Supporting Information

for

Regioselective *O*-Alkylation of 2-Pyridones by TfOH-Catalyzed Carbenoid Insertion

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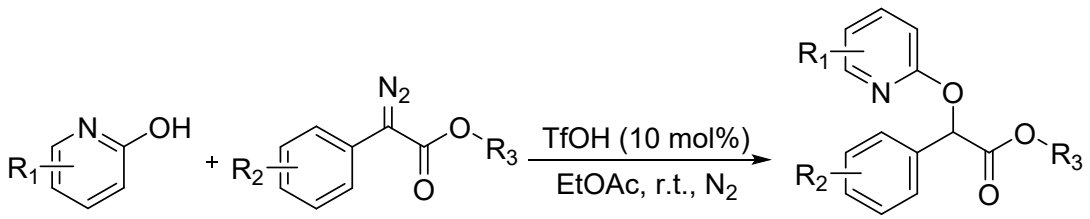
1. General Information and Materials

All ^{1}H NMR (400 MHz) and ^{13}C NMR (100 MHz) and ^{19}F NMR (376 MHz) spectra were recorded on Brucker spectrometers in $CDCl_3$ or DMSO-d_6. Chemical shifts (δ) for NMR were quoted in ppm relative to the solvent peak (7.26 ppm for ^{1}H and 77.16 ppm for ^{13}C in $CDCl_3$; 2.50 ppm for ^{1}H and 40.00 ppm for ^{13}C in DMSO-d_6). Chemical shifts are reported in parts per million as follows: chemical shift, multiplicity (s =singlet, d = doublet, t = triplet, q = quartet, m = multiplet). Coupling constants *J* are recorded in Hz. High-resolution mass spectra (HRMS) were reported from the Thermo Orbitrap Elite or Bruker Daltonics APEXII 47e FT-ICR instrument with an ESI source. Melting points (m.p.) were uncorrected. Infrared Spectrum was reported from the Bruker ALPHA II.

Unless otherwise noted, all reactions were carried out under nitrogen in a flamedried or oven-dried flask containing magnetic stir bar. All 2-pyridones (**1a–k**) were purchased from Bidepharm.com and were used directly without further purification. Diazo compounds **2a–y** were prepared according to literature reported procedure [1-4]. The other materials obtained from commercial suppliers were used directly without further purification. Reactions were monitored by thin layer chromatography (TLC) using pre-coated silica gel plates (GF254). Flash column chromatography was performed on silica gel (particle size 200-300 mesh ASTM) and eluted with petroleum ether/ethylacetate. Solvents for the column chromatography were distilled before used.

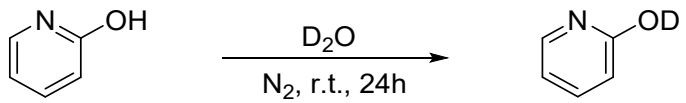
2. General Experimental Procedures



1 **2** **3**

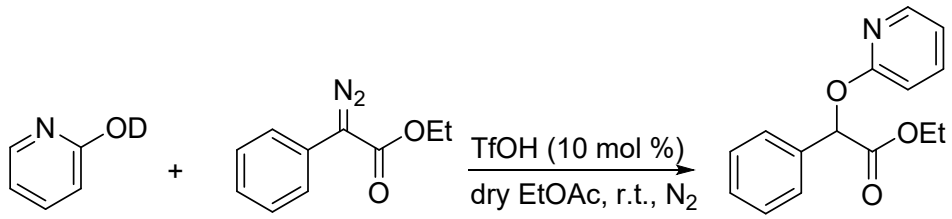
2-Pyridone **1** (0.50 mmol), diazo compound **2** (0.75 mmol) and EA (1.5 mL) were

added into a 10 mL glass tube. Then a solution of CF_3SO_3H (7.5 mg, 0.05 mmol, 10 mol %) dissolved in EtOAc (1.5 mL) was introduced into the reaction mixture. The resulting mixture was continually stirred under nitrogen atmosphere at r.t. for 3-6 hours. The reaction solution was quenched with saturated aq. NH_4Cl and extracted with EA (5.0 mL×3). The combined organic phase was dried over anhydrous Na_2SO_4, filtrated and concentrated under reduced pressure. The crude product was purified by column chromatography on silica gel (*n*-hexane/acetone = 5:1) to afford the pure product **3**.



1a **d-1a,** 75% D

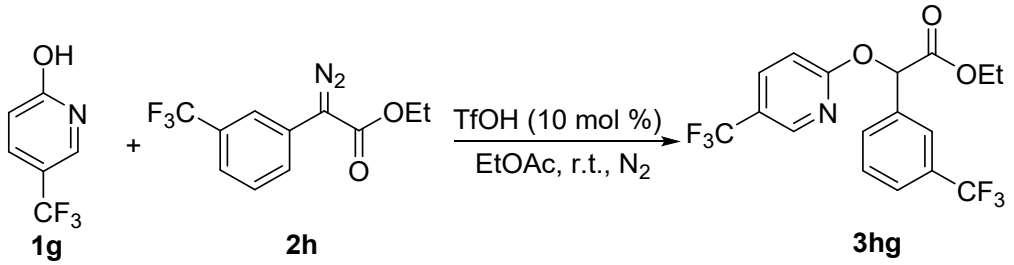
2-Hydroxypyridine **1a** (0.50 mmol) and deuterium oxide (2.0 mL) and were added into a 10 mL glass tube. Stirred at room temperature under nitrogen atmosphere at r.t. for 24 h, drain The reaction solution was extracted with EA (5.0 mL×3). The combined organic phase was dried over anhydrous Na_2SO_4, filtrated and concentrated under reduced pressure to afford **d-1a** (75% D).



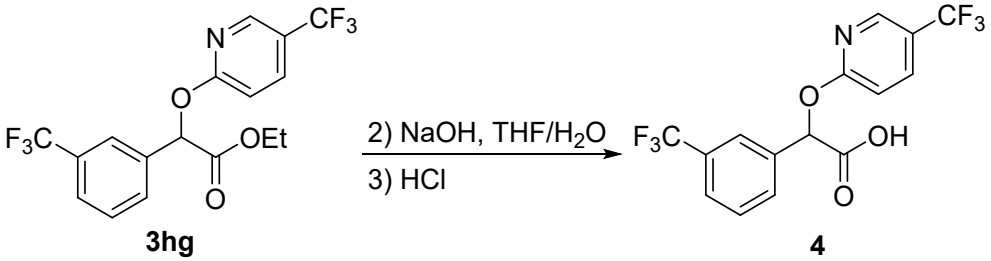
d-1a, 75% D **2a** **d-3a,** 54% D

2-Pyridone **d-1a** (0.20 mmol), ethyl 2-diazo-2-phenylacetate **2a** (0.30 mmol) and EtOAc (0.5 mL) were added into a 5 mL glass tube. Then a solution of CF_3SO_3H (3.0 mg, 0.02 mmol, 10 mol %) dissolved in EtOAc (1.0 mL) was introduced into the reaction mixture. The resulting mixture was continually stirred under nitrogen atmosphere at r.t. for 12 h. The reaction solution was quenched with saturated aq. NH_4Cl and extracted with EtOAc (5.0 mL×3). The combined organic phase was dried over anhydrous Na_2SO_4, filtrated and concentrated under reduced pressure. The crude product was purified by column chromatography on silica gel (*n*-hexane/acetone = 5:1)

to afford the pure product **d-3a** (54% D).



5-(Trifluoromethyl)pyridin-2-ol **1g** (0.50 mmol), ethyl 2-diazo-2-(4-(trifluoromethyl)phenyl)acetate **2h** (0.75 mmol) and EtOAc (1.5 mL) were added into a 10.0 mL glass tube. Then a solution of CF_3SO_3H (7.5 mg, 0.05 mmol, 10 mol %) dissolved in EtOAc (1.5 mL) was introduced into the reaction mixture. The resulting mixture was continually stirred under nitrogen atmosphere at r.t. for 12 h. The reaction solution was quenched with saturated aq. NH_4Cl and extracted with EtOAc (5.0 mL×3). The combined organic phase was dried over anhydrous Na_2SO_4, filtrated and concentrated under reduced pressure. The crude product was purified by column chromatography on silica gel (*n*-hexane/acetone = 10:1) to afford ester **3hg** (119 mg, 61%) as a yellow oil.



To a solution of the easter **3hg** (119 mg, 0.31 mmol) in THF/H_2O (3.0 mL/1.0 mL) at r.t. was added sodium hydroxide (80 mg, 2 mmol). The resulting solution was stirred at r.t. for 4 h. The reaction was quenched with 1M aqueous HCl and the mixture was extracted with EtOAc. The organic layer was washed with brine, dried over Na_2SO_4 and concentrated in vacuo to afford acid **4** (109.6mg, 98%). The total yield is 60%.

3. References

[1] Chen, R.; Zhao, Y.; Sun, H.; Shao, Y.; Xu, Y.; Ma, M.; Ma, L.; Wan, X. *J. Org.*

Chem. **2017**, *82*, 9291-9304.

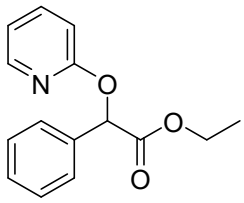
[2] Gutierrez, S.; Tomas-Gamasa, M.; Mascarenas, J. L. *Angew. Chem.* **2021**, *60*, 22017-22025.

[3] Keipour, H.; Ollevier, T. *Org. Lett*. **2017**, *19*, 5736-5739.

[4] Xu, B.; Zhu, S. F.; Zuo, X. D.; Zhang, Z. C.; Zhou, Q. L. *Angew. Chem.* **2014**, *126*, 3994-3997.

4. Characterization Data of Compounds

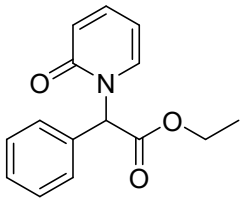
ethyl 2-phenyl-2-(pyridin-2-yloxy)acetate (3a)



Yellow oil, yield: 96%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.12 (ddd, J = 5.1, 2.1, 0.9 Hz, 1H), 7.65 – 7.59 (m, 3H), 7.40 (qd, J = 6.8, 2.9 Hz, 3H), 6.95 – 6.88 (m, 2H), 6.21 (s, 1H), 4.24 – 4.13 (m, 2H), 1.19 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.5, 162.5, 146.7, 139.0, 135.4, 129.0, 128.8, 127.8, 117.7, 111.4, 75.9, 61.4, 14.1; HRMS (ESI): *m/z* $[M+Na]^+$ calcd for $C_{15}H_{15}NNaO_3^+$: 280.0944; found: 280.0937.

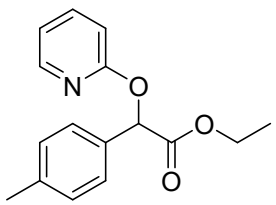
ethyl 2-(2-oxopyridin-1(*2H*)-yl)-2-phenylacetate (3aa)



Yellow oil, yield: 21%

^{1}H NMR (400 MHz, DMSO-d_6) δ = 7.45 (td, J = 4.3, 1.5 Hz, 3H), 7.40 (ddd, J = 7.2, 4.9, 2.0 Hz, 3H), 7.21 (dd, J = 7.0, 2.0 Hz, 1H), 6.46 (dt, J = 9.1, 1.1 Hz, 1H), 6.41 (s, 1H), 6.20 (td, J = 6.8, 1.4 Hz, 1H), 4.20 (q, J = 7.1 Hz, 2H), 1.17 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, DMSO-d_6) δ = 168.4, 161.3, 140.2, 136.4, 133.4, 129.4, 129.1, 129.1, 119.3, 105.6, 62.2, 61.4, 13.8; HRMS (ESI): *m/z* $[M+Na]^+$ calcd for $C_{15}H_{15}NNaO_3^+$: 280.0944; found: 280.0959.

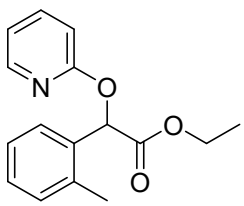
ethyl 2-(pyridin-2-yloxy)-2-(*p*-tolyl)acetate (3b)



Yellow oil, yield: 82%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.12 (ddd, J = 5.1, 2.0, 0.9 Hz, 1H), 7.60 (ddd, J = 8.4, 7.1, 2.0 Hz, 1H), 7.53 – 7.46 (m, 2H), 7.22 (d, J = 7.8 Hz, 2H), 6.95 – 6.87 (m, 2H), 6.17 (s, 1H), 4.24 – 4.12 (m, 2H), 2.37 (s, 3H), 1.20 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.6, 162.6, 146.6, 138.9, 138.9, 132.4, 129.5, 127.8, 117.6, 111.5, 75.8, 61.3, 21.4, 14.1; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{16}H_{18}NO_3^+$: 272.1281; found: 272.1294.

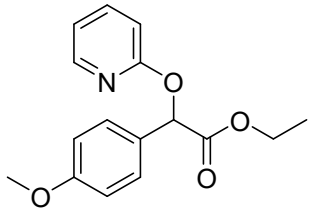
ethyl 2-(pyridin-2-yloxy)-2-(*o*-tolyl)acetate (3c)



Yellow oil, yield: 86%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.13 (dd, J = 5.4, 2.0 Hz, 1H), 7.63 – 7.56 (m, 2H), 7.28 – 7.23 (m, 3H), 6.92 – 6.87 (m, 2H), 6.51 (s, 1H), 4.25 – 4.14 (m, 2H), 2.52 (s, 3H), 1.20 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.7, 162.7, 146.7, 139.0, 137.2, 134.0, 130.8, 128.9, 128.0, 126.4, 117.6, 111.5, 72.8, 61.3, 19.7, 14.2; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{16}H_{18}NO_3^+$: 272.1281; found: 272.1274.

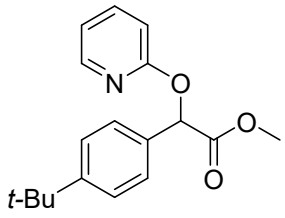
ethyl 2-(4-methoxyphenyl)-2-(pyridin-2-yloxy)acetate (3d)



Yellow oil, yield: 30%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.11 (ddd, J = 5.0, 2.0, 0.9 Hz, 1H), 7.60 (ddd, J = 8.9, 7.1, 2.0 Hz, 1H), 7.56 – 7.48 (m, 2H), 6.96 – 6.85 (m, 4H), 6.14 (s, 1H), 4.24 – 4.11 (m, 2H), 3.82 (d, J = 1.3 Hz, 3H), 1.19 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.7, 162.6, 160.2, 146.7, 139.0, 129.2, 127.5, 117.6, 114.2, 111.5, 75.5, 61.3, 55.5, 14.2; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{16}H_{18}NO_4^+$: 288.1230; found: 288.1234.

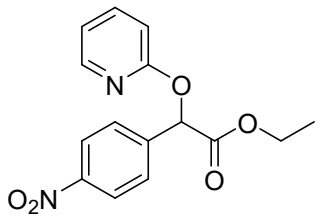
methyl 2-(4-(*tert*-butyl)phenyl)-2-(pyridin-2-yloxy)acetate (3e)



Yellow oil, yield: 88%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.12 (ddd, J = 5.0, 2.0, 0.9 Hz, 1H), 7.61 (ddd, J = 8.3, 7.1, 2.0 Hz, 1H), 7.54 – 7.51 (m, 2H), 7.45 – 7.42 (m, 2H), 6.93 – 6.89 (m, 2H), 6.20 (s, 1H), 3.72 (s, 3H), 1.33 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 171.2, 162.6, 152.2, 146.7, 139.0, 132.2, 127.6, 125.9, 117.7, 111.5, 75.6, 52.5, 34.8, 31.4; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{18}H_{22}NO_3^+$: 300.1594; found: 300.1589.

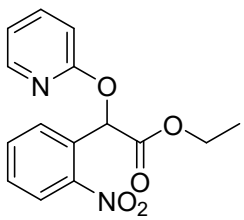
ethyl 2-(4-nitrophenyl)-2-(pyridin-2-yloxy)acetate (3f)



Yellow oil, yield: 56%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.28 – 8.23 (m, 2H), 8.11 (ddd, J = 5.0, 2.0, 0.9 Hz, 1H), 7.86 – 7.80 (m, 2H), 7.65 (ddd, J = 8.4, 7.1, 1.9 Hz, 1H), 7.00 – 6.92 (m, 2H), 6.35 (s, 1H), 4.25 – 4.14 (m, 2H), 1.20 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.3, 161.9, 148.3, 146.7, 142.5, 139.3, 128.4, 123.9, 118.2, 111.4, 74.8, 61.9, 14.1; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{15}H_{15}N_2O_5^+$: 303.0975; found: 303.0977.

ethyl 2-(2-nitrophenyl)-2-(pyridin-2-yloxy)acetate (3g)

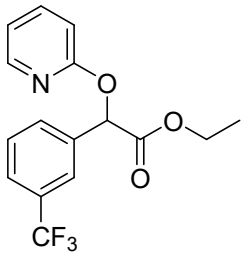


Yellow oil, yield: 44%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.07 (ddd, J = 4.6, 1.9, 1.0 Hz, 1H), 8.01 (dd, J = 8.2, 1.4 Hz, 1H), 7.81 (dd, J = 7.9, 1.5 Hz, 1H), 7.64 – 7.59 (m, 2H), 7.52 – 7.47 (m, 1H), 7.25 (s, 1H), 6.91 (ddd, J = 7.2, 5.0, 0.9 Hz, 2H), 4.25 – 4.19 (m, 2H), 1.22 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.0, 161.8, 148.8,

146.8, 139.2, 133.4, 131.3, 129.4, 129.4, 125.0, 118.1, 111.2, 71.0, 62.0, 14.1; HRMS (ESI): *m/z* $[M+Na]^+$ calcd for $C_{15}H_{14}N_2NaO_5^+$: 325.0795; found: 325.0799.

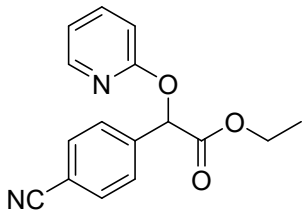
ethyl 2-(pyridin-2-yloxy)-2-(3-(trifluoromethyl)phenyl)acetate (3h)



Yellow oil, yield: 64%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.12 (ddd, *J* = 5.1, 2.0, 0.8 Hz, 1H), 7.91 (q, *J* = 1.4 Hz, 1H), 7.82 (d, *J* = 7.7 Hz, 1H), 7.65 – 7.60 (m, 2H), 7.53 (t, *J* = 7.8 Hz, 1H), 6.98 – 6.91 (m, 2H), 6.29 (s, 1H), 4.20 (p, *J* = 7.1 Hz, 2H), 1.20 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.8, 162.2, 146.7, 139.2, 136.5, 131.4, 131.0, 131.0, 129.3, 125.8, 125.8, 125.7, 125.7, 124.6, 124.5, 124.5, 124.5, 122.8, 118.0, 111.4, 75.1, 61.7, 14.1; ^{19}F NMR (376 MHz, $CDCl_3$): δ = -62.6; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{16}H_{15}F_3NO_3^+$: 326.0999; found: 326.0998.

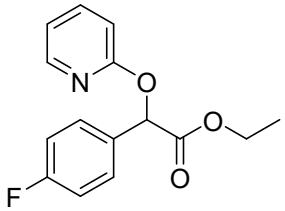
ethyl 2-(4-cyanophenyl)-2-(pyridin-2-yloxy)acetate (3i)



Yellow oil, yield: 50%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.11 (ddd, *J* = 5.0, 2.0, 0.9 Hz, 1H), 7.76 (d, *J* = 8.2 Hz, 2H), 7.71 – 7.68 (m, 2H), 7.64 (ddd, *J* = 8.4, 7.1, 2.0 Hz, 1H), 6.96 – 6.92 (m, 2H), 6.28 (s, 1H), 4.23 – 4.14 (m, 2H), 1.19 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.4, 162.0, 146.7, 140.6, 139.3, 132.5, 128.2, 118.6, 118.1, 112.8, 111.3, 75.0, 61.9, 14.1; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{16}H_{15}N_2O_3^+$: 283.1077; found: 283.1084.

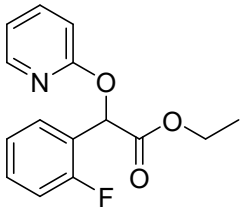
ethyl 2-(4-fluorophenyl)-2-(pyridin-2-yloxy)acetate (3j)



Yellow oil, yield: 72%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.19 – 8.02 (m, 1H), 7.67 – 7.52 (m, 3H), 7.09 (t, *J* = 8.7 Hz, 2H), 6.97 – 6.86 (m, 2H), 6.18 (s, 1H), 4.18 (qq, *J* = 10.8, 7.1 Hz, 2H), 1.19 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.3, 164.4, 162.4, 162.0, 146.7, 139.1, 131.3, 129.6, 129.6, 117.8, 115.9, 115.7, 111.4, 75.2, 61.5, 14.1; ^{19}F NMR (376 MHz, $CDCl_3$): δ = -112.9 – -113.0 (m); HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{15}H_{15}FNO_3^+$: 276.1030; found: 276.1036.

ethyl 2-(2-fluorophenyl)-2-(pyridin-2-yloxy)acetate (3k)

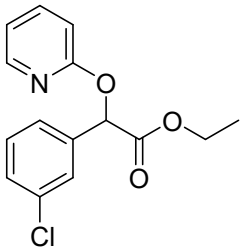


Yellow oil, yield: 87%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.13 (ddd, *J* = 5.0, 2.0, 0.9 Hz, 1H), 7.66 – 7.58 (m, 2H), 7.39 – 7.33 (m, 1H), 7.19 (td, *J* = 7.6, 1.2 Hz, 1H), 7.12 (ddd, *J* = 9.7, 8.3, 1.2 Hz, 1H), 6.93 – 6.88 (m, 2H), 6.63 (s, 1H), 4.27 – 4.16 (m, 2H), 1.21 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.9, 162.4, 161.9, 159.4, 146.7, 139.0, 130.9, 130.8, 129.7, 129.6, 124.6, 124.5, 123.2, 123.0, 117.8, 116.0, 115.8, 111.3, 69.1, 69.1, 61.6, 14.1; ^{19}F NMR (376 MHz, $CDCl_3$): δ = -117.1 (dt, *J* =

10.2, 6.2 Hz); HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{15}H_{15}FNO_3^+$: 276.1030; found: 276.1041.

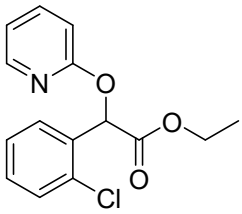
ethyl 2-(3-chlorophenyl)-2-(pyridin-2-yloxy)acetate (3l)



Yellow oil, yield: 85%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.11 (ddd, J = 5.1, 2.0, 0.8 Hz, 1H), 7.69 – 7.57 (m, 2H), 7.50 (ddd, J = 7.6, 5.4, 3.3 Hz, 1H), 7.34 (dd, J = 4.8, 2.0 Hz, 2H), 6.97 – 6.88 (m, 2H), 6.19 (s, 1H), 4.24 – 4.14 (m, 2H), 1.20 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.9, 162.2, 146.7, 139.1, 137.4, 134.7, 130.0, 129.1, 127.8, 125.8, 117.9, 111.4, 75.1, 61.6, 14.1; HRMS (ESI): *m/z* $[M+Na]^+$ calcd for $C_{15}H_{14}ClNNaO_3^+$: 314.0554; found: 314.0580.

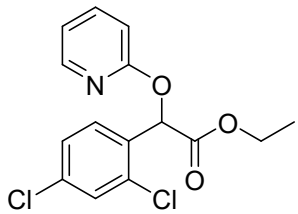
ethyl 2-(2-chlorophenyl)-2-(pyridin-2-yloxy)acetate (3m)



Yellow oil, yield: 90%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.14 (ddd, J = 5.0, 2.0, 0.9 Hz, 1H), 7.68 – 7.64 (m, 1H), 7.61 (ddd, J = 8.3, 7.1, 2.0 Hz, 1H), 7.46 – 7.42 (m, 1H), 7.33 – 7.29 (m, 2H), 6.93 – 6.88 (m, 2H), 6.77 (s, 1H), 4.22 (ddt, J = 15.0, 7.8, 3.6 Hz, 2H), 1.22 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.0, 162.4, 146.7, 139.0, 134.4, 133.6, 130.2, 130.0, 129.6, 127.3, 117.8, 111.3, 72.3, 61.6, 14.2; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{15}H_{15}ClNO_3^+$: 292.0735; found: 292.0742.

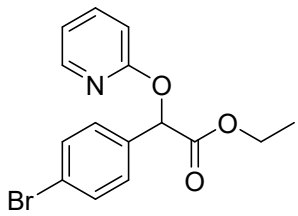
ethyl 2-(2,4-dichlorophenyl)-2-(pyridin-2-yloxy)acetate (3n)



Yellow oil, yield: 99%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.12 (ddd, J = 5.0, 2.0, 0.9 Hz, 1H), 7.63 – 7.56 (m, 2H), 7.45 (d, J = 2.1 Hz, 1H), 7.30 (dd, J = 8.4, 2.1 Hz, 1H), 6.93 – 6.87 (m, 2H), 6.71 (s, 1H), 4.26 – 4.16 (m, 2H), 1.22 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.6, 162.2, 146.7, 139.1, 135.5, 135.0, 132.4, 130.5, 129.8, 127.7, 117.9, 111.3, 71.7, 61.8, 14.1; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{15}H_{14}Cl_2NO_3^+$: 326.0345; found: 326.0351.

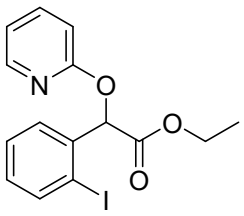
ethyl 2-(4-bromophenyl)-2-(pyridin-2-yloxy)acetate (3o)



Yellow oil, yield: 86%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.13 – 8.06 (m, 1H), 7.65 – 7.58 (m, 1H), 7.54 – 7.47 (m, 4H), 6.93 – 6.89 (m, 2H), 6.17 (s, 1H), 4.17 (ddp, J = 14.1, 7.2, 3.6 Hz, 2H), 1.19 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 170.0, 162.3, 146.7, 139.1, 134.5, 131.9, 129.4, 123.1, 117.9, 111.4, 75.1, 61.6, 14.1; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{15}H_{15}BrNO_3^+$: 336.0230; found: 336.0235.

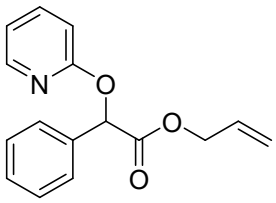
ethyl 2-(2-iodophenyl)-2-(pyridin-2-yloxy)acetate (3p)



Yellow oil, yield: 65%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.16 – 8.13 (m, 1H), 7.91 (dd, J = 8.0, 1.3 Hz, 1H), 7.62 – 7.58 (m, 2H), 7.39 (t, J = 7.6 Hz, 1H), 7.08 – 7.04 (m, 1H), 6.92 – 6.87 (m, 2H), 6.58 (s, 1H), 4.22 (ddt, J = 14.3, 7.2, 3.5 Hz, 2H), 1.23 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.1, 162.4, 146.8, 140.0, 139.0, 138.7, 130.6, 129.2, 128.7, 117.8, 111.2, 100.2, 79.1, 61.6, 14.2; HRMS (ESI): *m/z* $[M+Na]^+$ calcd for $C_{15}H_{14}INNaO_3^+$: 405.9911; found: 405.9903.

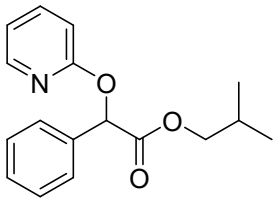
allyl 2-phenyl-2-(pyridin-2-yloxy)acetate (3q)



Yellow oil, yield: 87%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.12 (ddd, J = 5.0, 2.0, 0.9 Hz, 1H), 7.69 – 7.56 (m, 3H), 7.44 – 7.34 (m, 3H), 6.98 – 6.87 (m, 2H), 6.25 (s, 1H), 5.82 (ddt, J = 17.2, 10.7, 5.5 Hz, 1H), 5.26 – 5.12 (m, 2H), 4.63 (qdt, J = 13.5, 5.5, 1.5 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.2, 162.5, 146.7, 139.0, 135.3, 131.8, 129.1, 128.8, 127.8, 118.1, 117.7, 111.4, 75.8, 65.7; HRMS (ESI): *m/z* $[M+Na]^+$ calcd for $C_{16}H_{15}NNaO_3^+$: 292.0944; found: 292.0948.

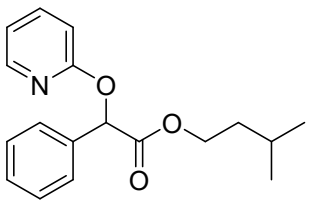
isobutyl 2-phenyl-2-(pyridin-2-yloxy)acetate (3r)



Yellow oil, yield: 89%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.11 (dd, J = 5.2, 1.9 Hz, 1H), 7.62 (ddt, J = 10.4, 7.1, 1.9 Hz, 3H), 7.45 – 7.35 (m, 3H), 7.00 – 6.81 (m, 2H), 6.22 (s, 1H), 3.96 – 3.86 (m, 2H), 1.87 (dp, J = 13.4, 6.7 Hz, 1H), 0.80 (dd, J = 6.7, 4.8 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.5, 162.6, 146.7, 139.0, 135.5, 129.0, 128.8, 127.8, 117.7, 111.4, 76.0, 71.3, 27.9, 18.9, 18.9; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{17}H_{20}NO_3^+$: 286.1438; found: 286.1447.

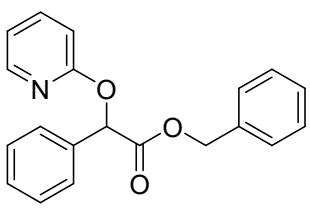
isopentyl 2-phenyl-2-(pyridin-2-yloxy)acetate (3s)



Yellow oil, yield: 98%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.11 (ddd, J = 5.0, 2.0, 0.9 Hz, 1H), 7.61 (ddt, J = 7.1, 6.2, 1.8 Hz, 3H), 7.43 – 7.36 (m, 3H), 6.94 – 6.88 (m, 2H), 6.20 (s, 1H), 4.31 – 4.01 (m, 2H), 1.56 – 1.49 (m, 1H), 1.44 (dq, J = 13.5, 6.6 Hz, 2H), 0.82 (dd, J = 12.2, 6.5 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.6, 162.6, 146.7, 139.0, 135.4, 129.0, 128.8, 127.8, 117.7, 111.5, 75.9, 64.0, 37.3, 25.0, 22.5, 22.4; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{18}H_{22}NO_3^+$: 300.1594; found: 300.1606.

benzyl 2-phenyl-2-(pyridin-2-yloxy)acetate (3t)

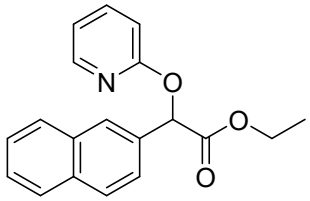


Yellow oil, yield: 96%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.05 (dd, J = 5.3, 1.9 Hz, 1H), 7.67 – 7.57 (m, 3H), 7.42 – 7.37 (m, 3H), 7.31 – 7.26

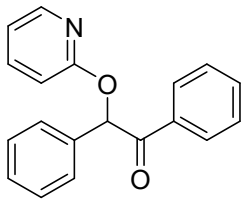
(m, 3H), 7.20 (dd, J = 6.8, 3.0 Hz, 2H), 6.96 – 6.87 (m, 2H), 6.25 (s, 1H), 5.24 – 5.10 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.4, 162.5, 146.7, 139.0, 135.8, 135.2, 129.1, 128.8, 128.5, 128.2, 128.0, 127.9, 117.7, 111.4, 76.0, 66.8; HRMS (ESI): *m/z* $[M+NH_4]^+$ calcd for $C_{20}H_{21}N_2O_3^+$: 337.1547; found: 337.1573.

ethyl 2-(naphthalen-2-yl)-2-(pyridin-2-yloxy)acetate (3u)



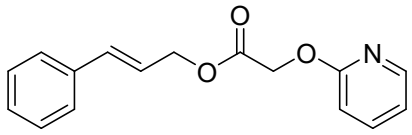
Yellow solid, m.p.: 67-68 °C, yield: 85%
^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.15 (ddd, J = 5.1, 2.0, 0.9 Hz, 1H), 8.10 (d, J = 1.7 Hz, 1H), 7.87 (td, J = 9.2, 2.9 Hz, 3H), 7.73 (dd, J = 8.5, 1.8 Hz, 1H), 7.63 (ddd, J = 8.4, 7.1, 2.0 Hz, 1H), 7.53 – 7.47 (m, 2H), 6.98 (dt, J = 8.3, 0.9 Hz, 1H), 6.92 (ddd, J = 7.1, 5.1, 0.9 Hz, 1H), 6.38 (s, 1H), 4.26 – 4.14 (m, 2H), 1.19 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.5, 162.6, 146.7, 139.0, 133.6, 133.4, 132.8, 128.6, 128.4, 127.9, 127.3, 126.6, 126.5, 125.2, 117.7, 111.5, 76.0, 61.5, 14.2; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{19}H_{18}NO_3^+$: 308.1281; found: 308.1288.

1,2-diphenyl-2-(pyridin-2-yloxy)ethan-1-one (3v)



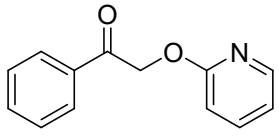
Yellow solid, m.p.: 122-124 °C, yield: 82%
^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.09 – 8.03 (m, 2H), 8.00 (dd, J = 5.1, 1.9 Hz, 1H), 7.65 – 7.55 (m, 3H), 7.52 (t, J = 7.4 Hz, 1H), 7.45 – 7.33 (m, 5H), 7.19 (s, 1H), 6.95 (d, J = 8.3 Hz, 1H), 6.85 (dd, J = 7.1, 5.1 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 196.2, 162.5, 146.6, 138.9, 135.7, 135.0, 133.1, 129.1, 129.0, 129.0, 128.8, 128.6, 117.5, 111.4, 78.6; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{19}H_{16}NO_2^+$: 290.1176; found: 290.1183.

cinnamyl 2-(pyridin-2-yloxy)acetate (3w)



Yellow oil, yield: 53%
^{1}H NMR (400 MHz, DMSO-d_6): δ = 8.18 – 8.05 (m, 1H), 7.74 (ddd, J = 8.6, 7.0, 2.0 Hz, 1H), 7.50 – 7.39 (m, 2H), 7.34 (dd, J = 8.3, 6.6 Hz, 2H), 7.30 – 7.21 (m, 1H), 7.01 (ddd, J = 7.2, 5.0, 1.0 Hz, 1H), 6.93 (d, J = 8.3 Hz, 1H), 6.64 (dd, J = 16.0, 1.7 Hz, 1H), 6.33 (dt, J = 16.0, 6.0 Hz, 1H), 4.98 (s, 2H), 4.79 (dd, J = 6.0, 1.4 Hz, 2H); ^{13}C NMR (100 MHz, DMSO-d_6): δ = 168.7, 161.9, 146.5, 139.5, 135.9, 133.0, 128.6, 128.0, 126.4, 123.3, 117.7, 110.7, 64.6, 61.9; HRMS (ESI): *m/z* $[M+Na]^+$ calcd for $C_{16}H_{15}NNaO_3^+$: 292.0944; found: 292.0954.

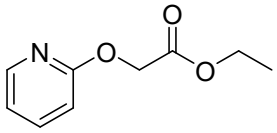
1-phenyl-2-(pyridin-2-yloxy)ethan-1-one (3x)



Yellow solid, m.p.: 57-59 °C, yield: 35%
^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.07 – 8.03 (m, 1H), 8.03 – 7.97 (m, 2H), 7.64 – 7.57 (m, 2H), 7.49 (t, J = 7.6 Hz, 2H), 6.94 (d, J = 8.3 Hz, 1H), 6.88 (dd, J = 7.1, 5.0 Hz, 1H), 5.63 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 194.6, 162.7, 146.7, 139.0, 135.0, 133.7,

128.9, 128.1, 117.6, 111.4, 67.6; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{13}H_{12}NO_2^+$: 214.0863; found: 214.0868.

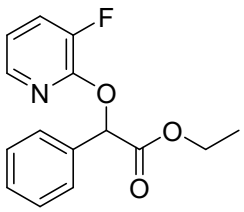
ethyl 2-(pyridin-2-yloxy)acetate (3y)



Yellow oil, yield: 57%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.15 – 8.00 (m, 1H), 7.57 (ddd, *J* = 8.7, 7.1, 2.0 Hz, 1H), 6.94 – 6.77 (m, 2H), 4.87 (s, 2H), 4.21 (q, *J* = 7.1 Hz, 2H), 1.24 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.5, 162.5, 146.6, 138.9, 117.6, 111.2, 62.5, 61.1, 14.2; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_9H_{12}NO_3^+$: 182.0812; found: 182.0813.

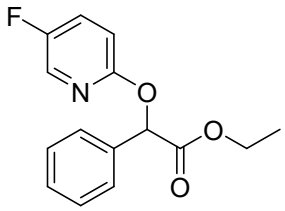
ethyl 2-((3-fluoropyridin-2-yl)oxy)-2-phenylacetate (3ab)



Yellow oil, yield: 73%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.89 (dd, *J* = 5.0, 1.5 Hz, 1H), 7.67 – 7.63 (m, 2H), 7.44 – 7.35 (m, 4H), 6.90 (ddd, *J* = 8.0, 5.0, 3.2 Hz, 1H), 6.22 (s, 1H), 4.19 (ddp, *J* = 14.2, 7.1, 3.6 Hz, 2H), 1.19 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.9, 152.0, 151.9, 148.7, 146.2, 141.2, 141.1, 134.8, 129.1, 128.8, 127.7, 123.8, 123.7, 118.0, 118.0, 76.2, 61.5, 14.1; ^{19}F NMR (376 MHz, $CDCl_3$): δ = -138.3 (dd, *J* = 10.1, 3.2 Hz); HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{15}H_{15}FNO_3^+$: 276.1030; found: 276.1031.

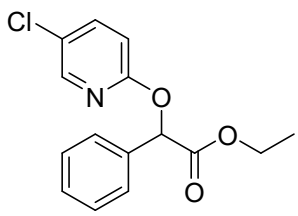
ethyl 2-((5-fluoropyridin-2-yl)oxy)-2-phenylacetate (3ac)



Yellow oil, yield: 61%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.95 (d, *J* = 3.1 Hz, 1H), 7.62 – 7.57 (m, 2H), 7.43 – 7.35 (m, 4H), 6.91 (ddd, *J* = 9.0, 3.5, 0.6 Hz, 1H), 6.13 (s, 1H), 4.24 – 4.12 (m, 2H), 1.20 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.3, 158.7, 157.2, 154.8, 135.2, 133.2, 132.9, 129.1, 128.8, 127.8, 127.1, 126.9, 112.1, 112.1, 76.4, 61.5, 14.2; ^{19}F NMR (376 MHz, $CDCl_3$): δ = -138.2 (dd, *J* = 7.6, 3.5 Hz); HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{15}H_{15}FNO_3^+$: 276.1030; found: 276.1019.

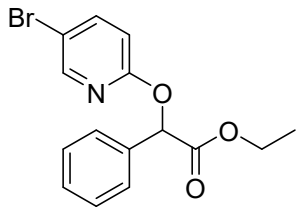
ethyl 2-((5-chloropyridin-2-yl)oxy)-2-phenylacetate (3ad)



Yellow oil, yield: 65%

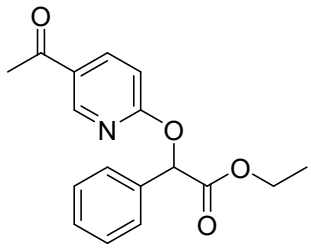
^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.07 (dd, *J* = 2.6, 0.7 Hz, 1H), 7.64 – 7.54 (m, 3H), 7.45 – 7.34 (m, 3H), 6.89 (dd, *J* = 8.8, 0.7 Hz, 1H), 6.14 (s, 1H), 4.27 – 4.10 (m, 2H), 1.20 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.1, 161.0, 145.0, 139.0, 135.0, 129.1, 128.8, 127.8, 125.2, 112.5, 76.3, 61.5, 14.2; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{15}H_{15}ClNO_3^+$: 292.0735; found: 292.0739.

ethyl 2-((5-bromopyridin-2-yl)oxy)-2-phenylacetate (3ae)



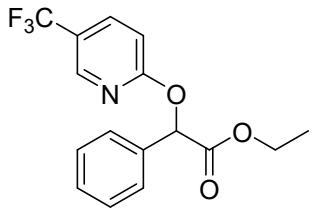
White solid, m.p.: 64-66 °C, yield: 64%
^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.17 (d, J = 2.5 Hz, 1H), 7.70 (dd, J = 8.8, 2.5 Hz, 1H), 7.62 – 7.56 (m, 2H), 7.44 – 7.37 (m, 3H), 6.85 (d, J = 8.7 Hz, 1H), 6.13 (s, 1H), 4.25 – 4.12 (m, 2H), 1.20 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.0, 161.4, 147.3, 141.6, 135.0, 129.1, 128.8, 127.8, 113.1, 112.8, 76.3, 61.5, 14.2; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{15}H_{15}BrNO_3^+$: 336.0230; found: 336.0235.

ethyl 2-((5-acetylpyridin-2-yl)oxy)-2-phenylacetate (3af)



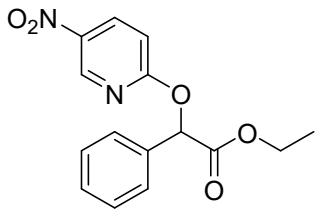
Yellow oil, yield: 70%
^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.74 (dd, J = 2.4, 0.8 Hz, 1H), 8.19 (dd, J = 8.7, 2.4 Hz, 1H), 7.64 – 7.55 (m, 2H), 7.46 – 7.37 (m, 3H), 6.98 (dd, J = 8.6, 0.8 Hz, 1H), 6.26 (s, 1H), 4.26 – 4.12 (m, 2H), 2.56 (s, 3H), 1.20 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 195.7, 169.8, 165.2, 149.0, 138.8, 134.7, 129.2, 128.9, 127.9, 127.8, 111.6, 76.6, 61.6, 26.5, 14.1; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{17}H_{18}NO_4^+$: 300.1230; found: 300.1248.

ethyl 2-phenyl-2-((5-(trifluoromethyl)pyridin-2-yl)oxy)acetate (3ag)



White solid, m.p.: 60-62 °C, yield: 56%
^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.42 (dt, J = 2.8, 1.0 Hz, 1H), 7.83 (dd, J = 8.7, 2.5 Hz, 1H), 7.63 – 7.58 (m, 2H), 7.45 – 7.39 (m, 3H), 7.02 (d, J = 8.7 Hz, 1H), 6.23 (s, 1H), 4.26 – 4.13 (m, 2H), 1.21 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.8, 164.6, 144.8, 144.7, 136.3, 136.2, 134.7, 129.3, 128.9, 127.8, 125.4, 121.3, 120.9, 111.7, 76.5, 61.7, 14.2; ^{19}F NMR (376 MHz, $CDCl_3$): δ = -61.6; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{16}H_{15}F_3NO_3^+$: 326.0999; found: 326.0997.

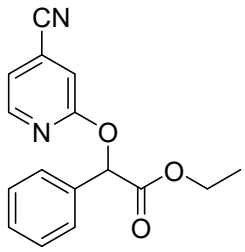
ethyl 2-((5-nitropyridin-2-yl)oxy)-2-phenylacetate (3ah)



Yellow solid, m.p.: 69-71 °C, yield: 44%
^{1}H NMR (400 MHz, $CDCl_3$): δ = 9.05 (d, J = 2.8 Hz, 1H), 8.42 (dd, J = 9.1, 2.8 Hz, 1H), 7.59 (dd, J = 7.5, 2.3 Hz, 2H), 7.43 (dd, J = 5.0, 2.3 Hz, 3H), 7.03 (d, J = 9.1 Hz, 1H), 6.27 (s, 1H), 4.26 – 4.13 (m, 2H), 1.21 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.2, 165.8, 144.5, 140.3, 134.5, 134.2, 129.5, 129.0, 127.9, 111.8, 77.3, 61.9, 14.2; HRMS (ESI): *m/z* $[M+Na]^+$ calcd for $C_{15}H_{14}N_2NaO_5^+$: 325.0795; found: 325.0799.

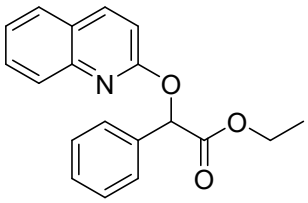
ethyl 2-((4-cyanopyridin-2-yl)oxy)-2-phenylacetate (3ai)

White solid, m.p.: 68-70 °C, yield: 31%



^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.28 (dd, J = 5.2, 0.9 Hz, 1H), 7.61 – 7.56 (m, 2H), 7.44 – 7.39 (m, 3H), 7.18 (t, J = 1.1 Hz, 1H), 7.13 (dd, J = 5.2, 1.3 Hz, 1H), 6.19 (s, 1H), 4.23 – 4.13 (m, 2H), 1.19 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.6, 162.8, 148.2, 134.5, 129.4, 128.9, 127.8, 123.0, 118.8, 116.4, 114.6, 76.6, 61.7, 14.1; HRMS (ESI): *m/z* $[M+K]^+$ calcd for $C_{16}H_{14}KN_2O_3^+$: 321.0636; found: 321.0650.

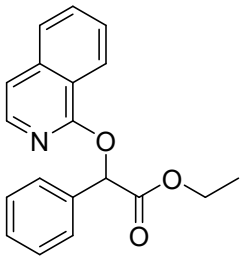
ethyl 2-phenyl-2-(quinolin-2-yloxy)acetate (3aj)



Yellow oil, yield: 97%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.39 (d, J = 8.3 Hz, 1H), 7.95 (d, J = 5.9 Hz, 1H), 7.78 – 7.69 (m, 3H), 7.66 (ddd, J = 8.2, 6.8, 1.3 Hz, 1H), 7.55 (ddd, J = 8.2, 6.8, 1.3 Hz, 1H), 7.47 – 7.38 (m, 3H), 7.25 (d, J = 2.6 Hz, 1H), 6.38 (s, 1H), 4.25 – 4.13 (m, 2H), 1.18 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.3, 159.3, 139.4, 138.3, 135.5, 130.8, 129.0, 128.8, 127.8, 126.9, 126.2, 124.5, 119.6, 115.9, 76.3, 61.4, 14.2; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{19}H_{18}NO_3^+$: 308.1281; found: 308.1291.

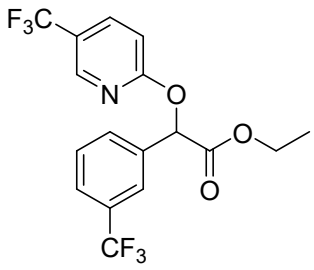
ethyl 2-(isoquinolin-1-yloxy)-2-phenylacetate (3ak)



Yellow oil, yield: 92%

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.05 (d, J = 8.8 Hz, 1H), 7.81 (dd, J = 8.4, 1.1 Hz, 1H), 7.74 (dd, J = 8.1, 1.5 Hz, 1H), 7.71 – 7.66 (m, 2H), 7.62 (ddd, J = 8.4, 7.0, 1.5 Hz, 1H), 7.45 – 7.38 (m, 4H), 7.09 (d, J = 8.8 Hz, 1H), 6.39 (s, 1H), 4.29 – 4.13 (m, 2H), 1.23 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.4, 160.8, 146.2, 139.3, 135.3, 129.7, 129.1, 128.8, 127.9, 127.6, 127.5, 125.6, 124.5, 112.9, 76.2, 61.4, 14.3; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{19}H_{18}NO_3^+$: 308.1281; found: 308.1269.

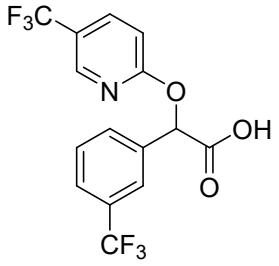
ethyl 2-(3-(trifluoromethyl)phenyl)-2-((5-(trifluoromethyl)pyridin-2-yl)oxy)acetate (3hg)



Yellow oil, yield: 61%

^{1}H NMR (400 MHz, DMSO-d_6) δ = 8.63 – 8.57 (m, 1H), 8.16 (dd, J = 8.8, 2.5 Hz, 1H), 7.98 – 7.89 (m, 2H), 7.82 (d, J = 8.1 Hz, 1H), 7.71 (d, J = 8.0 Hz, 1H), 7.26 (d, J = 8.7 Hz, 1H), 6.45 (s, 1H), 4.13 (td, J = 7.1, 5.5 Hz, 2H), 1.09 (t, J = 7.0 Hz, 3H); ^{13}C NMR (100 MHz, DMSO-d_6) δ = 168.6, 164.0, 144.6, 144.5, 144.5, 137.1, 137.1, 135.7, 131.7, 130.1, 129.7, 129.6, 129.4, 126.0, 126.0, 125.9, 125.3, 125.3, 124.2, 124.2, 124.1, 122.6, 120.1, 119.8, 111.7, 75.0, 61.3, 13.7; ^{19}F NMR (376 MHz, DMSO-d_6) δ = -60.1, -61.3; HRMS (ESI): *m/z* $[M+Na]^+$ calcd for $C_{17}H_{13}F_6NNaO_3^+$: 416.0692; found: 416.0699.

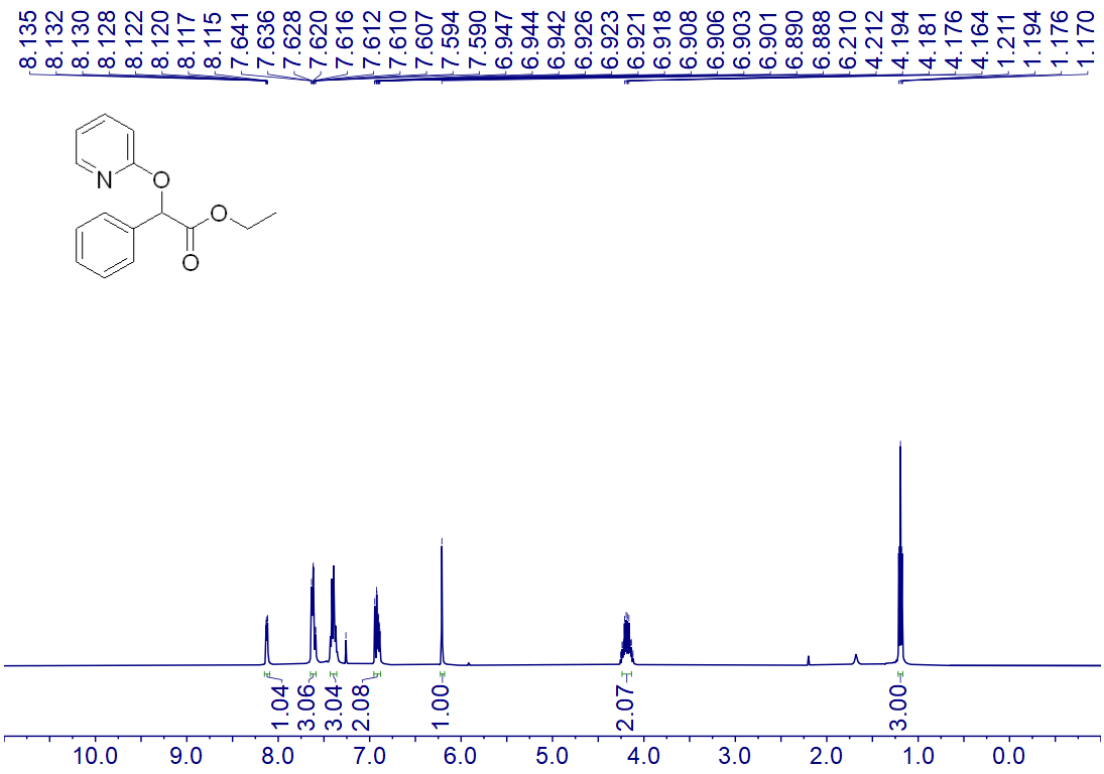
2-(3-(trifluoromethyl)phenyl)-2-((5-(trifluoromethyl)pyridin-2-yl)oxy)acetic acid (4)



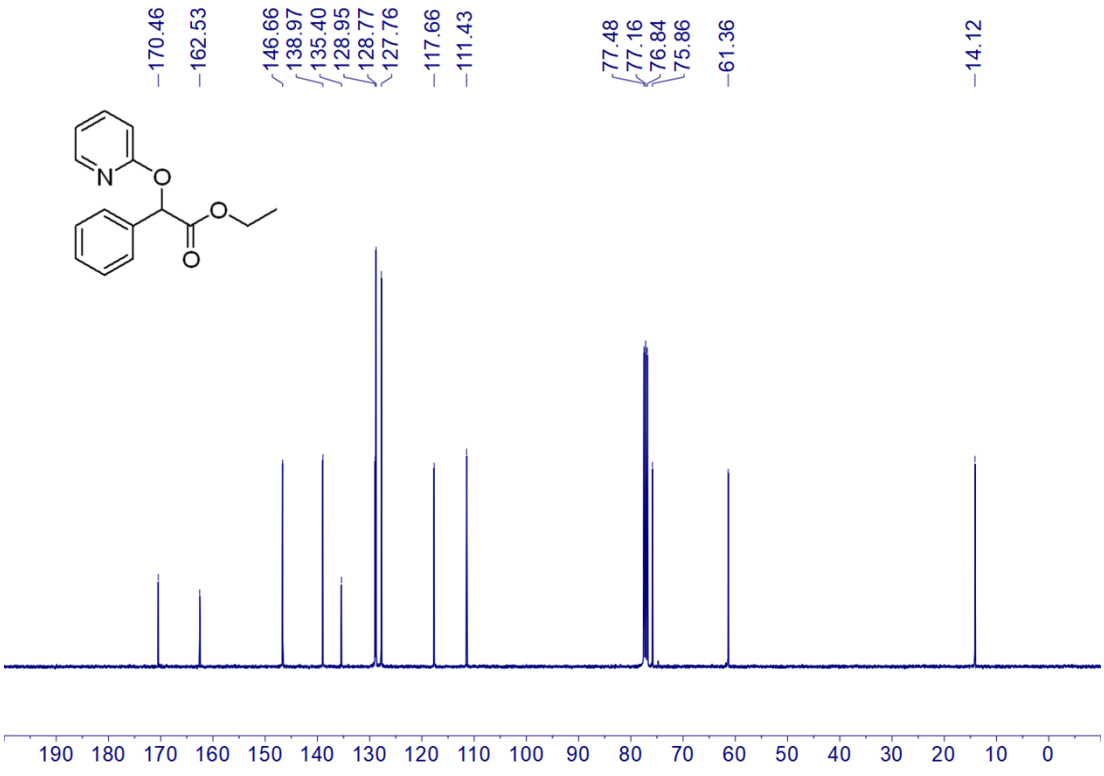
Brown oil, yield: 98%

^{1}H NMR (400 MHz, DMSO-d_6) δ = 8.61 (dd, J = 2.4, 1.2 Hz, 1H), 8.14 (dd, J = 8.8, 2.6 Hz, 1H), 7.99 – 7.89 (m, 2H), 7.80 (d, J = 7.8 Hz, 1H), 7.71 (t, J = 7.8 Hz, 1H), 7.23 (d, J = 8.7 Hz, 1H), 6.38 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6) δ = 169.9, 164.2, 144.6, 144.6, 136.9, 136.9, 136.8, 136.4, 131.7, 129.9, 129.6, 129.3, 125.7, 125.7, 125.6, 125.3, 125.3, 124.1, 124.1, 124.1, 124.0, 122.6, 119.9, 119.6, 111.7, 75.0; ^{19}F NMR (376 MHz, DMSO-d_6) δ = -60.1, -61.2; HRMS (ESI): *m/z* $[M+H]^+$ calcd for $C_{15}H_{10}F_6NO_3^+$: 366.0559; found: 366.0561.

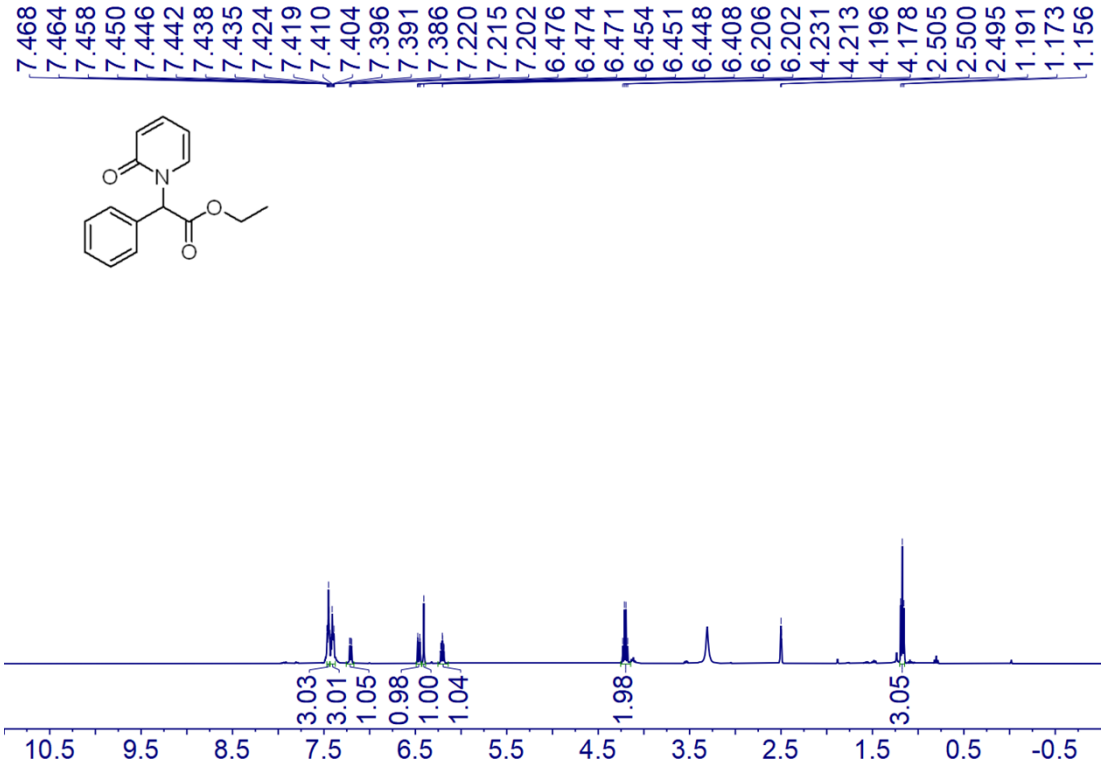
5. NMR Spectra of Compounds



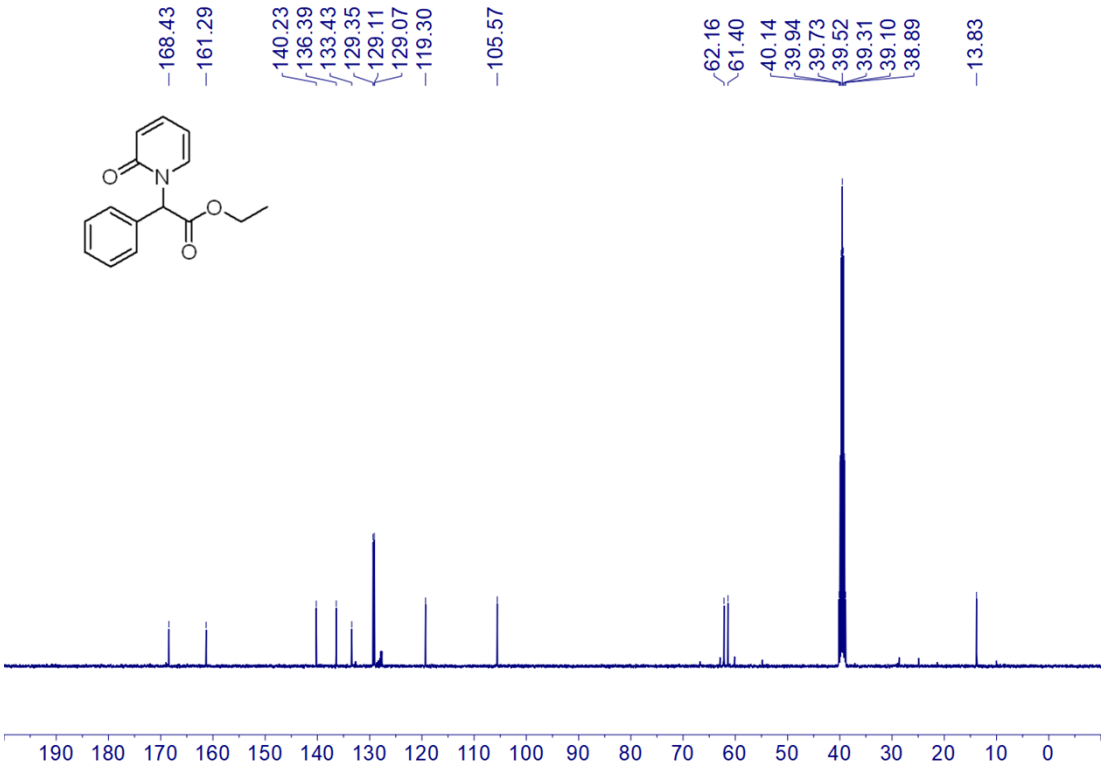
^{1}H NMR Spectrum of Compound **3a** (400 MHz, $CDCl_3$).



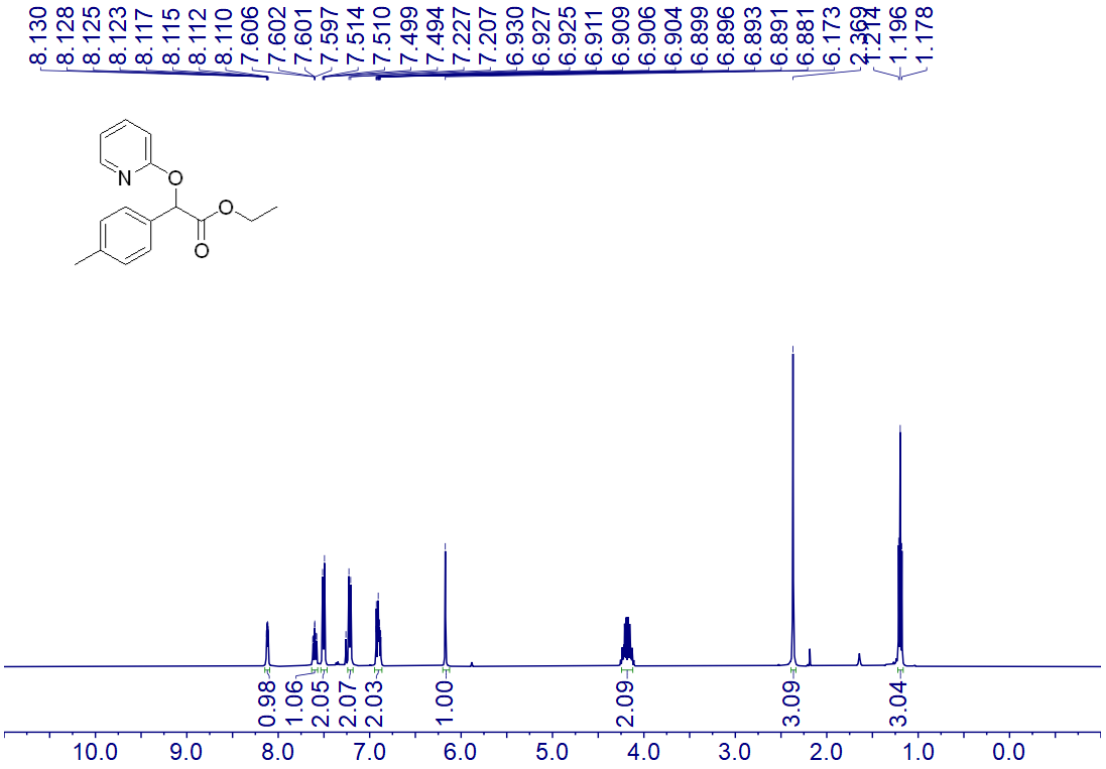
^{13}C NMR Spectrum of Compound **3a** (100 MHz, $CDCl_3$).



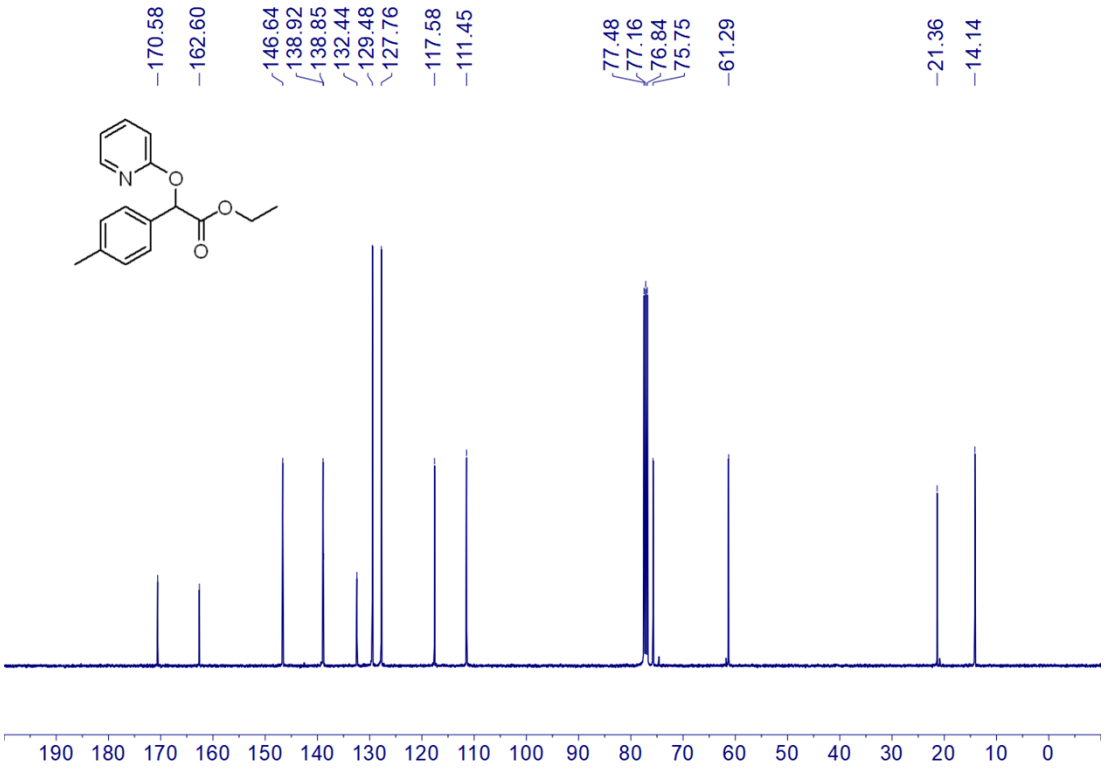
^{1}H NMR Spectrum of Compound **3aa** (400 MHz, DMSO-d_6).



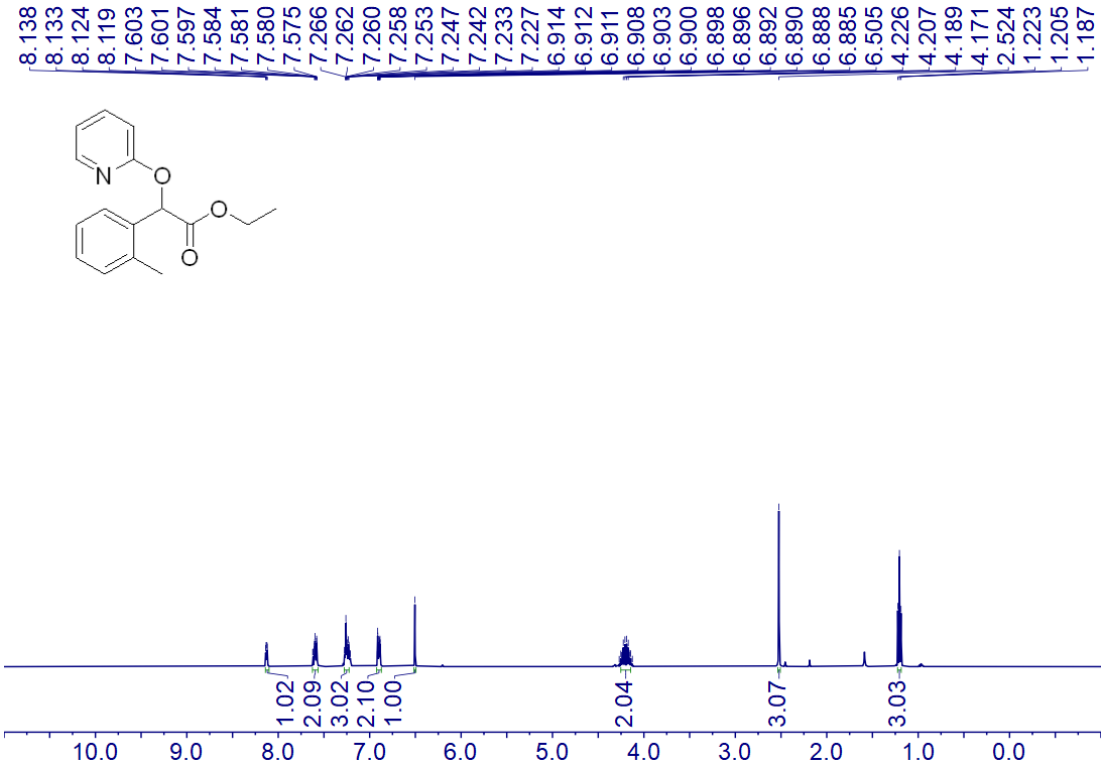
^{13}C NMR Spectrum of Compound **3aa** (100 MHz, DMSO-d_6).



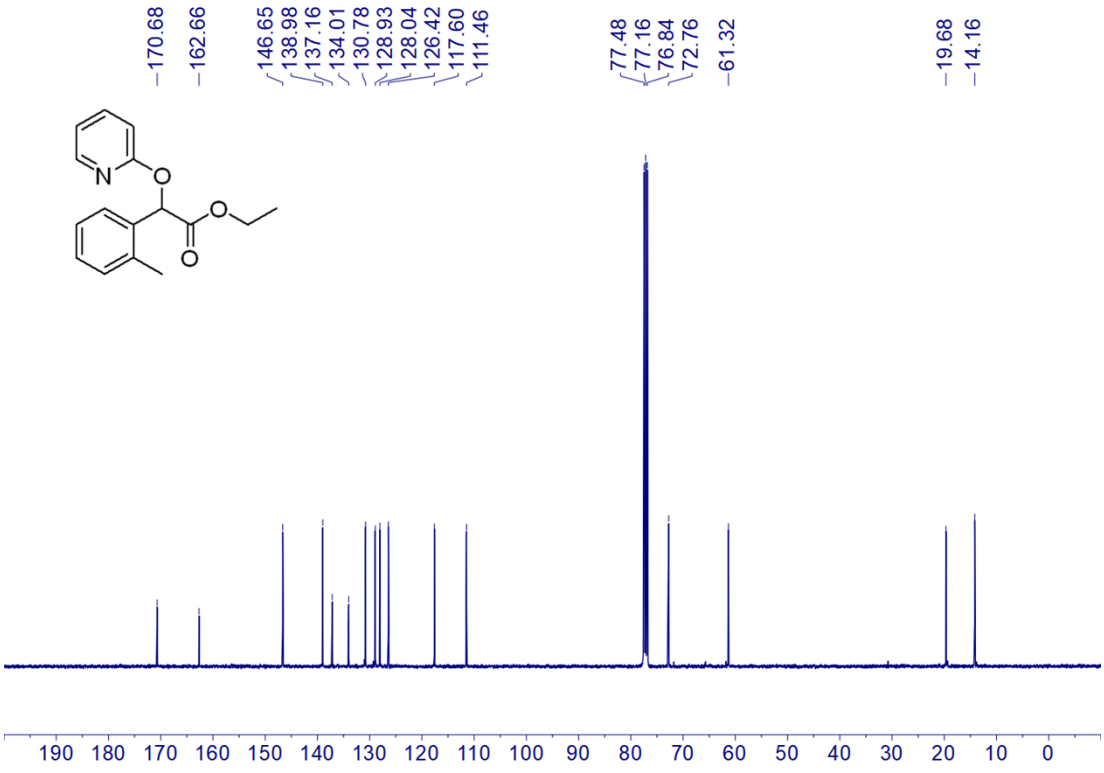
^{1}H NMR Spectrum of Compound **3b** (400 MHz, $CDCl_3$).



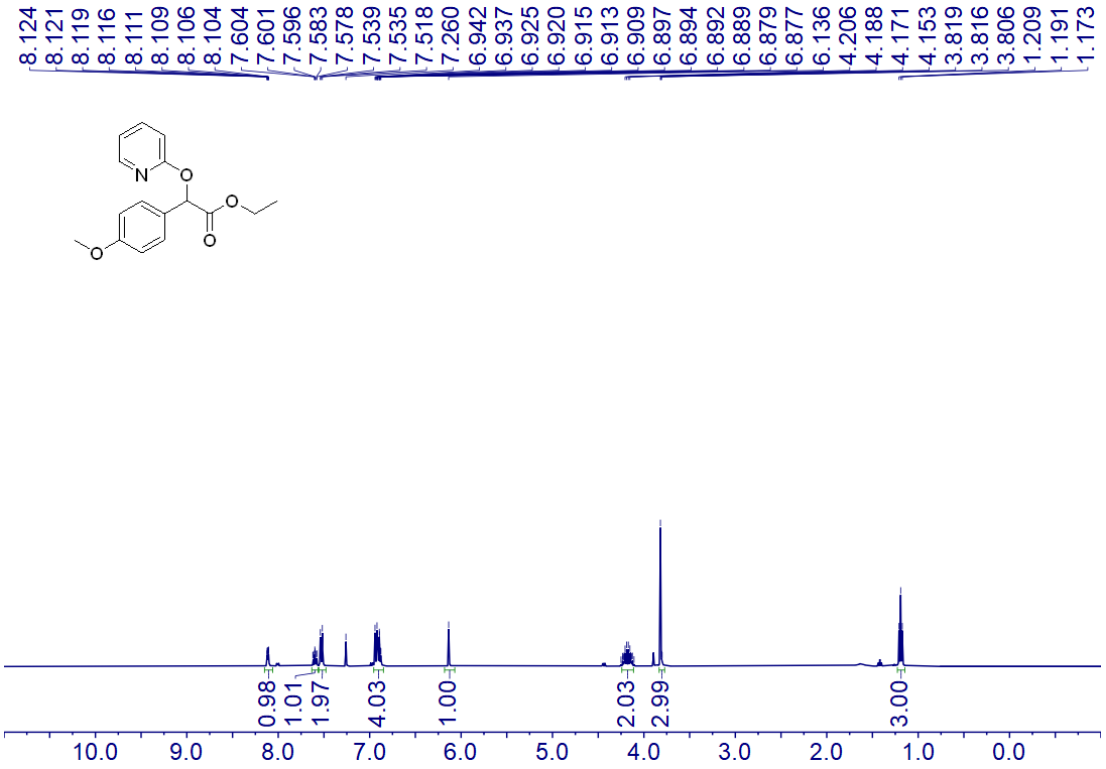
^{13}C NMR Spectrum of Compound **3b** (100 MHz, $CDCl_3$).



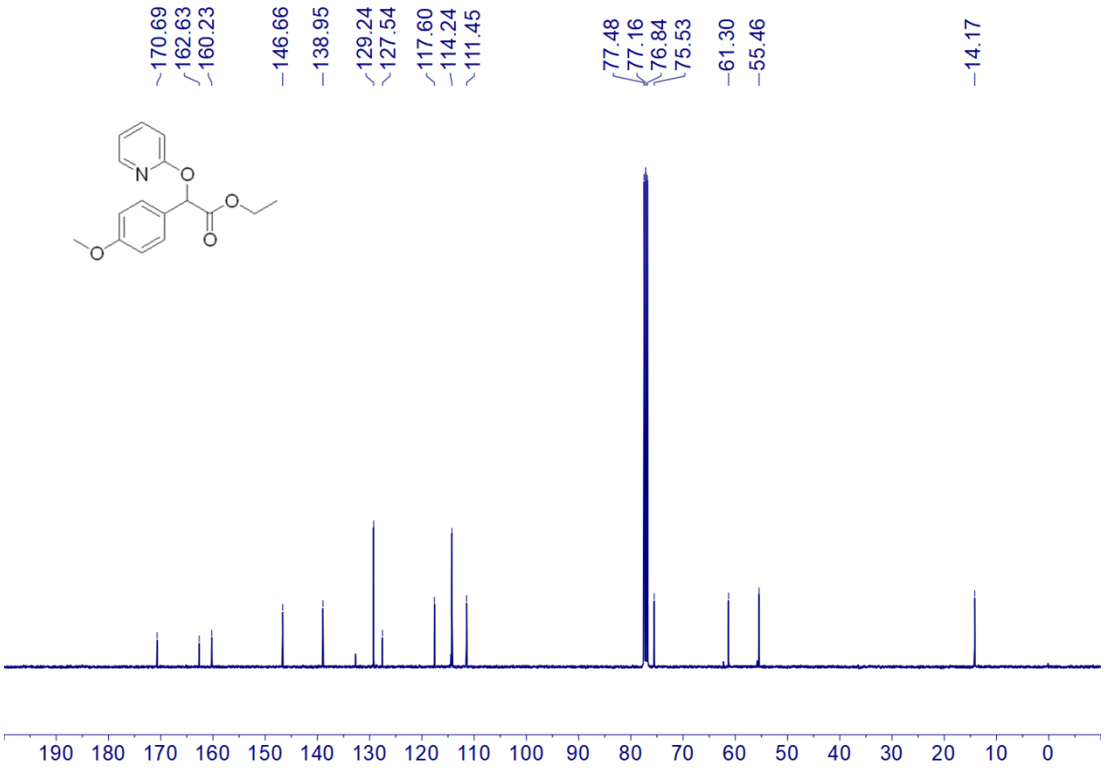
^{1}H NMR Spectrum of Compound **3c** (400 MHz, $CDCl_3$).



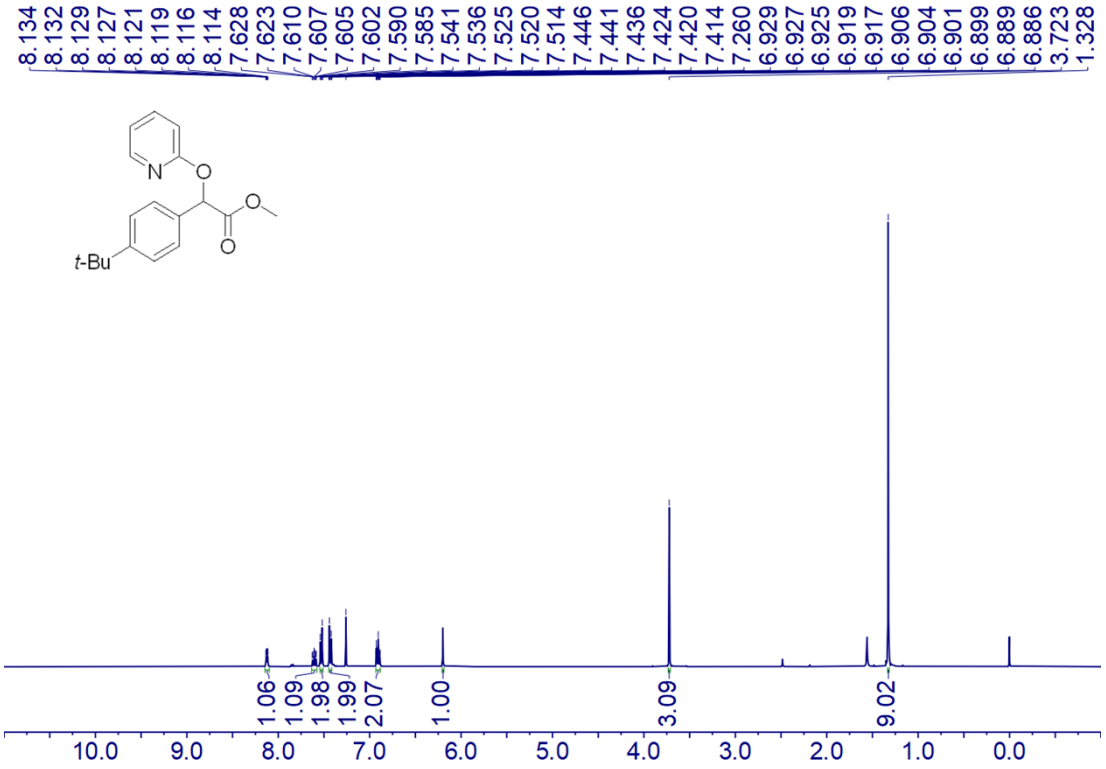
^{13}C NMR Spectrum of Compound **3c** (100 MHz, $CDCl_3$).



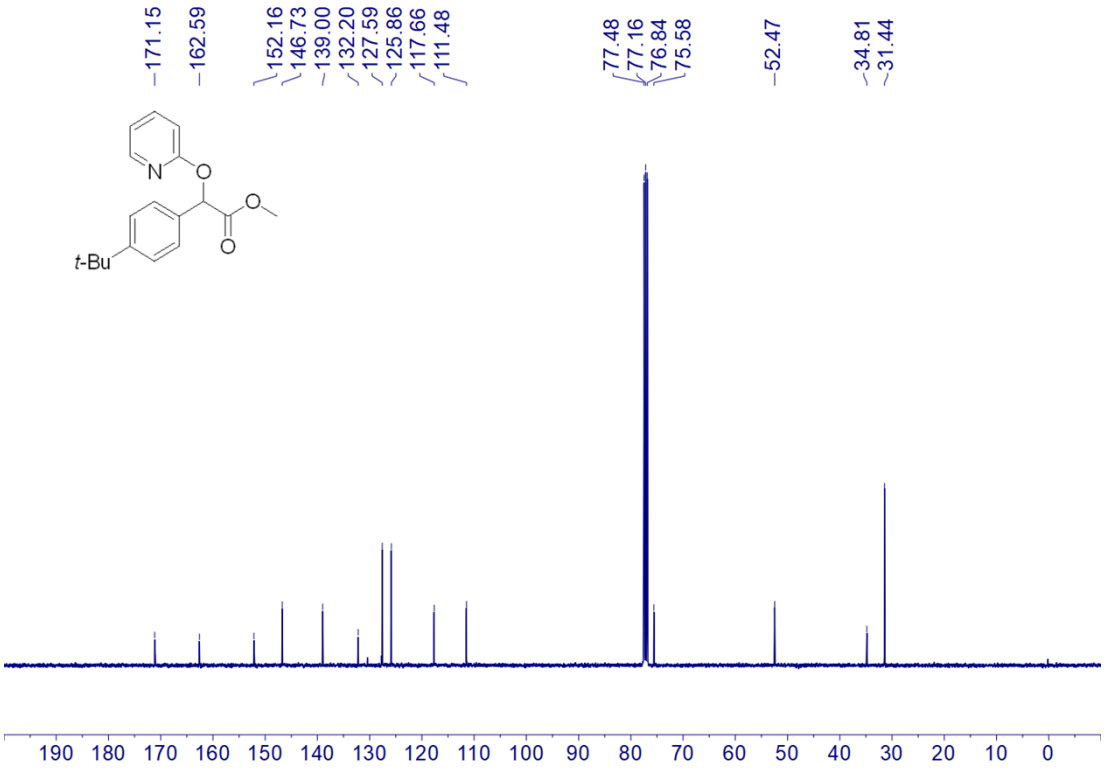
^{1}H NMR Spectrum of Compound **3d** (400 MHz, $CDCl_3$).



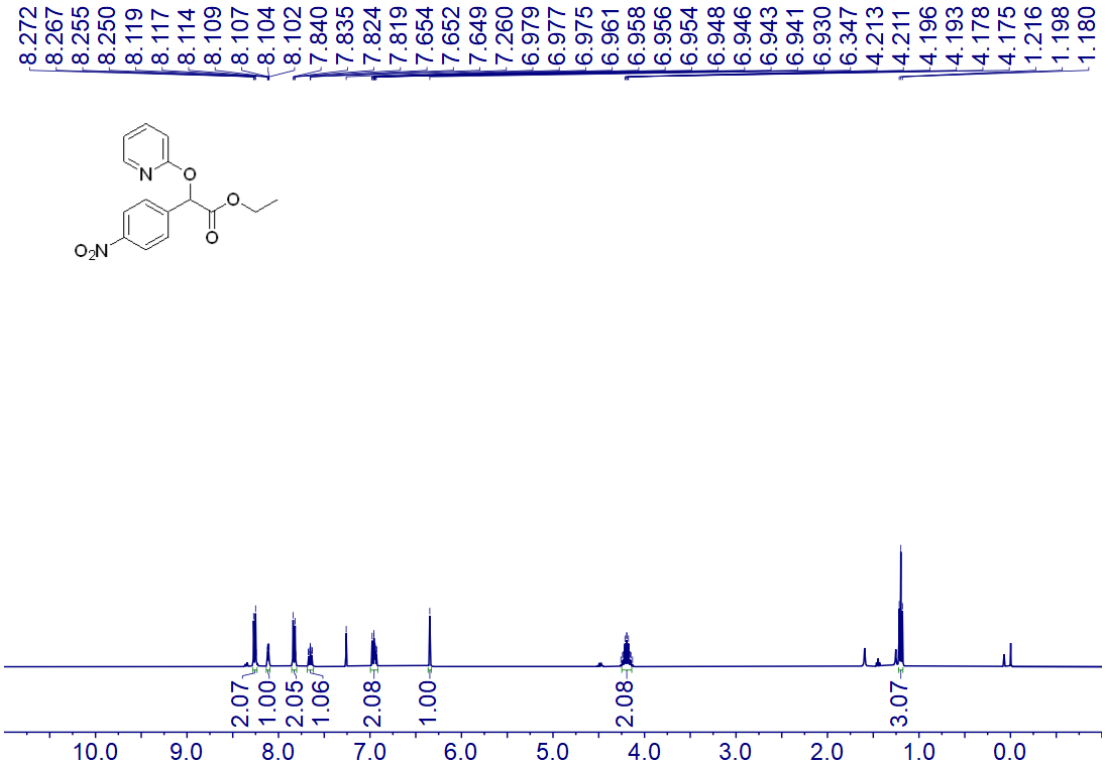
^{13}C NMR Spectrum of Compound **3d** (100 MHz, $CDCl_3$).



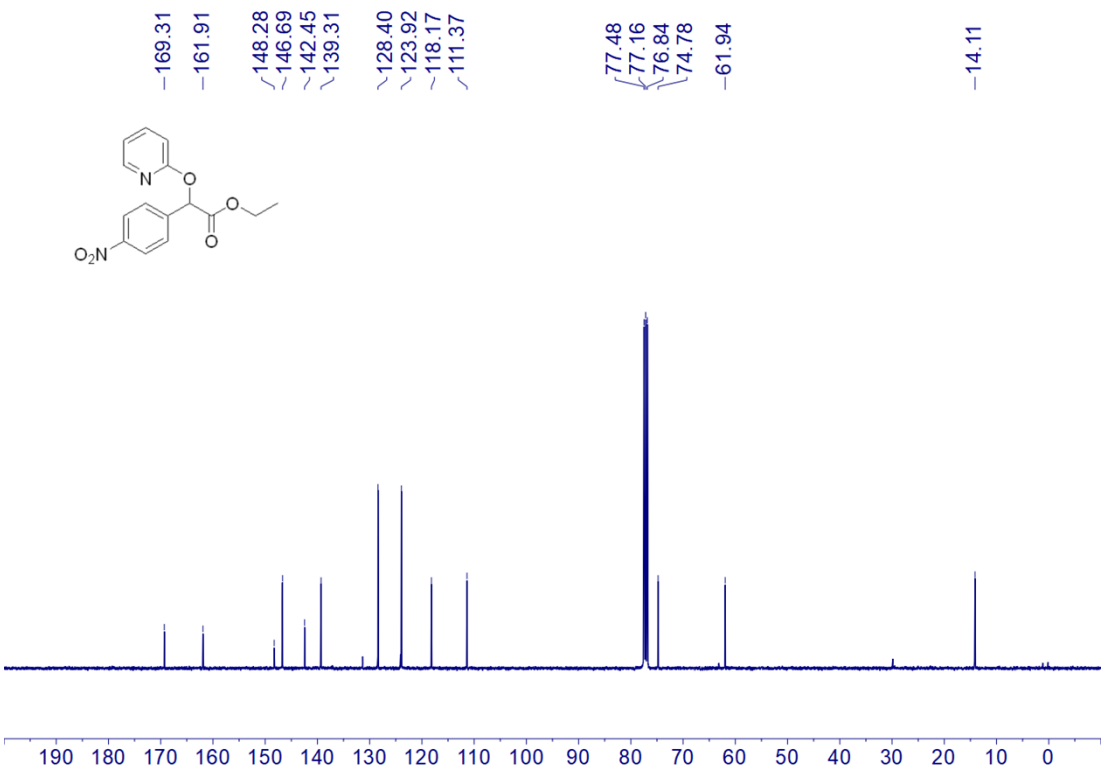
^{1}H NMR Spectrum of Compound **3e** (400 MHz, $CDCl_3$).



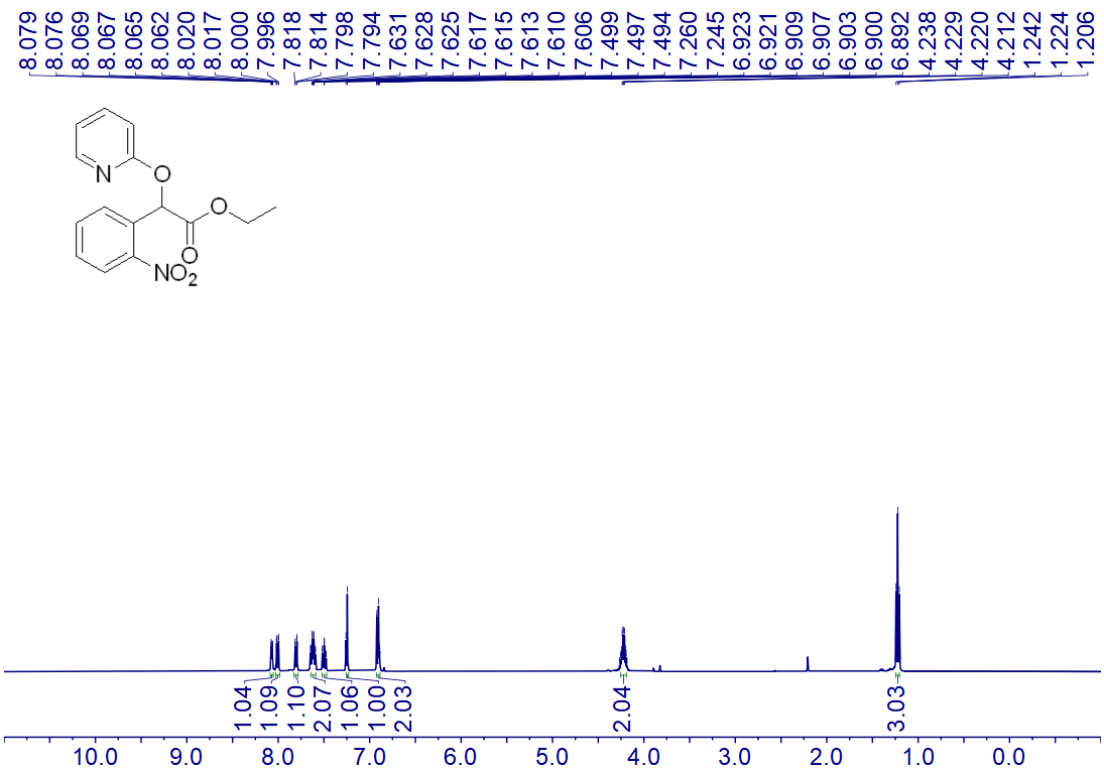
^{13}C NMR Spectrum of Compound **3e** (100 MHz, $CDCl_3$).



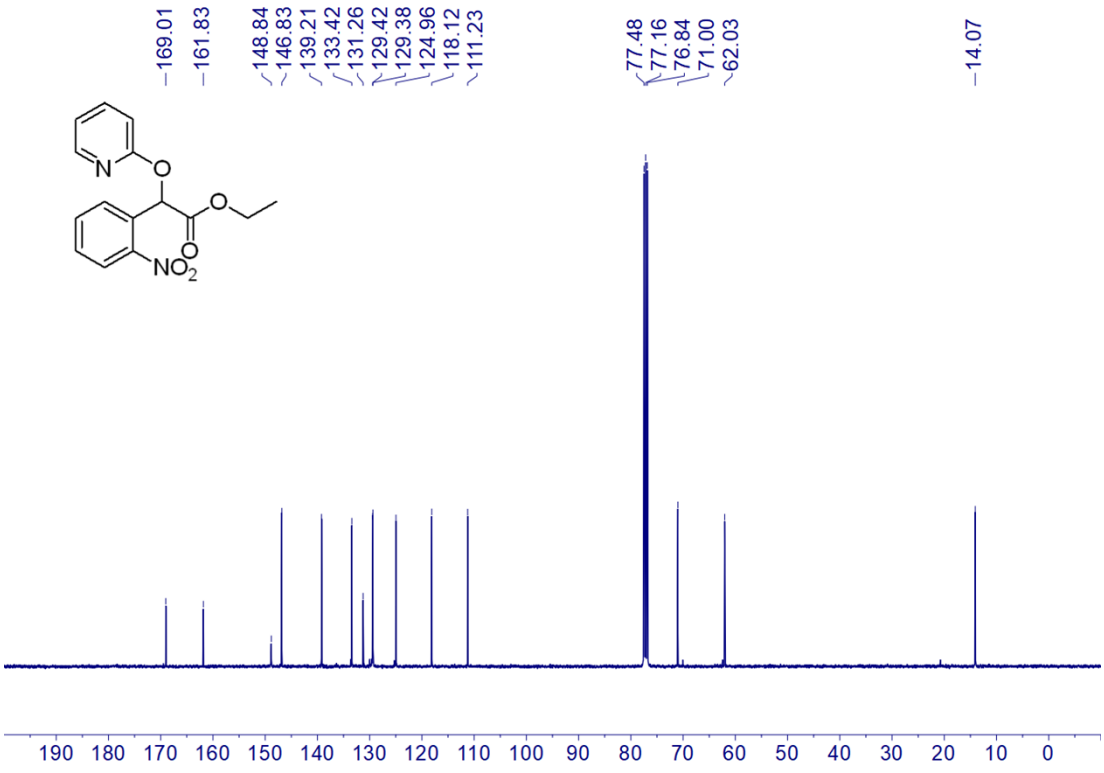
^{1}H NMR Spectrum of Compound **3f** (400 MHz, $CDCl_3$).



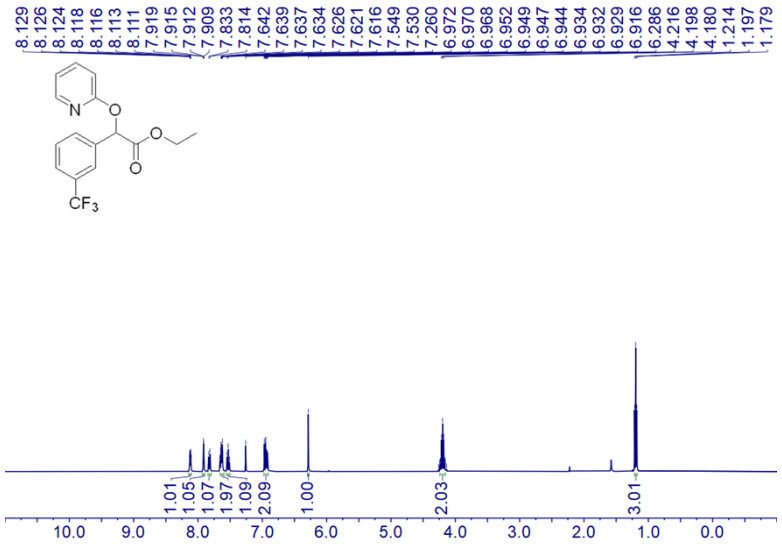
^{13}C NMR Spectrum of Compound **3f** (100 MHz, $CDCl_3$).



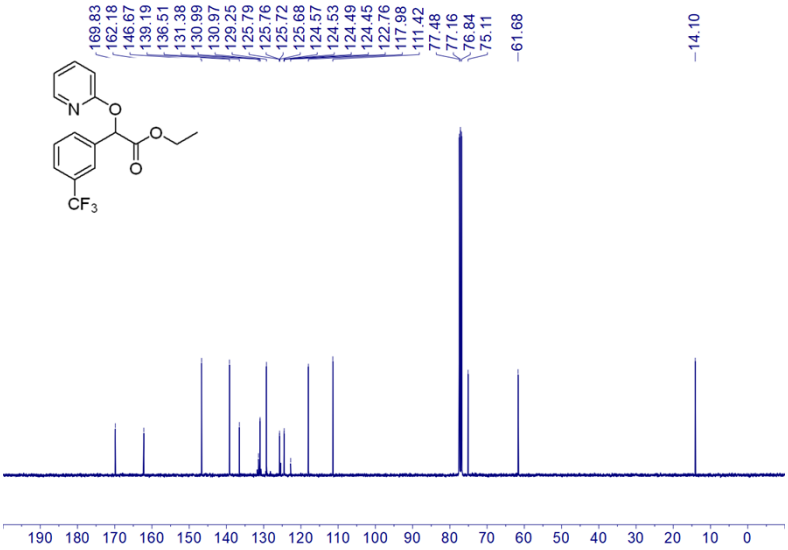
^{1}H NMR Spectrum of Compound **3g** (400 MHz, $CDCl_3$).



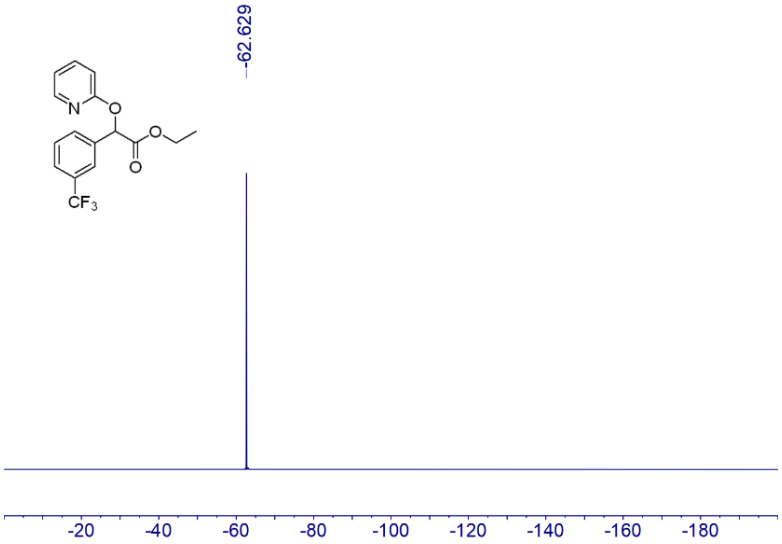
^{13}C NMR Spectrum of Compound **3g** (100 MHz, $CDCl_3$).



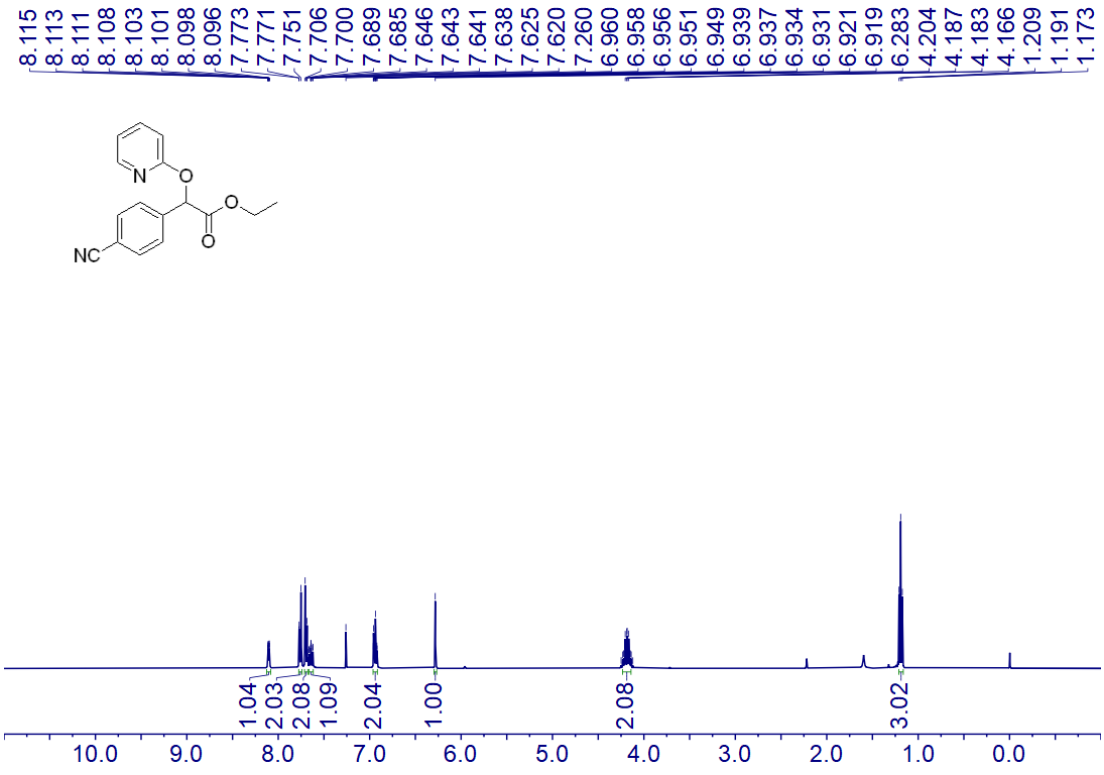
^{1}H NMR Spectrum of Compound **3h** (400 MHz, $CDCl_3$).



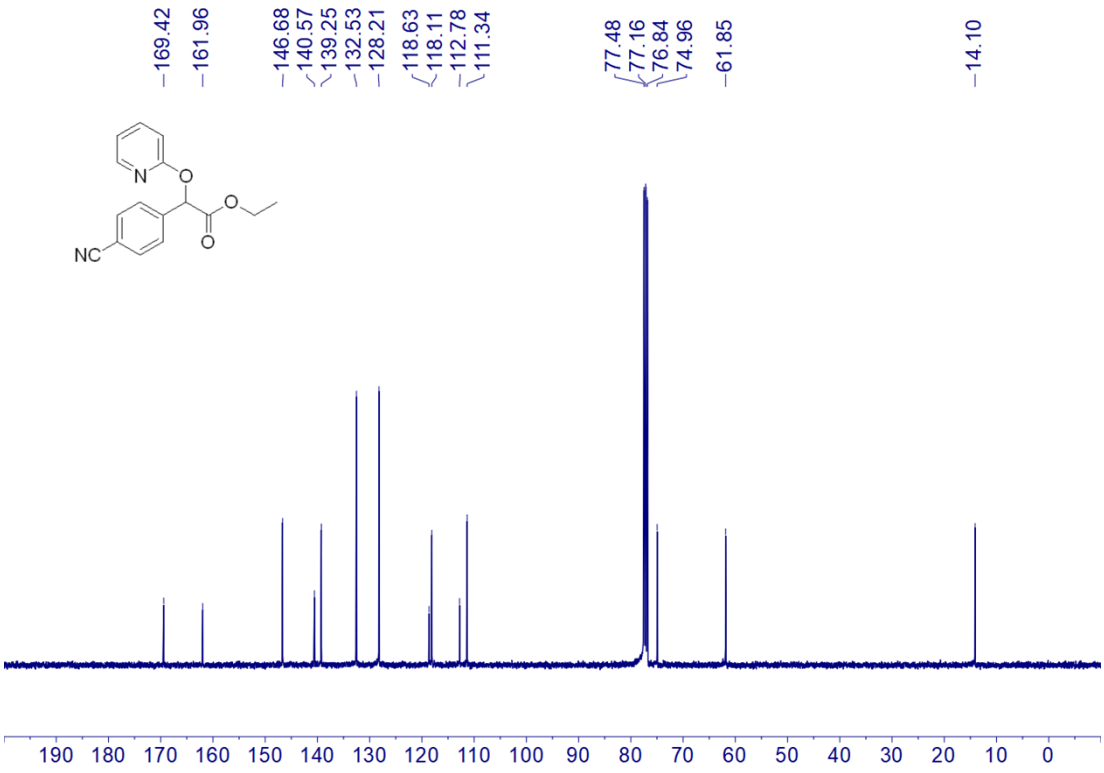
^{13}C NMR Spectrum of Compound **3h** (100 MHz, $CDCl_3$).



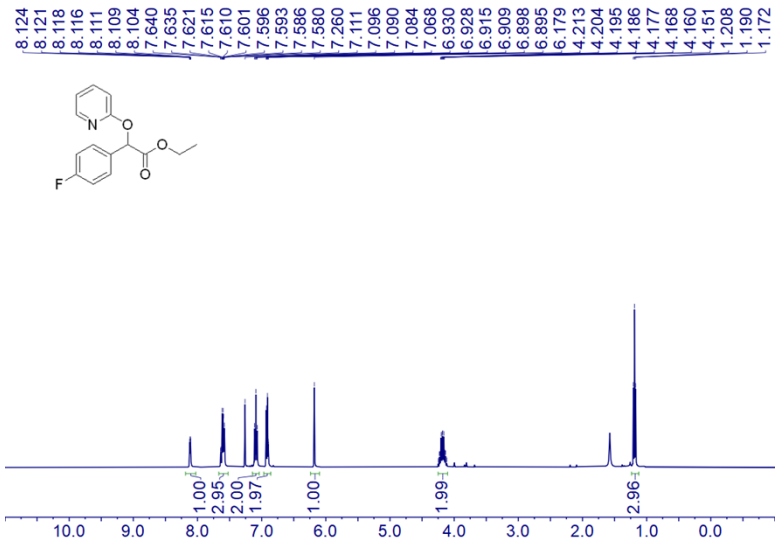
^{19}F NMR Spectrum of Compound **3h** (376 MHz, $CDCl_3$)



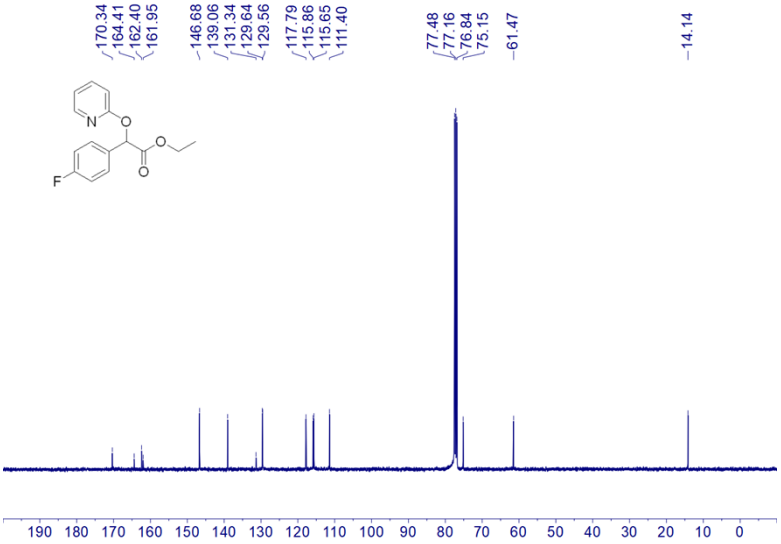
^{1}H NMR Spectrum of Compound **3i** (400 MHz, $CDCl_3$).



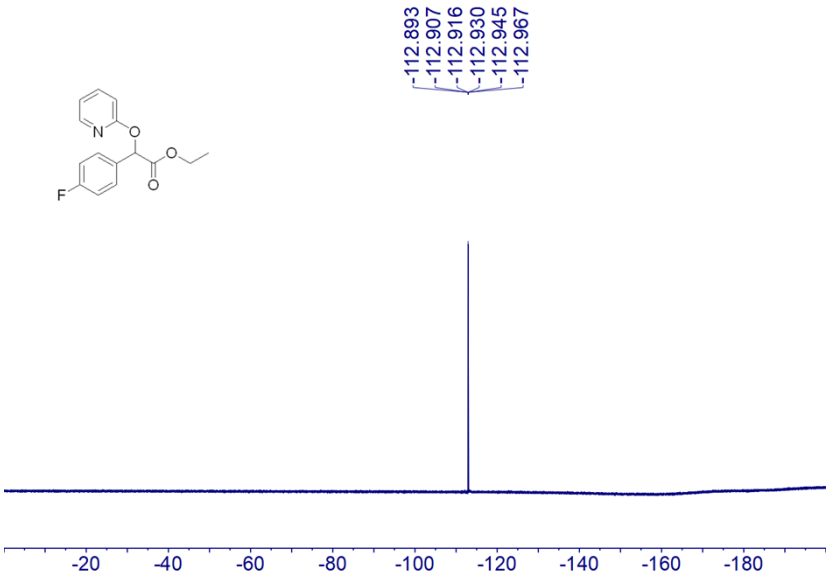
^{13}C NMR Spectrum of Compound **3i** (100 MHz, $CDCl_3$).



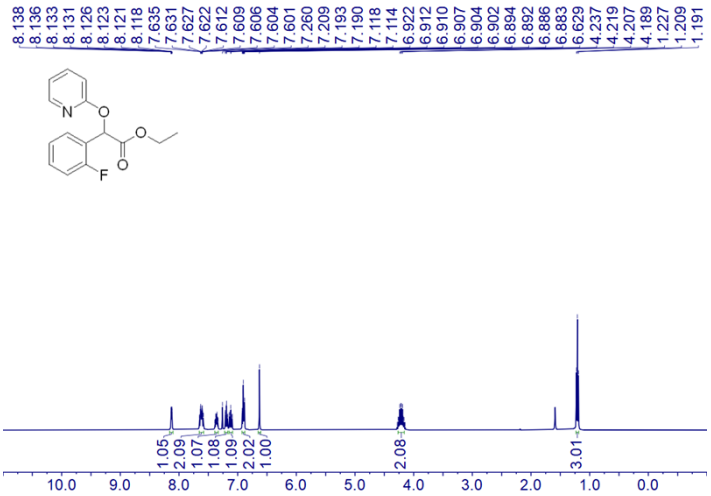
^{1}H NMR Spectrum of Compound **3j** (400 MHz, $CDCl_3$).



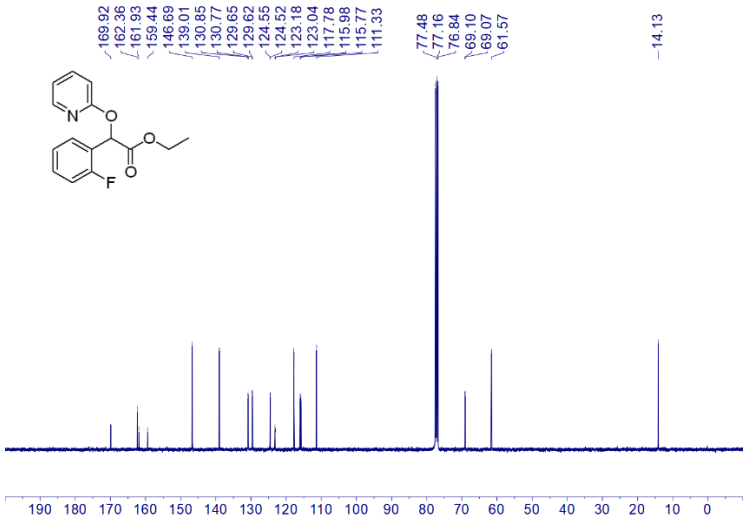
^{13}C NMR Spectrum of Compound **3j** (100 MHz, $CDCl_3$).



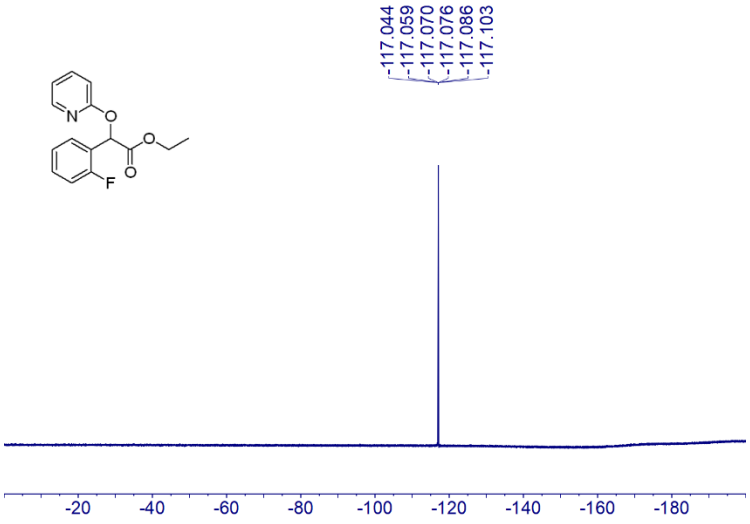
^{19}F NMR Spectrum of Compound **3j** (376 MHz, $CDCl_3$)



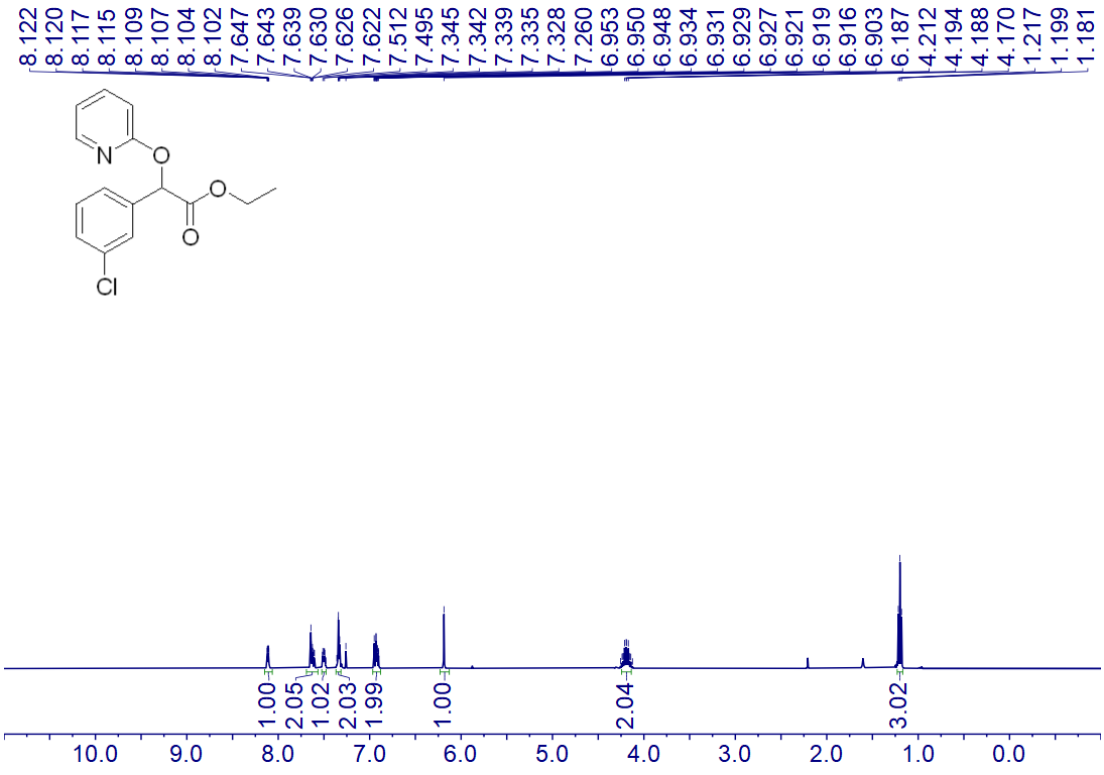
^{1}H NMR Spectrum of Compound **3k** (400 MHz, $CDCl_3$).



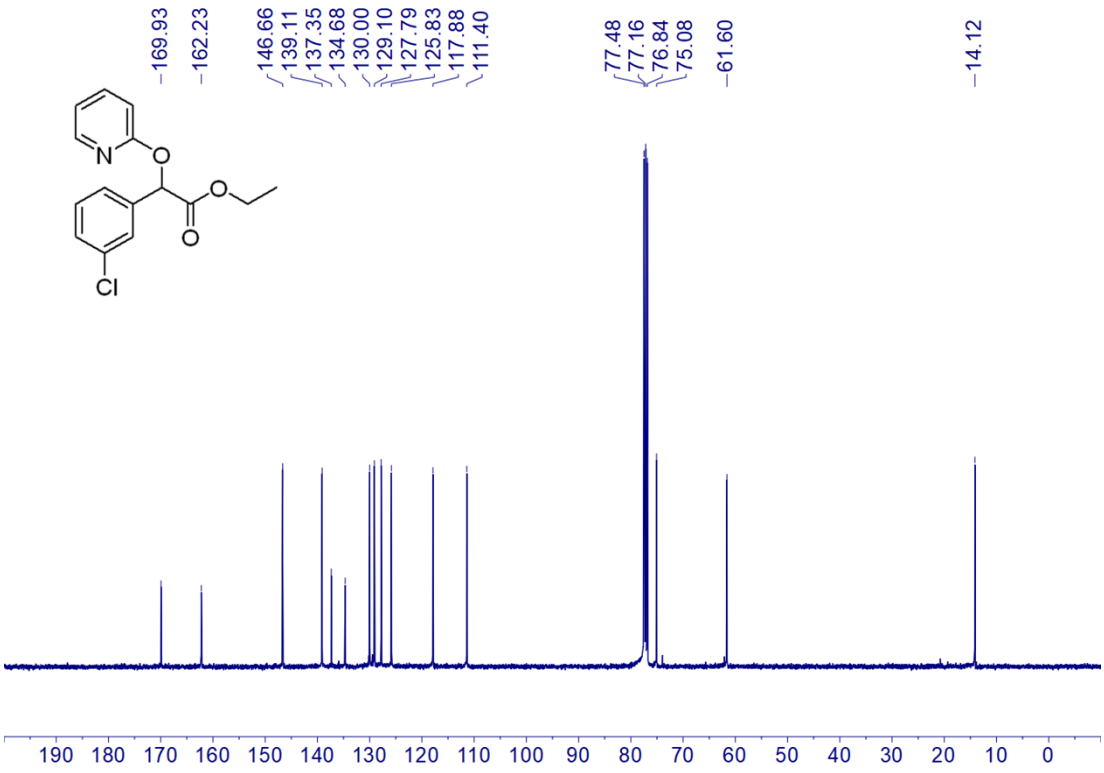
^{13}C NMR Spectrum of Compound **3k** (100 MHz, $CDCl_3$).



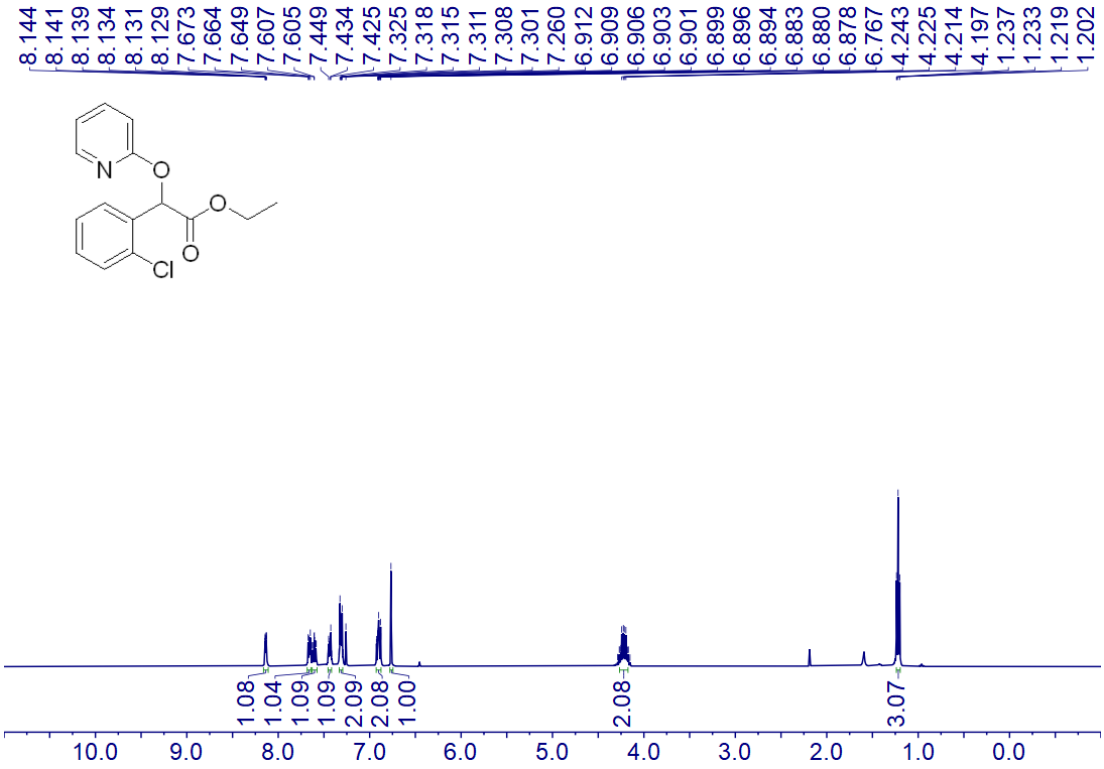
^{19}F NMR Spectrum of Compound **3k** (376 MHz, $CDCl_3$)



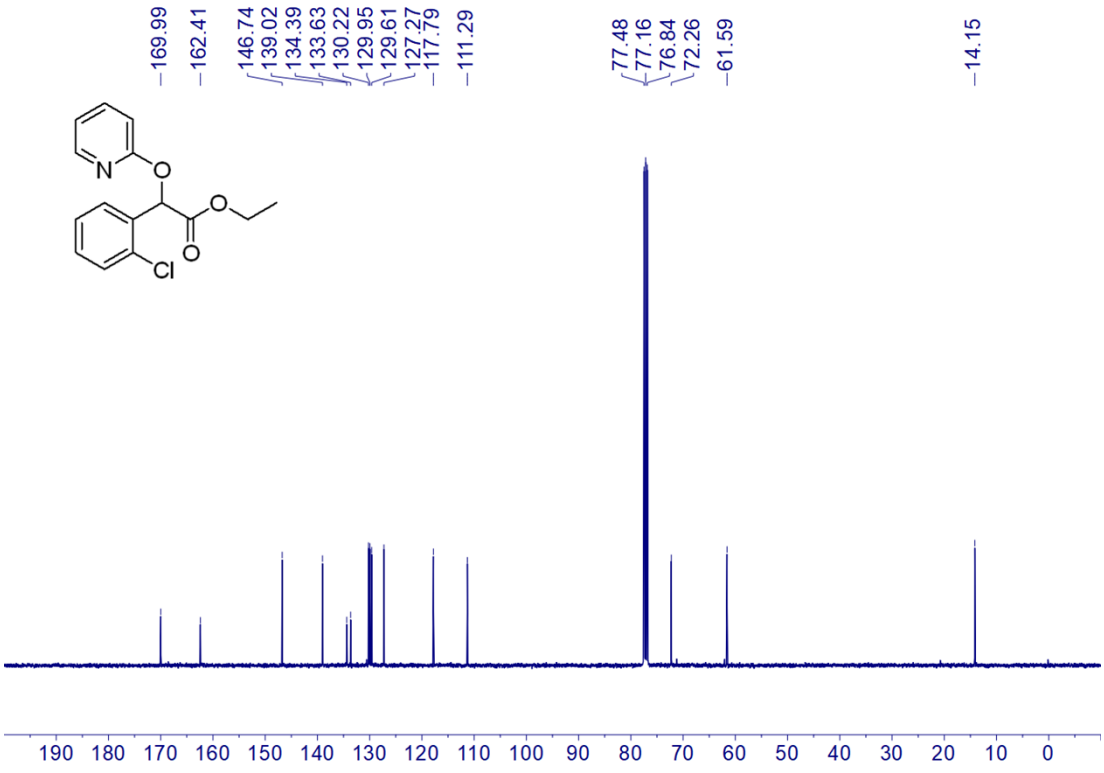
^{1}H NMR Spectrum of Compound **3l** (400 MHz, $CDCl_3$).



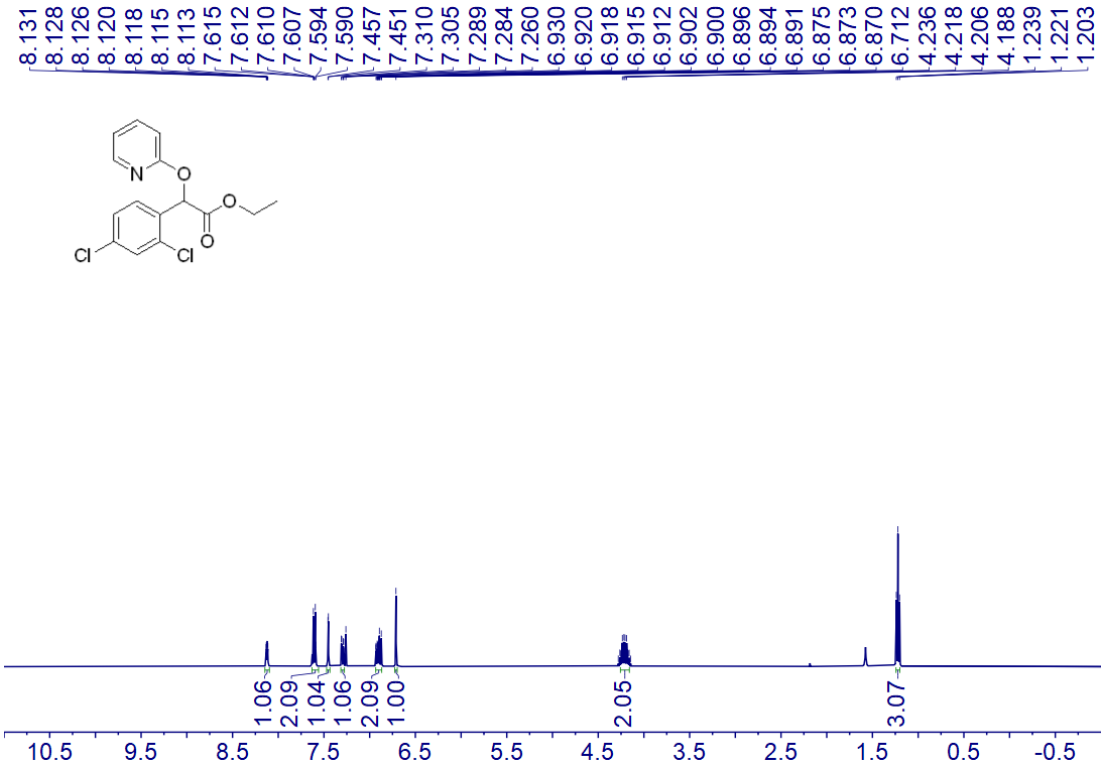
^{13}C NMR Spectrum of Compound **3l** (100 MHz, $CDCl_3$).



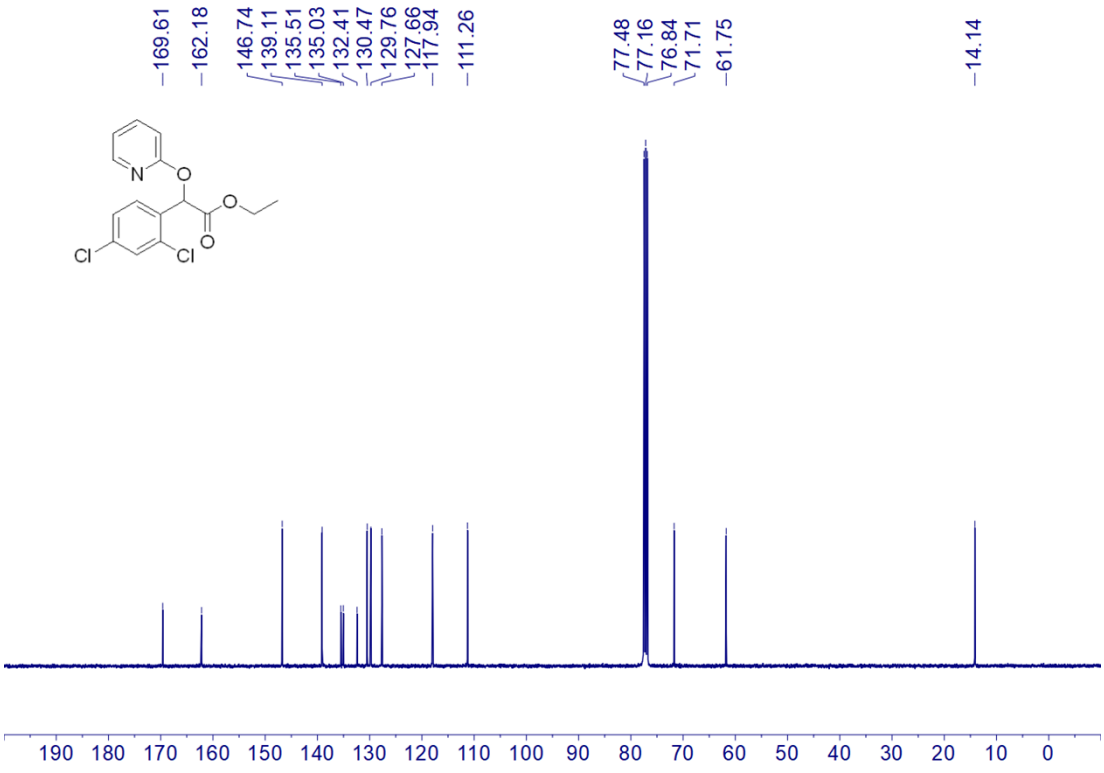
^{1}H NMR Spectrum of Compound **3m** (400 MHz, $CDCl_3$).



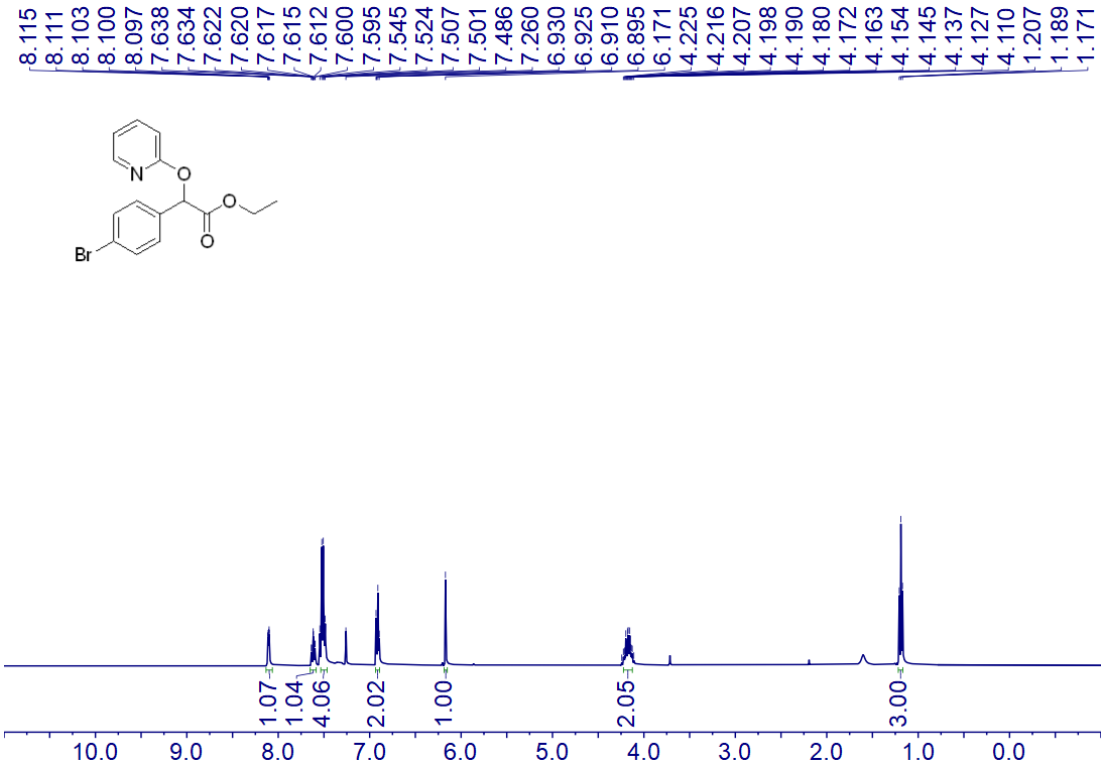
^{13}C NMR Spectrum of Compound **3m** (100 MHz, $CDCl_3$).



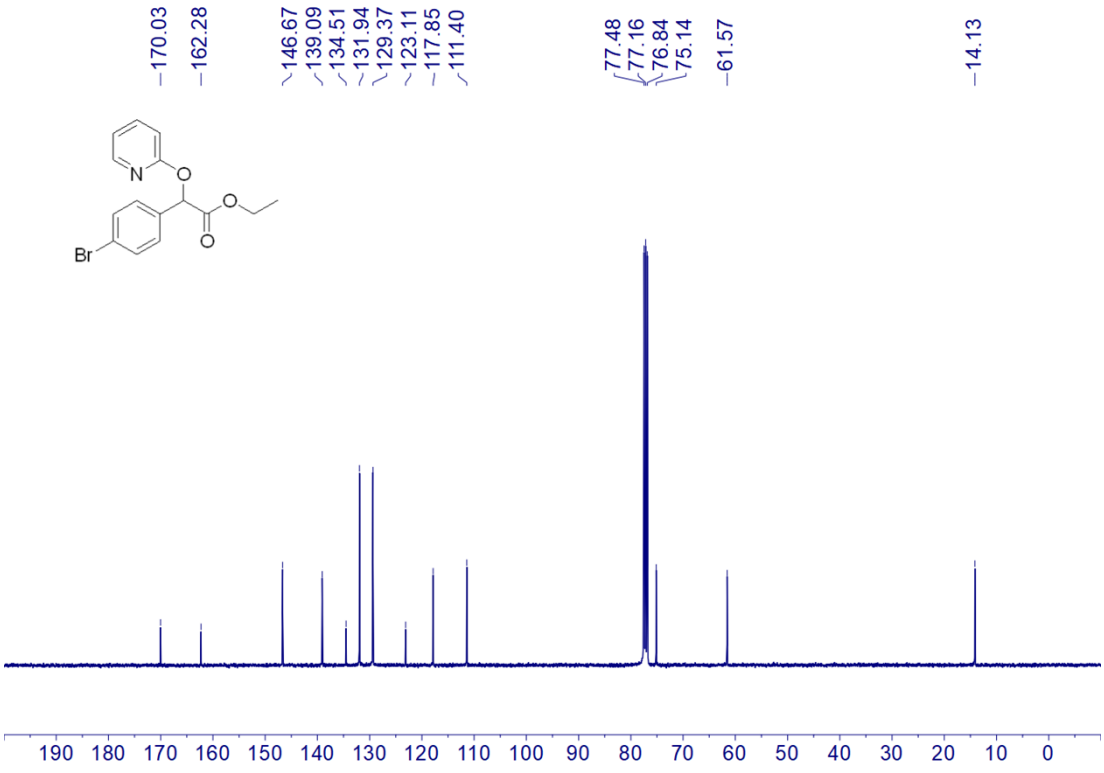
^{1}H NMR Spectrum of Compound **3n** (400 MHz, $CDCl_3$).



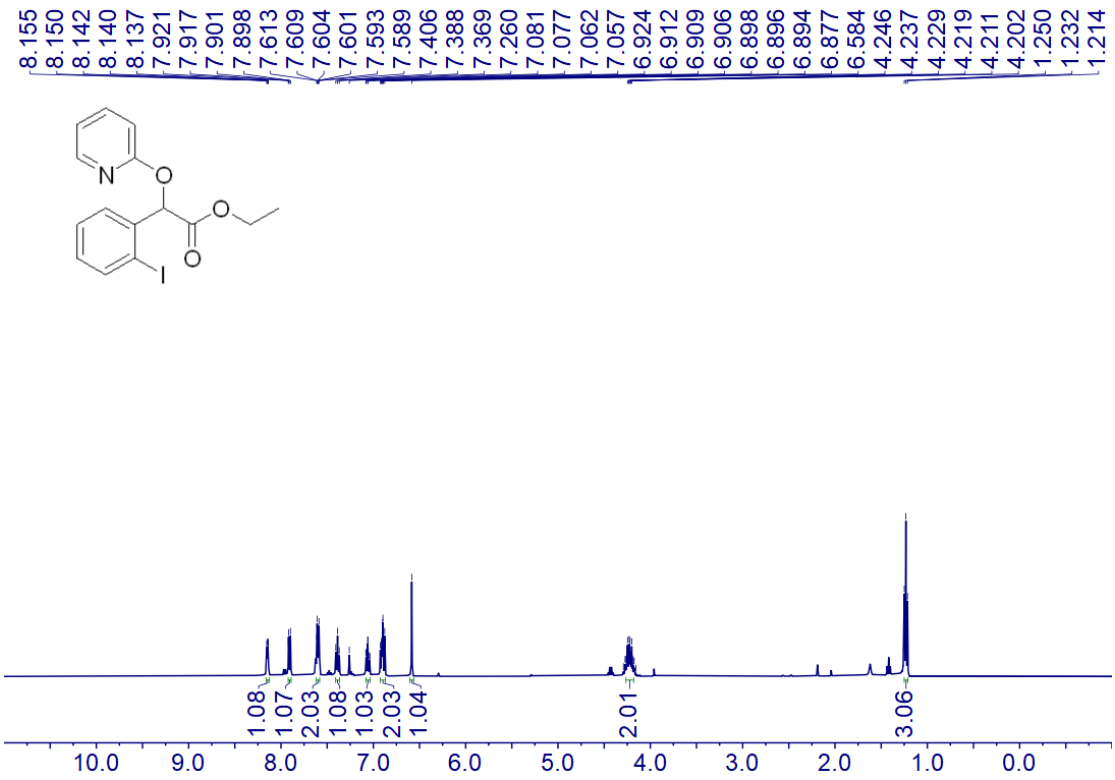
^{13}C NMR Spectrum of Compound **3n** (100 MHz, $CDCl_3$).



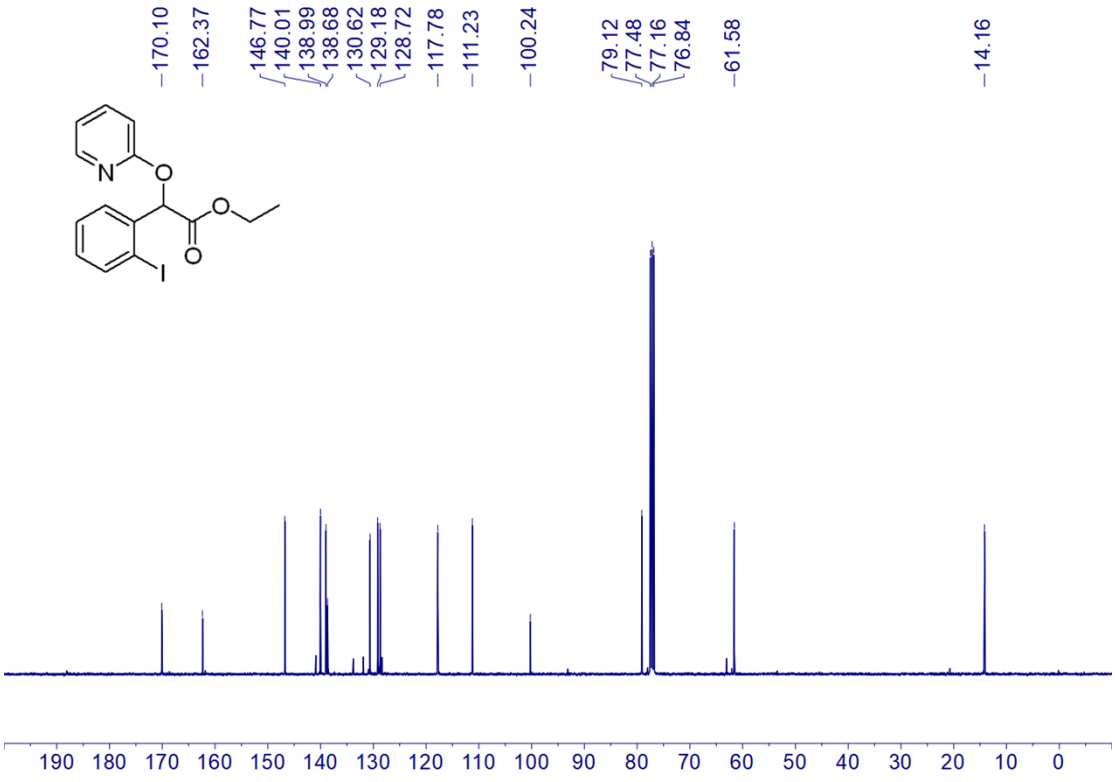
^{1}H NMR Spectrum of Compound **3o** (400 MHz, $CDCl_3$).



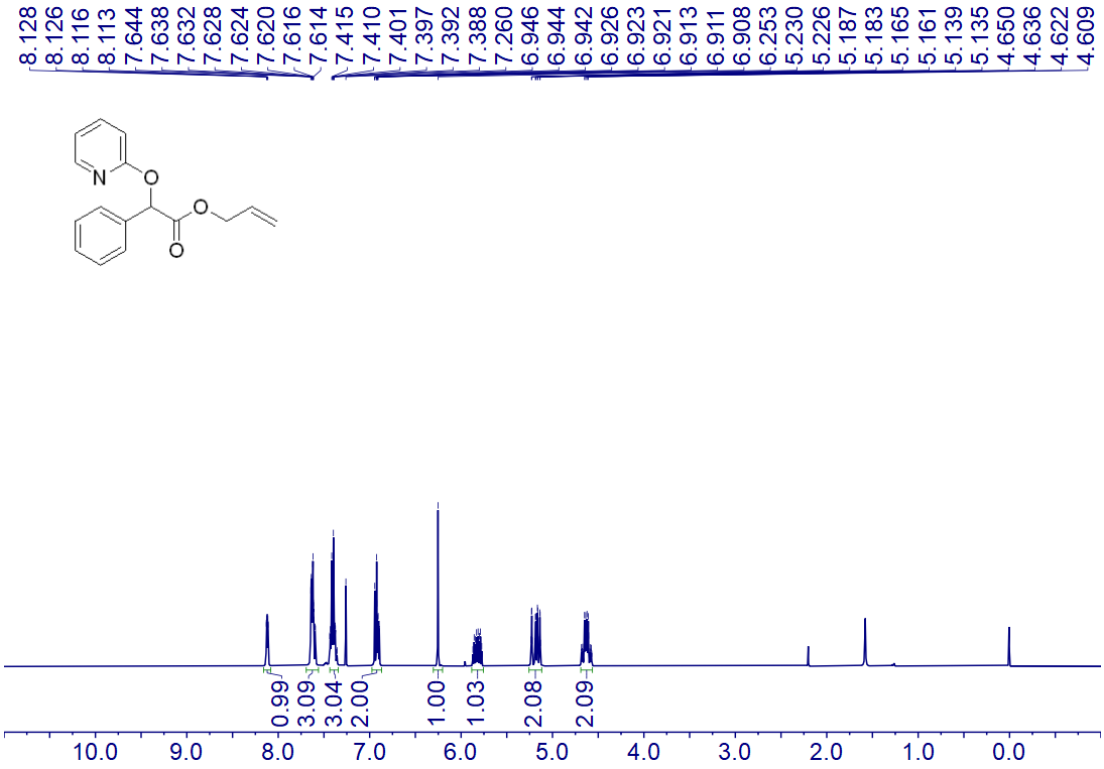
^{13}C NMR Spectrum of Compound **3o** (100 MHz, $CDCl_3$).



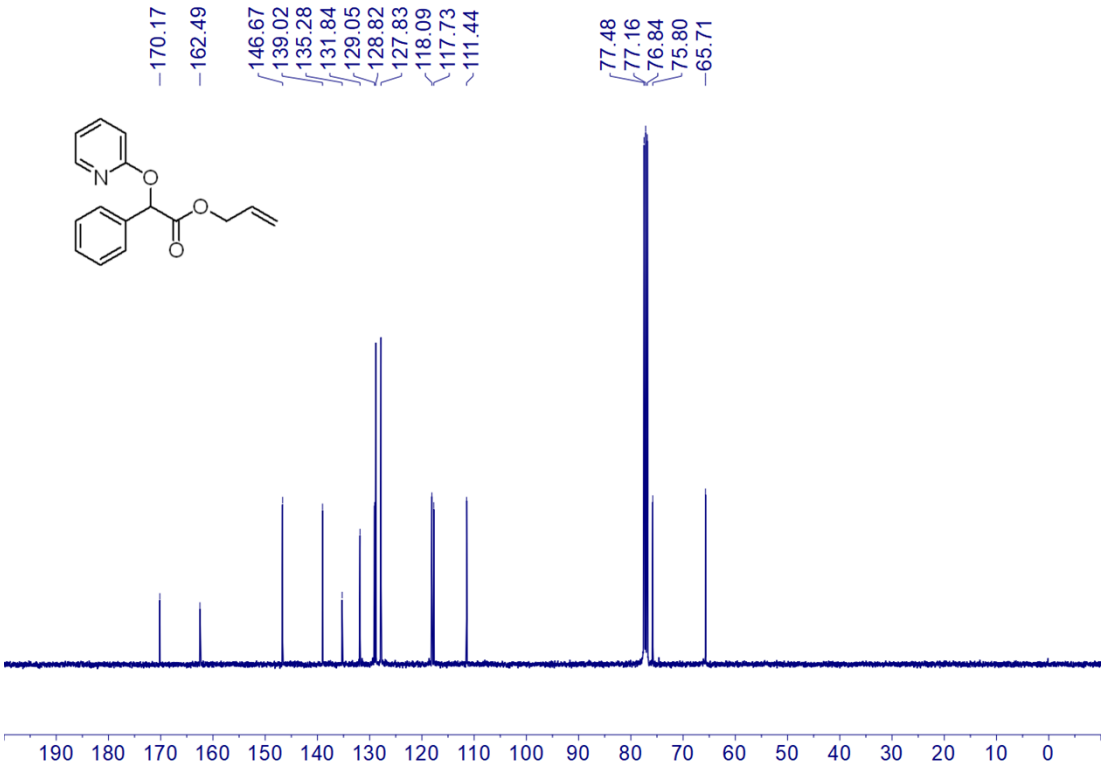
^{1}H NMR Spectrum of Compound **3p** (400 MHz, $CDCl_3$).



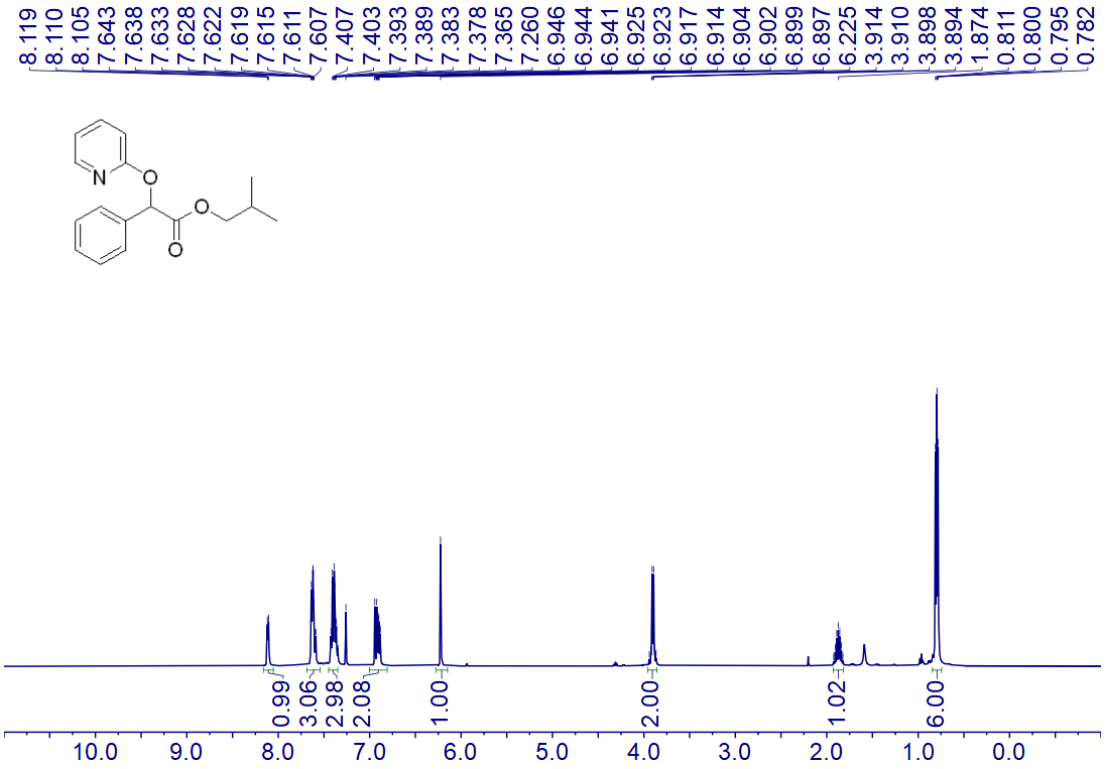
^{13}C NMR Spectrum of Compound **3p** (100 MHz, $CDCl_3$).



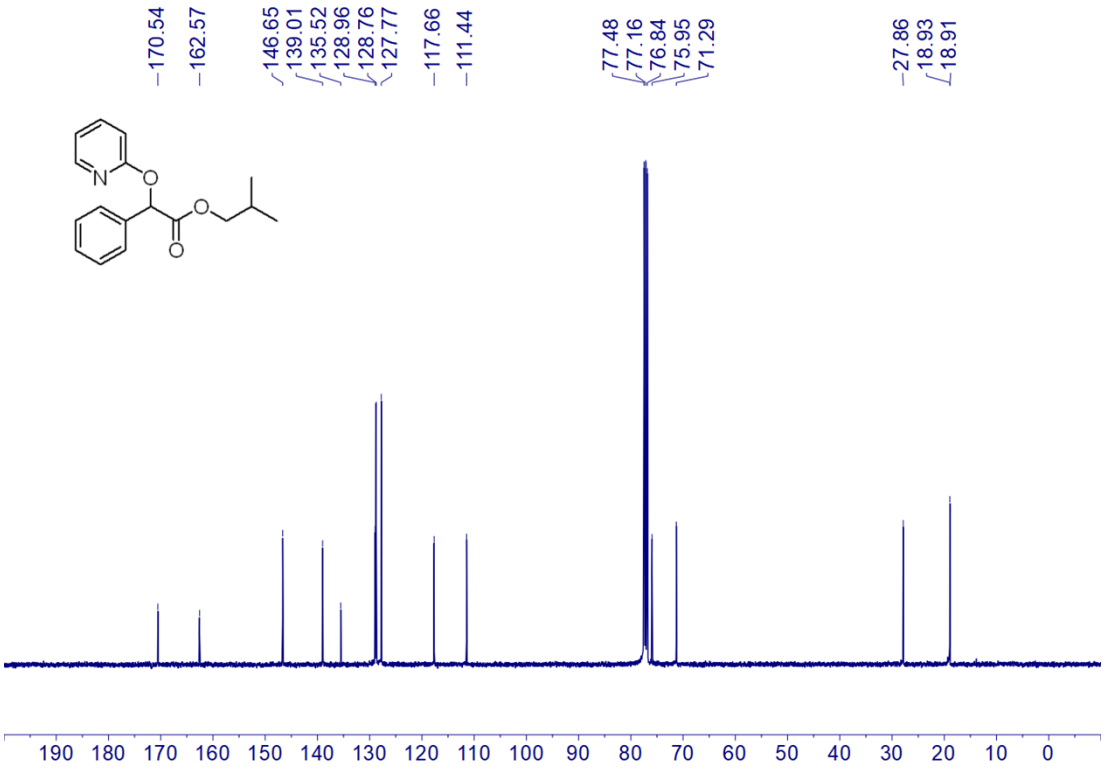
^{1}H NMR Spectrum of Compound **3q** (400 MHz, $CDCl_3$).



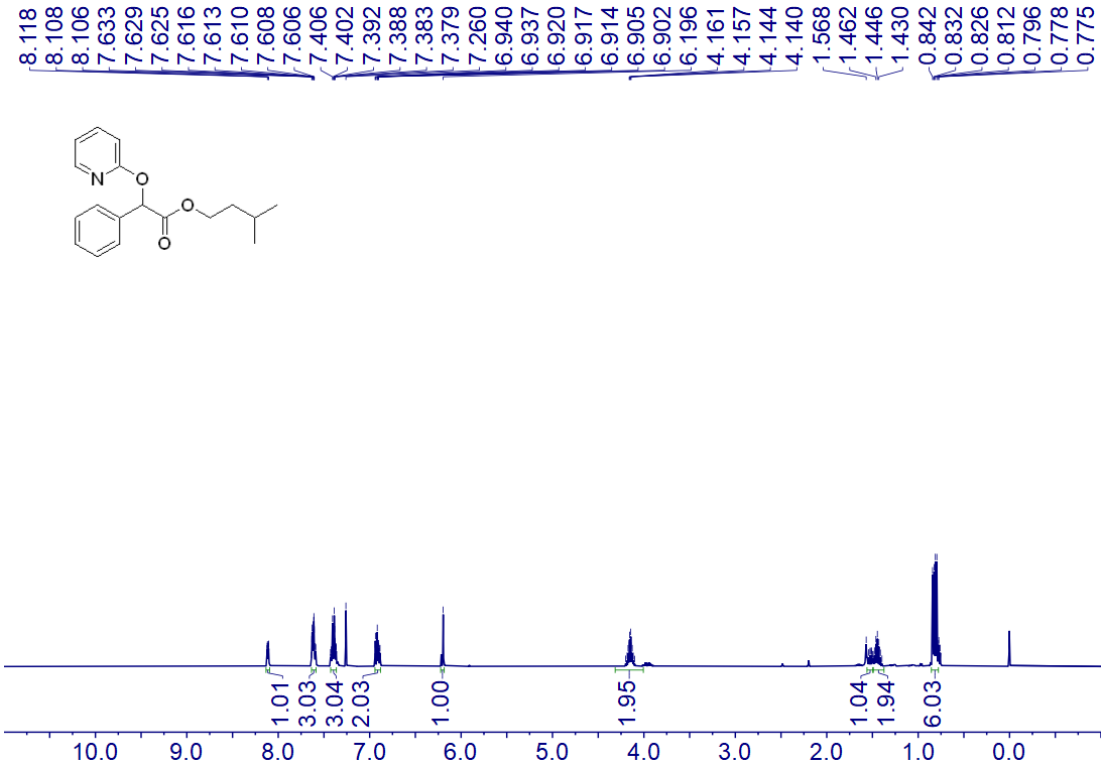
^{13}C NMR Spectrum of Compound **3q** (100 MHz, $CDCl_3$).



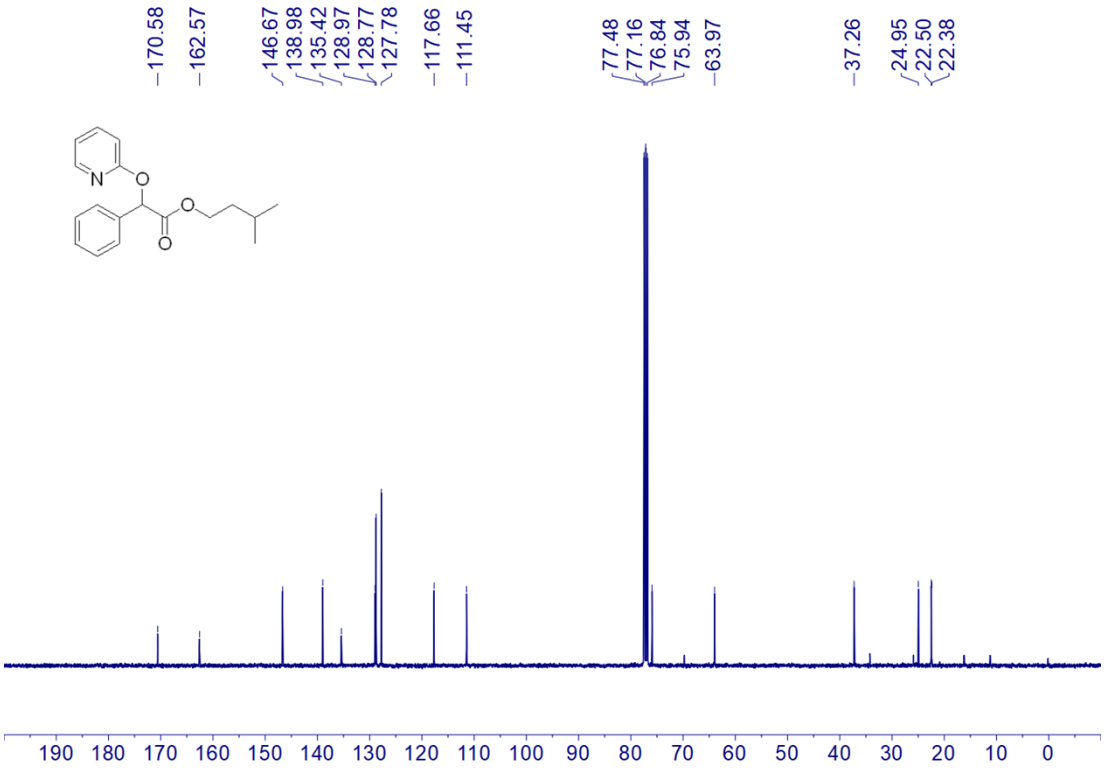
^{1}H NMR Spectrum of Compound **3r** (400 MHz, $CDCl_3$).



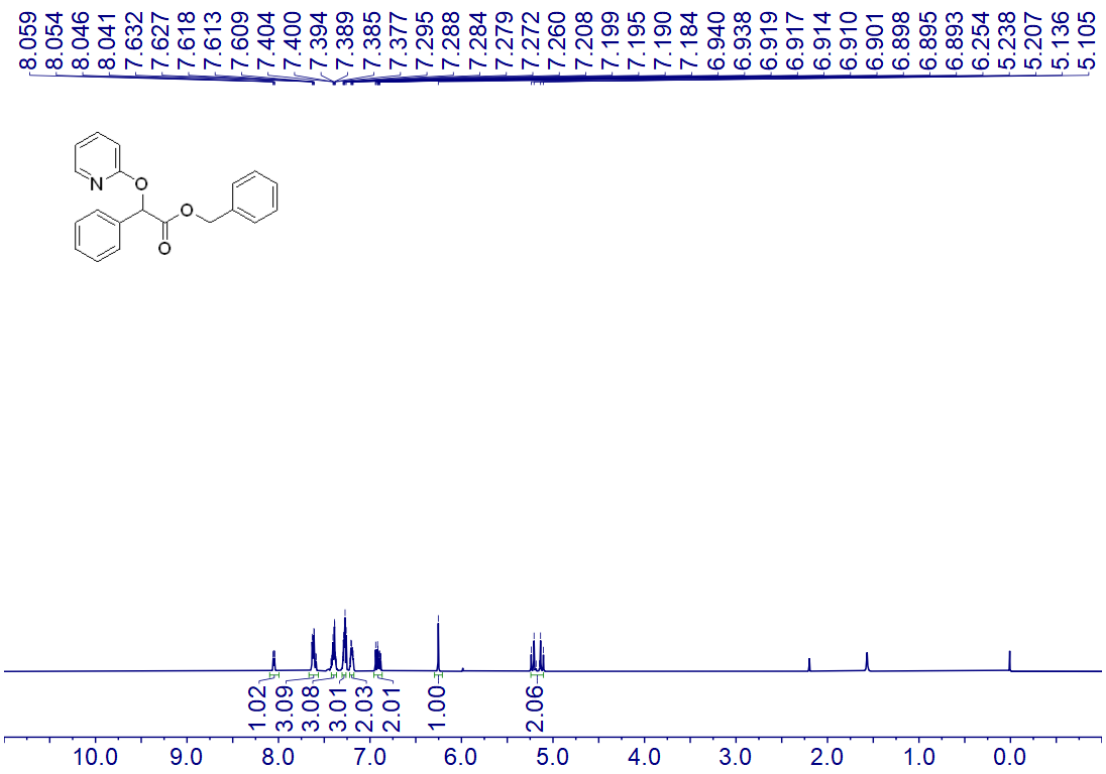
^{13}C NMR Spectrum of Compound **3r** (100 MHz, $CDCl_3$).



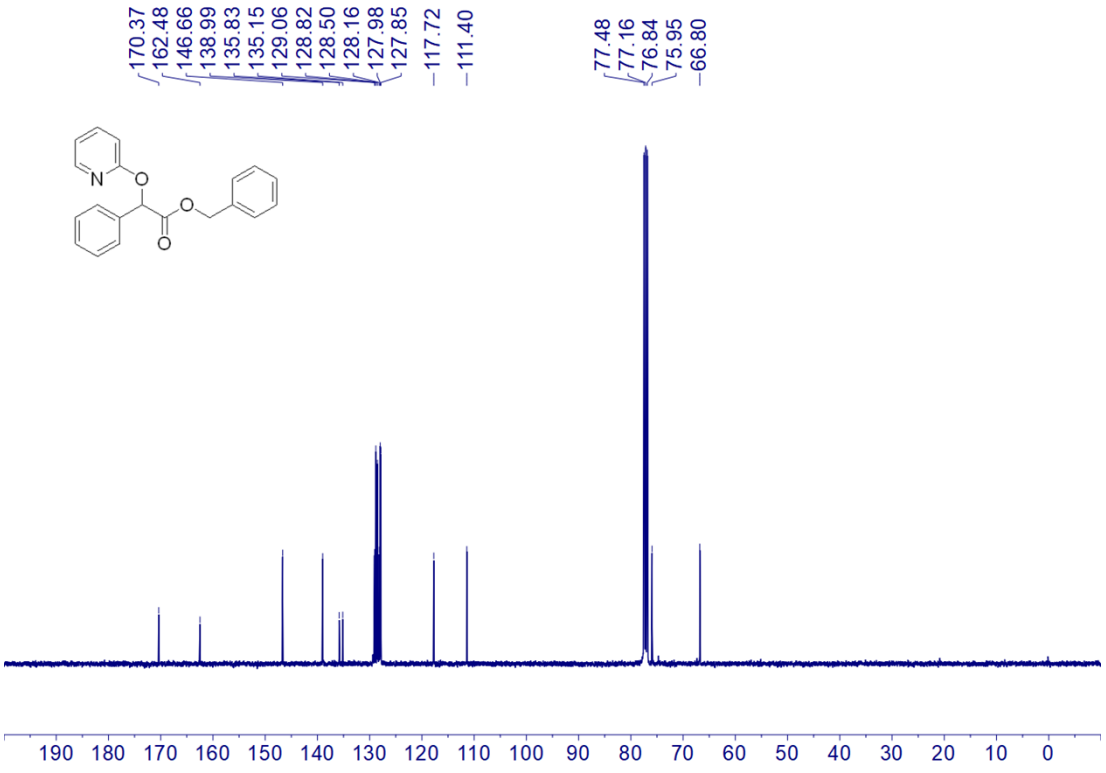
^{1}H NMR Spectrum of Compound **3s** (400 MHz, $CDCl_3$).



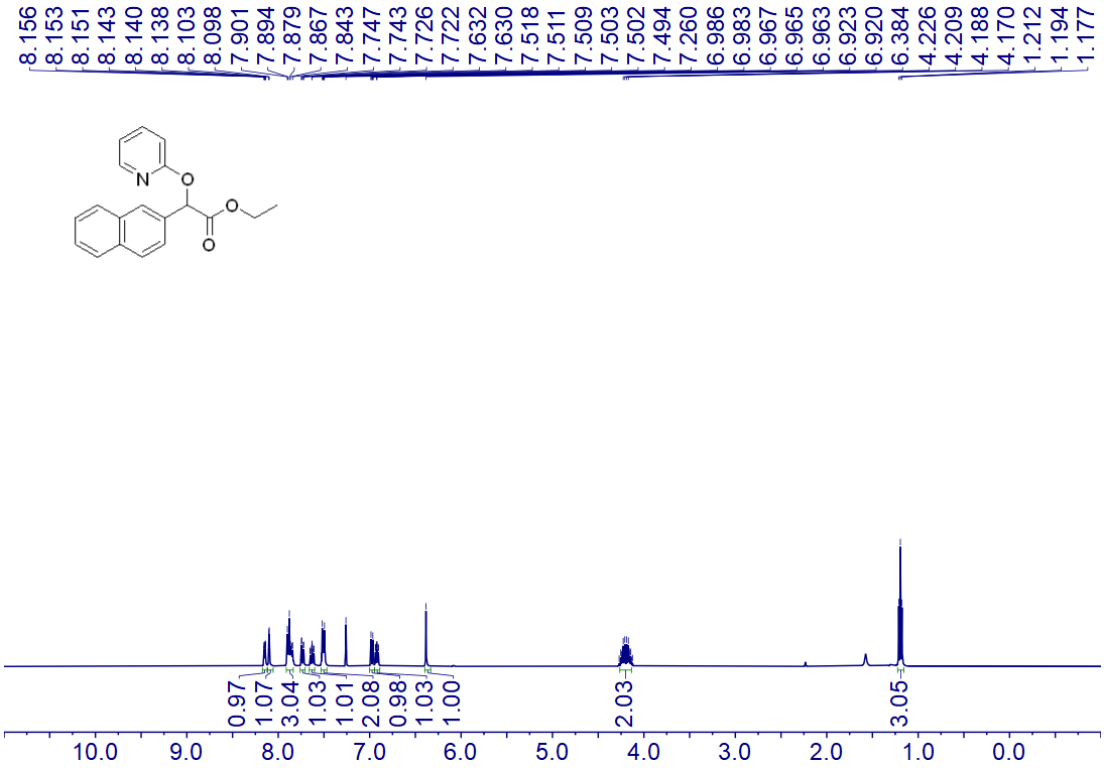
^{13}C NMR Spectrum of Compound **3s** (100 MHz, $CDCl_3$).



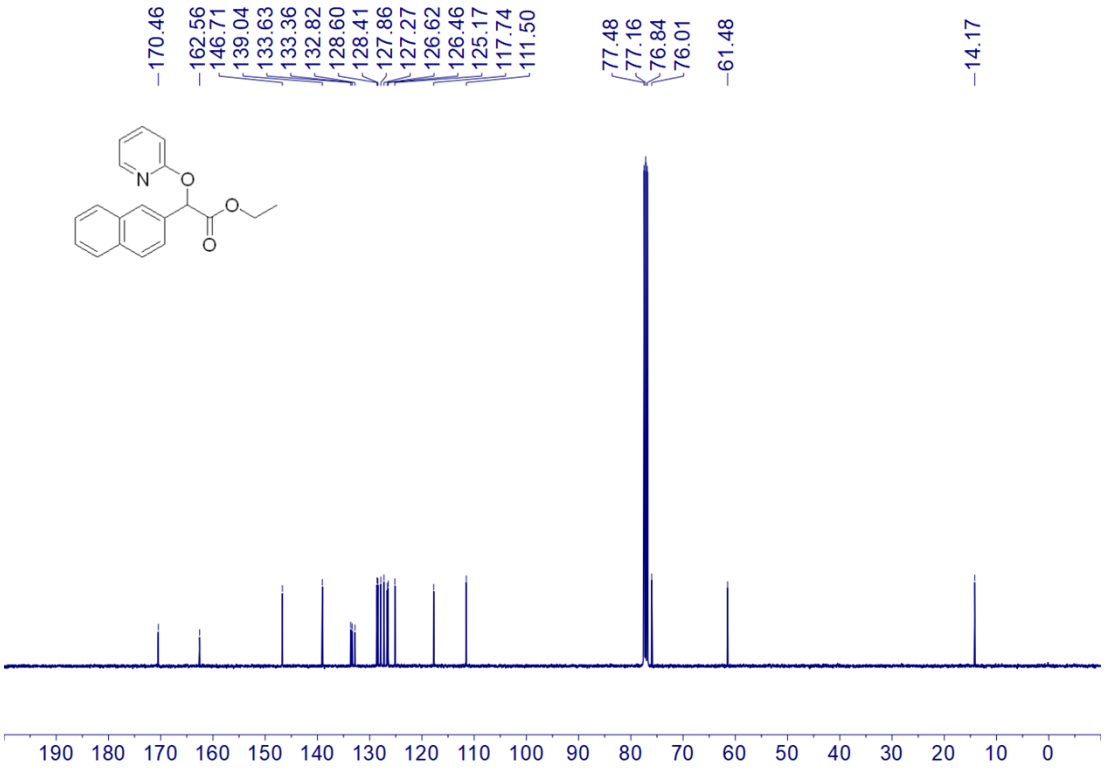
^{1}H NMR Spectrum of Compound **3t** (400 MHz, $CDCl_3$).



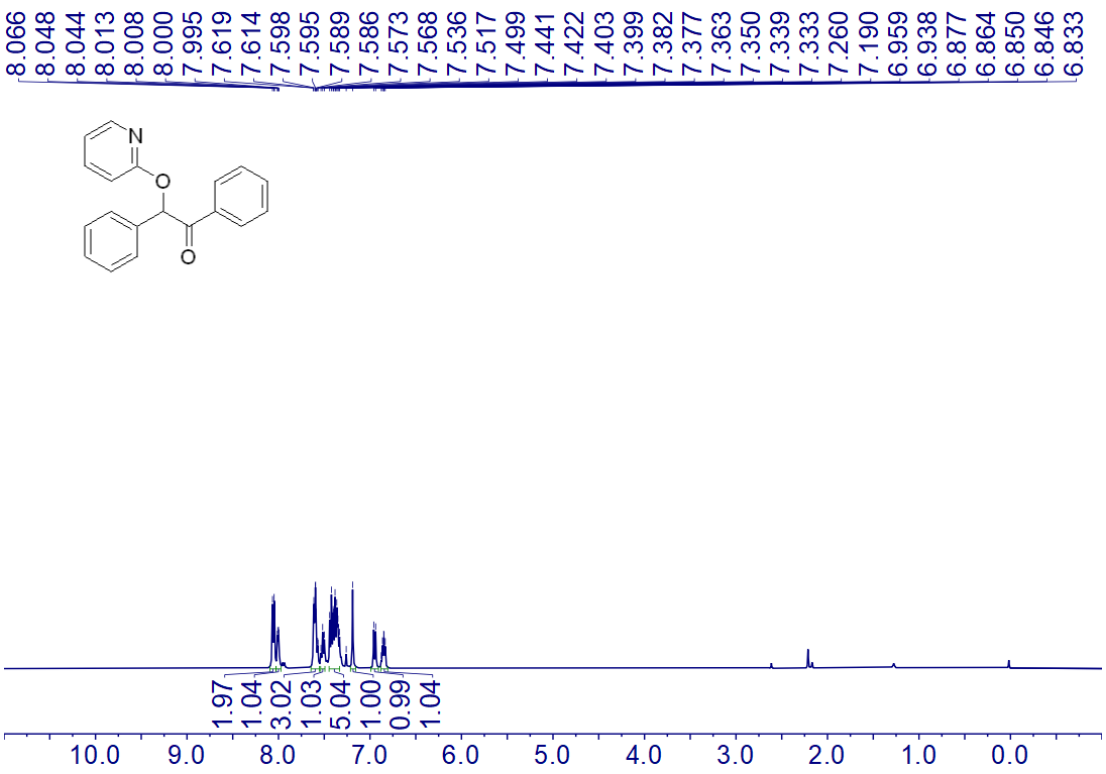
^{13}C NMR Spectrum of Compound **3t** (100 MHz, $CDCl_3$).



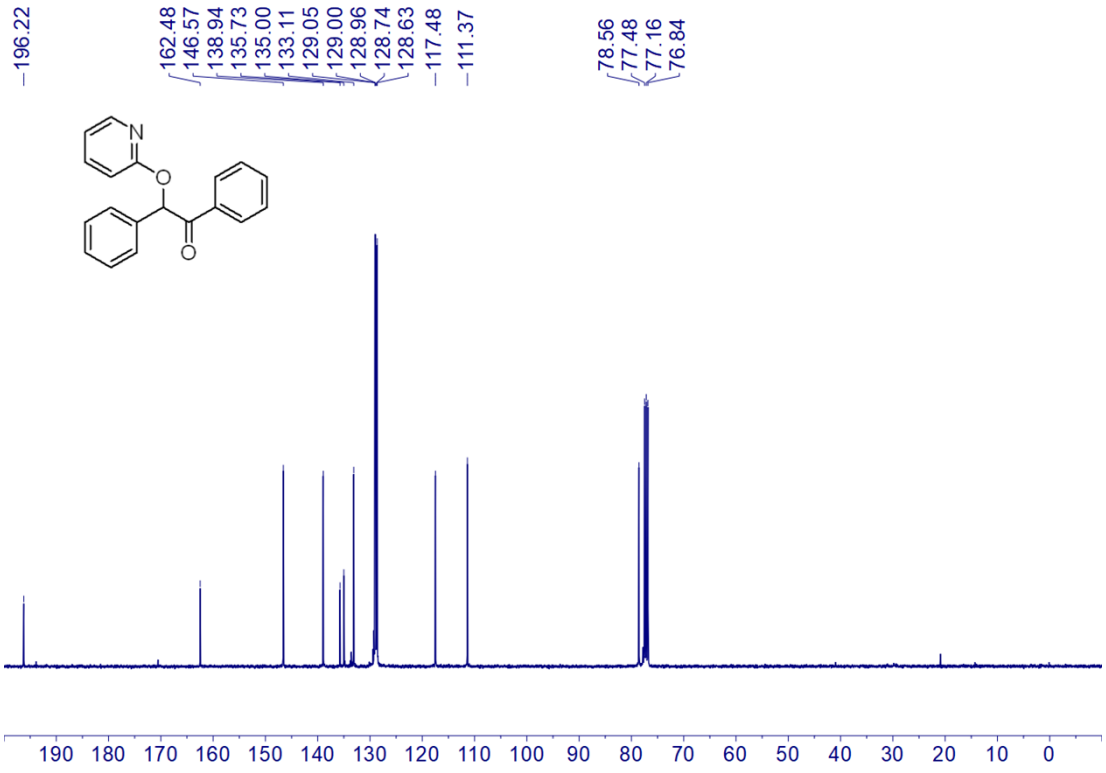
^{1}H NMR Spectrum of Compound **3u** (400 MHz, $CDCl_3$).



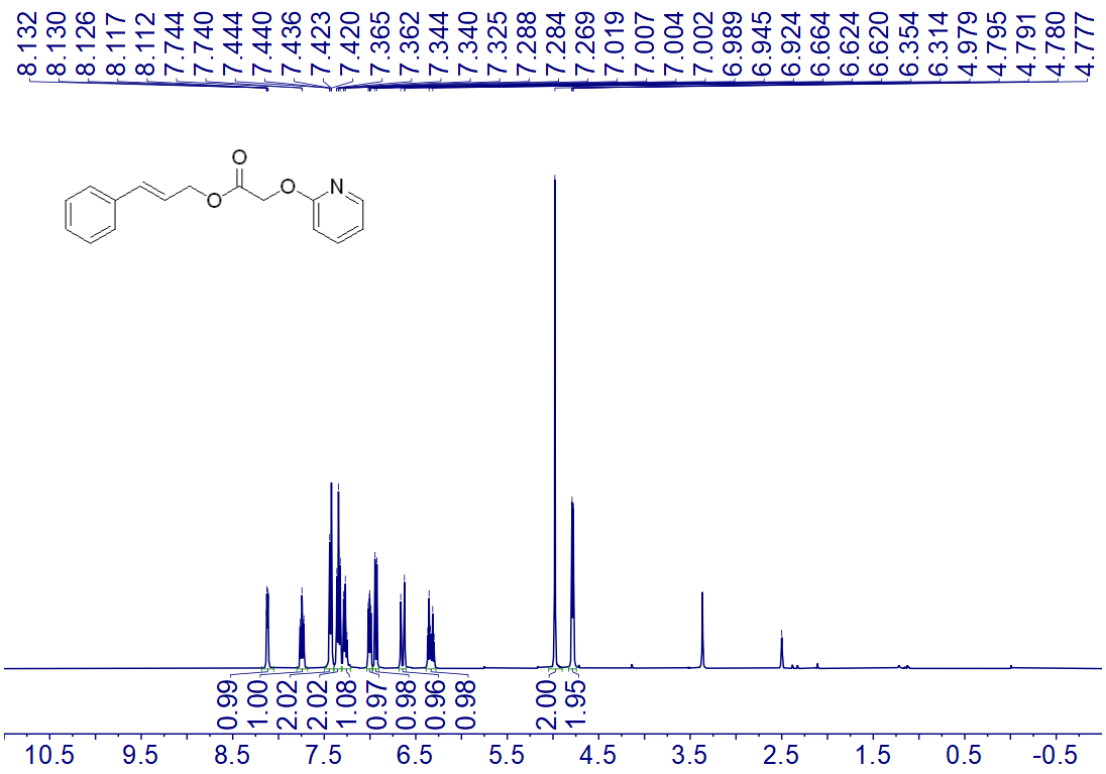
^{13}C NMR Spectrum of Compound **3u** (100 MHz, $CDCl_3$).



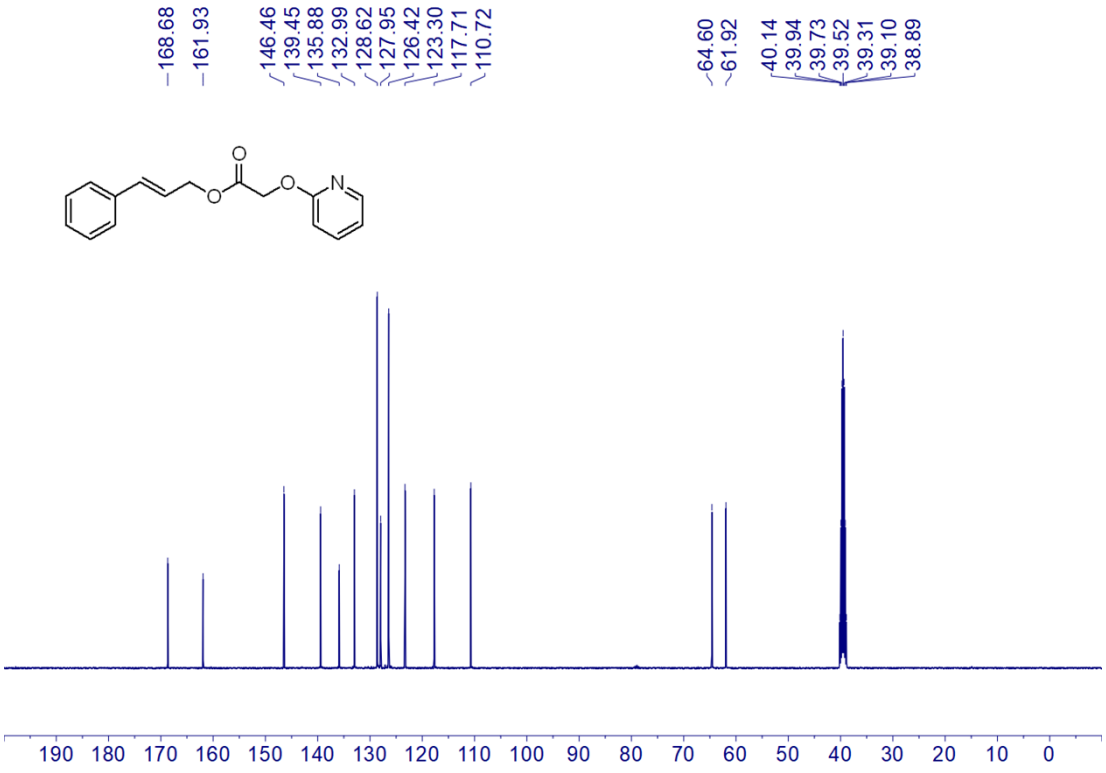
^{1}H NMR Spectrum of Compound **3v** (400 MHz, $CDCl_3$).



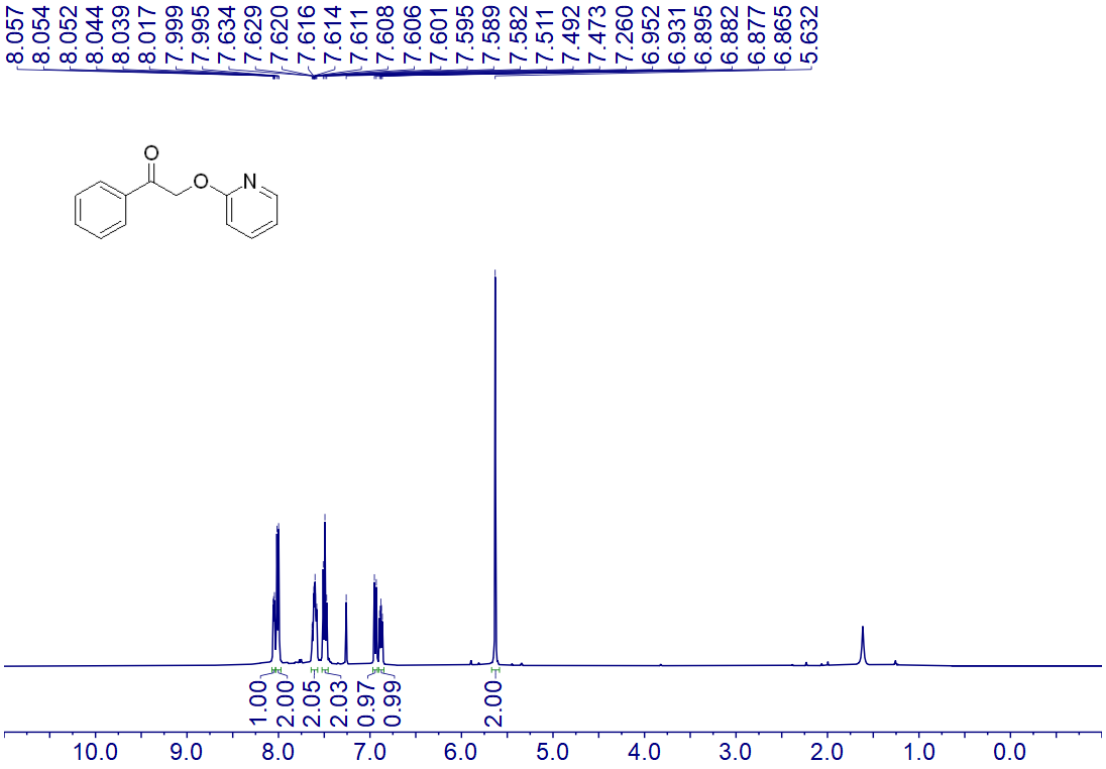
^{13}C NMR Spectrum of Compound **3v** (100 MHz, $CDCl_3$).



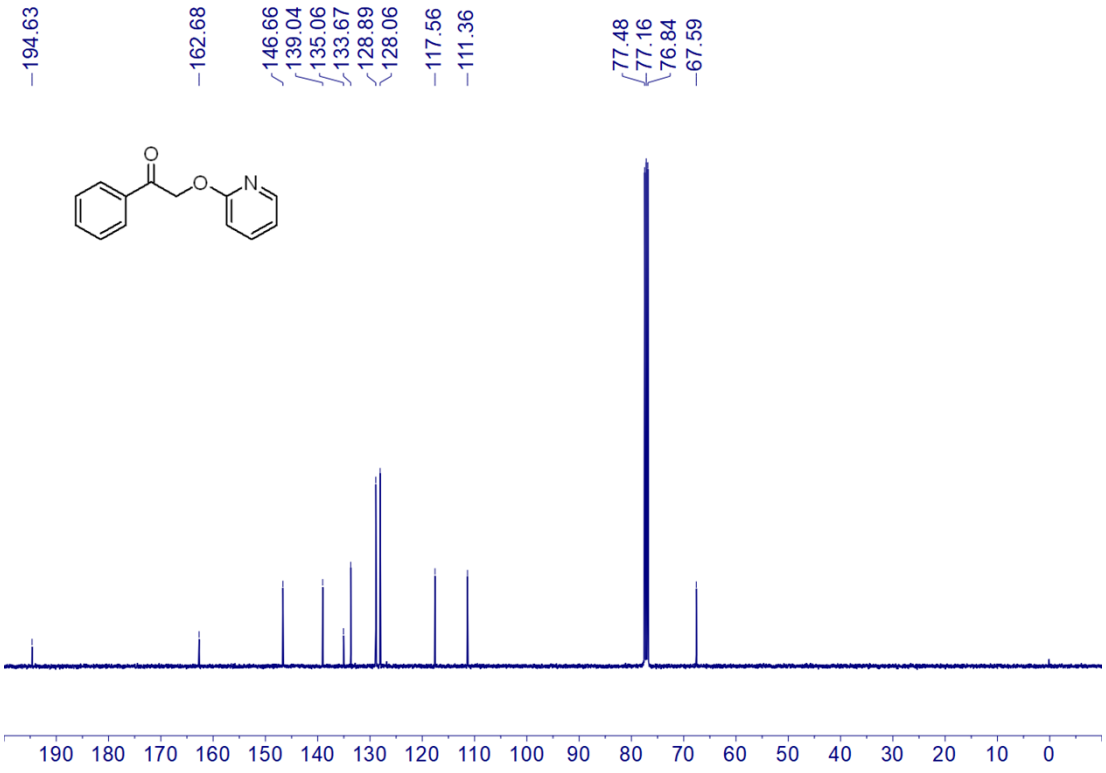
^{1}H NMR Spectrum of Compound **3w** (400 MHz, DMSO-d_6).



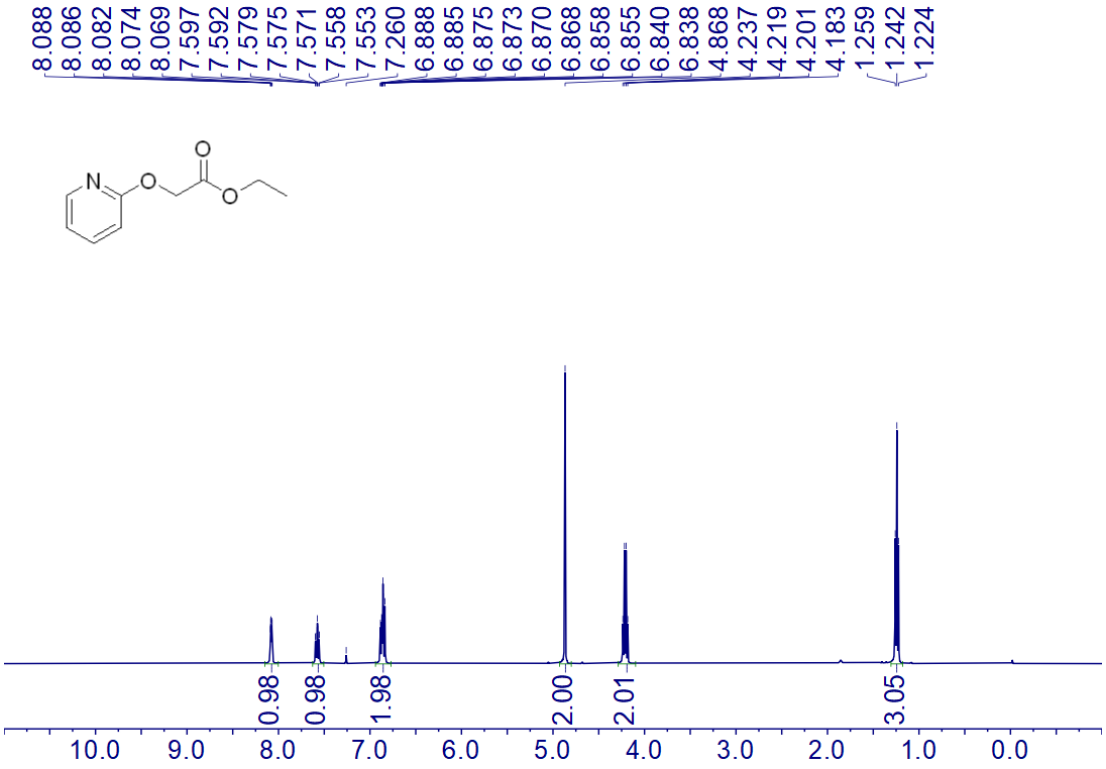
^{13}C NMR Spectrum of Compound **3w** (100 MHz, DMSO-d_6).



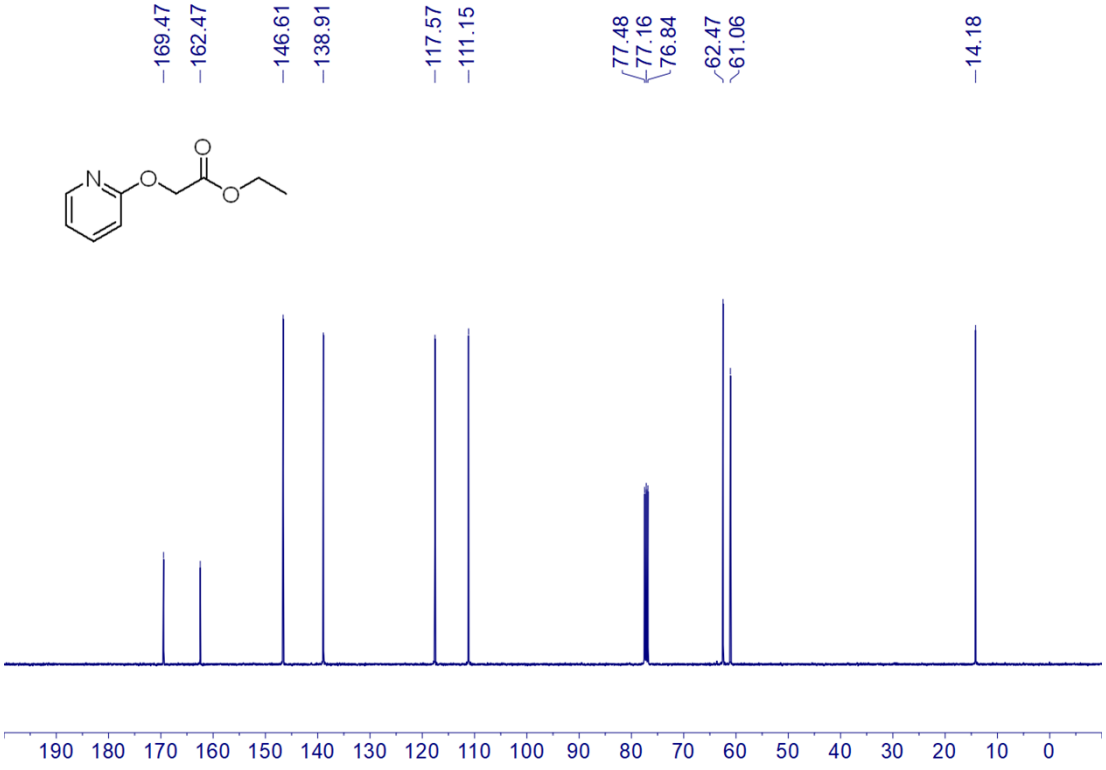
^{1}H NMR Spectrum of Compound **3x** (400 MHz, $CDCl_3$).



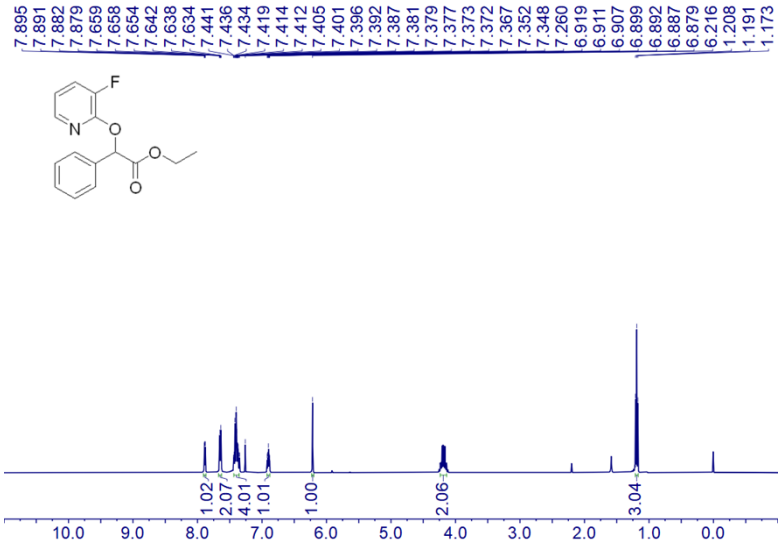
^{13}C NMR Spectrum of Compound **3x** (100 MHz, $CDCl_3$).



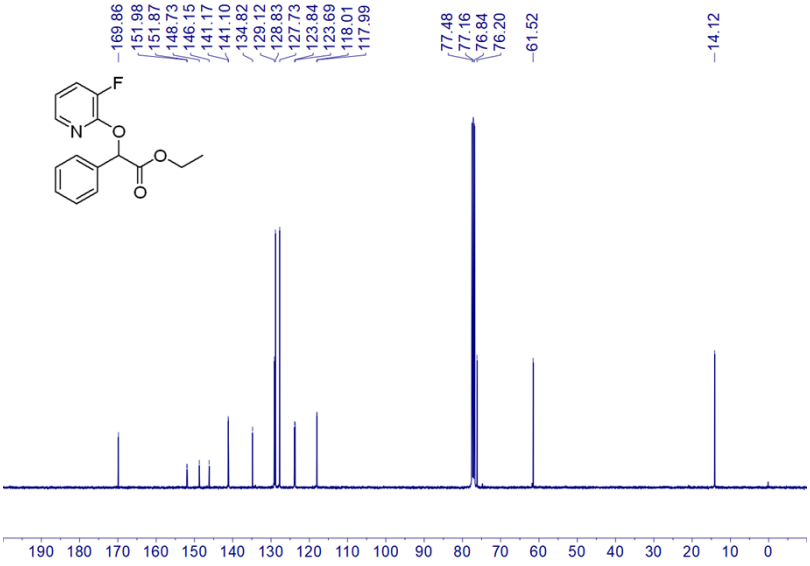
^{1}H NMR Spectrum of Compound **3y** (400 MHz, $CDCl_3$).



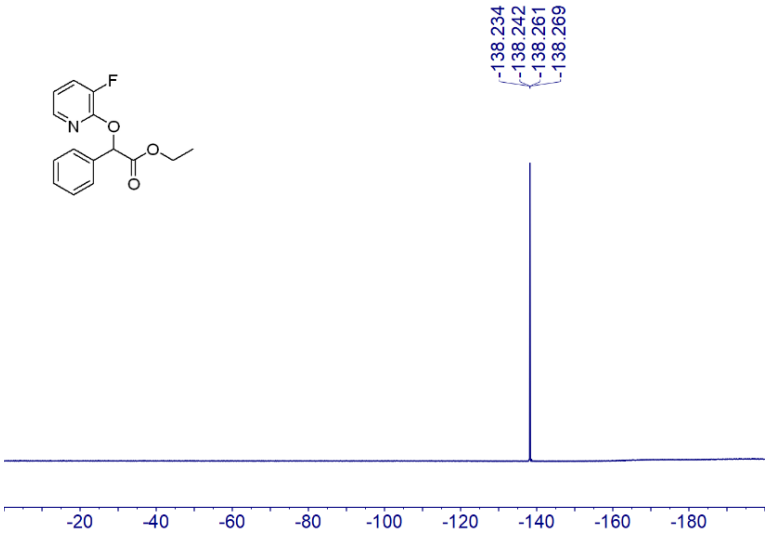
^{13}C NMR Spectrum of Compound **3y** (100 MHz, $CDCl_3$).



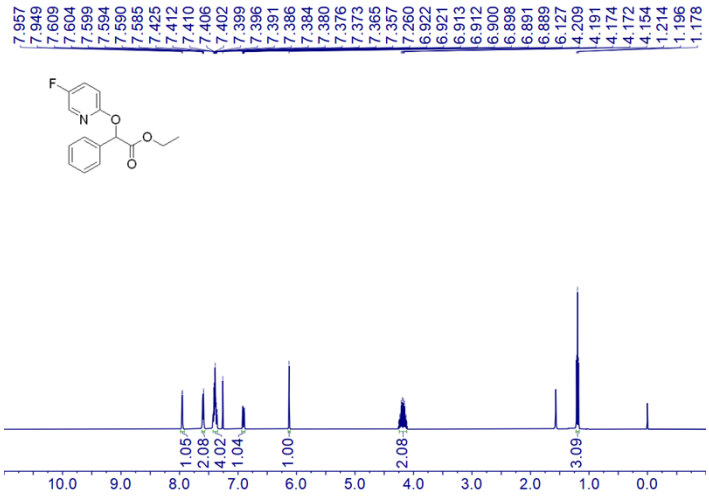
^{1}H NMR Spectrum of Compound **3ab** (400 MHz, $CDCl_3$).



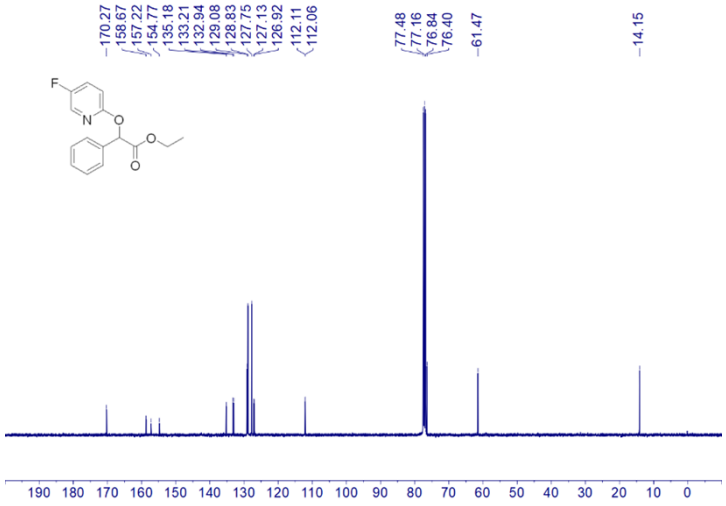
^{13}C NMR Spectrum of Compound **3ab** (100 MHz, $CDCl_3$).



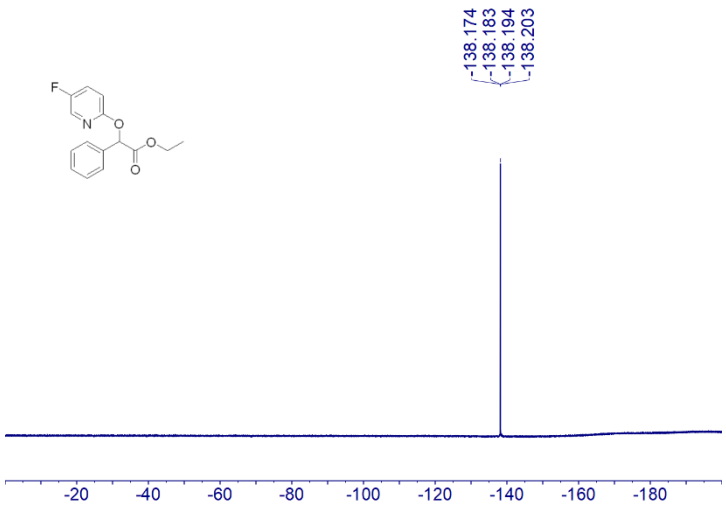
^{19}F NMR Spectrum of Compound **3ab** (376 MHz, $CDCl_3$)



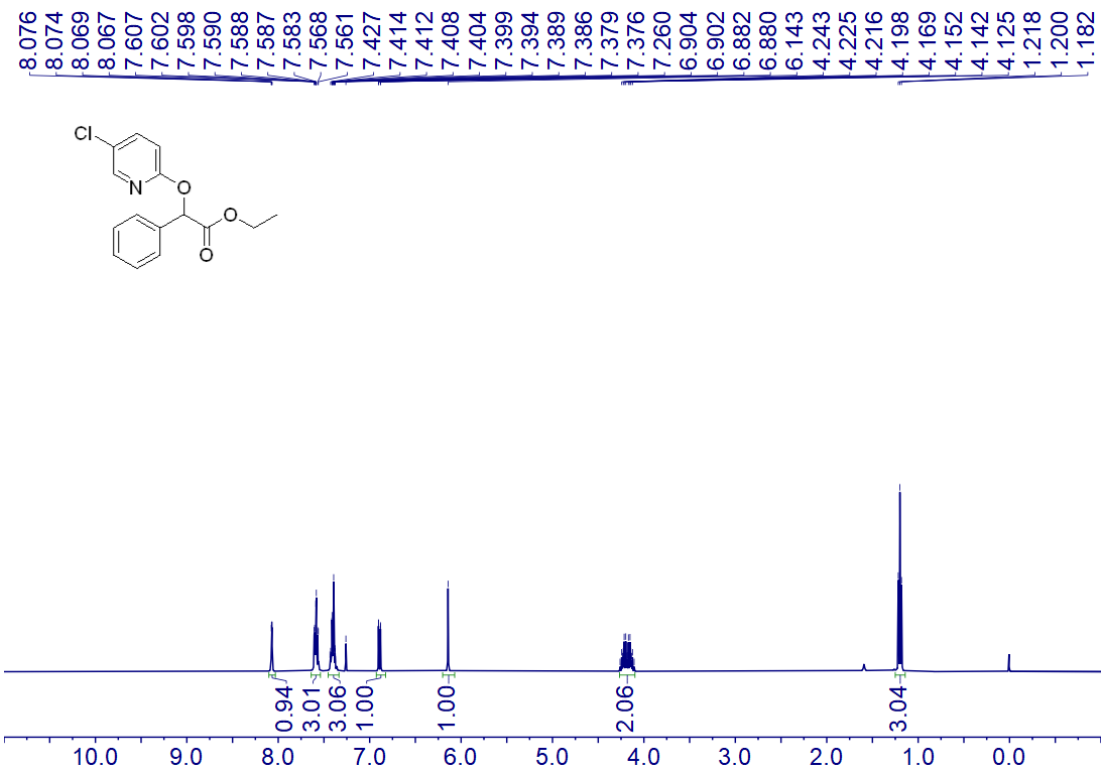
^{1}H NMR Spectrum of Compound **3ac** (400 MHz, $CDCl_3$).



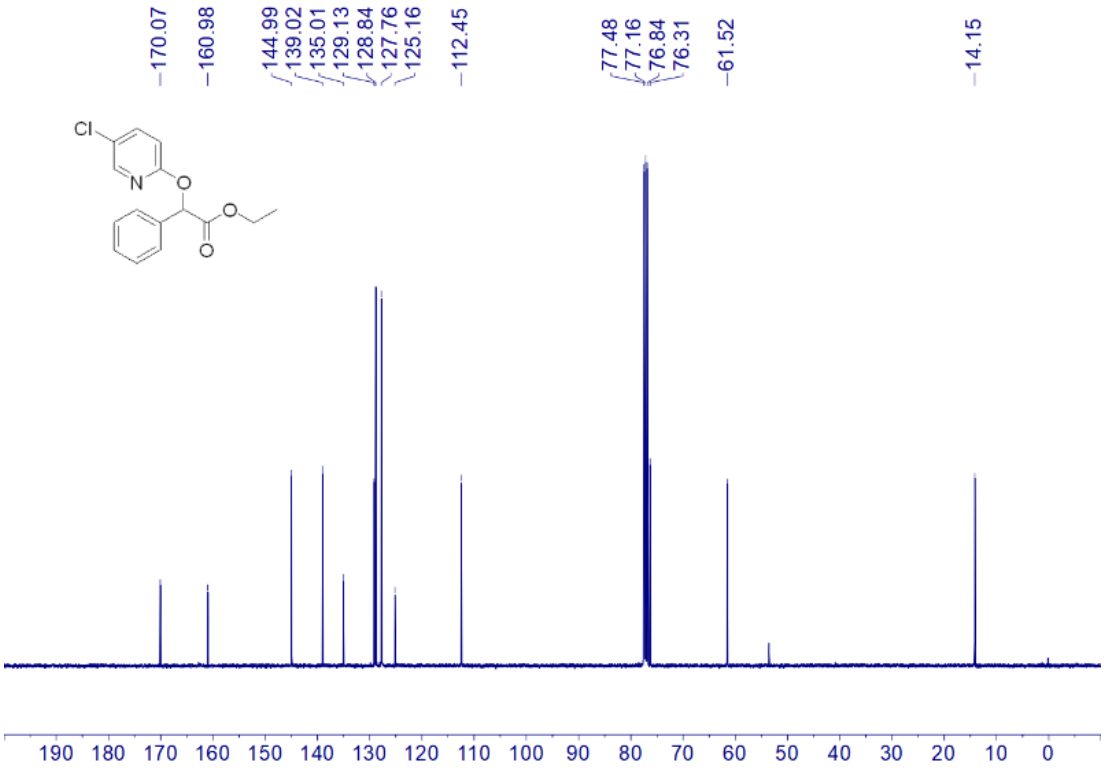
^{13}C NMR Spectrum of Compound **3ac** (100 MHz, $CDCl_3$).



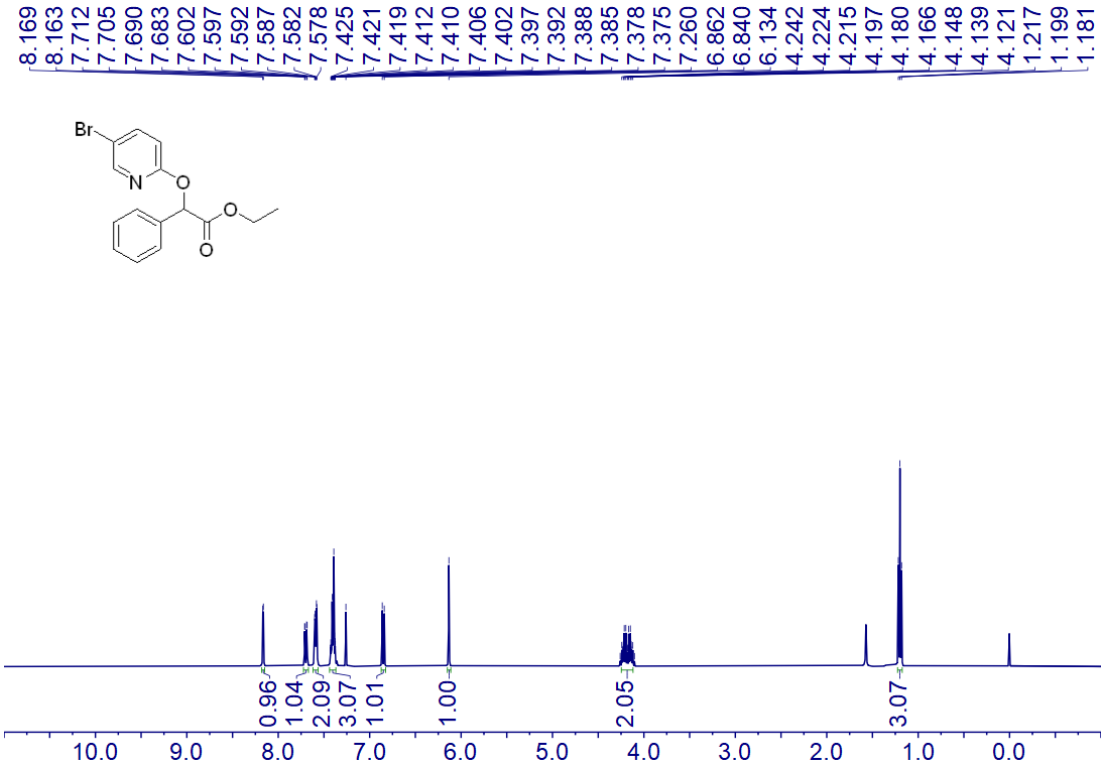
^{19}F NMR Spectrum of Compound **3ac** (376 MHz, $CDCl_3$)



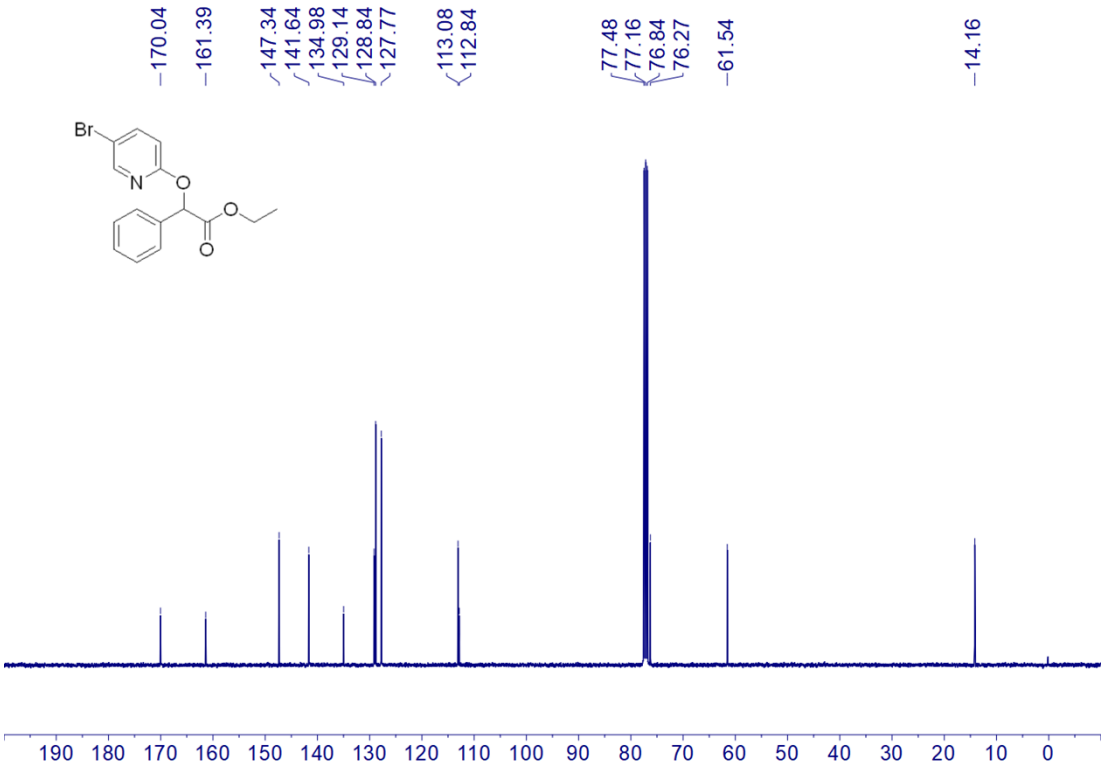
^{1}H NMR Spectrum of Compound **3ad** (400 MHz, $CDCl_3$).



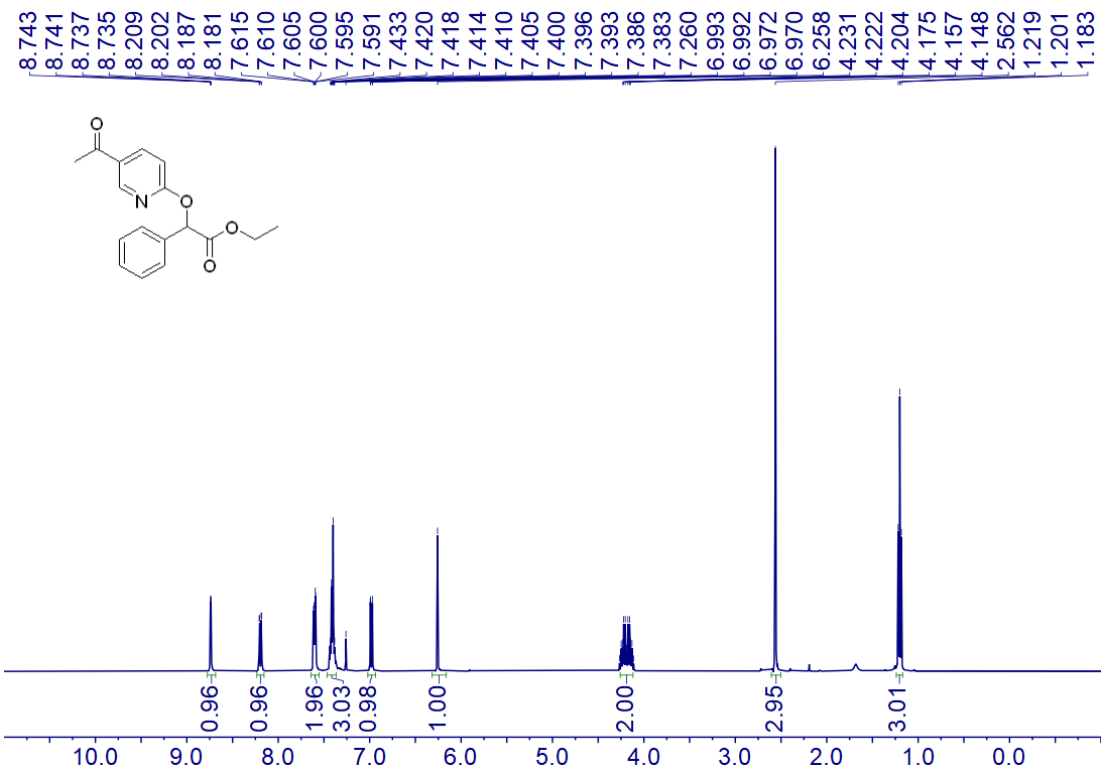
^{13}C NMR Spectrum of Compound **3ad** (100 MHz, $CDCl_3$).



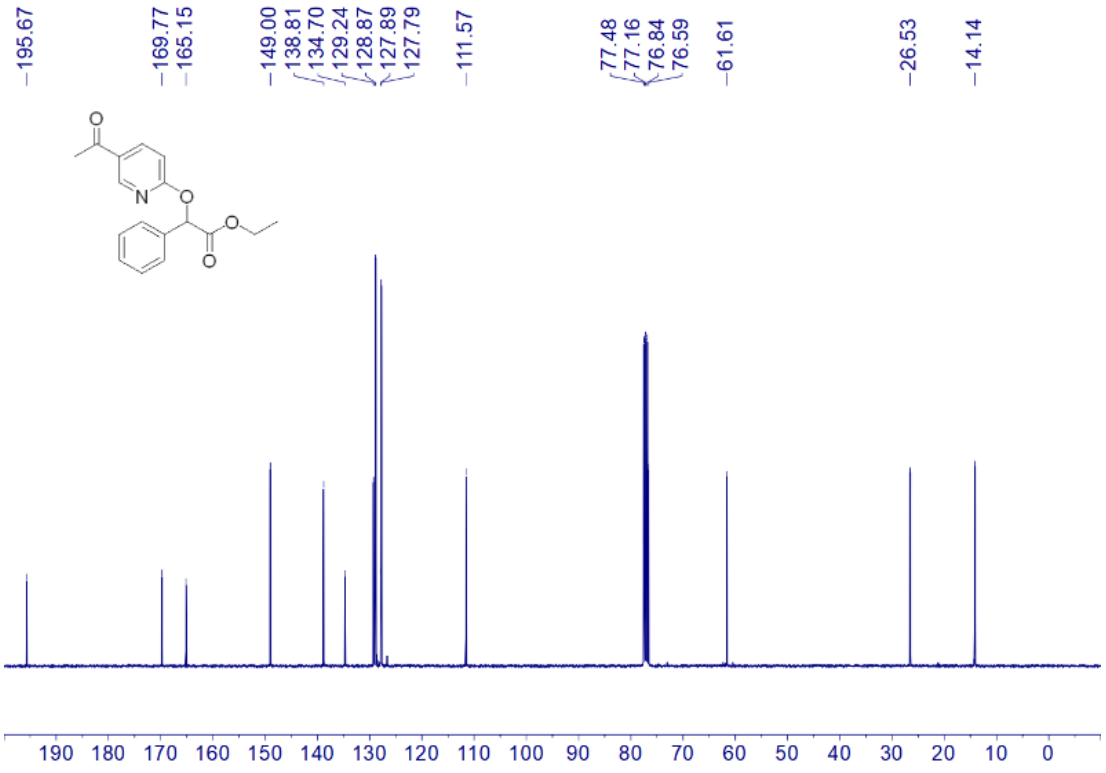
^{1}H NMR Spectrum of Compound **3ae** (400 MHz, $CDCl_3$).



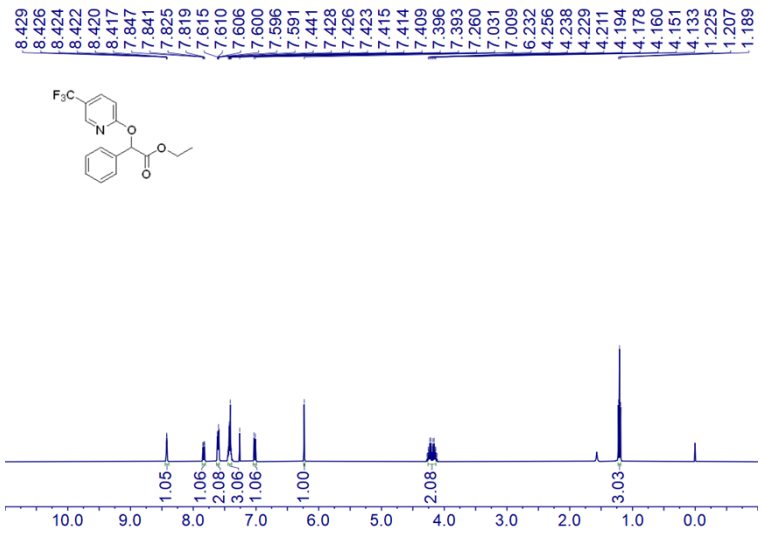
^{13}C NMR Spectrum of Compound **3ae** (100 MHz, $CDCl_3$).



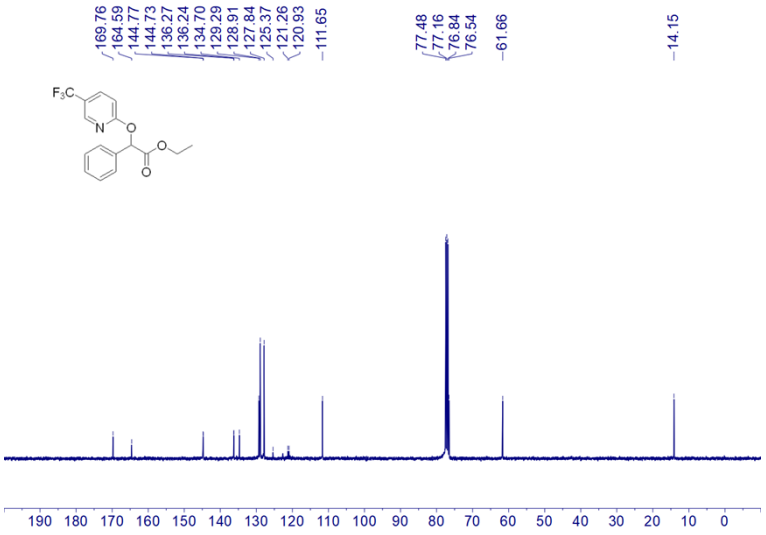
^{1}H NMR Spectrum of Compound **3af** (400 MHz, $CDCl_3$).



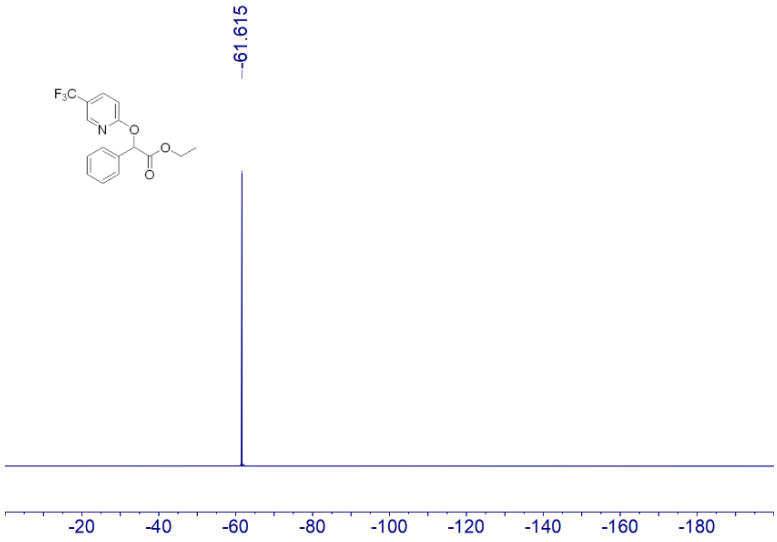
^{13}C NMR Spectrum of Compound **3af** (100 MHz, $CDCl_3$).



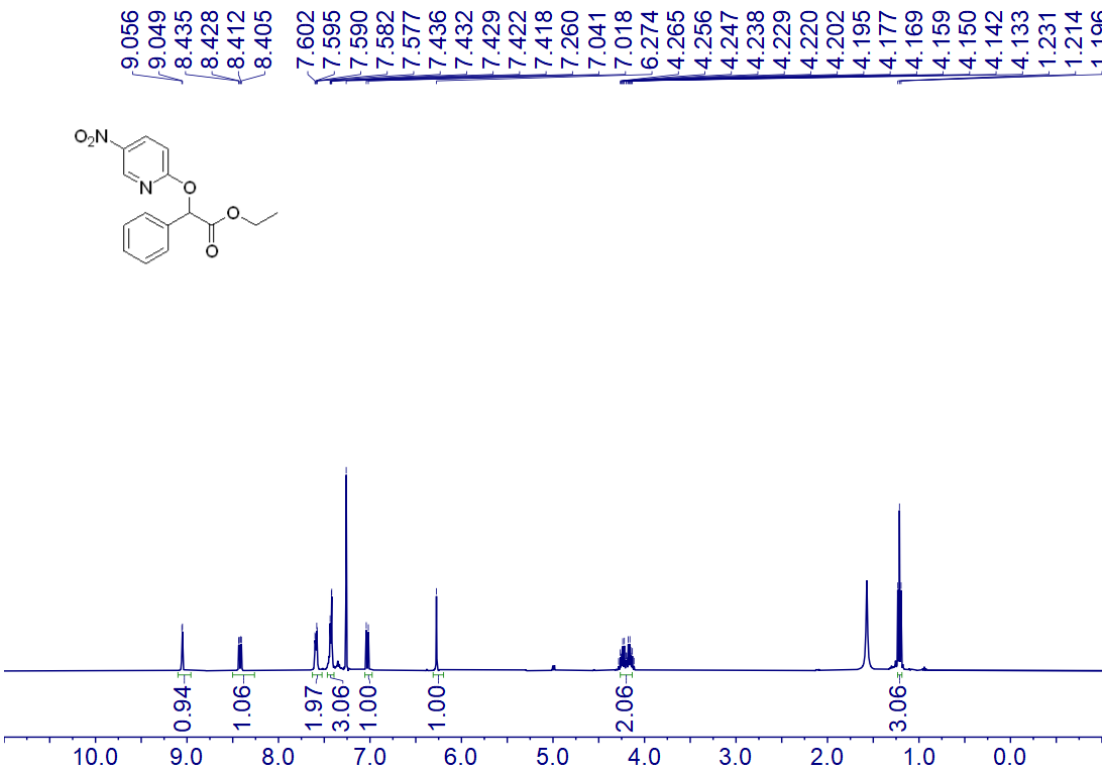
^{1}H NMR Spectrum of Compound **3ag** (400 MHz, $CDCl_3$).



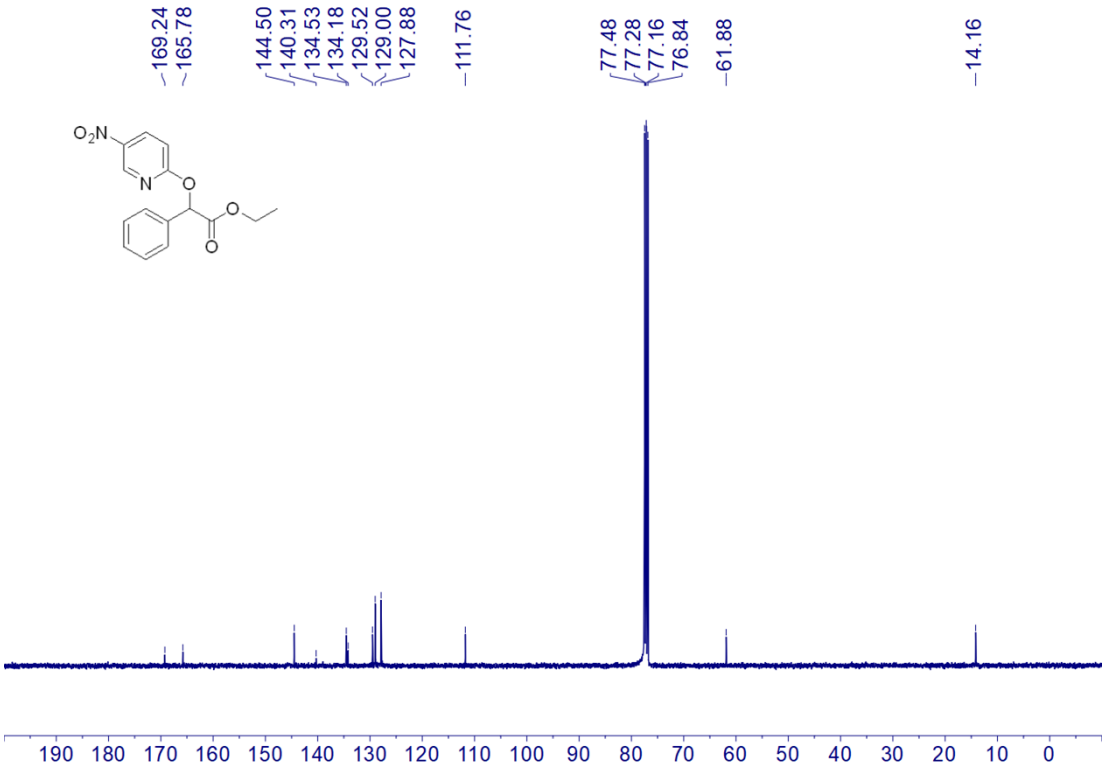
^{13}C NMR Spectrum of Compound **3ag** (100 MHz, $CDCl_3$).



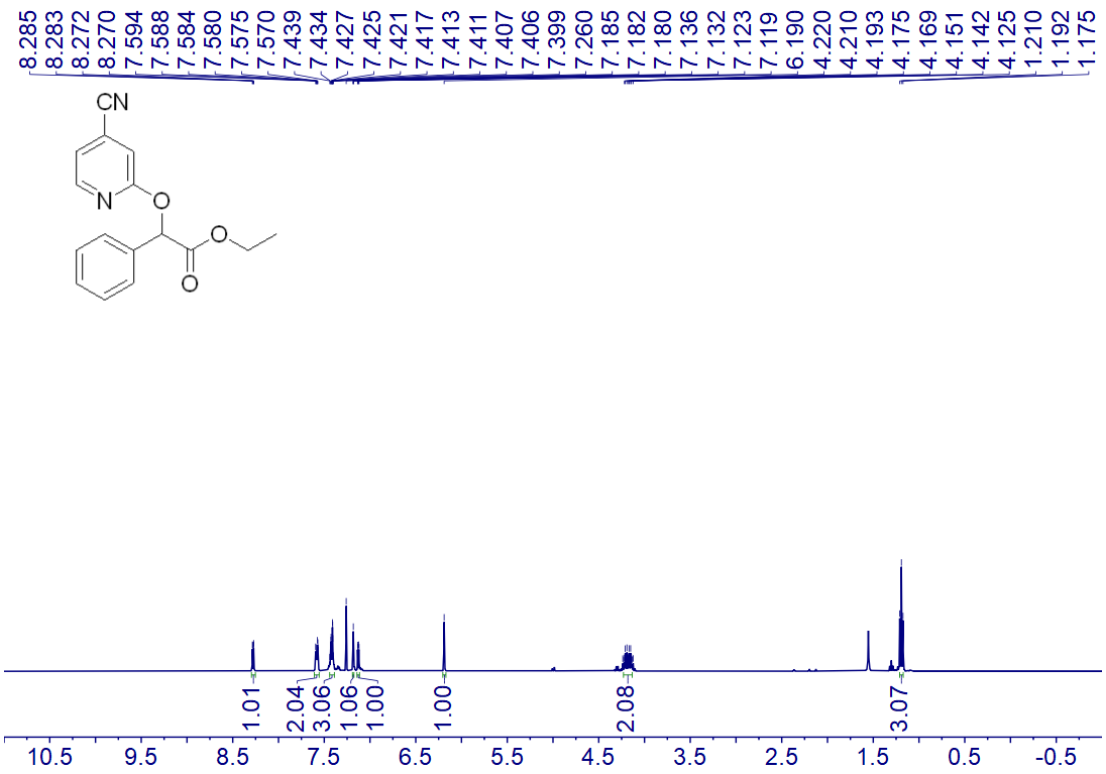
^{19}F NMR Spectrum of Compound **3ag** (376 MHz, $CDCl_3$)



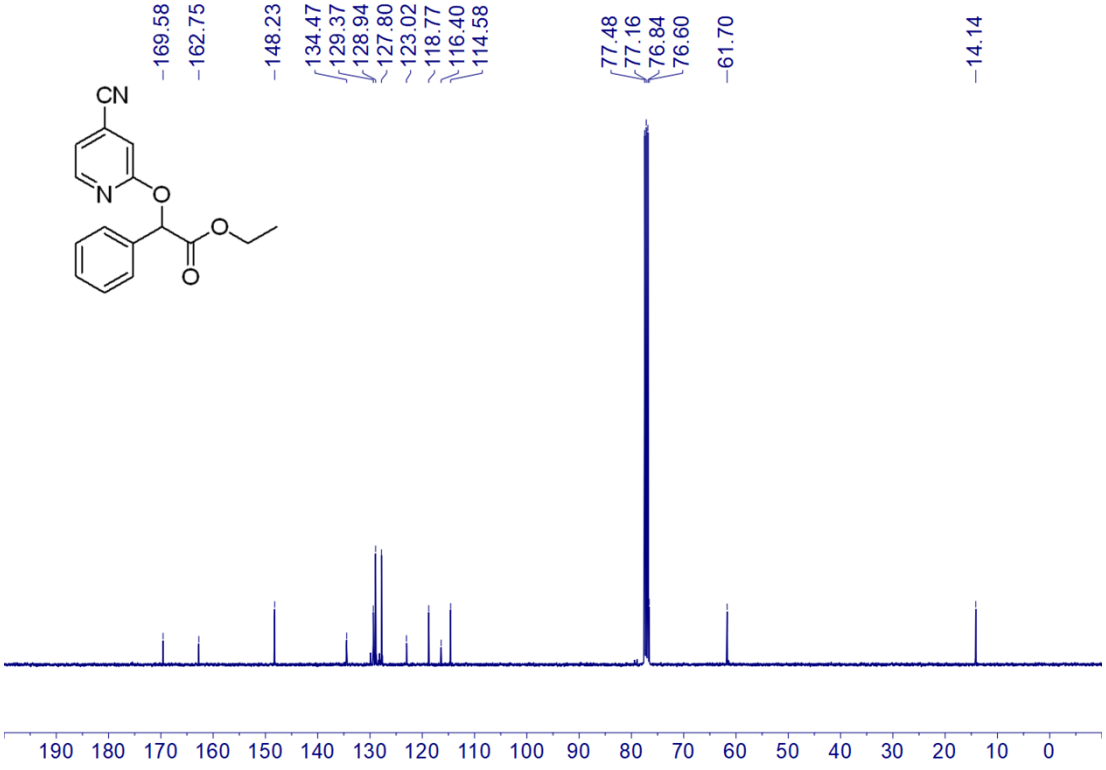
^{1}H NMR Spectrum of Compound **3ah** (400 MHz, $CDCl_3$).



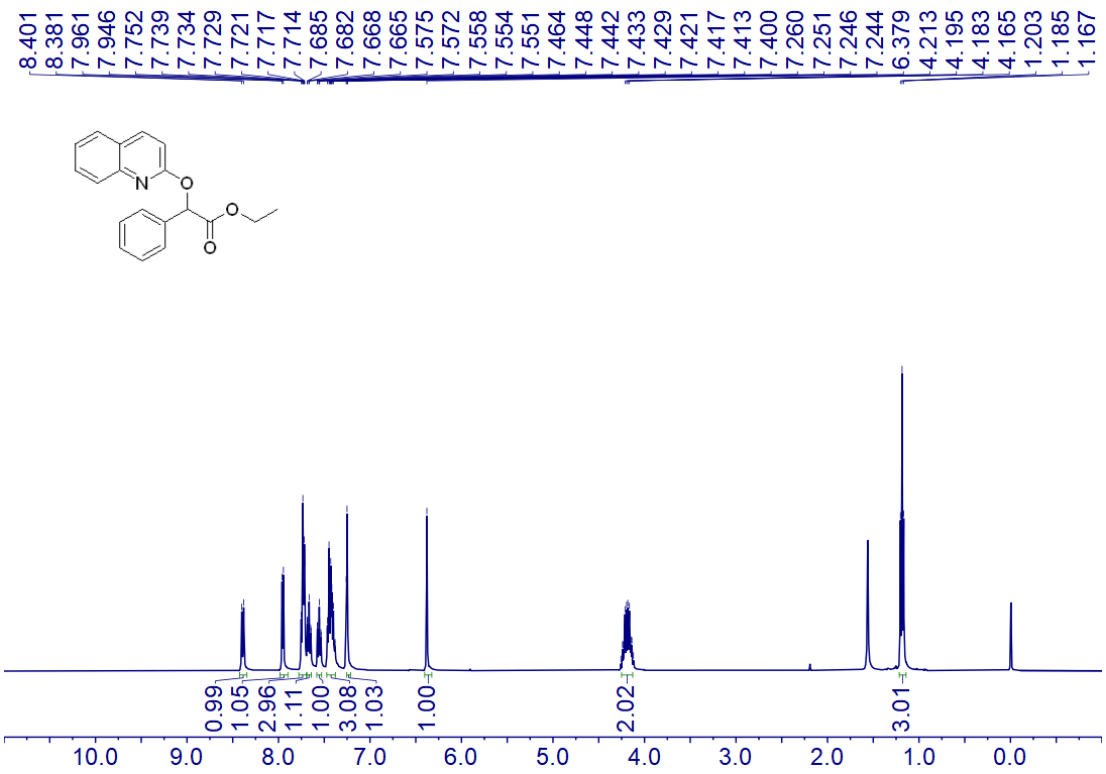
^{13}C NMR Spectrum of Compound **3ah** (100 MHz, $CDCl_3$).



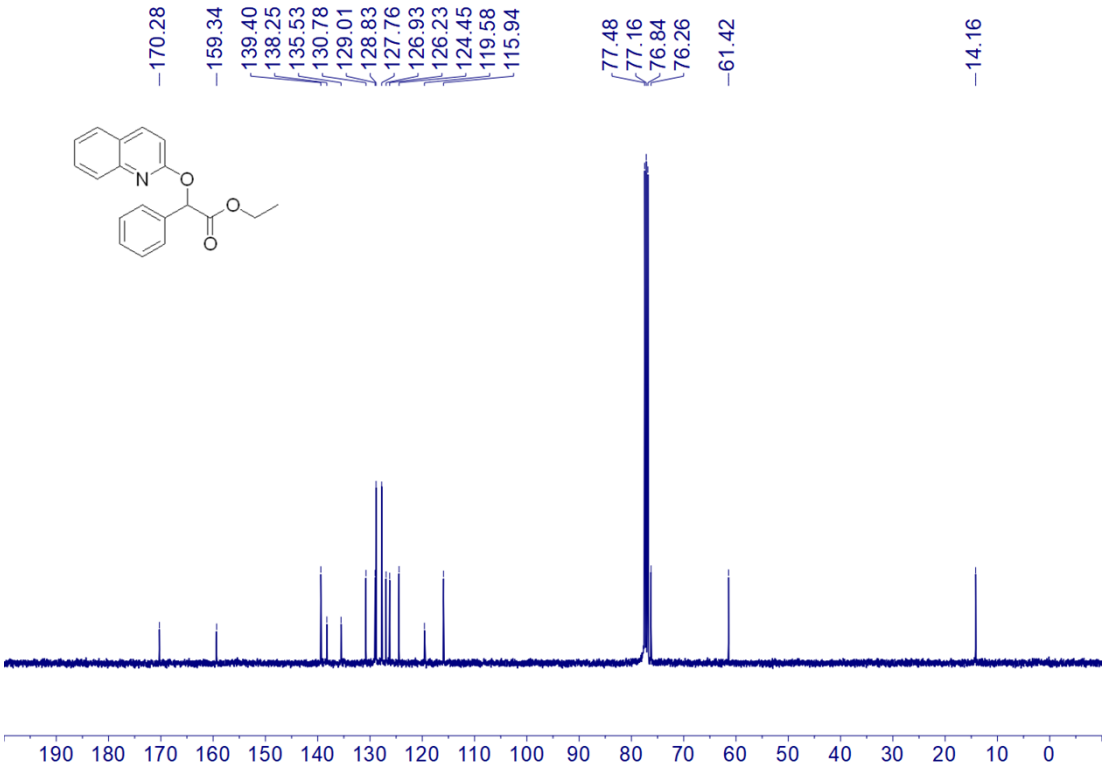
^{1}H NMR Spectrum of Compound **3ai** (400 MHz, $CDCl_3$).



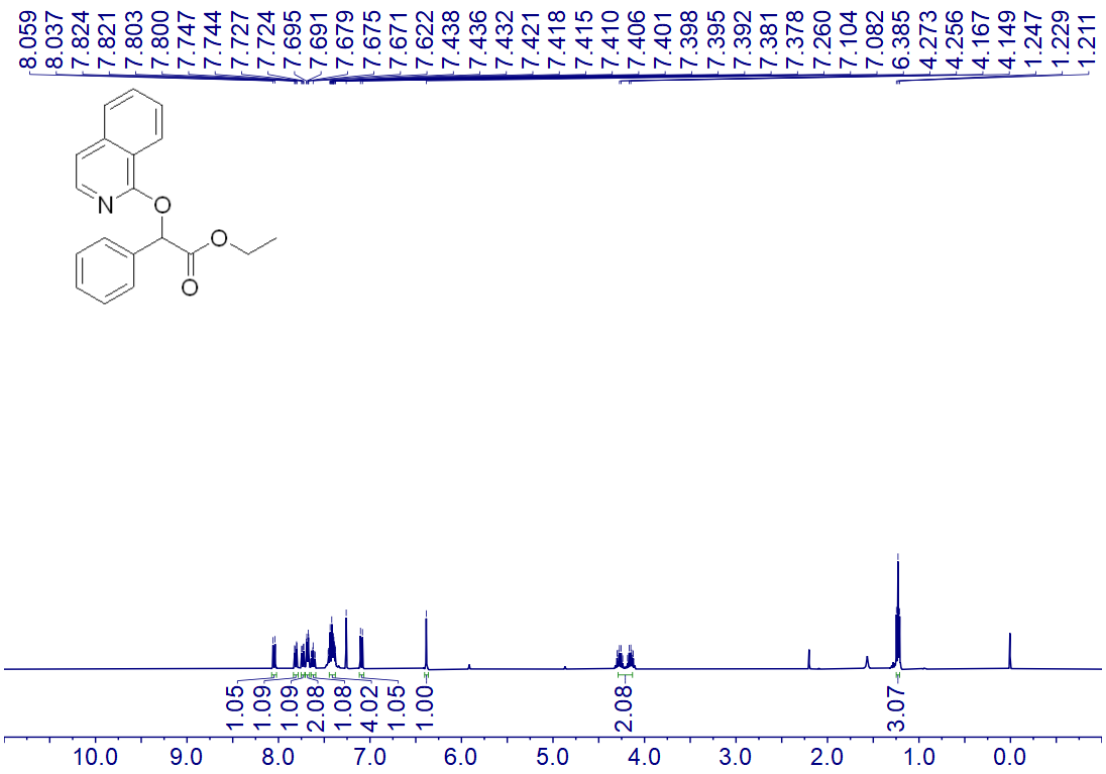
^{13}C NMR Spectrum of Compound **3ai** (100 MHz, $CDCl_3$).



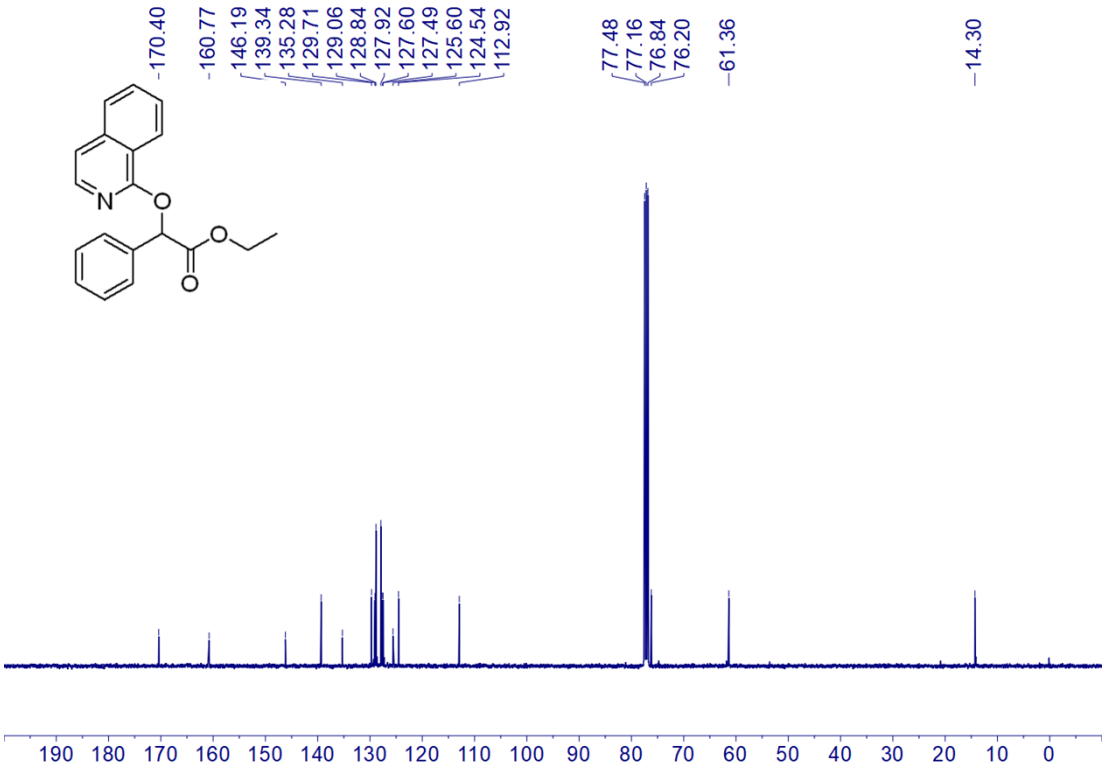
^{1}H NMR Spectrum of Compound **3aj** (400 MHz, $CDCl_3$).



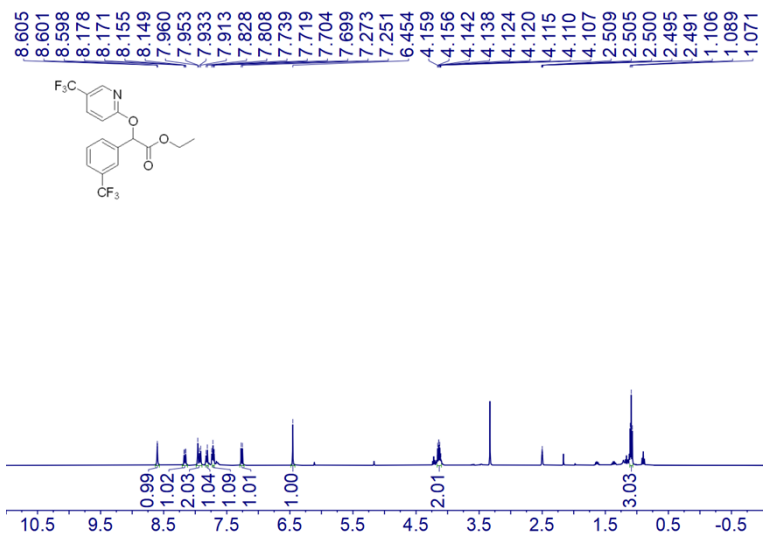
^{13}C NMR Spectrum of Compound **3aj** (100 MHz, $CDCl_3$).



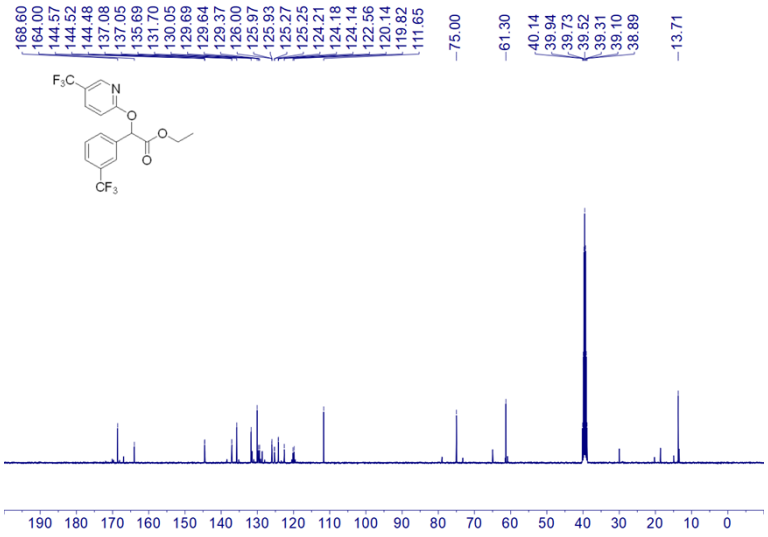
^{1}H NMR Spectrum of Compound **3ak** (400 MHz, $CDCl_3$).



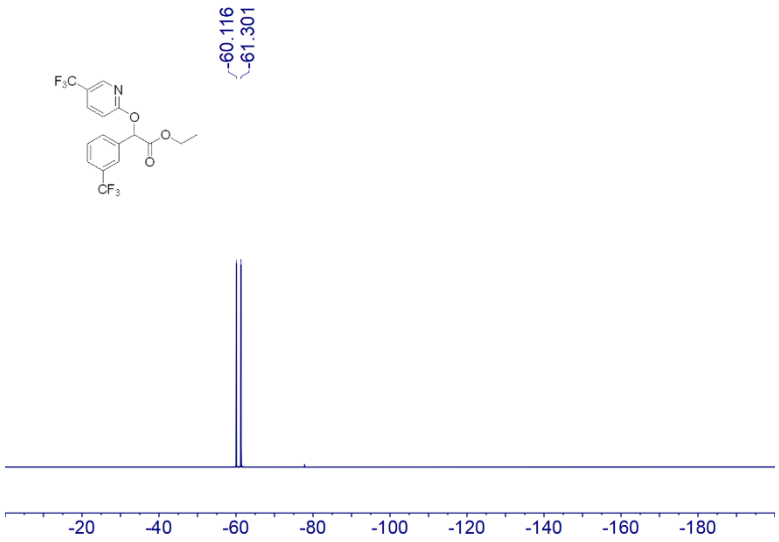
^{13}C NMR Spectrum of Compound **3ak** (100 MHz, $CDCl_3$).



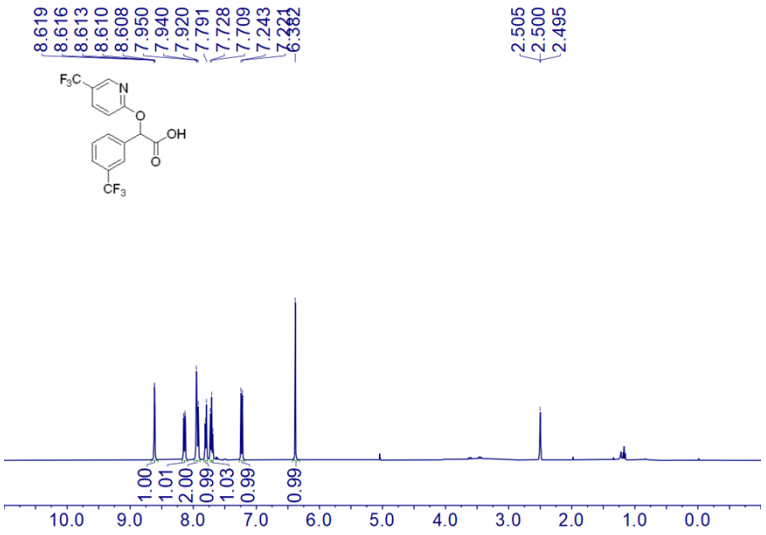
^{1}H NMR Spectrum of Compound **3hg** (400 MHz, DMSO-d_6).



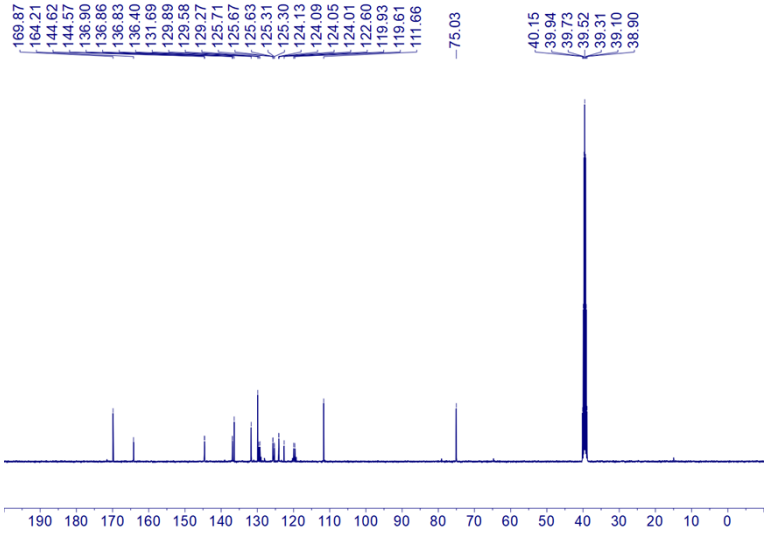
^{13}C NMR Spectrum of Compound **3hg** (100 MHz, DMSO-d_6).



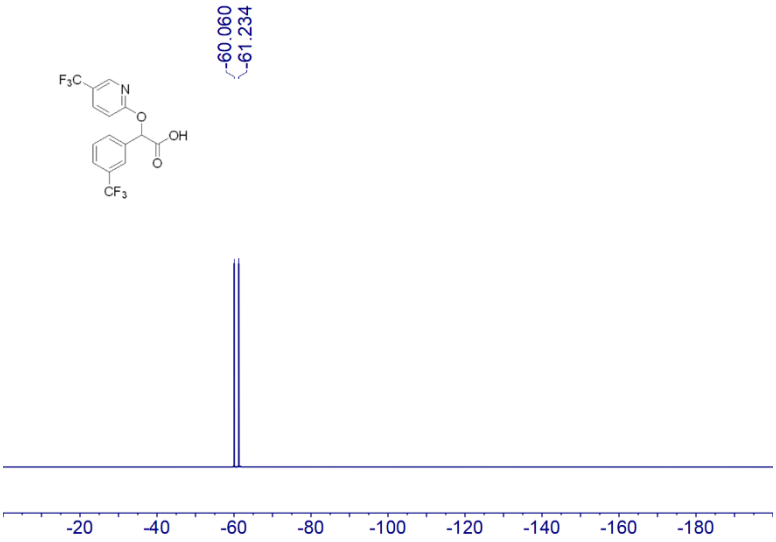
^{19}F NMR Spectrum of Compound **3hg** (376 MHz, DMSO-d_6)



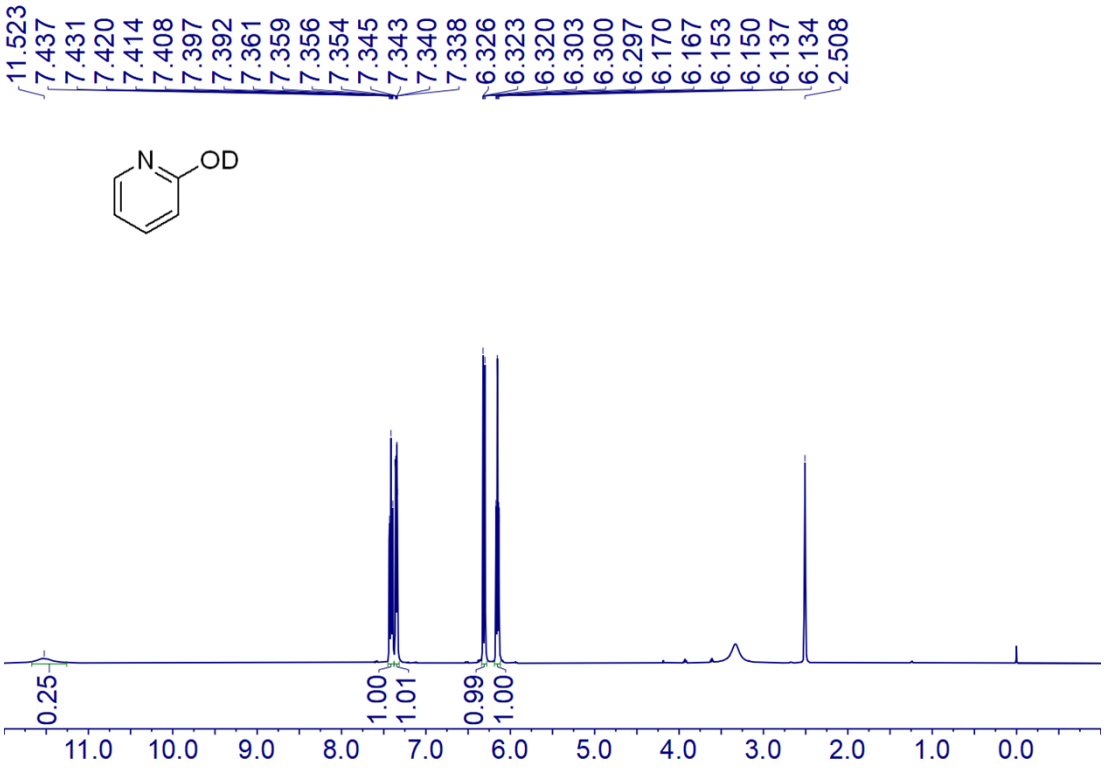
^{1}H NMR Spectrum of Compound **4** (400 MHz, DMSO-d_6).



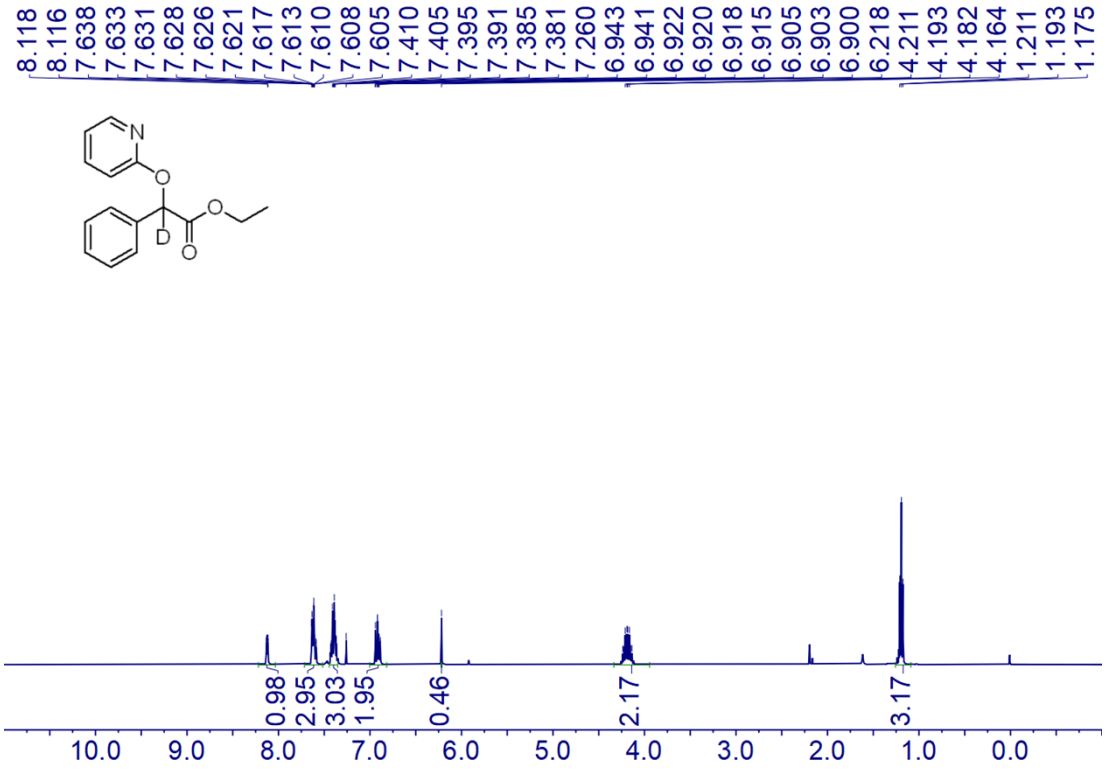
^{13}C NMR Spectrum of Compound **4** (100 MHz, DMSO-d_6).



^{19}F NMR Spectrum of Compound **4** (376 MHz, DMSO-d_6)

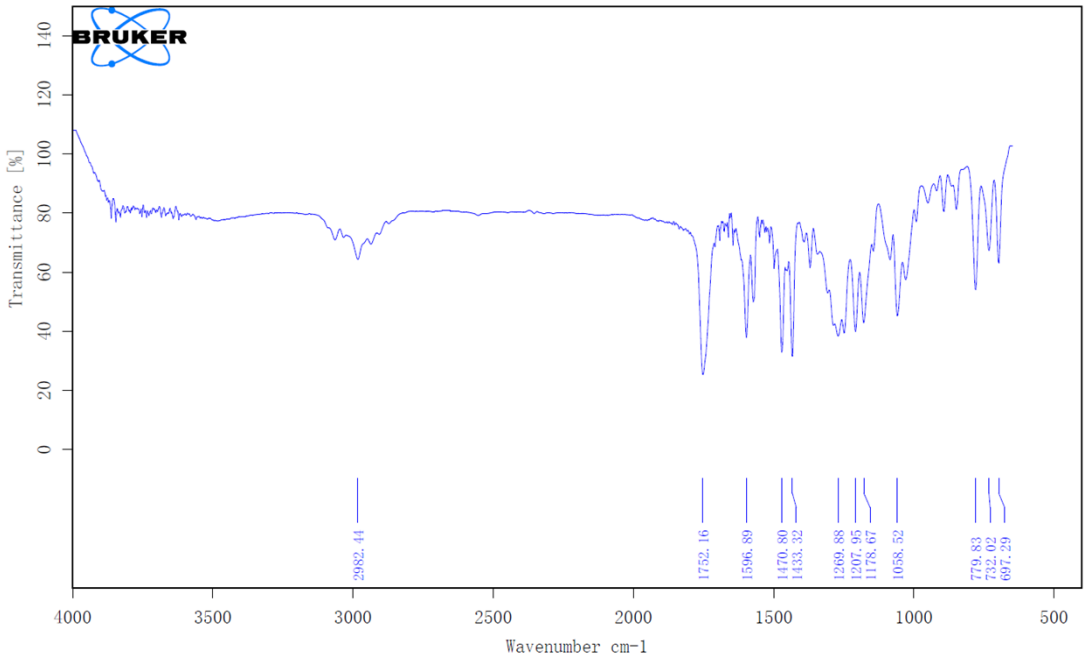


^{1}H NMR Spectrum of Compound **d-1a** (400 MHz, DMSO-d_6).



^{1}H NMR Spectrum of Compound **d-3a** (400 MHz, $CDCl_3$).

6. Infrared Spectrum of 3a



Infrared Spectrum of Compound **3a**