Supporting Information

Pd(II)-Catalyzed Arylation of Unactivated Methylene C(sp^3)–H bonds with Aryl Halides Using a Removable Bidentate Auxiliary

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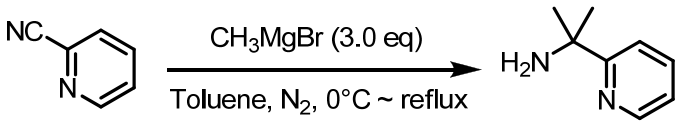
General Information

Toluene were dried by sodium and distilled. $Pd(OAc)_2$ was obtained from Strem® and CH_3MgBr from Rockwood Lithium®. The other materials and solvents were purchased from Adamas-beta and other suppliers and used without further purification.

NMR spectra were recorded on a Bruker-400 instrument and calibrated using residual undeuterated solvent (or Tetramethylsilane in several cases) as an internal reference. The following abbreviations (or combinations thereof) were used to explain multiplicities: s = singlet, d = doublet, t = triplet, m= multiplet, br = broad, q = quadruplet. High-resolution mass spectra (HRMS) were recorded on EI-TOF (electrospray ionization-time of flight) (or ESI-TOF in several cases).

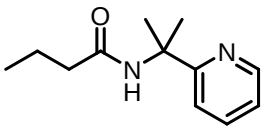
Experimental Procedures

Preparation of 2-(Pyridin-2-yl)isopropylamine (PIP-amine)

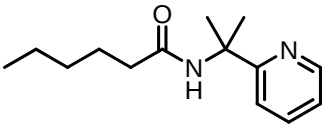


An improvement of the work-up procedure to the literature[1] was used: To a solution of 2-cyanopyridine (33.0 g, 0.32 mol) in 500 ml of toluene was added CH_3MgBr (3.2M in 2-methyl tetrahydrofuran, 300ml, 0.96 mol) dropwise at 0 ^oC in a nitrogen atmosphere by vigorous magnetometric stirring. Upon completion of addition, the mixture was refluxed overnight. The reaction was quenched by adding saturated aqueous NH_4Cl dropwise at 0 ^oC until the dark mixture changed to yellow. The suspension was filtrated through a pad of celite® and the filtration was acidified by aqueous HCl (6 M, 10 ml). The resulting water phase combined with the filter residue was basified by saturated aqueous NaOH until the yellow colored mixture turned dark brown with slurry sticky to the bottom. The mixture was washed with dichloromethane (500 ml×4) carefully and the supernatant was combined and concentrated using a rotary evaporator. The crude product was further purified by distillation under reduced pressure. The target product was obtained as a light yellow liquid (>98% purity. 24 g, 55%). ^1H NMR (400 MHz, $CDCl_3$) δ 8.55 (d, J = 4.2 Hz, 1 H), 7.63 (td, J = 7.8, 1.8 Hz, 1 H), 7.45 (d, J = 8.0 Hz, 1 H), 7.12 (ddd, J = 7.4, 4.8, 0.8 Hz, 1 H), 1.87 (s, 2 H), 1.50 (s, 6 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 168.32, 148.78, 136.55, 121.41, 118.53, 54.14, 31.35.

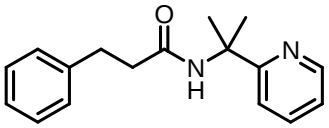
Preparation of Starting Materials



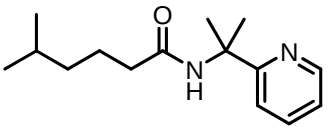
1a



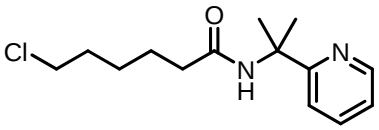
1v



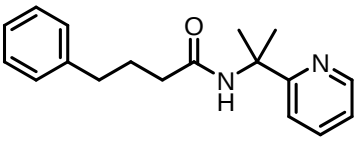
1w



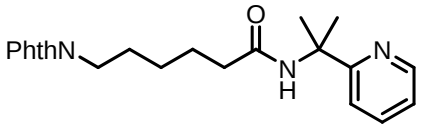
1x



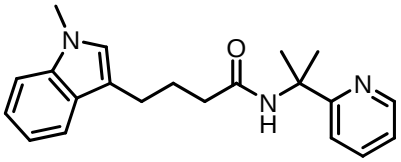
1y



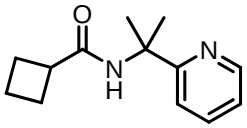
1z



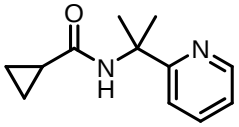
1aa



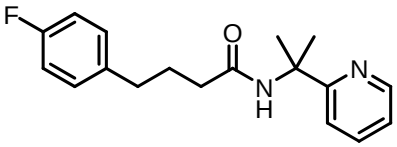
1ac



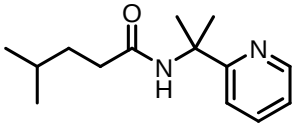
1ab



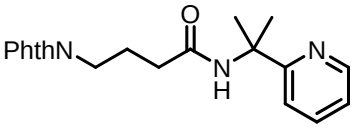
1ad



1ae



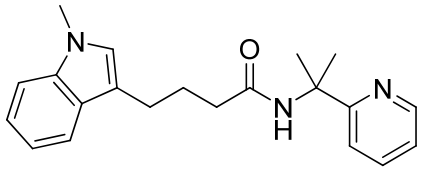
1af



1ag

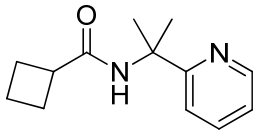
Compounds **1a**, **1v**, **1w**, **1x**, **1y**, **1z**, **1aa**, **1ae** and **1ag** were known compounds and were prepared according to literature. [2] **1ab**, **1ac**, **1ad, 1af** and **1ag** were prepared according to the following procedure. To a round bottom flask were added the corresponding acid (5.5 mmol), N-methylmorpholine (12 mmol) and anhydrous dichloromethane (20 mL). The flask was submerged in an ice-salt bath and precooled for about 15 min. Then isobutylchloroformate (6 mmol) was added dropwise and the reaction mixture was stirred for a further 30min. After the dropwise addition of PIP amine (5 mmol), the reaction was stirred overnight and allowed to warm to room temperature. The resulting mixture was diluted with dichloromethane, washed with sat. $NaHCO_3$ followed by brine and dried over $MgSO_4$. After filtration and concentration, the residue was purified by flash chromatography to give the desired product.

4-(1-Methyl-1H-indol-3-yl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (1ac)



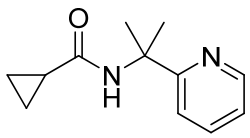
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.50 (d, *J* = 4.8 Hz, 1H), 7.71 (dt, *J* = 8.0, 1.6 Hz, 1H), 7.66-7.59 (m, 2H), 7.40 (d, *J* = 8.0 Hz, 1H), 7.28 (d, *J* = 8.0 Hz, 1H), 7.23-7.16 (m, 2H), 7.10-7.06 (m, 1H), 6.88 (s, 1H), 3.74 (s, 3H), 2.82 (t, *J* = 7.2 Hz, 2H), 2.32 (t, *J* = 7.2 Hz, 2H), 2.11-2.03 (m, 2H), 1.75 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.4, 164.8, 147.7, 137.2, 128.1, 126.6, 122.0, 121.6, 119.7, 119.2, 118.7, 114.6, 109.2, 56.5, 37.4, 32.7, 27.7, 26.5, 24.5; HRMS (EI-TOF) calc. for $C_{21}H_{25}N_3O$ (M^+): 335.1998; Found: 335.1998.

***N*-(2-(Pyridin-2-yl)propan-2-yl)cyclobutanecarboxamide (1ab)**



^{1}H NMR (400 MHz, $CDCl_3$) δ 8.50 (d, *J* = 4.4 Hz, 1H), 7.70 (dt, *J* = 7.6, 1.6 Hz, 1H), 7.59 (brs, 1H), 7.40 (d, *J* = 8.0 Hz, 1H), 7.18 (ddd, *J* = 7.6, 5.2, 0.8 Hz, 1H), 3.14-3.05 (m, 1H), 2.36-2.25 (m, 2H), 2.21-2.12 (m, 2H), 2.01-1.88 (m, 2H), 1.75 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 174.4, 164.9, 147.8, 137.2, 121.9, 119.6, 56.3, 41.1, 27.7, 25.5, 18.2; HRMS (EI-TOF) calc. for $C_{13}H_{18}N_2O$ (M^+): 218.1419; Found: 218.1421.

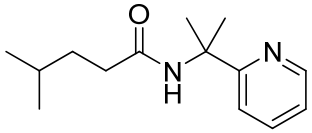
***N*-(2-(Pyridin-2-yl)propan-2-yl)cyclopropanecarboxamide (1ad)**



^{1}H NMR (400 MHz, $CDCl_3$) δ 8.52 (d, *J* = 4.4 Hz, 1H), 7.83 (brs, 1H), 7.71 (dt, *J* = 8.0, 1.6 Hz, 1H), 7.40 (d, *J* = 8.0 Hz, 1H), 7.19 (ddd, *J* = 7.6, 5.2, 0.8 Hz, 1H), 1.75 (s, 6H), 1.54-1.47 (m, 1H), 0.95-0.90 (m, 2H), 0.73-0.67 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.6, 164.9, 147.8, 137.2, 121.9, 119.6, 56.7, 27.9, 15.8, 6.9; HRMS (EI-TOF) calc. for $C_{12}H_{16}N_2O$ (M^+): 204.1263; Found:

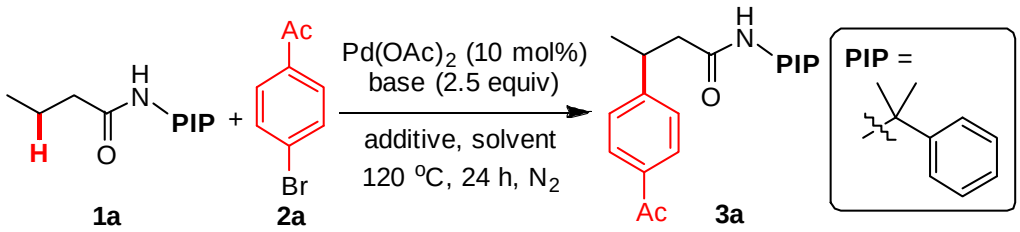
204.1265.

4-Methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)pentanamide (1af)



^{1}H NMR (400 MHz, $CDCl_3$) δ 8.52 (d, *J* = 4.4 Hz, 1H), 7.73-7.64 (m, 2H), 7.40 (d, *J* = 8.0 Hz, 1H), 7.19 (ddd, *J* = 8.0, 4.8, 0.8 Hz, 1H), 2.28-2.23 (m, 2H), 1.75 (s, 6H), 1.62-1.53 (m, 3H), 0.92 (d, *J* = 6.0 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.7, 164.9, 147.8, 137.2, 121.9, 119.6, 56.5, 36.0, 34.7, 28.0, 27.7, 22.5. HRMS (EI-TOF) calc. for $C_{14}H_{22}N_2O$ (M^+): 234.1732; Found: 234.1727.

Optimization of the Reaction Conditions for Arylation

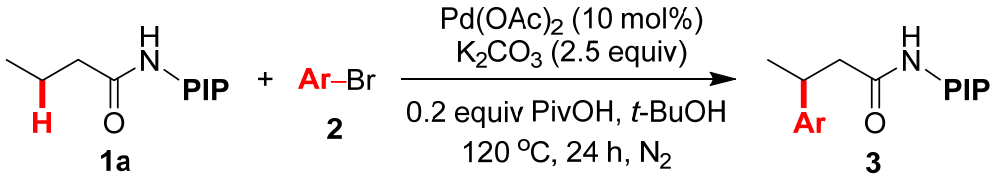


Entry	Base	Additive (equiv)	Solvent	Yield (%)[b]
1	K_2CO_3	$(BnO)_2PO_2H$ (0.2)	*t*-Amyl-OH	39
2	K_2CO_3	MesCOOH (0.2)	*t*-Amyl-OH	41
3	K_2CO_3	PivOH (0.2)	*t*-Amyl-OH	53
4	AgF	-	*t*-Amyl-OH	trace
5	$KHCO_3$	PivOH (0.2)	*t*-Amyl-OH	17
6	K_3PO_4	PivOH (0.2)	*t*-Amyl-OH	43
7	$CsCO_3$	PivOH (0.2)	*t*-Amyl-OH	23
8	$NaHCO_3$	PivOH (0.2)	*t*-Amyl-OH	trace
9	K_2CO_3	PivOH (0.2)	DCM	36
10	K_2CO_3	PivOH (0.2)	toluene	25
11	K_2CO_3	PivOH (0.2)	*t*-BuOH	**75**[c]
12[d]	K_2CO_3	PivOH (0.2)	*t*-Amyl-OH	41

[a] Reaction conditions: **1a** (0.15 mmol), $Pd(OAc)_2$ (10 mol%), base and additive in 1.5 mL solvent at 120 °C for 36 h. [b] ^1H NMR yield using CH_2Br_2 as the internal standard. [c] Isolated yield. [d] $Pd(TFA)_2$ (10 mmol%) was used.

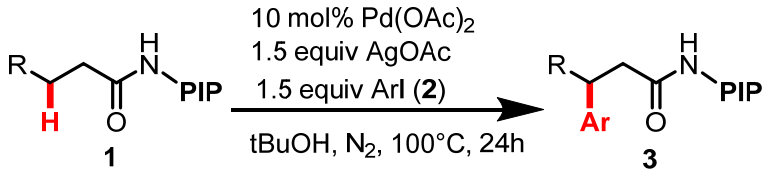
General Procedures for Arylation

General Procedure for Arylation Using Aryl Bromides as Arylating Reagents (GP1)



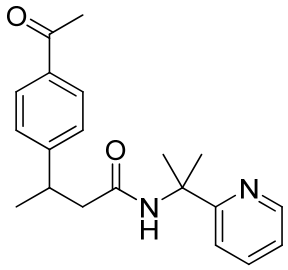
To a 50 mL Schlenk tube, **1** (30.9 mg, 0.15 mmol), aryl bromide (0.3 mmol), $Pd(OAc)_2$ (3.4 mg, 0.015 mmol), K_2CO_3 (51.8 mg, 0.375 mmol), Pivalic acid (3.1 mg, 0.03 mmol) and *t*-BuOH (2 mL) were added. The tube was charged with N_2 and heated at 120 °C for 24 hours. After cooling to room temperature, the reaction mixture was diluted with dichloromethane and filtered through a pad of $MgSO_4$. After concentration, the residue was purified by flash chromatography to give the target products.

General Procedure for Arylation Using Aryl Iodides as Arylating Reagents (GP2)



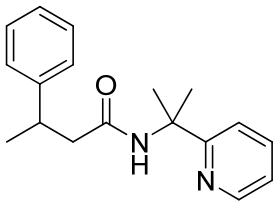
To a 50 mL Schlenk tube, **1** (0.2 mmol), $Pd(OAc)_2$ (4.5 mg, 0.02 mmol), AgOAc (50.1 mg, 0.3 mmol), aryl iodide (0.3 mmol), *t*-BuOH (2 mL) were added. The tube was charged with N_2 and the mixture was then heated at 100 ^oC for 24 h. After cooling to room temperature, the reaction mixture was diluted with ethyl acetate and filtered through a pad of celite® and concentrated. The target product was obtained by flash chromatography.

3-(4-Acetylphenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3a)



The title compound **3a** was prepared according to **GP1.** A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 3 gave **3a** as a white solid (36.3 mg, 75%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.46 (d, *J* = 4.4 Hz, 1H), 7.89 (d, *J* = 8.4 Hz, 2H), 7.75-7.61 (m, 2H), 7.37 (d, *J* = 8.4 Hz, 2H), 7.29 (d, *J* = 7.6 Hz, 1H), 7.17 (dd, *J* = 6.8, 5.6 Hz, 1H), 3.50-3.34 (m, 1H), 2.62-2.43 (m, 5H), 1.68 (s, 3H), 1.62 (s, 3H), 1.34 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 198.0, 170.3, 164.3, 152.0, 147.5, 137.1, 135.4, 128.7,127.3, 121.9, 119.5, 56.5, 46.2, 37.1, 27.5, 27.4, 26.7, 21.4; HRMS (EI-TOF) calc. for $C_{20}H_{24}N_2O_2$ (M^+): 324.1838; Found: 324.1831.

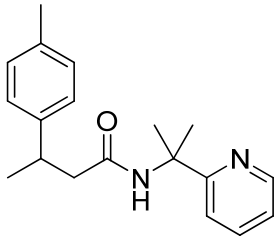
3-Phenyl-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3b)



The title compound **3b** was prepared according to **GP1.** A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 4 gave **3b** as a light yellow oil (31.5 mg, 74%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.49-8.43 (m, 1H), 7.64 (dt, *J* = 8.0, 1.6 Hz, 1H), 7.51 (brs, 1H), 7.33-7.21 (m, 5H),

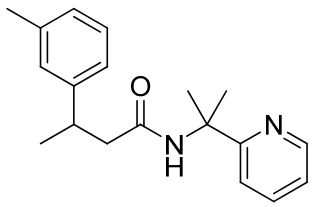
7.21-7.09 (m, 2H), 3.39-3.27 (m, *J* = 7.2 Hz, 1H), 2.57-2.51 (ABd, 1H), 2.49-2.43 (ABd, 1H), 1.67 (s, 3H), 1.62 (s, 3H), 1.32 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.9, 164.5, 147.6, 146.3, 137.0, 128.5, 127.0, 126.3, 121.8, 119.4, 56.5, 46.7, 37.2, 27.5, 27.4, 21.7; HRMS (EI-TOF) calc. for $C_{18}H_{22}N_2O$ (M^+): 282.1732; Found: 282.1725.

***N*-(2-(Pyridin-2-yl)propan-2-yl)-3-p-tolylbutanamide (3c)**



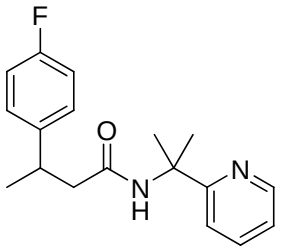
The title compound **3c** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 1 gave **3c** as a colorless oil (31.0 mg, 70%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 4.4 Hz, 1H), 7.68-7.61 (m, 1H), 7.49 (brs, 1H), 7.27 (d, *J* = 8.0 Hz, 1H), 7.20-7.13 (m, 3H), 7.10 (d, *J* = 8.0, 2H), 3.37-3.20 (m, 1H), 2.56-2.50 (ABd, 1H), 2.46-2.40(ABd, 1H), 2.30 (s, 3H), 1.68 (s, 3H), 1.64 (s, 3H), 1.30 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.0, 164.6, 147.7, 143.3, 137.0, 135.7, 129.2, 126.9, 121.8, 119.5, 56.6, 46.8, 36.8, 27.6, 27.5, 21.8, 21.1; HRMS (EI-TOF) calc. for $C_{19}H_{24}N_2O$ (M^+): 296.1889; Found: 296.1887.

***N*-(2-(Pyridin-2-yl)propan-2-yl)-3-m-tolylbutanamide (3d)**



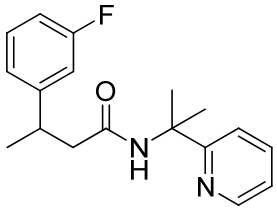
The title compound **3d** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 1 gave **3d** as a colorless oil (29.0 mg, 65%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 4.4 Hz, 1H), 7.65 (dt, *J* = 8.0, 1.2 Hz, 1H), 7.49 (brs, 1H), 7.27 (d, *J* = 7.6 Hz, 1H), 7.22-7.11 (m, 2H), 7.10-7.03 (m, 2H), 6.99 (d, *J* = 7.2 Hz, 1H), 3.36-3.20 (m, 1H), 2.56-2.50 (ABd, 1H), 2.47-2.41(ABd, 1H), 2.31 (s, 3H), 1.68 (s, 3H), 1.61 (s, 3H), 1.31 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.0, 164.6, 147.6, 146.2, 138.0, 137.1, 128.4, 127.9, 127.1, 124.0, 121.8, 119.5, 56.5, 46.8, 37.2, 27.5, 27.5, 21.7, 21.6; HRMS (EI-TOF) calc. for $C_{19}H_{24}N_2O$ (M^+): 296.1889; Found: 296.1897.

3-(4-Fluorophenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3e)



The title compound **3e** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 4 gave **3e** as a colorless oil (20.2 mg, 45%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.46 (d, *J* = 4.4 Hz, 1H), 7.67 (dt, *J* = 8.0, 1.2 Hz, 1H), 7.59 (brs, 1H), 7.28 (d, *J* = 8.0 Hz, 1H), 7.22 (dd, *J* = 8.0, 5.6 Hz, 2H), 7.17 (dd, *J* = 7.2, 5.2 Hz, 1H), 6.96 (t, *J* = 8.8 Hz, 2H), 3.38-3.28 (m, 1H), 2.52-2.42 (ABd, 2H), 1.68 (s, 3H), 1.62 (s, 3H), 1.31 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.7, 164.4, 161.4 (d, *J* = 242 Hz), 147.6, 141.9 (d, *J* = 3 Hz), 137.1, 128.5 (d, *J* = 8 Hz), 121.9, 119.5, 115.2 (d, *J* = 21 Hz), 56.5, 46.9, 36.5, 27.5, 27.4, 21.9; ^{19}F NMR (376 MHz, $CDCl_3$) δ -117.29; HRMS (EI-TOF) calc. for $C_{18}H_{21}FN_2O$ (M^+): 300.1638; Found: 300.1640.

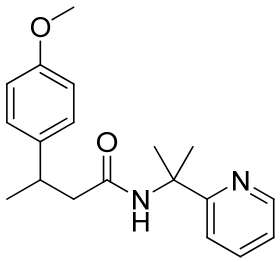
3-(3-Fluorophenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3f)



The title compound **3f** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 4 gave **3f** as a colorless oil (30.0 mg, 67%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 4.4 Hz, 1H), 7.67 (dt, *J* = 8.0, 1.6 Hz, 1H), 7.63 (brs, 1H), 7.29 (d, *J* = 8.4 Hz, 1H), 7.26-7.20 (m, 1H), 7.17 (dd, *J* = 7.2, 5.2 Hz, 1H), 7.05 (d, *J* = 7.6 Hz, 1H), 7.00-6.95 (m, 1H), 6.86 (dt, *J* = 8.4, 2.0 Hz, 1H), 3.40-3.30 (m, 1H), 2.55-2.42 (ABd, 2H), 1.69 (s, 3H), 1.63 (s, 3H), 1.32 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.5, 164.4, 163.0 (d, *J* = 244 Hz), 149.0 (d, *J* = 7 Hz), 147.6, 137.1, 129.9 (d, *J* = 8 Hz), 122.8 (d, *J* = 3 Hz), 121.9, 119.5, 113.9 (d, *J* = 21 Hz), 113.1 (d, *J* = 21 Hz), 56.5, 46.5, 36.9, 27.5, 27.4, 21.5; ^{19}F NMR (376 MHz, $CDCl_3$) δ -113.50;

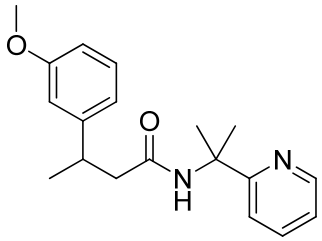
HRMS (EI-TOF) calc. for $C_{18}H_{21}FN_2O$ (M^+): 300.1638; Found: 300.1637.

3-(4-Methoxyphenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3g)



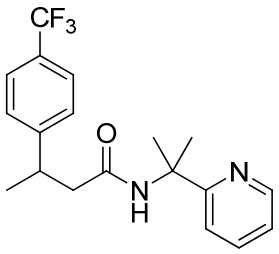
The title compound **3g** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 1 gave **3g** as a colorless oil (22.0 mg, 46%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 4.4 Hz, 1H), 7.65 (t, *J* = 7.6 Hz, 1H), 7.50 (brs, 1H), 7.27 (d, *J* = 8.0 Hz, 1H), 7.20-7.13 (m, 3H), 6.83 (d, *J* = 8.4 Hz, 2H), 3.76 (s, 3H), 3.33-3.24 (m, 1H), 2.53-2.40 (ABd, 2H), 1.68 (s, 3H), 1.63 (s, 3H), 1.30 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.0, 164.5, 158.0, 147.6, 138.4, 137.0, 127.9, 121.8, 119.5, 113.8, 56.5, 55.3, 47.0, 36.4, 27.6, 27.4, 21.9; HRMS (EI-TOF) calc. for $C_{19}H_{24}N_2O_2$ (M^+): 312.1838; Found: 312.1840.

3-(3-Methoxyphenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3h)



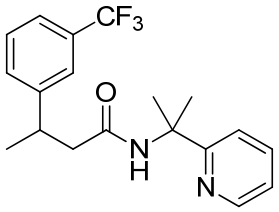
The title compound **3h** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 1 gave **3h** as a colorless oil (29.2 mg, 62%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 8.4 Hz, 1H), 7.66 (t, *J* = 7.6 Hz, 1H), 7.52 (brs, 1H), 7.27 (d, *J* = 8.0 Hz, 1H), 7.21 (t, *J* = 7.6 Hz, 1H), 7.16 (dd, *J* = 6.8, 5.6 Hz, 1H), 6.87 (d, *J* = 7.6 Hz, 1H), 6.82 (s, 1H), 6.72 (dd, *J* = 7.6, 1.6 Hz, 1H), 3.78 (s, 3H), 3.38-3.24 (m, 1H), 2.57-2.51 (ABd, 1H), 2.47-2.41 (ABd, 1H), 1.68 (s, 3H), 1.63 (s, 3H), 1.32 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.9, 164,5, 159.7, 148.0, 147.6, 137.1, 129.5, 121.8, 119.5, 119.4, 112.9, 111.6, 56.5, 55.2, 46.7, 37.2, 27.6, 27.4, 21.6; HRMS (EI-TOF) calc. for $C_{19}H_{24}N_2O_2$ (M^+): 312.1838; Found: 312.1843.

***N*-(2-(Pyridin-2-yl)propan-2-yl)-3-(4-(trifluoromethyl)phenyl)butanamide (3i)**



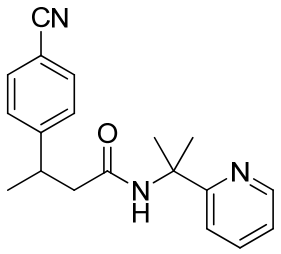
The title compound **3i** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 4 gave **3i** as a white solid (31.8 mg, 61%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.4 Hz, 1H), 7.67-7.64 (m, 2H), 7.53 (d, *J* = 8.0 Hz, 2H), 7.38 (d, *J* = 8.0 Hz, 2H), 7.28 (d, *J* = 8.4 Hz, 1H), 7.17 (dd, *J* = 7.2, 4.8 Hz, 1H), 3.47-3.37 (m, 1H), 2.57-2.46 (ABd, 2H), 1.68 (s, 3H), 1.62 (s, 3H), 1.34 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.3, 164.4, 150.4, 147.6, 137.2, 128.6 (q, *J* = 32 Hz), 127.5, 125.4 (q, *J* = 4 Hz), 124.4 (q, *J* = 270 Hz), 122.0, 119.5, 56.5, 46.4, 37.0, 27.5, 27.4, 21.5; ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.35; HRMS (EI-TOF) calc. for $C_{19}H_{21}F_3N_2O$ (M^+): 350.1606; Found: 350.1601.

***N*-(2-(Pyridin-2-yl)propan-2-yl)-3-(3-(trifluoromethyl)phenyl)butanamide (3j)**



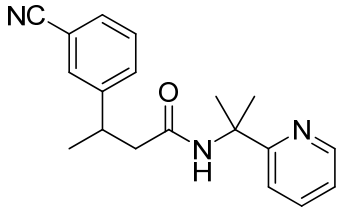
The title compound **3j** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 4 gave **3j** as a yellow solid (31.1 mg, 59%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.4 Hz, 1H), 7.68-7.64 (m, 2H), 7.51 (s, 1H), 7.48 - 7.36 (m, 3H), 7.28 (d, *J* = 8.4Hz, 1H), 7.16 (dd, *J* = 7.1, 5.2 Hz, 1H), 3.47-3.35 (m, 1H), 2.51 (d, *J* = 7.5 Hz, 2H), 1.67 (s, 3H), 1.58 (s, 3H), 1.34 (d, *J* = 7.0 Hz, 3H). ^{13}C NMR (100 MHz, CDCl3) δ 170.3, 164.4, 147.6, 147.2, 137.2, 130.8 (d, $J_{C\text{-}F}$ = 1.0 Hz), 130.8(q, $J_{C\text{-}F}$ =32.0 Hz) 128.9, 124.37(q, $J_{C\text{-}F}$ =270.7 Hz), 123.8(q, $J_{C\text{-}F}$ =3.8 Hz), 123.2(q, $J_{C\text{-}F}$ =3.8 Hz), 121.9, 119.5, 56.5, 46.6, 37.1, 27.5, 27.4, 21.6; ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.50; HRMS (EI-TOF) calc. for $C_{19}H_{21}F_3N_2O$ (M^+): 350.1606; Found: 350.1613.

3-(4-Cyanophenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3k)



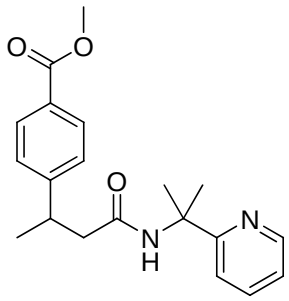
The title compound **3k** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 4 gave **3k** as a white solid (29.3 mg, 64%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.43 (d, *J* = 4.8 Hz, 1H), 7.71 (brs, 1H), 7.66 (t, *J* = 8.0 Hz, 1H), 7.54 (d, *J* = 8.0 Hz, 2H), 7.35 (d, *J* = 8.4 Hz, 2H), 7.28 (d, *J* = 8.0 Hz, 1H), 7,16 (dd, *J* = 6.8, 5.2 Hz, 1H), 3.46-3.20 (m, 1H), 2.49 (d, *J* = 7.6 Hz, 2H), 1.65 (s, 3H), 1.57 (s, 3H), 1.30 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 169.9, 164.2, 151.8, 147.5, 137.2, 132.3, 128.0, 122.0, 119.5, 119.1, 110.0, 56.5, 46.0, 37.2, 27.4, 27.3, 21.3; HRMS (EI-TOF) calc. for $C_{19}H_{21}N_3O$ (M^+): 307.1685; Found: 307.1685.

3-(3-Cyanophenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3l)



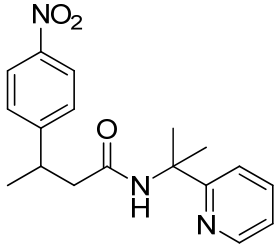
The title compound **3l** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 1 gave **3l** as a colorless oil (22.0 mg, 48%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.48 (d, *J* = 4.8 Hz, 1H), 7.75 (brs, 1H), 7.69 (dt, *J* = 8.0, 1.2 Hz, 1H), 7.58 (s, 1H), 7.52 (d, *J* = 7.6 Hz, 1H), 7.47 (d, *J* = 7.6 Hz, 1H), 7.38 (t, *J* = 8.4 Hz, 1H), 7.31 (d, *J* = 8.0 Hz, 1H), 7.19 (dd, *J* = 7.2, 5.2 Hz, 1H), 3.48-3.32 (m, 1H), 2.56-2.46 (ABd, 2H), 1.68 (s, 3H), 1.60 (s, 3H), 1.34 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.0, 164.2, 147.6, 147.5, 137,2, 132.0, 130.6, 130.0, 129.2, 121.9, 119.4, 119.1, 112.3, 56.4, 46.2, 36.7, 27.4, 27.3, 21.4; HRMS (EI-TOF) calc. for $C_{19}H_{21}N_3O$ (M^+): 307.1685; Found: 307.1682.

Methyl 4-(4-oxo-4-(2-(pyridin-2-yl)propan-2-ylamino)butan-2-yl)benzoate (3m)



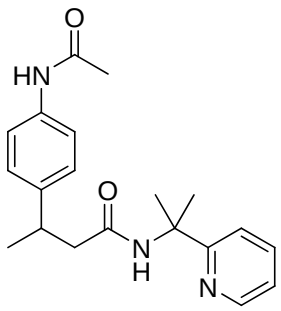
The title compound **3m** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 4 gave **3m** as a colorless oil (24.1 mg, 47%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.46 (d, *J* = 4.4 Hz, 1H), 7.95 (d, *J* = 8.4 Hz, 2H), 7.69-7.64 (m, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 7.28 (d, *J* = 8.0 Hz, 1H), 7.16 (dd, *J* = 7.2, 5.2 Hz, 1H), 3.89 (s, 3H), 3.46-3.36 (m, 1H), 2.57-2.46 (ABd, 2H), 1.68 (s, 3H), 1.61 (s, 3H), 1.34 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.4, 167.2, 164.4, 151.7, 147.6, 137.1, 129.9, 128.2, 127.2, 121.9, 119.5, 56.5, 52.1, 46.3, 37.1, 27.5, 27.4, 21.5; HRMS (EI-TOF) calc. for $C_{20}H_{24}N_2O_3$ (M^+): 340.1787; Found: 340.1790.

3-(4-Nitrophenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3n)



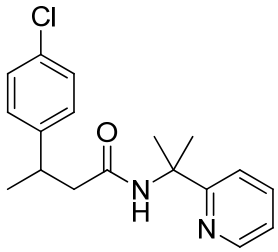
The title compound **3n** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 4 gave **3n** as a light yellow oil (21.0 mg, 43%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 (d, *J* = 4.4 Hz, 1H), 8.11 (d, *J* = 8.8 Hz, 2H), 7.74 (brs, 1H), 7.65 (t, *J* = 7.6 Hz, 1H), 7.41 (d, *J* = 8.8 Hz, 2H), 7.28 (d, *J* = 8.0 Hz, 1H), 7.15 (dd, *J* = 6.8, 5.2 Hz, 1H), 3.53-3.38 (m, 1H), 2.52 (d, *J* = 7.6 Hz, 2H), 1.66 (s, 3H), 1.58 (s, 3H), 1.33 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 169.8, 164.2, 154.1, 147.5, 146.5, 137.2, 128.0, 123.7, 122.0, 119.5, 56.5, 46.0, 37.0, 27.4, 27.3, 21.4; HRMS (EI-TOF) calc. for $C_{18}H_{21}N_3O$ (M^+): 327.1583; Found: 327.1580.

3-(4-Acetamidophenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3o)



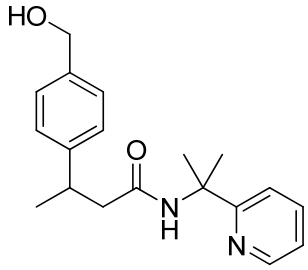
The title compound **3o** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : acetone = 1 : 1 gave **3o** as a white solid (23.0 mg, 45%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 4.8 Hz, 1H), 7.66 (t, *J* = 7.6 Hz, 1H), 7.55 (brs, 1H), 7.40 (d, *J* = 8.0 Hz, 2H), 7.33 (brs, 1H), 7.27 (d, *J* = 8.4 Hz, 1H), 7.21-7.14 (m, 3H), 3.34-3.24 (m, 1H), 2.53-2.40 (ABd, 2H), 2.14 (s, 3H), 1.67 (s, 3H), 1.63 (s, 3H), 1.29 (d, *J* = 7.6 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.0, 168.6, 164.5, 147.7, 142.1, 137.1, 136.3, 127.4, 121.9, 120.2, 119.5, 56.6, 46.7, 36.6, 27.6, 27.5, 24.6, 21.8; HRMS (EI-TOF) calc. for $C_{20}H_{25}N_3O_2$ (M^+): 339.1947; Found: 339.1961.

3-(4Chlorophenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3p)



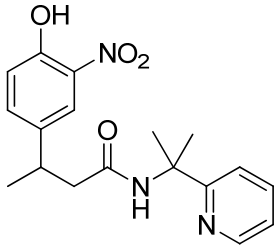
The title compound **3p** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 4 gave **3p** as a colorless oil (11.0 mg, 23%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 4.4 Hz, 1H), 7.67 (t, *J* = 8.4 Hz, 1H), 7.60 (brs, 1H), 7.28-7.15 (m, 6H), 3.67-3.28 (m, 1H), 2.52-2.42 (ABd, 2H), 1.68 (s, 3H), 1.63 (s, 3H), 1.30 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.5, 164.4, 147.6, 144.7, 137.1, 131.8, 128.6, 128.5, 121.9, 119.5, 56.5, 46.6, 36.6, 27.6, 27.4, 21.7; HRMS (EI-TOF) calc. for $C_{18}H_{21}ClN_2O$ (M^+): 316.1342; Found: 316.1347.

3-(4-(Hydroxymethyl)phenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3q)



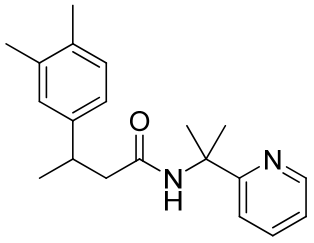
The title compound **3q** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 1 gave **3q** as a colorless oil (18.0 mg, 38%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.4 Hz, 1H), 7.66 (t, *J* = 7.6 Hz, 1H), 7.55 (brs, 1H), 7.30-7.26 (m, 3H), 7.23 (d, *J* = 8.0 Hz, 2H), 7.18-7.14 (m, 1H), 4.62 (s, 2H), 3.36-3.26 (m, 1H), 2.71-2.39 (m, 3H), 1.67 (s, 3H), 1.63 (s, 3H), 1.30 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.0, 164.4, 147.6, 145.6, 139.1, 137.1, 127.3, 127.2, 121.9, 119.5, 65.0, 56.5, 46.6, 36.8, 27.6, 27.4, 21.7; HRMS (EI-TOF) calc. for $C_{19}H_{24}N_2O_2$ (M^+): 312.1838; Found: 312.1834.

3-(4-Hydroxy-3-nitrophenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3r)



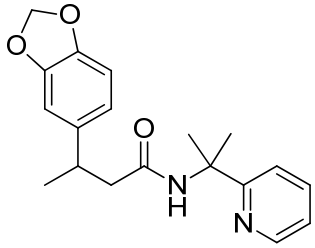
The title compound **3r** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 1 gave **3r** as a yellow oil (14.0 mg, 27%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.43 (brs, 1H), 8.43 (d, *J* = 4.4 Hz, 1H), 7.96 (s, 1H), 7.75 (brs, 1H), 7.66 (t, *J* = 7.6 Hz, 1H), 7.50 (d, *J* = 8.4 Hz, 1H), 7.30 (d, *J* = 8.0 Hz, 1H), 7.16 (dd, *J* = 7.2, 4.8 Hz, 1H), 7.05 (d, *J* = 8.4 Hz, 1H), 3.39-3.30 (m, 1H), 2.52-2.42 (m, 2H), 1.67 (s, 3H), 1.60 (s, 3H), 1.30 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.0, 164.3, 153.6, 147.5, 138.7, 137.2, 133.4, 122.6, 122.0, 119.9, 119.5, 56.5, 46.3, 36.0, 27.4, 27.4, 21.5; HRMS (EI-TOF) calc. for $C_{18}H_{21}N_3O_4$ (M^+): 343.1532; Found: 343.1528.

3-(3, 4-Dimethylphenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3s)



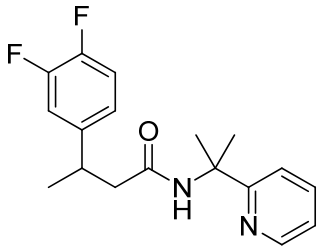
The title compound **3s** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 1 gave **3s** as a light yellow oil (21.0 mg, 45%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 4.8 Hz, 1H), 7.64 (dt, *J* = 8.0, 1.6 Hz, 1H), 7.49 (brs, 1H), 7.27 (d, *J* = 8.4 Hz, 1H), 7.15 (dd, *J* = 6.8, 5.2 Hz, 1H), 7.07-7.03 (m, 2H), 7.00 (d, *J* = 8.0 Hz, 1H), 3.31-3.20 (m, 1H), 2.55-2.39 (ABd, 2H), 2.22 (s, 3H), 2.20 (s, 3H), 1.68 (s, 3H), 1.64 (s, 3H), 1.30 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.1, 164.6, 147.6, 143.8, 137.0, 136.5, 134.3, 129.8, 128.4, 124.2, 121.8, 119.5, 56.5, 46.8, 36.7, 27.6, 27.4, 21.8, 19.9, 19.4; HRMS (EI-TOF) calc. for $C_{20}H_{26}N_2O$ (M^+): 310.2045; Found: 310.2044.

3-(Benzo[d][1,3]dioxol-5-yl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3t)



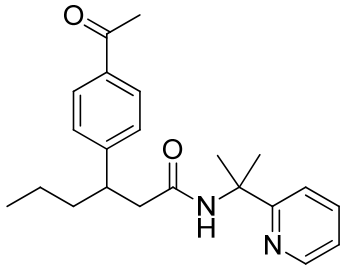
The title compound **3t** was prepared according to **GP1**. A purification by flash chromatography in dichloromethane : ethyl acetate = 2 : 1 gave **3t** as a colorless oil (25.0 mg, 51%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 4.4 Hz, 1H), 7.66 (td, *J* = 7.9, 1.7 Hz, 1H), 7.52 (s, 1H), 7.29 (d, *J* = 8.1 Hz, 1H), 7.19–7.11 (m, 1H), 6.76 (s, 1H), 6.71 (s, 2H), 5.88 (s, 2H), 3.31–3.19 (m, 1H), 2.51-2.35 (ABd, 2H), 1.68 (s, 3H), 1.63 (s, 3H), 1.27 (d, *J* = 6.9 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.8, 164.6, 147.7, 147.6, 145.9, 140.4, 137.1, 121.8, 120.0, 119.5, 108.3, 107.5, 100.8, 56.6, 47.1, 37.0, 27.6, 27.5, 22.0. HRMS (EI-TOF) calc. for $C_{19}H_{22}N_2O_3$ (M^+): 326.1630; Found: 326.1633.

3-(3,4-Difluorophenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3u)



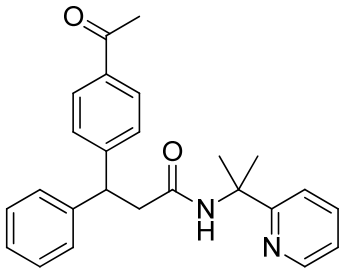
The title compound **3u** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 4 gave **3u** as a light yellow oil (27.9 mg, 58%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.4 Hz, 1H), 7.69-7.65 (m, 2H), 7.29 (d, *J* = 8.0 Hz, 1H), 7.19-7.15 (m, 1H), 7.09-6.92 (m, 3H), 3.36-3.26 (m, 1H), 2.44 (d, *J* = 7.2 Hz, 2H), 1.68 (s, 3H), 1.61 (s, 3H), 1.28 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.3, 164.4, 150.8 (dd, *J* = 143, 13 Hz), 148.3 (dd, *J* = 141, 13 Hz), 147.6, 143.3 (t, *J* = 4 Hz), 137.2, 123.0 (dd, *J* = 6, 3 Hz), 122.0, 119.5, 117.1 (d, *J* = 17 Hz), 115.8 (d, *J* = 17 Hz), 56.5, 46.7, 36.5, 27.5, 27.4, 21.7; ^{19}F NMR (376 MHz, $CDCl_3$) δ -138.22 (*J* = -22.4 Hz), -141.84 (*J* = -22.8 Hz); HRMS (EI-TOF) calc. for $C_{18}H_{20}F_2N_2O$ (M^+): 318.1544; Found: 318.1547.

3-(4-Acetylphenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)hexanamide (3v)



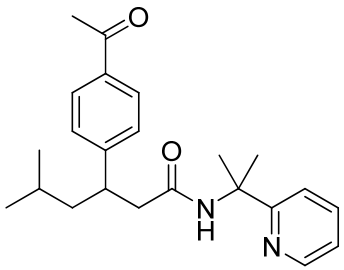
The title compound **3v** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 1 gave **3v** as a yellow solid (46.0 mg, 87%). An alternative method according to **GP2** also gave product **3v** (54.0 mg, 77%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.48-8.42 (m, 1H), 7.87 (d, *J* = 8.3 Hz, 2H), 7.64 (dt, *J* = 7.8, 1.8 Hz, 1H), 7.53 (s, 1H), 7.32 (d, *J* = 8.3 Hz, 2H), 7.24 (d, *J* = 8.1 Hz, 1H), 7.15 (ddd, *J* = 7.4, 4.9, 0.8 Hz, 1H), 3.29–3.18 (m, 1H), 2.62–2.56 (ABd, 1H), 2.55 (s, 3H), 2.50–2.43(ABd, 1H), 1.75–1.59 (m, 7H), 1.53 (s, 3H), 0.85 (t, *J* = 7.3 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 198.0, 170.4, 164.5, 150.7, 147.6, 137.1, 135.5, 128.7, 128.1, 121.9, 119.5, 56.5, 45.2, 42.8, 38.3, 27.5, 27.4, 26.7, 20.7, 14.1. HRMS (EI-TOF) calc. for $C_{22}H_{28}N_2O_2$ (M^+): 352.2151; Found: 352.2150.

3-(4-Acetylphenyl)-3-phenyl-*N*-(2-(pyridin-2-yl)propan-2-yl)propanamide (3w)



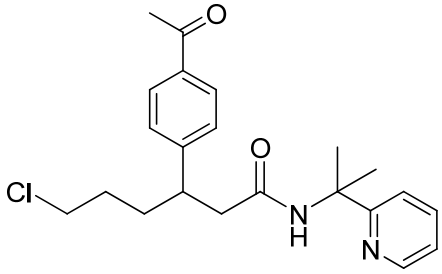
The title compound **3w** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 2 : 3 gave **3w** as a colorless oil (46.4 mg, 80%). An alternative method according to **GP2** also gave product **3w** (47.9 mg, 62%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.44 (d, *J* = 4.4 Hz, 1H), 7.86 (d, *J* = 8.4 Hz, 2H), 7.67 (s, 1H), 7.66–7.60 (m, 1H), 7.38 (d, *J* = 8.2 Hz, 2H), 7.32–7.24 (m, 4H), 7.23–7.12 (m, 3H), 4.68 (t, *J* = 7.9 Hz, 1H), 3.00 (d, *J* = 7.9 Hz, 2H), 2.54 (s, 3H), 1.56 (d, *J* = 3.3 Hz, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 197.9, 169.7, 164.3, 149.7, 147.6, 143.2, 137.2, 135.5, 128.8, 128.7, 128.3, 128.0, 126.8, 121.9, 119.5, 56.6, 47.6, 43.9, 27.4, 26.7. HRMS (EI-TOF) calc. for $C_{25}H_{26}N_2O_2$ (M^+): 386.1994; Found: 386.1996.

3-(4-Acetylphenyl)-5-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)hexanamide (3x)



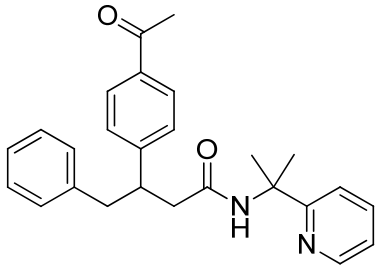
The title compound **3x** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 2 : 3 gave **3x** as a yellow solid (49.0 mg, 89%). An alternative method according to **GP2** with an additional treatment with 0.5 mL triethylamine for 5h before filtration also gave product **3x** (59.1 mg, 81%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 (d, *J* = 4.4 Hz, 1H), 7.86 (d, *J* = 8.0 Hz, 2H), 7.62 (t, *J* = 7.6 Hz, 1H), 7.50 (brs, 1H), 7.33 (d, *J* = 8.0 Hz, 2H), 7.21 (d, *J* = 8.0 Hz, 1H), 7.14 (dd, *J* = 7.2, 5.2 Hz, 1H), 3.37-3.29 (m, 1H), 2.59-2.52 (m, 4H), 2.46-2.40 (m, 1H), 1.68-1.60 (m, 4H), 1.51-1.45 (m, 4H), 1.34-1.26 (m, 1H), 0.86 (d, *J* = 6.4 Hz, 3H), 0.82 (d, *J* = 6.4 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 198.0, 170.3, 164.4, 150.7, 147.6, 137.1, 135.5, 128.7, 128.1, 121.9, 119.5, 56.5, 45.7, 45.2, 40.8, 27.5, 27.4, 26.7, 25.5, 23.6, 21.7; HRMS (EI-TOF) calc. for $C_{23}H_{30}N_2O_2$ (M^+): 366.2307; Found: 366.2313.

3-(4-Acetylphenyl)-6-chloro-*N*-(2-(pyridin-2-yl)propan-2-yl)hexanamide (3y)



The title compound **3y** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : acetone = 2 : 1 gave **3y** as a yellow oil (41.8 mg, 72%). An alternative method according to **GP2** with an additional treatment with 0.5 mL triethylamine for 5h before filtration also gave product **3y** (40.8 mg, 53%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45 (ddd, *J* = 4.8, 1.6, 0.8 Hz, 1H), 7.89 (d, *J* = 8.4 Hz, 2H), 7.68-7.64 (m, 2H), 7.34 (d, *J* = 8.4 Hz, 2H), 7.29-7.24 (m, 1H), 7.17 (ddd, *J* = 7.6, 4.8, 0.8 Hz, 1H), 3.47 (t, *J* = 6.4 Hz, 2H), 3.31-3.22 (m, 1H), 2.64-2.58 (ABd, 1H), 2.56 (s, 3H), 2.54-2.48 (ABd, 1H), 1.95-1.86 (m, 1H), 1.85-1.63 (m, 5H), 1.63-1.53 (m, 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 197.9, 170.0, 164.3, 149.7, 147.5, 137.2, 135.7, 128.8, 128.0, 122.0, 119.5, 56.5, 45.1, 45.0, 42.4, 33.1, 30.6, 27.5, 27.4, 26.7; HRMS (EI-TOF) calc. for $C_{22}H_{27}ClN_2O_2$ (M^+): 386.1761; Found: 386.1764.

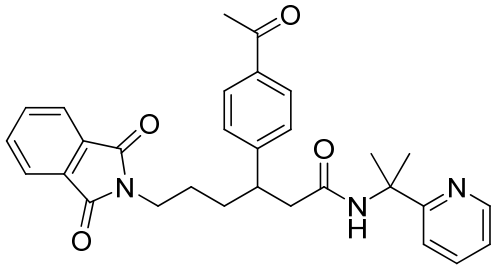
3-(4-Acetylphenyl)-4-phenyl-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3z)



The title compound **3z** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 1 gave **3z** as a yellow solid (50.0 mg, 83%). An alternative method according to **GP2** also gave product **3z** (63.1 mg, 79%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.44 (d, *J* = 4.3 Hz, 1H), 7.82 (d, *J* = 8.3 Hz, 2H), 7.68–7.57 (m, 2H), 7.29–7.21 (m, 3H), 7.20–7.10(m, 4H), 7.07–6.99 (m, 2H), 3.64–3.50 (m, 1H), 3.06–3.00 (m, 1H), 2.96–2.87 (m, 1H), 2.70–2.62 (m, 1H), 2.60–2.49 (m, 4H), 1.62 (s, 3H), 1.53 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 198.0, 170.1, 164.4, 149.7, 147.6, 139.4, 137.2, 135.6, 129.3, 128.5, 128.3, 128.2, 126.3, 121.9, 119.5, 56.6, 44.7,

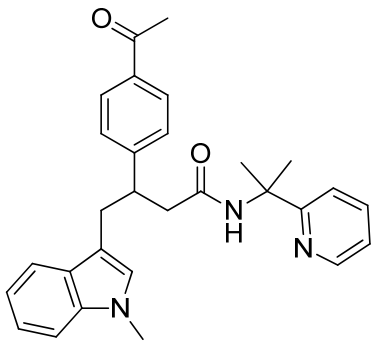
43.7, 42.5, 27.5, 27.4, 26.7. HRMS (EI-TOF) calc. for $C_{26}H_{28}N_2O_2$ (M^+): 400.2151; Found: 400.2146.

3-(4-Acetylphenyl)-6-(1,3-dioxoisoindolin-2-yl)-*N*-(2-(pyridin-2-yl)propan-2-yl)hexanamide (3aa)



The title compound **3aa** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : acetone = 5 : 3 gave **3aa** as a yellow solid (13.3 mg, 23%). An alternative method according to **GP2** with an additional treatment with 0.5 mL triethylamine for 5h before filtration also gave product **3aa** (84.6 mg, 85%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.41 (d, *J* = 4.4 Hz, 1H), 7.82 (d, *J* = 8.0 Hz, 2H), 7.77-7.74 (m, 2H), 7.67-7.64 (m, 2H), 7.63-7.57 (m, 2H), 7.29 (d, *J* = 8.0 Hz, 2H), 7.20 (d, *J* = 8.0 Hz, 1H), 7.12 (dd, *J* = 7.2, 4.8 Hz, 1H), 3.66-3.54 (m, 2H), 3.27-3.19 (m, 1H), 2.61-2.43 (m, 5H), 1.77-1.65 (m, 2H), 1.63-1.54 (m, 4H), 1.49-1.41 (m, 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 197.9, 169.9, 168.3, 164.2, 149.7, 147.5, 137.1, 135.6, 133.9, 132.1, 128.7, 128.0, 123.2, 121.8, 119,4, 56.4, 44.8, 42.6, 37.8, 33.0, 27.4, 27.3, 26.6, 26.6; HRMS (EI-TOF) calc. for $C_{30}H_{31}N_3O_4$ (M^+): 497.2315; Found: 497.2320.

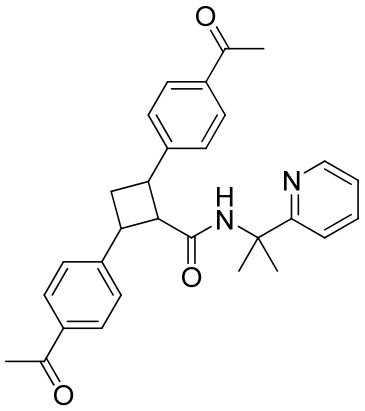
3-(4-Acetylphenyl)-4-(1-methyl-1H-indol-3-yl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3ab)



The title compound **3ab** was prepared according to **GP1**. A purification by flash chromatography in

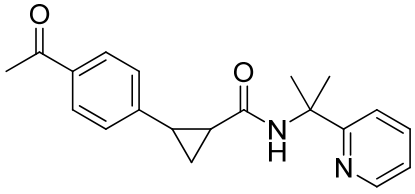
petroleum ether : ethyl acetate = 1 : 1 gave **3ab** as a yellow oil (22.0 mg, 32%). An alternative method according to **GP2** also gave product **3ab** (48.4 mg, 53%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45-8.41 (m, 1H), 7.83 (d, *J* = 8.3 Hz, 2H), 7.62 (dt, *J* = 6.4, 3.2 Hz, 1H), 7.58 – 7.49 (m, 2H), 7.33 (d, *J* = 8.3 Hz, 2H), 7.26–7.21 (m, 2H), 7.21–7.16 (m, 1H), 7.15–7.11 (m, 1H), 7.09–7.02 (m, 1H), 6.65 (s, 1H), 3.73–3.63 (m, 4H), 3.20-3.03 (ABd, 2H), 2.78–2.71 (m, 1H), 2.61–2.50 (m, 4H), 1.62 (s, 3H), 1.54 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 198.2, 170.5, 164.4, 150.7, 147.6, 137.1, 137.0, 135.5, 128.6, 128.2, 128.1, 127.4, 121.9, 121.6, 119.5, 119.1, 118.9, 112.0, 109.2, 56.6, 44.0, 43.7, 32.7, 31.9, 27.5, 27.4, 26.7. HRMS (EI-TOF) calc. for $C_{29}H_{31}N_3O_2$ (M^+): 453.2416; Found: 453.2418.

2,4-Bis(4-acetylphenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)cyclobutanecarboxamide (3ac)



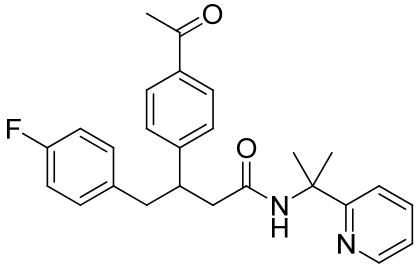
The title compound **3ac** was prepared according to **GP1**. A purification by flash chromatography in dichloromethane : ethyl acetate = 1 : 1 gave **3ac** as a yellow solid (26.0 mg, 38%). An alternative method according to **GP2** with an additional treatment with 0.5 mL triethylamine for 5h before filtration (dichloromethane was applied in the dilution before filtration instead of ethyl acetate due to bad solubility) also gave product **3ac** (62.7 mg, 69%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.41 (d, *J* = 4.4 Hz, 1H), 7.83 (d, *J* = 8.0 Hz, 4H), 7.68 (brs, 1H), 7.53 (t, *J* = 8.0 Hz, 1H), 7.34 (d, *J* = 8.4 Hz, 4H), 7.12-7.08 (m, 1H), 7.03 (d, *J* = 8.0 Hz, 1H), 4.02-3.89 (m, 3H), 3.48 (q, *J* = 10.4 Hz, 1H), 2.74-2.67 (m, 1H), 2.54 (s, 6H), 1.15 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 198.1, 168.6, 164.3, 147.3, 147.1, 137.0, 135.0, 128.1, 127.3, 121.8, 119.5, 56.3, 53.6, 38.5, 29.6, 27.0, 26.7; HRMS (EI-TOF) calc. for $C_{29}H_{30}N_2O_3$ (M^+): 454.2256; Found: 454.2260.

2-(4-Acetylphenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)cyclopropanecarboxamide (3ad)



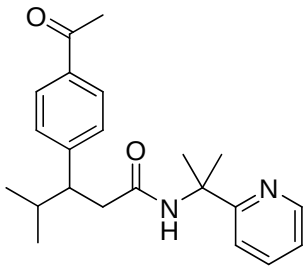
The title compound **3ad** was prepared according to **GP2**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 3 gave **3ad** as a light yellow solid (38.9 mg, 60%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.45 (dd, *J* = 4.8, 0.8 Hz, 1H), 7.79 (d, *J* = 8.4 Hz, 2H), 7.76 (brs, 1H), 7.58 (dt, *J* = 8.0, 1.6 Hz, 1H), 7.33 (d, *J* = 8.4 Hz, 2H), 7.18 (d, *J* = 8.0 Hz, 1H), 7.12 (ddd, *J* = 7.2, 4.8, 0.8 Hz, 1H), 2.53 (s, 3H), 2.50-2.42 (m, 1H), 2.15-2.08 (m, 1H), 1.78-1.72 (m, 1H), 1.54 (s, 3H), 1.41 (s, 3H), 1.31-1.23 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 198.1, 167.8, 164.4, 147.6, 143.4, 137.1, 135.2, 129.4, 127.9, 121.8, 119.5, 55.6, 27.6, 27.4, 26.7, 25.2, 24.4, 10.0; HRMS (EI-TOF) calc. for $C_{20}H_{22}N_2O_2$ (M^+): 322.1681; Found: 322.1671.

3-(4-Acetylphenyl)-4-(4-fluorophenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3ae)



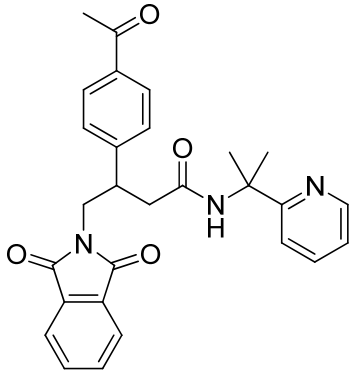
The title compound **3ae** was prepared according to **GP2** with an additional treatment with 0.5 mL triethylamine for 5h before filtration. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 2 gave **3ae** as a light yellow solid (71.6 mg, 86%).^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 (d, *J* = 4.4 Hz, 1H), 7.81 (d, *J* = 8.0 Hz, 2H), 7.67-7.60 (m, 2H), 7.24-7.21 (m, 3H), 7.14 (dd, *J* = 6.8, 5.2 Hz, 1H), 6.94 (dd, *J* = 8.4, 6.0 Hz, 2H), 6.83 (t, *J* = 8.8 Hz, 2H), 3.55-3.47 (m, 1H), 3.04-2.98 (ABd, 1H), 2.89-2.82 (ABd, 1H), 2.67-2.61 (m, 1H), 2.58-2.50 (m, 4H), 1.62 (s, 3H), 1.53 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 198.0, 170.0, 164.2, 161.4 (d, *J* = 243 Hz), 149.3, 147.5, 137.1, 135.5, 135.0 (d, *J* = 3 Hz), 130.6 (d, *J* = 8 Hz), 128.5, 128.1, 121.9, 119.4, 115.0 (d, *J* = 21 Hz), 56.5, 44.7, 43.5, 41.5, 27.5, 27.3, 26.6; ^{19}F NMR (376 MHz, $CDCl_3$) δ -117.06; HRMS (EI-TOF) calc. for $C_{26}H_{27}FN_2O_2$ (M^+): 418.2057; Found: 418.2059.

3-(4-Acetylphenyl)-4-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)pentanamide (3af)



The title compound **3af** was prepared according to **GP2**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 2 gave **3af** as a colorless oil (38.0 mg, 54%). An application of AgF (38.1 mg, 0.3 mmol) in **GP2** instead of AgOAc and an additional treatment with 0.5 mL triethylamine for 5h before filtration also gave product **3af** (50.0 mg, 71%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.43 (d, *J* = 4.4 Hz, 1H), 7.84 (d, *J* = 8.0 Hz, 2H), 7.59 (t, *J* = 8.0 Hz, 1H), 7.49 (brs, 1H), 7.30 (d, *J* = 8.0 Hz, 2H), 7.18–7.11 (m, 2H), 3.04–2.93 (m, 1H), 2.82–2.74 (ABd, 1H), 2.53 (s, 3H), 2.52–2.42 (ABd, 1H), 1.99–1.83 (m, 1H), 1.55 (s, 3H), 1.42 (s, 3H), 0.99 (d, *J* = 6.4 Hz, 3H), 0.75 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 198.1, 170.7, 164.4, 149.6, 147.5, 137.1, 135.4, 128.8, 128.3, 121.9, 119.4, 56.4, 49.9, 42.0, 33.2, 27.4, 27.3, 26.7, 20.9, 20.7; HRMS (EI-TOF) calc. for $C_{22}H_{28}N_2O_2$ (M^+): 352.2151; Found: 352.2152.

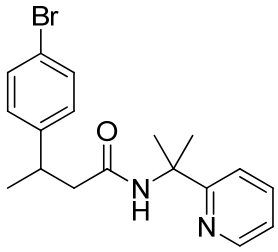
3-(4-Acetylphenyl)-4-(1,3-dioxoisoindolin-2-yl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3ag)



The title compound **3ag** was prepared according to **GP2** with an additional treatment with 0.5 mL triethylamine for 5h before filtration. A purification by flash chromatography in petroleum ether : acetone = 5 : 3 gave **3ag** as a white solid (37.6 mg, 40%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.43 (d, *J* = 4.4 Hz, 1H), 7.84 (d, *J* = 8.0 Hz, 2H), 7.81-7.72 (m, 2H), 7.71-7.64 (m, 3H), 7.61 (t, *J* = 7.6 Hz, 1H), 7.41 (d, *J* = 8.4 Hz, 2H), 7.20 (d, *J* = 8.0 Hz, 1H), 7.13 (dd, *J* = 6.8, 5.6 Hz, 1H), 4.05-3.76 (m, 3H), 2.79-2.68 (ABd, 1H), 2.68-2.58 (ABd, 1H), 2.52 (s, 3H), 1.52 (s, 3H), 1.47 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 197.9, 169.3, 168.3, 164.2, 147.6, 146.7, 137.1, 136.1, 134.1, 131.9, 128.7,

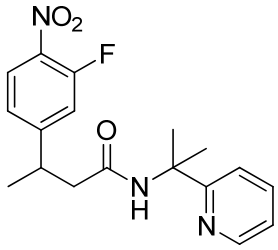
128.3, 123.4, 121.9, 119.4, 56.6, 42.9, 41.7, 41.5, 27.4, 27.3, 26.7; HRMS (EI-TOF) calc. for $C_{28}H_{27}N_3O_4$ (M^+): 469.2002; Found: 469.2000.

3-(4-Bromophenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3ah)



The title compound **3ah** was prepared according to **GP2**. A purification by flash chromatography in petroleum ether : ethyl acetate = 2 : 5 gave **3ah** as a colorless oil (61.9 mg, 86%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 4.8 Hz, 1H), 7.67 (dt, *J* = 8.4, 1.2 Hz, 1H), 7.61 (brs, 1H), 7.39 (d, *J* = 8.4 Hz, 2H), 7.27 (d, *J* = 8.0 Hz, 1H), 7.19-7.13 (m, 3H), 3.36-3.26 (m, 1H), 2.52-2.42 (ABd, 2H), 1.68 (s, 3H), 1.63 (s, 3H), 1.30 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.4, 164.4, 147.6, 145.3, 137.1, 131.5, 128.9, 121.9, 119.9, 119.5, 56.5, 46.5, 36.5, 27.6, 27.4, 21.6; HRMS (EI-TOF) calc. for $C_{18}H_{21}BrN_2O$ (M^+): 360.0837; Found: 360.0843.

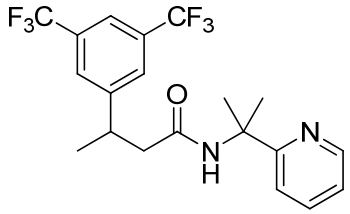
3-(3-Fluoro-4-nitrophenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3ai)



The title compound **3ai** was prepared according to **GP1**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 3 gave **3ai** as a yellow solid (12.0 mg, 23%). An alternative method according to **GP2** also gave product **3ai** (51.6 mg, 75%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.8 Hz, 1H), 7.98 (t, *J* = 8.0 Hz, 1H), 7.79 (brs, 1H), 7.69 (dt, *J* = 7.6, 0.8 Hz, 1H), 7.32 (d, *J* = 8.0 Hz, 1H), 7.20-7.16 (m, 3H), 3.50-3.40 (m, 1H), 2.57-2.46 (ABd, 2H), 1.69 (s, 3H), 1.61 (s, 3H), 1.34 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 169.5, 164.2, 156.1 (d, *J* = 8 Hz), 155.6 (d, *J* = 263 Hz), 147.5, 137.4, 135.5 (d, *J* = 7 Hz), 126.3 (d, *J* = 2 Hz), 123.4 (d, *J* = 4 Hz), 122.1, 119.6, 116.9 (d, *J* = 21 Hz), 56.6, 45.8, 36.9, 27.5, 27.4, 21.2; ^{19}F NMR (376 MHz, $CDCl_3$) δ

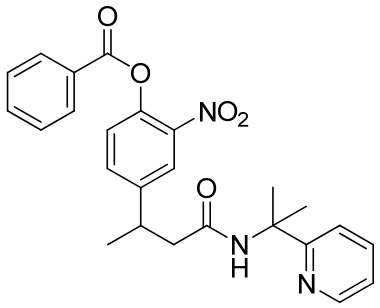
-117.14; HRMS (EI-TOF) calc. for $C_{18}H_{20}FN_3O_3$ (M^+): 345.1489; Found: 345.1495.

3-(3,5-Bis(trifluoromethyl)phenyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)butanamide (3aj)



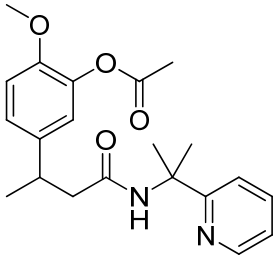
The title compound **3aj** was prepared according to **GP2**. A purification by flash chromatography in petroleum ether : ethyl acetate = 2 : 3 gave **3aj** as a white solid (64.7 mg, 77%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.43 (d, *J* = 4.8 Hz, 1H), 7.82 (brs, 1H), 7.71 (s, 2H), 7.69-7.65 (m, 2H), 7.30 (d, *J* = 8.0 Hz, 1H), 7.16 (dd, *J* = 7.6, 4.8 Hz, 1H), 3.56-3.47 (m, 1H), 2.59-2.47 (m, 2H), 1.67 (s, 3H), 1.55 (s, 3H), 1.37 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 169.6, 164.2, 148.7, 147.5, 137.3, 131.7 (q, *J* = 33 Hz), 127.5, 123.5 (q, *J* = 271 Hz), 122.0, 120.4 (m, *J* = 4 Hz), 119.5, 56.5, 46.3, 36.9, 27.3, 21.3; ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.81; HRMS (EI-TOF) calc. for $C_{20}H_{20}F_6N_2O$ (M^+): 418.1480; Found: 418.1487.

2-Nitro-4-(4-oxo-4-(2-(pyridin-2-yl)propan-2-ylamino)butan-2-yl)phenyl benzoate (3ak)



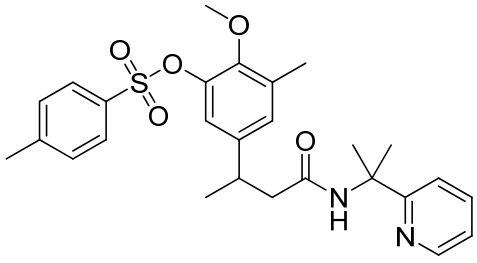
The title compound **3ak** was prepared according to **GP2**. A purification by flash chromatography in ethyl acetate gave **3ak** as a colorless oil (78.5 mg, 88%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.48 (d, *J* = 4.4 Hz, 1H), 8.18 (d, *J* = 7.2 Hz, 2H), 8.04 (d, *J* = 1.2 Hz, 1H), 7.80 (brs, 1H), 7.71-7.60 (m, 3H), 7.51 (t, *J* = 8.0 Hz, 2H), 7.33 (d, *J* = 8.0 Hz, 1H), 7.28 (d, *J* = 8.0 Hz, 1H), 7.18 (dd, *J* = 6.8, 5.6 Hz, 1H), 3.55-3.45 (m, 1H), 2.55 (d, *J* = 7.6 Hz, 2H),1.71 (s, 3H), 1.65 (s, 3H), 1.38 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 169.8, 164.5, 164.2, 147.6, 145.6, 142.5, 141.7, 137.2, 134.1, 133.8, 130.5, 128.7, 128.6, 125,2, 124.0, 122.0, 119.5, 56.6, 46.1, 36.3, 27.5, 27.4, 21.3; HRMS (EI-TOF) calc. for $C_{25}H_{25}N_3O_5$ (M^+): 447.1794; Found: 447.1784.

2-Methoxy-5-(4-oxo-4-(2-(pyridin-2-yl)propan-2-ylamino)butan-2-yl)phenyl acetate (3al)



The title compound **3al** was prepared according to **GP2**. A purification by flash chromatography in ethyl acetate gave **3al** as a colorless oil (66.4 mg, 90%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 4.4 Hz, 1H), 7.66 (t, *J* = 7.6 Hz, 1H), 7.52 (brs, 1H), 7.29 (d, *J* = 7.2 Hz, 1H), 7.16 (dd, *J* = 6.8, 5.2 Hz, 1H), 7.09 (dd, *J* = 8.4, 1.6 Hz, 1H), 6.96 (d, *J* = 1.6 Hz, 1H), 6.88 (d, *J* = 8.4 Hz, 1H), 3.78 (s, 3H), 3.35-3.22 (m, 1H), 2.52-2.37 (ABd, 2H), 2.29 (s, 3H), 1.68 (s, 3H), 1.64 (s, 3H), 1.29 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.7, 169.1, 164.5, 149.4, 147.6, 139.6, 139.0, 137.0, 125.3, 121.8, 121.2, 119.5, 112.3, 56.5, 56.0,46.8, 36.1, 27.5, 27.5, 21.5, 20.8; HRMS (EI-TOF) calc. for $C_{21}H_{26}N_2O_4$ (M^+): 370.1893; Found: 370.1888.

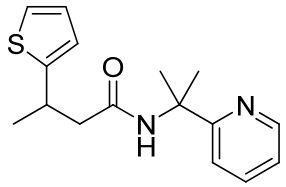
2-Methoxy-3-methyl-5-(4-oxo-4-(2-(pyridin-2-yl)propan-2-ylamino)butan-2-yl)phenyl 4-methylbenzenesulfonate (3am)



The title compound **3am** was prepared according to **GP2**. A purification by flash chromatography in petroleum ether : ethyl acetate = 1 : 3 gave **3am** as a light yellow oil (80.4 mg, 81%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.48 (d, *J* = 4.8 Hz, 1H), 7.76 (d, *J* = 8.0 Hz, 2H), 7.66 (dt, *J* = 8.0, 1.2 Hz, 1H), 7.58 (brs, 1H), 7.29 (t, *J* = 8.4 Hz, 3H), 7.16 (dd, *J* = 7.6, 5.2 Hz, 1H), 6.95 (s, 1H), 6.74 (d, *J* = 1.6 Hz, 1H), 3.64 (s, 3H), 3.23-3.13 (m, 1H), 2.44 (s, 3H), 2.42-2.32 (ABd, 2H), 2.17 (s, 3H), 1.68 (s, 3H), 1.62 (s, 3H), 1.20 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.5, 164.4, 149.0, 147.6, 145.3, 142.4, 141.8, 137.1, 133.2, 132.8, 129.6, 128.6, 128.5, 121.8, 119.4, 119.2, 60.6, 56.5, 46.5, 36.3, 27.5, 27.4, 21.8, 21.4, 16.1; HRMS (EI-TOF) calc. for $C_{27}H_{32}N_2O_5S$ (M^+): 496.2032;

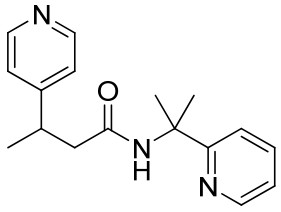
Found: 496.2038.

***N*-(2-(Pyridin-2-yl)propan-2-yl)-3-(thiophen-2-yl)butanamide (3an)**



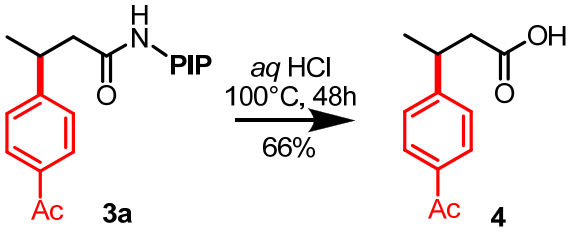
The title compound **3an** was prepared according to **GP2**. A purification by flash chromatography in petroleum ether : ethyl acetate = 2 : 3 gave **3an** as a colorless oil (51.2 mg, 89%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 4.4 Hz, 1H), 7.67 (dt, *J* = 7.6, 1.6 Hz, 1H), 7.63 (brs, 1H), 7.31 (d, *J* = 8.4 Hz, 1H), 7.16 (dd, *J* = 7.2, 5.2 Hz, 1H), 7.11 (d, *J* = 4.8 Hz, 1H), 6.89 (dd, *J* = 4.8, 3.6 Hz, 1H), 6.85 (d, *J* = 3.2 Hz, 1H), 3.70-3.60 (m, 1H), 2.63-2.44 (ABd, 2H), 1.71 (s, 3H), 1.67 (s, 3H), 1.39 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.4, 164.5, 150.4, 147.6, 137.1, 126.6, 123.2, 122.9, 121.9, 119.5, 56.6, 47.5, 32.6, 27.5, 27.5, 22.6; HRMS (EI-TOF) calc. for $C_{16}H_{20}N_2OS$ (M^+): 288.1296; Found: 288.1299.

***N*-(2-(Pyridin-2-yl)propan-2-yl)-3-(pyridin-4-yl)butanamide (3ao)**



The title compound **3ao** was prepared according to **GP2** with an additional treatment with 0.5 mL triethylamine for 5h before filtration. A purification by flash chromatography in petroleum ether : acetone = 1 : 2 gave **3ao** as a white solid (28.7 mg, 51%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.49-8.43 (m, 3H), 7.72 (brs, 1H), 7.66 (dt, *J* = 8.0, 1.6 Hz, 1H), 7.29 (d, *J* = 8.4 Hz, 1H), 7.19-7.13 (m, 3H), 3.38-3.28 (m, 1H), 2.54-2.43 (ABd, 2H), 1.67 (s, 3H), 1.60 (s, 3H), 1.31 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.0, 164.3, 155.2, 149.9, 147.6, 137.2, 122.6, 122.0, 119.5, 56.6, 45.7, 36.4, 27.5, 27.4, 20.9; HRMS (EI-TOF) calc. for $C_{17}H_{21}N_3O$ (M^+): 283.1685; Found: 283.1683.

Cleavage of Directing Group

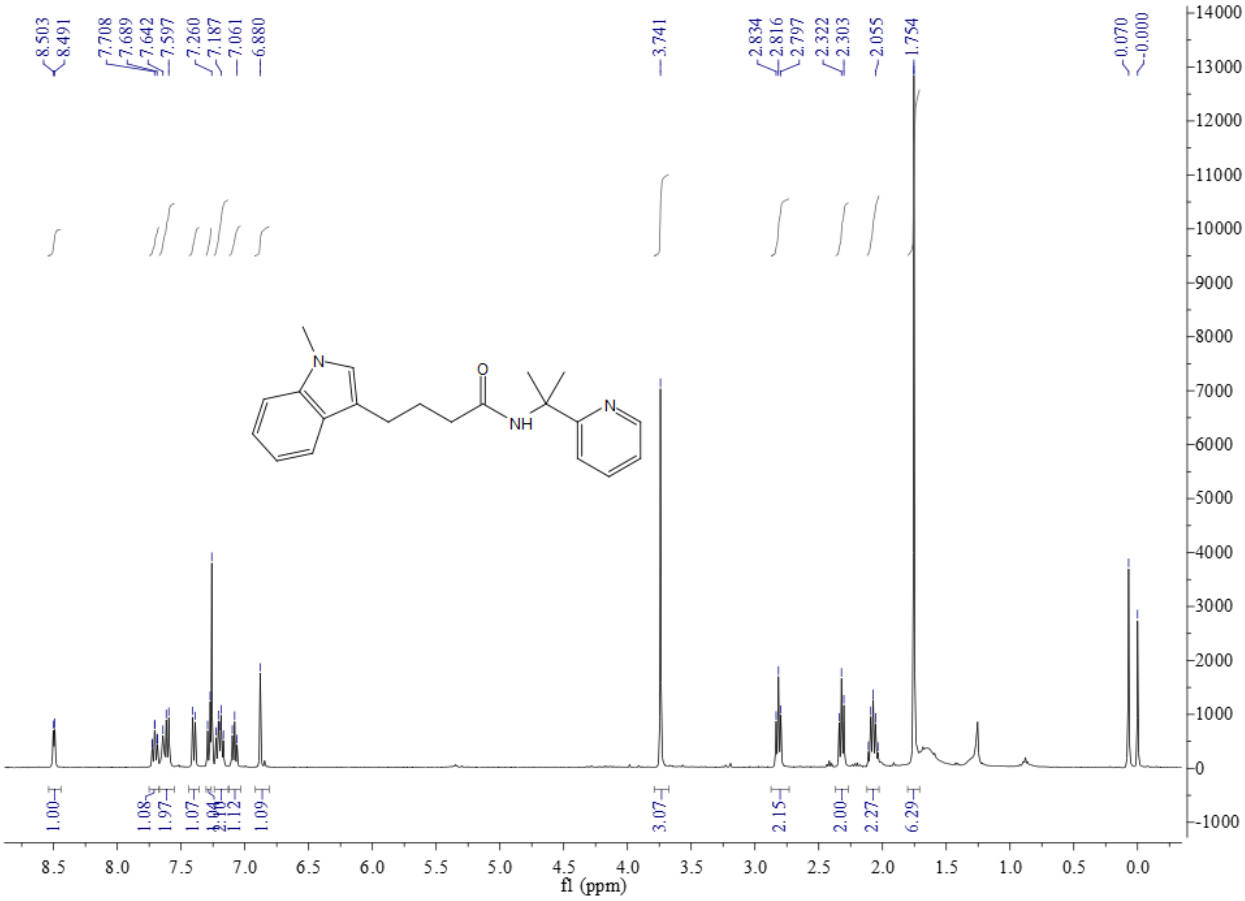


To a 25 mL round bottom flask equipped with a reflux condenser were added **3a** (38.5 mg, 0.12 mmol) and aq. HCl (6M, 10 mL). The tube was heated at 100°C for 48h. After cooling to room temperature, the reaction mixture was extracted with dichloromethane for 3 times. The combined organic phase was dried with $MgSO_4$, filtered and concentrated. The residue was purified by flash chromatography using dichloromethane : methanol = 10 : 1 as eluent and **4** was obtained as a white solid (16.0 mg, 66%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90 (d, J = 8.0 Hz, 2H), 7.32 (d, J = 8.4 Hz, 2H), 3.38-3.28 (m, 1H), 2.71-2.57 (m, 5H), 1.33 (d, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 198.0, 177.3, 151.2, 135.8, 128.9, 127.2, 42.1, 36.3, 26.7, 21.9; HRMS (ESI-TOF) calc. for $C_{12}H_{14}O_3$ (M^+): 206.0943; Found: 206.0948.

References

[1] K. M. Yager, E. A. Plaza, D. V. Kumar and I. C. Kim, US Pat., 20080207573 A1.

[2] F-J. Chen, S. Zhao, F. Hu, K. Chen, Q. Zhang, S-Q. Zhang and B-F. Shi, *Chem. Sci.*, 2013, **4**, 4187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7.187
7.061
6.880
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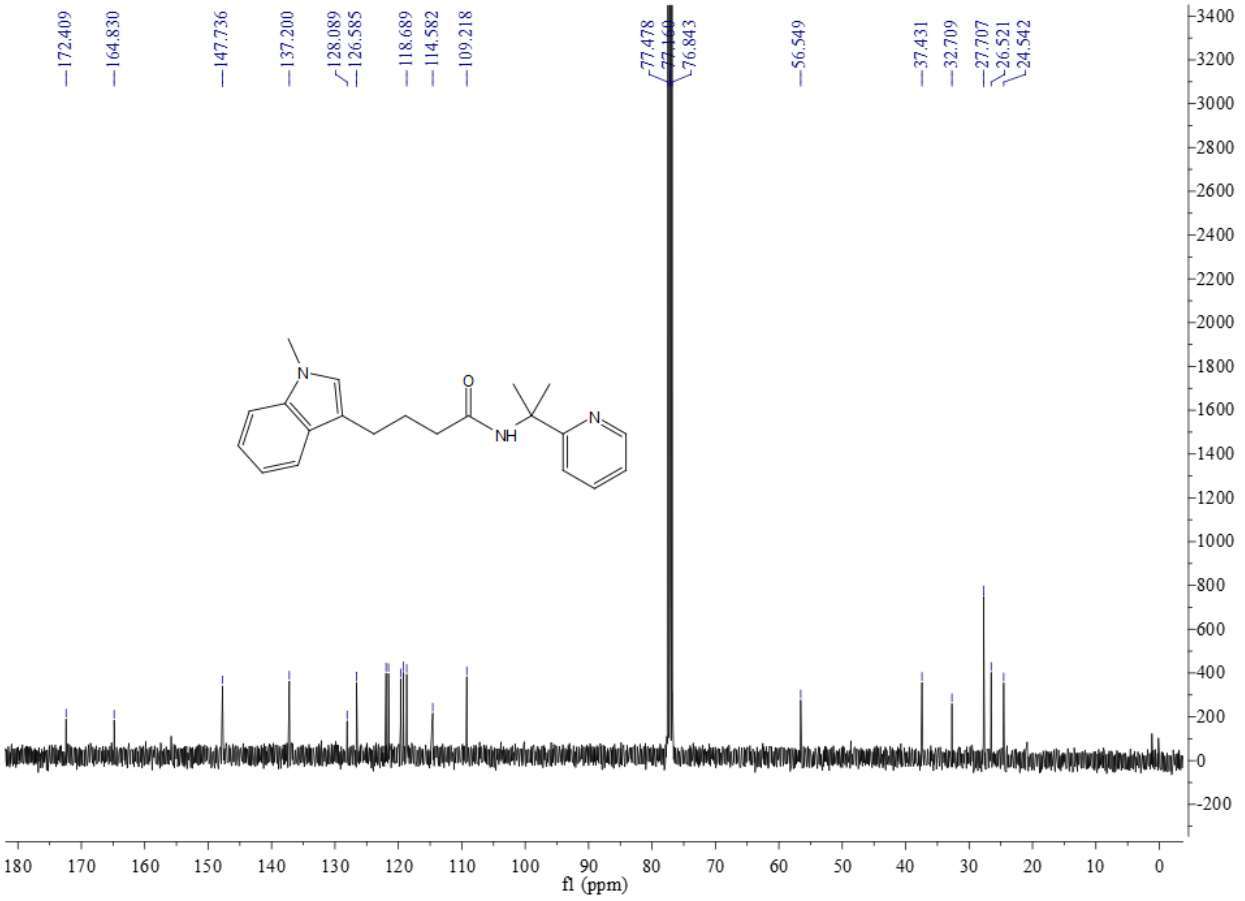
2.816
2.797
2.322
2.303
2.055
1.754
0.070
0.000
1.00
1.08
1.97
1.07
1.04
1.12
1.09
3.07
2.15
2.00
2.27
6.29
O
NH
N
f1 (ppm)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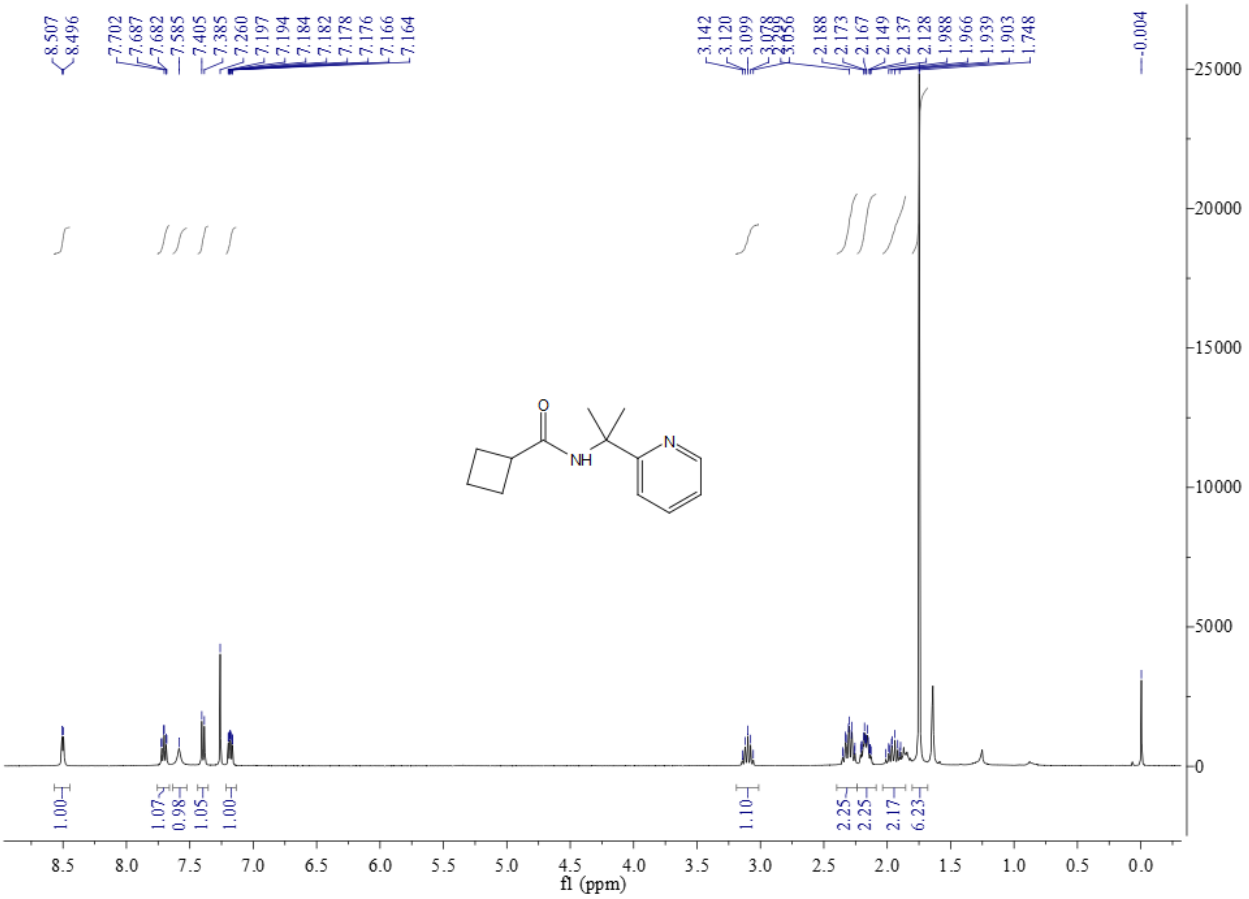
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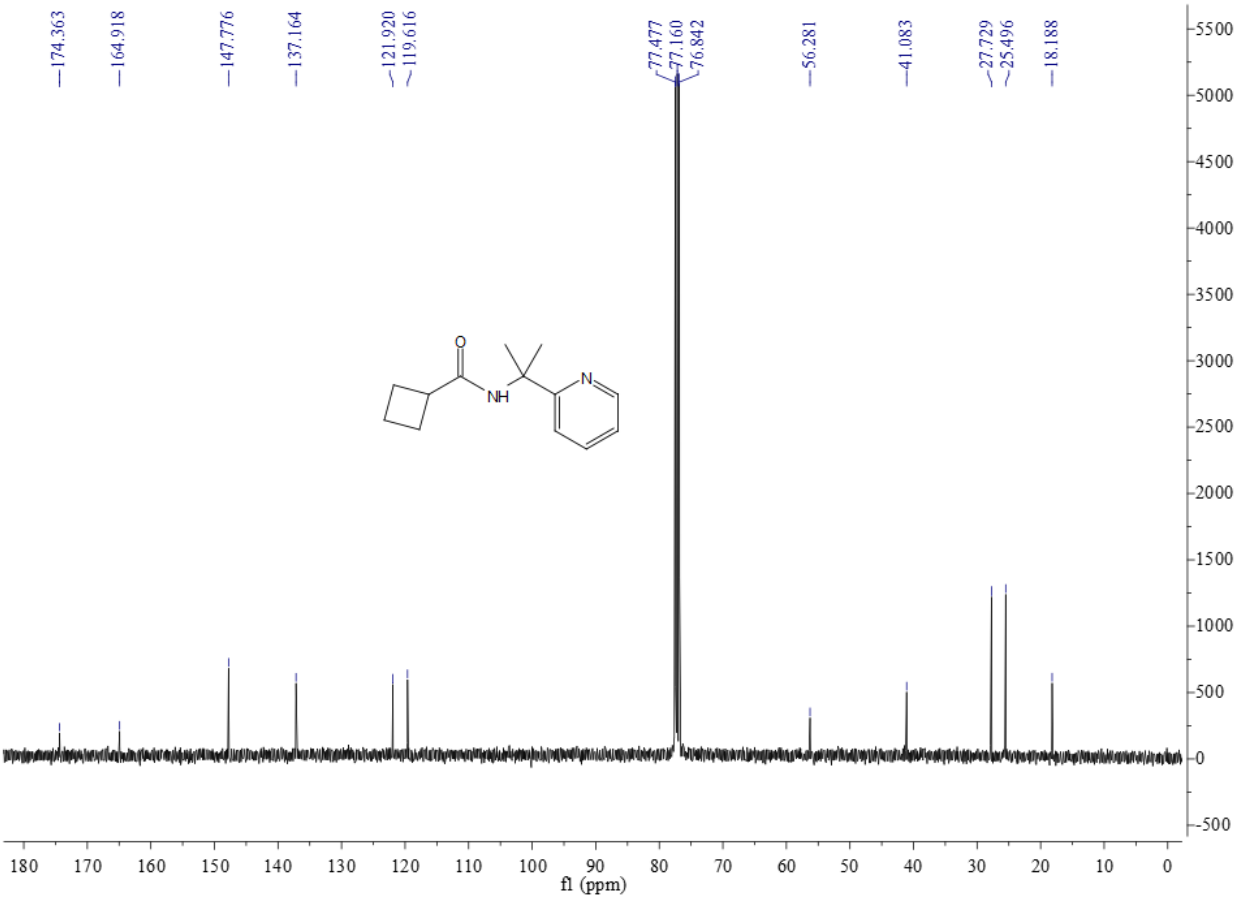
6.23
f1 (ppm)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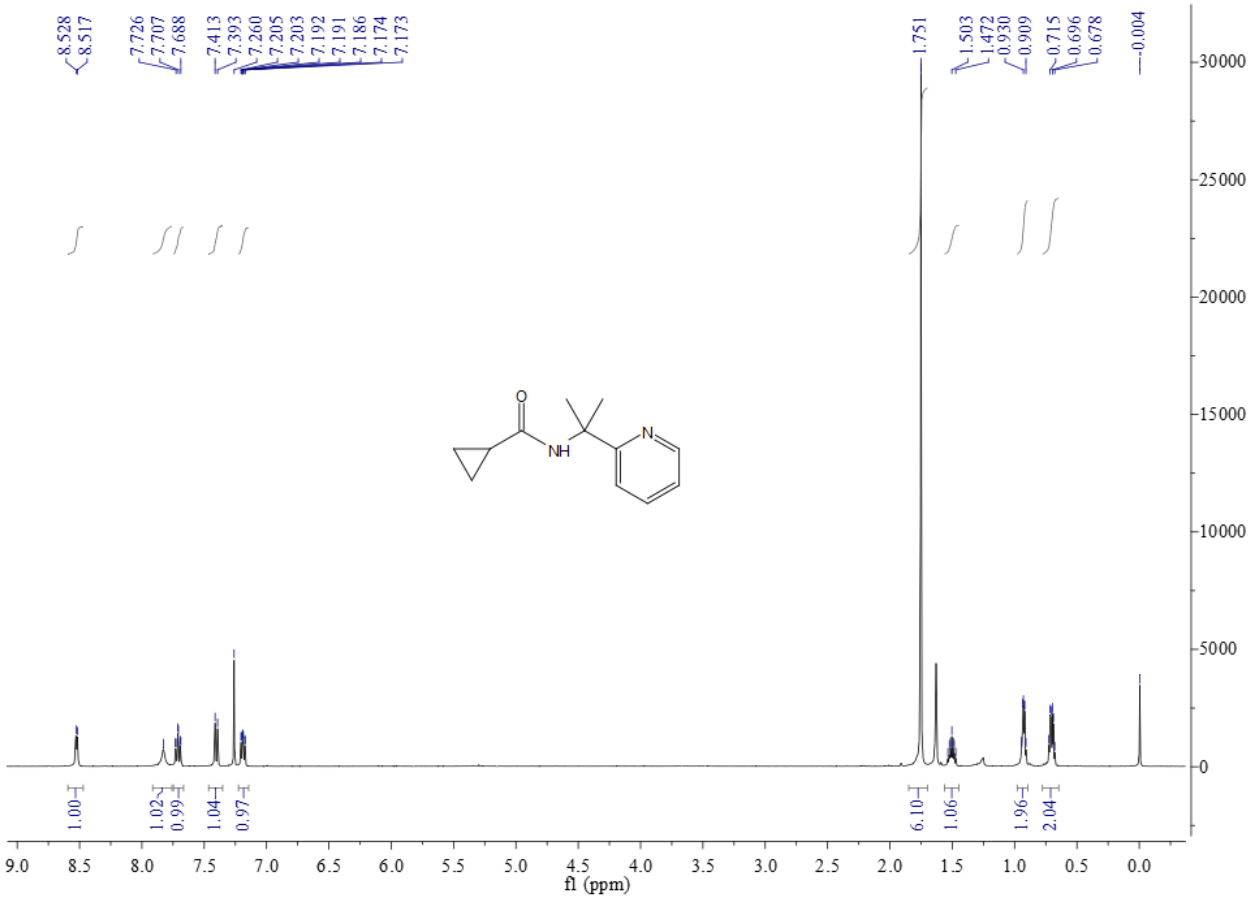
164.918
147.776
137.164
121.920
119.616
77.477
77.160
76.842
56.281
41.083
27.729
25.496
18.188
O
NH
N
f1 (ppm)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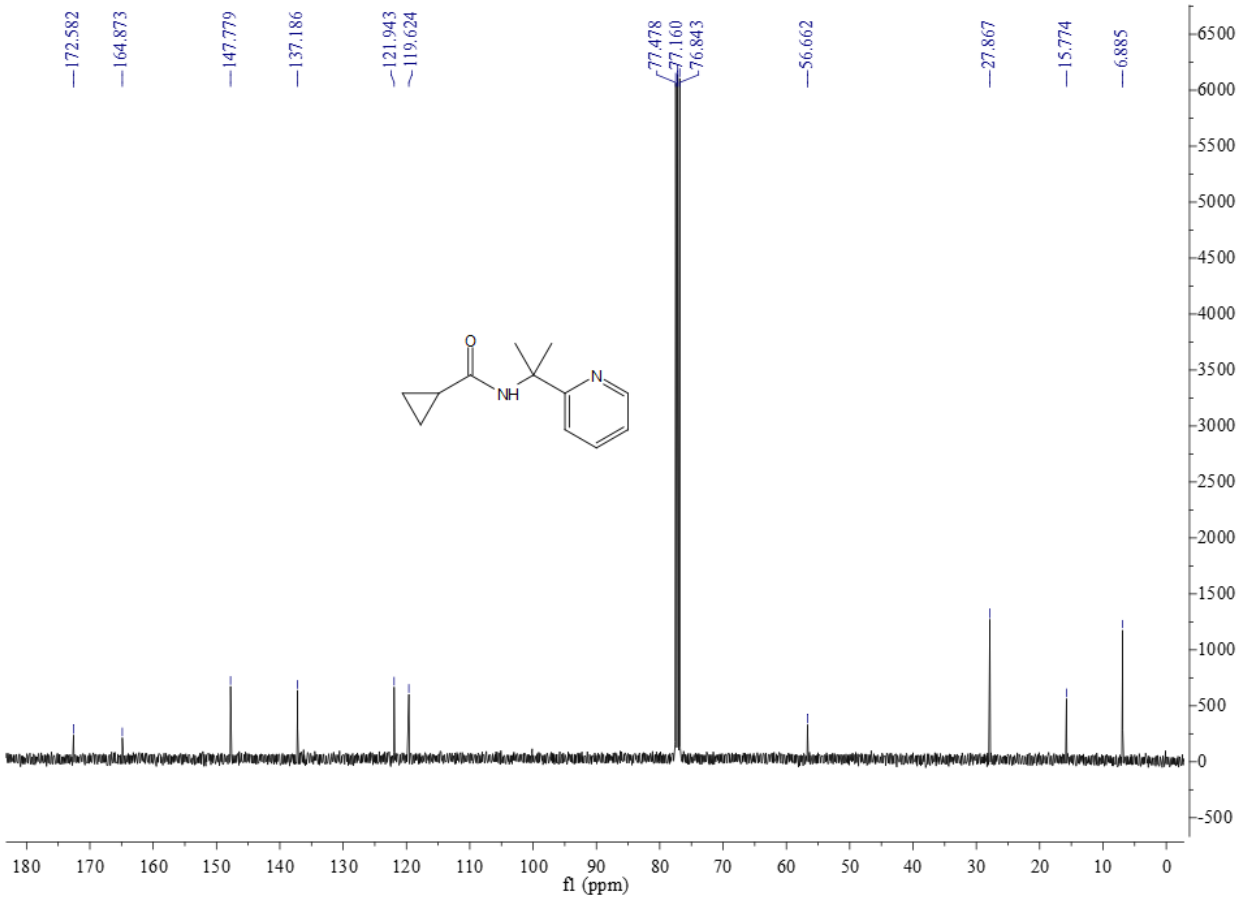
8.517
7.726
7.707
7.688
7.413
7.393
7.260
7.205
7.203
7.192
7.191
7.186
7.174
7.173
1.751
1.503
1.472
0.930
0.909
0.715
0.696
0.678
-0.004
1.00
1.02
0.99
1.04
0.97
6.10
1.06
1.96
2.04
O
NH
N
f1 (ppm)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147.779
137.186
121.943
119.624
77.478
77.160
76.843
56.662
27.867
15.774
6.885
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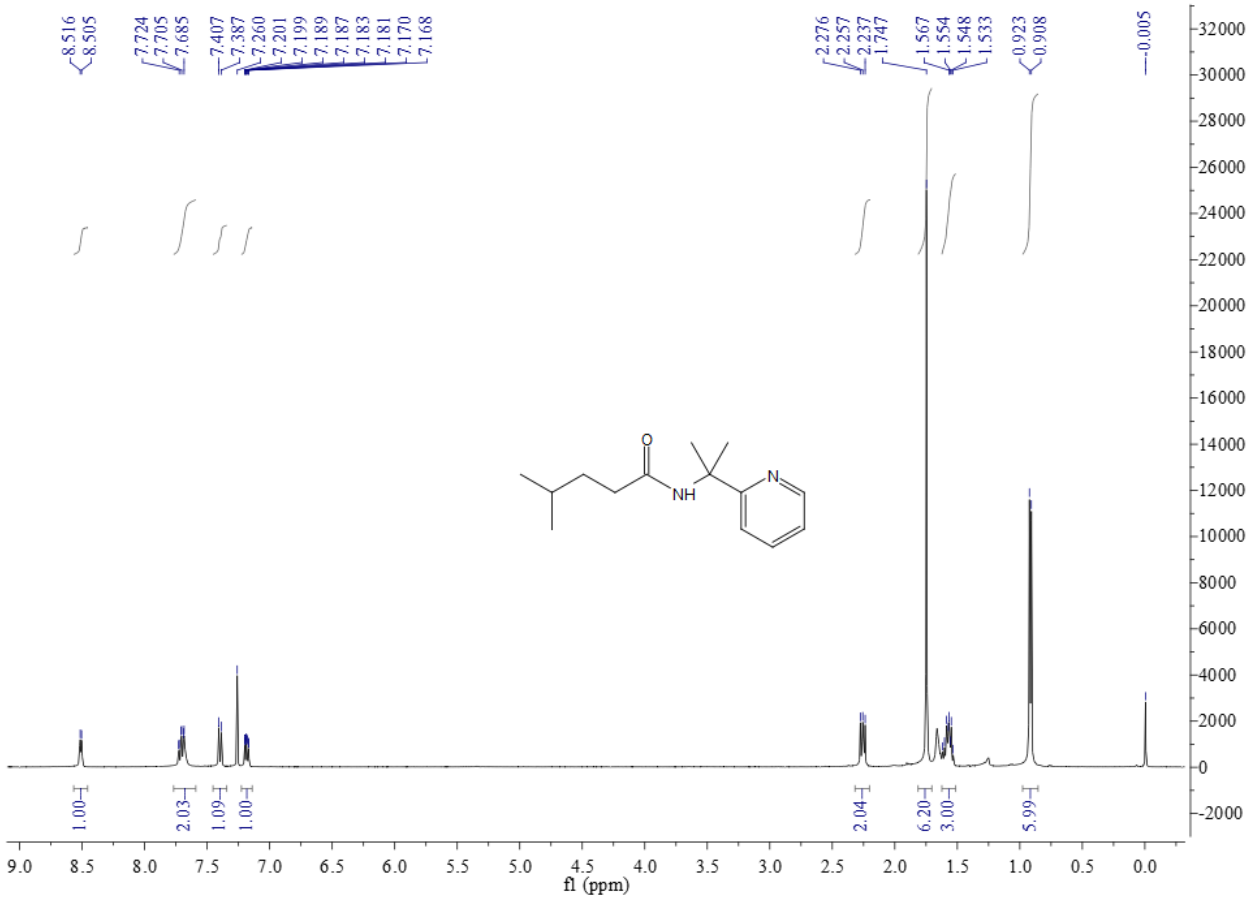
NH
N
f1 (ppm)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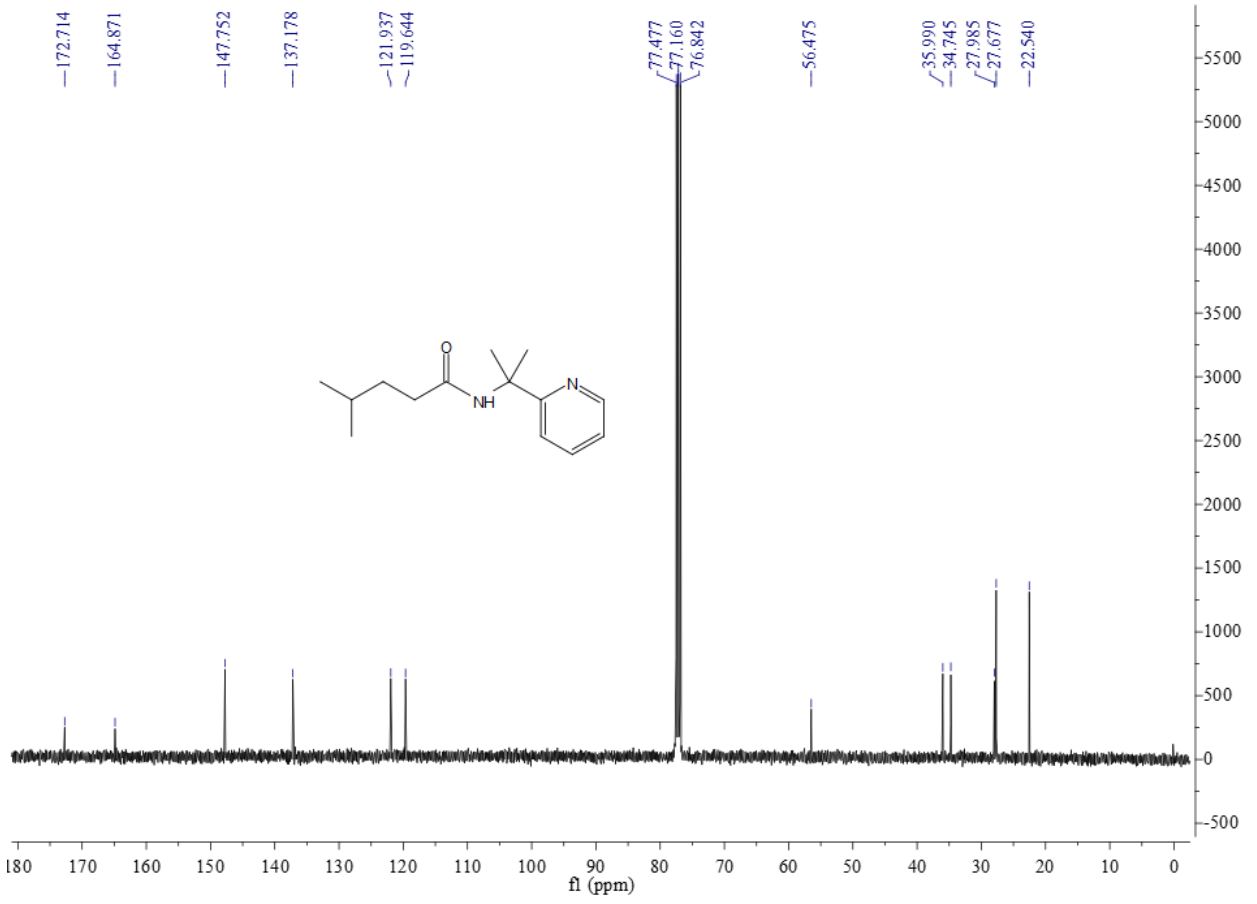
7.724
7.705
7.685
7.407
7.387
7.260
7.201
7.199
7.189
7.187
7.183
7.181
7.170
7.168
2.276
2.257
2.237
1.747
1.567
1.554
1.548
1.533
0.923
0.908
-0.005
1.00
2.03
1.09
1.00
2.04
6.20
3.00
5.99
O
NH
N
fl (ppm)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137.178
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119.644
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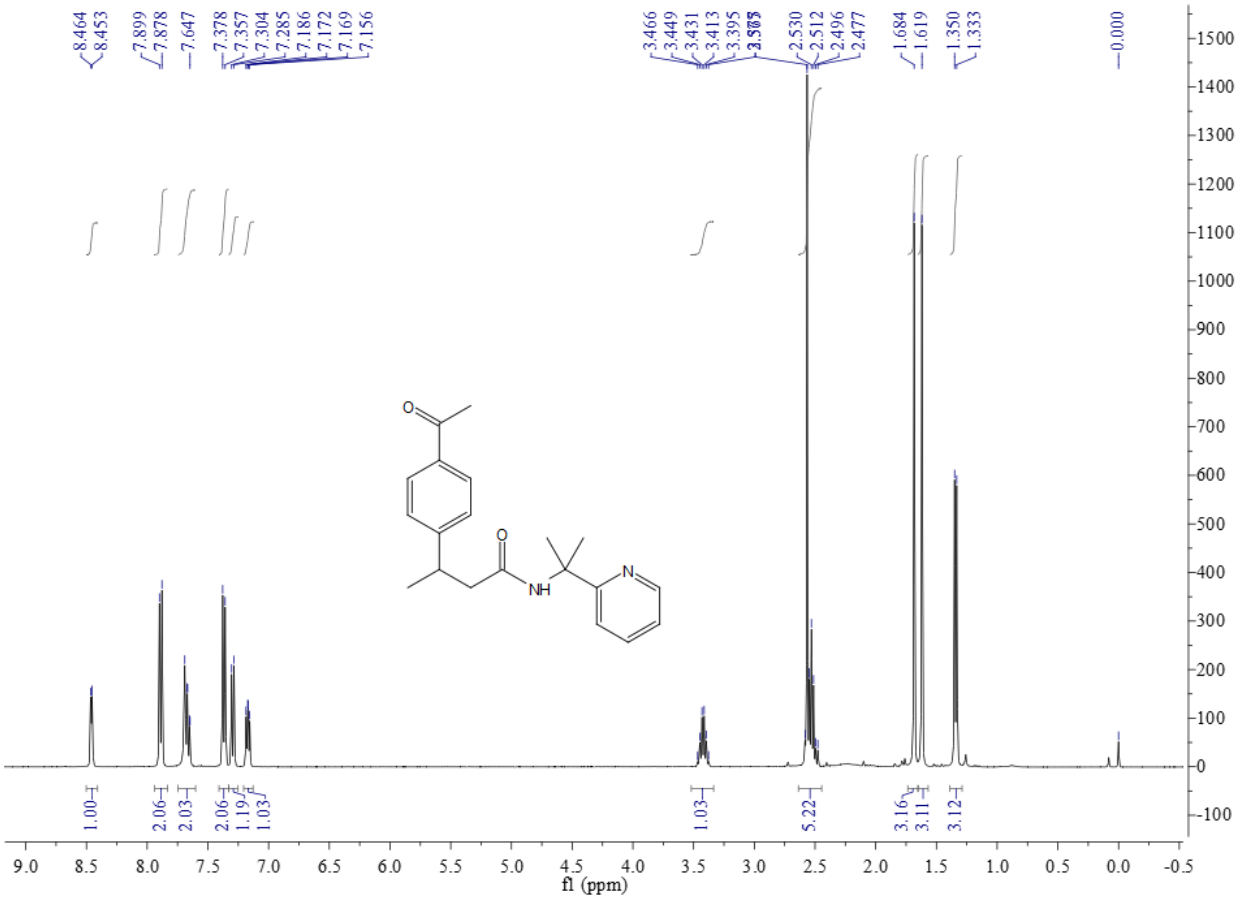
77.160
76.842
56.475
35.990
34.745
27.985
27.677
22.540
O
NH
N
fl (ppm)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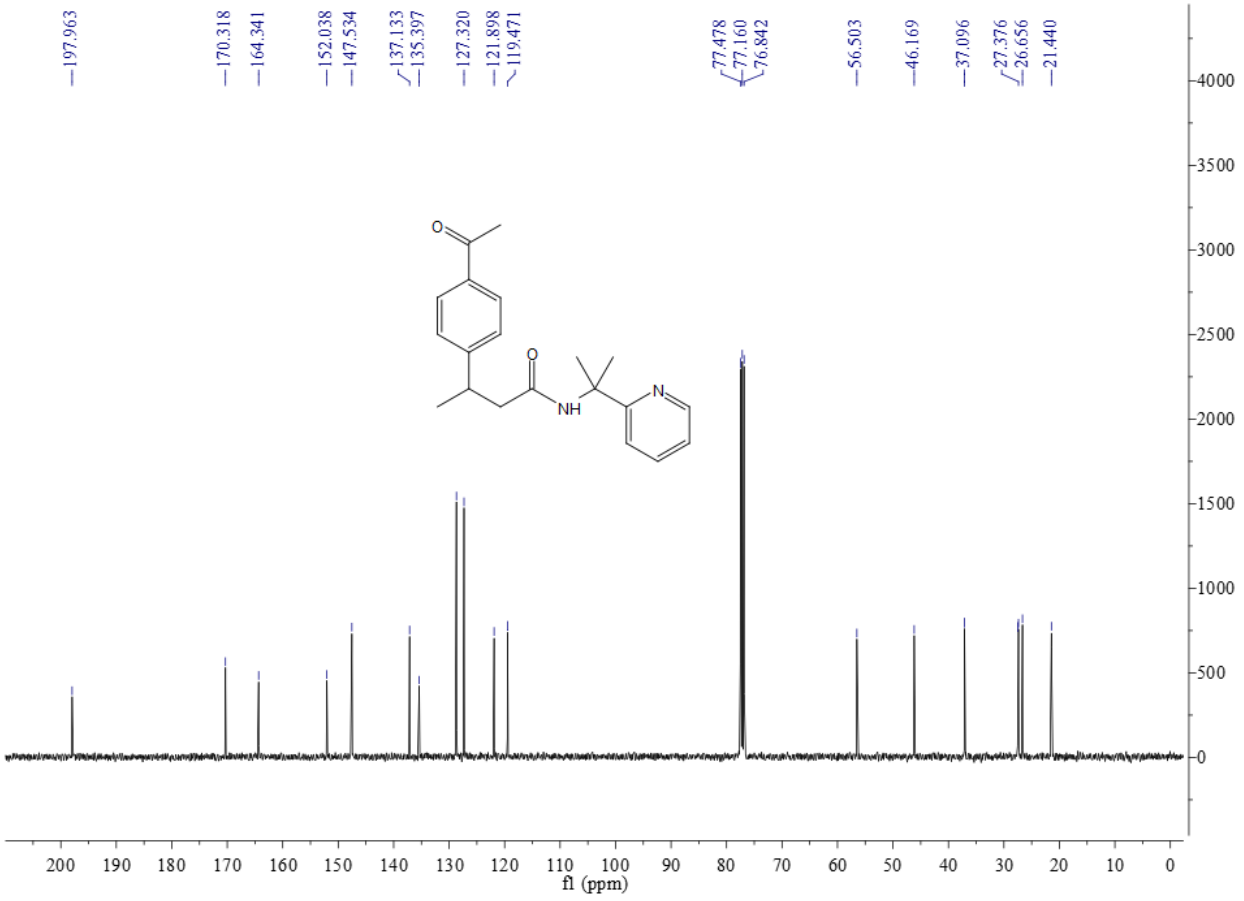
8.453
7.899
7.878
7.647
7.378
7.357
7.304
7.285
7.186
7.172
7.169
7.156
3.466
3.449
3.431
3.413
3.395
2.530
2.512
2.496
2.477
1.684
1.619
1.350
1.333
0.000
1.00
2.06
2.03
2.06
1.19
1.03
1.03
5.22
3.16
3.11
3.12
O
O
NH
N
f1 (ppm)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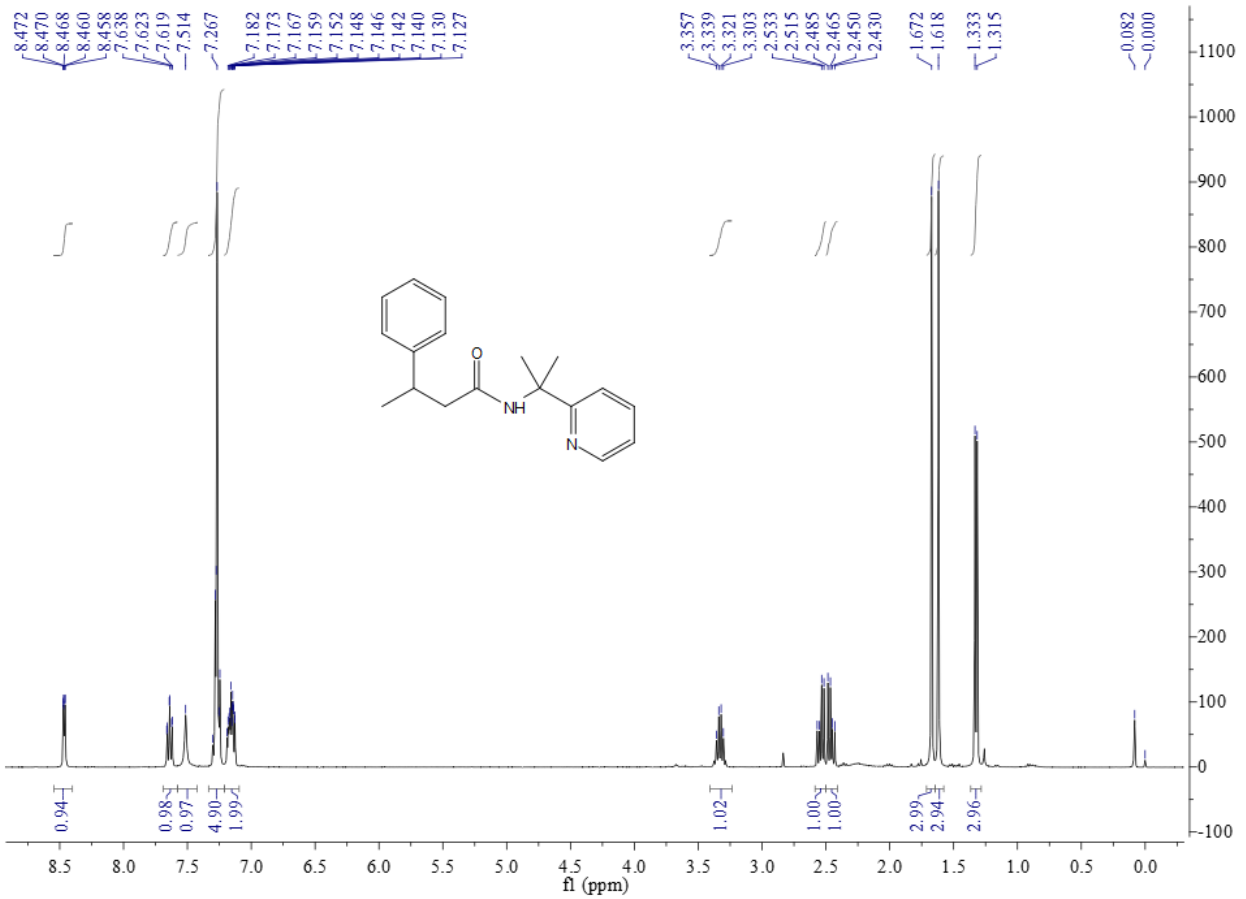
137.133
135.397
127.320
121.898
119.471
77.478
77.160
76.842
56.503
46.169
37.096
27.376
26.656
21.440
O
O
NH
N
f1 (ppm)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8.470
8.468
8.460
8.458
7.638
7.623
7.619
7.514
7.267
7.182
7.173
7.167
7.159
7.152
7.148
7.146
7.142
7.140
7.130
7.127
3.357
3.339
3.321
3.303
2.533
2.515
2.485
2.465
2.450
2.430
1.672
1.618
1.333
1.315
0.082
0.000
O
NH
N
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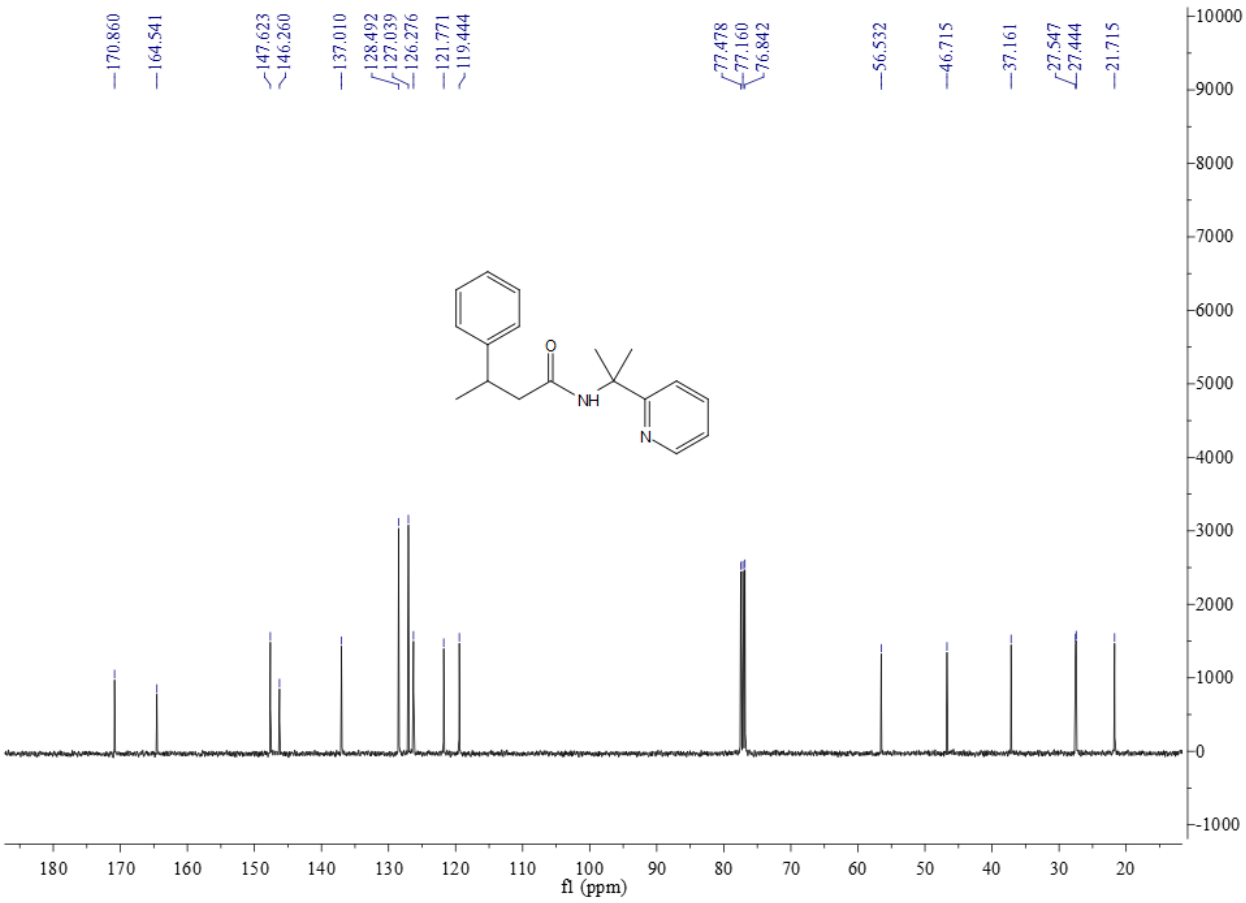
0.98
0.97
4.90
1.99
1.02
1.00
1.00
2.99
2.94
2.96
fl (ppm)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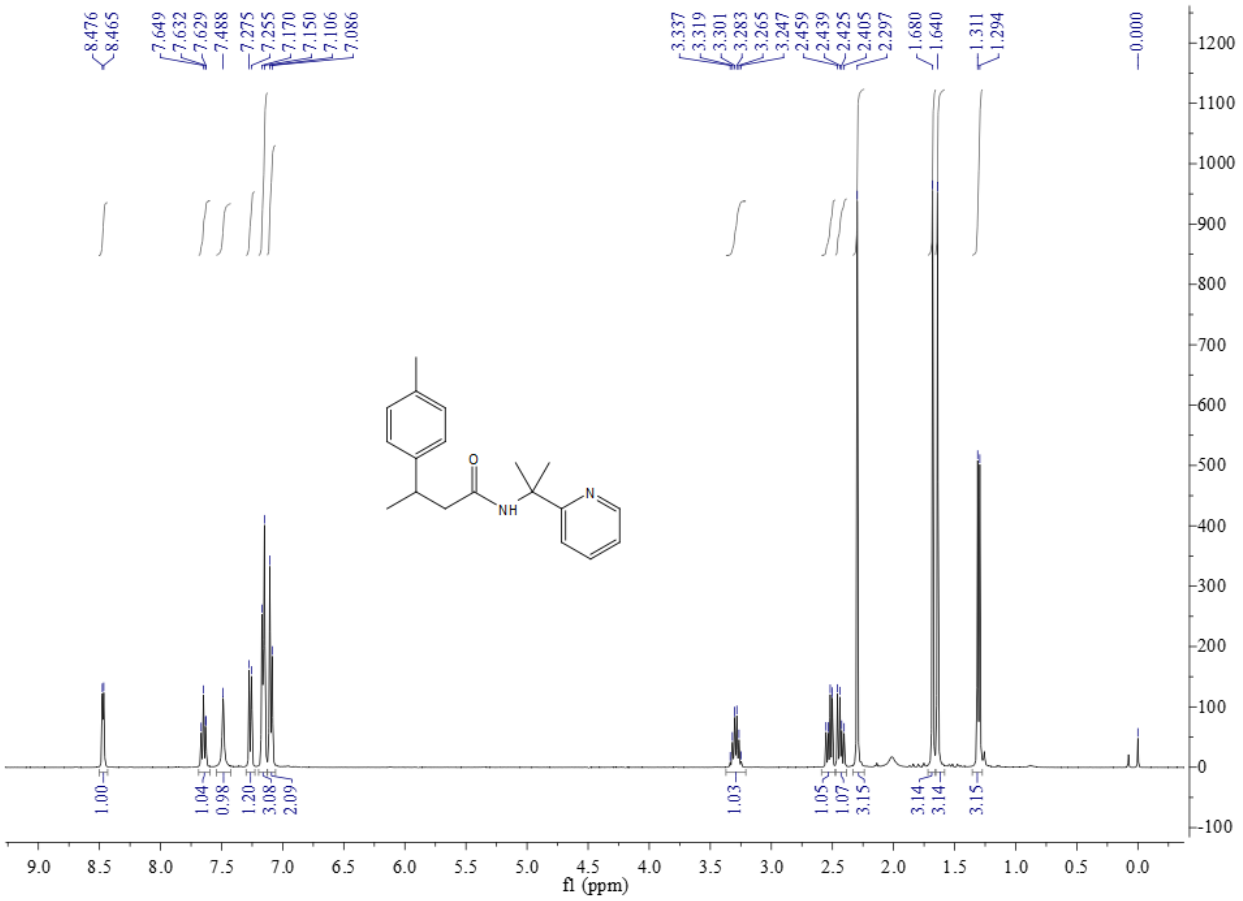
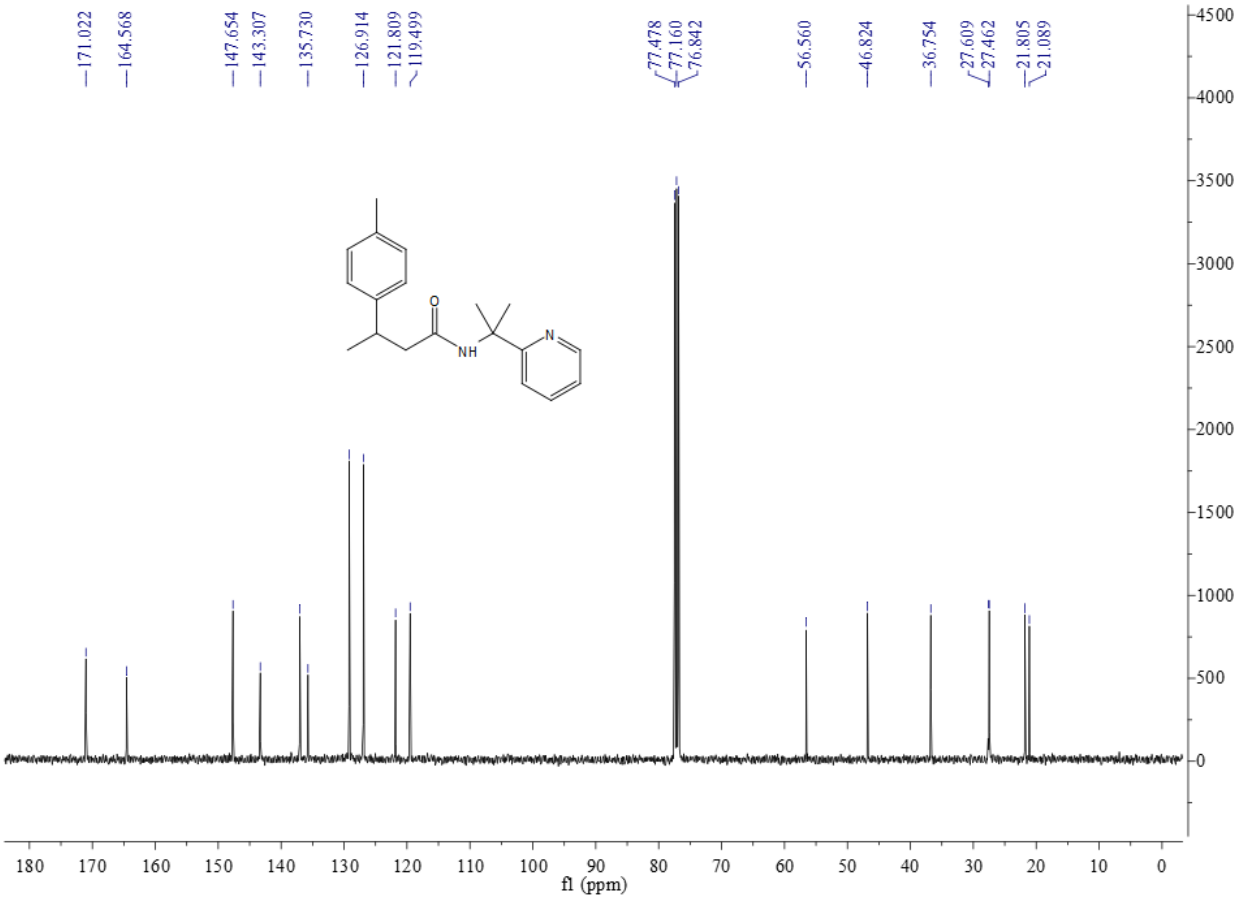
164.541
147.623
146.260
137.010
128.492
127.039
126.276
121.771
119.444
77.478
77.160
76.842
56.532
46.715
37.161
27.547
27.444
21.715
O
NH
N
fl (ppm)


8.476
8.465
7.649
7.632
7.629
7.488
7.275
7.255
7.170
7.150
7.106
7.086
3.337
3.319
3.301
3.283
3.265
3.247
2.459
2.439
2.425
2.405
2.297
1.680
1.640
1.311
1.294
0.000
1.00
1.04
0.98
1.20
3.08
2.09
1.03
1.05
1.07
3.15
3.14
3.14
3.15
O
NH
N
f1 (ppm)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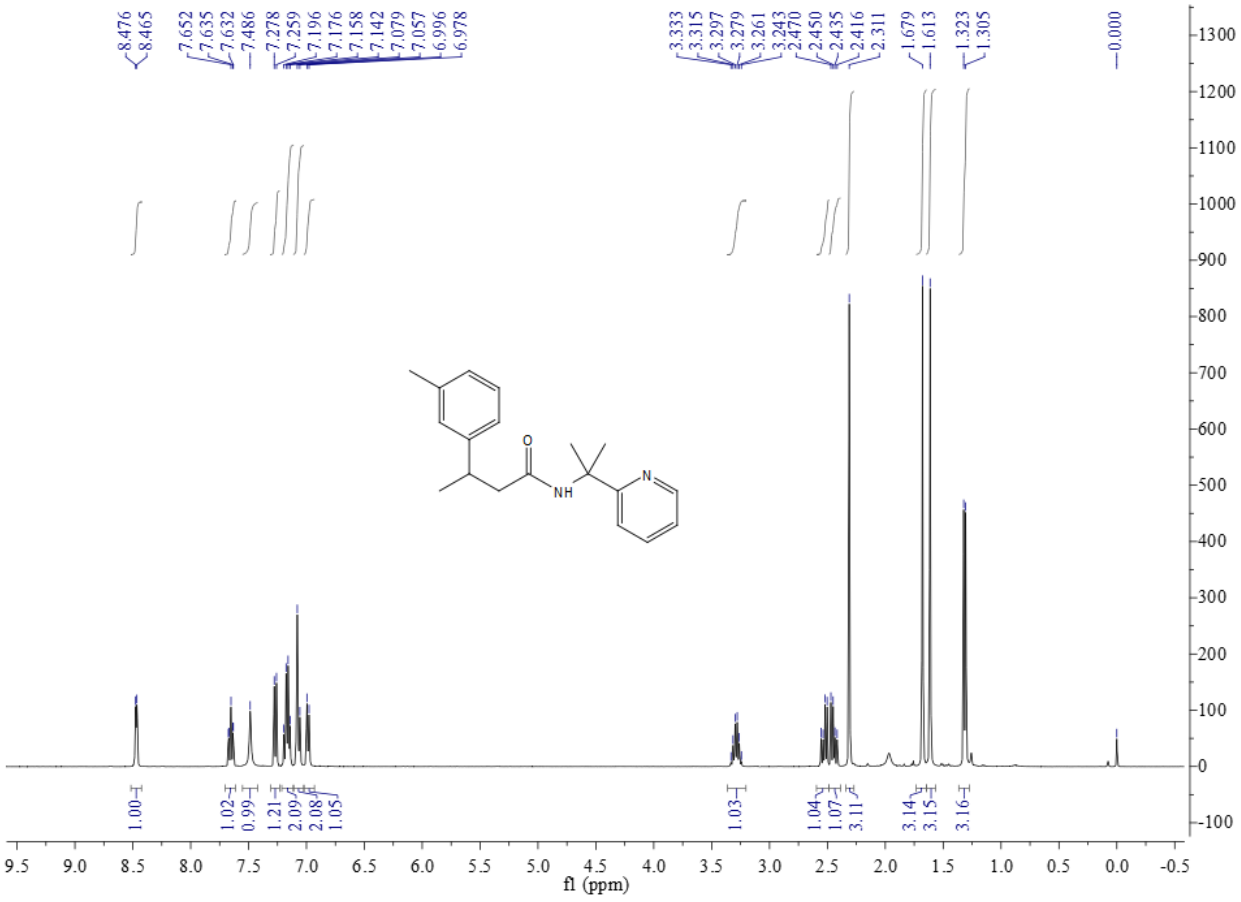
147.654
143.307
135.730
126.914
121.809
119.499
77.478
77.160
76.842
56.560
46.824
36.754
27.609
27.462
21.805
21.089
O
NH
N
f1 (ppm)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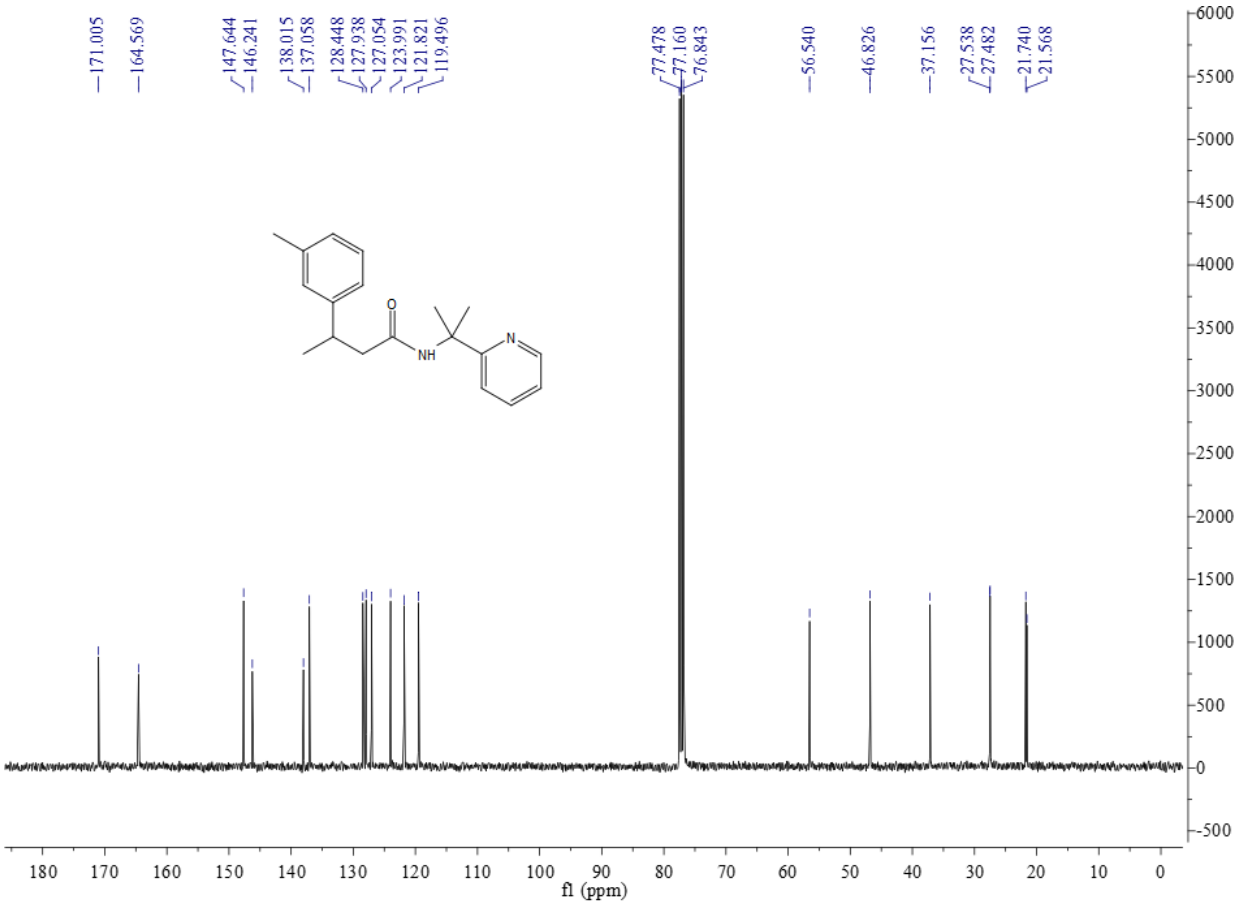
8.465
7.652
7.635
7.632
7.486
7.278
7.259
7.196
7.176
7.158
7.142
7.079
7.057
6.996
6.978
3.333
3.315
3.297
3.279
3.261
3.243
2.470
2.450
2.435
2.416
2.311
1.679
1.613
1.323
1.305
0.000
1.00
1.02
0.99
1.21
2.09
2.08
1.05
1.03
1.04
1.07
3.11
3.14
3.15
3.16
O
NH
N
f1 (ppm)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147.644
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127.938
127.054
123.991
121.821
119.496
77.478
77.160
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46.826
37.156
27.538
27.482
21.740
21.568
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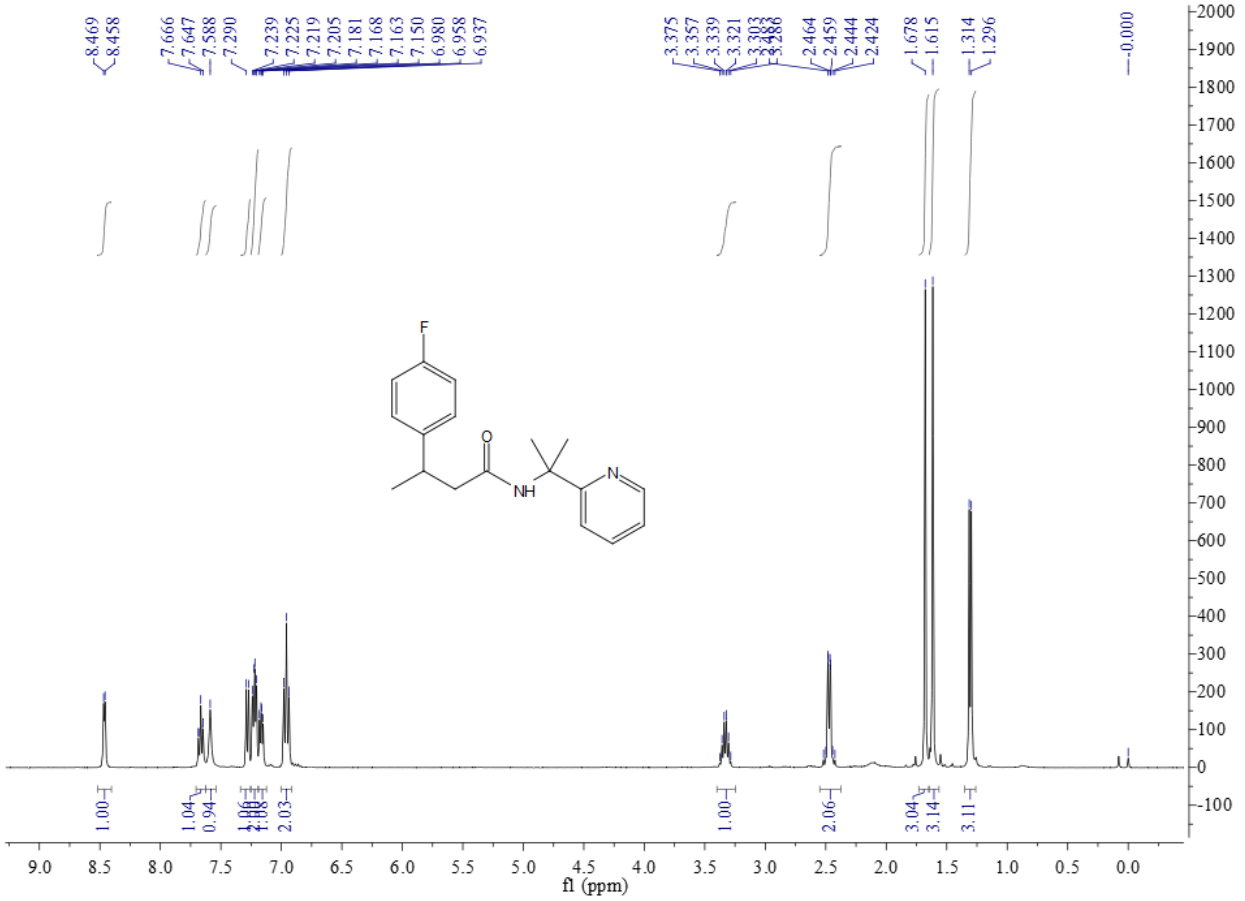
NH
N
f1 (ppm)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7.666
7.647
7.588
7.290
7.239
7.225
7.219
7.205
7.181
7.168
7.163
7.150
6.980
6.958
6.937
3.375
3.357
3.339
3.321
2.464
2.459
2.444
2.424
1.678
1.615
1.314
1.296
-0.000
F
O
NH
N
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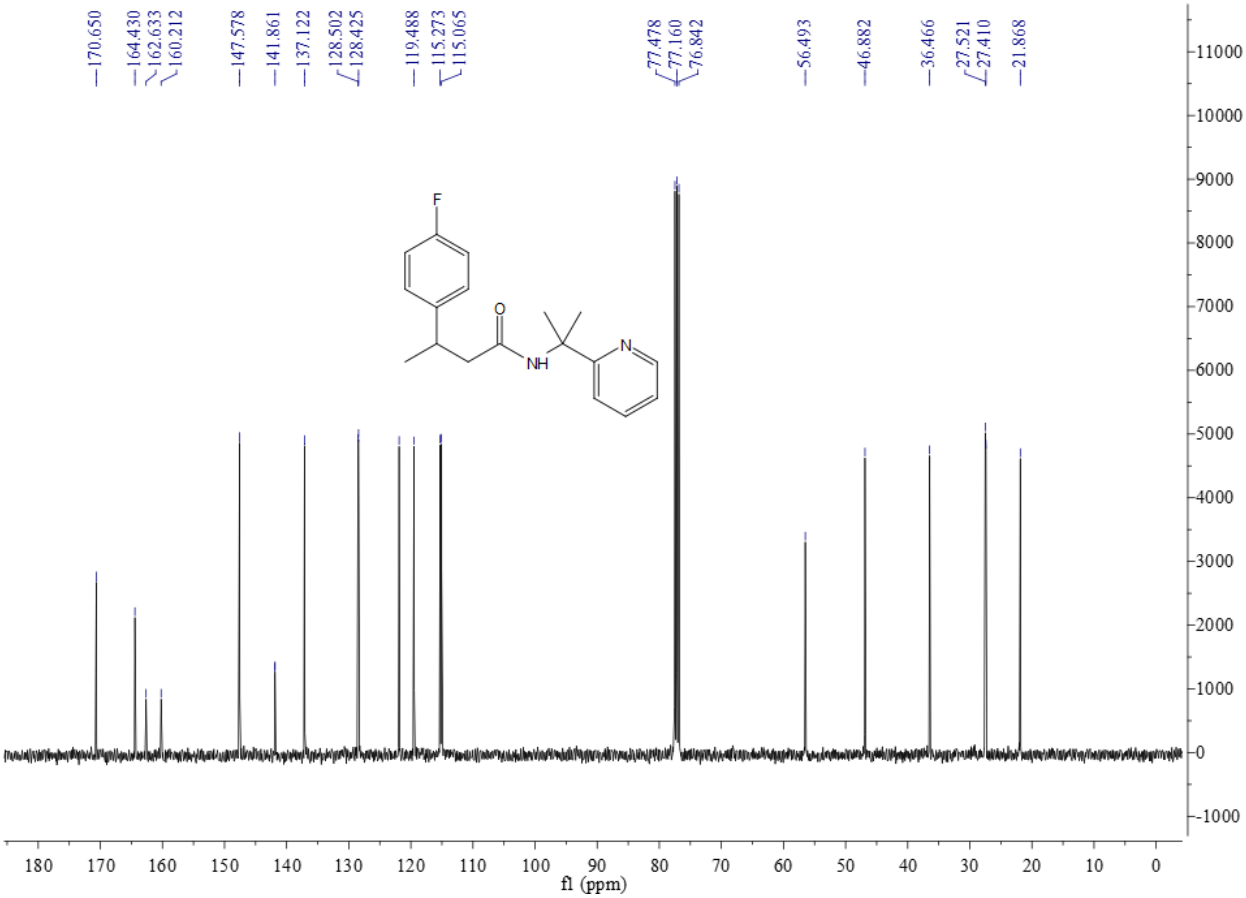
1.04
0.94
2.03
1.00
2.06
3.04
3.14
3.11
f1 (ppm)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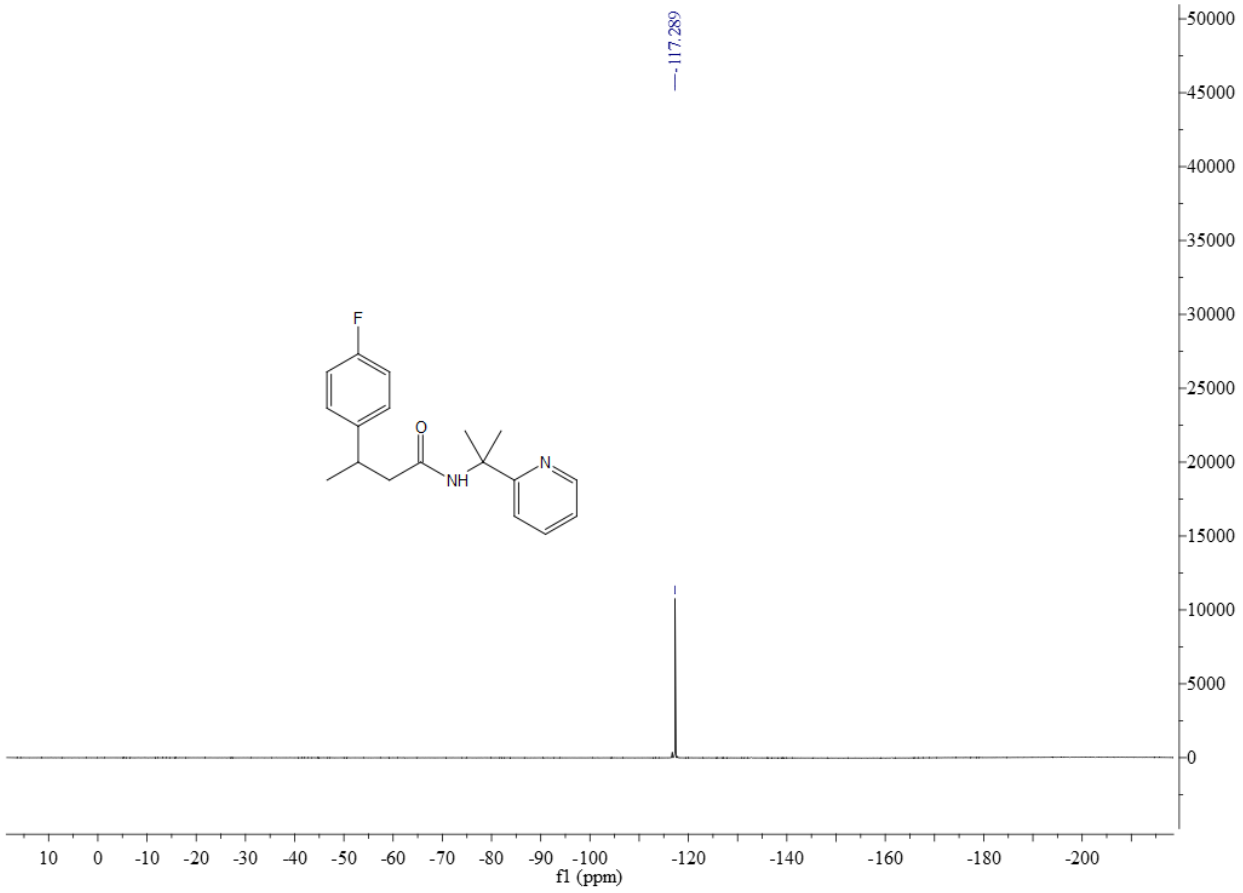
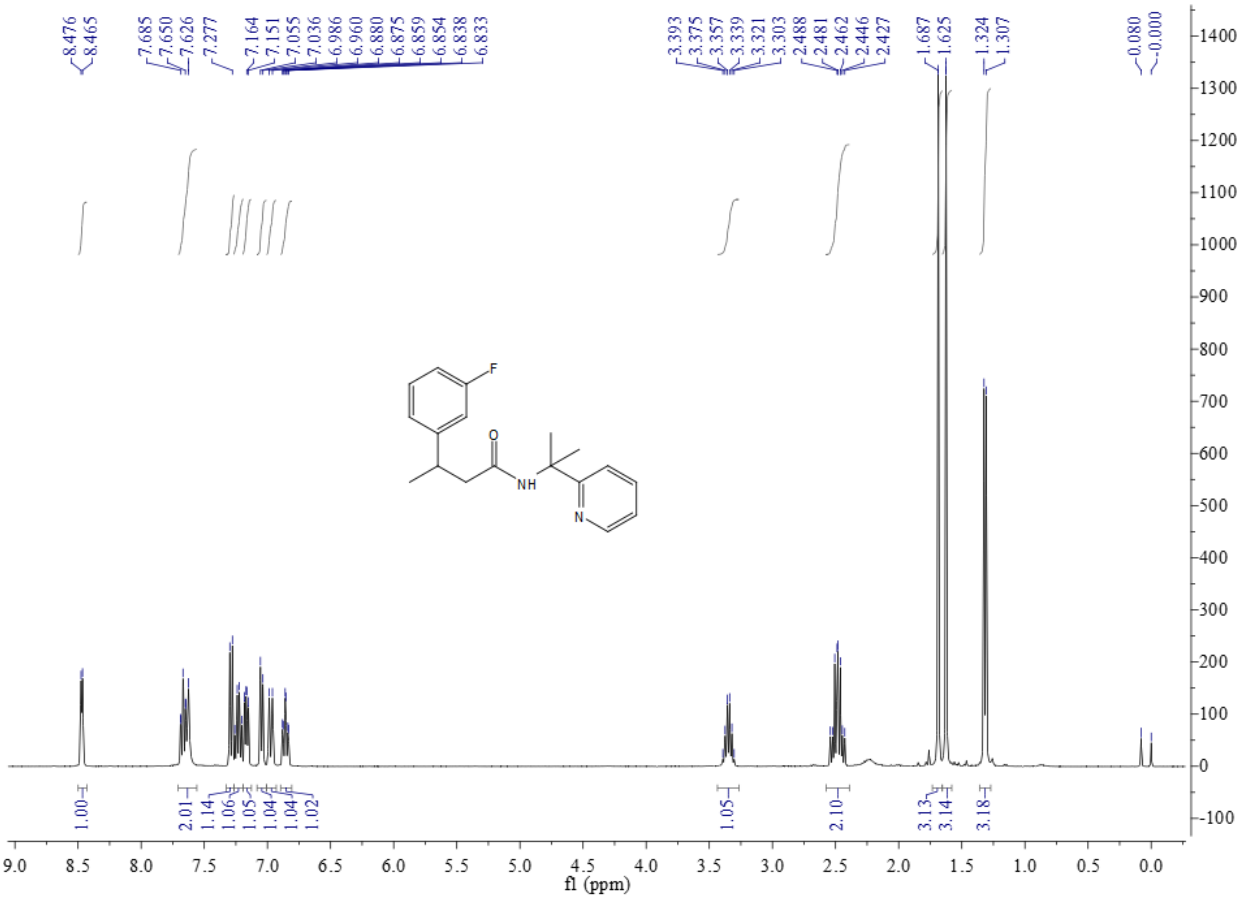
160.212
147.578
141.861
137.122
128.502
128.425
119.488
115.273
115.065
77.478
77.160
76.842
56.493
46.882
36.466
27.521
27.410
21.868
F
O
NH
N
f1 (ppm)


-117.289
F
O
NH
N
f1 (ppm)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7.626
7.277
7.164
7.151
7.055
7.036
6.986
6.960
6.880
6.875
6.859
6.854
6.838
6.833
3.393
3.375
3.357
3.339
3.321
3.303
2.488
2.481
2.462
2.446
2.427
1.687
1.625
1.324
1.307
0.080
-0.000
1.00
2.01
1.14
1.06
1.05
1.04
1.04
1.02
1.05
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3.14
3.18
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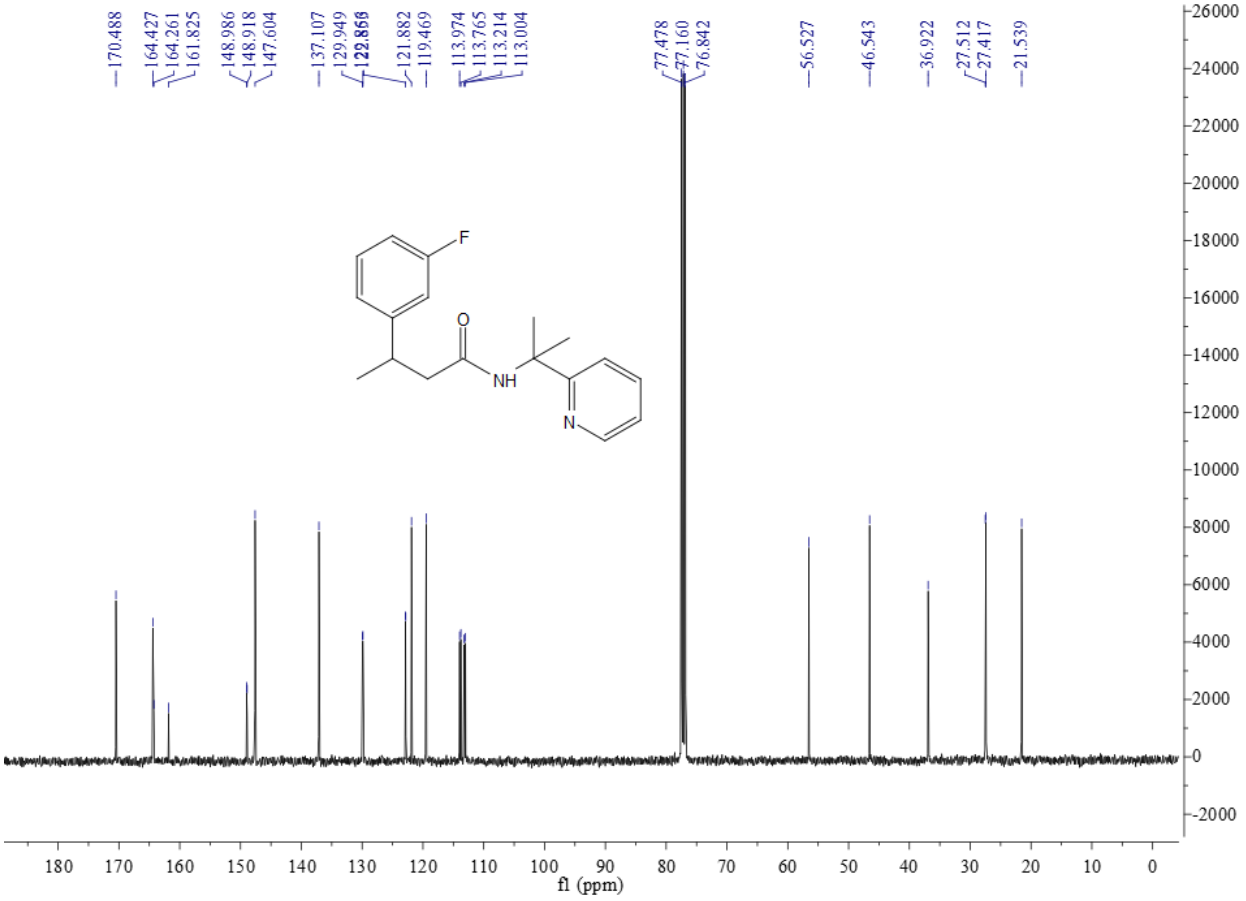
O
NH
N
f1 (ppm)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137.107
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122.868
121.882
119.469
113.974
113.765
113.214
113.004
77.478
77.160
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56.527
46.543
36.922
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27.417
21.539
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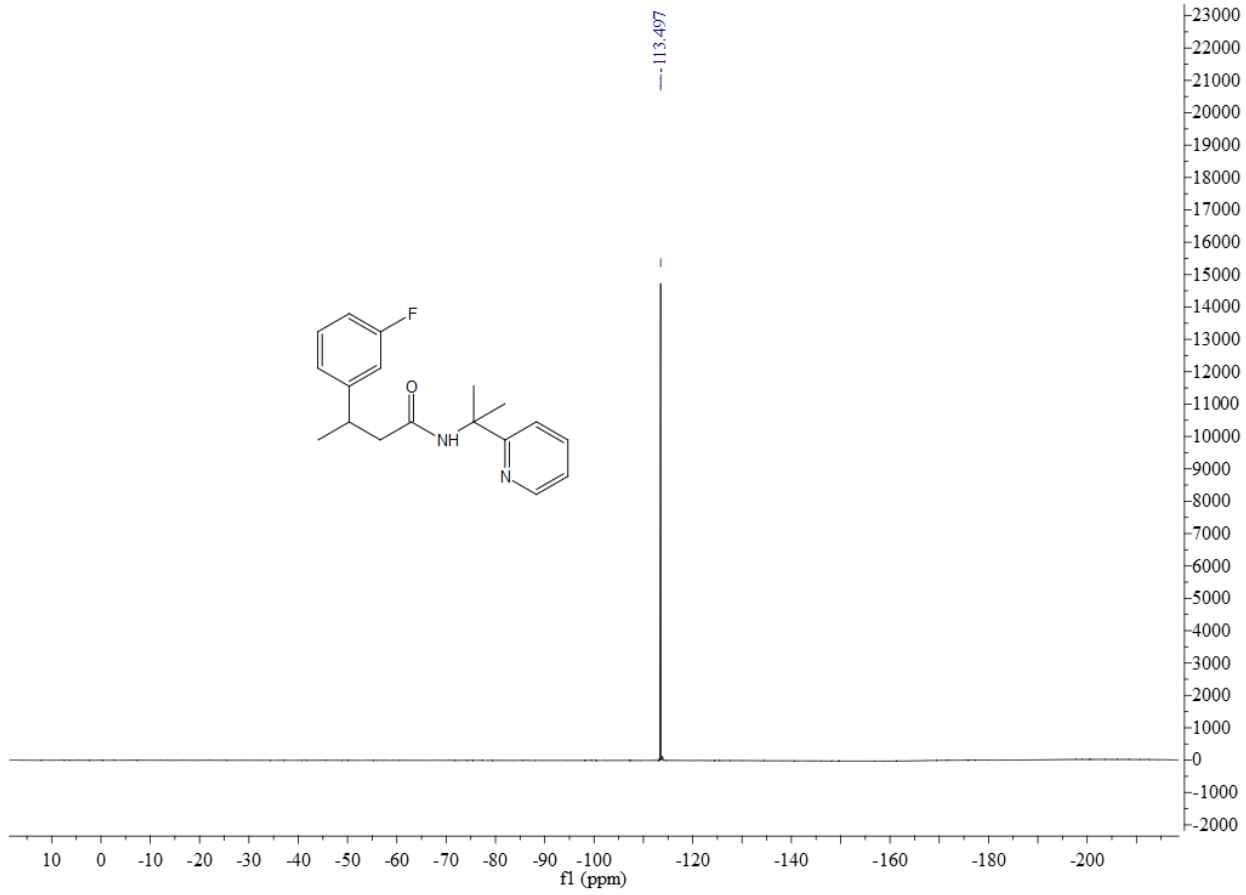
O
NH
N
fl (ppm)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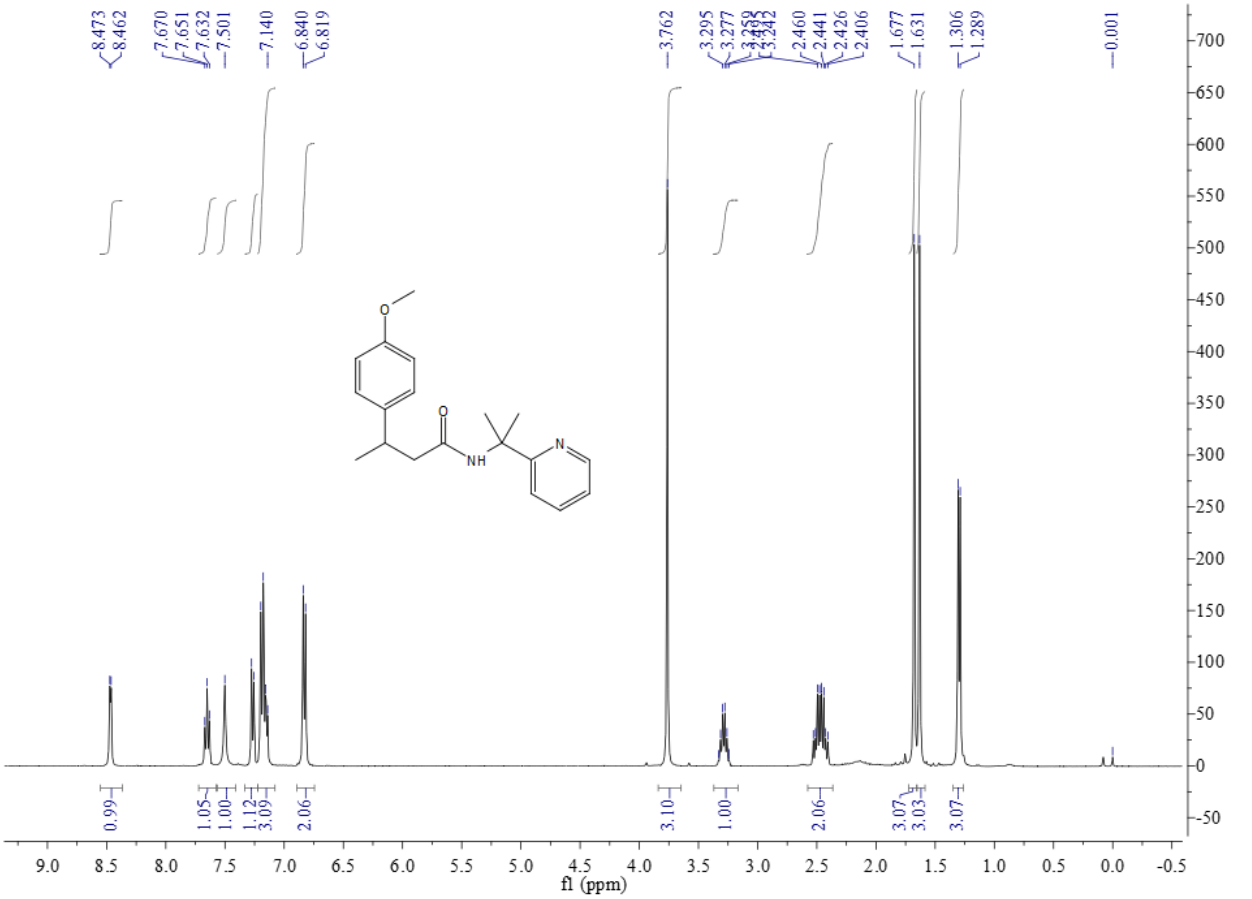
NH
N
fl (ppm)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6.840
6.819
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3.295
3.277
2.460
2.441
2.426
2.406
1.677
1.631
1.306
1.289
0.001
O
NH
N
0.99
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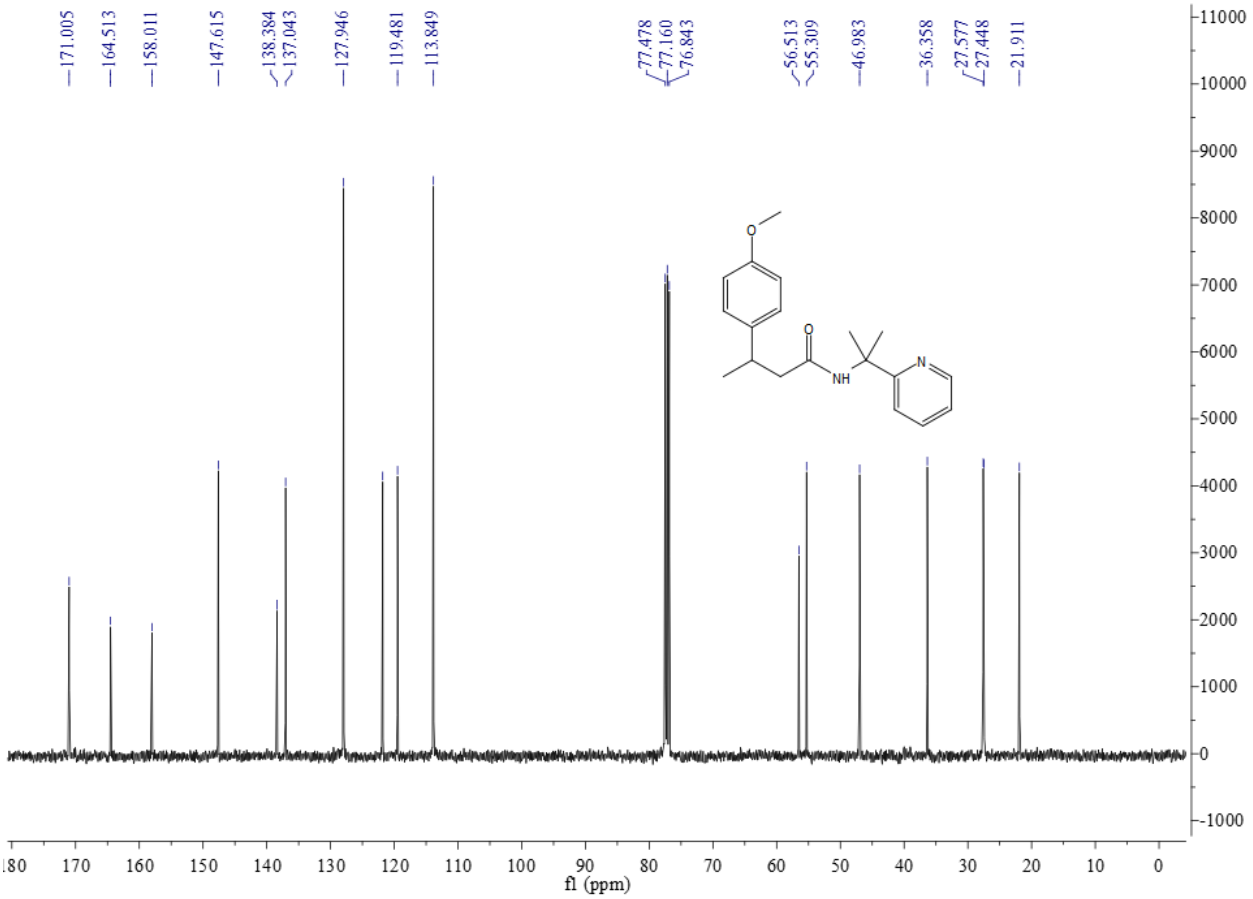
1.00
1.12
3.09
2.06
3.10
1.00
2.06
3.07
3.03
3.07
fl (ppm)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119.481
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27.448
21.911
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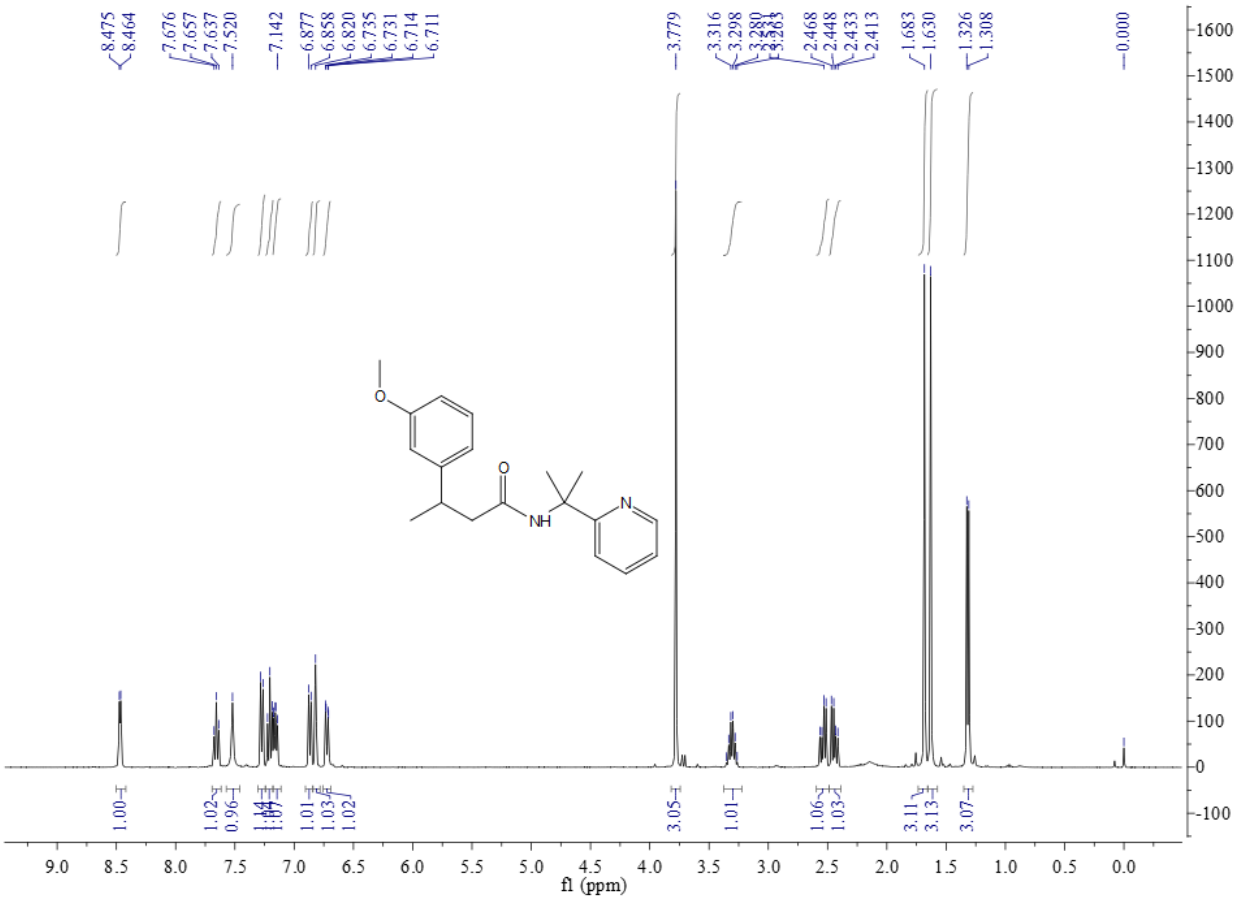
NH
N
fl (ppm)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6.735
6.731
6.714
6.711
3.779
3.316
3.298
3.280
2.468
2.448
2.433
2.413
1.683
1.630
1.326
1.308
0.000
O
NH
N
1.00
1.02
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1.02
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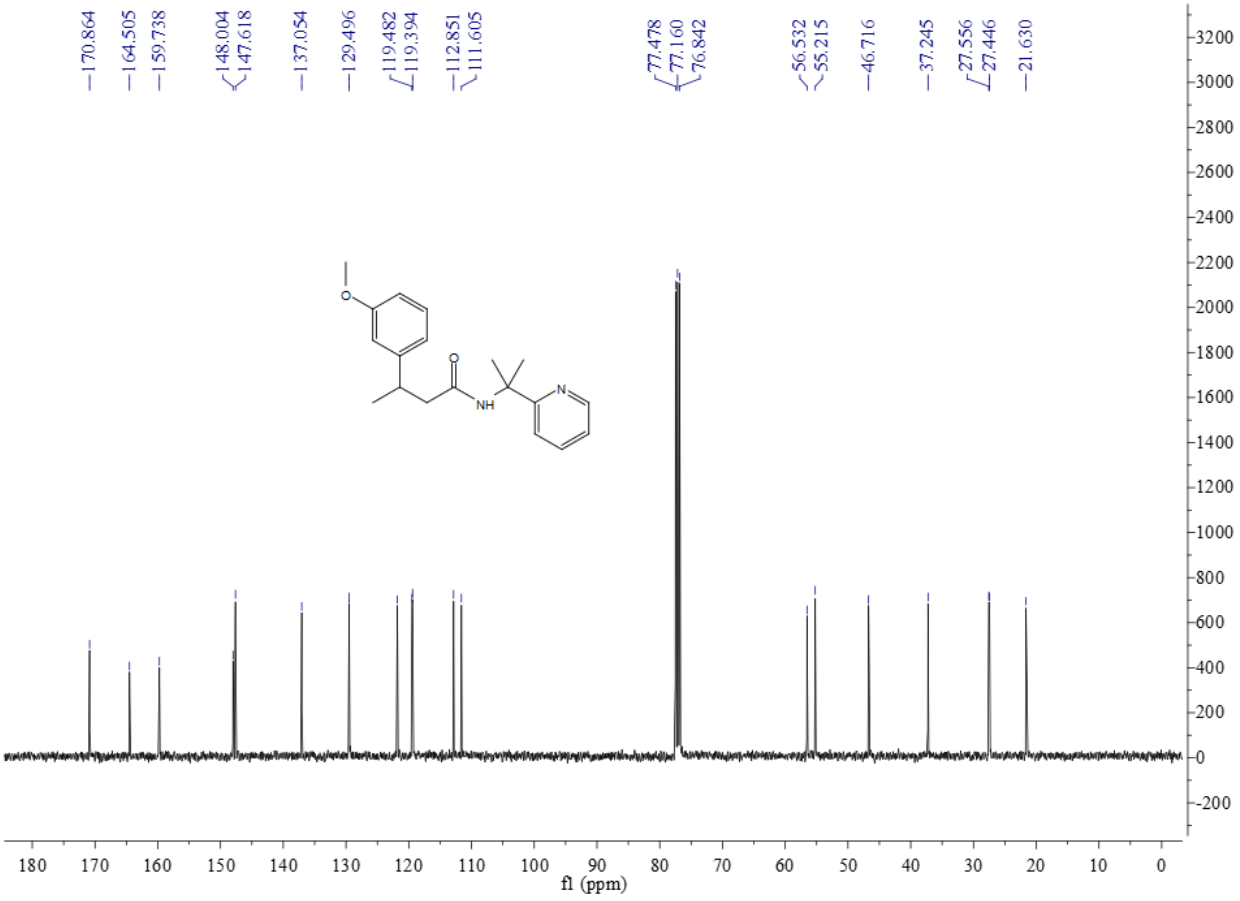
1.01
1.06
1.03
3.11
3.13
3.07
f1 (ppm)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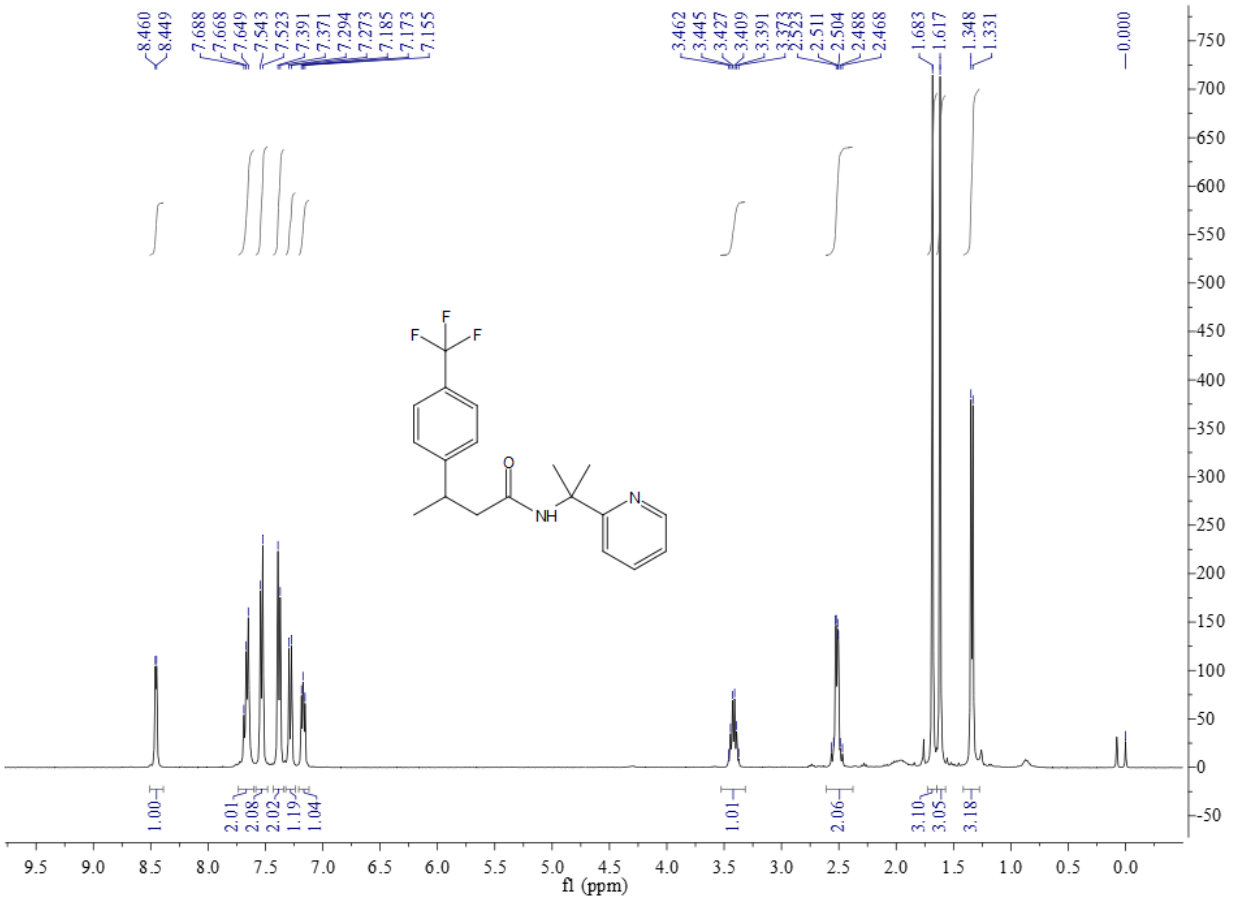
46.716
37.245
27.556
27.446
21.630
O
NH
N
f1 (ppm)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7.391
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7.294
7.273
7.185
7.173
7.155
3.462
3.445
3.427
3.409
3.391
3.373
2.523
2.511
2.504
2.488
2.468
1.683
1.617
1.348
1.331
0.000
F
F
F
O
NH
N
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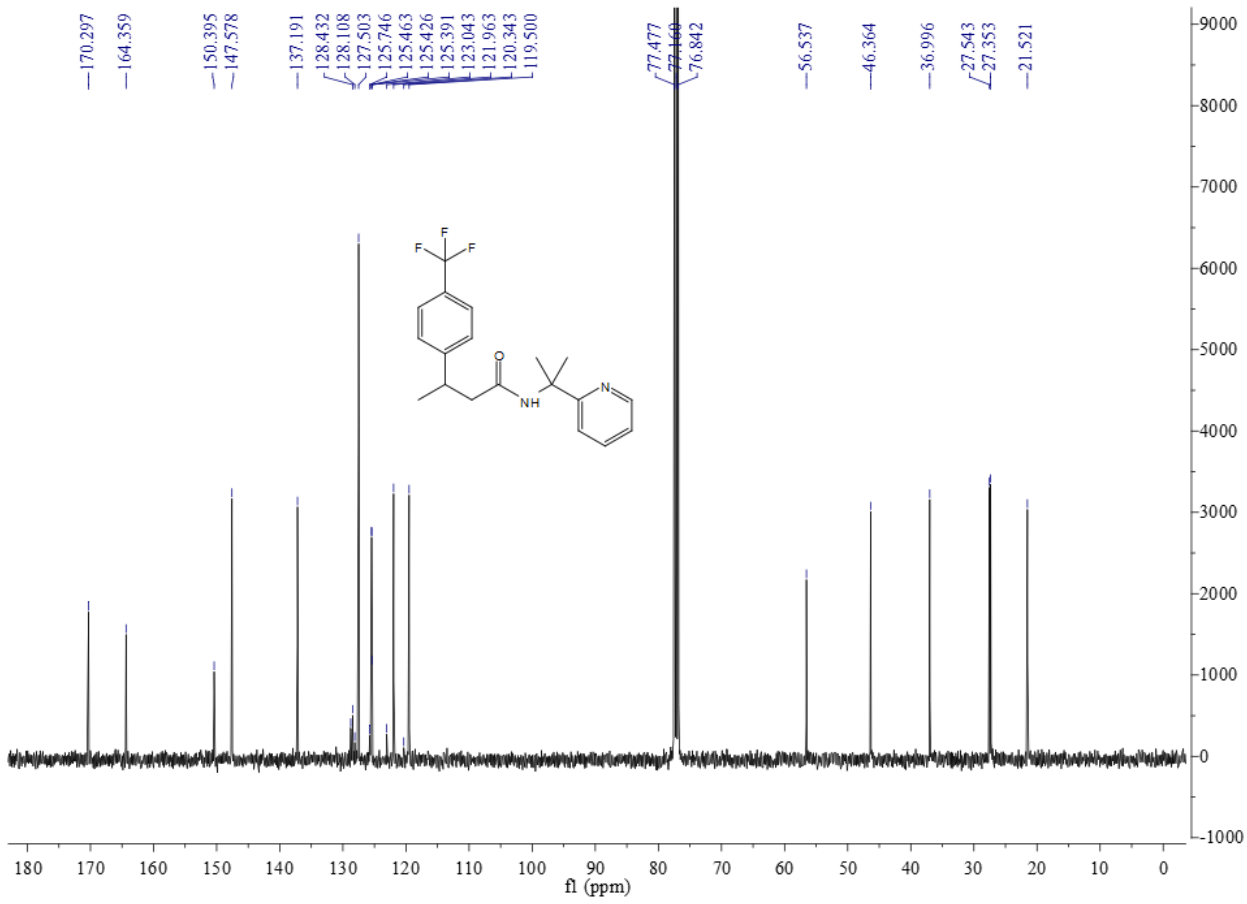
2.02
1.19
1.04
1.01
2.06
3.10
3.05
3.18
fl (ppm)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125.426
125.391
123.043
121.963
120.343
119.500
77.477
77.160
76.842
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46.364
36.996
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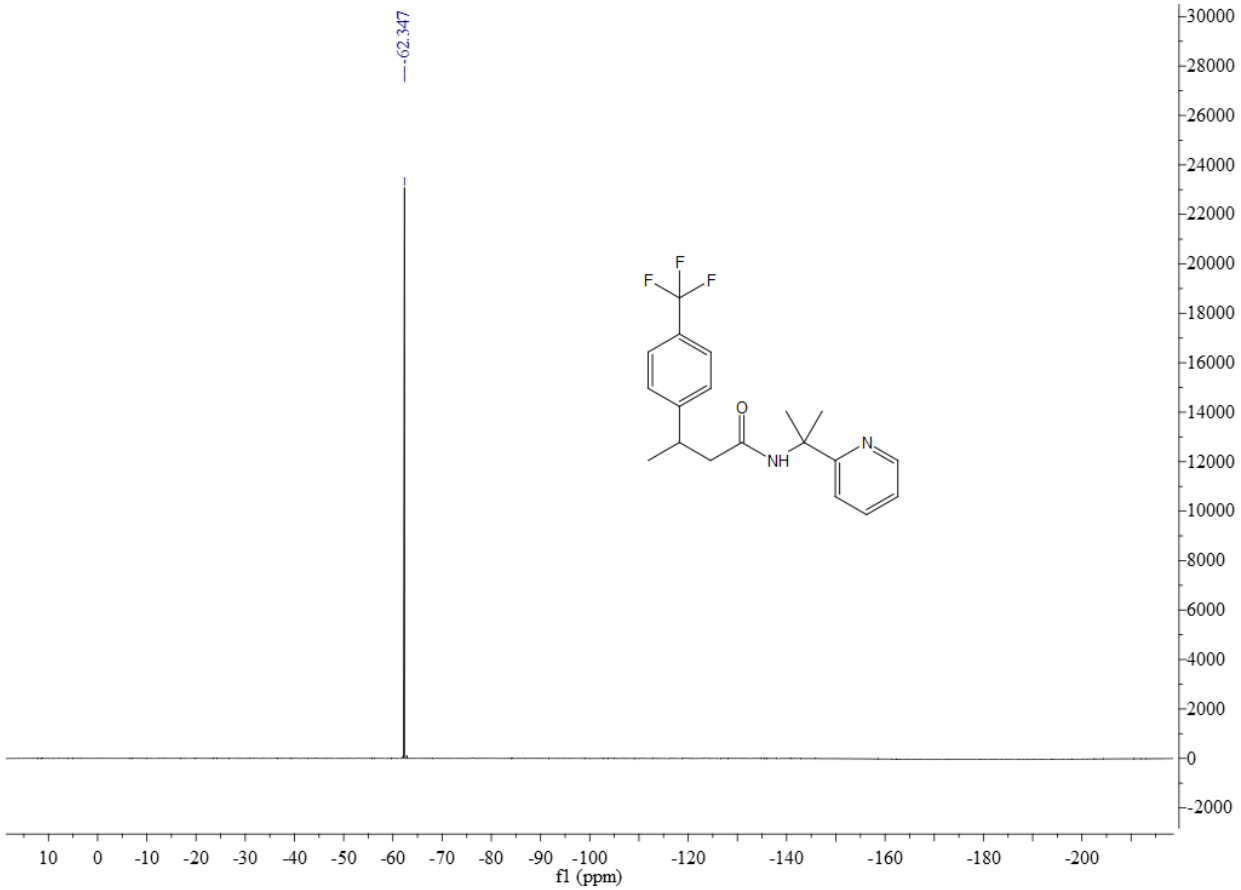
27.353
21.521
F
F
F
O
NH
N
fl (ppm)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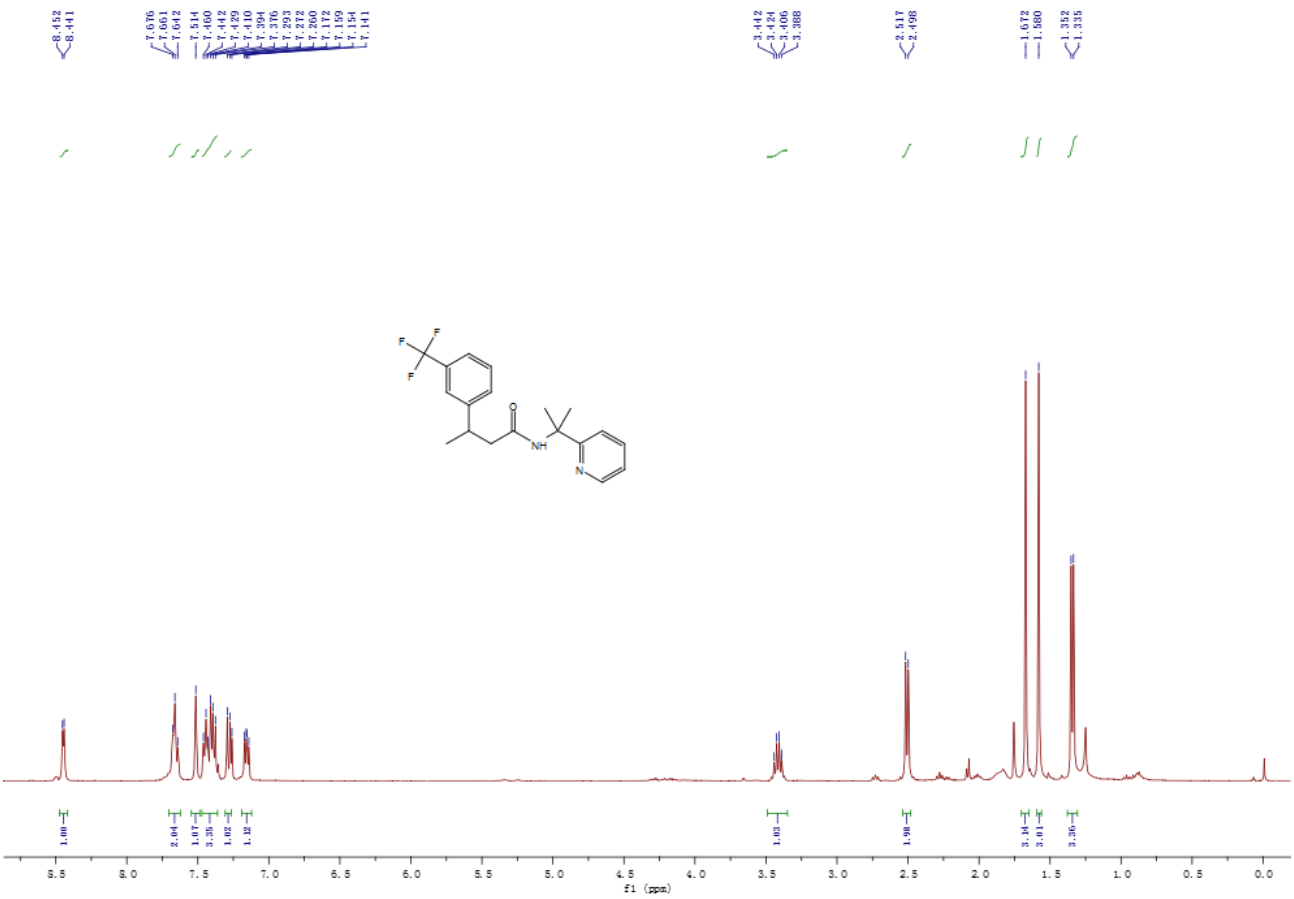
F
F
O
NH
N
f1 (ppm)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7.442
7.429
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7.293
7.273
7.260
7.172
7.159
7.154
7.141
3.442
3.424
3.406
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1.335
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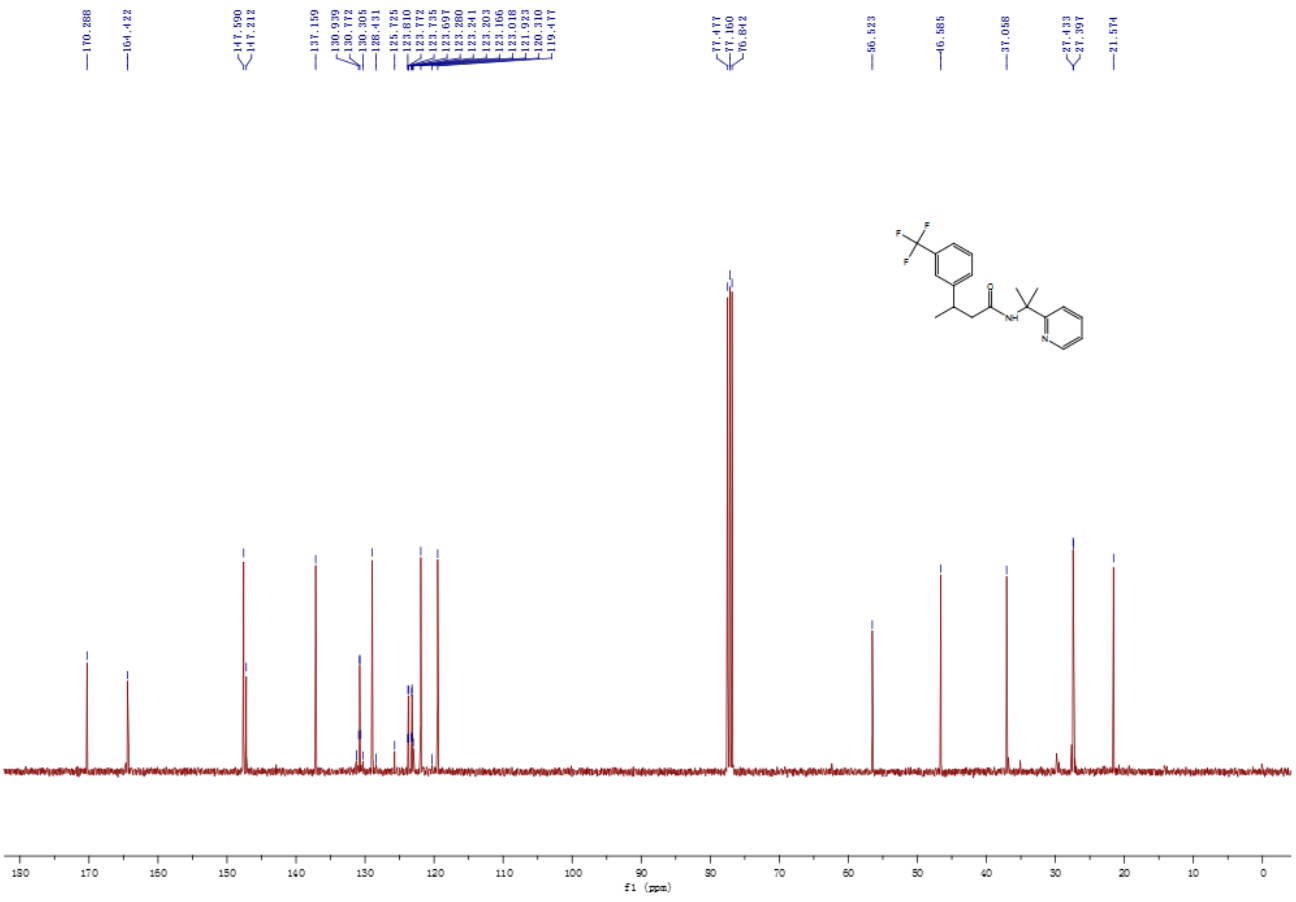
F
F
O
NH
N
f1 (ppm)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123.735
123.697
123.280
123.241
123.203
123.166
123.018
121.923
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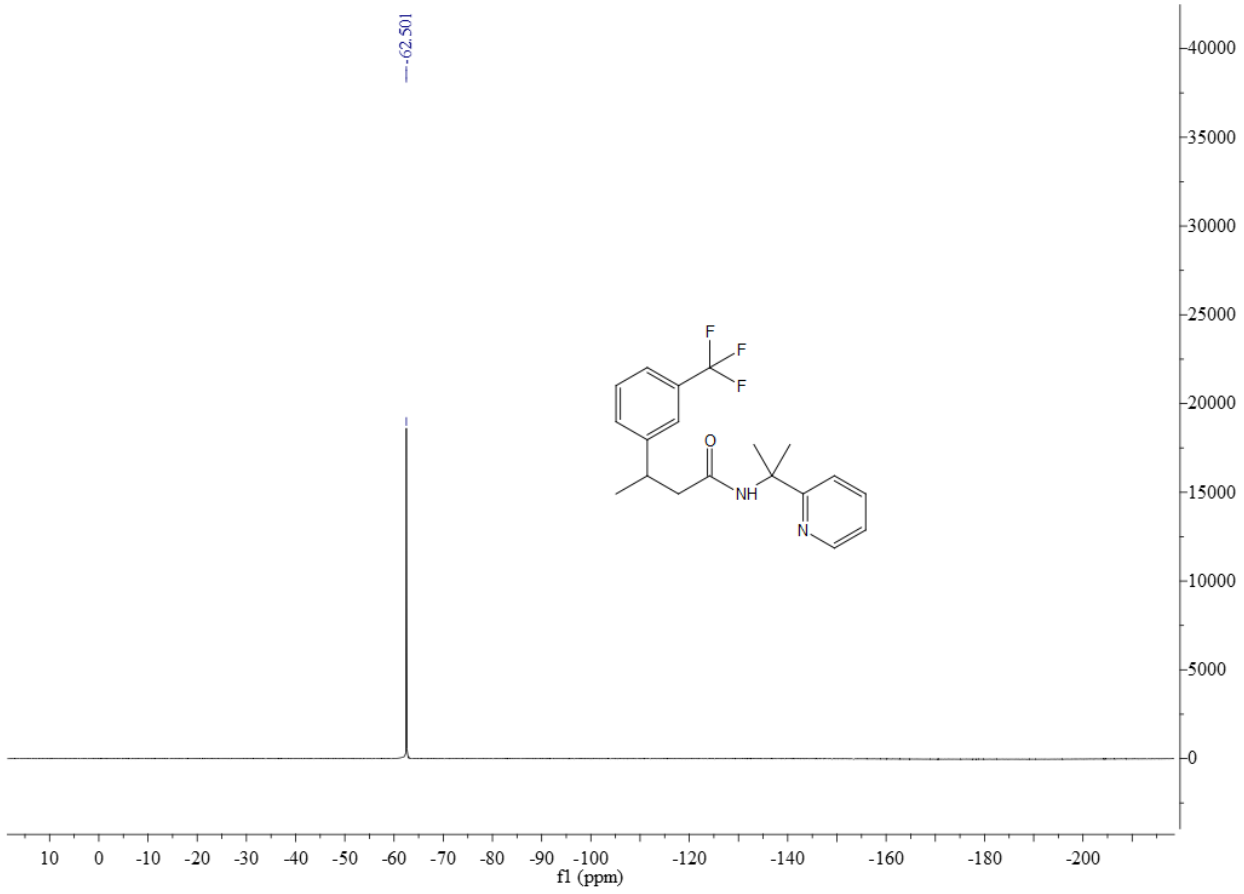
119.477
77.417
77.160
76.842
56.523
46.585
37.088
27.433
27.397
21.574
f1 (ppm)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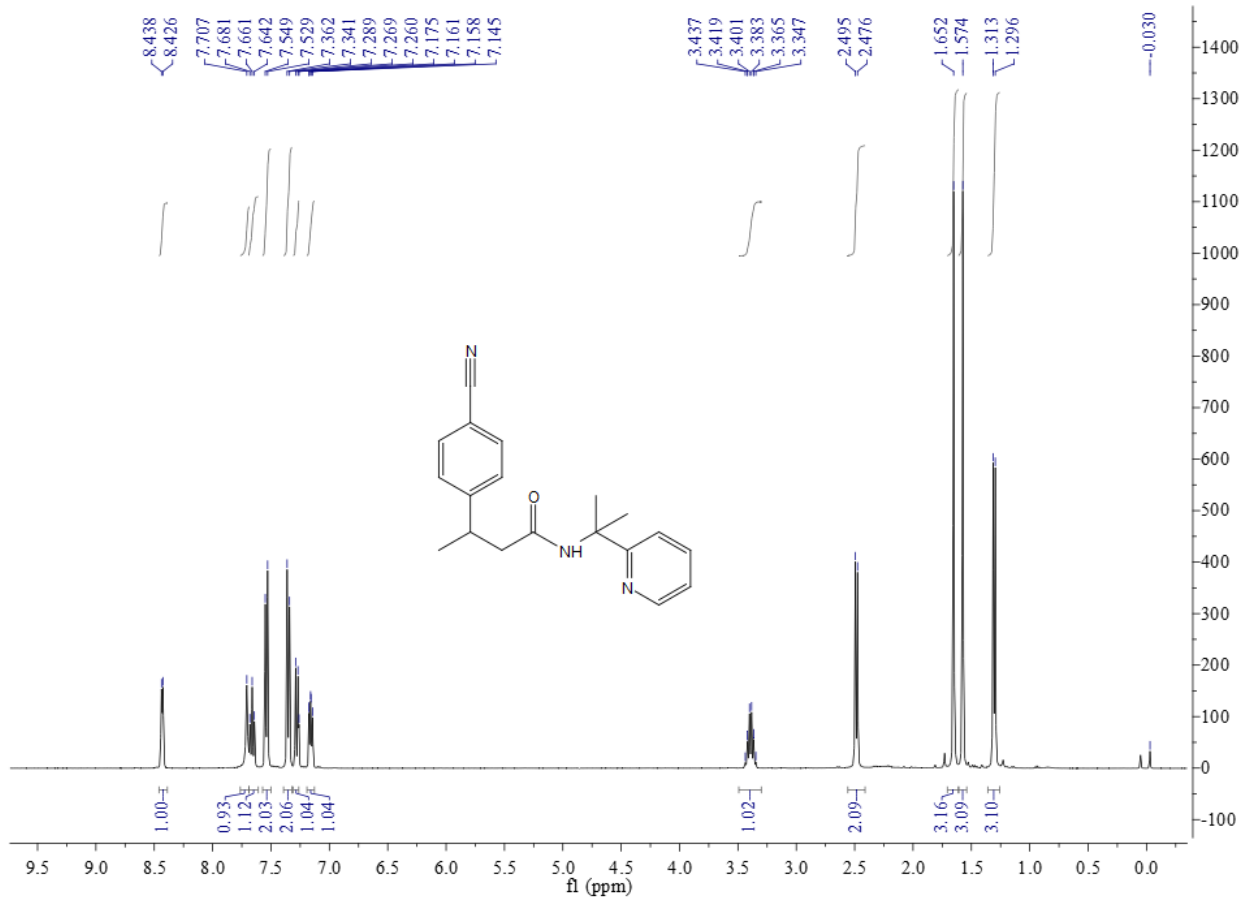
F
F
F
O
NH
N
f1 (ppm)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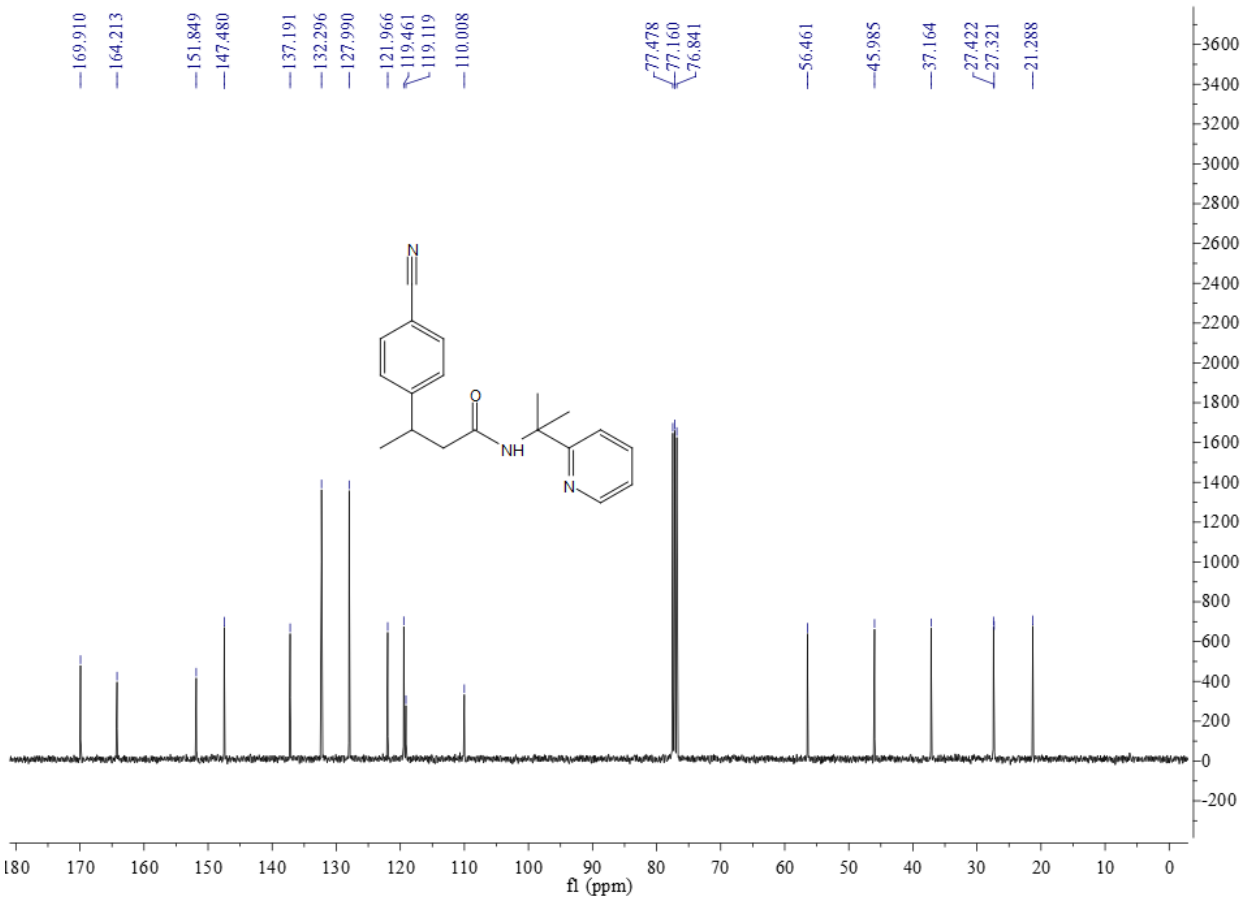
7.549
7.529
7.362
7.341
7.289
7.269
7.260
7.175
7.161
7.158
7.145
3.437
3.419
3.401
3.383
3.365
3.347
2.495
2.476
1.652
1.574
1.313
1.296
-0.030
1.00
0.93
1.12
2.03
2.06
1.04
1.04
1.02
2.09
3.16
3.09
3.10
N
O
NH
N
fl (ppm)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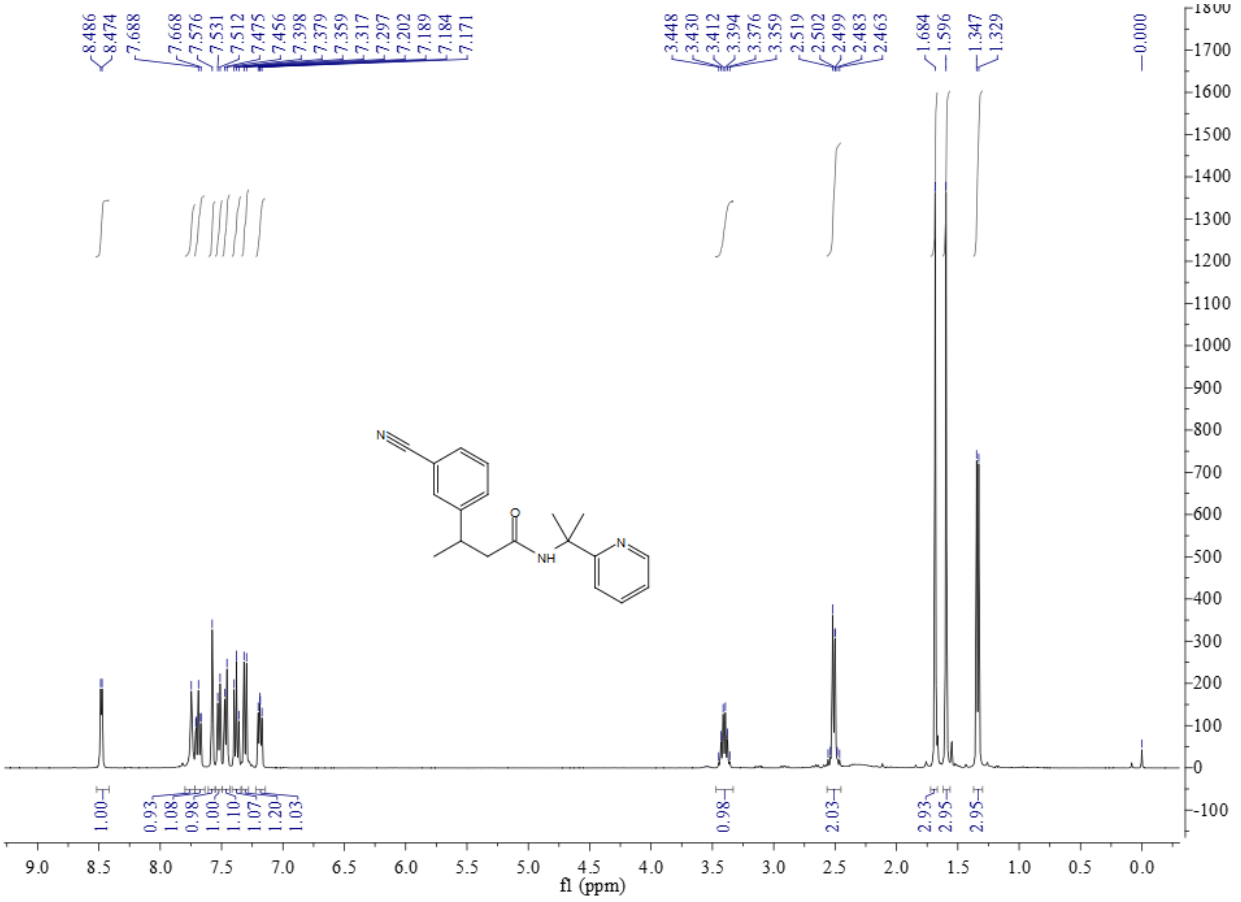
164.213
151.849
147.480
137.191
132.296
127.990
121.966
119.461
119.119
110.008
77.478
77.160
76.841
56.461
45.985
37.164
27.422
27.321
21.288
N
O
NH
N
fl (ppm)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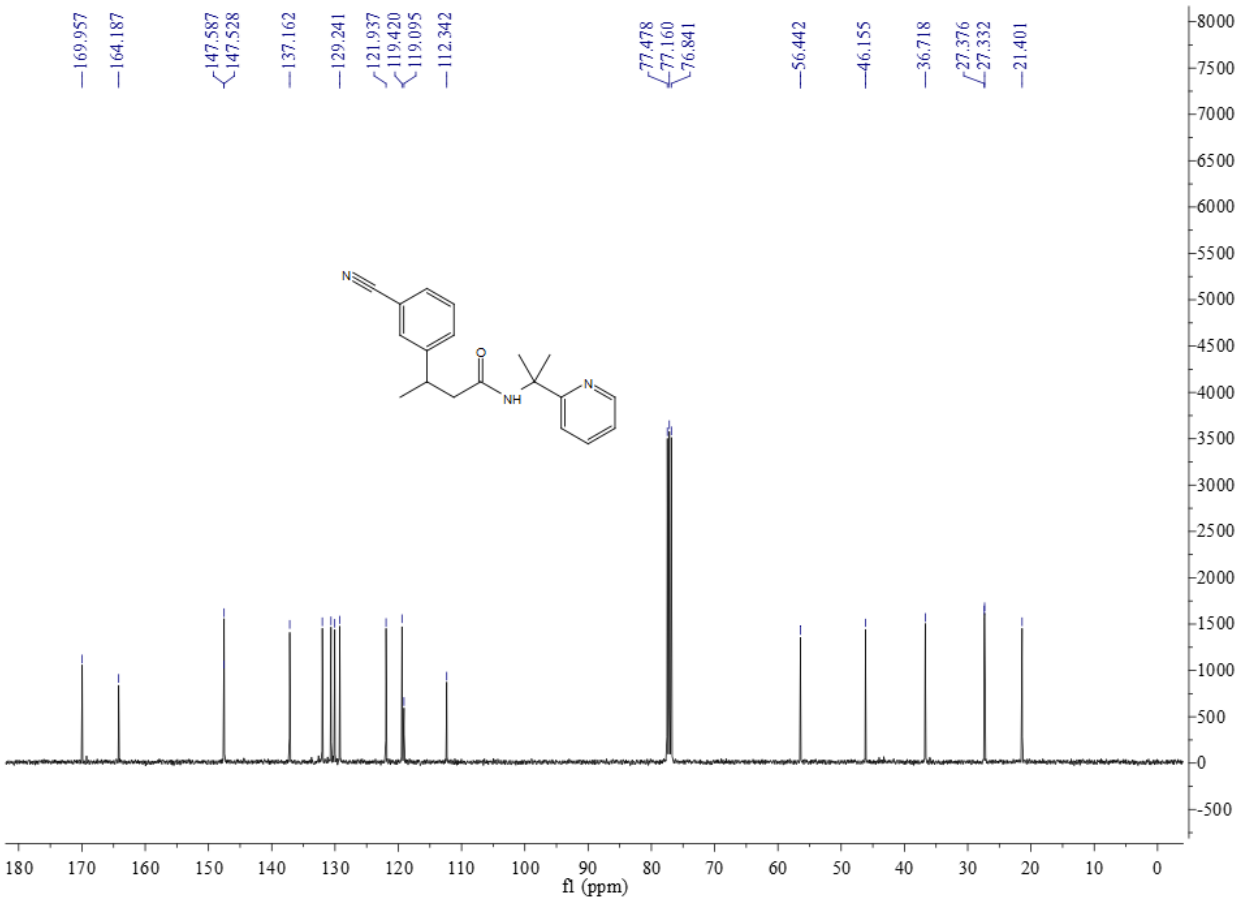
8.474
7.688
7.668
7.576
7.531
7.512
7.475
7.456
7.398
7.379
7.359
7.317
7.297
7.202
7.189
7.184
7.171
3.448
3.430
3.412
3.394
3.376
3.359
2.519
2.502
2.499
2.483
2.463
1.684
1.596
1.347
1.329
0.000
1.00
0.93
1.08
0.98
1.00
1.10
1.07
1.20
1.03
0.98
2.03
2.93
2.95
2.95
fl (ppm)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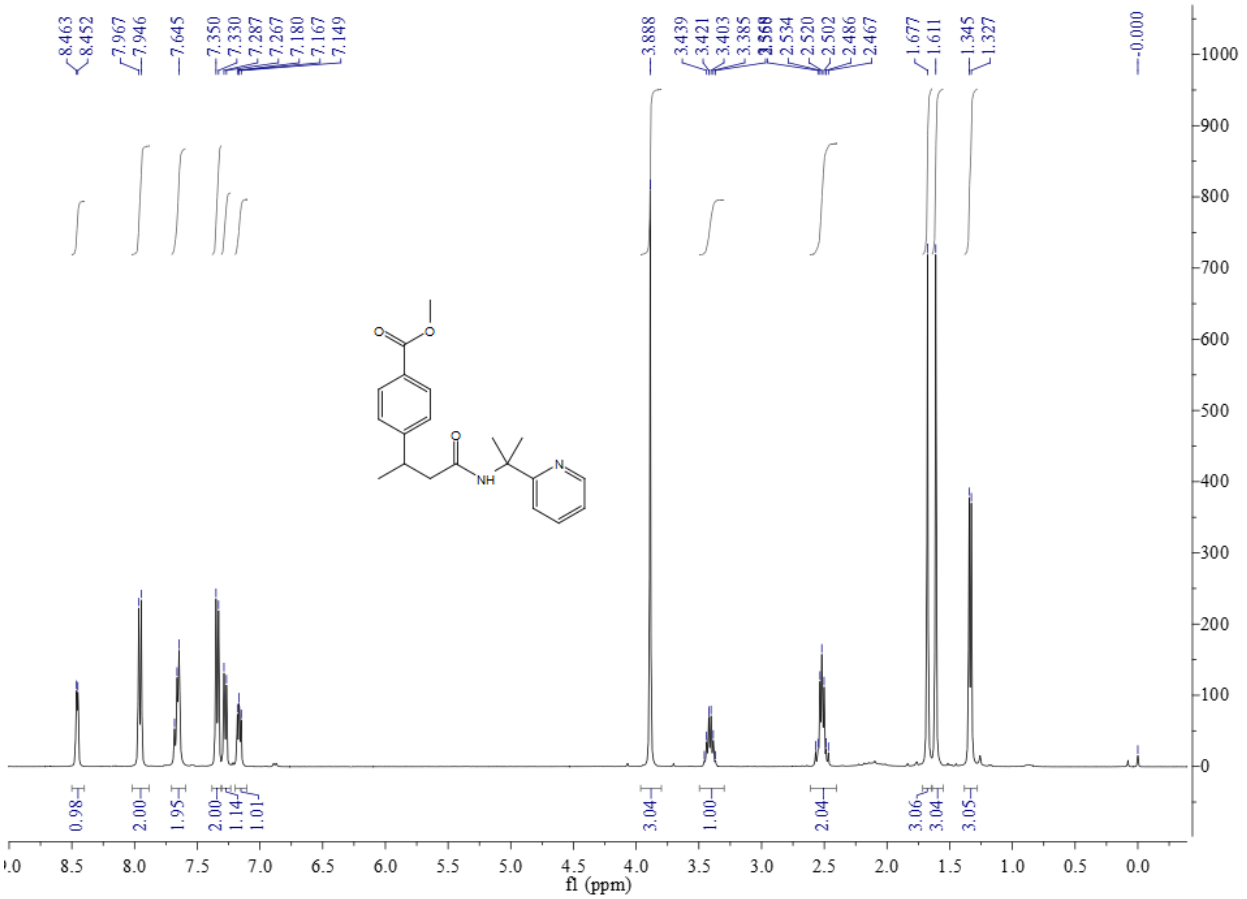
147.528
137.162
129.241
121.937
119.420
119.095
112.342
77.478
77.160
76.841
56.442
46.155
36.718
27.376
27.332
21.401
fl (ppm)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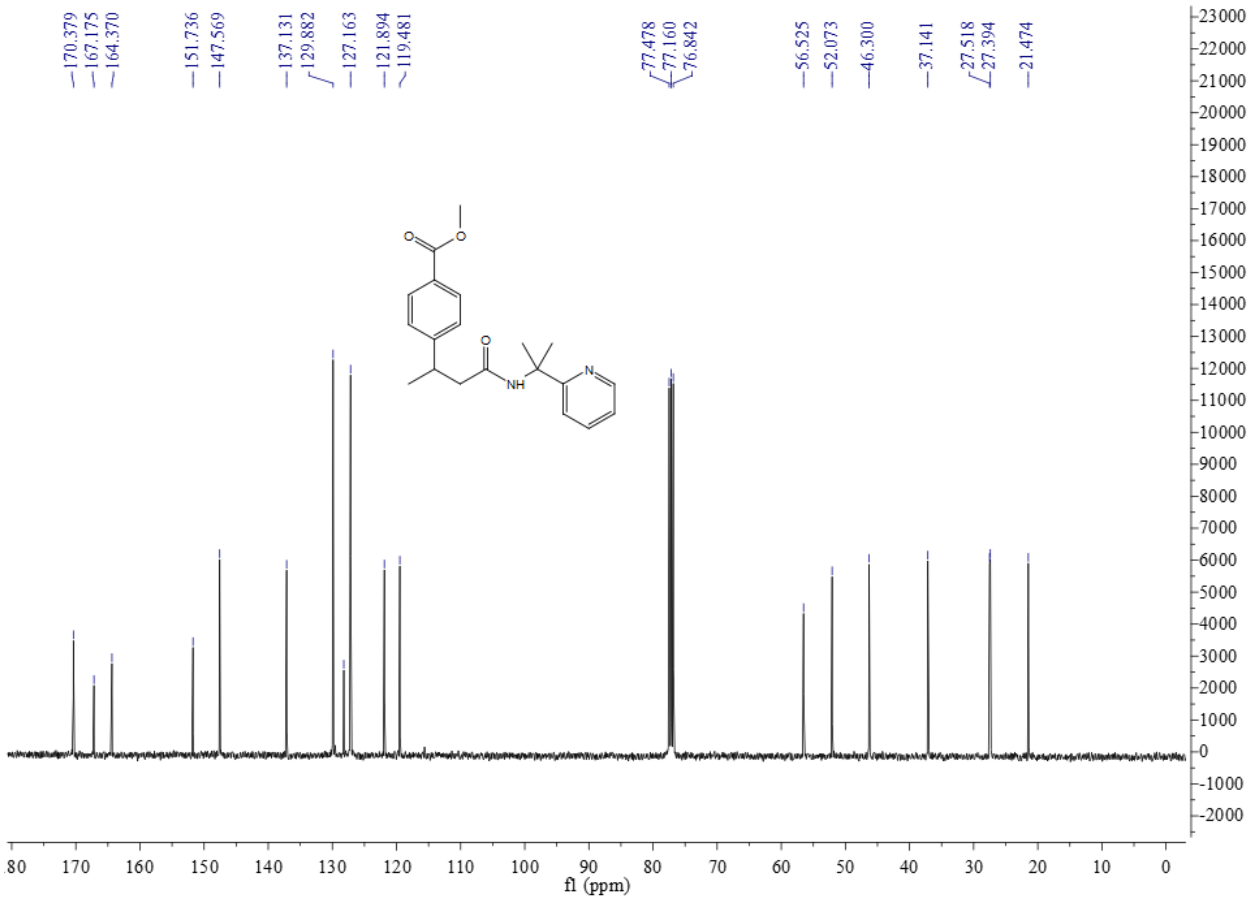
8.452
7.967
7.946
7.645
7.350
7.330
7.287
7.267
7.180
7.167
7.149
3.888
3.439
3.421
3.403
3.385
2.534
2.520
2.502
2.486
2.467
1.677
1.611
1.345
1.327
-0.000
0.98
2.00
1.95
2.00
1.14
1.01
3.04
1.00
2.04
3.06
3.04
3.05
NH
N
f1 (ppm)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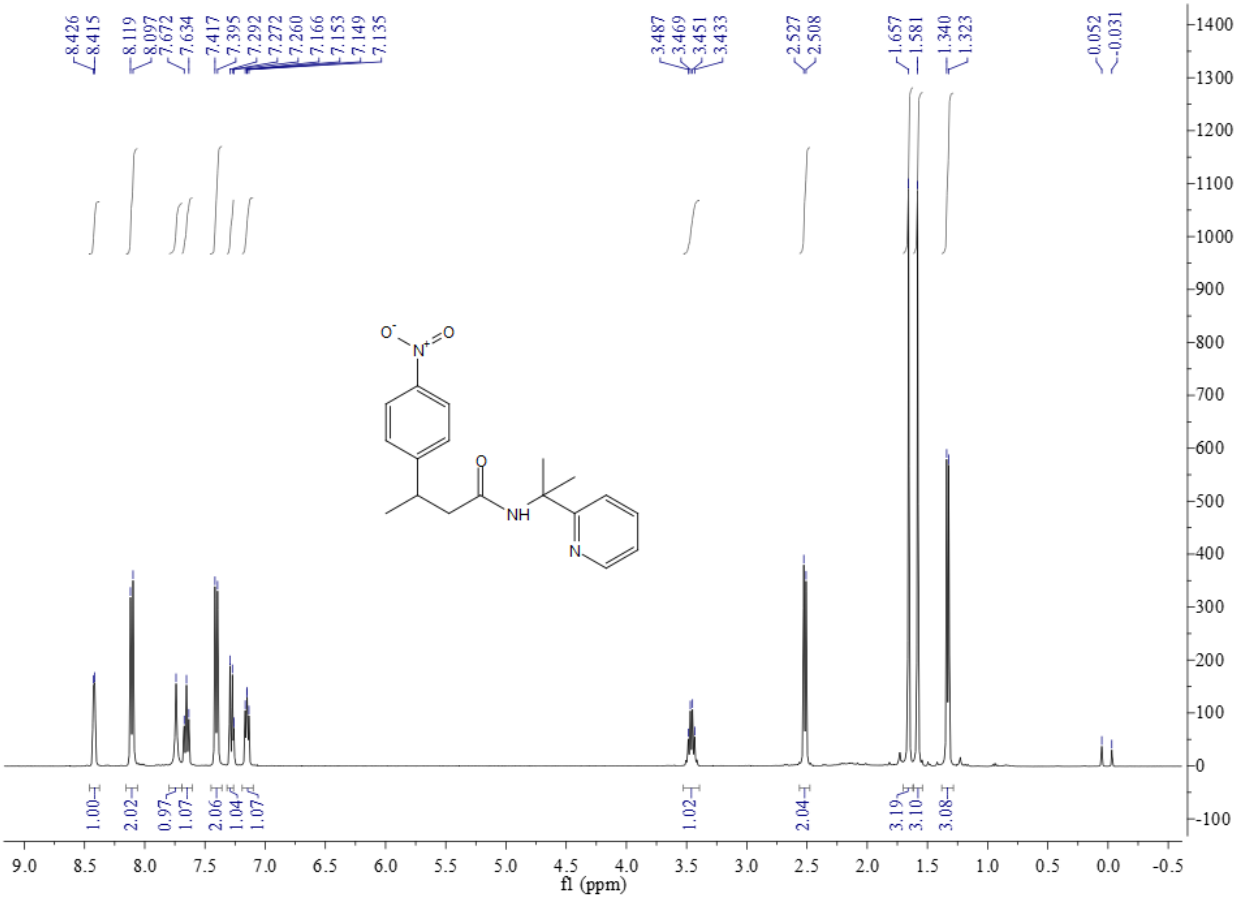
167.175
164.370
151.736
147.569
137.131
129.882
127.163
121.894
119.481
77.478
77.160
76.842
56.525
52.073
46.300
37.141
27.518
27.394
21.474
NH
N
f1 (ppm)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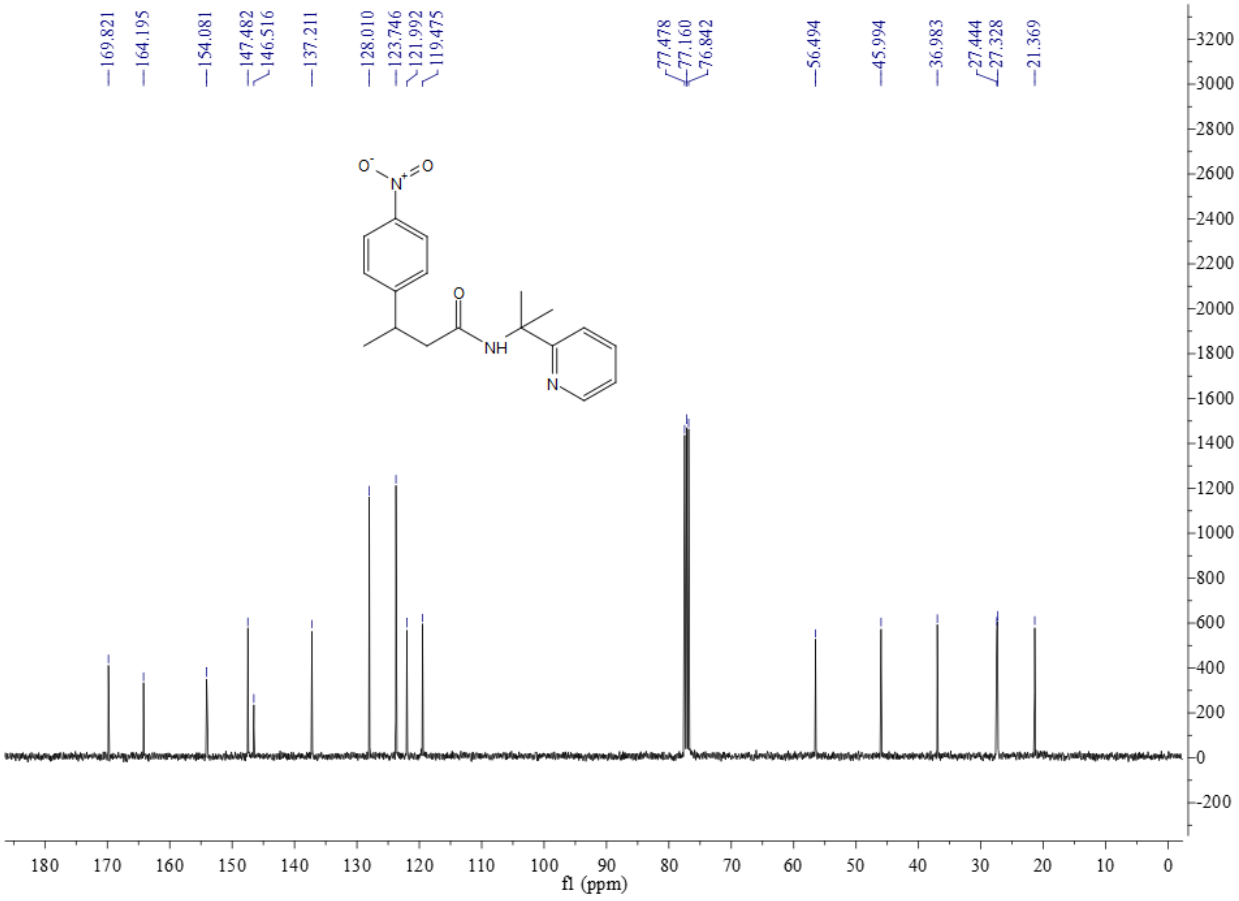
8.119
8.097
7.672
7.634
7.417
7.395
7.292
7.272
7.260
7.166
7.153
7.149
7.135
3.487
3.469
3.451
3.433
2.527
2.508
1.657
1.581
1.340
1.323
0.052
-0.031
1.00
2.02
0.97
1.07
2.06
1.04
1.07
1.02
2.04
3.19
3.10
3.08
O
N
O
NH
N
f1 (ppm)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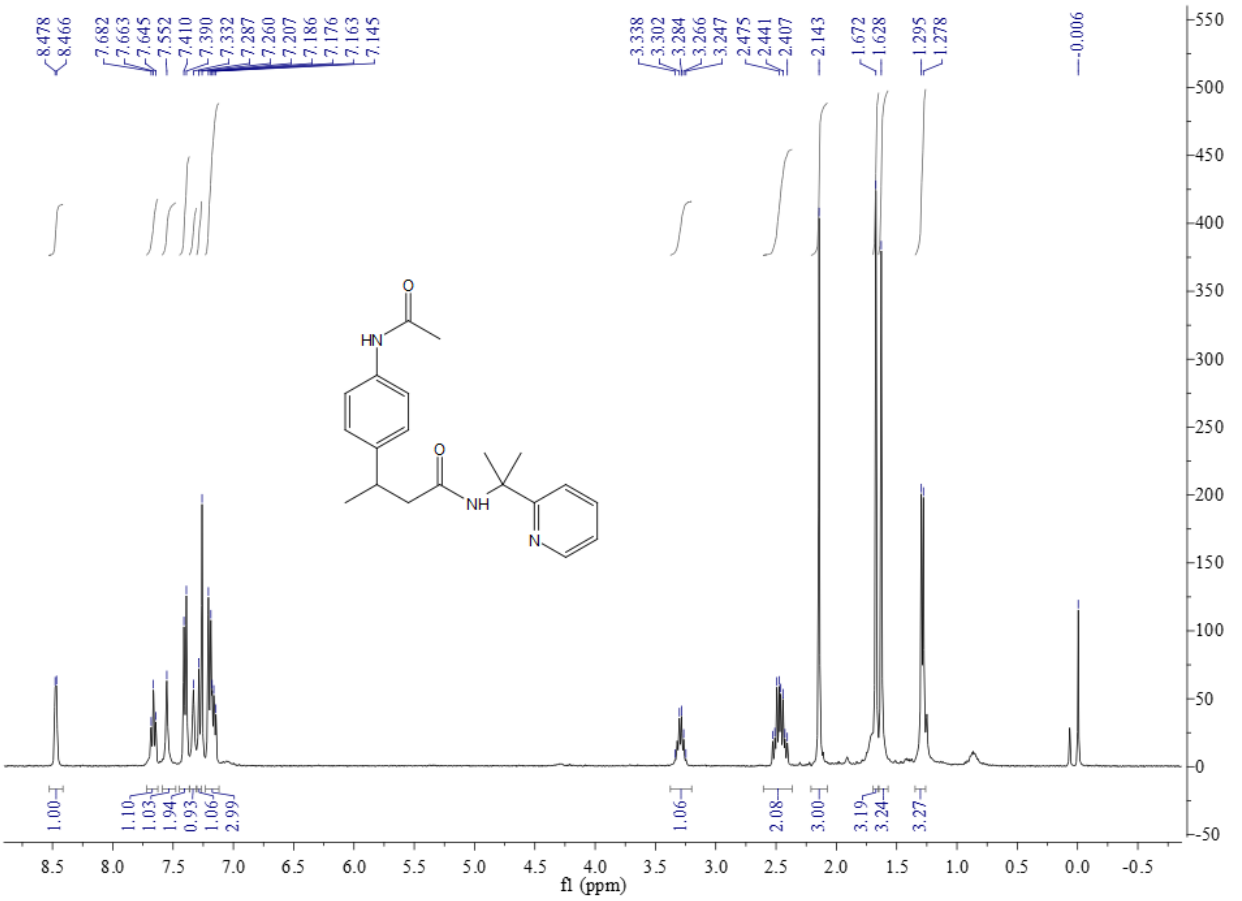
154.081
147.482
146.516
137.211
128.010
123.746
121.992
119.475
77.478
77.160
76.842
56.494
45.994
36.983
27.444
27.328
21.369
O
N
O
NH
N
f1 (ppm)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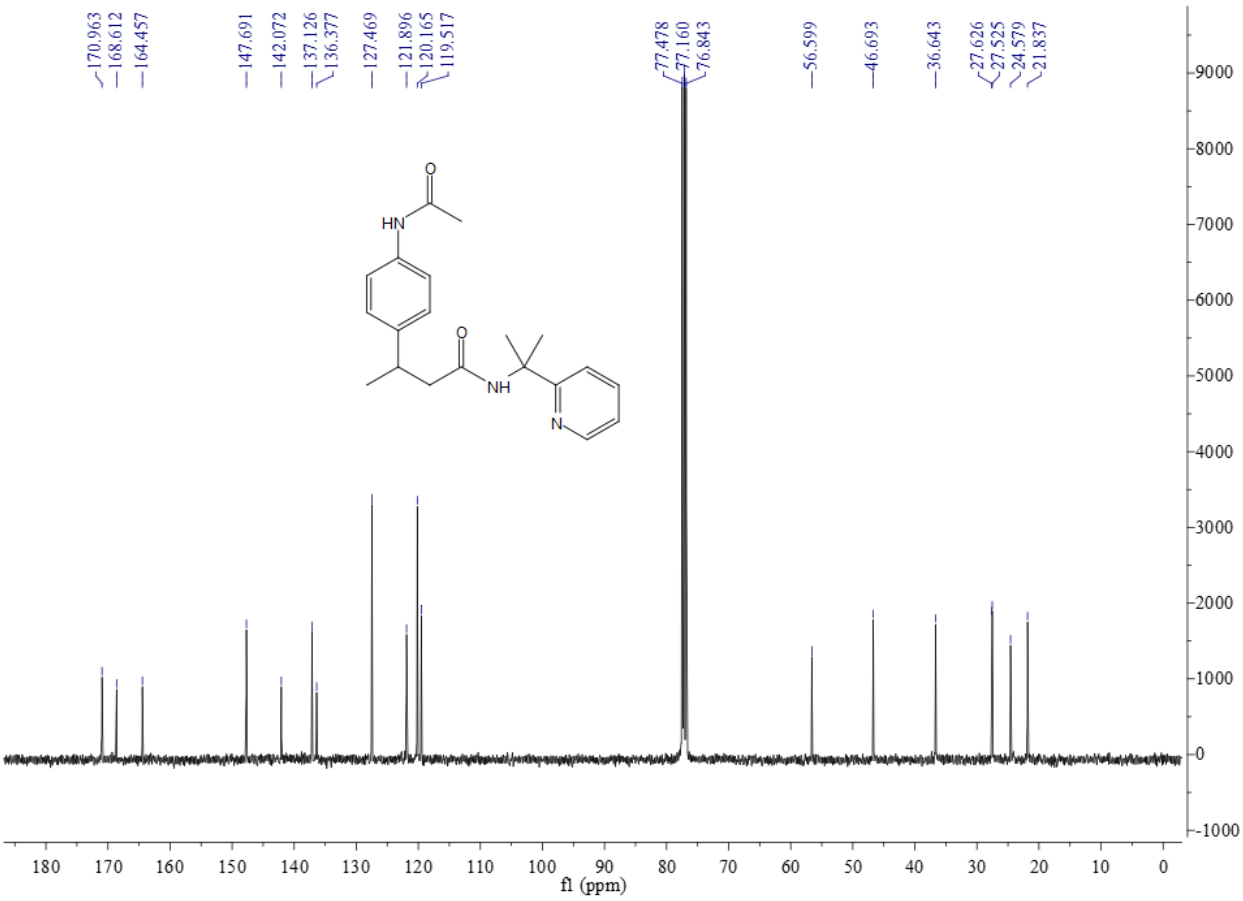
8.466
7.682
7.663
7.645
7.552
7.410
7.390
7.332
7.287
7.260
7.207
7.186
7.176
7.163
7.145
3.338
3.302
3.284
3.266
3.247
2.475
2.441
2.407
2.143
1.672
1.628
1.295
1.278
-0.006
HN
O
O
NH
N
1.00
1.10
1.03
1.94
0.93
1.06
2.99
1.06
2.08
3.00
3.19
3.24
3.27
f1 (ppm)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136.377
127.469
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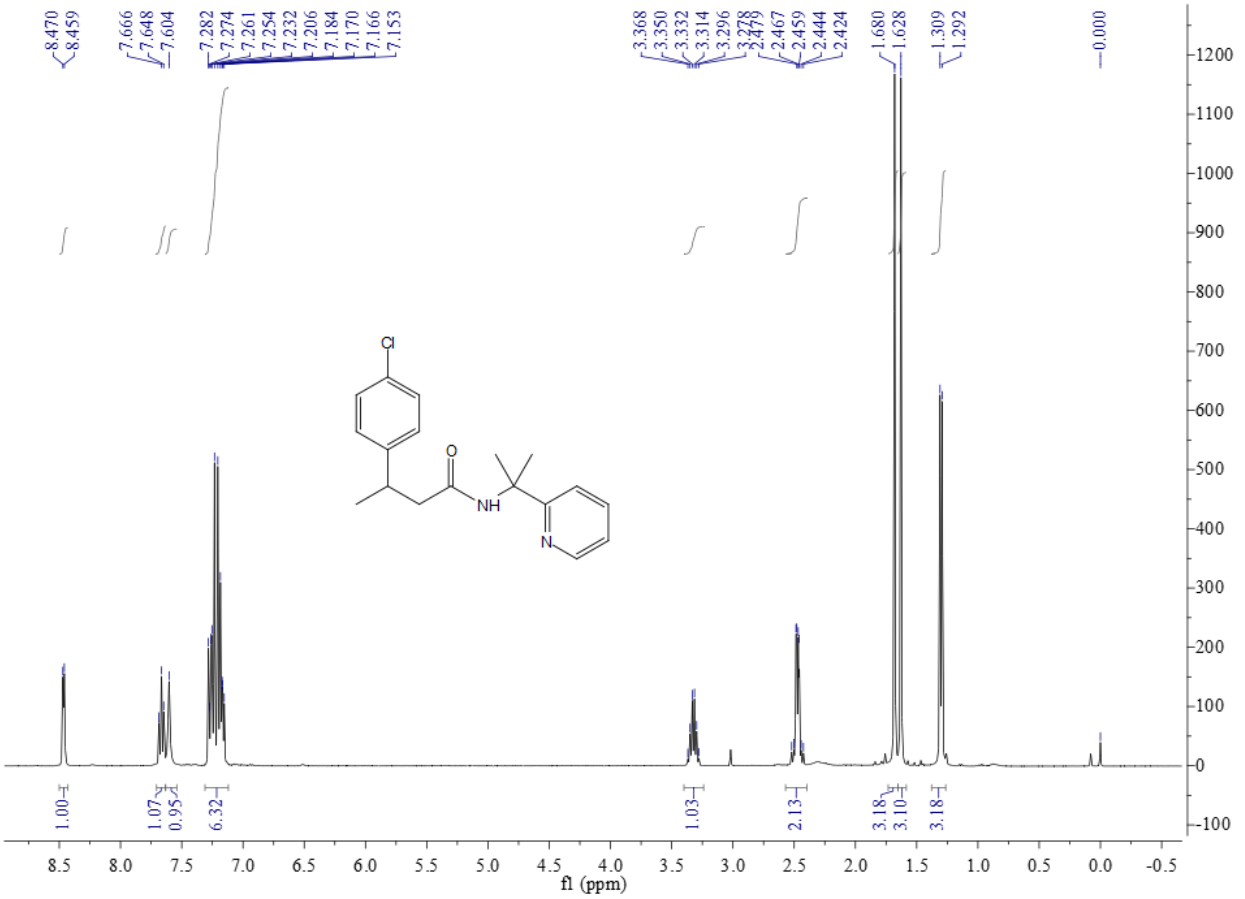
120.165
119.517
77.478
77.160
76.843
56.599
46.693
36.643
27.626
27.525
24.579
21.837
HN
O
O
NH
N
f1 (ppm)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8.459
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7.648
7.604
7.282
7.274
7.261
7.254
7.232
7.206
7.184
7.170
7.166
7.153
3.368
3.350
3.332
3.314
3.296
3.278
2.467
2.459
2.444
2.424
1.680
1.628
1.309
1.292
0.000
Cl
O
NH
N
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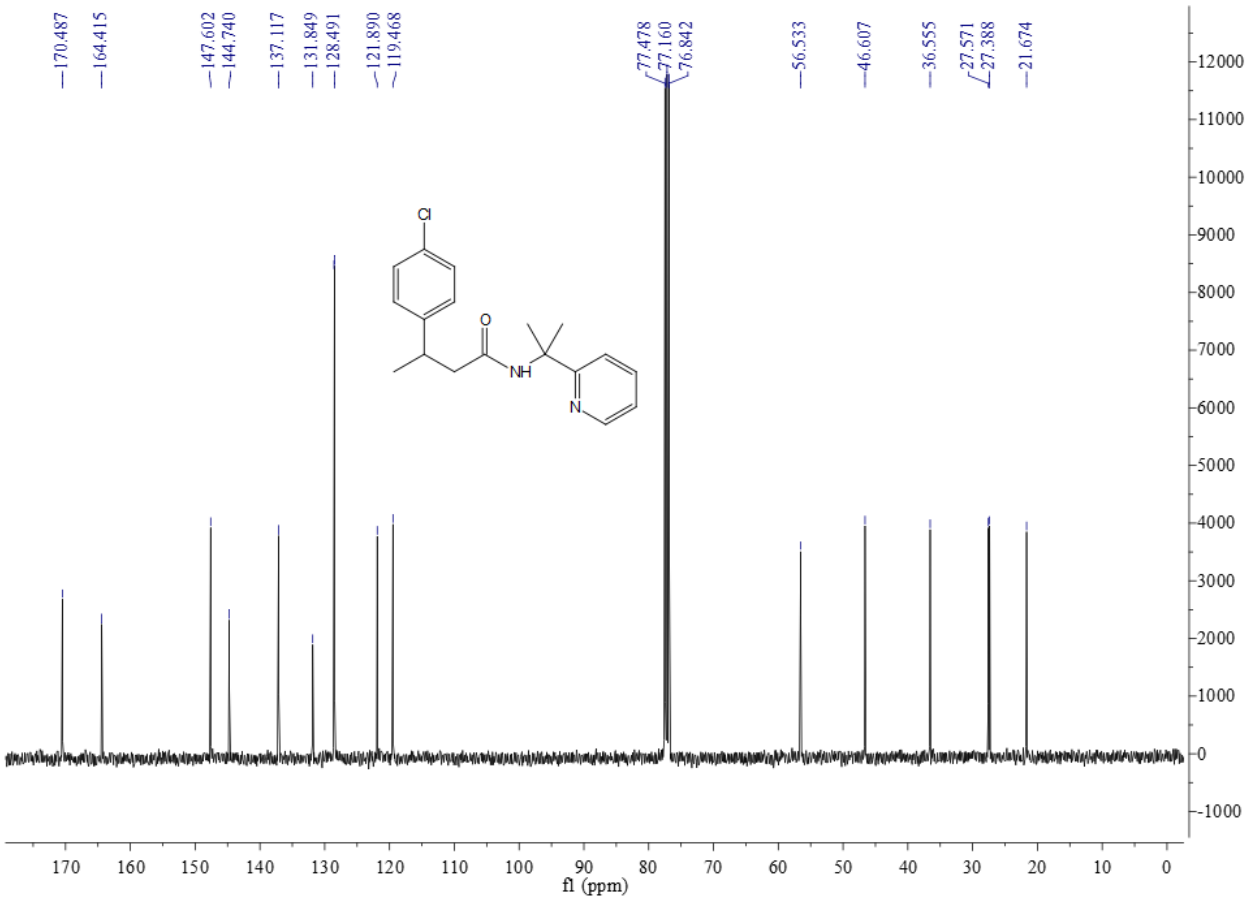
1.07
0.95
6.32
1.03
2.13
3.18
3.10
3.18
f1 (ppm)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144.740
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128.491
121.890
119.468
77.478
77.160
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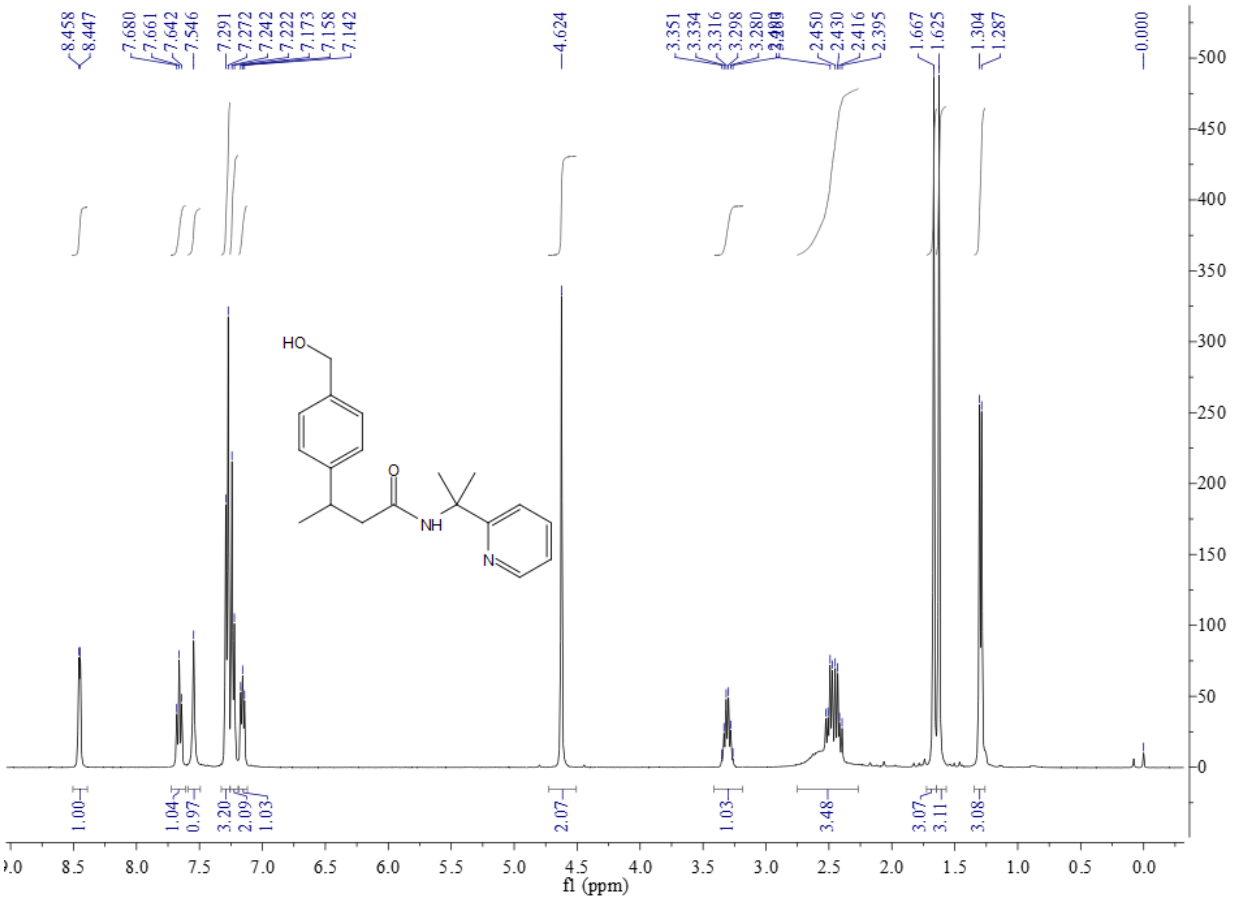
56.533
46.607
36.555
27.571
27.388
21.674
Cl
O
NH
N
f1 (ppm)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7.661
7.642
7.546
7.291
7.272
7.242
7.222
7.173
7.158
7.142
4.624
3.351
3.334
3.316
3.298
3.280
2.450
2.430
2.416
2.395
1.667
1.625
1.304
1.287
0.000
HO
O
NH
N
1.00
1.04
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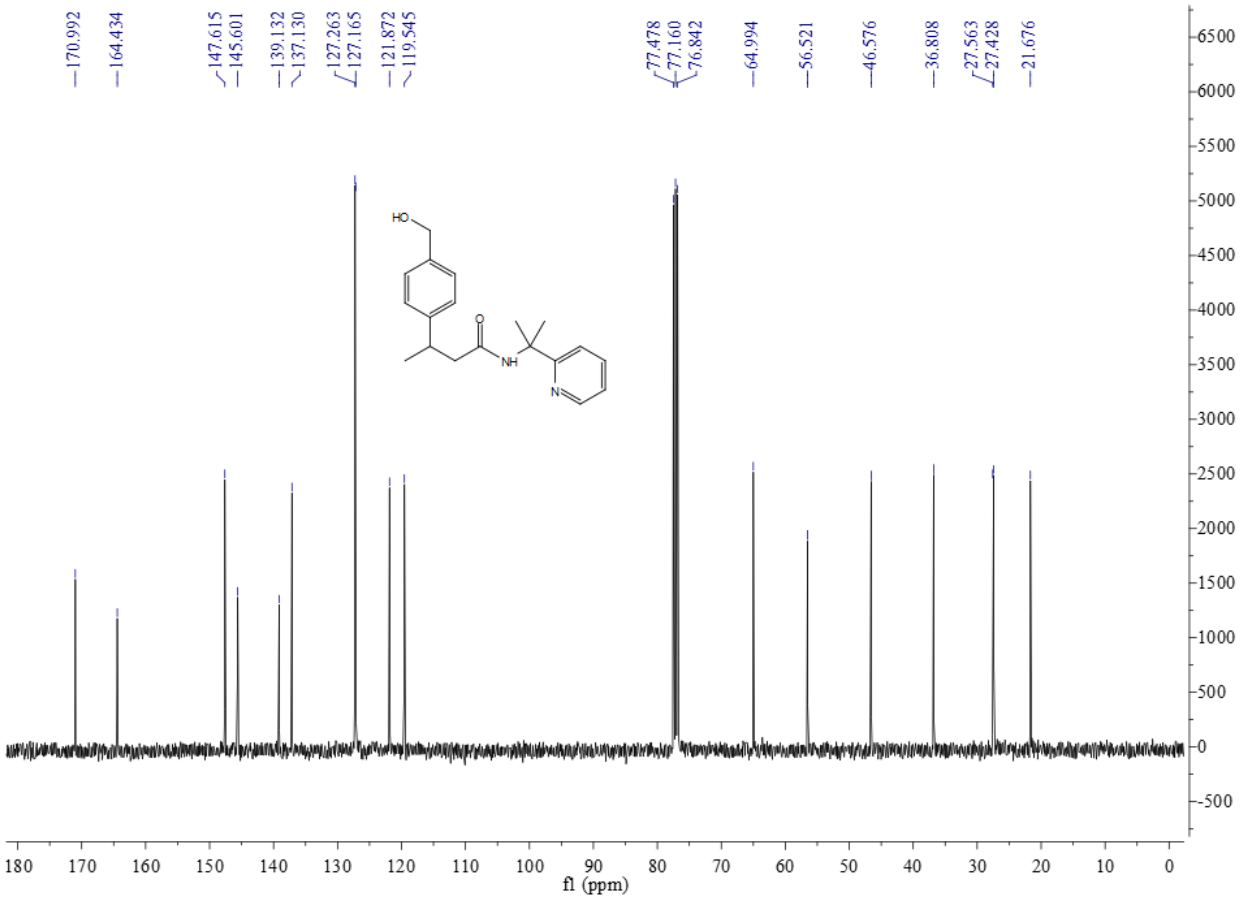
2.09
1.03
2.07
1.03
3.48
3.07
3.11
3.08
f1 (ppm)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147.615
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139.132
137.130
127.263
127.165
121.872
119.545
77.478
77.160
76.842
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56.521
46.576
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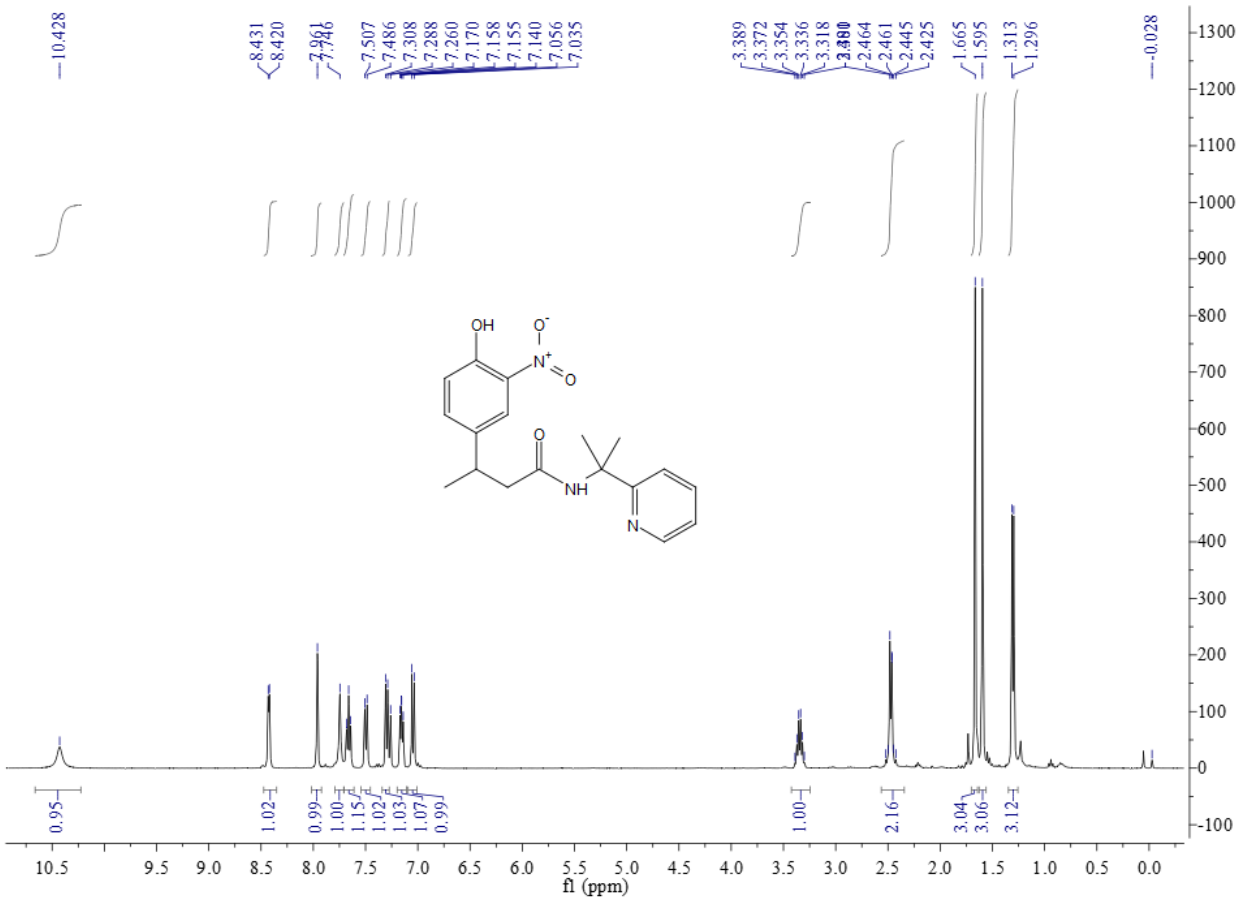
27.428
21.676
HO
O
NH
N
f1 (ppm)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8.420
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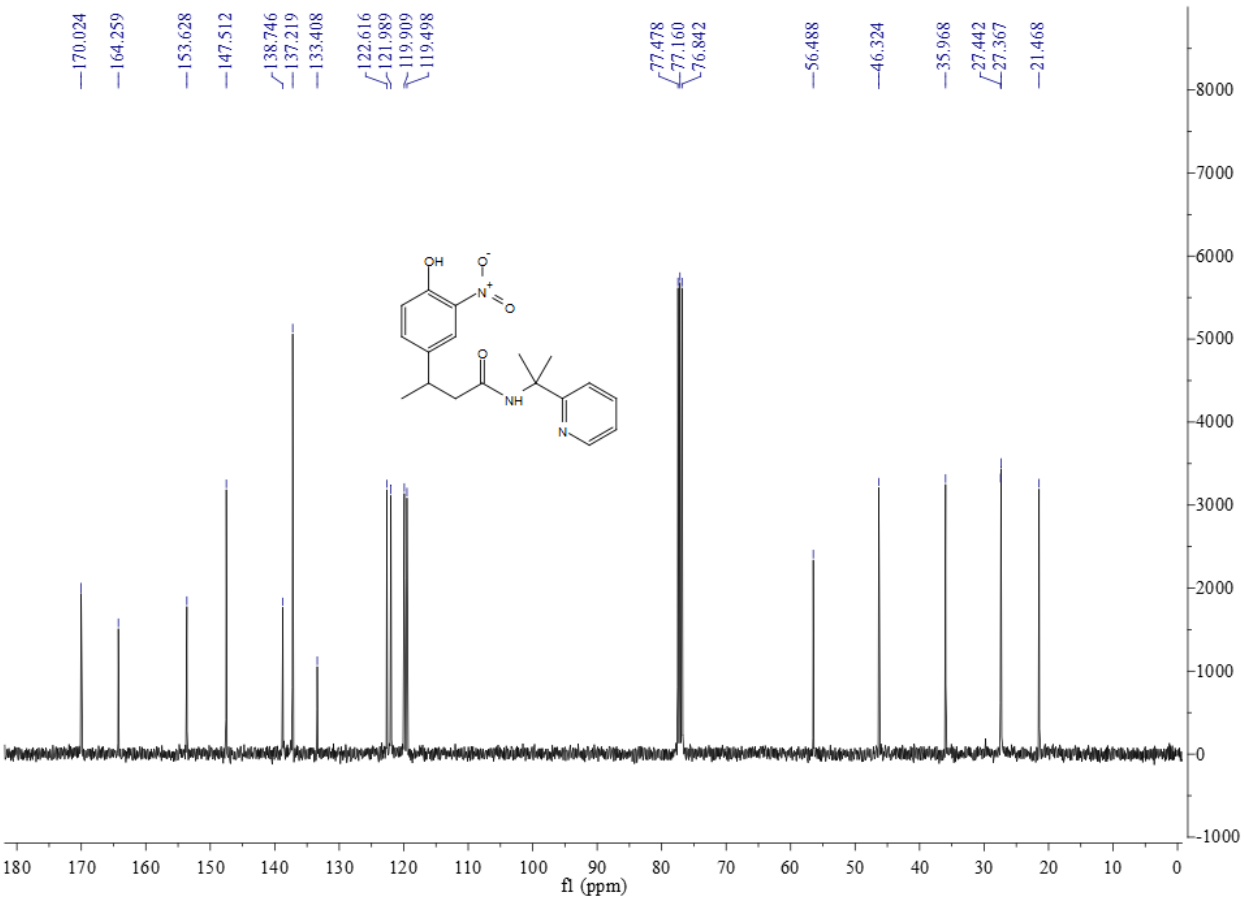
7.946
7.507
7.486
7.308
7.288
7.260
7.170
7.158
7.155
7.140
7.056
7.035
3.389
3.372
3.354
3.336
3.318
2.464
2.461
2.445
2.425
1.665
1.595
1.313
1.296
-0.028
0.95
1.02
0.99
1.00
1.15
1.02
1.03
1.07
0.99
1.00
2.16
3.04
3.06
3.12
OH
O
N
O
O
NH
N
fl (ppm)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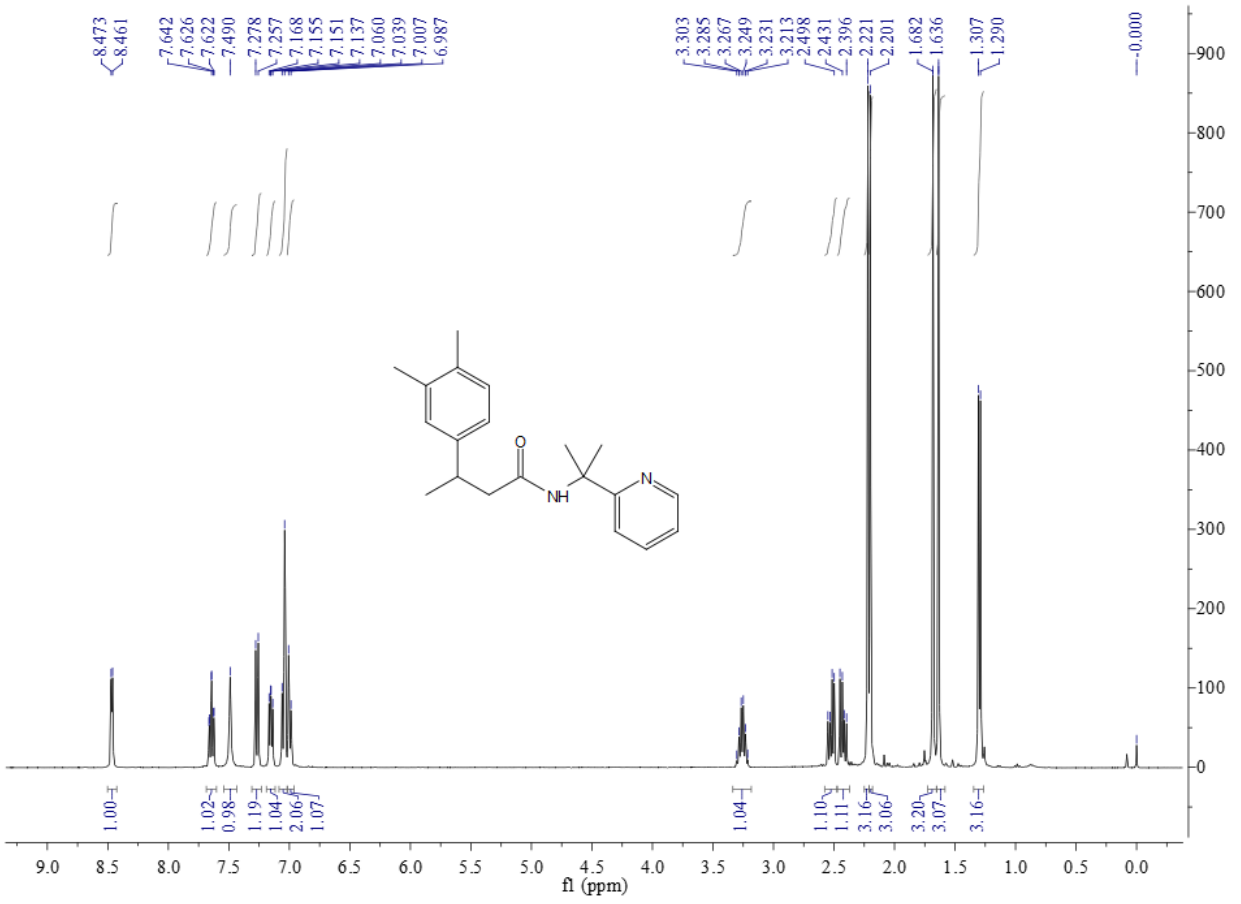
133.408
122.616
121.989
119.909
119.498
77.478
77.160
76.842
56.488
46.324
35.968
27.442
27.367
21.468
OH
O
N
O
O
NH
N
fl (ppm)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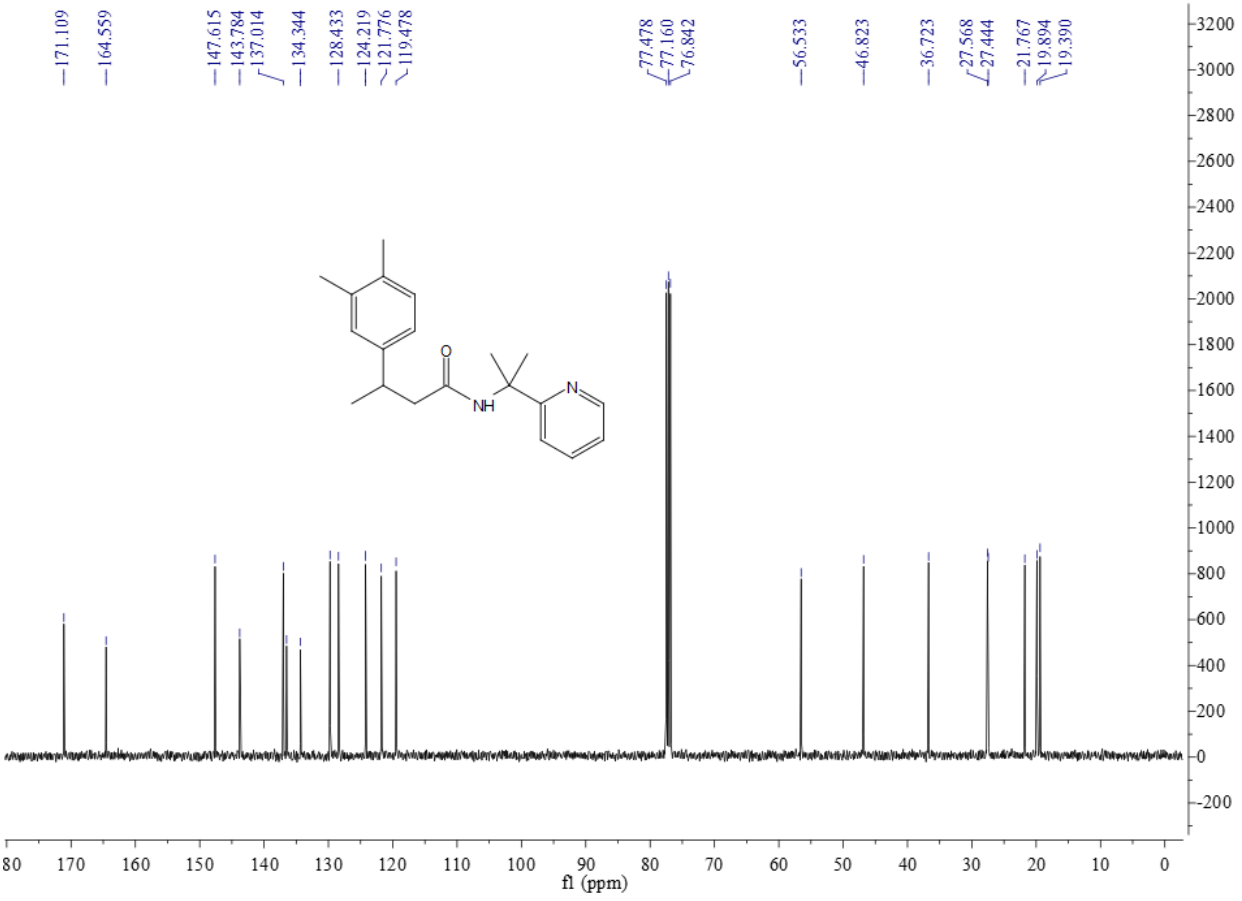
7.626
7.622
7.490
7.278
7.257
7.168
7.155
7.151
7.137
7.060
7.039
7.007
6.987
3.303
3.285
3.267
3.249
3.231
3.213
2.498
2.431
2.396
2.221
2.201
1.682
1.636
1.307
1.290
-0.000
O
NH
N
1.00
1.02
0.98
1.19
1.04
2.06
1.07
1.04
1.10
1.11
3.16
3.06
3.20
3.07
3.16
f1 (ppm)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128.433
124.219
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77.478
77.160
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36.723
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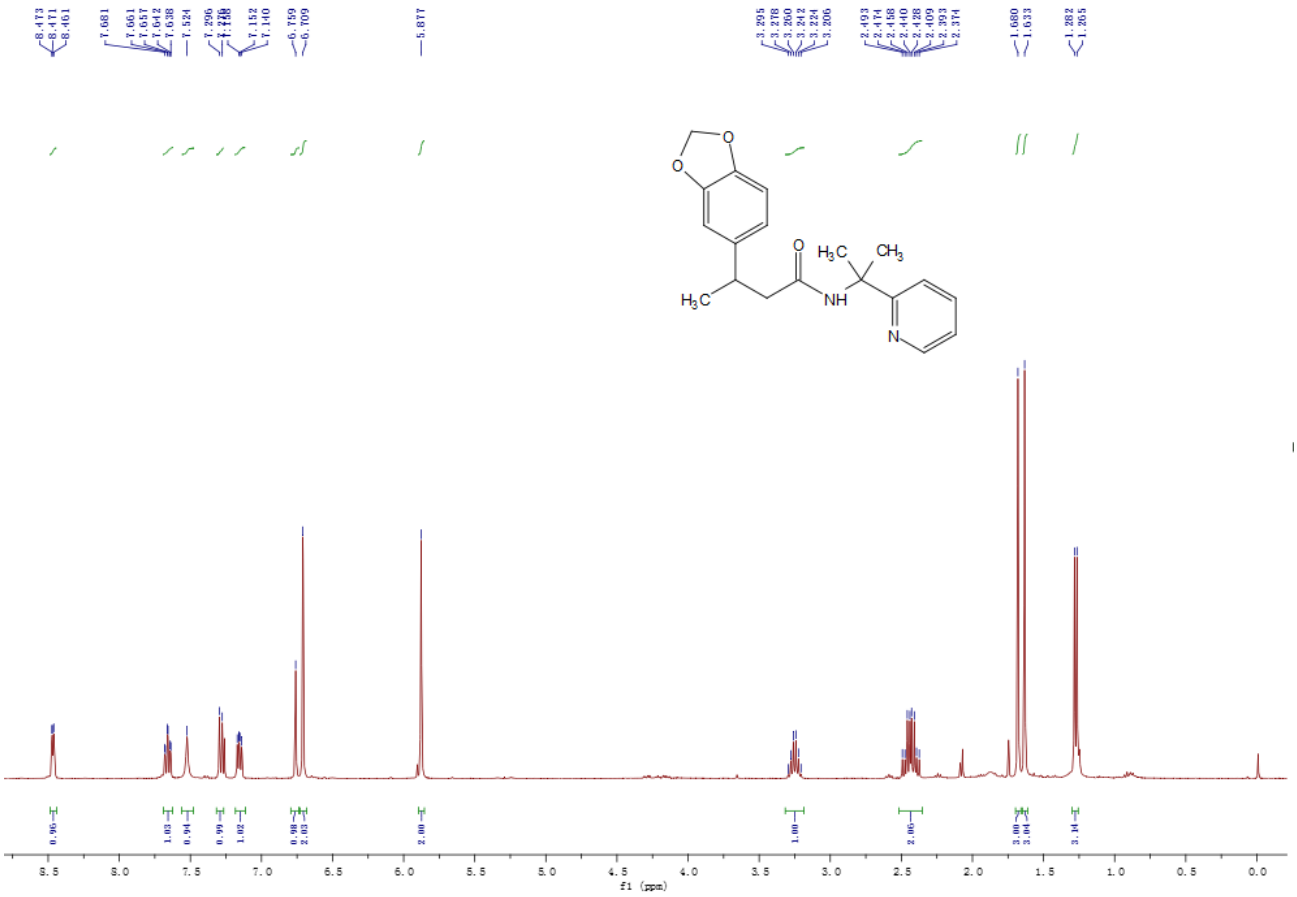
27.444
21.767
19.894
19.390
O
NH
N
f1 (ppm)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8.461
7.681
7.661
7.657
7.642
7.638
7.524
7.296
7.152
7.140
6.759
6.709
5.877
3.295
3.278
3.260
3.242
3.224
3.206
2.493
2.474
2.458
2.440
2.409
2.393
2.374
1.680
1.633
1.282
1.265
O
O
O
H3C
CH3
NH
H3C
N
0.96
1.03
0.94
0.99
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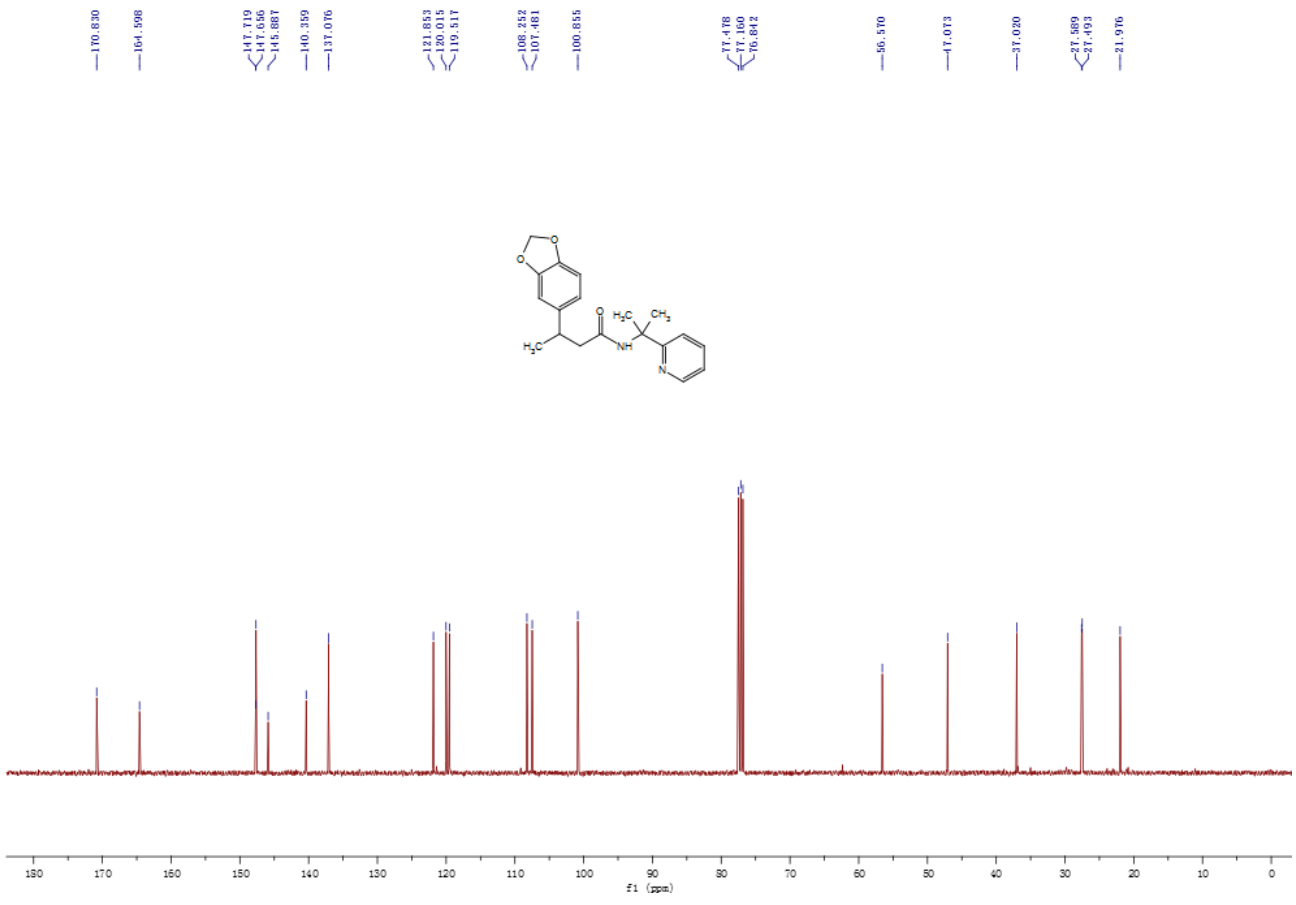
0.98
2.03
2.00
1.00
2.06
3.00
3.04
3.14
f1 (ppm)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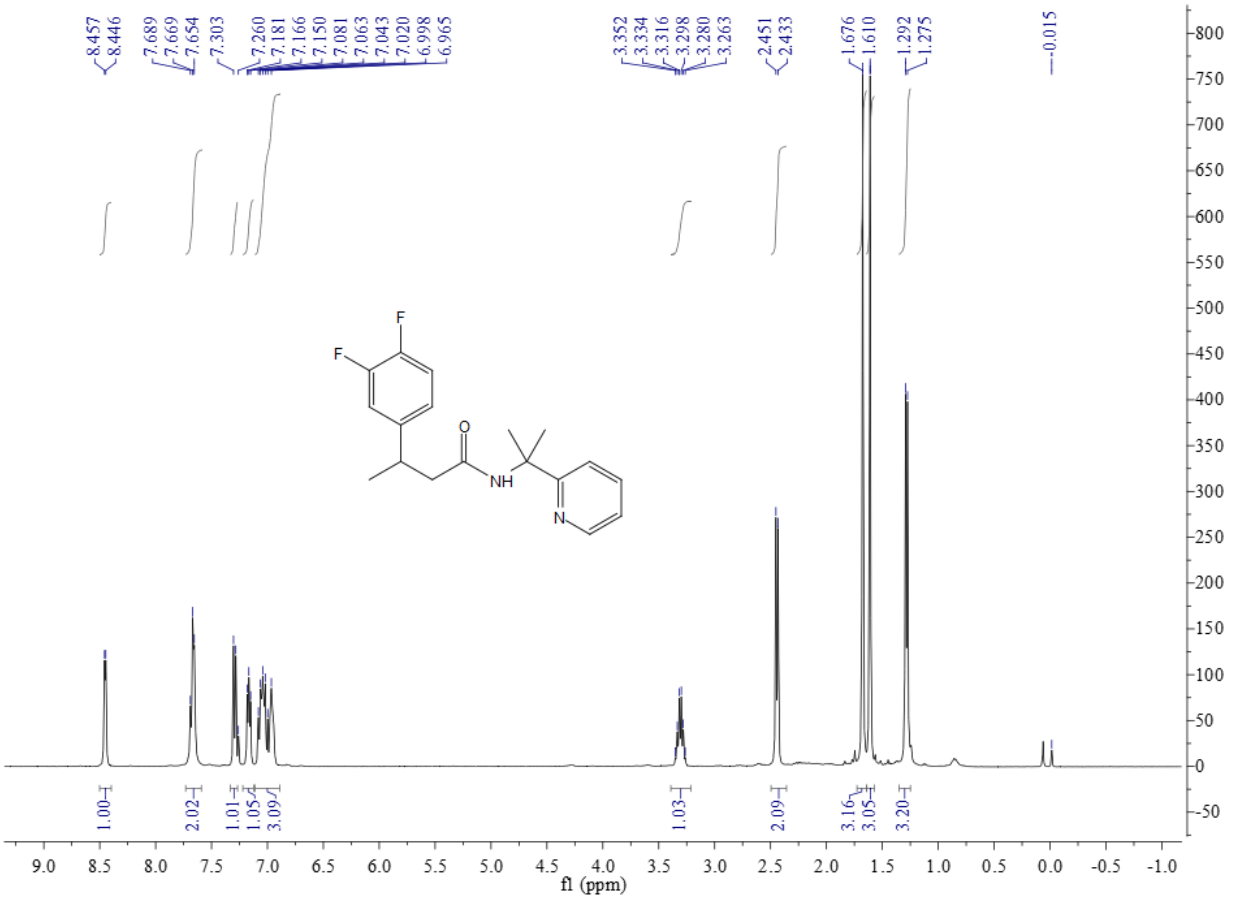
108.252
107.481
100.855
77.478
77.160
76.842
56.570
47.073
37.020
27.689
27.493
21.976
O
O
O
H3C
CH3
NH
N
f1 (ppm)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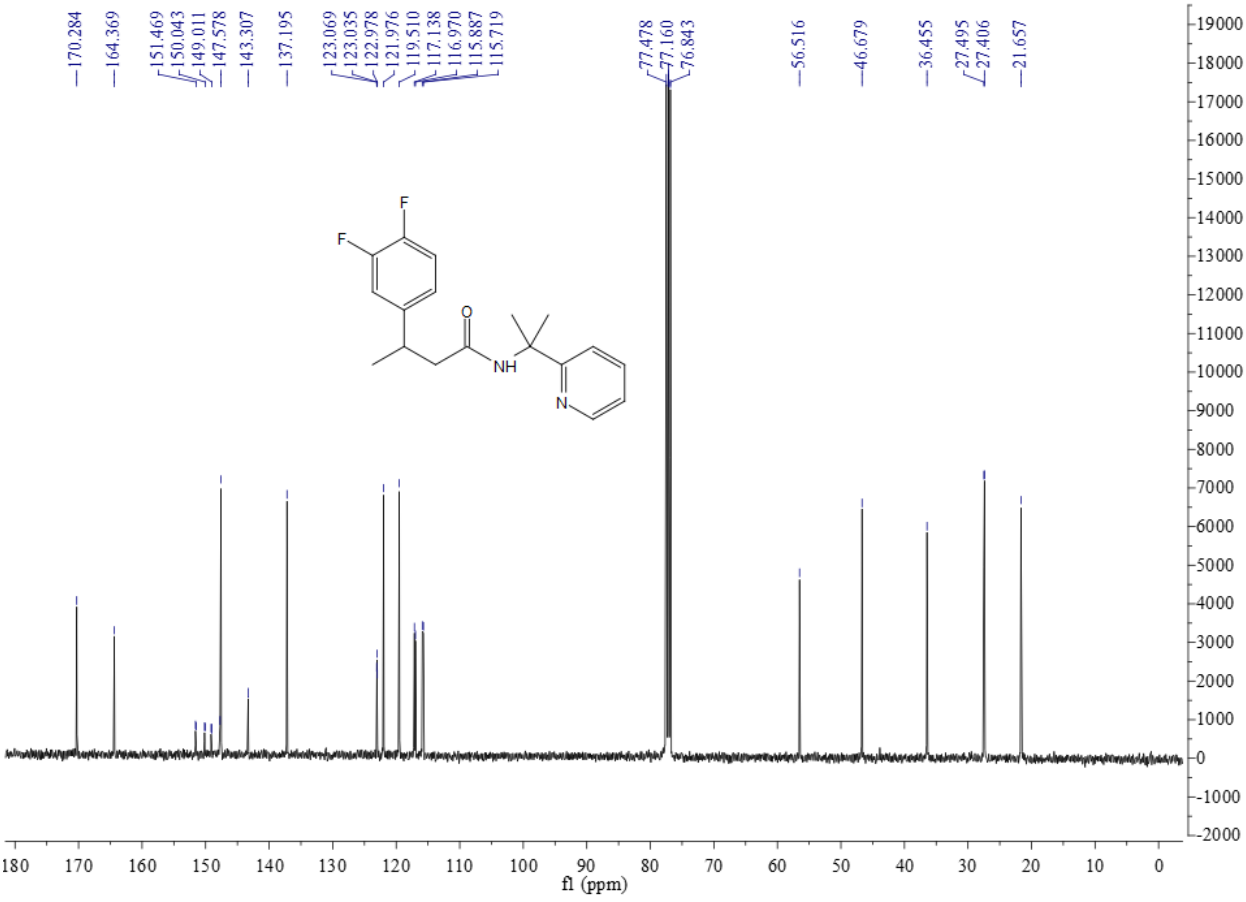
7.181
7.166
7.150
7.081
7.063
7.043
7.020
6.998
6.965
3.352
3.334
3.316
3.298
3.280
3.263
2.451
2.433
1.676
1.610
1.292
1.275
-0.015
F
F
O
NH
N
1.00
2.02
1.01
1.05
3.09
1.03
2.09
3.16
3.05
3.20
f1 (ppm)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137.195
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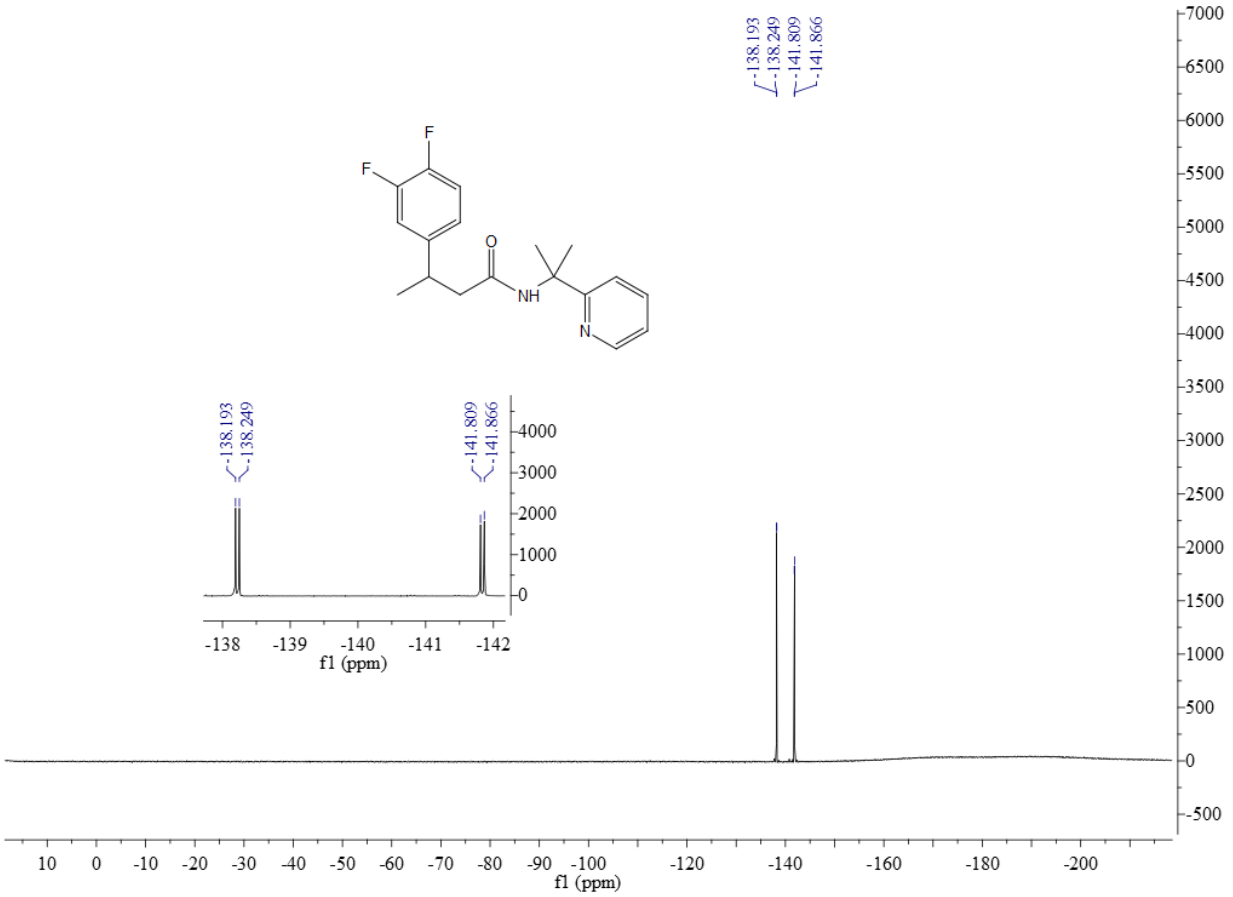
123.035
122.978
121.976
119.510
117.138
116.970
115.887
115.719
77.478
77.160
76.843
56.516
46.679
36.455
27.495
27.406
21.657
F
F
O
NH
N
f1 (ppm)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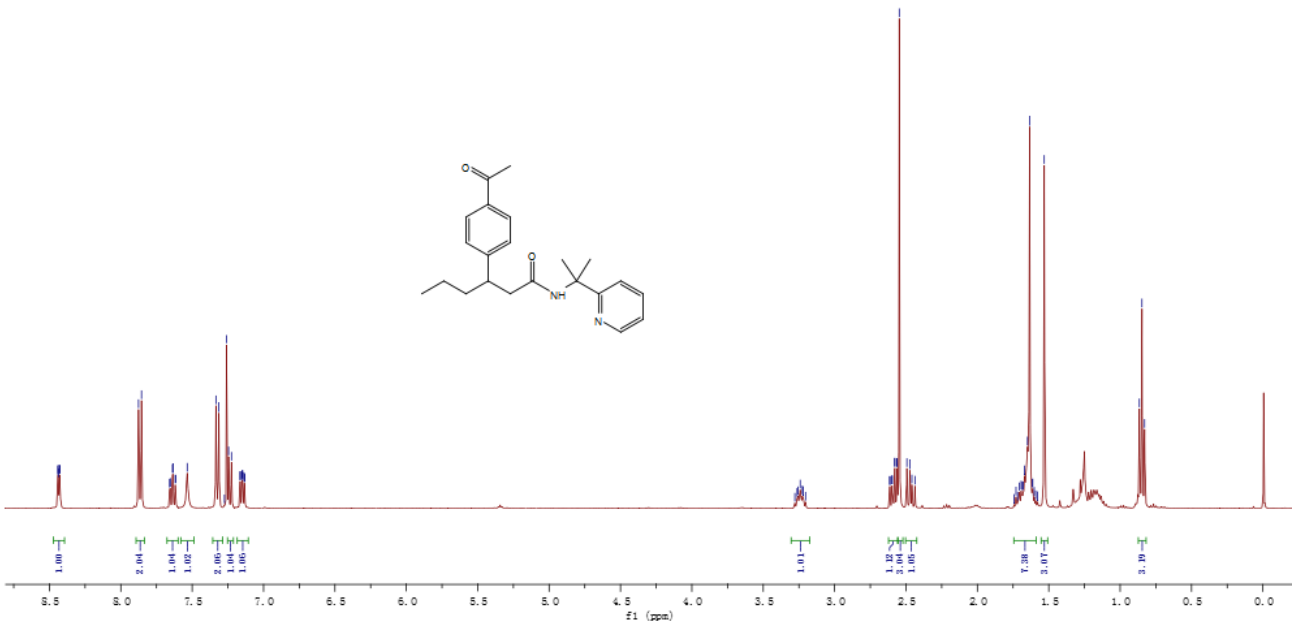
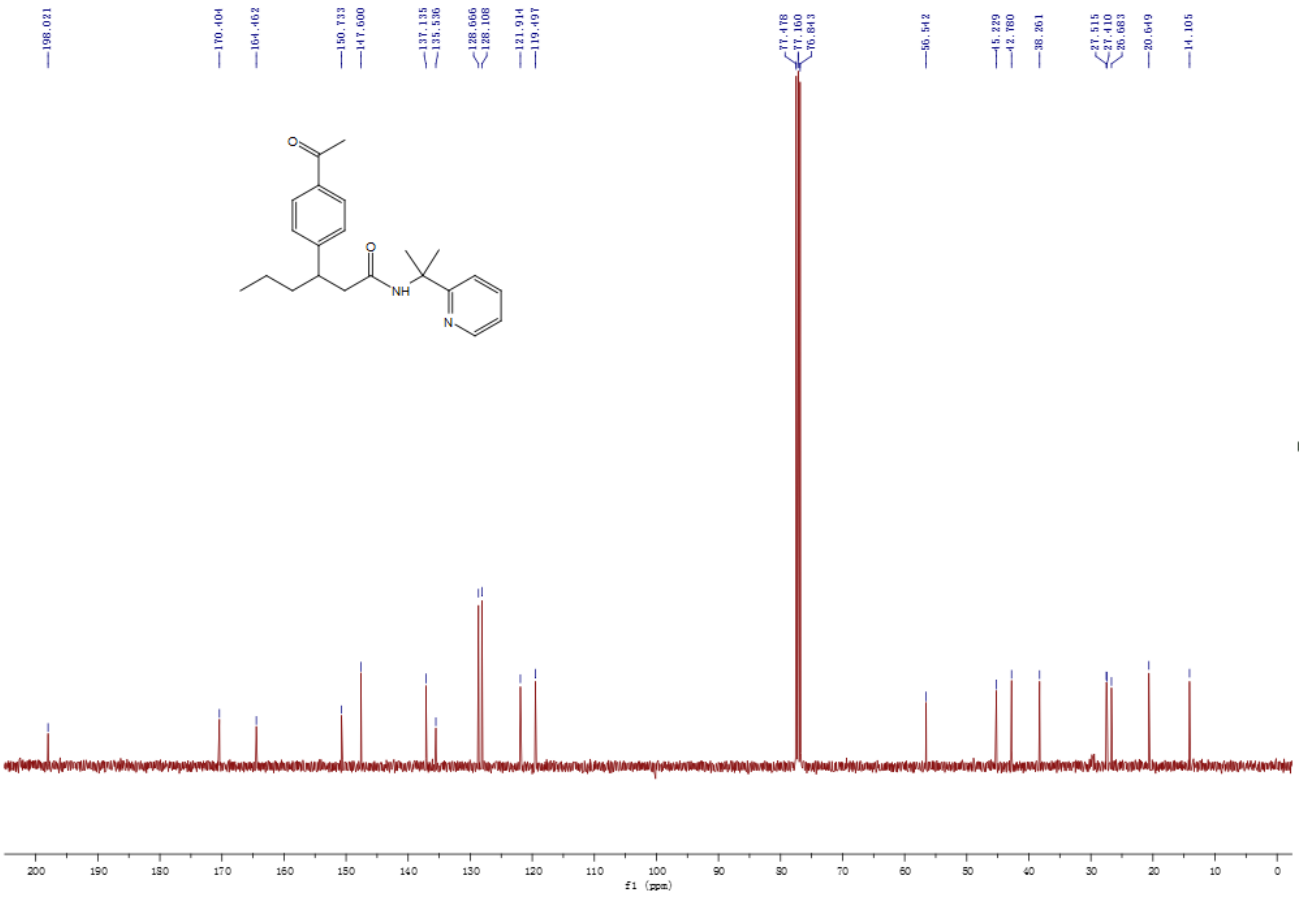
-138.249
-141.809
-141.866
F
F
O
NH
N
f1 (ppm)


O
O
NH
N
f1 (ppm)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137.135
135.536
128.666
128.108
121.914
119.497
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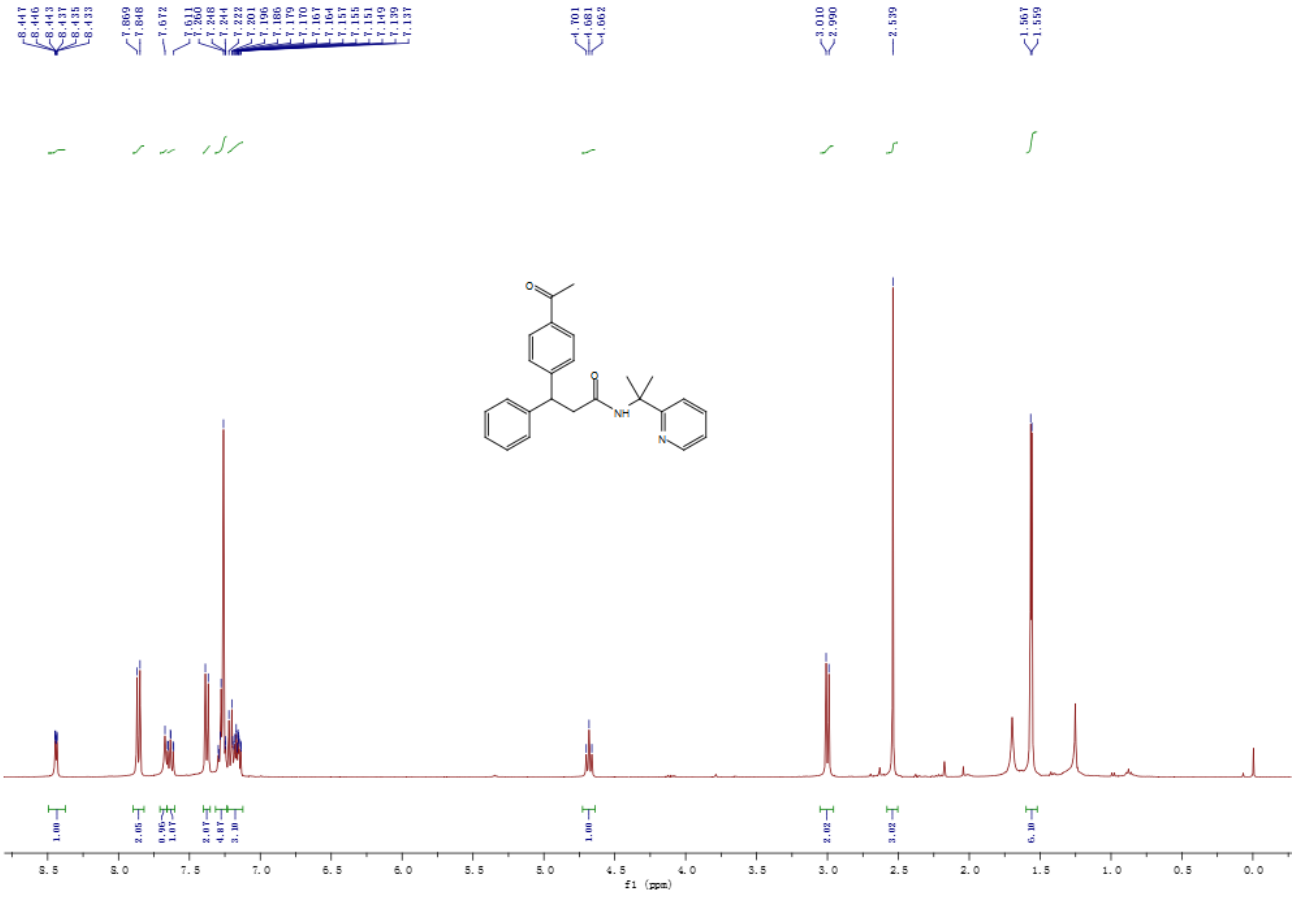
77.160
76.843
56.542
45.279
42.780
38.261
27.515
27.410
26.683
20.649
14.105
O
O
NH
N
f1 (ppm)


8.447
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8.435
8.433
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7.848
7.672
7.611
7.600
7.248
7.244
7.222
7.201
7.196
7.186
7.179
7.170
7.167
7.164
7.157
7.155
7.141
7.140
7.139
7.137
4.701
4.681
4.662
3.010
2.990
2.539
1.567
1.559
1.00
2.05
0.95
1.01
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3.10
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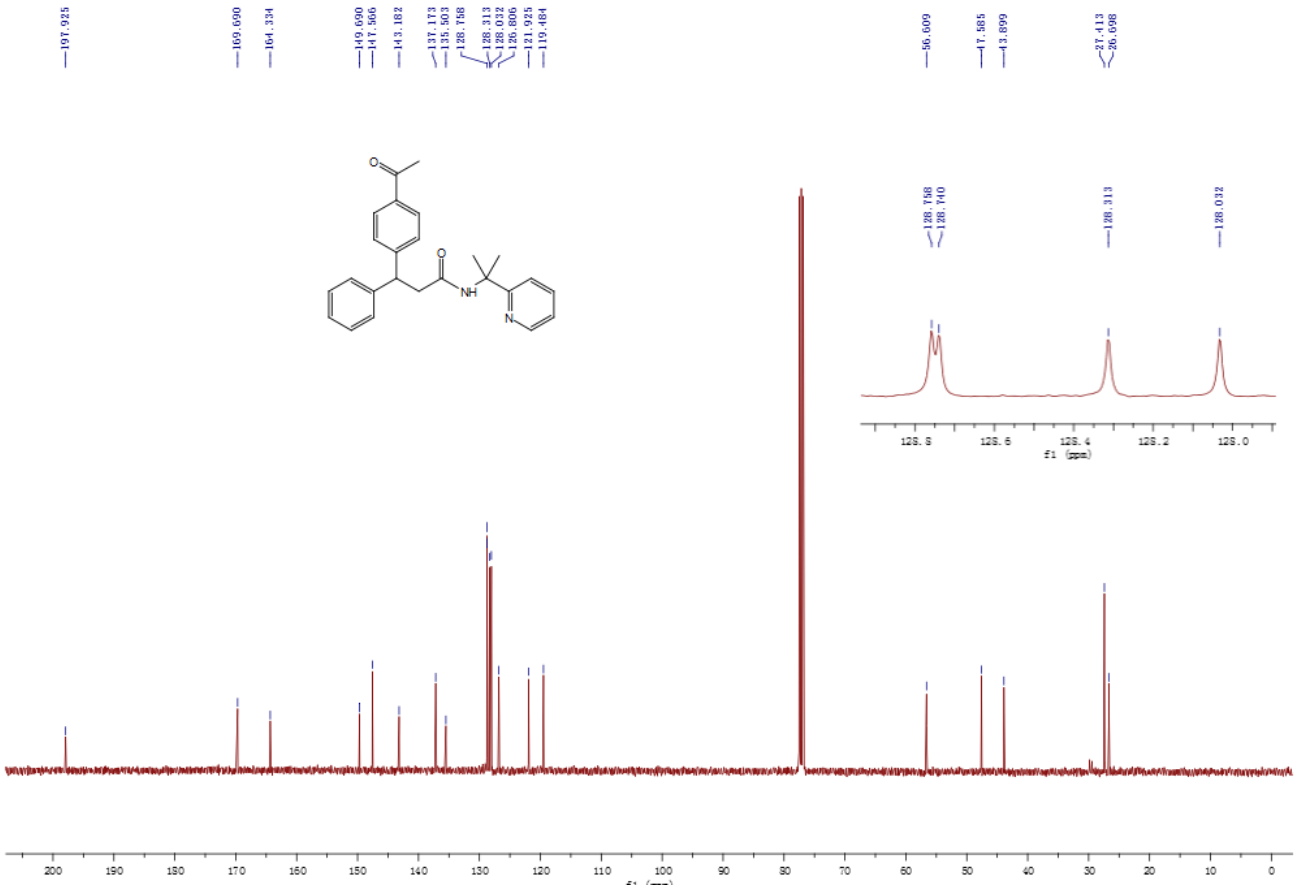
3.02
6.10
O
O
NH
N
f1 (ppm)


197.925
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164.334
149.690
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143.182
137.173
135.503
128.758
128.313
128.032
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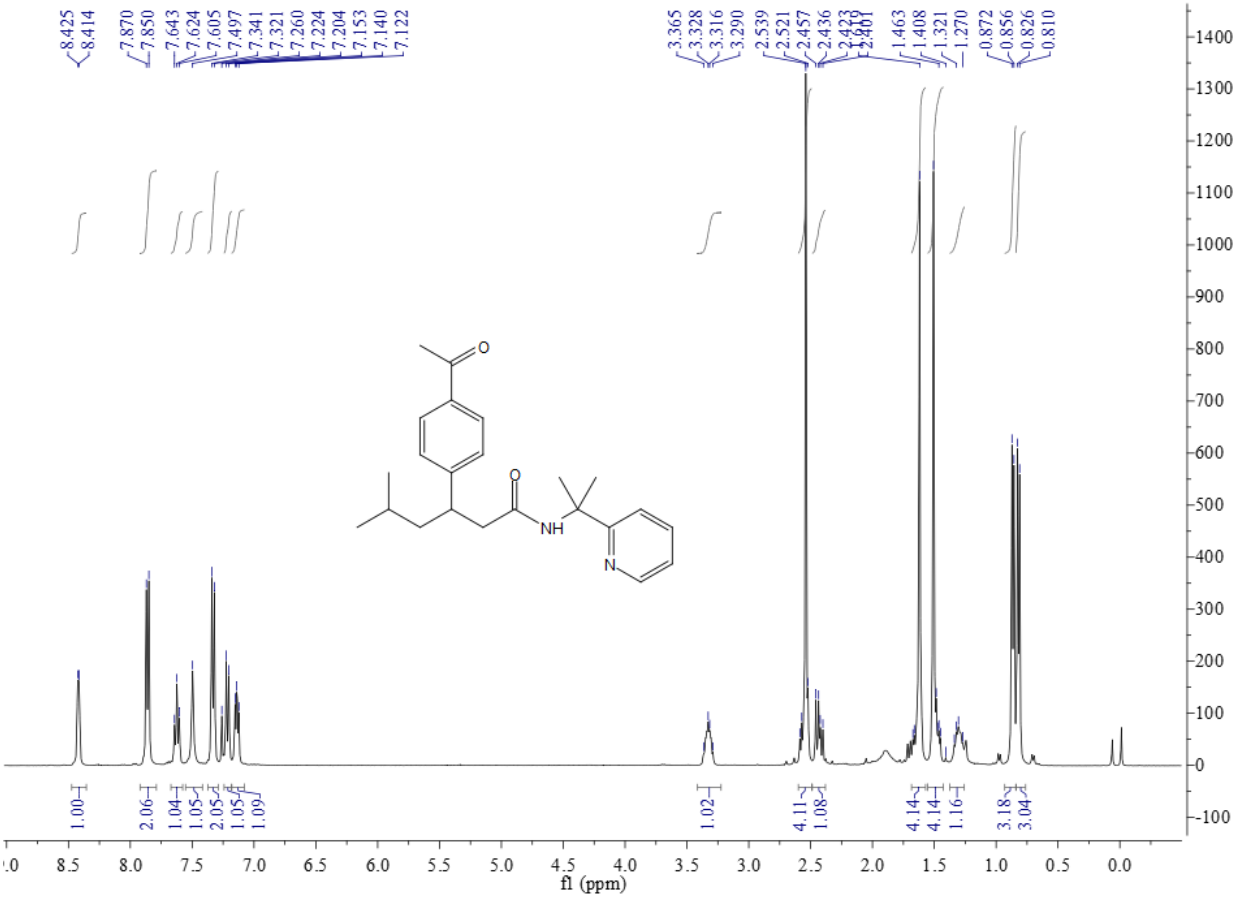
121.925
119.484
56.609
47.585
43.899
27.413
26.698
128.758
128.740
128.313
128.032
f1 (ppm)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7.321
7.260
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7.204
7.153
7.140
7.122
3.365
3.328
3.316
3.290
2.539
2.521
2.457
2.436
1.463
1.408
1.321
1.270
0.872
0.856
0.826
0.810
1.00
2.06
1.04
1.05
2.05
1.05
1.09
1.02
4.11
1.08
4.14
4.14
1.16
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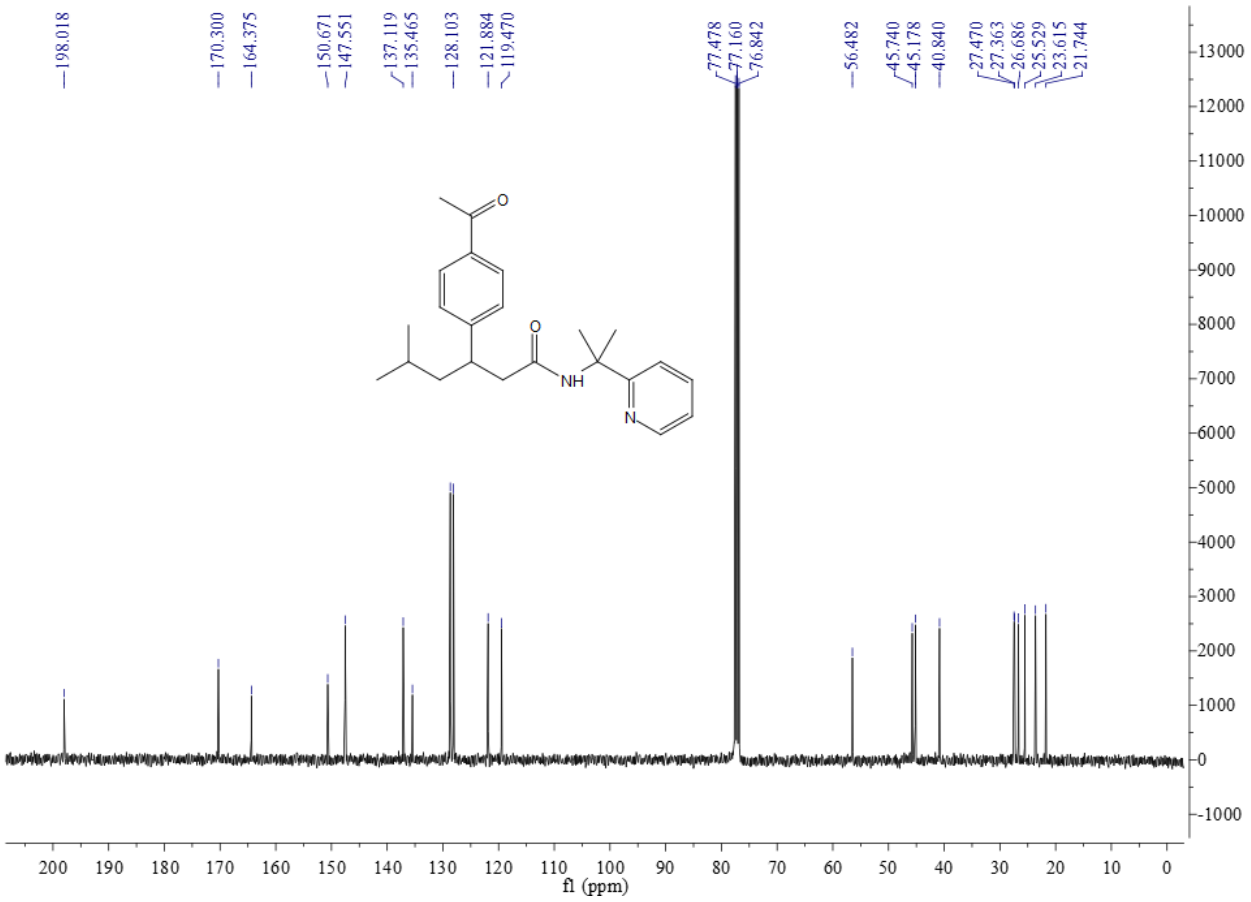
3.04
f1 (ppm)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128.103
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119.470
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77.160
76.842
56.482
45.740
45.178
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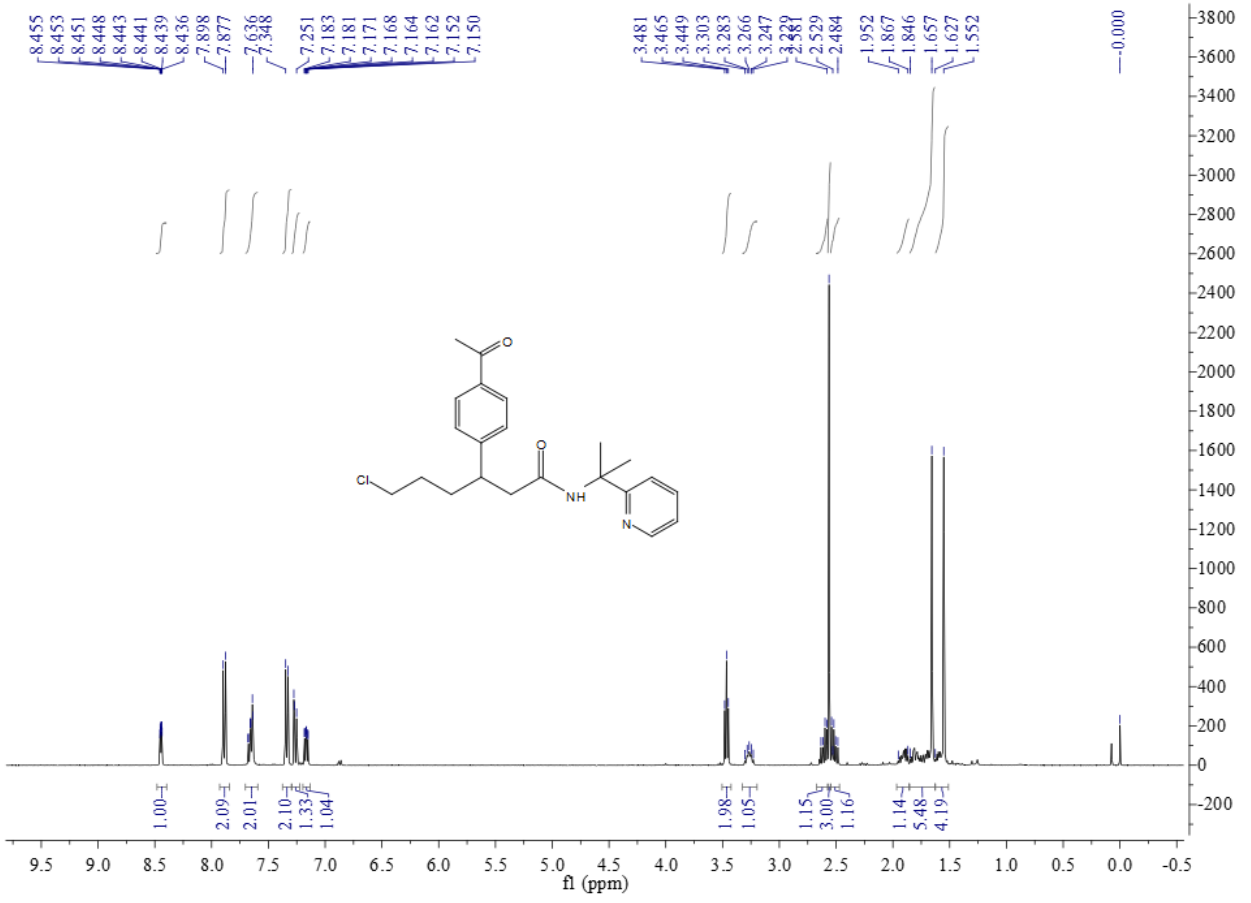
27.470
27.363
26.686
25.529
23.615
21.744
O
O
NH
N
f1 (ppm)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7.251
7.183
7.181
7.171
7.168
7.164
7.162
7.152
7.150
3.481
3.465
3.449
3.303
3.283
3.266
3.247
2.529
2.484
1.952
1.867
1.846
1.657
1.627
1.552
0.000
1.00
2.09
2.01
2.10
1.33
1.04
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3.00
1.16
1.14
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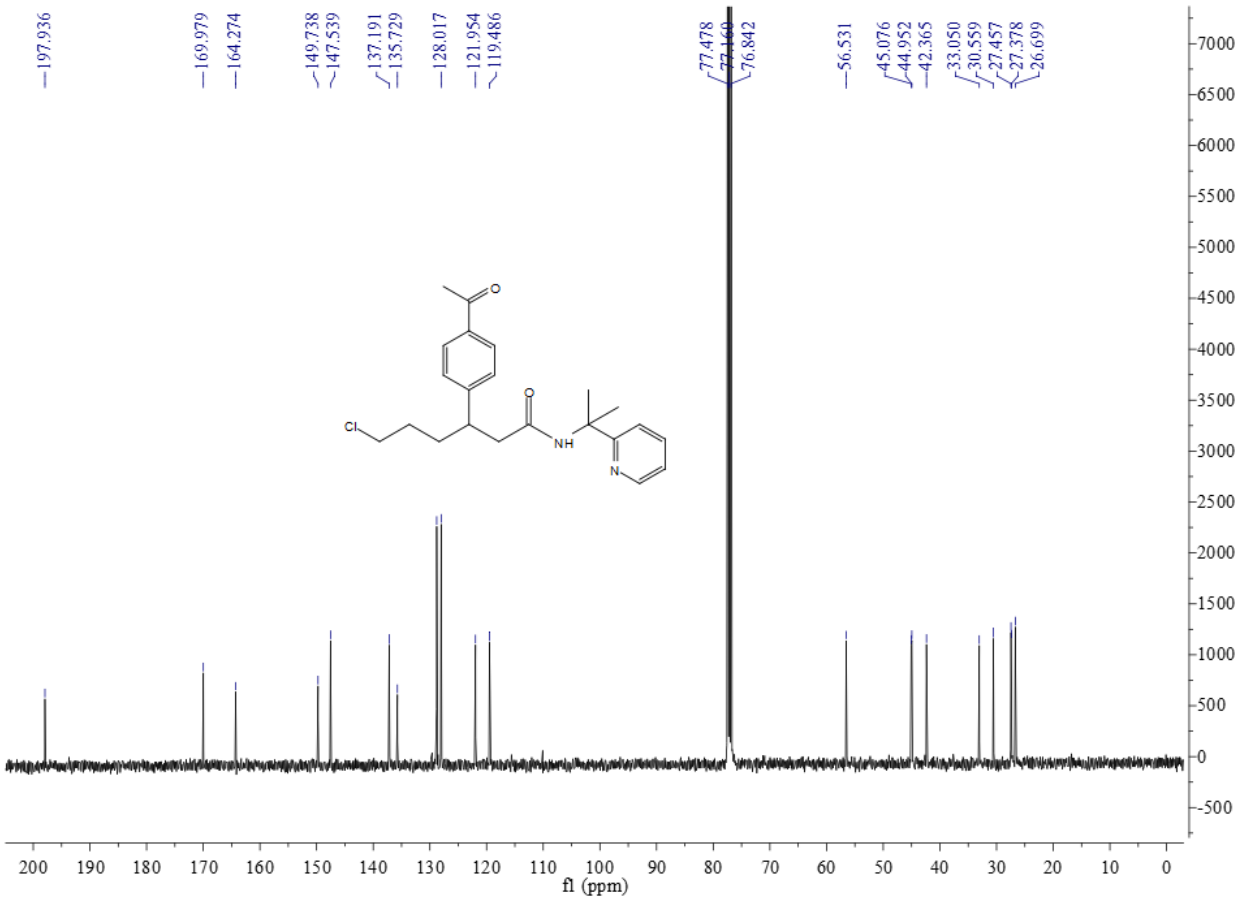
O
Cl
O
NH
N
f1 (ppm)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76.842
56.531
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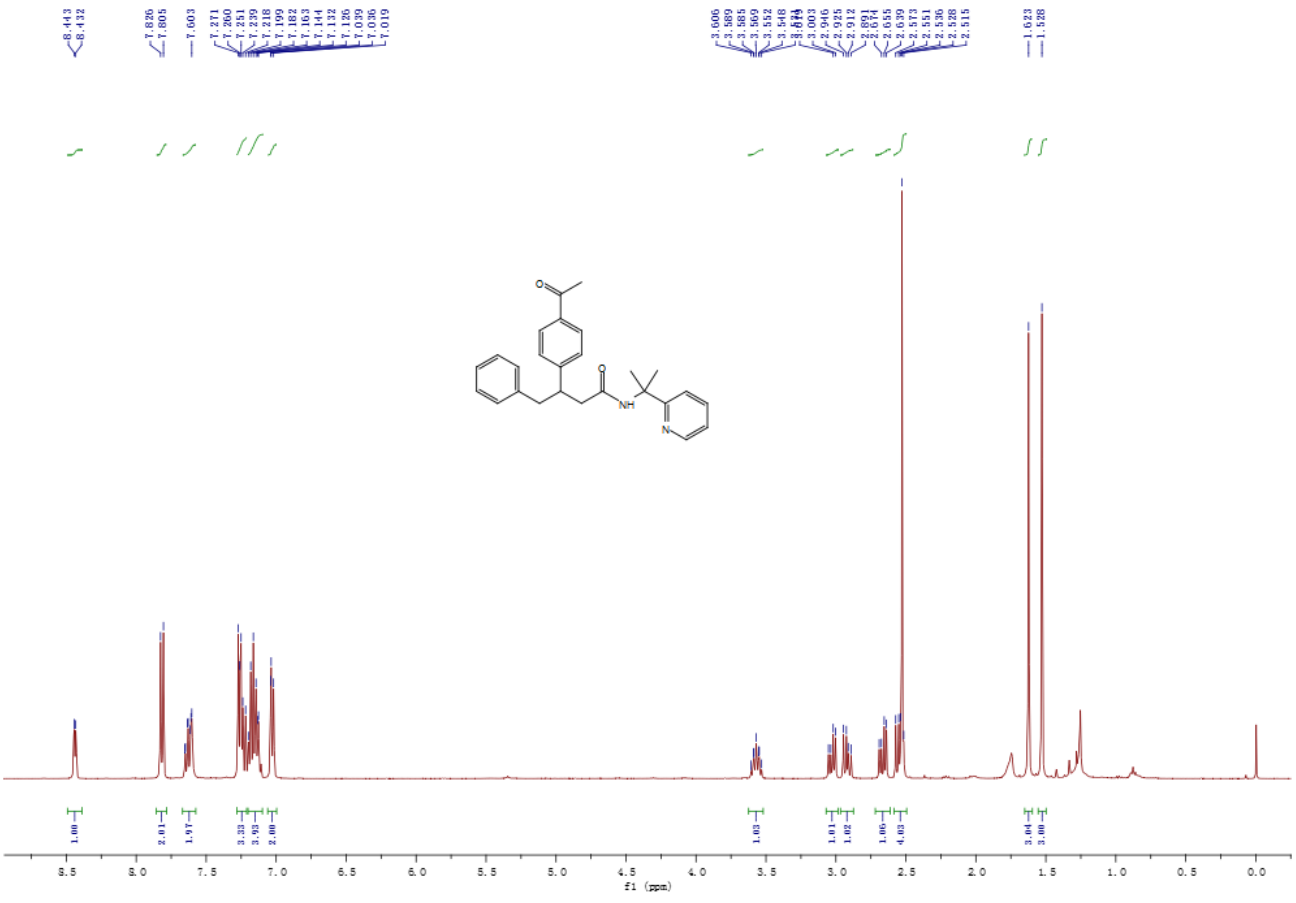
Cl
O
NH
N
f1 (ppm)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7.251
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7.199
7.182
7.163
7.144
7.132
7.126
7.039
7.036
7.019
3.606
3.589
3.585
3.569
3.552
3.548
3.003
2.946
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2.573
2.551
2.536
2.528
2.515
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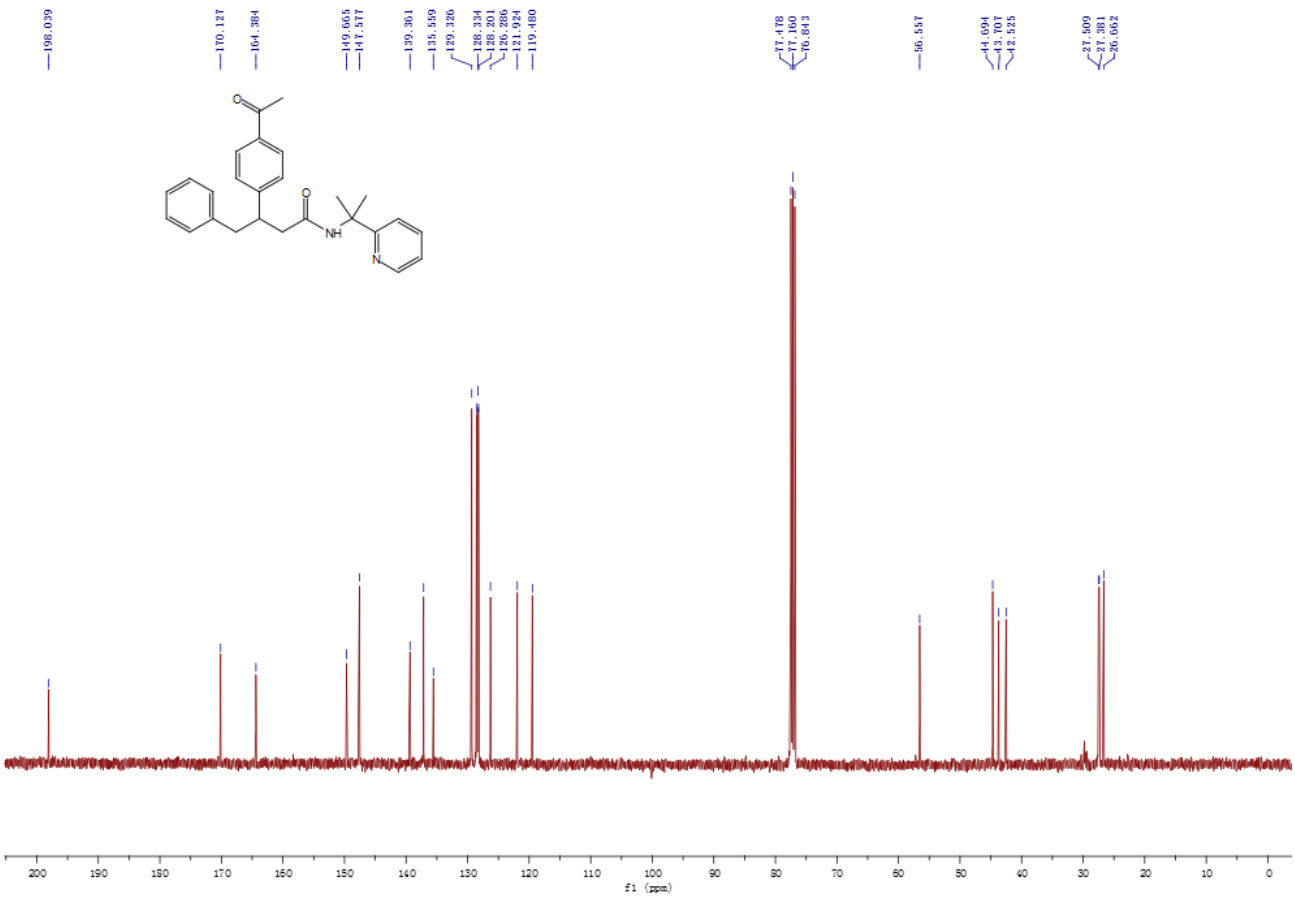
NH
N
f1 (ppm)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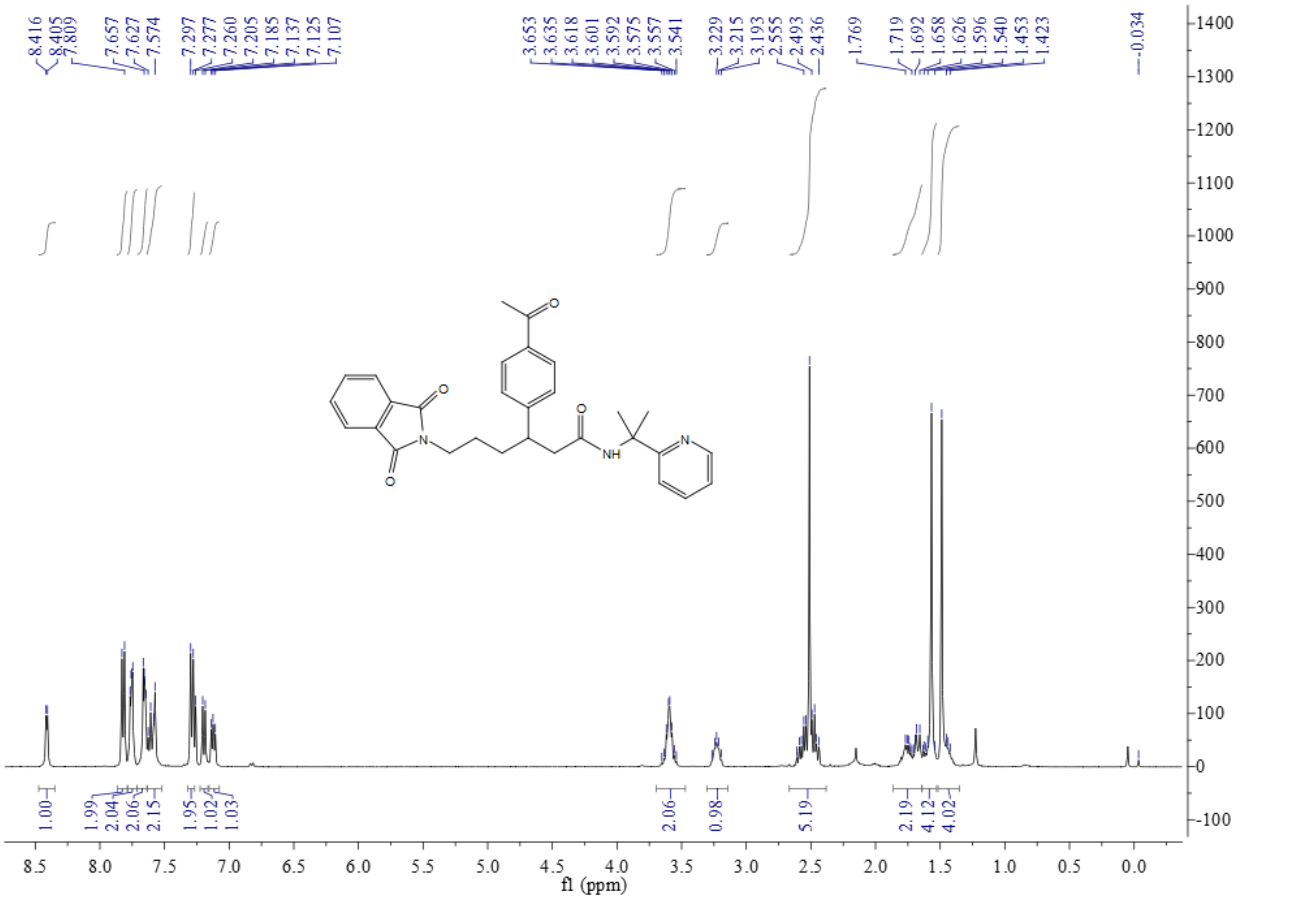
26.662
f1 (ppm)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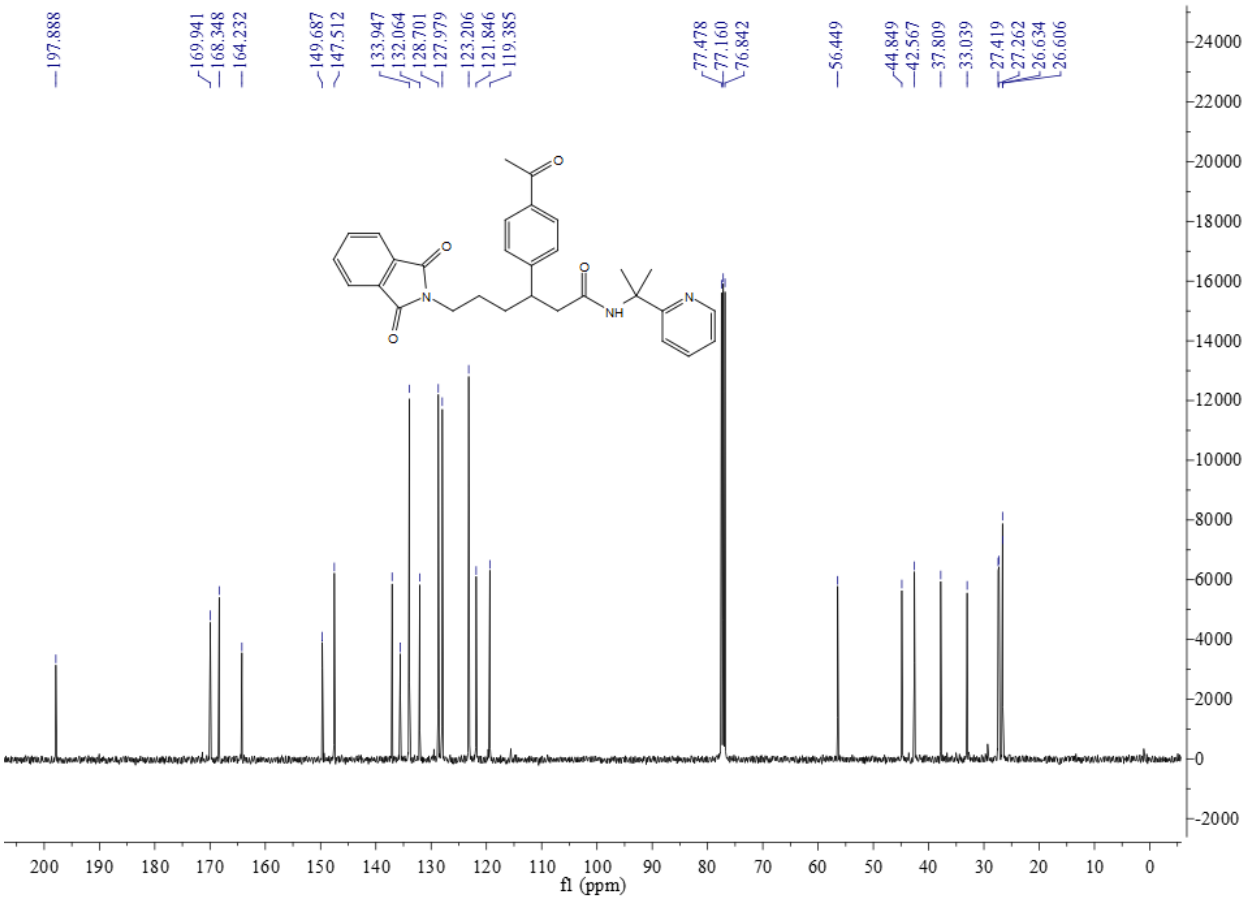
7.627
7.574
7.297
7.277
7.260
7.205
7.185
7.137
7.125
7.107
3.653
3.635
3.618
3.601
3.592
3.575
3.557
3.541
3.229
3.215
3.193
2.555
2.493
2.436
1.769
1.719
1.692
1.658
1.626
1.596
1.540
1.453
1.423
-0.034
1.00
1.99
2.04
2.06
2.15
1.95
1.02
1.03
2.06
0.98
5.19
2.19
4.12
4.02
f1 (ppm)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132.064
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121.846
119.385
77.478
77.160
76.842
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44.849
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37.809
33.039
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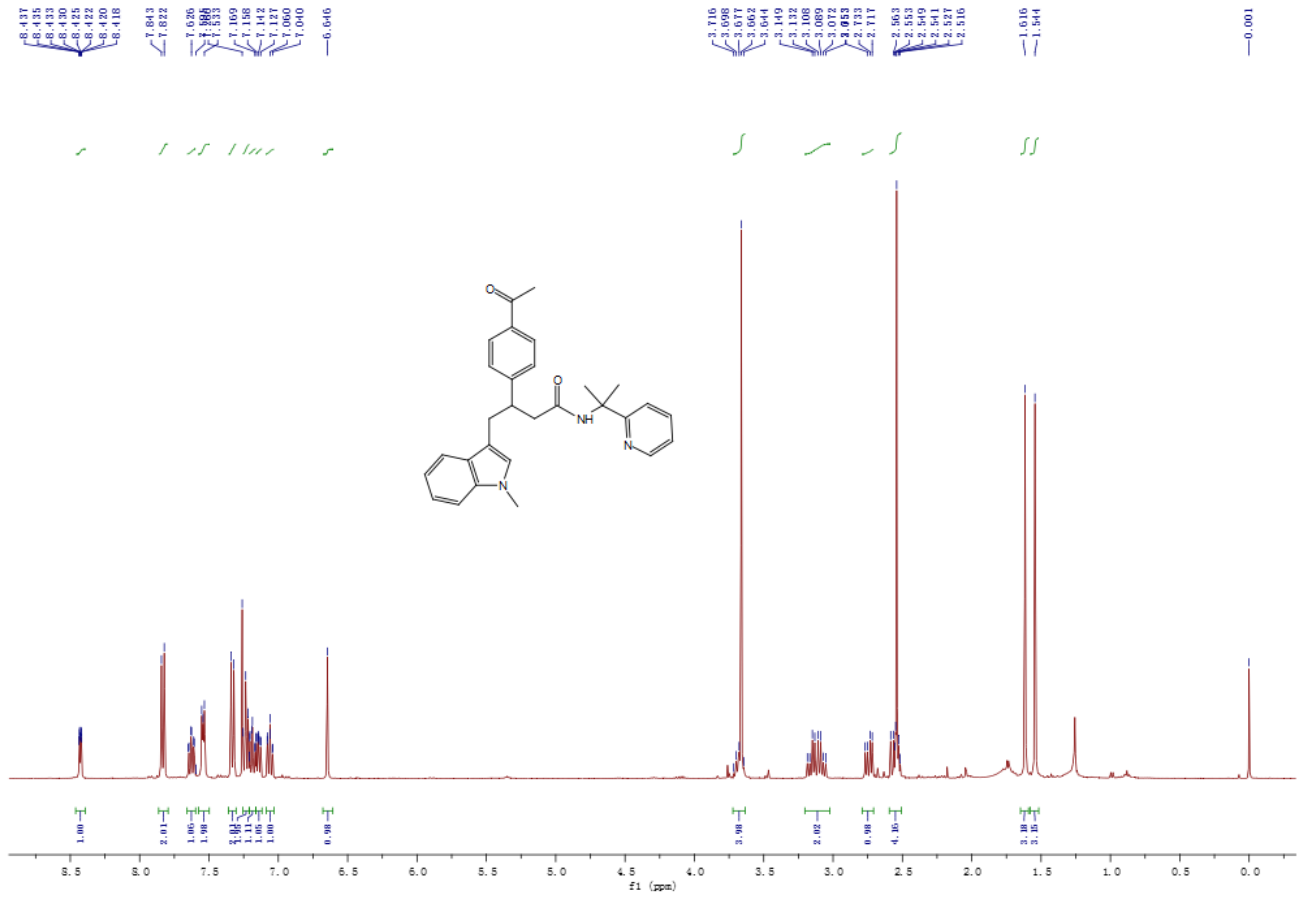
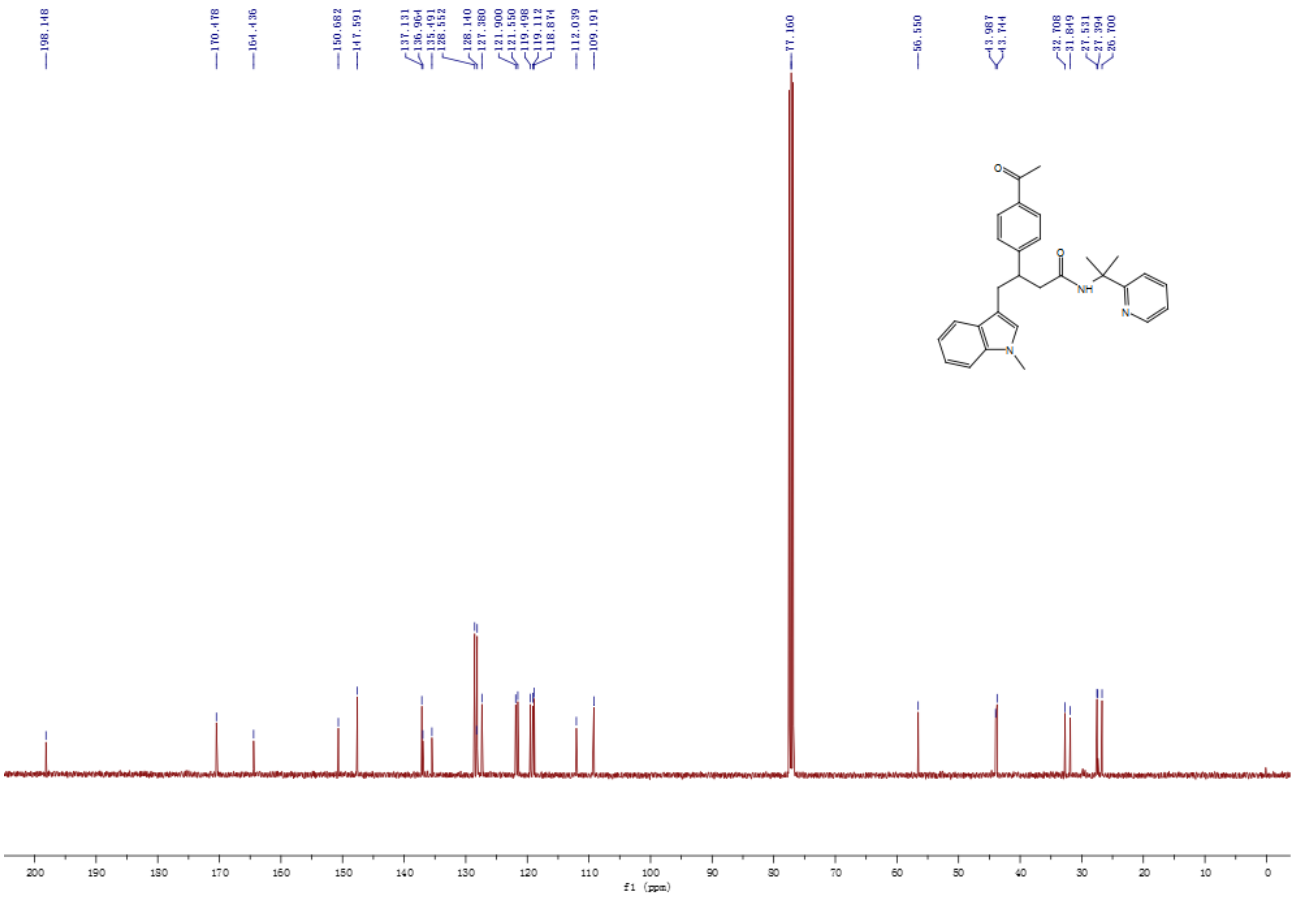
26.606
f1 (ppm)


f1 (ppm)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137.131
136.964
135.491
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127.380
121.900
121.560
119.998
119.112
118.874
112.039
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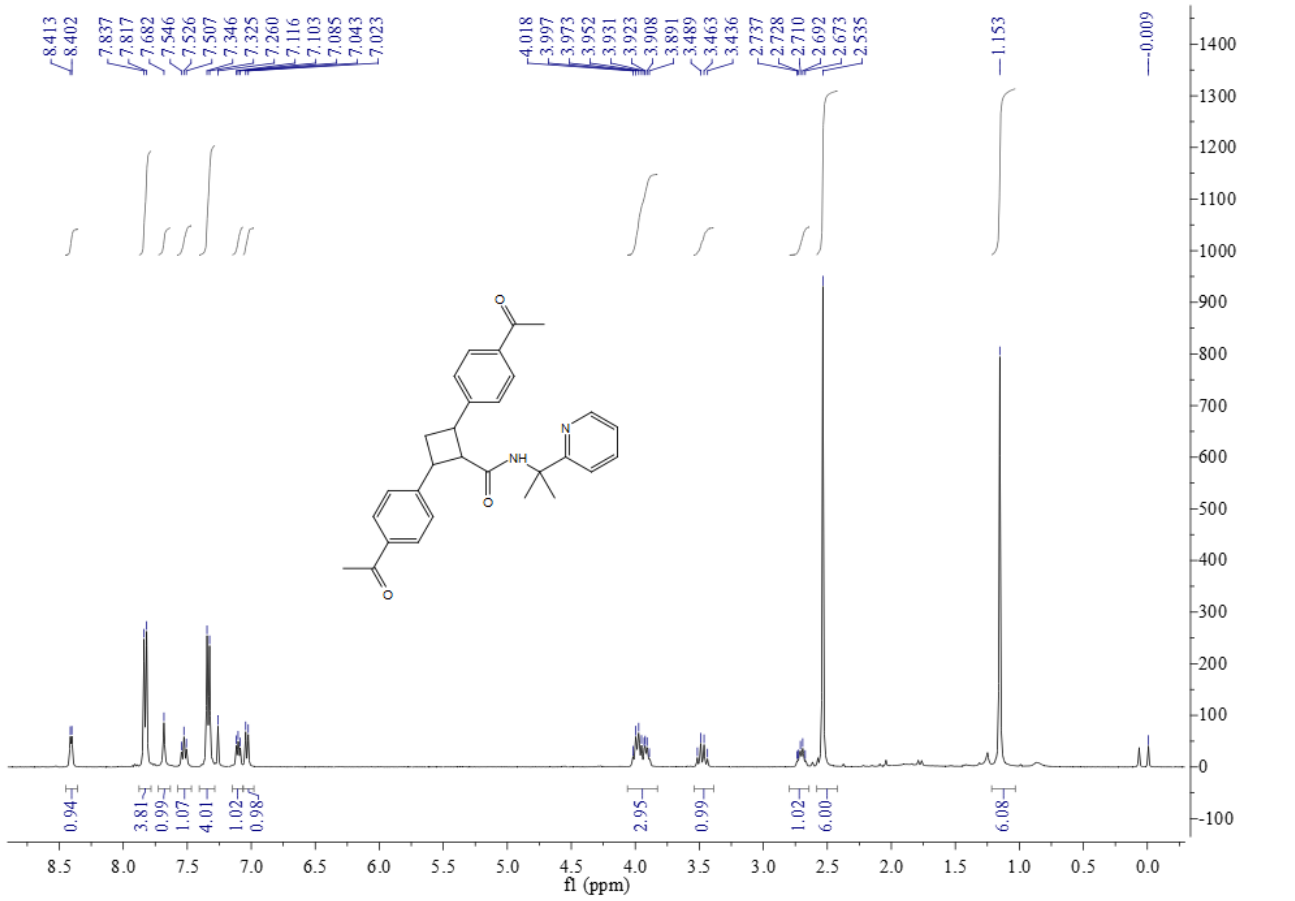
56.550
43.987
43.744
32.708
31.849
27.531
27.394
26.700
f1 (ppm)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8.402
7.837
7.817
7.682
7.546
7.526
7.507
7.346
7.325
7.260
7.116
7.103
7.085
7.043
7.023
4.018
3.997
3.973
3.952
3.931
3.923
3.908
3.891
3.489
3.463
3.436
2.737
2.728
2.710
2.692
2.673
2.535
1.153
-0.009
0.94
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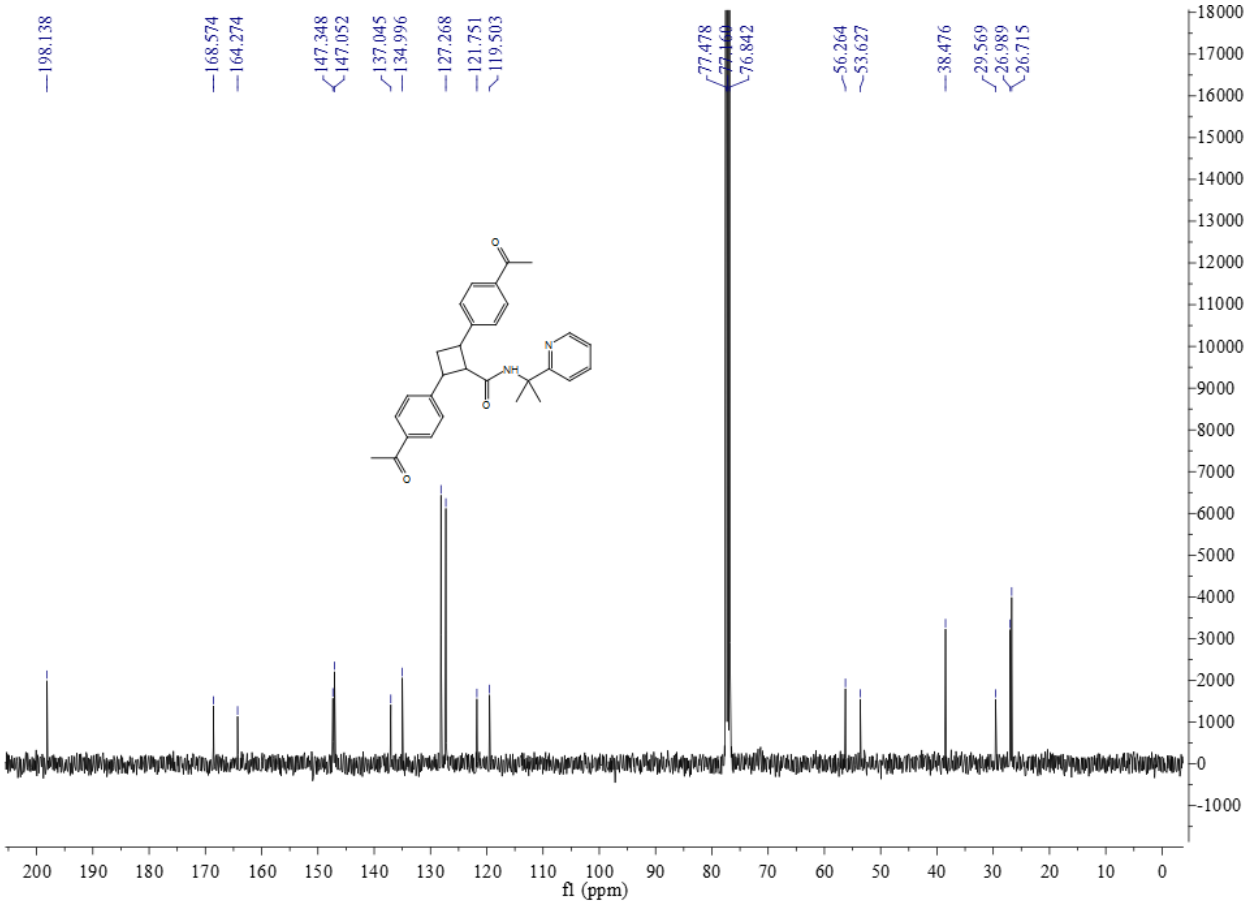
1.07
4.01
1.02
0.98
2.95
0.99
1.02
6.00
6.08
f1 (ppm)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134.996
127.268
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119.503
77.478
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53.627
38.476
29.569
26.989
26.715
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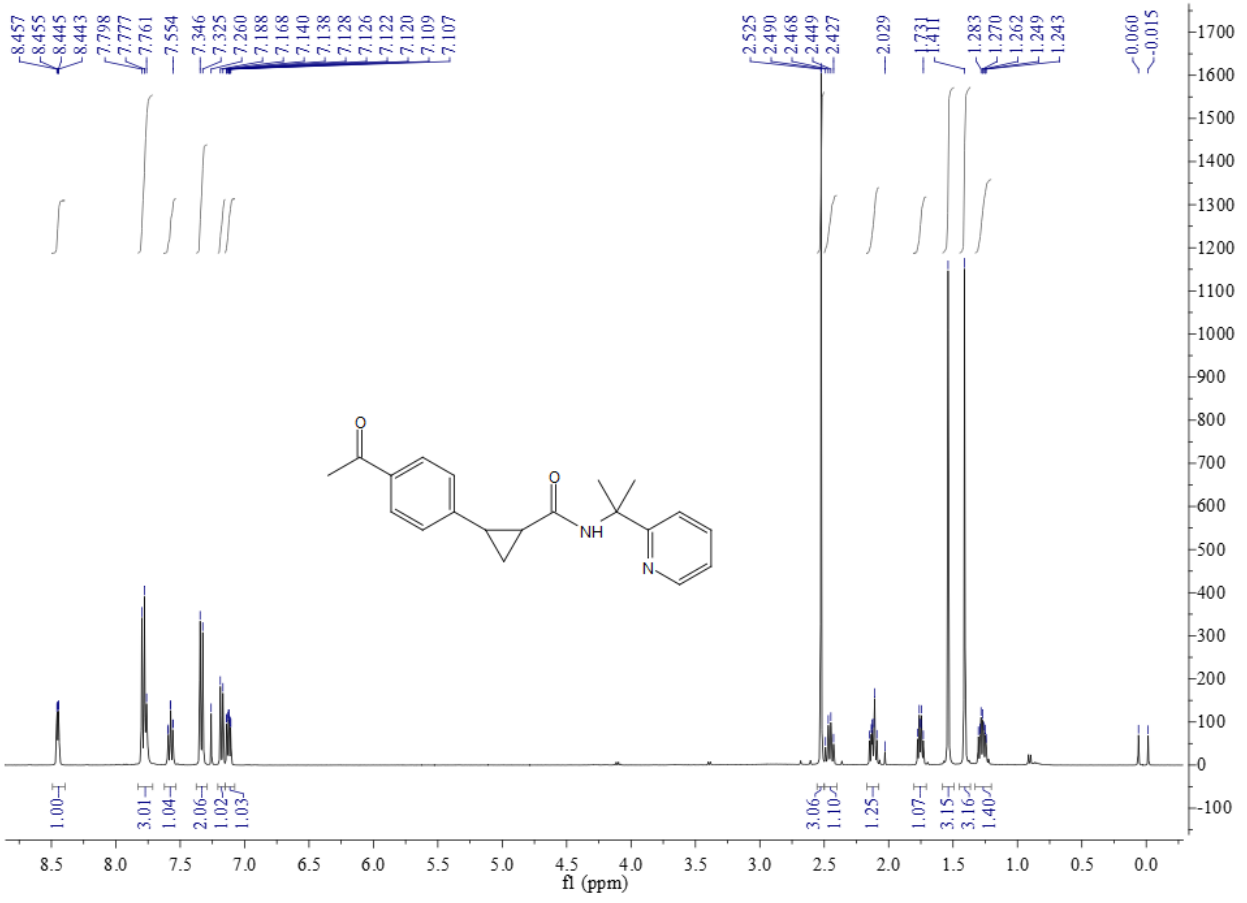
O
NH
N
O
fl (ppm)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8.443
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7.777
7.761
7.554
7.346
7.325
7.260
7.188
7.168
7.140
7.138
7.128
7.126
7.122
7.120
7.109
7.107
2.525
2.490
2.468
2.449
2.427
2.029
1.283
1.270
1.262
1.249
1.243
0.060
-0.015
1.00
3.01
1.04
2.06
1.02
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1.10
1.25
1.07
3.15
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1.40
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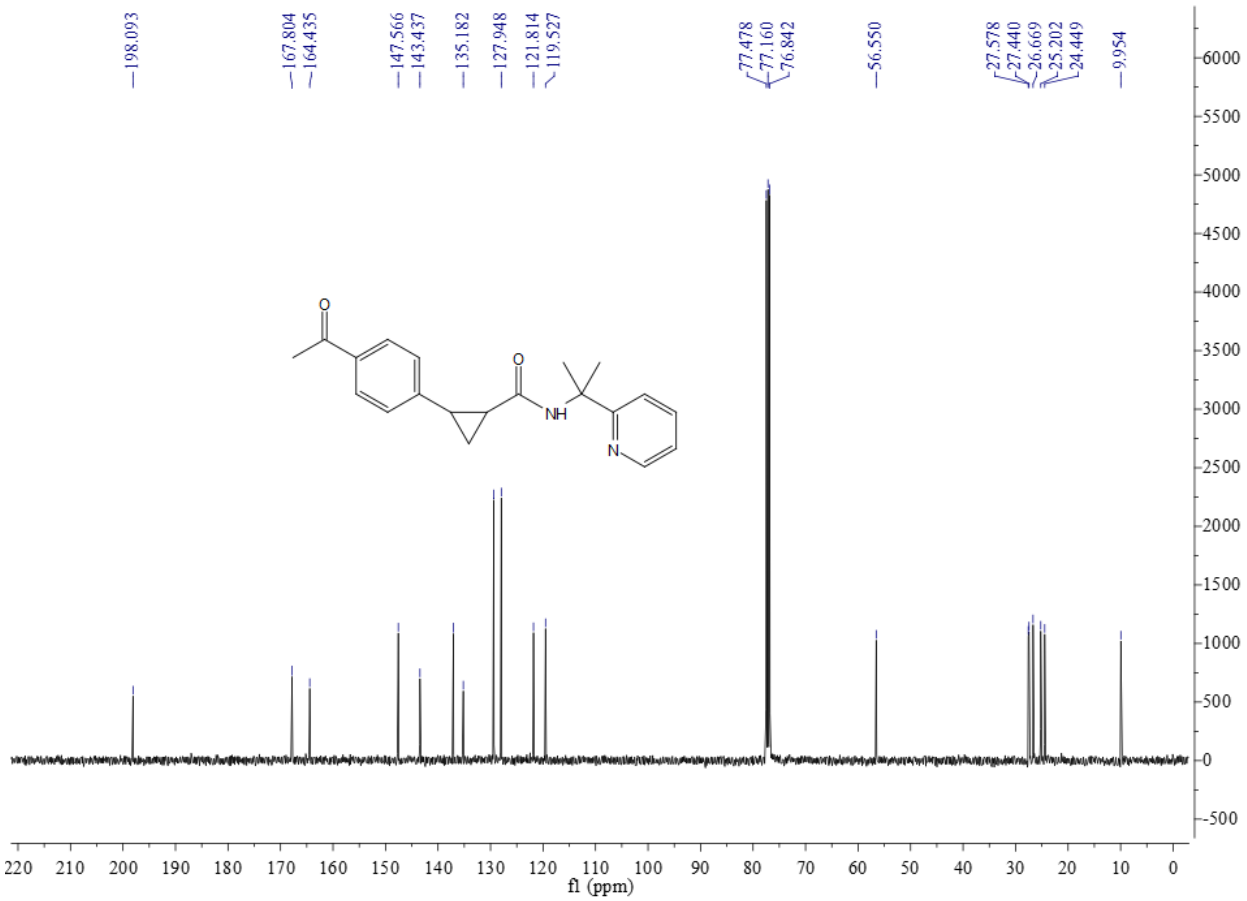
O
NH
N
fl (ppm)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121.814
119.527
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77.160
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27.440
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25.202
24.449
9.954
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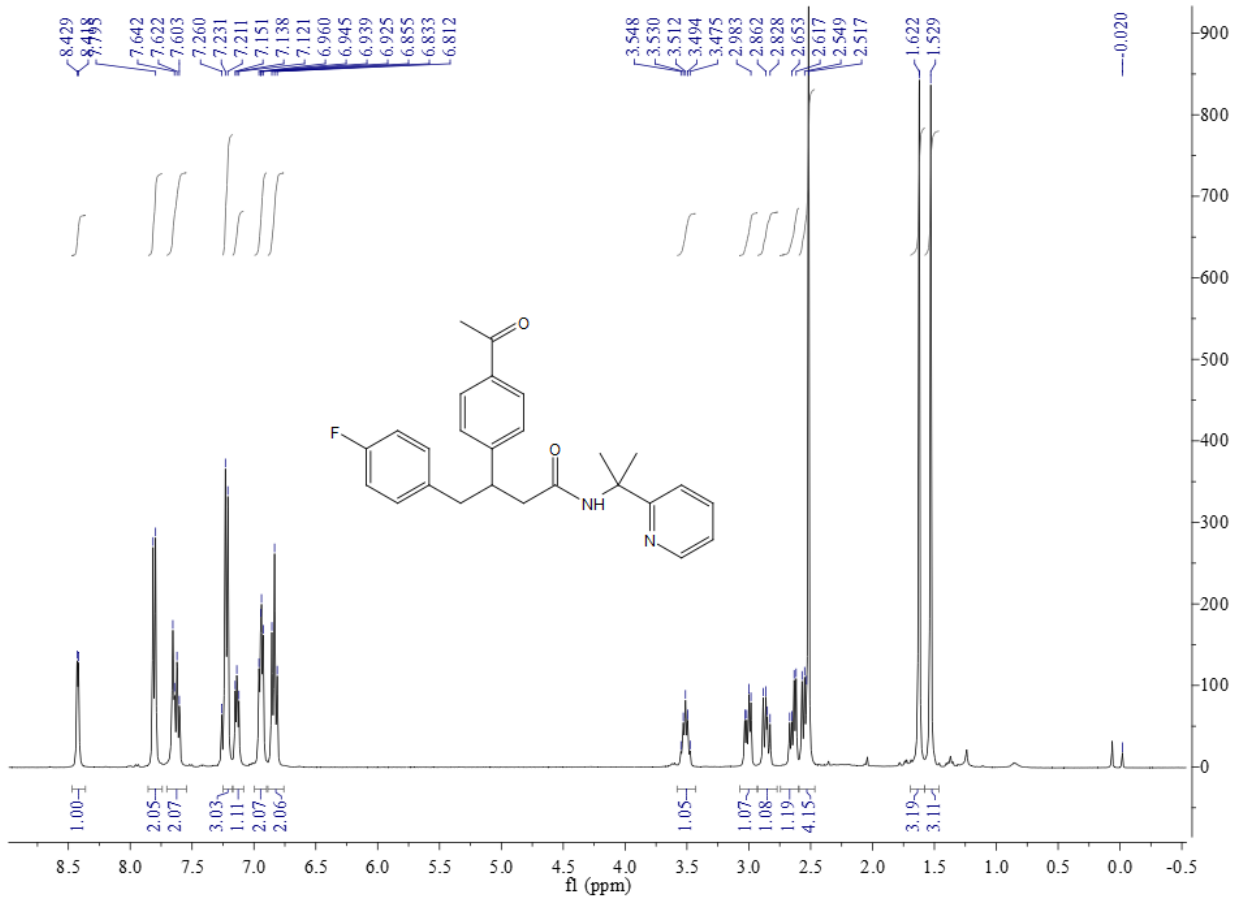
NH
N
f1 (ppm)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7.231
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7.151
7.138
7.121
6.960
6.945
6.939
6.925
6.855
6.833
6.812
3.548
3.530
3.512
3.494
3.475
2.983
2.862
2.828
2.653
2.617
2.549
2.517
1.622
1.529
0.020
F
O
O
NH
N
1.00
2.05
2.07
3.03
1.11
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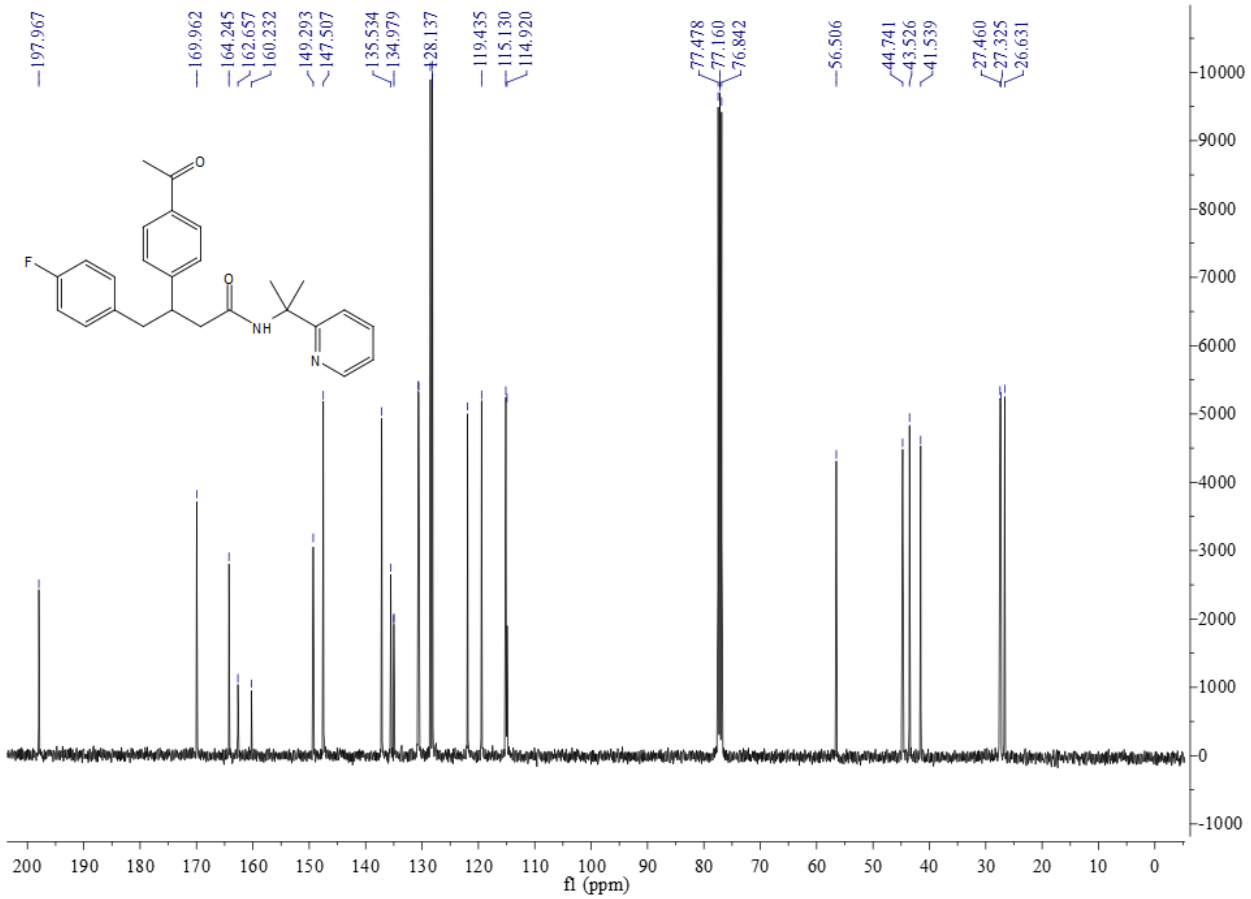
2.06
1.05
1.07
1.08
1.19
4.15
3.19
3.11
f1 (ppm)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115.130
114.920
77.478
77.160
76.842
56.506
44.741
43.526
41.539
27.460
27.325
26.631
O
F
O
NH
N
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000
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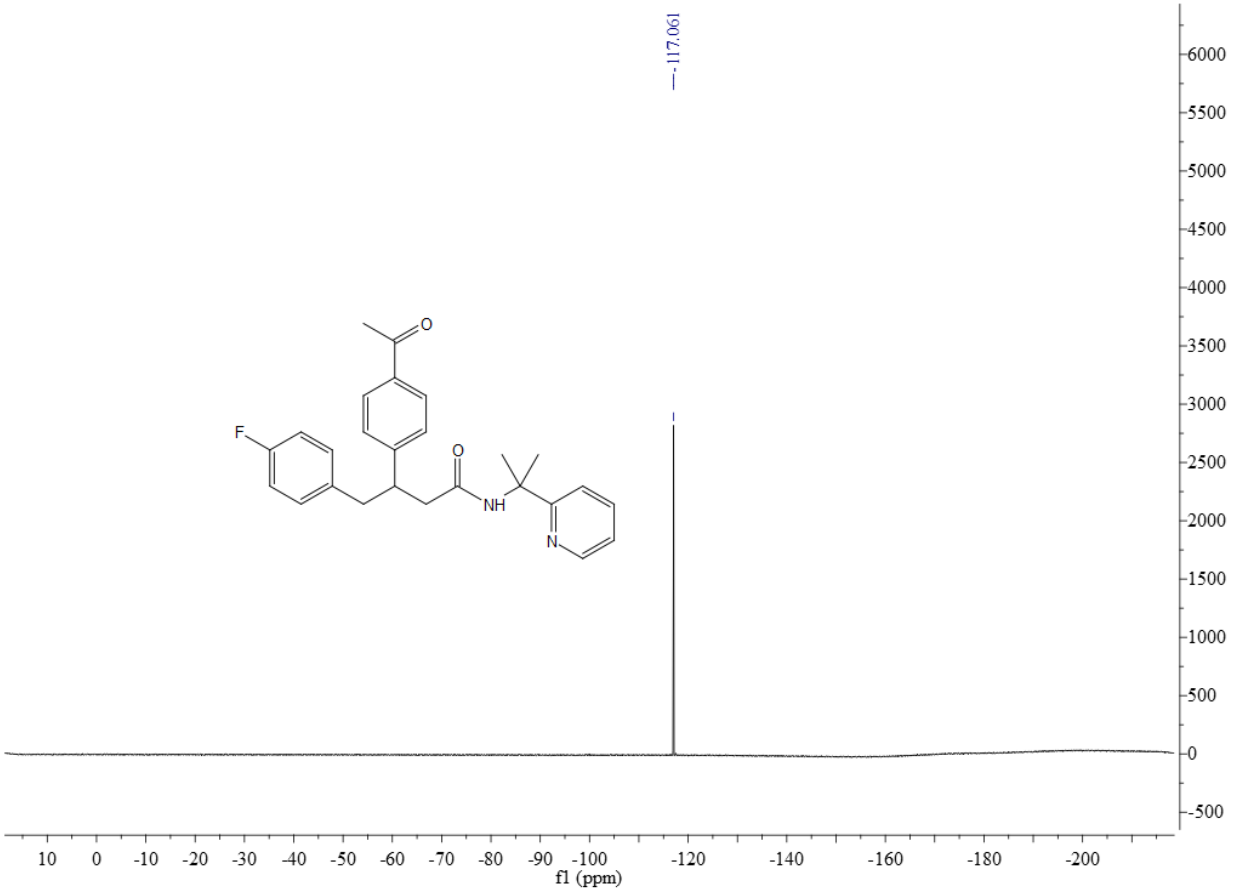
f1 (ppm)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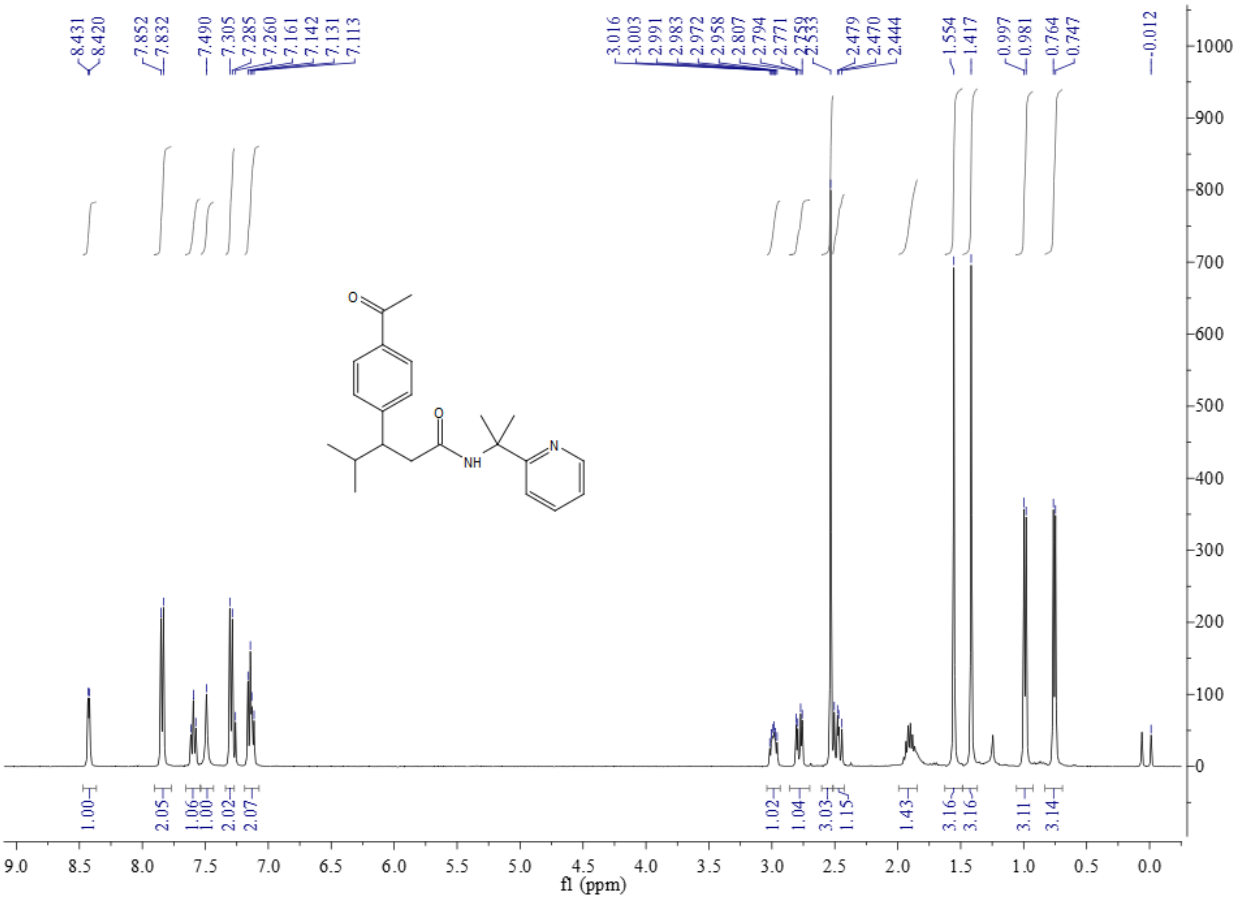
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
-500
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)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7.285
7.260
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7.142
7.131
7.113
3.016
3.003
2.991
2.983
2.972
2.958
2.807
2.794
2.771
2.759
2.533
2.479
2.470
2.444
1.554
1.417
0.997
0.981
0.764
0.747
-0.012
O
O
NH
N
1.00
2.05
1.06
1.00
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1.04
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3.16
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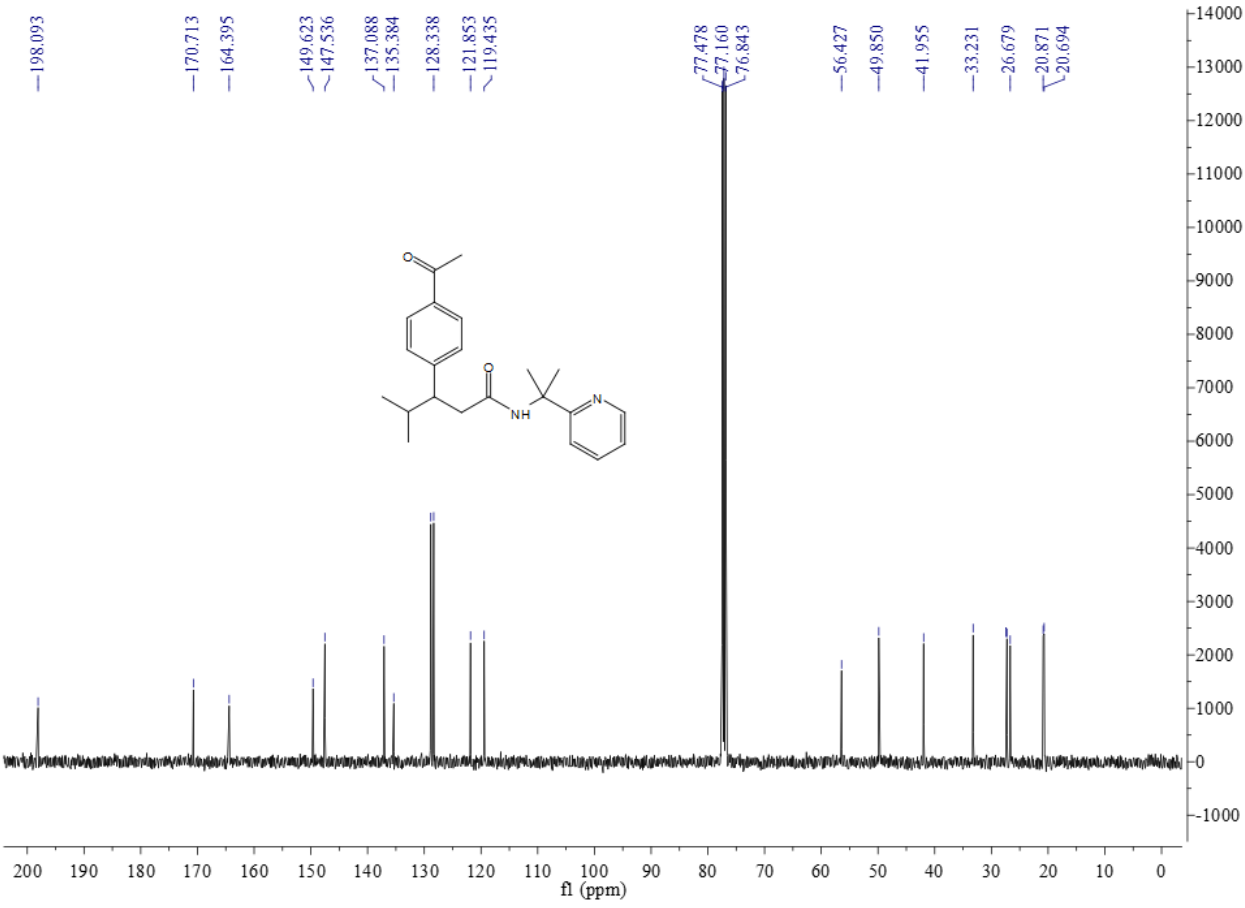
3.14
f1 (ppm)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128.338
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119.435
77.478
77.160
76.843
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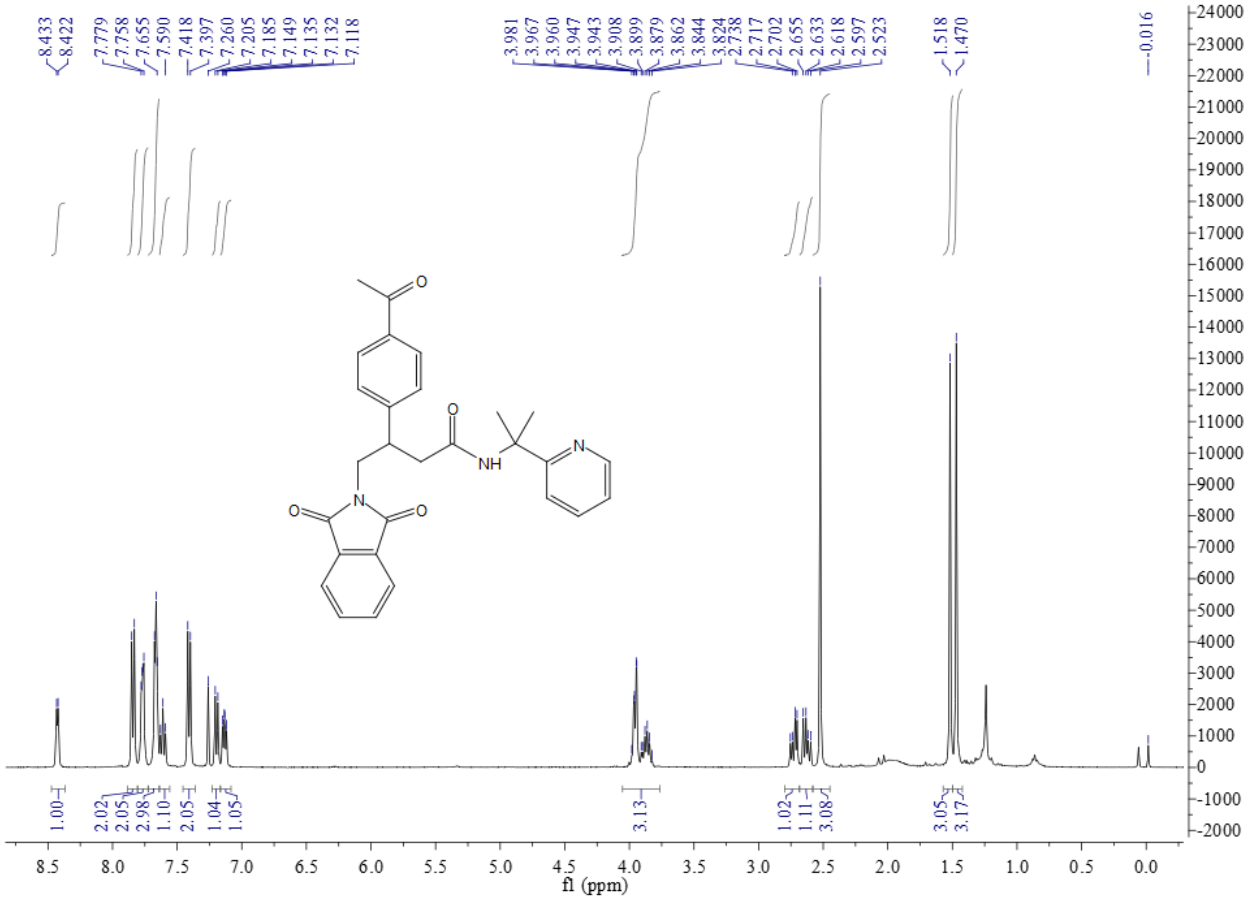
49.850
41.955
33.231
26.679
20.871
20.694
O
O
NH
N
f1 (ppm)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7.149
7.135
7.132
7.118
3.981
3.967
3.960
3.947
3.943
3.908
3.899
3.879
3.862
3.844
3.824
2.738
2.717
2.702
2.655
2.633
2.618
2.597
2.523
1.518
1.470
-0.016
1.00
2.02
2.05
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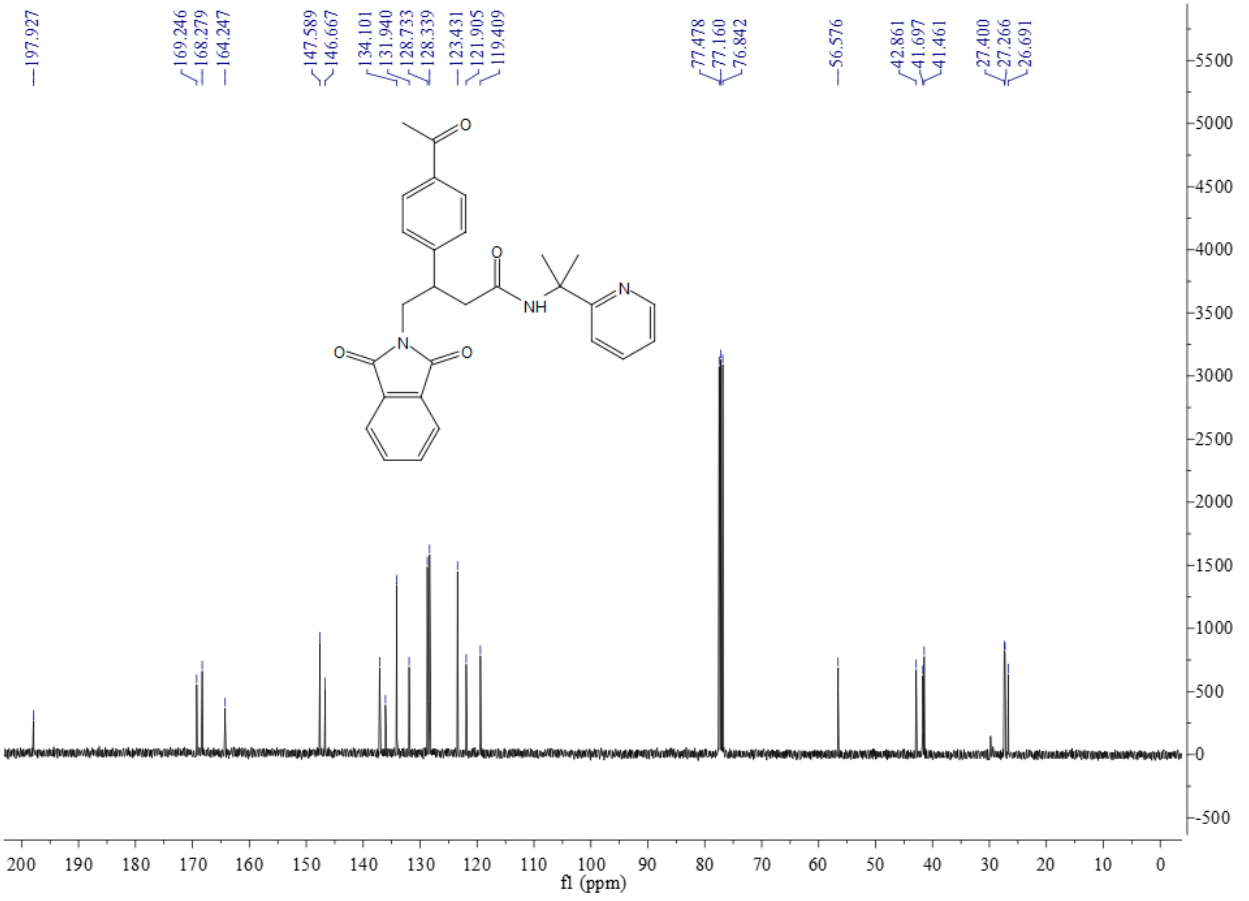
1.02
1.11
3.08
3.05
3.17
fl (ppm)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76.842
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42.861
41.697
41.461
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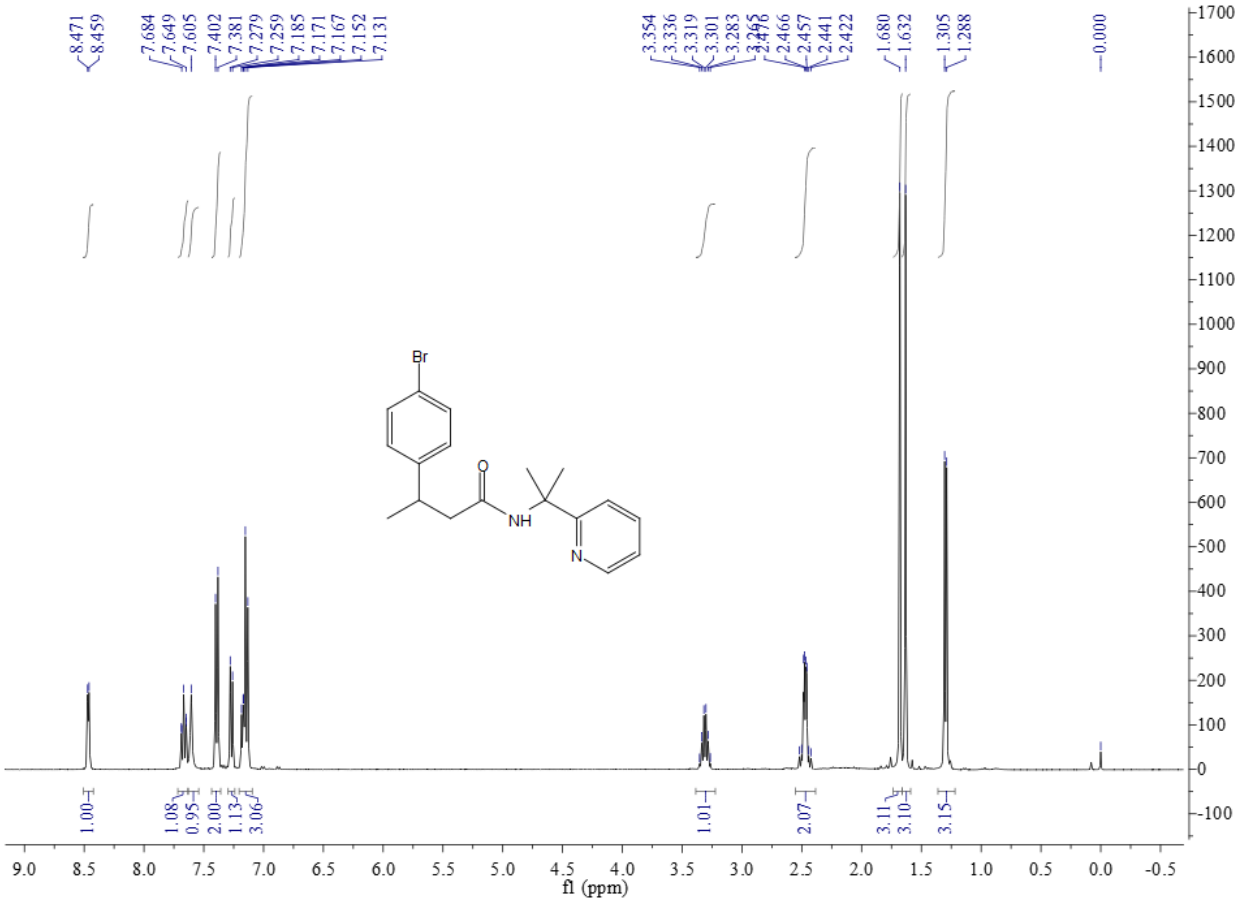
27.266
26.691
fl (ppm)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7.152
7.131
3.354
3.336
3.319
3.301
3.283
2.466
2.457
2.441
2.422
1.680
1.632
1.305
1.288
0.000
Br
O
NH
N
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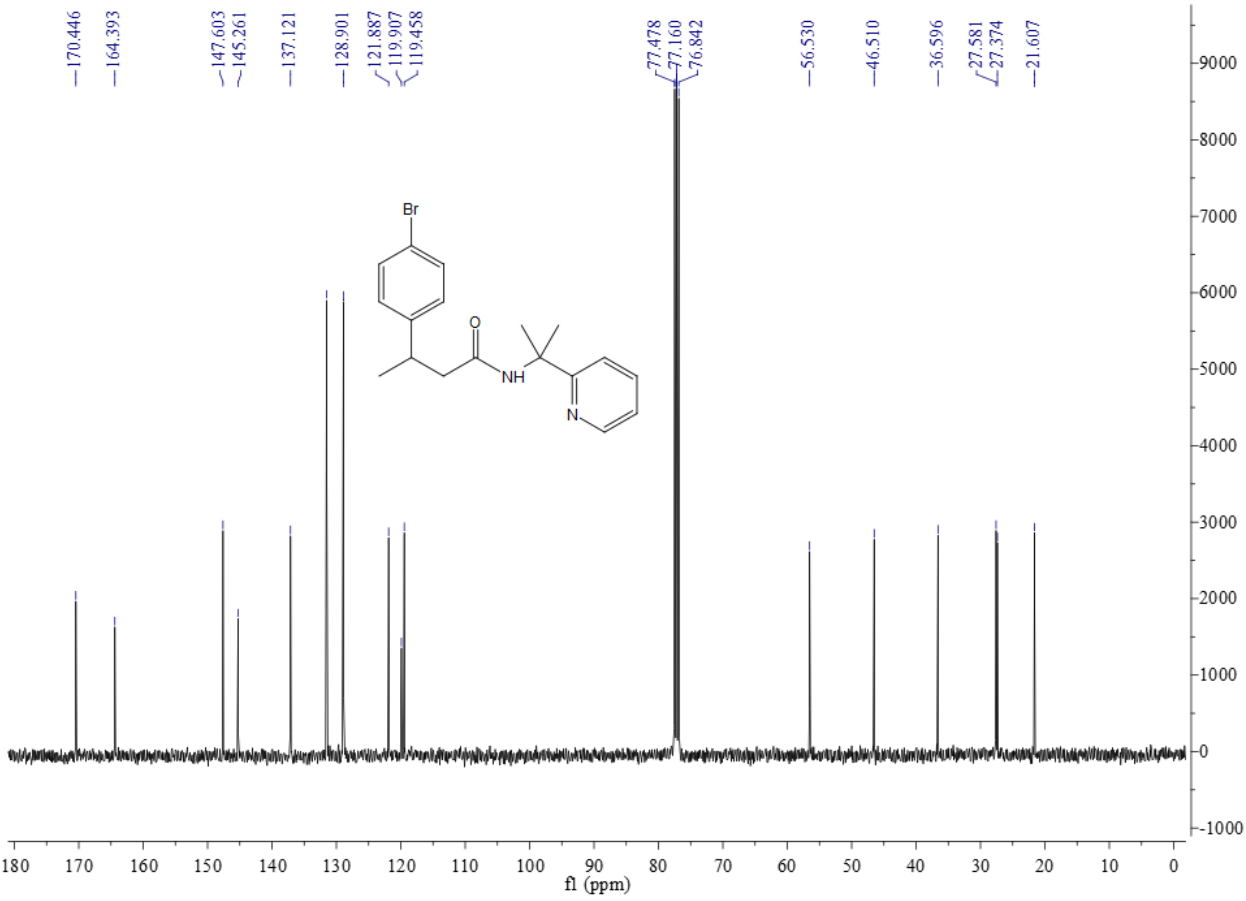
2.00
1.13
3.06
1.01
2.07
3.11
3.10
3.15
fl (ppm)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27.581
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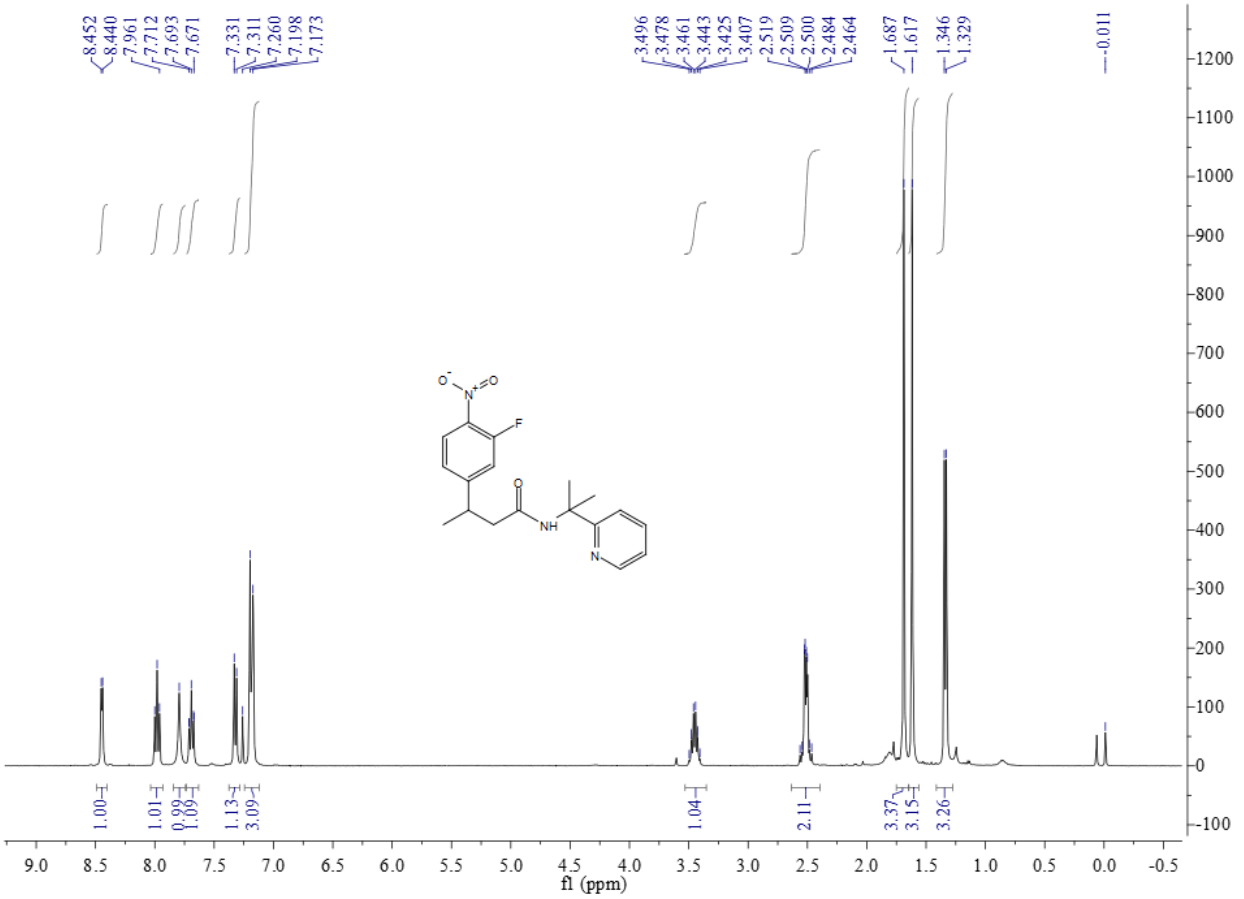
21.607
Br
O
NH
N
fl (ppm)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3.478
3.461
3.443
3.425
3.407
2.519
2.509
2.500
2.484
2.464
1.687
1.617
1.346
1.329
-0.011
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1.01
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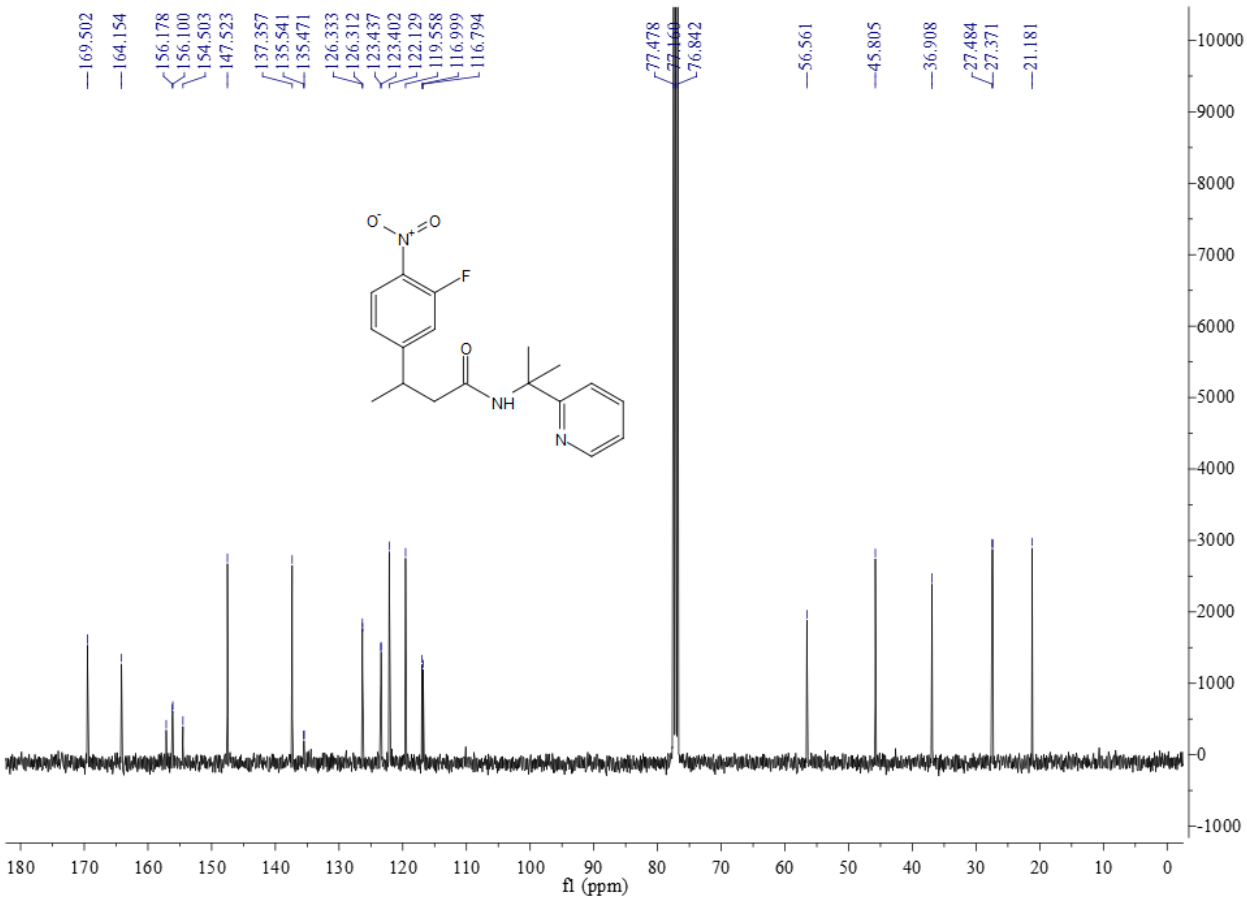
1.09
1.13
3.09
1.04
2.11
3.37
3.15
3.26
fl (ppm)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122.129
119.558
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116.794
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77.160
76.842
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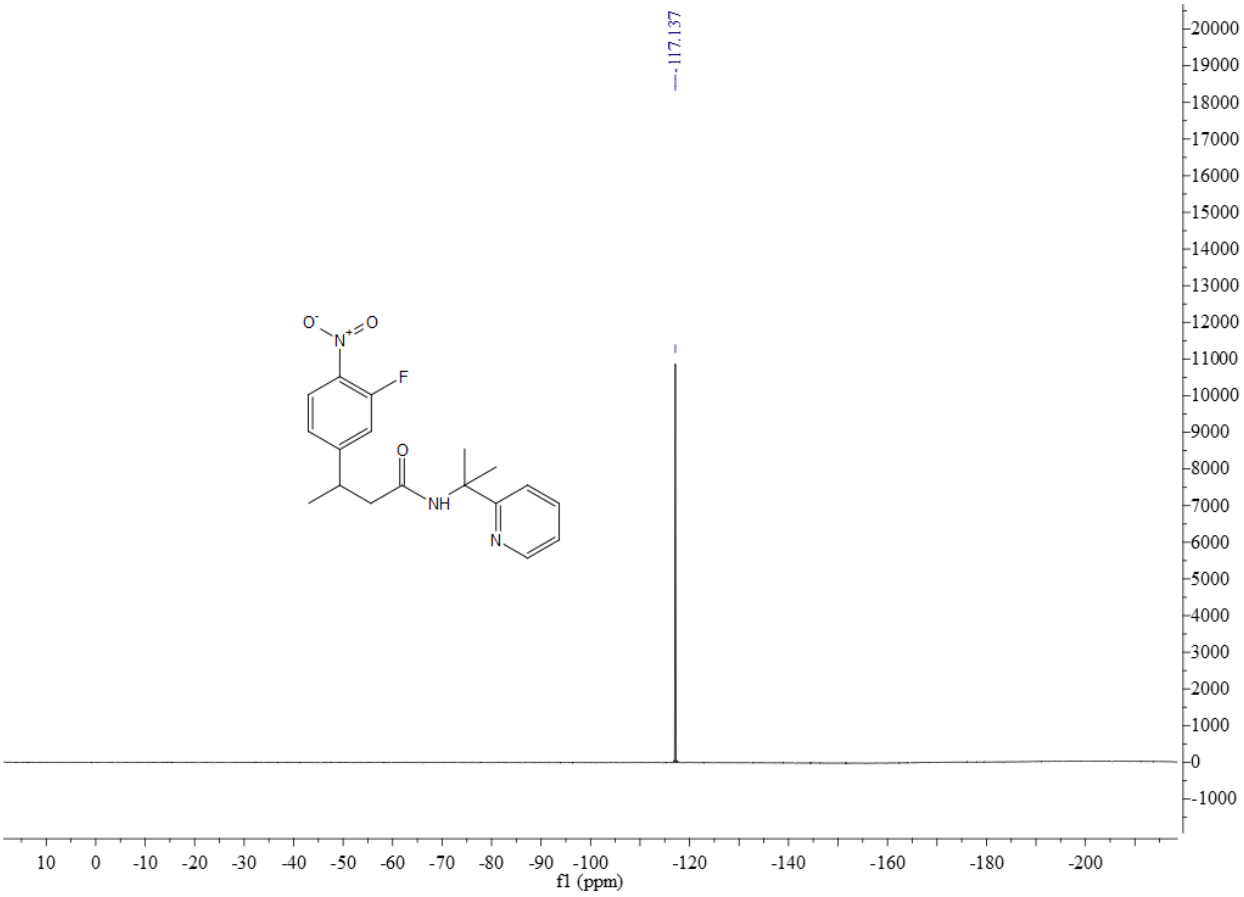
21.181
fl (ppm)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F
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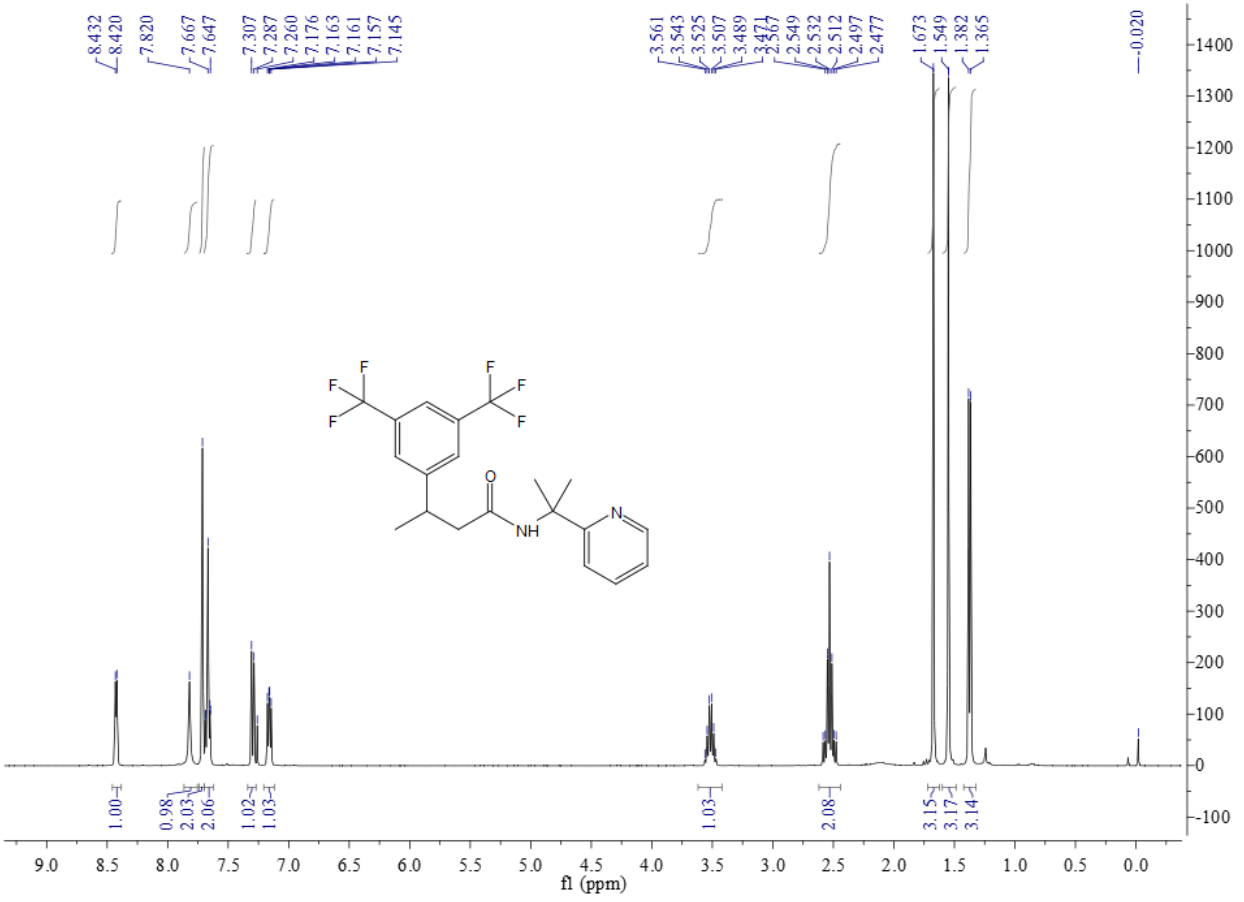
N
f1 (ppm)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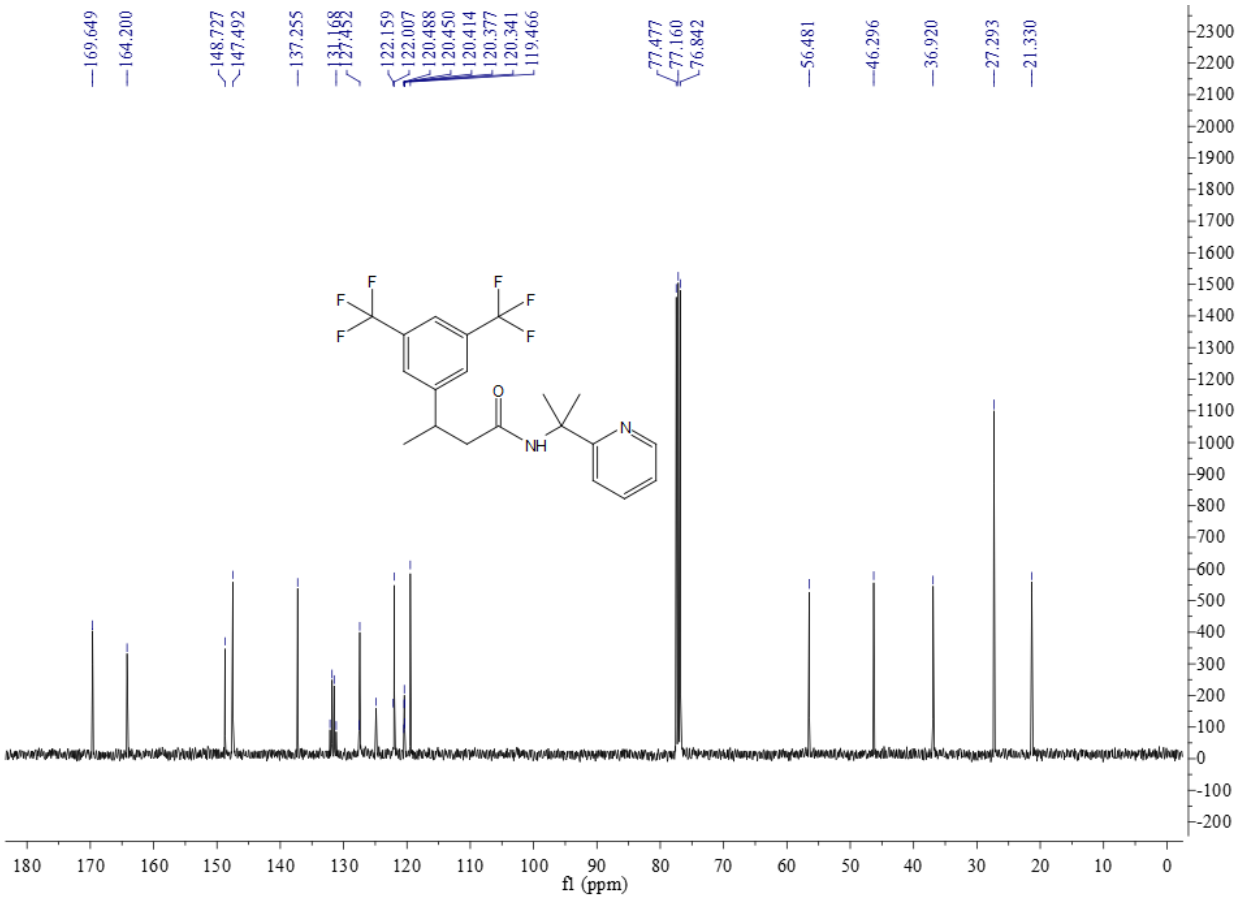
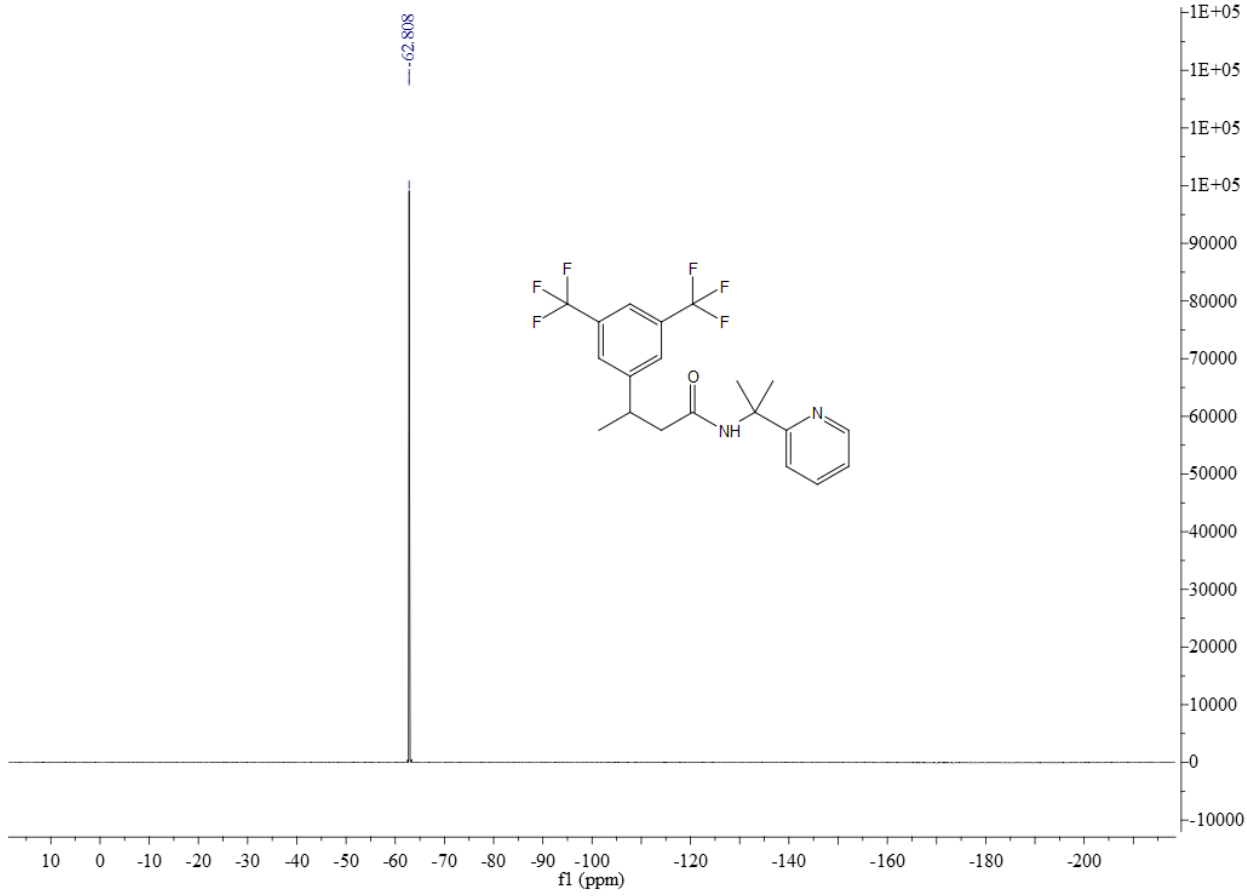
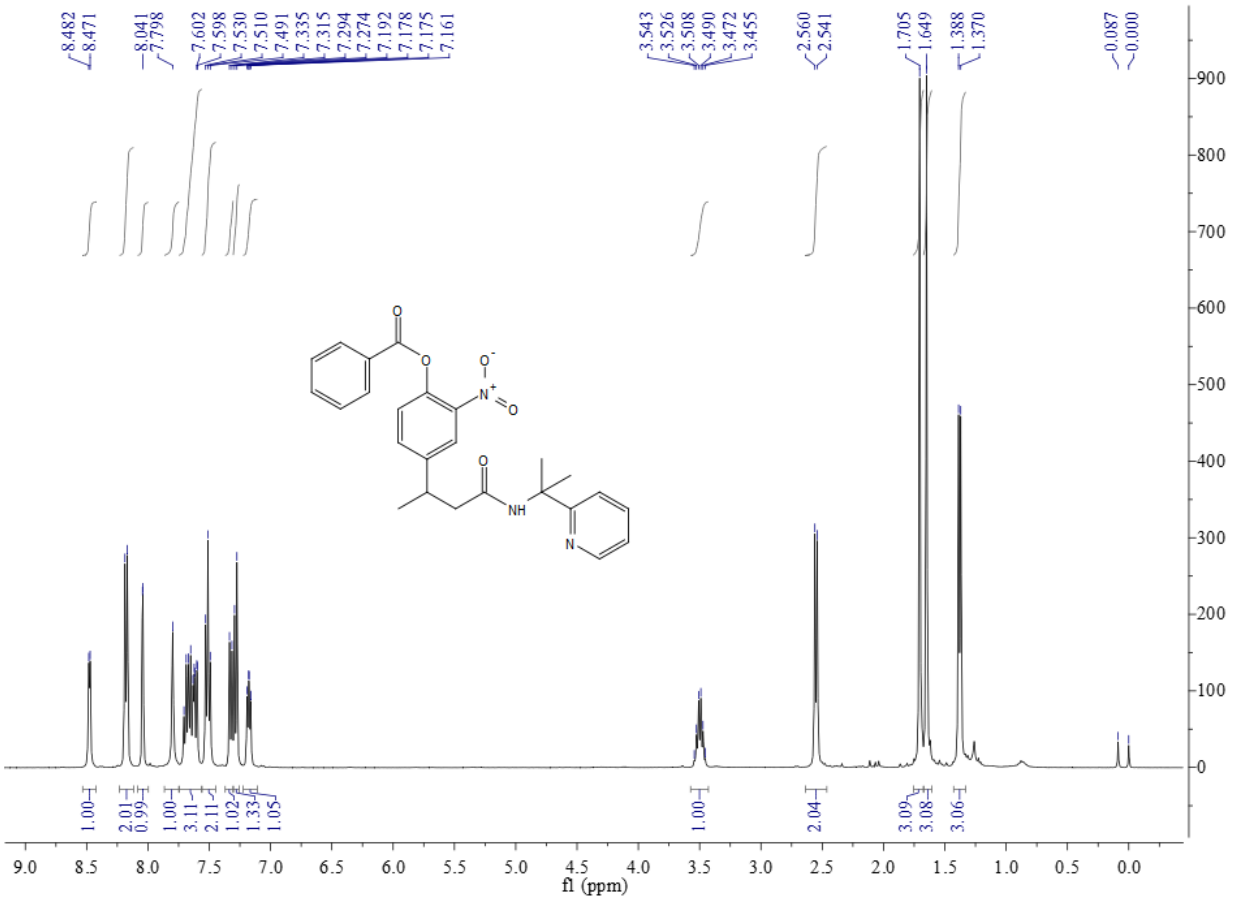
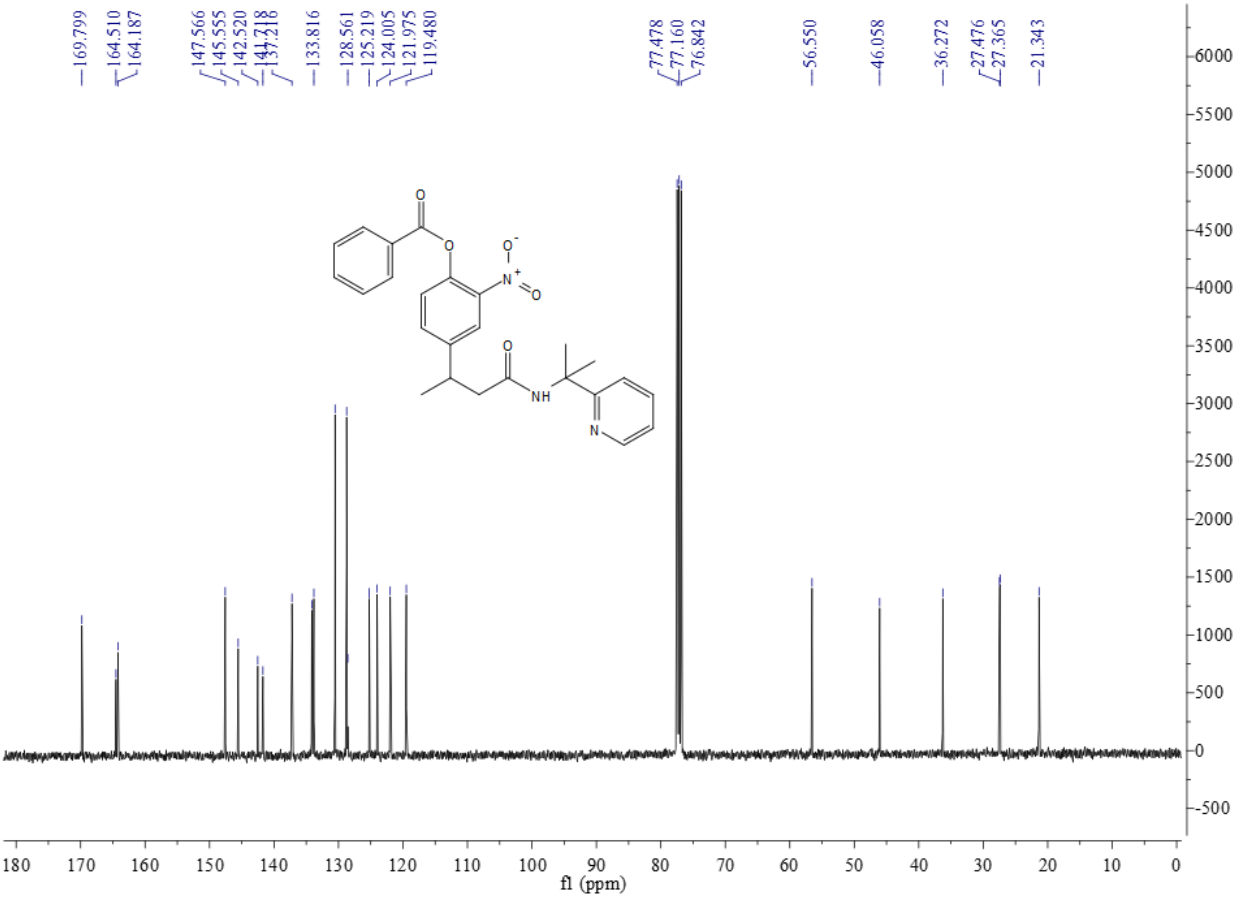
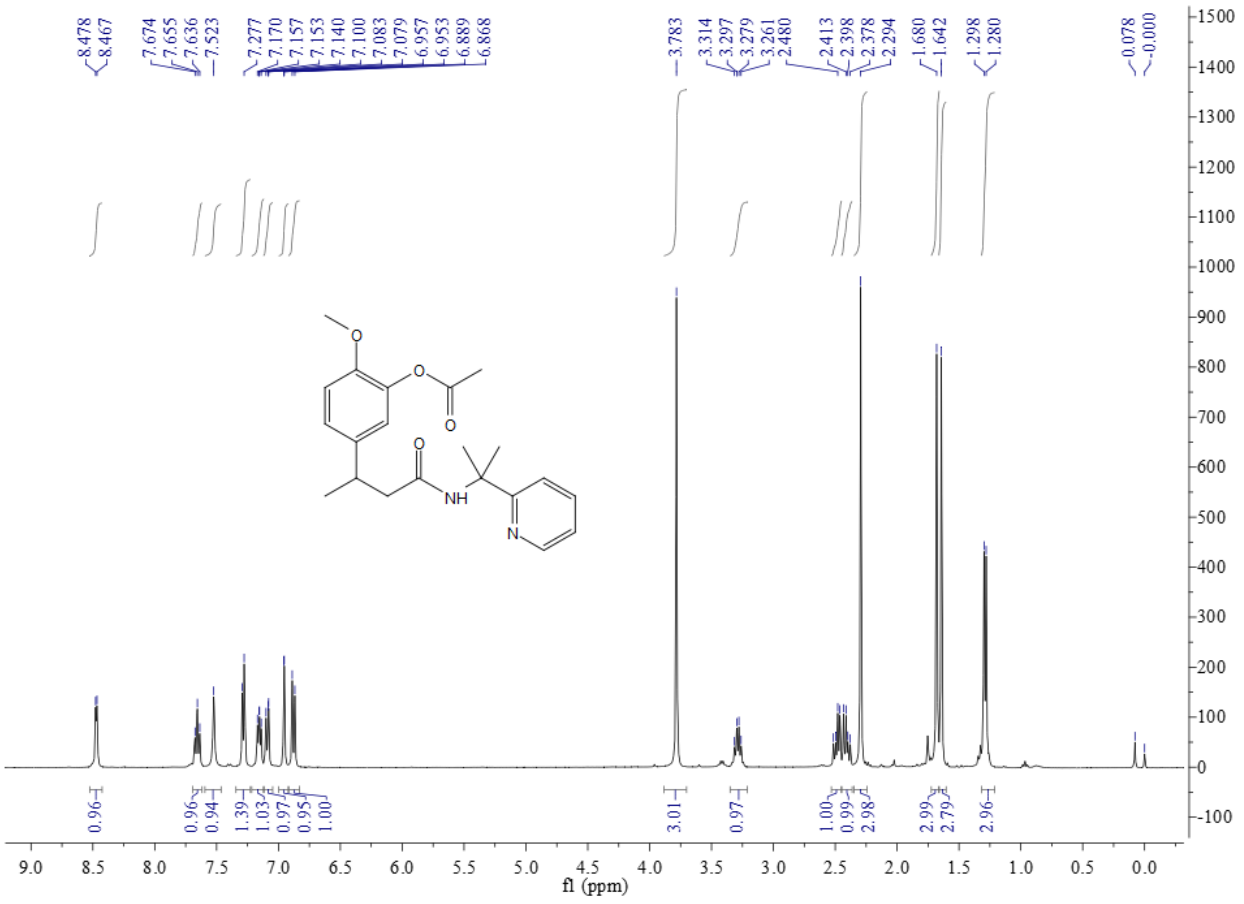
1.549
1.382
1.365
-0.020
1.00
0.98
2.03
2.06
1.02
1.03
1.03
2.08
3.15
3.17
3.14
F
O
NH
N
f1 (ppm)

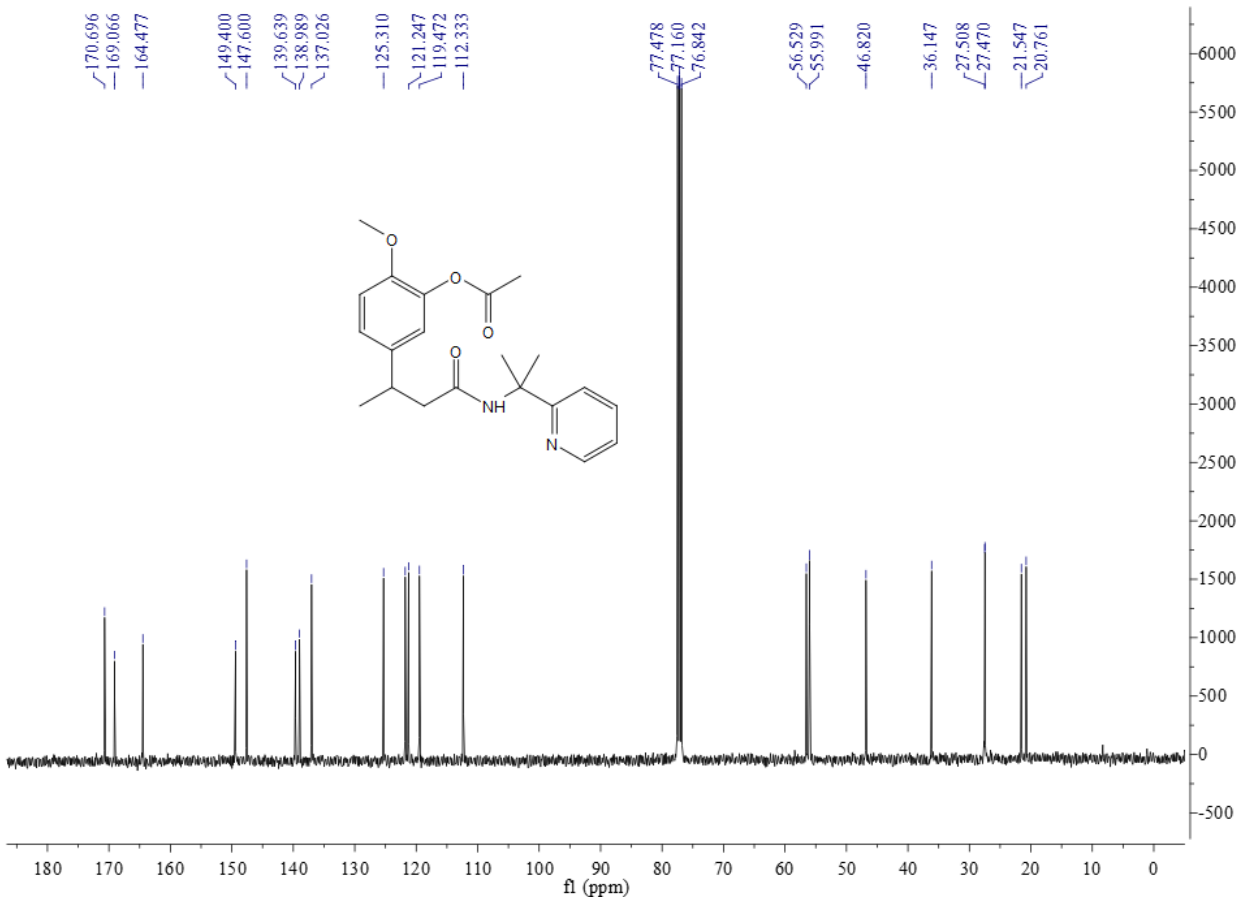

169.649
164.200
148.727
147.492
137.255
131.168
127.452
122.159
122.007
120.488
120.450
120.414
120.377
120.341
119.466
77.477
77.160
76.842
56.481
46.296
36.920
27.293
21.330
F
F
F
F
F
F
O
NH
N
fl (ppm)

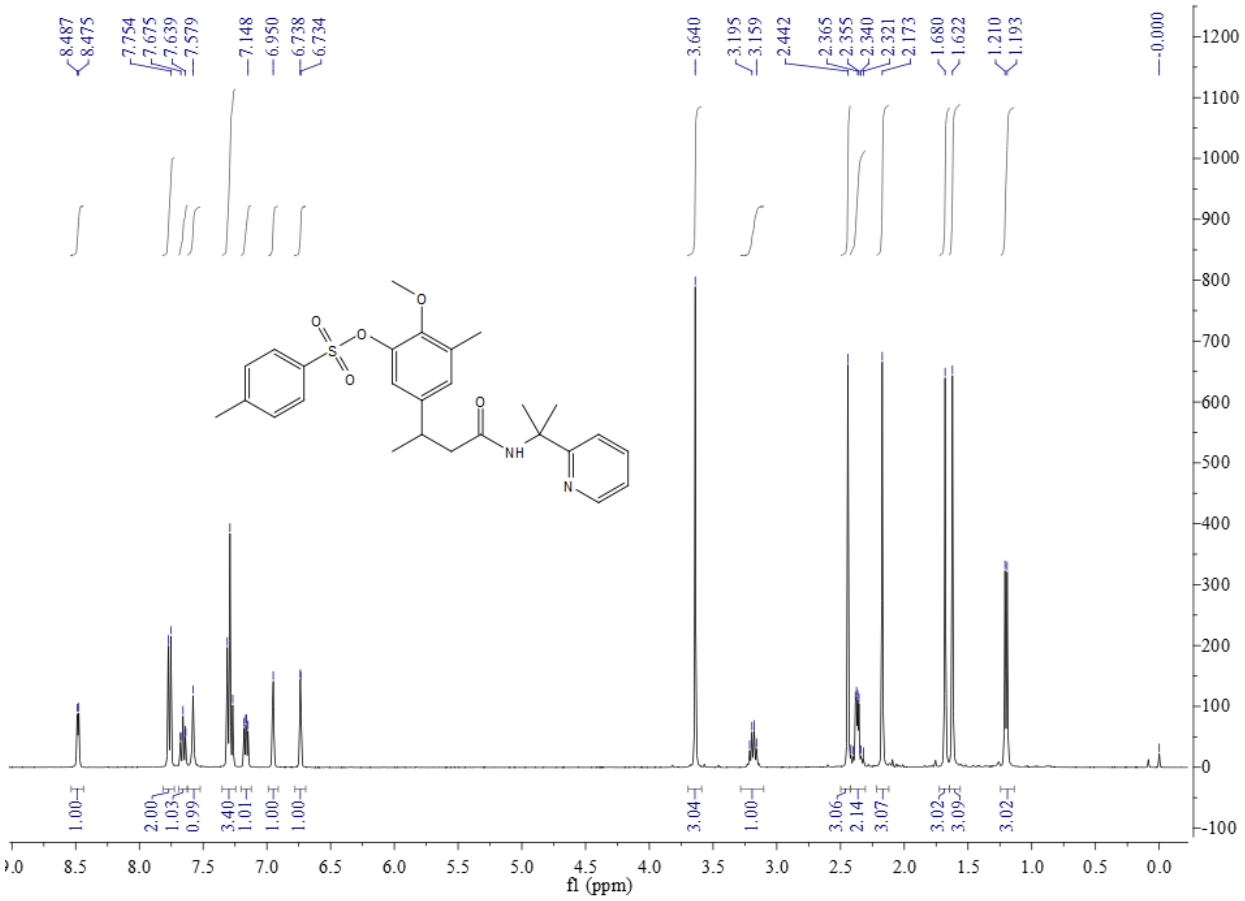

-62.808
F
F
F
F
F
F
O
NH
N
fl (ppm)

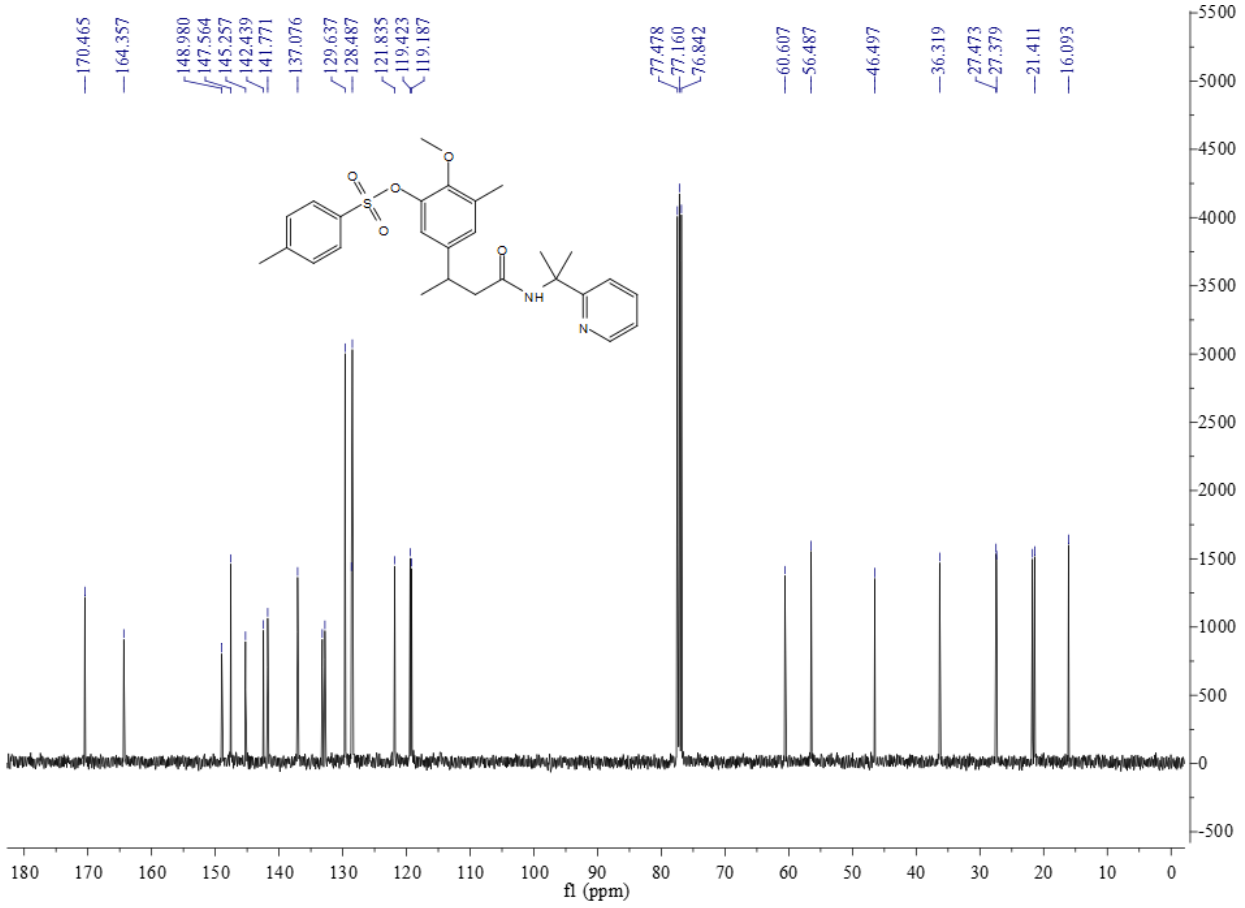

8.482
8.471
8.041
7.798
7.602
7.598
7.530
7.510
7.491
7.335
7.315
7.294
7.274
7.192
7.178
7.175
7.161
3.543
3.526
3.508
3.490
3.472
3.455
2.560
2.541
1.705
1.649
1.388
1.370
0.087
0.000
1.00
2.01
0.99
1.00
3.11
2.11
1.02
1.33
1.05
1.00
2.04
3.09
3.08
3.06
f1 (ppm)

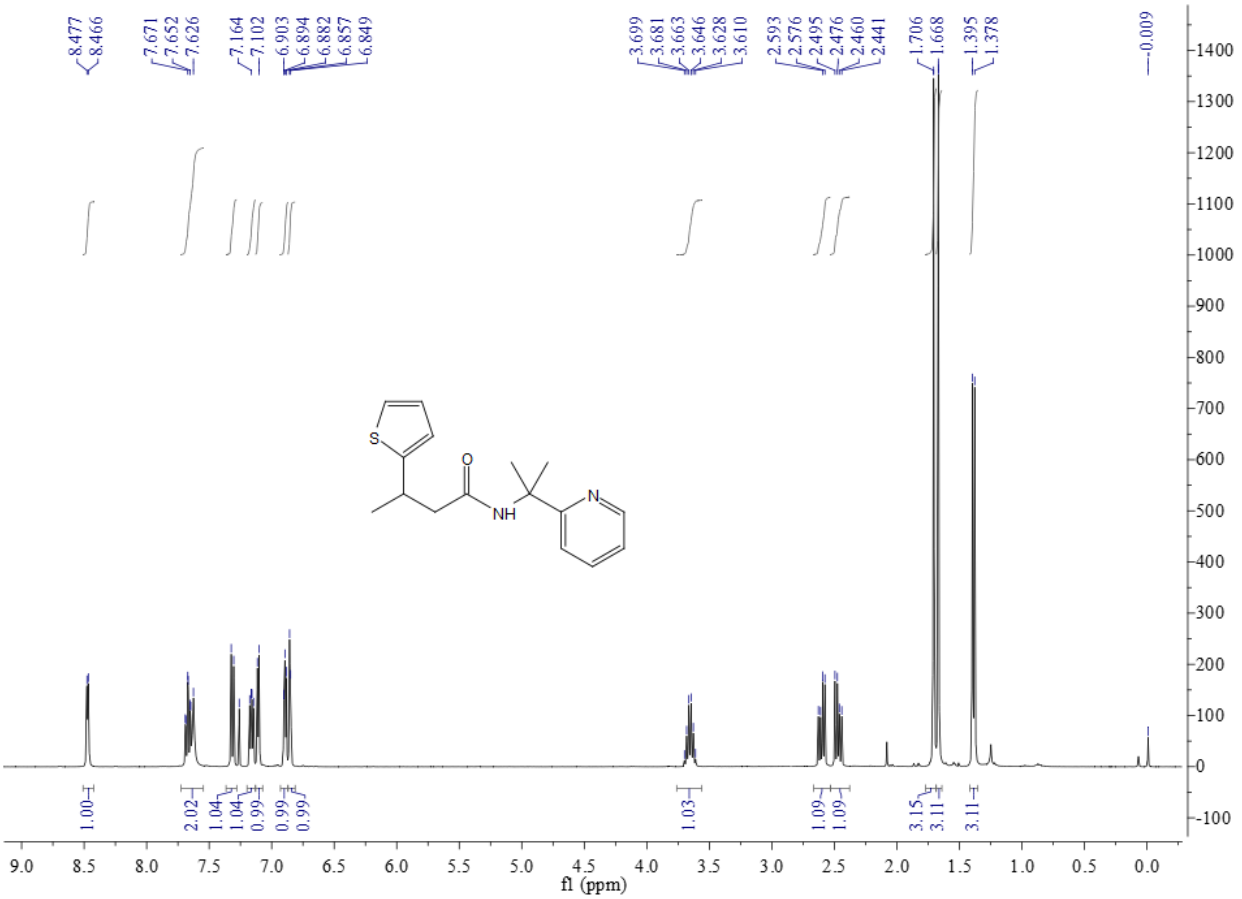

169.799
164.510
164.187
147.566
145.555
142.520
141.718
137.218
133.816
128.561
125.219
124.005
121.975
119.480
77.478
77.160
76.842
56.550
46.058
36.272
27.476
27.365
21.343
f1 (ppm)

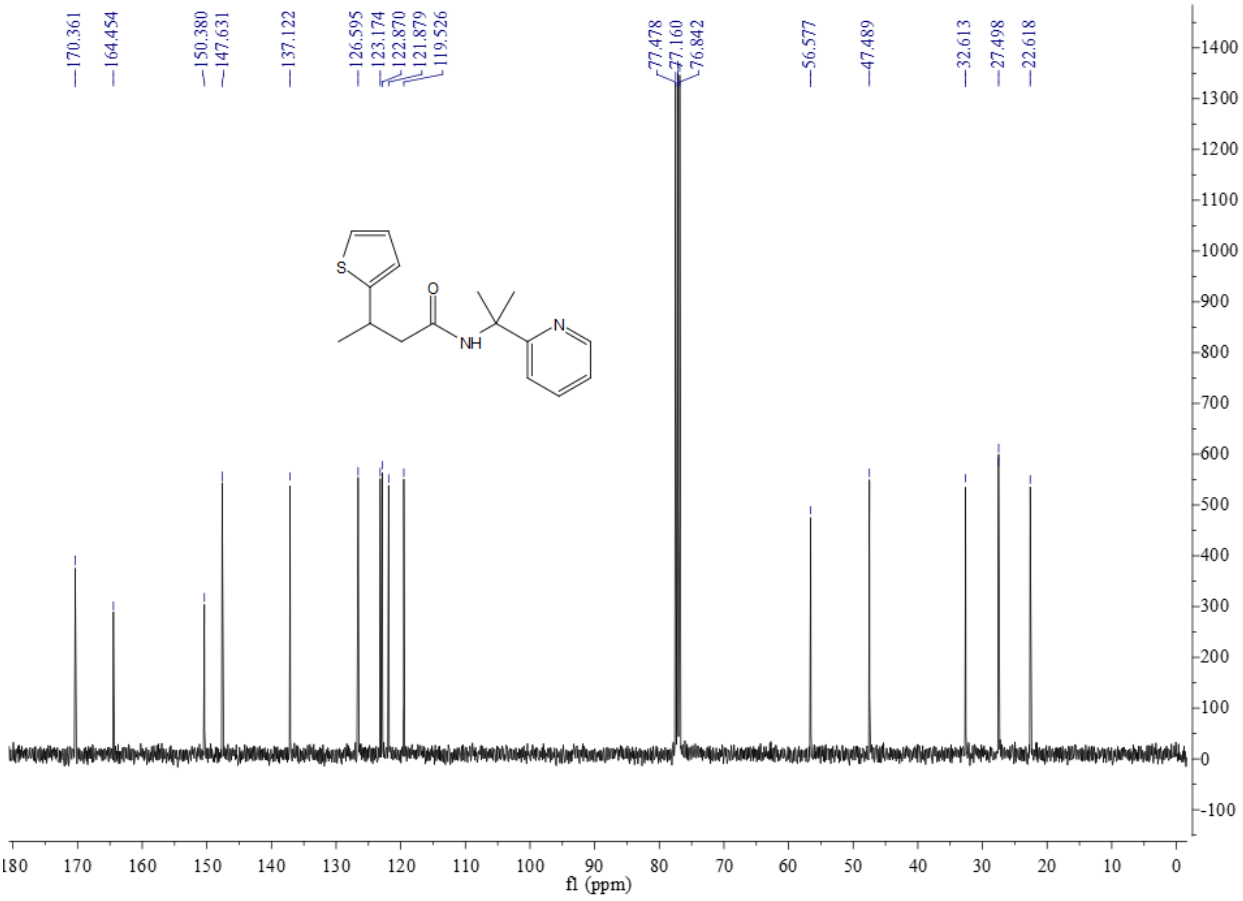

8.478
8.467
7.674
7.655
7.636
7.523
7.277
7.170
7.157
7.153
7.140
7.100
7.083
7.079
6.957
6.953
6.889
6.868
3.783
3.314
3.297
3.279
3.261
2.480
2.413
2.398
2.378
2.294
1.680
1.642
1.298
1.280
0.078
-0.000
0.96
0.96
0.94
1.39
1.03
0.97
0.95
1.00
3.01
0.97
1.00
0.99
2.98
2.99
2.79
2.96
O
O
O
NH
N
fl (ppm)

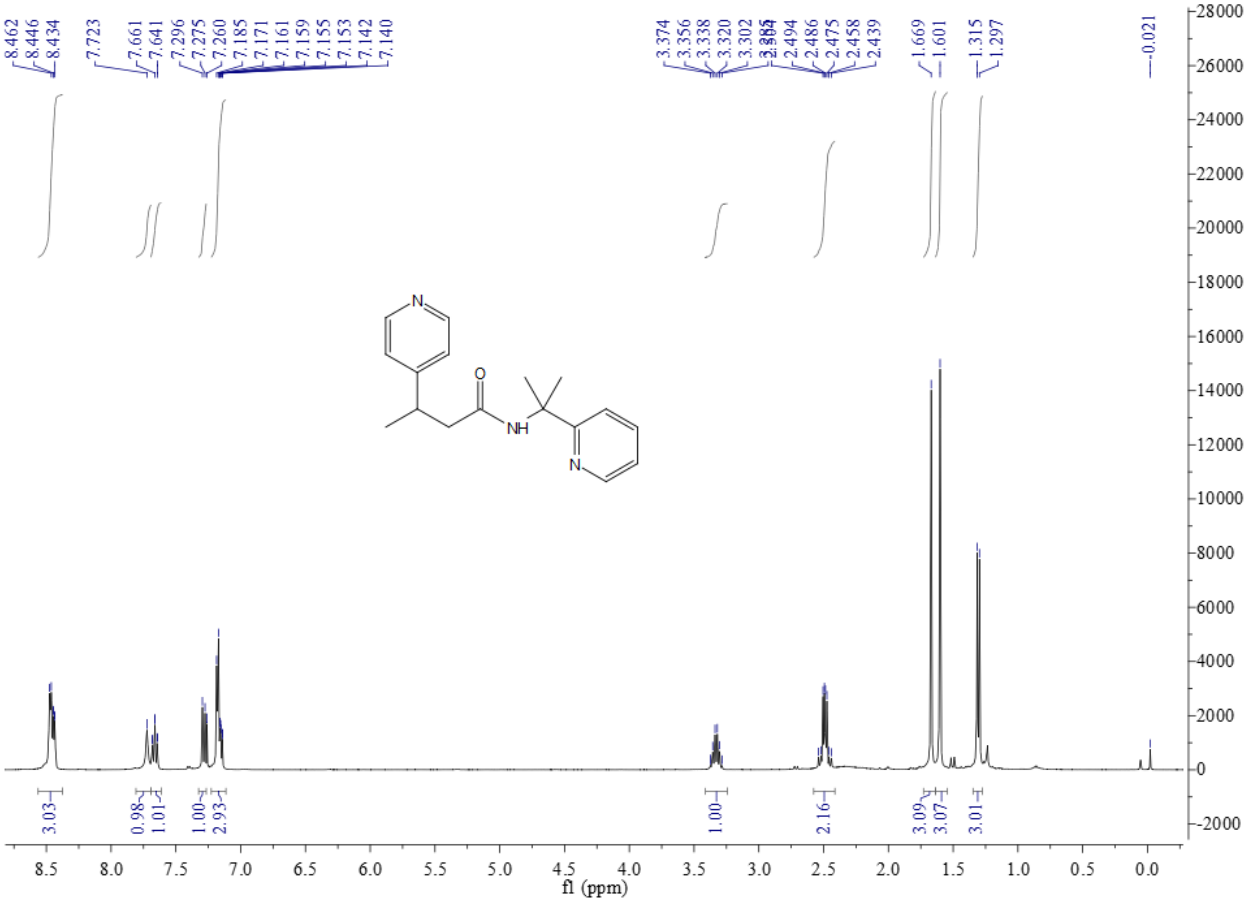

170.696
169.066
164.477
149.400
147.600
139.639
138.989
137.026
125.310
121.247
119.472
112.333
77.478
77.160
76.842
56.529
55.991
46.820
36.147
27.508
27.470
21.547
20.761
O
O
O
NH
N
fl (ppm)

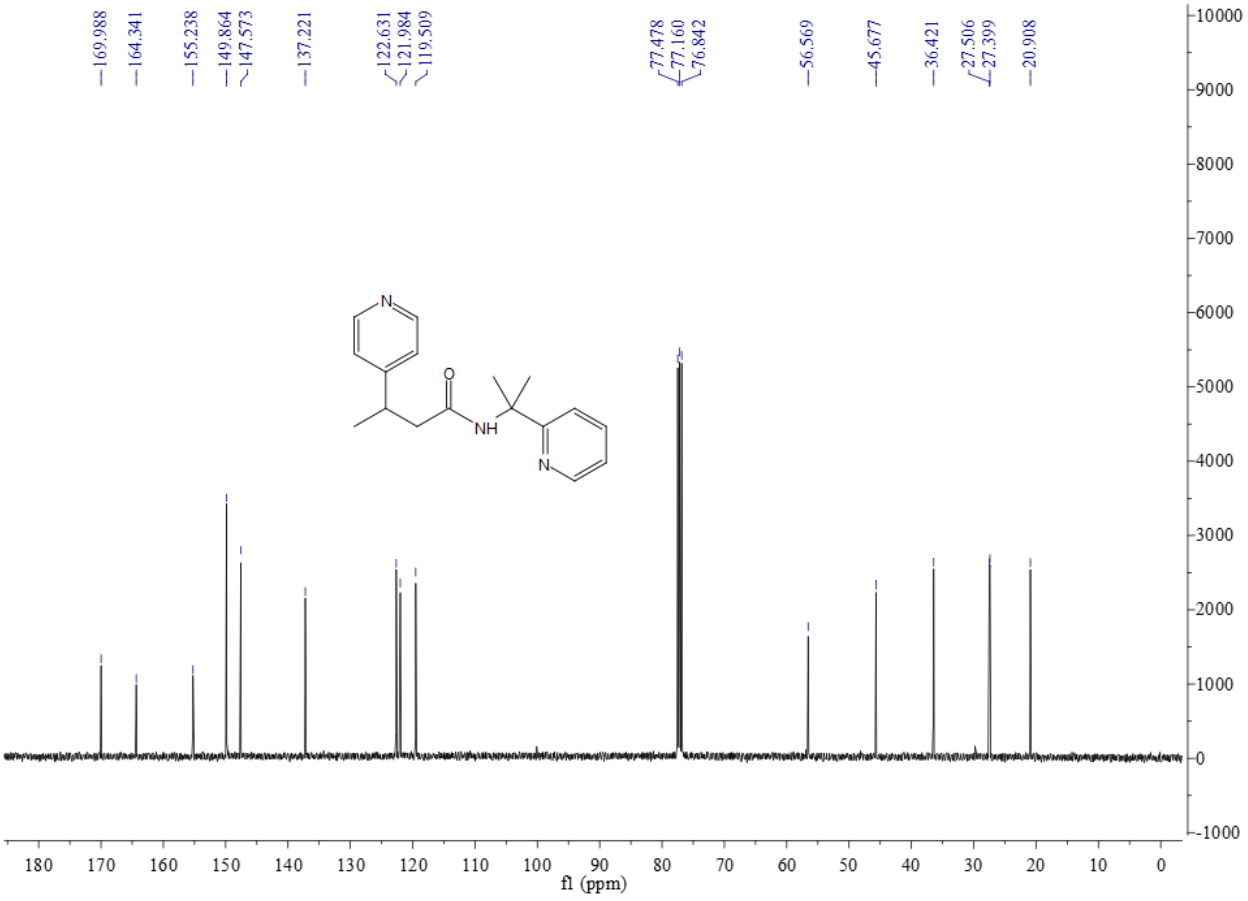

8.487
8.475
7.754
7.675
7.639
7.579
7.148
6.950
6.738
6.734
3.640
3.195
3.159
2.442
2.365
2.355
2.340
2.321
2.173
1.680
1.622
1.210
1.193
-0.000
1.00
2.00
1.03
0.99
3.40
1.01
1.00
1.00
3.04
1.00
3.06
2.14
3.07
3.02
3.09
3.02
f1 (ppm)

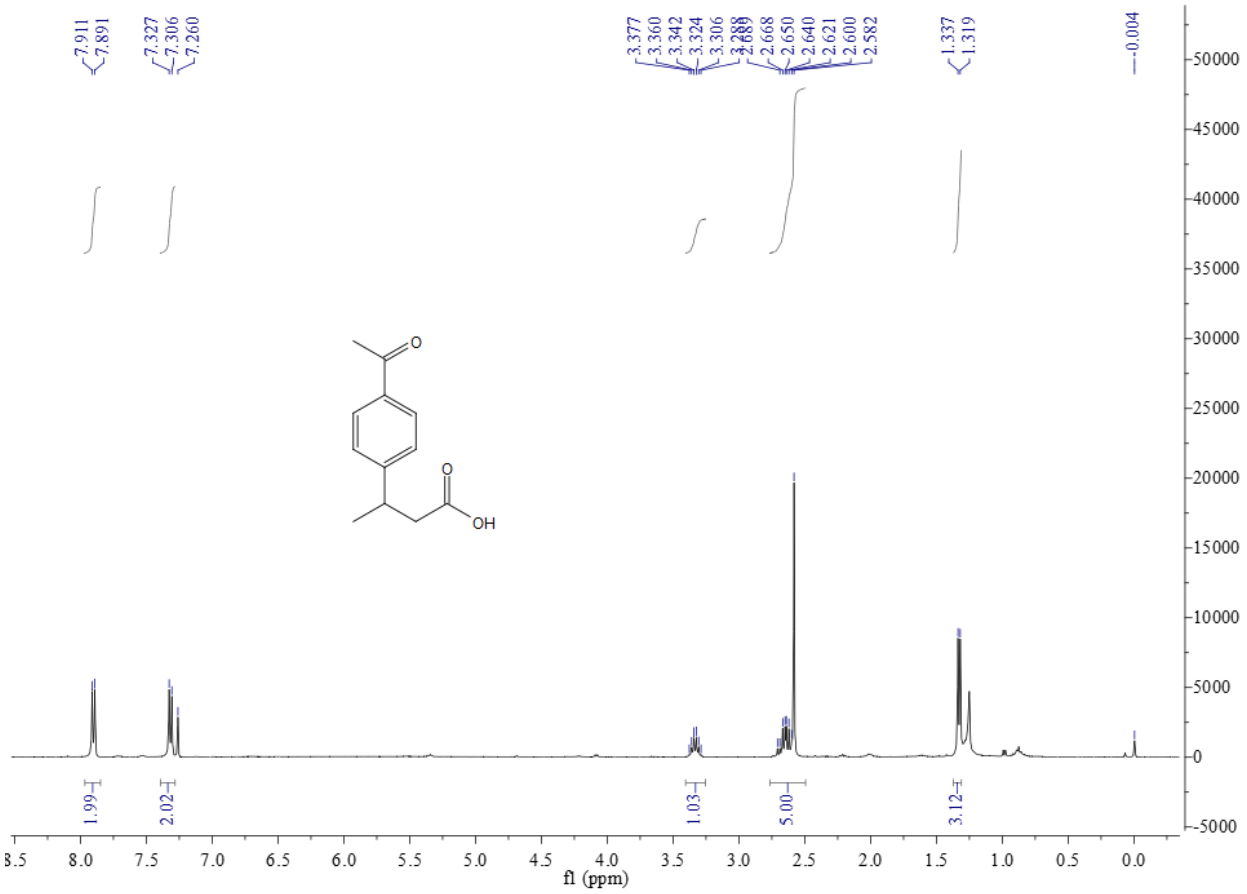

170.465
164.357
148.980
147.564
145.257
142.439
141.771
137.076
129.637
128.487
121.835
119.423
119.187
77.478
77.160
76.842
60.607
56.487
46.497
36.319
27.473
27.379
21.411
16.093
f1 (ppm)

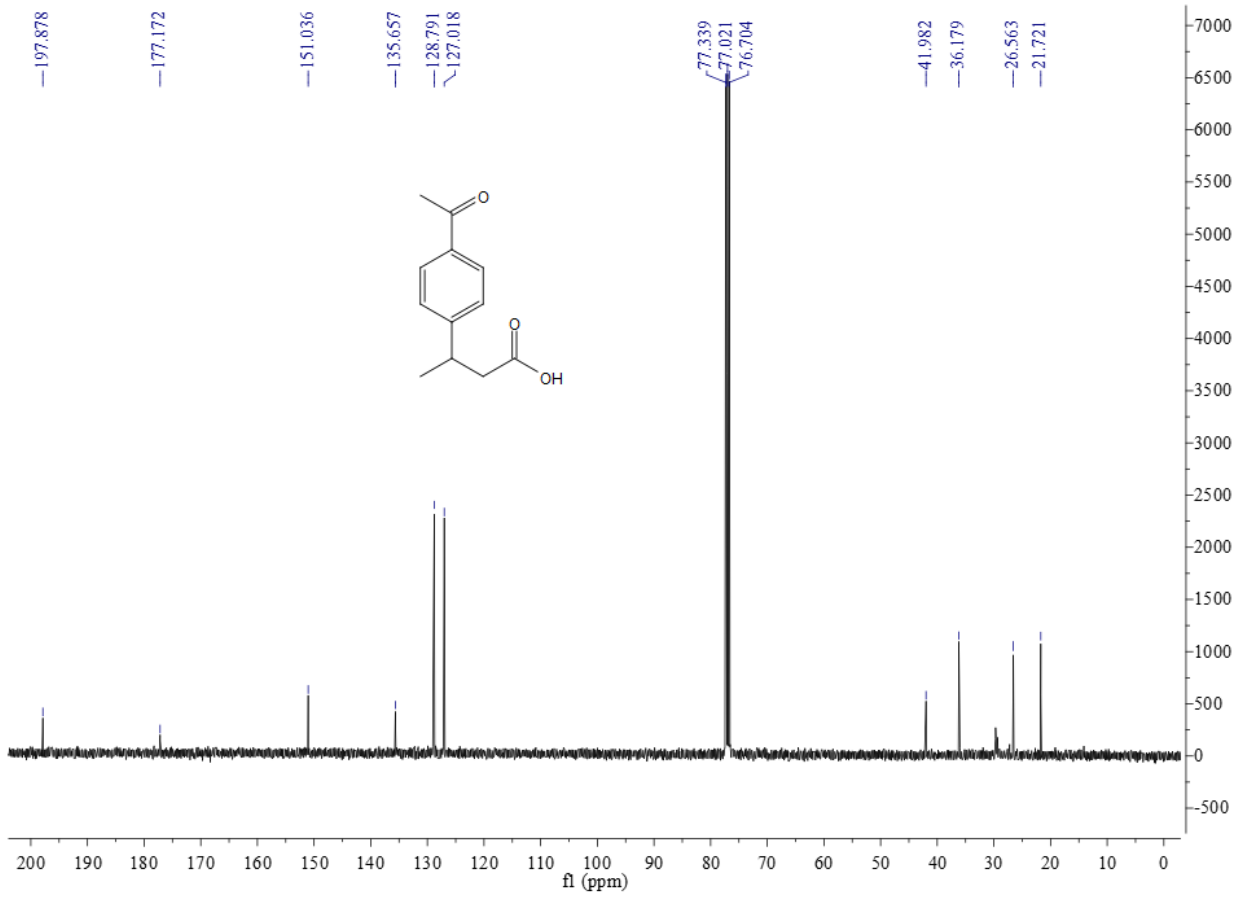

8.477
8.466
7.671
7.652
7.626
7.164
7.102
6.903
6.894
6.882
6.857
6.849
3.699
3.681
3.663
3.646
3.628
3.610
2.593
2.576
2.495
2.476
2.460
2.441
1.706
1.668
1.395
1.378
-0.009
1.00
2.02
1.04
1.04
0.99
0.99
0.99
1.03
1.09
1.09
3.15
3.11
3.11
S
O
NH
N
f1 (ppm)


170.361
164.454
150.380
147.631
137.122
126.595
123.174
122.870
121.879
119.526
77.478
77.160
76.842
56.577
47.489
32.613
27.498
22.618
S
O
NH
N
f1 (ppm)


8.462
8.446
8.434
7.723
7.661
7.641
7.296
7.275
7.260
7.185
7.171
7.161
7.159
7.155
7.153
7.142
7.140
3.374
3.356
3.338
3.320
3.302
2.494
2.486
2.475
2.458
2.439
1.669
1.601
1.315
1.297
-0.021
N
O
NH
N
3.03
0.98
1.01
1.00
2.93
1.00
2.16
3.09
3.07
3.01
f1 (ppm)


169.988
164.341
155.238
149.864
147.573
137.221
122.631
121.984
119.509
77.478
77.160
76.842
56.569
45.677
36.421
27.506
27.399
20.908
N
O
NH
N
f1 (ppm)


7.911
7.891
7.327
7.306
7.260
3.377
3.360
3.342
3.324
3.306
2.668
2.650
2.640
2.621
2.600
2.582
1.337
1.319
0.004
O
O
OH
1.99
2.02
1.03
5.00
3.12
f1 (ppm)


197.878
177.172
151.036
135.657
128.791
127.018
77.339
77.021
76.704
41.982
36.179
26.563
21.721
O
O
OH
f1 (ppm)