Supporting Information

Cp*Co(III)-Catalyzed C−H Acylmethylation of Arenes by Employing Sulfoxonium Ylides as Carbene Precursors

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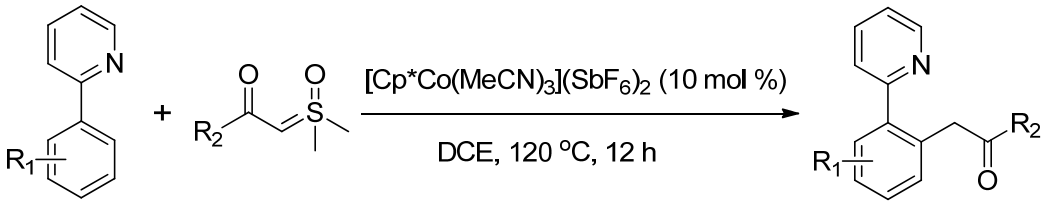
General Considerations. All the reactions were carried out under argon atmosphere using standard Schlenk technique. ^{1}H NMR (400 MHz), ^{19}F NMR (376 MHz), and ^{13}C NMR (100 MHz) were recorded on Bruker AV400 NMR spectrometer with $CDCl_3$ as solvent. Chemical shifts of ^{1}H, ^{19}F, and ^{13}C NMR spectra are reported in parts per million (ppm). The residual solvent signals were used as references and the chemical shifts converted to the TMS scale ($CDCl_3$: δ_H = 7.26 ppm, δ_C = 77.00 ppm). All coupling constants (*J* values) were reported in Hertz (Hz). Multiplicities are reported as follows: singlet (s), doublet (d), doublet of doublets (dd), doublet of doublet of doublets (ddd), doublet of triplets (dt), triplet (t), triplet of doublets (td), quartet (q), and multiplet (m). Column chromatography was performed on silica gel (200-300 mesh) using ethyl acetate (EA)/petroleum ether (PE). Analytical thin-layer chromatography (TLC) was performed on pre-coated, glass-backed silica gel plates. Visualization of the developed chromatogram was performed by UV absorbance (254 nm). High-resolution mass spectrometry (HRMS) were done on Varian 7.0 T FTICR-mass spectrometer. Cp*Co(CO)I_2 was prepared from $Co_2(CO)_8$ following a literature procedure.[1] [Cp*Co(MeCN)$_3$(SbF$_6$)$_2$] was prepared from Cp*Co(CO)I_2 following a literature procedure.[2] Unless otherwise noted, all other compounds have been reported in the literature or were obtained from commercial suppliers and used without further purification.

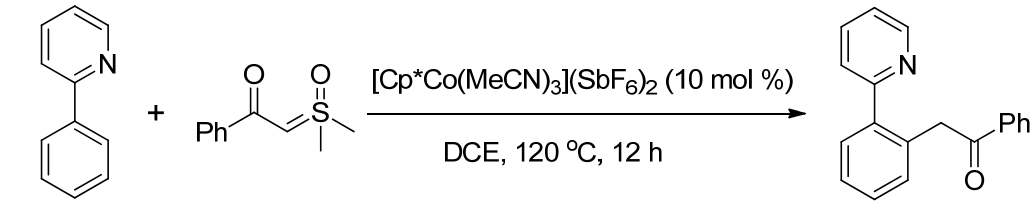
General Procedures for the Cp*Co(III)-Catalyzed Acylmethylation



1 (0.2 mmol) **2** (0.3 mmol) **3**

A mixture of substituted 2-arylpyridines (**1**, 0.2 mmol, 1.0 equiv), sulfoxonium ylides (**2**, 0.3 mmol, 1.5 equiv), [Cp*Co(CH_3CN)$_3$](SbF$_6$)$_2$ (15.8 mg, 0.02mmol, 10 mol %) were weighted in a Schlenk tube equipped with a stir bar. Dry 1,2-dichloroethane (1.5 mL) was added and the mixture was stirred at 120 °C for 12 h under Ar atmosphere. Afterwards, it was diluted with CH_2Cl_2 and transferred to a round bottom flask. Silica was added to the flask and volatiles were evaporated under reduced pressure. The purification was performed by flash column chromatography on silica gel with EtOAc/petroleum ether.

Preparation of 3aa in 1.0 mmol scale



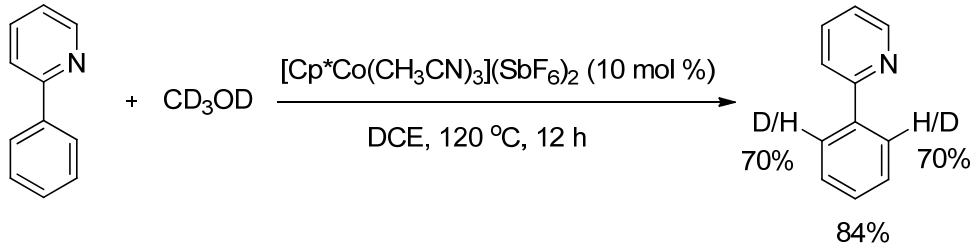
1a (1.0 mmol) **2a** (1.5 mmol) **3aa**

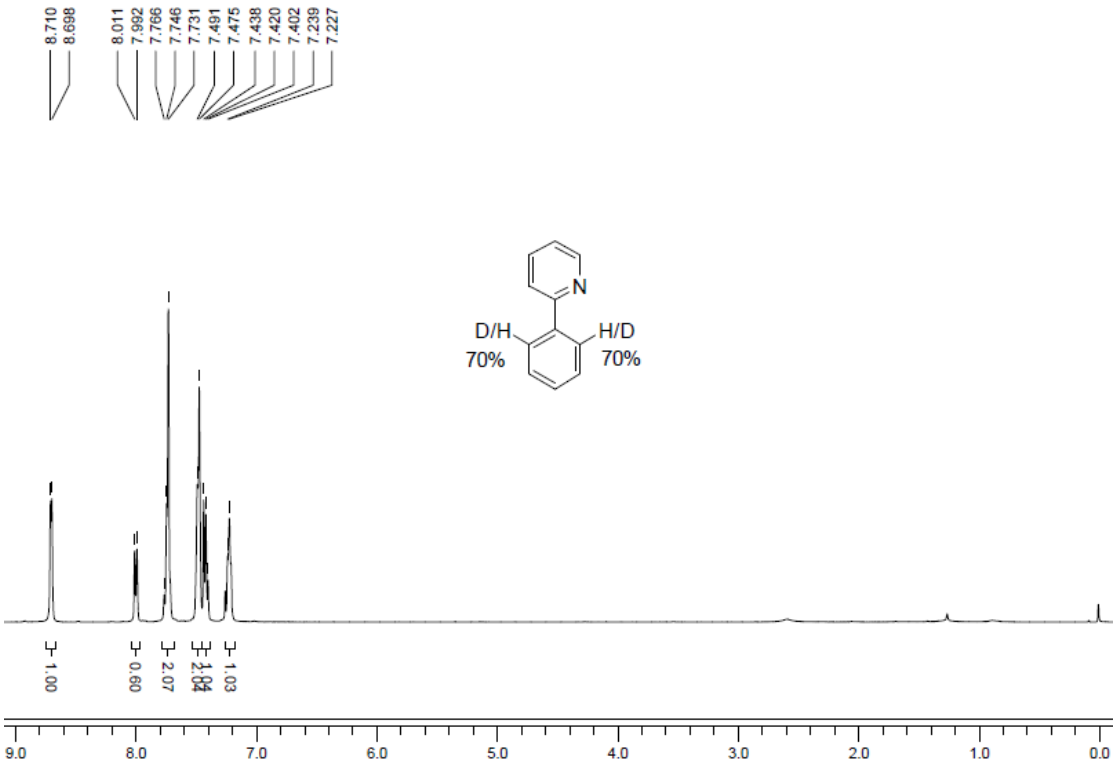
A mixture of substituted 2-phenylpyridine (**1a**, 1.0 mmol, 1.0 equiv), α-benzoyl sulfur ylide (**2a**, 1.5 mmol, 1.5 equiv), $[Cp^*Co(CH_3CN)_3](SbF_6)_2$ (78.9 mg, 0. 2 mmol, 10 mol %) were weighted in a Schlenk tube equipped with a stir bar. Dry 1,2-dichloroethane (5.0 mL) was added and the mixture was stirred at 120 °C for 12 h under argon atmosphere. Afterwards, it was diluted with CH_2Cl_2 and transferred to a round bottom flask. Silica was added to the flask and volatiles were evaporated under reduced pressure. The purification was performed by flash column chromatography on silica gel with EtOAc/petroleum ether, the product **3aa** was affored as a yellow solid in 78% yield (213.3 mg, 0.78 mmol).

Deuterium Experiments:

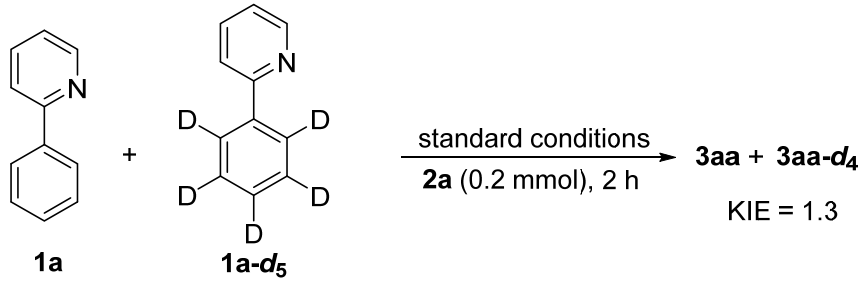
(a) H/D Exchange Experiment:

A mixture of 2-phenylpyridine (**1a**) (0.2 mmol, 1.0 equiv), $[Cp^*Co(CH_3CN)_3](SbF_6)_2$ (15.8 mg, 0.02 mmol, 10 mol %) were weighted in a Schlenk tube equipped with a stir bar. Dry 1,2-dichloroethane (1.5 mL) and CD_3OD (2.0 mmol, 10.0 equiv) were added and the mixture was stirred at 120 °C for 12 h under Ar atmosphere. Afterwards, it was diluted with CH_2Cl_2 and transferred to a round bottom flask. Silica was added to the flask and volatiles were evaporated under reduced pressure. The residue was purified by flash column chromatography on silica gel with EtOAc/petroleum ether to recover 2-phenylpyridine in 84% yield.

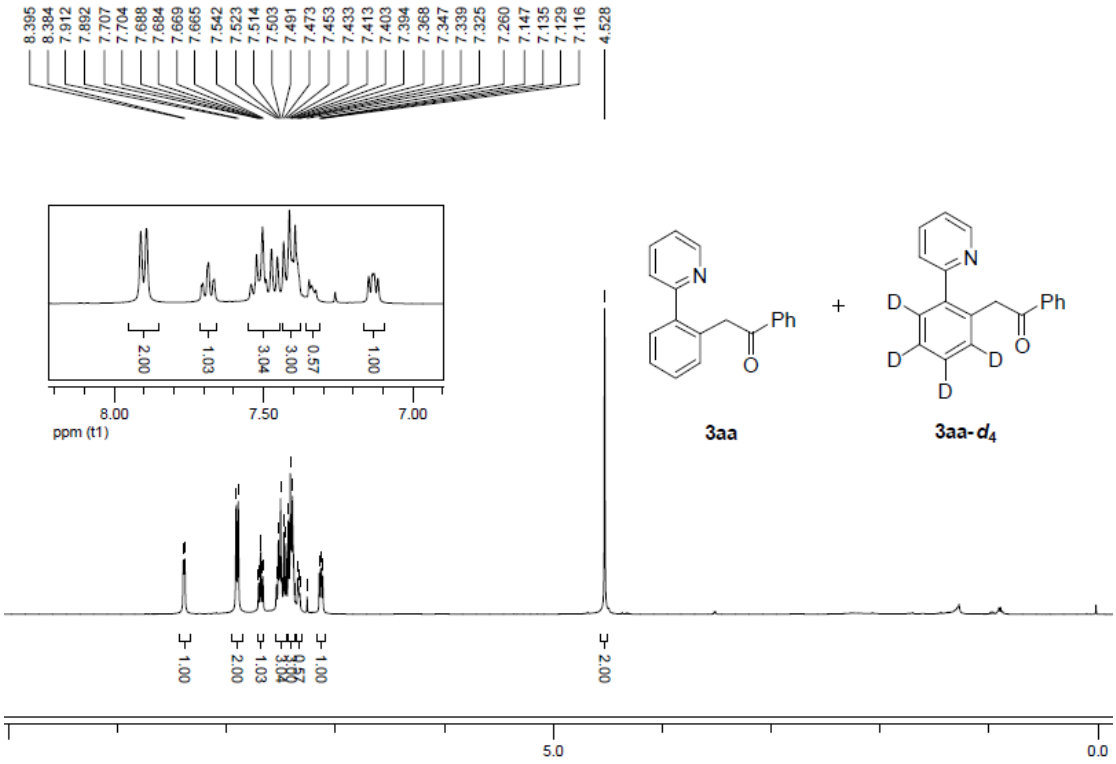



8.710
8.698
8.011
7.992
7.766
7.746
7.731
7.491
7.475
7.438
7.420
7.402
7.239
7.227
N
D/H
70%
H/D
70%
1.00
0.60
2.07
1.03
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

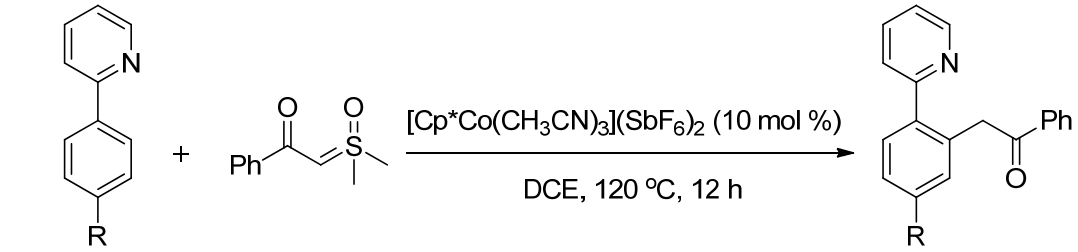
(b) Competition KIE Experiment:



A mixture of 2-phenylpyridine (**1a**) (0.2 mmol, 1.0 equiv), **1a-*d*$_5$** (0.2mmol, 1.0 equiv), **2a** (39.2 mg, 0.2 mmol, 1.0 equiv), [Cp*Co(CH_3CN)$_3$](SbF_6)$_2$ (15.8 mg, 0.02 mmol, 10 mol %) were weighted in a Schlenk tube equipped with a stir bar. Dry DCE (1.5 mL) was added and the mixture was stirred at 120 °C for 2 h under Ar atmosphere. Afterwards, it was diluted with CH_2Cl_2 and transferred to a round bottom flask. Silica was added to the flask and volatiles were evaporated under reduced pressure. The purification was performed by flash column chromatography on silica gel with EtOAc/petroleum ether. The KIE value was determined to be k_H/k_D = 1.3 on the basis of ^{1}H NMR analysis.

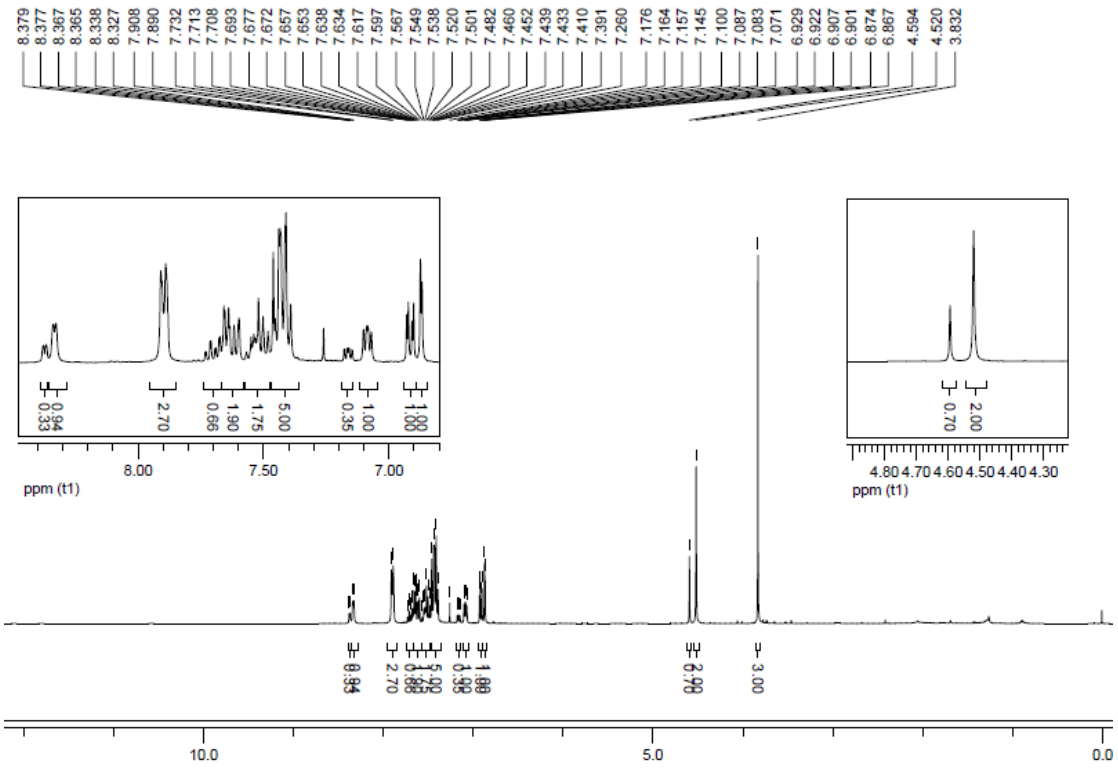


Competition Experiment:



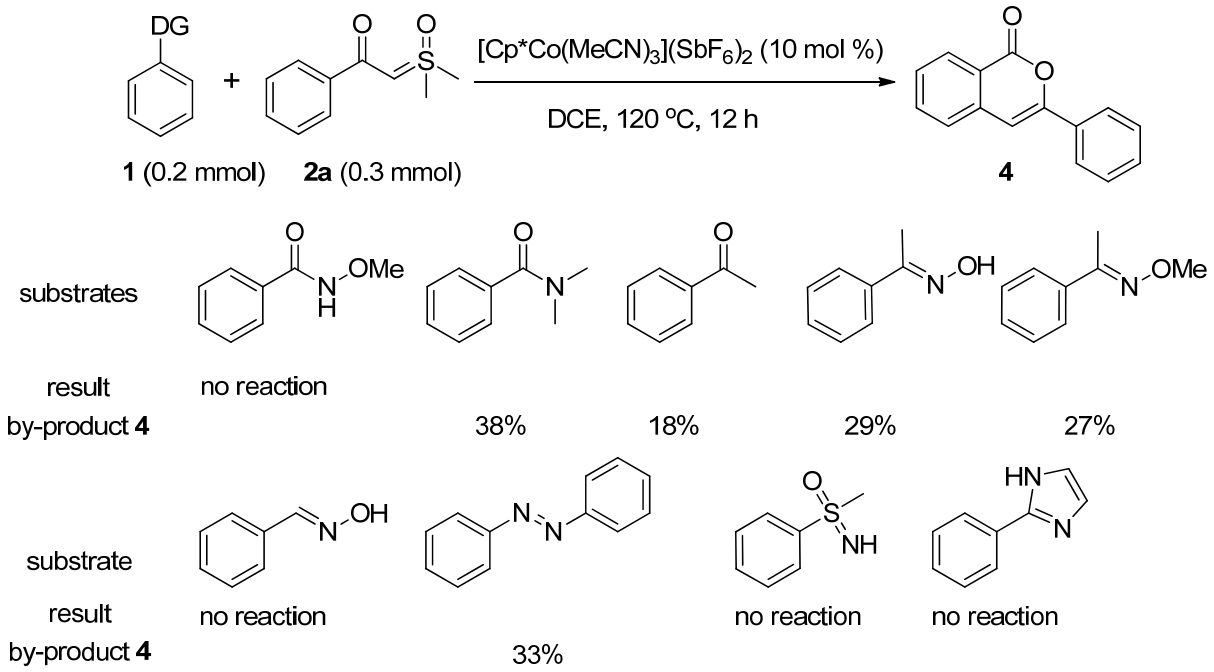
R = OMe/CF_3 (**1c**/**1g**) = 1:1 R = OMe/CF_3 (**3ca**/**3ga**) = 1:0.35

A mixture of 2-(4-methoxyphenyl)pyridine (0.2 mmol, 1.0 equiv), 2-(4-(trifluoromethyl)phenyl)pyridine (0.2 mmol, 1.0 equiv), α-benzoyl sulfur ylide (**2a**) (0.2mmol, 1.0 equiv), $[Cp^*Co(CH_3CN)_3](SbF_6)_2$ (15.8 mg, 0.02 mmol, 10 mol %) were weighted in a Schlenk tube equipped with a stir bar. Dry DCE (1.5 mL) was added and the mixture was stirred at 120 °C for 12 h under Ar atmosphere. Afterwards, it was diluted with CH_2Cl_2 and transferred to a round bottom flask. Silica was added to the flask and volatiles were evaporated under reduced pressure. The residue was purified by flash column chromatography on silica gel with EtOAc/petroleum ether to give a mixture of products **3ca** and **3ga** at a ratio of 1:0.35.



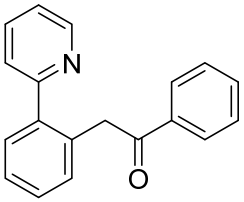
Reactions of Substrates with Other Directing Group

Substrates with other directing groups that failed to undergo productive reaction with **2a** under optimized conditions. In some cases a by-product **4**, the self-coupling product of **2a**, was isolated in 18-38% yields.



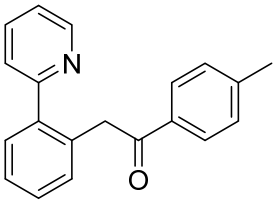
A mixture of substrate **1** (0.2 mmol, 1.0 equiv), sulfoxonium ylides **2a** (0.3 mmol, 1.5 equiv), $[Cp^*Co(CH_3CN)_3](SbF_6)_2$ (15.8 mg, 0.02 mmol, 10 mol %) were weighed in a Schlenk tube equipped with a stir bar. Dry 1,2-dichloroethane (1.5 mL) was added and the mixture was stirred at 120 °C for 12 h under Ar atmosphere. Afterwards, it was diluted with CH_2Cl_2 and indicated by thin layer chromatography (TLC), then transferred to a round bottom flask. Silica was added to the flask and volatiles were evaporated under reduced pressure. The purification was performed by flash column chromatography on silica gel with EtOAc/petroleum ether. Compound **4** was isolated as a white solid.

Characterization of Products 3 and 4



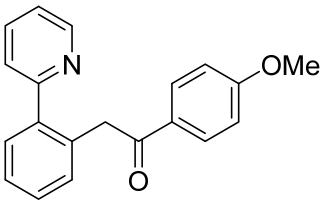
1-Phenyl-2-(2-(pyridin-2-yl)phenyl)ethan-1-one (3aa).[3,4]

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a yellow solid in 91% yield (49.8 mg, 0.182 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.39 (d, *J* = 4.1 Hz, 1H), 7.90 (d, *J* = 7.6 Hz, 2H), 7.69 (t, *J* = 7.6 Hz, 1H), 7.55–7.48 (m, 2H), 7.45–7.47 (m, 1H), 7.44–7.36 (m, 4H), 7.33–7.34 (m, 1H), 7.17–7.10 (m, 1H), 4.53 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 197.8, 159.3, 148.5, 139.8, 137.0, 136.6, 133.3, 132.6, 131.8, 129.7, 128.5, 128.4, 128.2, 127.2, 123.7, 121.7, 43.5.



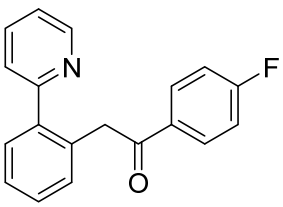
2-(2-(Pyridin-2-yl)phenyl)-1-(*p*-tolyl)ethan-1-one (3ab).[4]

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a yellow oil in 53% yield (30.7 mg, 0.107mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.44 (d, *J* = 4.4 Hz, 1H), 7.79 (d, *J* = 8.1 Hz, 2H), 7.69 (td, *J* = 7.7, 1.7 Hz, 1H), 7.51–7.43 (m, 2H), 7.42–7.35 (m, 2H), 7.34–7.29 (m, 1H), 7.20 (d, *J* = 8.1 Hz, 2H), 7.15 (dd, *J* = 7.3, 5.1 Hz, 1H), 4.49 (s, 2H), 2.39 (s, 3H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 197.5, 159.4, 148.6, 143.4, 139.9, 136.6, 134.5, 133.4, 131.7, 129.8, 129.1, 128.5, 128.3, 127.1, 123.9, 121.7, 43.30, 21.6.



1-(4-Methoxyphenyl)-2-(2-(pyridin-2-yl)phenyl)ethan-1-one (3ac).[3]

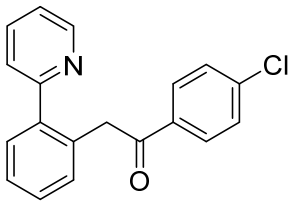
The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/5) as a yellow oil in 39% yield (23.4 mg, 0.077 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.46 (d, *J* = 4.2 Hz, 1H), 7.87 (d, *J* = 8.9 Hz, 2H), 7.68 (td, *J* = 7.7, 1.8 Hz, 1H), 7.51–7.42 (m, 2H), 7.39–7.34 (m, 2H), 7.34–7.30 (m, 1H), 7.14 (dd, *J* = 6.6, 4.9 Hz, 1H), 6.87 (d, *J* = 8.9 Hz, 2H), 4.46 (s, 2H), 3.82 (s, 3H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 196.5, 163.2, 159.5, 148.6, 139.9, 136.7, 133.5, 131.6, 130.5, 129.9, 129.8, 128.6, 127.1, 124.0, 121.8, 113.6, 55.4, 43.0.



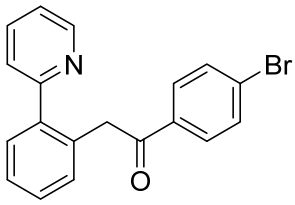
1-(4-Fluorophenyl)-2-(2-(pyridin-2-yl)phenyl)ethan-1-one (3ad).

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a light yellow solid in 82% yield

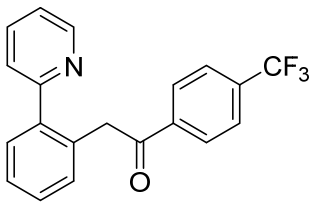
(47.6 mg, 0.164mmol). Mp: 60–62 °C. **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.38 (d, *J* = 4.2 Hz, 1H), 7.96–7.90 (m, 2H), 7.70 (td, *J* = 7.7, 1.8 Hz, 1H), 7.52–7.44 (m, 2H), 7.42–7.36 (m, 2H), 7.35–7.30 (m, 1H), 7.17–7.12 (m, 1H), 7.11–7.04 (m, 2H), 4.49 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 196.3, 165.4 (d, *J* = 254.1 Hz), 159.3, 148.4, 139.6, 136.64, 133.4 (d, *J* = 2.9 Hz), 133.1, 131.8, 130.8 (d, *J* = 9.2 Hz), 129.8, 128.6, 127.3, 123.7, 121.7, 115.4 (d, *J* = 21.8 Hz), 43.4. **^{19}F NMR ($CDCl_3$, 376 MHz):** δ −106.09. **HRMS (ESI):** Calcd for $C_{19}H_{15}FNO$ $[M+H]^+$ 292.1132, found: 292.1135.



1-(4-Chlorophenyl)-2-(2-(pyridin-2-yl)phenyl)ethan-1-one (3ae). The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a light yellow solid in 81% yield (49.9 mg, 0.162 mmol). Mp: 62–64 °C. **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.35 (d, *J* = 4.3 Hz, 1H), 7.84 (d, *J* = 8.5 Hz, 2H), 7.71 (td, *J* = 7.8, 1.7 Hz, 1H), 7.52–7.44 (m, 2H), 7.43–7.36 (m, 4H), 7.35–7.30 (m, 1H), 7.18–7.12 (m, 1H), 4.48 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 196.6, 159.2, 148.4, 139.5, 138.9, 136.7, 135.4, 133.0, 131.8, 129.8, 129.6, 128.7, 128.6, 127.3, 123.7, 121.6, 43.5. **HRMS (ESI):** Calcd for $C_{19}H_{15}ClNO$ $[M+H]^+$ 308.0837, found: 308.0839.

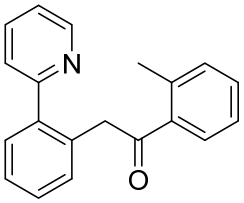


1-(4-Bromophenyl)-2-(2-(pyridin-2-yl)phenyl)ethan-1-one (3af).[3] The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a light yellow solid in 79% yield (55.6 mg, 0.158 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.35 (d, *J* = 4.2 Hz, 1H), 7.77 (d, *J* = 8.5 Hz, 2H), 7.71 (td, *J* = 7.8, 1.6 Hz, 1H), 7.55 (d, *J* = 8.5 Hz, 2H), 7.53–7.44 (m, 2H), 7.43–7.36 (m, 2H), 7.35–7.29 (m, 1H), 7.15 (dd, *J* = 7.4, 5.0 Hz, 1H), 4.47 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 196.8, 159.2, 148.4, 139.5, 136.7, 135.8, 133.0, 131.9, 131.7, 129.8, 128.6, 127.7, 127.4, 123.7, 121.8, 43.5.



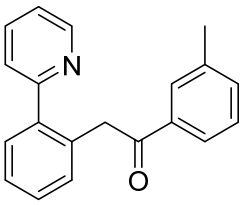
2-(2-(Pyridin-2-yl)phenyl)-1-(4-(trifluoromethyl)phenyl)ethan-1-one (3ag). The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/20) as a light yellow solid in 74% yield (50.3 mg, 0.147mmol). Mp: 78–80 °C. **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.28 (d, *J* = 4.4 Hz, 1H), 8.01 (d, *J* = 8.2 Hz, 2H), 7.75–7.65 (m, 3H), 7.57– .46 (m, 2H), 7.45–7.37 (m, 2H),

7.37–7.31 (m, 1H), 7.14 (dd, J = 6.9, 5.0 Hz, 1H), 4.53 (s, 2H). **^{13}C NMR ($CDCl_3$, 100MHz):** δ 196.8, 159.1, 148.3, 139.9, 139.35, 136.8, 133.8 (q, J = 32.5 Hz), 132.8, 132.0, 129.8, 128.7, 128.5, 127.5, 125.4 (q, J = 3.6 Hz), 123.6, 123.6 (q, J = 272.6 Hz), 121.8, 43.9. **^{19}F NMR ($CDCl_3$, 376 MHz):** δ –62.92. **HRMS (ESI):** Calcd for $C_{20}H_{15}F_3NO$ $[M+H]^+$ 342.1100, found: 342.1101.



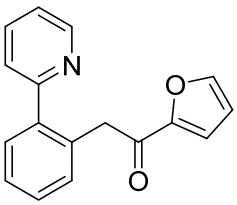
2-(2-(Pyridin-2-yl)phenyl)-1-(*o*-tolyl)ethan-1-one (3ah).

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a yellow oil in 89% yield (50.9 mg, 0.177 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.41 (d, J = 4.4 Hz, 1H), 7.71 (td, J = 7.7, 1.5 Hz, 1H), 7.54 (d, J = 7.6 Hz, 1H), 7.50–7.44 (m, 2H), 7.43–7.36 (m, 2H), 7.36–7.30 (m, 2H), 7.23–7.13 (m, 3H), 4.46 (s, 2H), 2.37 (s, 3H). **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ 201.3, 159.4, 148.4, 139.8, 138.1, 138.0, 136.6, 133.3, 132.1, 131.6, 130.8, 129.8, 128.5, 128.1, 127.2, 125.4, 123.7, 121.7, 46.5, 20.9. **HRMS (ESI):** Calcd for $C_{20}H_{18}NO$ $[M+H]^+$ 288.1383, found: 288.1385.



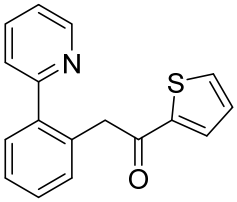
2-(2-(Pyridin-2-yl)phenyl)-1-(*m*-tolyl)ethan-1-one (3ai).

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a yellow oil in 69% yield (37.8 mg, 0.132 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.44 (d, J = 3.4 Hz, 1H), 7.75–7.64 (m, 3H), 7.51–7.45 (m, 2H), 7.42–7.36 (m, 2H), 7.35–7.27 (m, 3H), 7.19–7.13 (m, 1H), 4.52 (s, 2H), 2.37 (s, 3H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 198.1, 159.4, 148.6, 139.9, 138.1, 137.0, 136.6, 133.4, 133.3, 131.7, 129.8, 128.7, 128.5, 128.2, 127.2, 125.4, 123.8, 121.7, 43.4, 21.3. **HRMS (ESI):** Calcd for $C_{20}H_{18}NO$ $[M+H]^+$ 288.1383, found: 288.1385.



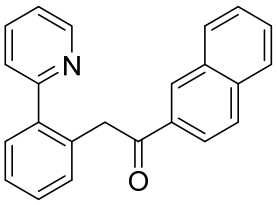
1-(Furan-2-yl)-2-(2-(pyridin-2-yl)phenyl)ethan-1-one (3aj).[3]

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/5) as a yellow oil in 71% yield (37.3 mg, 0.142 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.49 (d, J = 3.3 Hz, 1H), 7.74 (t, J = 7.6 Hz, 1H), 7.55–7.44 (m, 3H), 7.43–7.32 (m, 3H), 7.24–7.17 (m, 1H), 7.12–7.04 (m, 1H), 6.52–6.42 (m, 1H), 4.36 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 186.7, 159.3, 152.4, 148.54, 146.0, 140.1, 136.6, 132.5, 131.7, 129.8, 128.5, 127.3, 123.9, 121.7, 117.1, 112.0, 43.0.



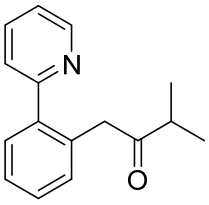
2-(2-(Pyridin-2-yl)phenyl)-1-(thiophen-2-yl)ethan-1-one (3ak).[3]

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a light yellow solid in 74% yield (41.4 mg, 0.148mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.48 (d, *J* = 4.3 Hz, 1H), 7.71 (td, *J* = 7.7, 1.8 Hz, 1H), 7.60 (dd, *J* = 3.8, 1.0 Hz, 1H), 7.56 (dd, *J* = 4.9, 1.0 Hz, 1H), 7.49 – 7.44 (m, 2H), 7.41 – 7.34 (m, 3H), 7.17 (ddd, *J* = 7.5, 4.9, 0.9 Hz, 1H), 7.05 (dd, *J* = 4.9, 3.8 Hz, 1H), 4.44 (s, 2H).**^{13}C NMR ($CDCl_3$, 100 MHz):** δ 190.7, 159.3, 148.6, 144.1, 140.0, 136.6, 133.2, 132.6, 132.0, 131.6, 129.8, 128.5, 127.9, 127.3, 123.9, 121.8, 44.0.



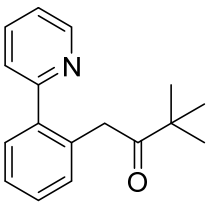
1-(Naphthalen-2-yl)-2-(2-(pyridin-2-yl)phenyl)ethan-1-one (3al).

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a light yellow solid in 82% yield (53.0 mg, 0.164 mmol). Mp: 99–101 °C. **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.41 (s, 2H), 7.98 (d, *J* = 8.6 Hz, 1H), 7.92–7.83 (m, 3H), 7.70 (t, *J* = 7.7 Hz, 1H), 7.62–7.56 (m, 1H), 7.56–7.47 (m, 3H), 7.44–7.36 (m, 3H), 7.16–7.09 (m, 1H), 4.66 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 197.8, 159.4, 148.6, 139.8, 136.6, 135.3, 134.3, 133.3, 132.4, 131.8, 129.8, 129.8, 129.5, 128.6, 128.2, 128.2, 127.6, 127.2, 126.5, 124.1, 123.8, 121.7, 43.5. **HRMS (ESI):** Calcd for $C_{23}H_{18}NO$ $[M+H]^+$ 324.1383, found: 324.1386.



3-Methyl-1-(2-(pyridin-2-yl)phenyl)butan-2-one (3am).[4]

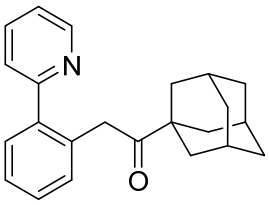
The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a colorless oil in 61% yield (29.2 mg, 0.122 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.61 (d, *J* = 4.3 Hz, 1H), 7.74 (td, *J* = 7.7, 1.7 Hz, 1H), 7.47–7.41 (m, 2H), 7.40–7.33 (m, 2H), 7.27–7.20 (m, 2H), 3.97 (s, 2H), 2.69–2.56 (m, 1H), 0.98 (d, *J* = 6.9 Hz, 6H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 211.8, 159.6, 148.5, 140.2, 136.6, 133.2, 131.7, 129.7, 128.5, 127.1, 123.9, 121.8, 45.6, 40.0, 18.2.



3,3-Dimethyl-1-(2-(pyridin-2-yl)phenyl)butan-2-one (3an).[4]

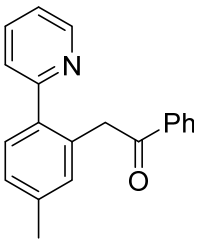
The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a colorless oil in 48% yield (24.2 mg, 0.096 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.61 (d, *J* = 4.1 Hz, 1H),

7.72 (td, *J* = 7.7, 1.8 Hz, 1H), 7.43–7.37 (m, 2H), 7.37–7.30 (m, 2H), 7.24–7.16 (m, 2H), 4.12 (s, 2H), 1.03 (s, 9H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 213.0, 160.1, 148.6, 140.5, 136.6, 133.3, 131.6, 129.7, 128.3, 126.9, 124.2, 121.7, 44.2, 41.5, 26.6.



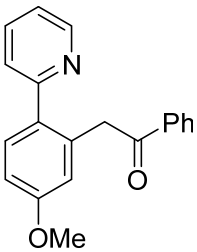
1-((*3r,5r,7r*)-Adamantan-1-yl)-2-(2-(pyridin-2-yl)phenyl)ethan-1-one (3ao).[3]

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/20) as a colorless liquid in 40% yield (26.6 mg, 0.080 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.62 (d, *J* = 4.1 Hz, 1H), 7.72 (td, *J* = 7.7, 1.8 Hz, 1H), 7.41–7.37 (m, 2H), 7.36–7.31 (m, 2H), 7.22 (dd, *J* = 7.5, 4.9 Hz, 1H), 7.18–7.14 (m, 1H), 4.06 (s, 2H), 1.98 (s, 3H), 1.75–1.67 (m, 9H), 1.66–1.59(m, 3H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 212.7, 160.0, 148.5, 140.5, 136.6, 133.3, 131.7, 129.7, 128.3, 126.9, 124.2, 121.7, 46.4, 41.2, 38.3, 36.5, 27.9.



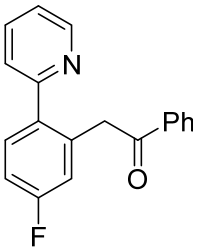
2-(5-Methyl-2-(pyridin-2-yl)phenyl)-1-phenylethan-1-one (3ba).

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a yellow oil in 55% yield (31.4 mg, 0.109 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.36 (d, *J* = 4.3 Hz, 1H), 7.91 (d, *J* = 7.8 Hz, 2H), 7.66 (t, *J* = 7.7 Hz, 1H), 7.55 – 7.49 (m, 1H), 7.48 – 7.37 (m, 4H), 7.20 (d, *J* = 7.8 Hz, 1H), 7.15 (s, 1H), 7.13 – 7.07 (m, 1H), 4.50 (s, 2H), 2.40 (s, 3H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 198.0, 159.4, 148.4, 138.3, 137.1, 137.0, 136.5, 133.1, 132.6, 132.5, 129.7, 128.3, 128.2, 127.9, 123.6, 121.4, 43.5, 21.1. **HRMS (ESI):** Calcd for $C_{20}H_{18}NO$ $[M+H]^+$ 288.1383, found: 288.1387.



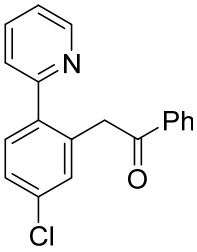
2-(5-Methoxy-2-(pyridin-2-yl)phenyl)-1-phenylethan-1-one (3ca)

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a yellow oil in 76% yield (46.0 mg, 0.152 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.33 (d, *J* = 4.2 Hz, 1H), 7.90 (d, *J* = 7.2 Hz, 2H), 7.65 (td, *J* = 7.7, 1.8 Hz, 1H), 7.55–7.49 (m, 1H), 7.47–7.38 (m, 4H), 7.08 (dd, *J* = 7.5, 4.0 Hz, 1H), 6.92 (dd, *J* = 8.5, 2.6 Hz, 1H), 6.87 (d, *J* = 2.6 Hz, 1H), 4.52 (s, 2H), 3.83 (s, 3H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 197.7, 159.6, 159.0, 148.4, 137.0, 136.5, 134.8, 132.6, 132.4, 131.0, 128.4, 128.2, 123.4, 121.2, 117.3, 112.6, 55.2, 43.8. **HRMS (ESI):** Calcd for $C_{20}H_{18}NO_2$ $[M+H]^+$ 304.1332, found: 304.1336.



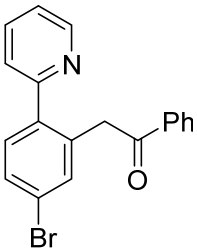
2-(5-Fluoro-2-(pyridin-2-yl)phenyl)-1-phenylethan-1-one (3da).

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a yellow oil in 74% yield (42.9 mg, 0.147 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.37 (d, *J* = 4.2 Hz, 1H), 7.88 (d, *J* = 7.7 Hz, 2H), 7.69 (t, *J* = 7.7 Hz, 1H), 7.57–7.51 (m, 1H), 7.49–7.39 (m, 4H), 7.16–7.11 (m, 1H), 7.10–7.02 (m, 2H), 4.51 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 197.1, 162.5 (d, *J* = 247.9 Hz), 158.5, 148.6, 136.9, 136.7, 136.1, 135.8 (d, *J* = 8.1 Hz), 132.8, 131.4 (d, *J* = 8.5 Hz), 128.5, 128.2, 123.7, 121.8, 118.7 (d, *J* = 21.7 Hz), 114.1 (d, *J* = 21.1 Hz), 43.4. **^{19}F NMR ($CDCl_3$, 376 MHz):** δ –113.59. **HRMS (ESI):** Calcd for $C_{19}H_{15}FNO$ $[M+H]^+$ 292.1132, found: 292.1135.



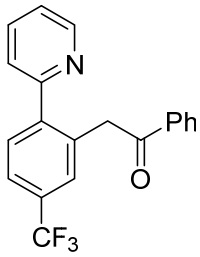
2-(5-Chloro-2-(pyridin-2-yl)phenyl)-1-phenylethan-1-one (3ea).

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a light yellow solid in 78% yield (48.0 mg, 0.156 mmol). Mp: 56–58 °C. **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.35 (d, *J* = 4.2 Hz, 1H), 7.88 (d, *J* = 7.6 Hz, 2H), 7.69 (t, *J* = 7.6 Hz, 1H), 7.54 (t, *J* = 7.4 Hz, 1H), 7.47–7.39 (m, 4H), 7.39–7.31 (m, 2H), 7.17–7.10 (m, 1H), 4.51 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 197.1, 158.3, 148.6, 138.3, 136.9, 136.8, 135.3, 134.3, 132.8, 131.9, 131.0, 128.5, 128.1, 127.4, 123.7, 122.0, 43.3. **HRMS (ESI):** Calcd for $C_{19}H_{15}ClNO$ $[M+H]^+$ 308.0837, found: 308.0838.



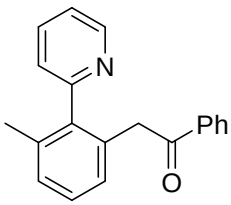
2-(5-Bromo-2-(pyridin-2-yl)phenyl)-1-phenylethan-1-one (3fa).

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a light yellow solid in 76% yield (53.3 mg, 0.152 mmol). Mp: 57–59 °C. **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.34 (d, *J* = 4.8 Hz, 1H), 7.88 (d, *J* = 7.3 Hz, 2H), 7.68 (td, *J* = 7.7, 1.7 Hz, 1H), 7.57–7.47 (m, 3H), 7.46–7.39 (m, 3H), 7.37 (d, *J* = 8.2 Hz, 1H), 7.13 (dd, *J* = 7.3, 5.0 Hz, 1H), 4.50 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 197.0, 158.3, 148.6, 138.785, 136.8, 136.8, 135.5, 134.8, 132.8, 131.2, 130.3, 128.5, 128.1, 123.6, 122.5, 122.0, 43.2. **HRMS (ESI):** Calcd for $C_{19}H_{15}BrNO$ $[M+H]^+$ 352.0332 and 354.0311, found: 352.0334 and 354.0313.



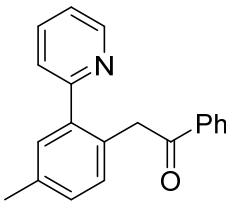
1-Phenyl-2-(2-(pyridin-2-yl)-5-(trifluoromethyl)phenyl)ethan-1-one (3ga).

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a light yellow solid in 52% yield (35.2 mg, 0.103 mmol). Mp: 56–58 °C. **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.38 (d, *J* = 4.2 Hz, 1H), 7.90 (d, *J* = 7.3 Hz, 2H), 7.72 (td, *J* = 7.8, 1.7 Hz, 1H), 7.68–7.58 (m, 3H), 7.55 (t, *J* = 7.4 Hz, 1H), 7.51–7.40 (m, 3H), 7.17 (dd, *J* = 7.5, 4.9 Hz, 1H), 4.60 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 196.9, 158.1, 148.7, 143.3, 136.9, 136.8, 134.4, 132.9, 130.4 (q, *J* = 32.4 Hz), 130.1, 128.9 (q, *J* = 3.9 Hz), 128.5, 128.1, 124.1 (q, *J* = 3.6 Hz), 124.0 (q, *J* = 272.3 Hz), 123.8 122.4, 43.4. **^{19}F NMR ($CDCl_3$, 376 MHz):** δ –62.41. **HRMS (ESI):** Calcd for $C_{20}H_{15}F_3NO$ $[M+H]^+$ 342.1100, found: 342.1102.



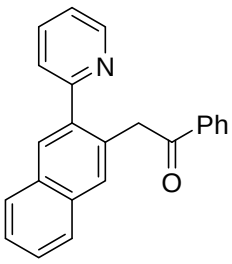
2-(3-Methyl-2-(pyridin-2-yl)phenyl)-1-phenylethan-1-one(3ha).

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a light yellow solid in 9% yield (5.1 mg, 0.018 mmol). Mp:100–102 °C. **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.64 (d, *J* = 4.5 Hz, 1H), 7.77 (d, *J* = 7.6 Hz, 2H), 7.65 (td, *J* = 7.7, 1.5 Hz, 1H), 7.49 (t, *J* = 7.4 Hz, 1H), 7.37 (t, *J* = 7.7 Hz, 2H), 7.30–7.16 (m, 4H), 7.12 (d, *J* = 7.5 Hz, 1H), 4.08 (s, 2H), 2.08 (s, 3H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 198.0, 159.0, 149.3, 140.2, 136.7, 136.4, 136.2, 133.1, 132.9, 129.0, 128.4, 128.2, 128.2, 128.1, 125.3, 122.0, 43.4, 20.4. **HRMS (ESI):** Calcd for $C_{20}H_{18}NO$ $[M+H]^+$ 288.1383, found: 288.1386.



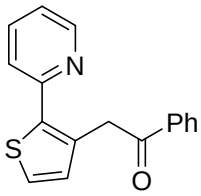
2-(4-Methyl-2-(pyridin-2-yl)phenyl)-1-phenylethan-1-one (3ia).

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a light yellow solid in 44% yield (25.3 mg, 0.088 mmol). Mp: 48–50 °C. **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.42 (d, *J* = 3.4 Hz, 1H), 7.89 (d, *J* = 7.4 Hz, 2H), 7.67 (t, *J* = 7.3 Hz, 1H), 7.51 (t, *J* = 7.3 Hz, 1H), 7.45 (d, *J* = 7.9 Hz, 1H), 7.40 (t, *J* = 7.5 Hz, 2H), 7.32 (s, 1H), 7.25–7.18 (m, 2H), 7.17–7.09 (m, 1H), 4.47 (s, 2H), 2.40 (s, 3H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 198.0, 159.5, 148.5, 139.7, 137.1, 136.7, 136.5, 132.6, 131.6, 130.5, 130.1, 129.3, 128.3, 128.2, 123.7, 121.6, 43.0, 21.0. **HRMS (ESI):** Calcd for $C_{20}H_{18}NO$ $[M+H]^+$ 288.1383, found: 288.1387.



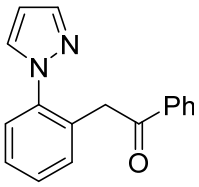
1-Phenyl-2-(3-(pyridin-2-yl)naphthalen-2-yl)ethan-1-one (3ja).

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a light yellow solid in 71% yield (45.8 mg, 0.142 mmol). Mp:97–99 °C. **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.39 (d, *J* = 4.4 Hz, 1H), 7.98 (s, 1H), 7.93 (d, *J* = 7.3 Hz, 2H), 7.90–7.86 (m, 1H), 7.86–7.82 (m, 1H), 7.80 (s, 1H), 7.72 (td, *J* = 7.7, 1.7 Hz, 1H), 7.61 (d, *J* = 7.8 Hz, 1H), 7.55–7.47 (m, 3H), 7.45–7.39 (m, 2H), 7.14 (dd, *J* = 6.7, 5.1 Hz, 1H), 4.72 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 197.9, 159.5, 148.4, 138.1, 137.1, 136.7, 133.2, 132.6, 132.5, 131.3, 130.8, 129.3, 128.4, 128.1, 127.8, 127.3, 126.5, 126.0, 124.0, 121.7, 43.9. **HRMS (ESI):** Calcd for $C_{23}H_{18}NO$ $[M+H]^+$ 324.1383, found: 324.1385.



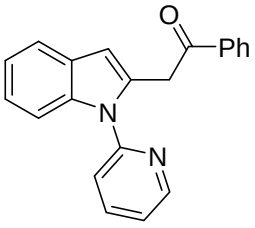
1-Phenyl-2-(2-(pyridin-2-yl)thiophen-3-yl)ethan-1-one (3ka).

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/20) as a yellow oil in 49% yield (27.2 mg, 0.097 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.43 (d, *J* = 4.5 Hz, 1H), 8.06–8.01 (m, 2H), 7.65 (td, *J* = 7.7, 1.8 Hz, 1H), 7.58–7.51 (m, 2H), 7.48–7.43 (m, 2H), 7.32 (d, *J* = 5.1 Hz, 1H), 7.10 (ddd, *J* = 7.4, 4.9, 0.8 Hz, 1H), 7.01 (d, *J* = 5.1 Hz, 1H), 4.76 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 197.7, 153.0, 149.0, 138.1, 137.1, 136.7, 133.3, 132.9, 131.7, 128.5, 128.4, 125.2, 121.9, 121.5, 39.8. **HRMS (ESI):** Calcd for $C_{17}H_{14}NOS$ $[M+H]^+$ 280.0791, found: 280.0795.



2-(2-(1H-pyrazol-1-yl)phenyl)-1-phenylethan-1-one (3la).[4]

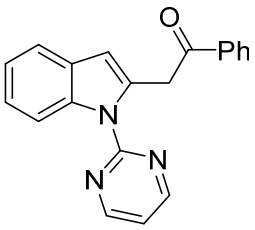
The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/20) as a light yellow solid in 63% yield (33.2 mg, 0.126 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 7.87 (d, *J* = 7.3 Hz, 2H), 7.65–7.57 (m, 2H), 7.54 (t, *J* = 7.4 Hz, 1H), 7.46–7.32 (m, 6H), 6.39–6.29 (m, 1H), 4.39 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 197.1, 140.6, 140.0, 136.5, 133.0, 132.1, 130.9, 130.8, 128.5, 128.4, 128.2, 127.9, 125.9, 106.4, 41.7.



1-Phenyl-2-(1-(pyridin-2-yl)-1H-indol-2-yl)ethan-1-one (3ma).[4]

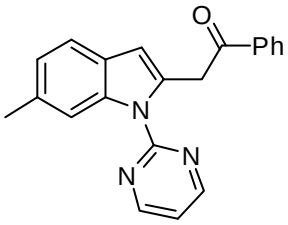
The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a light yellow solid in 83% yield

(51.9 mg, 0.166 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.38 (dd, *J* = 4.8, 1.3 Hz, 1H), 7.92 (d, *J* = 7.2 Hz, 2H), 7.84 (td, *J* = 7.8, 1.9 Hz, 1H), 7.64–7.52 (m, 3H), 7.49–7.40 (m, 3H), 7.22–7.14 (m, 3H), 6.59 (s, 1H), 4.70 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 196.1, 151.3, 149.1, 138.3, 136.8, 136.5, 133.8, 132.9, 128.5, 128.5, 128.2, 122.2, 121.5, 120.8, 120.4, 120.1, 110.2, 105.9, 38.3.



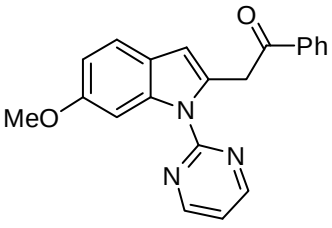
1-Phenyl-2-(1-(pyrimidin-2-yl)-1H-indol-2-yl)ethan-1-one (3na).[4]

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a light yellow solid in 83% yield (52.0 mg, 0.166 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.63 (d, *J* = 8.4 Hz, 1H), 8.38 (d, *J* = 4.8 Hz, 2H), 8.03 (d, *J* = 7.2 Hz, 2H), 7.63–7.55 (m, 2H), 7.54–7.46 (m, 2H), 7.33–7.27 (m, 1H), 7.25–7.20 (m, 1H), 6.91 (t, *J* = 4.8 Hz, 1H), 6.64 (s, 1H), 4.81 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 196.4, 157.9, 157.4, 137.3, 136.9, 134.2, 132.6, 129.3, 128.5, 128.1, 123.2, 122.0, 119.9, 116.3, 115.7, 110.4, 40.7.



2-(6-Methyl-1-(pyrimidin-2-yl)-1H-indol-2-yl)-1-phenylethan-1-one (3oa).[4]

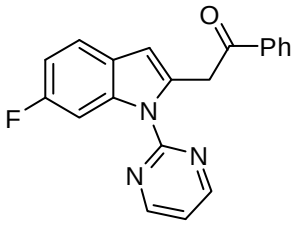
The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a white solid in 77% yield (50.1 mg, 0.153 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.46–8.41 (m, 1H), 8.39 (d, *J* = 4.8 Hz, 2H), 8.06–7.98 (m, 2H), 7.61–7.57 (m, 1H), 7.53–7.43 (m, 3H), 7.07 (d, *J* = 7.9 Hz, 1H), 6.90 (t, *J* = 4.8 Hz, 1H), 6.58 (s, 1H), 4.78 (s, 2H), 2.52 (s, 3H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 196.5, 158.0, 157.5, 137.4, 137.3, 133.5, 133.0, 132.6, 128.5, 128.1, 127.1, 123.6, 119.6, 116.2, 115.7, 110.2, 40.7, 22.1.



2-(6-Methoxy-1-(pyrimidin-2-yl)-1H-indol-2-yl)-1-phenylethan-1-one (3pa).[4]

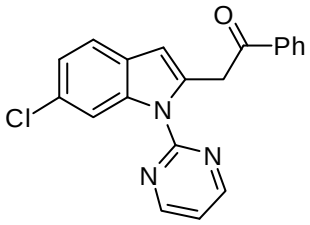
The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a white solid in 58% yield (40.1 mg, 0.116 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.37 (d, *J* = 4.8 Hz, 2H), 8.29 (d, *J* = 2.3 Hz, 1H), 8.07–7.99 (m, 2H), 7.62–7.56 (m, 1H), 7.52–7.47 (m, 2H), 7.44 (d, *J* = 8.5 Hz, 1H), 6.94–6.85 (m, 2H), 6.56 (s, 1H), 4.78 (s, 2H), 3.90 (s, 3H). **^{13}C NMR ($CDCl_3$,**

100 MHz): δ 196.6, 158.1, 157.4, 157. 1, 137.8, 137.4, 133.1, 132.6, 128.5, 128.1, 123.4, 120.2, 116.2, 110.8, 110.2, 100.9, 55.8, 40.8.



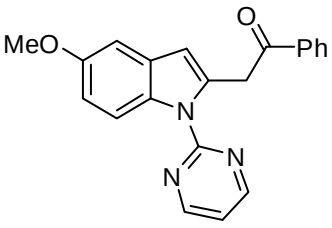
2-(6-Fluoro-1-(pyrimidin-2-yl)-1H-indol-2-yl)-1-phenylethan-1-one (3qa).[4]

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a white solid in 67% yield (45.0 mg, 0.136 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.44 (dd, *J* = 11.4, 2.4 Hz, 1H), 8.36 (d, *J* = 4.8 Hz, 2H), 8.08–7.96 (m, 2H), 7.65–7.56 (m, 1H), 7.56–7.41 (m, 3H), 7.04–6.95 (m, 1H), 6.91 (t, *J* = 4.8 Hz, 1H), 6.60 (s, 1H), 4.79 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 196.4, 160.4 (d, *J* = 237.0 Hz), 157.9, 157.5, 137.3, 137.0 (d, *J* = 4.0 Hz), 134.8 (d, *J* = 13.3 Hz), 132.8, 128.6, 128.1, 125.7, 120.3 (d, *J* = 10.0 Hz), 116.5, 110.5, 110.2, 103.3 (d, *J* = 29.3 Hz), 40.8. **^{19}F NMR ($CDCl_3$, 376 MHz):** δ −119.07.



2-(6-Chloro-1-(pyrimidin-2-yl)-1H-indol-2-yl)-1-phenylethan-1-one (3ra).[4]

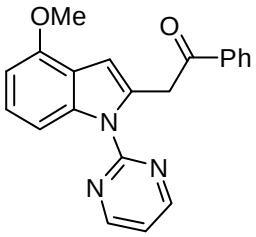
The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a white solid in 70% yield (48.5 mg, 0.140 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.71 (d, *J* = 1.7 Hz, 1H), 8.36 (d, *J* = 4.8 Hz, 2H), 8.06–7.95 (m, 2H), 7.64–7.56 (t, *J* = 7.4 Hz, 1H), 7.54–7.41 (m, 3H), 7.20 (dd, *J* = 8.3, 1.9 Hz, 1H), 6.91 (t, *J* = 4.8 Hz, 1H), 6.58 (s, 1H), 4.77 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 196.2, 157.6, 157.5, 137.1, 135.1, 132.8, 129.0, 128.6, 128.1, 127.8, 122.6, 120.6, 116.6, 116.1, 110.1, 40.7.



2-(5-Methoxy-1-(pyrimidin-2-yl)-1H-indol-2-yl)-1-phenylethan-1-one (3sa).[4]

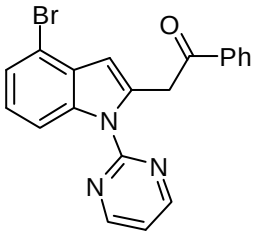
The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a yellow solid in 75% yield (51.4 mg, 0.150 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.57 (d, *J* = 9.1 Hz, 1H), 8.32 (d, *J* = 4.8 Hz, 2H), 8.06–7.98 (m, 2H), 7.62–7.55 (m, 1H), 7.53–7.46 (m, 2H), 7.04 (d, *J* = 2.6 Hz, 1H), 6.92 (dd, *J* = 9.1, 2.6 Hz, 1H), 6.85 (t, *J* = 4.8 Hz, 1H), 6.55 (s, 1H), 4.77 (s, 2H),

3.87 (s, 3H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 196.4, 157.8, 157.4, 155.4, 137.4, 134.9, 132.6, 131.8, 130.1, 128.5, 128.1, 116.8, 116.0, 112.0, 110.4, 102.4, 55.6, 40.8.



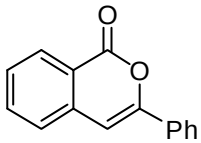
2-(4-Methoxy-1-(pyrimidin-2-yl)-1H-indol-2-yl)-1-phenylethan-1-one (**3ta**).[4]

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a white solid in 74% yield (50.9 mg, 0.148 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.40 (d, *J* = 4.8 Hz, 2H), 8.21 (d, *J* = 8.5 Hz, 1H), 8.06–7.99 (m, 2H), 7.62–7.55 (m, 1H), 7.52–7.47 (m, 2H), 7.21 (t, *J* = 8.2 Hz, 1H), 6.92 (t, *J* = 4.8 Hz, 1H), 6.76 (s, 1H), 6.67 (d, *J* = 7.9 Hz, 1H), 4.81 (s, 2H), 3.96 (s, 3H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 196.4, 158.1, 157.5, 152.3, 138.2, 137.3, 132.6, 128.5, 128.1, 123.9, 119.7, 116.4, 109.0, 107.2, 102.5, 55.4, 40.7.



2-(4-Bromo-1-(pyrimidin-2-yl)-1H-indol-2-yl)-1-phenylethan-1-one (**3ua**).[4]

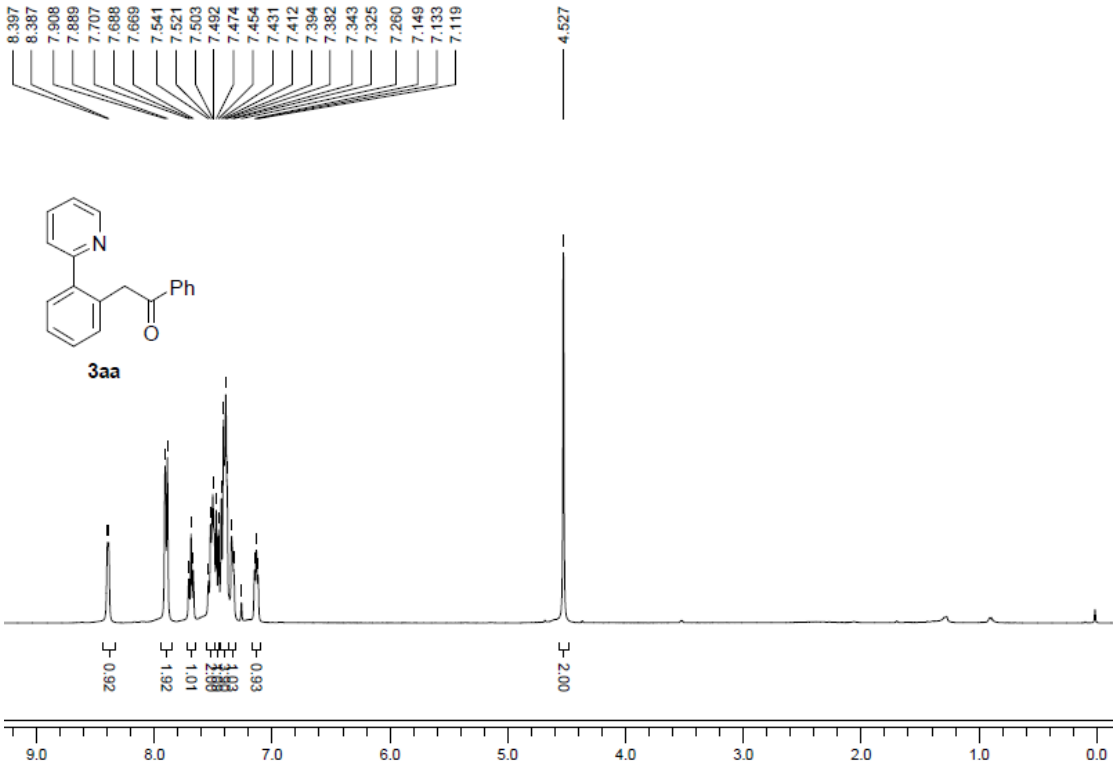
The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a yellow solid in 69% yield (53.9 mg, 0.138 mmol). **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.58 (d, *J* = 8.4 Hz, 1H), 8.38 (d, *J* = 4.8 Hz, 2H), 8.04–7.97 (m, 2H), 7.64–7.57 (m, 1H), 7.54–7.48 (m, 2H), 7.39 (d, *J* = 7.6 Hz, 1H), 7.14 (t, *J* = 8.1 Hz, 1H), 6.94 (t, *J* = 4.8 Hz, 1H), 6.71 (s, 1H), 4.81 (s, 2H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 196.1, 157.8, 157.6, 137.2, 137.1, 135.1, 132.8, 129.8, 128.6, 128.1, 124.9, 124.1, 116.8, 114.9, 113.8, 110.1, 40.7.

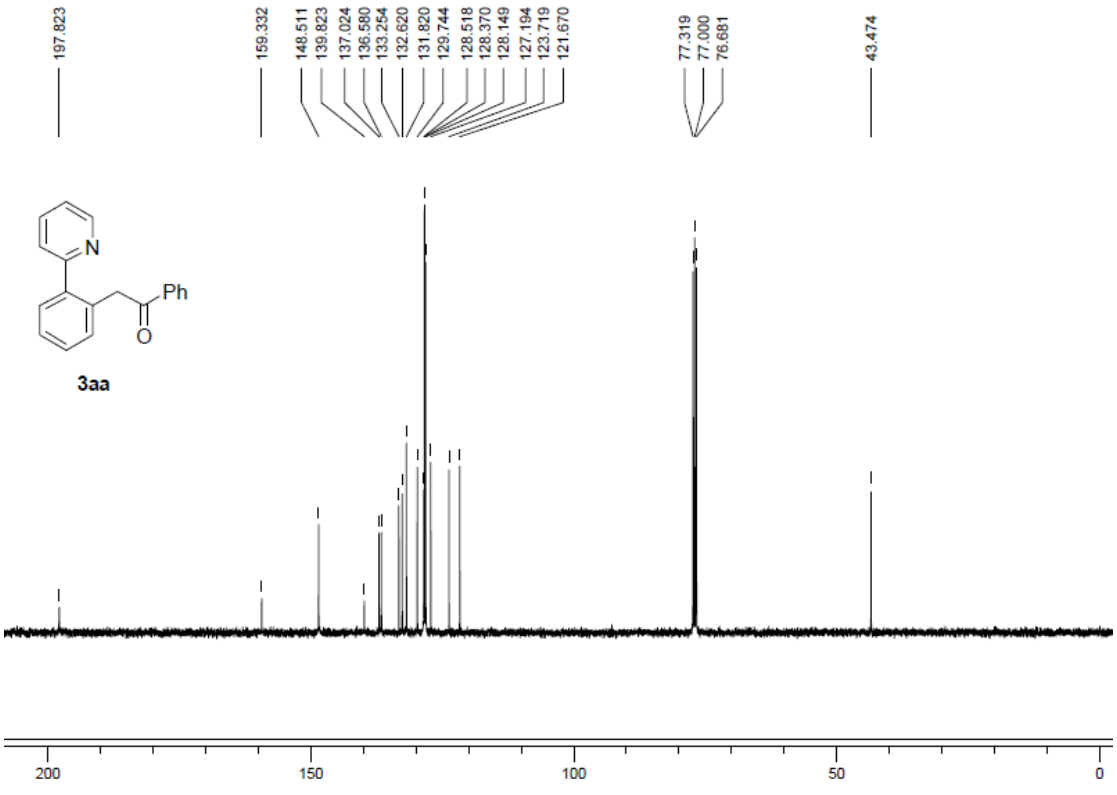


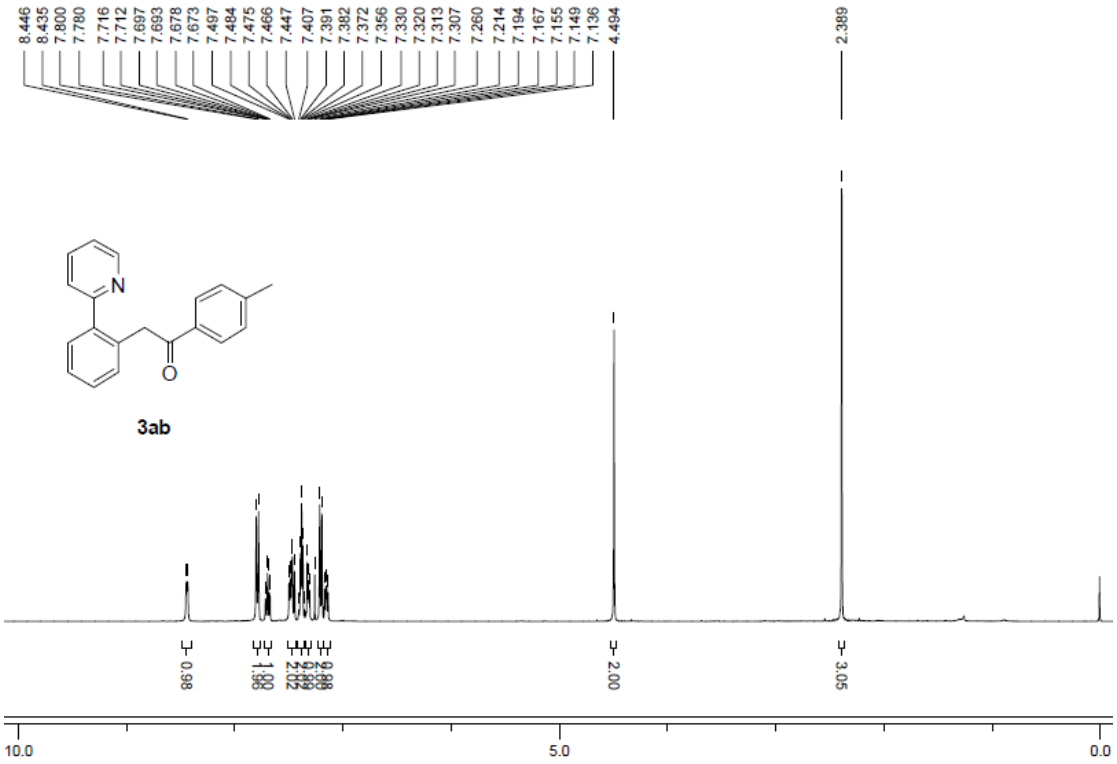
3-Phenyl-1H-isochromen-1-one (**4**).[5]

The title compound was isolated by column chromatography (eluent: EtOAc/petroleum ether = 1/10) as a white solid. **^{1}H NMR ($CDCl_3$, 400 MHz):** δ 8.30 (d, *J* = 8.2 Hz, 1H), 7.90–7.84 (m, 2H), 7.75–7.68 (m, 1H), 7.52–7.41 (m, 5H), 6.94 (s, 1H). **^{13}C NMR ($CDCl_3$, 100 MHz):** δ 162.3, 153.5, 137.5, 134.8, 131.9, 129.9, 129.6, 128.8, 128.1, 125.9, 125.2, 120.5, 101.8.

Spectral Copies of ^{1}H, ^{13}C, ^{19}F NMR of Compounds Obtained in This Study



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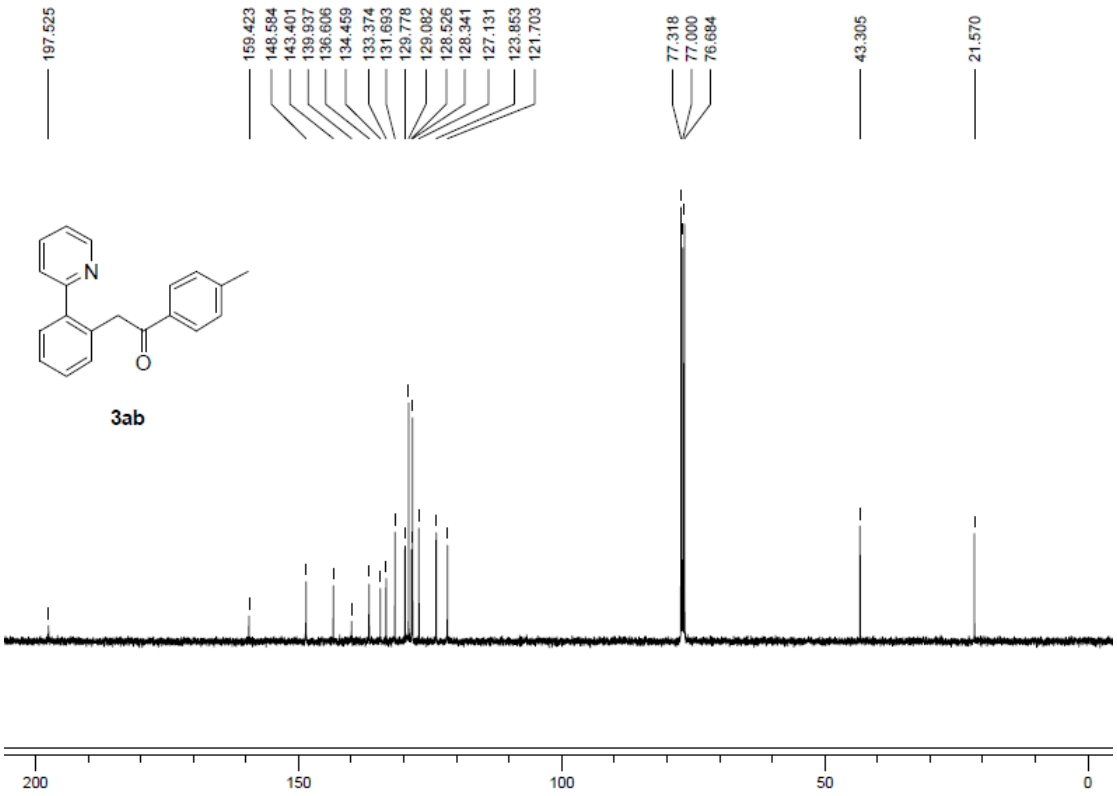
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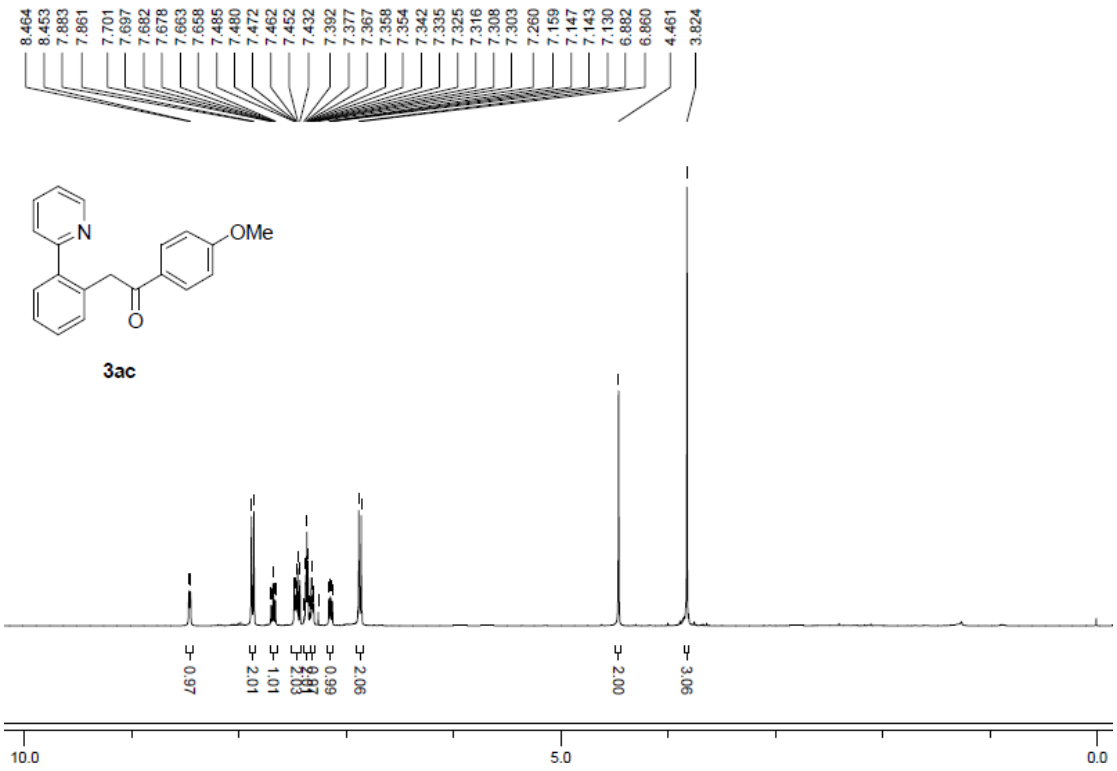
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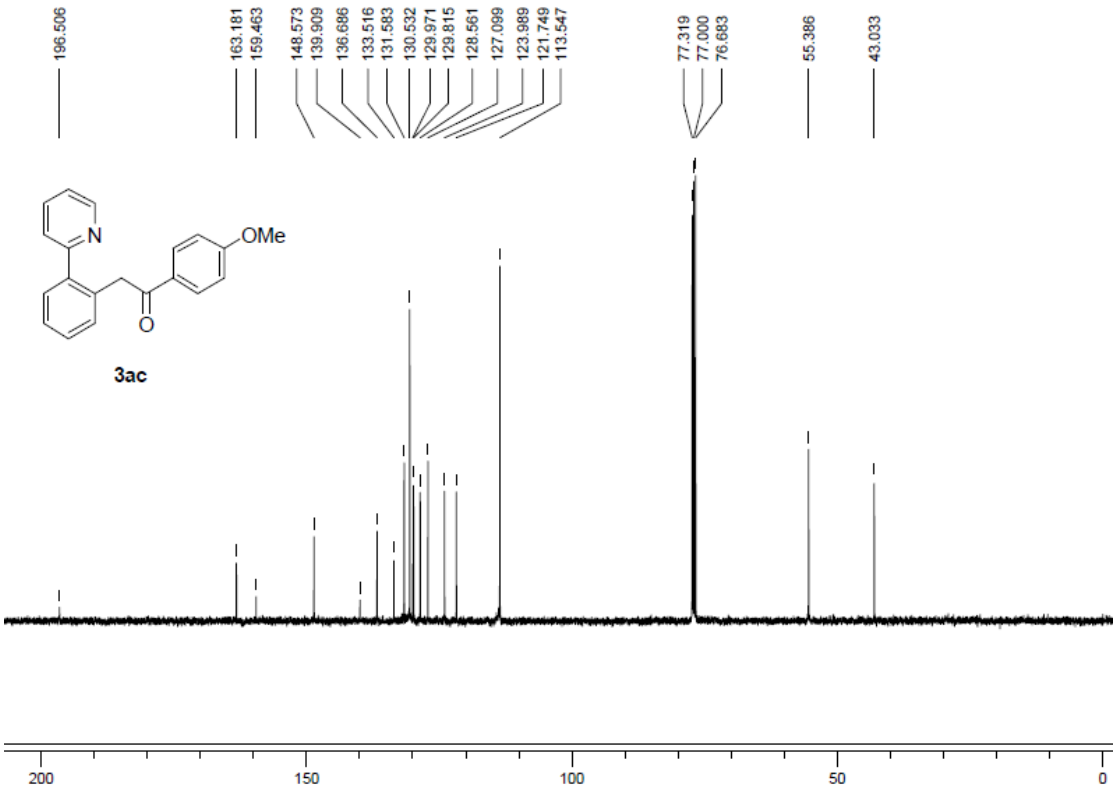
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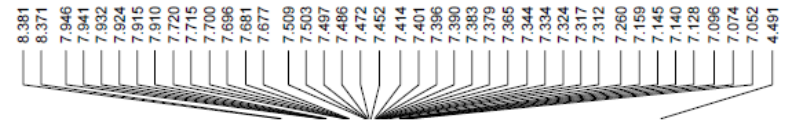
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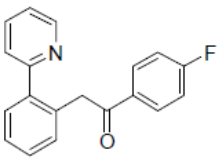
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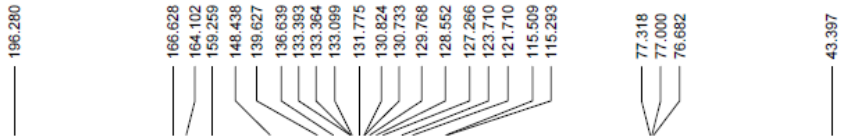
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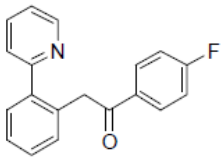
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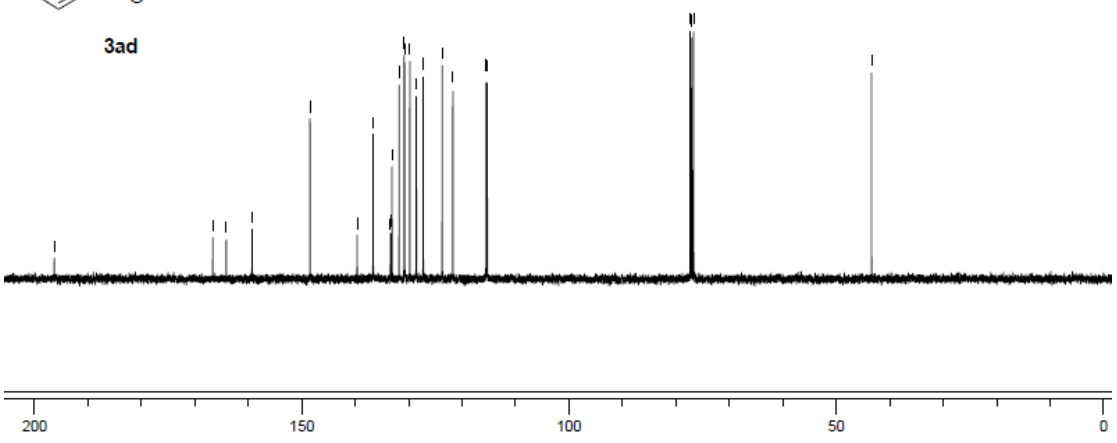
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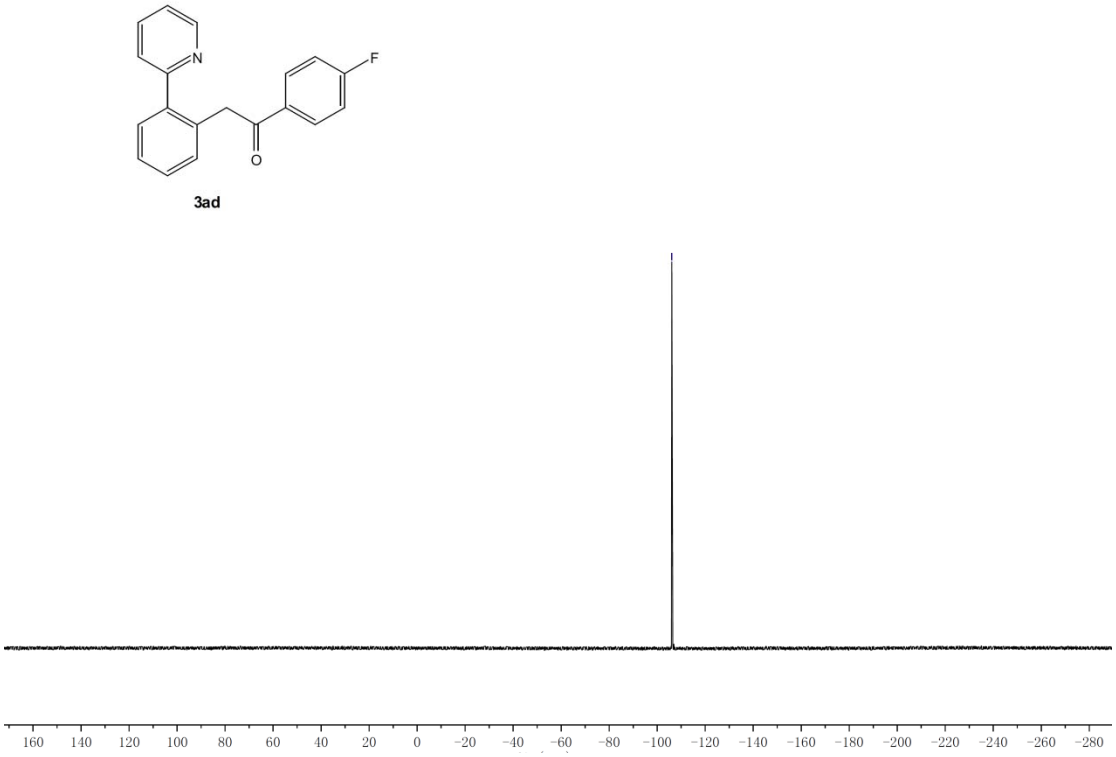
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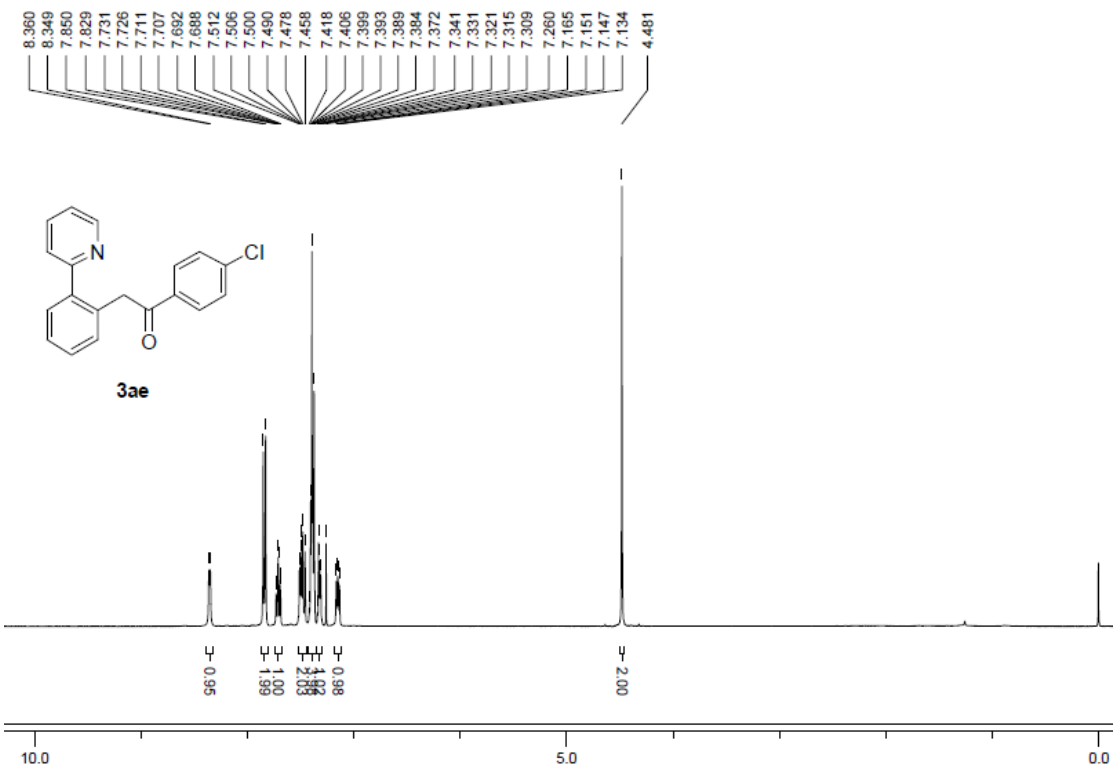
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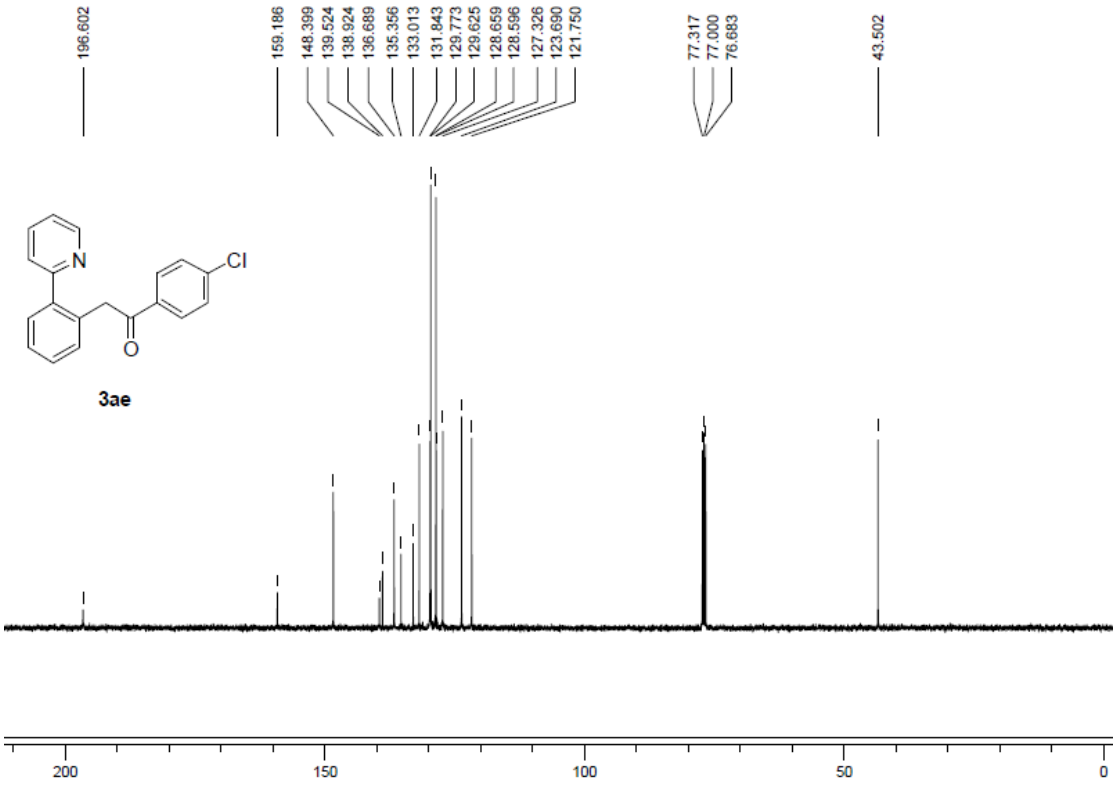
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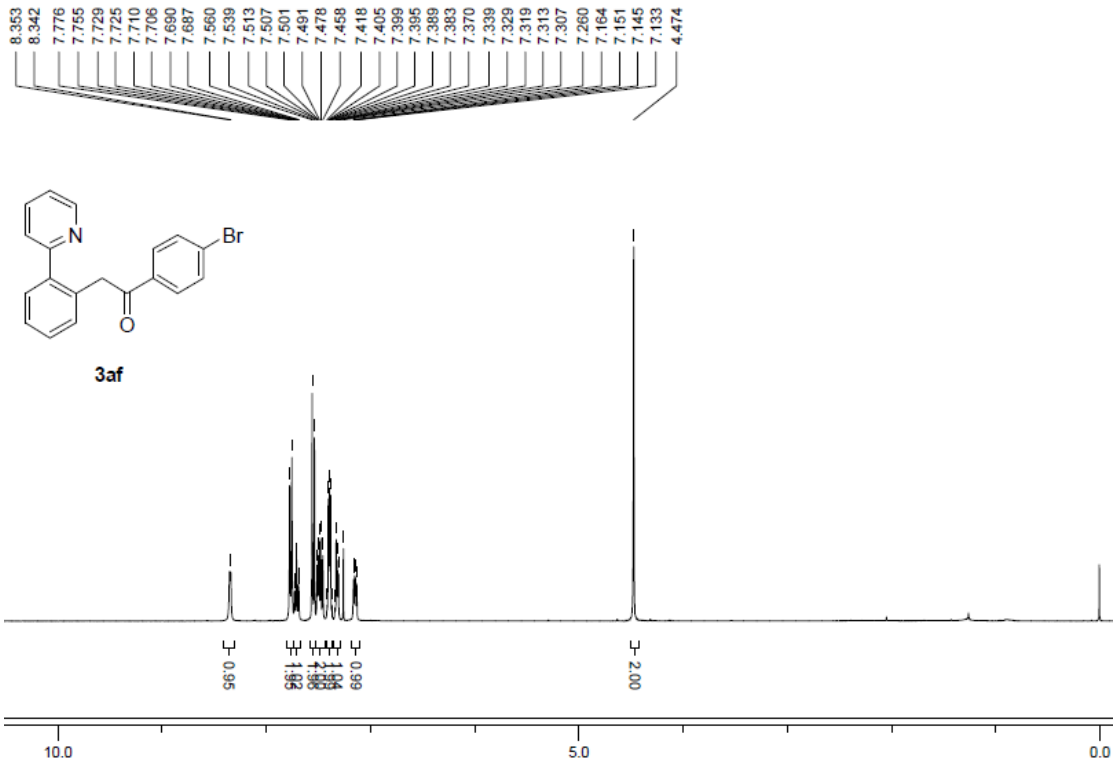
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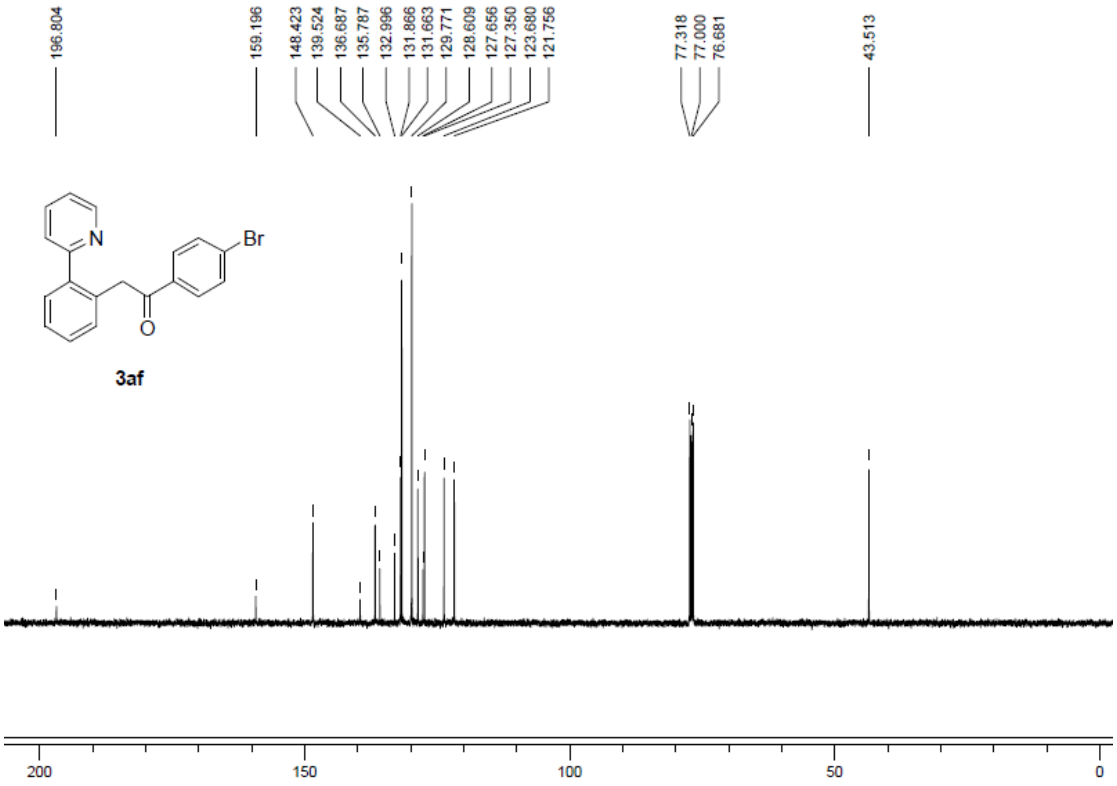
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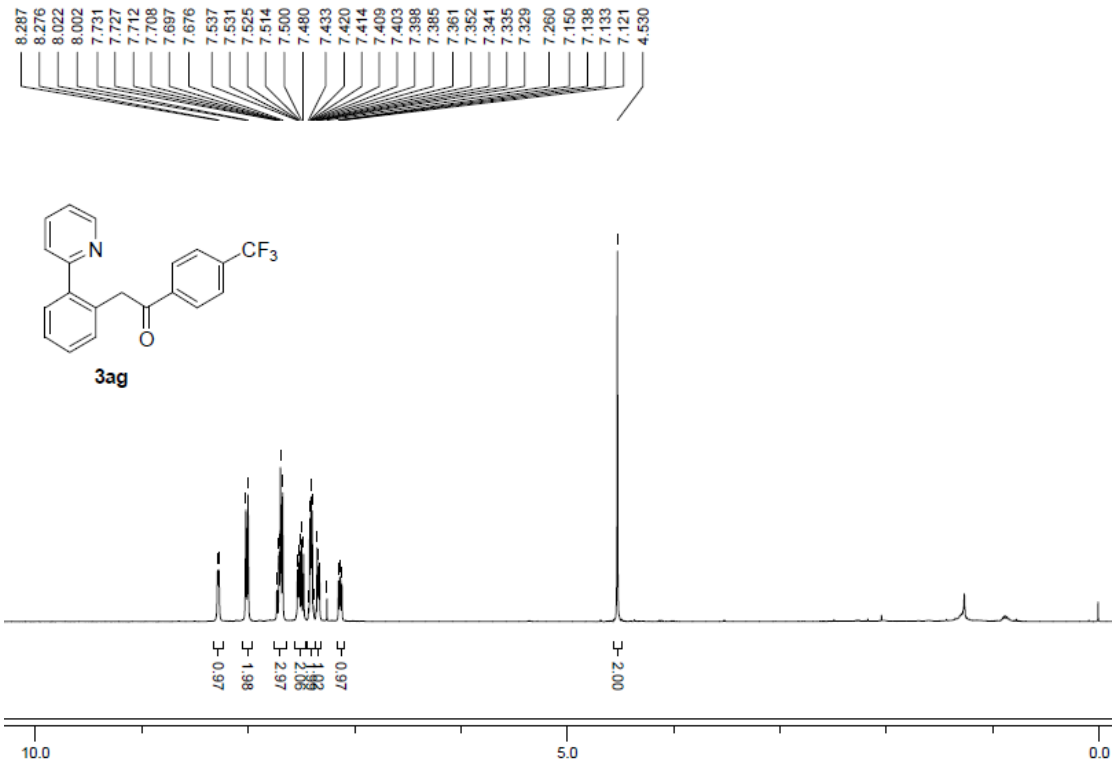
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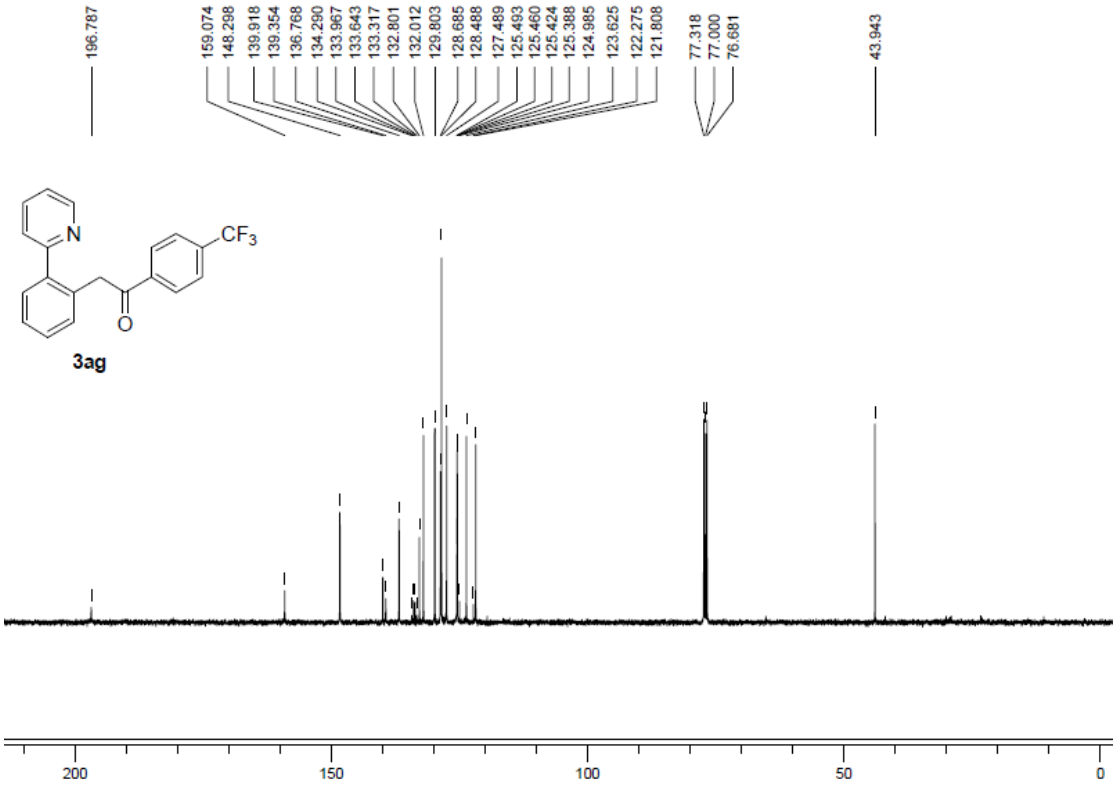
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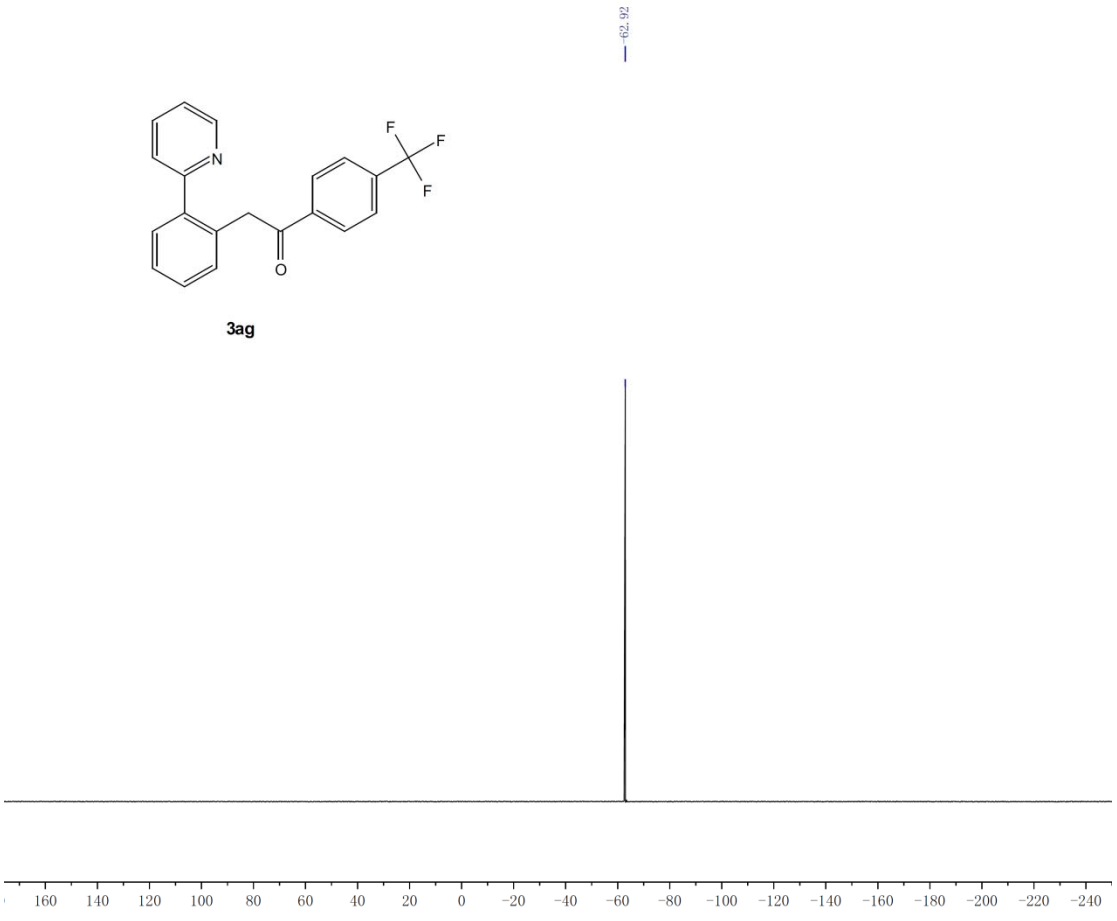
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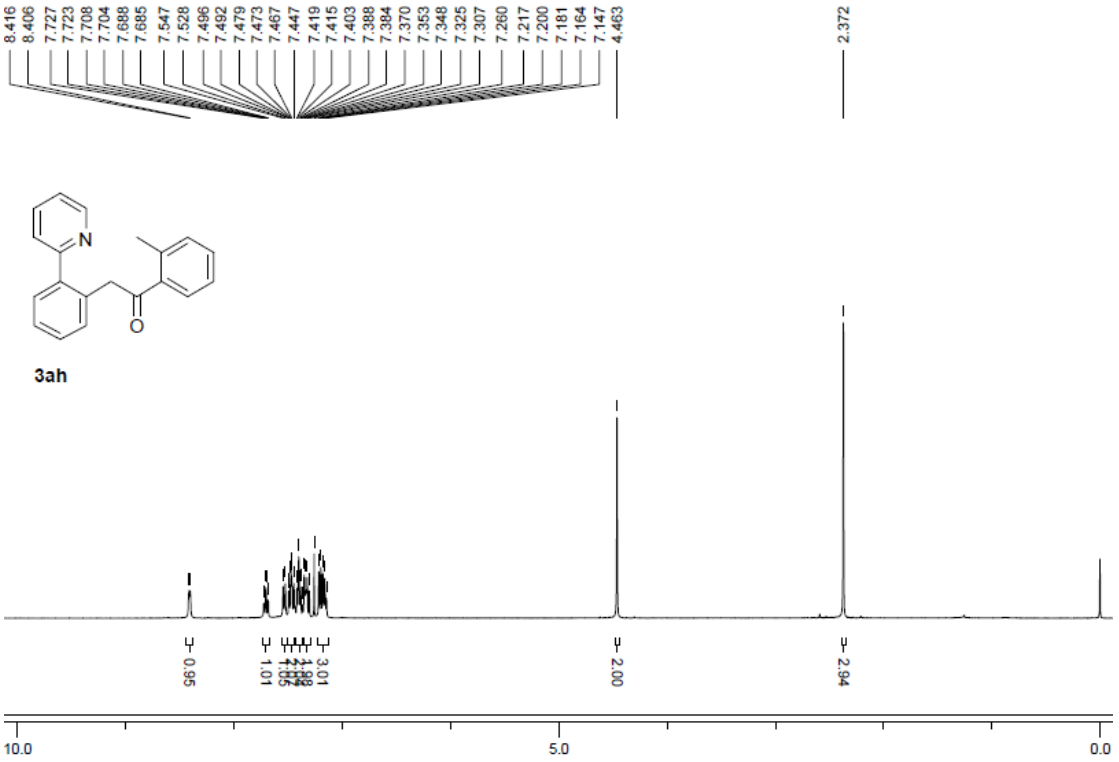
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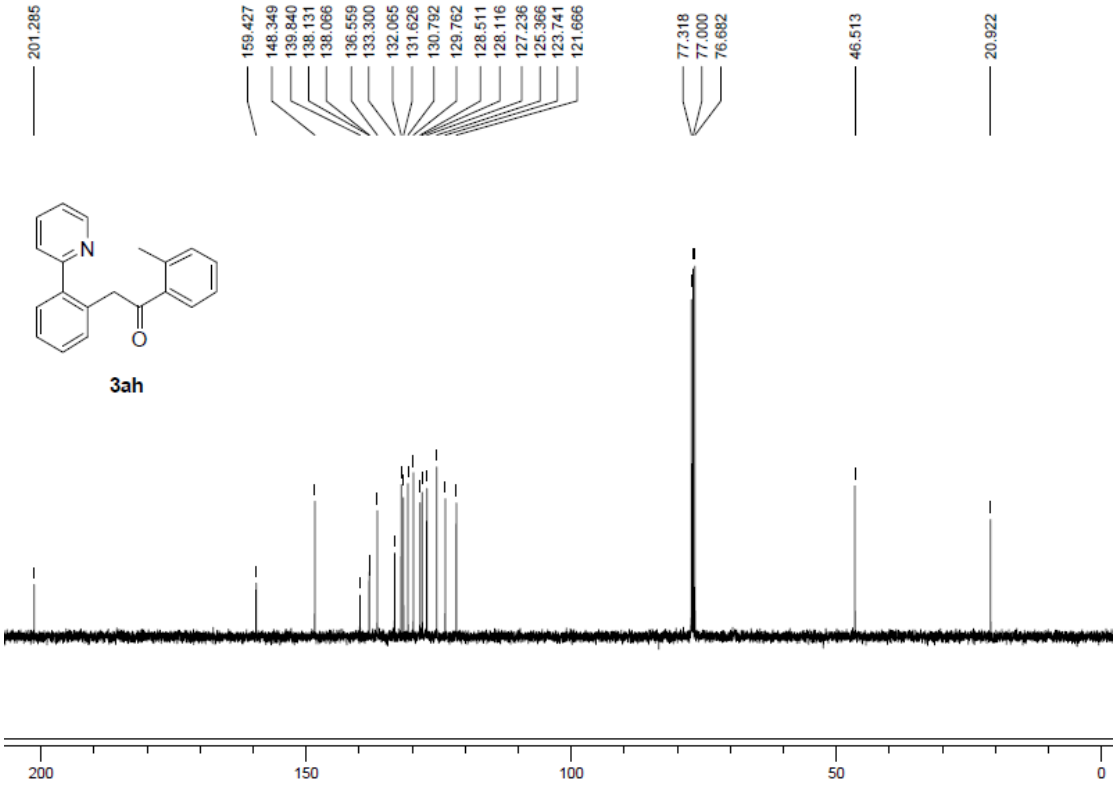
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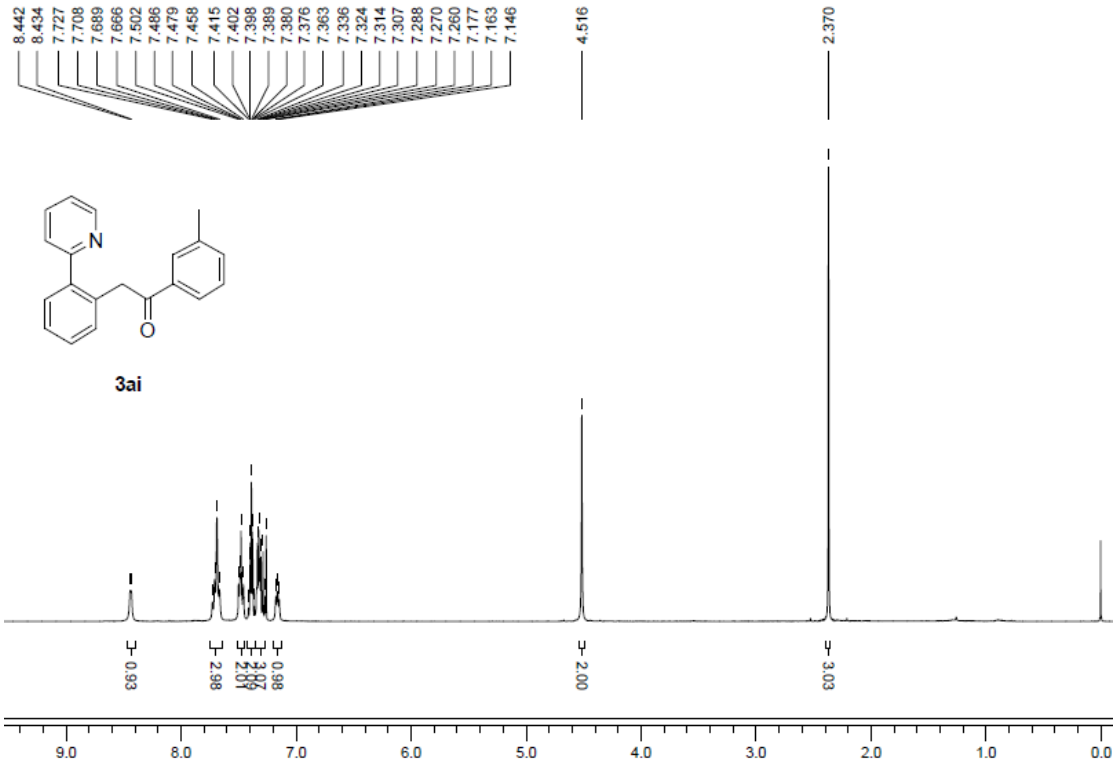
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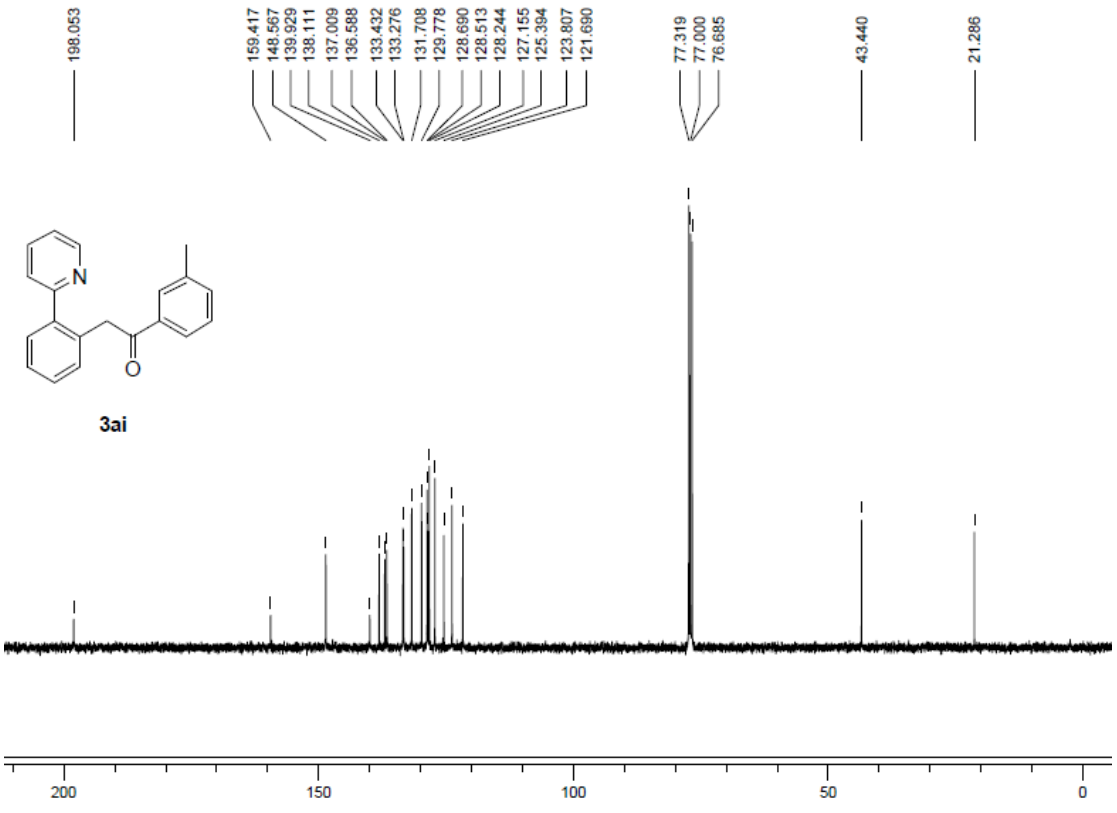
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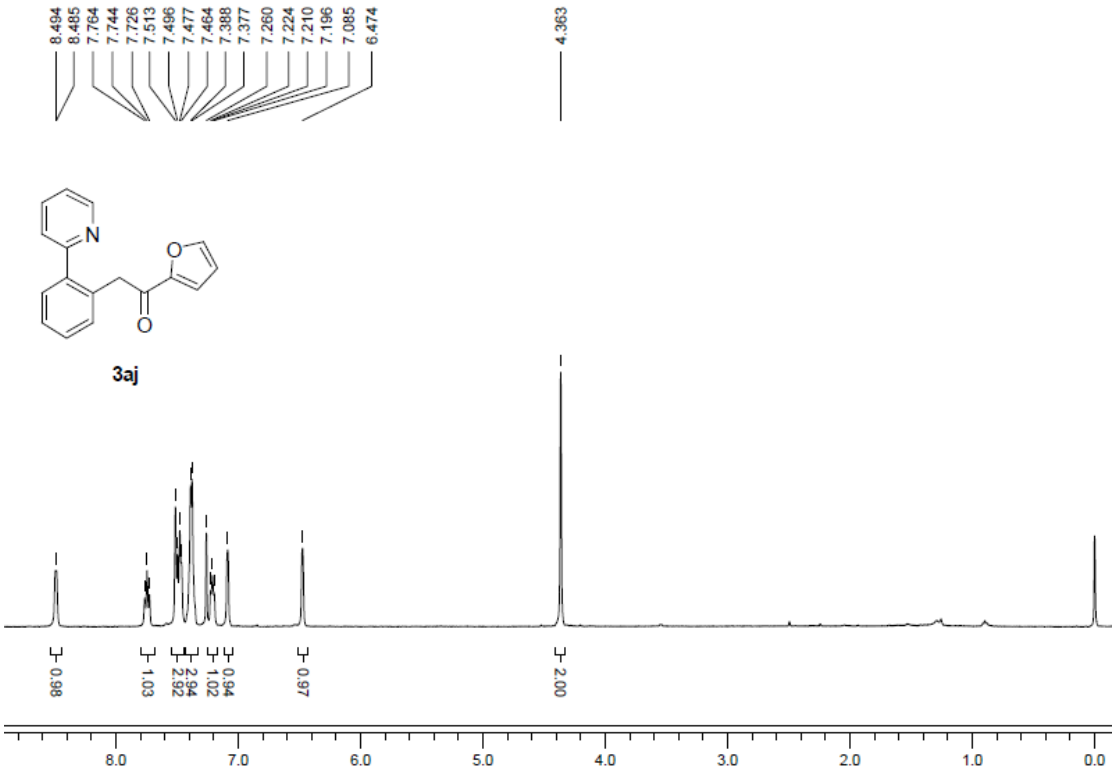
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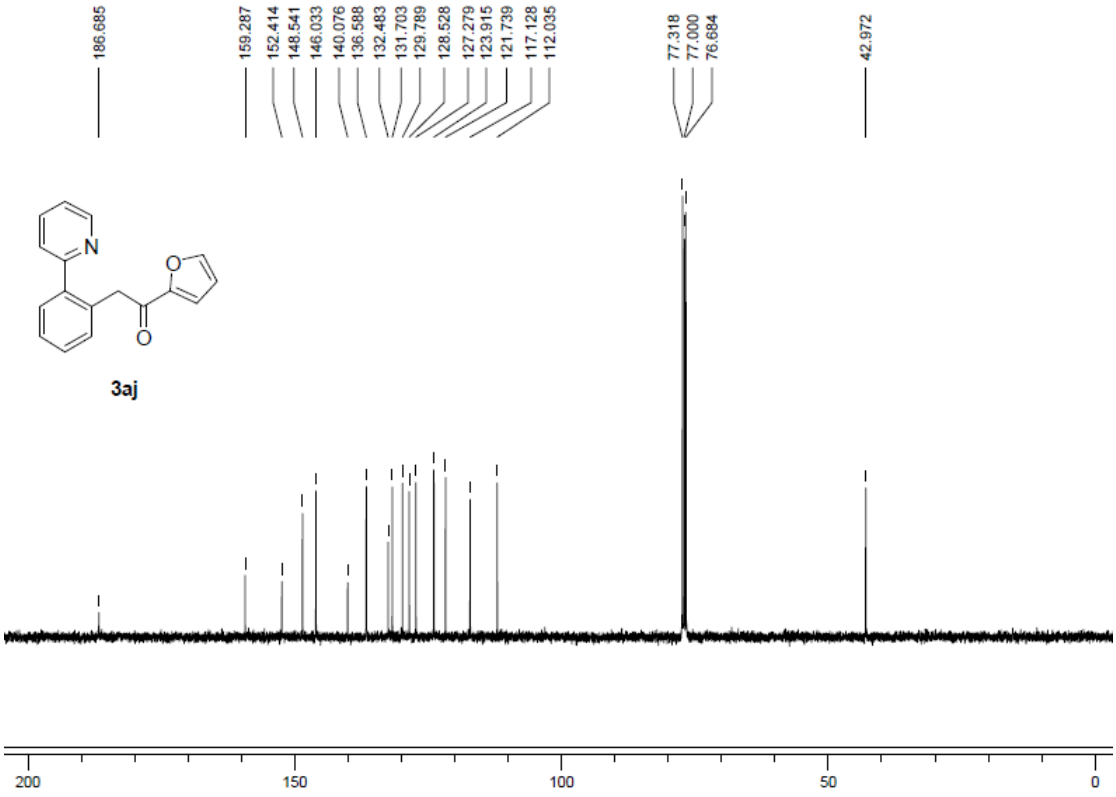
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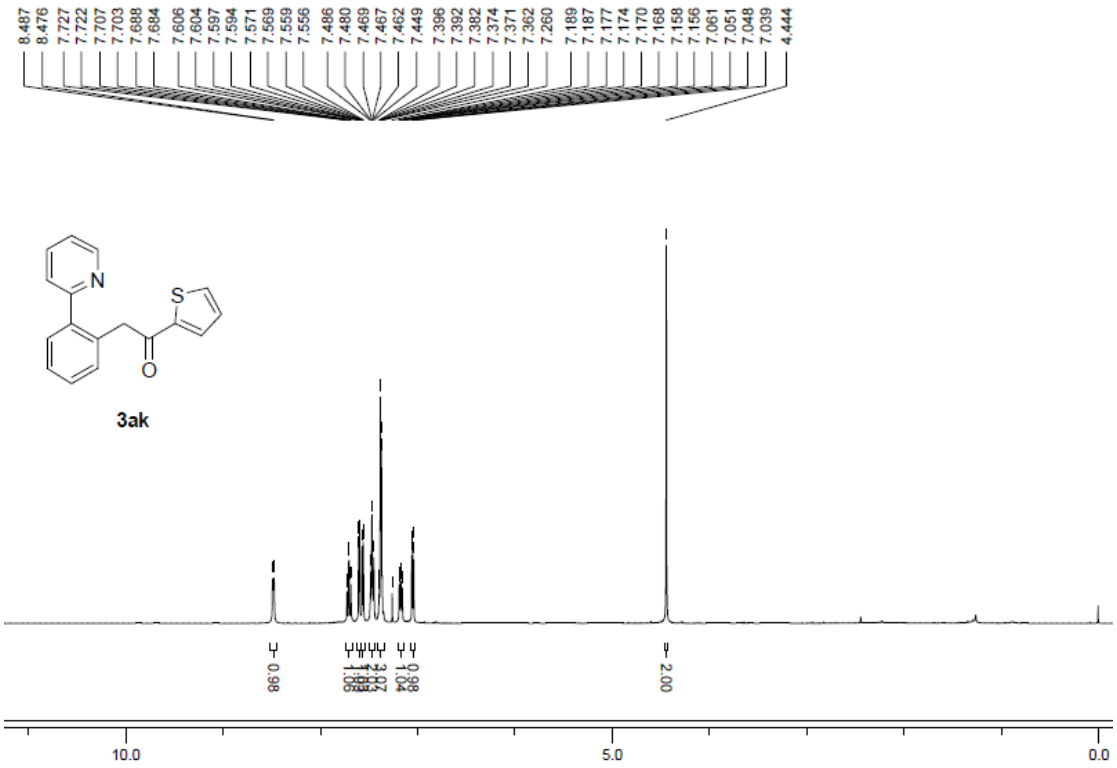
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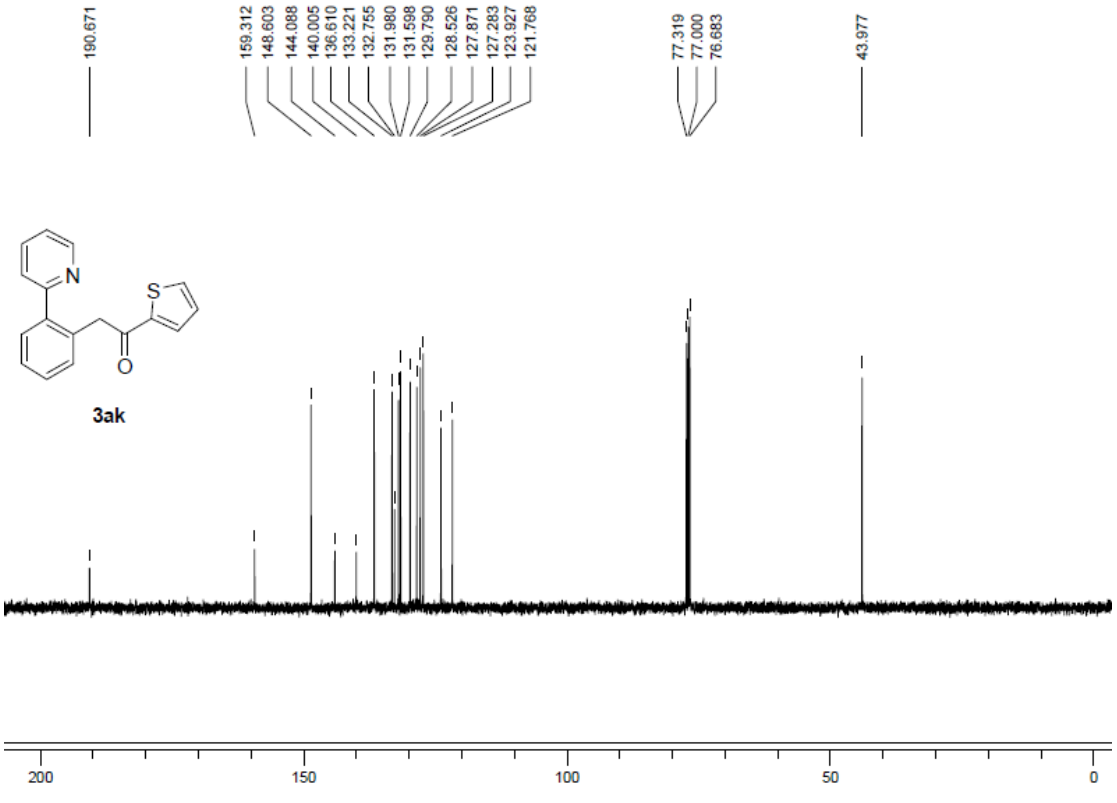
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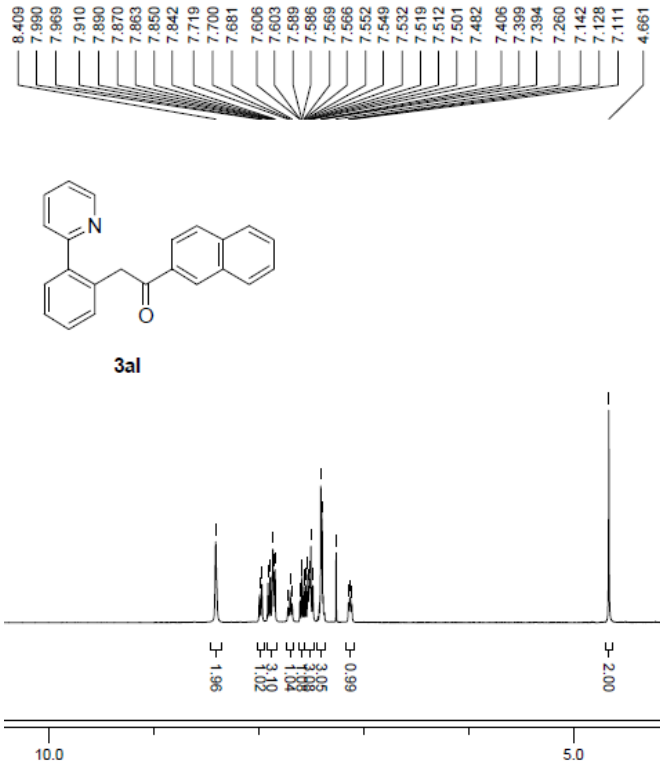
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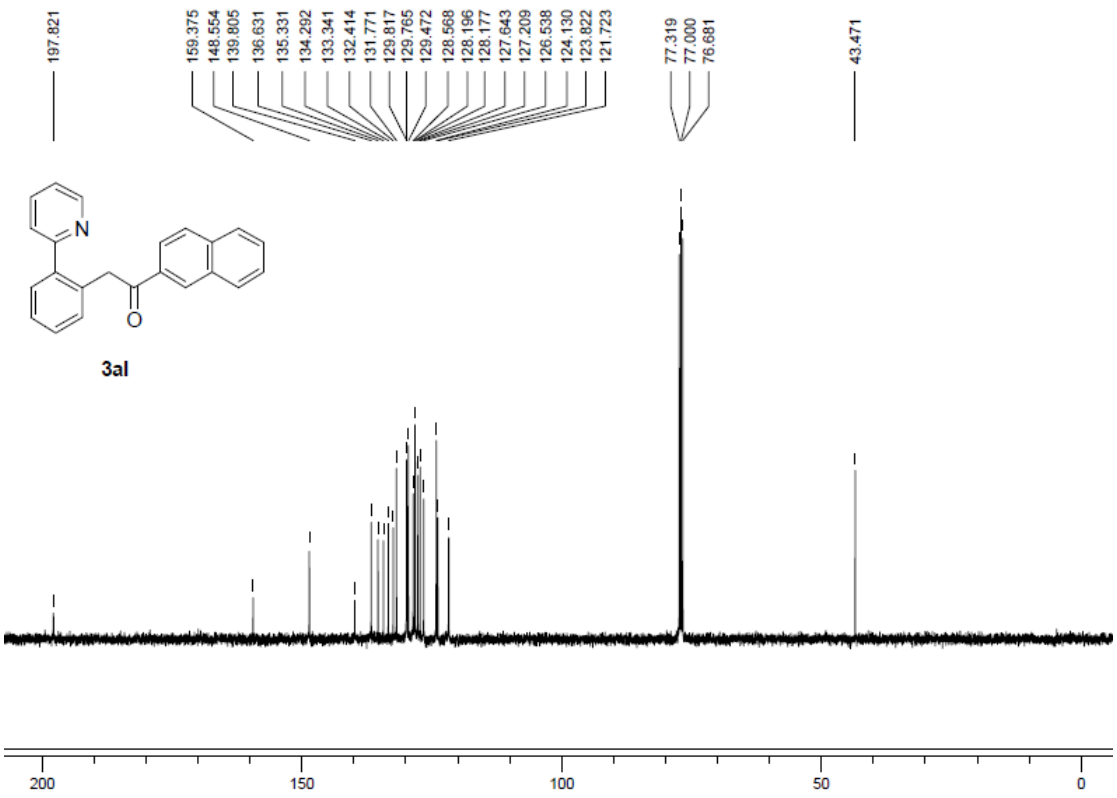
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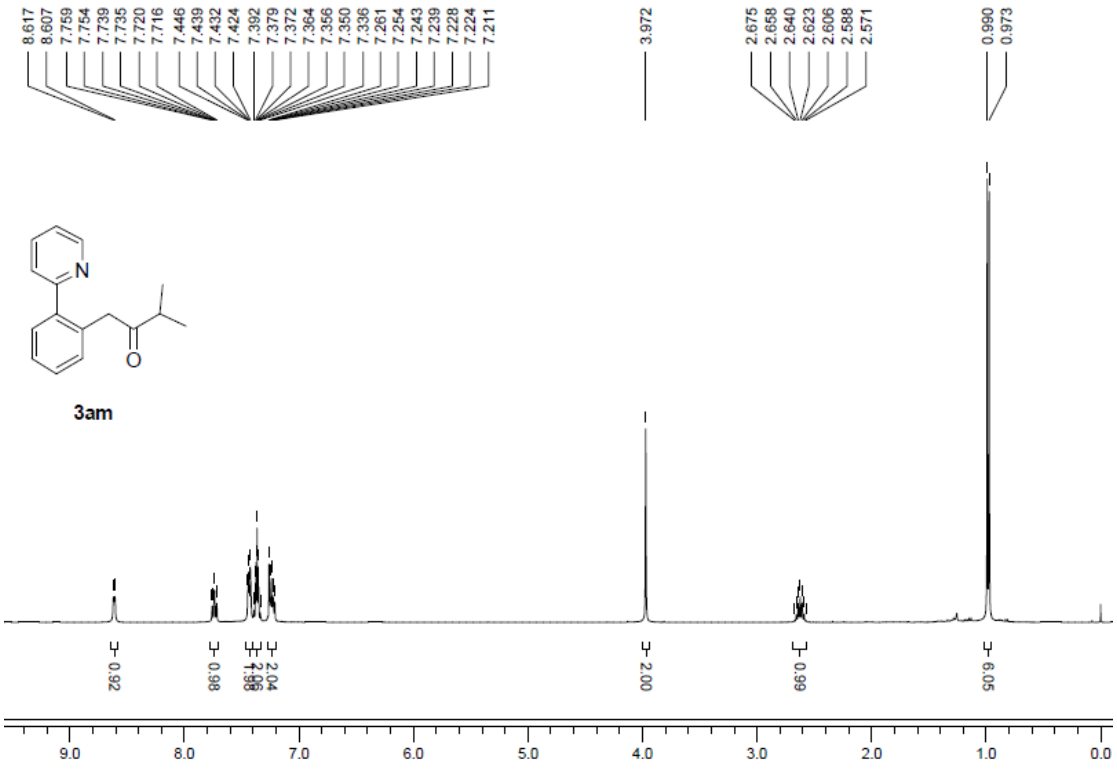
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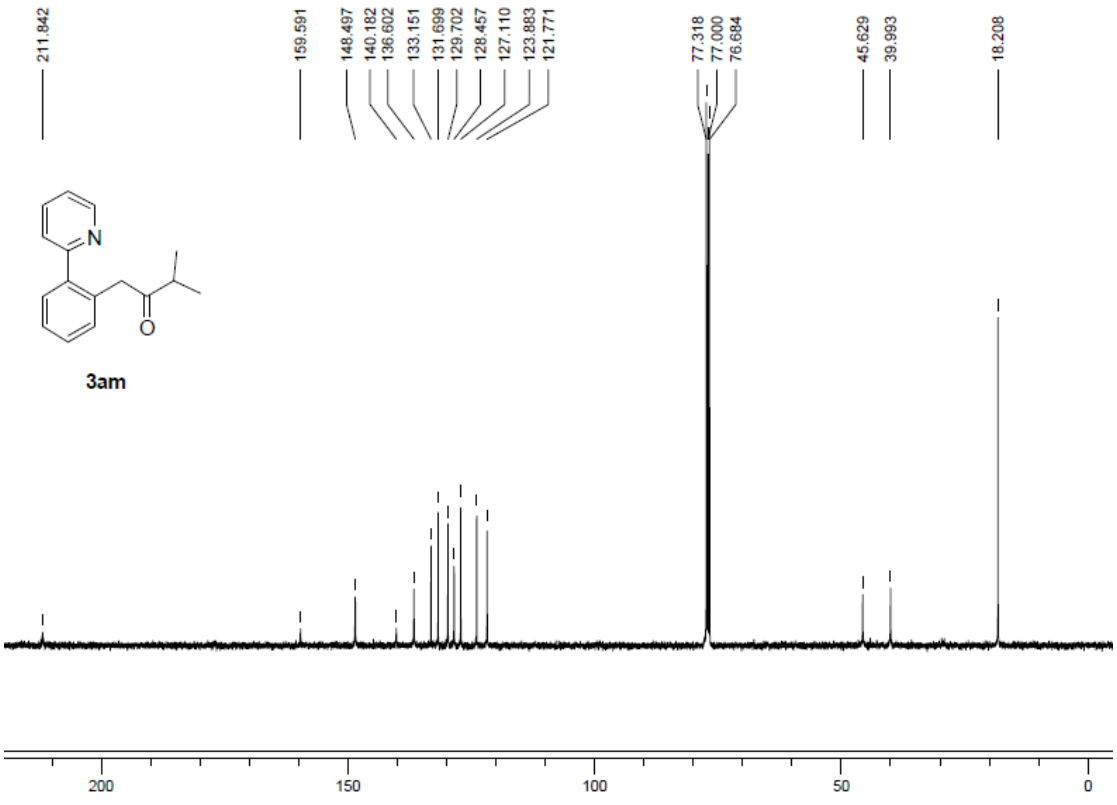
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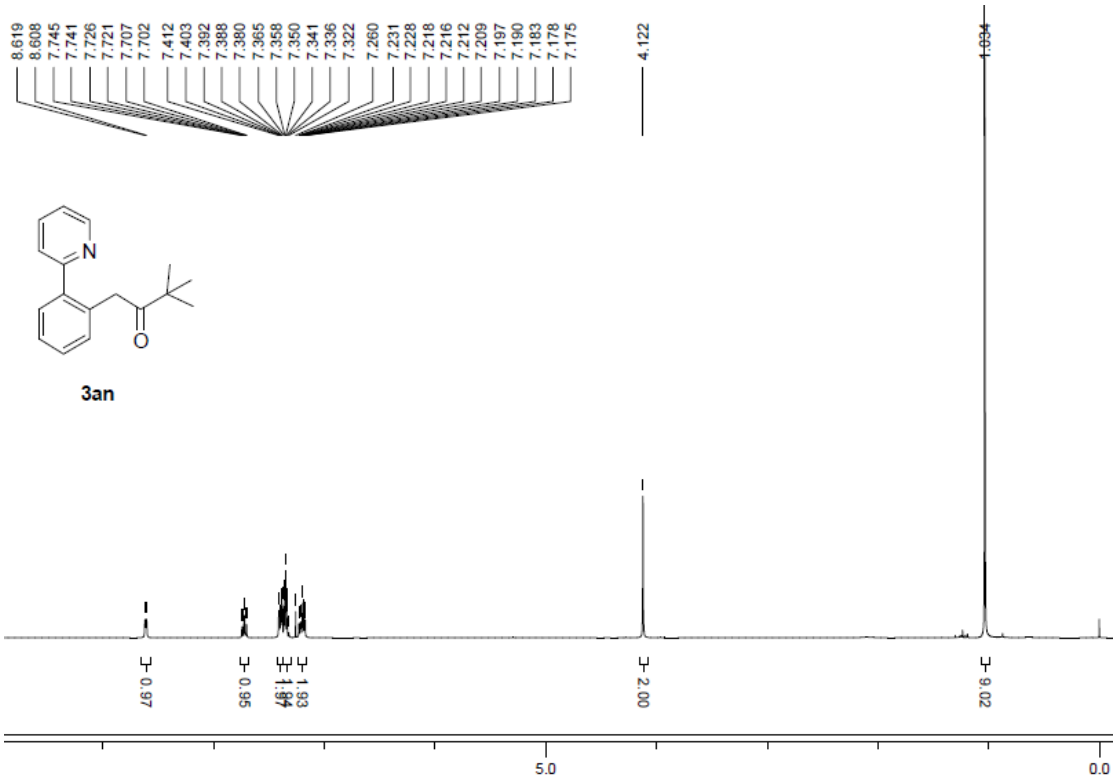
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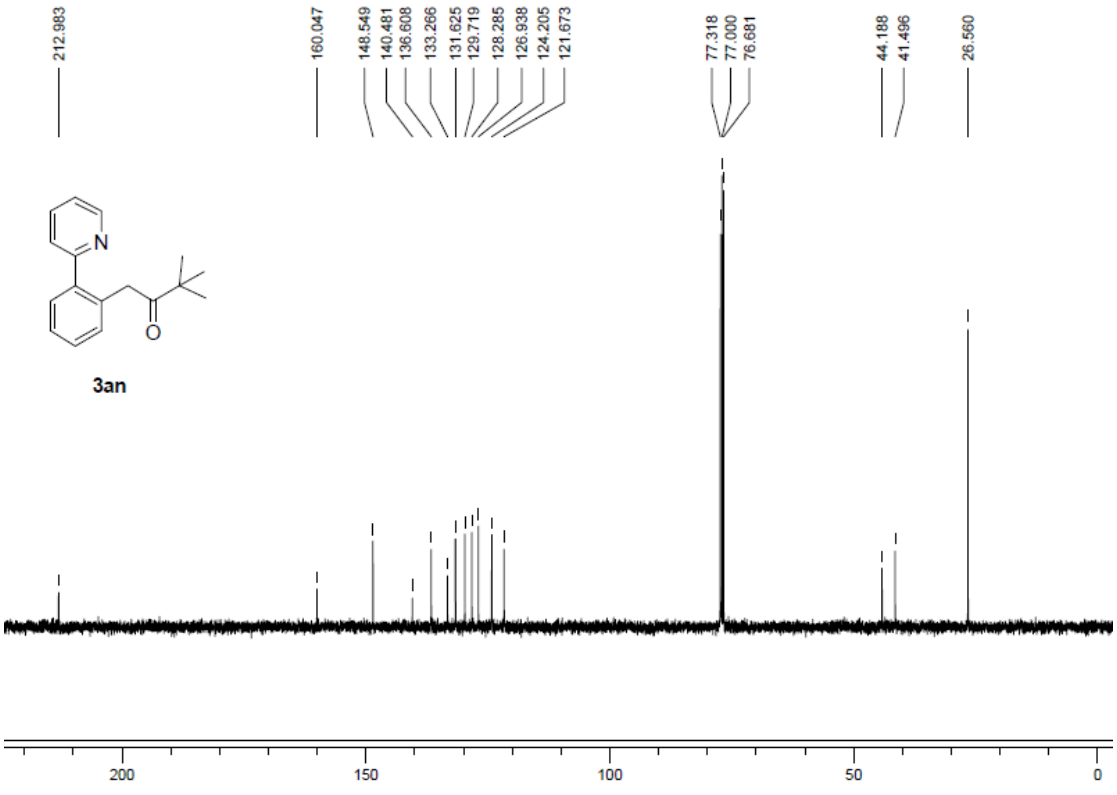
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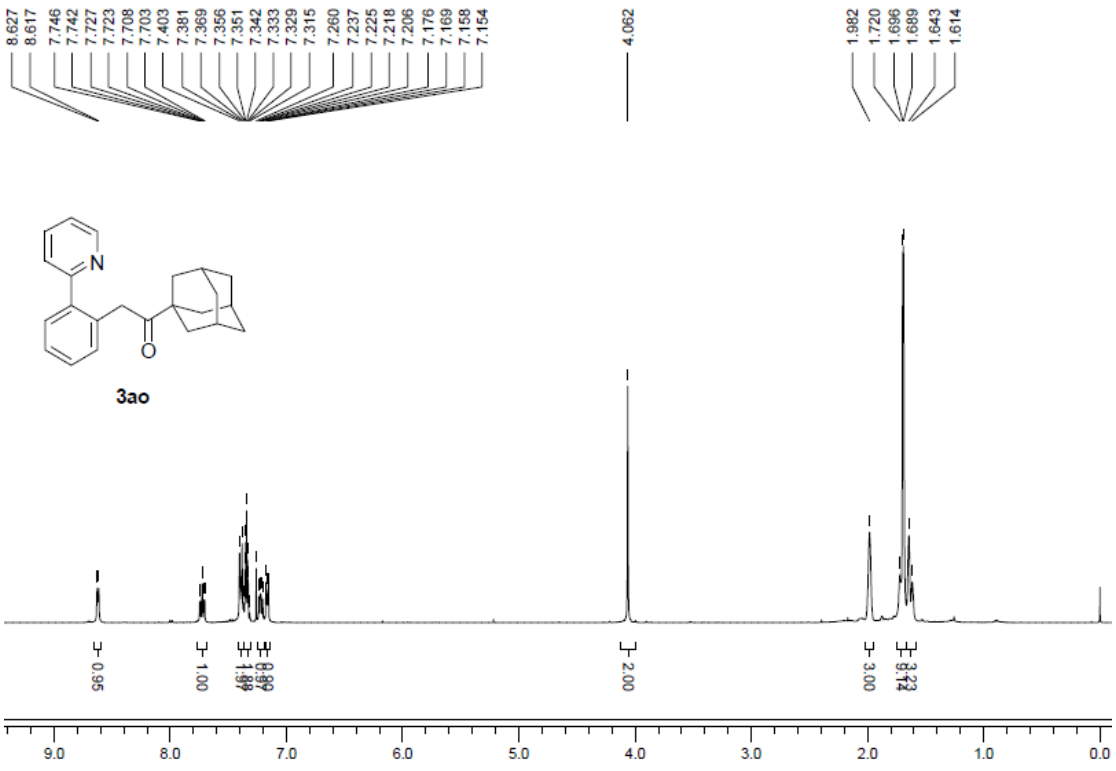
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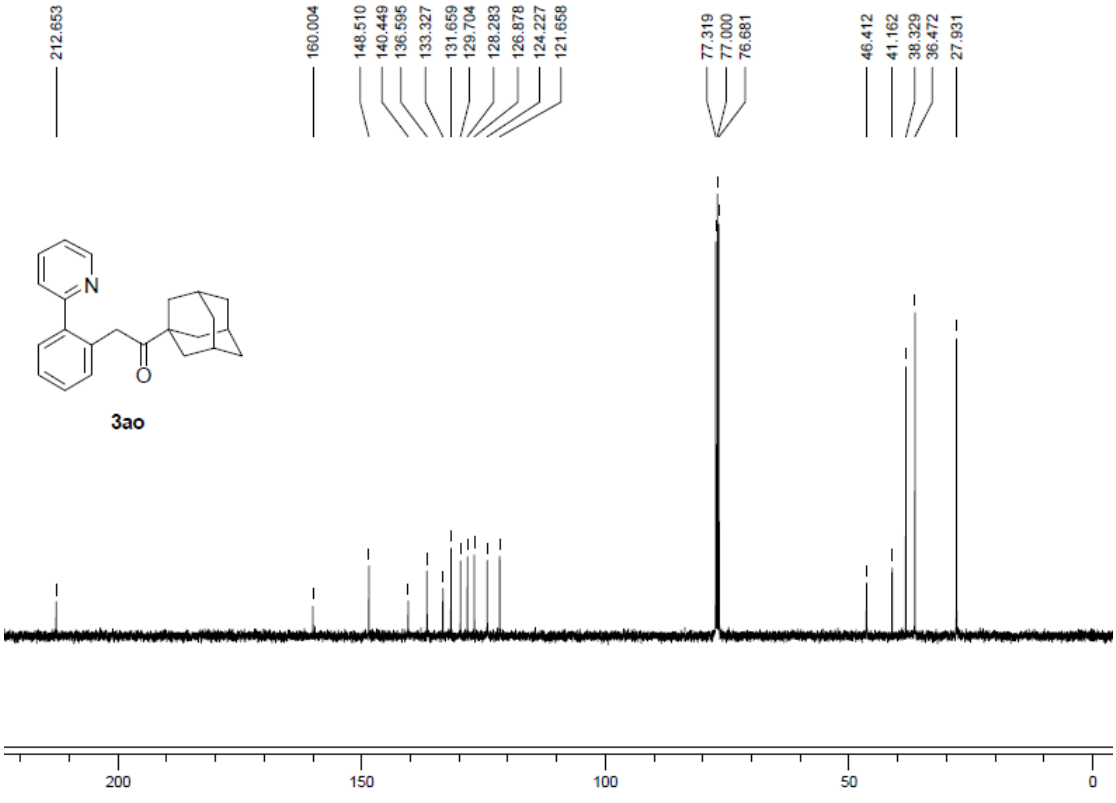
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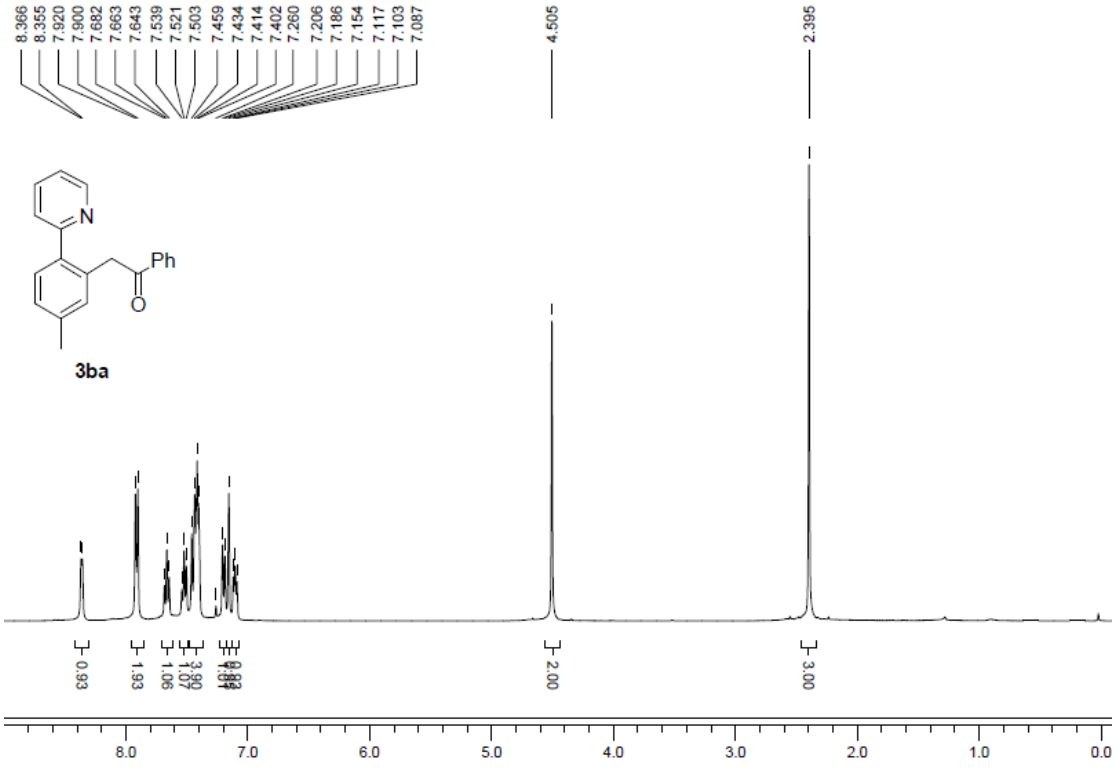
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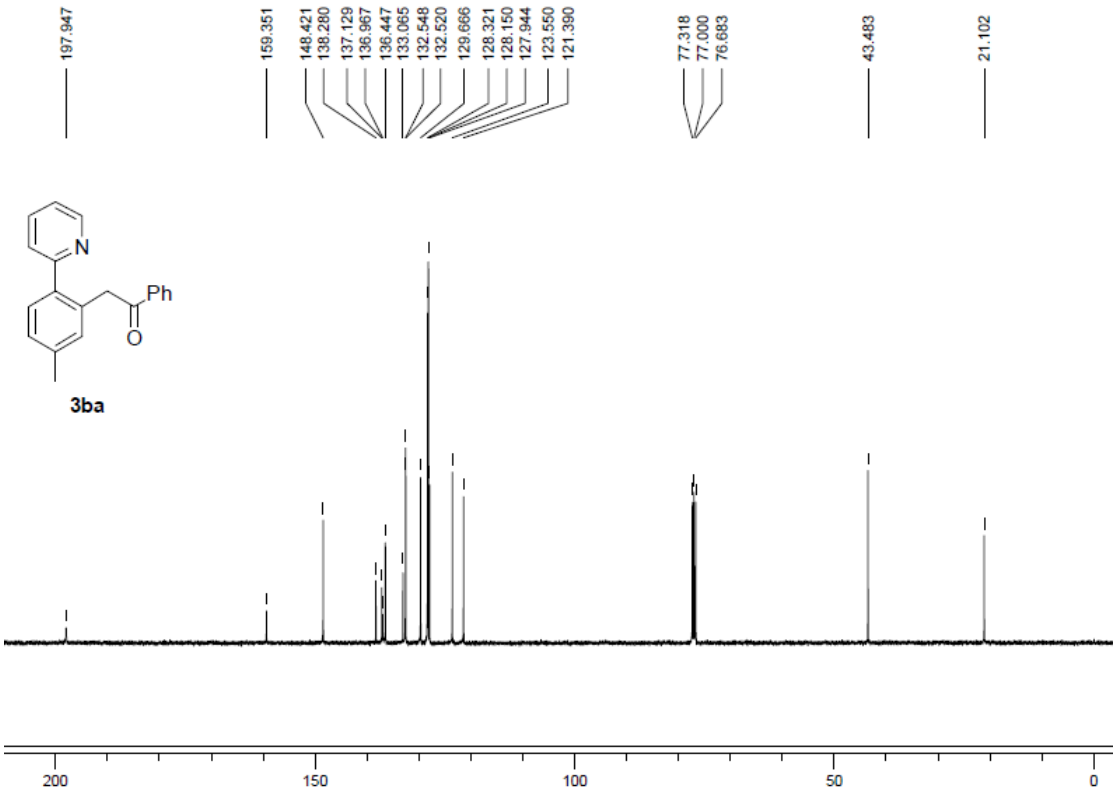
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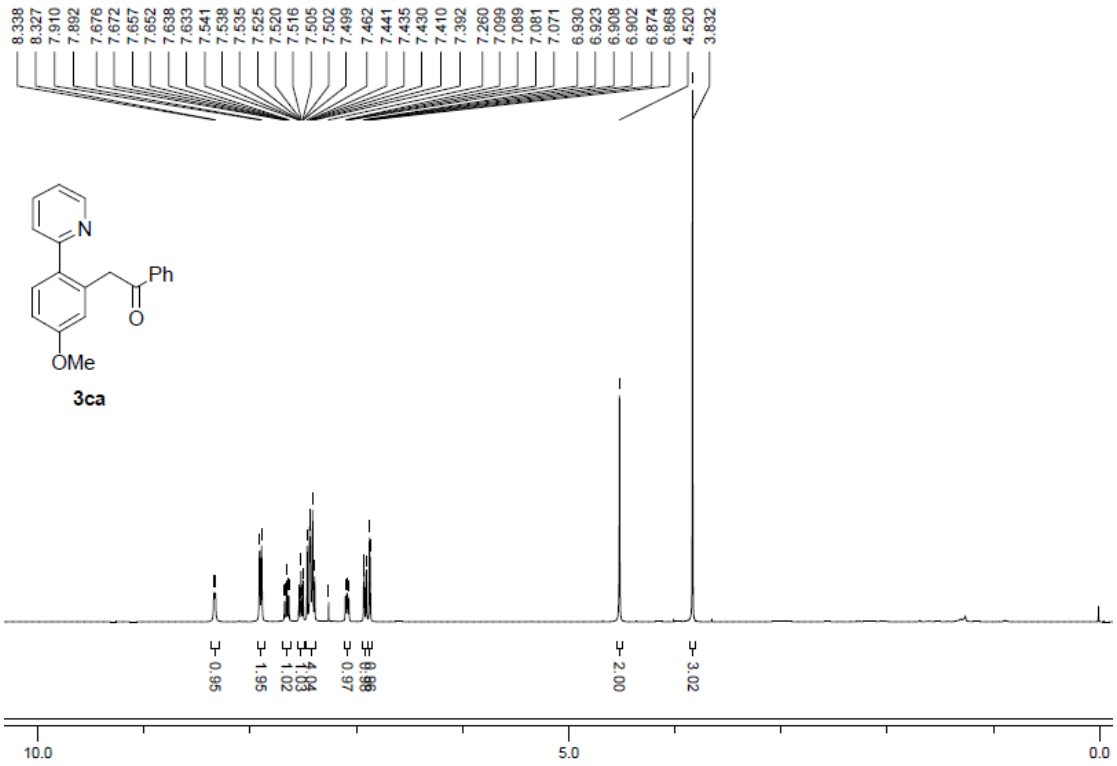
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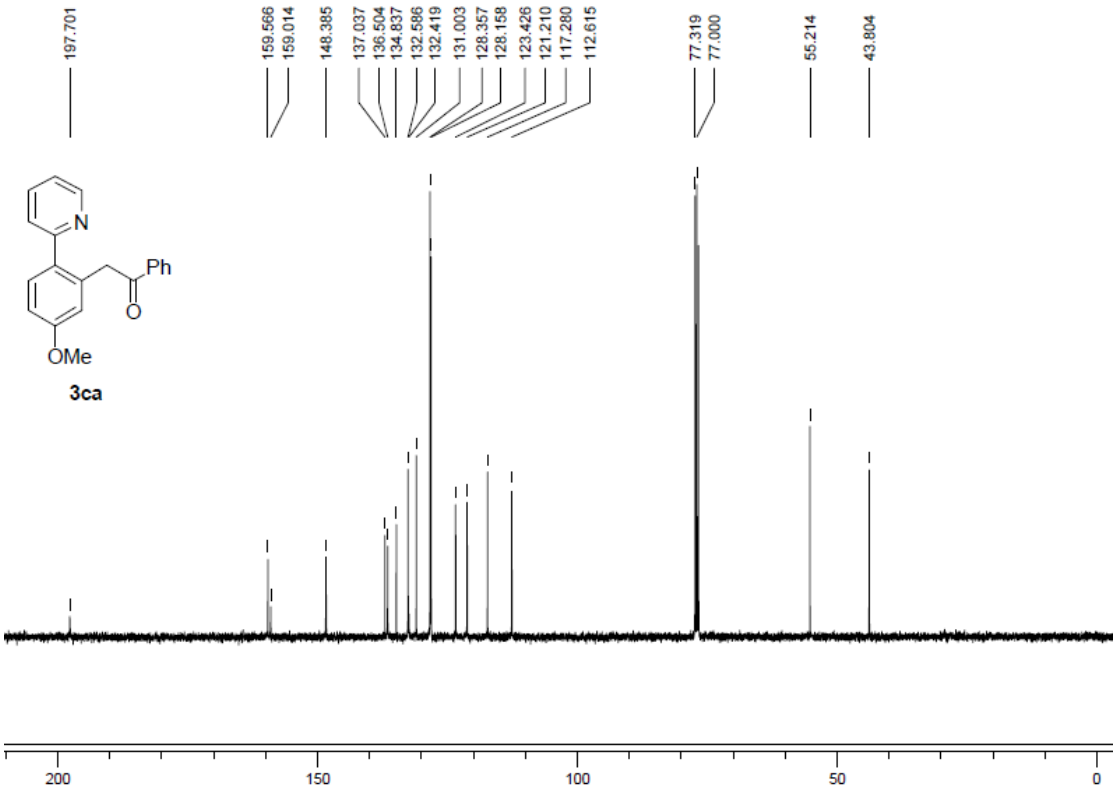
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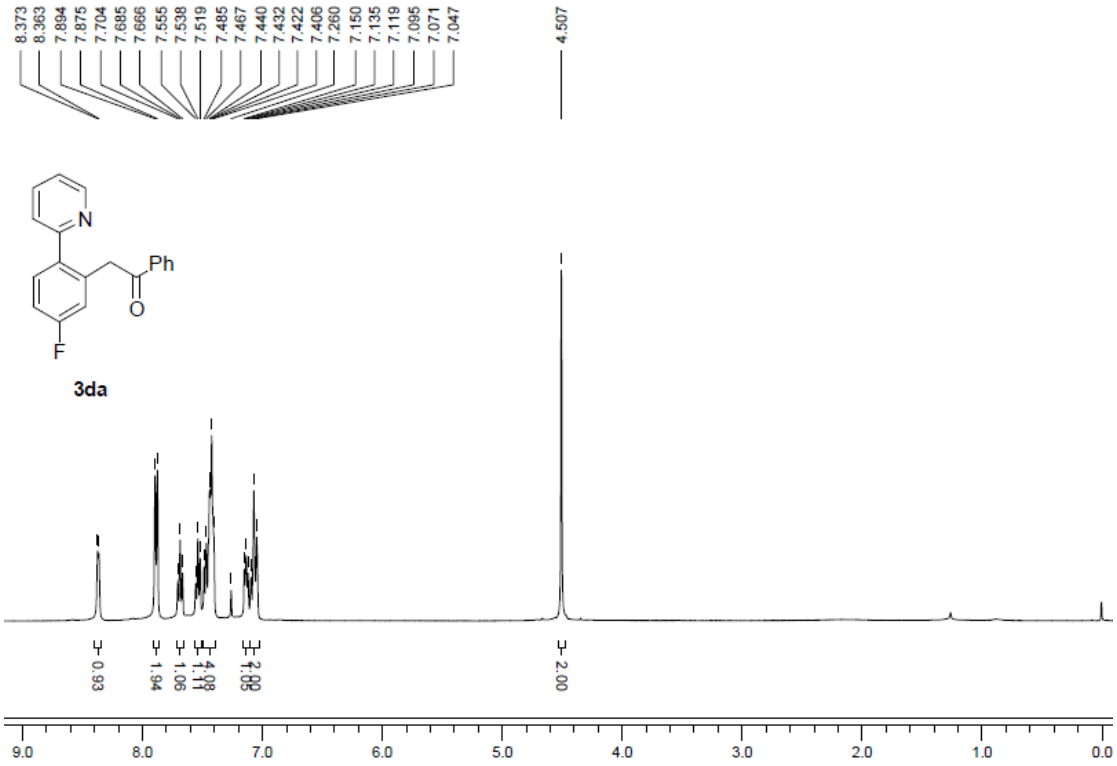
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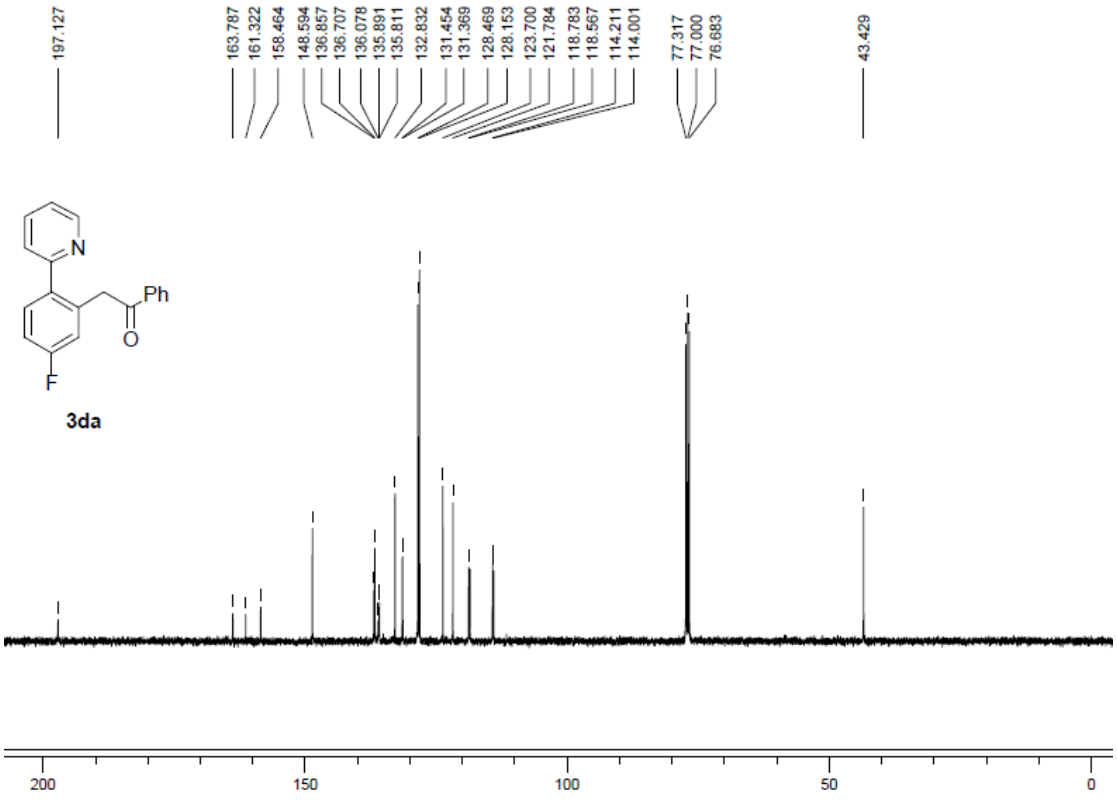
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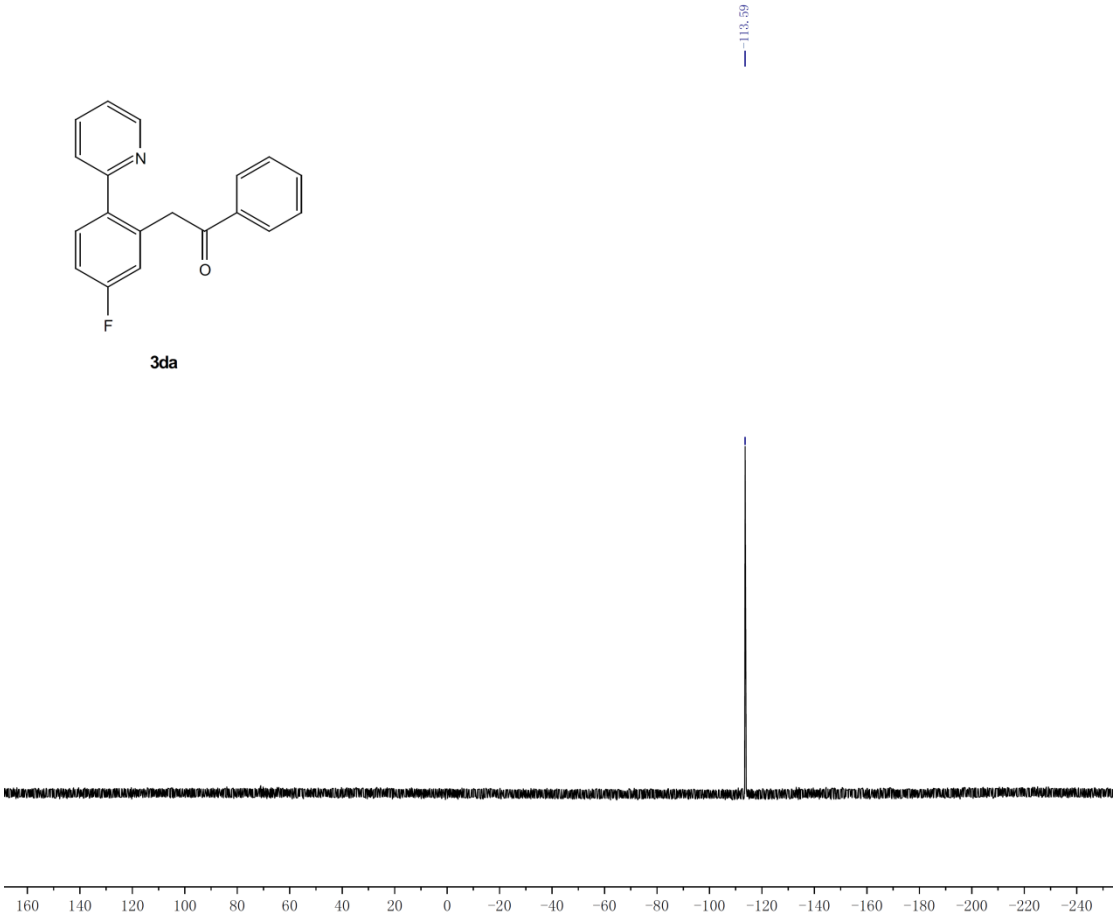
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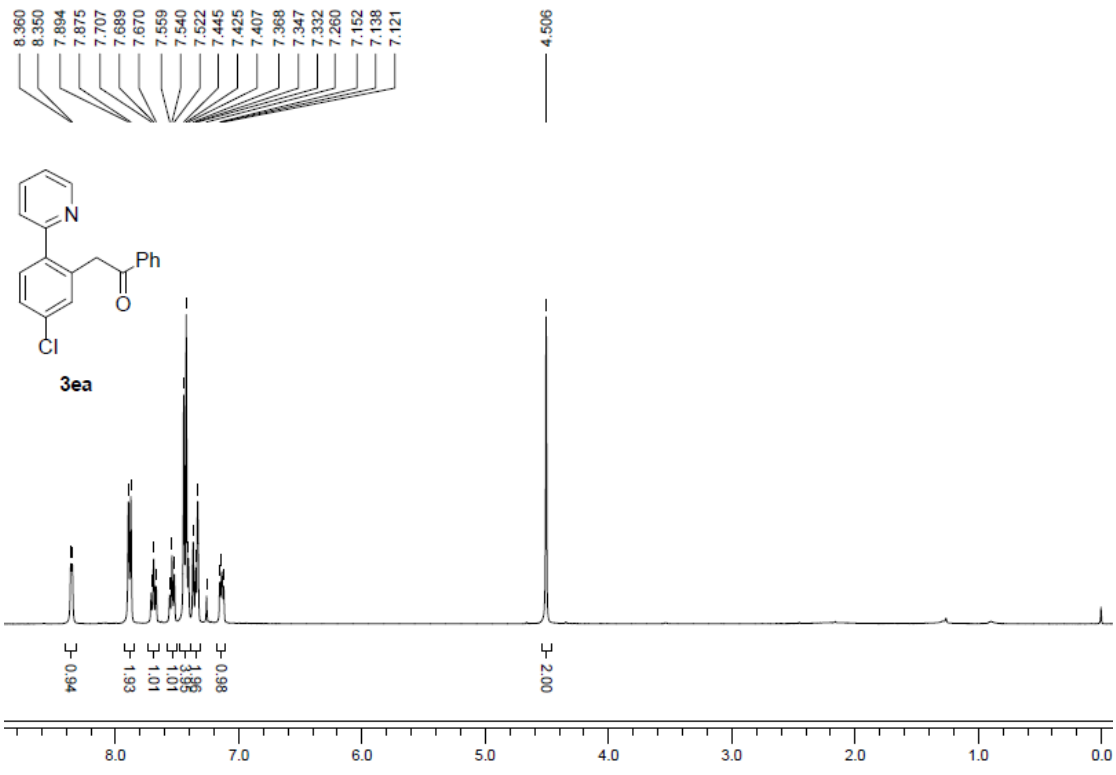
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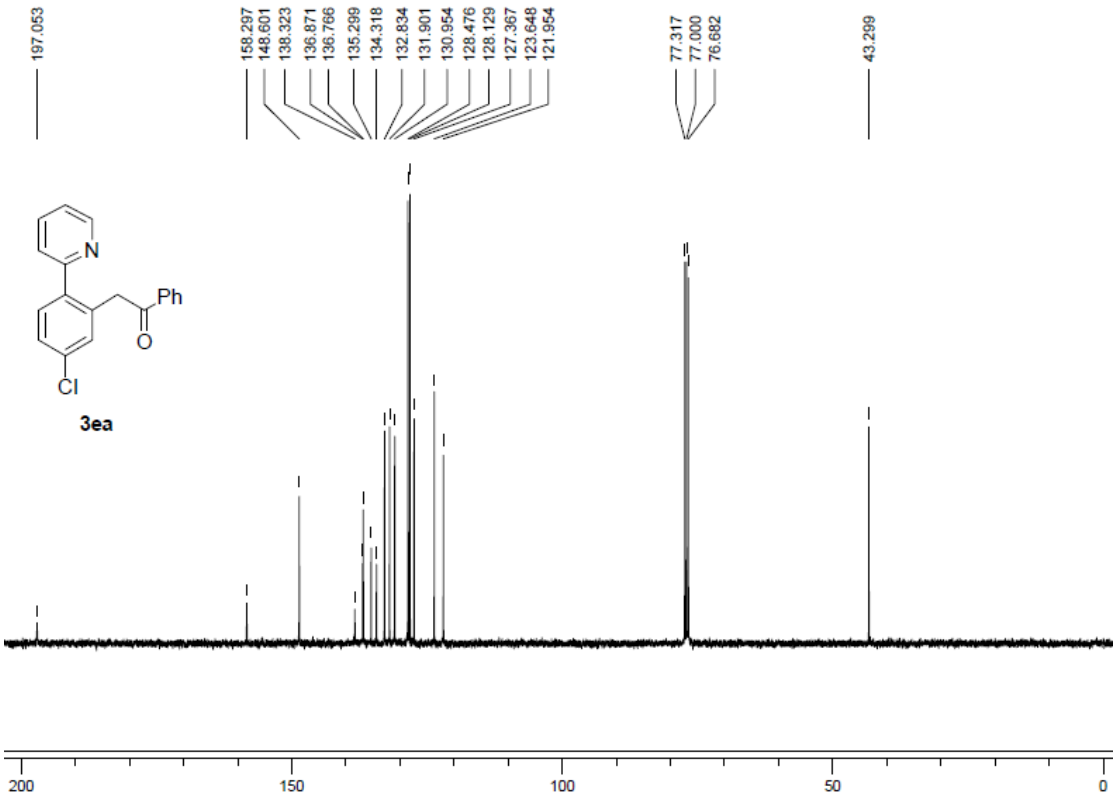
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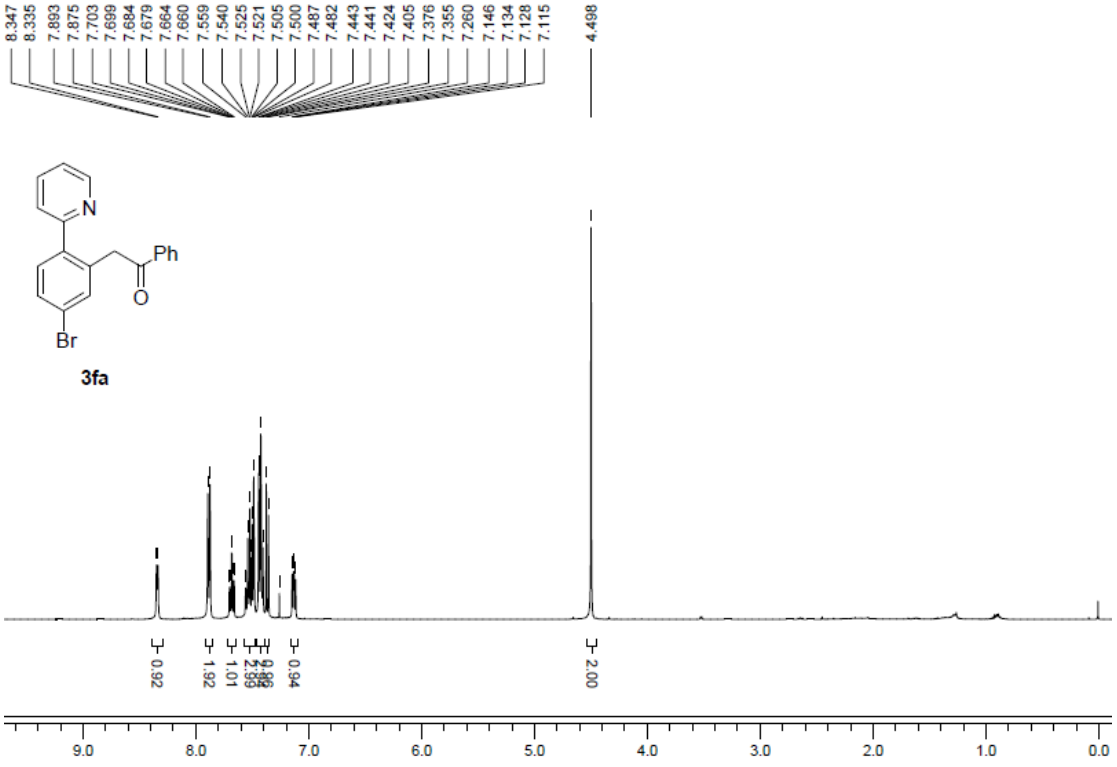
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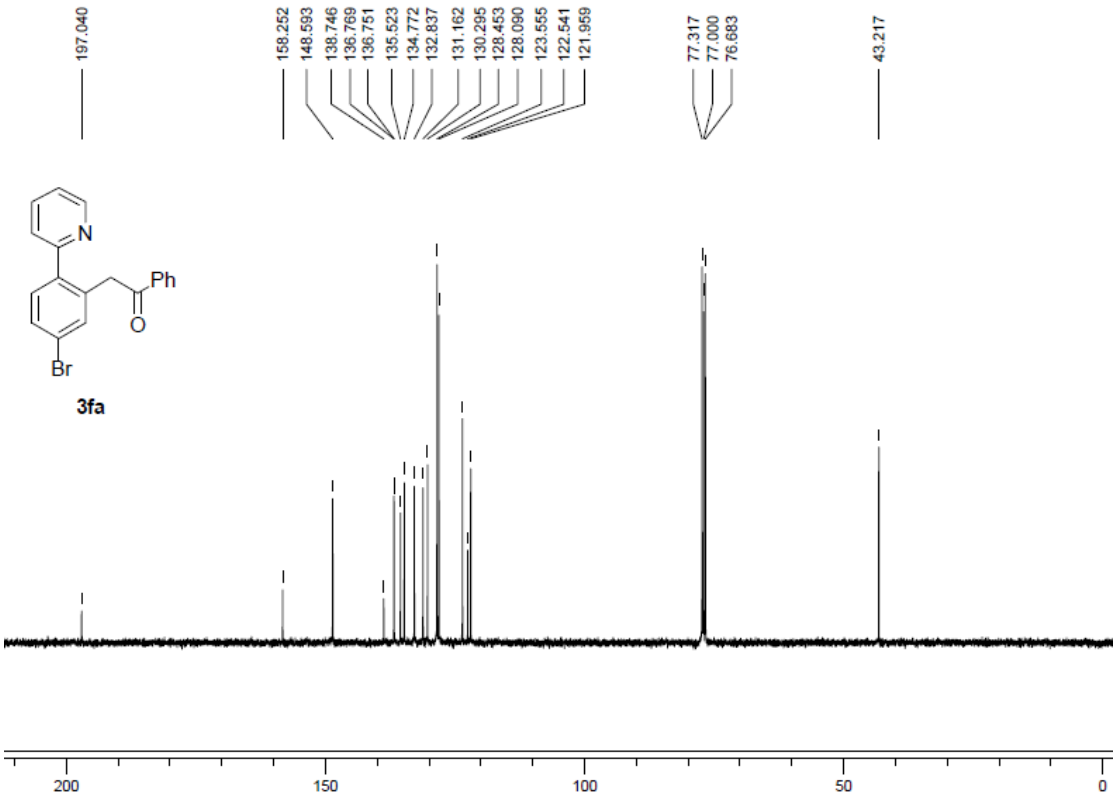
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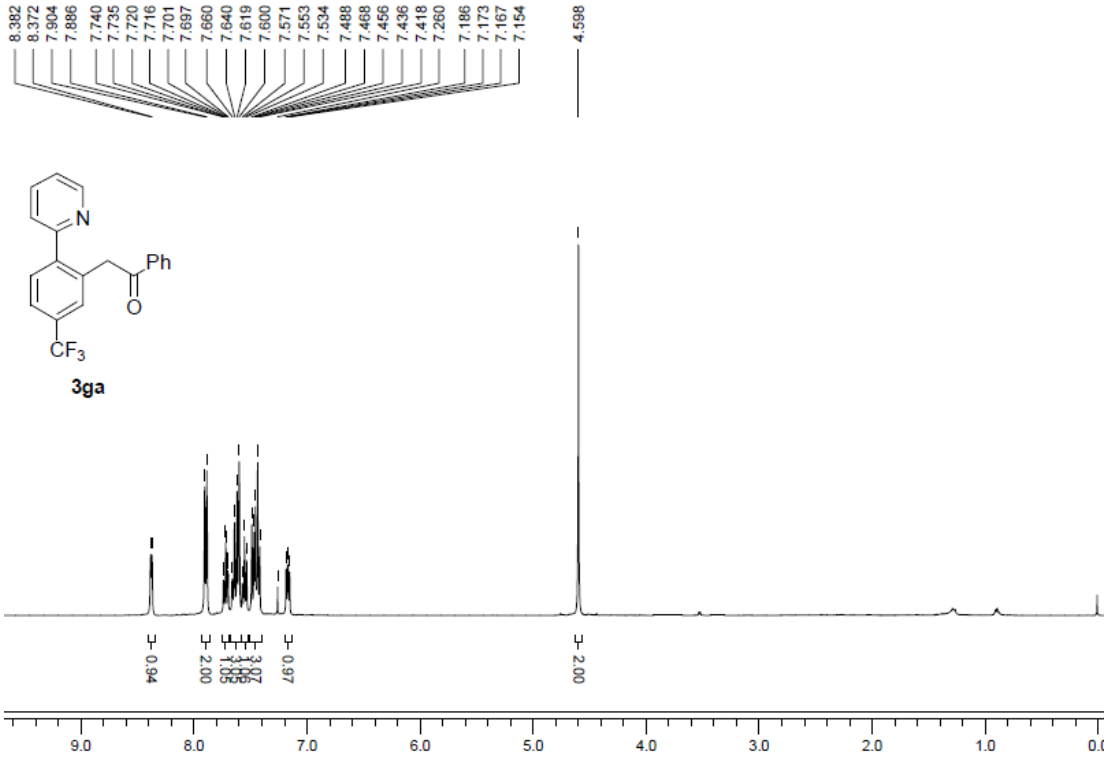
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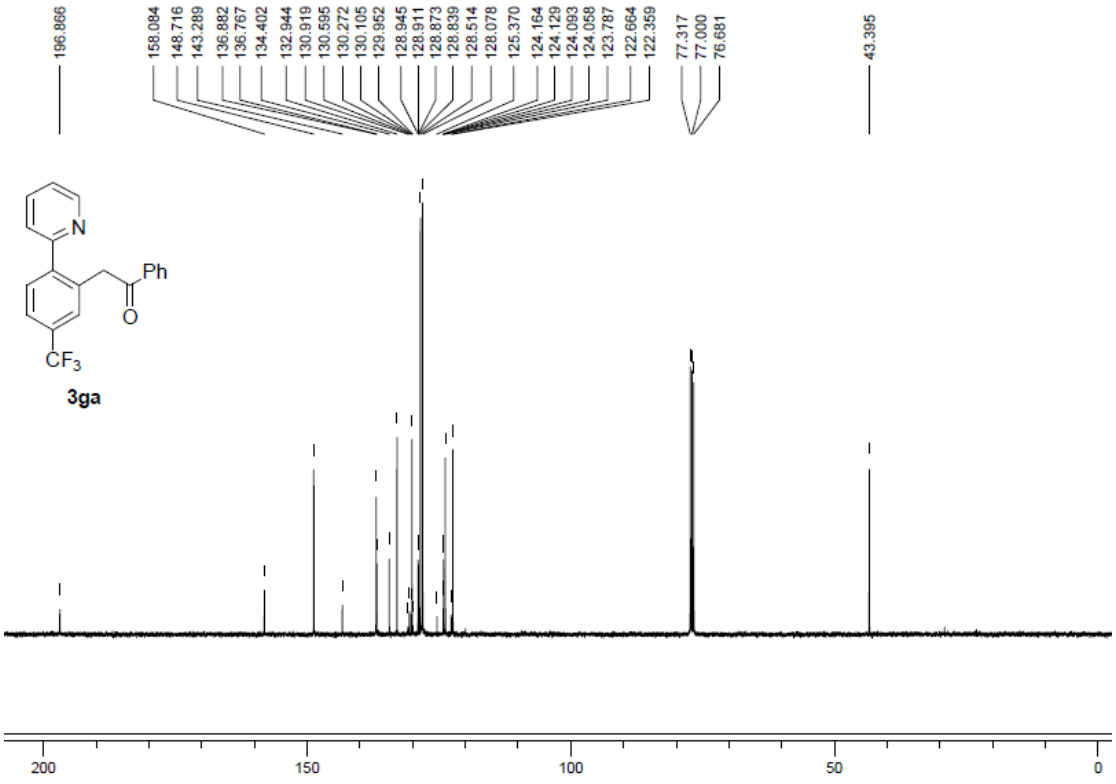
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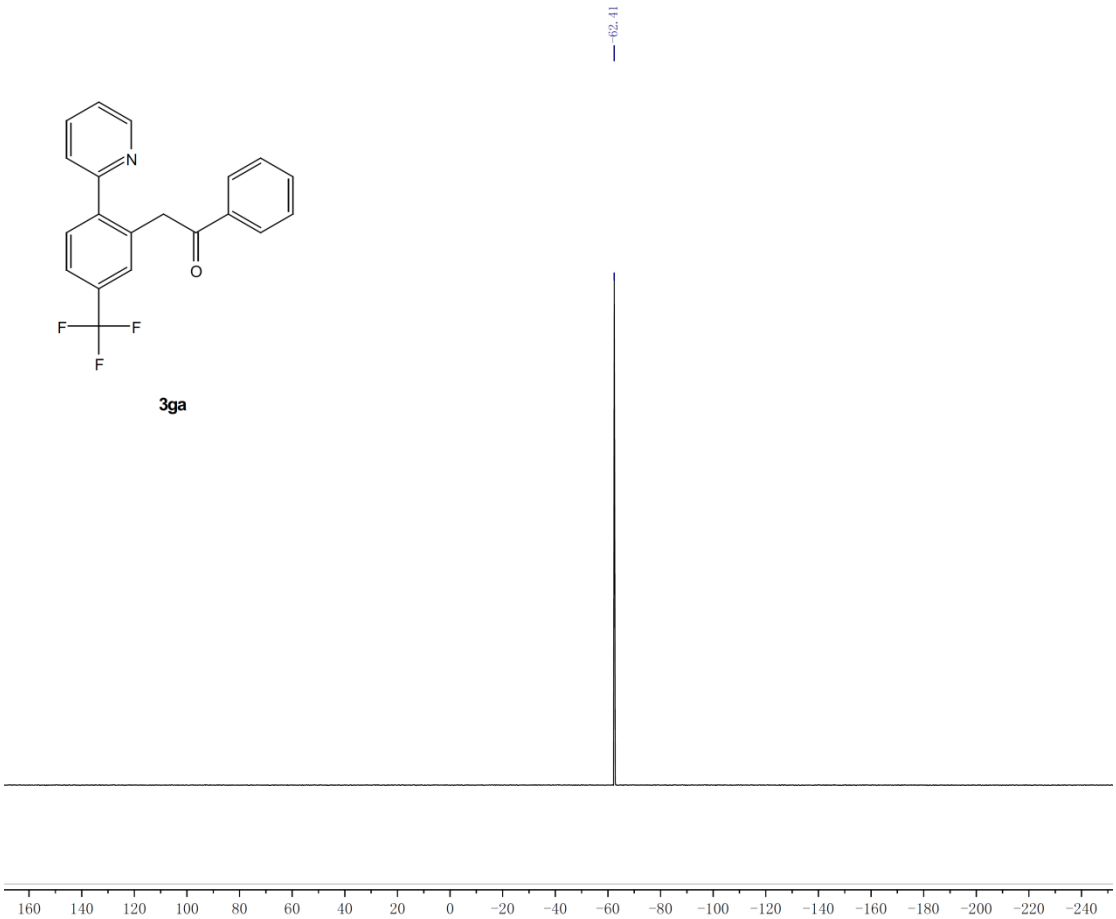
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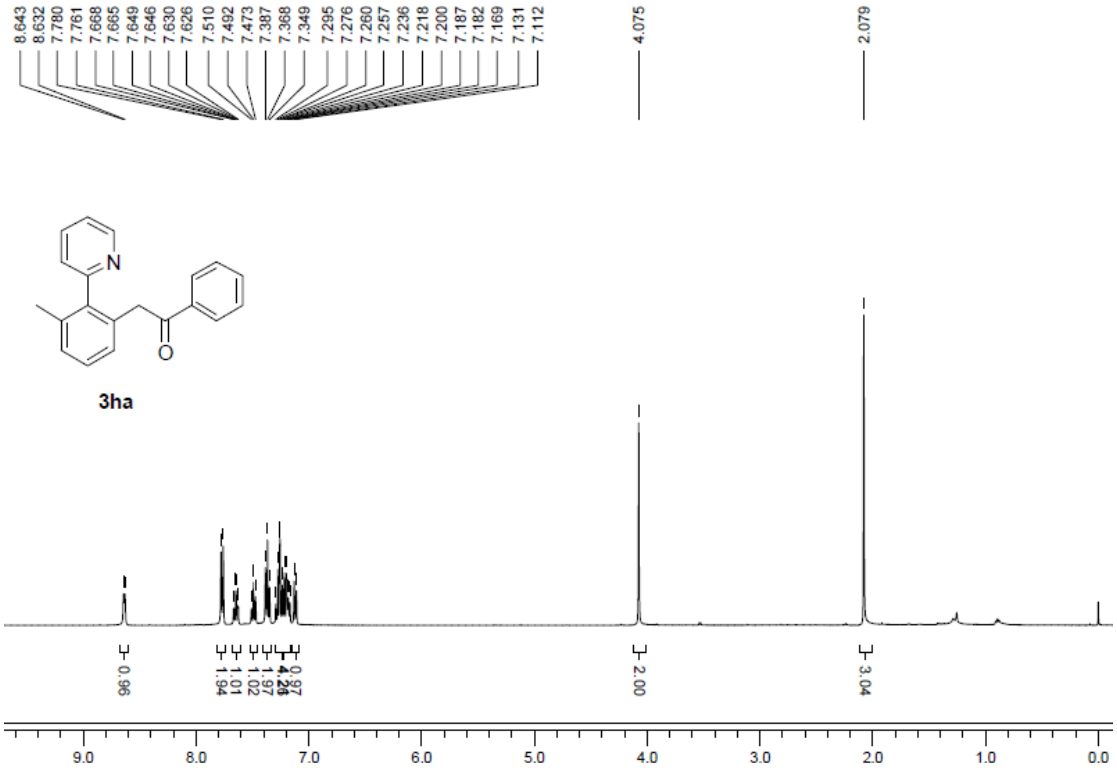
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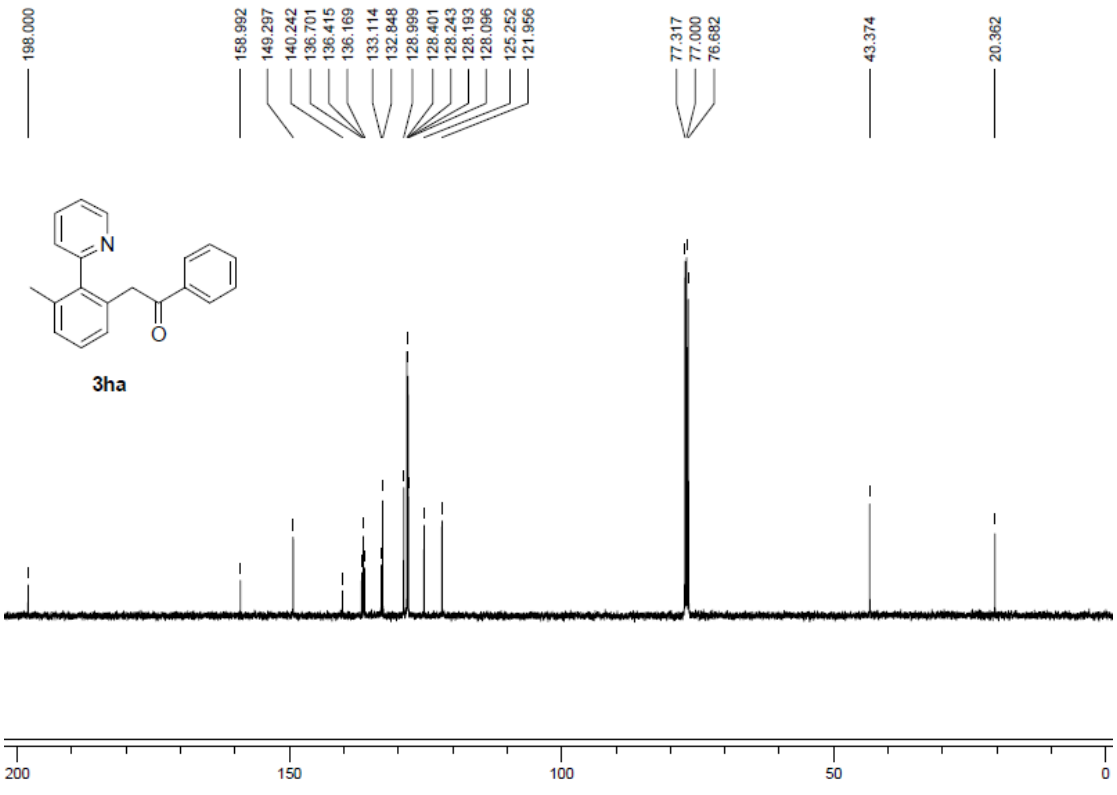
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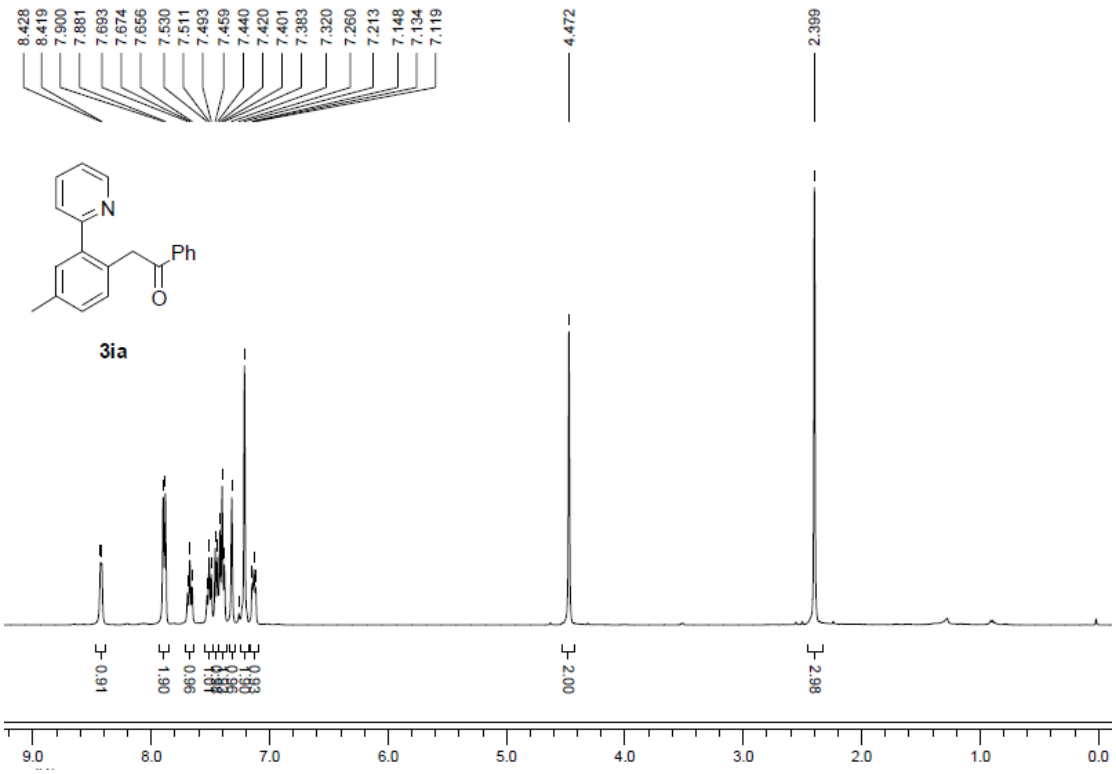
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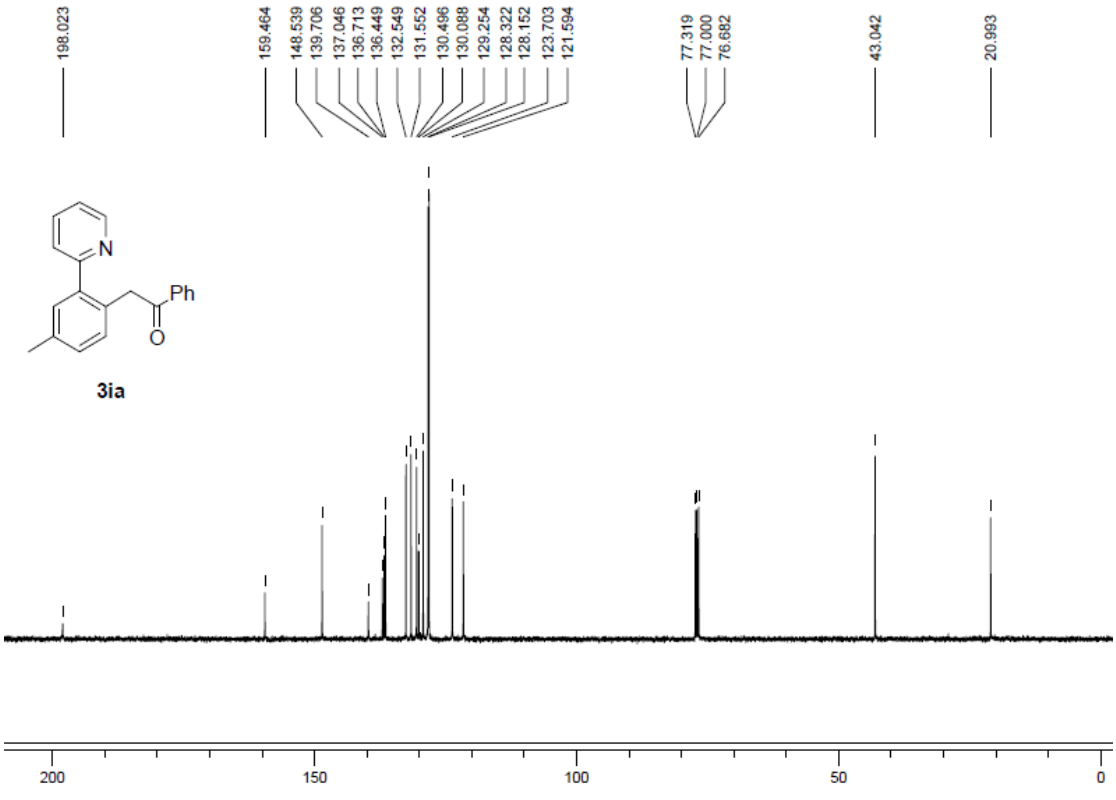
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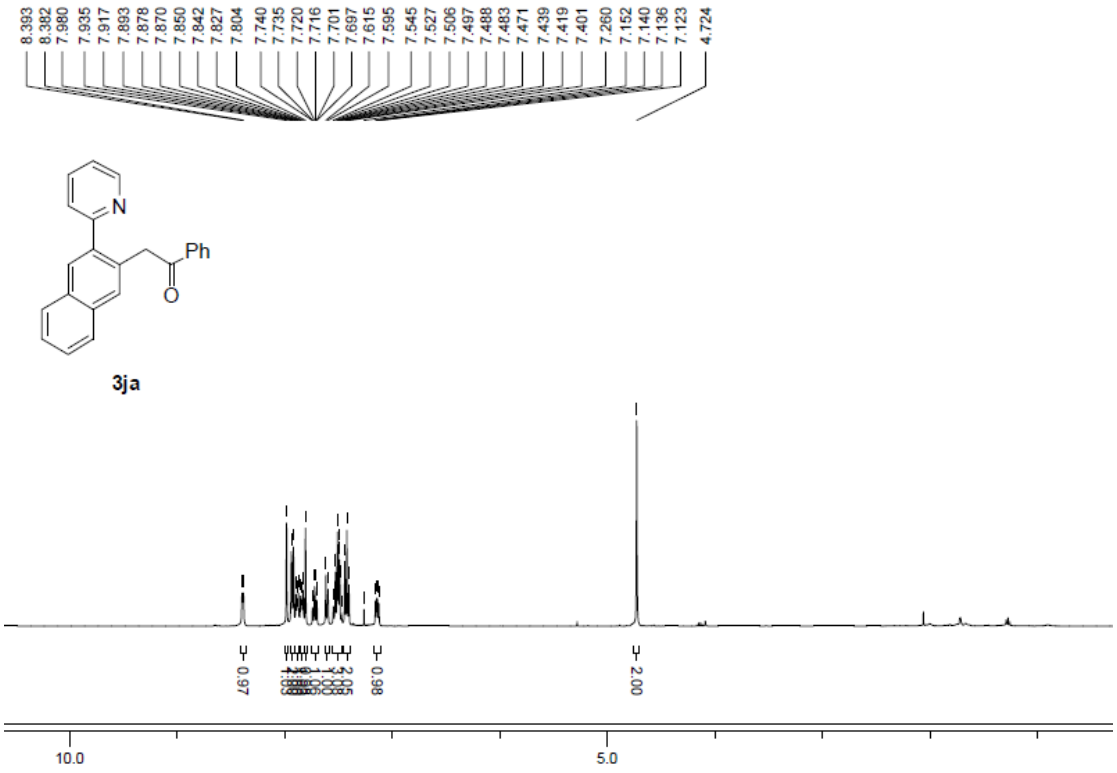
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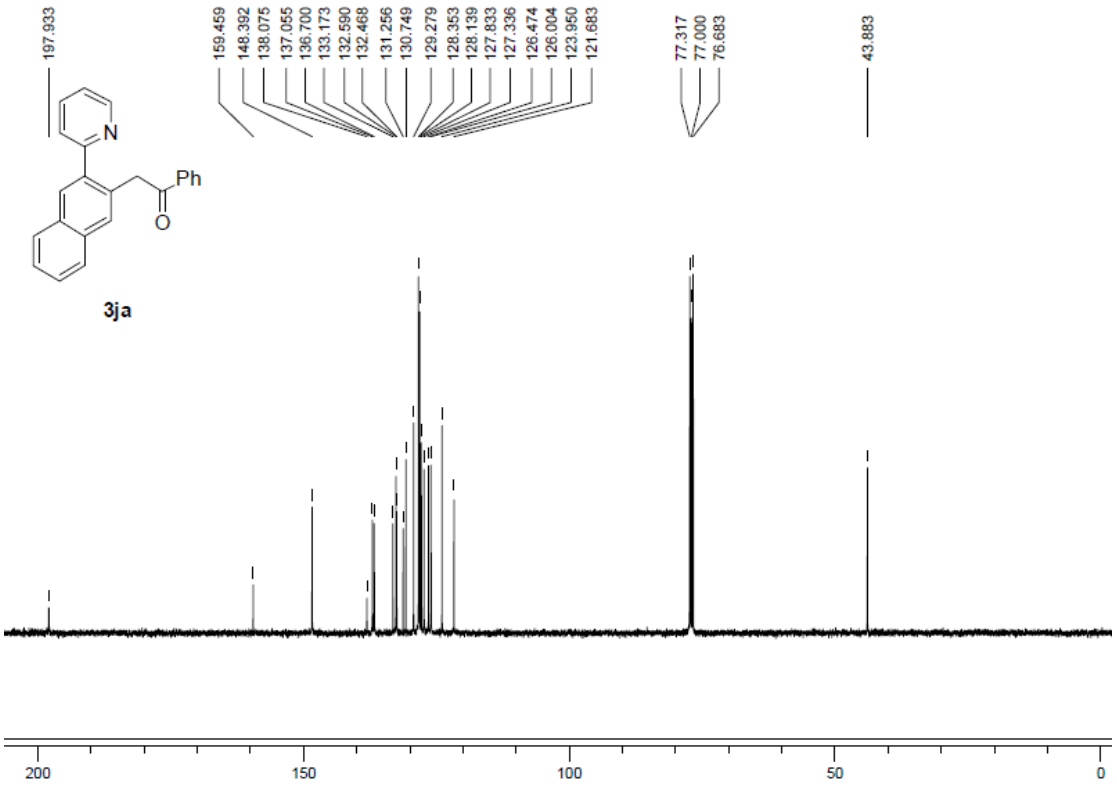
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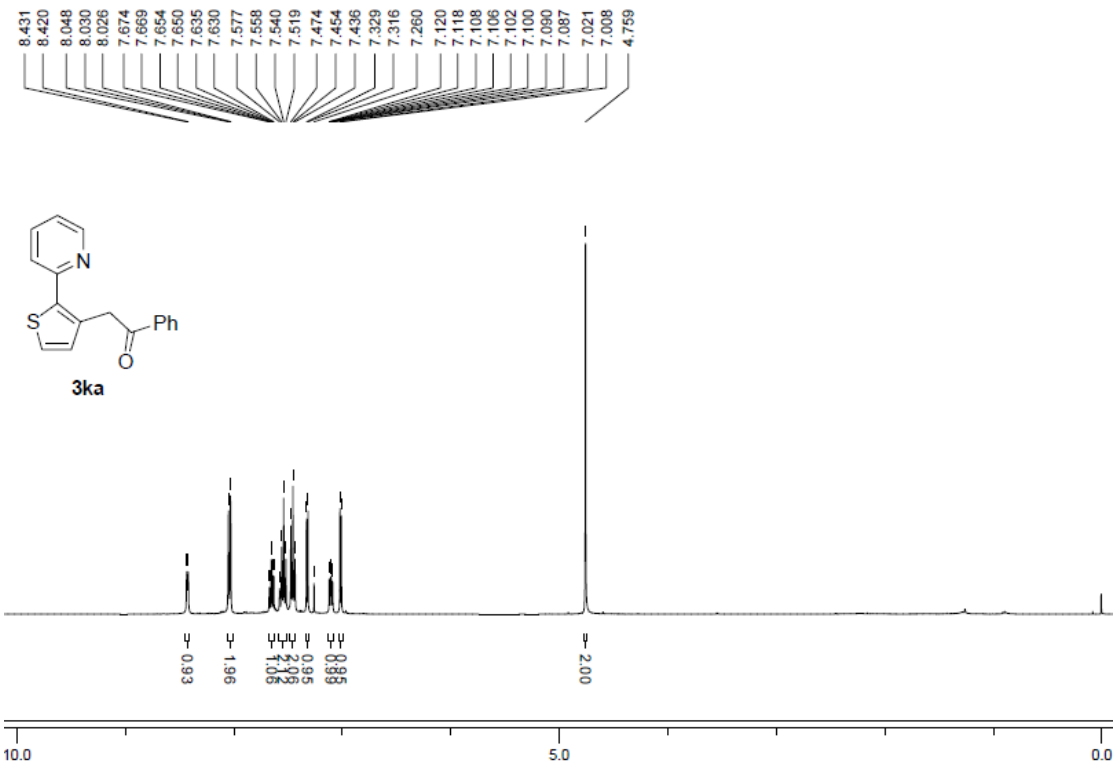
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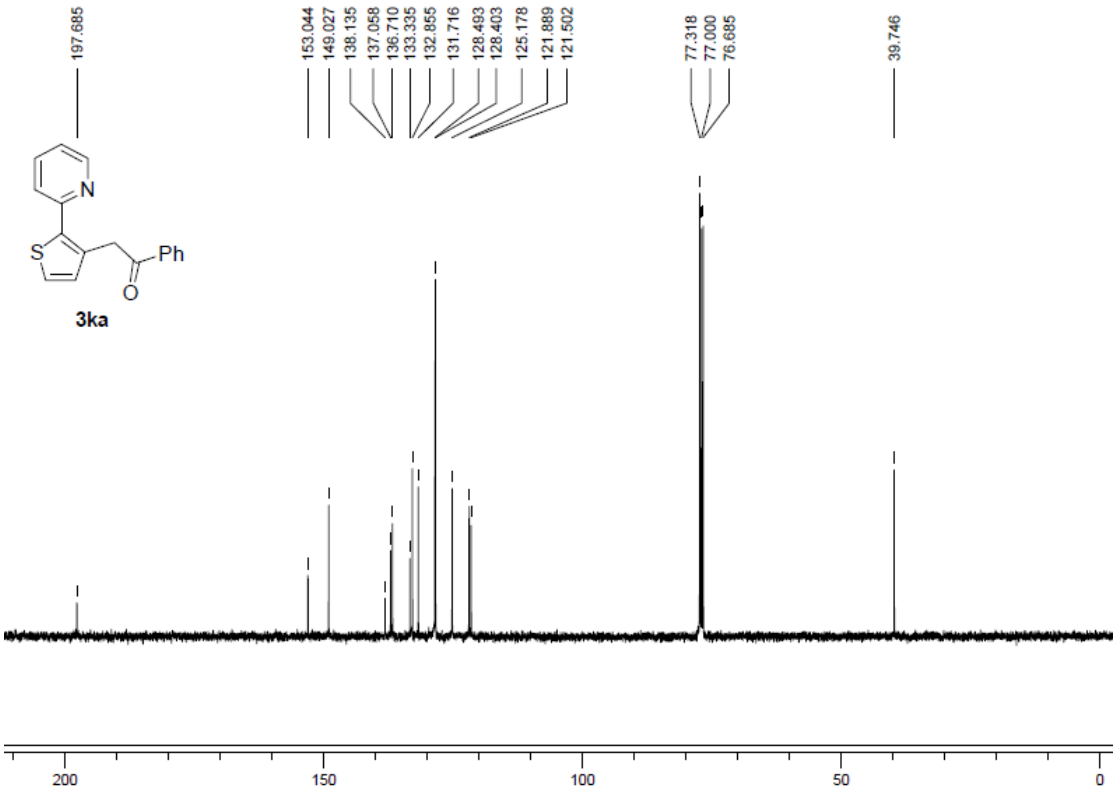
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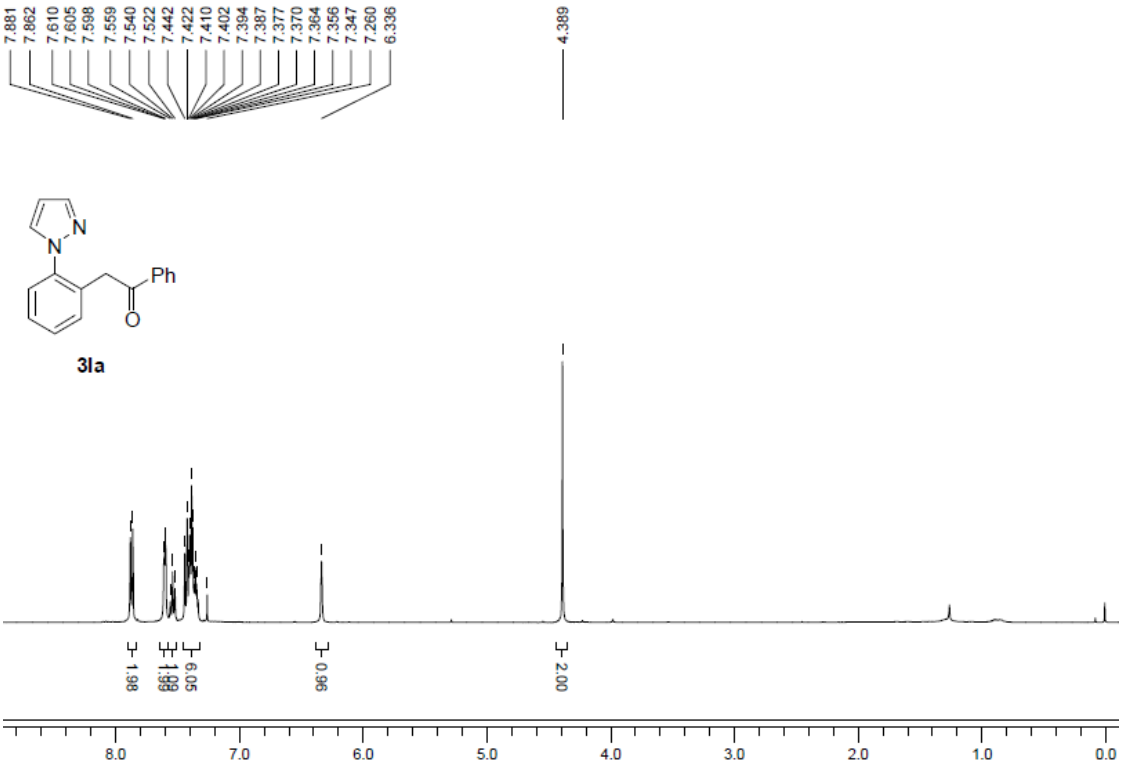
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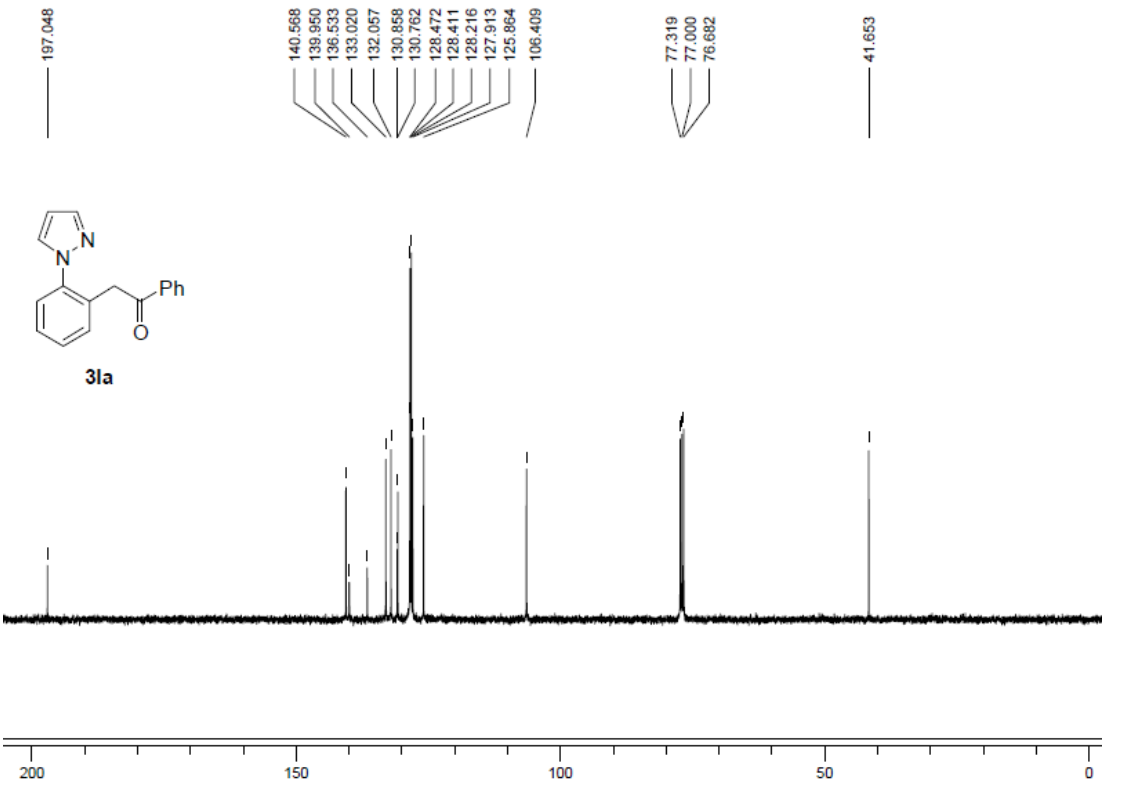
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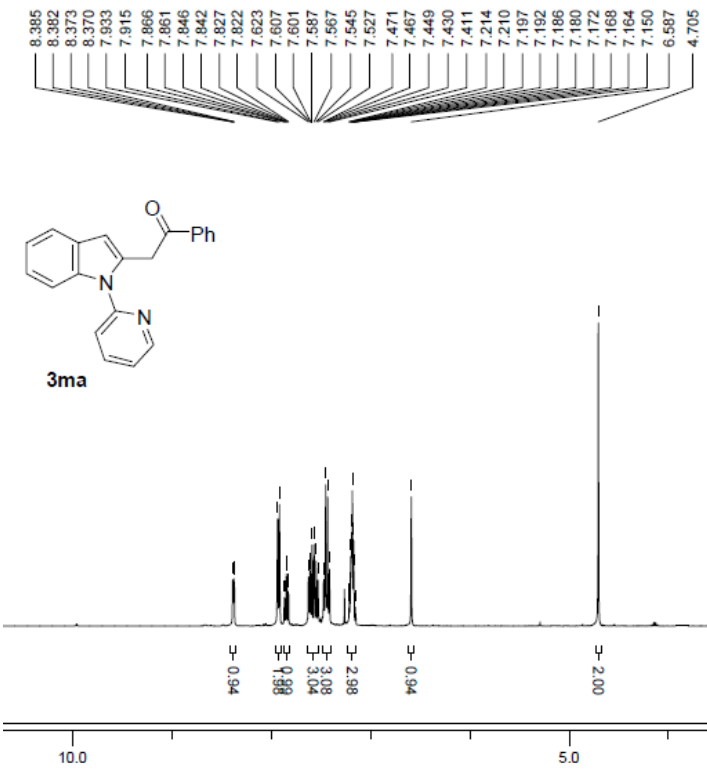
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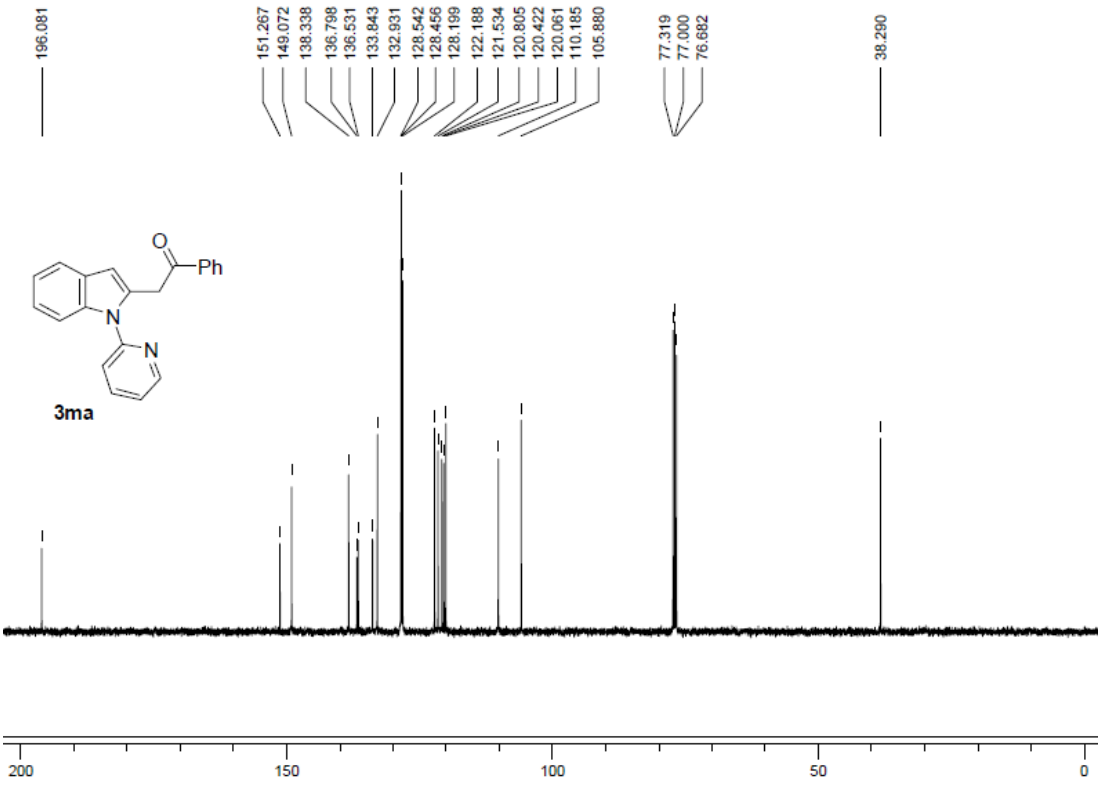
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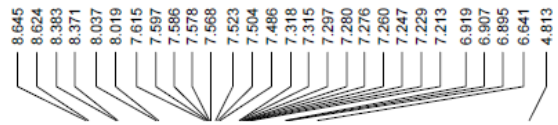
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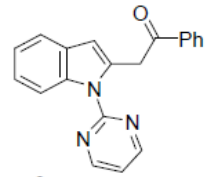
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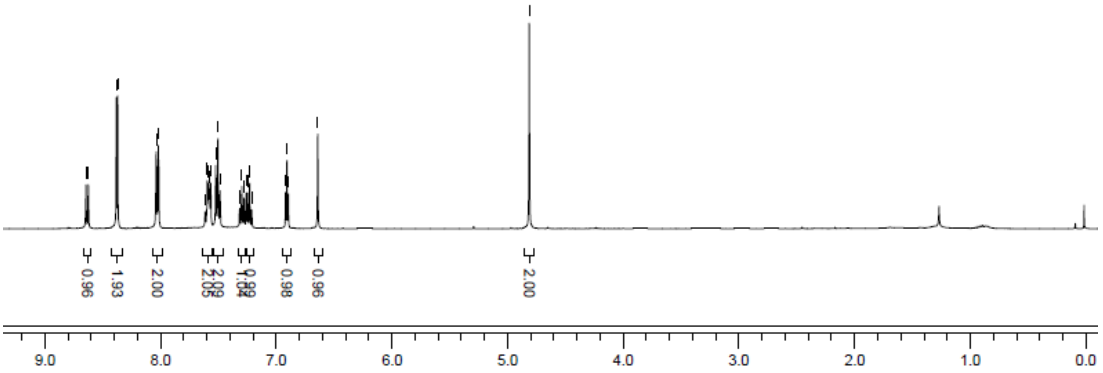
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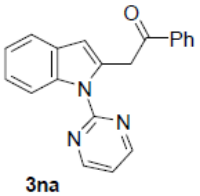
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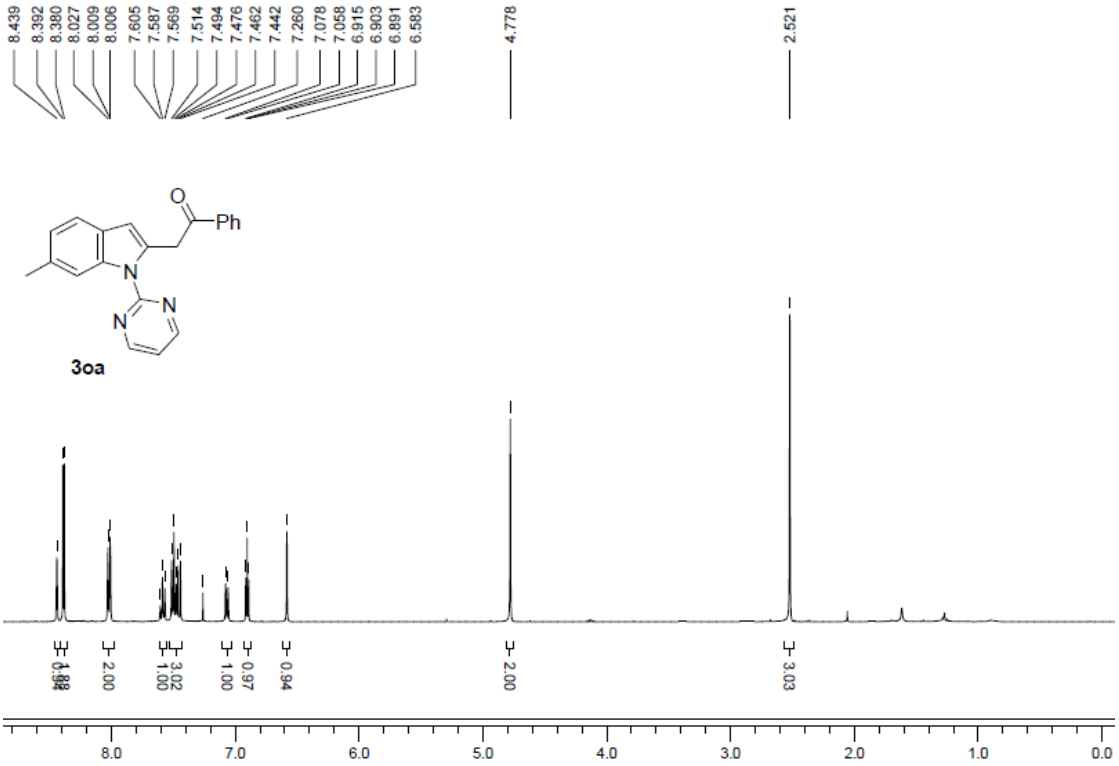
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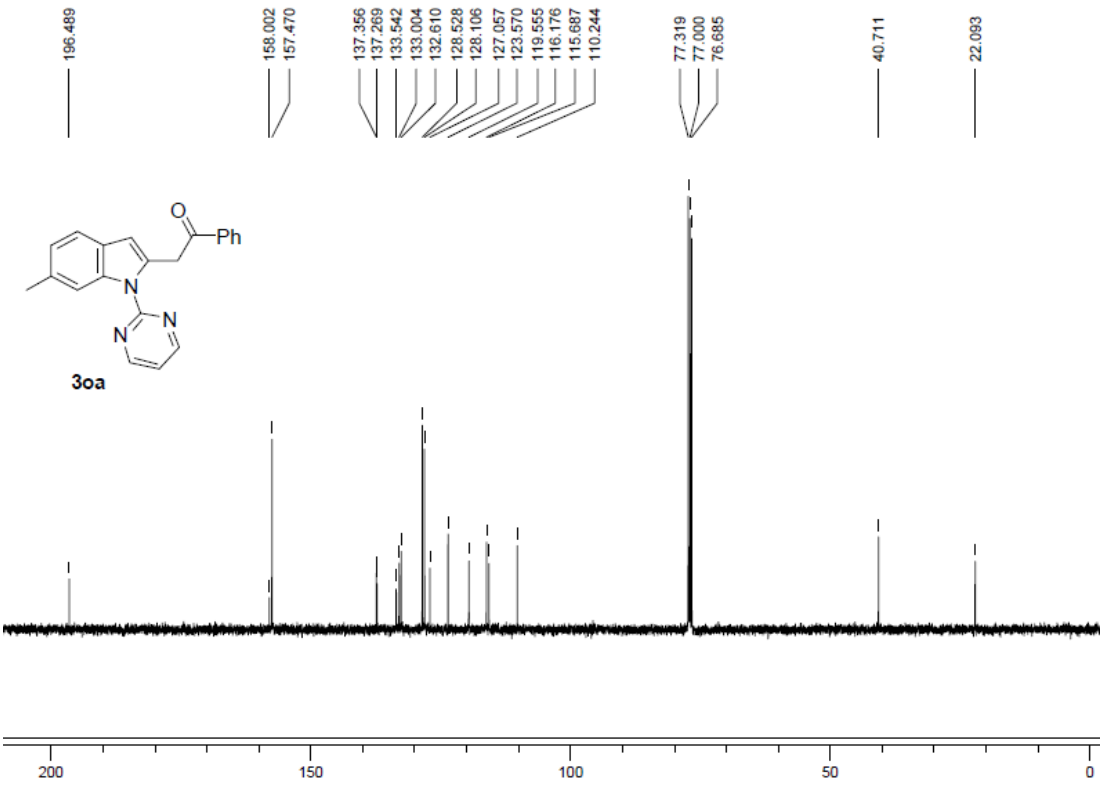
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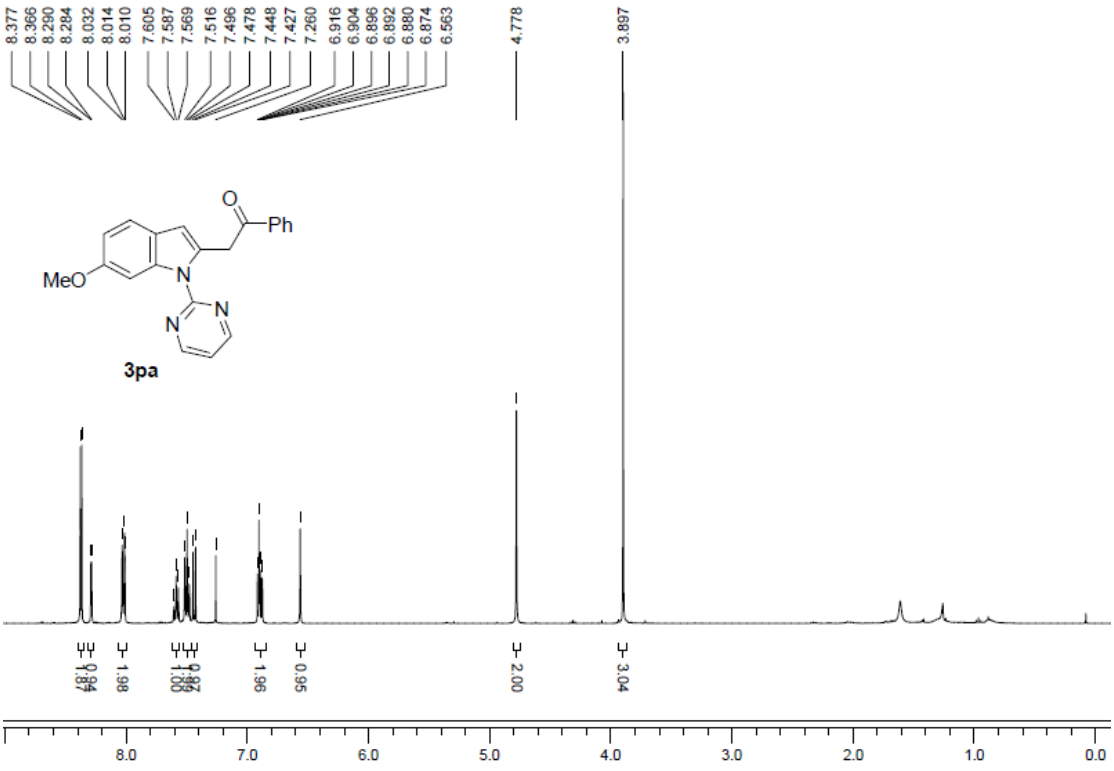
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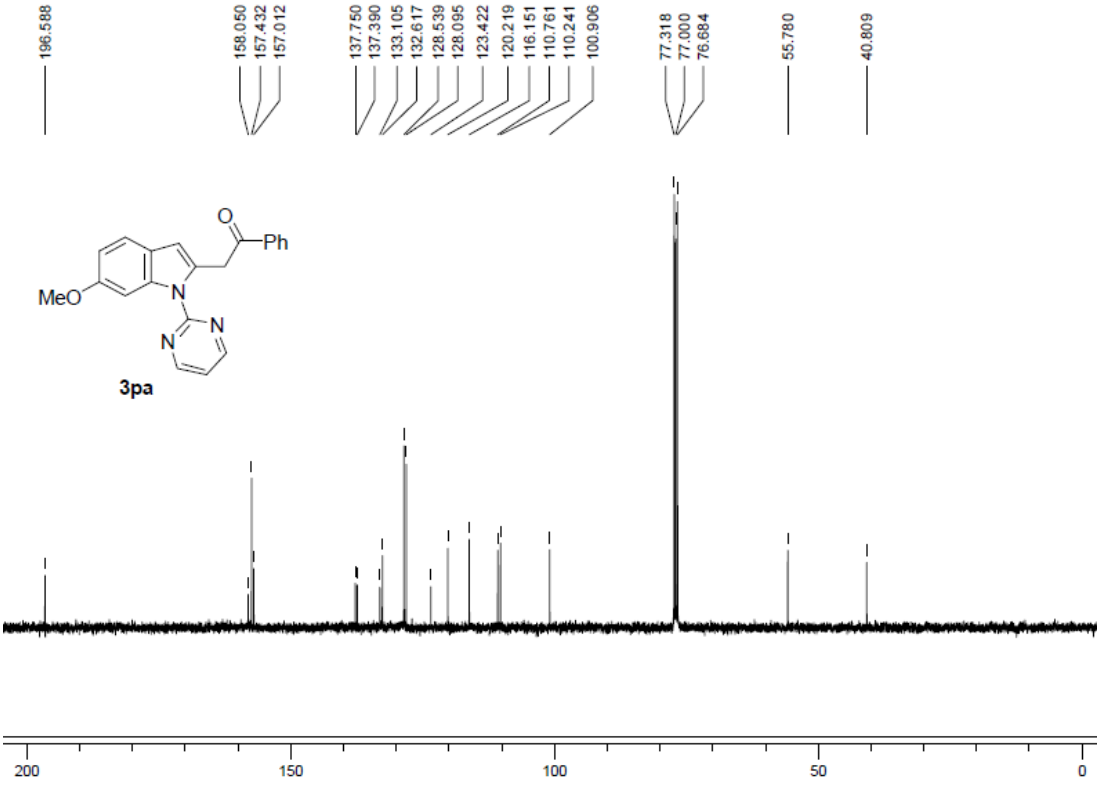
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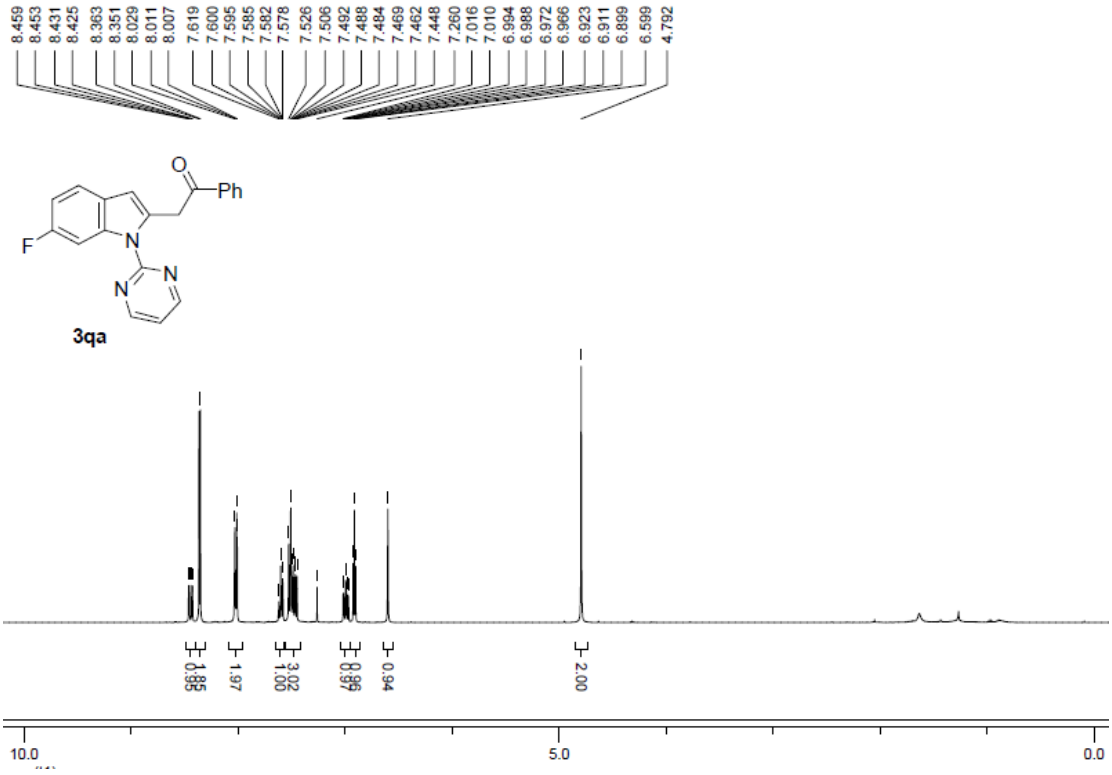
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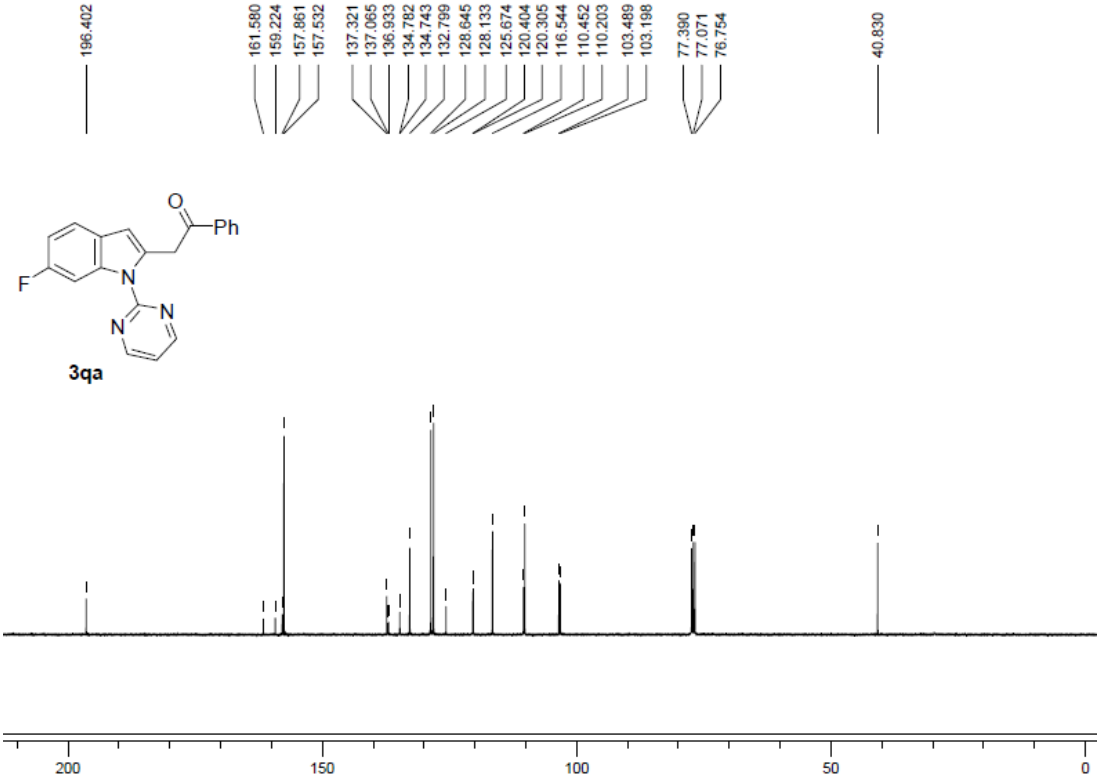
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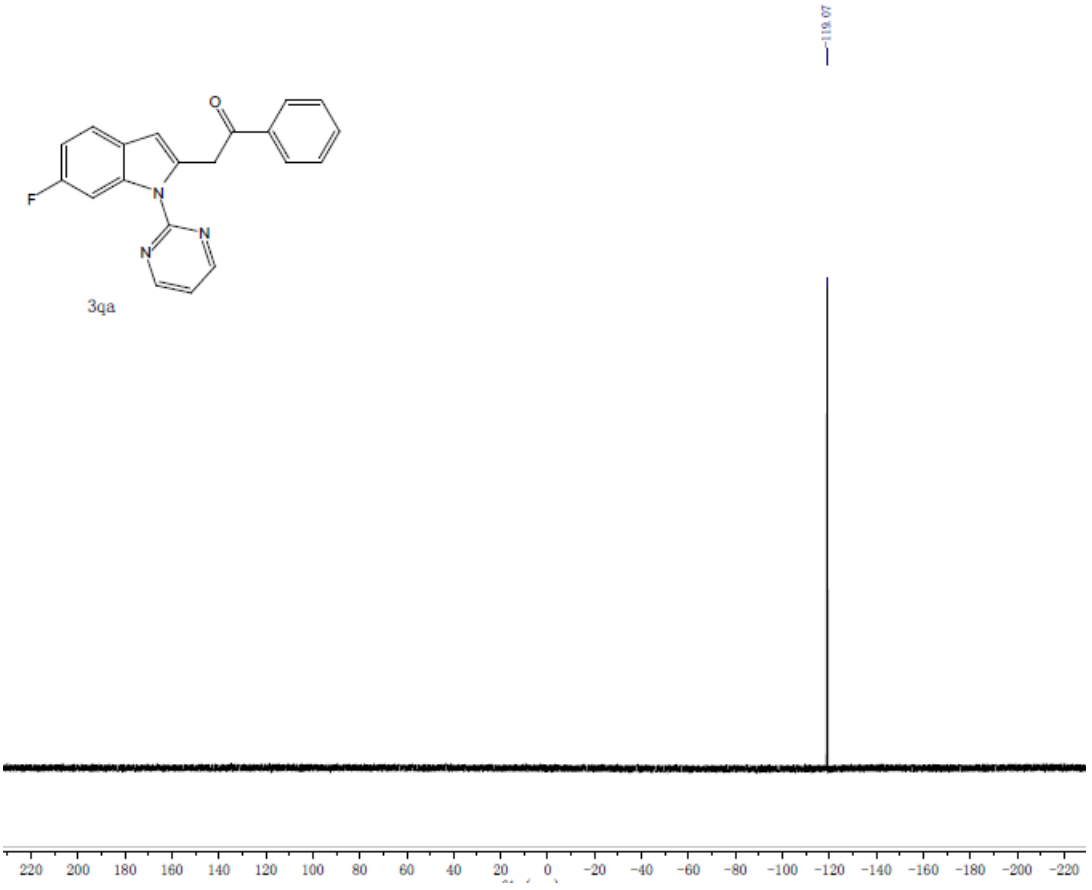
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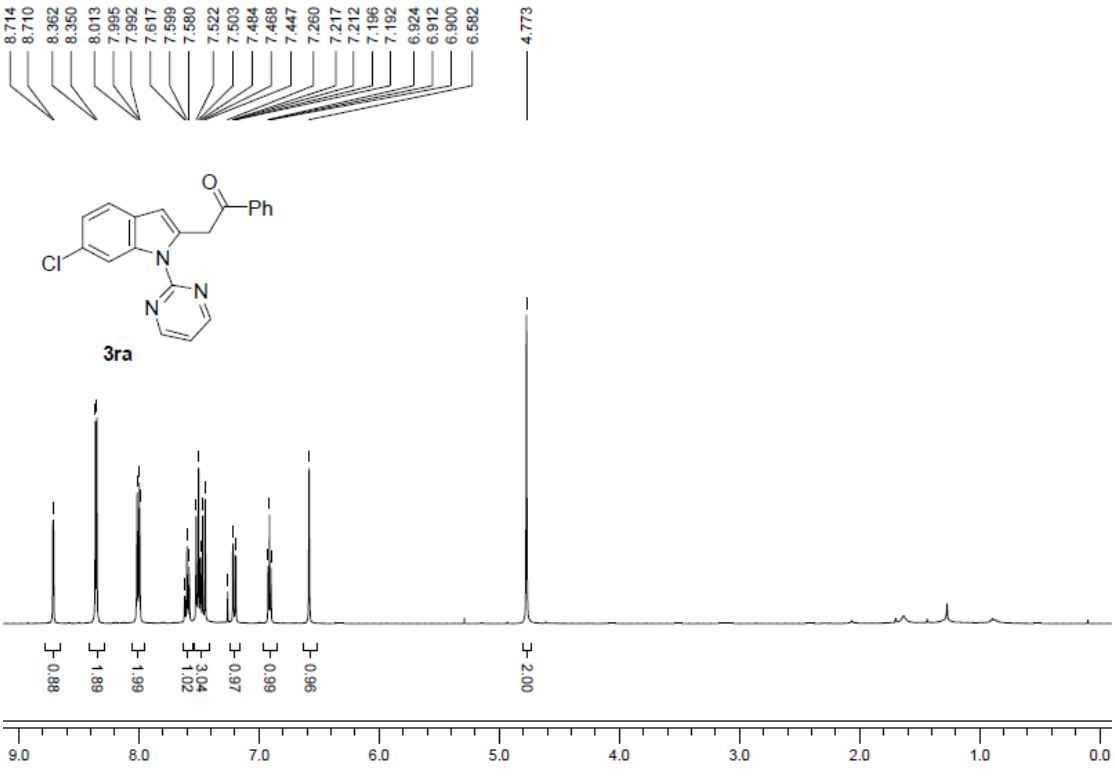
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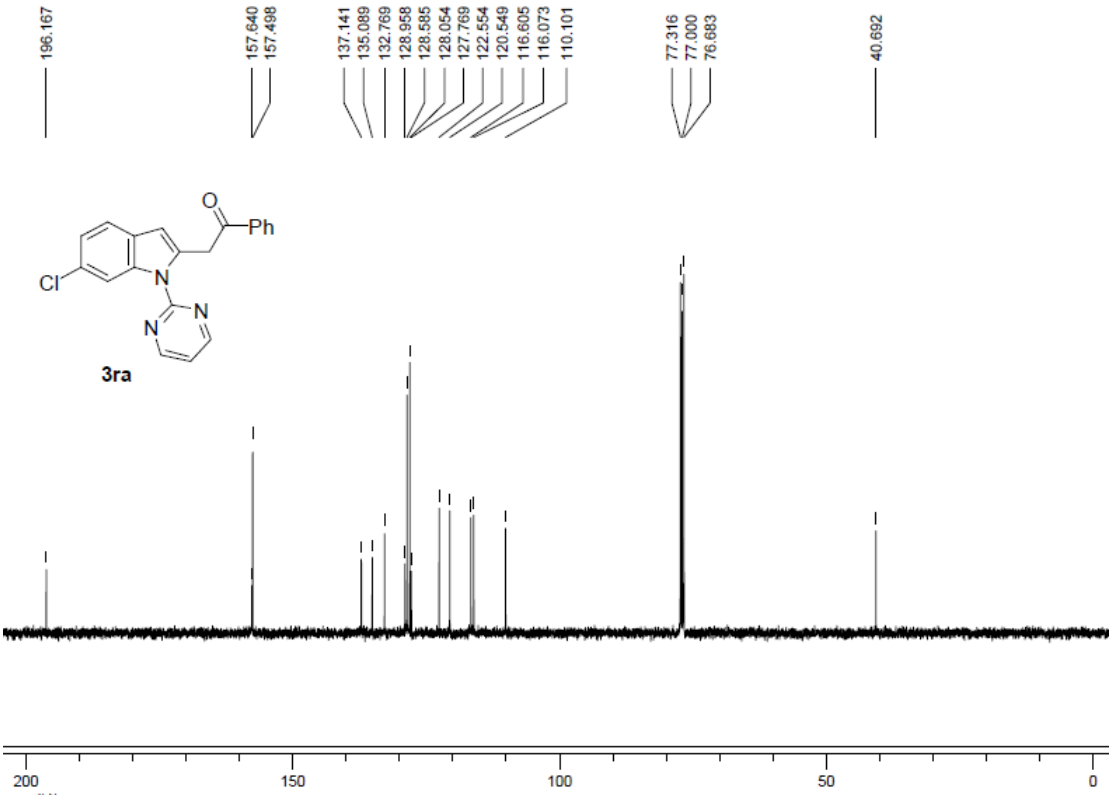
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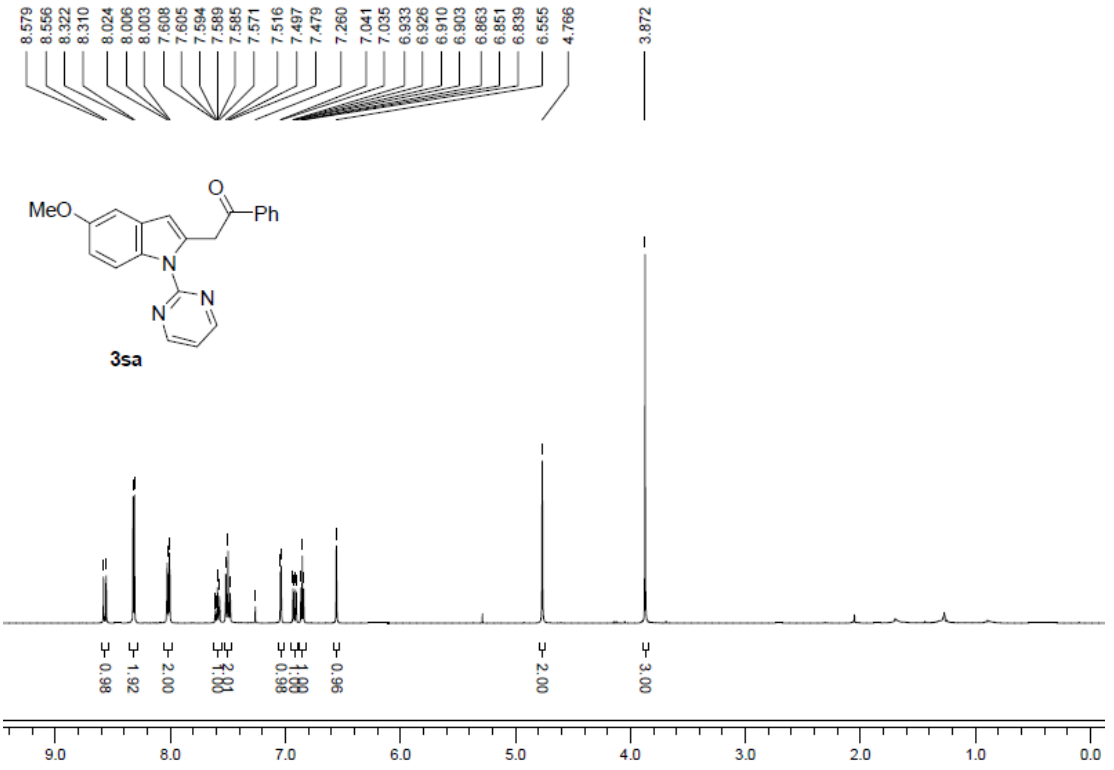
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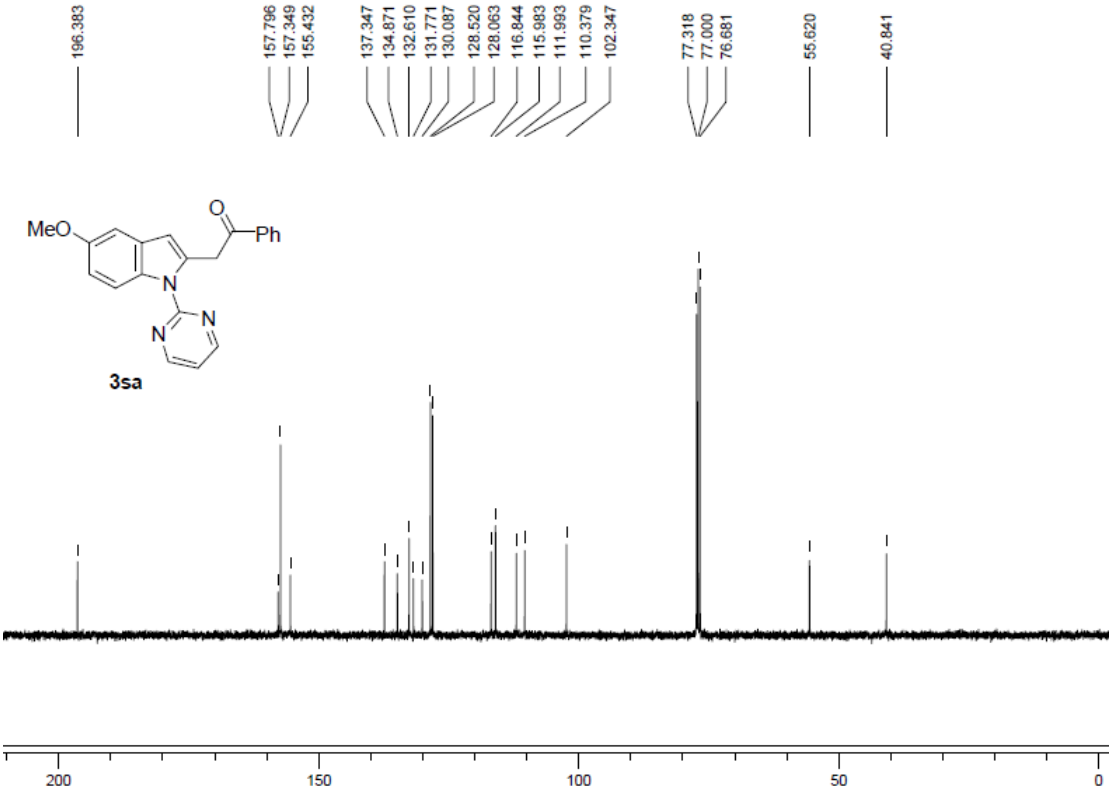
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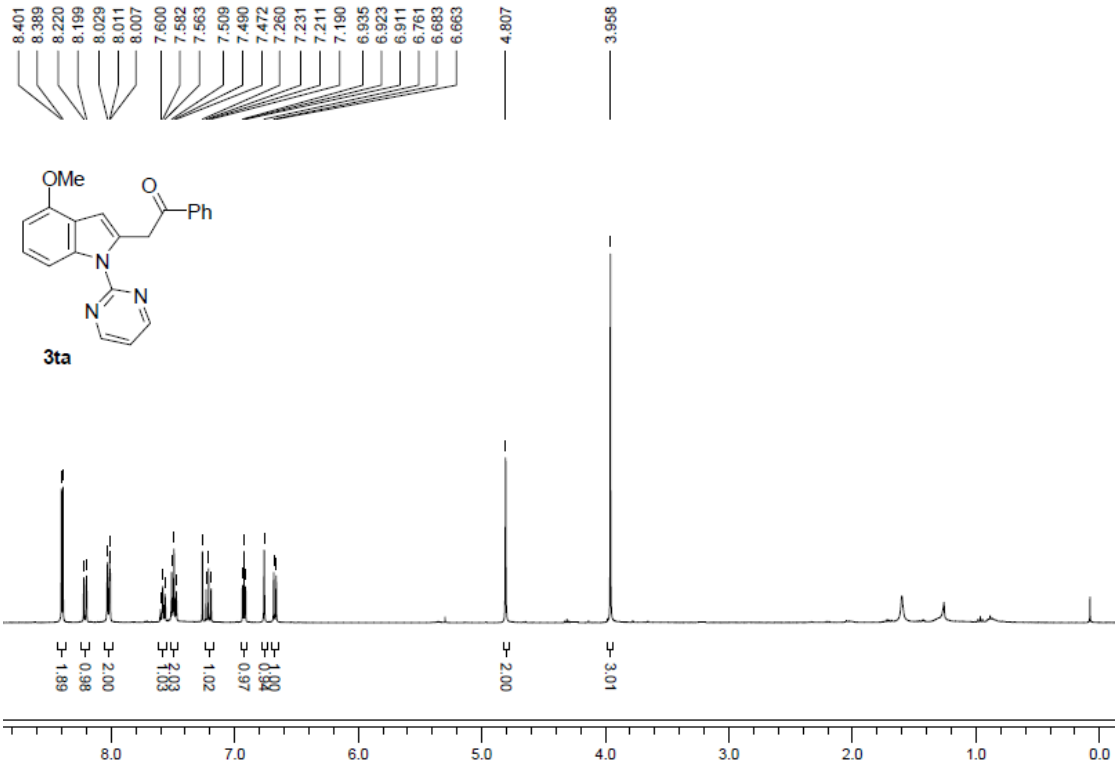
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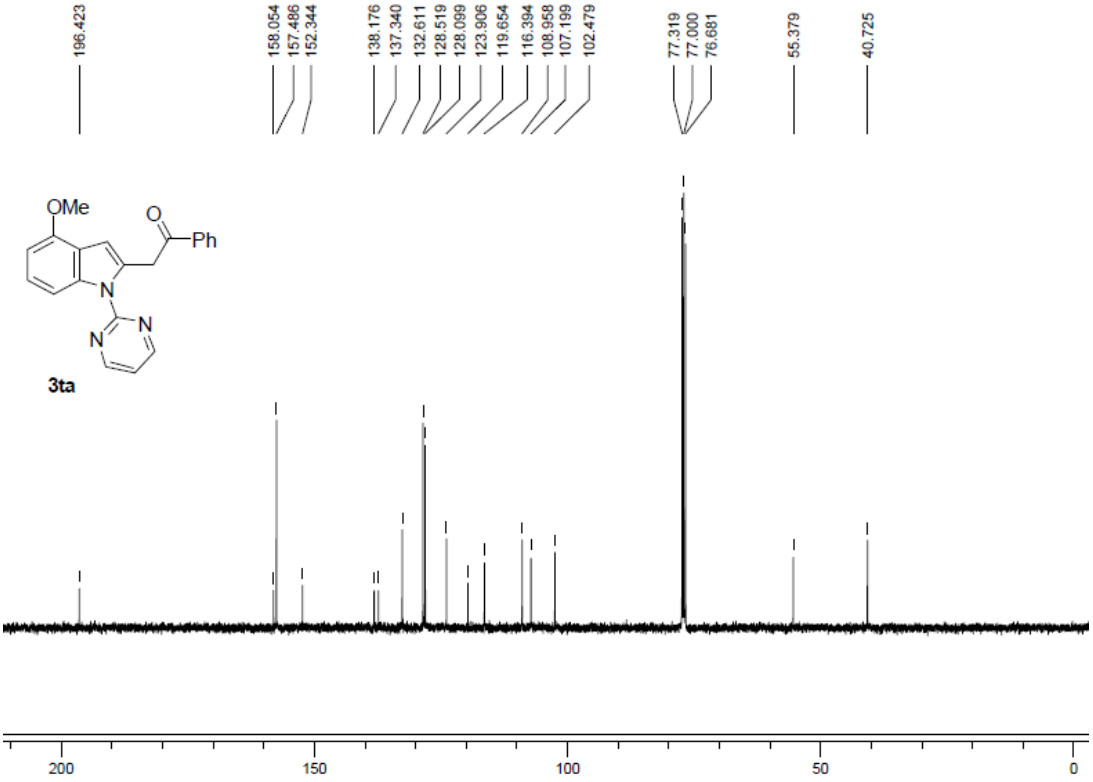
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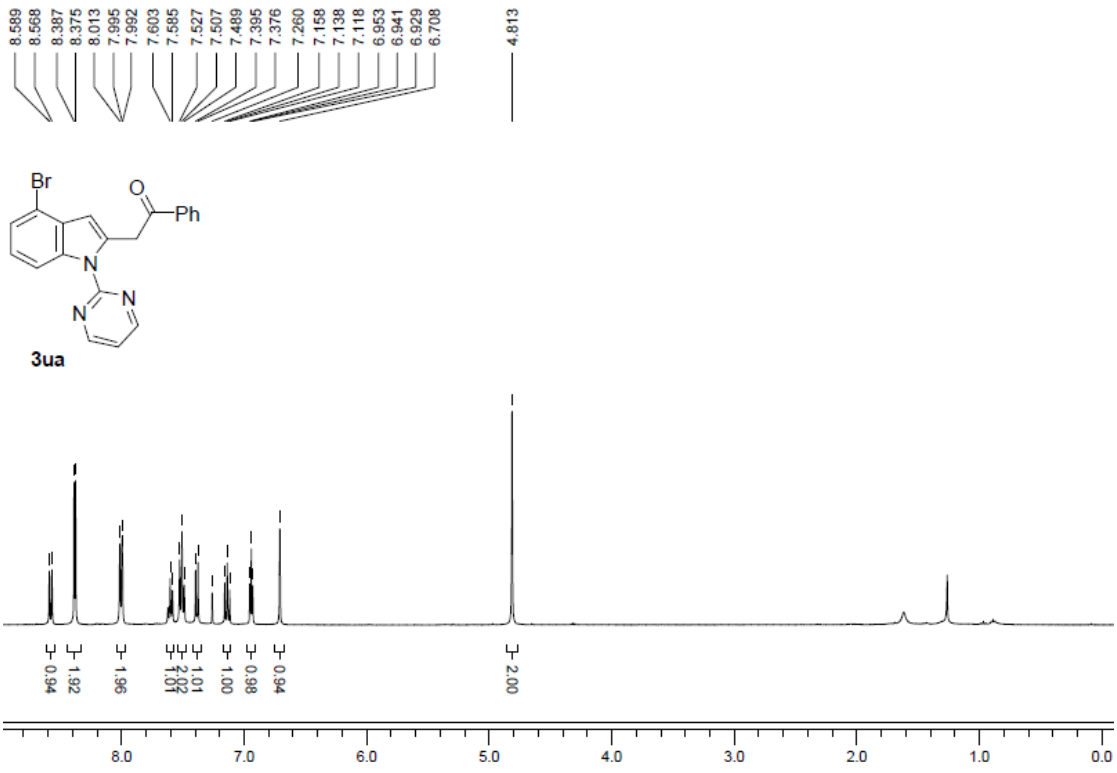
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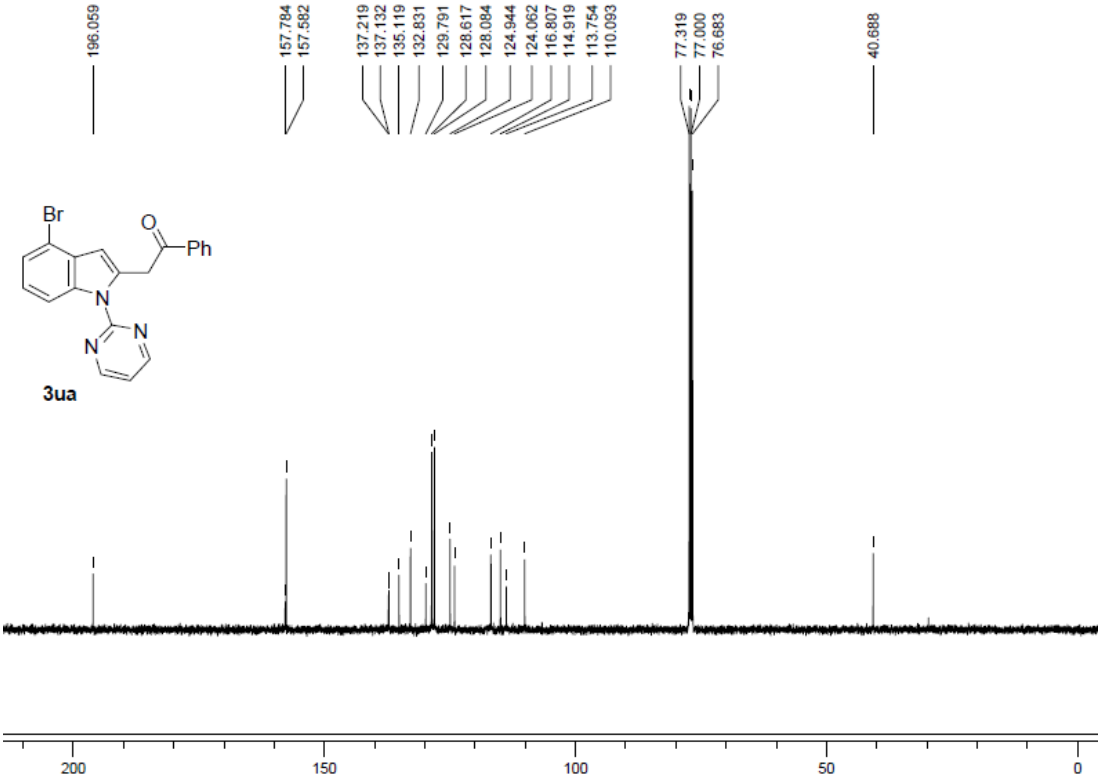
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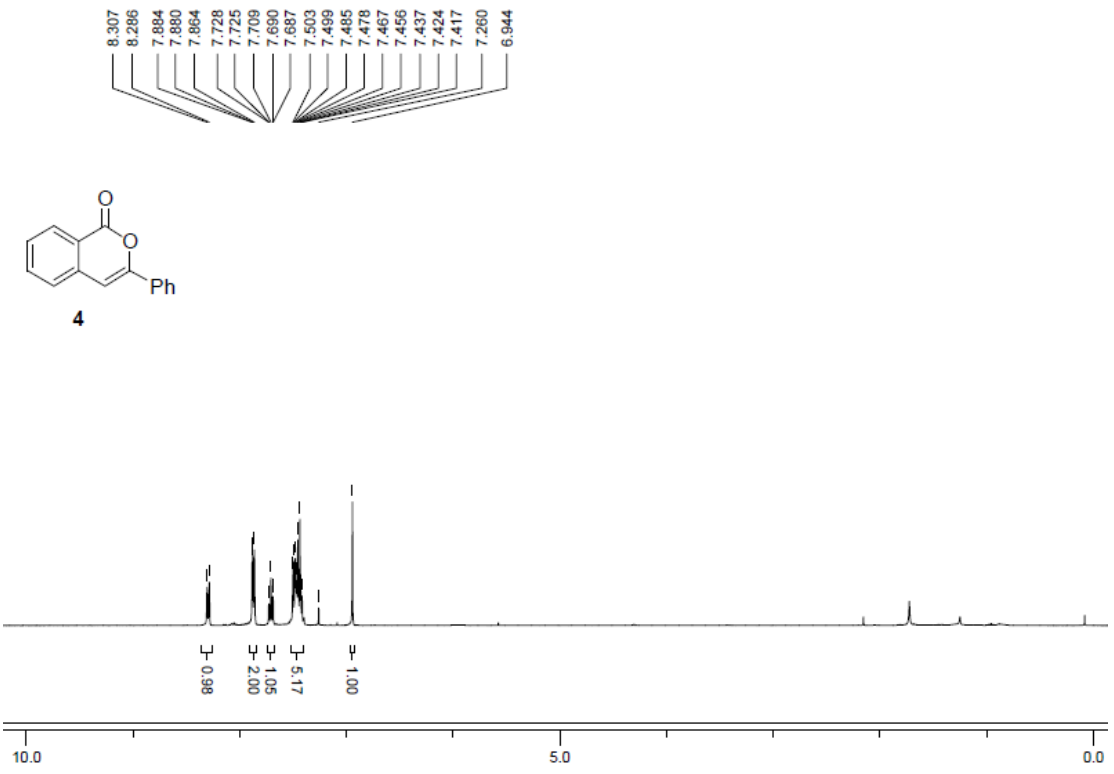
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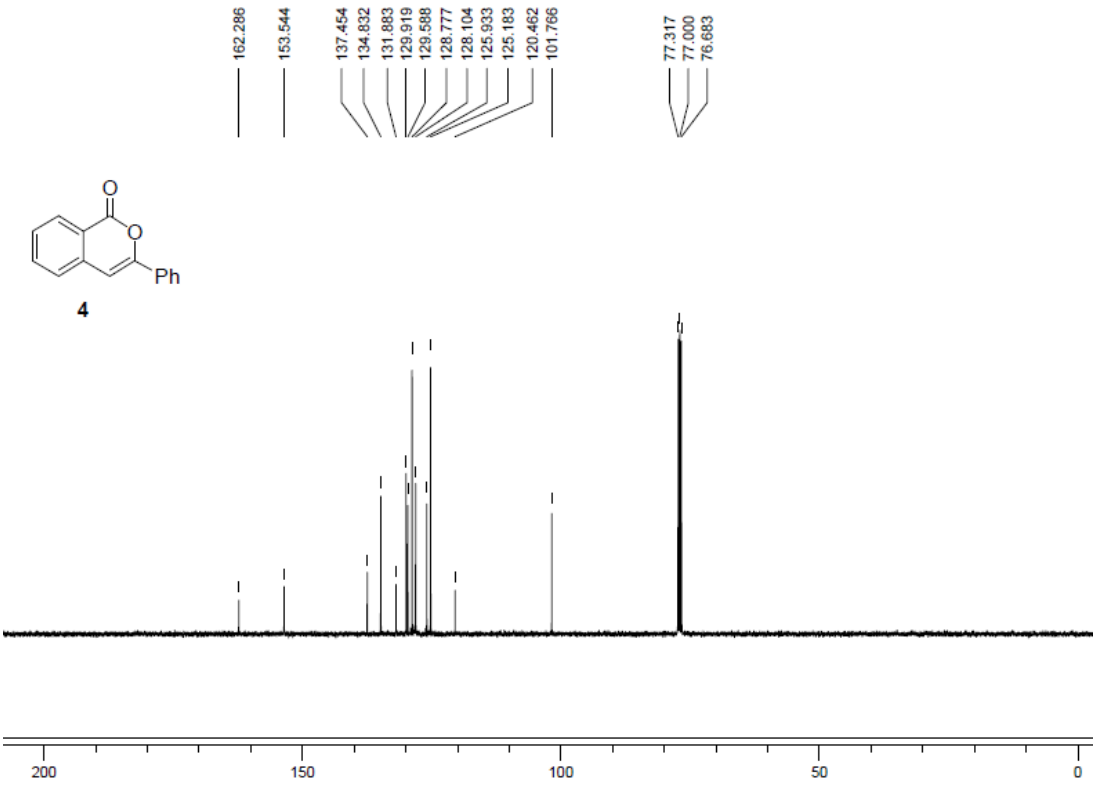
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(2) Yu, D. G.; Gensch, T.; de Azambuja, F.; Vásquez-Céspedes, S.; Glorius, F. *J. Am. Chem. Soc.* **2014**, *136*, 17722.

(3) Barday, M.; Janot, C.; Halcovitch, N. R.; Muir, J.; Aïssa, C. *Angew. Chem., Int. Ed*. **2017**, *56*, 13117.

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