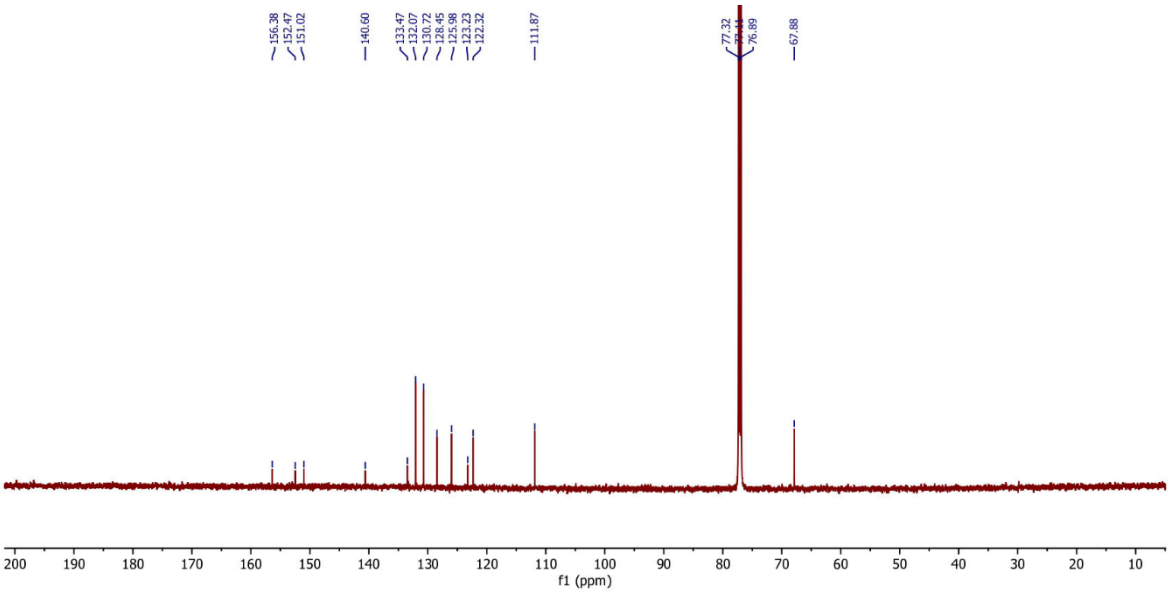
^{13}C NMR Spectrum of **5g** (101 MHz, $CDCl_3$)



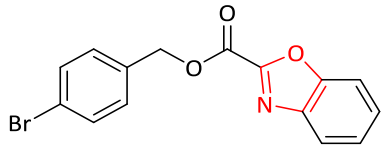
4-chlorobenzyl benzo[d]oxazole-2-carboxylate (5h)



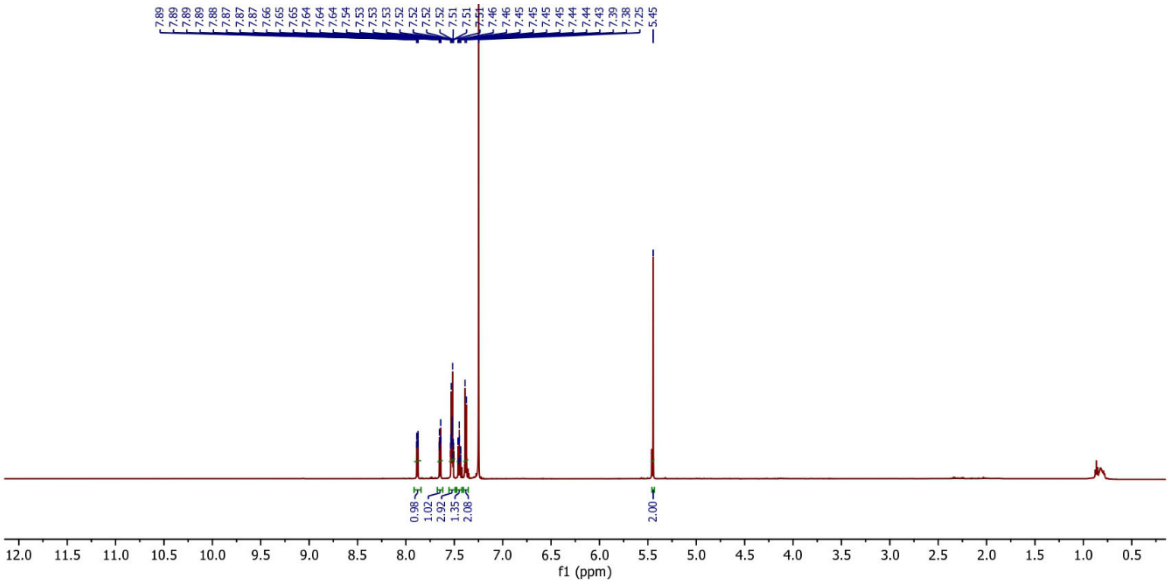
^{1}H NMR Spectrum of **5h** (600 MHz, $CDCl_3$)



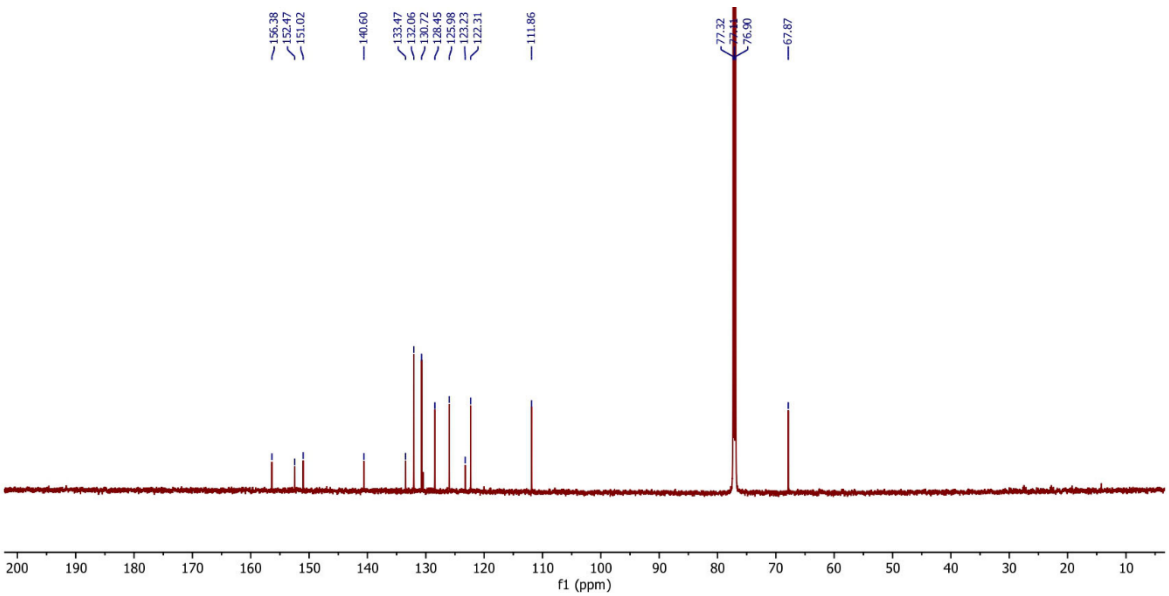
^{13}C NMR Spectrum of **5h** (151 MHz, $CDCl_3$)



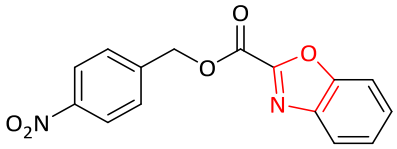
4-bromobenzyl benzo[d]oxazole-2-carboxylate (5i)



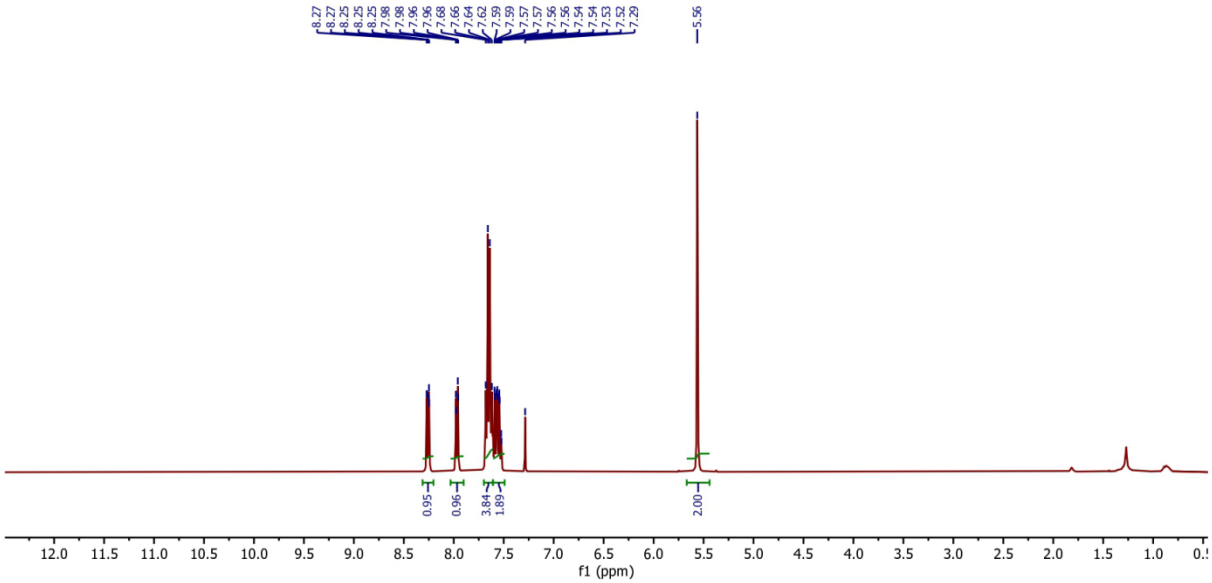
^{1}H NMR Spectrum of **5i** (600 MHz, $CDCl_3$)



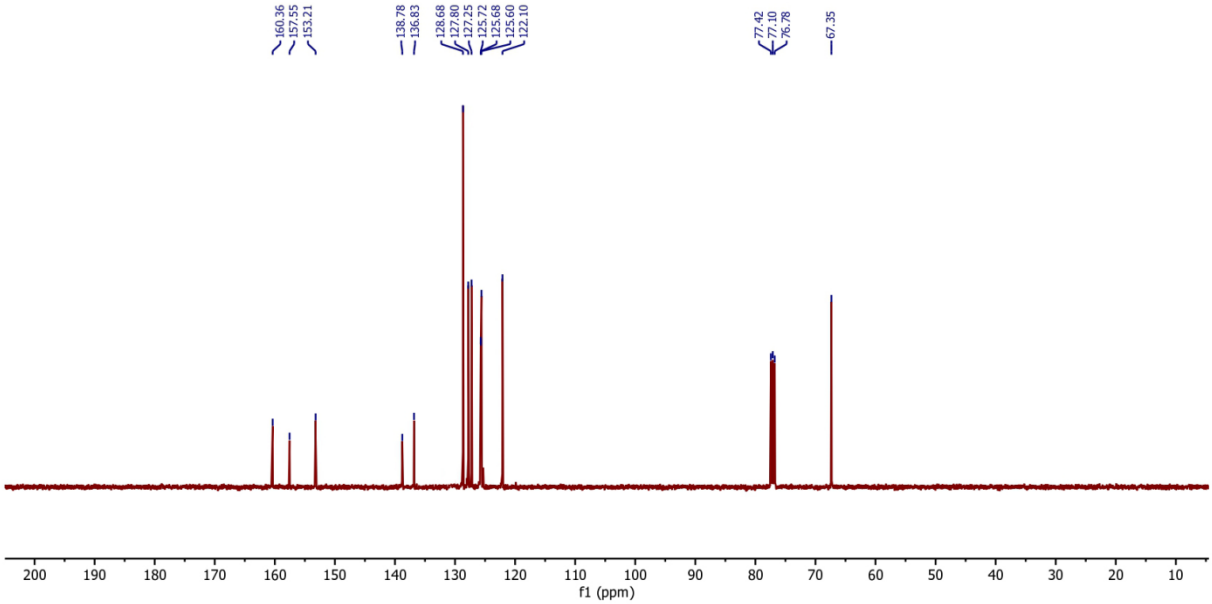
^{13}C NMR Spectrum of **5i** (151 MHz, $CDCl_3$)



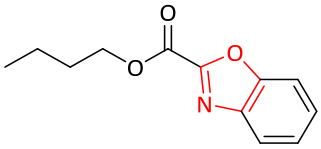
4-nitrobenzyl benzo[d]oxazole-2-carboxylate (5j)



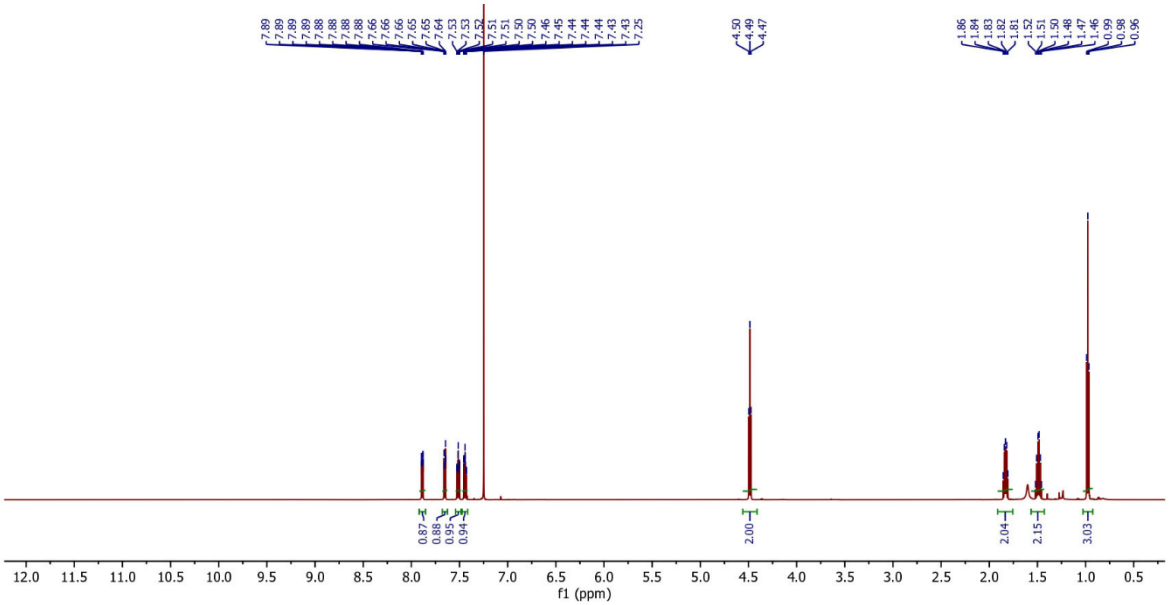
^{1}H NMR Spectrum of **5j** (400 MHz, $CDCl_3$)



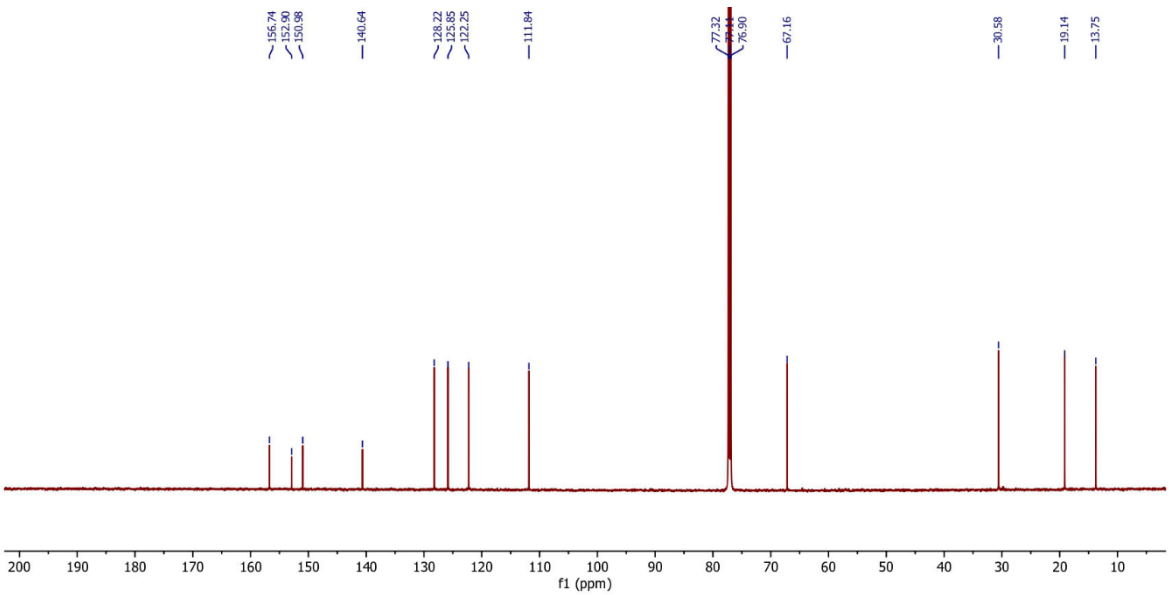
^{13}C NMR Spectrum of **5j** (101 MHz, $CDCl_3$)



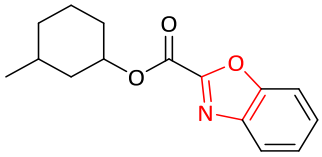
Butyl benzo[d]oxazole-2-carboxylate (5k)



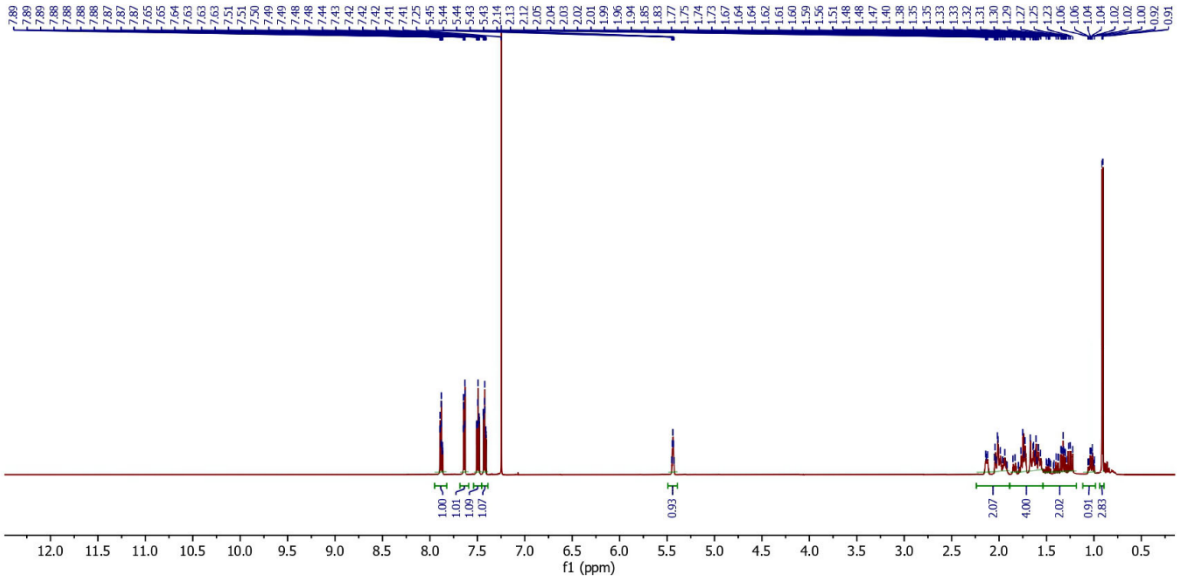
^{1}H NMR Spectrum of **5k** (600 MHz, $CDCl_3$)



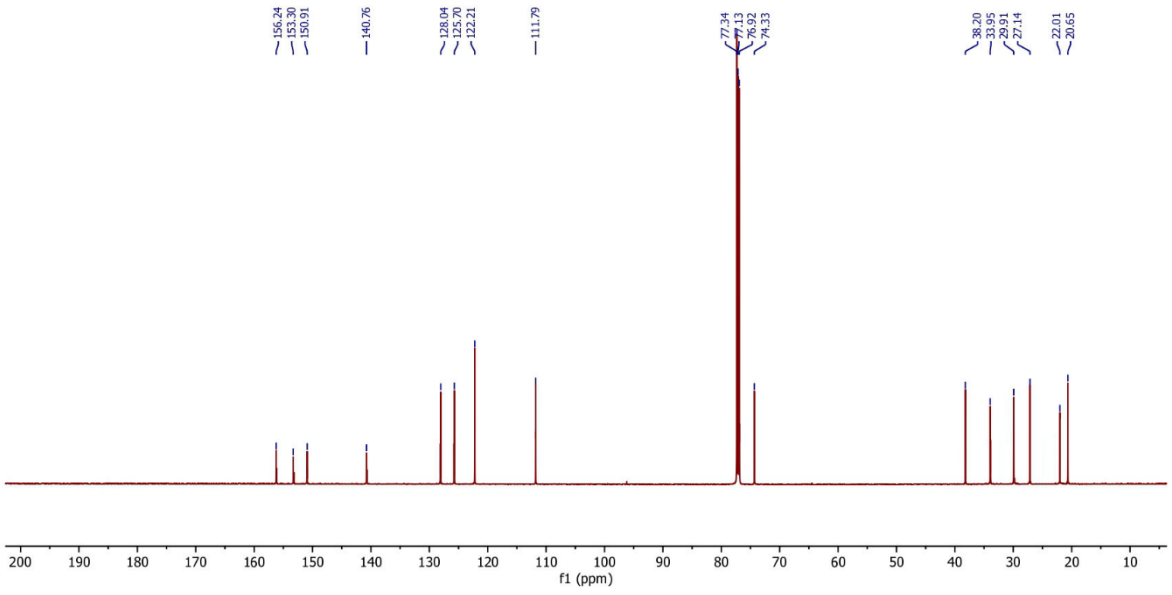
^{13}C NMR Spectrum of **5k** (151 MHz, $CDCl_3$)



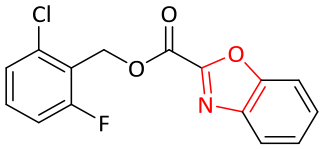
3-methylcyclohexyl benzo[d]oxazole-2-carboxylate (5l)



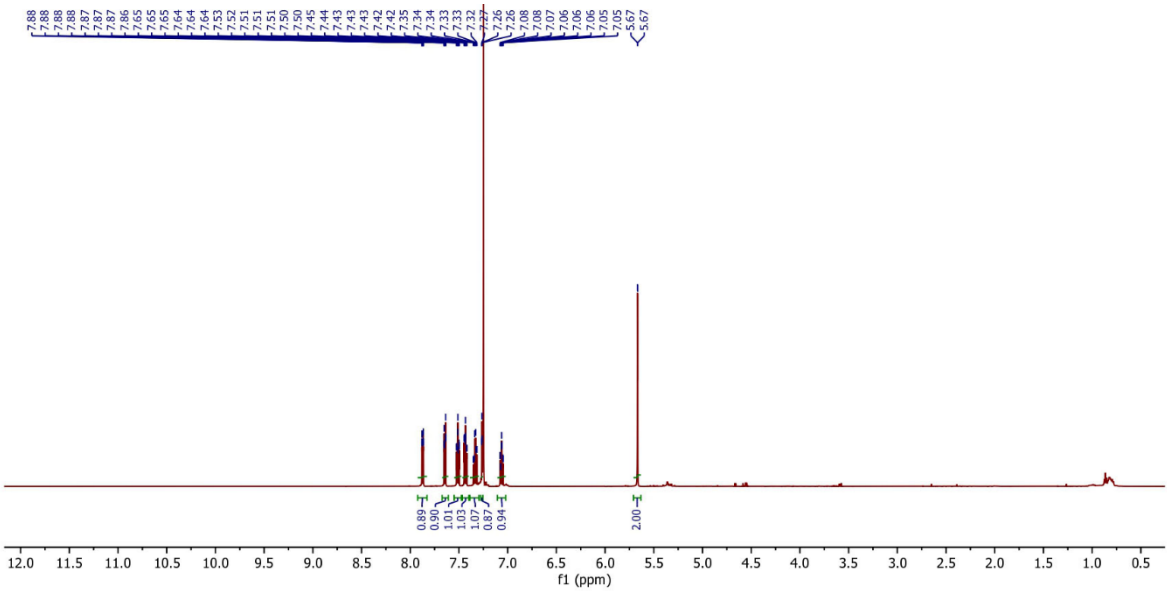
^{1}H NMR Spectrum of **5l** (600 MHz, $CDCl_3$)



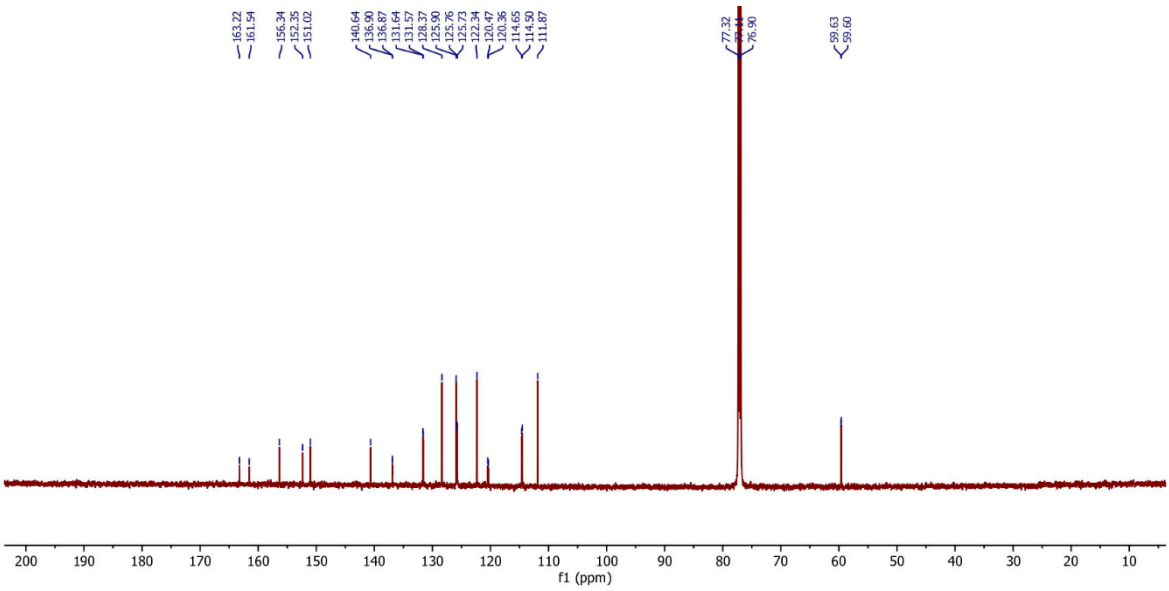
^{13}C NMR Spectrum of **5l** (151 MHz, $CDCl_3$)



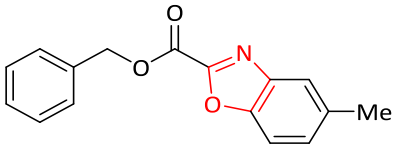
2-chloro-6-fluorobenzyl benzo[d]oxazole-2-carboxylate (5m)



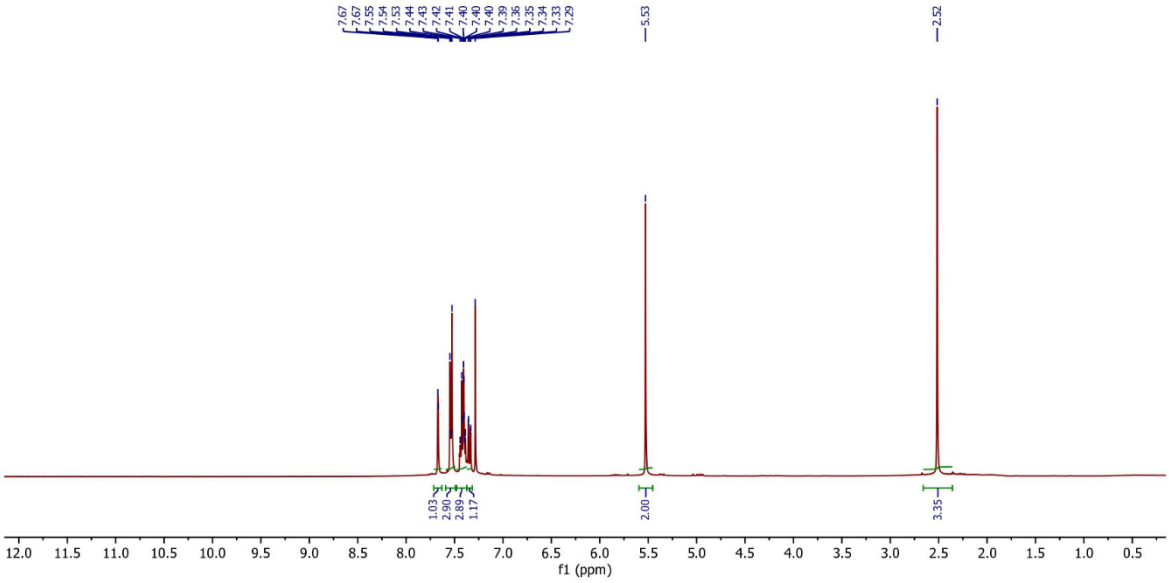
^{1}H NMR Spectrum of **5m** (600 MHz, $CDCl_3$)



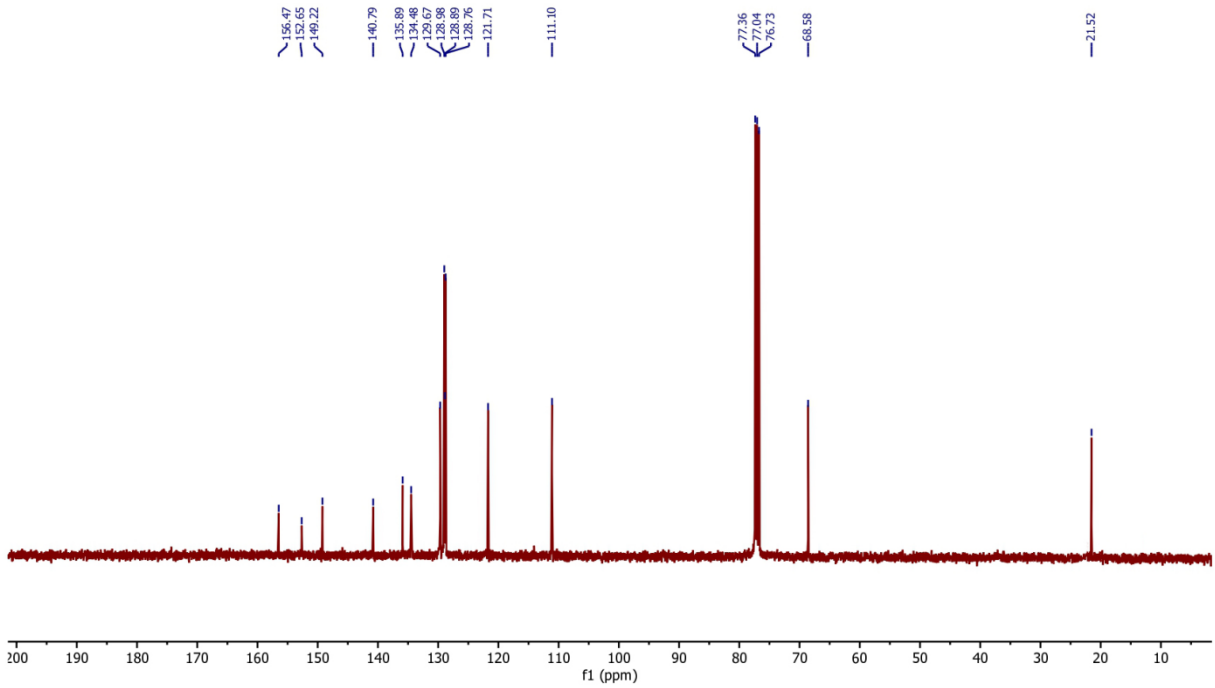
^{13}C NMR Spectrum of **5m** (151 MHz, $CDCl_3$)



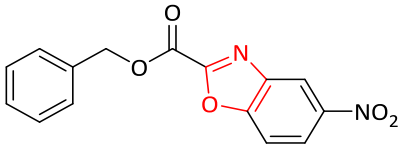
Benzyl 5-methylbenzo[d]oxazole-2-carboxylate (5n)



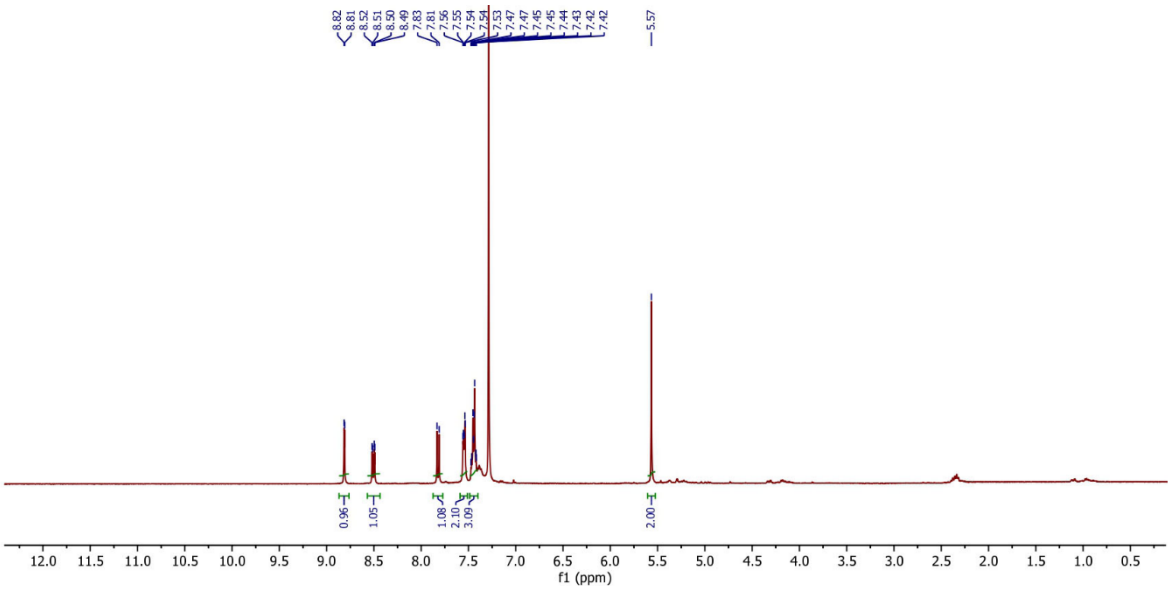
^{1}H NMR Spectrum of **5n** (400 MHz, $CDCl_3$)



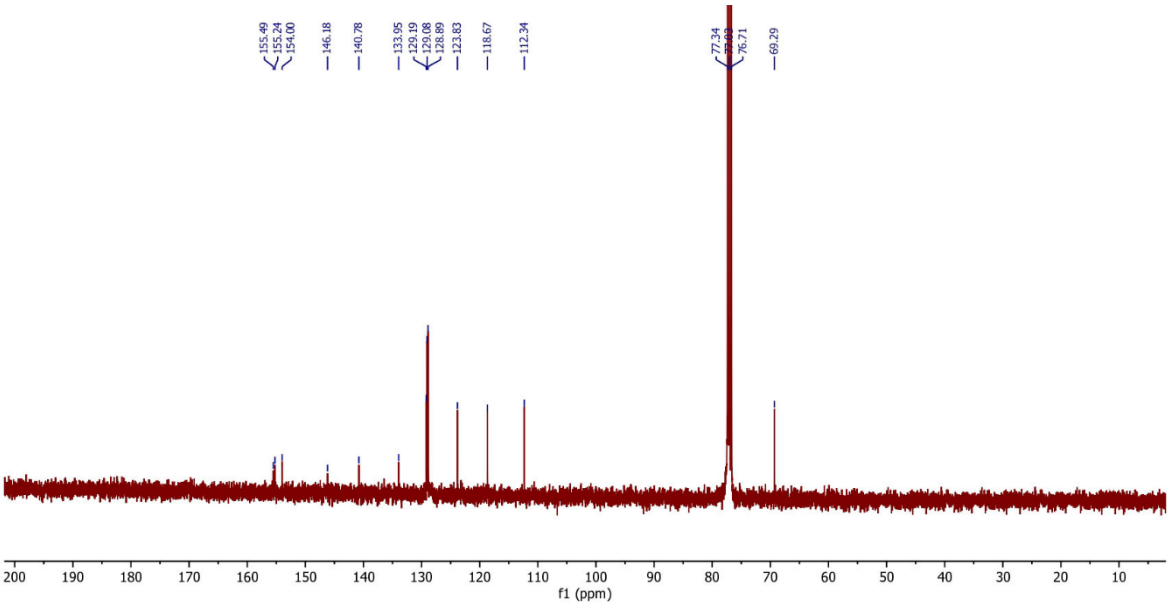
^{13}C NMR Spectrum of **5n** (101 MHz, $CDCl_3$)



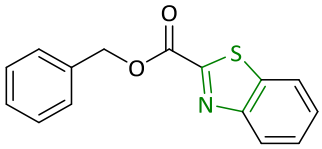
Benzyl 5-nitrobenzo[d]oxazole-2-carboxylate (5o)



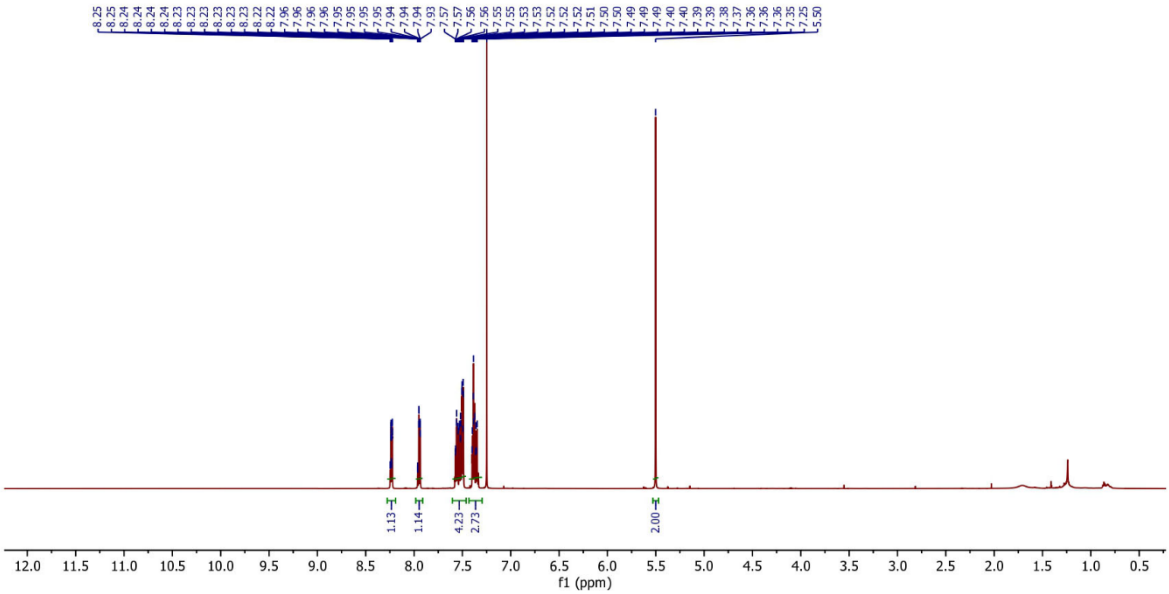
^{1}H NMR Spectrum of **5o** (400 MHz, $CDCl_3$)



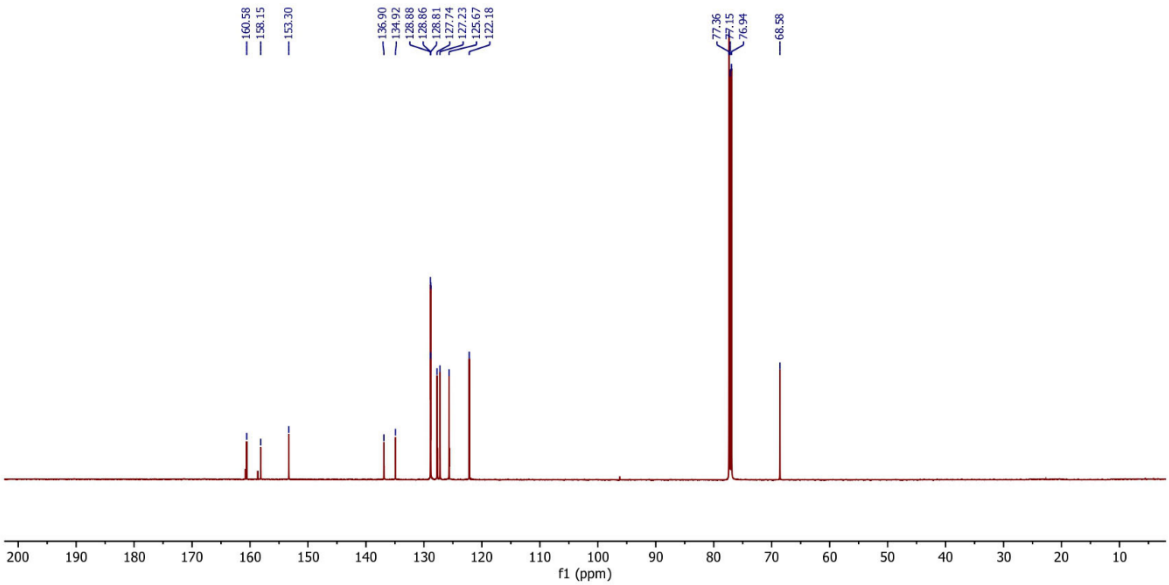
^{13}C NMR Spectrum of **5o** (101 MHz, $CDCl_3$)



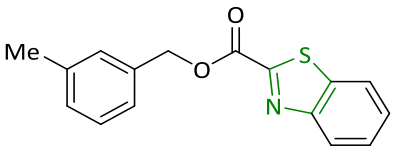
Benzyl benzo[d]thiazole-2-carboxylate (6a)



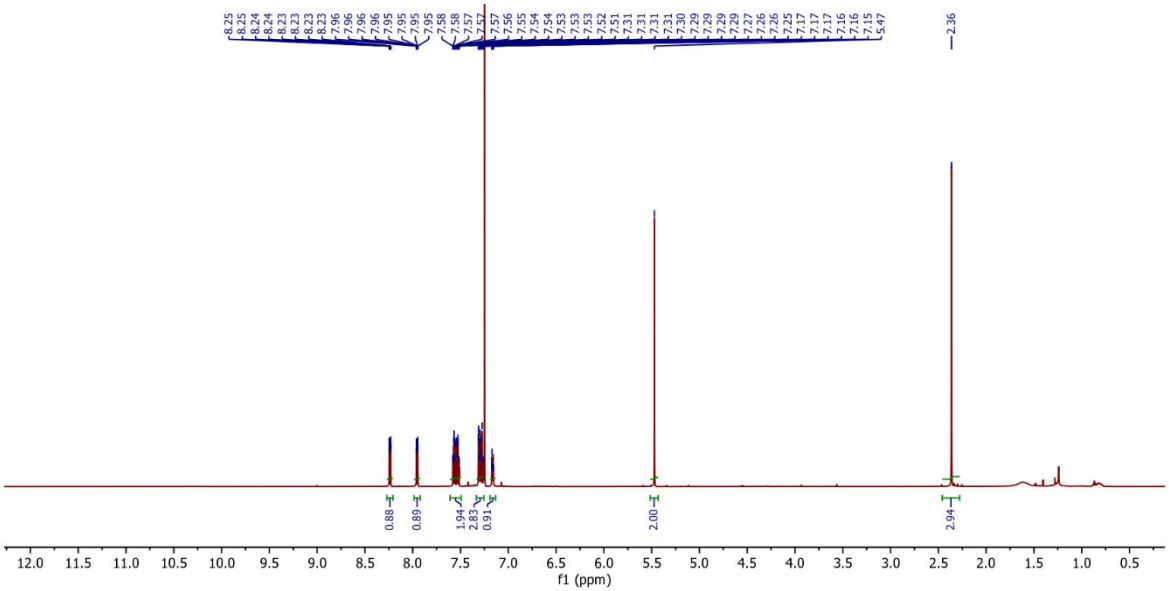
^{1}H NMR Spectrum of **6a** (600 MHz, $CDCl_3$)



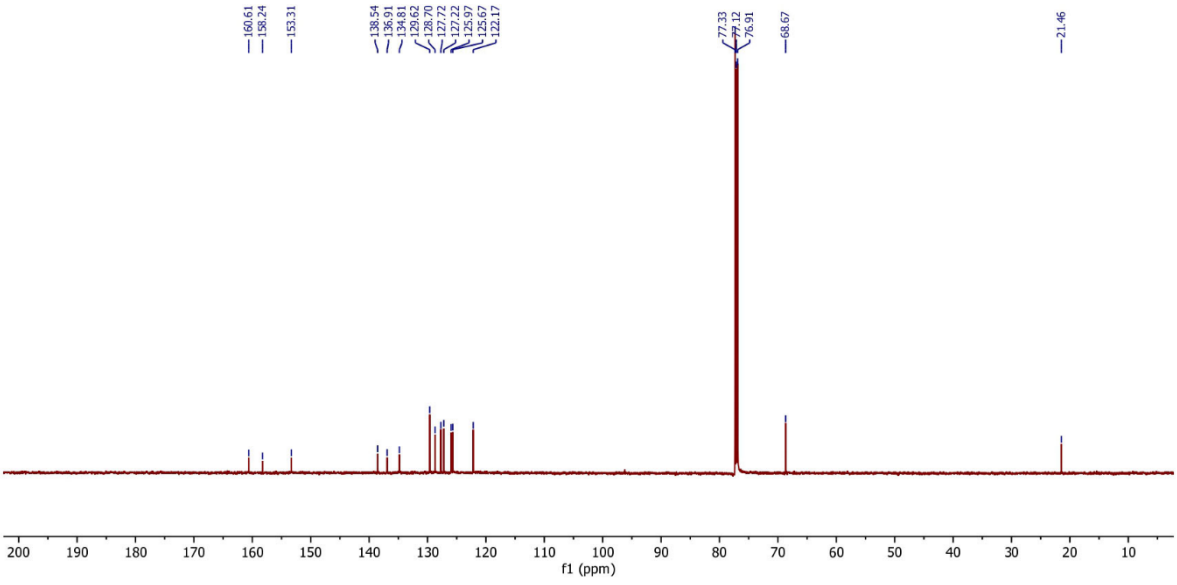
^{13}C NMR Spectrum of **6a** (151 MHz, $CDCl_3$)



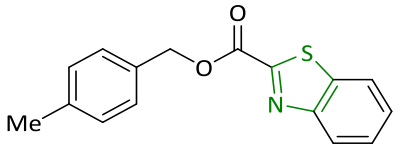
3-methylbenzyl benzo[d]thiazole-2-carboxylate (6b)



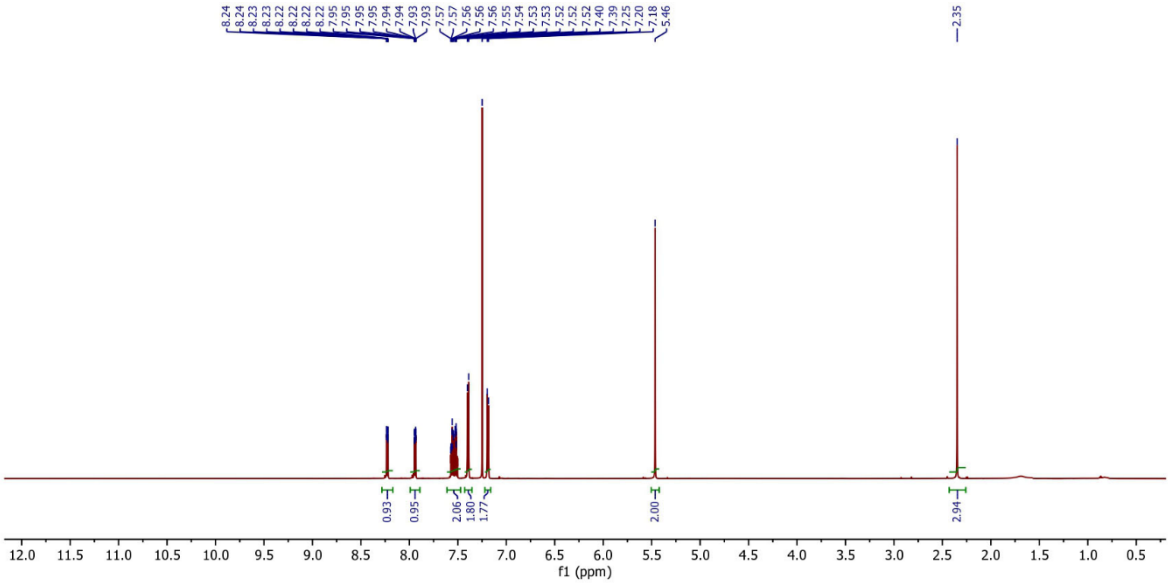
^{1}H NMR Spectrum of **6b** (600 MHz, $CDCl_3$)



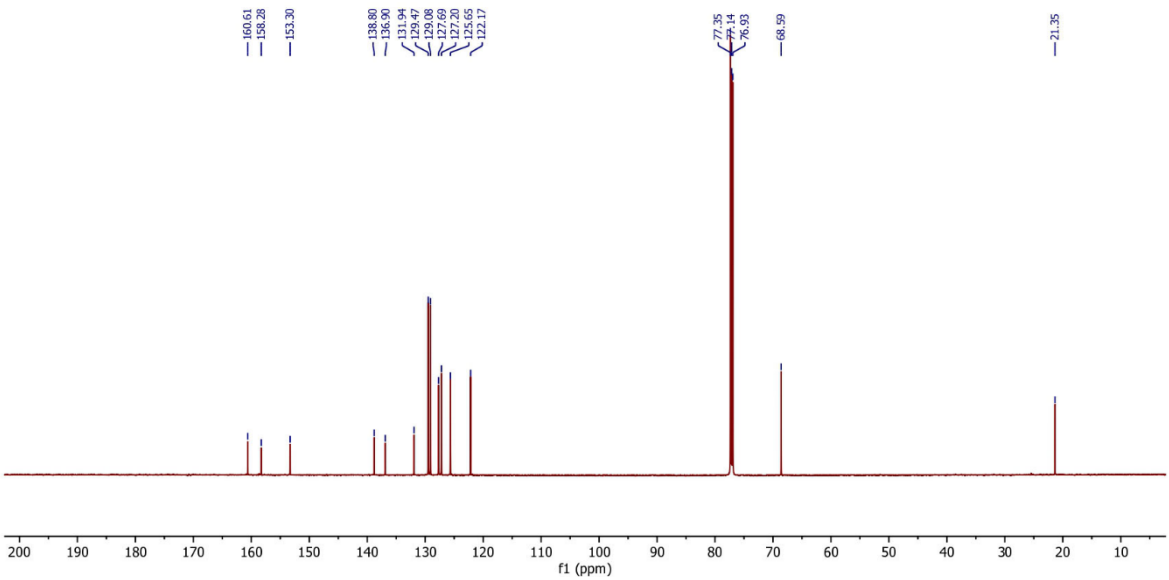
^{13}C NMR Spectrum of **6b** (151 MHz, $CDCl_3$)



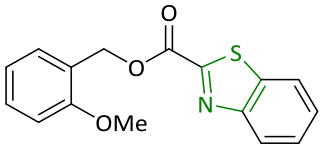
4-methylbenzyl benzo[d]thiazole-2-carboxylate (6c)



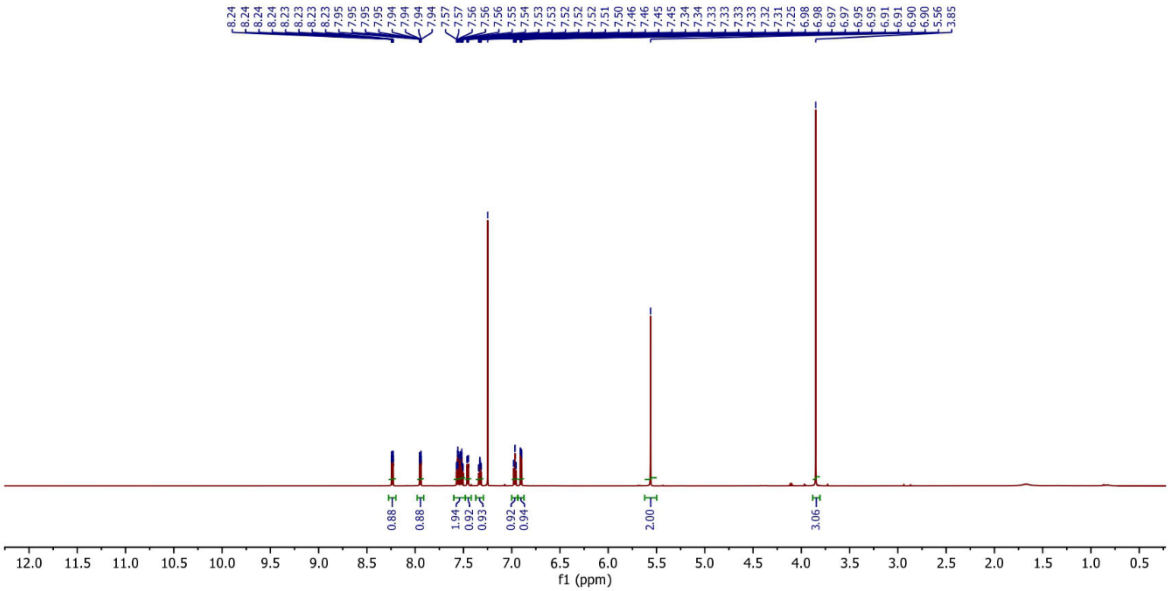
^{1}H NMR Spectrum of **6c** (600 MHz, $CDCl_3$)



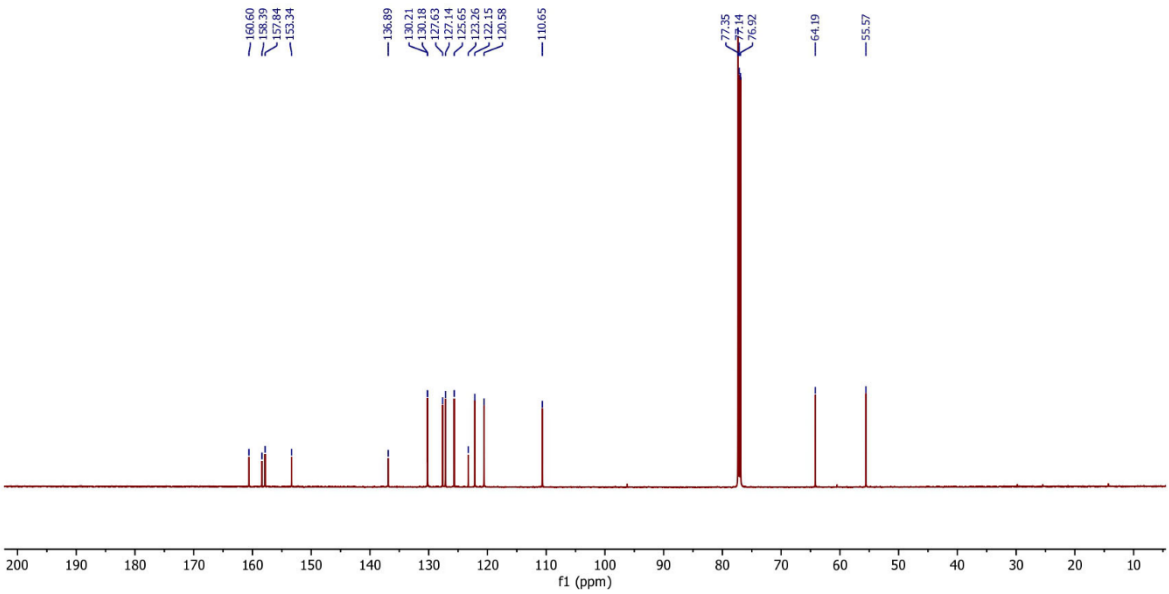
^{13}C NMR Spectrum of **6c** (151 MHz, $CDCl_3$)



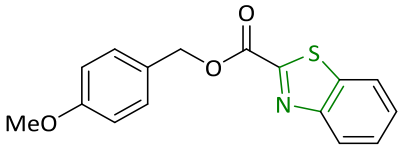
2-methoxybenzyl benzo[d]thiazole-2-carboxylate (6d)



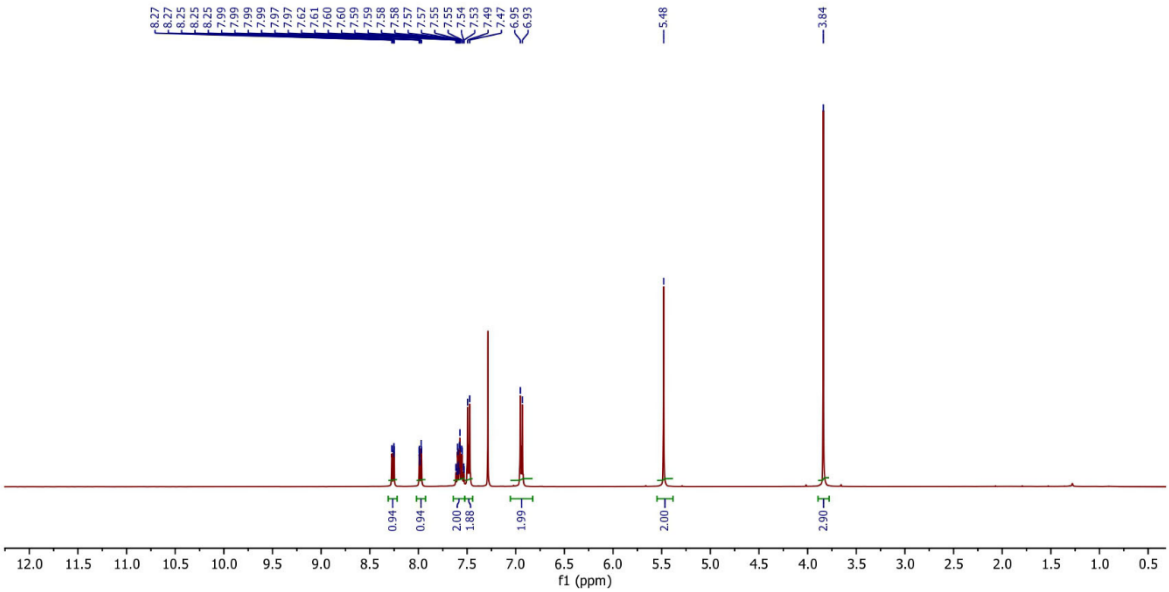
^{1}H NMR Spectrum of **6d** (600 MHz, $CDCl_3$)



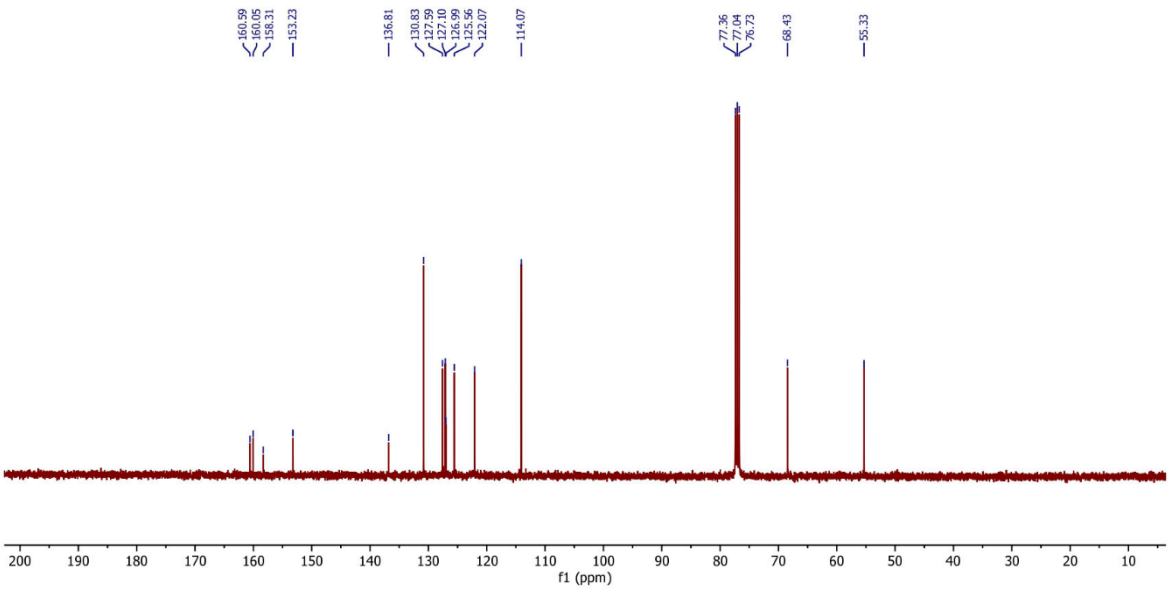
^{13}C NMR Spectrum of **6d** (151 MHz, $CDCl_3$)



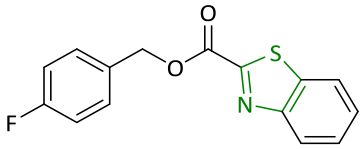
4-methoxybenzyl benzo[d]thiazole-2-carboxylate (6e)



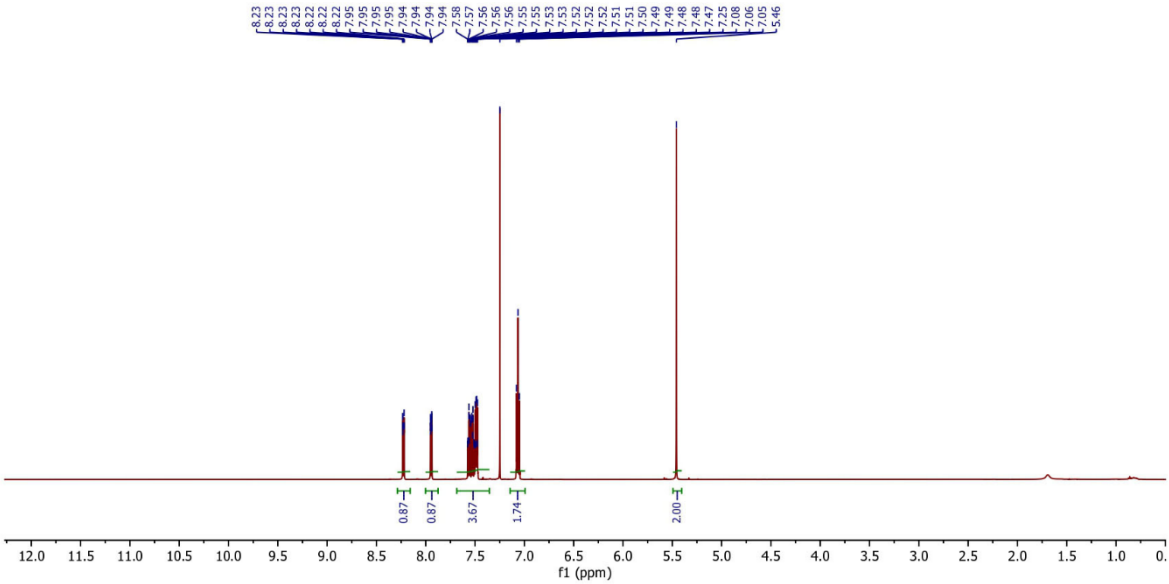
^{1}H NMR Spectrum of **6e** (400 MHz, $CDCl_3$)



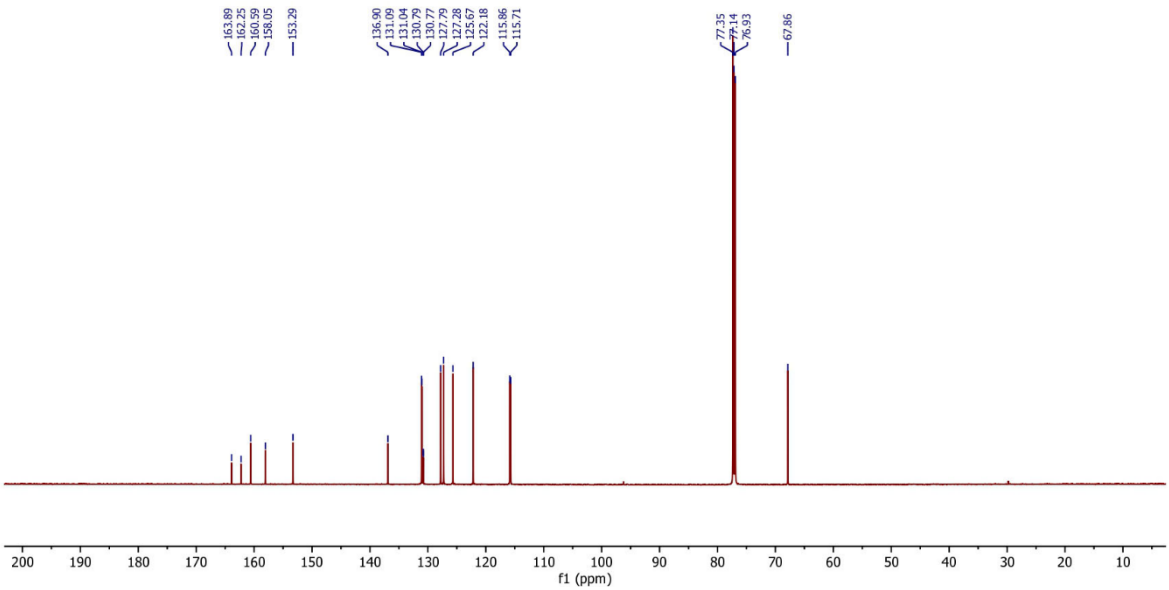
^{13}C NMR Spectrum of **6e** (101 MHz, $CDCl_3$)



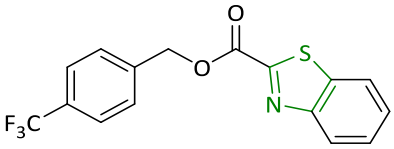
4-fluorobenzyl benzo[d]thiazole-2-carboxylate (6f)



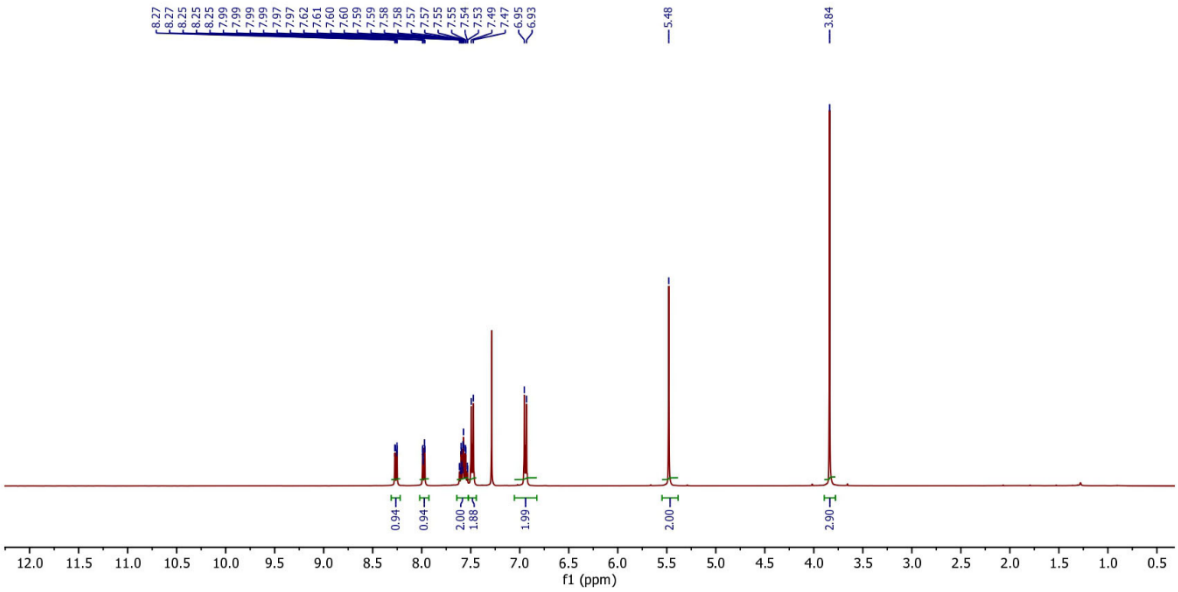
^{1}H NMR Spectrum of **6f** (600 MHz, $CDCl_3$)



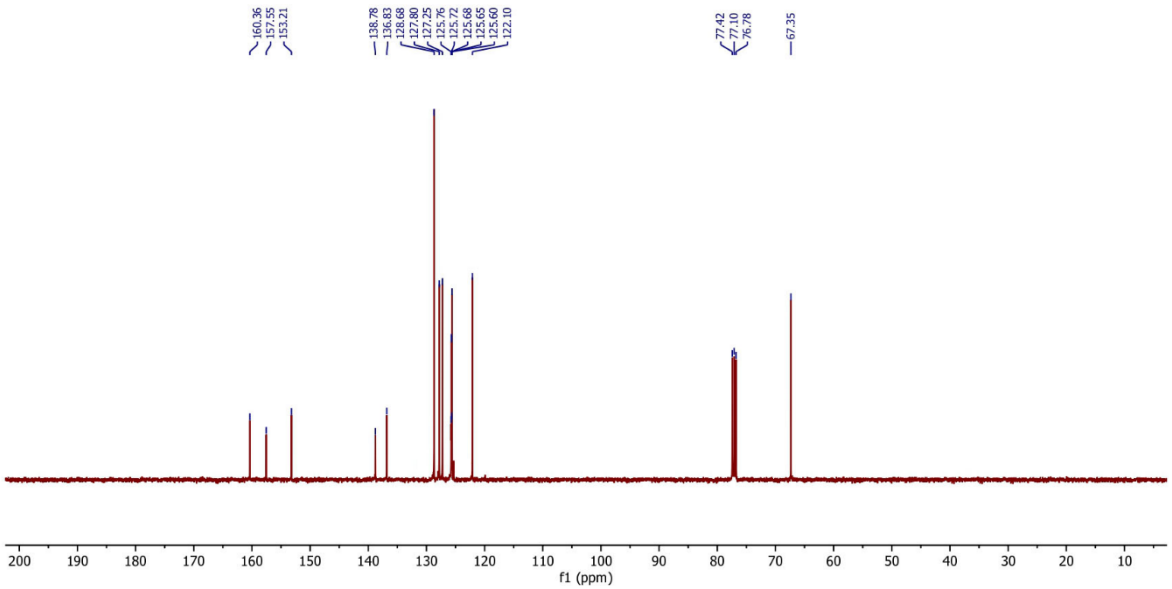
^{13}C NMR Spectrum of **6f** (151 MHz, $CDCl_3$)



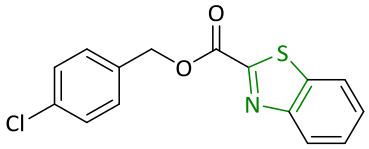
4-(trifluoromethyl)benzyl benzo[d]thiazole-2-carboxylate (6g)



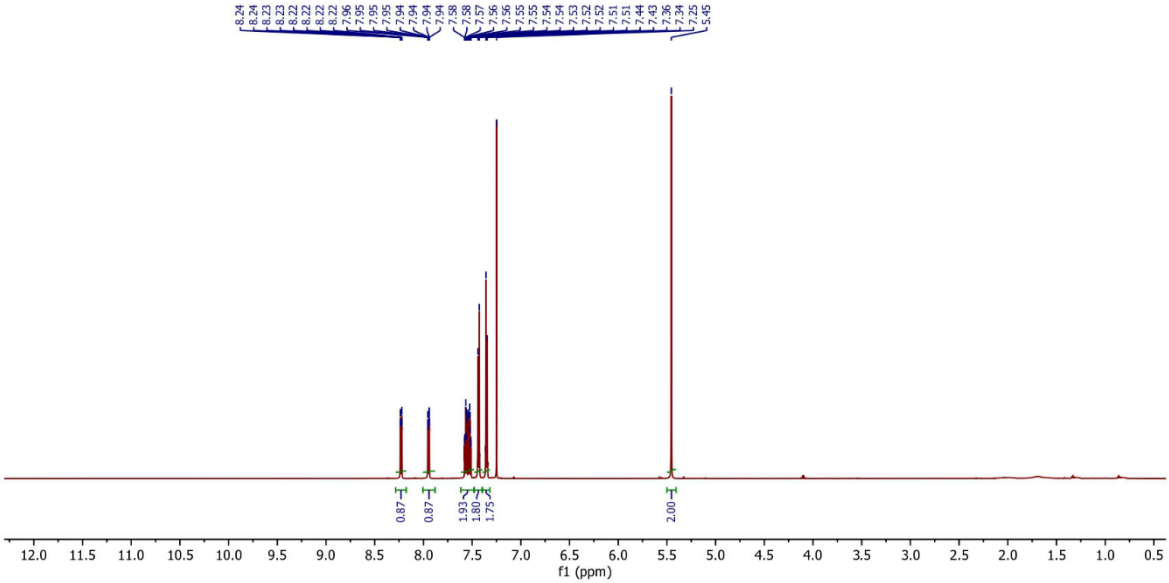
^{1}H NMR Spectrum of **6g** (400 MHz, $CDCl_3$)



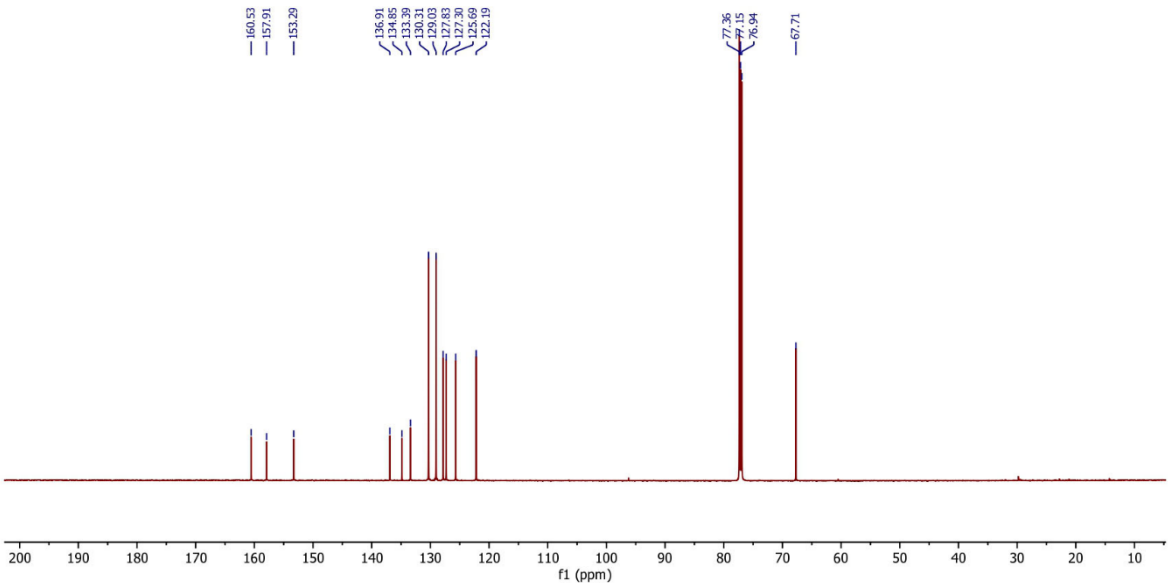
^{13}C NMR Spectrum of **6g** (101 MHz, $CDCl_3$)



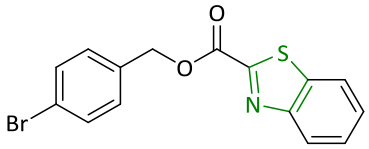
4-chlorobenzyl benzo[d]thiazole-2-carboxylate (6h)



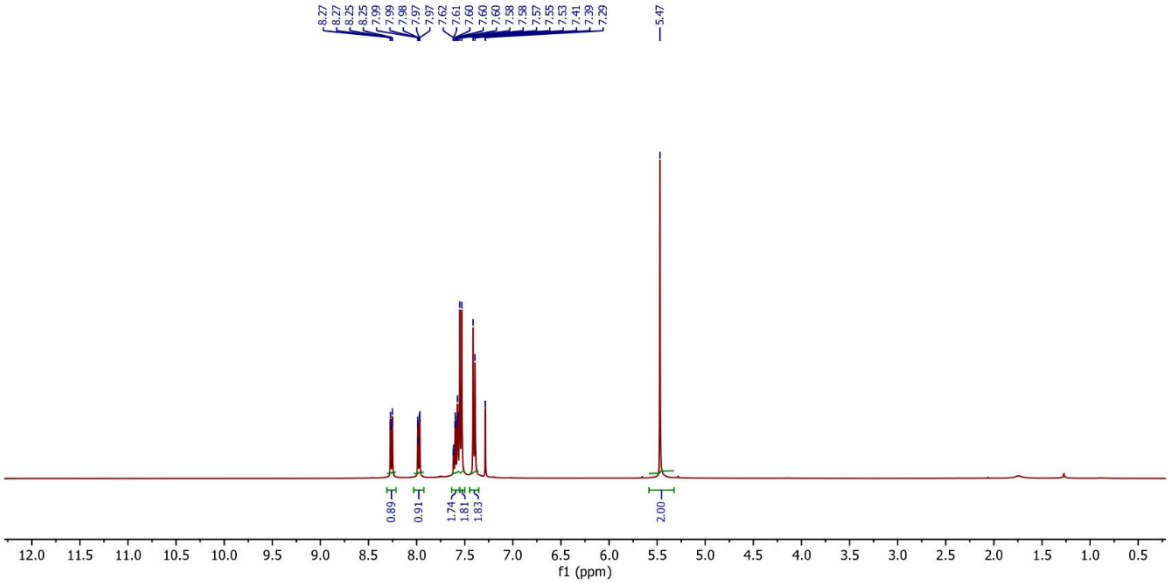
^{1}H NMR Spectrum of **6h** (600 MHz, $CDCl_3$)



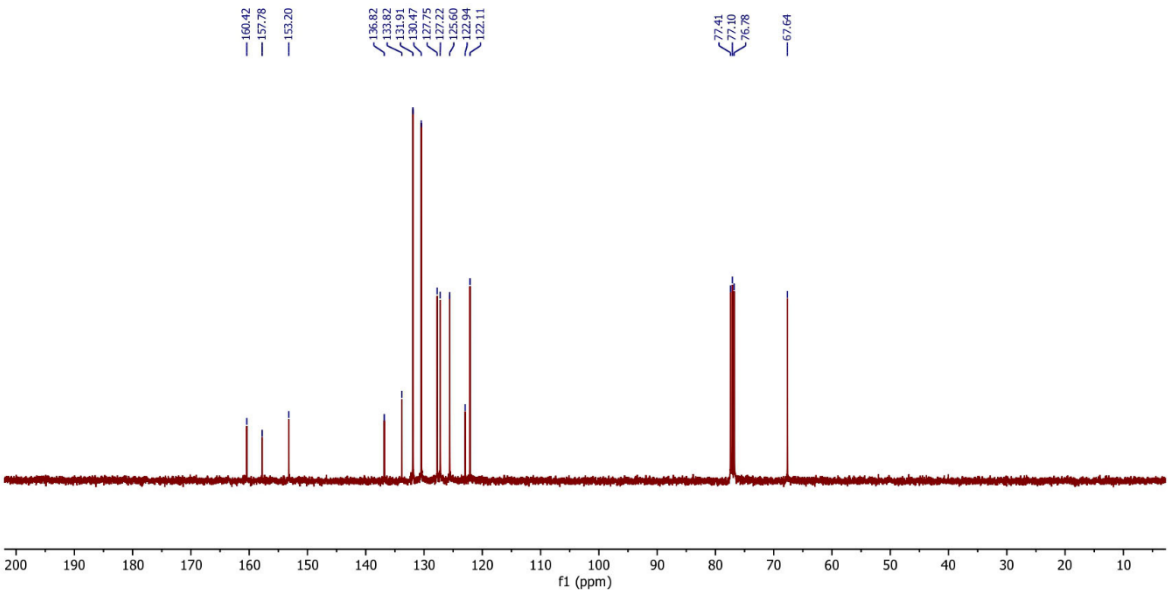
^{13}C NMR Spectrum of **6h** (151 MHz, $CDCl_3$)



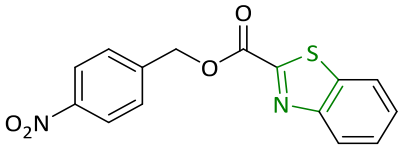
4-bromobenzyl benzo[d]thiazole-2-carboxylate (6i)



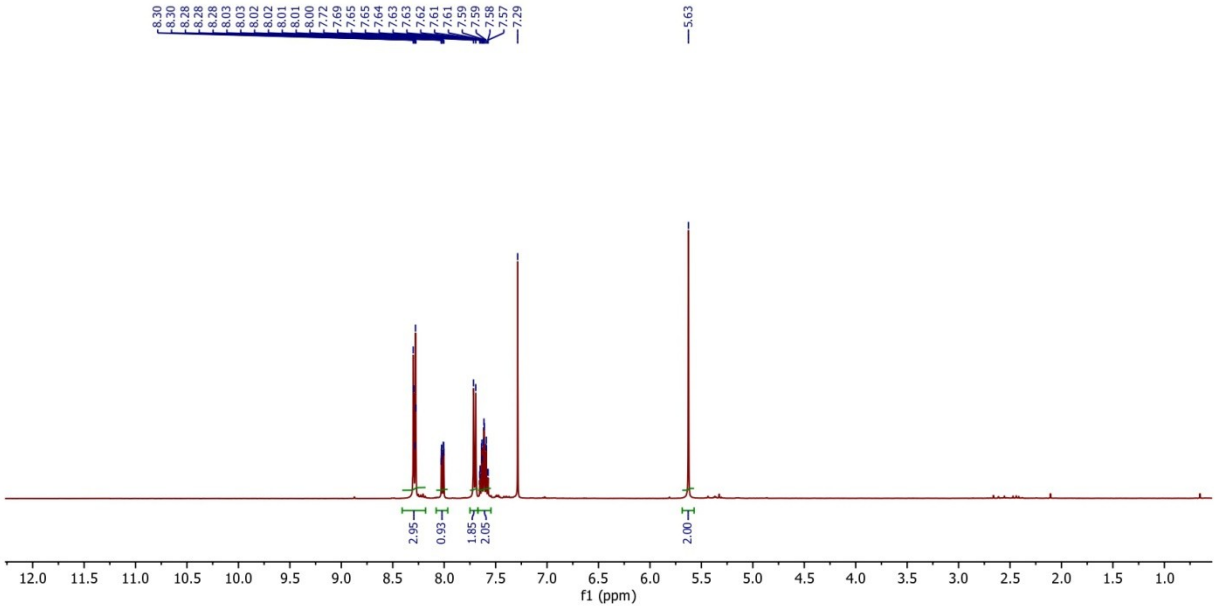
^{1}H NMR Spectrum of **6i** (600 MHz, $CDCl_3$)



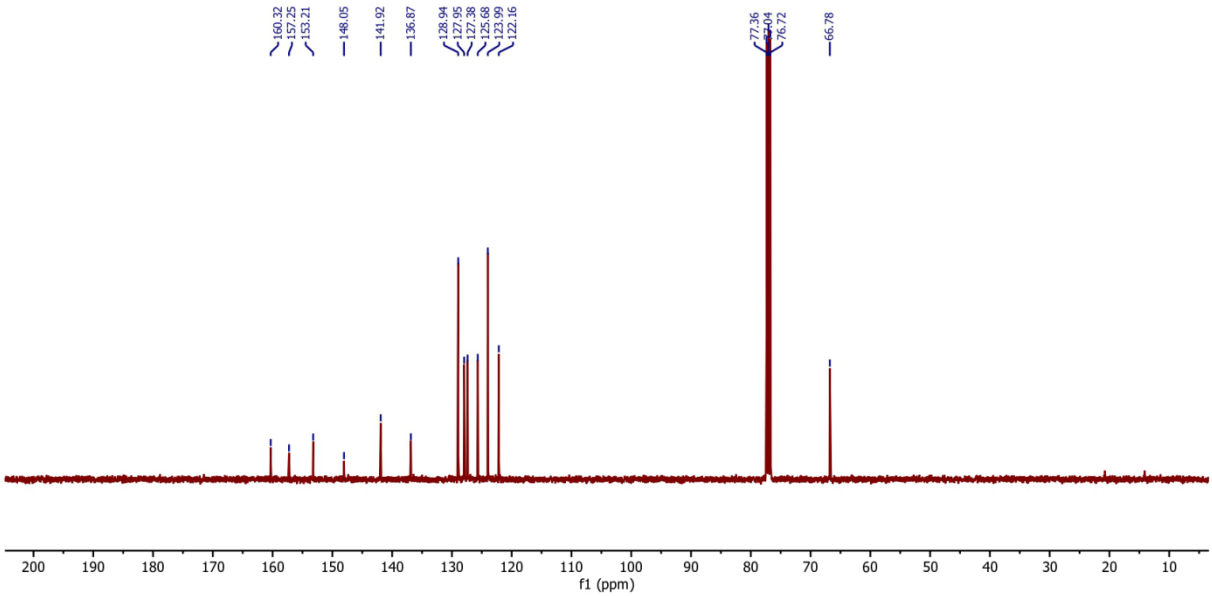
^{13}C NMR Spectrum of **6i** (151 MHz, $CDCl_3$)



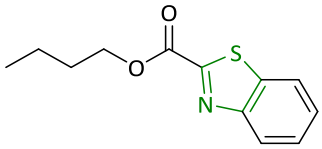
4-nitrobenzyl benzo[d]thiazole-2-carboxylate (6j)



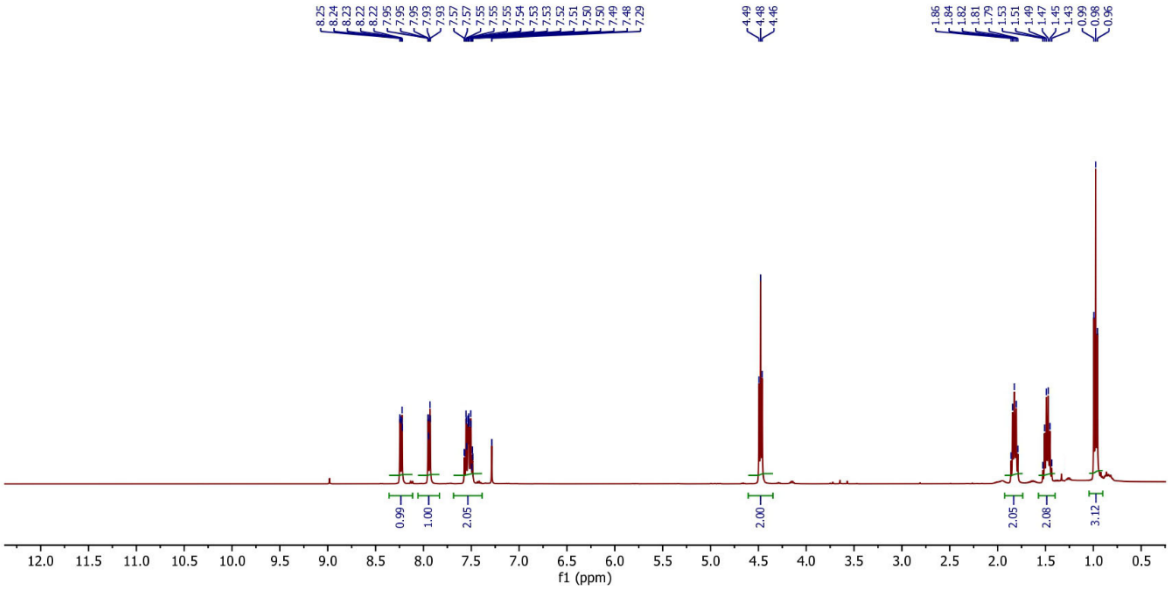
^{1}H NMR Spectrum of **6j** (400 MHz, $CDCl_3$)



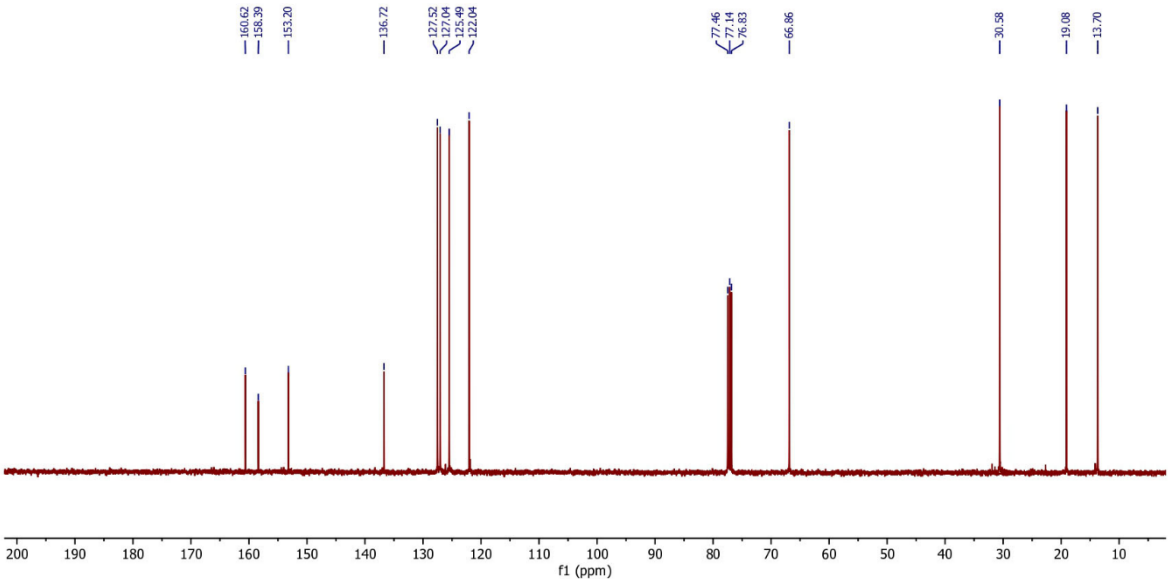
^{13}C NMR Spectrum of **6j** (101 MHz, $CDCl_3$)



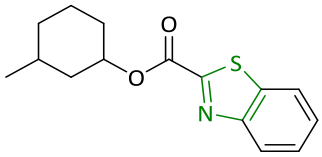
Butyl benzo[d]thiazole-2-carboxylate (6k)



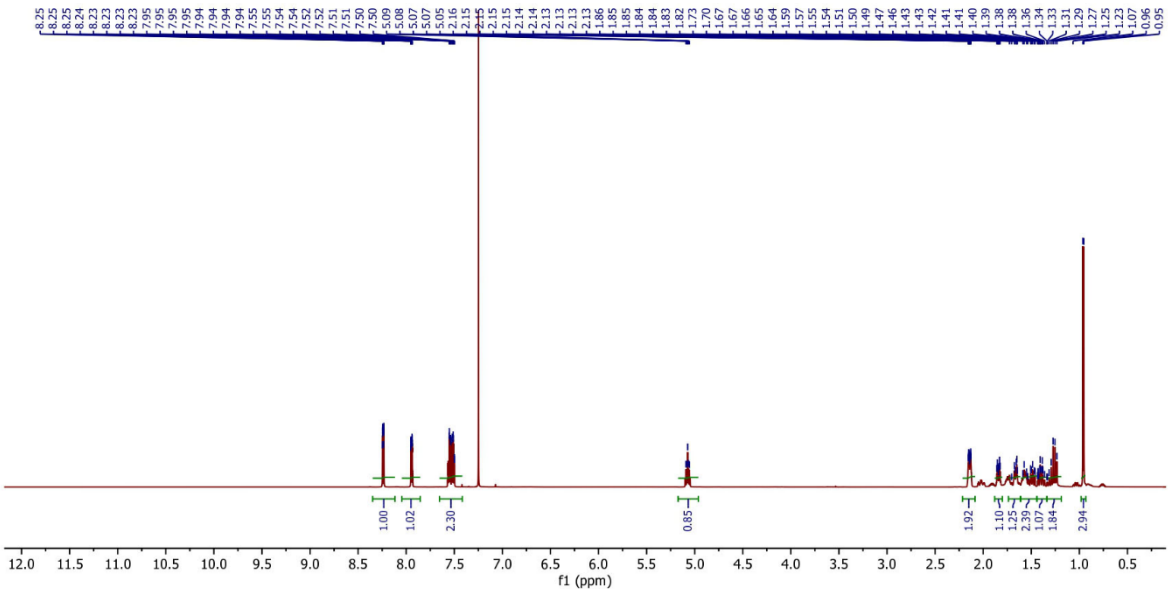
^{1}H NMR Spectrum of **6k** (400 MHz, $CDCl_3$)



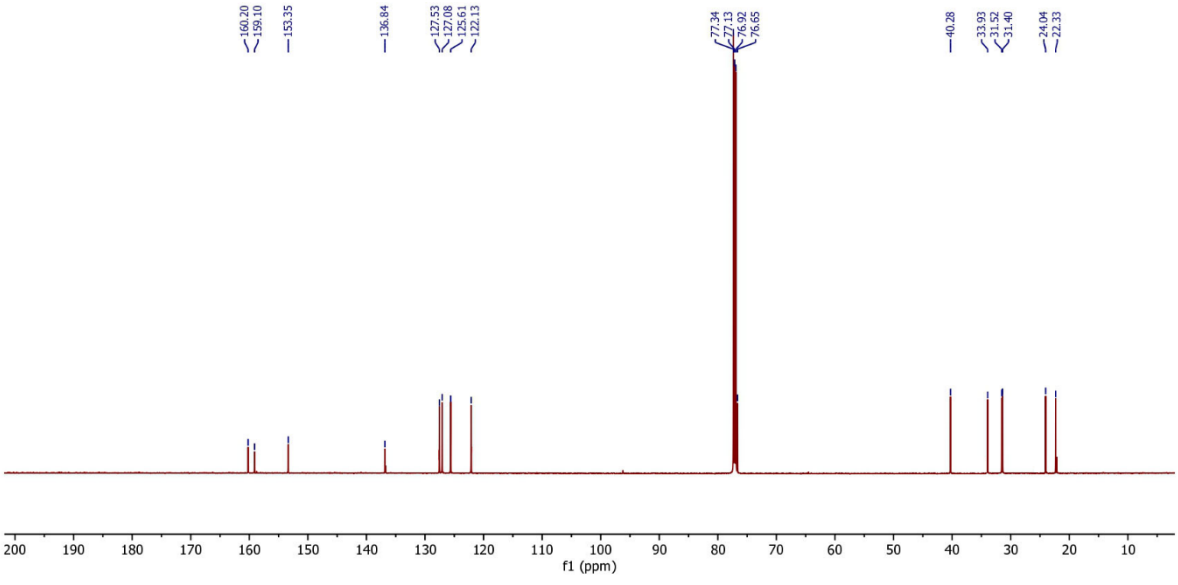
^{13}C NMR Spectrum of **6k** (101 MHz, $CDCl_3$)



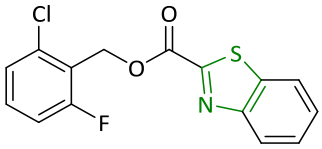
3-methylcyclohexyl benzo[d]thiazole-2-carboxylate (6l)



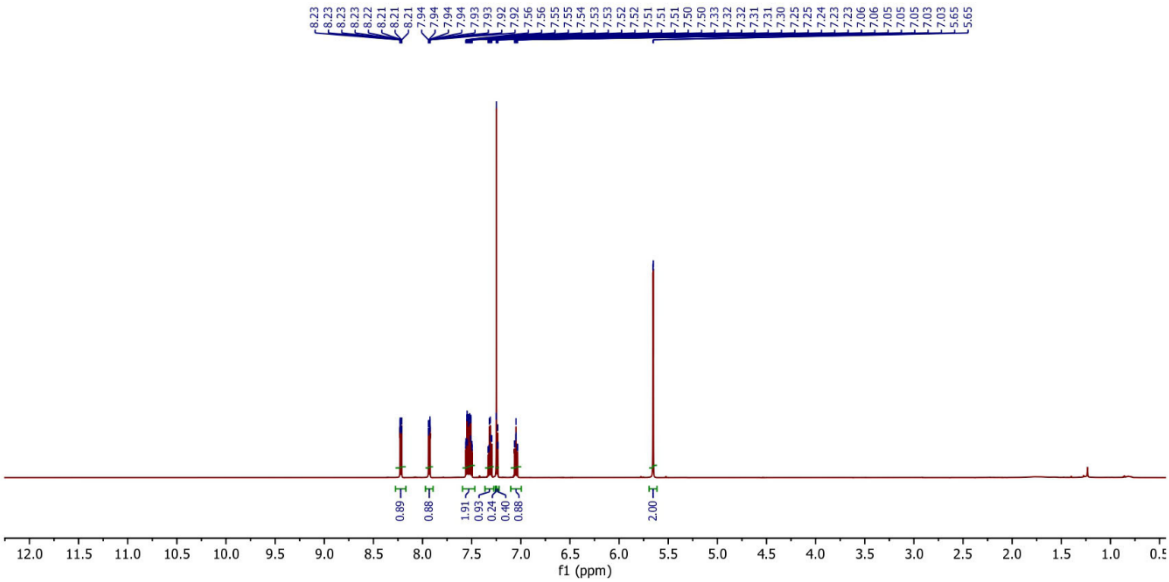
^{1}H NMR Spectrum of **6l** (600 MHz, $CDCl_3$)



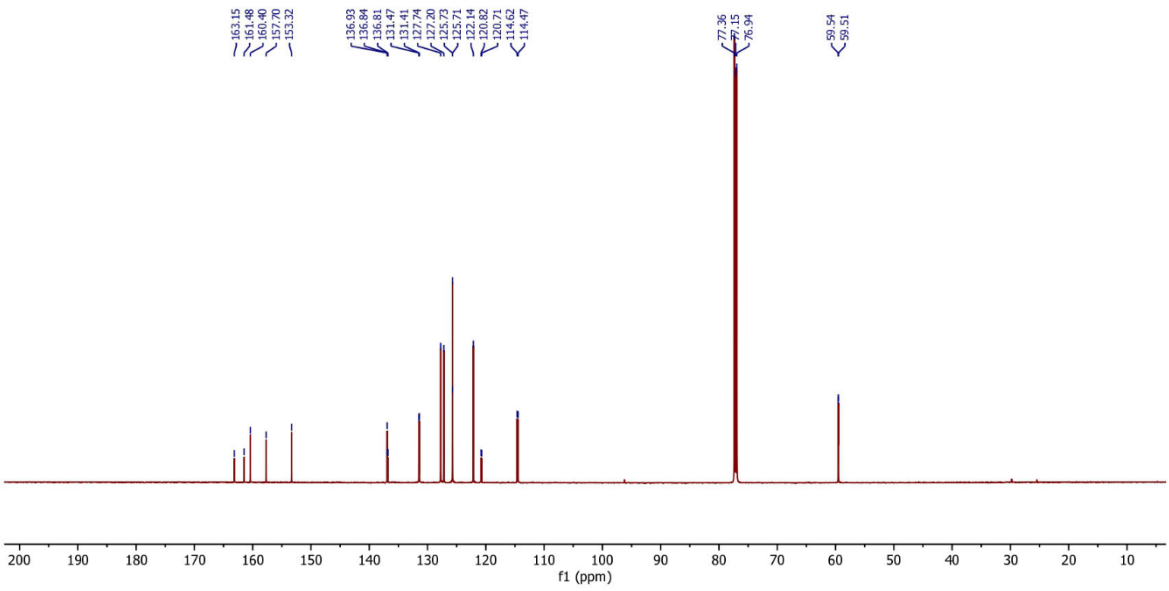
^{13}C NMR Spectrum of **6l** (151 MHz, $CDCl_3$)



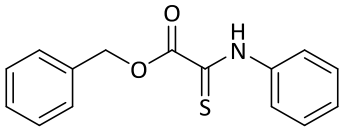
2-chloro-6-fluorobenzyl benzo[d]thiazole-2-carboxylate (6m)



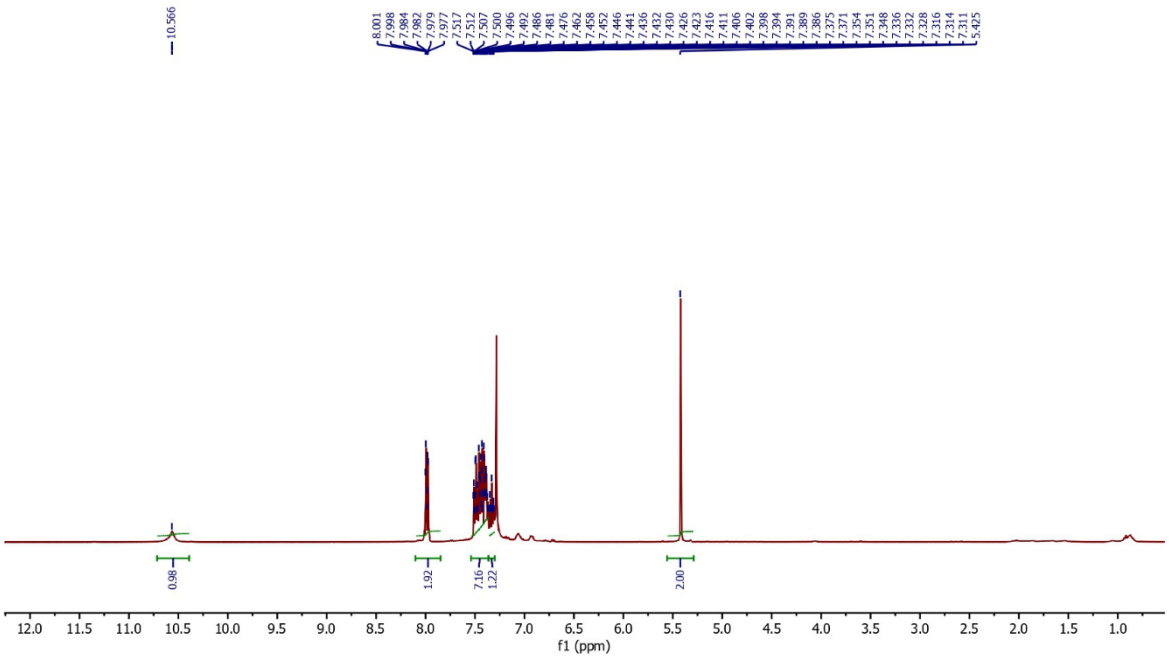
^{1}H NMR Spectrum of **6m** (600 MHz, $CDCl_3$)



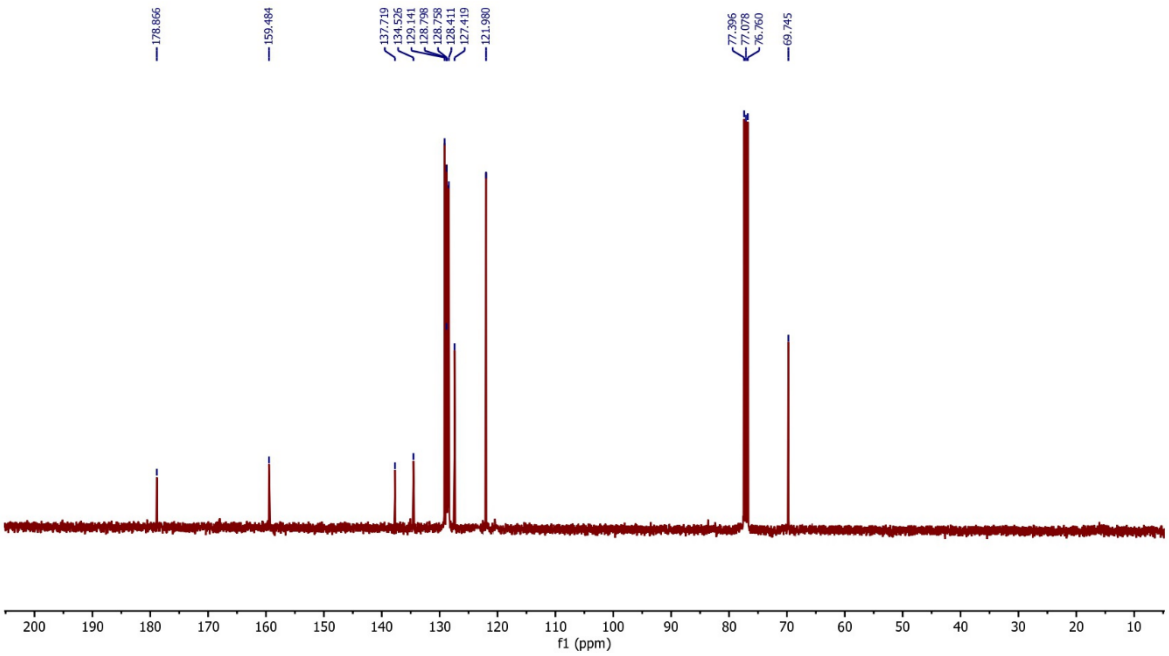
^{13}C NMR Spectrum of **6m** (151 MHz, $CDCl_3$)



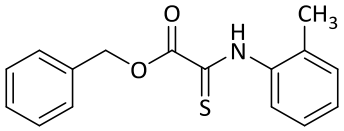
Benzyl 2-(phenylamino)-2-thioxoacetate (7a)



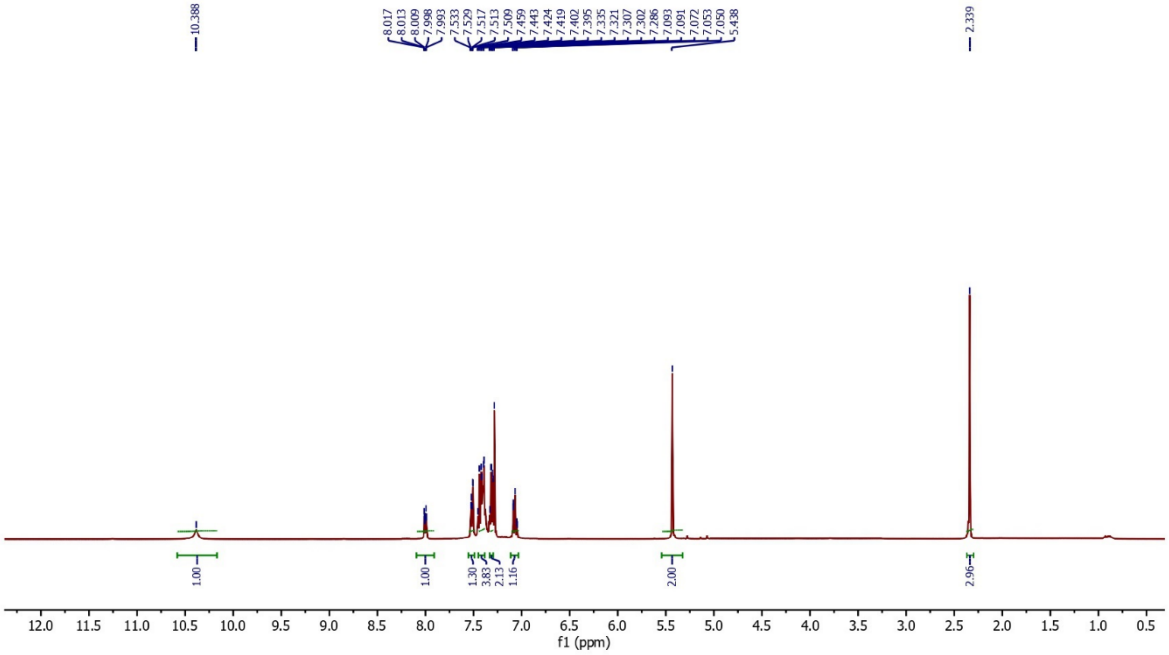
^{1}H NMR Spectrum of **7a** (400 MHz, $CDCl_3$)



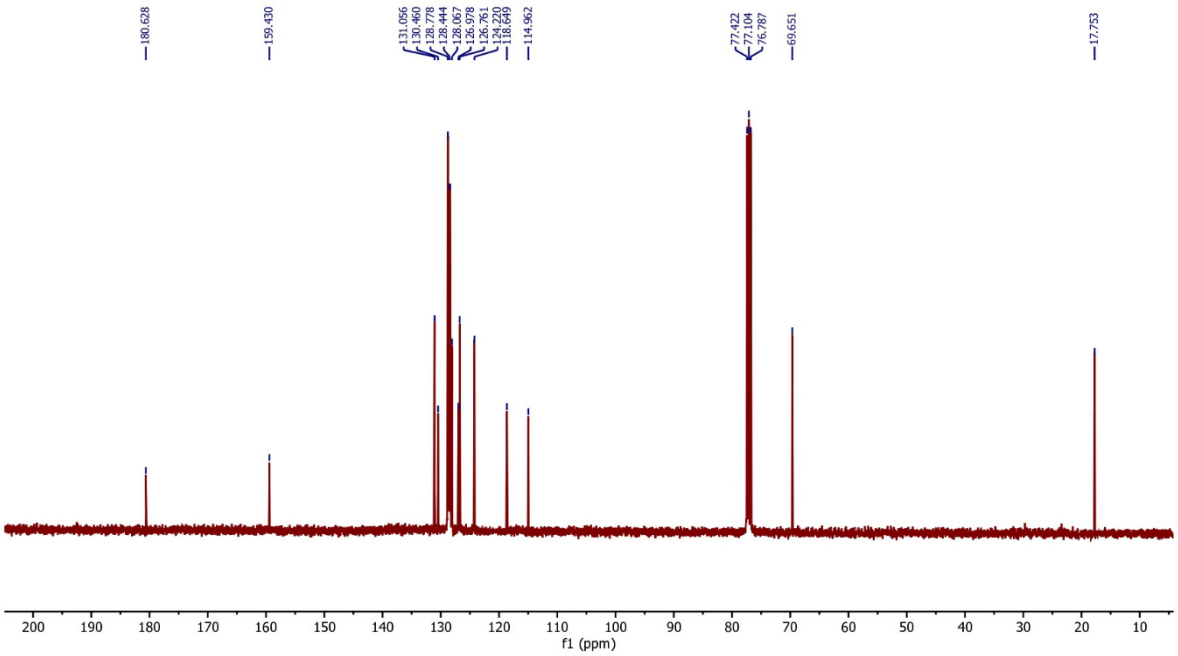
^{13}C NMR Spectrum of **7a** (101 MHz, $CDCl_3$)



Benzyl 2-thioxo-2-(*o*-tolylamino)acetate (7b)



^{1}H NMR Spectrum of **7b** (400 MHz, $CDCl_3$)



^{13}C NMR Spectrum of **7b** (101 MHz, $CDCl_3$)

Table Percentage cell viability of SH-SY5Y cells treated with benzazole derivatives

Compound	Sample Concentration (µg/ml)				
	6.25 µg/ml	12.5 µg/ml	25 µg/ml	50 µg/ml	100 µg/ml
4a	92.75272	89.39347	76.36081	57.57387	15.08554
4b	99.12908	97.32504	94.74339	87.15397	71.66407
4c	99.62675	99.06687	97.7605	97.23173	96.01866
4d	99.0743	98.5284	98.1063	96.6585	95.4628
4e	98.8347	98.2639	97.7448	96.3357	95.0875
4f	95.9432	89.9827	82.0539	71.894	65.3382
4g	99.0386	98.9522	98.4853	92.4725	88.6624
4h	99.4472	99.0684	98.8143	98.0592	96.0361
4i	99.9689	99.50233	99.19129	98.69362	98.00933
4j	98.6401	96.0153	96.9802	92.5294	89.8503
4k	96.8362	92.0157	85.0439	84.8953	78.0335
4l	99.37792	98.78694	97.54277	95.61431	93.43701
4m	89.0571	86.982	85.4862	70.0672	73.4491
4n	99.56454	98.91135	97.72939	94.33904	91.35303
4o	99.44012	99.19129	98.32037	97.57387	96.45412
4p	97.0471	96.893	88.9412	80.9447	80.0286
5a	99.72006	98.69362	91.97512	84.60342	57.54277
5b	98.9875	98.6843	95.8367	89.0544	89.8952
5c	99.34681	98.32037	97.38725	96.45412	93.12597
5d	94.4812	90.7915	81.8669	65.1529	35.1624
5e	99.4323	97.2879	92.6521	75.9381	48.1866
5f	97.8362	89.9873	83.863	62.8776	28.9632
5g	99.5584	90.4761	84.8943	69.2841	42.2894
5h	92.75272	89.39347	76.36081	57.57387	15.08554
5i	99.37792	98.78694	97.54277	95.61431	93.43701
5j	94.48124	90.79155	81.86692	65.15295	35.16241
5k	99.43236	97.28792	92.65216	75.93819	48.18669
5l	96.9965	96.4345	89.8623	74.9853	79.8465
5m	99.5585	90.47619	84.89436	69.28414	42.2895
5n	99.5782	98.0625	94.0531	94.9762	90.0642
5o	98.0736	97.8634	89.9374	78.3574	65.925
6a	99.84232	92.74677	92.39987	90.06623	83.60139
6b	98.61243	96.90949	92.90445	90.50773	86.12425
6c	98.61243	96.90949	92.90445	90.50773	86.12425
6d	99.49543	96.94103	92.80984	78.52412	59.57111
6e	99.21161	97.91864	97.13024	95.71113	92.52602
6f	98.92778	97.57174	92.24219	80.44781	57.67897
6g	98.5472	97.4327	91.747	82.8735	76.9867
6h	98.61243	96.90949	92.90445	90.50773	86.12425
6i	94.48124	90.79155	81.86692	65.15295	35.16241
6j	99.5584	90.4761	84.8943	69.2841	42.2894
6k	99.0476	98.5228	93.0456	93.6854	90.7161

6l	99.37792	98.78694	97.54277	95.61431	93.43701
6m	98.61243	96.90949	92.90445	90.50773	86.12425

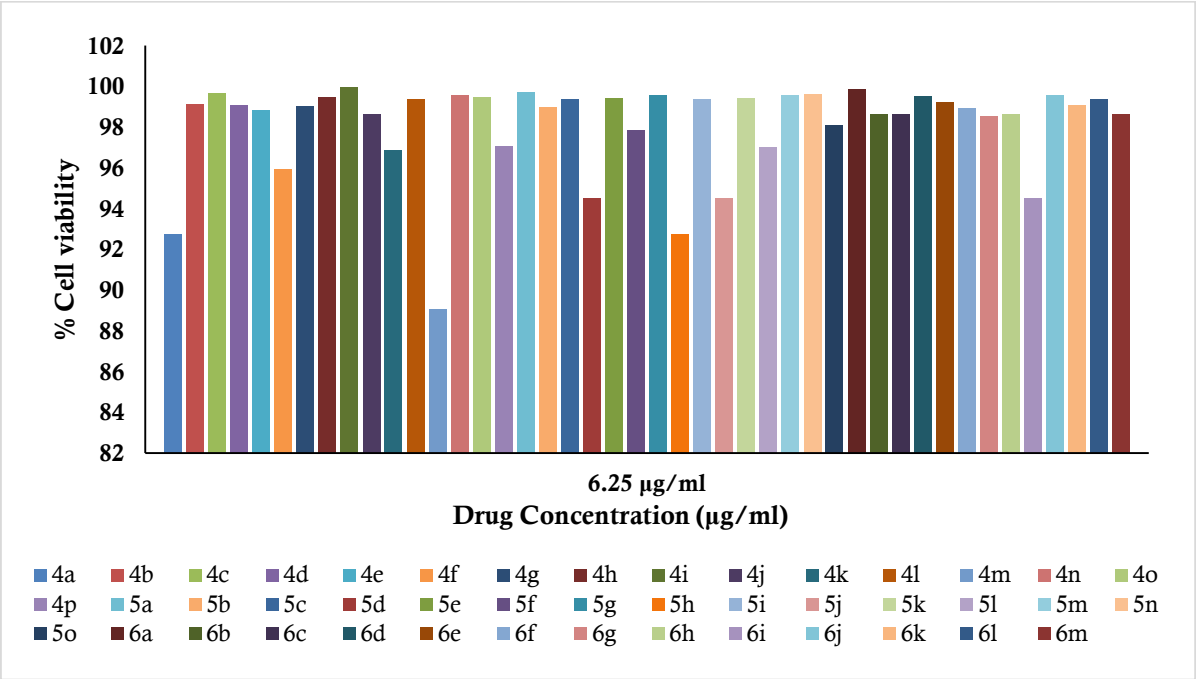


Fig. 1 Percentage cell viability of SH-SY5Y cells treated with benzazole derivatives at 6.25 µM

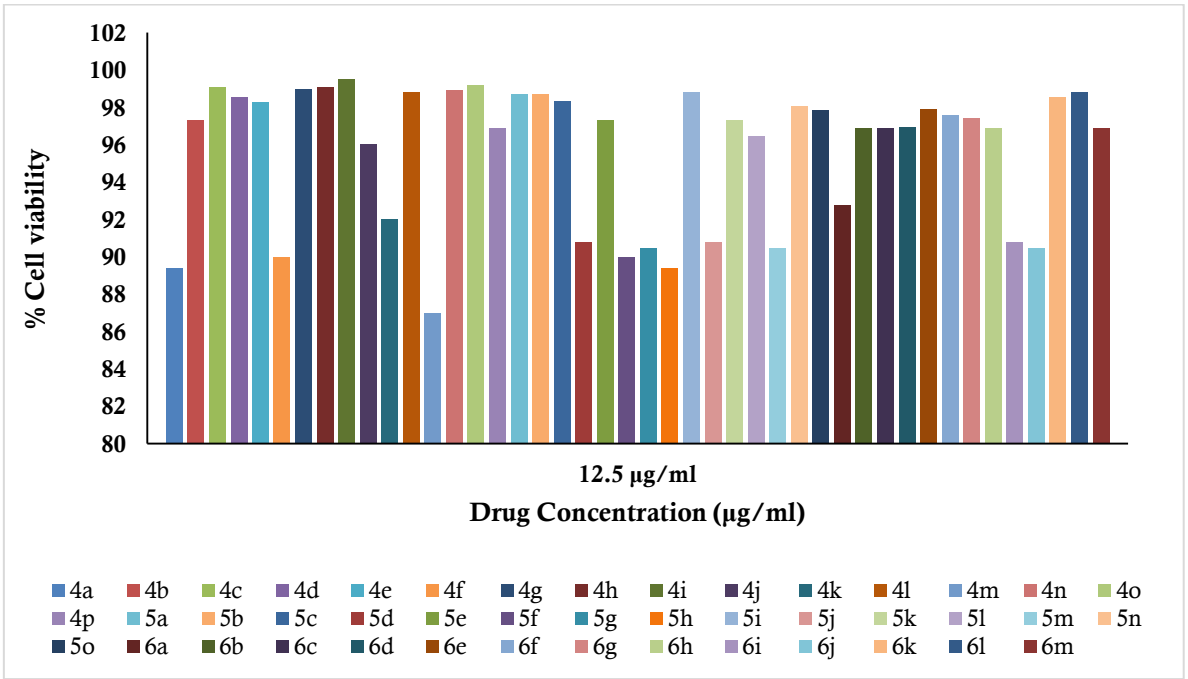


Fig. 2 Percentage cell viability of SH-SY5Y cells treated with benzazole derivatives at 12.5 Mm

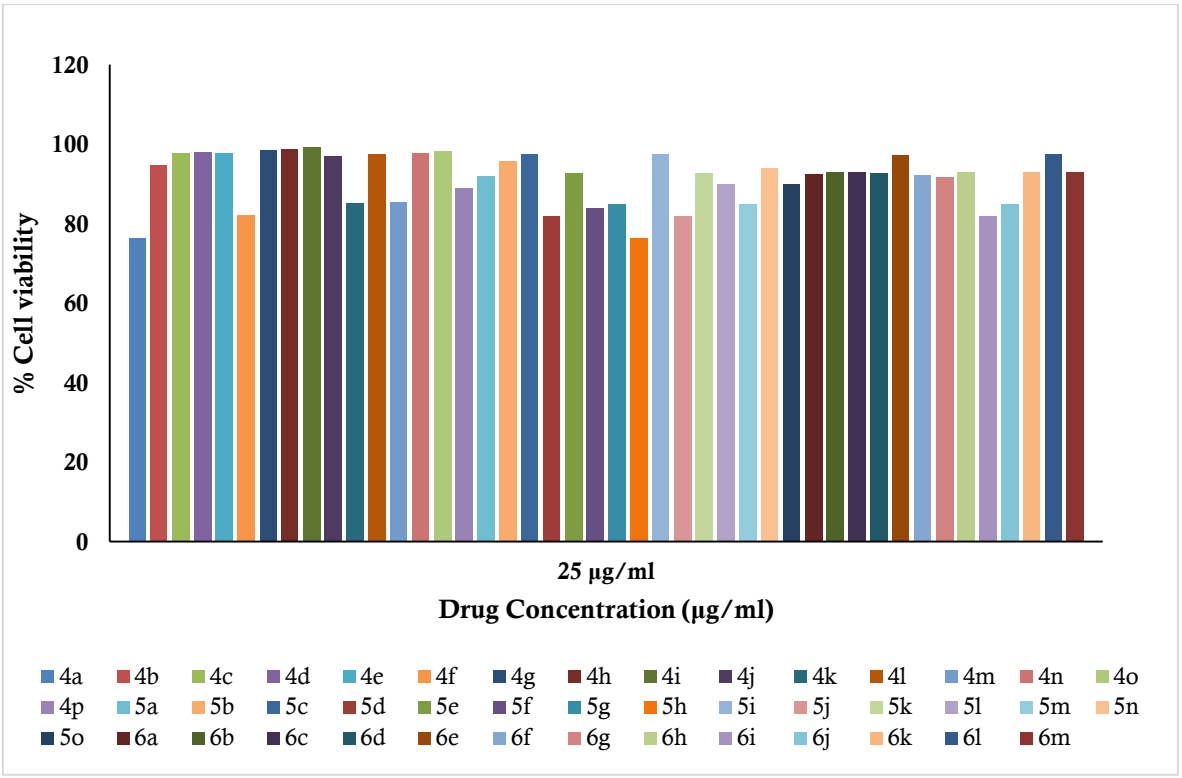


Fig. 3 Percentage cell viability of SH-SY5Y cells treated with benzazole derivatives at 25 µM

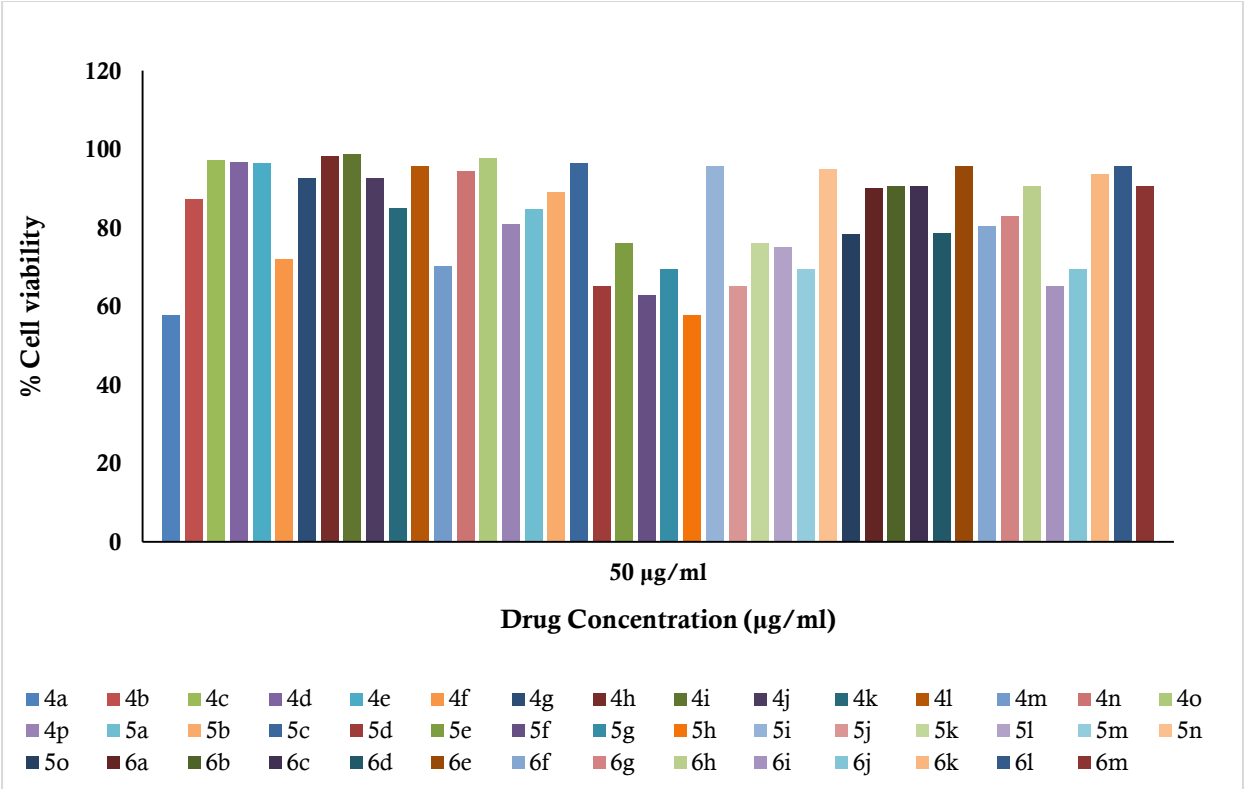


Fig. 4 Percentage cell viability of SH-SY5Y cells treated with benzazole derivatives at 50 µM

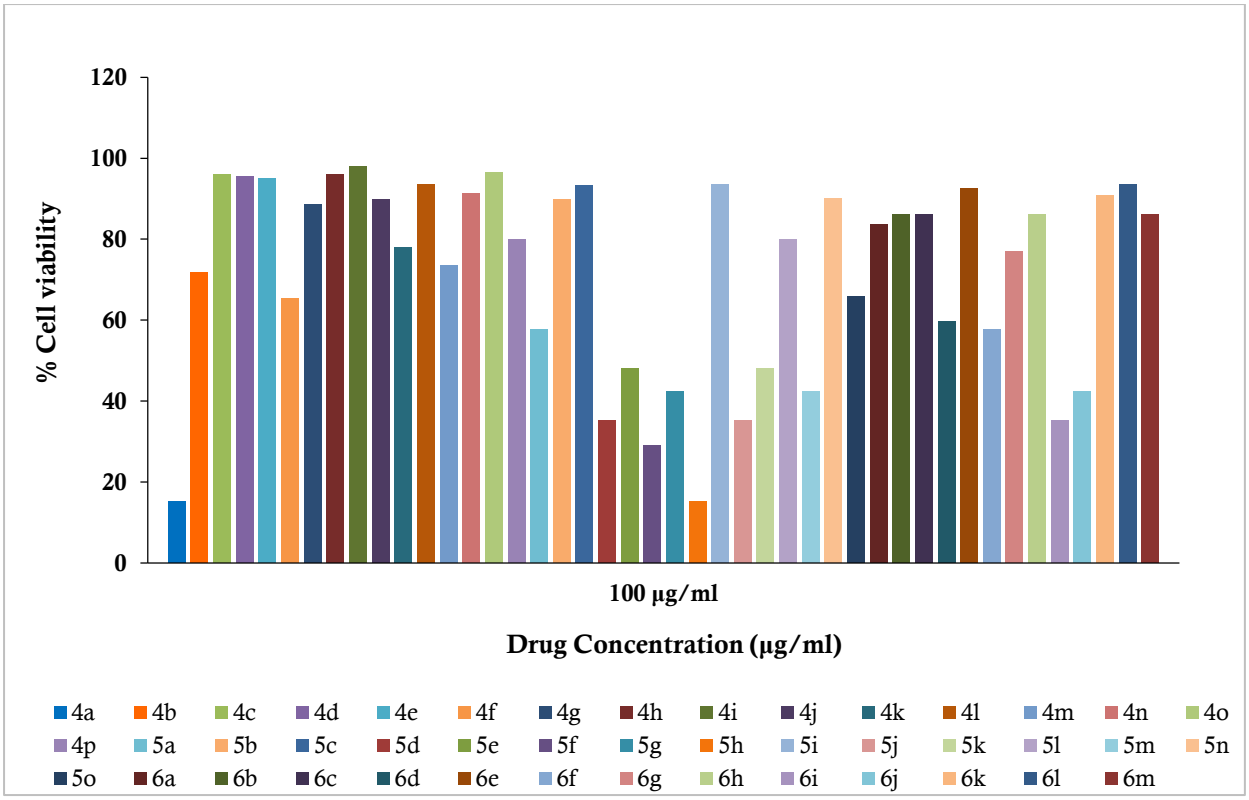


Fig. 5 Percentage cell viability of SH-SY5Y cells treated with benzazole derivatives at 100 µM

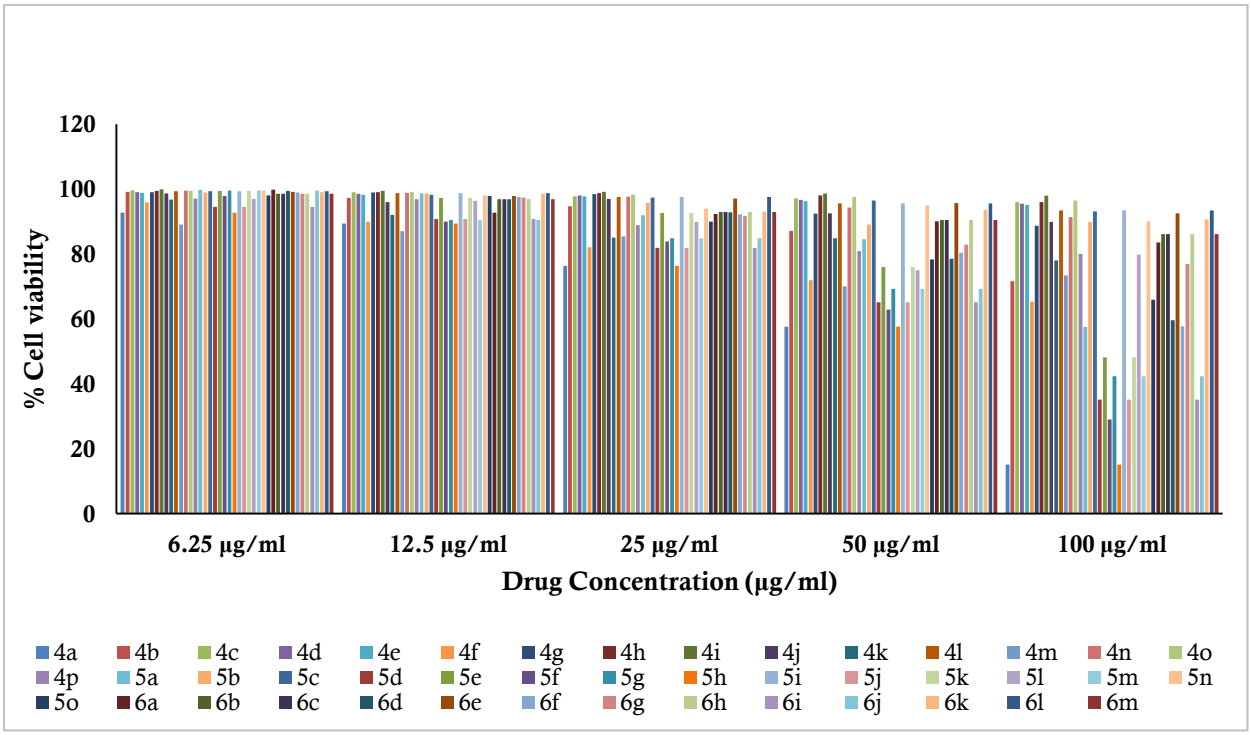


Fig. 6 Percentage cell viability of SH-SY5Y cells treated with benzazole derivatives at 6.25-100 µM

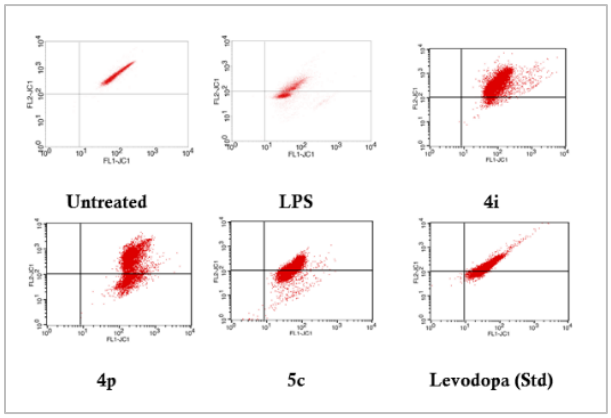
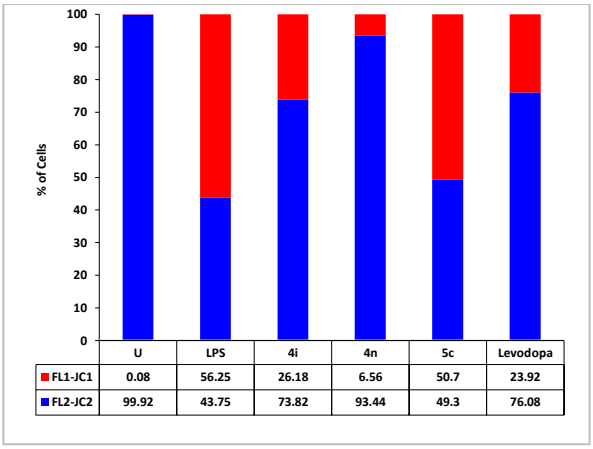
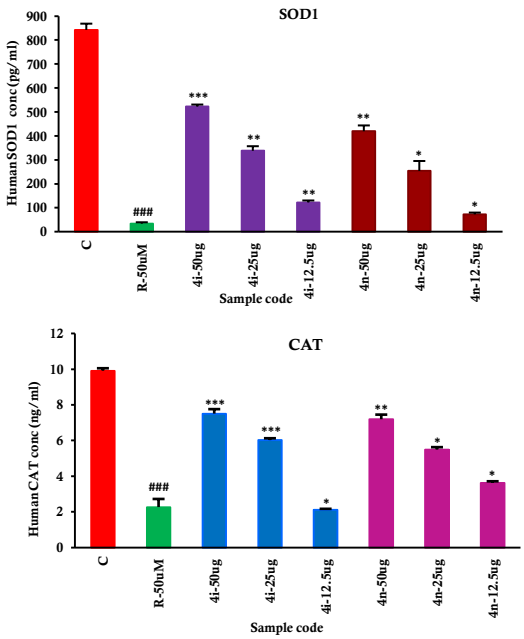


Fig. 7 Quadrant analysis of JC-1 staining showing Δψm in untreated SH-SY5Y cells, LPS-induced cells, and LPS-induced SH-SY5Y cells treated with compounds **4i**, 4n, 5c, and levodopa, analyzed using FL1-JC-1 and FL2-JC-1 channels.



	U	LPS	4i	4n	5c	Levodopa
FL1-JC1	0.08	56.25	26.18	6.56	50.7	23.92
FL2-JC2	99.92	43.75	73.82	93.44	49.3	76.08

Fig. 8 JC-1 assay showing Δψm in LPS-induced SH-SY5Y cells treated with compounds 4d, 4e, 5b, and levodopa.



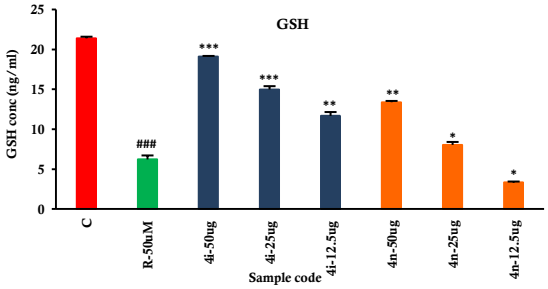


Fig. 9 Effect of test compounds on SOD1, CAT and GSH levels in rotenone treated SH-SY5Y cells.