Supporting Information

I_2-Catalyzed One-pot Synthesis of Pyrrolo[1,2-*a*]quinoxaline and Imidazo[1,5-*a*]quinoxaline Derivatives *via* sp^3 and sp^2 C-H Cross-Dehydrogenative Coupling

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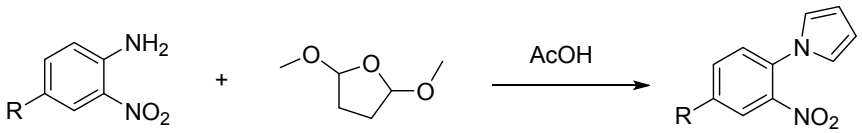
1. General information

2-(1*H*-pyrrol-1-yl)aniline, 2-(1*H*-indol-1-yl)aniline and 2-(1*H*-imidazol-1-yl)aniline were prepared according to literature procedures.[1-3] Other reagents were commercially available and were used without further purification. All reactions were monitored by thin-layer chromatography (TLC). ^{1}H NMR spectra were recorded on a Bruker Avance 300 spectrometer at 300 MHz, using $CDCl_3$, CD_2Cl_2 and DMSO-d_6 as solvent and tetramethylsilane (TMS) as internal standard. ^{13}C NMR spectra were run in the same instrument at 75 MHz. HRMS spectra were determined on a Q-TOF6510 spectrograph (Agilent).

2. Preparation of starting material

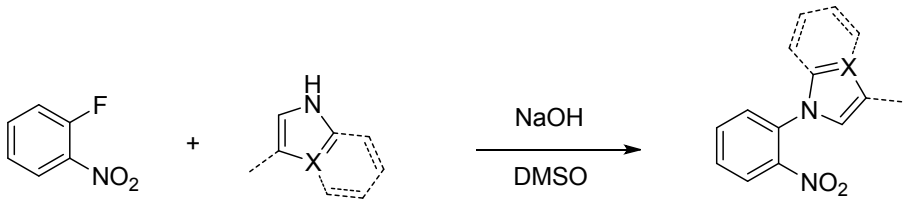
2.1 General procedure for preparation of 1-(2-nitrophenyl)-1*H*-pyrrole IV[1]



I **IV**

A mixture of *o*-nitroaniline I (10.00 mmol) and 2,5-dimethoxytetrahydrofuran (10.00 mmol) in acetic acid was refluxed for 1 h with vigorous stirring. The reaction mixture was cooled to ambient temperature and then poured into water. The precipitate was filtered and washed with water. The precipitate thus obtained was dissolved in ethyl acetate, dried over $MgSO_4$ and evaporated to dryness under reduced pressure. The residue thus obtained was filtered through a short pad of silica gel, using hexane/ethyl acetate as eluent, to afford compound **IV** which were directly used for next step without further purification.

2.2 General procedure for preparation of 1-(2-nitrophenyl)-1*H*-indole V and 1-(2-nitro Phenyl)-1*H*-imidazole VI[2]

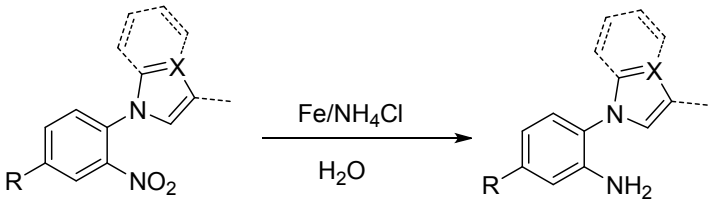


V or **VI**

To a well-stirred solution of N-heterocycle (1.0 mmol) in DMSO (1.0 mL), NaOH (1.0 equiv.) and 1-fluoro-2-nitrobenzene (1.0 mmol) were added slowly. The reaction mixture was

stirred vigorously for 1–1.5 h at room temperature until no more starting material was detectable by TLC analysis. The reaction mixture was extracted with ethyl acetate and water and dried with $MgSO_4$. The solvent was evaporated *in vacuo* and the solid obtained was purified by column chromatography (petroleum ether/ethyl acetate) on silica gel to afford **V** or **VI** which were directly used for next step without further purification.

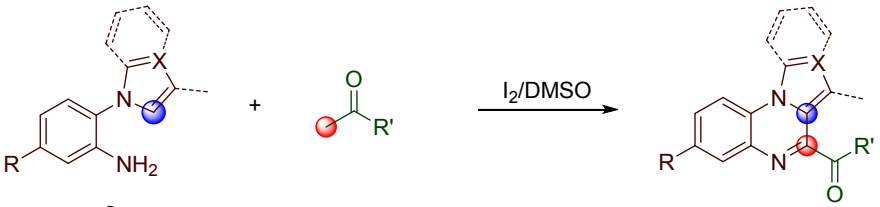
2.3 General procedure for preparation of 2-(1*H*-N-heterocycl-1-yl)aniline 2[3]



IV, V or **VI** **2**

A mixture of iron powder (38.2 mmol), NH_4Cl (5.1 mmol) in H_2O (10 mL) was heated to 100 °C for 15 min. Then the mixture was added in substituted nitrobenzene **IV**, **V** or **VI** (10.0 mmol), and stirred for corresponding time (TLC monitored). Then the mixture was cooled to room temperature and neutralized with 5% $NaHCO_3$ solution(V/V) and extracted with ethyl acetate (4 × 30 mL) and dried with $MgSO_4$. The solvent was evaporated *in vacuo* and the solid obtained was purified by column chromatography (petroleum ether/ethyl acetate) on silica gel to afford **2** with good yields.

3. General experimental procedures for the synthesis of Pyrrolo[1,2-a]quinoxaline and Imidazo[1,5-a]quinoxaline 3

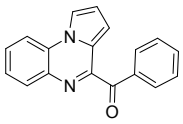


2 **1** **3**

A mixture of arylethanone 1 (0.5 mmol), I_2 (0.1 mmol) in DMSO (2 mL) was heated to 120 °C (TLC monitored). Then the mixture was added in substituted aniline **2** (0.5 mmol), and stirred for corresponding time (TLC monitored). Then the mixture was cooled to room temperature and diluted with water (30 mL) and extracted with dichloromethane twice (2 × 30 mL). The extract was washed with 10% $Na_2S_2O_3$ solution(V/V), dried over anhydrous $MgSO_4$ and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel to afford **3**.

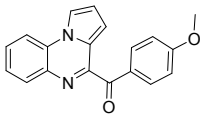
4. Spectra data

Phenyl(pyrrolo[1,2-a]quinoxalin-4-yl)methanone 3aa



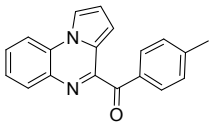
The title compound **3aa** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3aa** as a Yellow solid (0.118 g, 87%). ^{1}H NMR (300 M, DMSO-d_6): δ 8.64 (1H, J = 1.2, 2.7 Hz, dd), 8.41 (1H, J = 0.9, 8.4 Hz, dd), 8.07-8.04 (2H, m), 7.96 (1H, J = 1.5, 8.1 Hz, dd), 7.77-7.71 (2H, m), 7.61-7.53 (3H, m), 7.11 (1H, J = 1.2, 4.2 Hz, dd); ^{13}C NMR (75 MHz, DMSO-d_6): δ 192.12, 149.53, 135.48, 134.03, 133.85, 130.45, 130.27, 129.81, 128.56, 127.52, 125.78, 123.36, 116.83, 115.03, 114.87, 108.25; HRMS calcd for $C_{18}H_{12}N_2O$ $(M+H)^+$ 273.1022; found: 273.1009.

(4-Methoxyphenyl)(pyrrolo[1,2-a]quinoxalin-4-yl)methanone 3ab



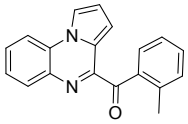
The title compound **3ab** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3ab** as a Yellow solid (0.128 g, 85%). ^{1}H NMR (300 M, $CDCl_3$): δ 8.23-8.18 (2H, m), 8.08-8.04 (2H, m), 7.95 (1H, J = 0.9, 8.1 Hz, dd), 7.67-7.61 (1H, m), 7.54-7.48 (1H, m), 7.18 (1H, J = 1.2, 4.2 Hz, dd), 7.03-6.96 (3H, m), 3.92 (3H, s); ^{13}C NMR (75 MHz, $CDCl_3$): δ 190.81, 164.21, 150.76, 134.89, 133.45, 131.01, 129.17, 128.70, 127.97, 125.44, 124.51, 114.79, 114.69, 113.87, 113.76, 108.87, 55.55; HRMS calcd for $C_{19}H_{14}N_2O_2$ $(M+H)^+$ 303.1128; found: 303.1157.

Pyrrolo[1,2-a]quinoxalin-4-yl(p-tolyl)methanone 3ac



The title compound **3ac** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3ac** as a Yellow solid (00.123 g, 86%). ^{1}H NMR (300 M, $CDCl_3$): δ 8.10-8.05 (4H, m), 7.93 (1H, J = 0.6, 2.1 Hz, dd), 7.65-7.60 (1H, m), 7.52-7.46 (1H, m), 7.30 (2H, J = 8.1 Hz, d), 7.19 (1H, J = 1.2, 4.2 Hz, dd), 6.97 (1H, J = 2.7, 4.2 Hz, dd); ^{13}C NMR (75 MHz, $CDCl_3$): δ 191.74, 150.25, 144.80, 134.39, 134.34, 133.22, 131.14, 130.82, 129.37, 129.16, 127.91, 125.57, 124.35, 115.03, 113.90, 109.34, 21.84; HRMS calcd for $C_{19}H_{14}N_2O$ $(M+H)^+$ 287.1179; found: 287.1174.

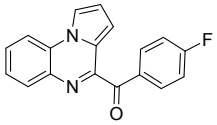
Pyrrolo[1,2-a]quinoxalin-4-yl(o-tolyl)methanone 3ad



The title compound **3ad** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3ad** as a Yellow solid (0.123 g, 88%). ^{1}H NMR (300 M, $CDCl_3$): δ 8.03-8.02 (1H, m), 7.97 (1H, J = 1.2, 8.1 Hz, dd), 7.92 (1H, J = 8.1 Hz, d), 7.65-7.58 (2H, m), 7.45 (2H, J = 7.8 Hz, t), 7.34-7.31 (2H, m), 7.28-7.23 (1H, m), 6.98 (1H, J = 3.0, 4.2 Hz, dd), 2.54 (3H, s); ^{13}C NMR (75 MHz, $CDCl_3$): δ 195.79, 150.18, 139.37, 139.33, 136.66, 136.61, 134.86, 131.68, 131.64, 131.59, 131.55, 131.48, 131.29, 129.59, 127.99, 125.40, 125.18, 124.26, 115.05,

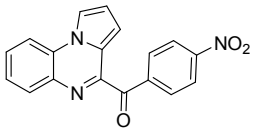
114.65, 113.82, 109.12, 21.06; HRMS calcd for $C_{19}H_{14}N_2O$ $(M+H)^+$ 287.1179; found: 287.1195.

(4-Fluorophenyl)(pyrrolo[1,2-a]quinoxalin-4-yl)methanone 3ae



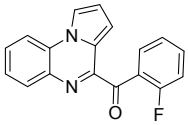
The title compound **3ae** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3ae** as a Yellow solid (0.116 g, 80%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.26-8.21 (2H, m), 8.10 (1H, J = 1.5Hz, d), 8.03-7.93 (2H, m), 7.70-7.65 (1H, m), 7.55-7.50 (1H, m), 7.26-7.19 (3H, m), 7.01-6.99 (1H, m); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 190.91, 166.41 ($^1J_{C,F}$ = 253.5, d), 149.77, 134.94, 134.06 ($^3J_{C,F}$ = 9, d), 132.87 ($^4J_{C,F}$ = 4, d), 131.20, 130.04, 128.36, 125.92, 124.67, 115.76 ($^2J_{C,F}$ = 21.75, d), 115.50, 115.23, 114.43, 109.30; HRMS calcd for $C_{18}H_{11}FN_2O$ $(M+H)^+$ 291.0928; found: 291.0935.

(4-Nitrophenyl)(pyrrolo[1,2-a]quinoxalin-4-yl)methanone 3af



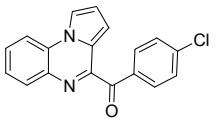
The title compound **3af** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 5 : 1 : 1 gave **3af** as a Yellow solid (0.130 g, 82%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.38-8.32 (4H, m), 8.15 (1H, J = 1.2, 2.7 Hz, dd), 8.05-8.00 (2H, m), 7.75-7.69 (1H, m), 7.58-7.52 (1H, m), 7.45 (1H, J = 0.9, 4.2 Hz, dd), 7.07 (1H, J = 2.7, 3.9 Hz, dd); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 191.10, 148.11, 141.88, 134.69, 132.34, 131.39, 130.76, 128.48, 126.10, 124.40, 123.52, 115.77, 115.68, 114.54, 109.78; HRMS calcd for $C_{18}H_{11}N_3O_3$ $(M+H)^+$ 318.0873; found: 318.0857.

(2-Fluorophenyl)(pyrrolo[1,2-a]quinoxalin-4-yl)methanone 3ag



The title compound **3ag** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3ag** as a Yellow solid (0.117 g, 81%). ^{1}H NMR (300 M, $CDCl_3$): δ 8.04 (1H, J = 0.9, 2.7 Hz, dd), 7.97 (1H, J = 1.5, 2.1 Hz, dd), 7.91(1H, J = 0.9, 8.1 Hz, dd), 7.88-7.83 (1H, m), 7.64-7.54 (2H, m), 7.48-7.41 (2H, m), 7.33-7.27 (1H, m), 7.17-7.11 (1H, m), 7.00 (1H, J = 2.7, 4.2 Hz, dd); ^{13}C NMR (75 MHz, $CDCl_3$): δ 191.71, 161.54 ($^1J_{C,F}$ = 258.8, d), 148.96, 134.78, 134.19 ($^3J_{C,F}$ = 8.3, d), 131.67 ($^4J_{C,F}$ = 2.3, d), 131.26, 129.84, 128.18, 126.29 ($^2J_{C,F}$ = 12.8, d), 125.45, 124.10 ($^3J_{C,F}$ = 3.8, d), 123.67, 116.30 ($^2J_{C,F}$ = 21.8, d), 115.21, 114.79, 113.89, 109.06; HRMS calcd for $C_{18}H_{11}FN_2O$ $(M+H)^+$ 291.0928; found: 291.0904.

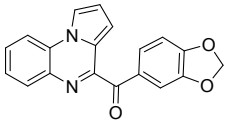
(4-Chlorophenyl)(pyrrolo[1,2-a]quinoxalin-4-yl)methanone 3ah



The title compound **3ah** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3ah** as a Yellow solid (0.127 g, 83%). ^{1}H NMR (300 M, $CDCl_3$): δ 8.16-8.12 (2H, m), 8.08-8.05 (2H, m), 7.94 (1H, J = 10.8 Hz, t), 7.68-7.62 (1H, m), 7.54-7.47 (3H, m), 7.29-7.26 (1H, m), 7.00 (1H, J = 2.7, 3.9 Hz, dd); ^{13}C NMR (75 MHz,

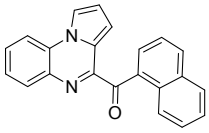
$CDCl_3$): δ 190.79, 157.87, 149.01, 140.18, 134.27, 132.47, 130.93, 129.79, 128.70, 125.69, 115.26, 115.18, 113.96, 109.50; HRMS calcd for $C_{18}H_{11}ClN_2O$ $(M+H)^+$ 307.0633; found: 307.0607.

Benzo[d][1,3]dioxol-5-yl(pyrrolo[1,2-a]quinoxalin-4-yl)methanone 3ai



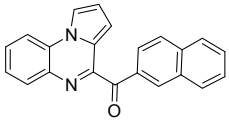
The title compound **3ai** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3ai** as a Yellow solid (0.135 g, 86%). ^{1}H NMR (300 M, $CDCl_3$): δ 8.04 (2H, J = 1.2, 8.4 Hz, dd), 7.92 (1H, J = 0.9, 8.1 Hz, dd), 7.79 (1H, J = 1.5, 8.1 Hz, dd), 7.69 (1H, J = 1.5 Hz, d), 7.65-7.59 (1H, m), 7.52-7.46 (1H, m), 7.13 (1H, J = 1.2, 4.2 Hz, dd), 6.95 (1H, J = 3.0, 4.2 Hz, dd), 6.88 (1H, J = 8.4 Hz, d), 6.07 (2H, s); ^{13}C NMR (75 MHz, $CDCl_3$): δ 190.35, 152.54, 150.54, 148.04, 134.74, 130.97, 130.28, 129.25, 128.33, 127.91, 125.48, 124.41, 114.83, 114.79, 113.87, 110.23, 108.85, 107.98, 101.93; HRMS calcd for $C_{19}H_{12}N_2O_3$ $(M+H)^+$ 317.0921; found: 317.0897.

Naphthalen-1-yl(pyrrolo[1,2-a]quinoxalin-4-yl)methanone 3aj



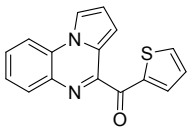
The title compound **3aj** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3aj** as a Yellow solid (130 g, 81%). ^{1}H NMR (300 M, $CDCl_3$): δ 8.62-8.58 (1H, m), 8.16 (1H, J = 1.2, 2.7 Hz, dd), 8.12 (1H, J = 8.1 Hz, d), 8.03-7.98 (2H, m), 7.95 (J = 1.2, 8.1 Hz, dd), 7.87 (J = 1.2, 7.2 Hz, dd), 7.71-7.60 (3H, m), 7.58-7.47 (2H, m), 7.40 (J = 1.2, 4.2 Hz, dd), 7.06 (J = 2.7, 3.9 Hz, dd); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 194.75, 154.89, 150.42, 134.03, 133,87, 133.07, 131.60, 131.27, 130.64, 129.79, 128.56, 127.91, 126.49, 125.61, 124.25, 115.38, 115.17, 114.07, 109.46; HRMS calcd for $C_{22}H_{14}N_2O$ $(M+H)^+$ 323.1179; found: 323.1172.

Naphthalen-2-yl(pyrrolo[1,2-a]quinoxalin-4-yl)methanone 3ak



The title compound **3ak** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3ak** as a Yellow solid (0.136 g, 85%). ^{1}H NMR (300 M, $CDCl_3$): δ 8.69 (1H, s), 8.24 (1H, J = 1.8, 8.7 Hz, dd), 8.07-8.04 (2H, m), 7.97-7.89 (4H, m), 7.68-7.59 (2H, m), 7.56-7.48 (2H, m), 7.23 (1H, J = 1.2, 3.9 Hz, dd), 6.98 (1H, J = 2.7, 3.9 Hz, dd); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 192.13, 150.14, 135.80, 134.76, 133.55, 133.36, 132.34, 130.85, 129.78, 129.46, 128.80, 128.11, 128.00, 127.74, 126.73, 125.49, 124.44, 115.07, 114.76, 114.03, 108.77; HRMS calcd for $C_{22}H_{14}N_2O$ $(M+H)^+$ 323.1179; found: 323.1176.

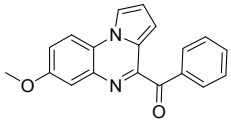
Pyrrolo[1,2-a]quinoxalin-4-yl(thiophen-2-yl)methanone 3al



The title compound **3al** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3al** as a Yellow solid

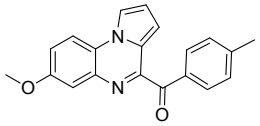
(0.118 g, 85%). ^{1}H NMR (300 M, CD_2Cl_2): δ *8.34* (1H, *J* = 1.2, 3.9 Hz, dd), 8.15 (1H, *J* = 1.2, 8.1 Hz, dd), 8.03 (1H, *J* = 0.9, 2.7 Hz, dd), 7.93 (1H, *J* = 0.9, 8.1 Hz, dd), 7.79 (1H, *J* = 1.2, 4.8 Hz, dd), 7.68-7.62 (1H, m),7.60 (1H, *J* = 1.2, 4.2 Hz, dd), 7.55-7.49 (1H, *m*), 7.21 (1H, *J* = 3.9, 4.8 Hz, dd), 7.00 (1H, *J* = 3.0, 4.2 Hz, dd); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 182.88, 147.89, 140.19, 136.61, 136.35, 134.39, 130.77, 129.96, 128.21, 127.50, 125.51, 123.75, 115.05, 114.96, 114.05, 109.60; HRMS calcd for $C_{16}H_{10}N_2OS$ $(M+H)^+$ 279.0587; found: 279.0583.

(7-Methoxypyrrolo[1,2-a]quinoxalin-4-yl)(phenyl)methanone 3ba



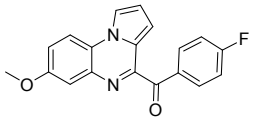
The title compound **3ba** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 10 : 1 : 1 gave **3ba** as a Yellow solid (0.129 g, 86%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.12-8.10 (2H, m), 8.02 (1H, *J* = 1.5 Hz, d), 7.89 (1H, *J* = 9.0 Hz, d), 7.68-7.64 (1H, m), 7.55-7.47 (3H, m), 7.27 (1H, *J* = 2.7, 9.0 Hz, dd), 7.18 (1H, *J* = 0.9, 3.9 Hz, dd), 6.95 (1H, *J* = 2.7, 4.2 Hz, dd); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 192.75, 157.84, 150.32, 136.61, 136.14, 133.79, 131.16, 128.67, 124.55, 122.66, 119.08, 115.33, 115.07, 114.88, 112.18, 108.77, 56.20; HRMS calcd for $C_{19}H_{14}N_2O_2$ $(M+H)^+$ 303.1128; found: 303.1120.

(7-Methoxypyrrolo[1,2-a]quinoxalin-4-yl)(p-tolyl)methanone 3bc



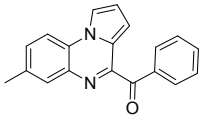
The title compound **3bc** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 10 : 1 : 1 gave **3bc** as a Yellow solid (0.129 g, 82%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.03-8.00 (3H, m), 7.88 (1H, *J* = 9.0 Hz, d), 7.47 (1H, *J* = 2.7 Hz, d), 7.33 (2H, *J* = 8.1 Hz, d), 7.25 (1H, *J* = 2.7, 9.0 Hz, dd), 7.13 (1H, *J* = 1.2, 4.2 Hz, dd), 6.93 (1H, *J* = 2.7, 4.2 Hz, dd); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 192.31, 157.82, 150.77, 145.12, 136.14, 133.90, 131.24, 129.42, 124.57, 122.62, 118.87, 115.31, 115.06, 114.80, 112.13, 108.72, 56.19, 21.91; HRMS calcd for $C_{20}H_{16}N_2O_2$ $(M+H)^+$ 317.1285; found: 317.1286.

(4-Fluorophenyl)(7-methoxypyrrolo[1,2-a]quinoxalin-4-yl)methanone 3be



The title compound **3be** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 10 : 1 : 1 gave **3be** as a Yellow solid (0.137 g; 86%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.21 (2H, *J* = 2.7, 8.7 Hz, dd), 8.02 (1H, *J* = 1.2 Hz, d), 7.89 (1H, *J* = 9.0 Hz, d), 7.47 (1H, *J* = 2.7 Hz, d), 7.29-7.18 (4H, m), 6.97-6.95 (1H, m), 3.92 (1H, s); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 191.03, 167.09 ($^1J_{C,F}$ = 253.5, d), 157.86, 149.98, 136.07, 134.04 ($^3J_{C,F}$ = 9.8, d), 132.93 ($^4J_{C,F}$ = 3.0, d), 124.50, 122.67, 119.17, 115.77 ($^2J_{C,F}$ = 21.8, d), 115.35, 115.11, 114.93, 112.20, 108.83, 56.20; HRMS calcd for $C_{19}H_{13}FN_2O_2$ $(M+H)^+$ 321.1034; found: 321.1033.

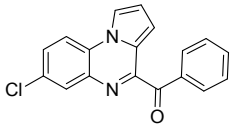
(7-Methylpyrrolo[1,2-a]quinoxalin-4-yl)(phenyl)methanone 3ca



The title compound **3ca** was prepared according to general procedure 3. A purification by flash

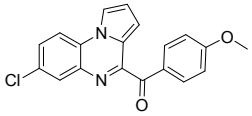
chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3ca** as a Yellow solid (0.121 g, 85%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.14-8.10 (2H, m), 8.05 (1H, J = 1.5, 2.7 Hz, dd), 7.87 (1H, J = 8.7 Hz, d), 7.81 (1H, J = 0.6 Hz, d), 7.68-7.63 (1H, m), 7.54-7.47 (3H, m), 7.20 (1H, J = 1.2, 4.2 Hz, dd), 6.96 (1H, J = 2.4, 3.9 Hz, dd), 2.51 (3H, s); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 192.74, 149.99, 136.62, 136.00, 134.96, 133.74, 131.18, 131.12, 130.89, 128.61, 126.22, 124.67, 115.16, 114.91, 114.11, 108.89, 21.10; HRMS calcd for $C_{19}H_{14}N_2O$ $(M+H)^+$ 287.1179; found: 287.1184.

(7-Chloropyrrolo[1,2-a]quinoxalin-4-yl)(phenyl)methanone 3da



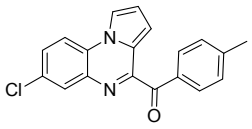
The title compound **3da** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3da** as a Yellow solid (0.119 g, 78%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.13-8.10 (4H, m), 8.06 (2H, J = 0.9, 2.4 Hz, dd), 7.99-7.99 (2H, J = 0.9, 2.4 Hz, d), 7.91 (2H, J = 9.0 Hz, d), 7.69-7.64 (2H, m), 7.60 (2H, J = 2.4, 8.7 Hz, dd), 7.55-7.50 (4H, m), 7.22 (2H, J = 0.9, 3.9 Hz, dd), 7.00 (2H, J = 2.7, 3.9 Hz, dd); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 192.34, 151.14, 136.22, 136.02, 134.00, 131.18, 130.90, 130.39, 129.74, 128.71, 127.04, 124.68, 115.88, 115.73, 115.57, 109.80; HRMS calcd for $C_{18}H_{11}ClN_2O$ $(M+H)^+$ 307.0633; found: 307.0610.

(7-Chloropyrrolo[1,2-a]quinoxalin-4-yl)(4-methoxyphenyl)methanone 3db



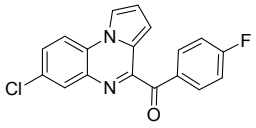
The title compound **3db** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3db** as a Yellow solid (0.129 g, 77%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.05-8.01 (2H, m), 7.96 (1H, J = 0.9, 2.4 Hz, dd), 7.92 (1H, J = 2.4 Hz, d), 7.82 (1H, J = 9.0 Hz, d), 7.51 (H, J = 2.4, 9.0 Hz, dd), 7.05 (1H, J = 1.2, 4.2 Hz, dd), 6.93-6.88 (3H, m), 3.81(3H, s); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 190.63, 164.73, 151.95, 136.05, 133.58, 130.86, 130.22, 129.47, 128.83, 126.99, 124.74, 115.87, 115.71, 115.44, 114.09, 109.74, 56.00; HRMS calcd for $C_{19}H_{13}ClN_2O_2$ $(M+H)^+$ 337.0738; found: 337.0730.

(7-Chloropyrrolo[1,2-a]quinoxalin-4-yl)(p-tolyl)methanone 3dc



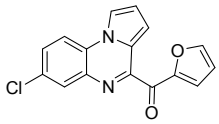
The title compound **3dc** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3dc** as a Yellow solid (0.123 g, 77%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.08 (1H, J = 1.2, 2.7 Hz, dd), 8.06-8.02 (3H, m), 7.94 (1H, J = 9.0 Hz, d), 7.63 (1H, J = 2.4, 8.7 Hz, dd), 7.36 (2H, J = 7.8 Hz, d), 7.20 (1H, J = 1.2, 3.9 Hz, dd), 7.02 (1H, J = 2.7, 3.9 Hz, dd); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 191.90, 151.60, 145.37, 136.06, 133.55, 131.25, 130.87, 130.31, 129.58, 129.47, 127.02, 124.70, 115.84, 115.71, 115.48, 109.73, 21.92; HRMS calcd for $C_{19}H_{13}ClN_2O$ $(M+H)^+$ 321.0789; found: 321.0762.

(7-Chloropyrrolo[1,2-a]quinoxalin-4-yl)(4-fluorophenyl)methanone 3de



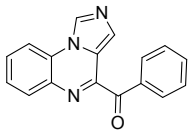
The title compound **3de** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3de** as a Yellow solid (0.126 g, 78%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.24-8.18 (4H, m), 8.07 (2H, J = 1.2, 2.7 Hz, dd), 8.01 (2H, J = 2.4 Hz, d), 7.93 (2H, J = 8.7 Hz, d), 7.62 (2H, J = 2.1, 8.7 Hz, dd), 7.26-7.17 (6H, m), 7.01 (2H, J = 3.0, 4.2 Hz, dd); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 190.61, 166.51 ($^1J_{C,F}$ = 253.5, d), 150.78, 135.91, 134.12, 133.99, 132.59 ($^4J_{C,F}$ = 3.0, d), 130.96, 130.13 ($^2J_{C,F}$ = 37.5, d), 127.06, 124.62, 115.98, 115.71($^3J_{C,F}$ = 8.3, d), 115.69, 109.93; HRMS calcd for $C_{18}H_{10}ClFN_2O$ $(M+H)^+$ 325.0539; found: 325.0549.

(7-Chloropyrrolo[1,2-a]quinoxalin-4-yl)(furan-2-yl)methanone 3dm



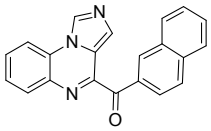
The title compound **3dm** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3dm** as a Yellow solid (0.126 g, 85%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.06-8.04 (2H, m), 7.91 (1H, J = 3.3 Hz, t), 7.87 (1H, s), 7.81 (1H, s), 7.60 (1H, J = 2.1, 9.0 Hz, dd), 7.48 (1H, J = 3.6 Hz, d), 7.02-7.00 (1H, m), 6.67 (1H, J = 1.8 Hz, d); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 191.17, 185.01, 178.50, 151.49, 149.45, 148.67, 135.95, 130.90, 130.47, 130.05, 127.24, 124.62, 124.19, 115.82, 112.90, 110.38; HRMS calcd for $C_{16}H_9ClN_2O_2$ $(M+H)^+$ 297.0425; found: 297.0405.

Imidazo[1,5-a]quinoxalin-4-yl(phenyl)methanone 3ea



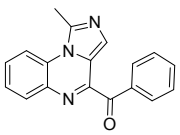
The title compound **3ea** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 5 : 1 : 1 gave **3ea** as a Yellow solid (0.114 g, 84%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.79 (1H, s), 8.23-8.19 (3H, m), 8.07-8.02 (2H, m), 7.75-7.58 (3H, m), 7.57-7.52 (2H, m); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 191.51, 149.79, 136.07, 135.34, 133.89, 131.70, 131.35, 131.11, 129.84, 129.29, 128.67, 127.63, 125.85, 122.91, 114.96; HRMS calcd for $C_{17}H_{11}N_3O$ $(M+H)^+$ 274.0975; found: 274.0959.

Imidazo[1,5-a]quinoxalin-4-yl(naphthalen-2-yl)methanone 3ej



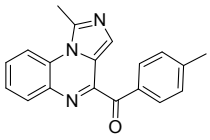
The title compound **3ej** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 5 : 1 : 1 gave **3ej** as a Yellow solid (0.135 g, 84%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.72 (2H, J =4.2 Hz, d), 8.17-8.10 (2H, m), 8.02-7.96 (2H, m), 7.92-7.85 (3H, m), 7.68-7.63 (1H, m), 7.60-7.46 (3H, m); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 191.31, 150.14, 136.17, 135.42, 134.13, 133.29, 132.69, 131.76, 131.09, 130.25, 129.85, 129.31, 129.25, 128.52, 128.15, 127.66, 127.19, 126.07, 125.86, 114.99; HRMS calcd for $C_{21}H_{13}N_3O$ $(M+H)^+$ 324.1131; found: 324.1136.

(1-Methylimidazo[1,5-a]quinoxalin-4-yl)(phenyl)methanone 3fa



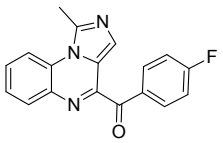
The title compound **3fa** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 5 : 1 : 1 gave **3fa** as a Yellow solid (0.126 g, 88%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.30 (1H, J = 0.6, 8.4 Hz, dd), 8.21-8.19 (2H, m), 8.07-8.04 (2H, m), 7.73-7.68 (2H, m), 7.63-7.54 (3H, m), 3.16 (3H, s); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 191.69, 150.21, 142.64, 136.45, 136.14, 133.89, 131.55, 131.27, 130.20, 128.66, 128.04, 127.56, 126.94, 124.33, 116.23, 19.01; HRMS calcd for $C_{18}H_{13}N_3O$ $(M+H)^+$ 288.1131; found: 288.1149.

(1-Methylimidazo[1,5-a]quinoxalin-4-yl)(p-tolyl)methanone 3fc



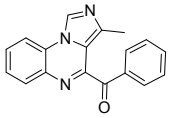
The title compound **3fc** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 5 : 1 : 1 gave **3fc** as a Yellow solid (0.129 g, 86%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.31 (1H, J = 1.2, 8.4 Hz, dd), 8.12-8.09 (2H, m), 8.06 (1H, J = 1.8, 8.1 Hz, dd), 7.99 (1H, s), 7.74-7.68 (1H, m), 7.64-7.58 (1H, m), 7.37 (2H, J = 8.1 Hz, d), 3.16 (3H, s), 2.50 (3H, s); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 191.26, 150.63, 145.25, 142.59, 136.51, 133.45, 131.49, 131.36, 130.05, 129.42, 128.01, 127.37, 126.94, 124.38, 116.23, 21.91, 18.96; HRMS calcd for $C_{19}H_{15}N_3O$ $(M+H)^+$ 302.1288; found: 302.1289.

(4-Fluorophenyl)(1-methylimidazo[1,5-a]quinoxalin-4-yl)methanone 3fe



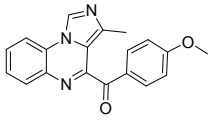
The title compound **3fe** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 5 : 1 : 1 gave **3fe** as a Yellow solid (0.126 g, 83%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.35-8.28 (3H, m), 8.09-8.05 (2H, m), 7.76-7.70 (1H, m), 7.65-7.59 (1H, m), 7.29-7.22 (2H, m), 3.17 (3H, s); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 189.91, 166.46 ($^1J_{C,F}$ = 253.5, d), 149.96, 142.67, 136.38, 134.25 ($^3J_{C,F}$ = 9.8, d), 132.54 ($^4J_{C,F}$ = 3.0, d), 131.58, 130.34, 128.03, 127.54, 127.02, 124.24, 116.26, 115.92, 115.63($^2J_{C,F}$ = 21.8, d), 18.94; HRMS calcd for $C_{18}H_{12}FN_3O$ $(M+H)^+$ 306.1037; found: 306.1036.

(3-Methylimidazo[1,5-a]quinoxalin-4-yl)(phenyl)methanone 3ga



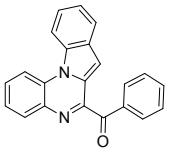
The title compound **3ga** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 5 : 1 : 1 gave **3ga** as a Yellow solid (0.129 g, 90%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.68 (1H, s), 8.07-8.04 (2H, m), 7.99-7.93 (2H, m), 7.72-7.61 (2H, m), 7.58-7.51 (3H, m), 2.35 (3H, s); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 192.23, 152.78, 137.95, 135.48, 135.34, 134.80, 130.89, 130.76, 129.84, 129.17, 128.68, 127.36, 125.89, 119.14, 114.63, 15.18; HRMS calcd for $C_{18}H_{13}N_3O$ $(M+H)^+$ 288.1131; found: 288.1125.

(4-Methoxyphenyl)(3-methylimidazo[1,5-a]quinoxalin-4-yl)methanone 3gb



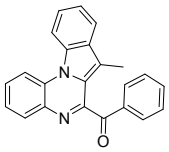
The title compound **3gb** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 5 : 1 : 1 gave **3gb** as a Yellow solid (0.138 g, 87%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.70 (1H, s), 8.08-8.04 (2H, m), 8.01-7.96 (2H, m), 7.69-7.63 (1H, m), 7.60-7.55 (1H, m), 7.05-7.02 (2H, m), 3.93 (3H, s), 2.37 (3H, s); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 190.78, 165.20, 153.22, 137.83, 135.46, 133.29, 130.69, 129.62, 128.59, 128.40, 127.31, 125.85, 119.14, 114.61, 114.50, 15.05; HRMS calcd for $C_{19}H_{15}N_3O_2$ $(M+H)^+$ 318.1237; found: 318.1238.

Indolo[1,2-a]quinoxalin-6-yl(phenyl)methanone 3ha



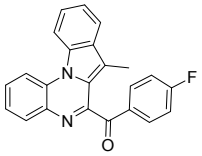
The title compound **3ha** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3ha** as a Red solid (0.116 g, 72%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.63 (1H, J = 0.9, 8.4 Hz, dd), 8.57 (1H, J = 0.6, 8.7 Hz, dd), 8.22-8.18 (2H, m), 8.10-8.04 (2H, m), 7.83-7.77 (1H, m), 7.75-7.64 (2H, m), 7.60-7.51 (5H, m); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 192.35, 152.10, 136.30, 135.19, 134.04, 133.13, 131.68, 131.47, 131.17, 130.85, 129.88, 128.78, 127.91, 125.17, 124.73, 123.50, 123.39, 115.38, 114.91, 102.64; HRMS calcd for $C_{22}H_{14}N_2O$ $(M+H)^+$ 323.1179; found: 323.1180.

(7-Methylindolo[1,2-a]quinoxalin-6-yl)(phenyl)methanone 3ia



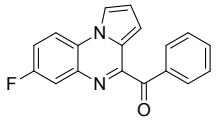
The title compound **3ia** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3ia** as a Red solid (0.146 g, 81%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.55-8.49 (2H, m), 8.08-8.05 (2H, m), 7.97-7.93 (2H, m), 7.72-7.60 (3H, m), 7.56-7.41 (4H, m), 2.35 (3H, s); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 193.40, 154.89, 135.80, 135.21, 134.78, 132.58, 131.44, 130.79, 130.75, 130.19, 129.84, 129.27, 125.47, 124.41, 124.35, 122.73, 121.23, 115.16, 114.75, 110.47, 10.15; HRMS calcd for $C_{23}H_{16}N_2O$ $(M+H)^+$ 337.1335; found: 337.1320.

(4-Fluorophenyl)(7-methylindolo[1,2-a]quinoxalin-6-yl)methanone 3ie



The title compound **3ie** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3ie** as a Red solid (0.141 g, 80%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.54-8.48 (2H, m), 8.16-8.09 (2H, m), 7.95 (2H, J = 1.8, 8.1 Hz, dd), 7.72-7.60 (2H, m), 7.52-7.41 (2H, m), 7.25-7.17 (2H, m), 2.35 (3H, s); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 191.73, 166.96 ($^1J_{C,F}$ = 255.0, d), 154.44, 135.04, 133.76 ($^3J_{C,F}$ = 9.8, d), 132.60, 132.31 ($^4J_{C,F}$ = 3.0, d), 131.43, 130.75, 130.18, 129.96, 125.58, 124.39, 124.29, 122.79, 121.25, 116.50 ($^2J_{C,F}$ = 21.8, d), 115.18, 114.75, 110.59, 10.17; HRMS calcd for $C_{23}H_{15}FN_2O$ $(M+H)^+$ 355.1241; found: 355.1243.

(7-fluoropyrrolo[1,2-a]quinoxalin-4-yl)(phenyl)methanone 3la



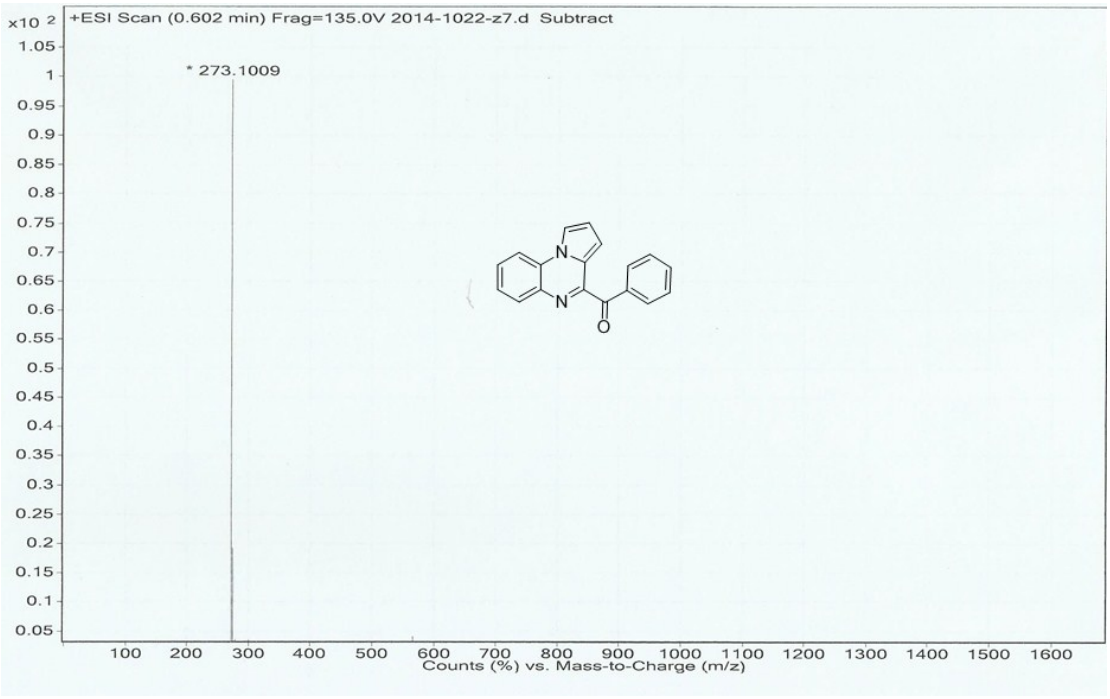
The title compound **3la** was prepared according to general procedure 3. A purification by flash chromatography in petroleum ether : ethyl acetate : dichloromethane = 8 : 1 : 1 gave **3la** as a yellow solid (0.109 g, 75%). ^{1}H NMR (300 M, CD_2Cl_2): δ 8.12-8.10 (3H, m), 8.07 (2H, J = 1.8, 2.7 Hz, dd), 7.95 (1H, J = 5.1, 9.3 Hz, dd), 7.71-7.64 (2H, m), 7.55-7.50 (2H, m), 7.44-7.37 (1H, m), 7.20 (1H, J = 1.2, 3.9 Hz, dd), 6.99 (1H, J = 2.7, 4.2 Hz, dd); ^{13}C NMR (75 MHz, CD_2Cl_2): δ 192.37, 160.30 ($^{1}J_{C,F}$ = 242.3, d), 151.23, 136.23, 136.20 ($^{3}J_{C,F}$ = 11.3, d), 134.02, 131.14, 128.73, 125.08, 124.59, 117.54 ($^{2}J_{C,F}$ = 24.0, d), 116.14 ($^{2}J_{C,F}$ = 22.5, d), 115.84, 115.71, 115.35, 109.64; HRMS calcd for $C_{18}H_{11}FN_2O$ $(M+H)^+$ 291.0928; found: 291.0911.

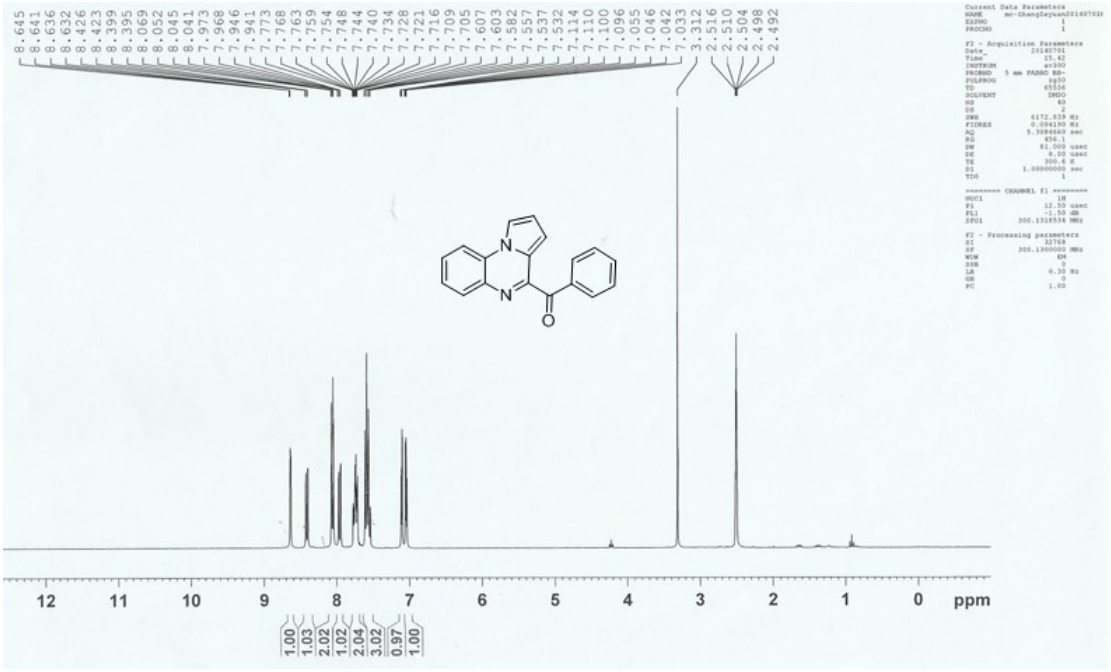
5. References

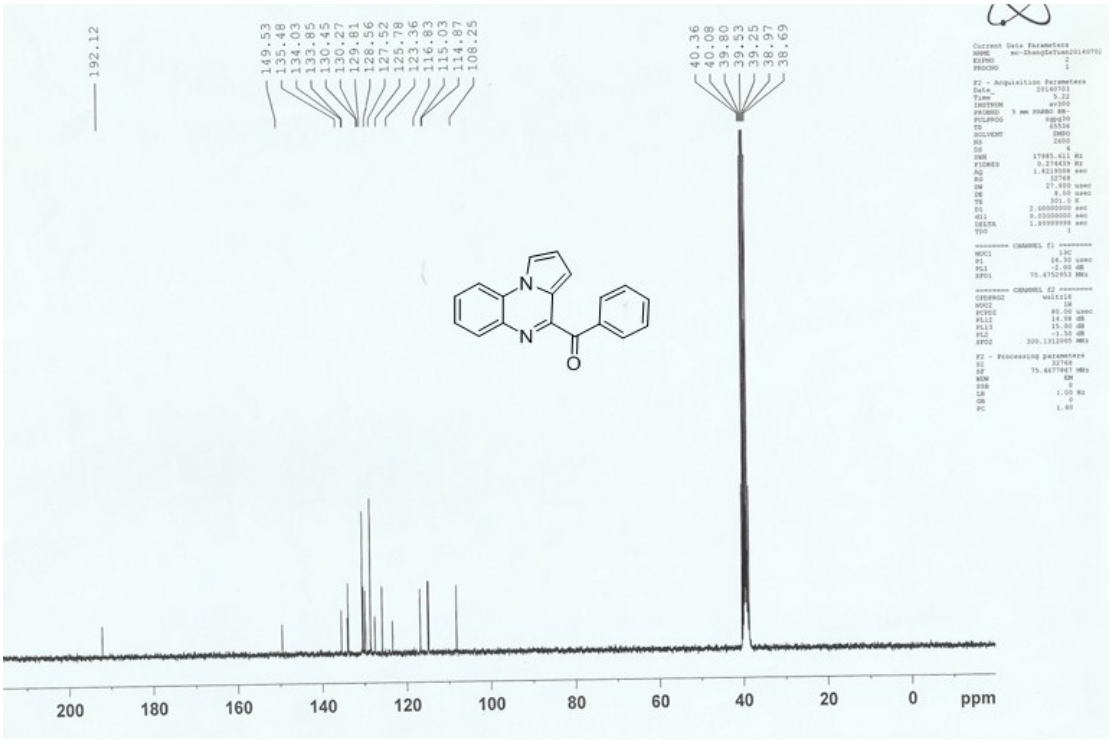
1. Patil, N. T.; Kavthe, R. D.; Shinde, V. S.; Sridhar, B. *J. Org. Chem.*, **2010***,* 10, 3371.
2. Verma, A. K.; Jha, R. R.; Sankar, V. K.; Aggarwal, T.; Singh, R. P.; Chandra, R. *Eur. J. Org. Chem.*, **2011**, 6998.
3. Kelly, T. R.; Cavero, M. *Org. Lett.*, **2002**, 16, 2653.

6. HRMS, ^{1}H NMR and ^{13}C NMR spectra

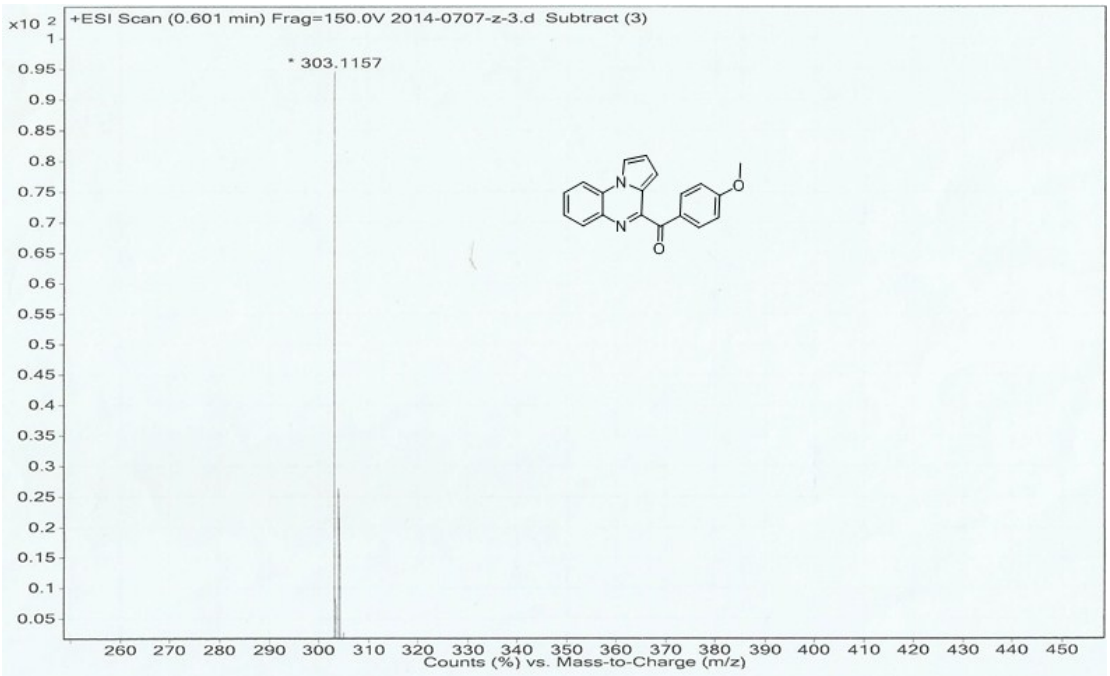
*Phenyl(pyrrolo[1,2-a]quinoxalin-4-yl)methanone (**3aa**).*

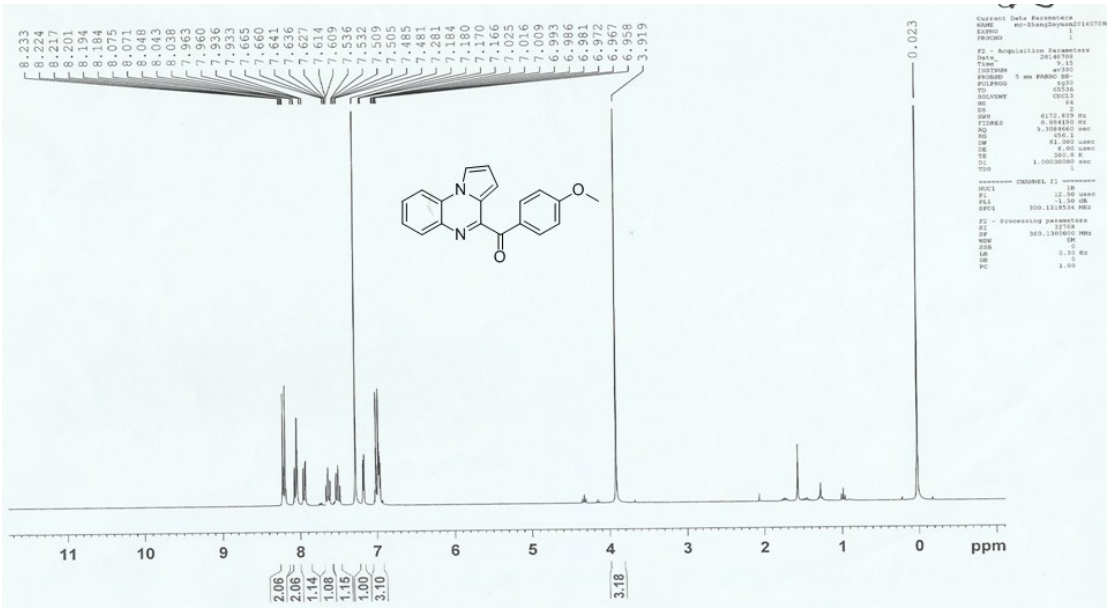






*(4-Methoxyphenyl)(pyrrolo[1,2-a]quinoxalin-4-yl)methanone (**3ab**)*.

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8.184
8.075
8.071
8.048
8.043
8.038
7.963
7.960
7.936
7.933
7.665
7.660
7.641
7.636
7.627
7.614
7.609
7.536
7.532
7.509
7.505
7.485
7.481
7.281
7.184
7.180
7.170
7.166
7.025
7.016
7.009
6.993
6.986
6.981
6.972
6.967
6.958
3.919
0.023
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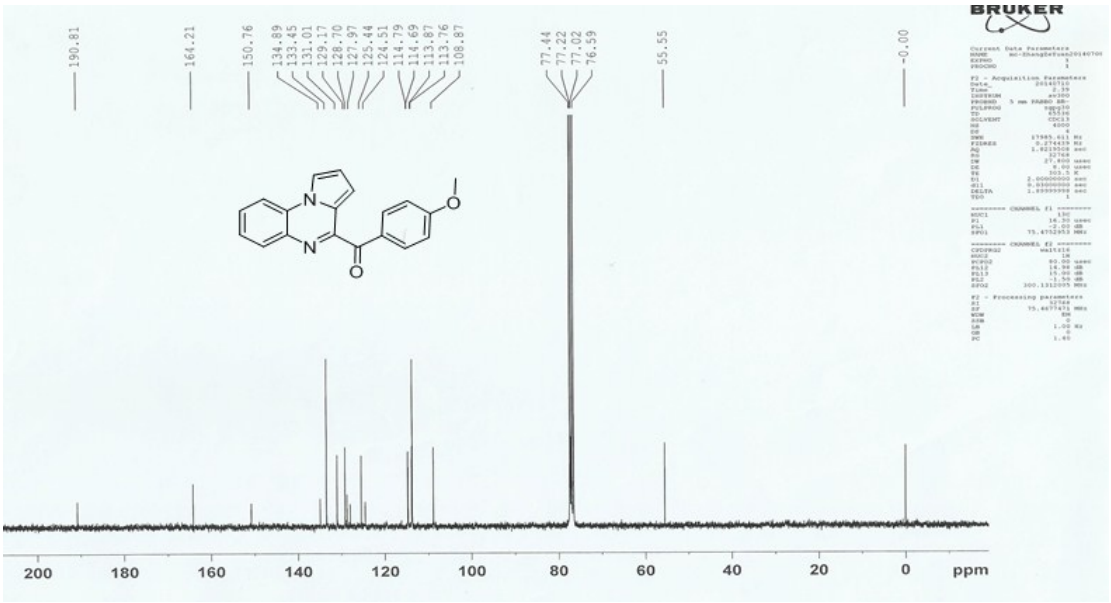
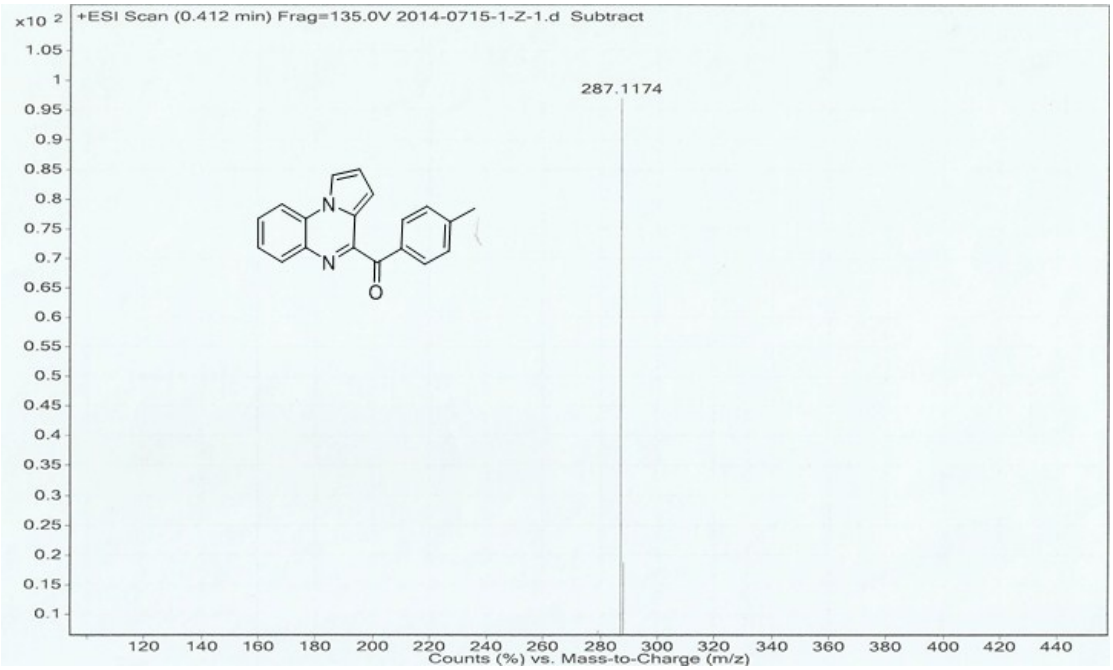
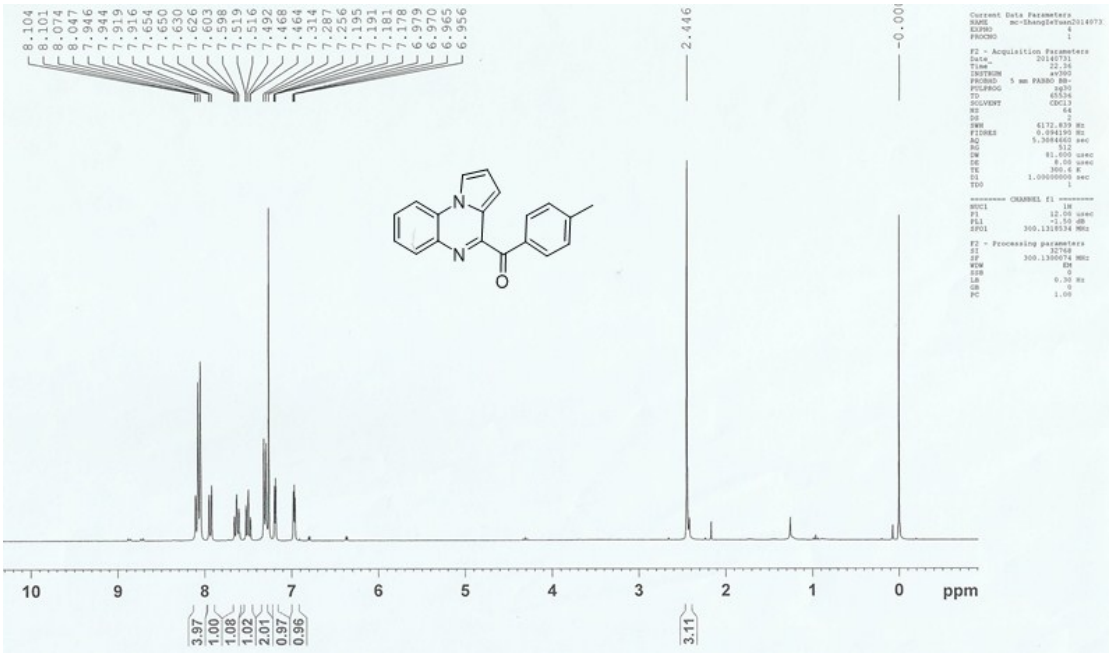
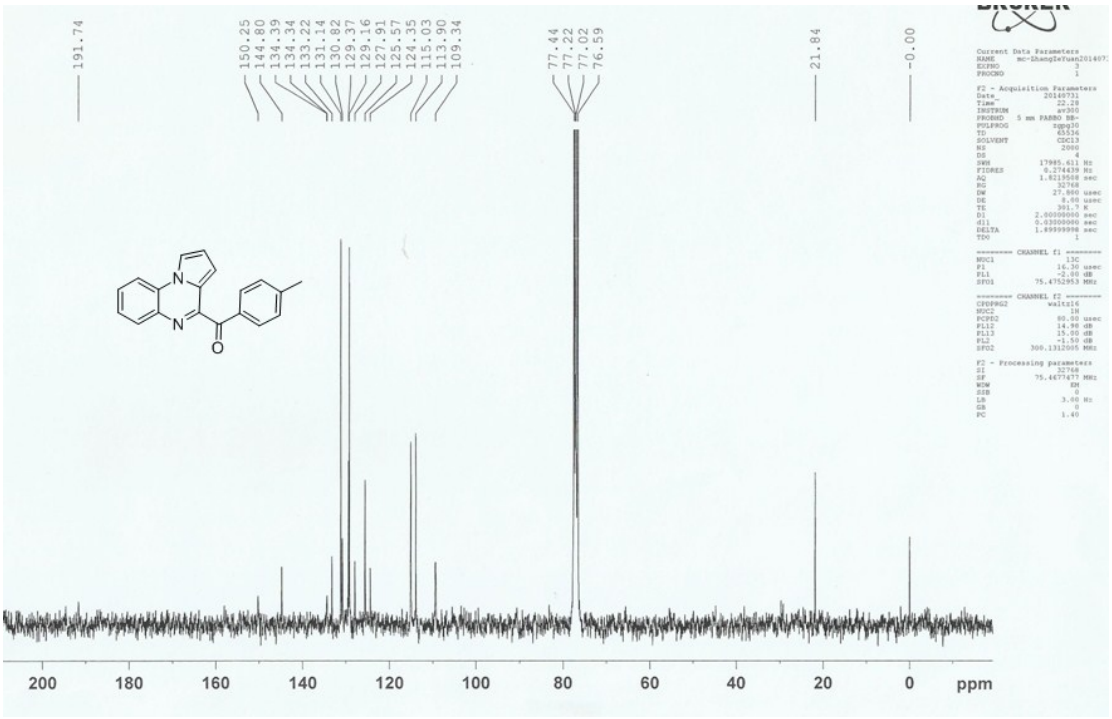
2.06
2.06
1.14
1.08
1.15
1.00
3.10
3.18


BRUKER
190.81
164.21
150.76
134.89
133.45
131.01
129.17
128.70
127.97
125.44
124.51
114.79
114.69
113.87
113.76
108.87
77.44
77.22
77.02
76.59
55.55
-0.00
200 180 160 140 120 100 80 60 40 20 0 ppm

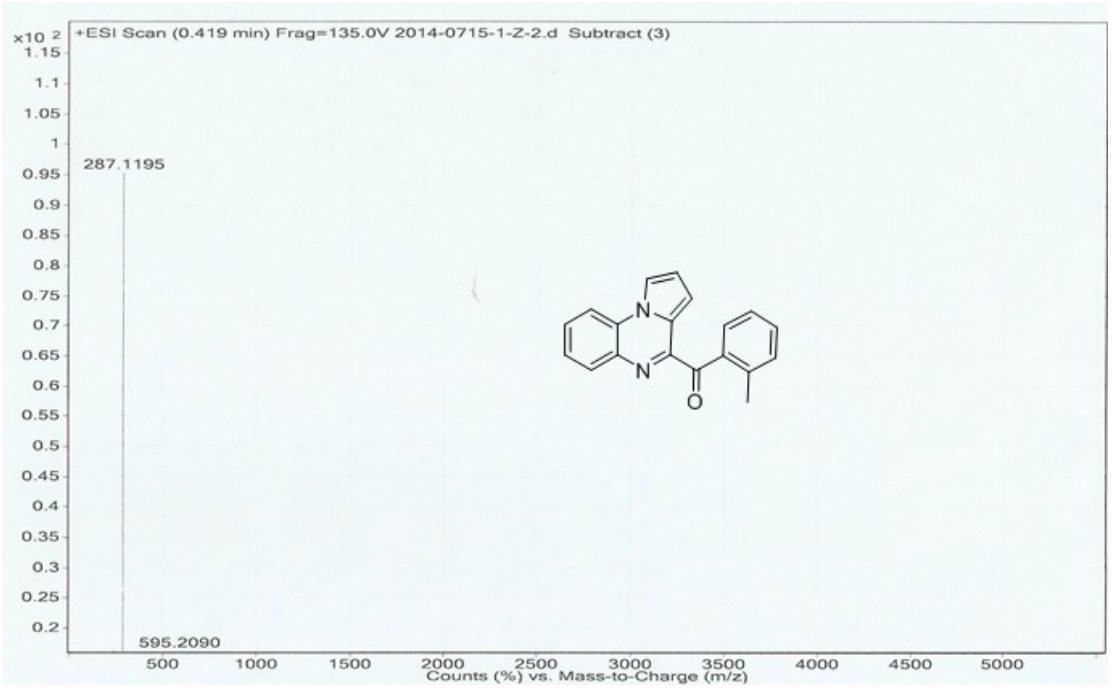
*Pyrrolo[1,2-a]quinoxalin-4-yl(p-tolyl)methanone (**3ac**)*.

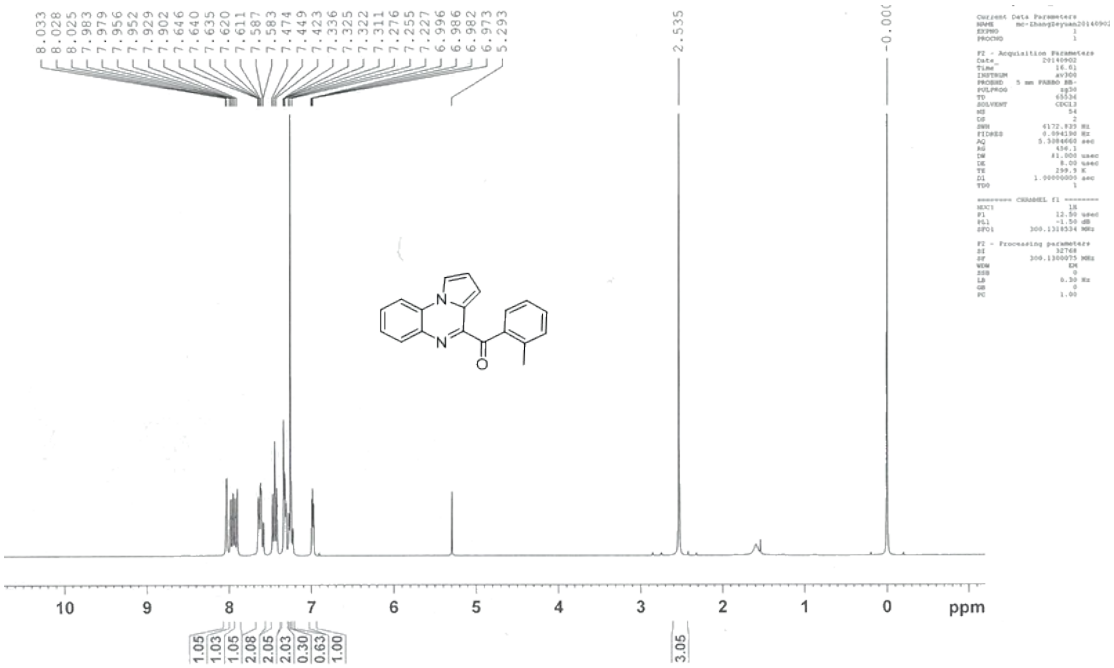






*Pyrrolo[1,2-a]quinoxalin-4-yl(o-tolyl)methanone (**3ad**).*

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7.952
7.929
7.902
7.646
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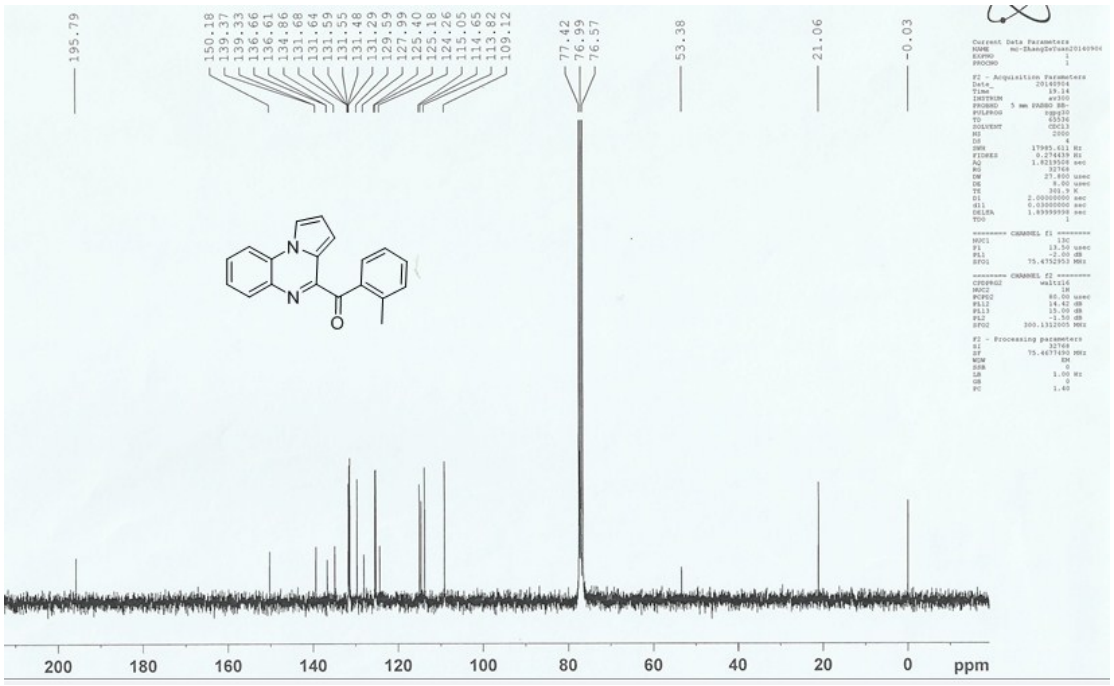
7.635
7.620
7.611
7.587
7.583
7.474
7.449
7.423
7.336
7.325
7.322
7.311
7.276
7.255
7.227
6.996
6.986
6.982
6.973
5.293
2.535
-0.00
10
9
8
7
6
5
4
3
2
1
0
ppm
1.05
1.03
1.05
2.08
2.05
2.03
0.30
0.63
1.00
3.05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136.66
136.61
134.86
131.68
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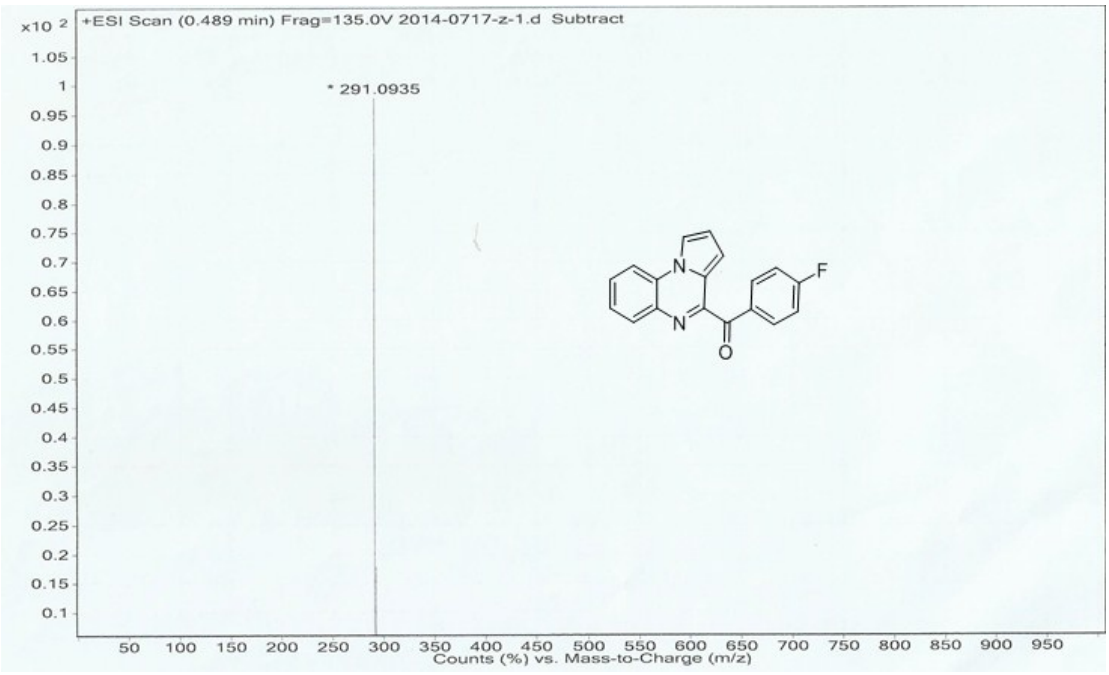
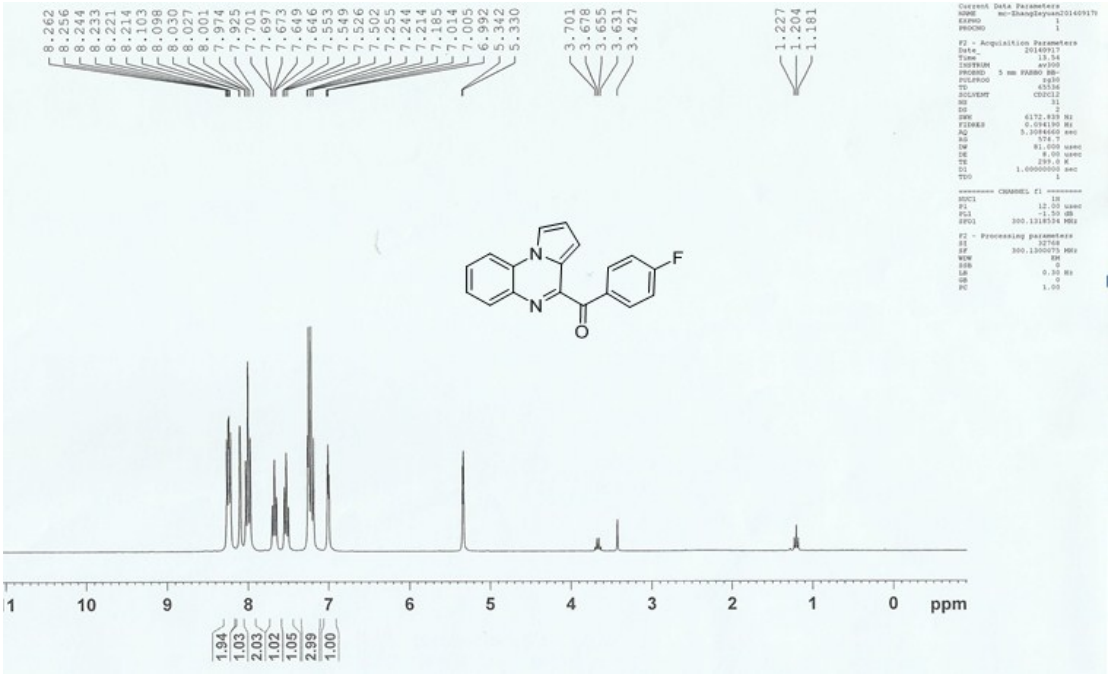
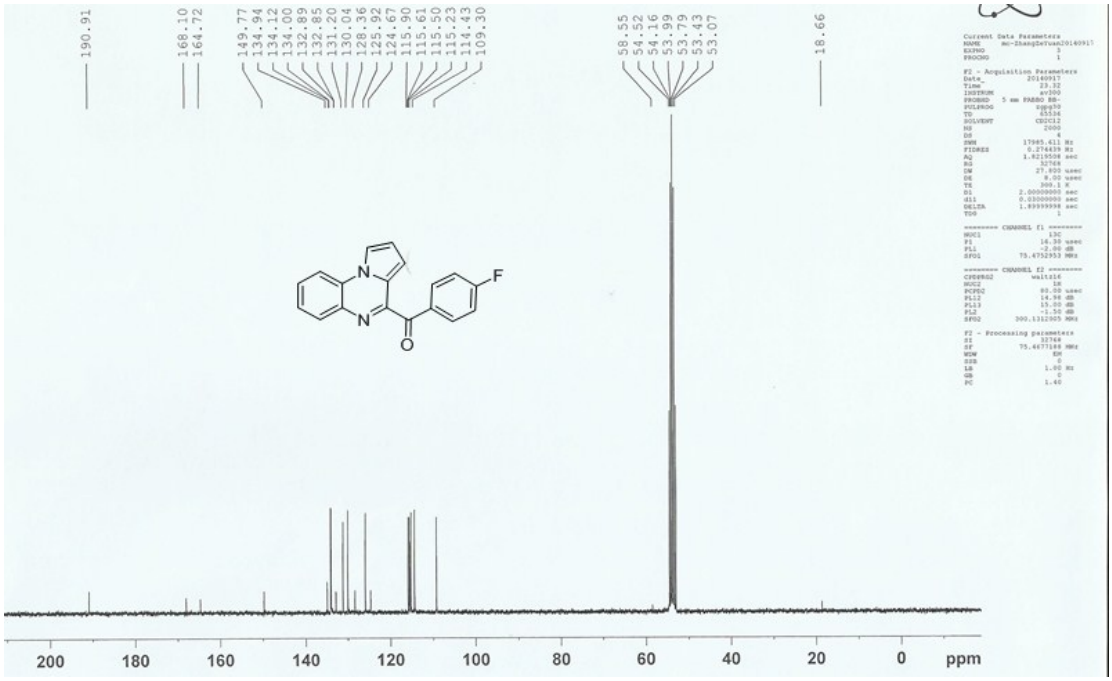
131.59
131.55
131.48
131.29
129.59
127.99
125.40
125.18
124.26
115.05
114.65
113.82
109.12
77.42
76.99
76.57
53.38
21.06
-0.03
200
180
160
140
120
100
80
60
40
20
0
ppm

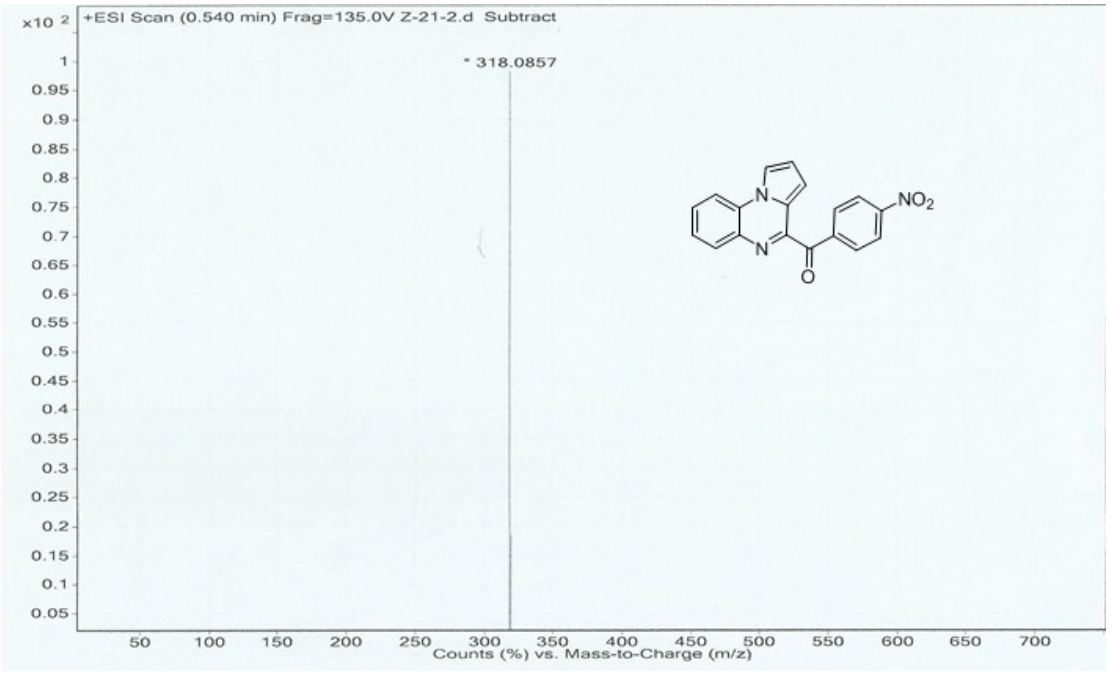
*(4-Fluorophenyl)(pyrrolo[1,2-a]quinoxalin-4-yl)methanone (**3ae**)*.

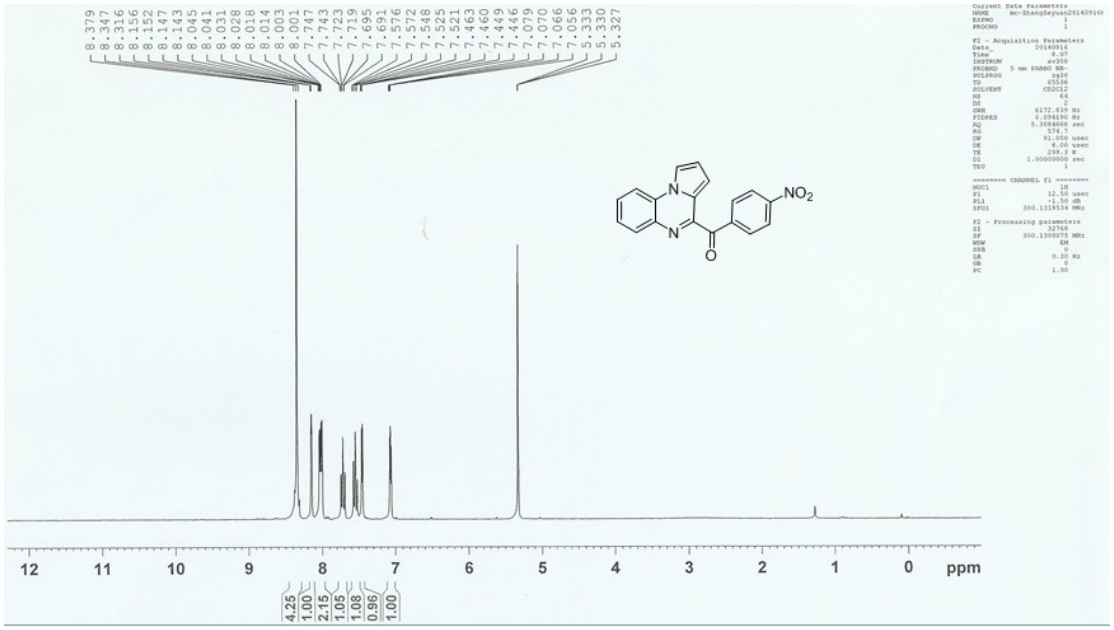






*(4-Nitrophenyl)(pyrrolo[1,2-a]quinoxalin-4-yl)methanone (**3af**).*

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8.143
8.045
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8.031
8.028
8.018
8.014
8.003
8.001
7.747
7.743
7.723
7.719
7.695
7.691
7.576
7.572
7.548
7.525
7.521
7.463
7.460
7.449
7.446
7.079
7.070
7.066
7.056
5.333
5.330
5.327
NO2
O
N
12
11
10
9
8
7
6
5
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3
2
1
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ppm
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1.00
2.15
1.05
1.08
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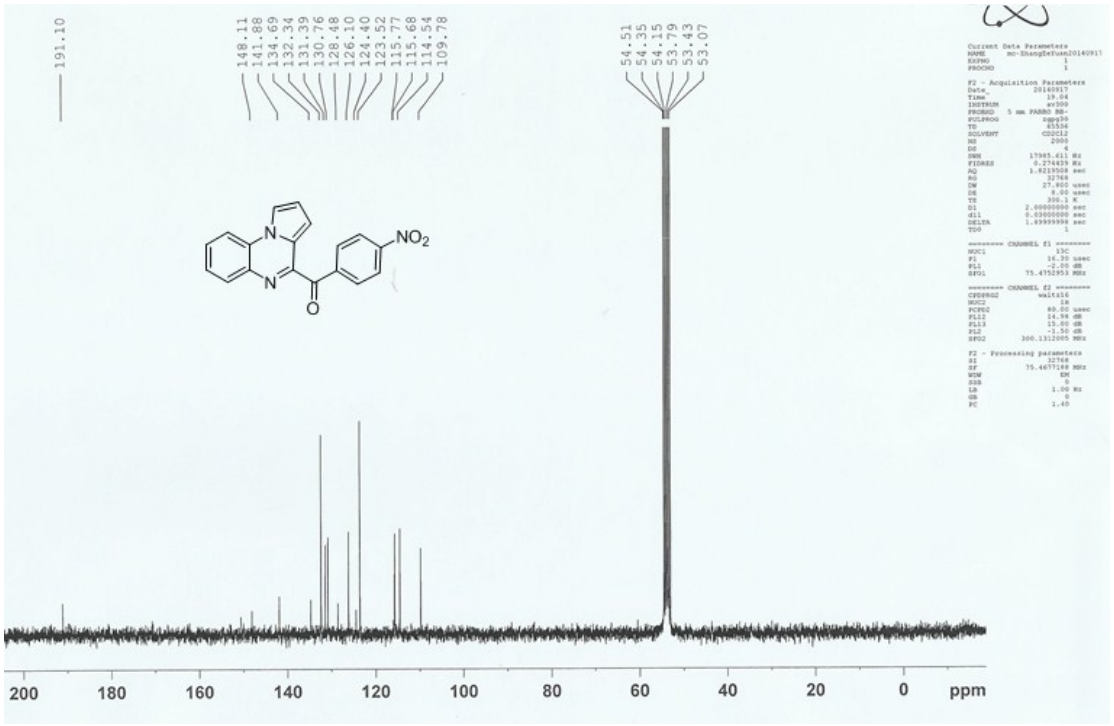
1.00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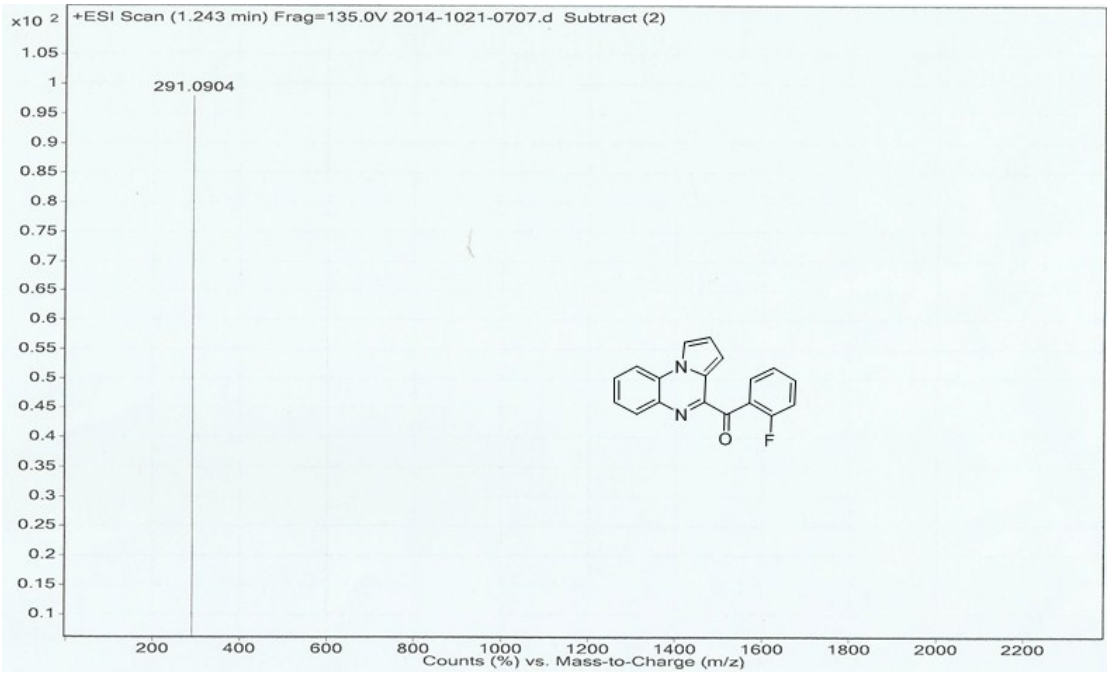
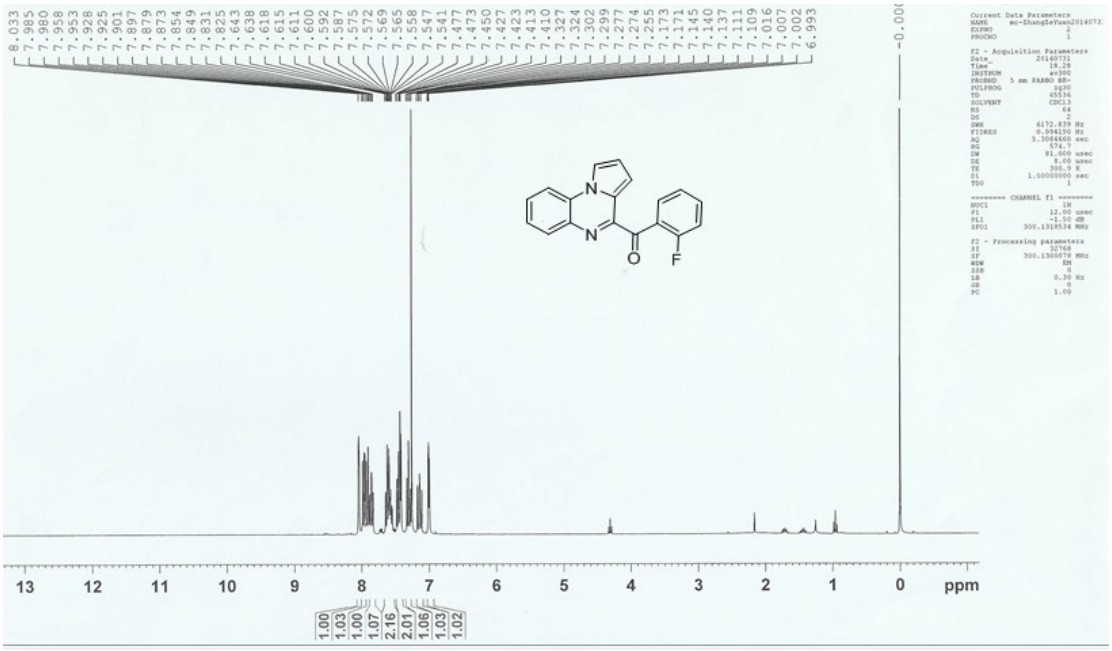
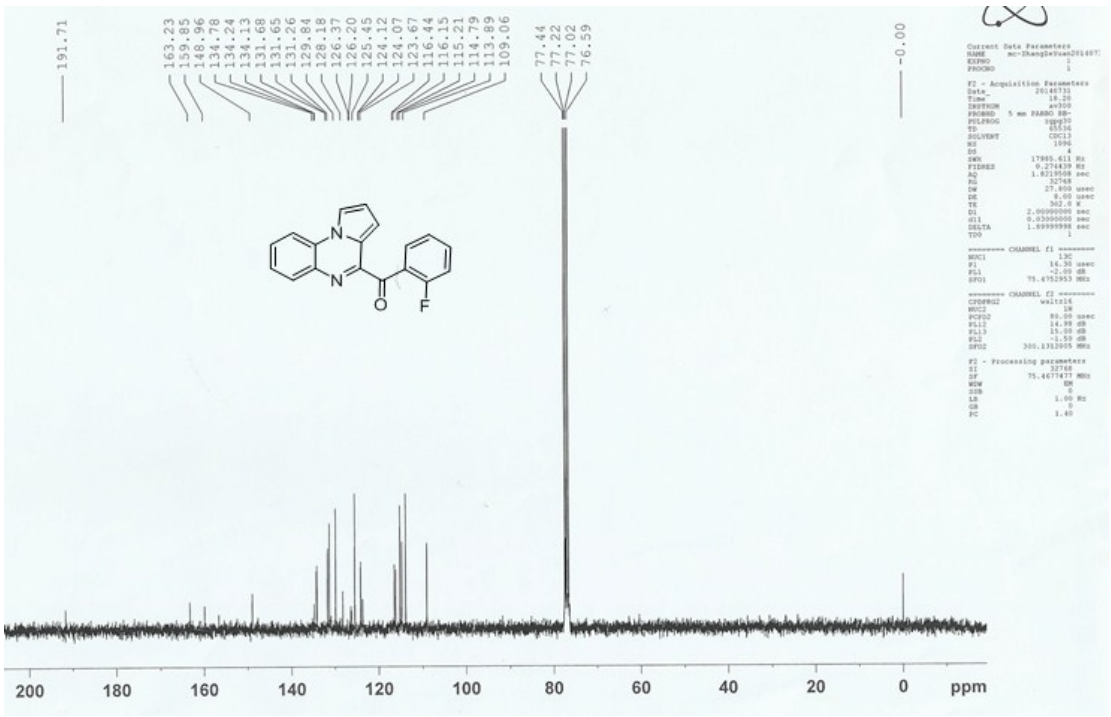
131.39
130.76
128.48
126.10
124.40
123.52
115.77
115.68
114.54
109.78
54.51
54.35
54.15
53.79
53.43
53.07
NO2
O
N
200
180
160
140
120
100
80
60
40
20
0
ppm

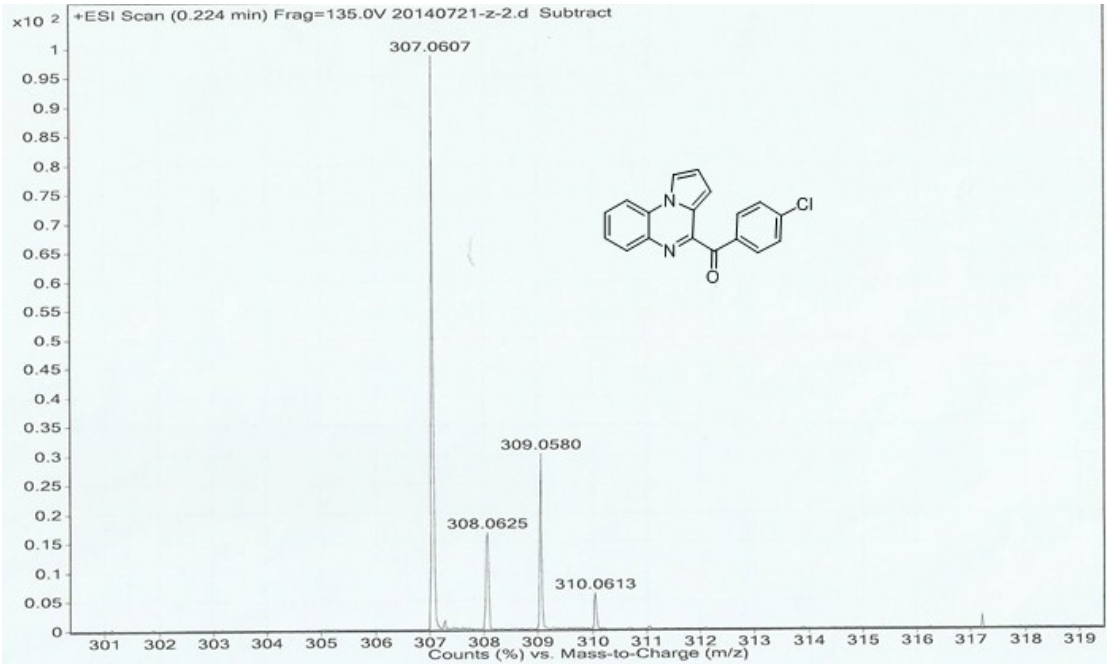
*(2-Fluorophenyl)(pyrrolo[1,2-a]quinoxalin-4-yl)methanone (**3ag**)*.

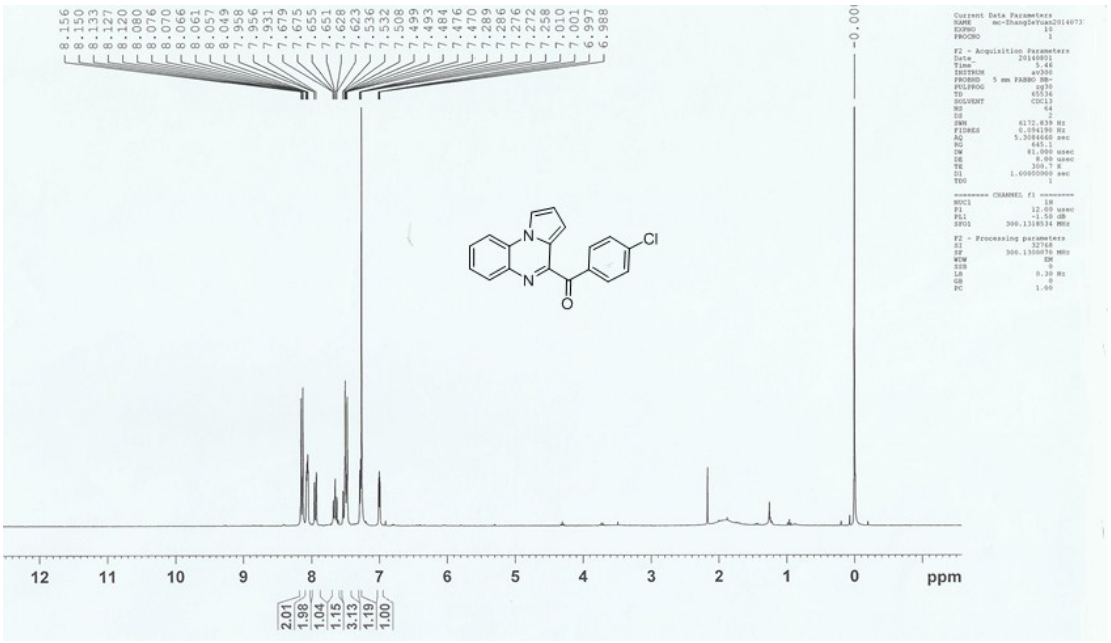






*(4-Chlorophenyl)(pyrrolo[1,2-a]quinoxalin-4-yl)methanone (**3ah**)*.

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8.080
8.076
8.070
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8.061
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7.956
7.931
7.679
7.675
7.655
7.651
7.628
7.623
7.536
7.532
7.508
7.499
7.493
7.484
7.476
7.470
7.289
7.286
7.276
7.272
7.258
7.010
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6.997
6.988
0.00
Cl
O
N
12
11
10
9
8
7
6
5
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ppm
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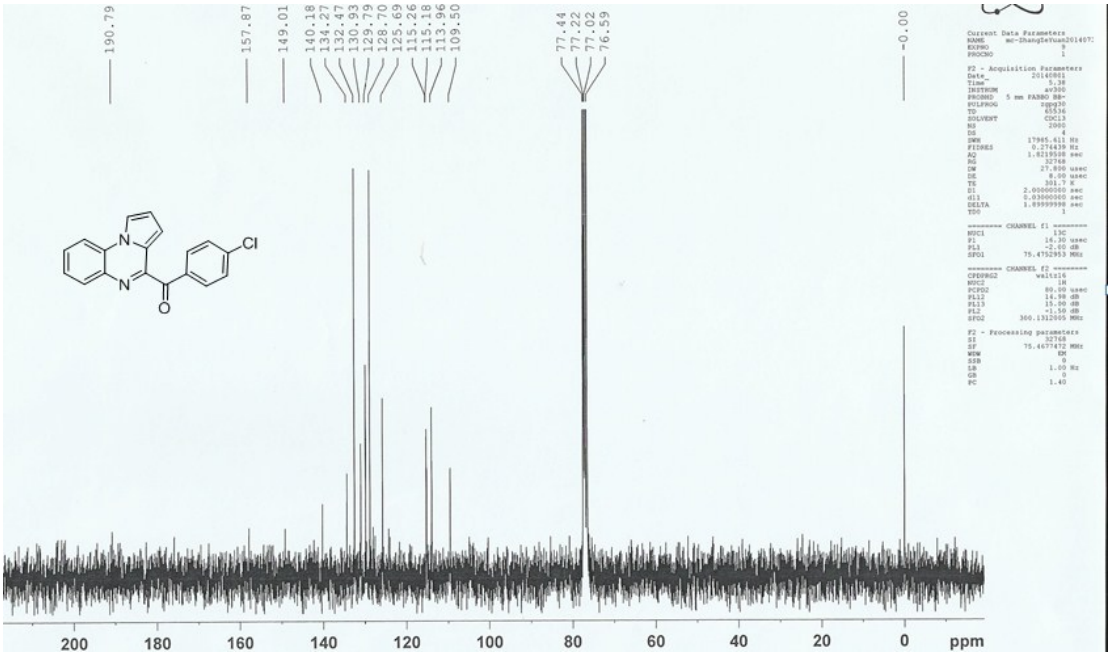
1.98
1.04
1.15
3.13
1.19
1.00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125.69
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115.18
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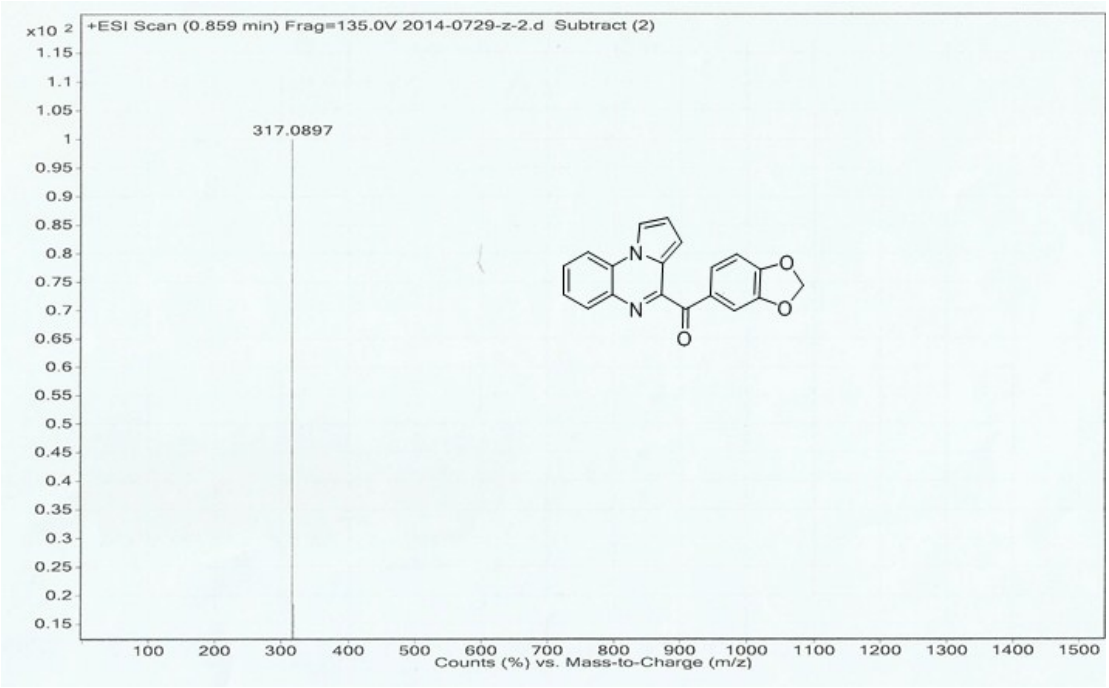
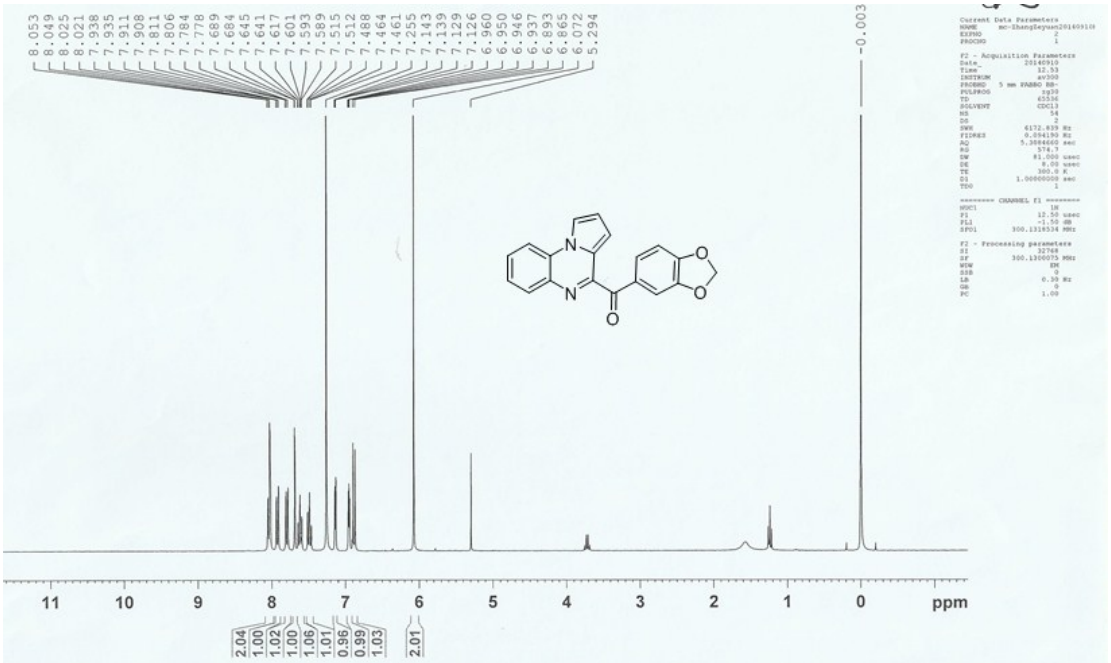
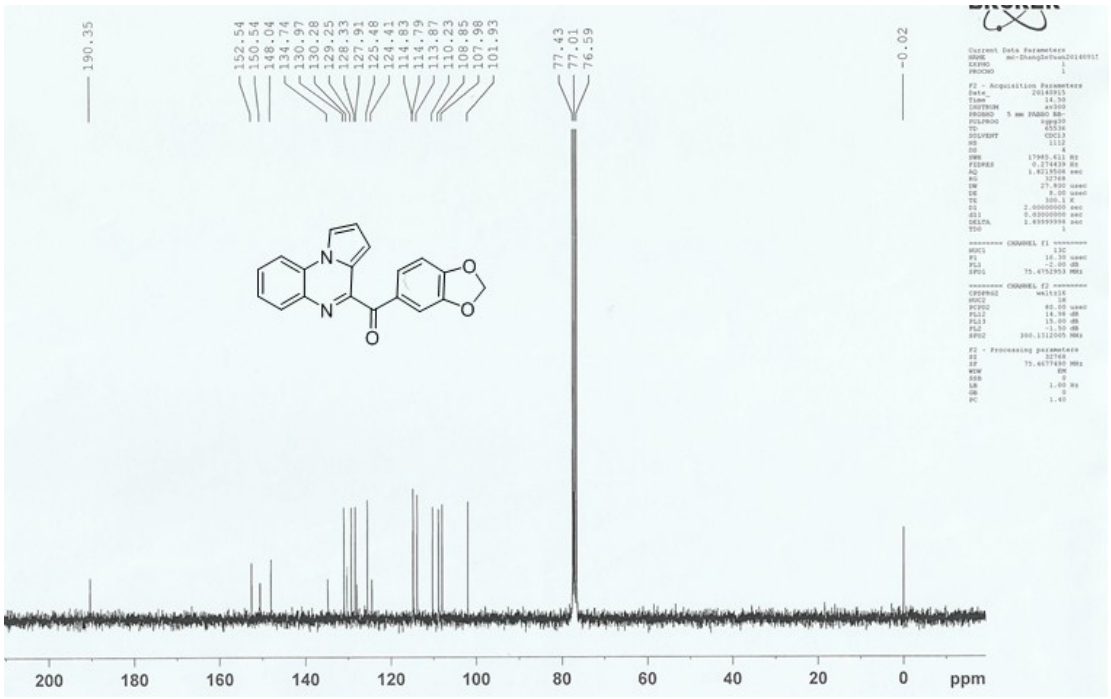
109.50
77.44
77.22
77.02
76.59
-0.00
Cl
O
N
200
180
160
140
120
100
80
60
40
20
0
ppm

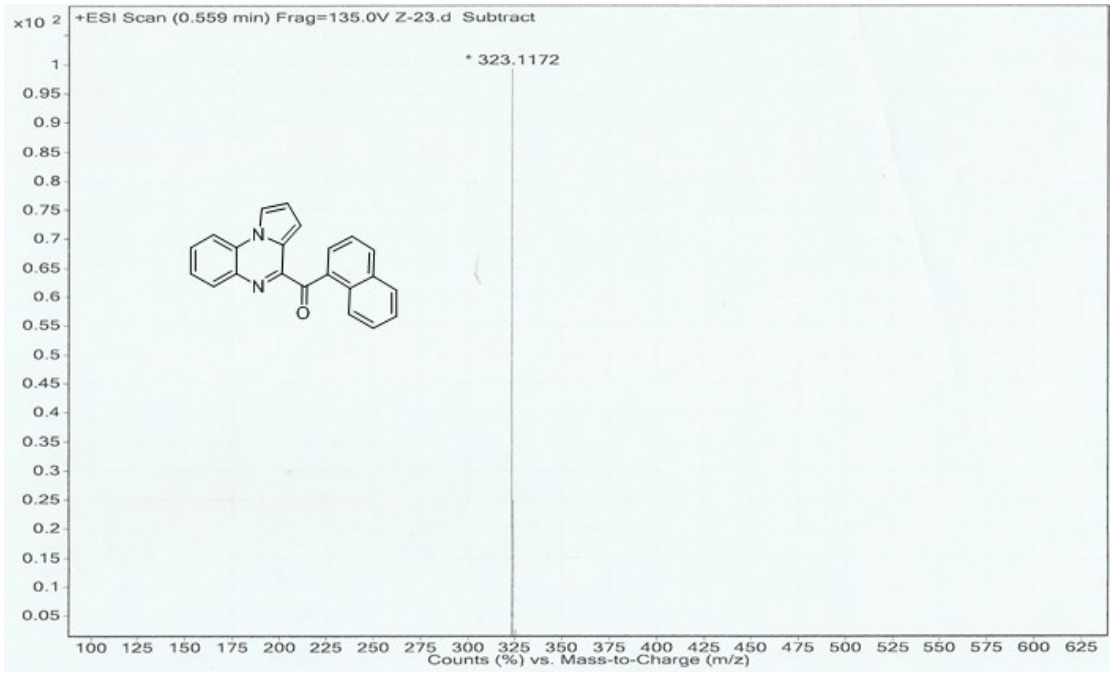
*Benzo[d][1,3]dioxol-5-yl(pyrrolo[1,2-a]quinoxalin-4-yl)methanone (**3ai**).*

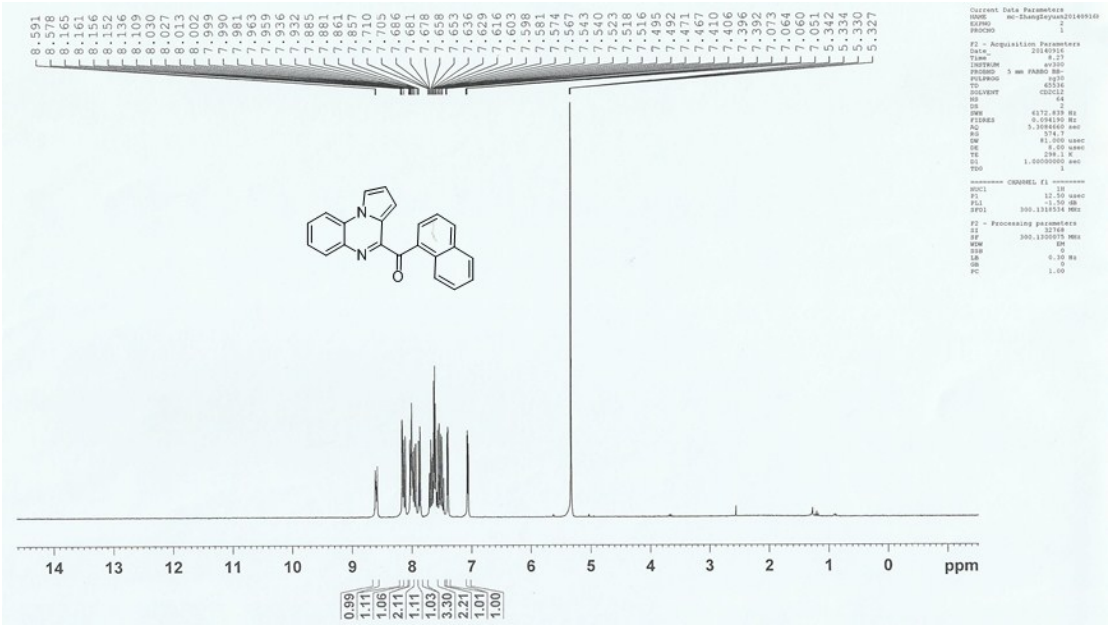


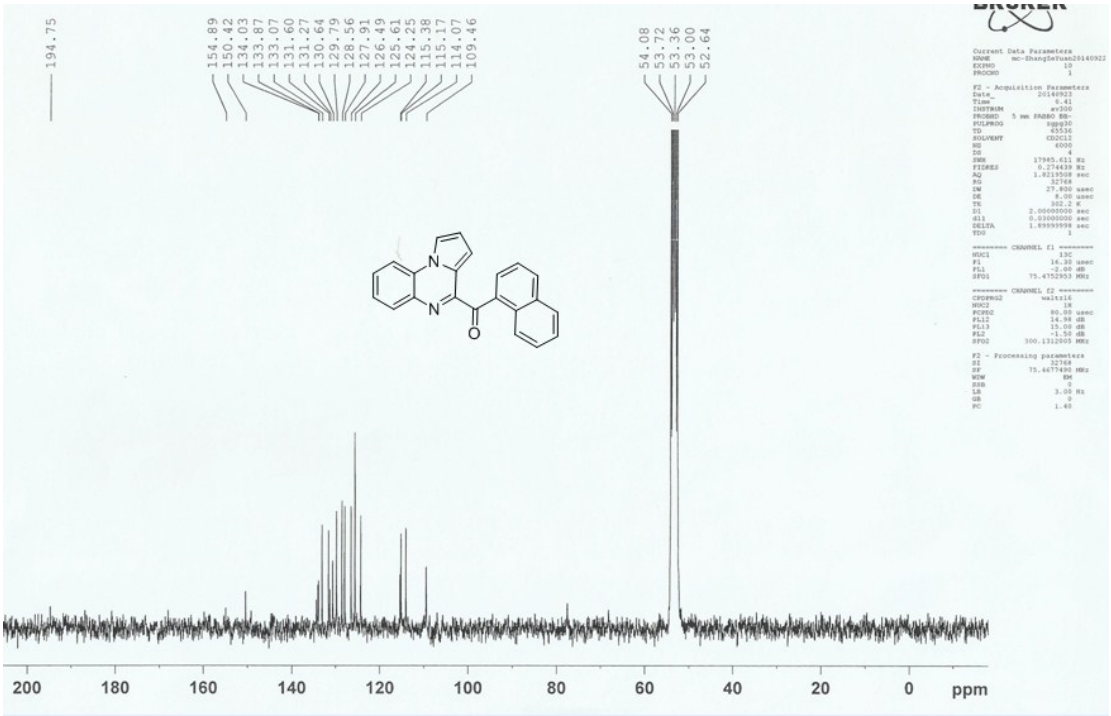




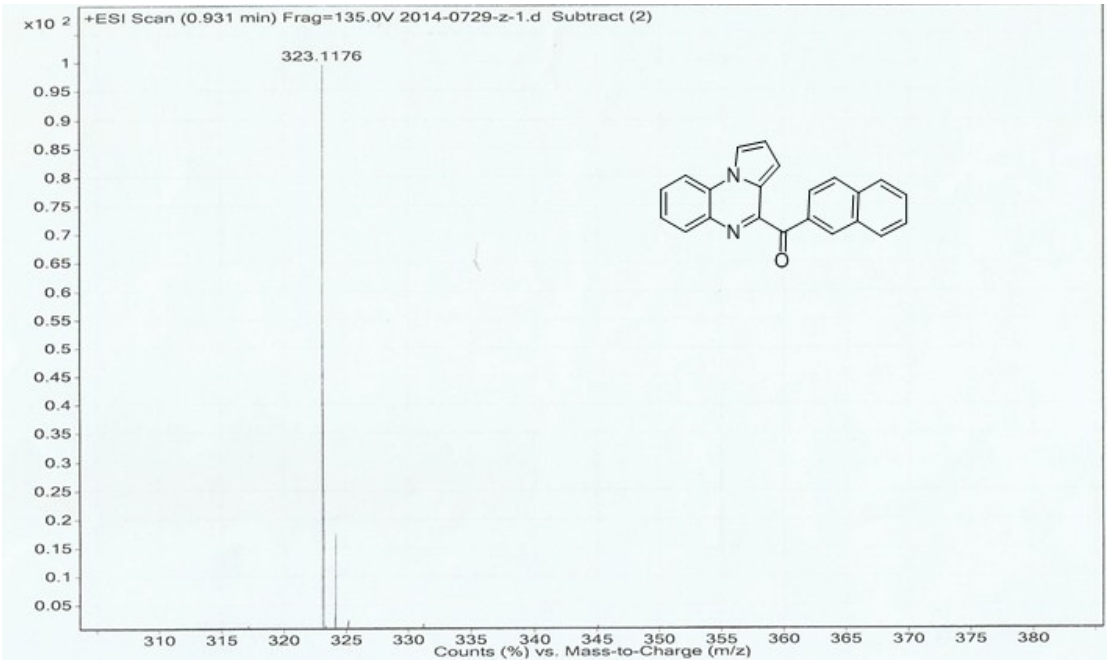
*Naphthalen-1-yl(pyrrolo[1,2-a]quinoxalin-4-yl)methanone (**3aj**)*.

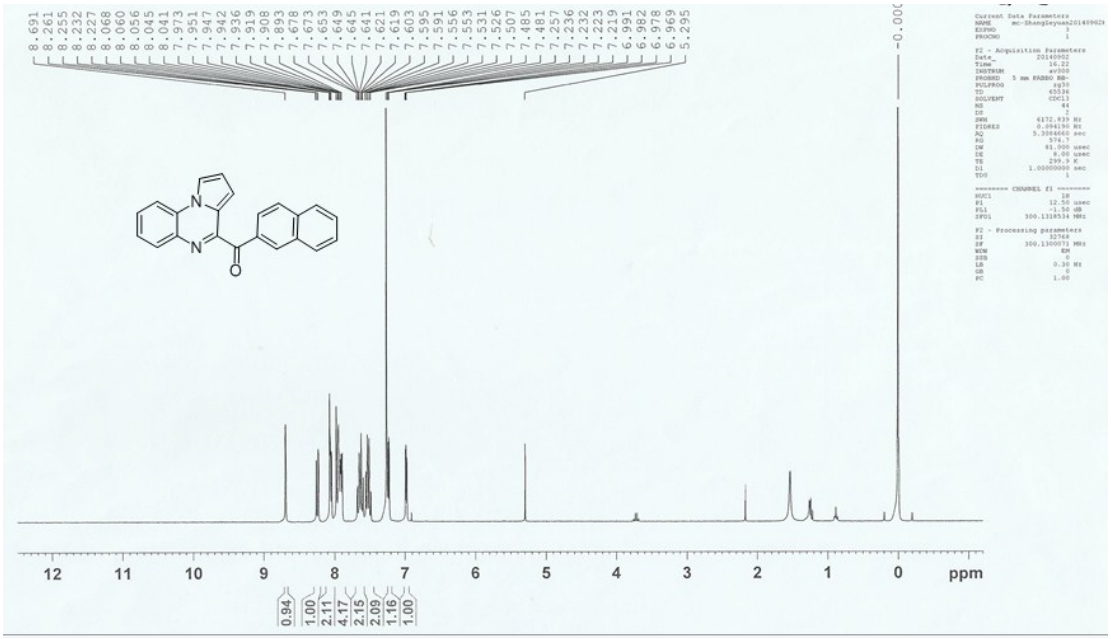


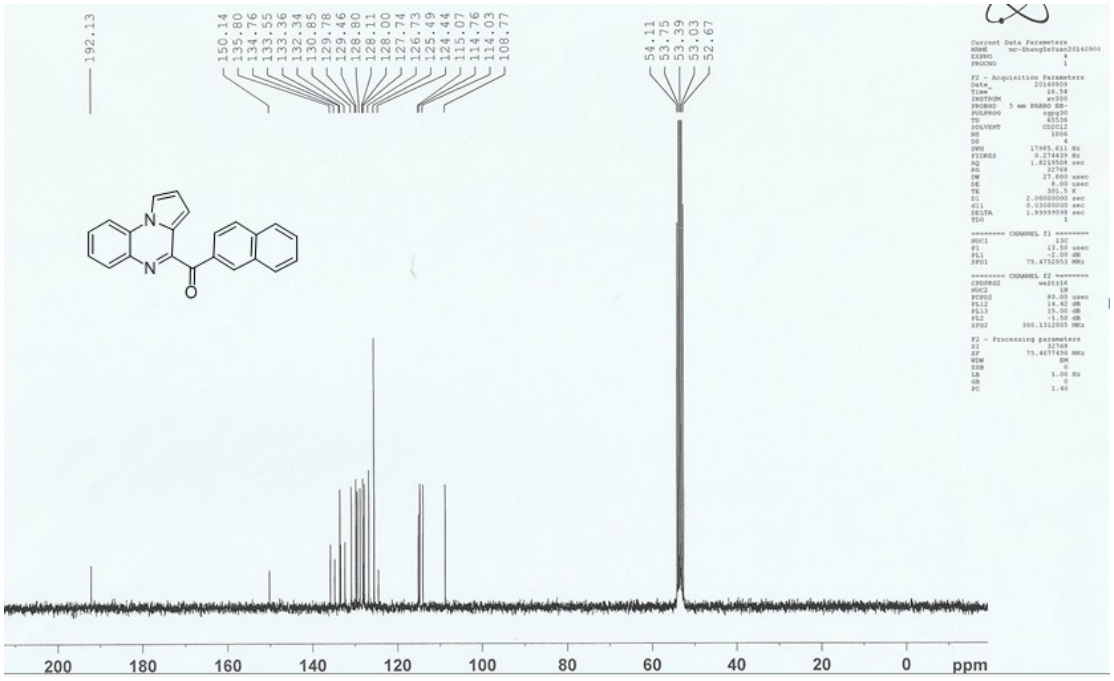




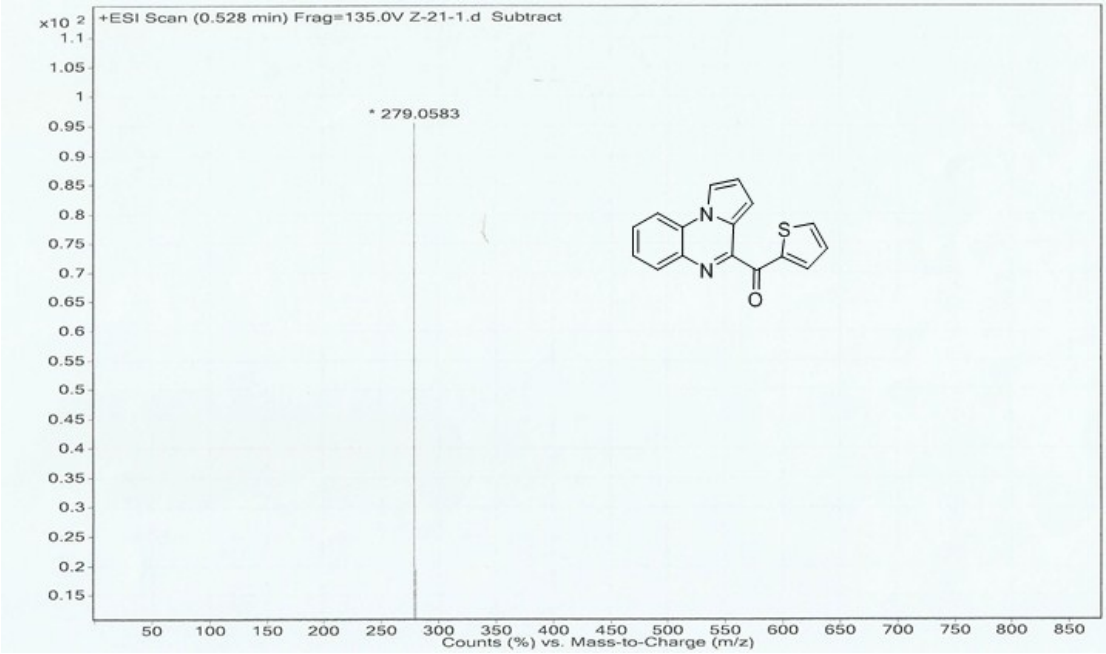
*Naphthalen-2-yl(pyrrolo[1,2-a]quinoxalin-4-yl)methanone (**3ak**).*

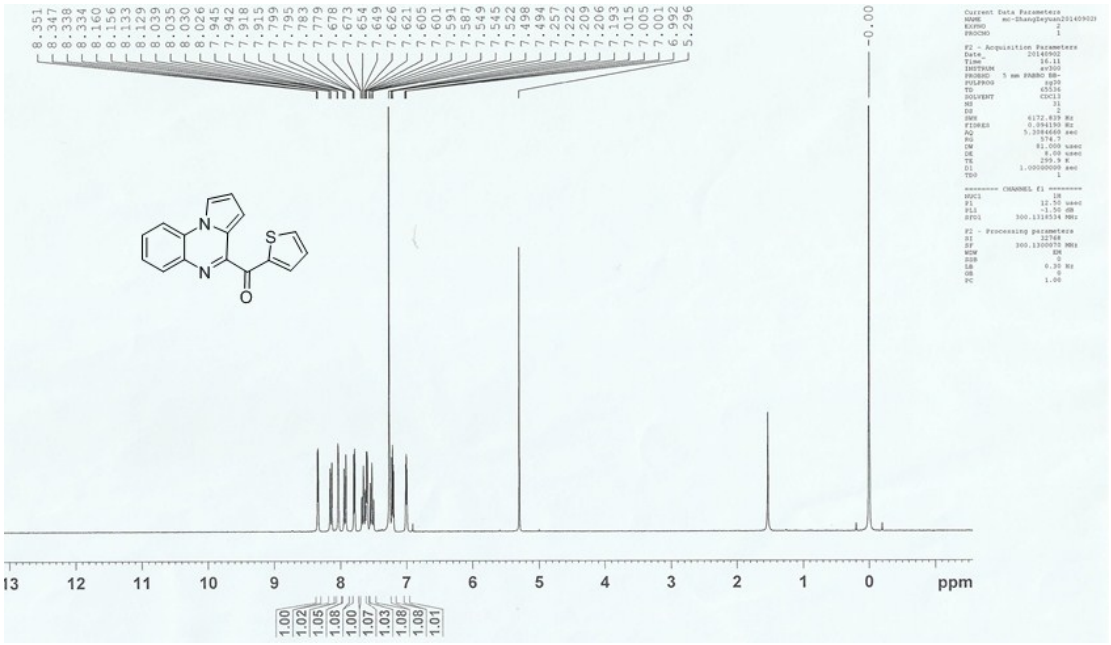


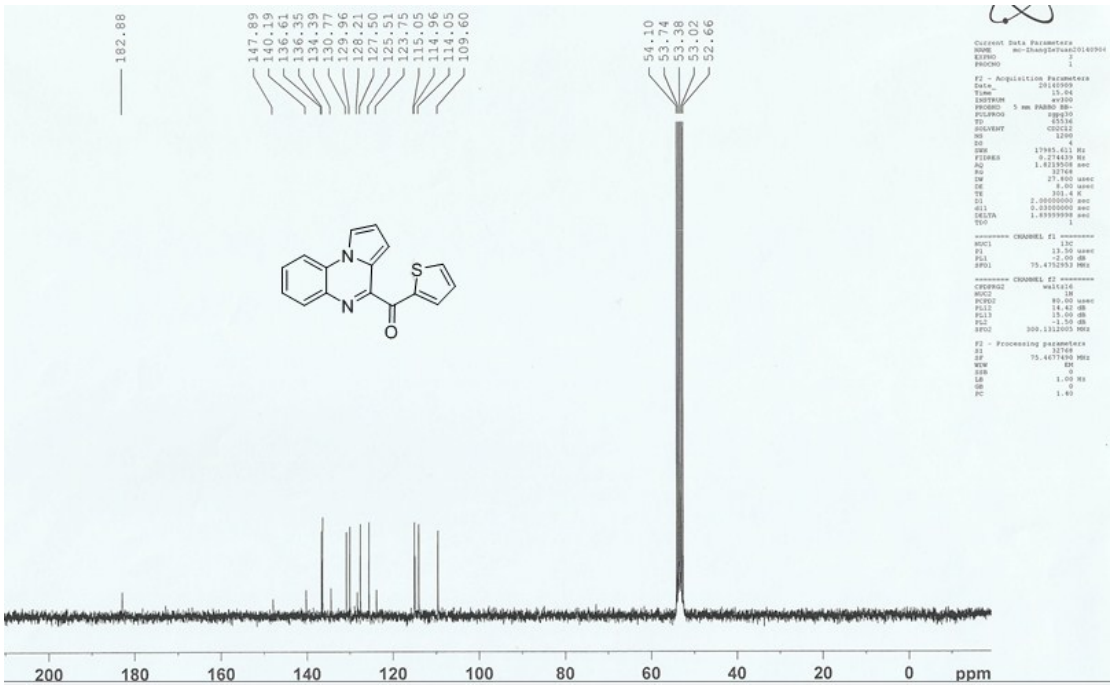




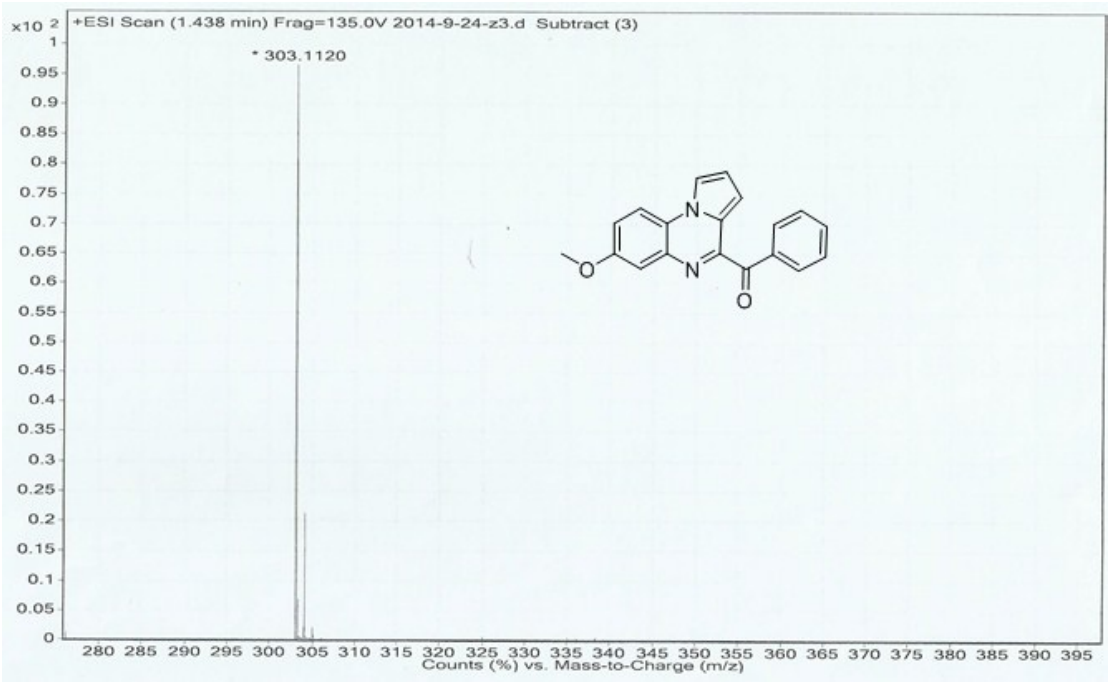
*Pyrrolo[1,2-a]quinoxalin-4-yl(thiophen-2-yl)methanone (**3al**).*

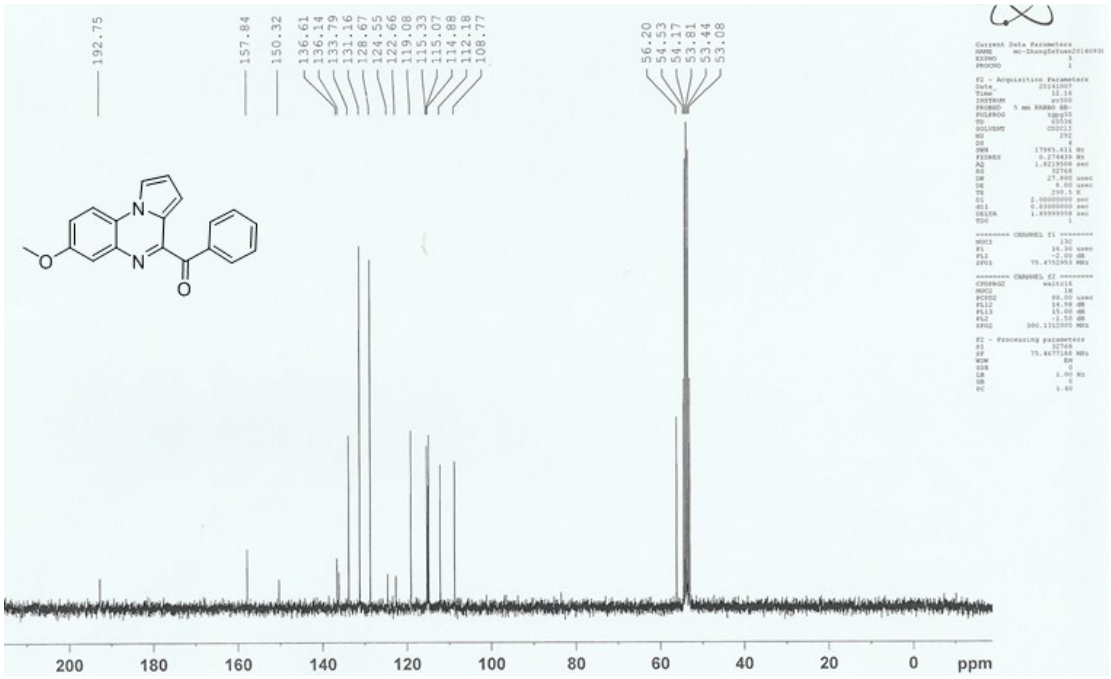



8.351
8.347
8.338
8.334
8.160
8.156
8.133
8.129
8.039
8.035
8.030
8.026
7.945
7.942
7.918
7.915
7.799
7.795
7.783
7.779
7.678
7.673
7.654
7.649
7.626
7.621
7.605
7.601
7.591
7.587
7.549
7.545
7.522
7.498
7.494
7.257
7.222
7.209
7.206
7.193
7.015
7.005
7.001
6.992
5.296
0.00
13 12 11 10 9 8 7 6 5 4 3 2 1 0 ppm
1.00 1.02 1.05 1.08 1.00 1.07 1.03 1.08 1.08 1.01

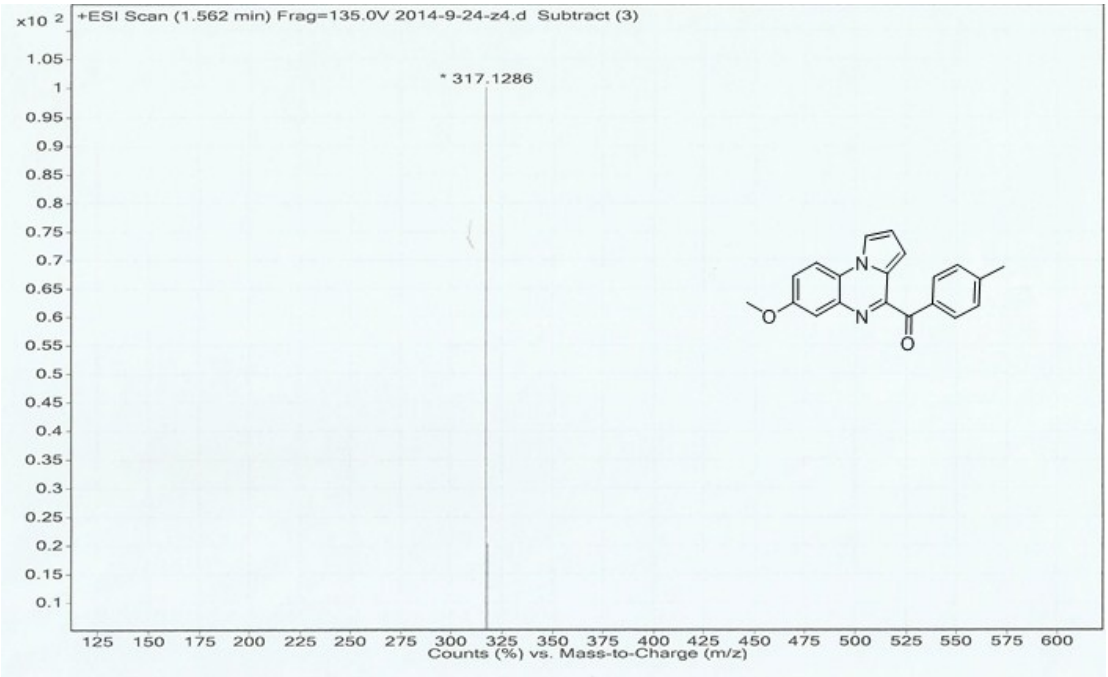

182.88
147.89
140.19
136.61
136.35
134.39
130.77
129.96
128.21
127.50
125.51
123.75
115.05
114.96
114.05
109.60
54.10
53.74
53.38
53.02
52.66
200 180 160 140 120 100 80 60 40 20 0 ppm

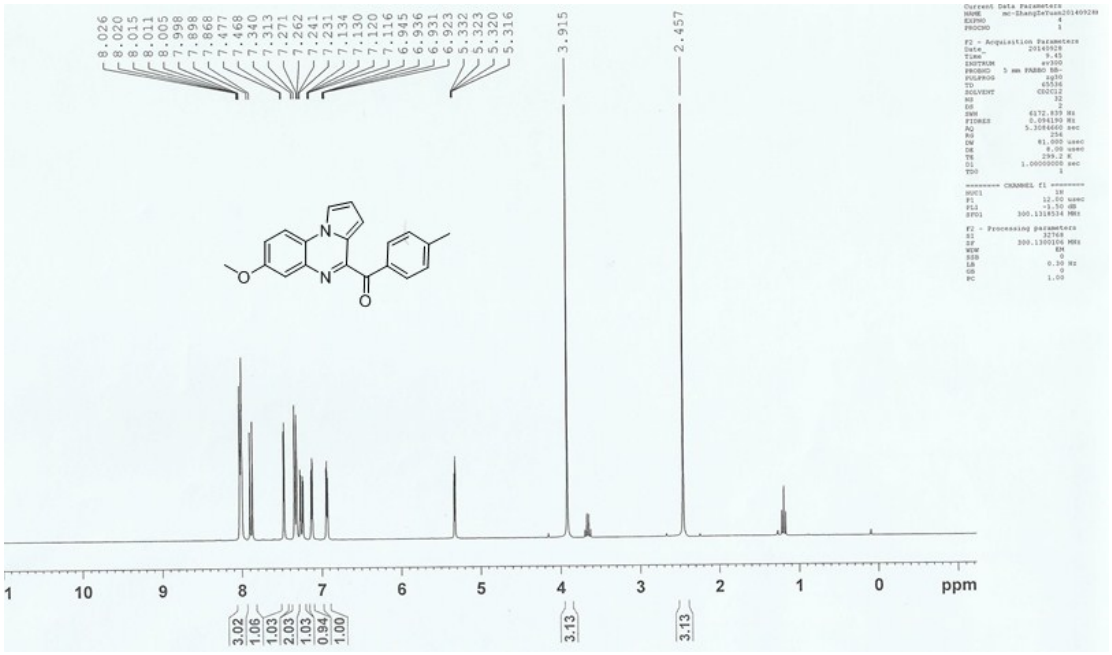
*(7-Methoxypyrrolo[1,2-a]quinoxalin-4-yl)(phenyl)methanone (**3ba**)*

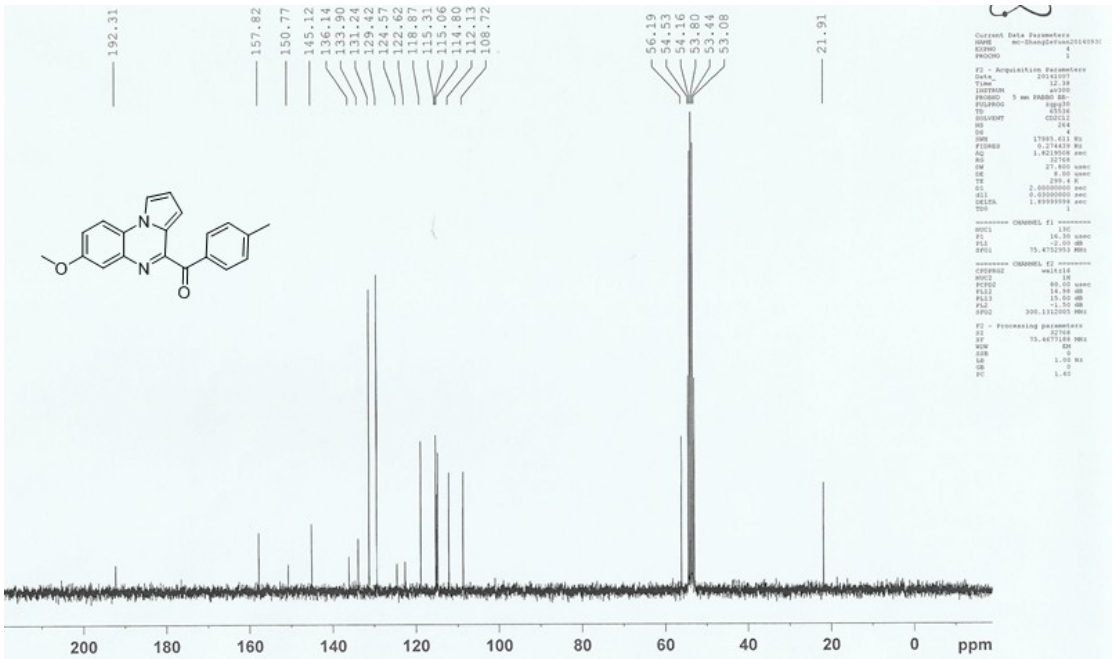




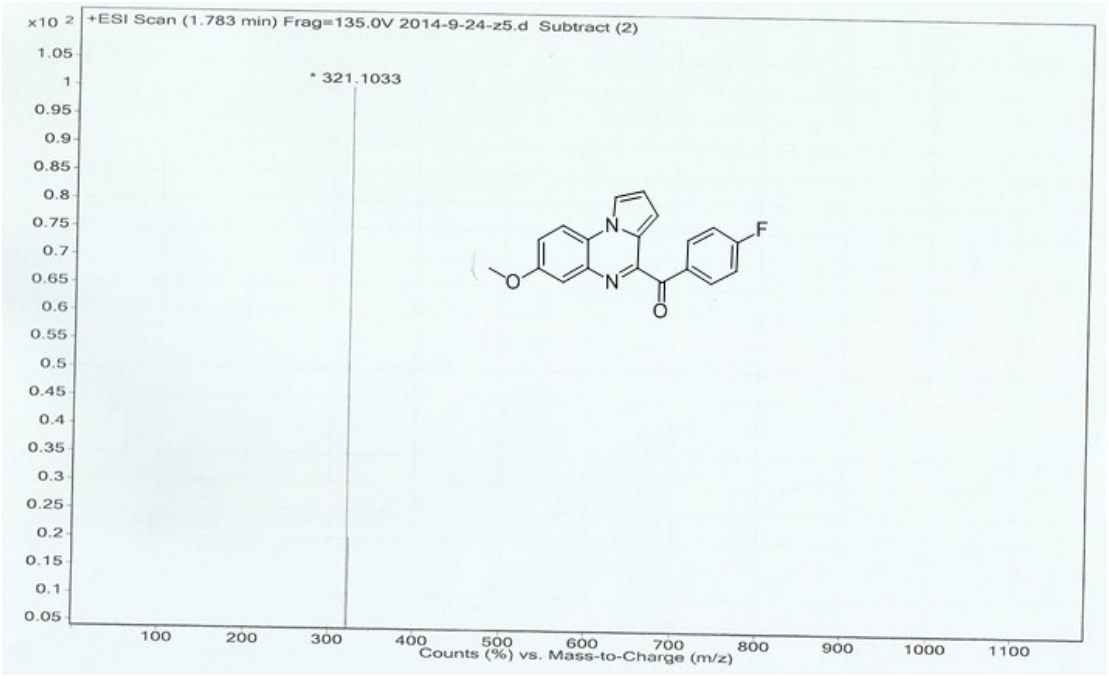
*(7-Methoxypyrrolo[1,2-a]quinoxalin-4-yl)(p-tolyl)methanone (**3bc**)*

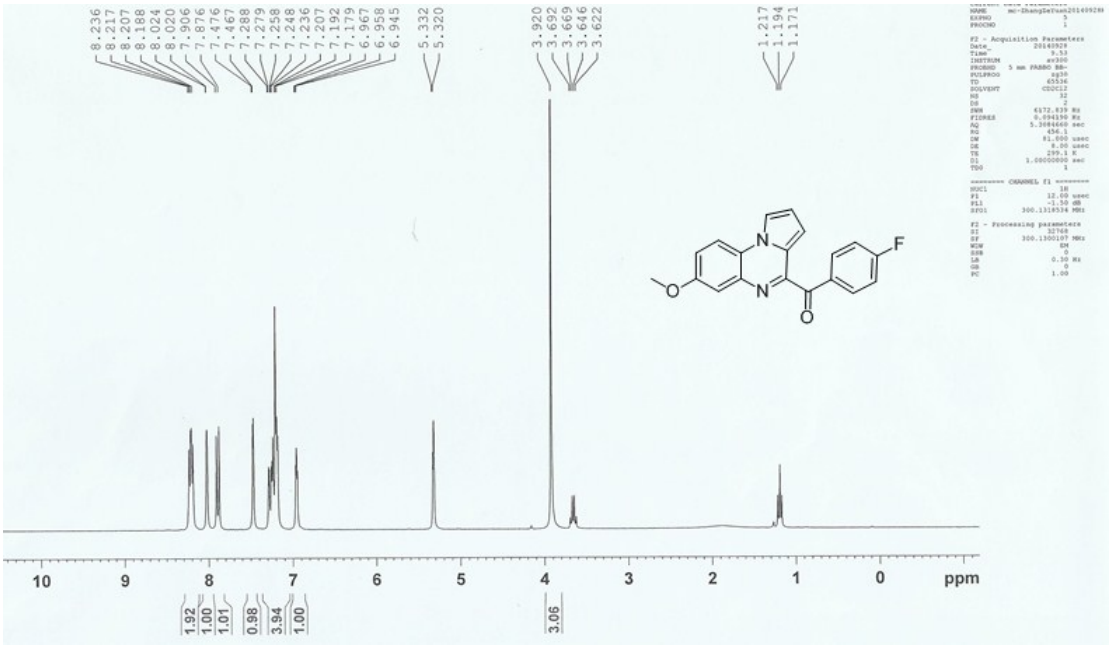


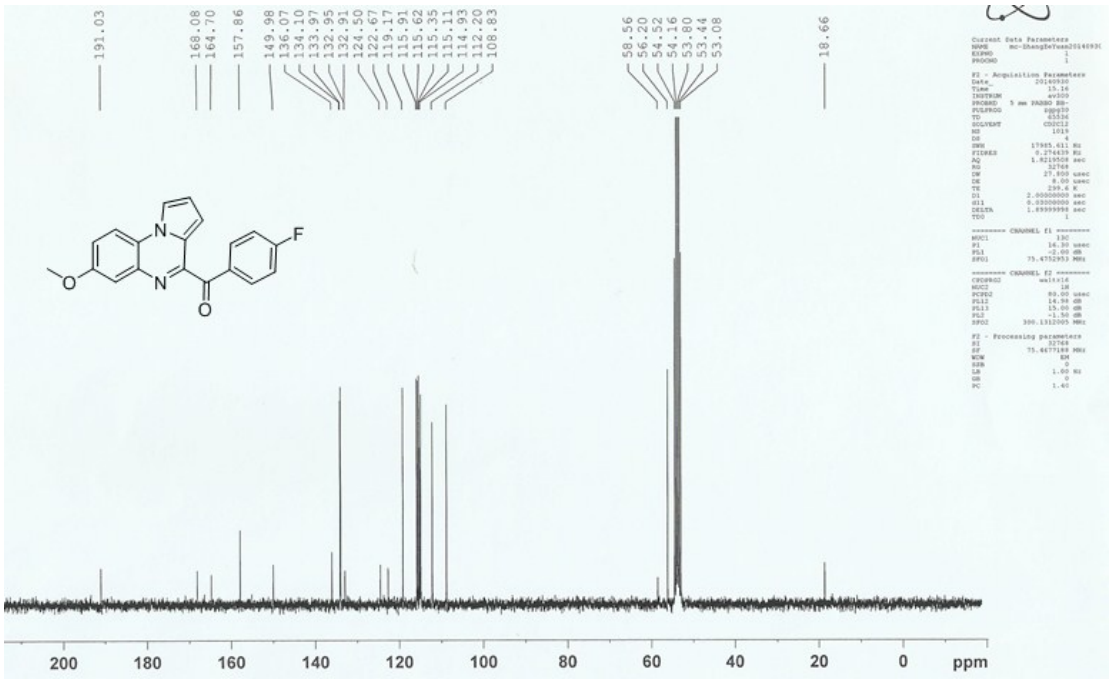

8.026
8.020
8.015
8.011
8.005
7.998
7.898
7.868
7.477
7.468
7.340
7.313
7.271
7.262
7.241
7.231
7.134
7.130
7.120
7.116
6.945
6.936
6.931
6.923
5.332
5.323
5.320
5.316
3.915
2.457
O
N
O
10
9
8
7
6
5
4
3
2
1
0
ppm
3.02
1.06
1.03
2.03
1.03
0.94
1.00
3.13
3.13


192.31
157.82
150.77
145.12
136.14
133.90
131.24
129.42
124.57
122.62
118.87
115.31
115.06
114.80
112.13
108.72
56.19
54.53
54.16
53.80
53.44
53.08
21.91
O
N
O
200
180
160
140
120
100
80
60
40
20
0
ppm

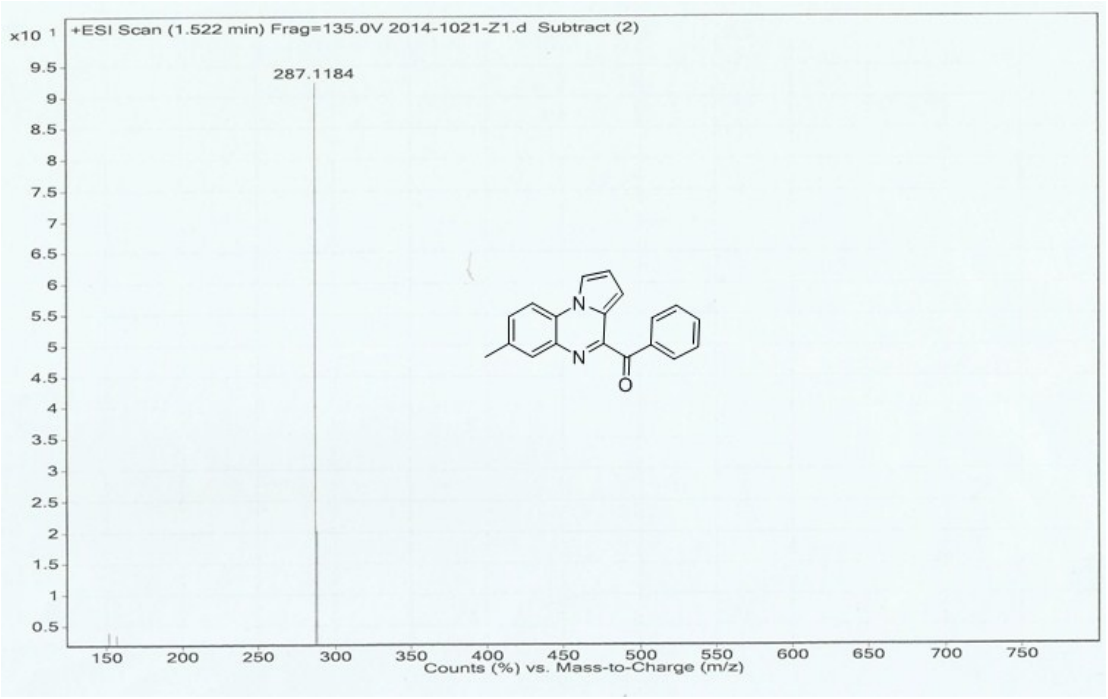
*(4-Fluorophenyl)(7-methoxypyrrolo[1,2-a]quinoxalin-4-yl)methanone (**3be**)*

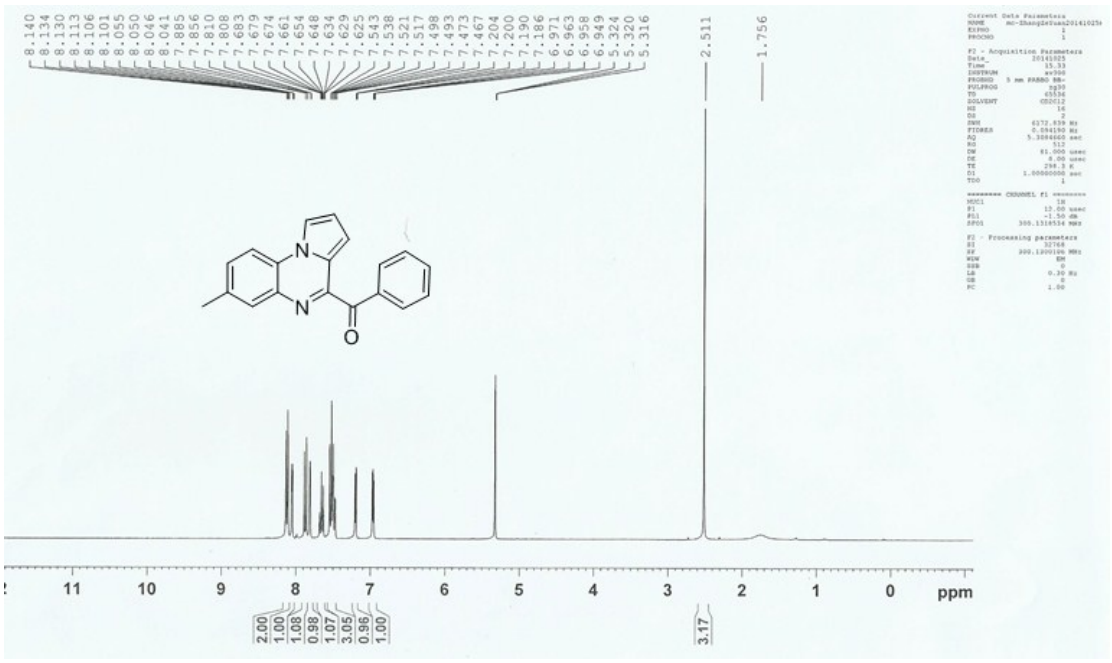


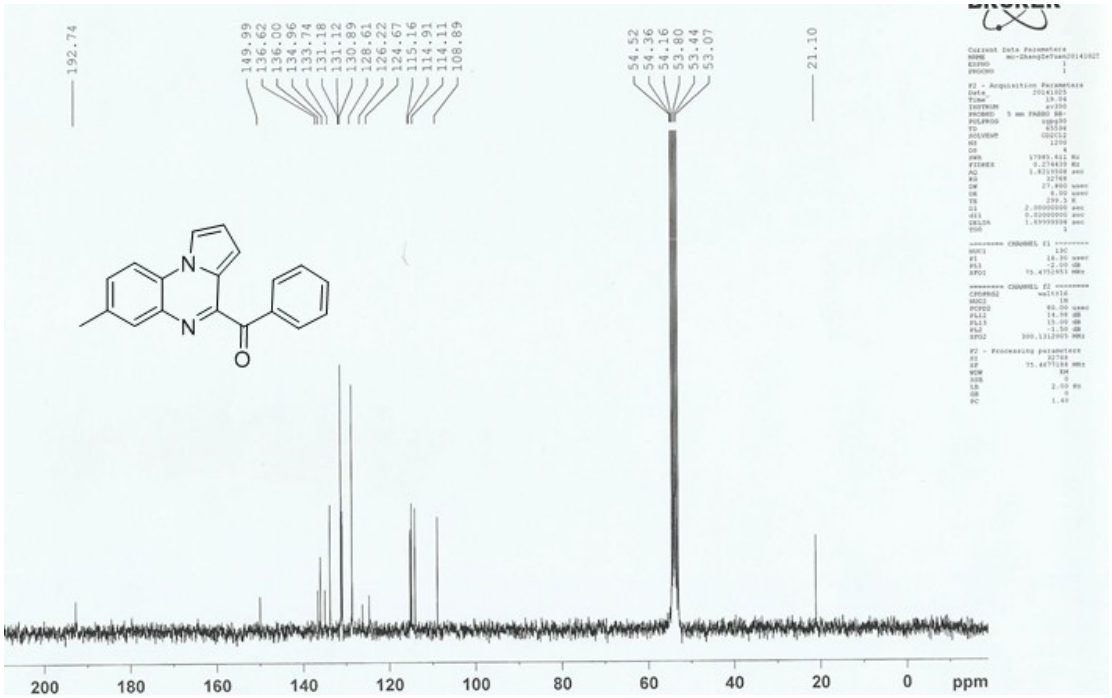




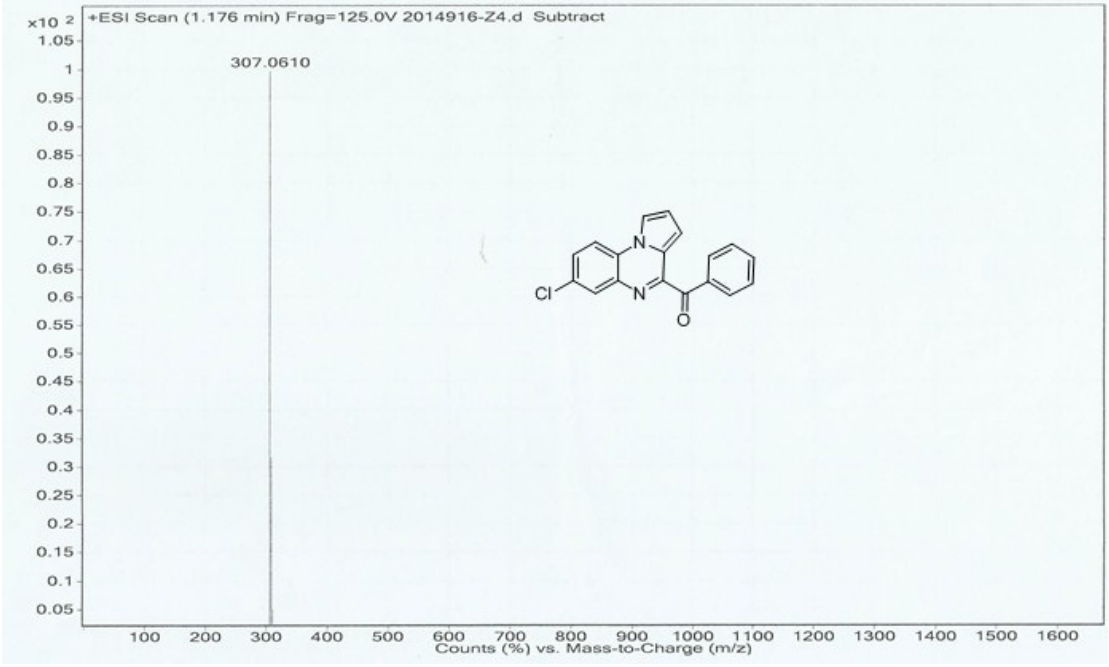
*(7-Methylpyrrolo[1,2-a]quinoxalin-4-yl)(phenyl)methanone (**3ca**)*

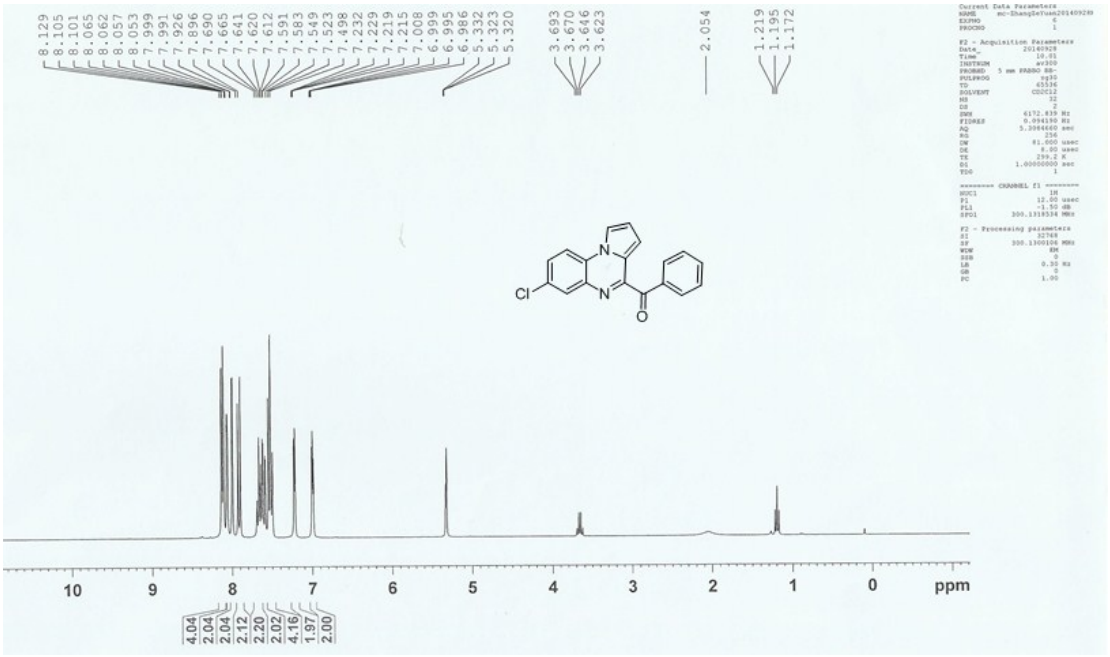


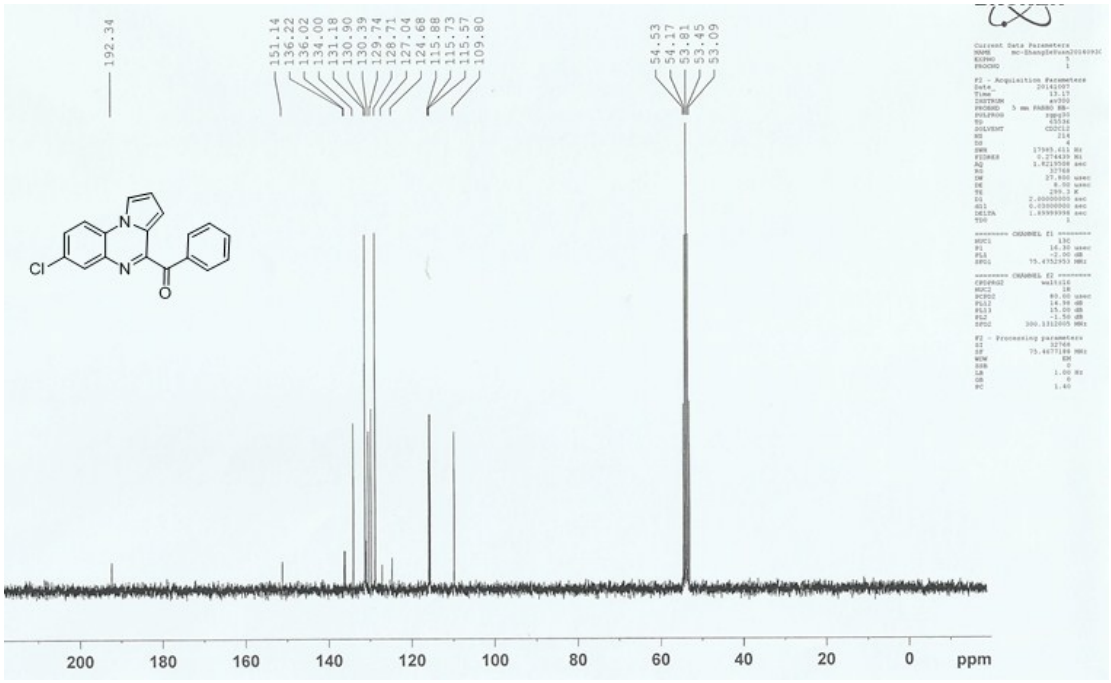

8.140
8.134
8.130
8.113
8.106
8.101
8.055
8.050
8.046
8.041
7.885
7.856
7.810
7.808
7.683
7.679
7.674
7.661
7.654
7.648
7.634
7.629
7.625
7.543
7.538
7.521
7.517
7.498
7.493
7.473
7.467
7.204
7.200
7.190
7.186
6.971
6.963
6.958
6.949
5.324
5.320
5.316
2.511
1.756
N
N
O
11
10
9
8
7
6
5
4
3
2
1
0
ppm
2.00
1.00
1.08
0.98
1.07
3.05
0.96
1.00
3.17


192.74
149.99
136.62
136.00
134.96
133.74
131.18
131.12
130.89
128.61
126.22
124.67
115.16
114.91
114.11
108.89
54.52
54.36
54.16
53.80
53.44
53.07
21.10
N
N
O
200
180
160
140
120
100
80
60
40
20
0
ppm

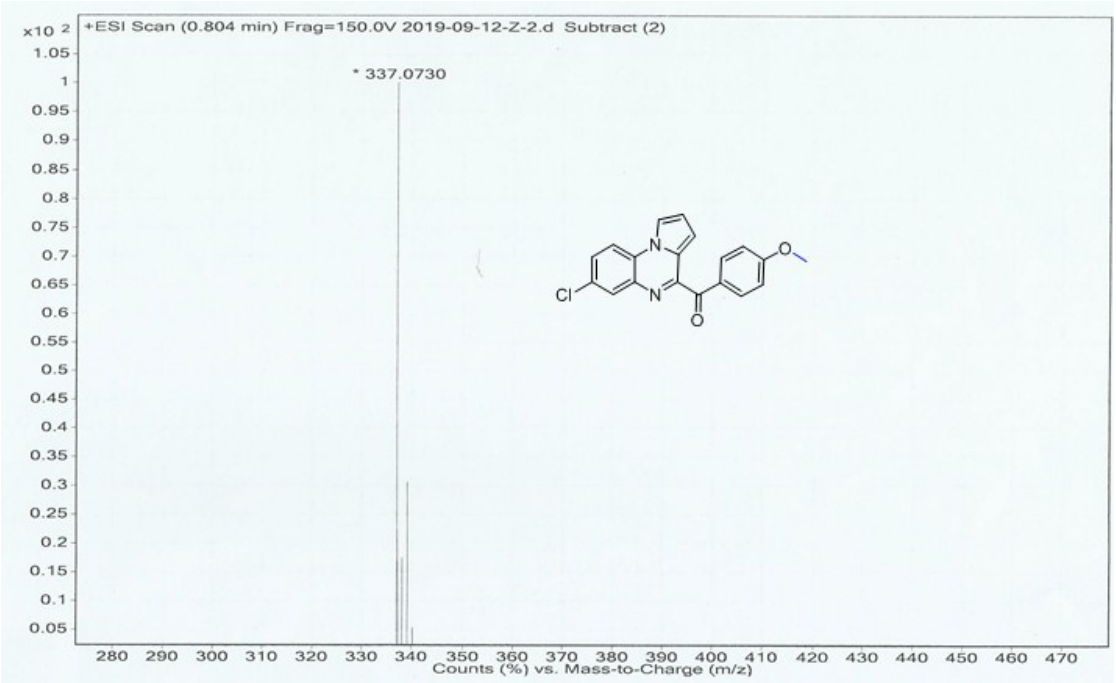
*(7-Chloropyrrolo[1,2-a]quinoxalin-4-yl)(phenyl)methanone (**3da**)*

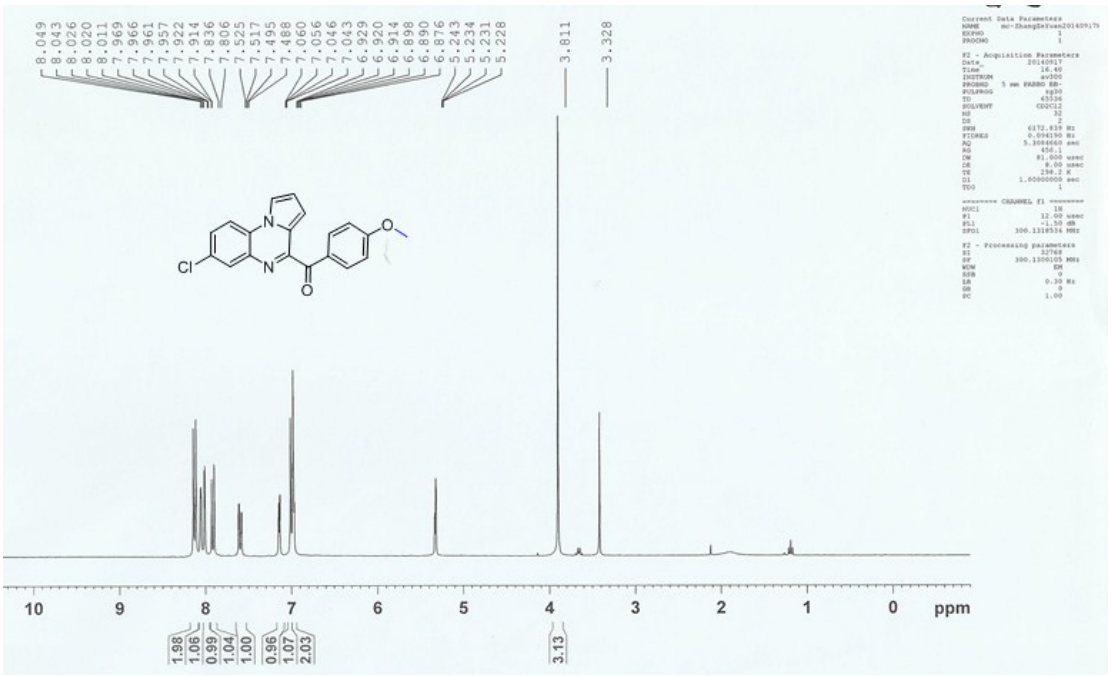


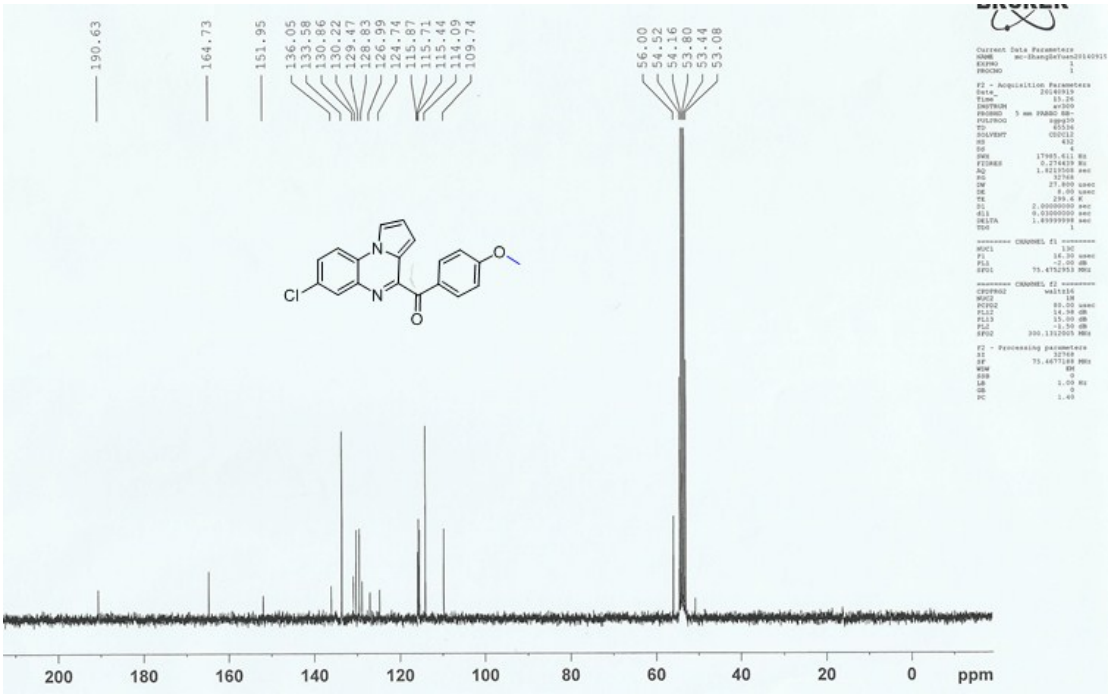




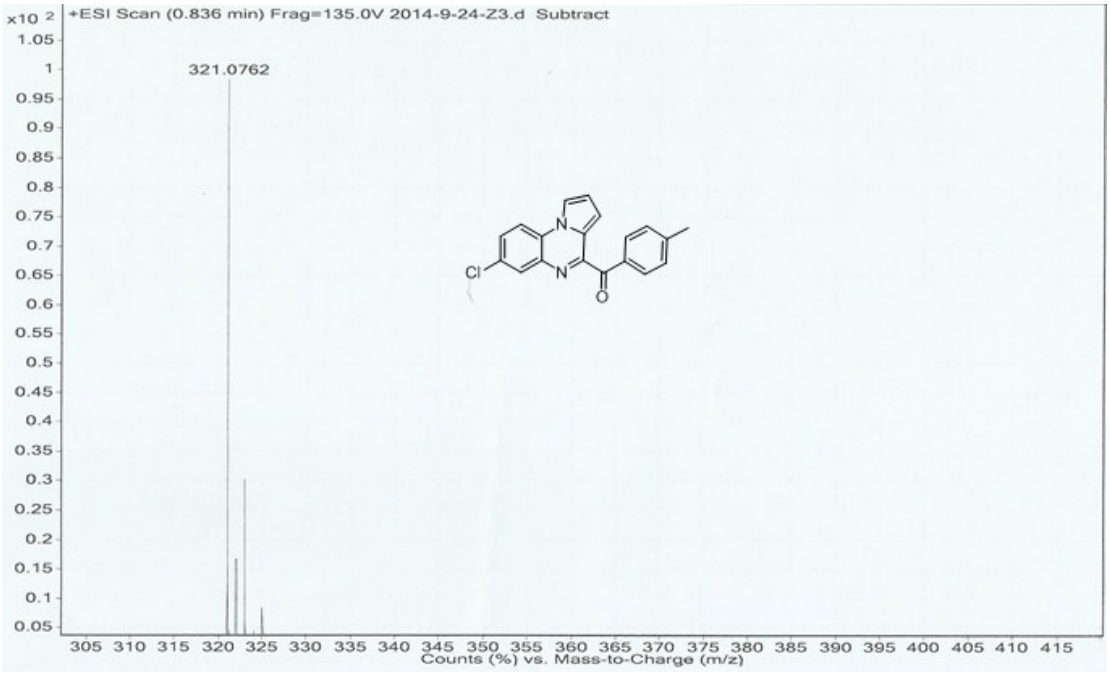
*(7-Chloropyrrolo[1,2-a]quinoxalin-4-yl)(4-methoxyphenyl)methanone (**3db**)*

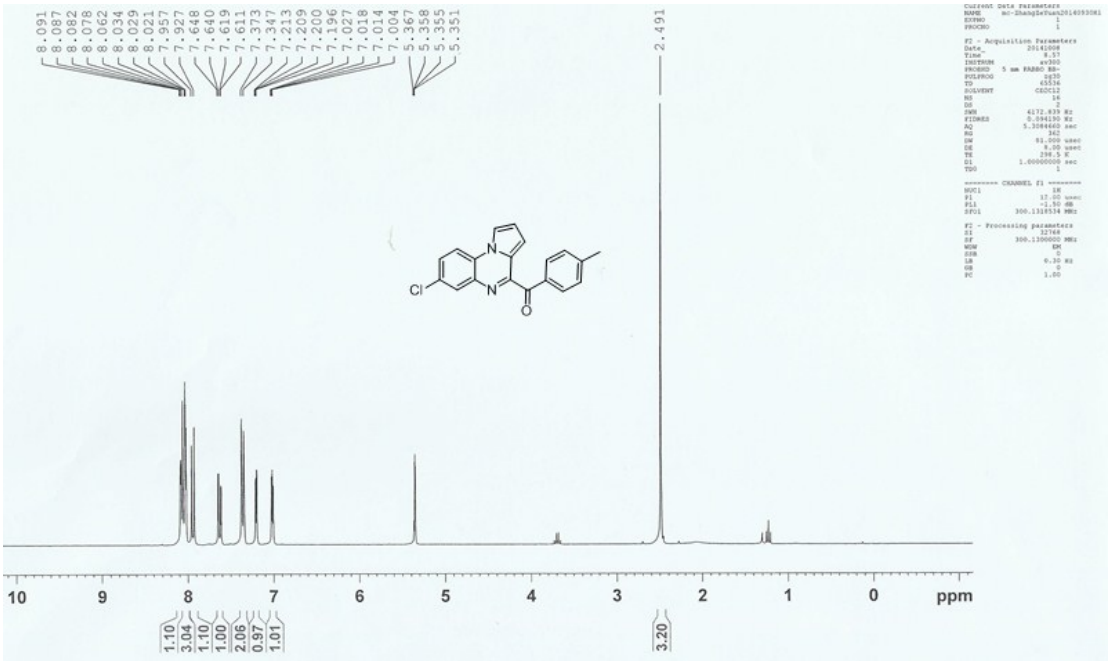


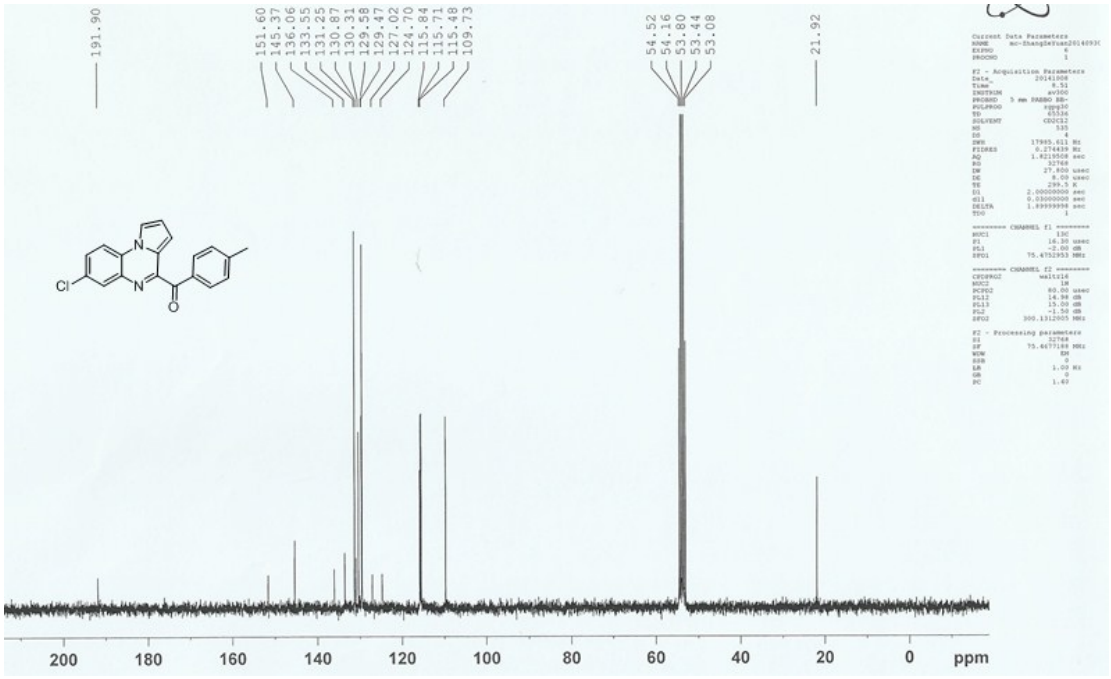

8.049
8.043
8.026
8.020
8.011
7.969
7.966
7.961
7.957
7.922
7.914
7.836
7.806
7.525
7.517
7.495
7.488
7.060
7.056
7.046
7.043
6.929
6.920
6.914
6.898
6.890
6.876
5.243
5.234
5.231
5.228
3.811
3.328
Cl
N
O
10
9
8
7
6
5
4
3
2
1
0
ppm
1.98
1.06
0.99
1.04
1.00
0.96
1.07
2.03
3.13


190.63
164.73
151.95
136.05
133.58
130.86
130.22
129.47
128.83
126.99
124.74
115.87
115.71
115.44
114.09
109.74
56.00
54.52
54.16
53.80
53.44
53.08
Cl
N
O
200
180
160
140
120
100
80
60
40
20
0
ppm

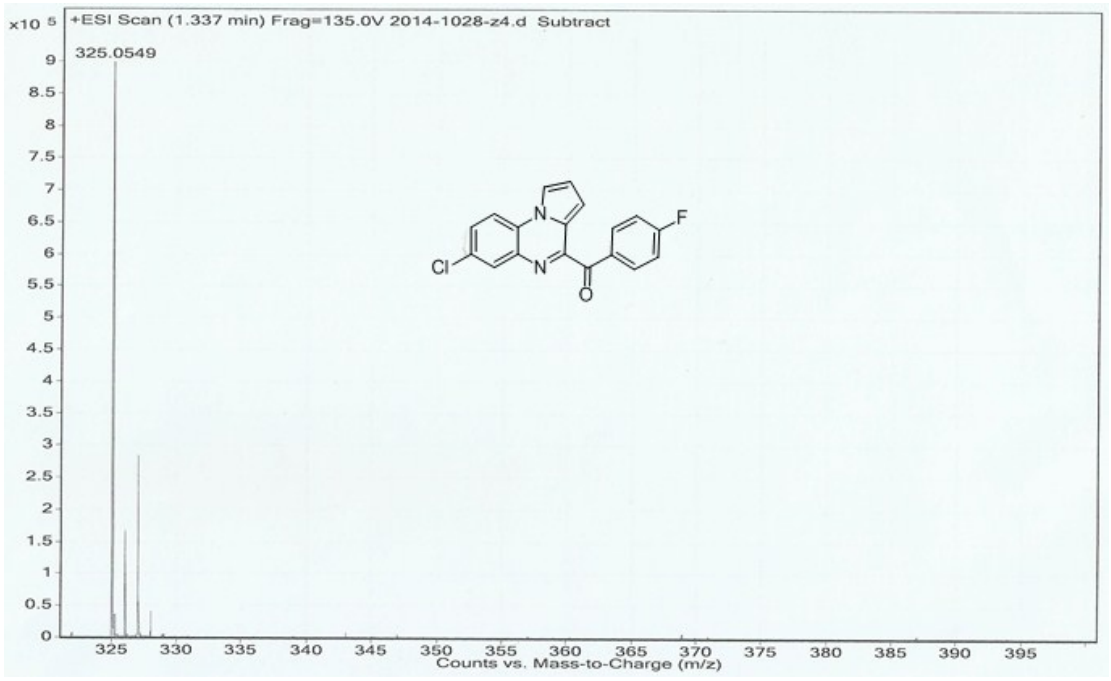
*(7-Chloropyrrolo[1,2-a]quinoxalin-4-yl)(p-tolyl)methanone (**3dc**)*

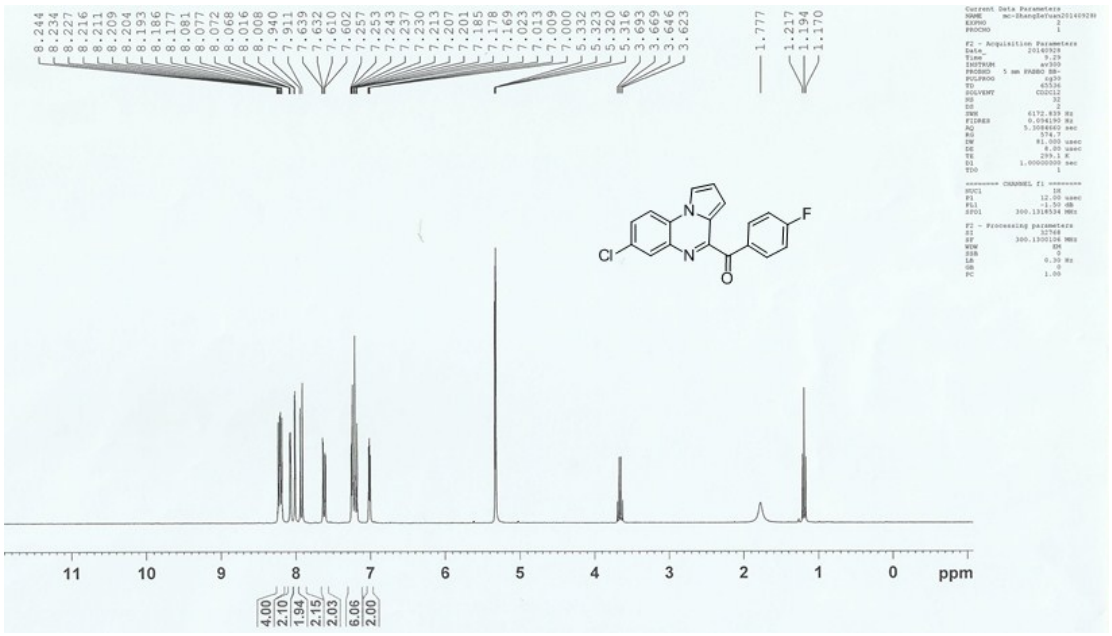


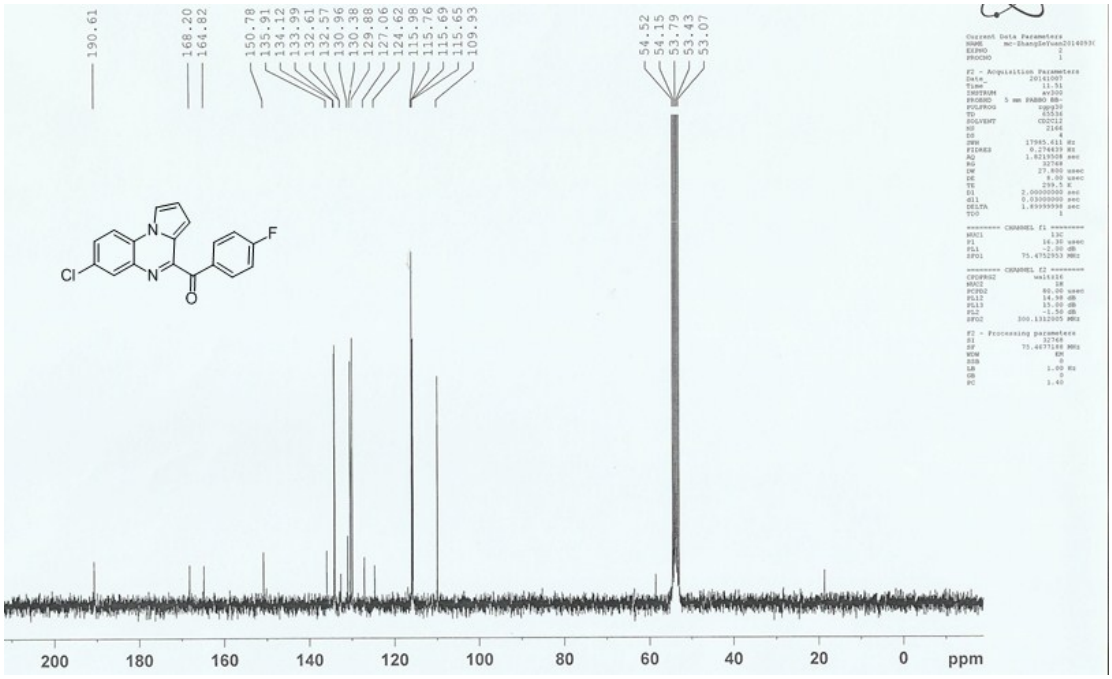




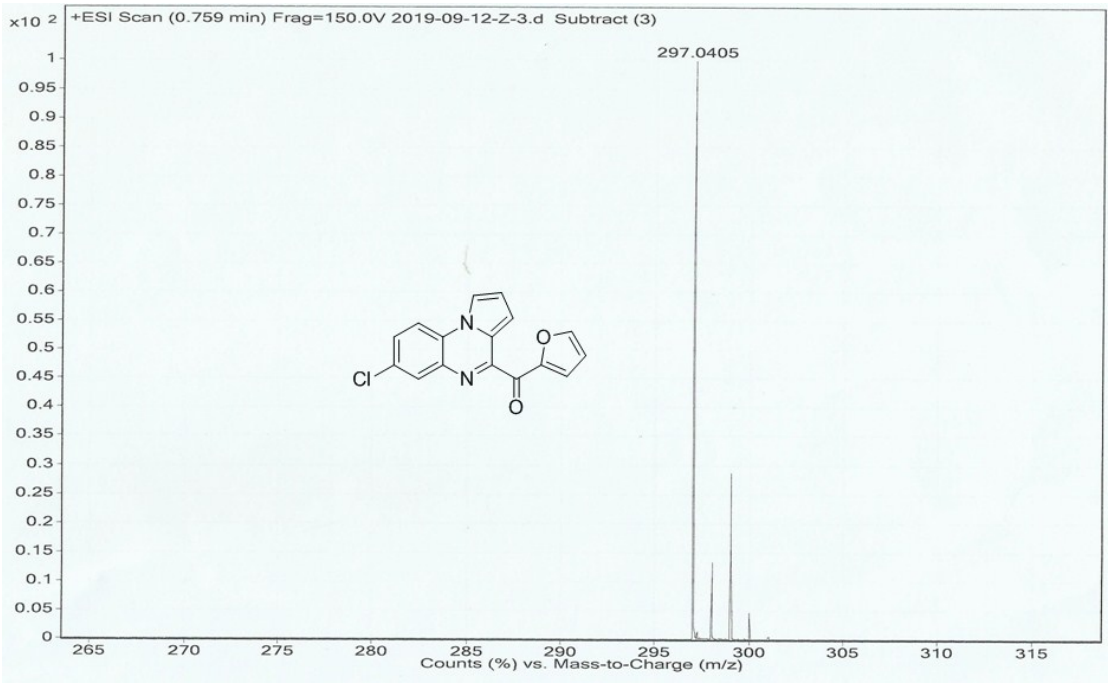
*(7-Chloropyrrolo[1,2-a]quinoxalin-4-yl)(4-fluorophenyl)methanone (**3de**)*

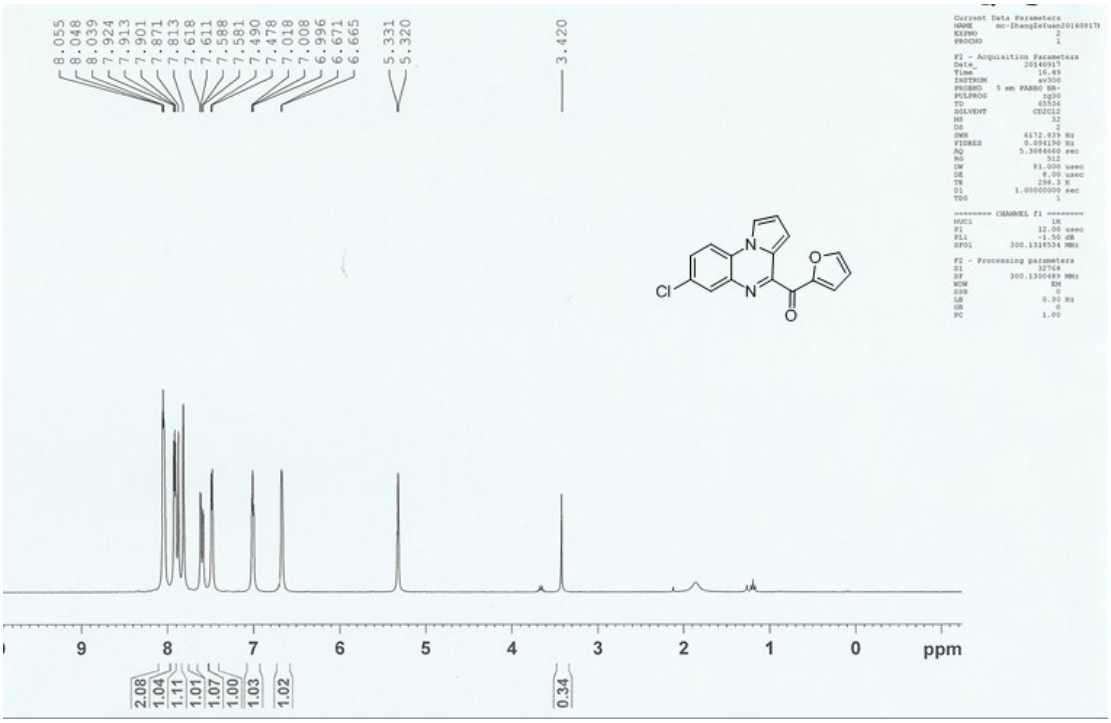


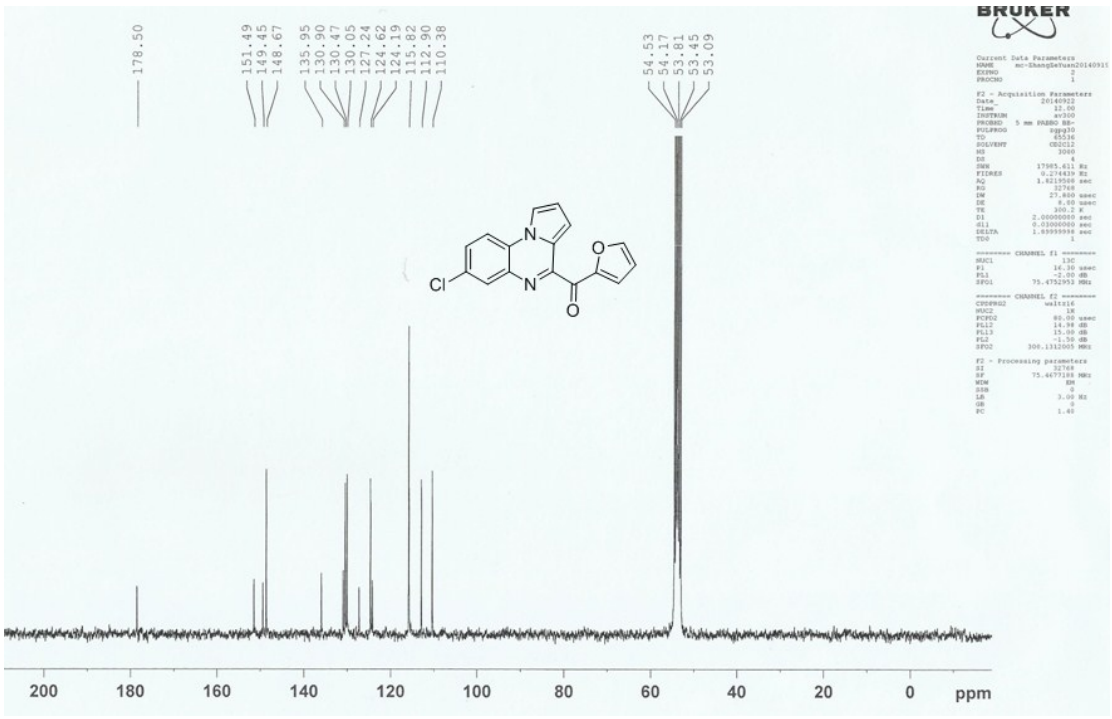

8.244
8.234
8.227
8.216
8.211
8.209
8.204
8.193
8.186
8.177
8.081
8.077
8.072
8.068
8.016
8.008
7.940
7.911
7.639
7.632
7.610
7.602
7.257
7.253
7.243
7.237
7.230
7.213
7.207
7.201
7.185
7.178
7.169
7.023
7.013
7.009
7.000
5.332
5.323
5.320
5.316
3.693
3.669
3.646
3.623
1.777
1.217
1.194
1.170
Cl
N
N
O
F
11
10
9
8
7
6
5
4
3
2
1
0
ppm
4.00
2.10
1.94
2.15
2.03
6.06
2.00


190.61
168.20
164.82
150.78
135.91
134.12
133.99
132.61
132.57
130.96
130.38
129.88
127.06
124.62
115.98
115.76
115.69
115.65
109.93
54.52
54.15
53.79
53.43
53.07
Cl
N
N
O
F
200
180
160
140
120
100
80
60
40
20
0
ppm

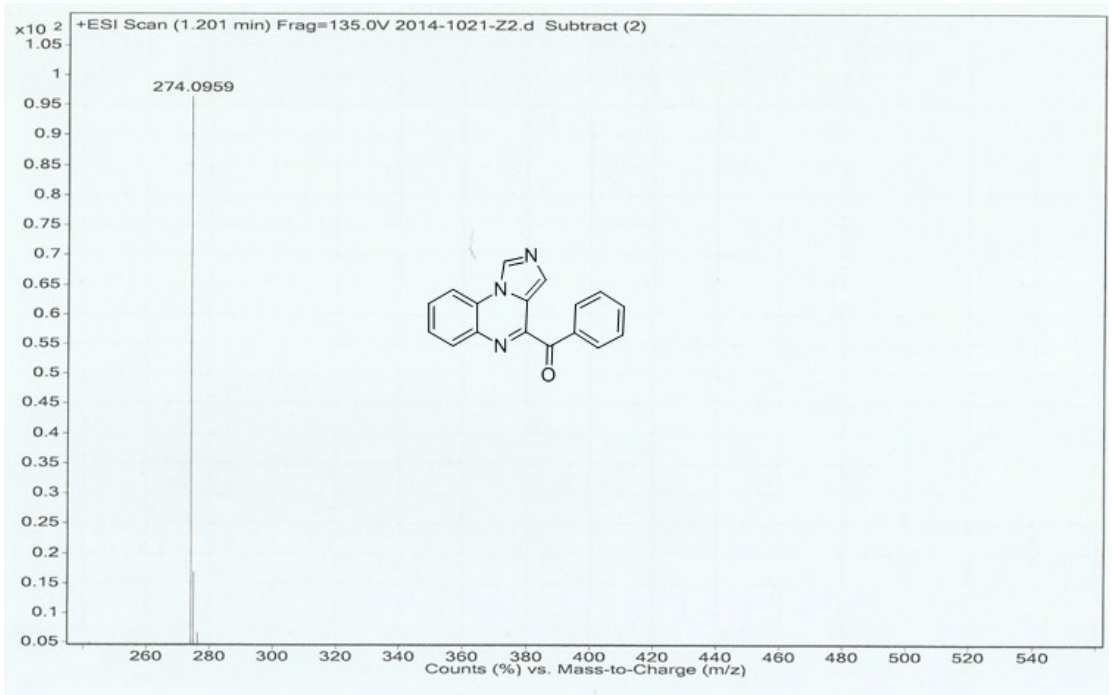
*(7-Chloropyrrolo[1,2-a]quinoxalin-4-yl)(furan-2-yl)methanone (**3dm**)*

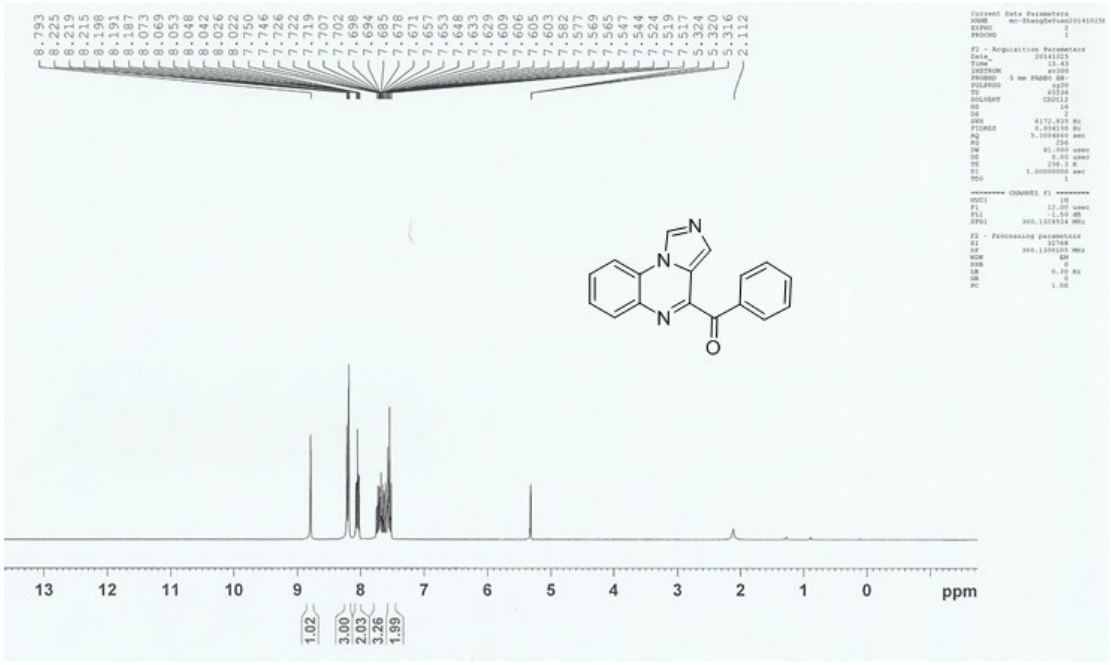






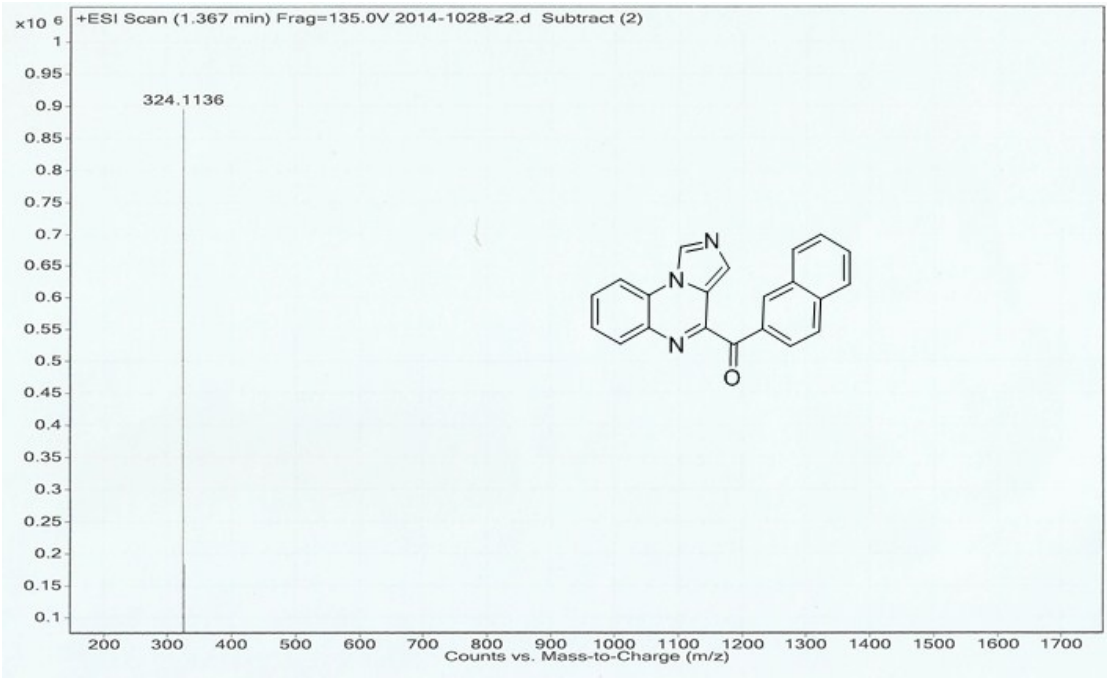
*Imidazo[1,5-a]quinoxalin-4-yl(phenyl)methanone (**3ea**)*

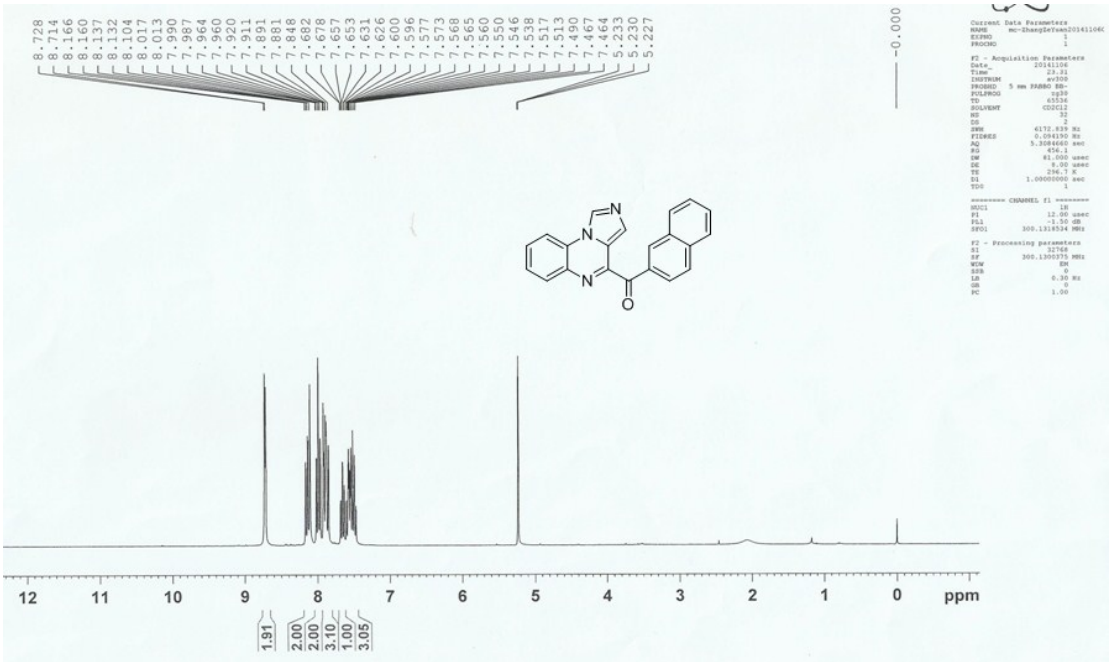


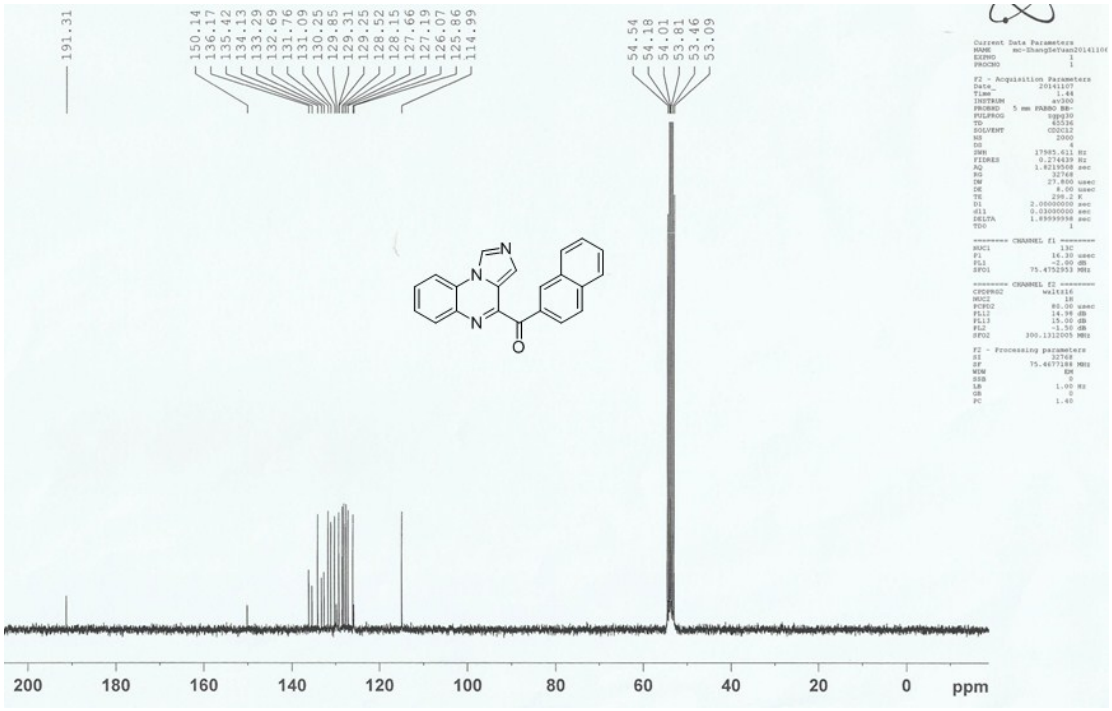

8.793
8.225
8.219
8.215
8.198
8.191
8.187
8.073
8.069
8.053
8.048
8.042
8.026
8.022
7.750
7.746
7.726
7.722
7.719
7.707
7.702
7.698
7.694
7.685
7.678
7.671
7.657
7.653
7.648
7.633
7.629
7.609
7.606
7.605
7.603
7.582
7.577
7.569
7.565
7.547
7.544
7.524
7.519
7.517
5.324
5.320
5.316
2.112
N
N
O
13
12
11
10
9
8
7
6
5
4
3
2
1
0
ppm
1.02
3.00
2.03
3.26
1.99


191.51
149.79
136.07
135.34
133.89
131.70
131.35
131.11
129.84
129.29
128.67
127.63
125.85
122.91
114.96
54.54
54.18
53.81
53.45
53.09
N
N
O
200
180
160
140
120
100
80
60
40
20
0
ppm

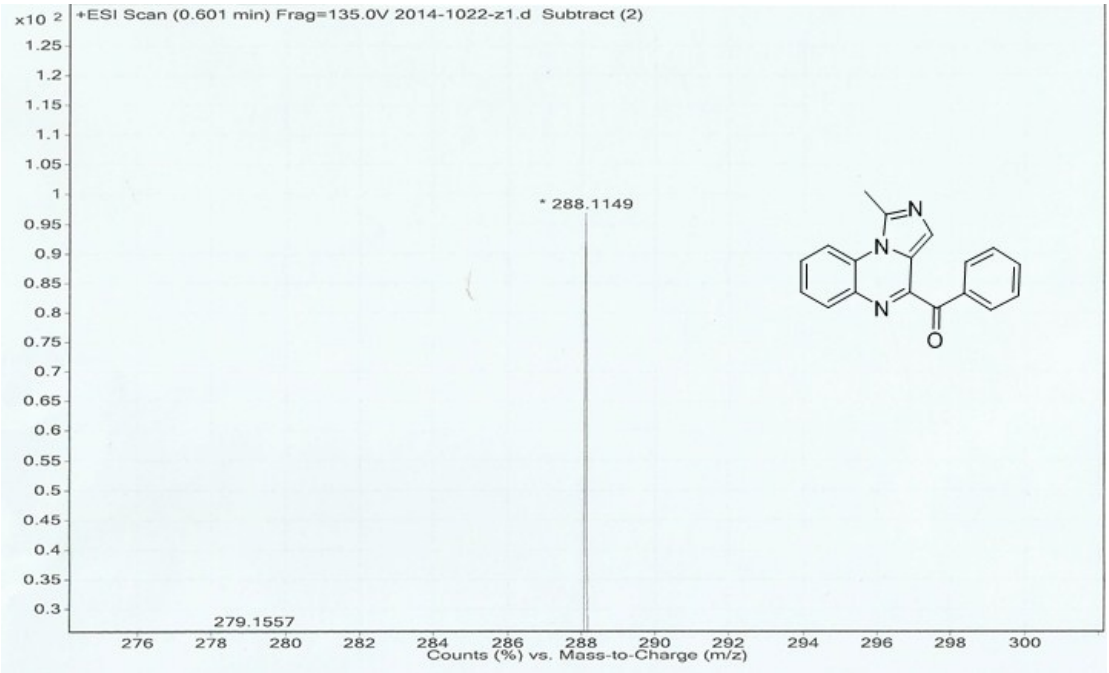
*Imidazo[1,5-a]quinoxalin-4-yl(naphthalen-2-yl)methanone (**3ej**)*

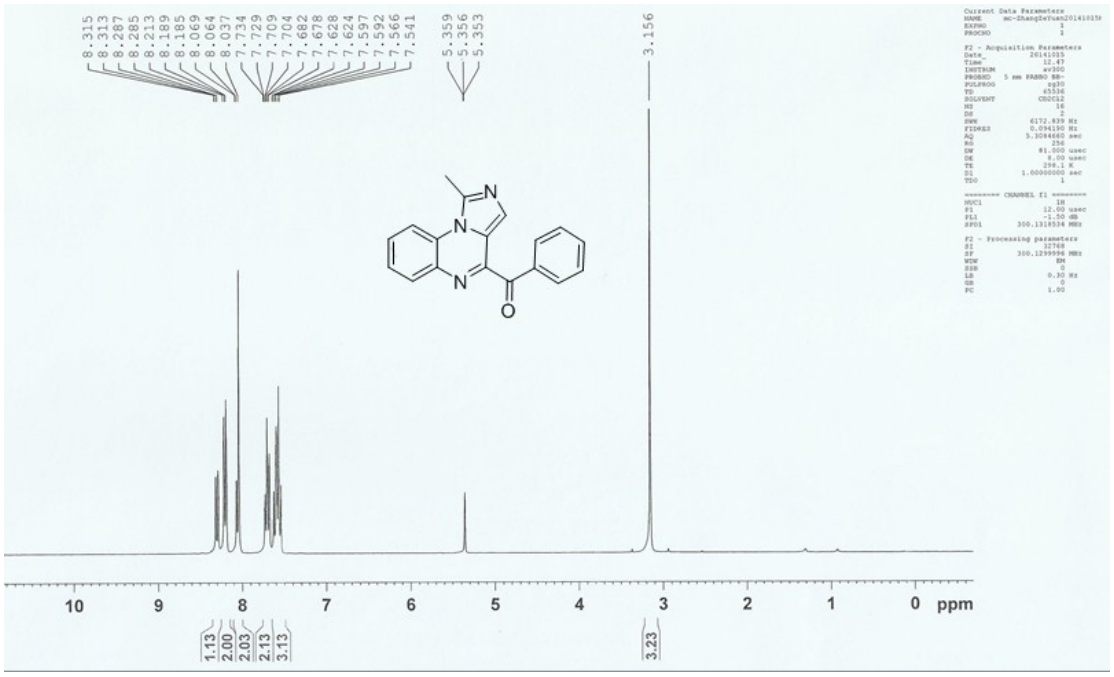






*(1-Methylimidazo[1,5-a]quinoxalin-4-yl)(phenyl)methanone (**3fa**)*

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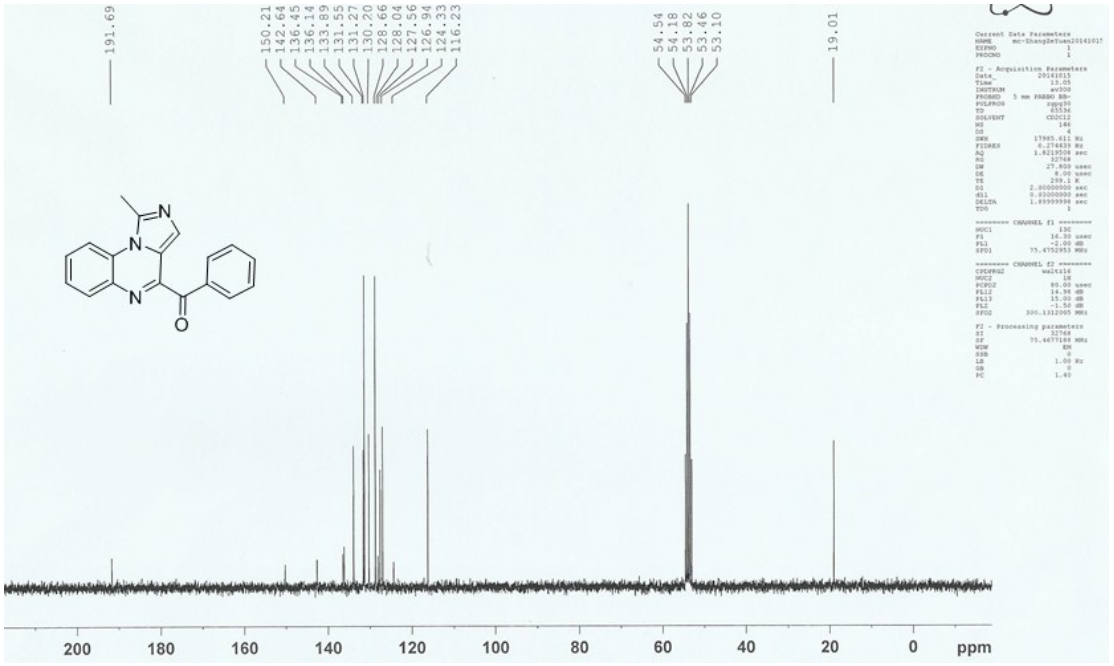
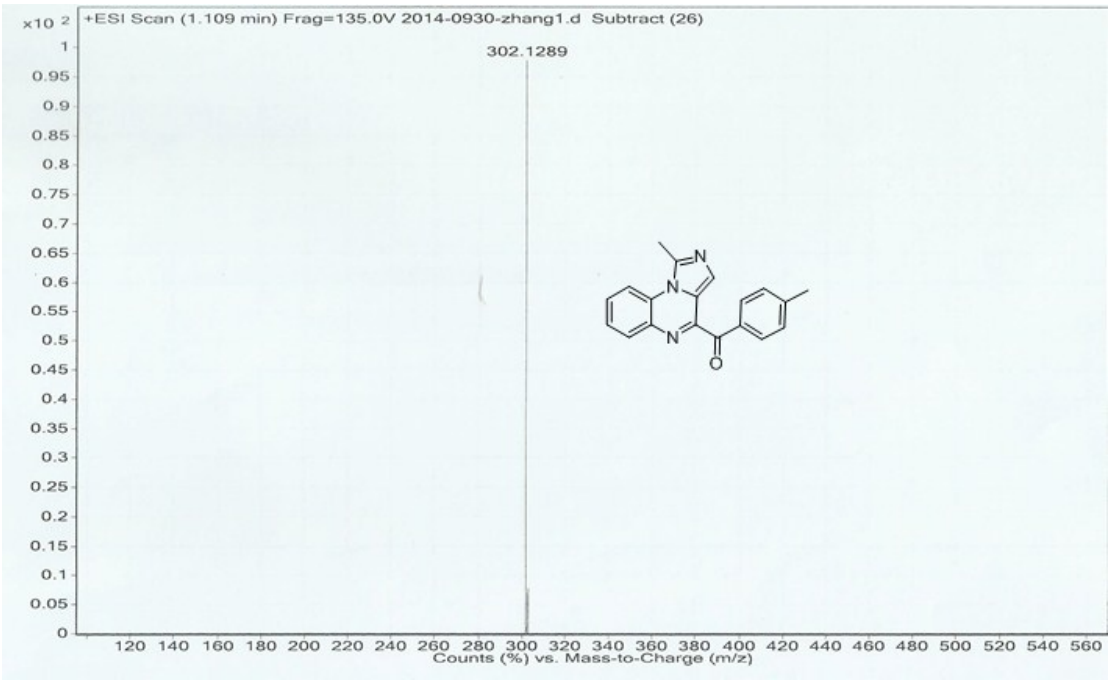
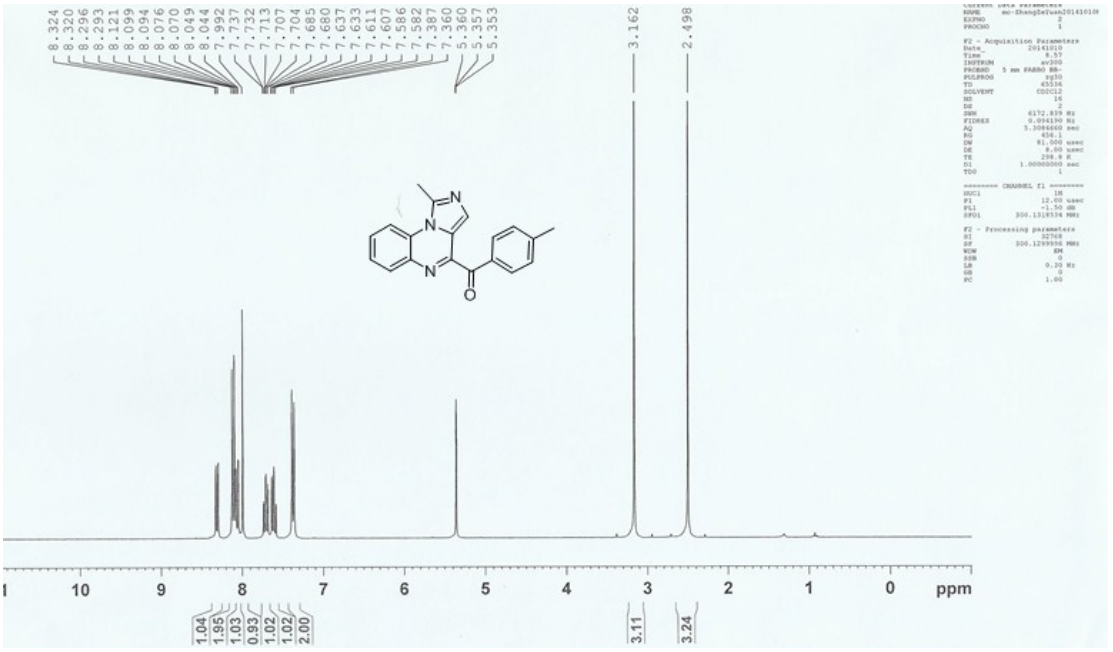
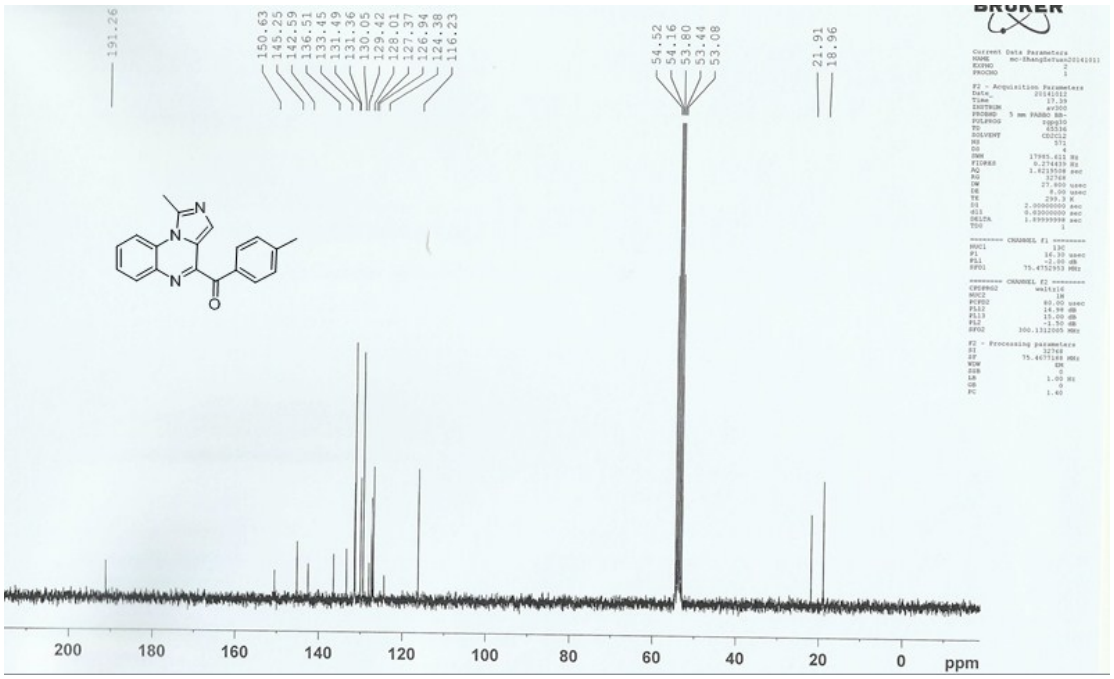
8.313
8.287
8.285
8.213
8.189
8.185
8.069
8.064
8.037
7.734
7.729
7.709
7.704
7.682
7.678
7.628
7.624
7.597
7.592
7.566
7.541
5.359
5.356
5.353
3.156
10
9
8
7
6
5
4
3
2
1
0
ppm
1.13
2.00
2.03
2.13
3.13
3.23


191.69
150.21
142.64
136.45
136.14
133.89
131.55
131.27
130.20
128.66
128.04
127.56
126.94
124.33
116.23
54.54
54.18
53.92
53.46
53.10
19.01
200
180
160
140
120
100
80
60
40
20
0
ppm

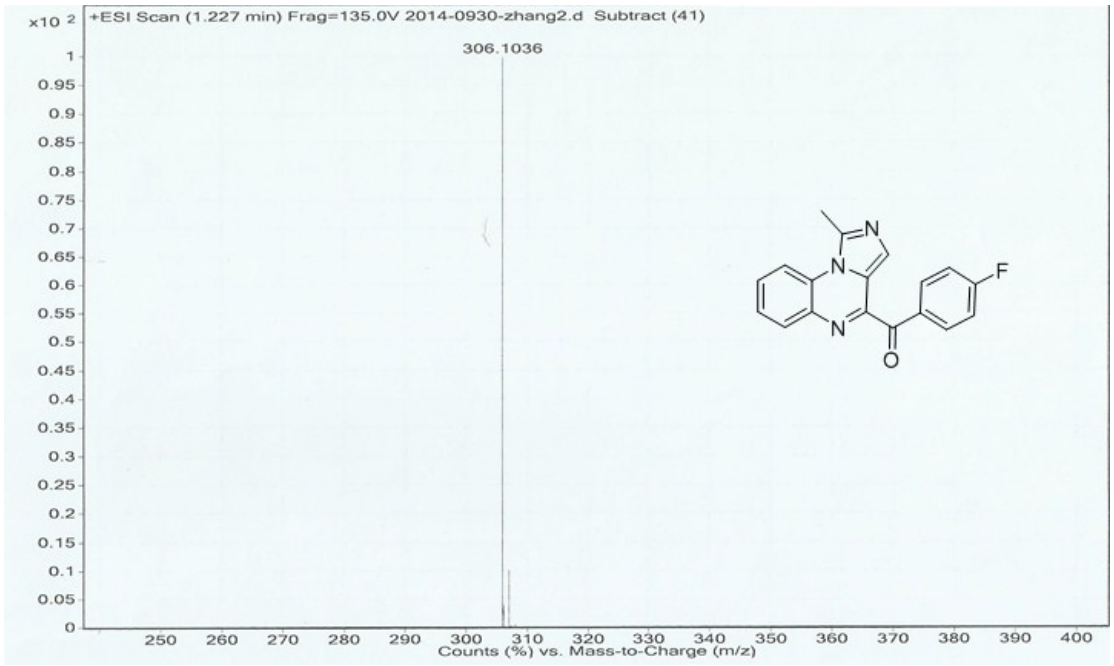
*(1-Methylimidazo[1,5-a]quinoxalin-4-yl)(p-tolyl)methanone (**3fc**)*

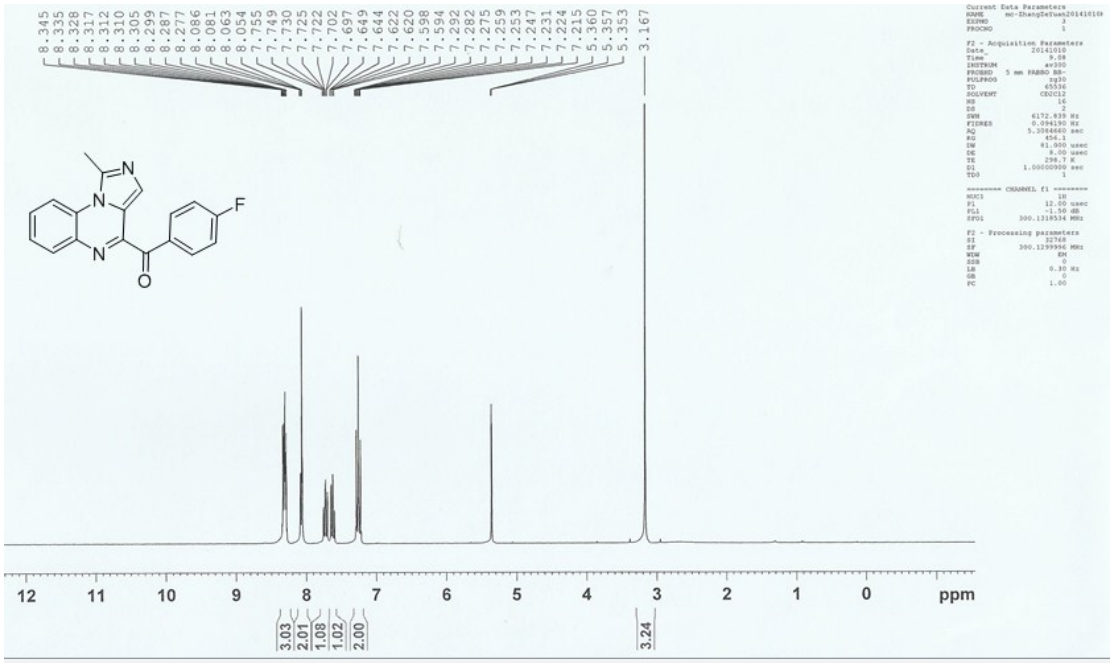


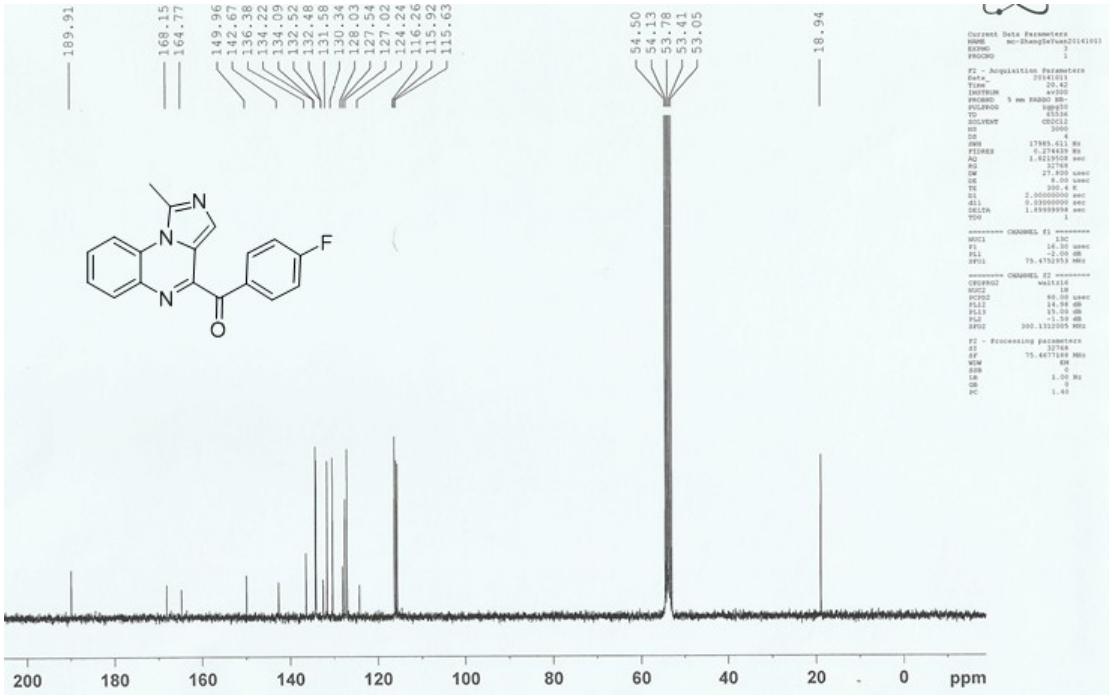




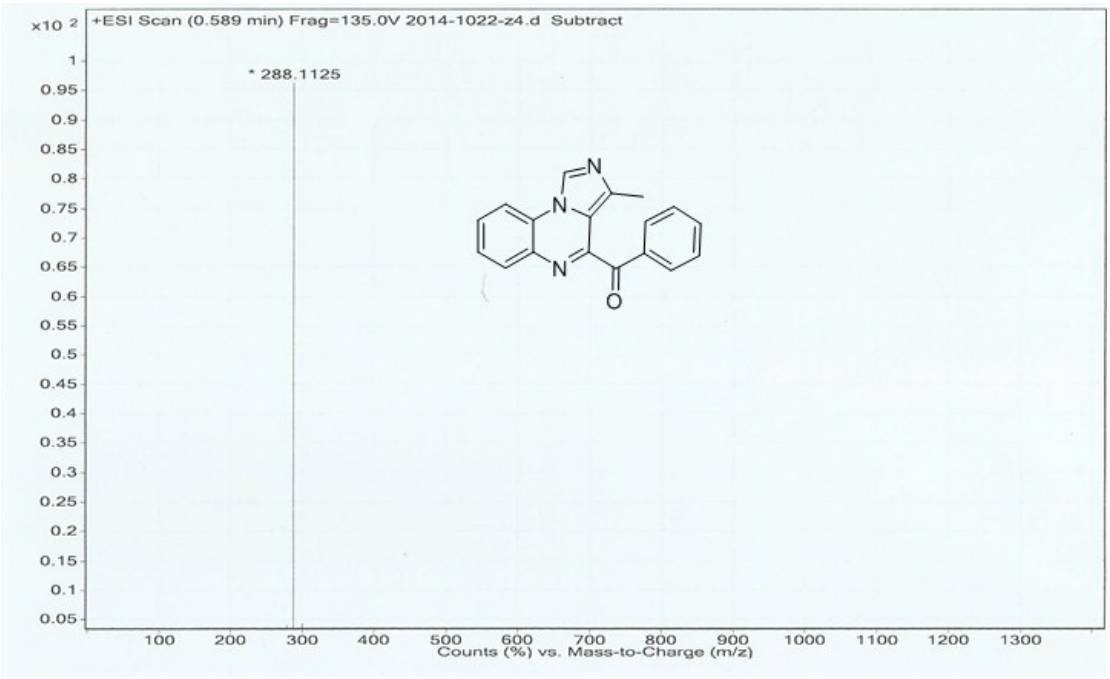
*(4-Fluorophenyl)(1-methylimidazo[1,5-a]quinoxalin-4-yl)methanone (**3fe**)*

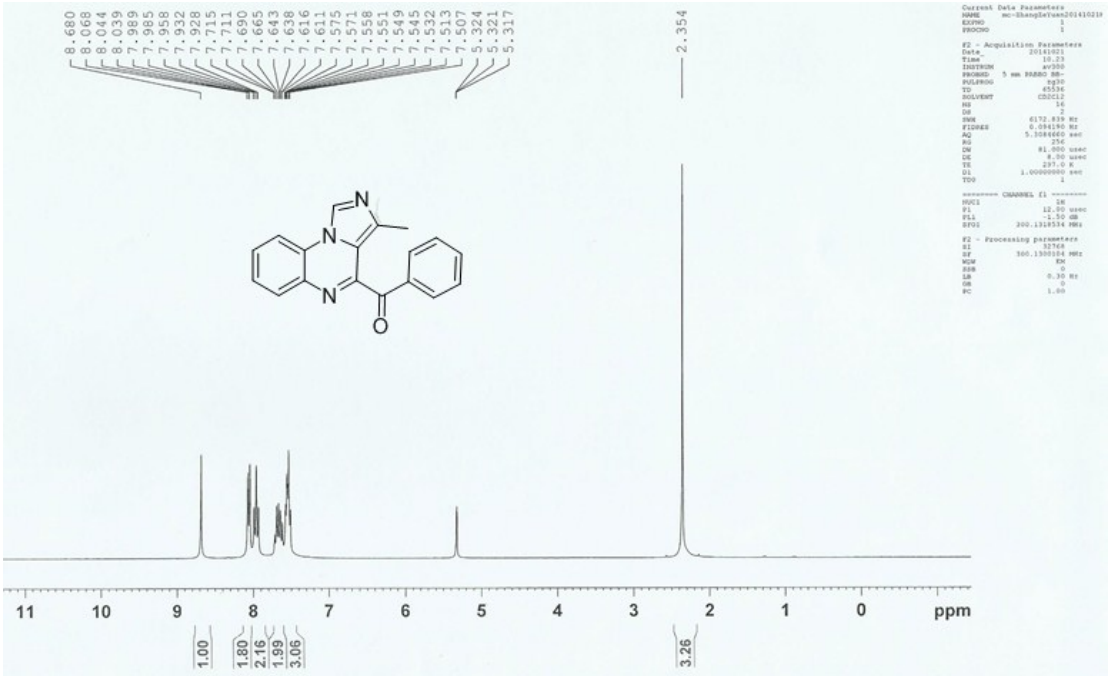


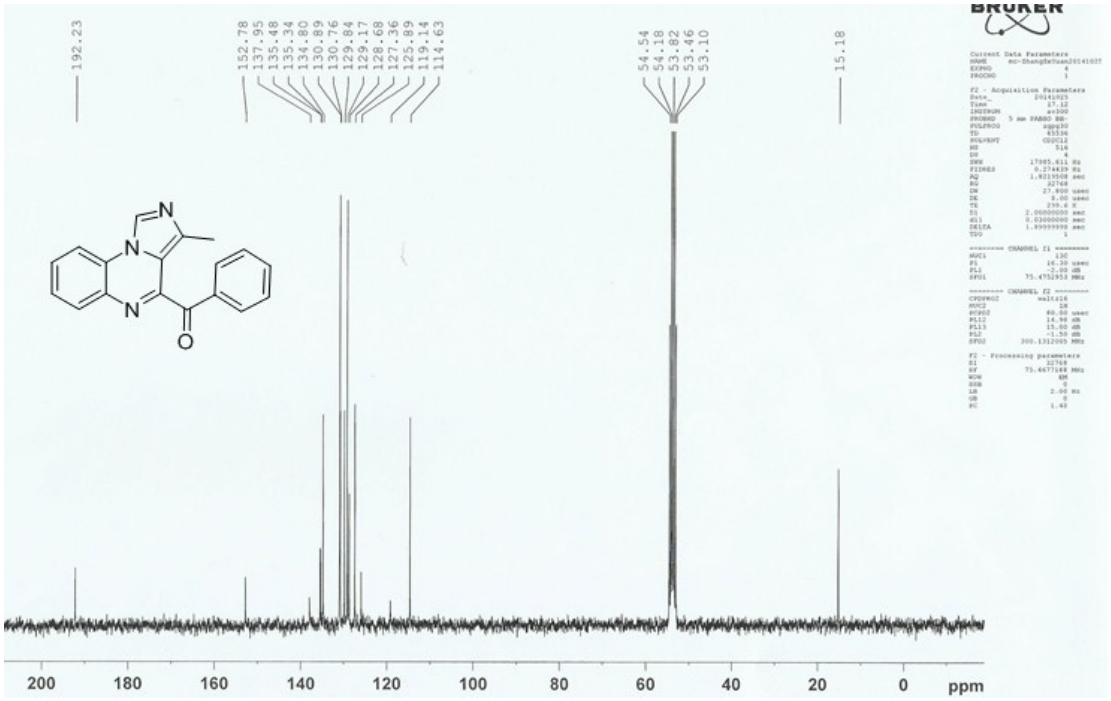

8.345
8.335
8.328
8.317
8.312
8.310
8.305
8.299
8.287
8.277
8.086
8.081
8.063
8.054
7.755
7.749
7.730
7.725
7.722
7.702
7.697
7.649
7.644
7.622
7.620
7.598
7.594
7.292
7.282
7.275
7.259
7.253
7.247
7.231
7.224
7.215
5.360
5.357
5.353
3.167
N
N
F
O
12
11
10
9
8
7
6
5
4
3
2
1
0
ppm
3.03
2.01
1.08
1.02
2.00
3.24


189.91
168.15
164.77
149.96
142.67
136.38
134.22
134.09
132.52
132.48
131.58
130.34
128.03
127.54
127.02
124.24
116.26
115.92
115.63
54.50
54.13
53.78
53.41
53.05
18.94
N
N
F
O
200
180
160
140
120
100
80
60
40
20
0
ppm

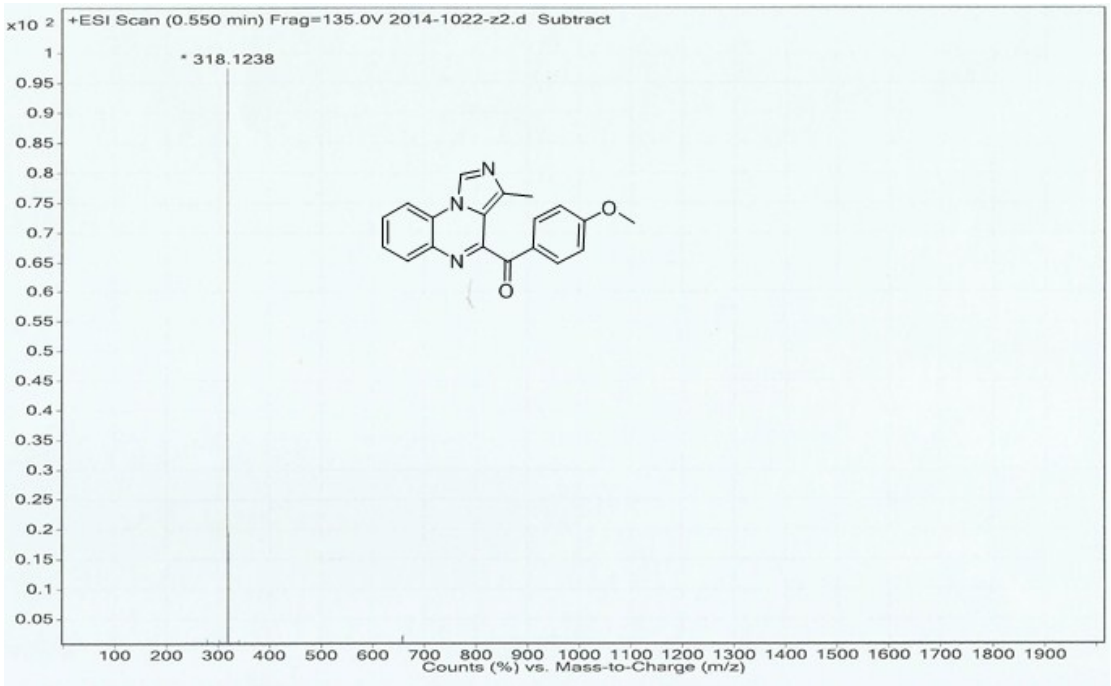
*(3-Methylimidazo[1,5-a]quinoxalin-4-yl)(phenyl)methanone (**3ga**)*

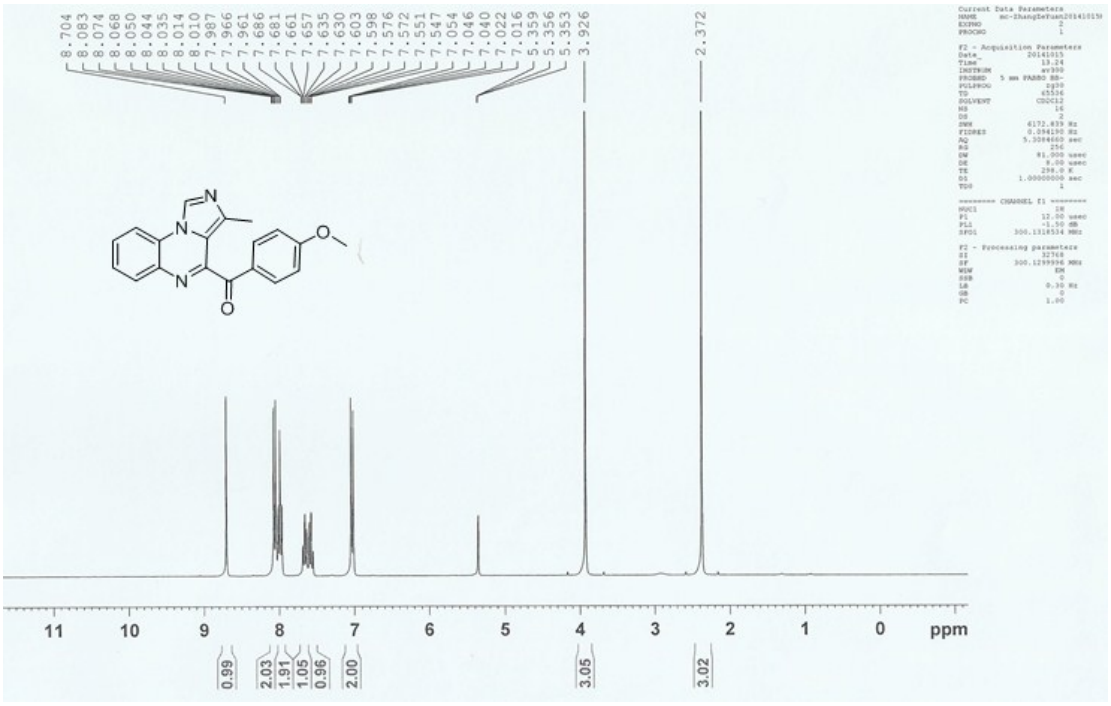


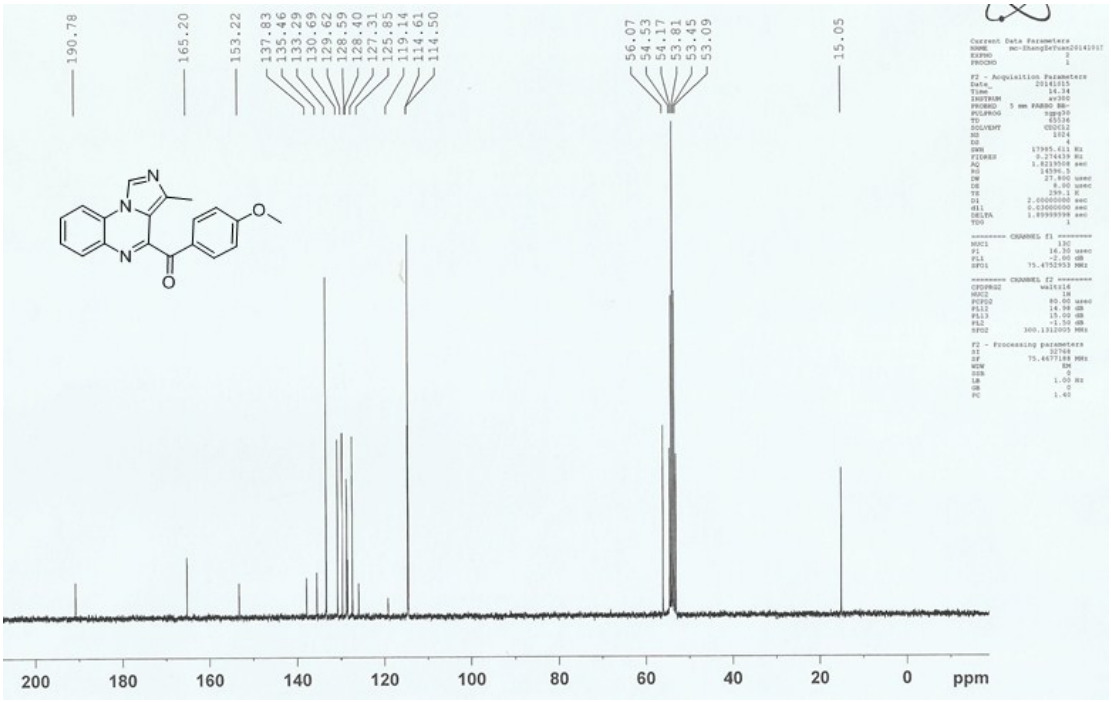




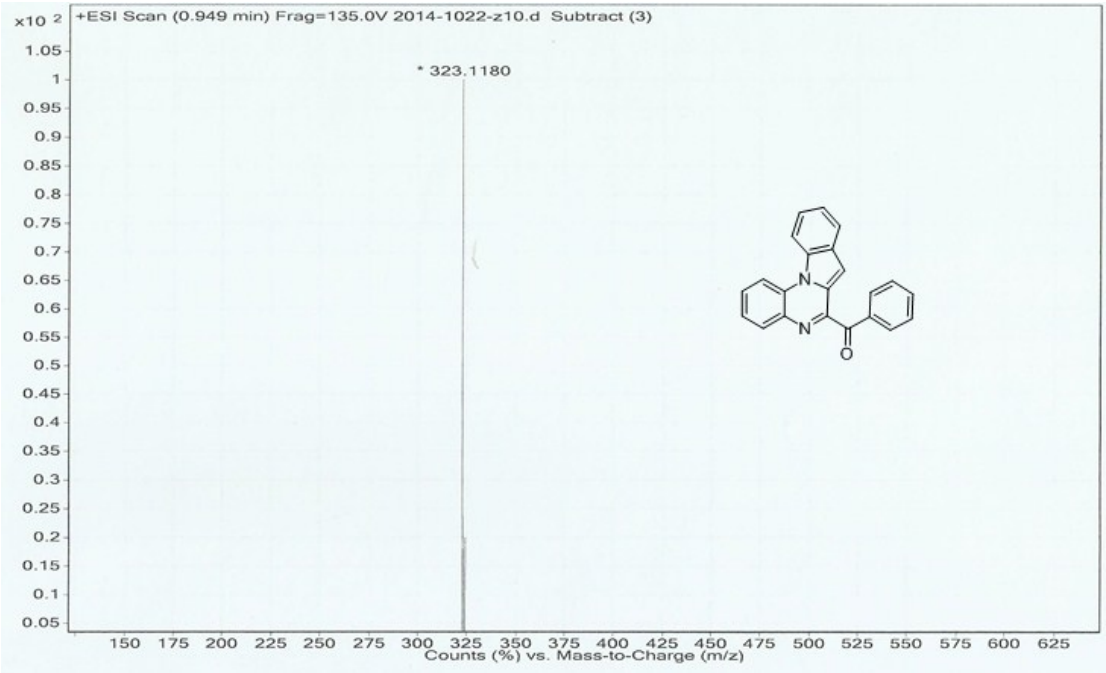
*(4-Methoxyphenyl)(3-methylimidazo[1,5-a]quinoxalin-4-yl)methanone (**3gb**)*

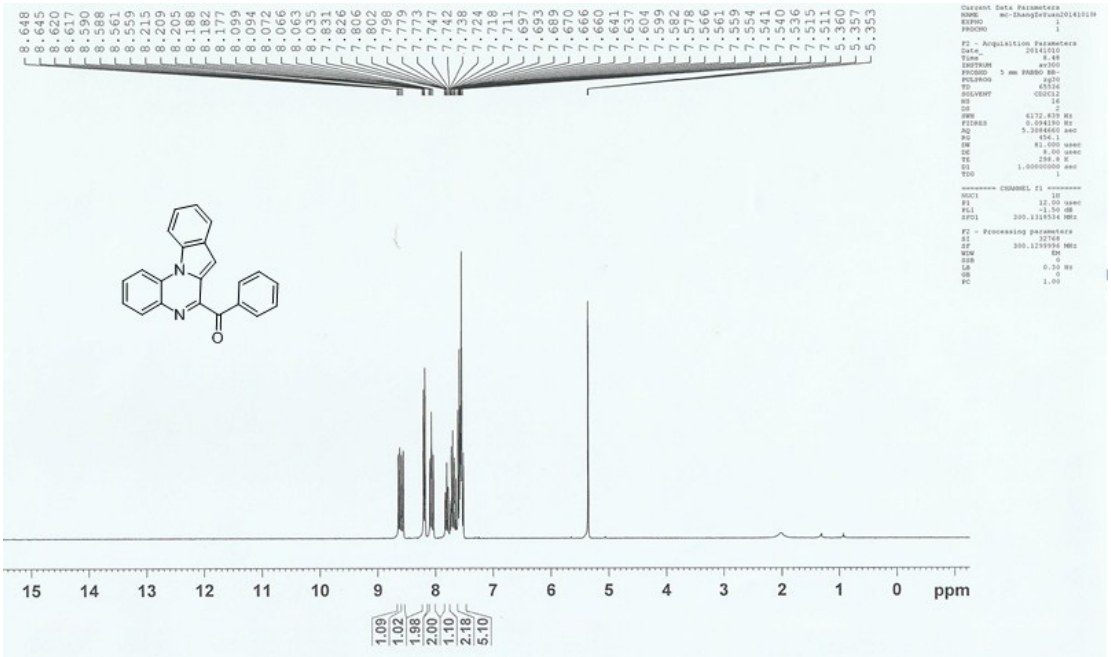


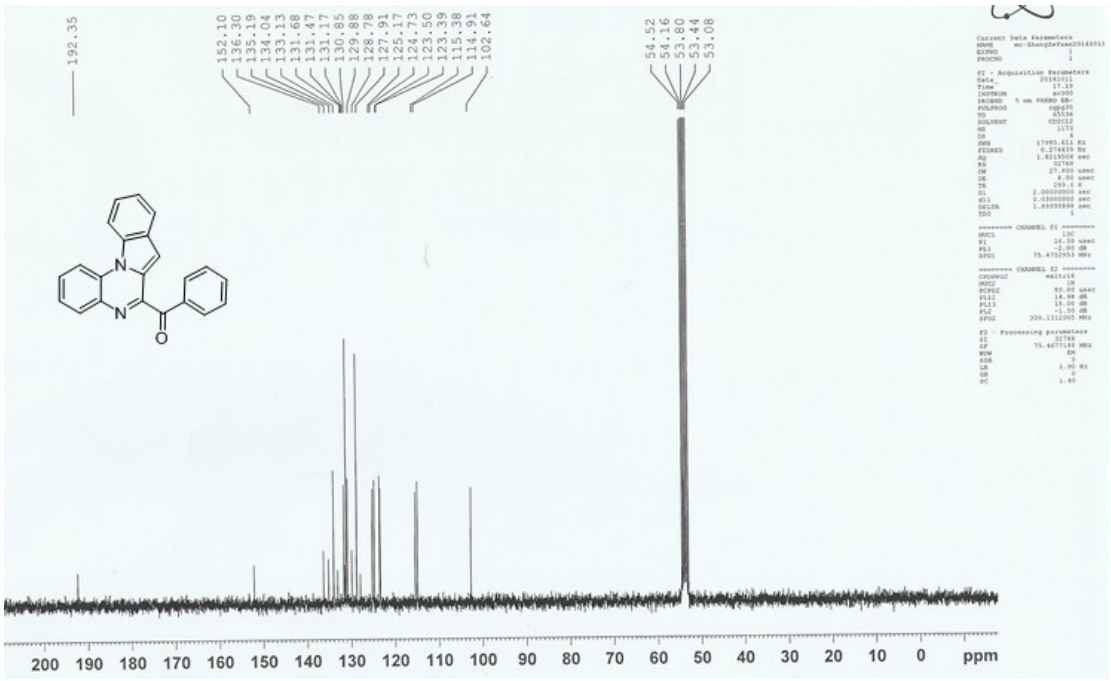

8.704
8.083
8.074
8.068
8.050
8.044
8.035
8.014
8.010
7.987
7.966
7.961
7.686
7.681
7.661
7.657
7.635
7.630
7.603
7.598
7.576
7.572
7.551
7.547
7.054
7.046
7.040
7.022
7.016
5.359
5.356
5.353
3.926
2.372
11
10
9
8
7
6
5
4
3
2
1
0
ppm
0.99
2.03
1.91
1.05
0.96
2.00
3.05
3.02


190.78
165.20
153.22
137.83
135.46
133.29
130.69
129.62
128.59
128.40
127.31
125.85
119.14
114.61
114.50
56.07
54.53
54.17
53.81
53.45
53.09
15.05
200
180
160
140
120
100
80
60
40
20
0
ppm

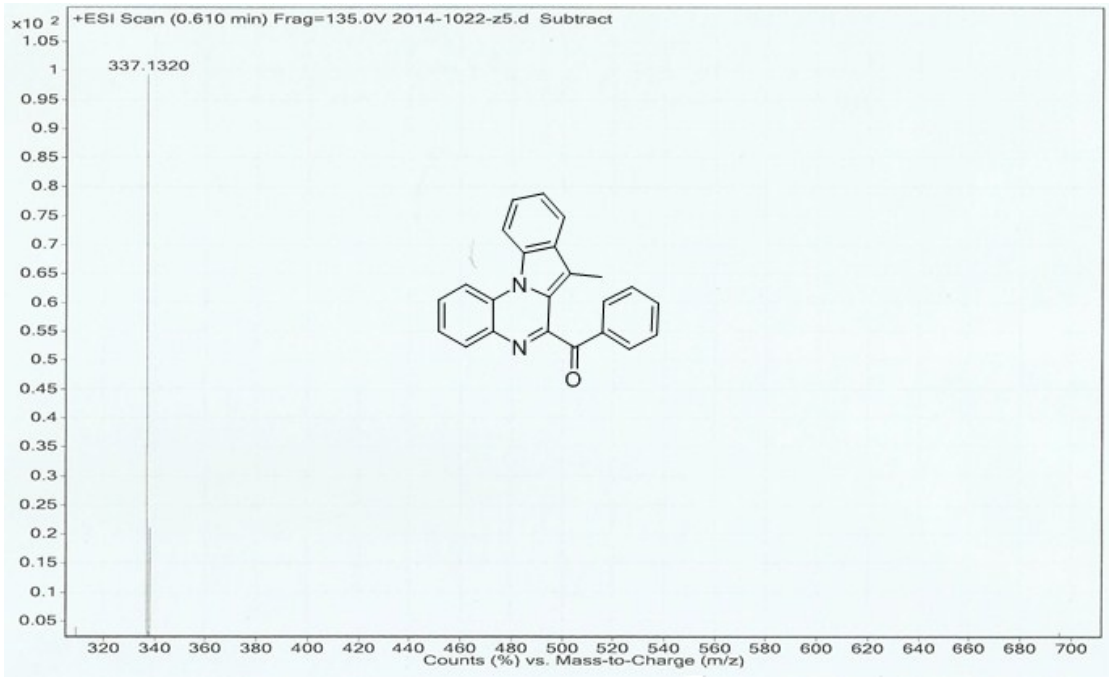
*Indolo[1,2-a]quinoxalin-6-yl(phenyl)methanone (**3ha**)*

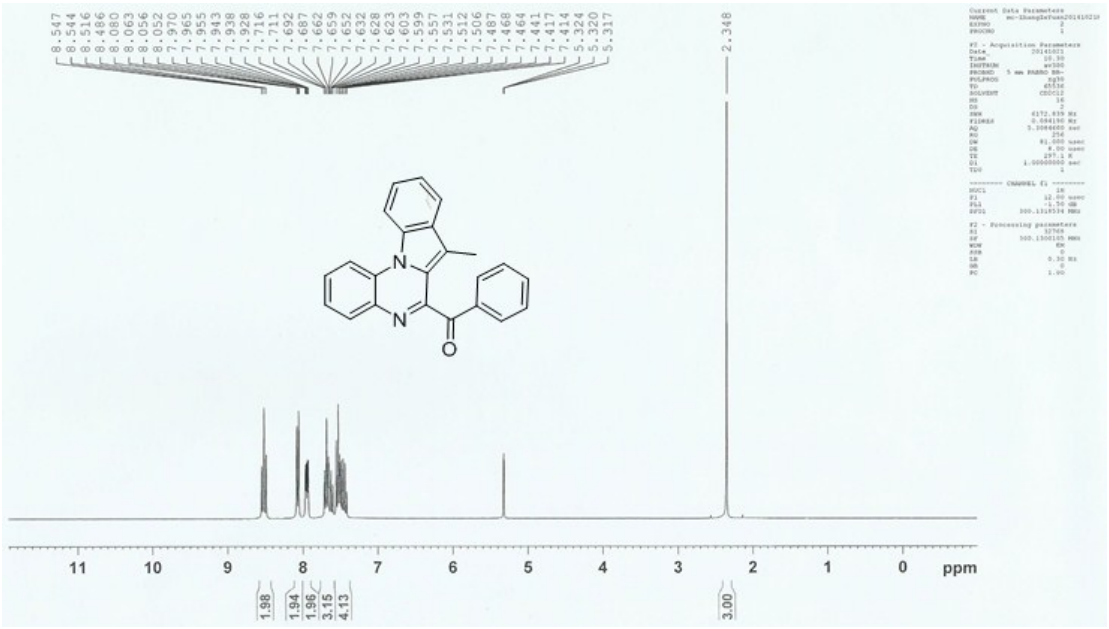


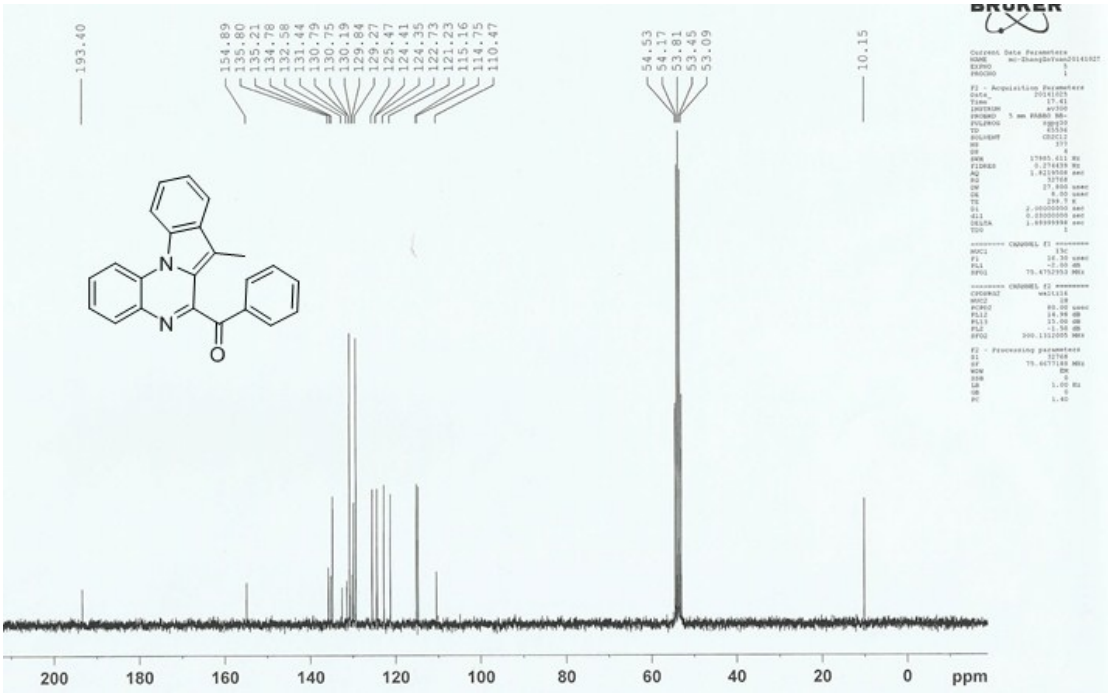




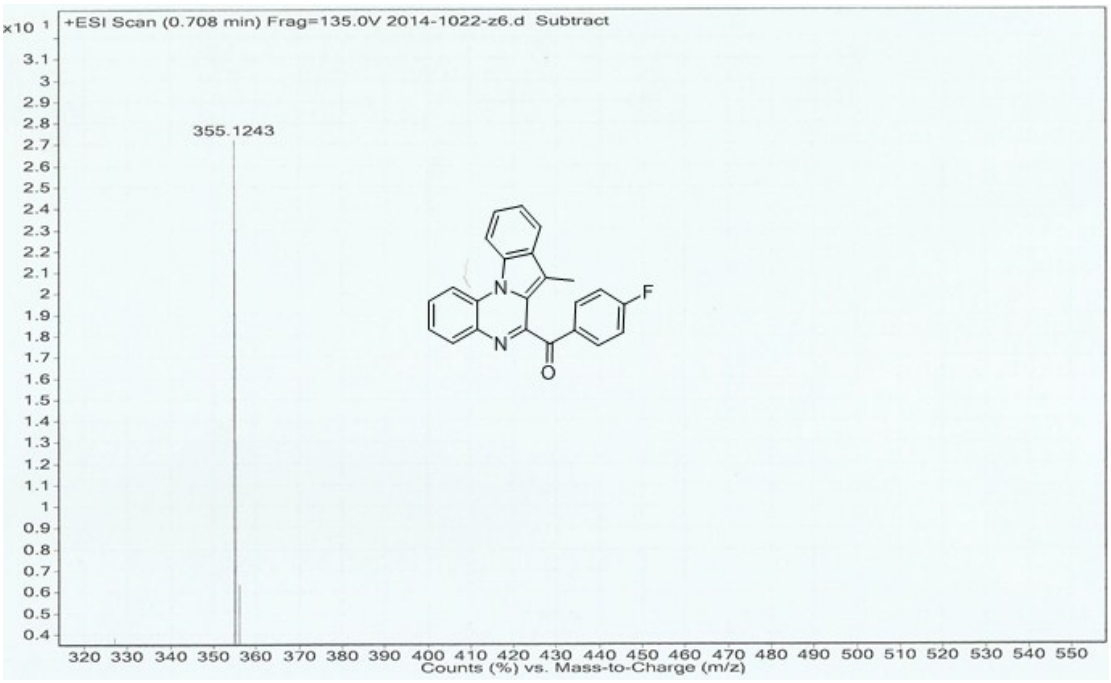
*(7-Methylindolo[1,2-a]quinoxalin-6-yl)(phenyl)methanone (**3ia**)*

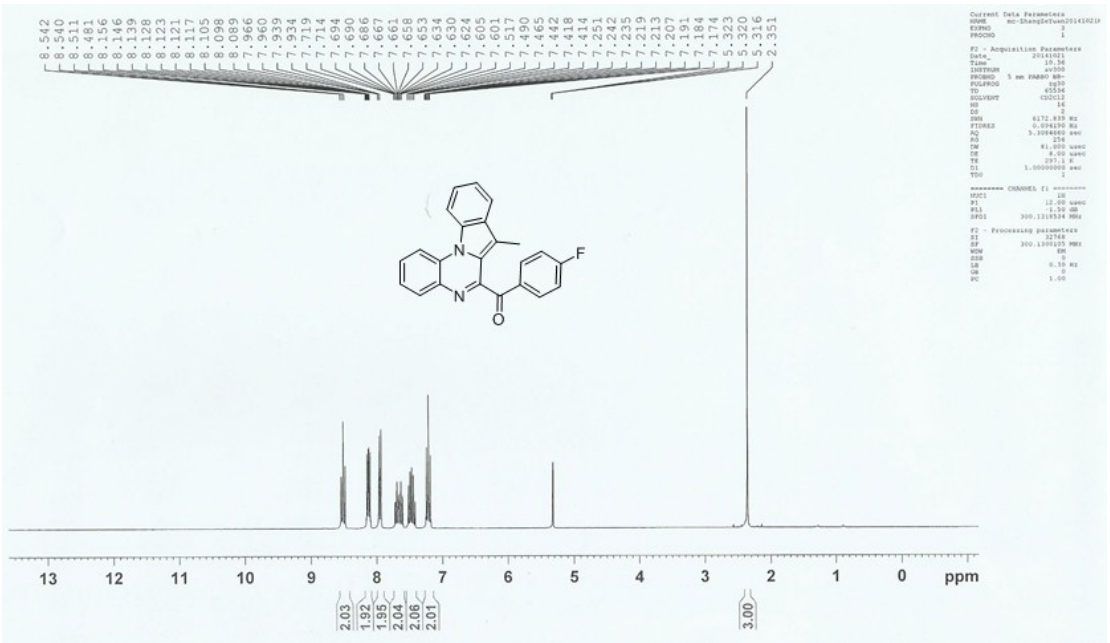


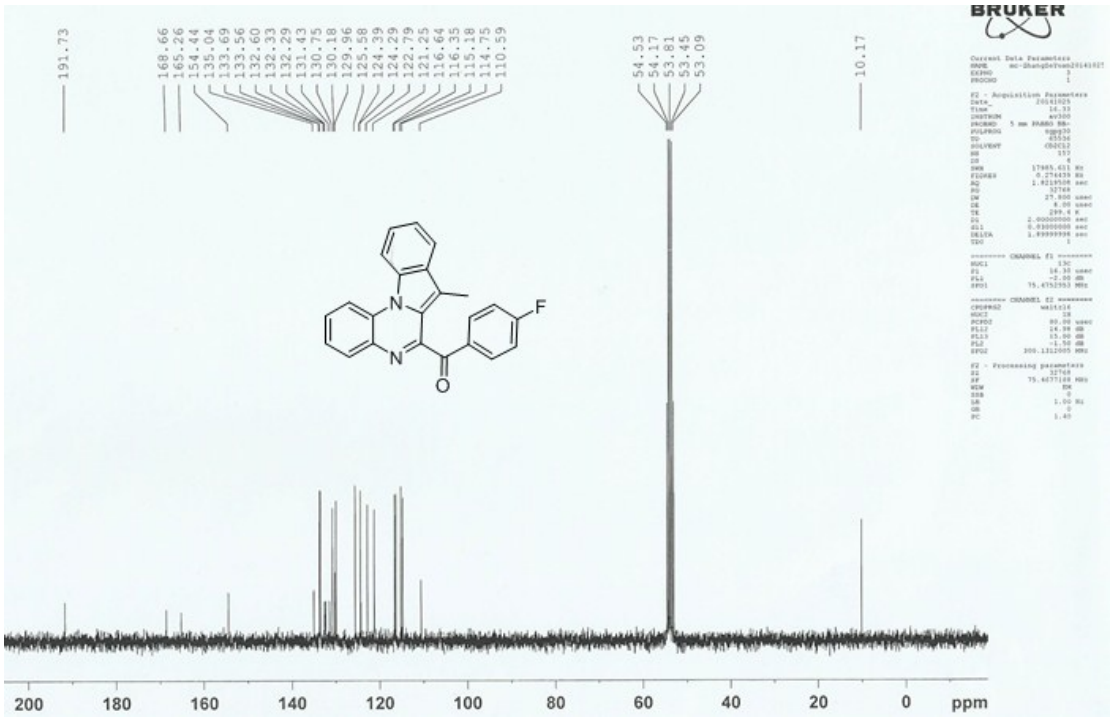

8.547
8.544
8.516
8.486
8.080
8.063
8.056
8.052
7.970
7.965
7.955
7.943
7.938
7.928
7.716
7.711
7.692
7.687
7.662
7.659
7.652
7.632
7.628
7.623
7.603
7.599
7.557
7.531
7.512
7.506
7.487
7.468
7.464
7.441
7.417
7.414
7.324
5.320
5.317
2.348
N
N
O
11
10
9
8
7
6
5
4
3
2
1
0
ppm
1.98
1.94
1.96
3.15
4.13
3.00


193.40
154.89
135.80
135.21
134.78
132.58
131.44
130.79
130.75
130.19
129.84
129.27
125.47
124.41
124.35
122.73
121.23
115.16
114.75
110.47
54.53
54.17
53.81
53.45
53.09
10.15
N
N
O
200
180
160
140
120
100
80
60
40
20
0
ppm

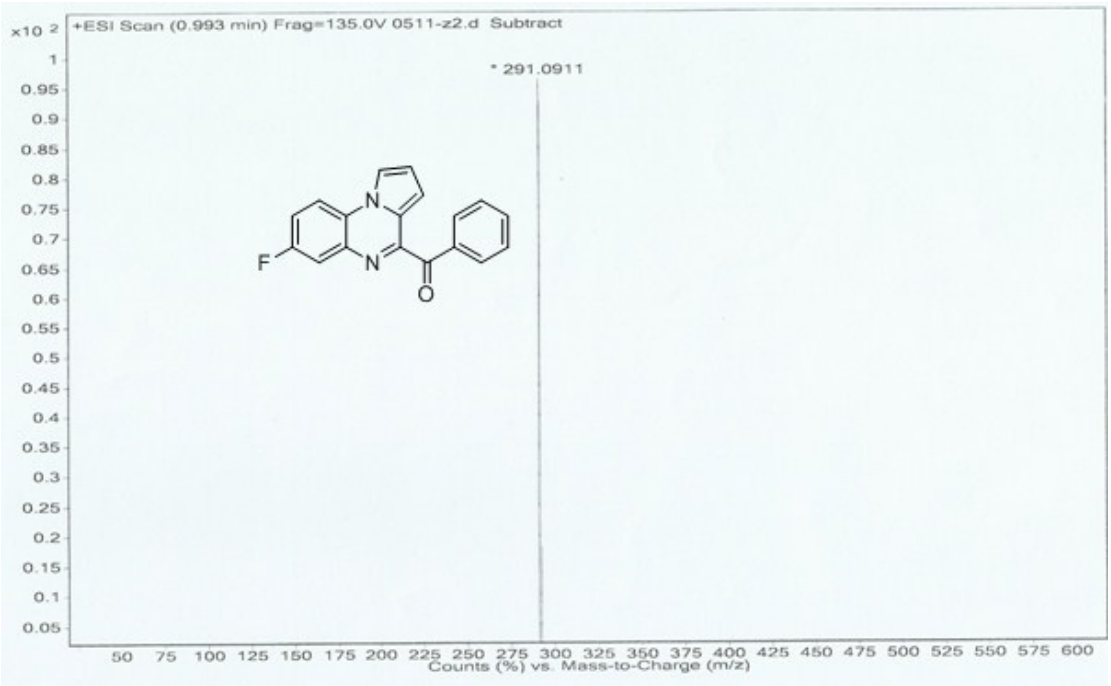
*(4-Fluorophenyl)(7-methylindolo[1,2-a]quinoxalin-6-yl)methanone (**3ie**)*

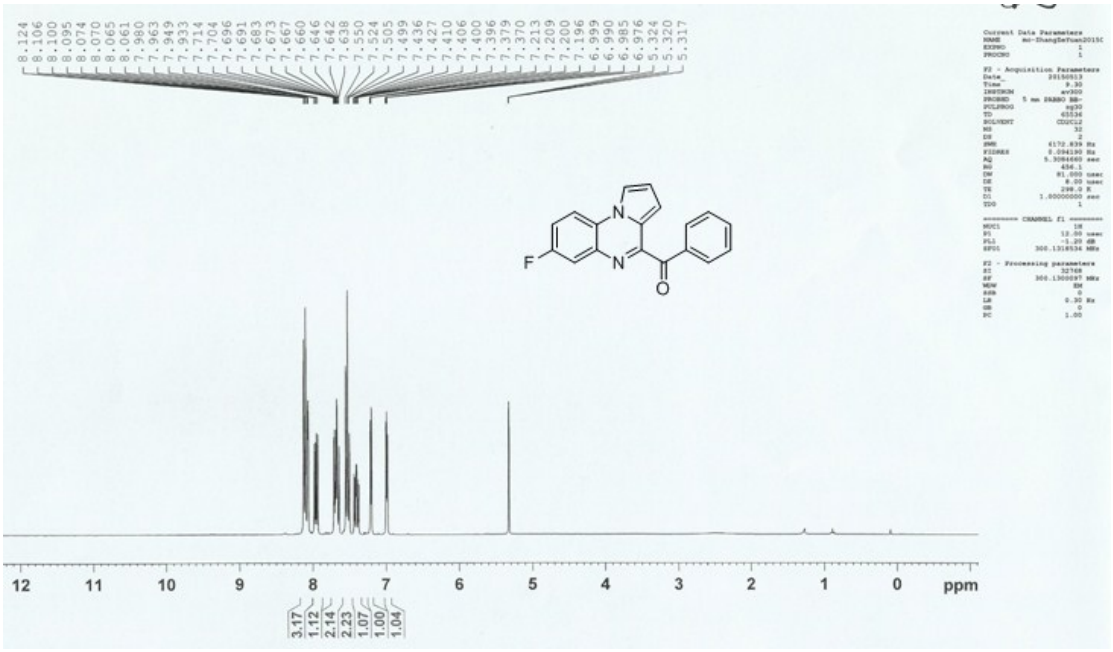






*(7-fluoropyrrolo[1,2-a]quinoxalin-4-yl)(phenyl)methanone (**3la**)*

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8.106
8.100
8.095
8.074
8.070
8.065
8.061
7.980
7.963
7.949
7.933
7.714
7.704
7.696
7.691
7.683
7.673
7.667
7.660
7.646
7.642
7.638
7.550
7.524
7.505
7.499
7.436
7.427
7.410
7.406
7.400
7.396
7.379
7.370
7.213
7.209
7.200
7.196
6.999
6.990
6.985
6.976
5.324
5.320
5.317
F
N
N
O
12
11
10
9
8
7
6
5
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3
2
1
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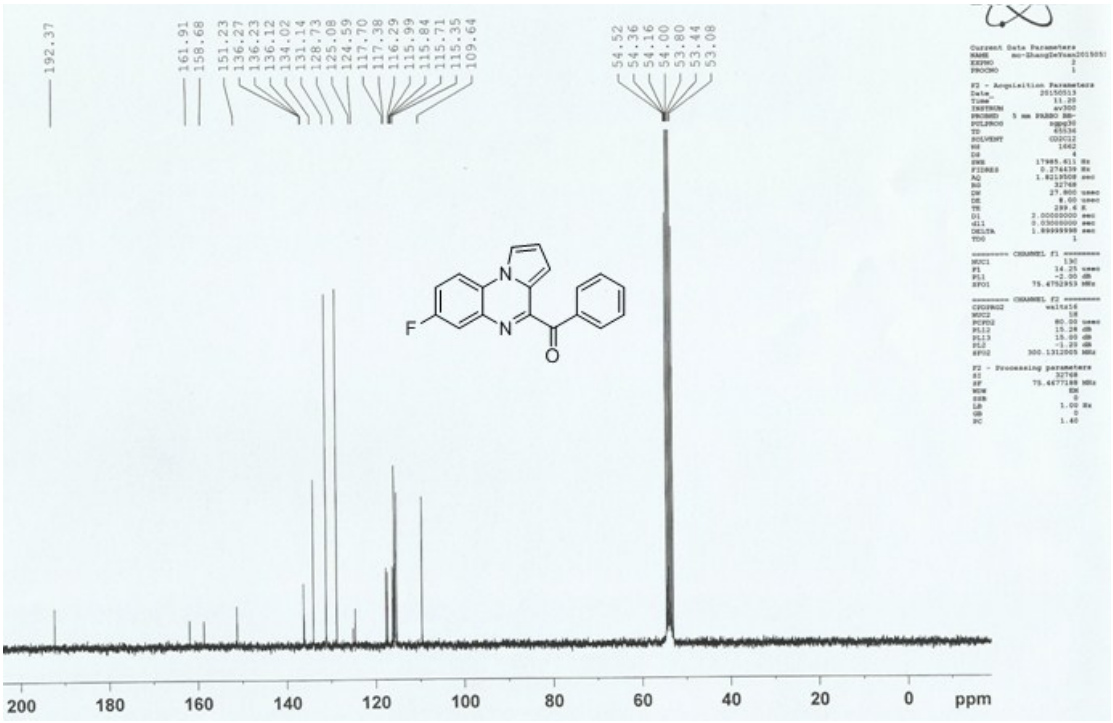
ppm
3.17
1.12
2.14
2.23
1.07
1.00
1.04


192.37
161.91
158.68
151.23
136.27
136.23
136.12
134.02
131.14
128.73
125.08
124.59
117.70
117.38
116.29
115.99
115.84
115.71
115.35
109.64
54.52
54.36
54.16
54.00
53.80
53.44
53.08
F
N
N
O
200
180
160
140
120
100
80
60
40
20
0
ppm