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Supporting information

$CuCl_2$/TBHP Mediated Synthesis of β-Enaminones via a Coupling Reaction of Vinyl Azides with Aldehydes

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1. General Information

Commercially available materials were used as received. Purifications of all the desired products were carried out by chromatography (silica gel 200-300 mesh). NMR spectra were recorded on a 400 MHz spectrometer, data are reported as follows: chemical shift, integration, multiplicity (s=singlet, d=doublet, t=triplet, q=quartet, m=multiplet). Chemical shifts (δ) were reported in ppm and the coupling constants J are given in Hz. For ^{1}H NMR, DMSO-d_6 (δ=2.50) or $CDCl_3$ (δ=7.26) was used as internal standard. For ^{13}C NMR, DMSO-d_6 (δ=39.50) or $CDCl_3$ (δ=77.16) was used as internal standard. HR-MS data was obtained using Waters XEVO G2-XS QTQF/H-CLASS LC/MS. Melting points were measured on a BÜCHI B-540 melting point apparatus and uncorrected. The starting material of vinyl azides**2**were prepared according to the reported methods.[1-3]

2. General procedures for synthesis of compounds 3aa-3ua

A mixture of aldehydes **1**(1.5mmol, 3.0 equiv), vinyl azides **2** (0.5 mmol), TBHP (1.0 mmol, 2.0 equiv) and $CuCl_2·2H_2O$ (0.05 mmol) in DMSO (3 mL) was stirred at 80 ºC for 8h. Upon completion of the reaction, the resulting mixture was diluted with saturated NaCl solution (5 mL) and extracted with EtOAc (3×10 mL). The combined organic phase was dried with anhydrous Na_2SO_4, concentrated and purified by chromatography (petroleum ether/ethylacetate = 15:1) on silica gel to afford the desired productsβ-enaminones (**3aa-3ua**).

3. Typical procedures for control experiments

(a)Typical procedure for radical trapping experiment

A mixture of benzaldehyde **1a** (1.5mmol, 3.0 equiv), α-phenylvinyl azide **2a** (0.5 mmol), TBHP (1.0 mmol, 2.0 equiv), $CuCl_2·2H_2O$ (0.05 mmol) and TEMPO (1.0 mmol, 2.0 equiv) in DMSO (3 mL) was stirred at 80 ºC for 8h. Upon completion of the reaction, the resulting mixture was diluted with saturated NaCl solution (5 mL) and extracted with EtOAc (3×10 mL). Then the resulting mixture was detected by LC-MS, no desired product **(3aa)** was detected.

(b) Typical procedure for radical trapping experiment in the absence of α-phenylvinyl azide

A mixture of benzaldehyde **1a** (1.5mmol, 3.0 equiv), TBHP (1.0 mmol, 2.0 equiv), $CuCl_2·2H_2O$ (0.05 mmol) and TEMPO (1.0 mmol, 2.0 equiv) in DMSO (3 mL) was stirred at 80 ºC for 8h. Upon completion of the reaction, the resulting mixture was diluted with saturated NaCl solution (5 mL) and extracted with EtOAc (3×10 mL). The combined organic phase was dried with anhydrous Na_2SO_4, concentrated and purified by chromatography on silica gel, the coupling product **(8)** was obtained in 76%yield (petroleum ether/ethylacetate = 15:1).

(c) Typical procedure for the reaction of 3-phenyl-2H-azirine (9) instead of 2a to with 1a

A mixture of benzaldehyde **1a** (1.5mmol, 3.0 equiv), 3-phenyl-2H-azirine **9** (0.5 mmol), TBHP (1.0 mmol, 2.0 equiv) and $CuCl_2·2H_2O$ (0.05 mmol) in DMSO (3 mL) was stirred at 80 ºC for 8h. The resulting mixture was detected by LC-MS, no desired product **(3aa)** was detected.

(d) Typical procedure for studying the role of enaminones (4) with benzaldehyde

A mixture of benzaldehyde**1a** (1.5 mmol, 3.0 equiv.), enaminones **4** (0.5 mmol), TBHP (1.0mmol, 2.0 equiv., 70% aqueous solution) and $CuCl_2 \cdot 2H_2O$ (0.05 mmol) in DMSO (3 mL) was stirred at 80 °C for 8h. Upon completion of the reaction, the resulting mixture was diluted with saturated NaCl solution (5 mL) and extracted with EtOAc (3×10 mL). The combined organic phase was dried with anhydrous Na_2SO_4, concentrated and purified by chromatography (petroleum ether/ethylacetate = 15:1) on silica gel to afford the desired products73% 3aa.

(e) Typical procedure for radical trapping experiment for the reaction of benzaldehyde with enaminones (4)

A mixture of benzaldehyde **1a** (1.5 mmol, 3.0 equiv.), enaminones **4** (0.5 mmol), TBHP (1.0mmol, 2.0 equiv., 70% aqueous solution), $CuCl_2 \cdot 2H_2O$ (0.05 mmol) and TEMPO (1.0 mmol, 2.0 equiv.) in DMSO (3 mL) was stirred at 80 °C for 8h. Upon completion of the reaction, the resulting mixture was diluted with saturated NaCl solution (5 mL) and extracted with EtOAc (3×10 mL). Then the resulting mixture was detected by LC-MS, no desired product (**3aa**) was detected.

4. Typical procedures for synthetic applications of 3aa

(a) Typical synthesis of N-unsubstituted β-enaminone 4

To a solution of compound **3aa** (0.1 mmol, 1.0 equiv) in MeOH (1.0 mL) was added NH_4HCO_3 (1.6 mmol, 16.0 equiv). The reaction mixture was stirred at 65 °C in oil bath for 24 h. Upon completion, the mixture was then concentrated under vacuum and the residue was purified by chromatography on silica gel (PE/EA) to afford **4** as a yellow oil in 92% yield.

(b) Typical synthesis of 1,3-diketone 5

Compound **3aa** (0.3 mmol) was added into a 5 mL reaction tube. THF (1.0 mL) and concentrated hydrochloric acid (1.0 mL) were then added at 0 °C sequentially by syringe. The resulting mixture was stirred at 50 °C for 24 hours. Upon completion as monitored by TLC, the solvent was removed under vacuum. The residue was purified directly by column chromatography, eluting with petroleum ether/ethyl acetate to afford **5** in 95% yield as colorless oil.

(c) Typical synthesis of 2,3,5-triphenyl-1H-pyrrole 6

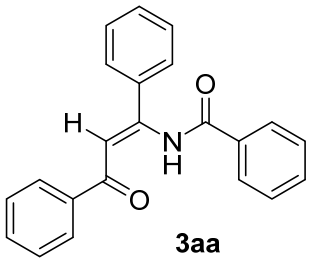
Under anhydrous conditions, titanium tetrachloride (2 mmol) was added dropwise using a syringe to a stirred suspension of samarium powder (2 mmol) in THF (15 mL) at at room room temperature under a nitrogen atmosphere. After the completion of addition, the mixture was refluxed for 2 h. The suspension of the low-valent titanium reagent formed was cooled to room temperature and a solution of substrates **3aa** (1 mmol) in anhydrous THF(2 mL) was added via a syringe. The mixture was refluxed for 1 h, and the deep dark color of the solution changed into a brownish red gradually. After completion monitored by TLC, the reaction was quenched with dilute HCl and extracted with ether (3 x 20 mL). The combined extract was washed with saturated brine (15 mL) and dried over anhydrous Na_2SO_4. After evaporating the solvent under reduced

pressure, the resulting crude product was purified silica gel column chromatography to afford **6** in 80% yield.

(d) Typical synthesis of 2,4,6-triphenyl-4H-1,3-oxazine 7

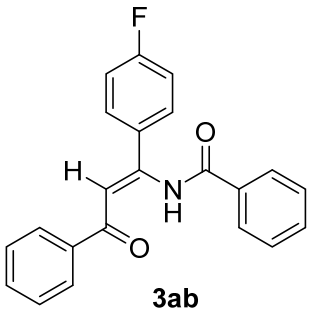
To a solution of BINAPO (10 mol%) and **3aa** (0.25 mmol) in dry dichloromethane (1 mL) was added dropwise trichlorosilane (ca. 3 M CH_2Cl_2 solution, 3 equiv.) at 0 °C. The reaction was stirred at rt for 24 h and quenched with water (3 mL) and dichloromethane (5 mL). The mixture was stirred for 1 h, filtered through a Celite pad with dichloromethane and extracted with dichloromethane for three times. The combined organic layers were dried over anhydrous Na_2SO_4, filtered, evaporated, and purified by silica gel column chromatography to afford **7** in 70% yield.

5. Characterization of Synthesized Compounds 3aa-3sa



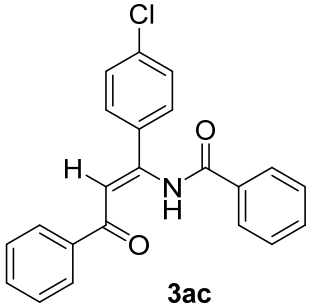
3aa

(Z)-N-(3-oxo-1,3-diphenylprop-1-en-1-yl)benzamide (3aa): Yellow oil, yield 88%, ^{1}H NMR (400 MHz, $CDCl_3$) δ 13.40 (s, 1H), 8.16 – 8.14 (m, 2H), 8.04 – 8.02 (m, 2H), 7.64 – 7.45 (m, 11H), 6.48 (s, 1H).^{13}C NMR (100 MHz, $CDCl_3$) δ 192.11, 165.34, 157.17, 138.64, 136.46, 133.44, 132.89, 132.86, 130.49, 129.90, 128.98, 128.76, 128.22, 127.96, 127.47, 105.45.HRMS (ESI): m/z calcd for $C_{22}H_{18}NO_2[M+H]^+$: 328.1338, found: 328.1336.



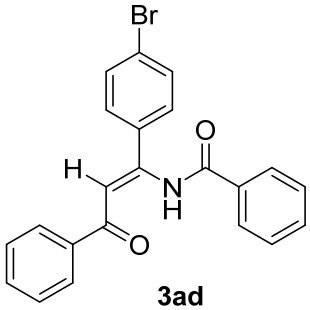
3ab

(Z)-N-(1-(4-fluorophenyl)-3-oxo-3-phenylprop-1-en-1-yl)benzamide (3ab): Yellow solid, m.p. 125.6 – 126.1°C, yield 83%, ^{1}H NMR (400 MHz, $CDCl_3$) δ 13.36 (s, 1H), 8.12-8.10 (m, 2H), 8.01 – 7.99 (m, 2H), 7.64 – 7.48 (m, 8H), 7.17 – 7.11 (m, 2H), 6.42 (s, 1H).^{13}C NMR (100 MHz, $CDCl_3$) δ 192.18, 165.54, 163.81 (d, J = 249 Hz), 156.08, 138.62, 133.36, 133.06, 132.50, 132.47, 129.55 (d, J = 8 Hz), 129.10, 128.88, 128.27, 128.03, 115.48 (d, J = 22 Hz), 105.50.HRMS (ESI): m/z calcd for $C_{22}H_{16}FNO_2[M+H]^+$: 346.1243, found: 346.1245.



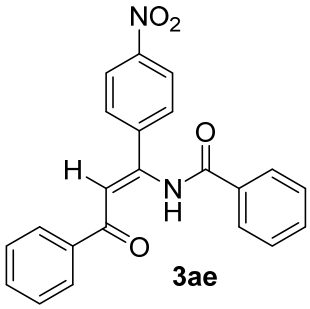
3ac

(Z)-N-(1-(4-chlorophenyl)-3-oxo-3-phenylprop-1-en-1-yl)benzamide (3ac): Yellow solid, m.p. 144.8 – 145.2°C, yield 84%, ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.77 (s, 1H), 8.13 (d, *J* = 7.2, Hz, 2H), 8.01 (d, *J* = 7.2 Hz, 2H), 7.73 – 7.61 (m, 6H), 7.57 – 7.51(m, 4H), 6.77 (s, 1H). ^{13}C NMR (100 MHz, DMSO-d_6) δ 191.30, 164.76, 153.78, 137.87, 134.78, 134.57, 133.28, 133.12, 133.06, 129.62, 129.15, 128.84, 128.24, 128.13, 127.79, 106.65. HRMS (ESI): m/z calcd for $C_{22}H_{17}ClNO_2[M+H]^+$: 362.0948, found: 362.0947.



3ad

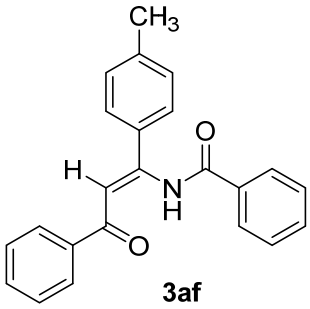
(Z)-N-(1-(4-bromophenyl)-3-oxo-3-phenylprop-1-en-1-yl)benzamide (3ad): Yellow solid, m.p. 181.4 – 181.8°C, yield 87%, ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.79 (s, 1H), 8.12 (d, *J* = 7.6 Hz, 2H), 8.01 (d, *J* = 7.2 Hz, 2H), 7.72 – 7.52 (m, 10H), 6.75 (s, 1H).^{13}C NMR (100 MHz, DMSO-d_6)δ 191.31, 164.74, 153.92, 137.86, 135.15, 133.29, 133.09, 131.05, 129.84, 129.16, 128.85, 128.25, 127.80, 123.37, 106.56.HRMS (ESI): m/z calcd for $C_{22}H_{17}BrNO_2[M+H]^+$: 406.0443, found: 406.0445.



3ae

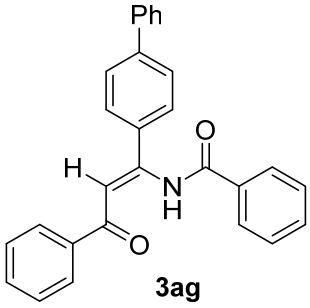
(Z)-N-(1-(4-nitrophenyl)-3-oxo-3-phenylprop-1-en-1-yl)benzamide (3ae): Yellow solid, m.p. 195.6 – 196.1°C, yield 82%,^{1}H NMR (400 MHz, $CDCl_3$) δ 13.37 (s, 1H), 8.31 (d, *J* = 8.8 Hz, 2H), 8.08 (d, *J* = 7.6 Hz, 2H), 8.01 (d, *J* = 7.6 Hz, 2H), 7.69 (d, *J* = 8.4 Hz, 2H), 7.64 – 7.59 (m, 2H), 7.57 – 7.46 (m, 4H), 6.45 (s, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 192.22, 165.46, 154.29, 148.41,

143.16, 138.25, 133.47, 133.34, 132.79, 129.20, 129.00, 128.62, 128.44, 128.27, 123.62, 106.35.HRMS (ESI): m/z calcd for $C_{22}H_{16}N_2O_4[M+H]^+$:373.1188, found: 372.1190.



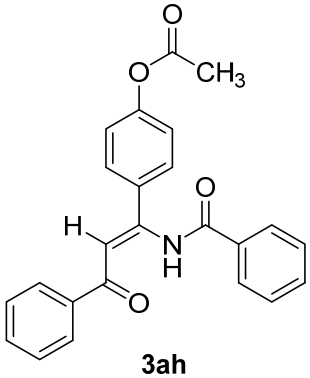
3af

(Z)-N-(3-oxo-3-phenyl-1-(p-tolyl)prop-1-en-1-yl)benzamide(3af): White solid, m.p.96.4 – 96.7, yield 89%, ^{1}H NMR (400 MHz, DMSO-d_6)) δ 12.82 (s, 1H), 8.11 (d, *J* = 7.2 Hz, 2H), 8.02 (d, *J* = 7.2 Hz, 2H), 7.71– 7.68 (m, 1H), 7.63 (q, *J* = 6.8 Hz, 3H), 7.55– 7.52 (m, 4H), 7.25 (d, *J* = 8.0 Hz, 2H), 6.70 (s, 1H), 2.37 (s, 3H).^{13}C NMR (100 MHz, DMSO-d_6) δ 191.13, 164.66, 155.46, 139.78, 138.03, 133.29, 132.97, 132.91, 132.85, 129.02, 128.71, 128.60, 128.02, 127.69, 127.65, 105.69, 20.91.HRMS (ESI): m/z calcd for $C_{23}H_{20}NO_2[M+H]^+$: 342.1494, found: 342.1491.



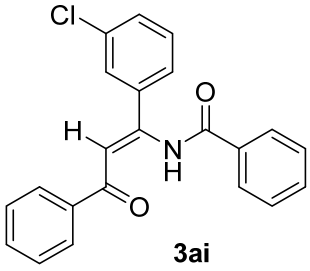
3ag

(Z)-N-(1-([1,1'-biphenyl]-4-yl)-3-oxo-3-phenylprop-1-en-1-yl)benzamide(3ag): White solid, m.p. 188.5 – 188.7, yield 89%, ^{1}H NMR (400 MHz, DMSO-d_6) δ12.83 (s, 1H), 8.15 (d, *J* = 7.2 Hz, 2H), 8.04 (d, *J* = 7.2Hz, 2H), 7.75– 7.40 (m, 15H), 6.82 (s, 1H).^{13}C NMR (100 MHz, DMSO-d_6) δ 191.24, 164.82, 154.83, 141.64, 139.40, 138.02, 134.93, 133.23, 133.18, 129.15, 129.10, 128.84, 128.44, 128.20, 127.95, 127.81 126.79, 126.34, 106.36.HRMS (ESI): m/z calcd for $C_{28}H_{22}NO_2[M+H]^+$: 404.1651, found: 404.1654.



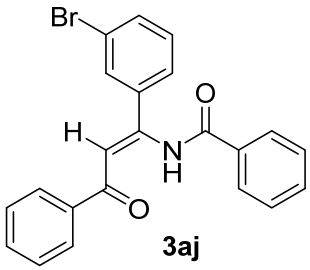
3ah

(Z)-4-(1-benzamido-3-oxo-3-phenylprop-1-en-1-yl)phenyl acetate(3ah): White solid, m.p. 92.8 – 93.4, yield 87%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.81 (s, 1H), 8.14 (d, *J* = 7.6 Hz, 2H), 8.03 (d, *J* = 7.2 Hz, 2H), 7.71– 7.69 (m, 3H), 7.66– 7.61 (m, 3H), 7.54 (t, *J* = 7.6 Hz, 2H), 7.22 (d, *J* = 8.4 Hz, 2H), 6.77 (s, 1H), 2.31 (s, 3H).^{13}C NMR(100 MHz, DMSO-d_6) δ 191.23, 169.10, 164.75, 154.29, 151.77, 137.95, 133.30, 133.21,133.19,133.00,129.12, 129.08, 128.81, 128.21, 127.80, 121.56, 106.47, 20.93.HRMS (ESI): m/z calcd for $C_{24}H_{20}NO_4[M+H]^+$: 386.1392, found: 386.1391.



3ai

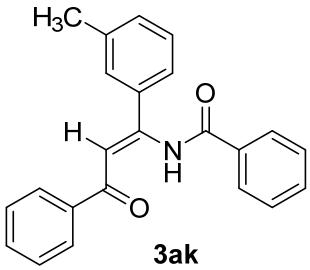
(Z)-N-(1-(3-chlorophenyl)-3-oxo-3-phenylprop-1-en-1-yl)benzamide(3ai): Yellow solid, m.p. 104.2 – 104.5°C, yield 82%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.80 (s, 1H), 8.14 (d, *J* = 7.6 Hz, 2H), 8.01 (d, *J* = 7.2 Hz, 2H), 7.73– 7.67 (m, 2H), 7.64 – 7.60 (m, 3H), 7.58– 7.53 (m, 4H), 7.48 – 7.44 (m, 1H), 6.77 (s, 1H).^{13}C NMR (100 MHz, DMSO-d_6) δ 191.37, 164.66, 153.33, 138.08, 137.78, 133.28, 133.06, 133.03, 132.84, 129.88, 129.54, 129.11, 128.79, 128.28, 127.78, 127.30 , 126.47, 106.91.HRMS (ESI): m/z calcd for $C_{22}H_{17}ClNO_2[M+H]^+$: 362.0948, found: 362.0945.



3aj

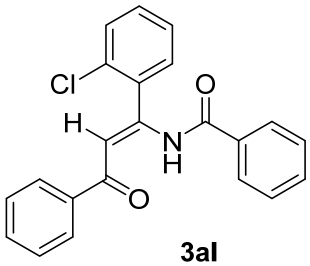
(Z)-N-(1-(3-bromophenyl)-3-oxo-3-phenylprop-1-en-1-yl)benzamide(3aj): Yellow solid, m.p. 96.3 – 96.5°C, yield 82%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.82 (s, 1H), 8.14 (d, *J* = 7.6 Hz, 2H), 8.01 (d, *J* = 7.6Hz, 2H), 7.84 (s, 1H), 7.69 – 7.60(m, 6H), 7.53 (t, *J* = 7.6 Hz, 2H), 7.39 (t, *J*=

7.6 Hz, 1H), 6.74 (s, 1H).^{13}C NMR(100 MHz, DMSO-d_6) δ191.30, 164.57, 153.25, 138.25, 137.75, 133.19, 133.01, 132.94, 132.36,130.04, 129.98, 129.03, 128.71, 128.21, 127.72, 126.78, 121.28, 106.80.HRMS (ESI): m/z calcd for $C_{22}H_{17}BrNO_2[M+H]^+$: 406.0443, found: 406.0446.



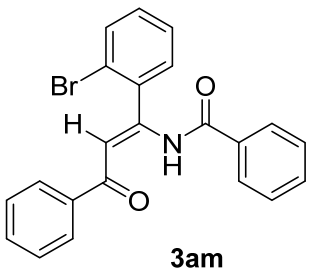
3ak

(Z)-N-(3-oxo-3-phenyl-1-(m-tolyl)prop-1-en-1-yl)benzamide(3ak): Yellow solid, m.p.113.7 – 114.1 °C, yield 85%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 13.36 (s, 1H), 8.14 – 8.12 (m, 2H), 8.03 –8.01 (m, 2H), 7.64– 7.48 (m, 6H), 7.37– 7.29 (m, 4H), 6.46 (s, 1H), 2.44 (s, 3H).^{13}C NMR (100 MHz, $CDCl_3$) δ 192.18, 165.41, 157.50, 138.76, 138.02, 136.52, 133.55, 132.89, 130.80, 129.02, 128.80, 128.29, 128.16, 128.00, 127.93, 124.72, 105.41, 21.63.HRMS (ESI): m/z calcd for $C_{23}H_{20}NO_2[M+H]^+$: 342.1494, found: 342.1496.



3al

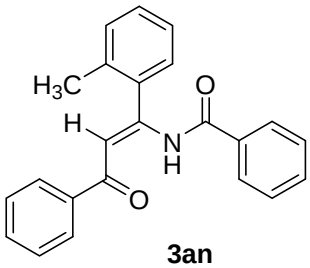
(Z)-N-(1-(2-chlorophenyl)-3-oxo-3-phenylprop-1-en-1-yl)benzamide(3al): Yellow solid, m.p. 142.3 – 142.6°C, yield 81%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 13.54 (s, 1H), 8.11 (d, *J* = 7.6 Hz, 2H), 7.97 (d, *J* = 7.2 Hz, 2H), 7.71 (t, *J* = 7.2 Hz, 1H), 7.67– 7.62 (m, 3H), 7.59 – 7.44 (m, 6H), 6.53 (s, 1H). ^{13}C NMR (100 MHz, DMSO-d_6) δ 191.90, 163.59, 153.02, 137.58, 135.42, 133.39, 133.38, 133.17, 132.67, 131.25, 130.43, 129.83, 129.30, 128.92, 128.89, 128.19, 127.57, 127.13, 104.71.HRMS (ESI): m/z calcd for $C_{22}H_{17}ClNO_2[M+H]^+$: 362.0948, found: 362.0949.



3am

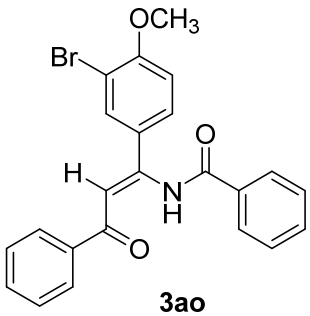
(Z)-N-(1-(2-bromophenyl)-3-oxo-3-phenylprop-1-en-1-yl)benzamide(3am): Yellow solid, m.p. 106.3 – 106.5°C, yield 82%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 13.55 (s, 1H), 8.12 (d, *J* = 7.2 Hz,

2H), 7.97 (d,*J* = 7.2Hz, 2H), 7.74 – 7.63 (m, 5H), 7.56 – 7.45 (m, 4H), 7.40 (td, *J* = 7.6, 1.6 Hz, 1H), 6.52 (s, 1H).^{13}C NMR (100 MHz, DMSO-d_6)δ191.93, 163.45, 154.31, 137.55, 137.39, 133.41, 133.18, 132.69, 132.04, 130.46, 129.84, 129.32, 128.90, 128.19, 127.56, 120.99, 104.48HRMS (ESI): m/z calcd for $C_{22}H_{17}BrNO_2[M+H]^+$: 406.0443, found: 406.0447.



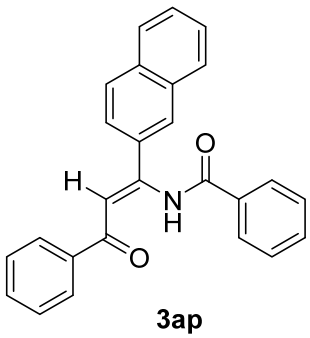
3an

(Z)-N-(3-oxo-3-phenyl-1-(o-tolyl)prop-1-en-1-yl)benzamide(3an): White solid, m.p. 89.2 – 89.3ºC, yield 84%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 13.60 (s, 1H), 8.09 (d, *J* = 7.2 Hz, 2H), 8.00 (d, *J* = 6.8 Hz, 2H), 7.70 (t, *J* = 7.2 Hz, 1H), 7.65– 7.61 (m, 3H), 7.52 (t, *J* = 7.6 Hz, 2H), 7.35 (t, *J* = 7.6 Hz, 2H), 7.29– 7.24 (m, 2H), 6.43 (s, 1H), 2.27 (s, 3H).^{13}C NMR (100 MHz, DMSO-d_6) δ 191.62, 163.72, 156.18, 137.80, 136.34, 134.96, 133.16, 133.08, 132.92, 129.61, 129.23, 128.83, 128.70, 128.09, 127.72, 127.61, 125.58, 104.42, 19.30. HRMS (ESI): m/z calcd for $C_{23}H_{20}NO_2[M+H]^+$: 342.1494, found: 342.1493.



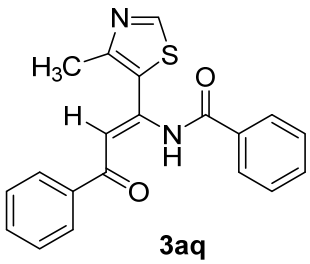
3ao

(Z)-N-(1-(3-bromo-4-methoxyphenyl)-3-oxo-3-phenylprop-1-en-1-yl)benzamide(3ao): White solid, m.p.135.8 – 136.2ºC, yield 88%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 13.31 (s, 1H), 8.11(d, *J* = 7.2 Hz, 2H), 8.00(d, *J* = 7.2 Hz, 2H), 7.76 (d, *J* = 1.2 Hz, 1H), 7.62– 7.47(m, 7H), 6.95 (d, *J* = 8.8 Hz, 1H), 6.42 (s, 1H), 3.95 (s, 3H).^{13}C NMR(100 MHz, $CDCl_3$) δ 192.11, 165.60, 157.34, 155.38, 138.70, 133.47, 133.01, 132.34, 129.93, 129.08, 128.86, 128.41, 128.29, 128.04, 111.59, 111.31, 105.30, 56.48.HRMS (ESI): m/z calcd for $C_{23}H_{19}BrNO_3[M+H]^+$: 436.0548, found: 436.0541.



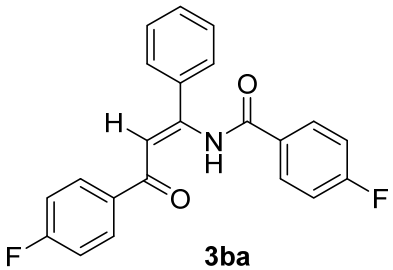
3ap

(Z)-N-(1-(naphthalen-2-yl)-3-oxo-3-phenylprop-1-en-1-yl)benzamide(3ap): White solid, m.p. 167.6 – 167.9 °C, yield 89%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.96 (s, 1H), 8.29 (s, 1H), 8.17 (d, *J* = 7.6 Hz, 2H), 8.04 (d, *J* = 7.2 Hz, 3H),7.99 – 7.93 (m, 2H), 7.74 – 7.55 (m, 9H), 6.89 (s, 1H).^{13}C NMR (100 MHz, DMSO-d_6) δ191.30,164.77, 155.31, 138.03, 133.67, 133.58, 133.14, 133.22, 133.06, 132.52, 129.18,128.86, 128.61, 128.23, 127.83, 127.57,127.24, 127.05, 126.55, 125.49, 106.53.HRMS (ESI): m/z calcd for $C_{26}H_{20}NO_2[M+H]^+$: 378.1494, found: 378.1497.



3aq

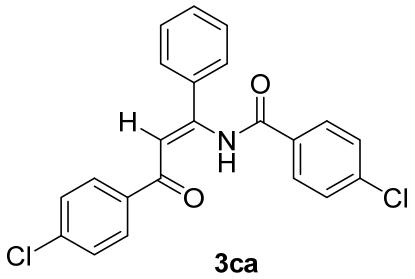
(Z)-N-(1-(4-methylthiazol-5-yl)-3-oxo-3-phenylprop-1-en-1-yl)benzamide(3aq): Yellow solid, m.p. 121.3 – 121.8 °C, yield 86%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.87 (s, 1H), 9.14 (s, 1H), 8.08 (d, *J* = 7.6 Hz, 2H), 8.00 (d, *J* = 7.2 Hz, 2H), 7.72 – 7.67(m, 1H), 7.65– 7.60 (m, 3H), 7.54 (t, *J* = 7.6 Hz, 2H), 6.76 (s, 1H), 2.49 (s, 3H).^{13}C NMR(100 MHz, DMSO-d_6) δ190.84, 164.42, 153.82, 152.02, 145.61, 137.65, 133.35,133.11, 132.93,129.18,128.89, 128.19, 127.73, 126.58, 107.85, 16.24.HRMS (ESI): m/z calcd for $C_{20}H_{17}N_2O_2S[M+H]^+$: 349.1011, found: 349.1015.



3ba

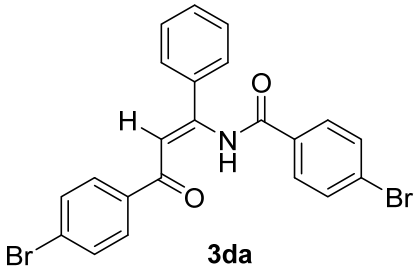
(Z)-4-fluoro-N-(3-(4-fluorophenyl)-3-oxo-1-phenylprop-1-en-1-yl)benzamide(3ba): White solid, m.p.144.2 – 144.7°C, yield 77%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.68 (s, 1H), 8.20 (dd, *J* = 8.8, 5.6 Hz, 2H), 8.07 (dd, *J* = 8.8, 5.6 Hz, 2H), 7.63 (d, *J* = 6.8 Hz, 2H), 7.45 – 7.42(m, 5H),

7.34 (t, *J* = 8.8 Hz, 2H), 6.73 (s, 1H).^{13}C NMR (100 MHz, DMSO-d_6) δ 189.74, 165.05 (d, *J* = 250 Hz), 164.85 (d, *J* = 249 Hz), 163.68, 155.10, 135.81, 134.59 (d, *J* = 3 Hz), 131.20 (d, *J* = 10 Hz), 130.65 (d, *J* = 10 Hz), 129.97, 129.84 (d, *J* = 3 Hz),128.09, 127.73, 116.13 (d, *J* = 22 Hz),115.79 (d, *J* = 21Hz),106.41.HRMS (ESI): m/z calcd for $C_{22}H_{16}F_2NO_2[M+H]^+$: 364.1149, found: 364.1147.



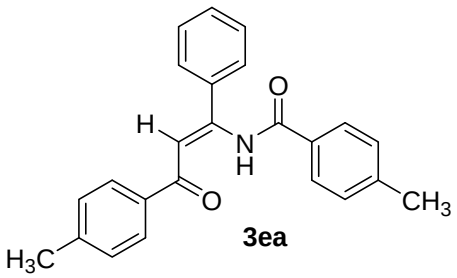
3ca

(Z)-4-chloro-N-(3-(4-chlorophenyl)-3-oxo-1-phenylprop-1-en-1-yl)benzamide(3ca): Yellowsoli d, m.p.119.1 – 119.6ºC, yield 74%.^{1}H NMR (400 MHz, $CDCl_3$) δ 13.36 (s, 1H), 8.04 (d, *J* = 8.4 Hz, 2H), 7.94 (d, *J* = 8.8 Hz, 2H), 7.54 – 7.44 (m, 9H), 6.39 (s, 1H).^{13}C NMR (100 MHz, $CDCl_3$) δ 190.83, 164.32, 157.68, 139.49, 139.44, 136.90, 136.14, 131.85, 130.19, 129.67, 129.44, 129.35, 129.15, 128.35, 127.50, 105.13.HRMS (ESI): m/z calcd for $C_{22}H_{16}Cl_2NO_2[M+H]^+$: 396.0558, found: 396.0555.



3da

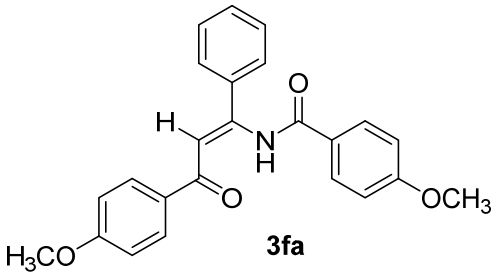
(Z)-4-bromo-N-(3-(4-bromophenyl)-3-oxo-1-phenylprop-1-en-1-yl)benzamide(3da): Yellow solid, m.p.128.3 – 128.7ºC, yield 74%.^{1}H NMR (400 MHz, $CDCl_3$) δ 13.35 (s, 1H), 7.96 (d, *J* = 4.8 Hz, 2H), 7.86 (d, *J* = 4.8 Hz, 2H), 7.68 (d, *J* = 4.8 Hz, 2H), 7.63 (d, *J* = 5.2 Hz, 2H), 7.53 – 7.45 (m, 5H), 6.39 (s, 1H).^{13}C NMR (100 MHz, $CDCl_3$) δ 191.06, 164.51, 157.76, 137.37, 136.15, 132.39, 132.34, 132.18, 130.24, 129.82, 129.58, 128.39, 128.24, 128.11, 127.53, 105.14.HRMS (ESI): m/z calcd for $C_{22}H_{16}Br_2NO_2[M+H]^+$: 483.9548, found: 483.9551.



3ea

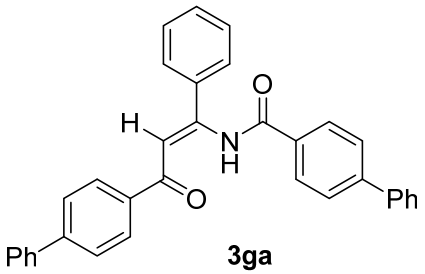
(Z)-4-methyl-N-(3-oxo-1-phenyl-3-(p-tolyl)prop-1-en-1-yl)benzamide(3ea): Yellow oil, yield 70%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 13.38 (s, 1H), 8.02 (d, *J* = 8.0 Hz, 2H), 7.93 (d, *J* = 8.0 Hz, 2H), 7.57 – 7.54 (m, 2H), 7.48 – 7.43(m, 3H), 7.32 (dd, *J* = 16.8, 8.0 Hz, 4H), 6.43 (s, 1H), 2.45 (s, 3H), 2.43 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 191.77, 165.34, 156.98, 143.73, 143.54, 136.75, 136.18, 130.79, 129.78, 129.67, 129.49, 128.32, 128.21, 128.12, 127.48, 105.31, 21.75, 21.72.

HRMS (ESI): m/z calcd for $C_{24}H_{22}NO_2[M+H]^+$: 356.1651, found: 356.1655.



3fa

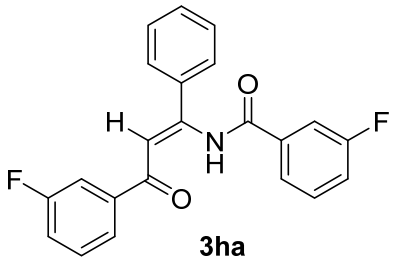
(Z)-4-methoxy-N-(3-(4-methoxyphenyl)-3-oxo-1-phenylprop-1-en-1-yl)benzamide(3fa): Light yellow oil, yield 69%. ^{1}H NMR (400 MHz, $CDCl_3$) δ13.38 (s, 1H),8.07 (d, *J* = 8.8 Hz, 2H), 8.00 (d, *J* = 7.2 Hz, 2H), 7.54 – 7.52 (m, 2H), 7.46 – 7.43(m, 3H), 6.99 (dd, *J* = 17.0, 9.0 Hz, 4H), 6.38 (s, 1H), 3.89 (s, 3H), 3.88 (s, 3H).^{13}C NMR(100 MHz, $CDCl_3$) δ 190.78, 164.93, 163.53, 163.35, 156.84, 136.96, 131.64, 130.36, 130.30, 129.72, 128.23, 127.49, 126.02, 114.24, 114.04, 105.02, 55.64.HRMS (ESI): m/z calcd for $C_{24}H_{22}NO_4[M+H]^+$: 388.1549, found: 388.1551.



3ga

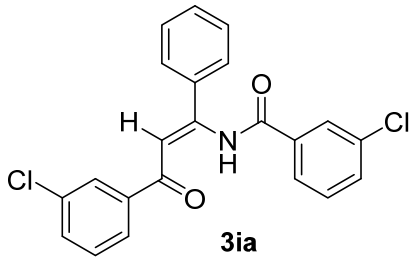
(Z)-N-(3-([1,1'-biphenyl]-4-yl)-3-oxo-1-phenylprop-1-en-1-yl)-[1,1'-biphenyl]-4-carboxamide (3ga): White solid, m.p.148.4 – 148.8°C, yield 73%.^{1}H NMR (400 MHz, $CDCl_3$) δ 13.50 (s, 1H), 8.21 (d, *J* = 8.4 Hz, 2H), 8.11 (d, *J* = 8.4 Hz, 2H), 7.78 (d, *J* = 8.4 Hz, 2H), 7.73 (d, *J* = 8.4 Hz, 2H),7.68 – 7.65 (m, 4H), 7.61 – 758(m, 2H), 7.52 – 7.46 (m, 7H), 7.44 – 7.40 (m, 2H), 6.52 (s, 1H).^{13}C NMR (100 MHz, $CDCl_3$) δ 191.67, 183.53, 165.17, 157.31, 145.68, 145.66, 140.01, 139.97, 137.47, 136.62, 132.23, 129.99, 129.11, 128.88, 128.68, 128.38, 128.33, 127.70, 127.58, 127.48,

127.43, 127.41, 105.49.HRMS (ESI): m/z calcd for $C_{34}H_{26}NO_2[M+H]^+$: 480.1964, found: 480.1966.



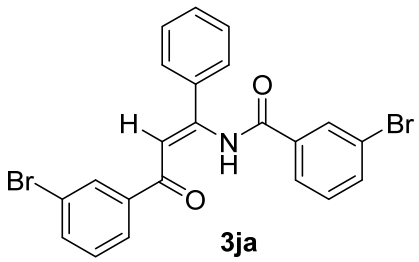
3ha

(Z)-3-Fluoro-N-(3-(3-fluorophenyl)-3-oxo-1-phenylprop-1-en-1-yl)benzamide(3ha): White solid, m.p. 90.3 – 90.6°C, yield 74%.^{1}H NMR (400 MHz, DMSO-d_6) δ 12.61 (s, 1H), 7.95 (d, *J* = 7.6 Hz, 1H), 7.91-7.85 (m, 2H), 7.75 (d, *J* = 9.6 Hz, 1H), 7.68 – 7.64 (m, 3H), 7.58 – 7.51 (m, 2H), 7.49-7.43 (m, 4H), 6.75 (s, 1H).^{13}C NMR (100 MHz, DMSO) δ 189.69, 162.30 (d, *J* = 244Hz),162.21 (d, *J* = 244Hz),155.08, 140.16 (d, *J* = 7 Hz), 135.63 (d, *J* = 7 Hz), 135.56, 131.27 (d, *J* = 8 Hz), 130.83 (d, *J* = 8 Hz),130.06, 128.07, 127.81,124.33, 124.31, 123.79, 123.76, 119.99 (d, *J* = 9 Hz), 119.78 (d, *J* = 9 Hz),119.88 (dd, *J* = 21, 9 Hz), 114.68 (dd, *J* = 23, 3 Hz), 106.78.HRMS (ESI): m/z calcd for $C_{22}H_{16}F_2NO_2[M+H]^+$: 364.1149, found: 364.1152.



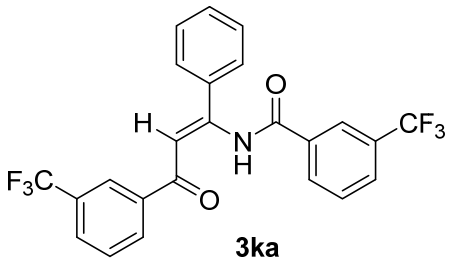
3ia

(Z)-3-Chloro-N-(3-(3-chlorophenyl)-3-oxo-1-phenylprop-1-en-1-yl)benzamide(3ia): Yellow oil, yield 72%.^{1}H NMR (400 MHz, DMSO-d_6) δ 12.36 (s, 1H), 8.13 (s, 1H), 8.07 (d, *J* = 8.0 Hz, 1H), 7.99 (s, 1H), 7.95 (d, *J* = 8.0 Hz, 1H), 7.77 (d, *J* = 8.0 Hz, 1H), 7.72 – 7.63 (m, 4H), 7.57 (t, *J* = 8.0 Hz, 1H), 7.52– 7.44 (m, 3H), 6.82 (s, 1H).^{13}C NMR (100 MHz, DMSO-d_6) δ 189.57, 163.55, 154.32,139.82, 135.57, 135.36, 133.73, 132.71, 132.57, 130.96, 130.67, 130.10, 128.28, 128.10, 127.86,127.77, 127.59, 126.82, 126.37, 107.51.HRMS (ESI): m/z calcd for $C_{22}H_{16}Cl_2NO_2[M+H]^+$: 396.0558, found: 396.0555.



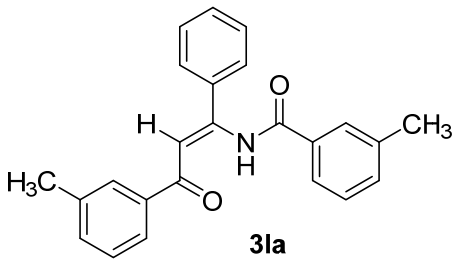
3ja

(Z)-3-Bromo-N-(3-(3-bromophenyl)-3-oxo-1-phenylprop-1-en-1-yl)benzamide(3ja): Yellow oil, yield 73%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 13.27 (s, 1H), 8.21 (t, *J* = 1.6 Hz, 1H), 8.13 (t, *J* = 1.6 Hz, 1H), 8.03 (d, *J* = 8.0 Hz, 1H), 7.92 (d, *J* = 8.0 Hz, 1H), 7.75– 7.69 (m, 2H), 7.54 – 7.35 (m, 7H), 6.39 (s, 1H).^{13}C NMR (100 MHz, $CDCl_3$) δ 190.63, 164.05, 157.83, 140.39, 135.98, 135.86, 135.39, 131.73, 131.14, 131.05, 130.59, 130.42, 130.32, 128.42, 127.53, 126.57, 126.49, 123.36, 123.22, 105.31.HRMS (ESI): m/z calcd for $C_{22}H_{16}Br_2NO_2[M+H]^+$:483.9548, found: 483.9550.



3ka

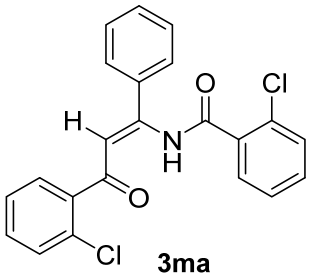
(Z)-N-(3-oxo-1-phenyl-3-(3-(trifluoromethyl)phenyl)prop-1-en-1-yl)-3-(trifluoromethyl)benz amide(3ka): Yellow oil, yield 74%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 13.43 (s, 1H), 8.37 (s, 1H), 8.31 (d, *J* = 7.6 Hz, 1H), 8.27 (s, 1H), 8.19 (d, *J* = 8.0 Hz, 1H), 7.88 (d, *J* = 7.6 Hz, 1H), 7.84 (d, *J* = 8.0 Hz, 1H),7.72 (t, *J* = 7.6 Hz, 1H), 7.65 (t, *J* = 7.6 Hz, 1H), 7.57 – 7.55 (m, 2H), 7.53 – 7.46 (m, 3H),6.48 (s, 1H).^{13}C NMR(100 MHz, $CDCl_3$) δ190.70, 164.08, 158.21, 139.12, 135.86, 134.28,131.99, 131.68, 131.19, 131.05, 130.99, 130.46, 129.78, 129.59, 129.54, 129.47, 128.48, 127.57, 125.75, 124.97,122.42,105.21. HRMS (ESI): m/z calcd for$C_{24}H_{16}F_6NO_2[M+H]^+$: 464.1085, found: 464.1089.



3la

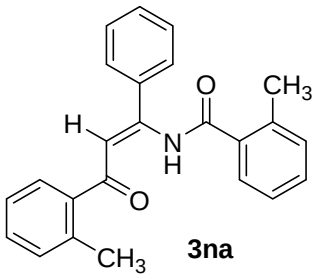
(Z)-3-Methyl-N-(3-oxo-1-phenyl-3-(m-tolyl)prop-1-en-1-yl)benzamide(3la): Yellow oil, yield 68%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.84 (s, 1H), 7.94 (s, 1H), 7.90 (d, *J* = 7.2 Hz, 1H), 7.82 (s, 2H), 7.62 (d, *J* = 6.8 Hz, 2H), 7.50 (d, *J* = 5.2 Hz, 2H), 7.51– 7.39 (m, 5H), 6.69 (s, 1H), 2.41

(s, 3H), 2.38 (s, 3H).^{13}C NMR (100 MHz, DMSO-d_6) δ 191.33, 164.73, 155.26, 138.49, 138.18, 138.00, 135.94, 133.70,133.51, 133.27, 129.79, 128.93, 128.62, 128.54, 128.26, 128.02, 127.64, 125.31, 124.81, 106.18, 20.93, 20.84.HRMS (ESI): m/z calcd for $C_{24}H_{22}NO_2[M+H]^+$: 356.1651, found: 356.1655.



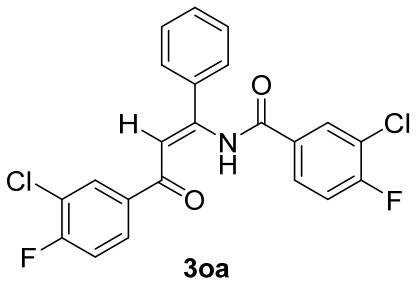
3ma

(Z)-2-Chloro-N-(3-(2-chlorophenyl)-3-oxo-1-phenylprop-1-en-1-yl)benzamide(**3ma**): Yellow oil, yield 71%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 12.27 (s, 1H), 7.73 (dd, *J* = 7.6, 1.6 Hz, 1H), 7.59 (dd, *J* = 7.6, 1.6 Hz, 2H), 7.56 (dd, *J* = 7.6, 1.6 Hz, 1H), 7.50 – 7.41 (m, 6H), 7.40 – 7.32 (m, 3H),6.25 (s, 1H).^{13}C NMR (100 MHz, $CDCl_3$) δ 193.35, 165.51, 155.15, 139.69, 135.66, 134.60, 132.34, 132.00, 131.38, 130.91, 130.70, 130.30, 130.26, 129.82, 128.41, 127.67, 127.31, 127.13, 110.15.HRMS (ESI): m/z calcd for $C_{22}H_{16}Cl_2NO_2[M+H]^+$: 396.0558, found: 396.0562.



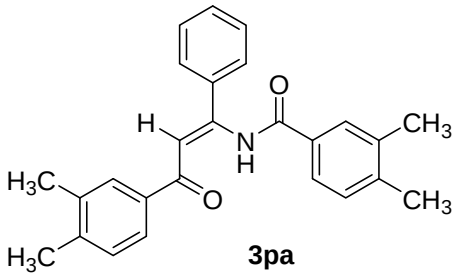
3na

(Z)-2-Methyl-N-(3-oxo-1-phenyl-3-(o-tolyl)prop-1-en-1-yl)benzamide(3na): Yellow solid, m.p. 121.2 – 121.5^{o}C, yield 68%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.94 (s, 1H), 7.74 (t, *J* = 6.8 Hz, 2H), 7.66– 7.64 (m, 2H), 7.48– 7.44(m, 4H), 7.42– 7.28 (m, 5H), 6.32 (s, 1H), 2.45 (s, 3H), 2.41 (s, 3H).^{13}C NMR (100 MHz, DMSO-d_6) δ 195.19, 167.11, 152.85, 139.18, 137.01, 136.88, 135.90, 134.62, 131.42, 131.36, 131.07, 129.88, 128.58, 128.16, 127.61, 127.54, 126.13, 125.85, 110.60, 20.39, 19.83.HRMS (ESI): m/z calcd for $C_{24}H_{22}NO_2[M+H]^+$: 356.1651, found: 356.1653.



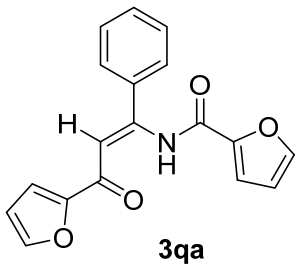
3oa

(Z)-3-chloro-N-(3-(3-chloro-4-fluorophenyl)-3-oxo-1-phenylprop-1-en-1-yl)-4-fluorobenzamide(3oa): White solid, m.p.153.8 – 154.1°C, yield 76%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 13.29 (s, 1H), 8.15 (dd, *J* = 6.8, 2.0 Hz, 1H), 8.09 (dd, *J* = 6.8, 2.0 Hz, 1H), 8.02– 7.98 (m, 1H), 7.93 – 7.89 (m, 1H), 7.52 – 7.44 (m, 5H), 7.32 (d, *J* = 8.5 Hz, 1H), 7. 29–7.24 (m, 1H), 6.37 (s, 1H).^{13}C NMR (100 MHz, $CDCl_3$) δ 189.47, 163.24, 161.13(d, *J* = 255 Hz), 161.09 (d, *J* = 249 Hz), 158.07, 135.86, 135.65 (d, *J* = 3 Hz), 131.53, 131.03, 130.68 (d, *J* = 2 Hz), 130.44, 128.46, 128.31 (d, *J* = 9 Hz), 127.52, 122.42 (d, *J* =19 Hz), 122.19 (d, *J* =18 Hz), 117.31 (d, *J* =19 Hz), 117.18, 117.09 (d, *J* =18 Hz), 104.92.HRMS (ESI): m/z calcd for $C_{22}H_{14}Cl_2F_2NO_2[M+H]^+$: 432.0370, found:432.0371.



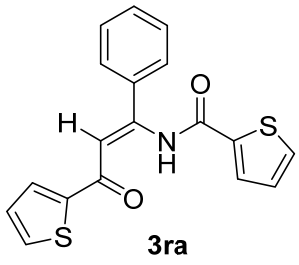
3pa

(Z)-N-(3-(3,4-dimethylphenyl)-3-oxo-1-phenylprop-1-en-1-yl)-3,4-dimethylbenzamide(3pa): Light yellow oil, yield 64%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 13.31 (s, 1H), 7.86 (d, *J* = 6.4 Hz, 2H), 7.79 (s, 1H), 7.74 (d, *J* = 8.0 Hz, 1H), 7.55 – 7.53 (m, 2H), 7.47 – 7.42 (m, 3H), 7.28 (d, *J* = 8.4 Hz, 1H), 7.24 (d, *J* = 8.0 Hz, 1H), 6.42 (s, 1H), 2.36 – 2.34 (m, 12H).^{13}C NMR (100 MHz, $CDCl_3$) δ 192.03, 165.64, 156.85, 142.49, 142.25, 137.37, 137.20, 136.95, 136.68, 131.20, 131.16, 130.21, 130.04, 129.71, 129.64, 129.20, 128.23, 127.51, 125.71, 105.44, 20.03, 19.99, 19.97, 19.93.HRMS (ESI): m/z calcd for $C_{26}H_{26}NO_2[M+H]^+$: 384.1964, found: 384.1965.



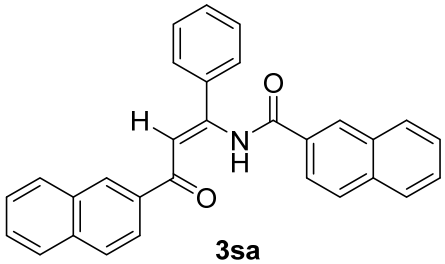
3qa

(Z)-N-(3-(furan-2-yl)-3-oxo-1-phenylprop-1-en-1-yl)furan-2-carboxamide(3qa): White solid, m.p.137.1 – 137.4°C, yield 73%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.72 (s, 1H), 8.06 (d, *J* = 12.0 Hz, 2H), 7.69 (d, *J* = 3.2 Hz, 1H), 7.55 (d, *J* = 7.2 Hz, 2H), 7.49– 7.41 (m, 3H), 7.33 (d, *J* = 3.2 Hz, 1H), 6.82 – 6.70 (m, 2H), 6.45 (s, 1H).^{13}C NMR (100 MHz, DMSO-d_6) δ 178.90, 155.04, 154.22, 152.71, 148.32, 147.06, 146.75, 135.42, 129.85, 127.98, 127.64, 118.64, 117.00, 113.01, 105.65.HRMS (ESI): m/z calcd for $C_{18}H_{14}NO_4[M+H]^+$: 308.0923, found: 308.0925.



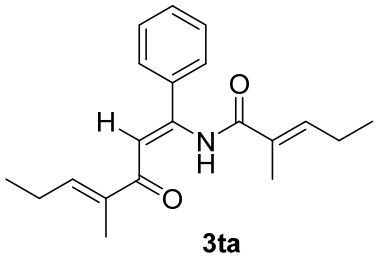
3ra

(Z)-N-(3-oxo-1-phenyl-3-(thiophen-2-yl)prop-1-en-1-yl)thiophene-2-carboxamide(3ra): White solid, m.p.160.1 – 160.4°C, yield 74%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 13.17 (s, 1H), 7.94 (dd, *J* = 3.6, 0.8 Hz, 1H), 7.78 (dd, *J* = 3.6, 0.8 Hz, 1H), 7.68 (dd, *J* = 4.8, 0.8 Hz, 1H), 7.61 (dd, *J* = 4.8, 0.8 Hz, 1H), 7.54 – 7.52 (m, 2H), 7.48 – 7.42 (m, 3H), 7.19 – 7.15(m, 2H), 6.26 (s, 1H). ^{13}C NMR(100 MHz, $CDCl_3$) δ 184.47, 159.88, 156.63, 145.78, 139.12, 135.97, 134.06, 132.82, 131.23, 130.61, 130.05, 128.56, 128.32, 128.27, 127.61, 105.05.HRMS (ESI): m/z calcd for $C_{18}H_{14}NO_2S_2[M+H]^+$: 340.0466, found: 340.0470.



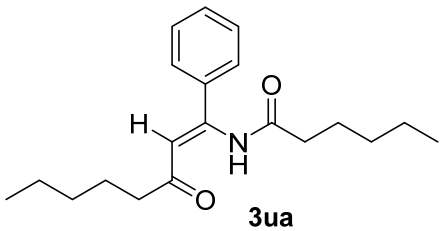
3sa

(Z)-N-(3-(naphthalen-2-yl)-3-oxo-1-phenylprop-1-en-1-yl)-2-naphthamide (3sa): White solid, m.p.194.1 – 194.5 ºC, yield 75%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 13.01 (s, 1H), 8.90 (s, 1H), 8.72 (s, 1H), 8.18 – 8.12 (m, 4H), 8.06 – 8.02 (m, 3H), 7.99 (d, *J* = 8.0 Hz, 1H), 7.73 – 7.60 (m, 6H), 7.50 (d, *J* = 7.2 Hz, 3H), 6.97 (s, 1H).^{13}C NMR (100 MHz, DMSO-d_6) δ 191.47, 165.35, 155.63, 136.52, 135.75, 135.46, 135.29, 132.78, 132.66, 131.13, 130.37, 130.16, 129.78, 129.31, 129.27, 129.14, 129.03, 128.88, 128.60, 128.22, 128.10, 127.68, 127.36, 124.27, 106.96.HRMS (ESI): m/z calcd for $C_{30}H_{22}NO_2[M+H]^+$: 428.1651, found: 428.1654.



3ta

(Z)-2-Methyl-N-((1Z,4E)-4-methyl-3-oxo-1-phenylhepta-1,4-dien-1-yl)pent-2-enamide(3ta):L ight yellow oil, yield 63%.^{1}H NMR (400 MHz, $CDCl_3$) δ 12.47 (s, 1H), 7.42 – 7.37 (m, 5H), 6.70 (td, *J* = 7.2, 1.2 Hz, 1H), 6.62 (td, *J* = 7.2, 1.2 Hz, 1H), 6.06 (s, 1H), 2.30 – 2.21 (m, 4H), 1.93 (s, 3H), 1.88(s, 3H), 1.11 – 1.06 (m, 6H).^{13}C NMR(100 MHz, $CDCl_3$) δ 194.26, 167.71, 155.20, 142.78, 141.69, 137.68, 137.35, 131.01, 129.35, 128.13, 127.20, 104.92, 22.50, 22.27, 13.23, 13.05, 12.46, 11.79.HRMS (ESI): m/z calcd for $C_{20}H_{26}NO_2[M+H]^+$: 312.1964, found: 312.1967.

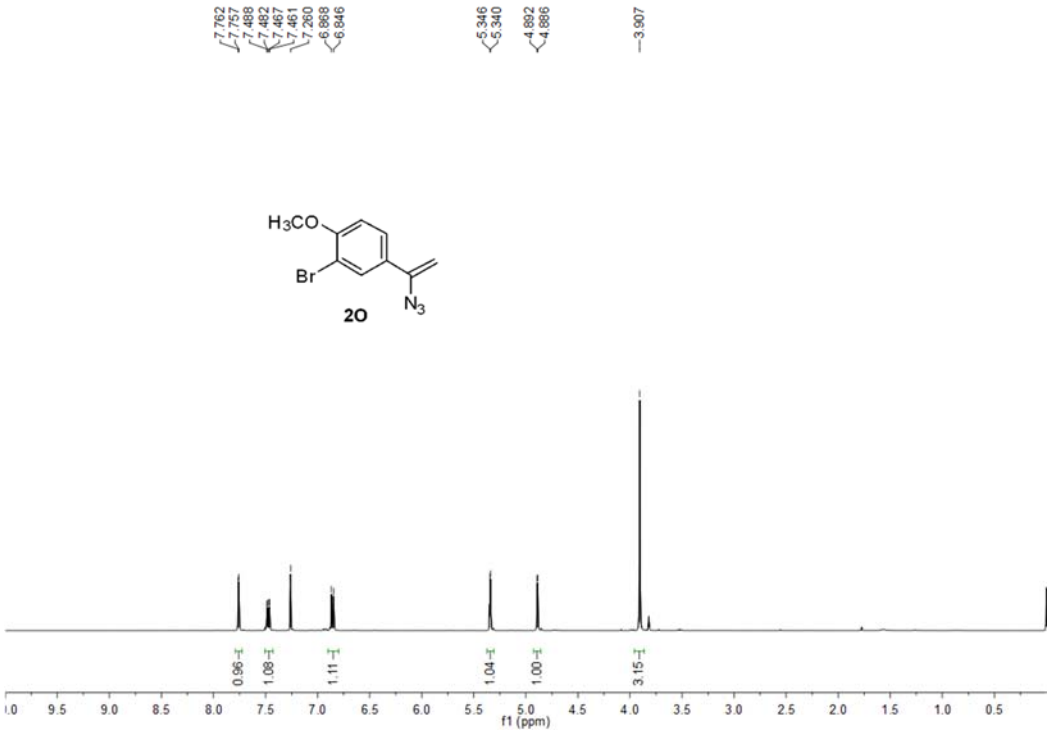


3ua

(Z)-N-(3-oxo-1-phenyloct-1-en-1-yl)hexanamide(3ua): Light yellow oil, yield 61%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 11.86 (s, 1H), 7.41 – 7.35 (m, 5H), 5.59 (s, 1H), 2.48 (t, *J* = 7.6 Hz, 2H), 2.41(d, *J* = 7.6 Hz, 2H), 1.68 – 1.61 (m, 4H), 1.34 – 1.31 (m, 8H), 0.92 – 0.87 (m, 6H).^{13}C NMR (100 MHz, $CDCl_3$) δ 203.05, 172.11, 154.28, 136.04, 129.63, 128.04, 127.31, 108.01, 43.92, 38.00, 31.51, 31.33, 24.75, 24.50, 22.55, 22.41, 13.99, 13.96.HRMS (ESI): m/z calcd for $C_{20}H_{30}NO_2[M+H]^+$: 316.2277, found: 316.2276.

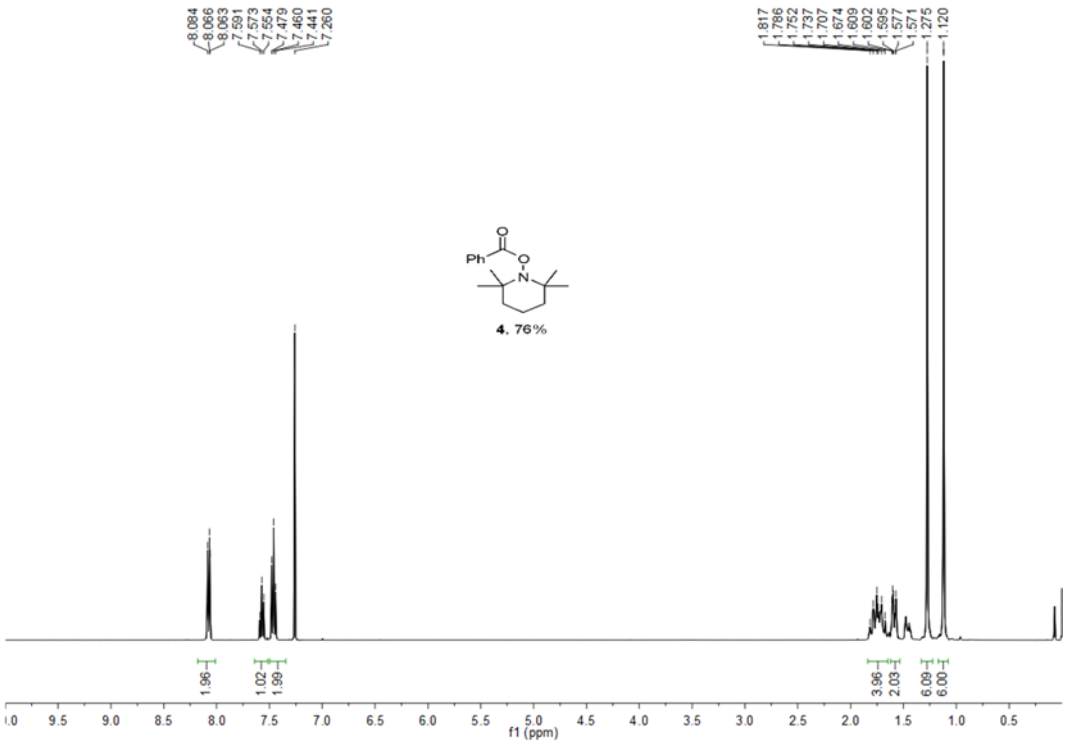
6. Characterization and NMR spectraof starting materials (2o)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 (d, *J* = 2.0 Hz, 1H), 7.48 (dd, *J* = 8.8, 2.0 Hz, 2H), 6.86 (d, *J* = 8.8 Hz, 1H), 5.34 (d, *J* = 2.4 Hz, 1H), 4.89 (d, *J* = 2.4 Hz, 1H), 3.91 (s, 3H).

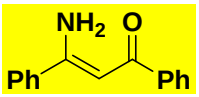


7. Characterization andNMR spectraof product 4 for control experiments

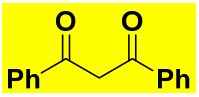
^{1}H NMR (400 MHz, $CDCl_3$)δ 8.08 – 8.06 (m, 2H), 7.57 (t, *J* = 7.6 Hz, 1H), 7.46 (t, *J* = 7.6 Hz, 2H), 1.82 – 1.67 (m, 4H), 1.61 – 1.57 (m, 2H), 1.28 (s, 6H), 1.12 (s, 6H).



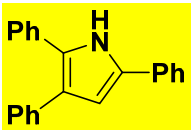
8. Characterization and NMR spectra of products for synthetic applications of 3aa



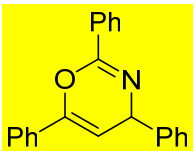
(Z)-3-Amino-1,3-diphenylprop-2-en-1-one (**4**): Yellow oil, yield 92%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.50 (s, 1H), 8.01 (d, *J* = 8.5 Hz, 2H), 7.67 (d, *J* = 8.5 Hz, 2H), 7.57 – 7.45 (m, 6H), 6.21 (s, 1H), 5.53 (s, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 190.33, 163.04, 140.53, 137.54, 131.14, 130.68, 129.00, 128.41, 127.21, 126.49, 91.99. HRMS (ESI): m/z calculated for $C_{15}H_{14}NO$ [M + H]+: 224.1070, found: 224.1075.



1,3-Diphenylpropane-1,3-dione (**5**): colorless oil, yield 95%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.03 -7.8.01 (m, 4H), 7.60 - 7.55 (m, 2H), 7.54 - 7.45 (m, 4H), 6.86 (s, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 185.03, 135.81, 132.86, 128.98, 127.52, 93.54. HRMS m/z: calcd for $C_{15}H_{13}O_2^+$ $[M+H]^+$ 225.0910, found: 225.0906.

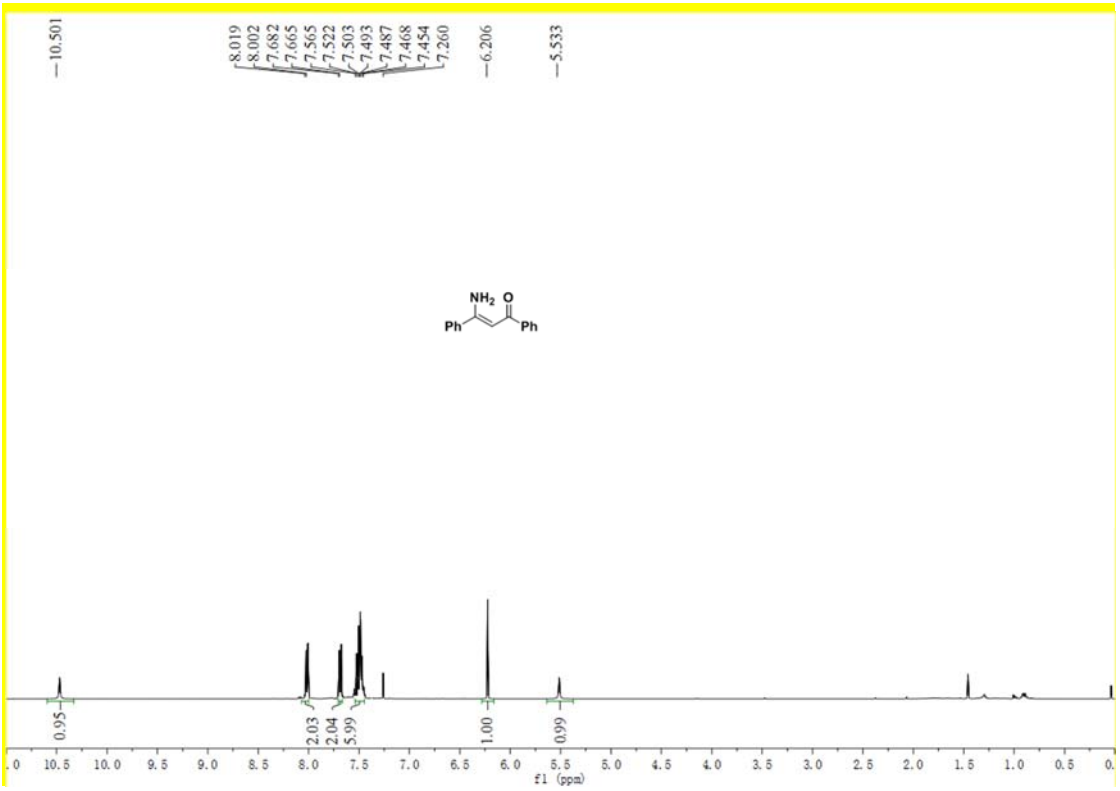


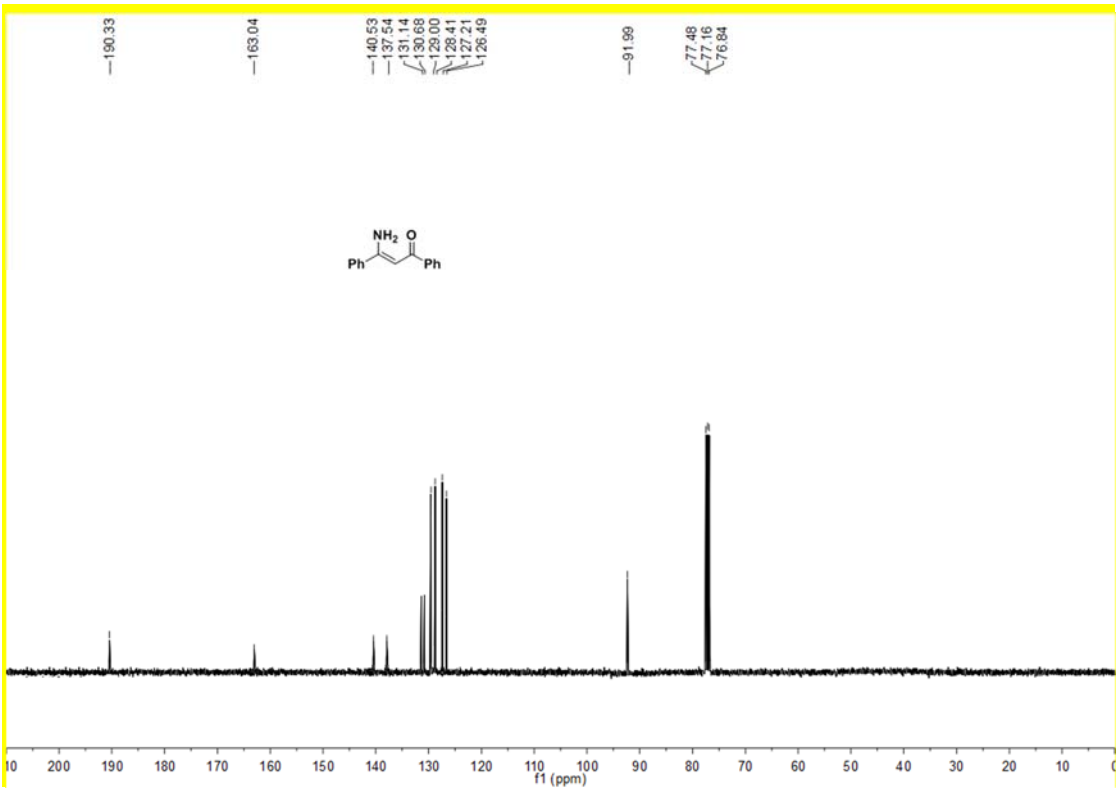
2,3,5-Triphenyl-1H-pyrrole (**6**): Light yellow solid, yield 80%, mp 135-138 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.44 (s, 1H), 7.57 (d, *J* = 7.6 Hz, 2H), 7.48 -7.21 (m, 13H), 6.74 (d, *J* = 2.8 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 136.42, 133.15, 132.38, 132.19, 129.76, 129.56, 129.00, 128.81, 128.36, 127.60, 127.09, 126.69, 126.05, 123.99, 123.86, 108.71. HRMS m/z: calcd for $C_{22}H_{17}N^+$ $[M+H]^+$ 295.1361, found: 295.1365.



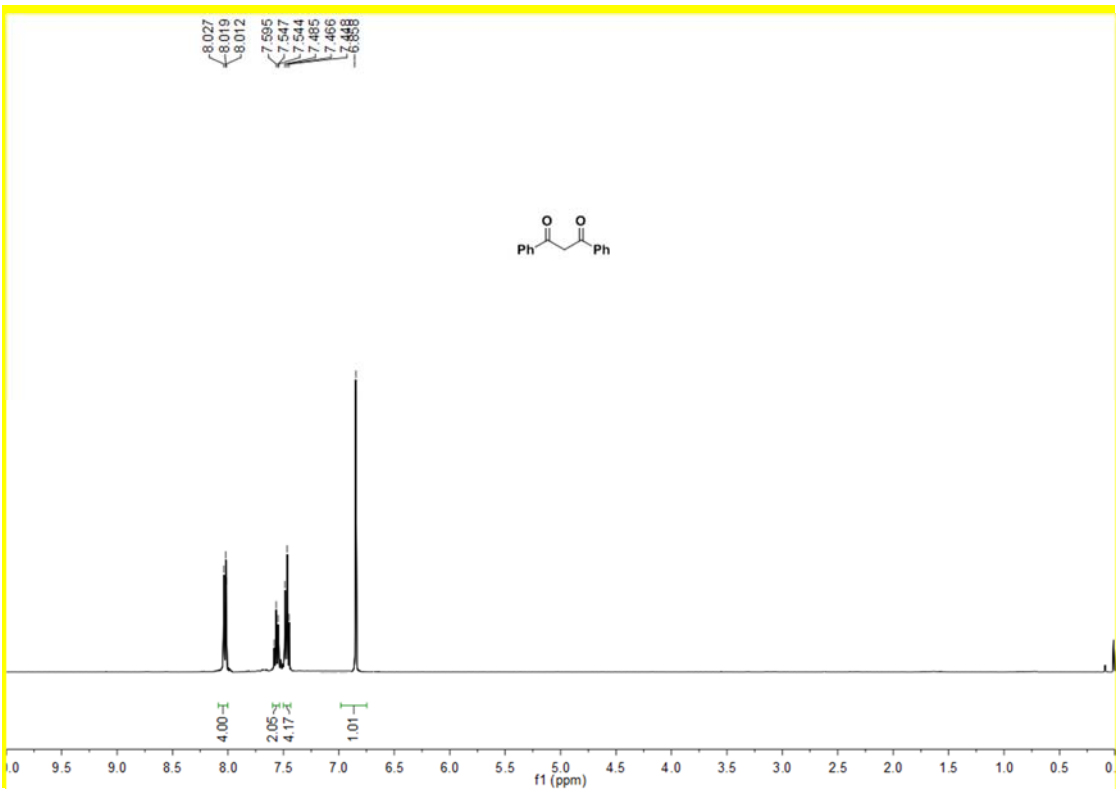
2,4,6-Triphenyl-4H-1,3-oxazine (**7**): Colorless solid, yield 70%, mp 97 - 99 °C, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.12 (d, *J* = 7.2 HZ, 2H), 7.78 (d, *J* = 7.6 HZ, 2H), 7.54 - 7.49 (m, 2H), 7.39 - 7.35 (m, 8H), 7.32-7.23 (m, 1H), 5.66 (d, *J* = 4.0 Hz, 1H), 5.46 (d, *J* = 4.0 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 152.31, 146.30, 144.52, 132.93, 132.50, 131.14, 129.00, 128.81, 128.61, 128.36, 127.60, 127.42, 127.27, 124.30, 100.86, 56.64. HRMS (ESI): m/z calcd. for $C_{22}H_{18}NO$ $(M+H^+)$ 312.1383, found 312.1386.

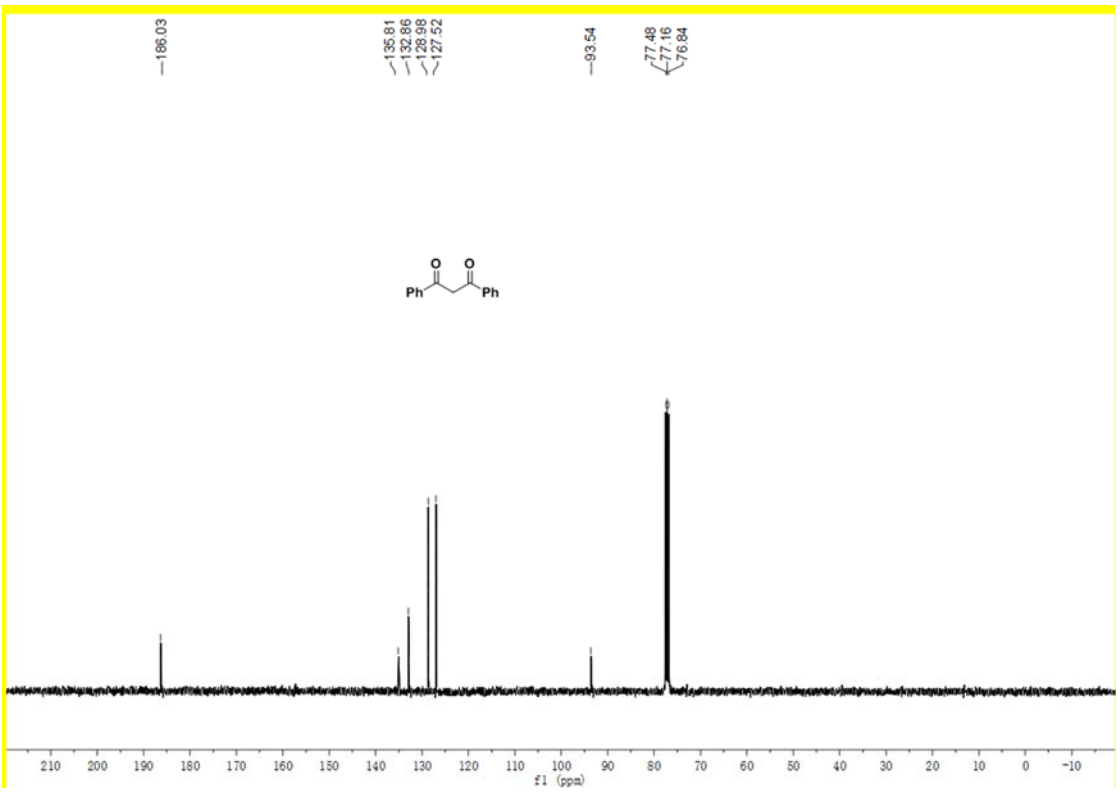
NMR spectra of 4



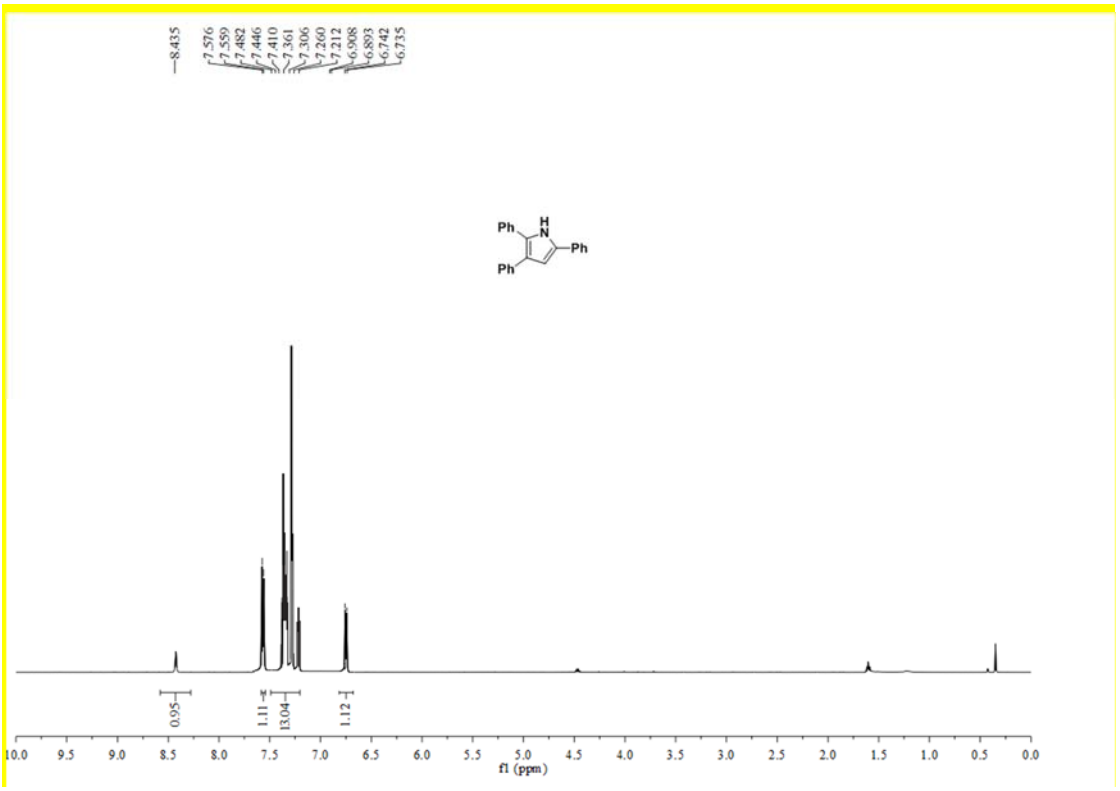


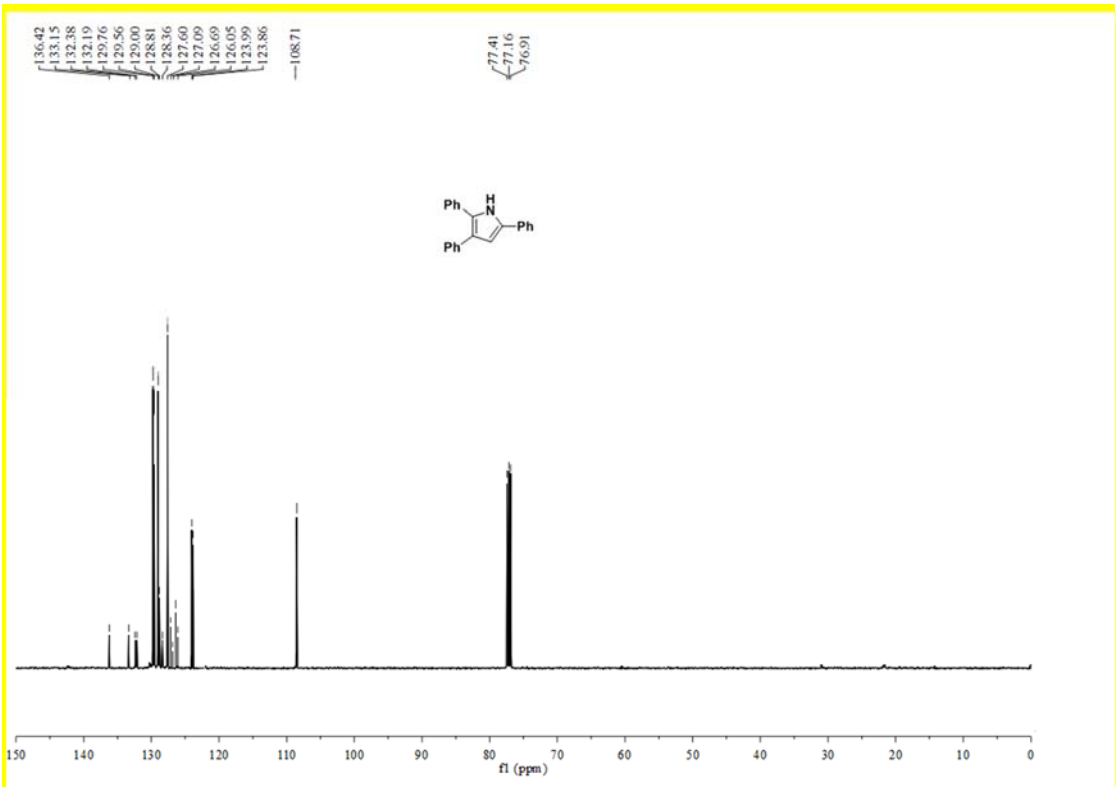
NMR spectra of 5



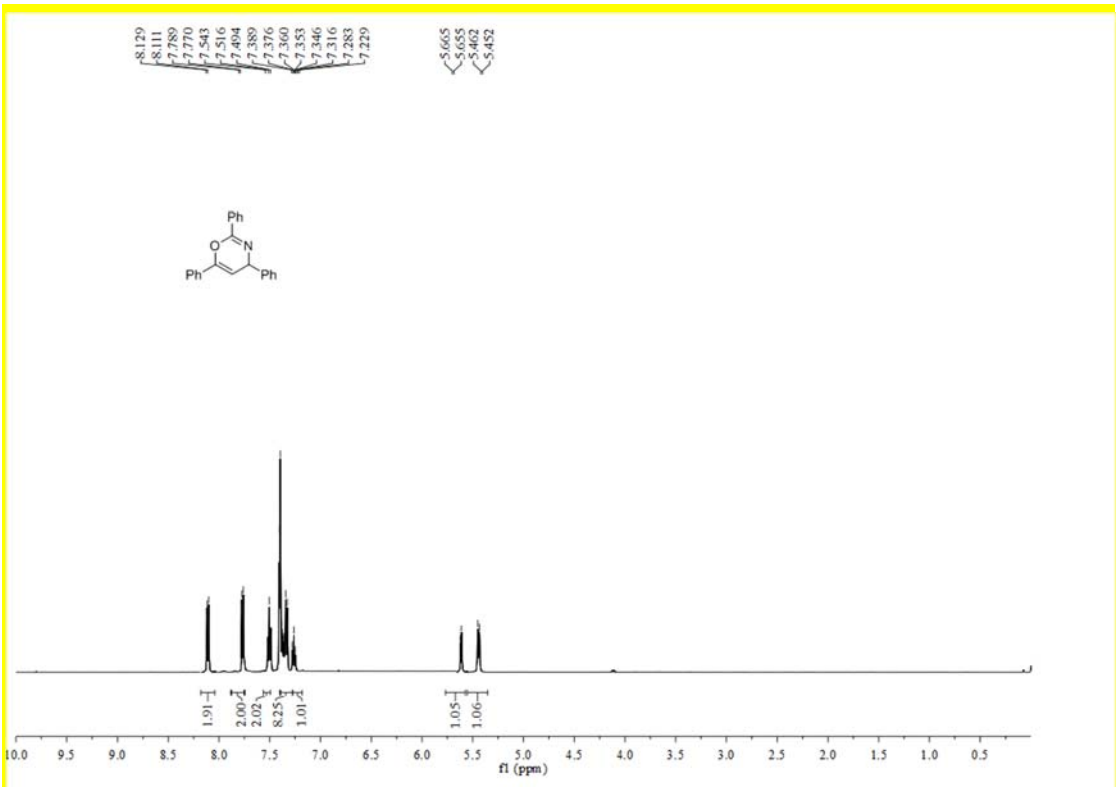


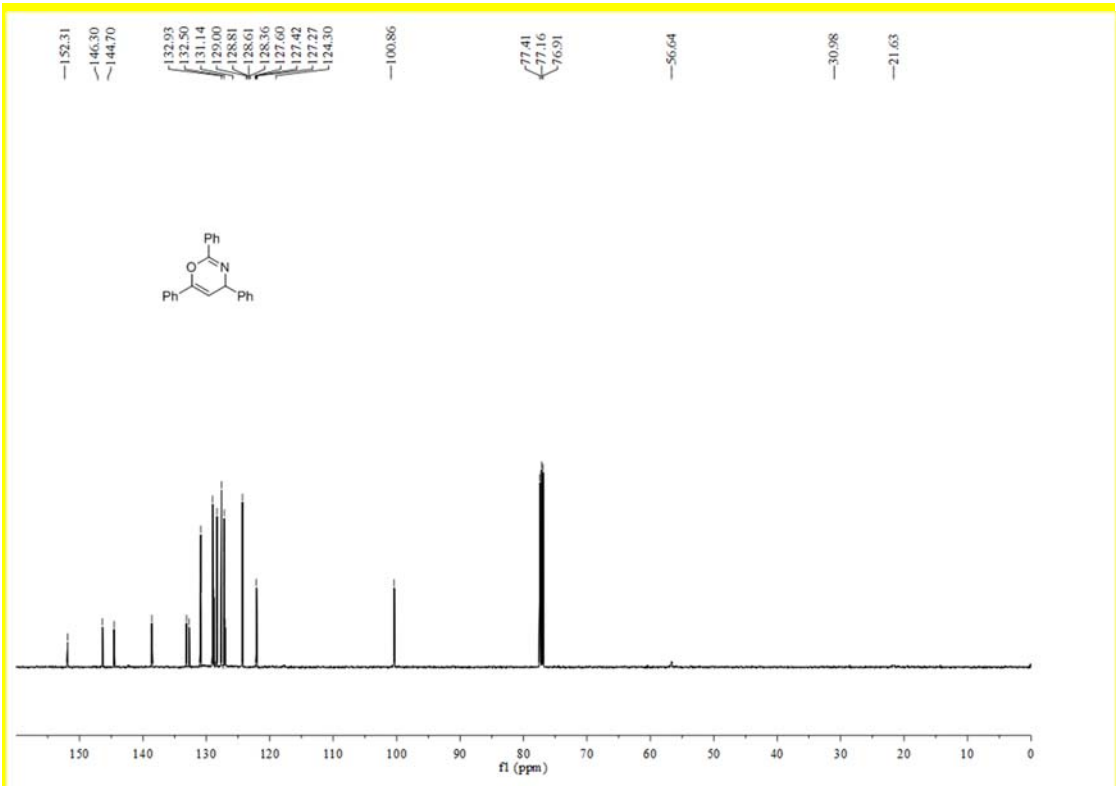
NMR spectra of 6





NMR spectra of 7





9. Crystallography of 3na

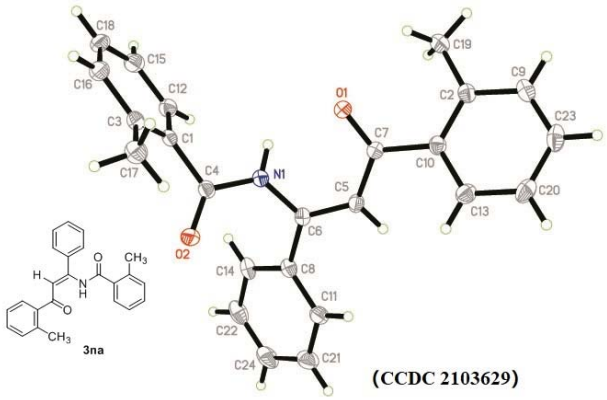
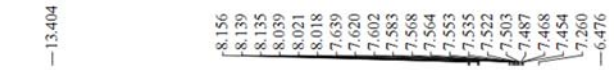
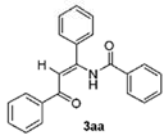


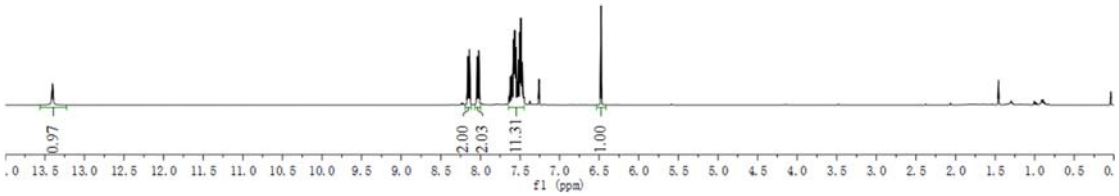
Table 1 Datablock of 3na

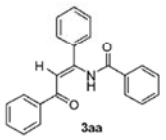
Empirical formula	$C_{24}H_{21}NO_2$	
Moiety formula	$C_{24}H_{21}NO_2$	
Sum formula	$C_{24}H_{21}NO_2$	
Bond precision	C-C = 0.0030 A, Wavelength=1.54178	
Unit cell dimensions	a=9.8259(3) alpha=97.864(2), b=9.8256(2) beta=108.797(2), c=10.8672(3) gamma=103.162(2)	
Temperature	153 K	
	Calculated	Reported
Volume	941.65(5)	941.65(4)
Space group	P -1	P -1
Hall group	-P 1	
Mr	355.42	355.42
Dx,g cm^{-3}	1.253	1.254
Z	2	2
Mu (mm-1)	0.627	0.627
F000	376.0	376.0
F000’	377.07	
h,k,lmax	11,11,12	11,11,12
Nref	3332	3333
Tmin,Tmax	0.882,0.939	0.378,1.000
Tmin’	0.882	
Correction method= # Reported T Limits:	Tmin=0.378, Tmax=1.000,AbsCorr = MULTI-SCAN	
Data completeness	1.000	
Theta(max)	66.590	
R(reflections)	0.0597(2887)	
wR2(reflections)	0.2913(3333)	
S	1.383	
Npar	244	

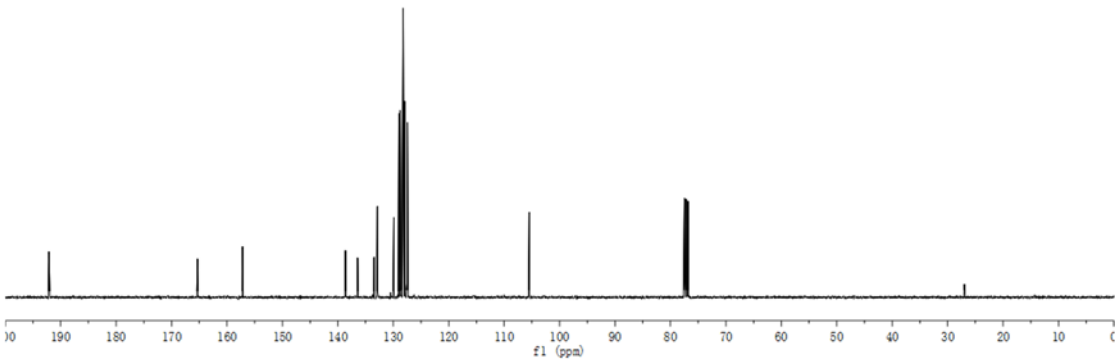
10. ^{1}H and ^{13}C NMR spectra of compounds 3aa-3ua

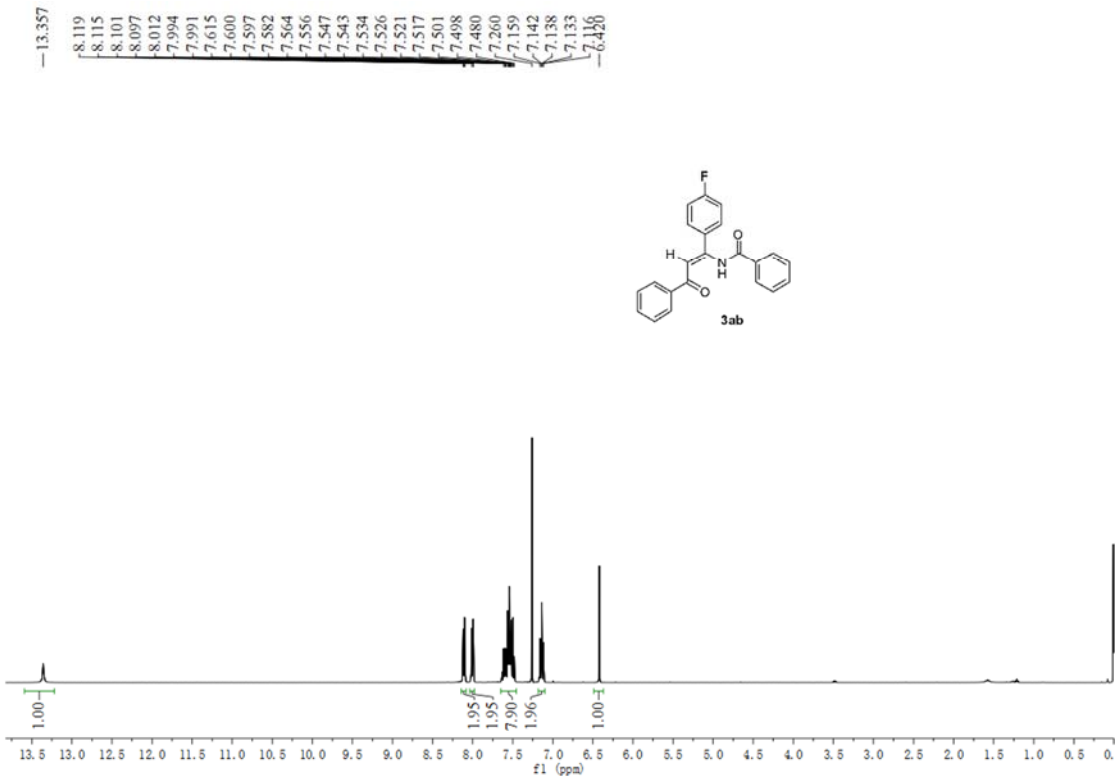








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7.556
7.547
7.543
7.534
7.526
7.521
7.517
7.501
7.498
7.480
7.260
7.159
7.142
7.138
7.133
6.420
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H
N
H
O
O
3ab
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7.90
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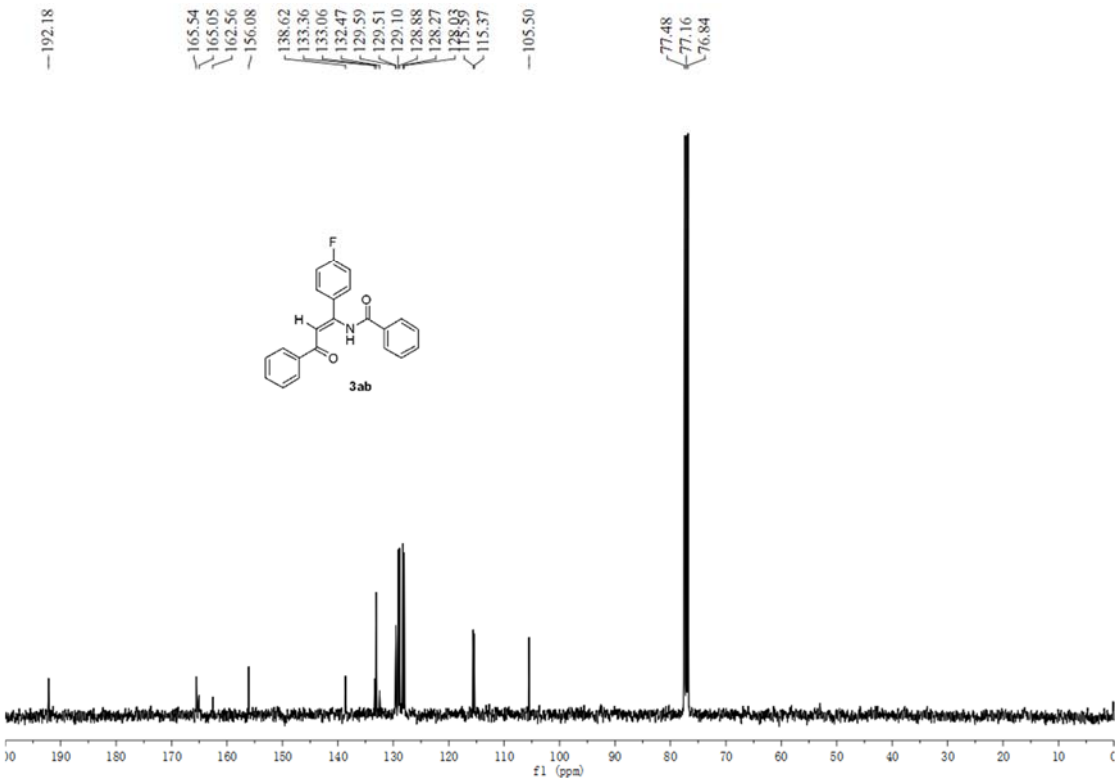
1.00
f1 (ppm)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133.06
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128.88
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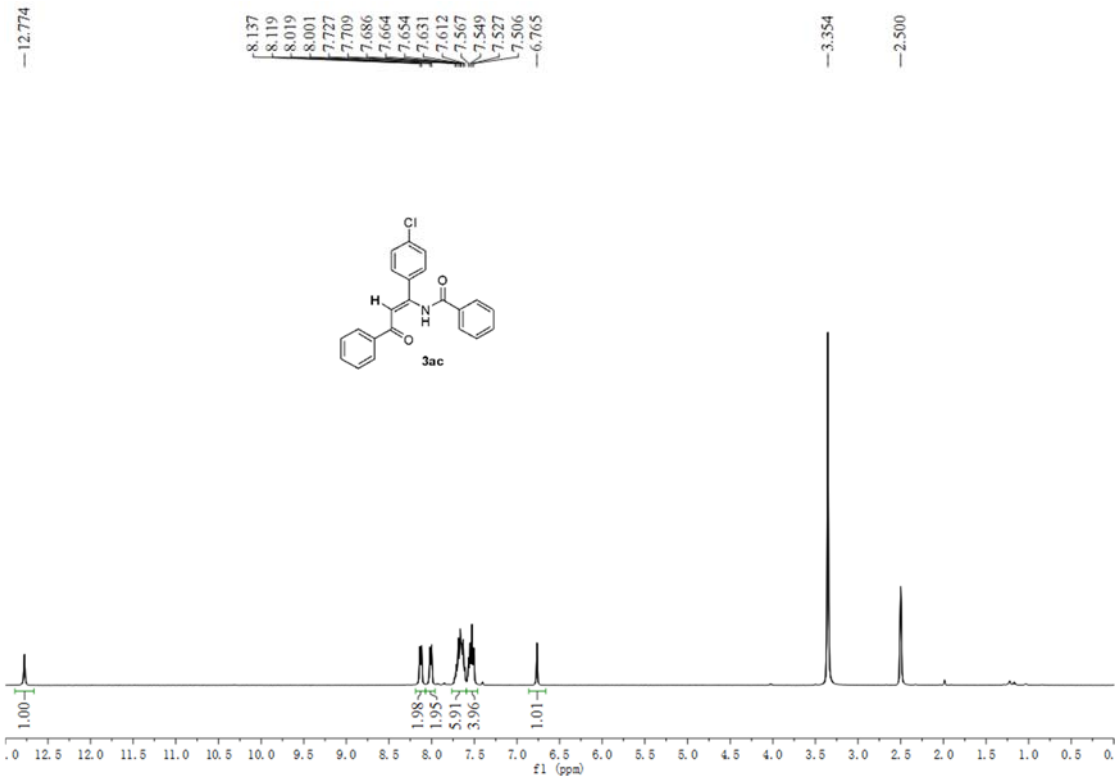
77.16
76.84
F
H
N
H
O
O
3ab
f1 (ppm)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7.549
7.527
7.506
6.765
3.354
2.500
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O
O
O
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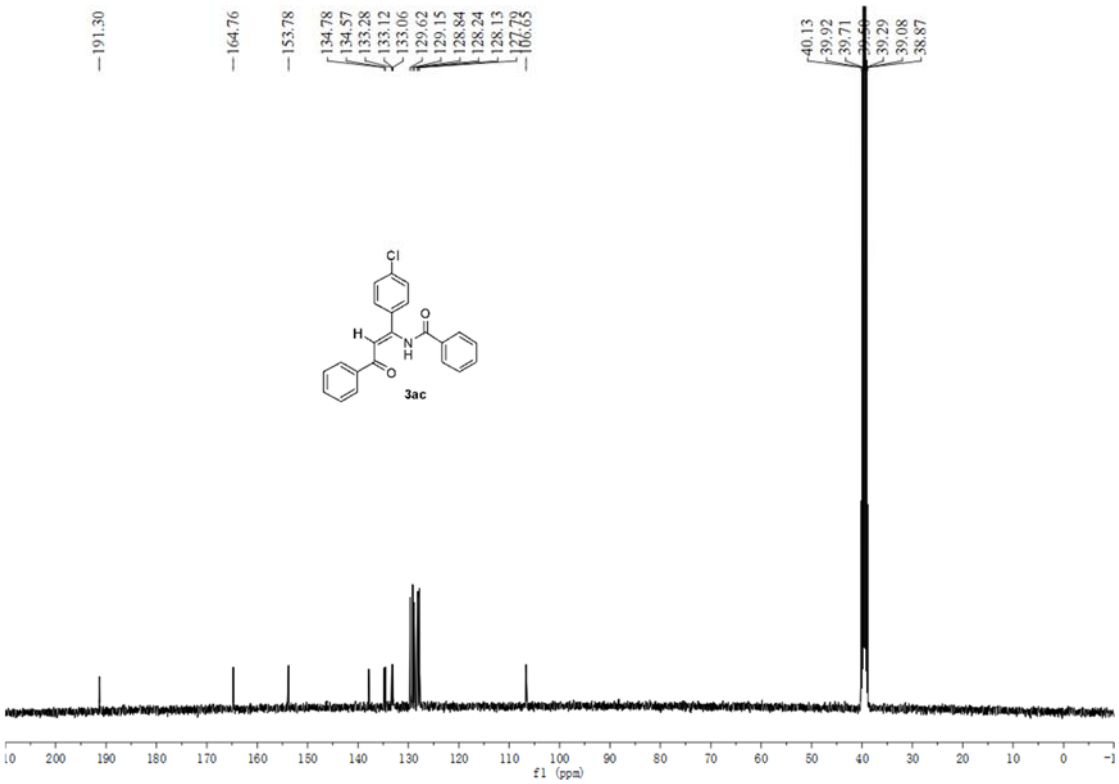
1.01
f1 (ppm)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106.65
40.13
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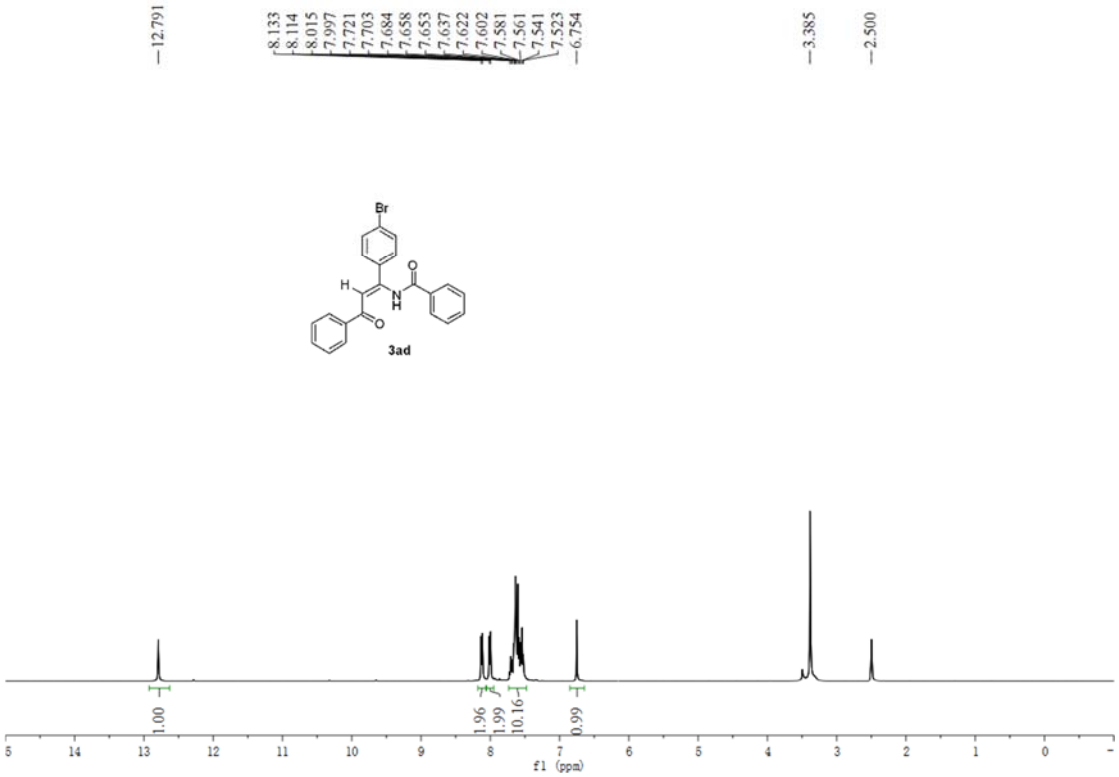
39.29
39.08
38.87
Cl
H
N
H
O
O
O
3ac
f1 (ppm)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7.602
7.581
7.561
7.541
7.523
6.754
3.385
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H
O
O
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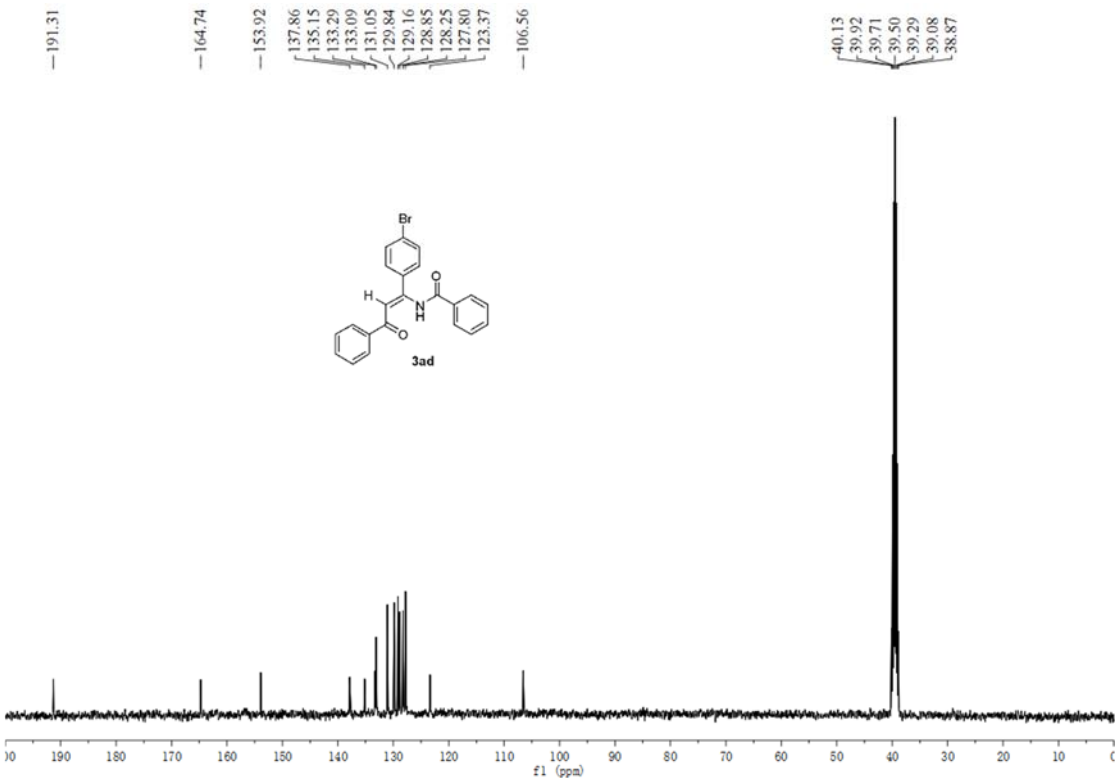
0.99
f1 (ppm)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106.56
40.13
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39.29
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Br
H
N
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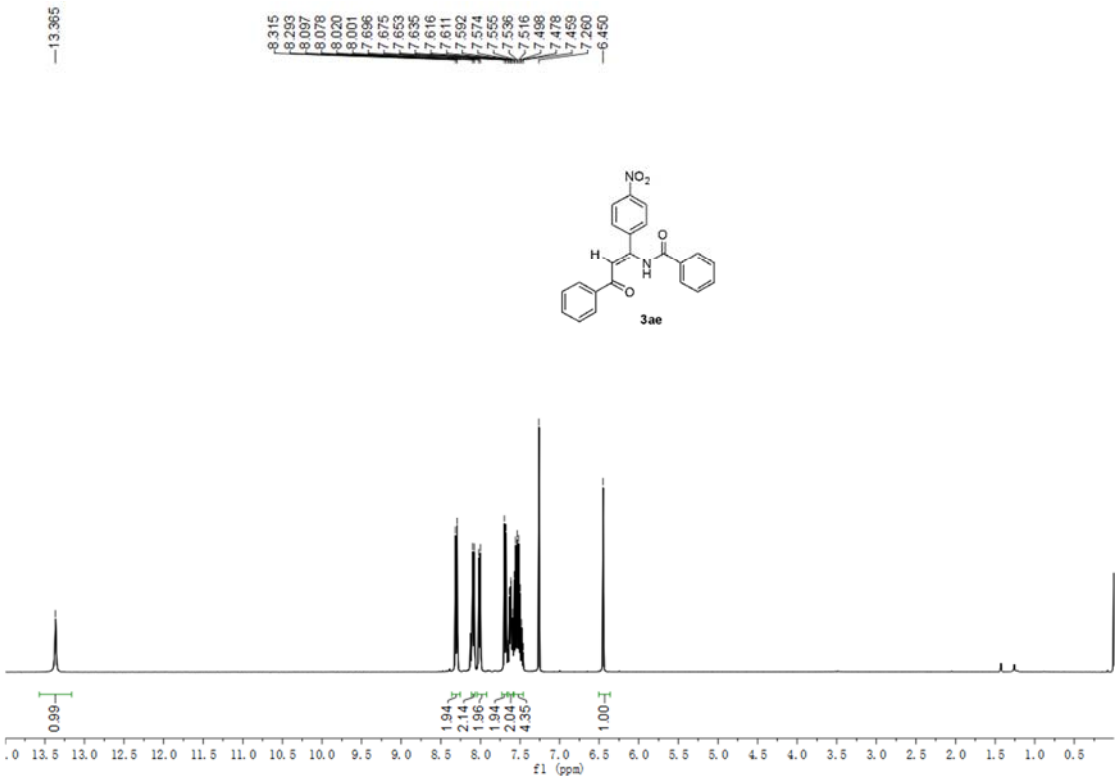
O
O
3ad
f1 (ppm)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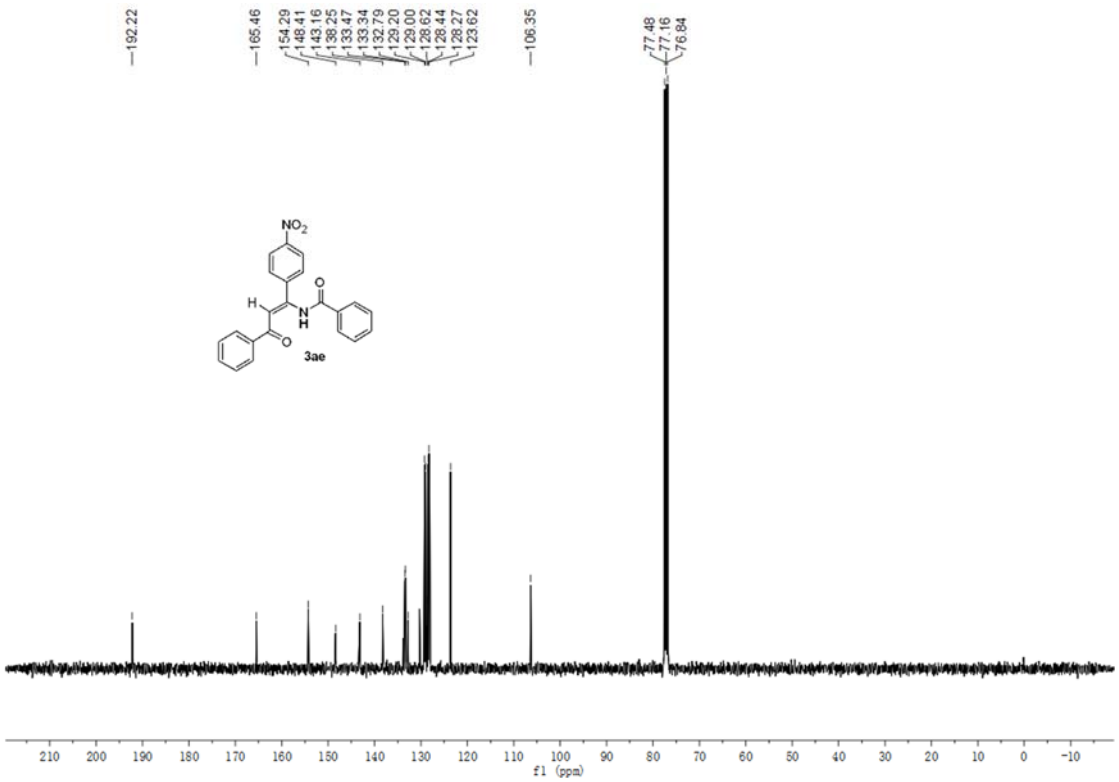
7.635
7.616
7.611
7.592
7.574
7.555
7.536
7.516
7.498
7.478
7.459
7.260
6.450
NO2
H
N
H
O
O
3ae
0.99
1.94
2.14
1.96
1.94
2.04
4.35
1.00
f1 (ppm)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128.44
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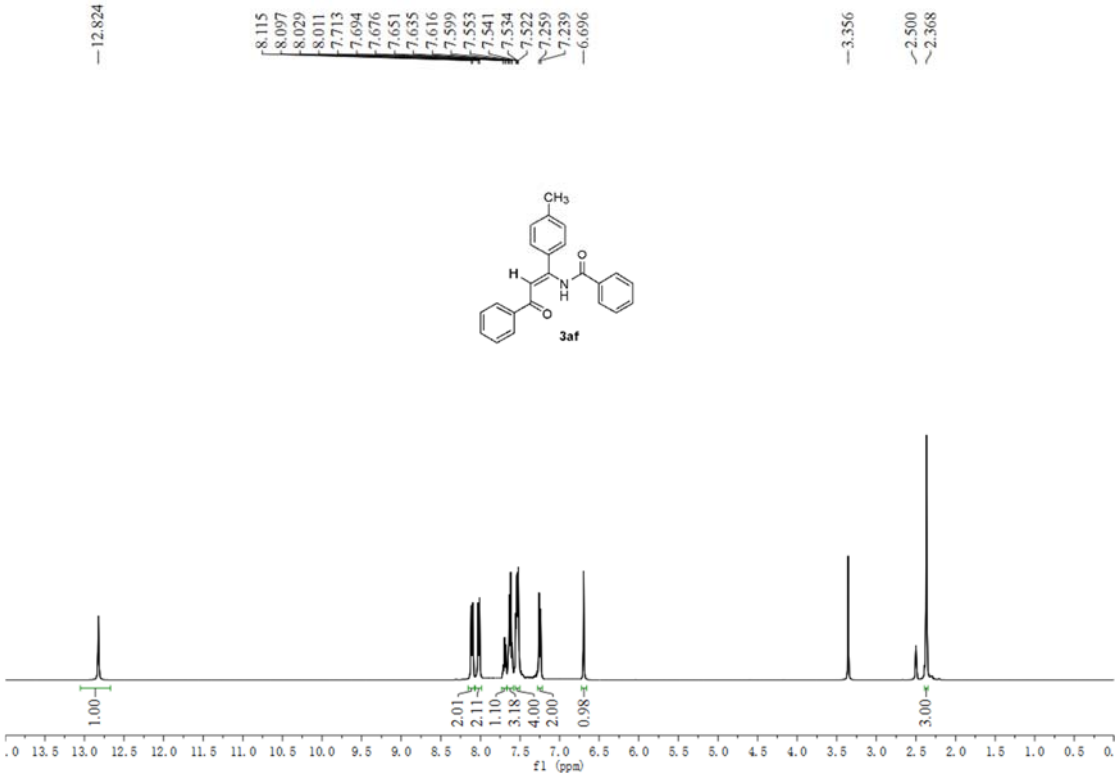
106.35
77.48
77.16
76.84
NO2
H
N
H
O
O
3ae
f1 (ppm)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7.541
7.534
7.522
7.259
7.239
6.696
3.356
2.500
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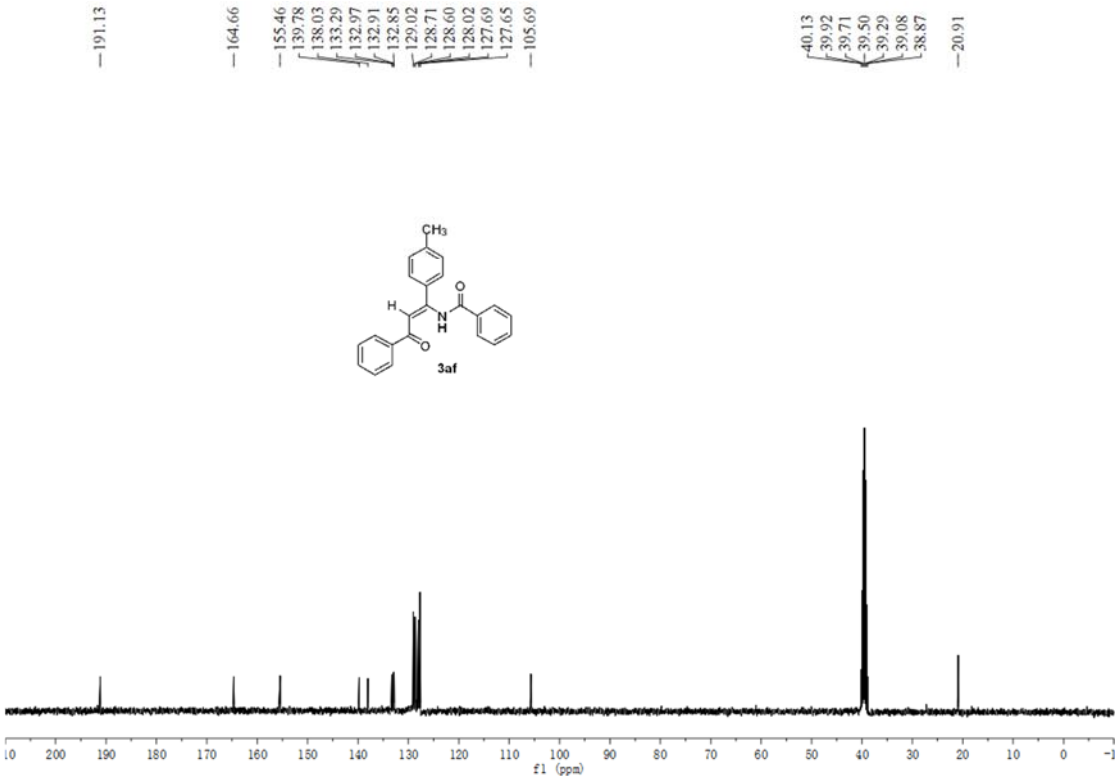
1.10
3.18
4.00
2.00
0.98
3.00
f1 (ppm)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127.69
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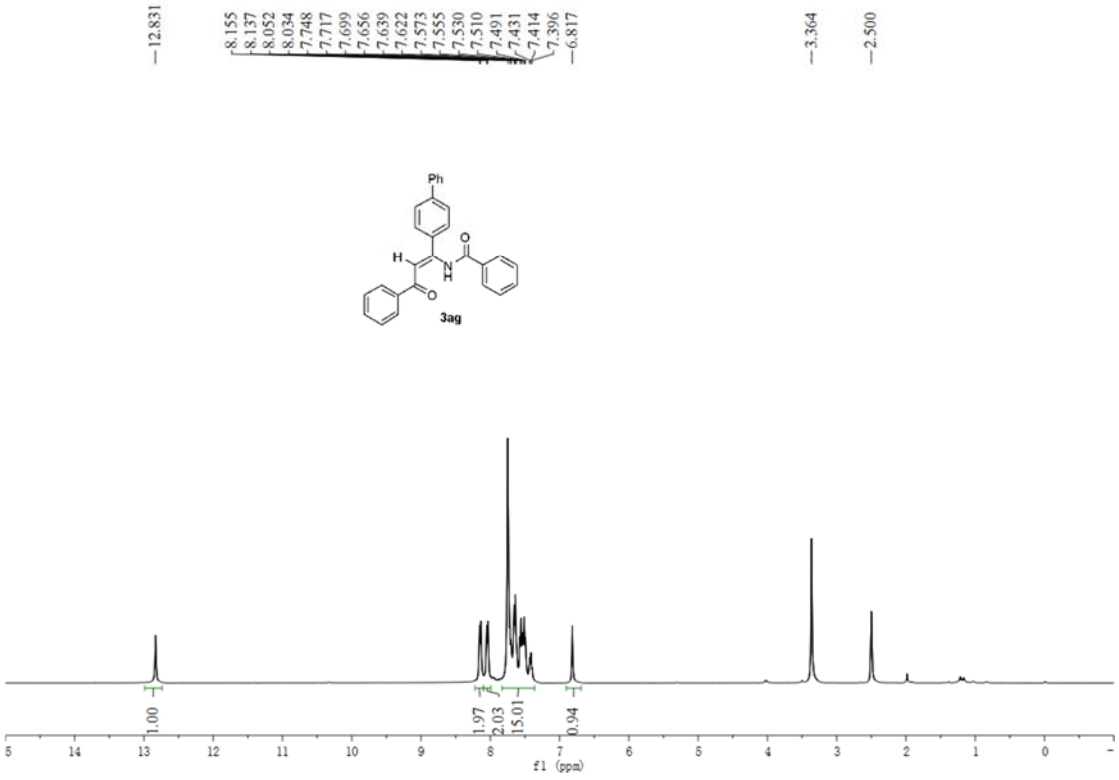
39.29
39.08
38.87
20.91
3af
f1 (ppm)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7.555
7.530
7.510
7.491
7.431
7.414
7.396
6.817
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N
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O
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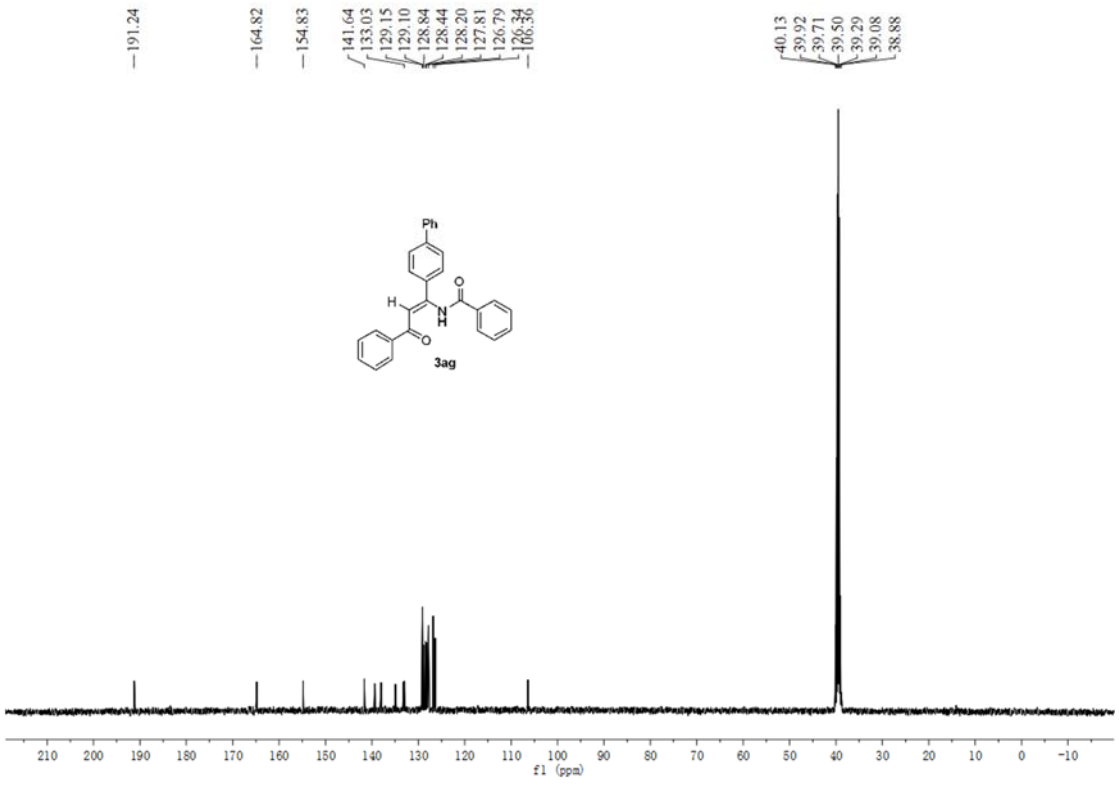
1.00
1.97
2.03
15.01
0.94
f1 (ppm)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127.81
126.79
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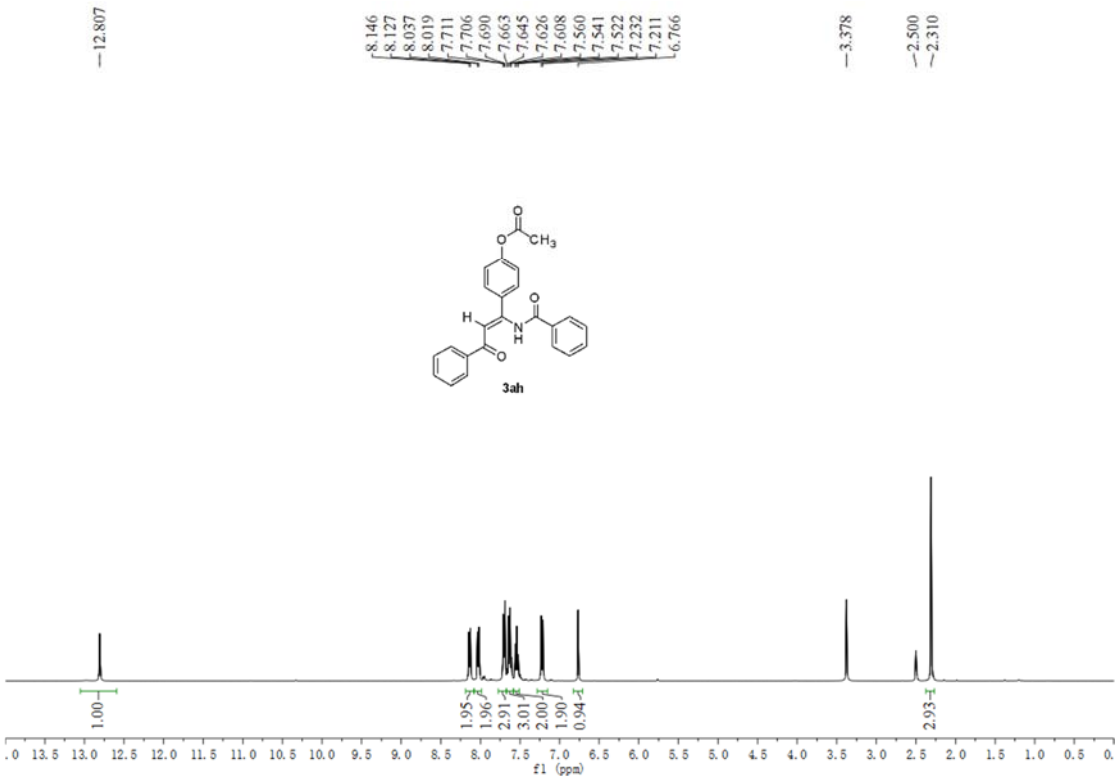
39.29
39.08
38.88
Ph
H
N
O
O
3ag
f1 (ppm)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7.541
7.522
7.232
7.211
6.766
3.378
2.500
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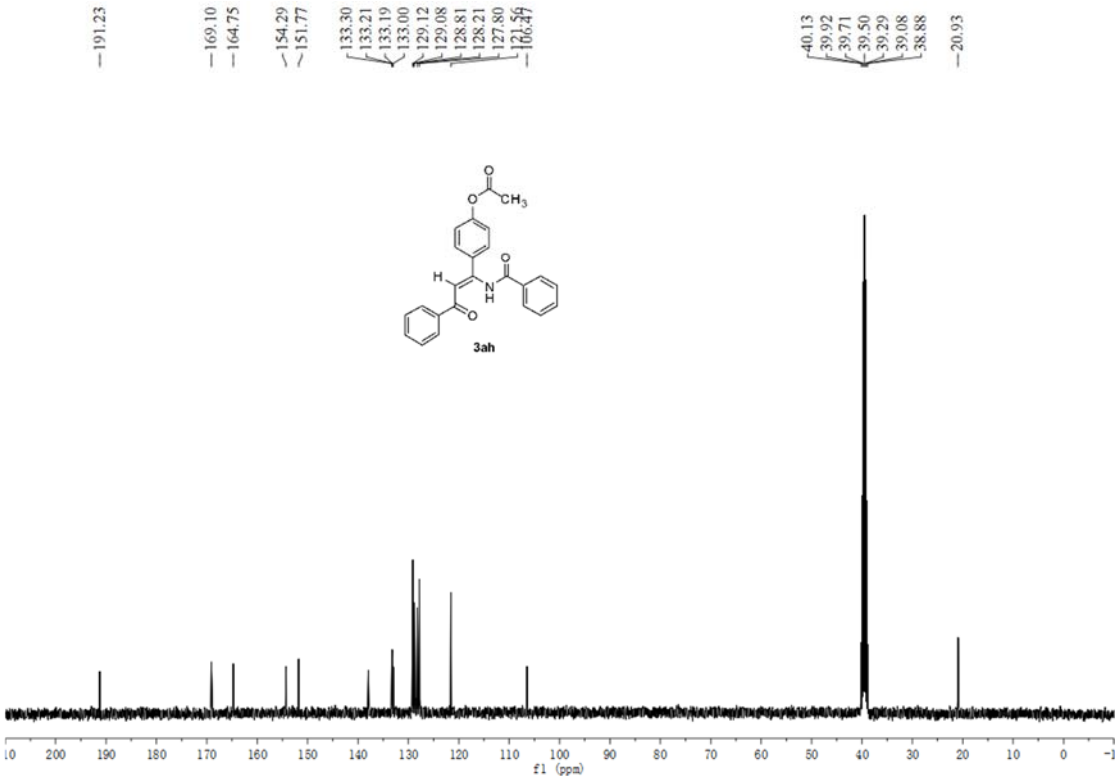
1.95
1.96
2.91
3.01
2.00
1.90
0.94
2.93
f1 (ppm)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128.81
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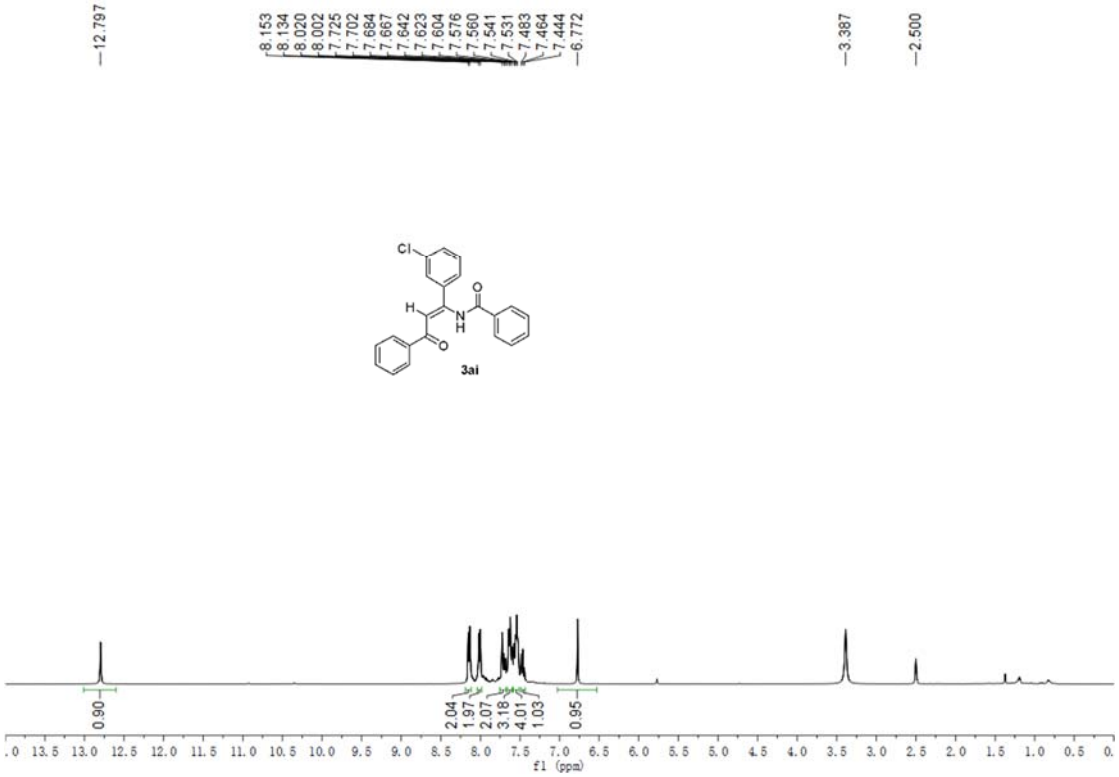
39.08
38.88
20.93
3ah
f1 (ppm)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7.604
7.576
7.560
7.541
7.531
7.483
7.464
7.444
6.772
3.387
2.500
Cl
H
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O
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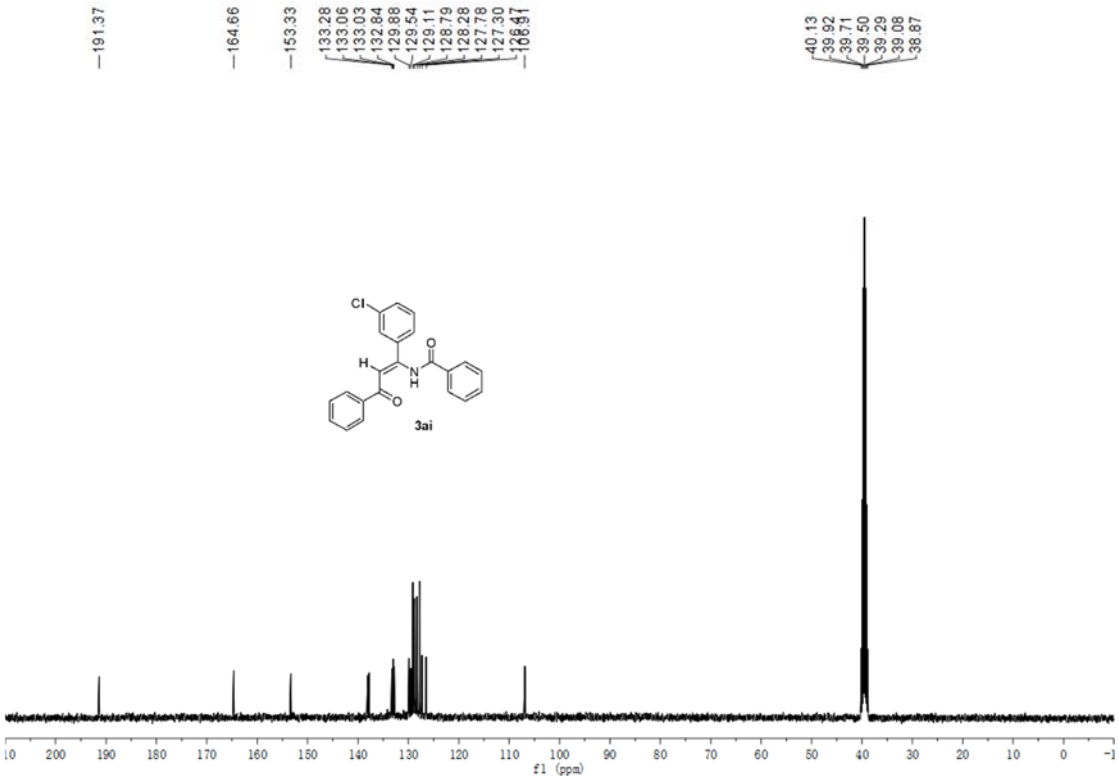
1.97
2.07
3.18
4.01
1.03
0.95
f1 (ppm)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127.30
126.47
40.13
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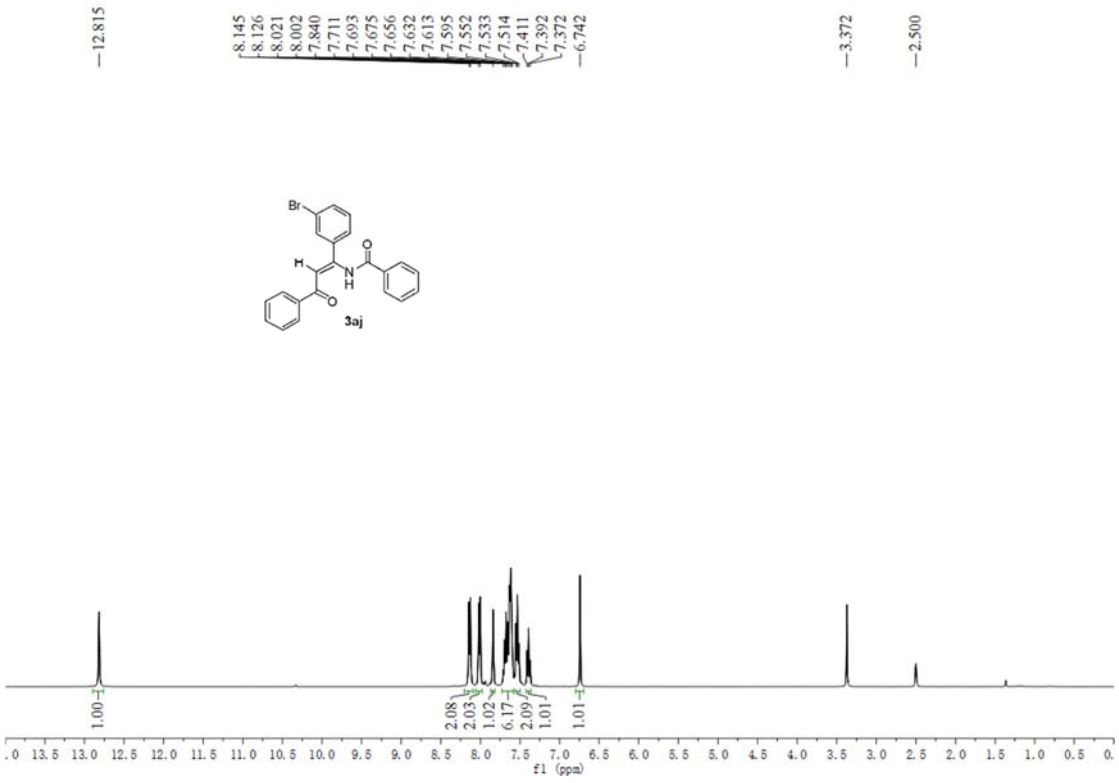
39.50
39.29
39.08
38.87
Cl
H
N
H
O
O
3ai
f1 (ppm)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7.656
7.632
7.613
7.595
7.552
7.533
7.514
7.411
7.392
7.372
6.742
3.372
2.500
Br
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O
O
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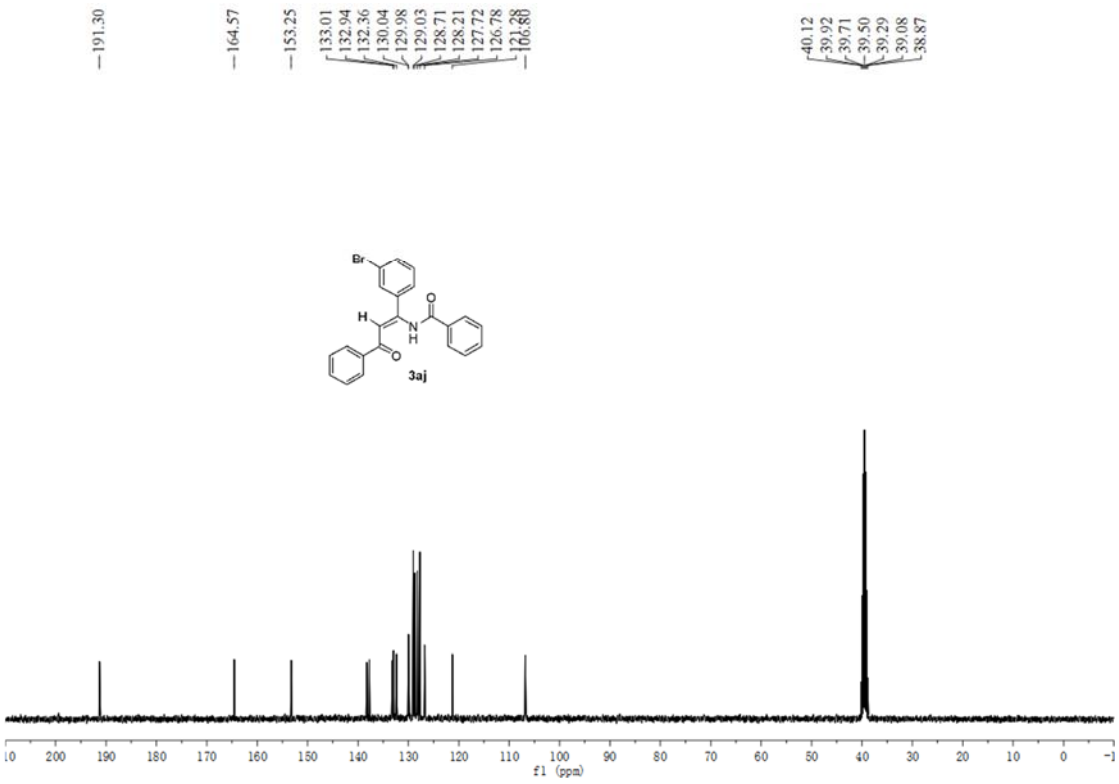
2.08
2.03
1.02
6.17
2.09
1.01
1.01
f1 (ppm)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121.28
106.80
40.12
39.92
39.71
39.50
39.29
39.08
38.87
Br
H
N
O
O
3aj
f1 (ppm)


13.364
8.138
8.120
8.117
8.027
8.009
8.006
7.615
7.600
7.597
7.594
7.578
7.566
7.560
7.551
7.547
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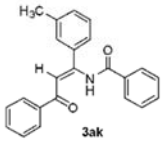
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H
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O
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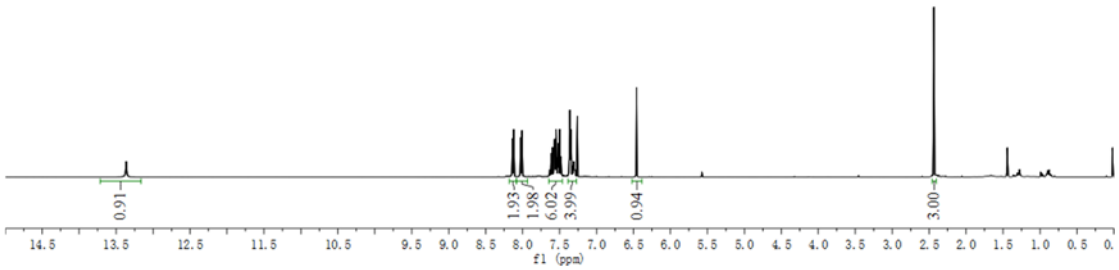
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9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
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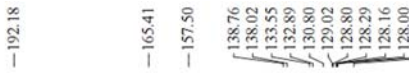
f1 (ppm)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128.16
128.00
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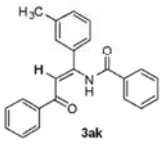
124.72
105.41
77.48
77.16
76.84
21.63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H
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H
O
O
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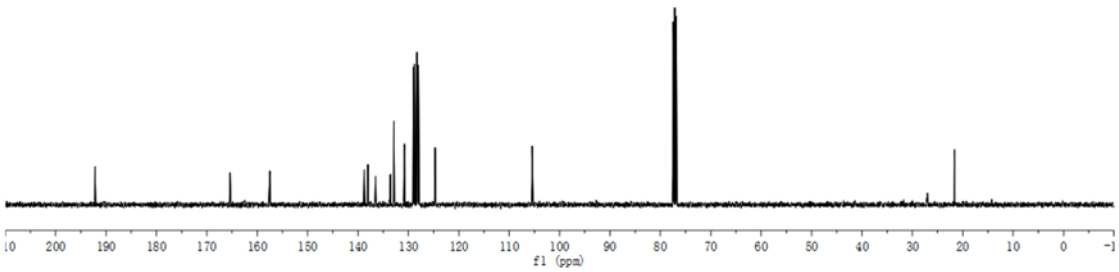
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200
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170
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140
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120
110
100
90
80
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60
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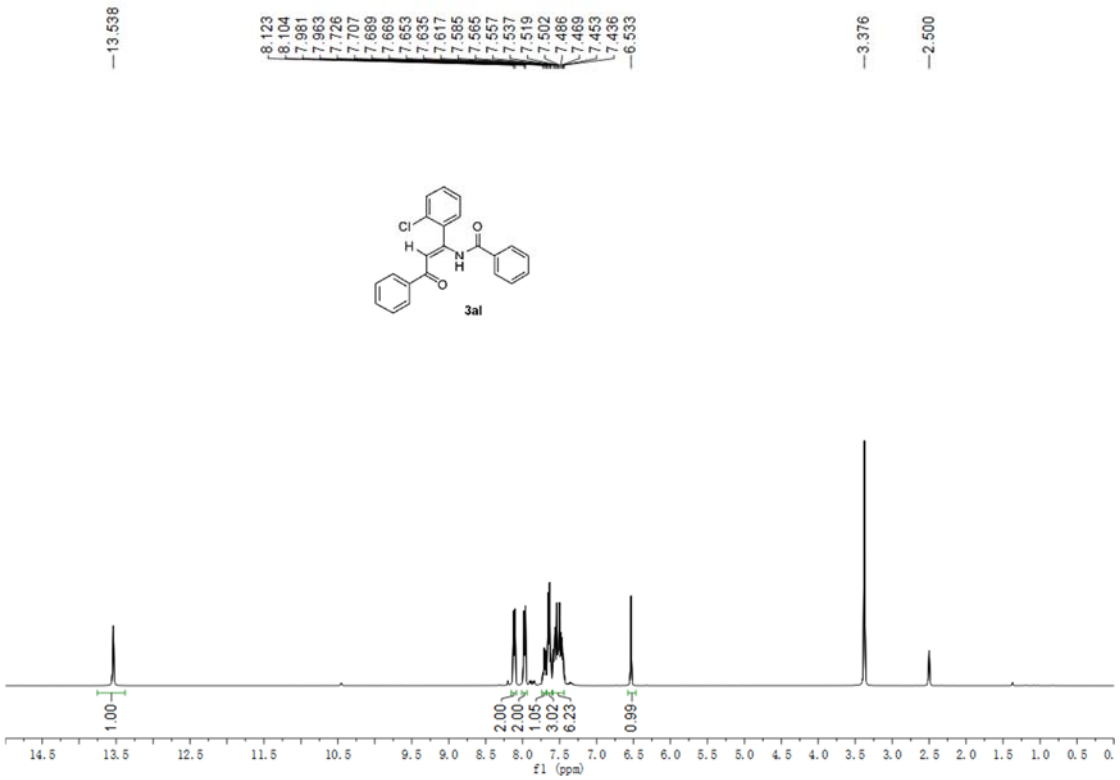
40
30
20
10
0
-1
f1 (ppm)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7.707
7.689
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7.617
7.585
7.565
7.557
7.537
7.519
7.502
7.486
7.469
7.453
7.436
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3al
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2.00
2.00
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3.02
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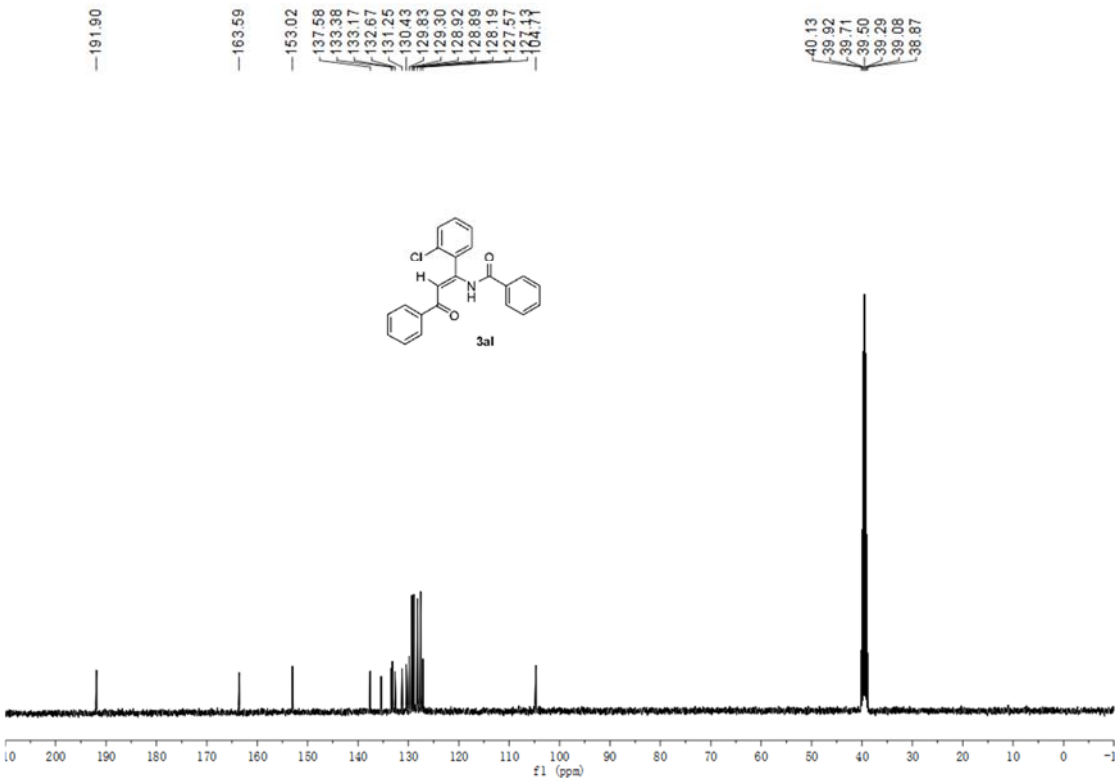
f1 (ppm)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40.13
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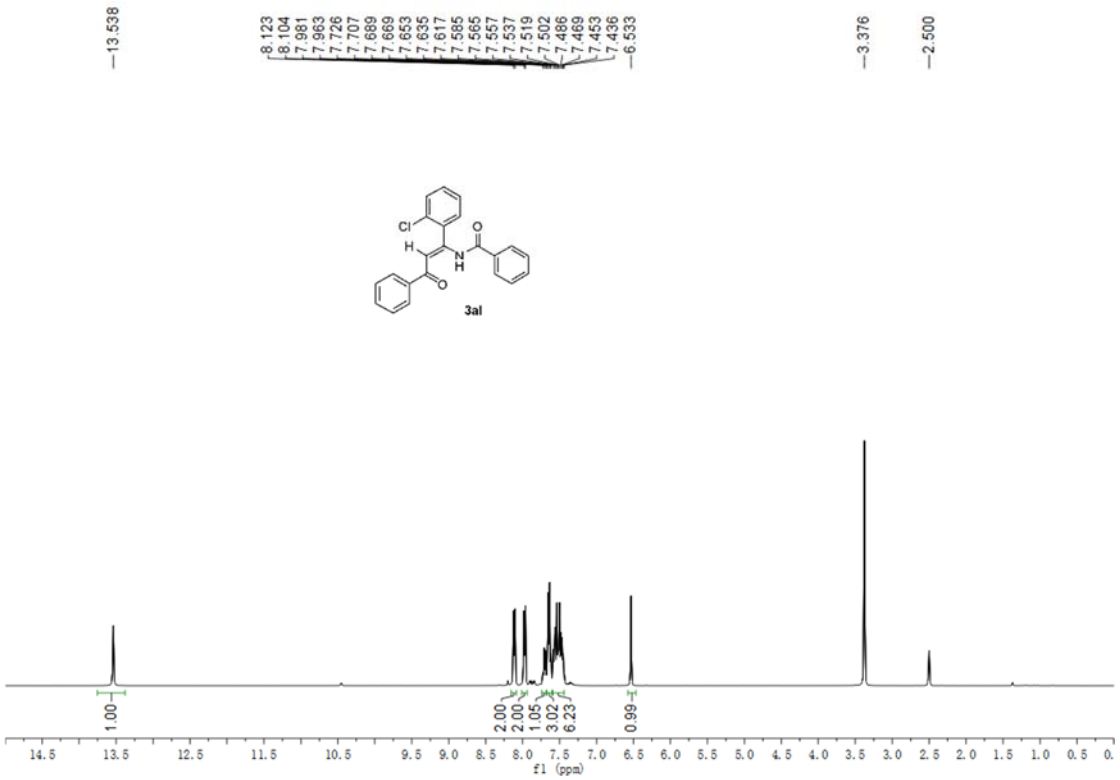
39.71
39.50
39.29
39.08
38.87
3al
f1 (ppm)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7.585
7.565
7.557
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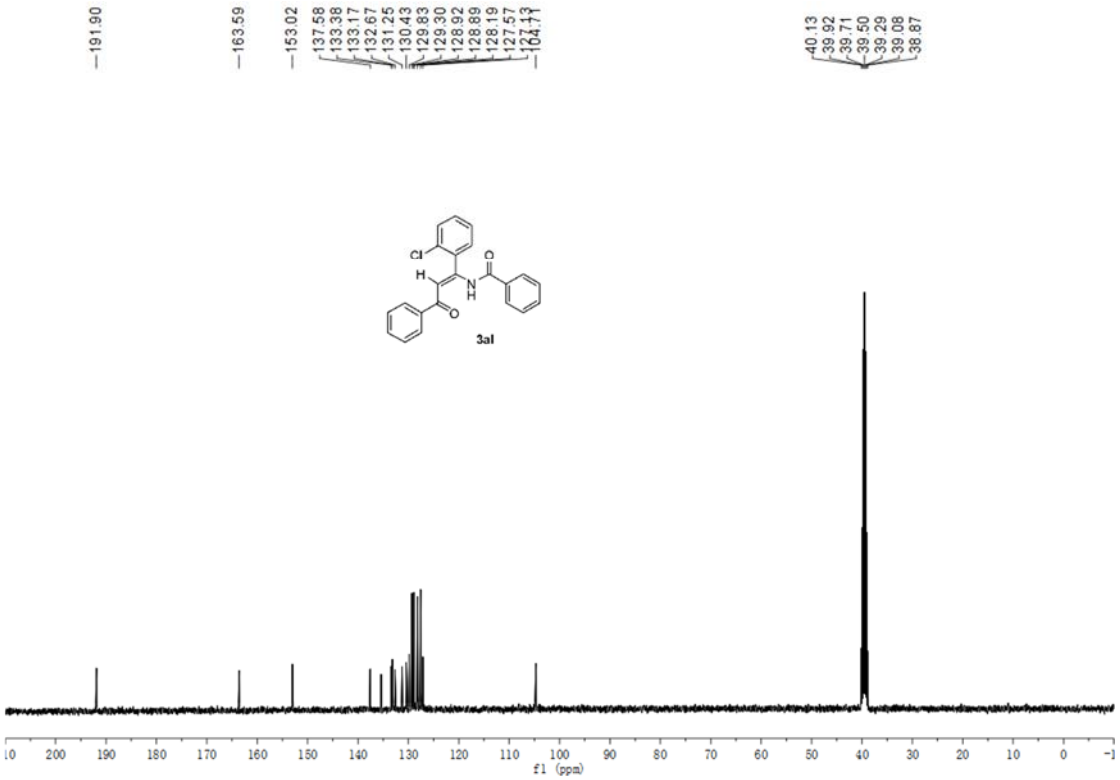
7.502
7.486
7.469
7.453
7.436
6.533
3.376
2.500
3al
1.00
2.00
2.00
1.05
3.02
6.23
0.99
f1 (ppm)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137.58
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128.19
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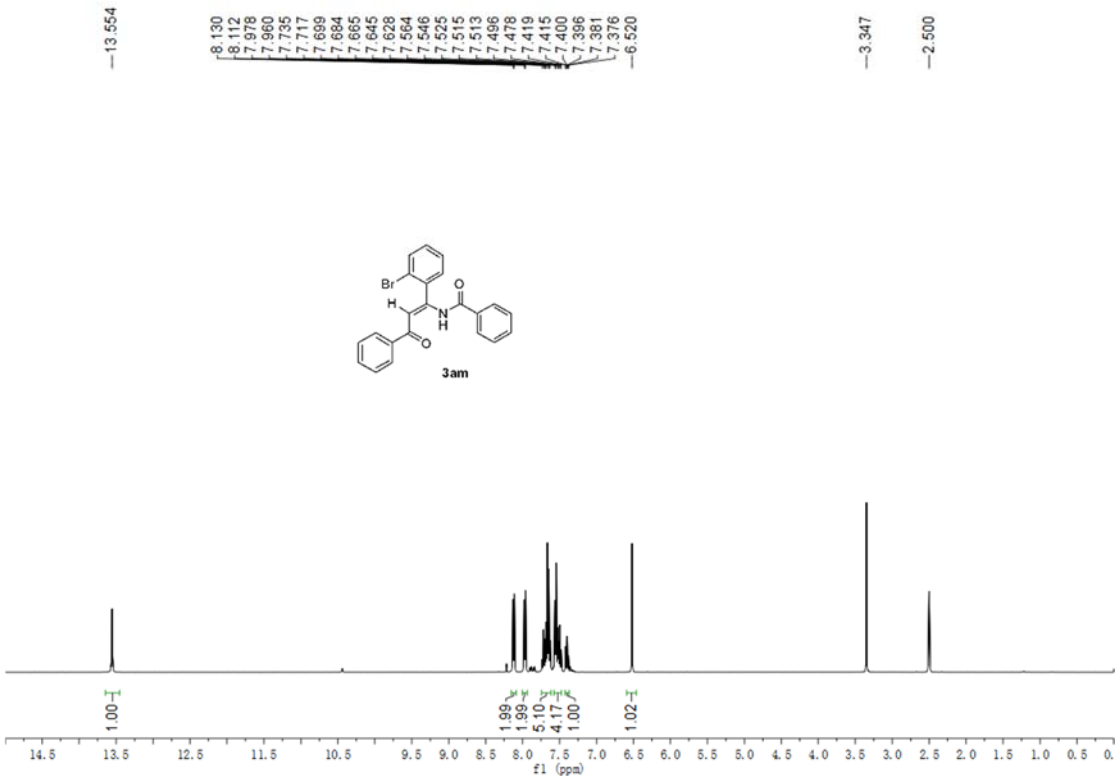
40.13
39.92
39.71
39.50
39.29
39.08
38.87
3al
f1 (ppm)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7.546
7.525
7.515
7.513
7.496
7.478
7.419
7.415
7.400
7.396
7.381
7.376
6.520
3.347
2.500
Br
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O
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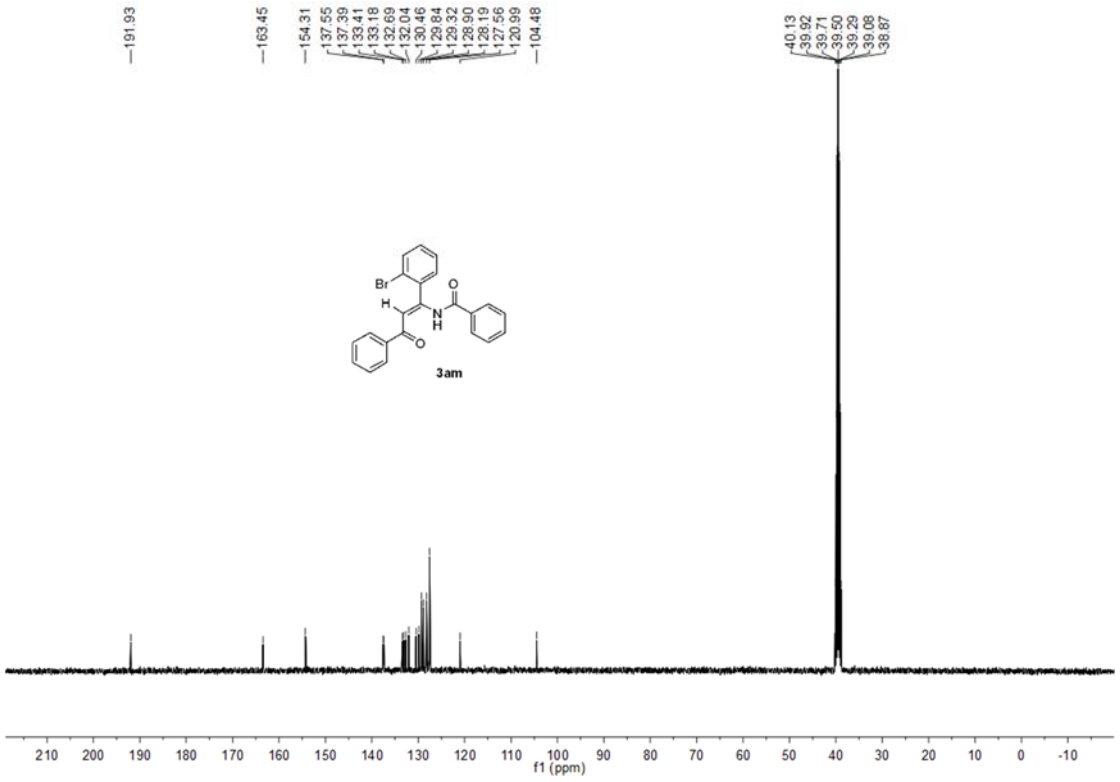
1.99
5.10
4.17
1.00
1.02
f1 (ppm)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154.31
137.55
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133.41
133.18
132.69
132.04
130.46
129.84
129.32
128.90
128.19
127.56
120.99
104.48
40.13
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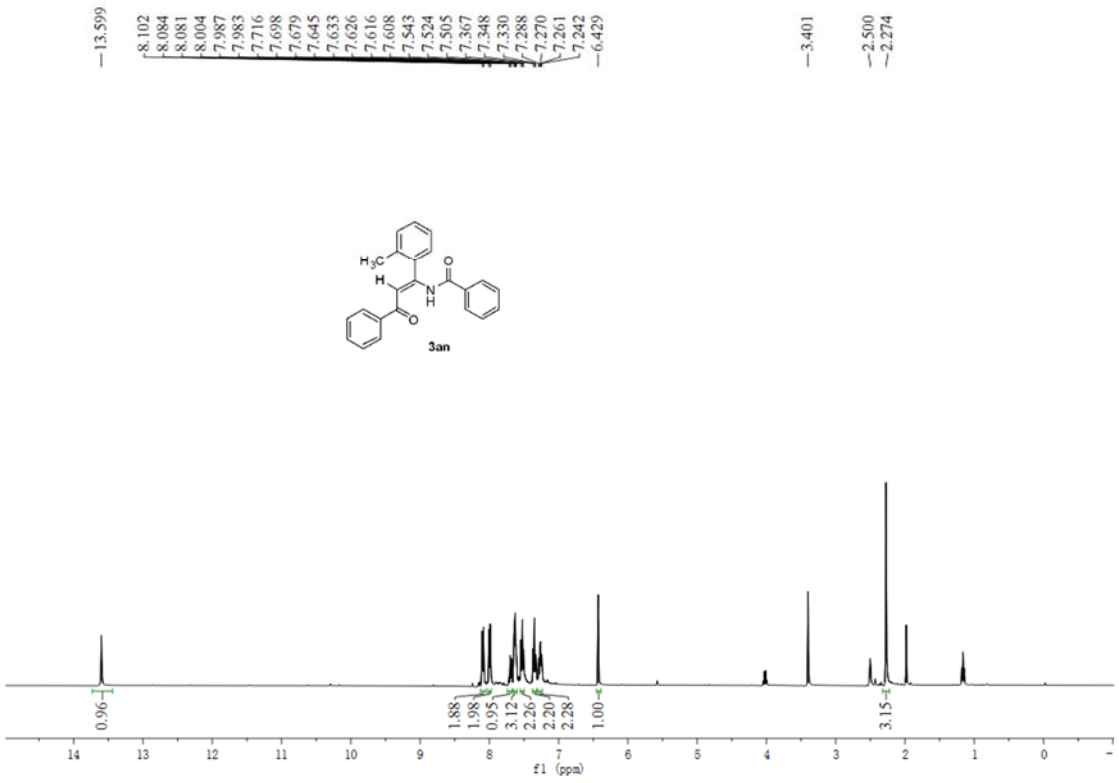
39.50
39.29
39.08
38.87
Br
H
N
H
O
O
3am
f1 (ppm)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7.716
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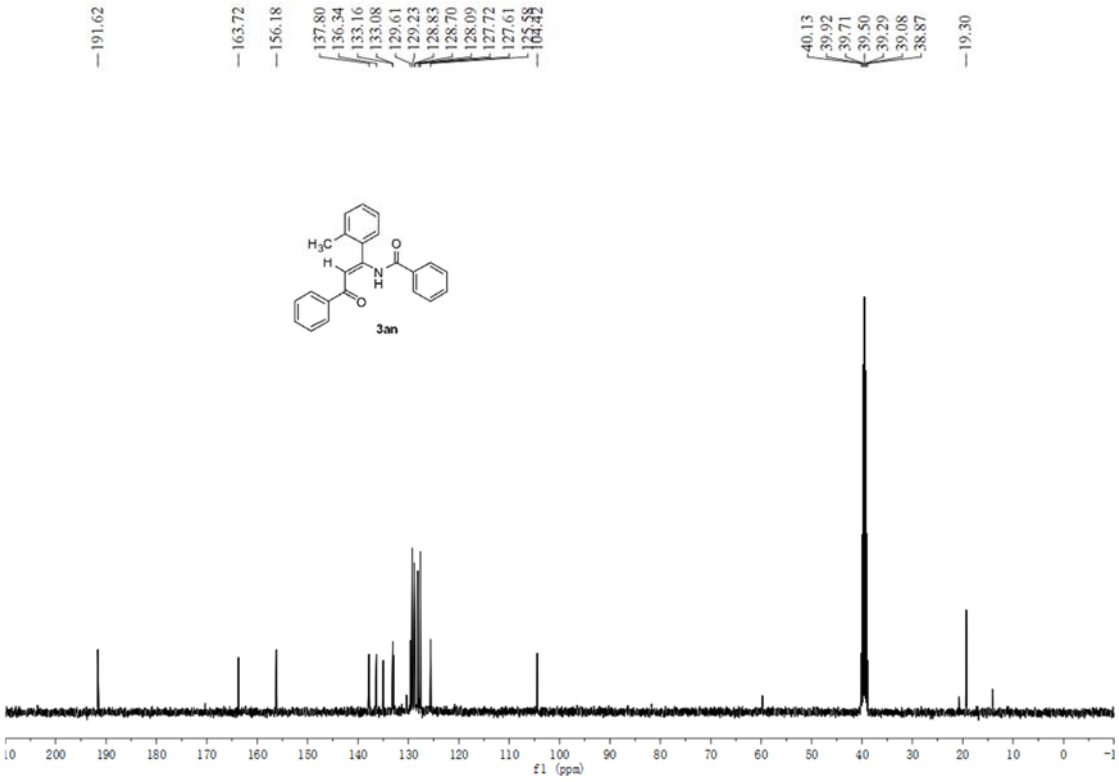
7.645
7.633
7.626
7.616
7.608
7.543
7.524
7.505
7.367
7.348
7.330
7.288
7.270
7.261
7.242
6.429
3.401
2.500
2.274
3an
0.96
1.88
1.98
0.95
3.12
2.26
2.20
2.28
1.00
3.15
f1 (ppm)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128.70
128.09
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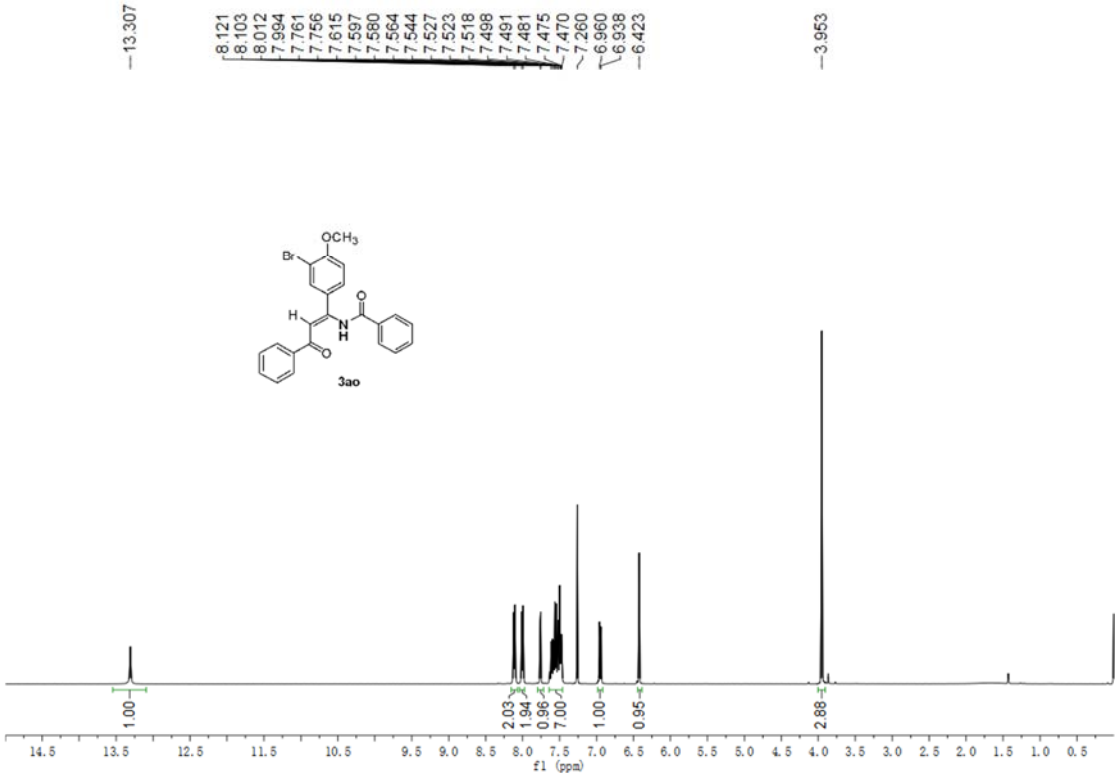
39.50
39.29
39.08
38.87
19.30
3an
f1 (ppm)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7.756
7.615
7.597
7.580
7.564
7.544
7.527
7.523
7.518
7.498
7.491
7.481
7.475
7.470
7.260
6.960
6.938
6.423
3.953
OCH3
Br
H
N
H
O
O
3ao
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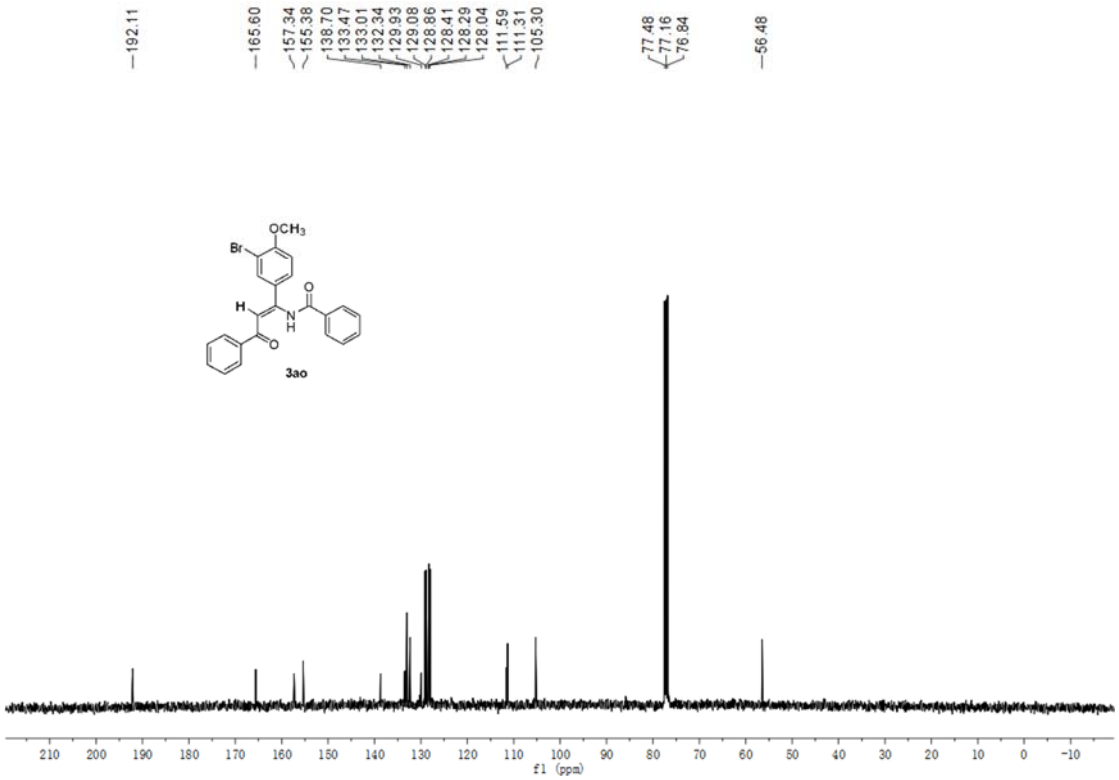
2.03
1.94
0.96
7.00
1.00
0.95
2.88
f1 (ppm)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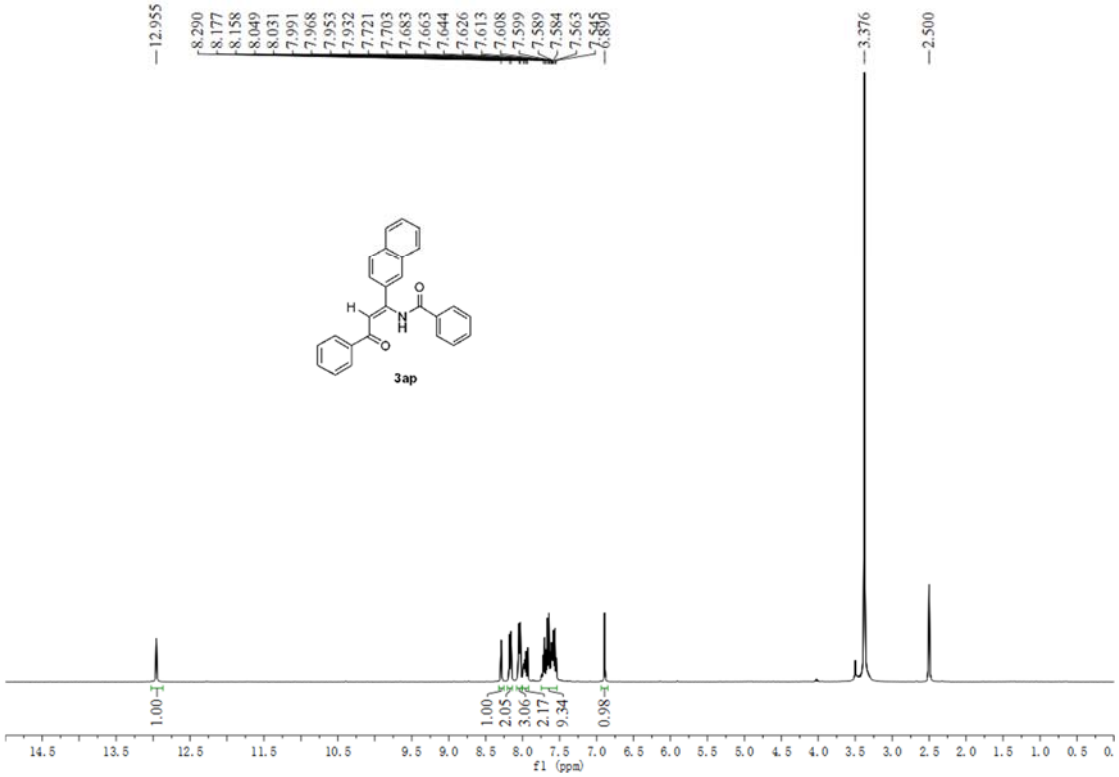
133.01
132.34
129.93
129.08
128.86
128.41
128.29
128.04
111.59
111.31
105.30
77.48
77.16
76.84
56.48
OCH3
Br
H
N
H
O
O
3ao
f1 (ppm)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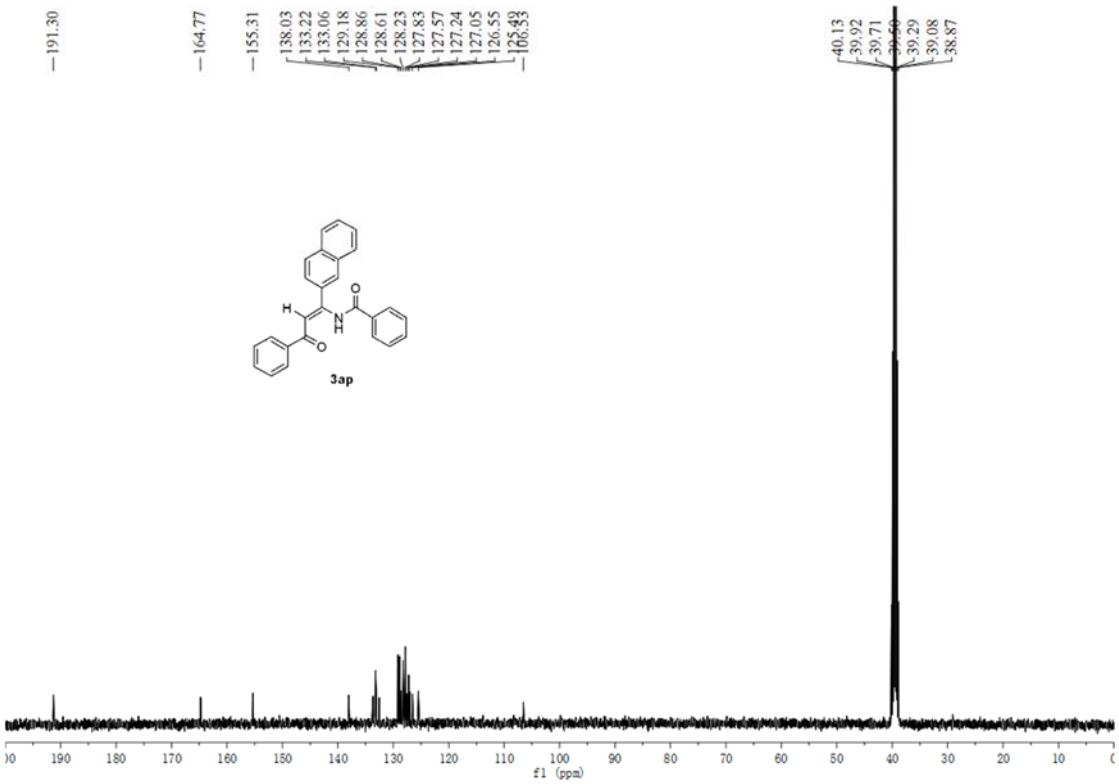
7.968
7.953
7.932
7.721
7.703
7.683
7.663
7.644
7.626
7.613
7.608
7.599
7.589
7.584
7.563
7.545
6.890
3.376
2.500
3ap
1.00
1.00
2.05
3.06
2.17
9.34
0.98
f1 (ppm)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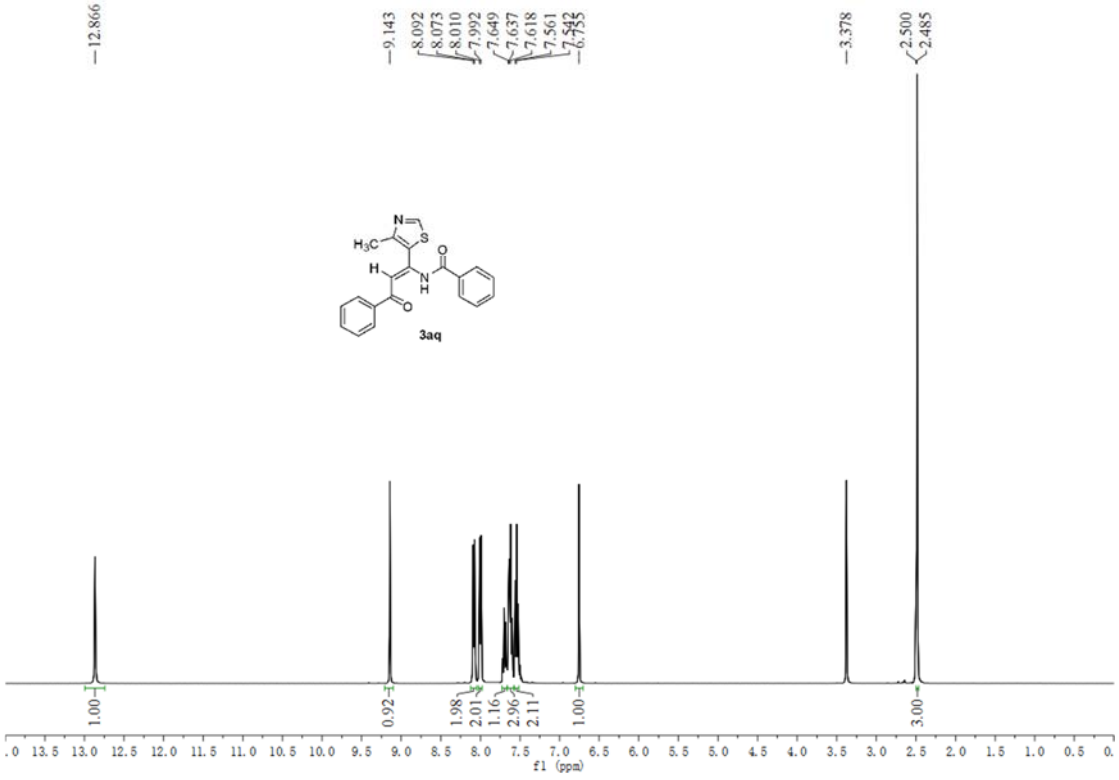
133.22
133.06
129.18
128.86
128.61
128.23
127.83
127.57
127.24
127.05
126.55
125.49
106.53
40.13
39.92
39.71
39.50
39.29
39.08
38.87
3ap
f1 (ppm)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8.092
8.073
8.010
7.992
7.649
7.637
7.618
7.561
7.542
6.755
3.378
2.500
2.485
3aq
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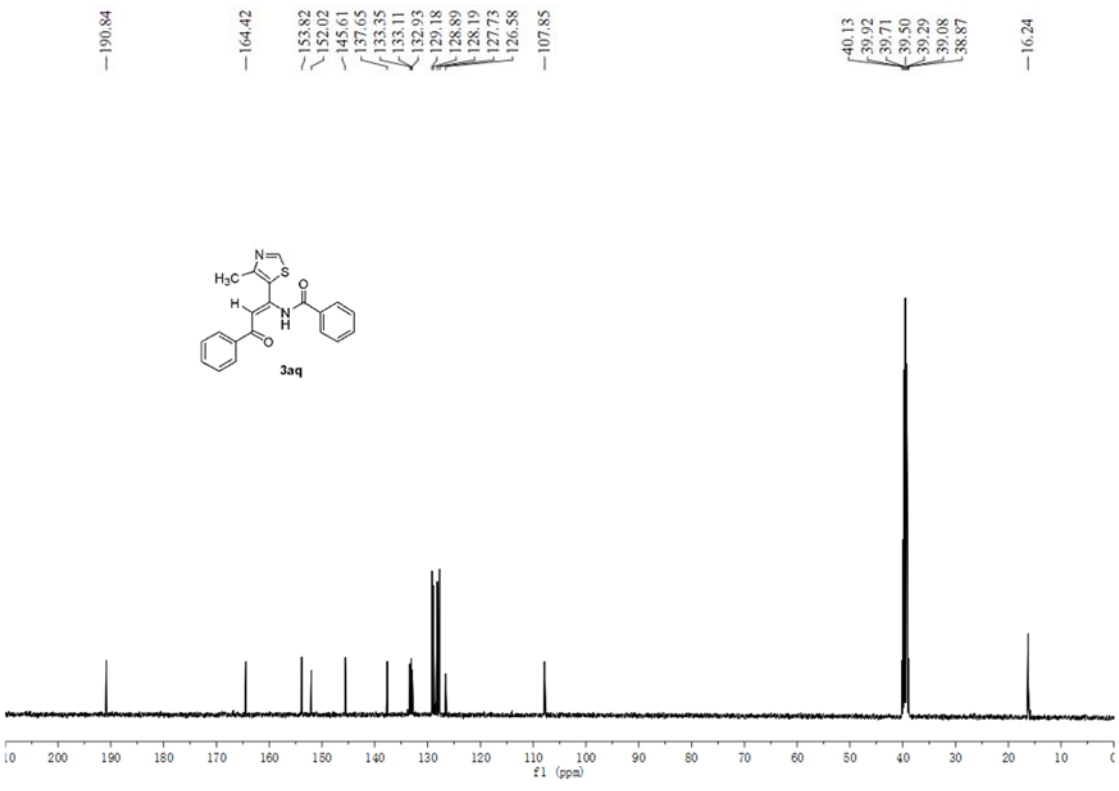
0.92
1.98
2.01
1.16
2.96
2.11
1.00
3.00
f1 (ppm)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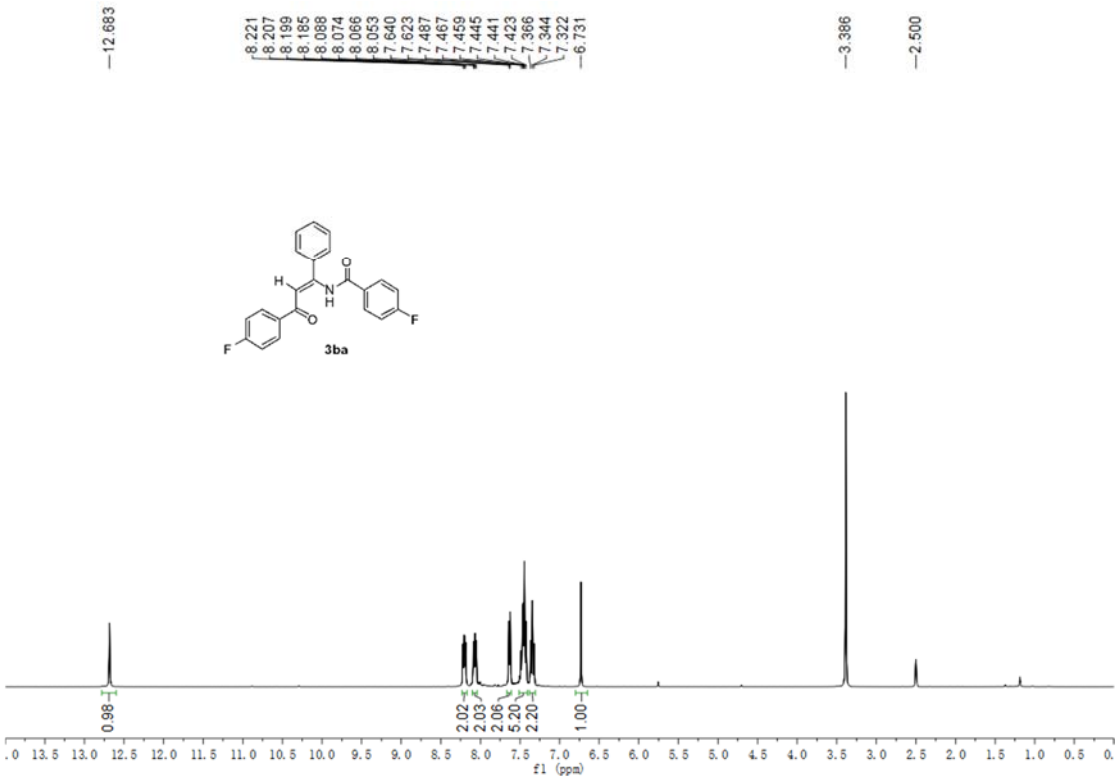
164.42
153.82
152.02
145.61
137.65
133.35
133.11
132.93
129.18
128.89
128.19
127.73
126.58
107.85
40.13
39.92
39.71
39.50
39.29
39.08
38.87
16.24
3aq
f1 (ppm)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8.207
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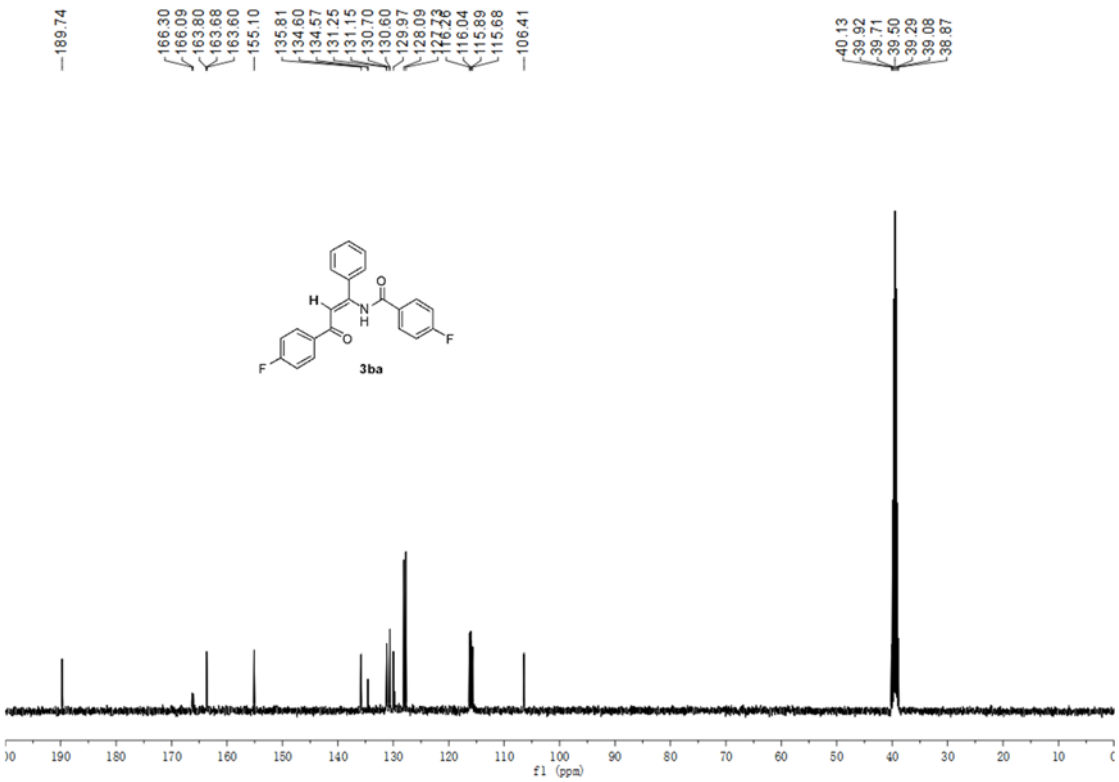
8.185
8.088
8.074
8.066
8.053
7.640
7.623
7.487
7.467
7.459
7.445
7.441
7.423
7.366
7.344
7.322
6.731
3.386
2.500
3ba
0.98
2.02
2.03
2.06
5.20
2.20
1.00
f1 (ppm)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166.09
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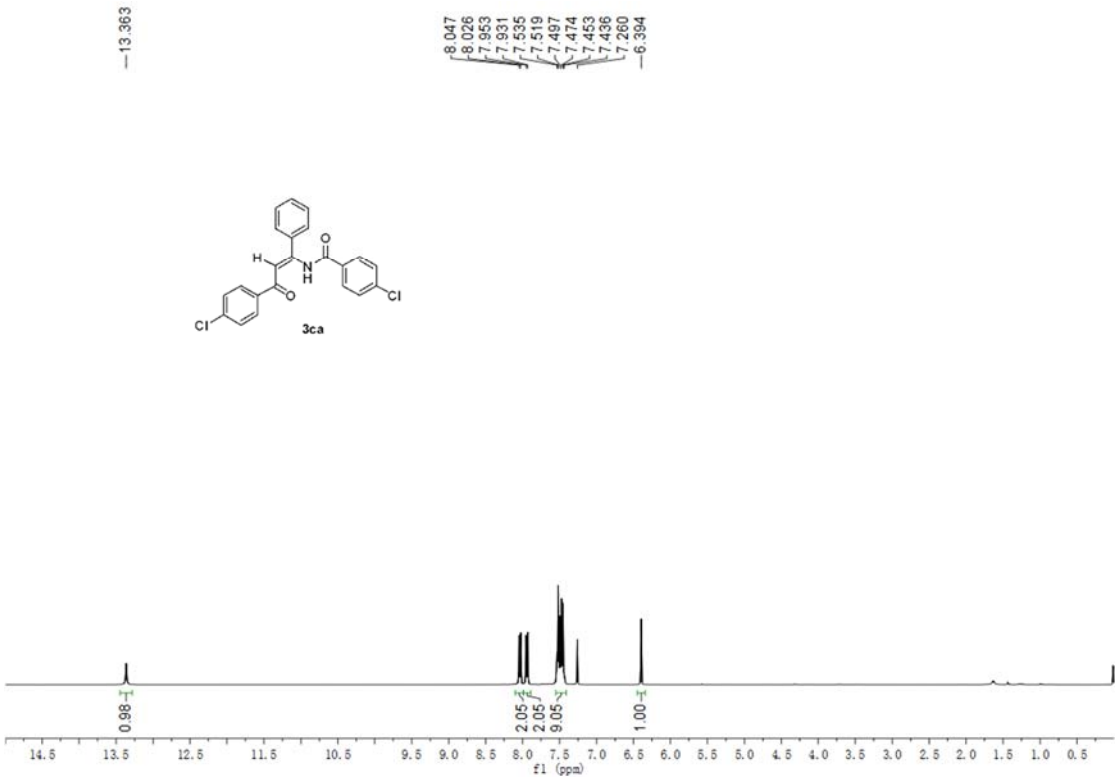
163.68
163.60
155.10
135.81
134.60
134.57
131.25
131.15
130.70
130.60
129.97
128.09
116.04
115.89
115.68
106.41
40.13
39.92
39.71
39.50
39.29
39.08
38.87
3ba
f1 (ppm)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8.026
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7.535
7.519
7.497
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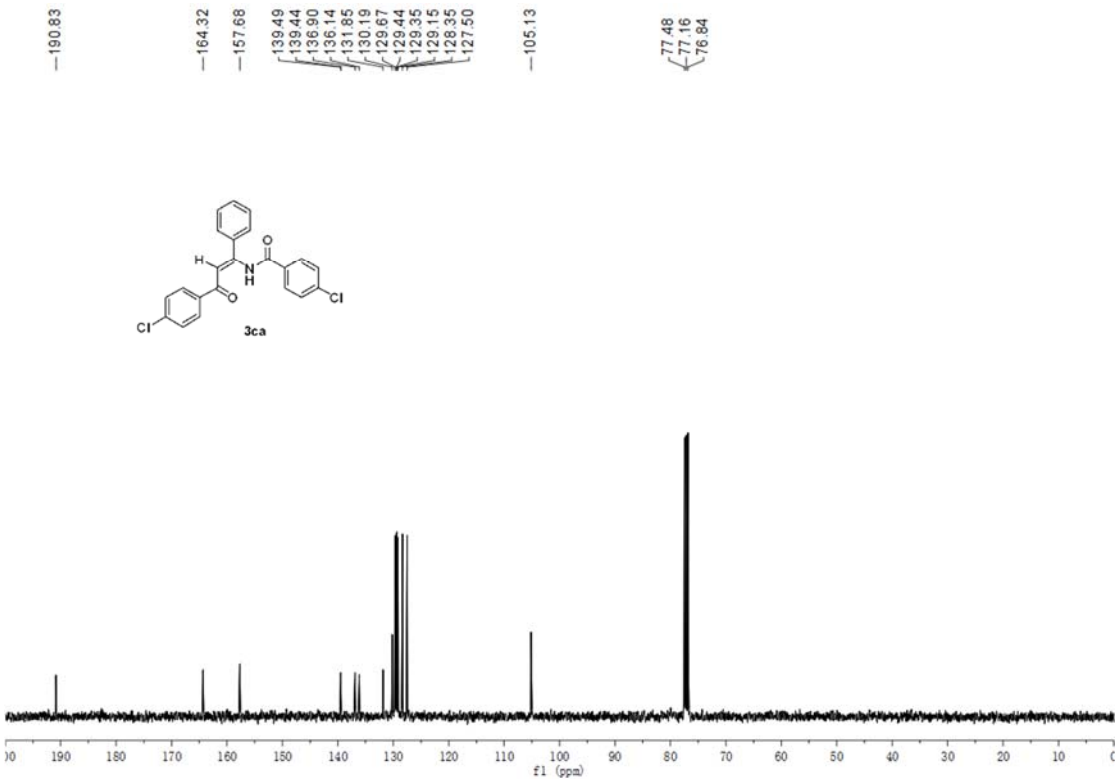
7.260
6.394
3ca
0.98
2.05
2.05
9.05
1.00
f1 (ppm)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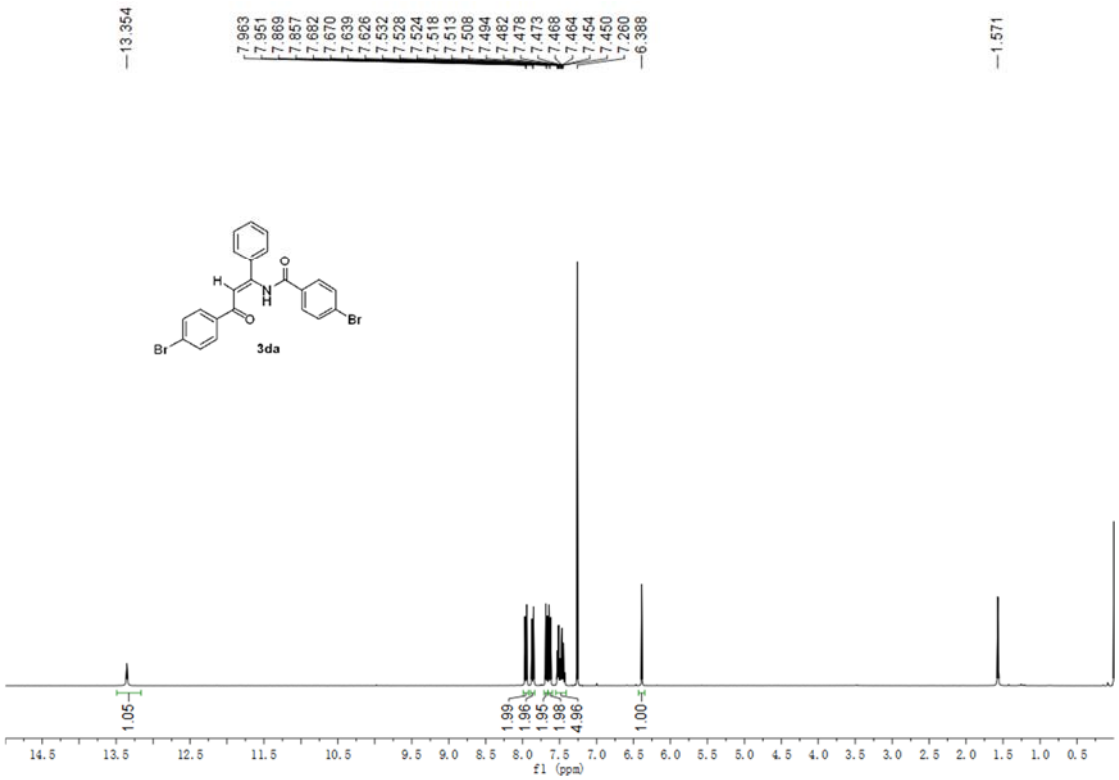
157.68
139.49
139.44
136.90
136.14
131.85
130.19
129.67
129.44
129.35
129.15
128.35
127.50
105.13
77.48
77.16
76.84
3ca
f1 (ppm)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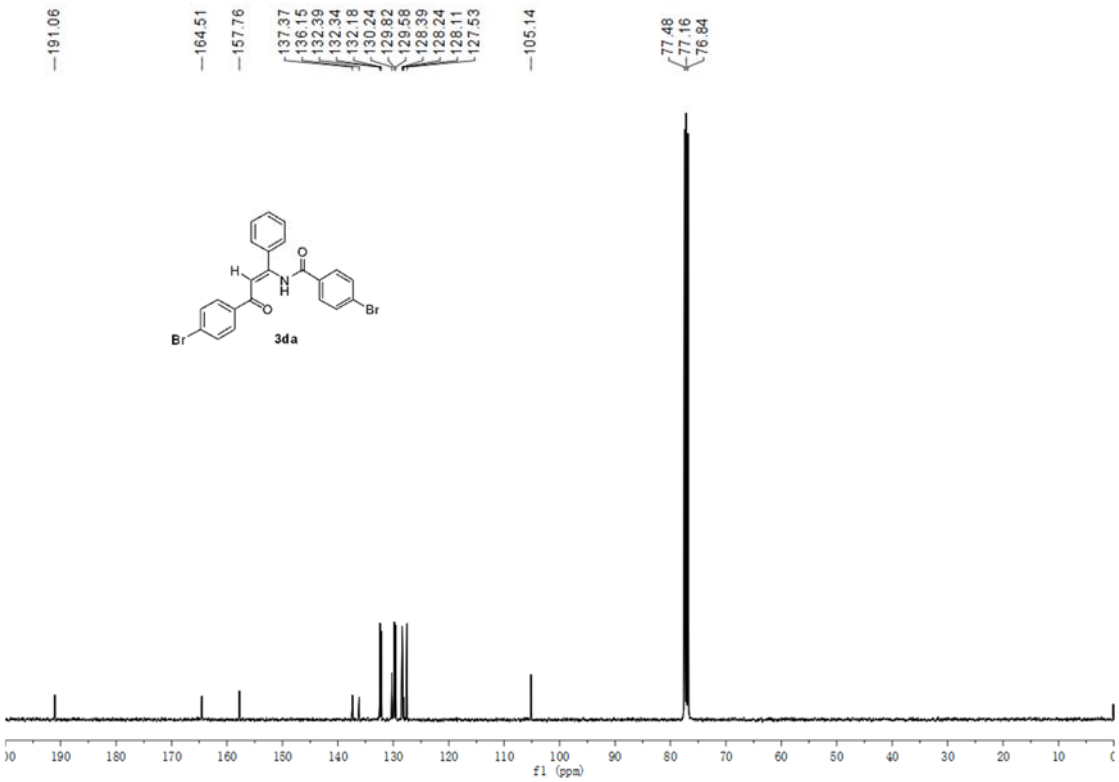
7.869
7.857
7.682
7.670
7.639
7.626
7.532
7.528
7.524
7.518
7.513
7.508
7.494
7.482
7.478
7.473
7.468
7.464
7.454
7.450
7.260
6.388
1.571
3da
1.05
1.99
1.96
1.95
1.98
4.96
1.00
f1 (ppm)


191.06
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157.76
137.37
136.15
132.39
132.34
132.18
130.24
129.82
129.58
128.39
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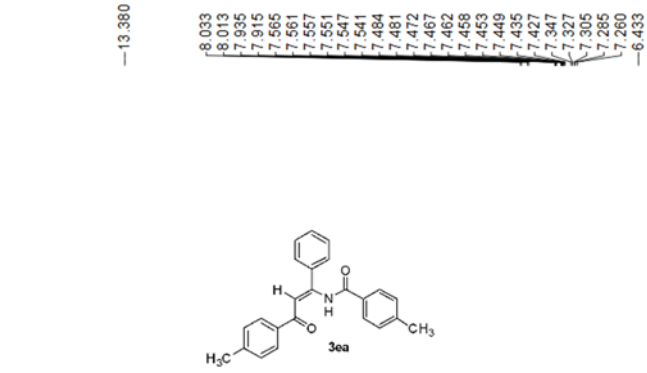
105.14
77.48
77.16
76.84
3da
f1 (ppm)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7.565
7.561
7.557
7.551
7.547
7.541
7.484
7.481
7.472
7.467
7.462
7.458
7.453
7.449
7.435
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7.347
7.327
7.305
7.285
7.260
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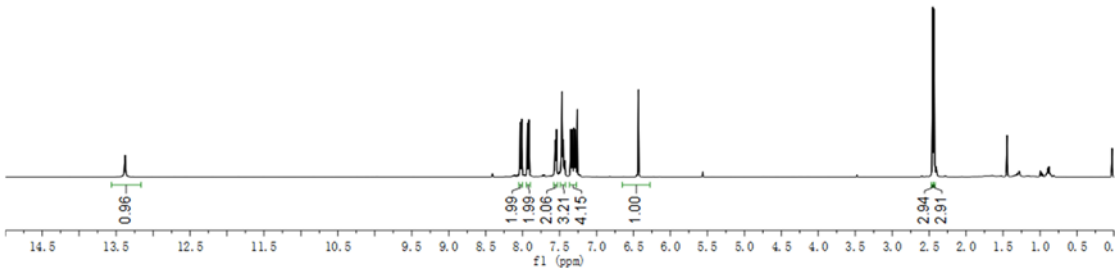
2.433
1.447
3ea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1.99
1.99
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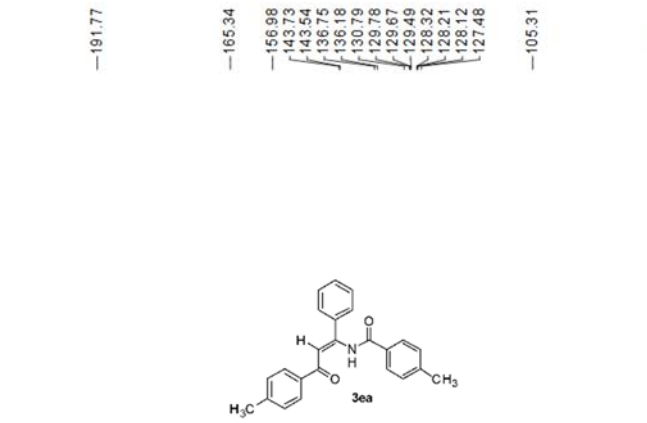
3.21
4.15
1.00
2.94
2.91
f1 (ppm)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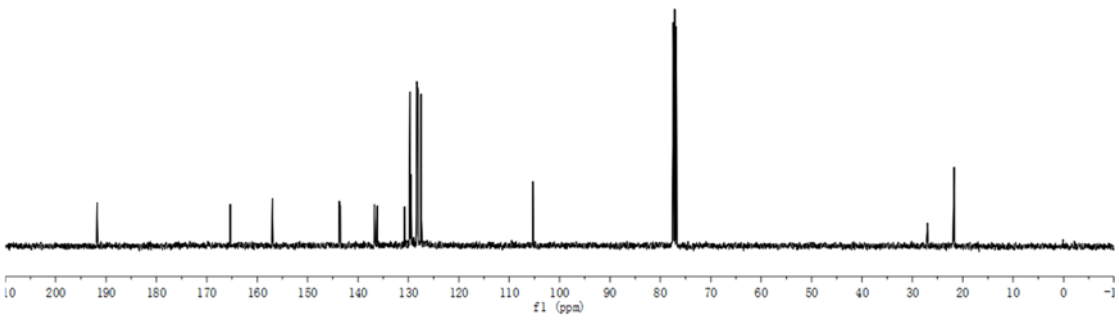
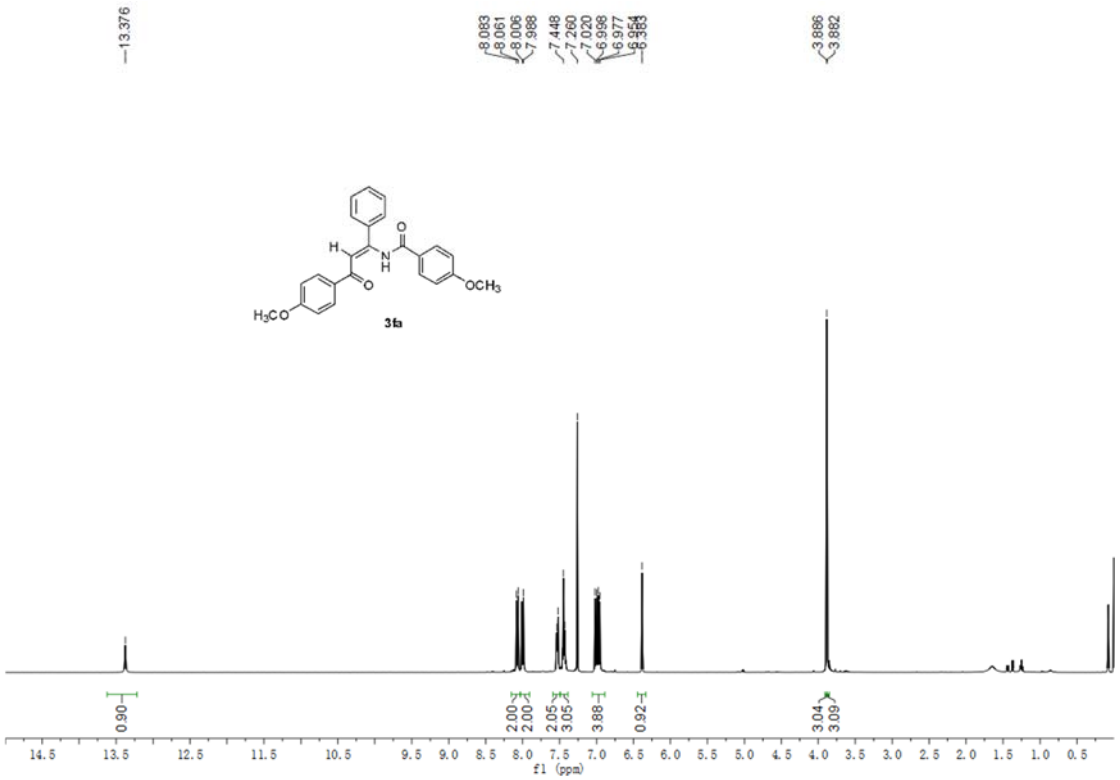
136.18
130.79
129.78
129.67
129.49
128.32
128.21
128.12
127.48
105.31
77.48
77.16
76.84
21.75
21.72
3ea


f1 (ppm)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8.061
8.006
7.988
7.448
7.260
7.020
6.998
6.977
6.954
6.933
3.886
3.882
3fa
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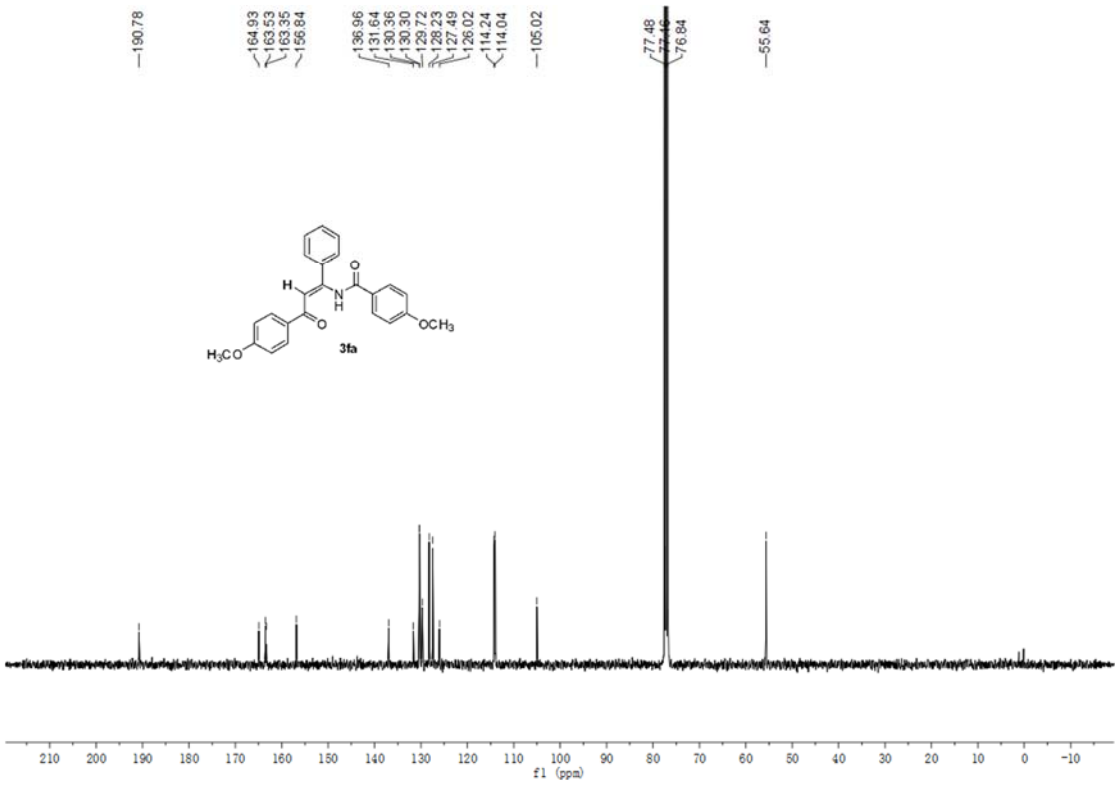
2.00
2.00
2.05
3.05
3.88
0.92
3.04
3.09
f1 (ppm)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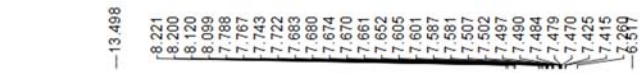
163.35
156.84
136.96
131.64
130.36
130.30
129.72
128.23
127.49
126.02
114.24
114.04
105.02
77.48
77.16
76.84
55.64
3fa
f1 (ppm)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8.099
7.788
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7.743
7.722
7.683
7.680
7.674
7.670
7.661
7.652
7.605
7.601
7.587
7.581
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7.497
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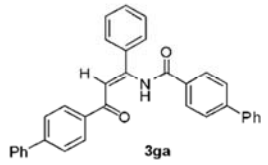
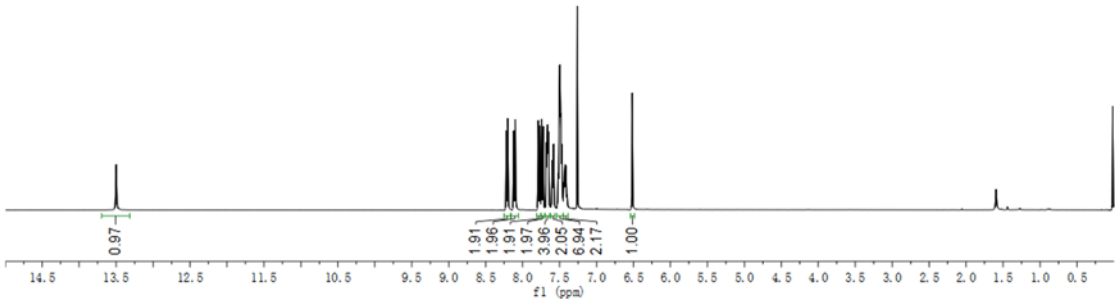
7.479
7.470
7.425
7.415
7.269
6.517


H
N
H
O
O
Ph
Ph

3ga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1.96
1.91
1.97
3.96
2.05
6.94
2.17
1.00
14.5
13.5
12.5
11.5
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)


191.67
183.53
165.17
157.31
145.68
145.66
139.97
132.23
129.99
129.11
128.88
128.68
128.38
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127.70
127.58
127.48
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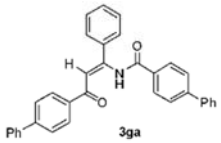
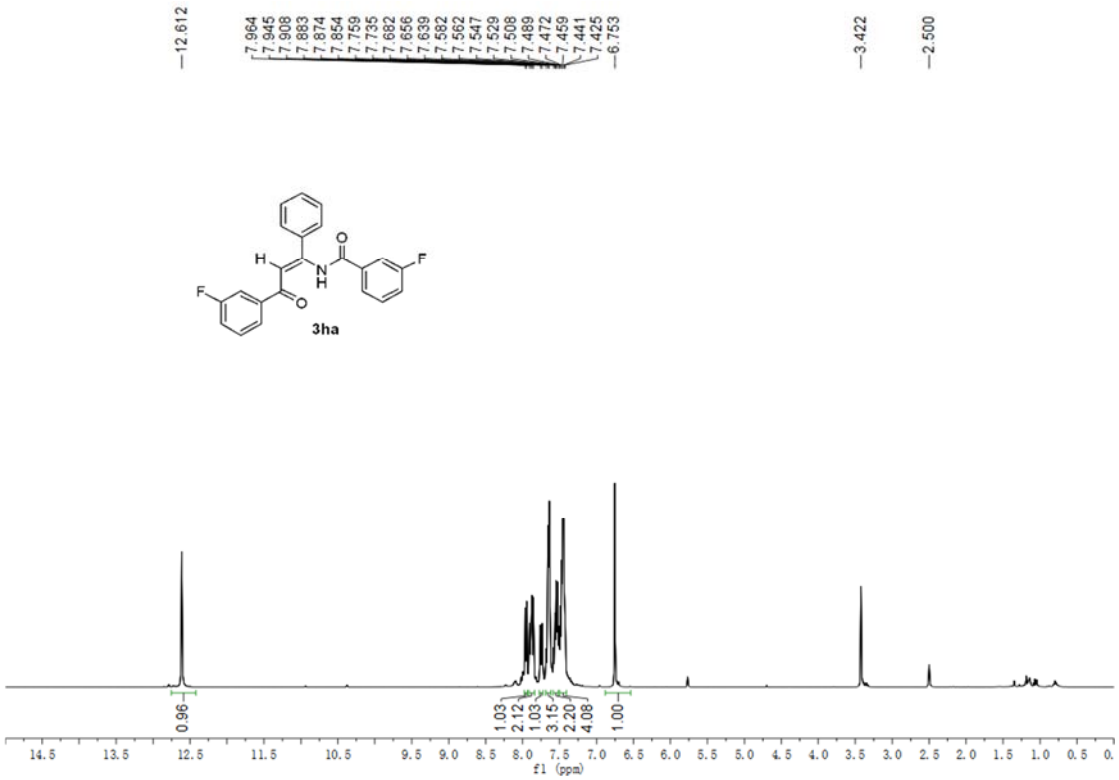
77.48
77.16
76.84


H
N
H
O
O
Ph
Ph

3ga

190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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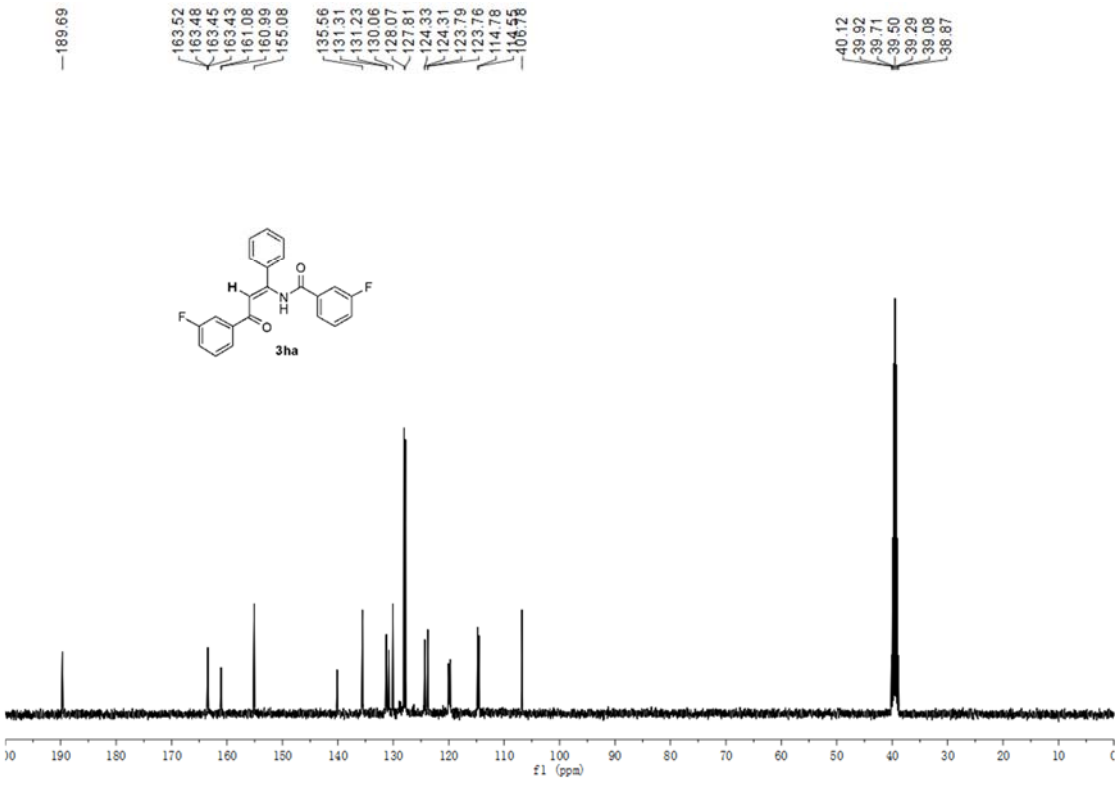
7.639
7.582
7.562
7.547
7.529
7.508
7.489
7.472
7.459
7.441
7.425
6.753
3.422
2.500
3ha
0.96
1.03
2.12
1.03
3.15
2.20
4.08
1.00
f1 (ppm)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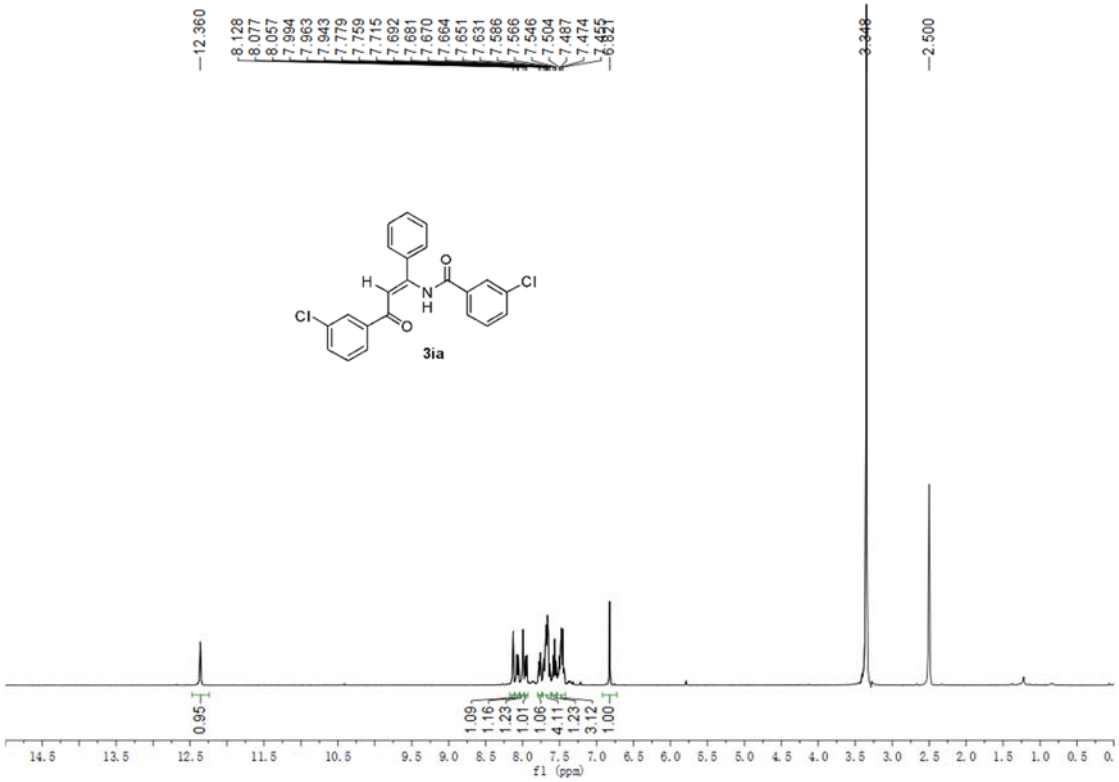
161.08
160.99
155.08
135.56
131.31
131.23
130.06
128.07
127.81
124.33
124.31
123.79
123.76
114.78
114.55
106.78
40.12
39.92
39.71
39.50
39.29
39.08
38.87
3ha
f1 (ppm)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8.077
8.057
7.994
7.963
7.943
7.779
7.759
7.715
7.692
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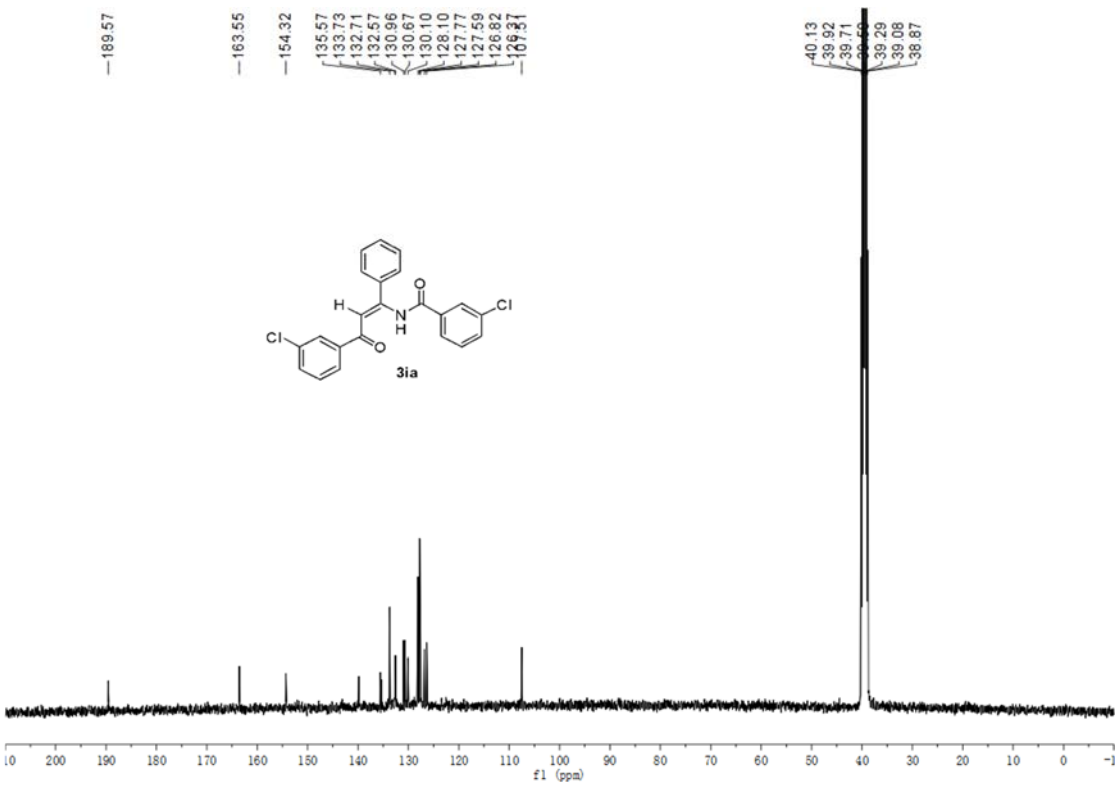
7.664
7.651
7.631
7.586
7.566
7.546
7.504
7.487
7.474
7.455
3.348
2.500
0.95
1.09
1.16
1.23
1.01
1.06
4.11
1.23
3.12
1.00
f1 (ppm)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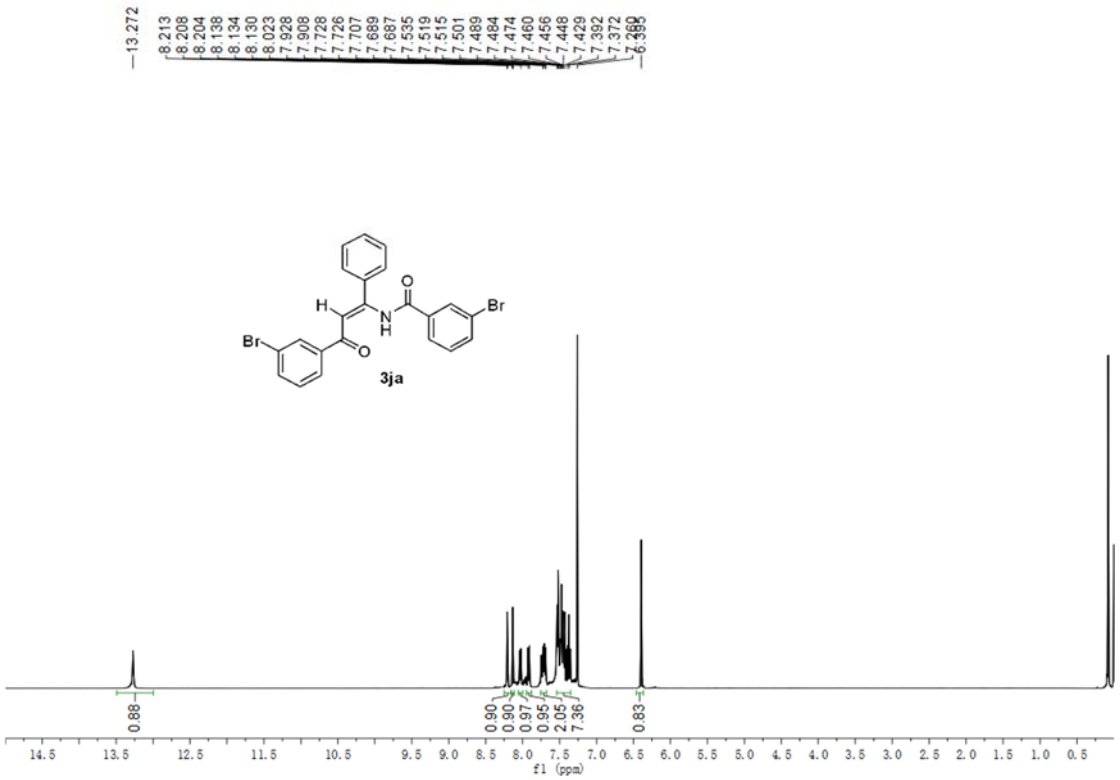
163.55
154.32
135.57
133.73
132.71
132.57
130.96
130.67
130.10
128.10
127.77
127.59
126.82
40.13
39.92
39.71
39.29
39.08
38.87
f1 (ppm)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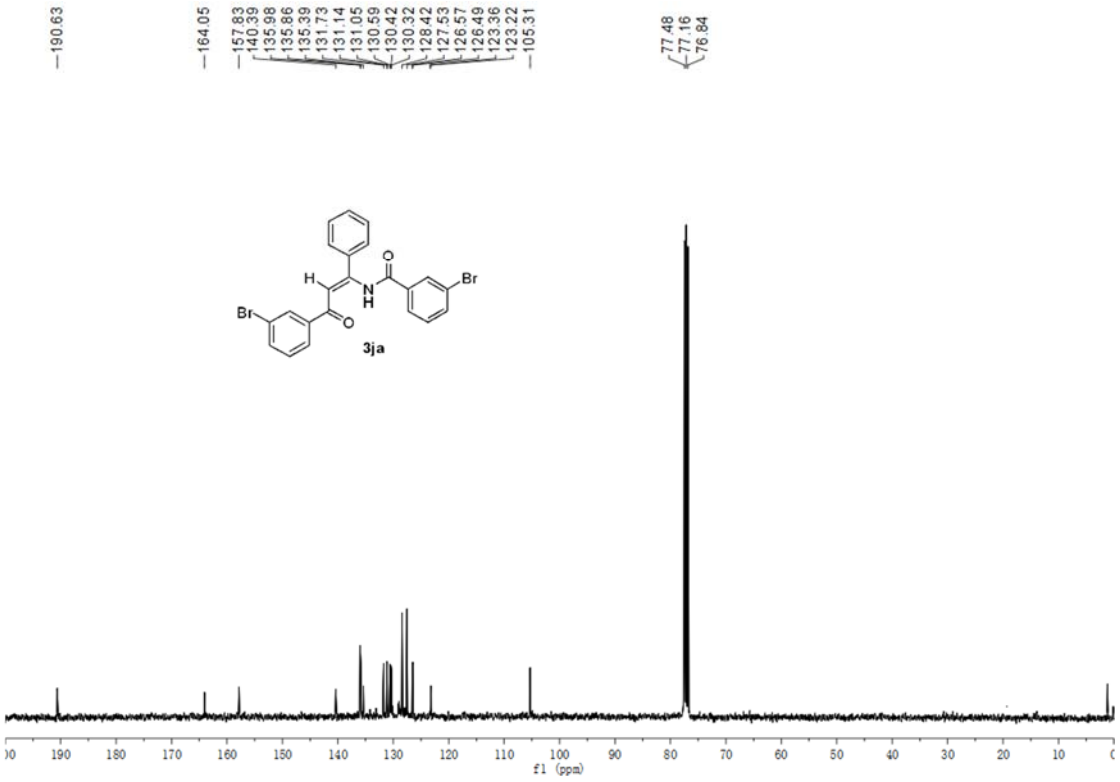
8.138
8.134
8.130
8.023
7.928
7.908
7.728
7.726
7.707
7.689
7.687
7.535
7.519
7.515
7.501
7.489
7.484
7.474
7.460
7.456
7.448
7.429
7.392
7.372
Br
O
H
N
H
O
Br
3ja
0.88
0.90
0.90
0.97
0.95
2.05
7.36
0.83
f1 (ppm)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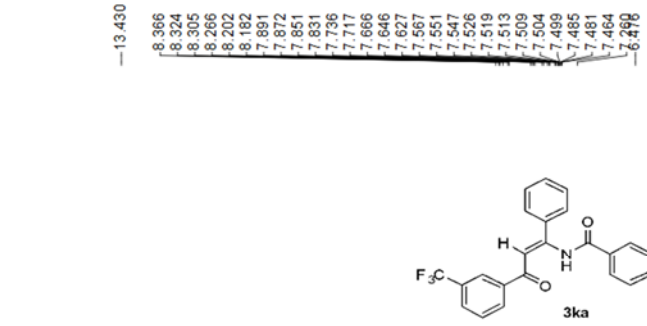
135.86
135.39
131.73
131.14
131.05
130.59
130.42
130.32
128.42
127.53
126.57
126.49
123.36
123.22
105.31
77.48
77.16
76.84
Br
O
H
N
H
O
Br
3ja
f1 (ppm)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7.831
7.736
7.717
7.666
7.646
7.627
7.567
7.551
7.547
7.526
7.519
7.513
7.509
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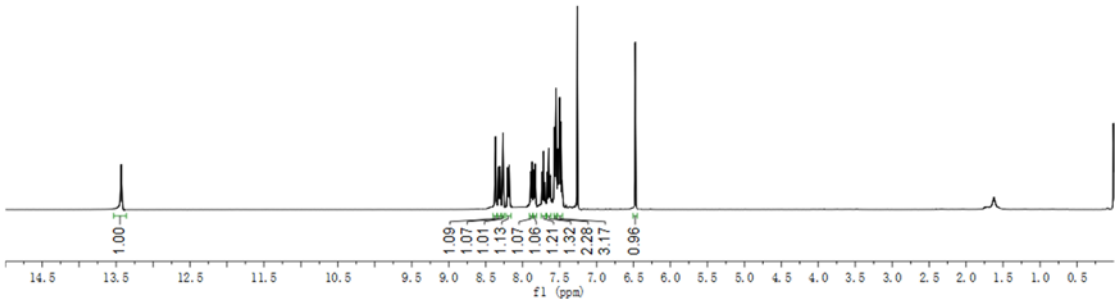
7.481
7.464
7.260
6.476

H
O
N
H
CF3
F3C
O

3ka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2.28
3.17
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14.5
13.5
12.5
11.5
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
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4.0
3.5
3.0
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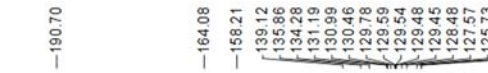
1.5
1.0
0.5
f1 (ppm)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134.28
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130.99
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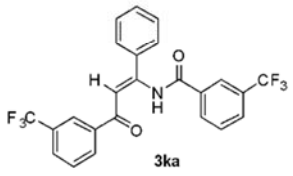
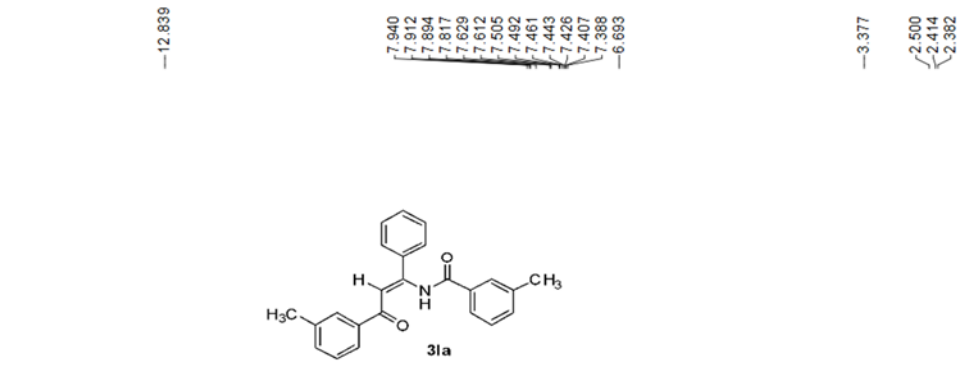
127.57
125.73
124.98
77.48
77.16
76.84


H
O
N
H
CF3
F3C
O

3ka

190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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7.426
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3.377
2.500
2.414
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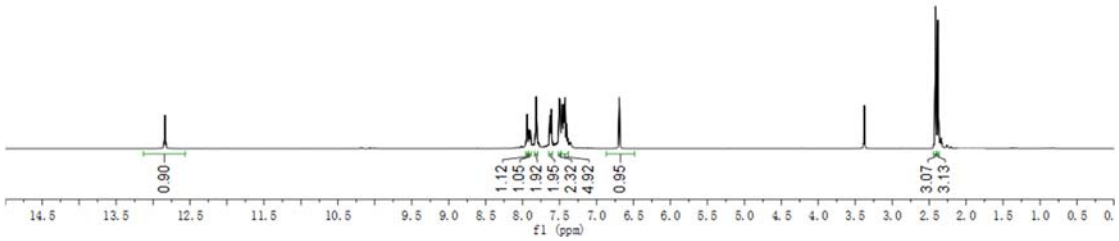
N
H
O
O
H3C
CH3
3la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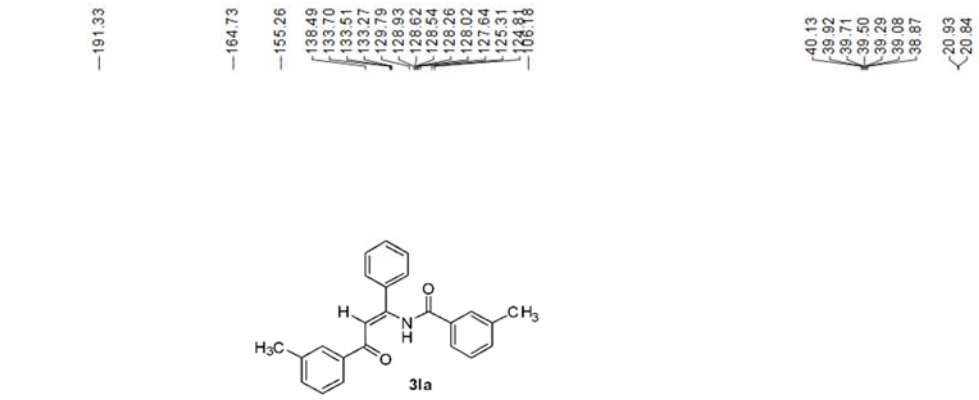
3.13
f1 (ppm)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128.62
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128.26
128.02
127.64
125.31
40.13
39.92
39.71
39.50
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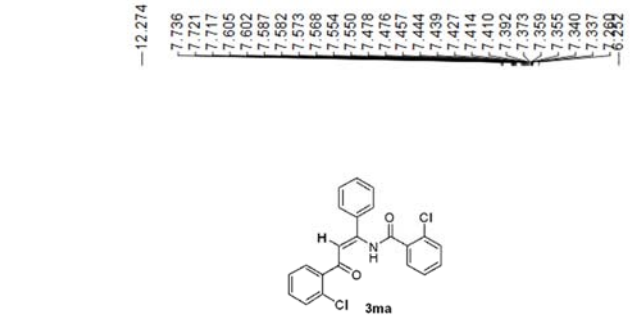
39.08
38.87
20.93
20.84
H
N
H
O
O
H3C
CH3
3la
f1 (ppm)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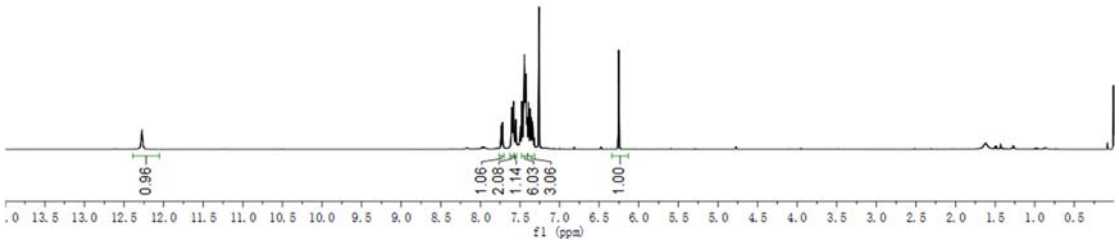
7.602
7.587
7.582
7.573
7.568
7.554
7.550
7.478
7.476
7.457
7.444
7.439
7.427
7.414
7.410
7.392
7.373
7.359
7.355
7.340
7.337
7.269
6.252
H
O
N
H
O
Cl
Cl
3ma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1.14
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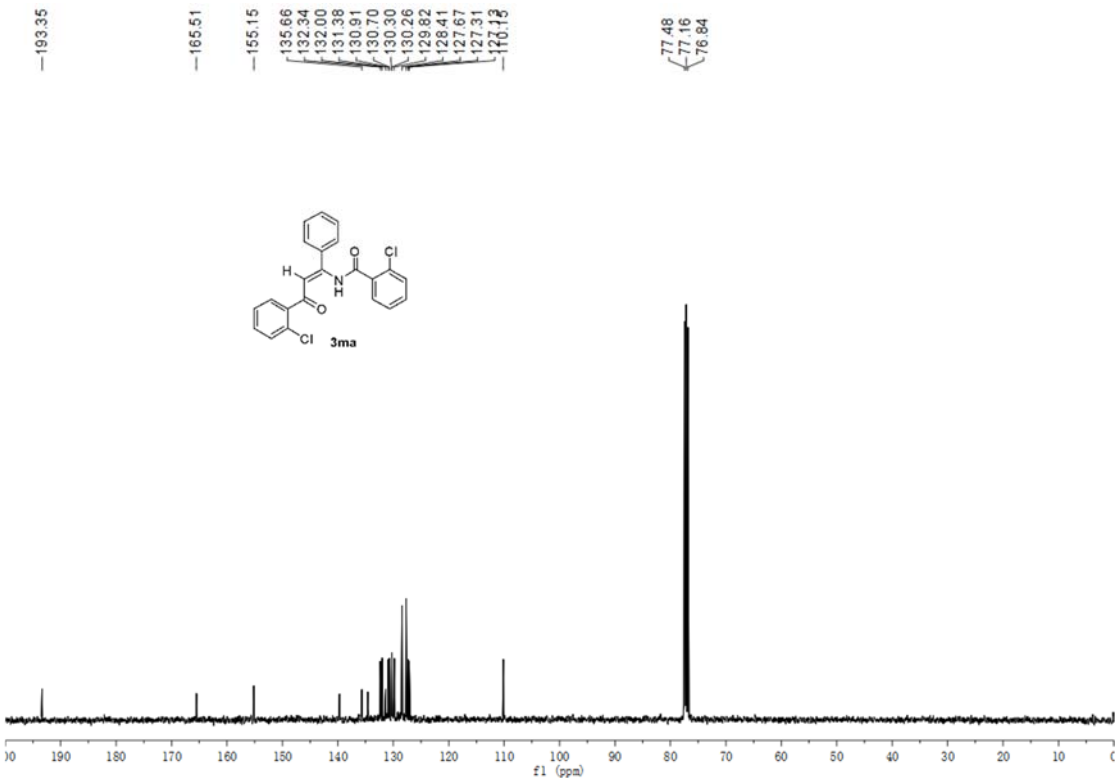
1.00
f1 (ppm)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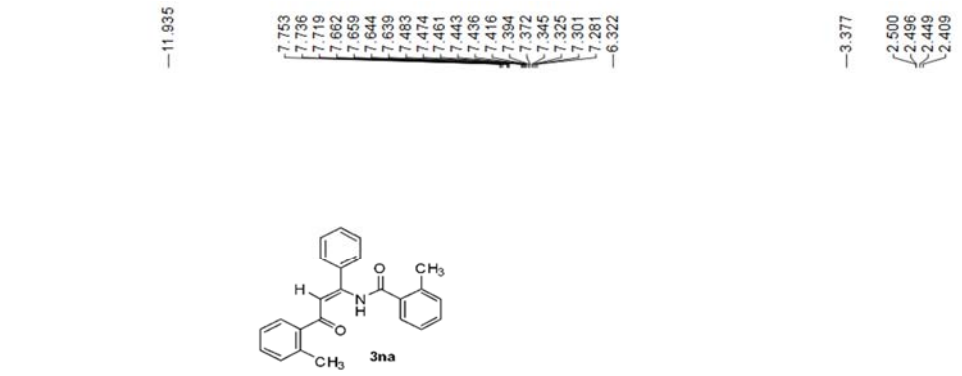
155.15
135.66
132.34
132.00
131.38
130.91
130.70
130.30
130.26
129.82
128.41
127.67
127.31
77.48
77.16
76.84
H
O
N
H
O
Cl
Cl
3ma
f1 (ppm)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7.639
7.483
7.474
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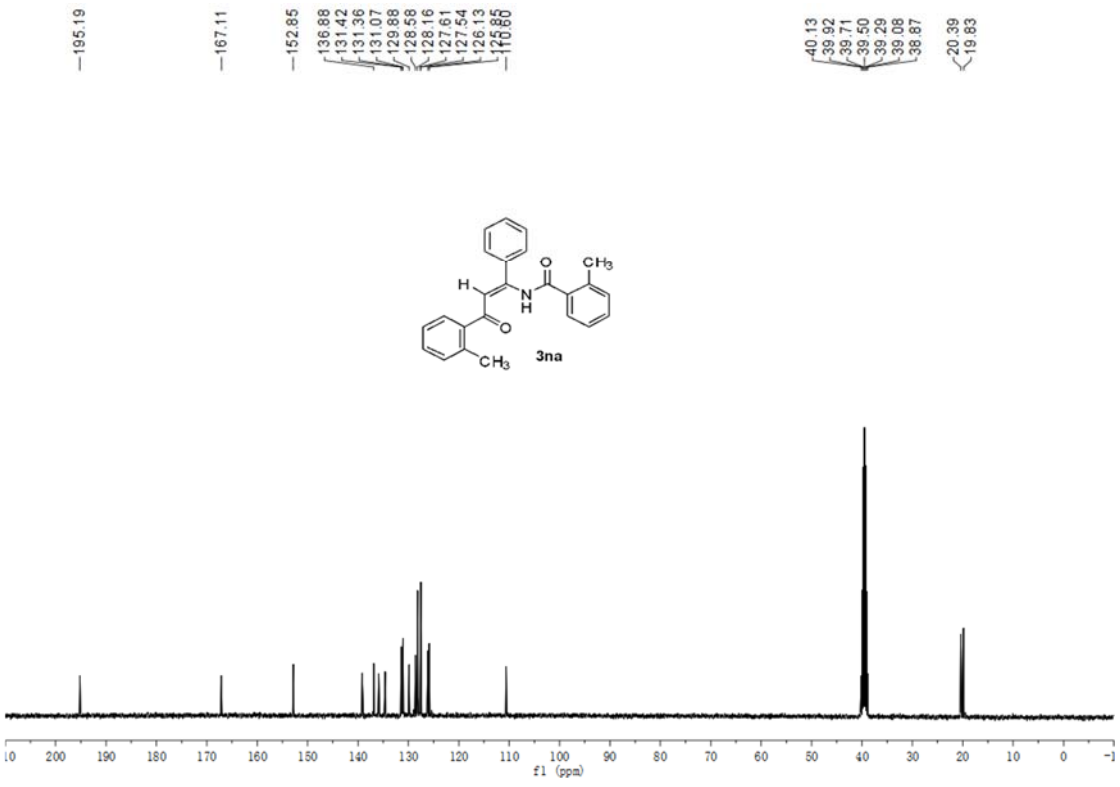
7.443
7.436
7.416
7.394
7.372
7.345
7.325
7.301
7.281
6.322
3.377
2.500
2.496
2.449
2.409
3na
0.98
2.00
1.99
4.08
5.19
1.00
2.90
3.00
f1 (ppm)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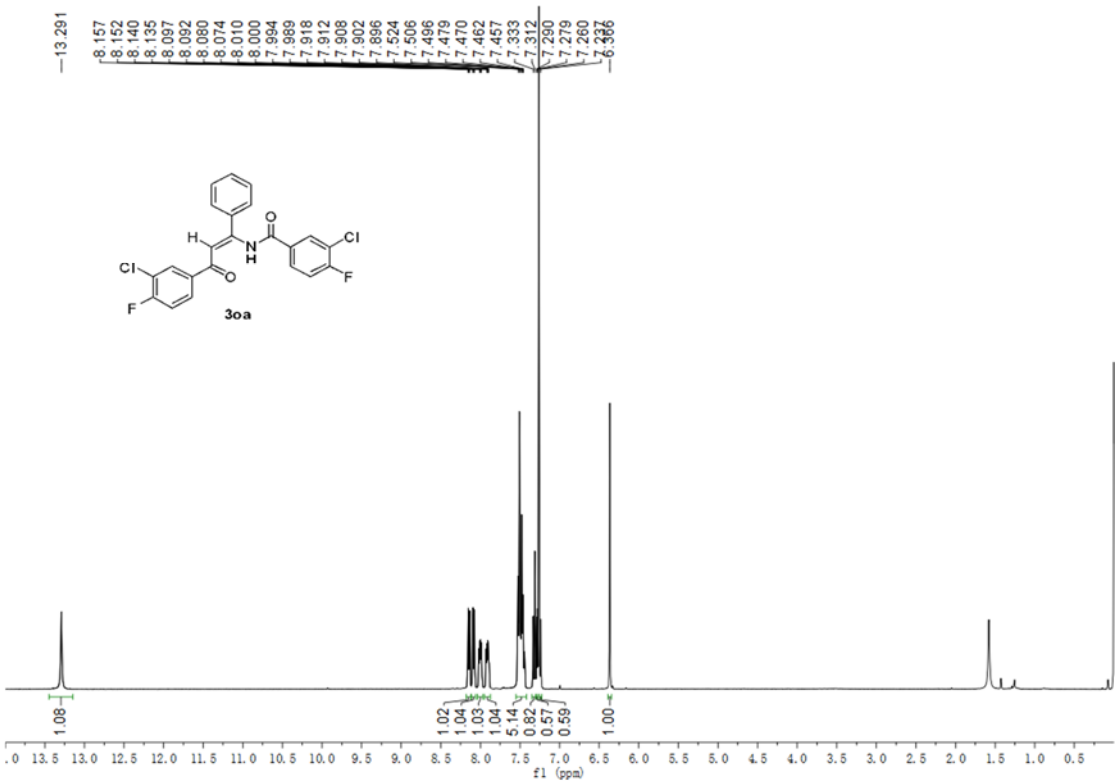
152.85
136.88
131.42
131.36
131.07
129.88
128.58
128.16
127.61
127.54
126.13
125.85
110.60
40.13
39.92
39.71
39.50
39.29
39.08
38.87
20.39
19.83
3na
f1 (ppm)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8.152
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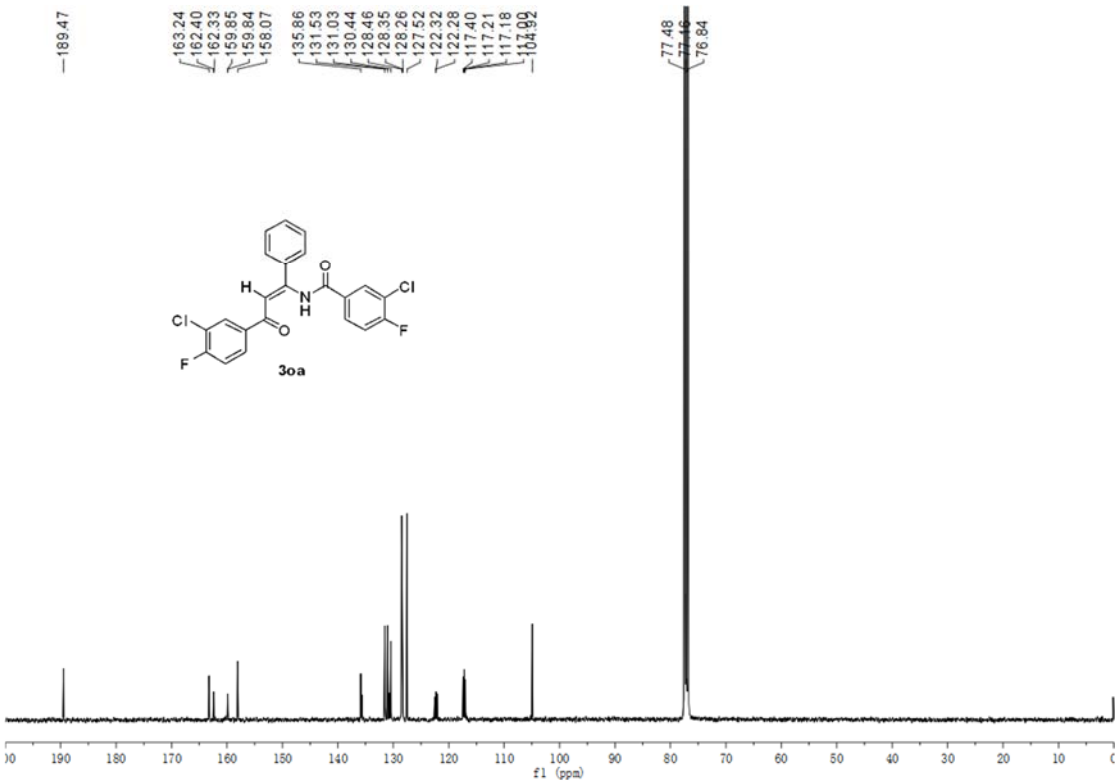
8.135
8.097
8.092
8.080
8.074
8.010
8.000
7.994
7.989
7.918
7.912
7.908
7.902
7.896
7.524
7.506
7.496
7.479
7.470
7.462
7.457
7.333
7.312
7.290
7.279
7.260
7.237
6.366
1.08
1.02
1.04
1.03
1.04
5.14
0.82
0.57
0.59
1.00
f1 (ppm)

3oa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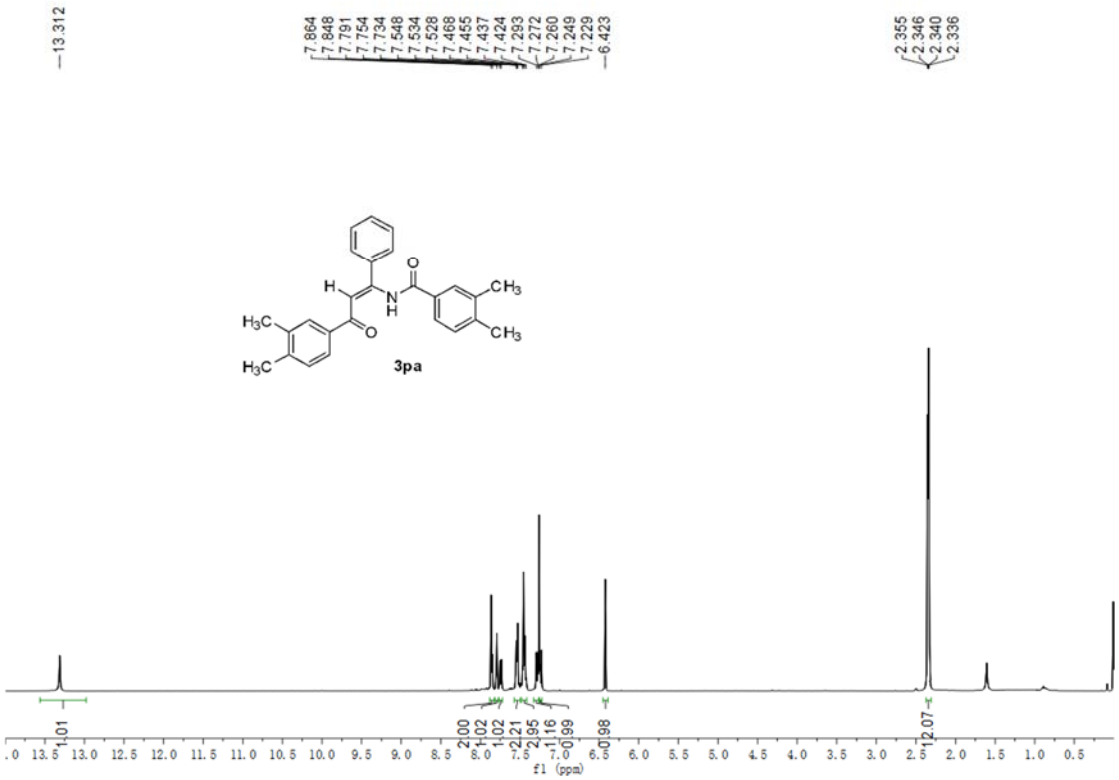
131.03
130.44
128.46
128.35
128.26
127.52
122.32
122.28
117.40
117.21
117.18
77.48
76.84
f1 (ppm)

3oa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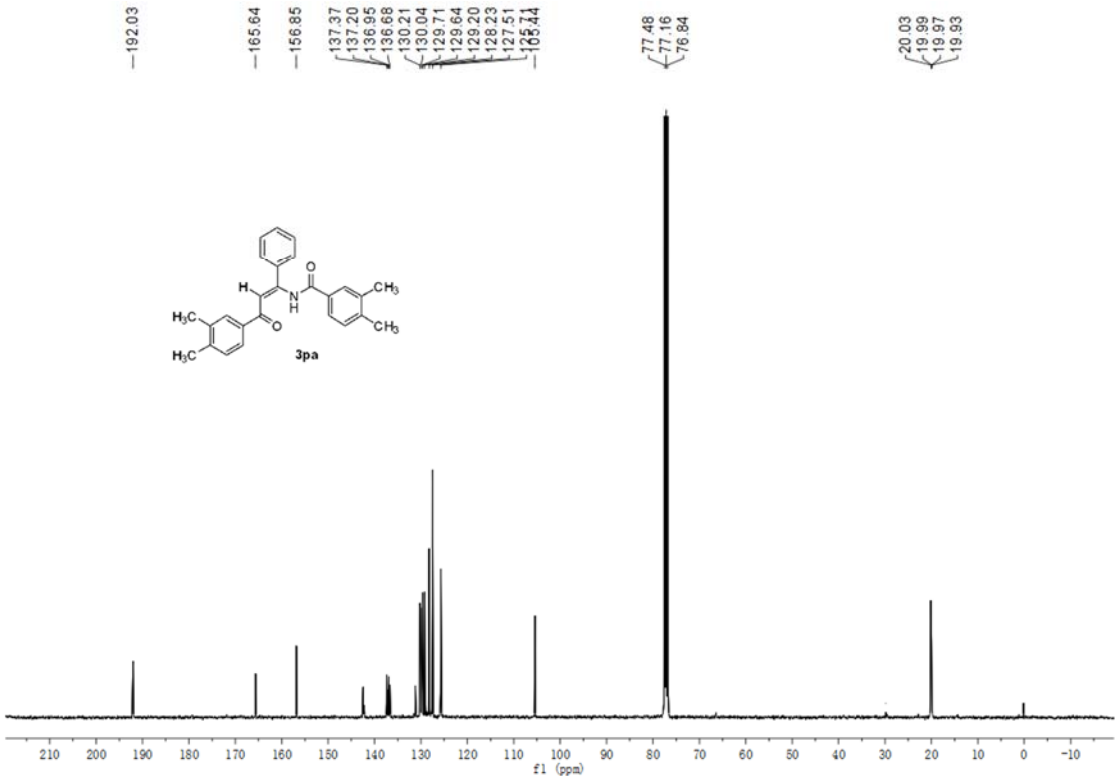
7.848
7.791
7.754
7.734
7.548
7.534
7.528
7.468
7.455
7.437
7.424
7.293
7.272
7.260
7.249
7.229
6.423
2.355
2.346
2.340
2.336
3pa
1.01
2.00
1.02
1.02
2.21
2.95
1.16
0.99
0.98
12.07
f1 (ppm)


192.03
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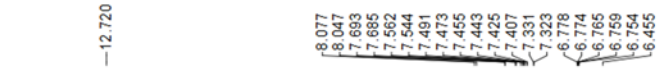
156.85
137.37
137.20
136.95
136.68
130.21
130.04
129.71
129.64
129.20
128.23
127.51
77.48
77.16
76.84
20.03
19.99
19.97
19.93
3pa
f1 (ppm)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7.491
7.473
7.455
7.443
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6.765
6.759
6.754
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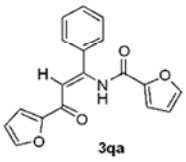
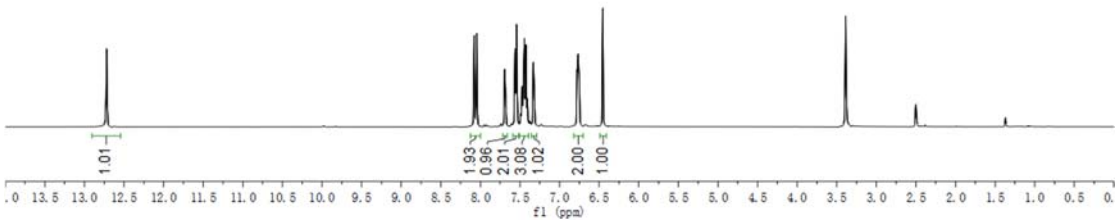
3.387
2.500


H
N
O
O
O
O

3qa


1.01
1.93
0.96
2.01
3.08
1.02
2.00
1.00
f1 (ppm)


178.90
155.04
154.22
152.71
148.32
147.06
146.75
135.42
129.85
127.98
127.64
118.64
117.00
113.01
105.65
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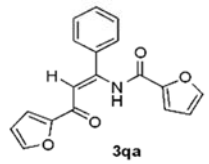
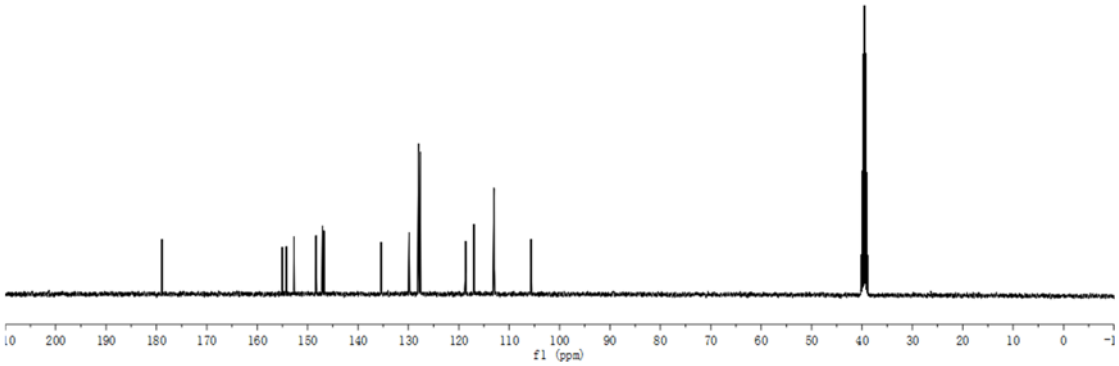
39.08
38.87


H
N
O
O
O
O

3qa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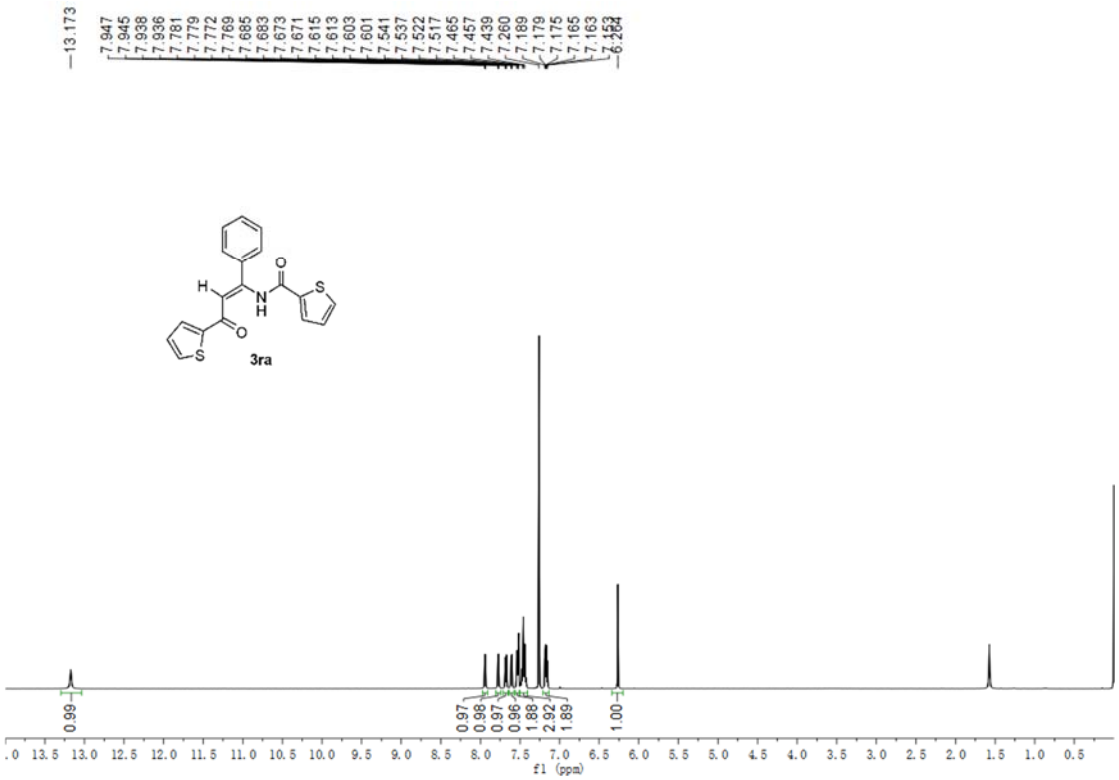
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7.673
7.671
7.615
7.613
7.603
7.601
7.541
7.537
7.522
7.517
7.465
7.457
7.439
7.260
7.189
7.179
7.175
7.165
7.163
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0.97
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0.96
1.88
2.92
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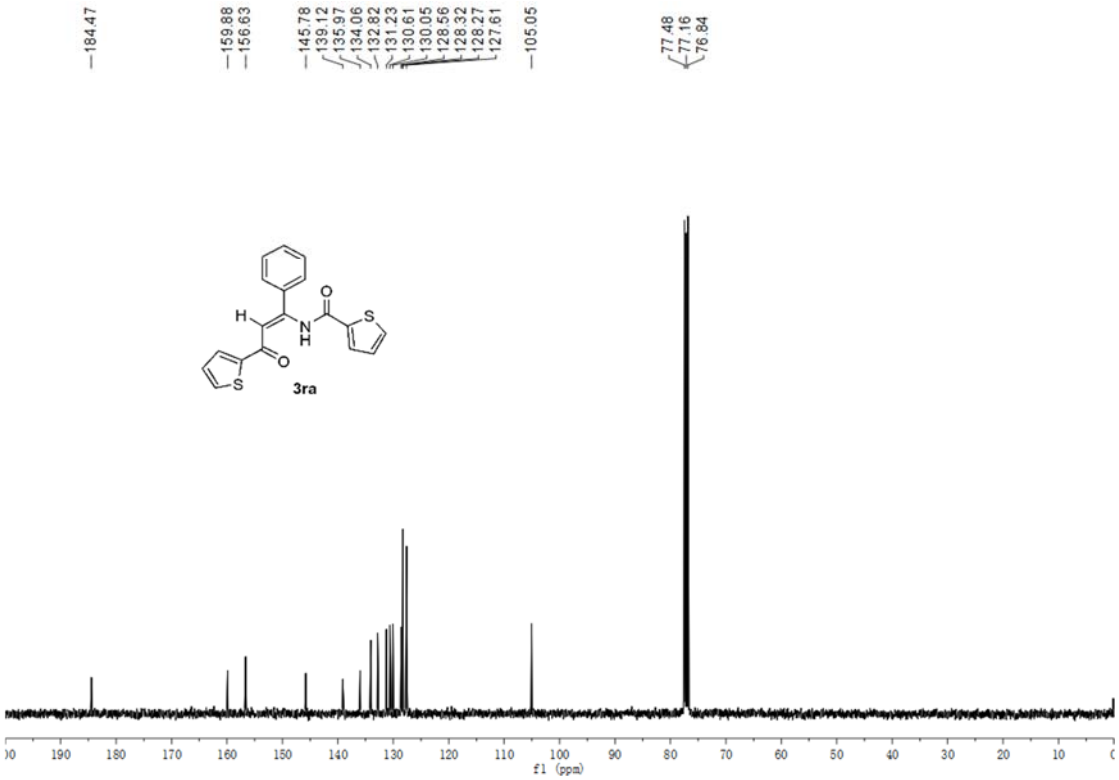
1.00
f1 (ppm)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139.12
135.97
134.06
132.82
131.23
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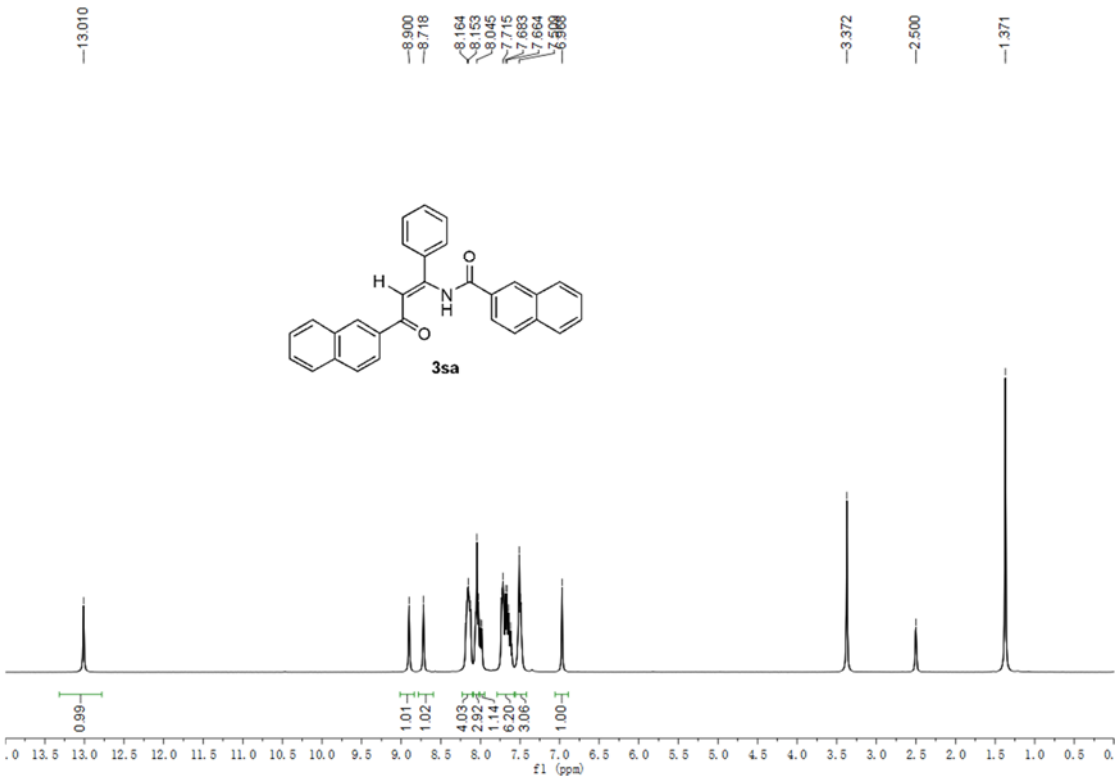
130.05
128.56
128.32
128.27
127.61
105.05
77.48
77.16
76.84
3ra
f1 (ppm)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7.664
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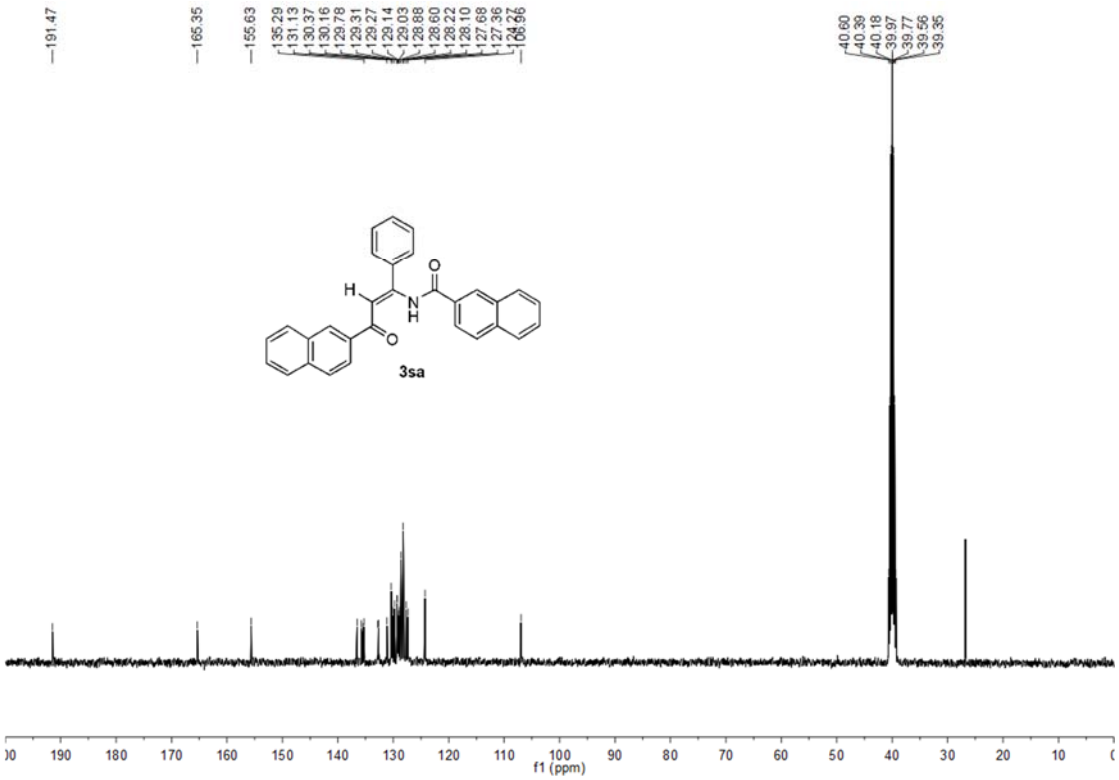
1.02
4.03
2.92
1.14
6.20
3.06
1.00
f1 (ppm)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165.35
155.63
135.29
131.13
130.37
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129.78
129.31
129.27
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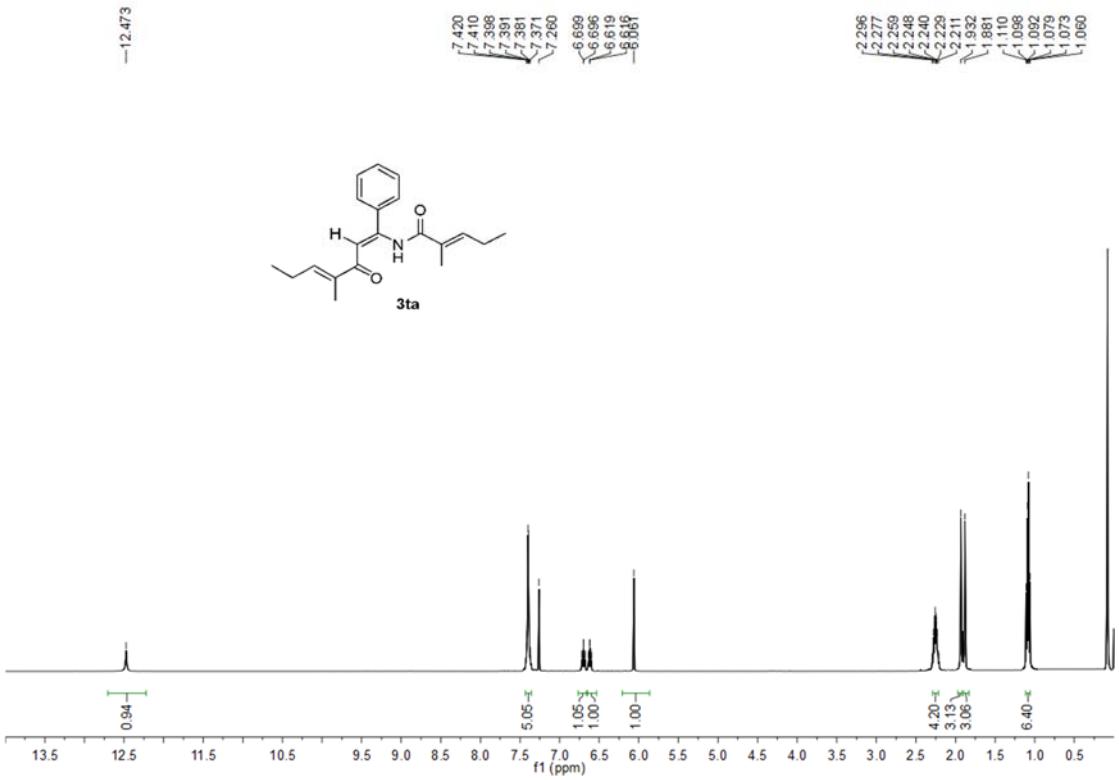
129.03
128.88
128.60
128.22
128.10
127.68
127.36
40.60
40.39
40.18
39.97
39.77
39.56
39.35
3sa
f1 (ppm)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6.616
6.061
2.296
2.277
2.259
2.248
2.240
2.229
2.211
1.932
1.881
1.110
1.098
1.092
1.079
1.073
1.060
3ta
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1.00
1.00
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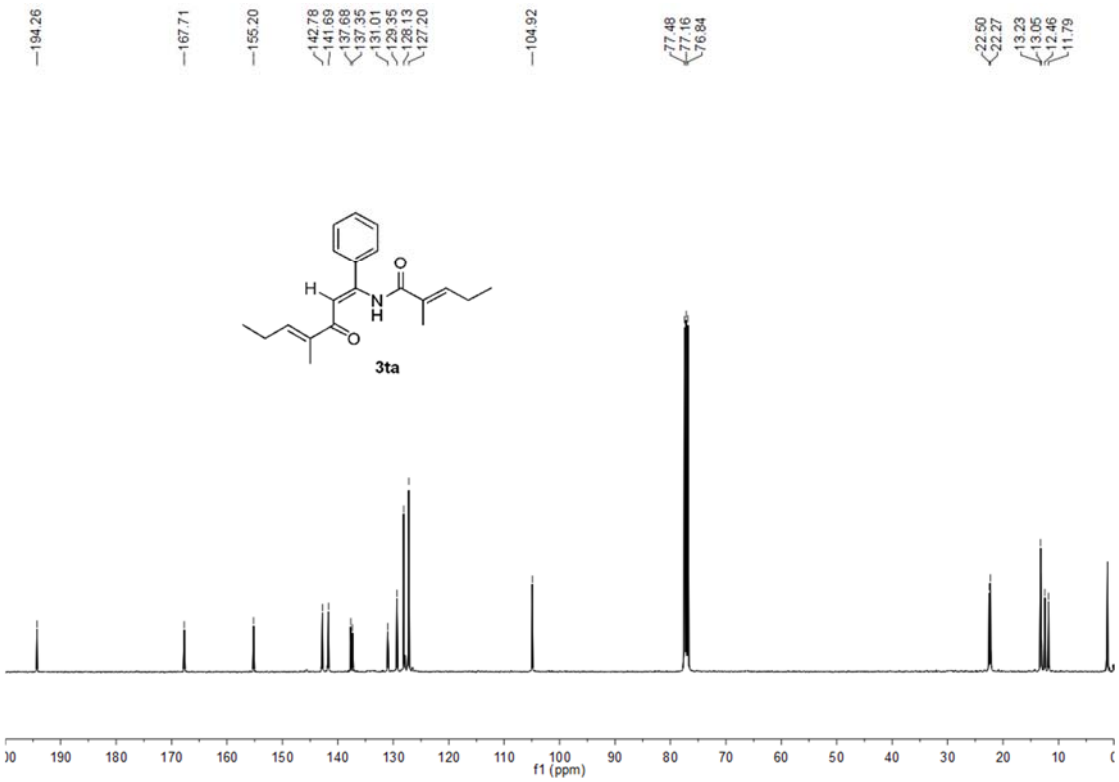
3.13
3.06
6.40
f1 (ppm)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167.71
155.20
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137.68
137.35
131.01
129.35
128.13
127.20
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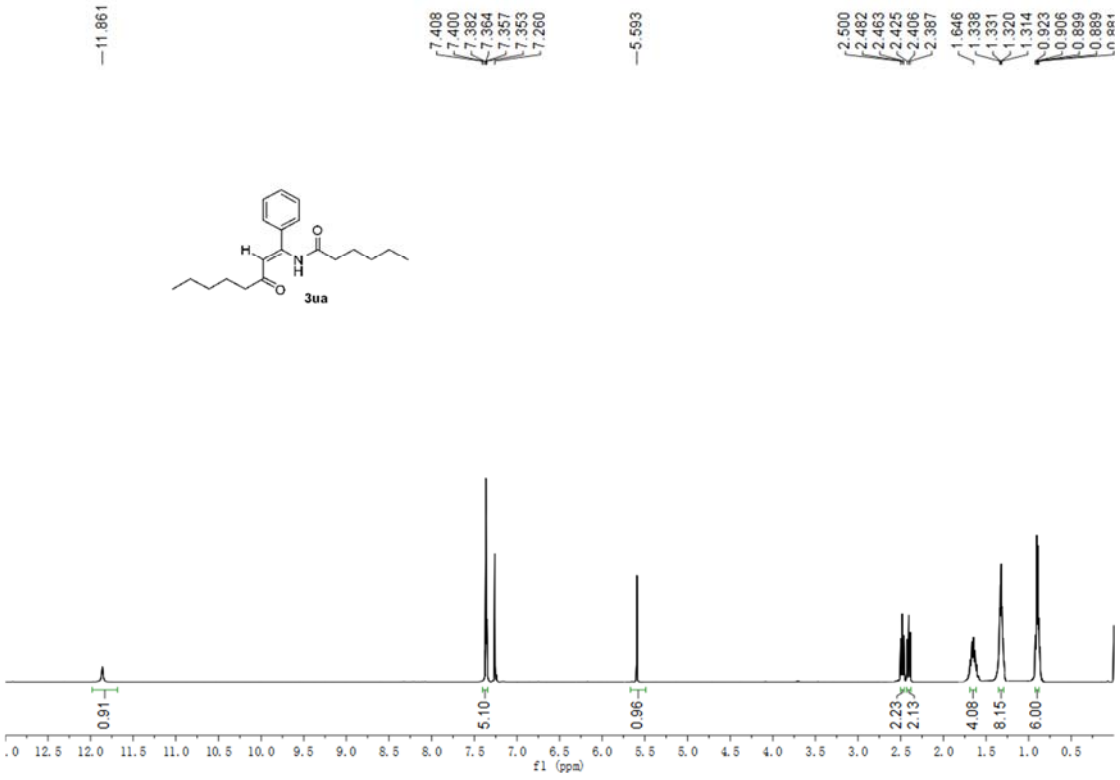
77.48
77.16
76.84
22.50
22.27
13.23
13.05
12.46
11.79
3ta
f1 (ppm)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2.463
2.425
2.406
2.387
1.646
1.338
1.331
1.320
1.314
0.923
0.906
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3ua
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0.96
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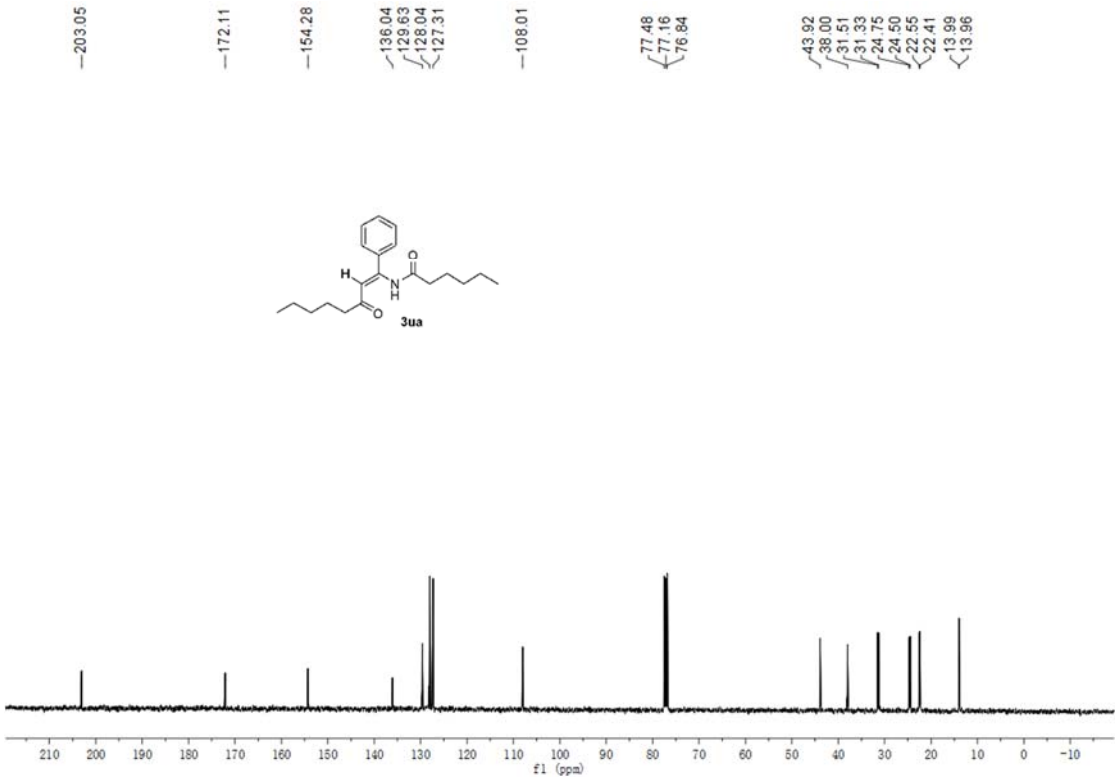
2.13
4.08
8.15
6.00
f1 (ppm)


203.05
172.11
154.28
136.04
129.63
128.04
127.31
108.01
77.48
77.16
76.84
43.92
38.00
31.51
31.33
24.75
24.50
22.55
22.41
13.99
13.96
3ua
f1 (ppm)

11. References

1. D. B. Ramachary, G.S. Reddy, S. Peraka, J. Gujral, Organo catalytic vinyl azide-carbonyl [3+2] cycloaddition: High-yielding synthesis of fully decorated N-vinyl-1,2,3-triazoles, ChemCatChem, 2017, 9, 263-267.
2. X. Zhu, S. Chiba, Construction of 1-pyrroline skeletons by lewis acid-mediated conjugate additionofvinylazides,Chemical Communications,2016, 52, 2473-2476.
3. Y.F. Wang, M. Hu, H. Hayashi, B. Xing, S. Chiba, Linking of alcohols with vinyl azides, Organic Letters, 2016, 18, 992-995.