Supporting Information

Electrochemical Quinuclidine-mediated Minisci-type Acylation of N-Heterocycles with Aldehydes

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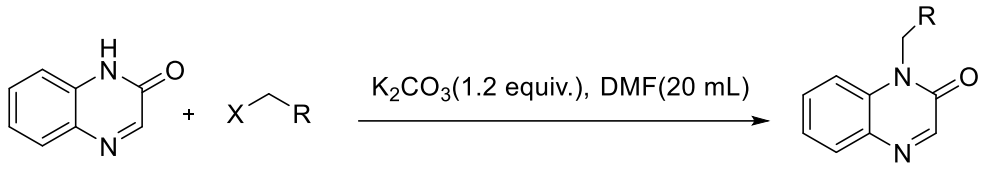
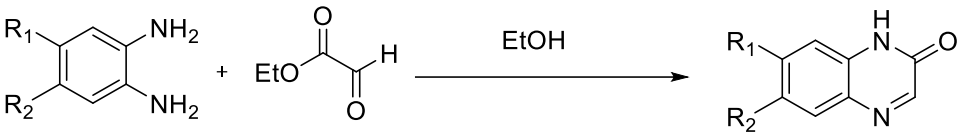
1. General information

Unless otherwise special indicated, all the reagents were purchased from commercial supplies unless otherwise stated. And all the solvents were used without any purification. Thin-layer chromatography (TLC) was performed on plastic plates coated with silica gel GF254 with 0.2 mm thickness (Yantai Yuanbo Biological Technology Co., Ltd.) and all compounds were visualized with a UV light at 254 nm. Flash column chromatography was performed using silica gel (200-300 mesh, Yantai Yuanbo Biological Technology Co., Ltd.). NMR spectra were recorded on a Bruker Avance III spectrometer operating at 600, 400 or 300 MHz for ^{1}H NMR and 100 or 150 MHz for ^{13}C NMR. Chemical shifts were reported in ppm downfield and referenced as follows: ^{1}H: residual internal $CHCl_3$ (δ 7.26 ppm); ^{13}C: internal $CDCl_3$ (δ 77.2 ppm). Coupling constants were quoted in Hz(*J*). Multiplicity was indicated as follows: s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet).

2. General procedure for the synthesis of starting materials



To a stirred solution of 2-quinoxalinone (5 mmol) in DMF (20 mL) was added the corresponding halide (1.6 equiv.) potassium and carbonate (1.2 equiv.) at room temperature overnight. Then resulting mixture was transferred to a separatory funnel. Ethanol and water were added to the reaction mixture, and the aqueous layer was extracted twice with ethyl acetate. The combined organic layers were washed with a saturated solution of NH_4Cl and then with brine, dried over Na_2SO_4, filtered and evaporated under reduced pressure. The residue was purified by column chromatography on silica gel to obtain product [1].



To ethanol (20 ml) suspension solution of o-arylenediamine (5 mmol) was added Ethyl 2-oxoacetate (1.1 equiv.). The reaction system was stirred and heated to reflux at 85 °C for 1 h, then stirred at room temperature for 16 h. After the reaction was completed (as monitored by TLC), the precipitate was filtered and washed with ethanol (5 ml*3), and finally dried to give quinoxalinone.

3 General procedure for the electrolysis

To an undivided cell (10 mL) was added **1a** (0.3 mmol), **2a** (0.9 mmol), quinuclidine (0.15 mmol), $LiClO_4$ (0.3 mmol), Cs_2CO_3 (0.3 mmol), and CH_3CN (5 mL) sequentially. Then, the undivided cell was equipped with a Ni foam cathode (10 mm × 10 mm × 1 mm) and a graphite felt anode (10 mm × 10 mm × 1 mm). The undivided cell was placed in an oil bath (50 ^{o}C) and was electrolyzed with a cell potential of 4 V for 8 h. After the reaction was completed, the mixture was quenched with water and extracted with ethyl acetate (3 x 15 mL). The organic layers were then combined and concentrated under vacuo. The resulting crude mixture was purified by flash column chromatography on silica gel (petroleum ether/ethyl acetate 10:1-3:1) to give the desired product **3aa** as a light yellow solid (61 mg, 77%).

4 A picture of the reaction setup

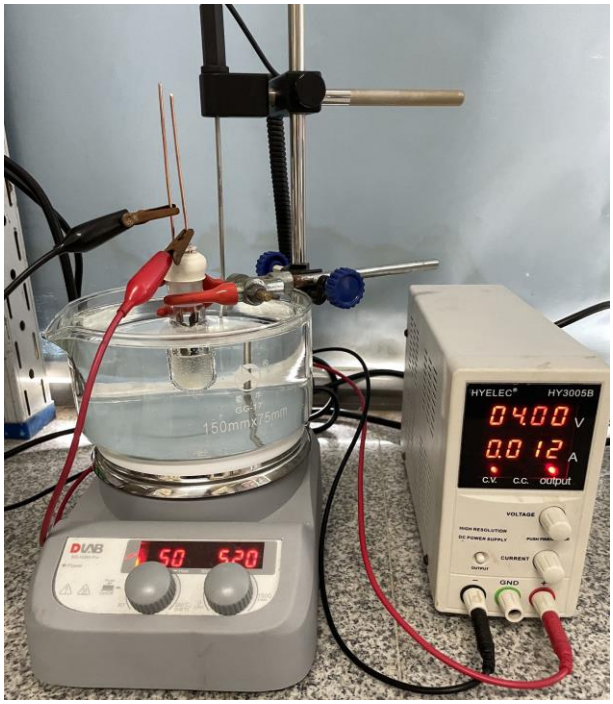
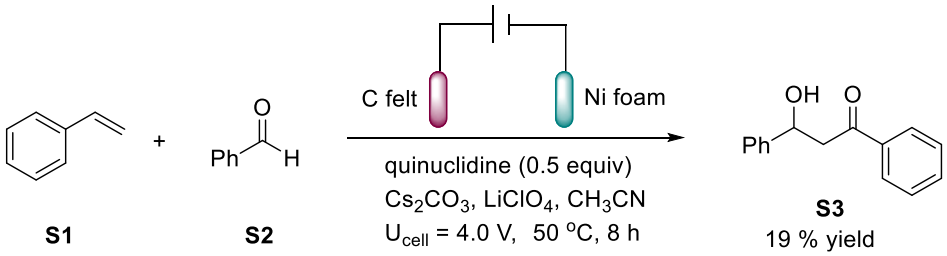


Figure S1. The reaction setup

5 The electrolysis between aldehyde and alkene

Under the optimal conditions, the trapping of acyl radical with alkene was carried out (Scheme S1).



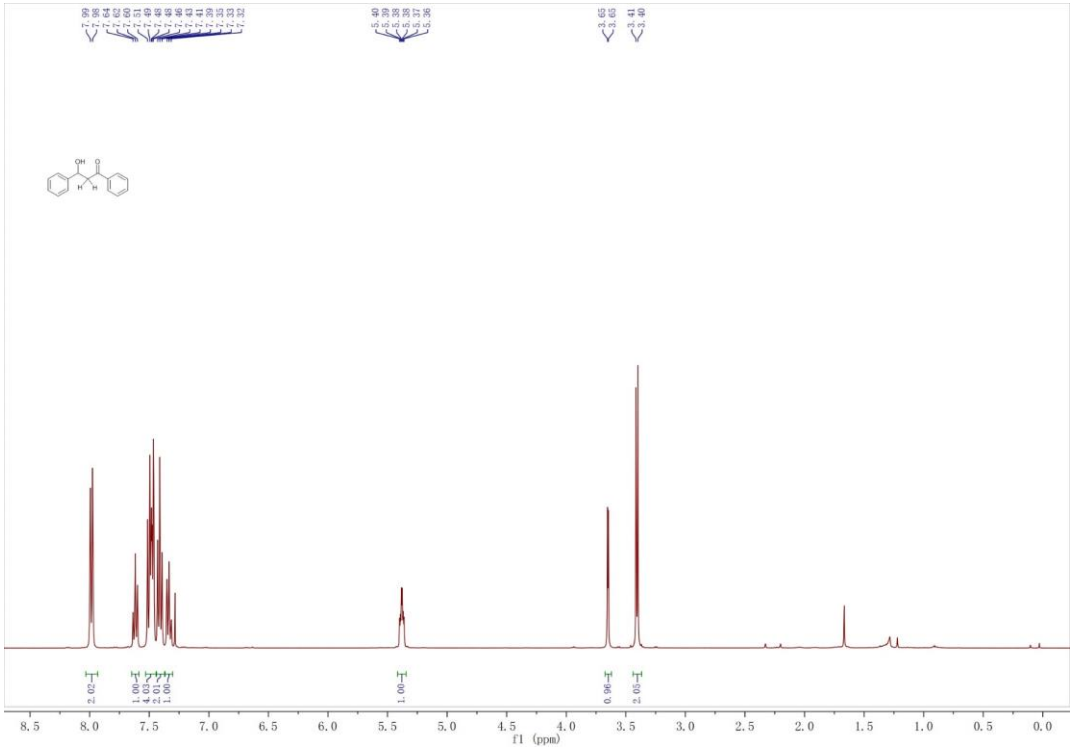
Scheme S1. The trapping of acyl radical with alkene

To an undivided cell (10 mL) was added **S1** (0.3 mmol), **S2** (0.9 mmol), quinuclidine (0.15 mmol), $LiClO_4$ (0.3 mmol), Cs_2CO_3 (0.3 mmol), and CH_3CN (5 mL) sequentially. Then, the undivided cell was equipped with a Ni foam cathode (10 mm × 10 mm × 1 mm) and a graphite felt anode (10 mm × 10 mm × 1 mm). The undivided cell was placed in an oil bath (50 ^oC) and was electrolyzed with a cell potential of 4 V for 8 h. After the reaction was completed, the mixture was quenched with water and

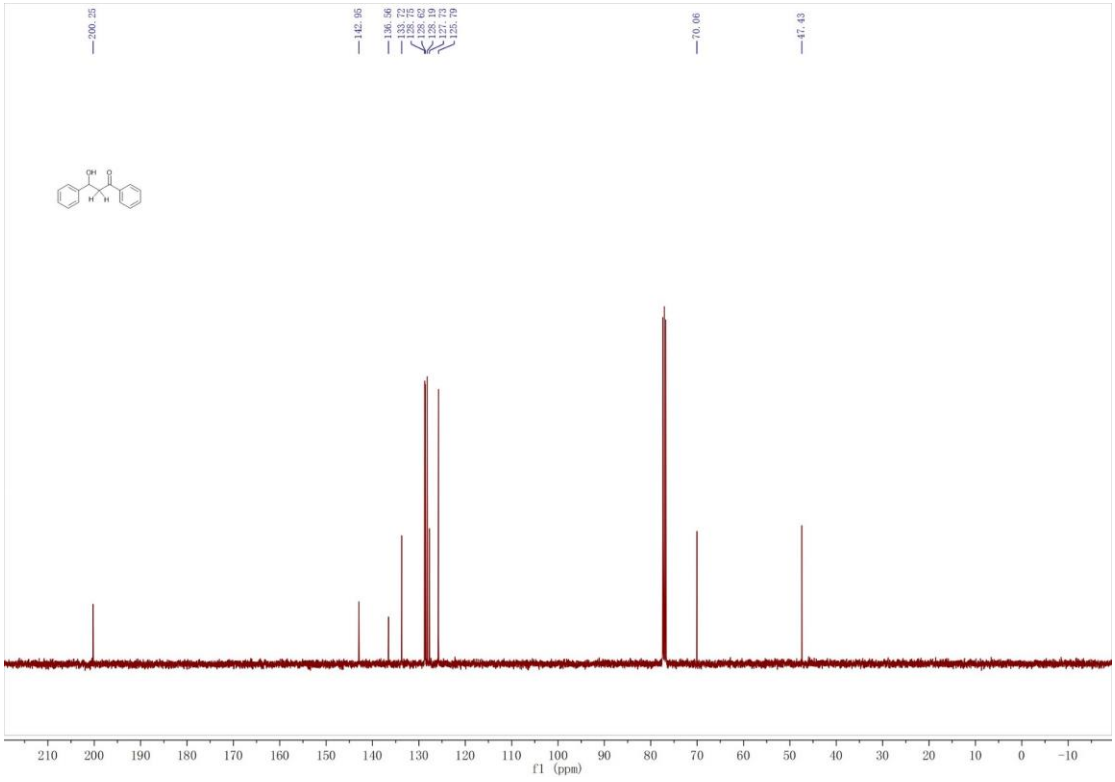
extracted with ethyl acetate (3 x 15 mL). The organic layers were then combined and concentrated under vacuo. The resulting crude mixture was purified by flash column chromatography on silica gel (petroleum ether/ethyl acetate 6:1-3:1) to give the desired product **S3** as a white solid (13 mg, 19%).

3-hydroxy-1,3-diphenylpropan-1-one (S3) White solid; Yield: 19% (13 mg); R_f = 0.62 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.99 (d, *J* = 7.3 Hz, 2H), 7.62 (t, *J* = 7.4 Hz, 1H), 7.53 – 7.44 (m, 4H), 7.41 (t, *J* = 7.5 Hz, 2H), 7.33 (t, *J* = 7.1 Hz, 1H), 5.38 (td, *J* = 6.1, 2.8 Hz, 1H), 3.65 (d, *J* = 2.9 Hz, 1H), 3.41 (d, *J* = 6.0 Hz, 2H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 200.3, 143.0, 136.6, 133.7, 128.8, 128.6, 128.2, 127.7, 125.8, 70.1, 47.4. The produced spectral data is consistent with that in the literature (Tetrahedron **2013**, *69*, 3551–3560).

^{1}H NMR of **S3**



^{13}C NMR of **S3**


200.25
142.95
136.56
133.72
128.75
128.62
128.19
127.73
125.79
70.06
47.43
OH
O
H
H
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)

6 General procedure for cyclic voltammetry (CV) experiments

Cyclic voltammetry was performed in a three-electrode cell at room temperature. The working electrode was a glassy carbon electrode, the counter electrode was a platinum wire. The reference was an $Ag/AgNO_3$ (0.1 M in CH_3CN) electrode. The scan rate is 0.1 V/s. The solvent is CH_3CN.

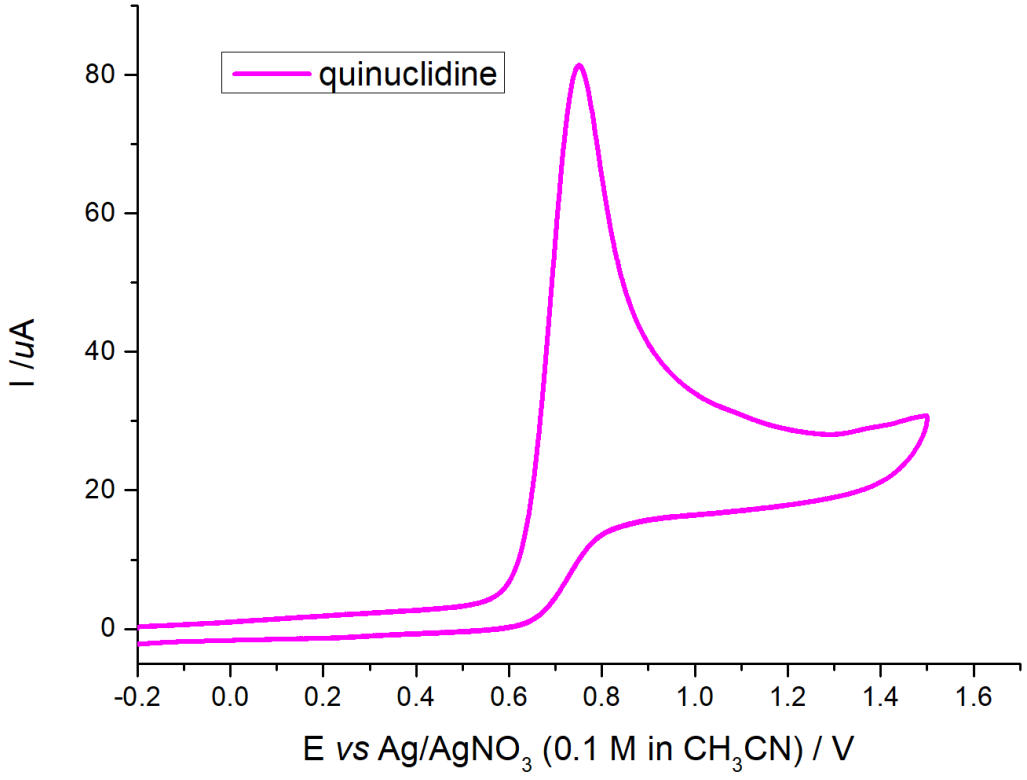


Figure S2. Cyclic voltammograms of 0.1 M $LiClO_4$ and related compounds in CH_3CN (5 mL) using glassy carbon working electrode, Pt wire, and $Ag/AgNO_3$ as counter electrode, (a) quinuclidine (5.0 mmol/L).

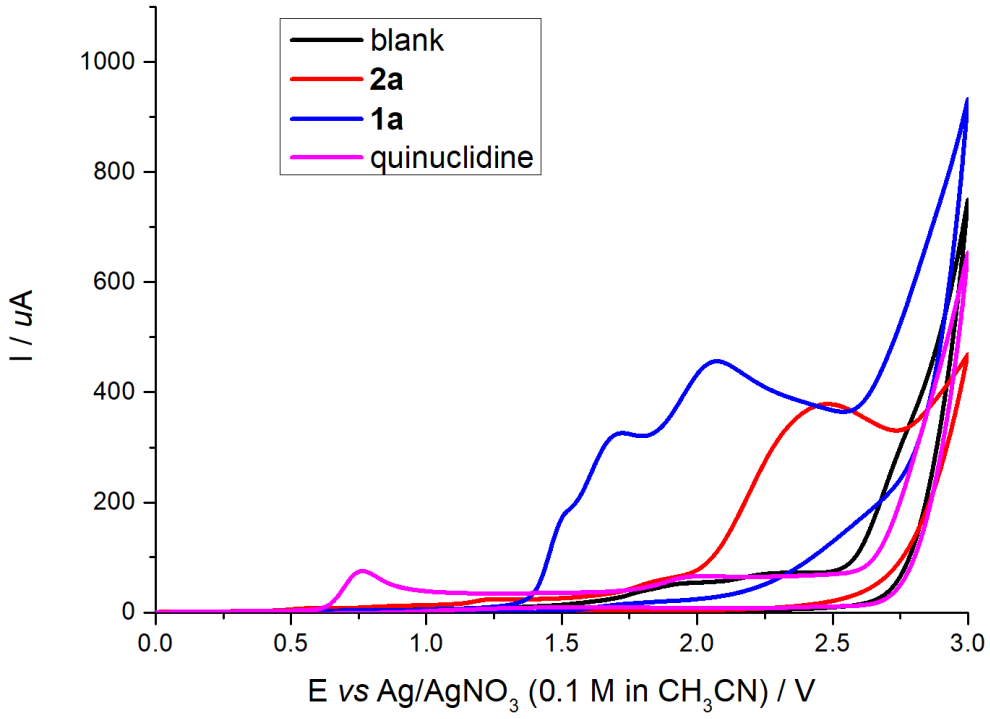
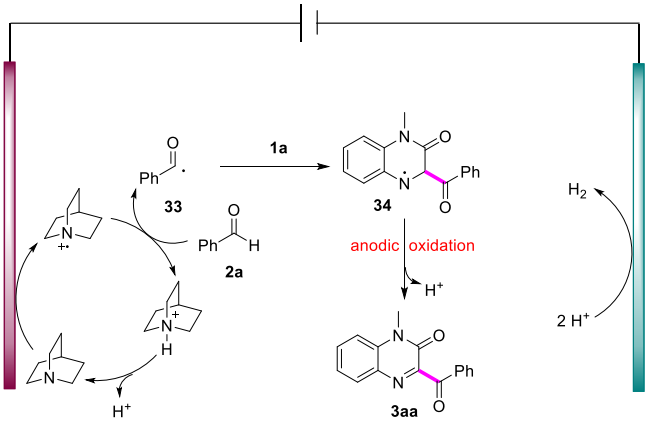


Figure S3. Cyclic voltammograms of 0.1 M $LiClO_4$ and related compounds in CH_3CN (5 mL) using glassy carbon working electrode, Pt wire, and $Ag/AgNO_3$ as counter, (a) 0.1 M $LiClO_4$ and Cs_2CO_3 in CH_3CN (b) **2a** (5.0 mmol/L), (c) **1a** (5.0 mmol/L) (d) quinuclidine (5.0 mmol/L).

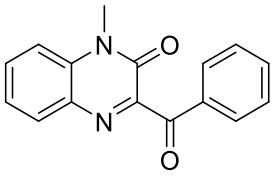
7 A plausible mechanism for the generation of 3aa

First, the anodic oxidation of quinuclidine affords quinuclidinyl radical cation, which abstracts the formyl hydrogen of aldehyde to give the corresponding acyl radical **33** and protonated quinuclidium ion. The latter was deprotonated by external base to afford quinuclidine. The radical addition of **33** to **1a** gives N-centered radical **34**. Finally, the anodic oxidation of radical **34** followed by proton releasing produces acylated product **3aa**. Simultaneously, the cathodic reduction of proton to hydrogen gas realizes the charge balance.

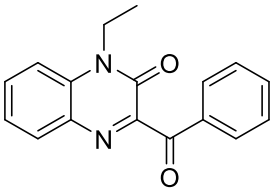


Scheme S1. A plausible mechanism for the generation of **3aa**

8. Characterization data of 3aa-3ai

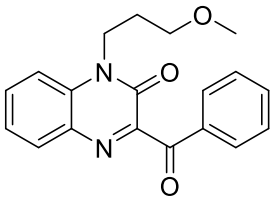


3-benzoyl-1-methylquinoxalin-2(1H)-one (3aa) [3] , Light yellow solid; m.p.147-148 °C; Yield: 77% (61 mg); R_f = 0.47 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (600 MHz, CDCl$_3$)** δ 8.06-7.97 (m, 2H), 7.97-7.92 (m, 1H), 7.70 (m, 1H), 7.67-7.61 (m, 1H), 7.51 (t, *J* = 7.8 Hz, 2H), 7.47-7.40 (m, 2H), 3.77 (s, 3H); **^{13}C NMR (150 MHz, CDCl$_3$)** δ 191.8, 154.7, 153.4, 134.9, 134.3, 133.9, 132.2, 132.1, 131.0, 130.0, 128.7, 124.2, 114.0, 29.1. The produced spectral data is consistent with that in the literature.

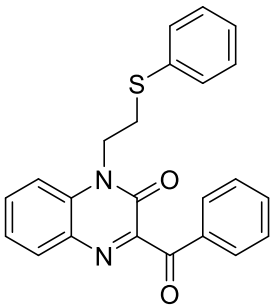


3-benzoyl-1-ethylquinoxalin-2(1H)-one (3ba) [3] Yellow solid; m.p.69-70 °C; Yield: 72% (60 mg); R_f = 0.51 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.03-7.96 (m, 2H), 7.93 (m, 1H), 7.70-7.60 (m, 2H), 7.48 (t, *J* = 7.8 Hz, 2H), 7.41 (m, 2H), 4.37 (q, *J* = 7.2 Hz, 2H), 1.42 (t, *J* = 7.2 Hz, 3H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ

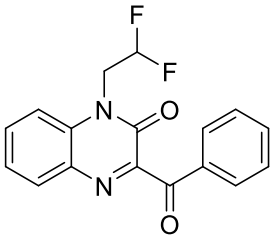
191.9, 154.7, 152.9, 134.9, 134.2, 132.9, 132.5, 132.1, 131.3, 130.0, 128.7, 124.0, 113.9, 37.4, 12.5. The produced spectral data is consistent with that in the literature.



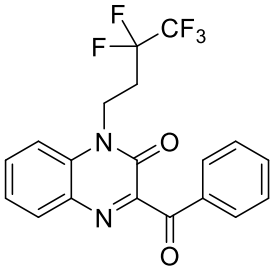
3-benzoyl-1-(3-methoxypropyl)quinoxalin-2(1H)-one (3ca) Yellow solid; m.p.79-80 °C; Yield: 47% (46 mg); R_f = 0.42 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.01 (d, *J* = 7.5 Hz, 2H), 7.97-7.92 (m, 1H), 7.67 (m, 2H), 7.58 (d, *J* = 8.4 Hz, 1H), 7.50 (t, *J* = 7.7 Hz, 2H), 7.42 (t, *J* = 7.6 Hz, 1H), 4.48-4.39 (m, 2H), 3.51 (t, *J* = 5.7 Hz, 2H), 3.39 (s, 3H), 2.16-2.03 (m, 2H); **^{13}C NMR (150 MHz, CDCl$_3$)** δ 191.9, 154.6, 153.2, 134.9, 134.2, 133.4, 132.5, 132.1, 131.2, 130.0, 128.7, 124.1, 114.2, 69.7, 58.8, 40.0, 27.6. HRMS (APCI) m/z calculated for $C_{19}H_{19}N_2O_3^+$ 323.1390, Found 323.1389.



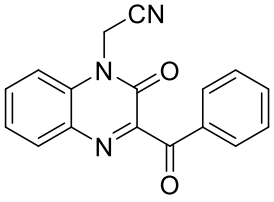
3-benzoyl-1-(2-(phenylthio)ethyl)quinoxalin-2(1H)-one (3da) Yellow oil. Yield: 51% (59 mg); R_f = 0.43 (petroleum ether/EtOAc, 3:1); **^{1}H NMR (600 MHz, CDCl$_3$)** δ 8.01 (m, 2H), 7.93 (m, 1H), 7.65 (t, *J* = 7.4 Hz, 1H), 7.63-7.58 (m, 1H), 7.54-7.45 (m, 4H), 7.41 (t, *J* = 7.6 Hz, 1H), 7.35 (t, *J* = 7.7 Hz, 2H), 7.28 (d, *J* = 8.2 Hz, 1H), 7.22 (d, *J* = 8.4 Hz, 1H), 4.54-4.47 (m, 2H), 3.35-3.28 (m, 2H); **^{13}C NMR (150 MHz, CDCl$_3$)** δ 191.5, 154.4, 153.0, 134.8, 134.3, 134.3, 133.0, 132.4, 132.1, 131.4, 130.1, 130.1, 129.3, 128.7, 127.0, 124.3, 113.7, 42.3, 30.2. HRMS (APCI) m/z calculated for $C_{23}H_{19}N_2O_2S^+$ 387.1162, Found 387.1167.



3-benzoyl-1-(2,2-difluoroethyl)quinoxalin-2(1H)-one (3ea) Yellow solid; m.p.73-74 °C; Yield: 65% (61 mg); R_f = 0.42 (petroleum ether/EtOAc, 3:1); **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.05-7.92 (m, 3H), 7.75-7.61 (m, 2H), 7.56-7.42 (m, 4H), 6.20 (m, 1H), 4.66 (m, 2H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ 191.1, 153.5, 134.7, 134.5, 133.3, 132.5, 132.4, 131.4, 130.1, 128.8, 124.8, 114.2, 112.8, 110.4 (t, $^1J_{C-F}$ = 242.7 Hz), 44.7 (t, $^2J_{C-F}$ = 28.7 Hz); **^{19}F NMR (376 MHz, CDCl$_3$)** δ -120.43; HRMS (APCI) m/z calculated for $C_{17}H_{13}F_2N_2O_2^+$ 315.0940, Found 315.0936.

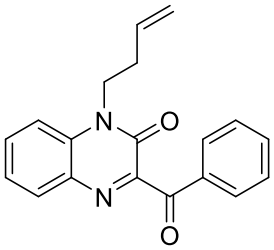


3-benzoyl-1-(3,3,4,4,4-pentafluorobutyl)quinoxalin-2(1H)-one (3fa) Yellow oil; Yield: 41% (49 mg); R_f = 0.55 (petroleum ether/EtOAc, 3:1); **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.01-7.95 (m, 3H), 7.76-7.70 (m, 1H), 7.64 (t, *J* = 7.4 Hz, 1H), 7.47 (m, 3H), 7.40 (d, *J* = 8.4 Hz, 1H), 4.65-4.55 (m, 2H), 2.59 (m, 2H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ 191.3, 154.4, 153.0, 134.8, 134.5, 132.7, 132.6, 132.6, 131.9, 130.1, 128.9, 124.8, 120.4 (m), 115.0(m), 113.0, 35.0 (t, $^3J_{C-F}$ = 4.8 Hz), 28.3 (t, $^2J_{C-F}$ = 21.7 Hz); **^{19}F NMR (376 MHz, CDCl$_3$)** δ -85.41, -118.11; HRMS (APCI) m/z calculated for $C_{19}H_{14}F_5N_2O_2^+$ 397.0970, Found 397.0969.

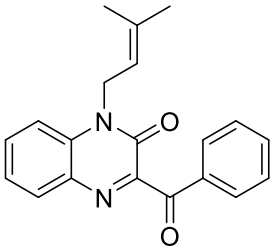


2-(3-benzoyl-2-oxoquinoxalin-1(2H)-yl)acetonitrile (3ga) Yellow solid; m.p.185-186 °C; Yield: 69% (51 mg); R_f = 0.51 (petroleum ether/EtOAc, 3:1); **^{1}H NMR (400**

MHz, $CDCl_3$) δ 8.02 (t, *J* = 6.9 Hz, 3H), 7.83-7.76 (m, 1H), 7.69 (t, *J* = 7.4 Hz, 1H), 7.54 (t, *J* = 7.7 Hz, 3H), 7.46 (d, *J* = 8.4 Hz, 1H), 5.27 (s, 2H); **^{13}C NMR (150 MHz, $CDCl_3$)** δ 190.4, 153.8, 151.9, 134.6, 134.5, 132.9, 132.2, 131.8, 131.7, 130.2, 128.8, 125.5, 113.4, 113.3, 29.2; HRMS (APCI) m/z calculated for $C_{17}H_{12}N_3O_2^+$ 290.0924, Found 290.0922.

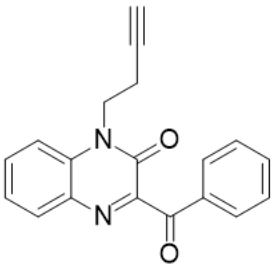


3-benzoyl-1-(but-3-en-1-yl)quinoxalin-2(1H)-one (3ha) Yellow oil; Yield: 39% (36 mg); R_f = 0.63 (petroleum ether/EtOAc, 4:1); **^{1}H NMR (600 MHz, $CDCl_3$)** δ 8.04-7.93 (m, 3H), 7.70 (m, 1H), 7.65 (t, *J* = 6.9 Hz, 1H), 7.51 (t, *J* = 7.8 Hz, 2H), 7.44 (t, *J* = 7.7 Hz, 2H), 5.91 (m, 1H), 5.18-5.11 (m, 2H), 4.43-4.37 (m, 2H), 2.60 (q, *J* = 7.2 Hz, 2H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 191.9, 154.8, 153.1, 134.9, 134.2, 133.7, 133.0, 132.5, 132.0, 131.4, 130.0, 128.7, 124.1, 118.0, 113.9, 41.5, 31.6; HRMS (APCI) m/z calculated for $C_{19}H_{17}N_2O_2^+$ 305.1285, Found 305.1284.

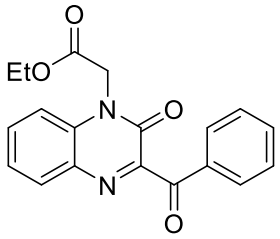


3-benzoyl-1-(3-methylbut-2-en-1-yl)quinoxalin-2(1H)-one (3ia) Yellow solid; m.p.187-188 °C; Yield: 48% (46 mg); R_f = 0.57 (petroleum ether/EtOAc, 3:1); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.02-7.96 (m, 2H), 7.92 (m, 1H), 7.68-7.59 (m, 2H), 7.48 (t, *J* = 7.7 Hz, 2H), 7.39 (m, 2H), 5.25-5.18 (m, 1H), 4.92 (d, *J* = 6.4 Hz, 2H), 1.89 (s, 3H), 1.74 (s, 3H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 191.9, 154.8, 153.0, 138.1, 134.9,

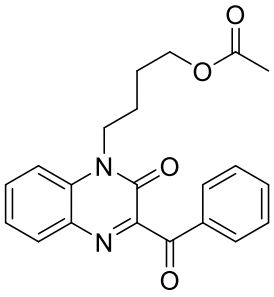
134.2, 133.3, 132.5, 131.9, 131.1, 130.0, 128.7, 124.0, 117.4, 114.5, 40.7, 25.7, 18.5; HRMS (APCI) m/z calculated for $C_{20}H_{19}N_2O_2^+$ 319.1441, Found 319.1447.



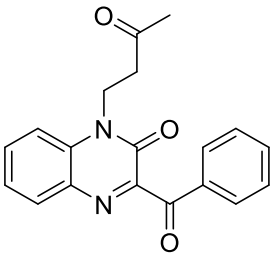
3-benzoyl-1-(but-3-yn-1-yl)quinoxalin-2(1H)-one (3ga) Yellow solid; m.p.97-98 °C; Yield: 29% (26 mg); R_f = 0.47 (petroleum ether/EtOAc, 3:1); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.99 (d, *J* = 7.2 Hz, 2H), 7.95 (m, 1H), 7.71-7.60 (m, 2H), 7.50 (q, *J* = 8.0 Hz, 3H), 7.42 (t, *J* = 8.0 Hz, 1H), 4.49 (t, *J* = 7.4 Hz, 2H), 2.74 (m, 2H), 2.03 (t, *J* = 2.7 Hz, 1H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 191.6, 154.6, 152.9, 134.8, 134.3, 133.0, 132.4, 132.0, 131.4, 130.1, 128.7, 124.3, 114.0, 79.7, 71.2, 40.9, 17.1; HRMS (APCI) m/z calculated for $C_{19}H_{15}N_2O_2^+$ 303.1128, Found 303.1134.



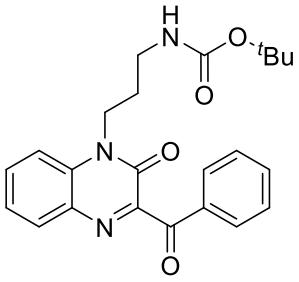
ethyl 2-(3-benzoyl-2-oxoquinoxalin-1(2H)-yl)acetate (3ka)[4] Yellow solid; Yield: 63% (64 mg); R_f = 0.48 (petroleum ether/EtOAc, 3:1); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.02-7.96 (m, 2H), 7.94 (m, 1H), 7.67-7.59 (m, 2H), 7.48 (t, *J* = 7.7 Hz, 2H), 7.44-7.38 (m, 1H), 7.17 (d, *J* = 8.4 Hz, 1H), 5.06 (s, 2H), 4.25 (q, *J* = 7.1 Hz, 2H), 1.28 (t, *J* = 7.1 Hz, 3H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 191.4, 166.7, 154.4, 152.9, 134.8, 134.3, 133.1, 132.3, 131.3, 130.0, 128.7, 124.5, 113.6, 62.3, 43.3, 14.1. The produced spectral data is consistent with that in the literature.



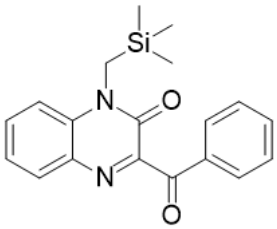
4-(3-benzoyl-2-oxoquinoxalin-1(2H)-yl)butyl acetate (3la) Yellow oil; Yield: 57% (62 mg); R_f = 0.41 (petroleum ether/EtOAc, 3:1); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.97 (m, 3H), 7.65 (m, 2H), 7.49 (t, *J* = 7.7 Hz, 2H), 7.41 (t, *J* = 7.7 Hz, 2H), 4.37-4.30 (m, 2H), 4.14 (t, *J* = 6.2 Hz, 2H), 2.05 (s, 3H), 1.90 (m, 2H), 1.82 (m, 2H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 191.8, 171.1, 154.7, 153.1, 134.9, 134.3, 133.0, 132.5, 132.1, 131.4, 130.0, 128.7, 124.1, 113.8, 63.7, 41.9, 26.2, 24.1, 21.0; HRMS (APCI) m/z calculated for $C_{21}H_{21}N_2O_4^+$ 365.1496, Found 365.1494.



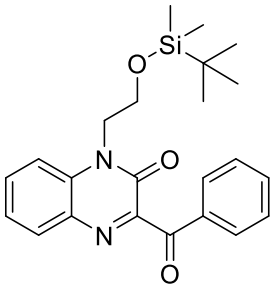
3-benzoyl-1-(3-oxobutyl)quinoxalin-2(1H)-one (3ma) Yellow oil; Yield: 53% (51 mg); R_f = 0.48 (petroleum ether/EtOAc, 3:1); **^{1}H NMR (600 MHz, $CDCl_3$)** δ 8.01 (m, 2H), 7.96 (m, 1H), 7.69 (m, 1H), 7.67-7.63 (m, 1H), 7.54-7.47 (m, 3H), 7.46-7.41 (m, 1H), 4.62-4.54 (m, 2H), 3.02-2.97 (m, 2H), 2.24 (s, 3H); **^{13}C NMR (150 MHz, $CDCl_3$)** δ 205.8, 191.6, 154.3, 153.1, 134.8, 134.3, 132.9, 132.5, 132.3, 131.4, 130.0, 128.7, 124.3, 113.4, 40.4, 37.4, 30.2; HRMS (APCI) m/z calculated for $C_{19}H_{17}N_2O_3^+$ 321.1234, Found 321.1240.



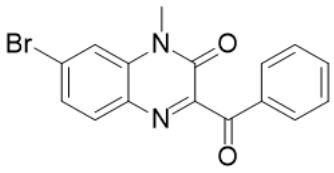
tert-butyl(3-(3-benzoyl-2-oxoquinoxalin-1(2H)-yl)propyl)carbamate (3na) Yellow oil; Yield: 56% (68 mg); R_f = 0.57 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (600 MHz, $CDCl_3$)** δ 8.01 (d, *J* = 8.0 Hz, 2H), 7.97 (d, *J* = 7.9 Hz, 1H), 7.70 (t, *J* = 7.9 Hz, 1H), 7.66 (t, *J* = 7.4 Hz, 1H), 7.51 (t, *J* = 7.8 Hz, 2H), 7.48-7.42 (m, 2H), 5.40 (s, 1H), 4.41 (t, *J* = 6.6 Hz, 2H), 3.19 (q, *J* = 6.2 Hz, 2H), 2.04 (m, 2H), 1.44 (s, 9H); **^{13}C NMR (150 MHz, $CDCl_3$)** δ 191.7, 156.1, 154.4, 153.7, 134.8, 134.3, 132.9, 132.6, 132.2, 131.4, 130.0, 128.8, 124.4, 114.0, 79.3, 39.8, 37.3, 28.4, 27.8; HRMS (APCI) m/z calculated for $C_{23}H_{25}N_3O_4$ 407.1845, Found 407.1853.



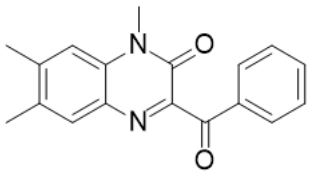
3-benzoyl-1-((trimethylsilyl)methyl)quinoxalin-2(1H)-one (3oa) Yellow oil; Yield: 48% (49 mg); R_f = 0.36 (petroleum ether/EtOAc, 3:1); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.85-7.80 (m, 3H), 7.56-7.45 (m, 2H), 7.34 (t, *J* = 7.7 Hz, 2H), 7.27 (t, *J* = 7.6 Hz, 2H), 3.79 (s, 2H), -0.00 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 193.4, 155.5, 154.2, 136.2, 135.4, 135.1, 133.9, 132.9, 132.4, 131.1, 129.9, 125.1, 115.9, 35.6, -0.00.



3-benzoyl-1-(3-((tert-butyldimethylsilyl)oxy)propyl)quinoxalin-2(1H)-one (3pa) Yellow oil; Yield: 43% (53 mg); R_f = 0.65 (petroleum ether/EtOAc, 3:1); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.00 (d, *J* = 7.4 Hz, 2H), 7.93 (d, *J* = 7.2 Hz, 1H), 7.71 (d, *J* = 8.2 Hz, 1H), 7.68-7.61 (m, 2H), 7.50 (t, *J* = 7.7 Hz, 2H), 7.40 (t, *J* = 7.2 Hz, 1H), 4.48 (t, *J* = 5.6 Hz, 2H), 4.05 (t, *J* = 5.6 Hz, 2H), 0.80 (s, 9H), -0.05 (s, 6H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 154.4, 153.3, 134.9, 134.2, 134.2, 132.3, 131.7, 130.8, 130.0, 128.7, 124.1, 115.5, 60.4, 44.9, 25.7, 25.7, 18.1, -5.56; HRMS (APCI) m/z calculated for $C_{23}H_{29}N_2O_3Si^+$ 409.1942, Found 409.1948.

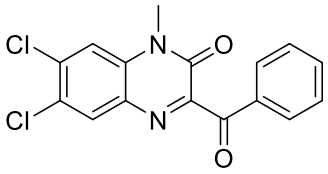


3-benzoyl-7-bromo-1-methylquinoxalin-2(1H)-one (3qa)[4] Yellow solid; m.p.219-220 °C ; Yield: 49% (51 mg); R_f = 0.41 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (600 MHz, $CDCl_3$)** δ 8.10 (d, *J* = 2.3 Hz, 1H), 7.99 (d, *J* = 7.7 Hz, 2H), 7.78 (m, 1H), 7.66 (t, *J* = 7.4 Hz, 1H), 7.52 (t, *J* = 7.8 Hz, 2H), 7.31 (d, *J* = 9.0 Hz, 1H), 3.75 (s, 3H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 191.2, 155.8, 153.0, 134.8, 134.6, 134.4, 133.3, 133.0, 132.9, 130.0, 128.8, 116.8, 115.5, 29.3. The produced spectral data is consistent with that in the literature.

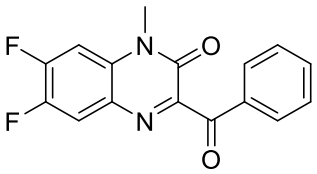


3-benzoyl-1,6,7-trimethylquinoxalin-2(1H)-one (3ia)[3] Yellow solid; m.p.150-151 °C; Yield: 68% (60 mg); R_f = 0.44 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (600 MHz, $CDCl_3$)** δ 8.00 (d, *J* = 8.0 Hz, 2H), 7.69 (s, 1H), 7.63 (t, *J* = 7.4 Hz, 1H), 7.49 (t, *J* = 7.8 Hz, 2H), 7.19 (s, 1H), 3.74 (s, 3H), 2.48 (s, 3H), 2.38 (s, 3H); **^{13}C NMR (150 MHz, $CDCl_3$)** δ 192.0, 153.5, 153.3, 142.5, 135.1, 134.1, 133.4, 132.0, 130.9, 130.7,

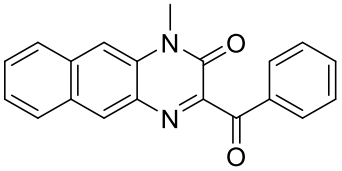
130.1, 128.6, 114.5, 29.0, 20.8, 19.2. The produced spectral data is consistent with that in the literature.



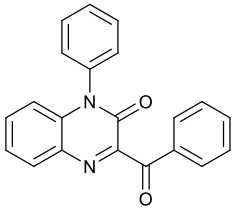
3-benzoyl-6,7-dichloro-1-methylquinoxalin-2(1H)-one (3sa)[3] Yellow solid; m.p.196-197 °C; Yield: 74% (72 mg); R_f = 0.66 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (600 MHz, $CDCl_3$)** δ 8.03 (s, 1H), 7.98 (d, *J* = 7.5 Hz, 2H), 7.67 (t, *J* = 7.4 Hz, 1H), 7.56-7.50 (m, 3H), 3.73 (s, 3H); **^{13}C NMR (150 MHz, $CDCl_3$)** δ 190.9, 155.8, 152.7, 136.4, 134.5, 134.5, 133.3, 131.7, 131.2, 130.0, 128.8, 128.3, 115.5, 29.3. The produced spectral data is consistent with that in the literature.



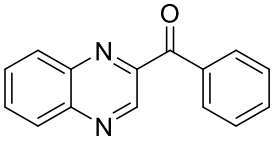
3-benzoyl-6,7-difluoro-1-methylquinoxalin-2(1H)-one (3ta)[3] Yellow solid; m.p.187-188 °C; Yield: 78% (70 mg); R_f = 0.59 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.01-7.95 (m, 2H), 7.76 (m, 1H), 7.66 (t, *J* = 7.4 Hz, 1H), 7.51 (t, *J* = 7.8 Hz, 2H), 7.24 (m, 1H), 3.73 (s, 3H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 191.2, 153.0, 152.8 ((dd, $^1J_{C-F}$ = 254.9 Hz, $^2J_{C-F}$ =14.3 Hz), 147.1 (dd, $^1J_{C-F}$ = 247. 5 Hz, $^2J_{C-F}$ =14.2 Hz), 134.6 (134.62), 134.6 (134.60), 131.5 (dd, $^2J_{C-F}$ = 9.4 Hz, $^3J_{C-F}$ =2.3 Hz), 130.1, 128.9, 128.4, 118.7 (dd, $^2J_{C-F}$ = 18.1 Hz, $^3J_{C-F}$ =2.7 Hz), 103.0, 102.7, 29.7. The produced spectral data is consistent with that in the literature.



3-benzoyl-1-methylbenzo[g]quinoxalin-2(1H)-one (3ua)[5] Yellow solid; m.p.175-176°C; Yield: 64% (60 mg); R_f = 0.57 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (600 MHz, CDCl$_3$)** δ 8.46 (s, 1H), 8.06 (d, *J* = 7.9 Hz, 2H), 7.99 (m, 2H), 7.71 (s, 1H), 7.66 (m, 2H), 7.54 (m, 3H), 3.82 (s, 3H). **^{13}C NMR (150 MHz, CDCl$_3$)** δ 191.7, 155.3, 153.2, 134.9, 134.6, 134.3, 131.7, 131.4, 130.8, 130.1, 129.8, 128.8, 128.8, 128.8, 127.3, 125.8, 110.5, 29.0; HRMS (APCI) m/z calculated for $C_{20}H_{15}N_2O_2^+$ 315.1128, Found 315.1126. The produced spectral data is consistent with that in the literature.

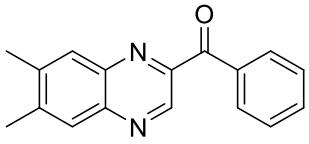


3-benzoyl-1-phenylquinoxalin-2(1H)-one (3va)[6] Yellow solid; Yield: 29% (29 mg); R_f = 0.45 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.07 (d, *J* = 7.7 Hz, 2H), 7.99 (d, *J* = 7.9 Hz, 1H), 7.69-7.55 (m, 4H), 7.50 (m, 3H), 7.44-7.35 (m, 3H), 6.82 (d, *J* = 8.4 Hz, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 191.6, 155.4, 153.0, 134.9, 134.9, 134.8, 134.3, 132.1, 131.8, 130.6, 130.4, 130.1, 129.8, 128.7, 128.3, 124.4, 115.8. The produced spectral data is consistent with that in the literature.

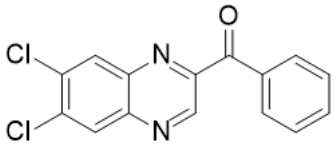


phenyl(quinoxalin-2-yl)methanone (3wa)[7] Yellow solid; m.p.80-81 °C; Yield: 39% (27 mg); R_f = 0.45 (petroleum ether/EtOAc, 15:1);**^{1}H NMR (300 MHz, CDCl$_3$)** δ 9.46 (s, 1H), 8.19 (m, 4H), 7.90-7.78 (m, 2H), 7.63 (t, *J* = 7.4 Hz, 1H), 7.51 (t, *J* = 7.6 Hz,

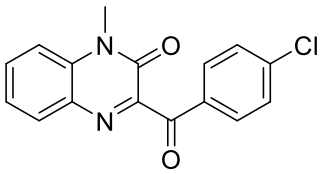
2H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 192.3, 148.6, 145.3, 143.1, 140.4, 135.5, 133.7, 132.0, 131.3, 130.8, 130.4, 129.4, 128.4. The produced spectral data is consistent with that in the literature.



(6,7-dimethylquinoxalin-2-yl)(phenyl)methanone (3xa)[8] Red solid; m.p.79-80 °C; Yield: 37% (29 mg); R_f = 0.60 (petroleum ether/EtOAc, 15:1); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 9.43 (s, 1H), 8.25 (d, *J* = 7.2 Hz, 2H), 7.97 (s, 2H), 7.68 (t, *J* = 7.4 Hz, 1H), 7.56 (t, *J* = 7.7 Hz, 2H), 2.56 (d, *J* = 11.4 Hz, 6H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 192.7, 147.8, 144.6, 143.3, 142.2, 141.6, 139.4; 135.8, 133.5, 131.3, 129.4, 128.4, 128.3, 20.7, 20.4. The produced spectral data is consistent with that in the literature.

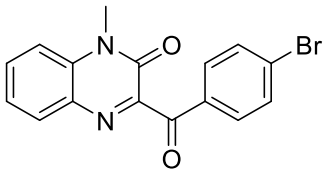


(6,7-dichloroquinoxalin-2-yl)(phenyl)methanone (3ya)[8] Yellow solid; m.p.151-152 °C; Yield: 29% (26 mg); R_f = 0.66 (petroleum ether/EtOAc, 15:1); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 9.50 (s, 1H), 8.36 (d, *J* = 1.9 Hz, 2H), 8.28-8.19 (m, 2H), 7.71 (t, *J* = 7.4 Hz, 1H), 7.57 (t, *J* = 7.7 Hz, 2H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 191.7, 149.2, 146.4, 141.8, 139.1, 137.0, 135.8, 135.1, 134.0, 131.2, 130.9, 130.1, 128.5. The produced spectral data is consistent with that in the literature.

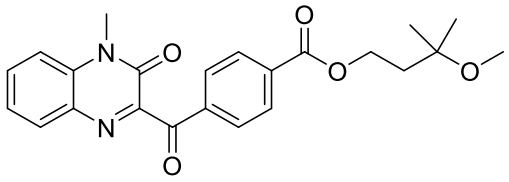


3-(4-chlorobenzoyl)-1-methylquinoxalin-2(1H)-one (3ab)[3] Yellow solid; m.p.113-114 °C; Yield: 58% (52 mg); R_f = 0.47 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (400**

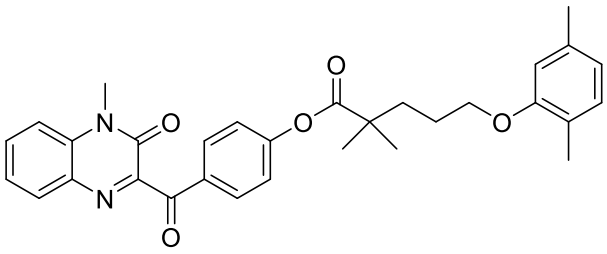
MHz, $CDCl_3$) δ 7.95 (m, 3H), 7.76-7.67 (m, 1H), 7.46 (m, 4H), 3.78 (s, 3H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 190.5, 154.0, 153.3, 140.8, 134.0, 133.3, 132.4, 132.1, 131.4, 131.1, 129.1, 124.4, 114.1, 29.2. The produced spectral data is consistent with that in the literature.



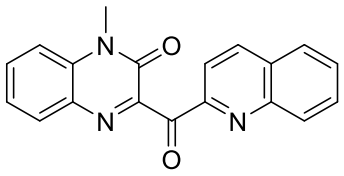
3-(4-bromobenzoyl)-1-methylquinoxalin-2(1H)-one (3ac)[5] Yellow solid; m.p.194-195 °C; Yield: 55% (56 mg); R_f = 0.48 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.91 (m, 3H), 7.67 (m, 3H), 7.44 (t, *J* = 7.3 Hz, 2H), 3.77 (s, 3H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 190.7, 154.0, 153.3, 134.0, 133.7, 132.3, 132.2, 132.1, 131.4, 131.1, 129.7, 124.3, 114.0, 29.1. The produced spectral data is consistent with that in the literature.



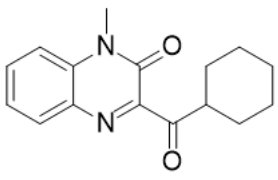
3-methoxy-3-methylbutyl4-(4-methyl-3-oxo-3,4-dihydroquinoxaline-2-carbonyl)benzoate (3ad) Yellow solid; m.p.71-72 °C; Yield: 46% (56 mg); R_f = 0.37 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.16-8.11 (m, 2H), 8.07-8.03 (m, 2H), 7.94 (m, 1H), 7.71 (m, 1H), 7.44 (t, *J* = 7.6 Hz, 2H), 4.46 (t, *J* = 7.2 Hz, 2H), 3.77 (s, 3H), 3.23 (s, 3H), 1.99 (t, *J* = 7.2 Hz, 2H), 1.25 (s, 6H); **^{13}C NMR (150 MHz, $CDCl_3$)** δ 191.1, 165.7, 154.0, 153.3, 138.1, 135.0, 134.0, 132.4, 132.2, 131.2, 129.8, 129.8, 124.3, 114.0, 73.5, 62.2, 49.3, 38.4, 29.1, 25.3; HRMS (APCI) m/z calculated for $C_{23}H_{25}N_2O_5^+$ 409.1758, Found 409.1764.



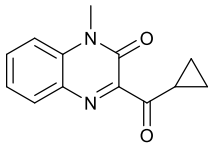
4-(4-methyl-3-oxo-3,4-dihydroquinoxaline-2-carbonyl)phenyl5-(2,5-dimethylphenoxy)-2,2-dimethylpentanoate (3ae) Yellow oil; Yield: 42% (65 mg); R_f = 0.49 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.02 (d, *J* = 8.7 Hz, 2H), 7.93 (d, *J* = 7.9 Hz, 1H), 7.72-7.66 (m, 1H), 7.42 (t, *J* = 7.8 Hz, 2H), 7.16 (d, *J* = 8.7 Hz, 2H), 6.99 (d, *J* = 7.4 Hz, 1H), 6.67-6.61 (m, 2H), 3.98 (t, *J* = 5.4 Hz, 2H), 3.76 (s, 3H), 2.30 (s, 3H), 2.16 (s, 3H), 1.88 (s, 4H), 1.38 (s, 6H); **^{13}C NMR (150 MHz, $CDCl_3$)** δ 190.4, 175.6, 156.8, 155.7, 154.3, 153.3, 136.5, 134.0, 132.4, 132.2, 131.7, 131.1, 130.4, 124.3, 123.6, 121.9, 120.8, 114.0, 112.0, 67.7, 42.7, 37.1, 29.1, 25.3, 25.1, 21.4, 15.8; HRMS (APCI) m/z calculated for $C_{31}H_{33}N_2O_5^+$ 513.2384, Found 513.2394.



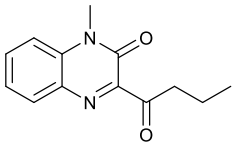
1-methyl-3-(quinoline-2-carbonyl)quinoxalin-2(1H)-one (3af) Yellow solid; m.p.228-229 °C; Yield: 46% (44 mg); R_f = 0.47 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.36 (d, *J* = 8.5 Hz, 1H), 8.29 (d, *J* = 8.5 Hz, 1H), 7.99 (m, 2H), 7.88 (d, *J* = 7.9 Hz, 1H), 7.72-7.65 (m, 2H), 7.65-7.59 (m, 1H), 7.43 (t, *J* = 7.6 Hz, 2H), 3.75 (s, 3H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 193.4, 157.4, 153.8, 152.4, 147.4, 137.3, 134.0, 132.9, 131.6, 131.1, 130.9, 129.9, 129.0, 127.7, 124.1, 118.7, 114.0, 28.9; HRMS (APCI) m/z calculated for $C_{19}H_{14}N_3O_2^+$ 316.1081, Found 316.1087.



3-(cyclohexanecarbonyl)-1-methylquinoxalin-2(1H)-one (3ag)[5] Yellow solid; m.p.109-110 °C; Yield: 33% (27 mg); R_f = 0.52 (petroleum ether/EtOAc, 2:1); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.94 (m, 1H), 7.72-7.62 (m, 1H), 7.46-7.34 (m, 2H), 3.73 (s, 3H), 3.33 (m, 1H), 2.00 (d, *J* = 15.9 Hz, 2H), 1.87-1.78 (m, 2H), 1.69 (m, 1H), 1.53 (q, *J* = 13.1, 12.5 Hz, 2H), 1.43-1.32 (m, 2H), 1.27 (d, *J* = 11.8 Hz, 1H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ 204.0, 154.3, 153.1, 134.0, 132.1, 131.2, 124.1, 113.9, 47.9, 29.0, 27.8, 25.9, 25.5. The produced spectral data is consistent with that in the literature.



3-(cyclopropanecarbonyl)-1-methylquinoxalin-2(1H)-one (3ah)[9] Yellow solids; m.p. 133-134℃; Yield: 21% (15 mg); R_f = 0.21 (petroleum ether/EtOAc, 3:1); **^{1}H NMR (600 MHz, $CDCl_3$)** δ 8.00 (d, *J* = 8.0 Hz, 1H), 7.74-7.66 (m, 1H), 7.47-7.35 (m, 2H), 3.76 (s, 3H), 2.85 (m, 1H), 1.41 (m, 2H), 1.18 (m, 2H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 200.5, 153.0, 152.8, 134.4, 132.5, 132.1, 131.5, 124.1, 113.9, 29.0, 20.0, 13.2. The produced spectral data is consistent with that in the literature.



3-butyryl-1-methylquinoxalin-2(1H)-one (3ai)[9] Yellow solid; Yield: 25% (17 mg); R_f = 0.51 (petroleum ether/EtOAc, 1:1); **^{1}H NMR (600 MHz, $CDCl_3$)** δ 7.95 (d, *J* = 8.0 Hz, 1H), 7.69 (t, *J* = 7.8 Hz, 1H), 7.46-7.32 (m, 2H), 3.74 (s, 3H), 3.08 (t, *J* = 7.3 Hz, 2H), 1.81 (h, *J* = 7.4 Hz, 2H), 1.04 (t, *J* = 7.4 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 201.0, 153.0, 152.9, 134.3, 132.5, 132.0, 131.3, 124.1, 113.9, 42.7, 29.0, 17.0, 13.8. The produced spectral data is consistent with that in the literature.

9. References

[1] Dou G Y, Jiang Y Y, Xu K, Zeng C C. Org. Chem. Front., **2019**, *6*, 2392-2397.

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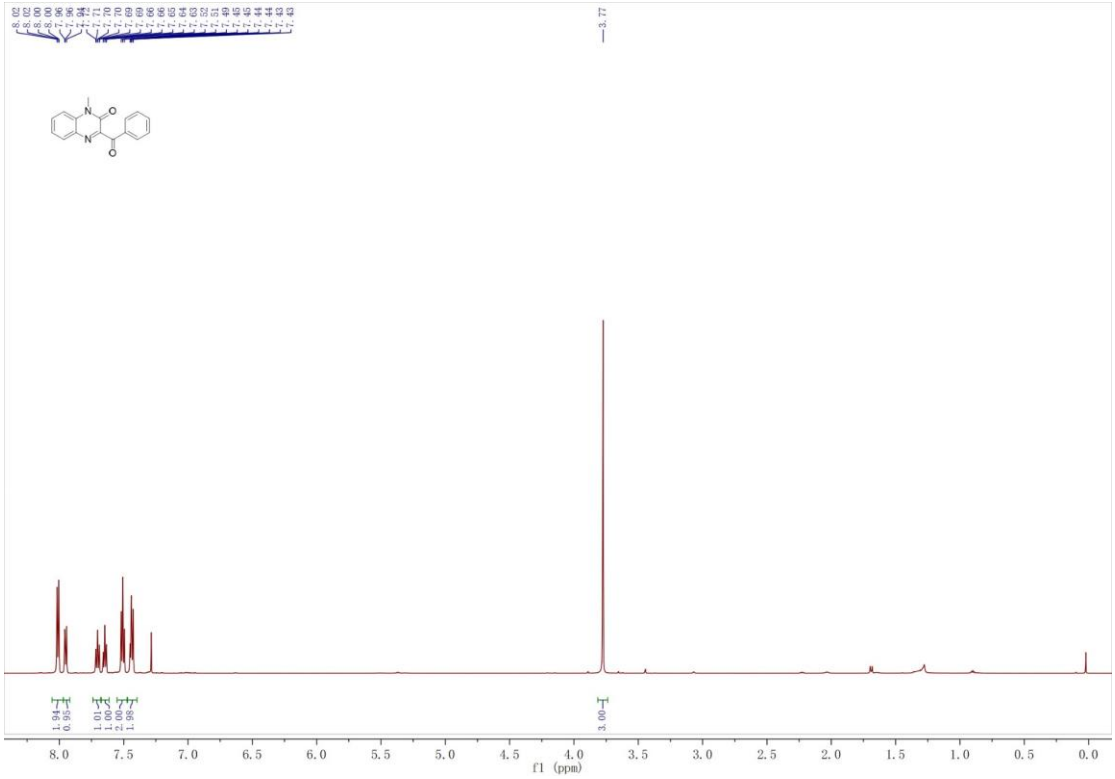
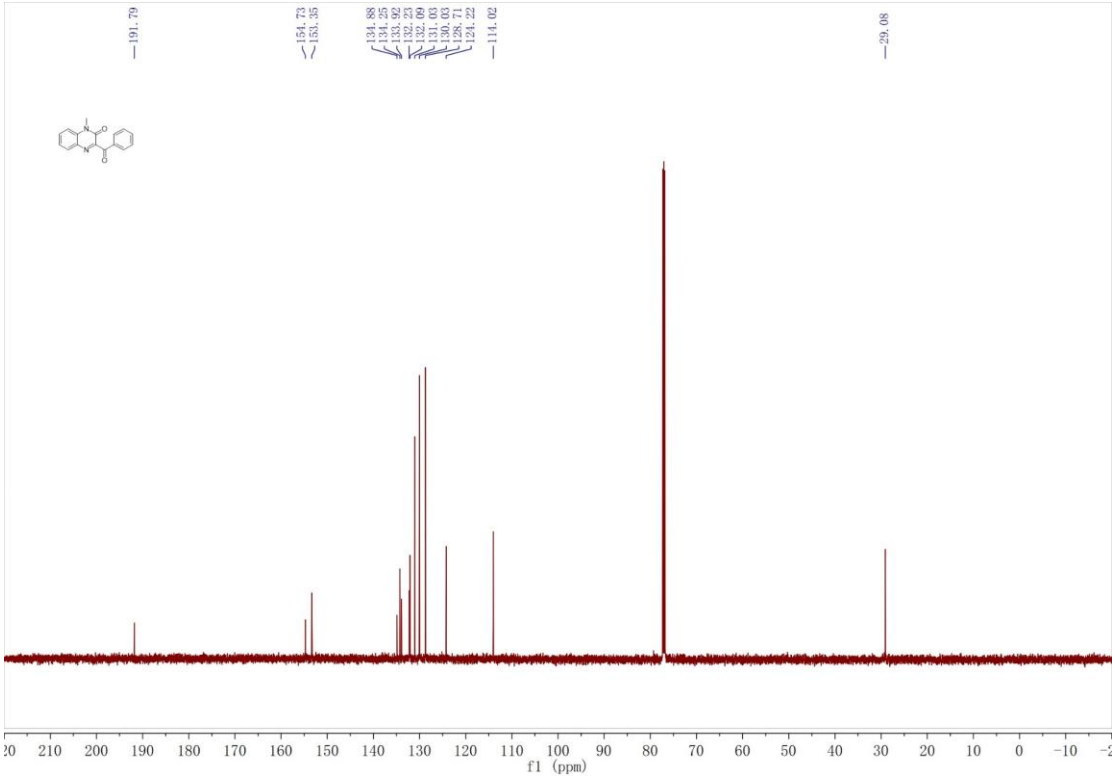
10. Spectra of prepared compounds

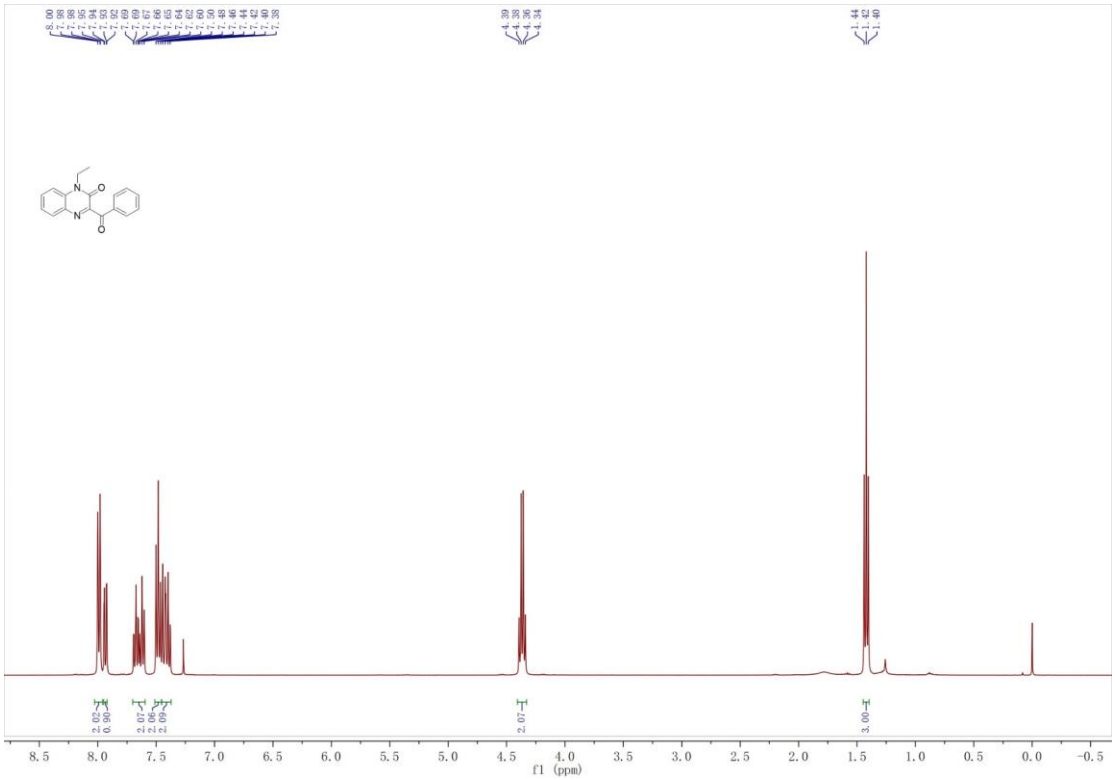
^{1}H NMR spectra of 3-benzoyl-1-methylquinoxalin-2(1H)-one(3aa)



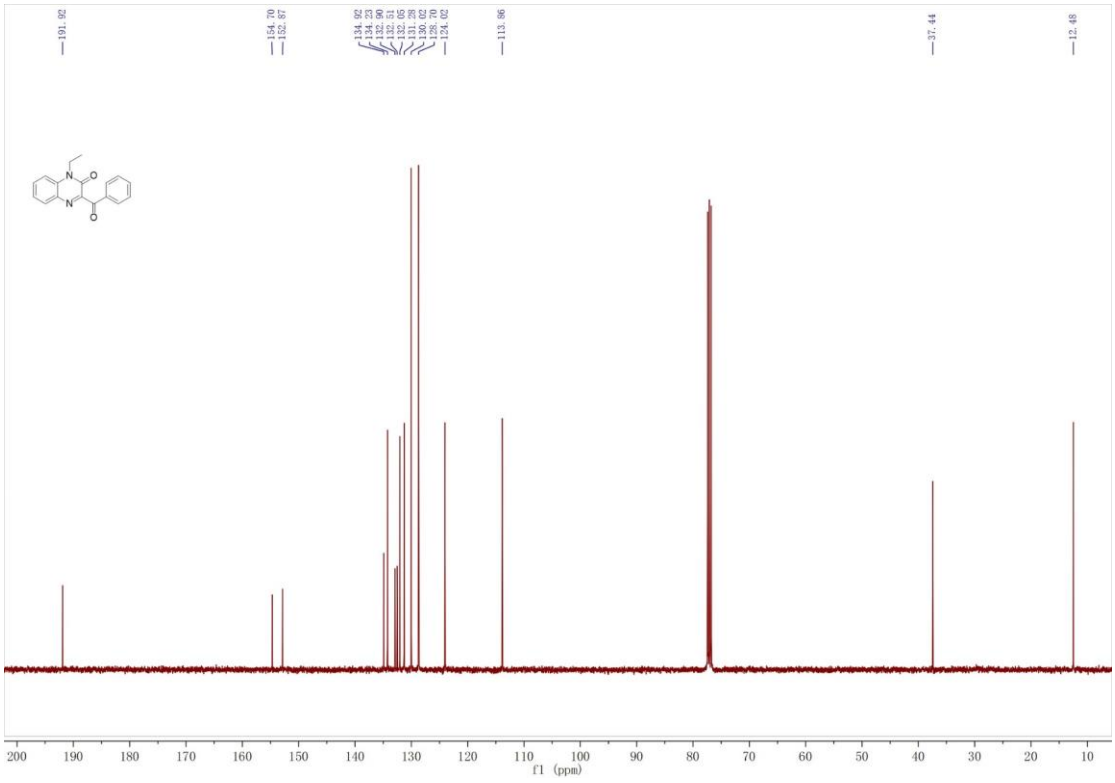
^{13}C NMR spectra of 3-benzoyl-1-methylquinoxalin-2(1H)-one(3aa)



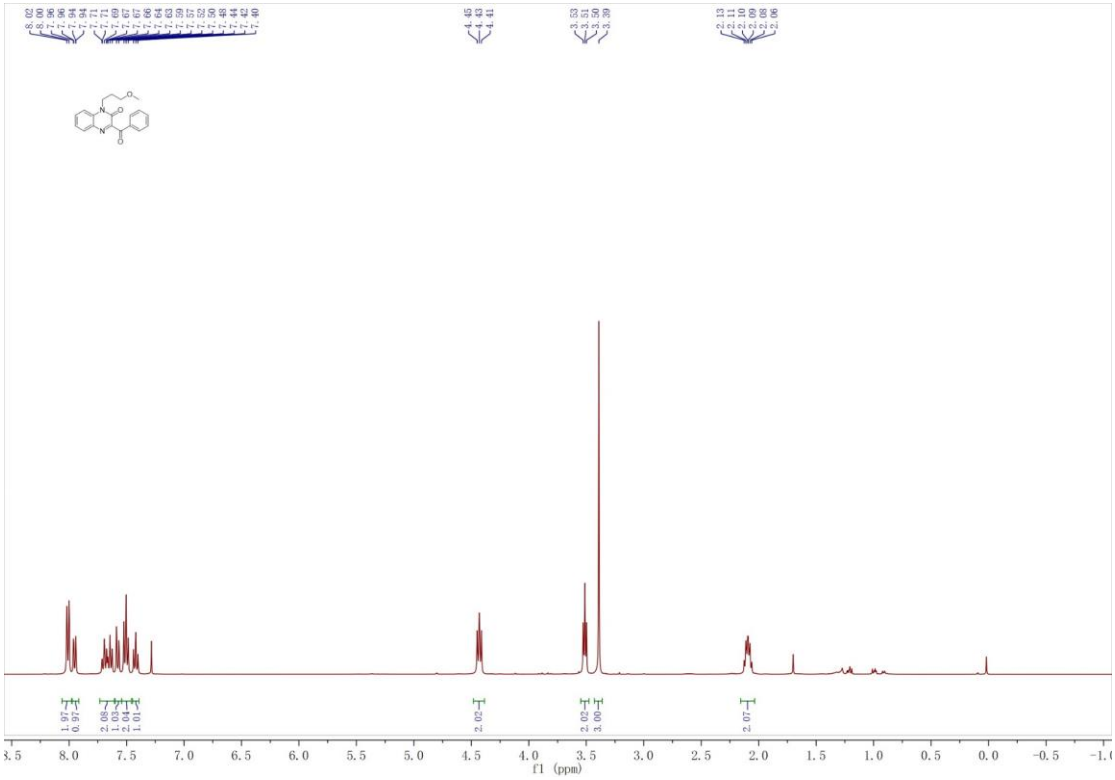
^{1}H NMR spectra of 3-benzoyl-1-ethylquinoxalin-2(1H)-one(3ba)



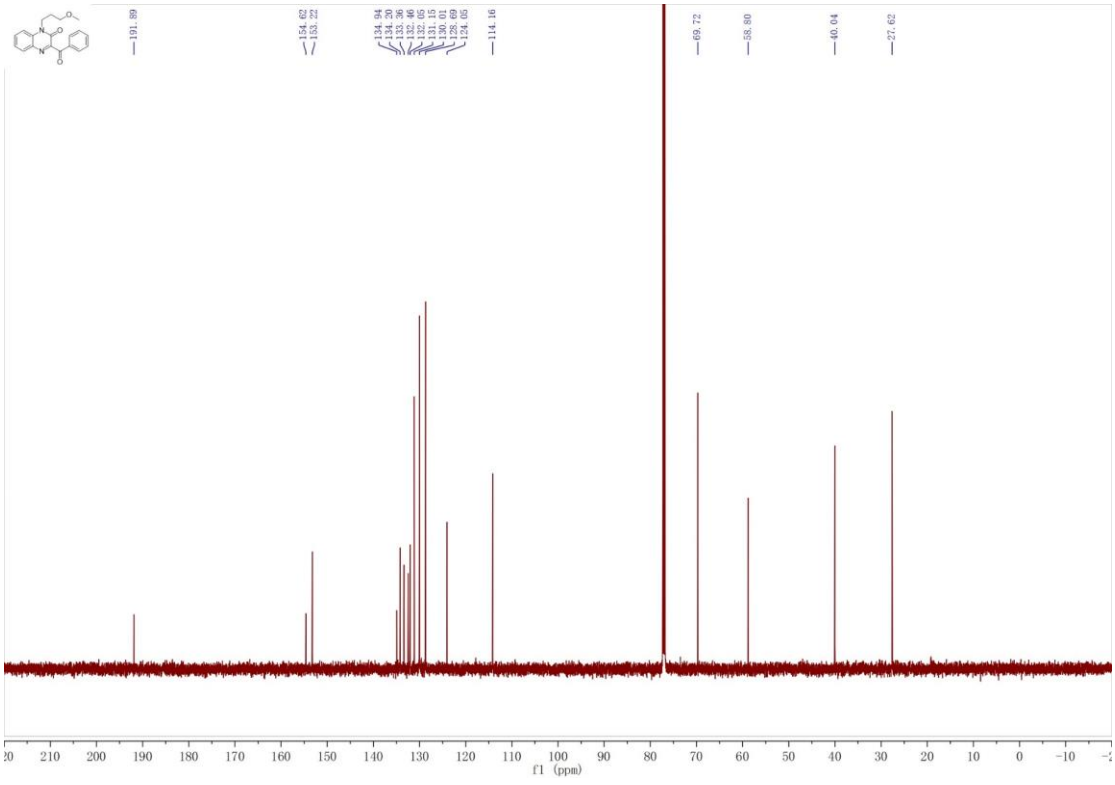
^{13}C NMR spectra of 3-benzoyl-1-ethylquinoxalin-2(1H)-one(3ba)



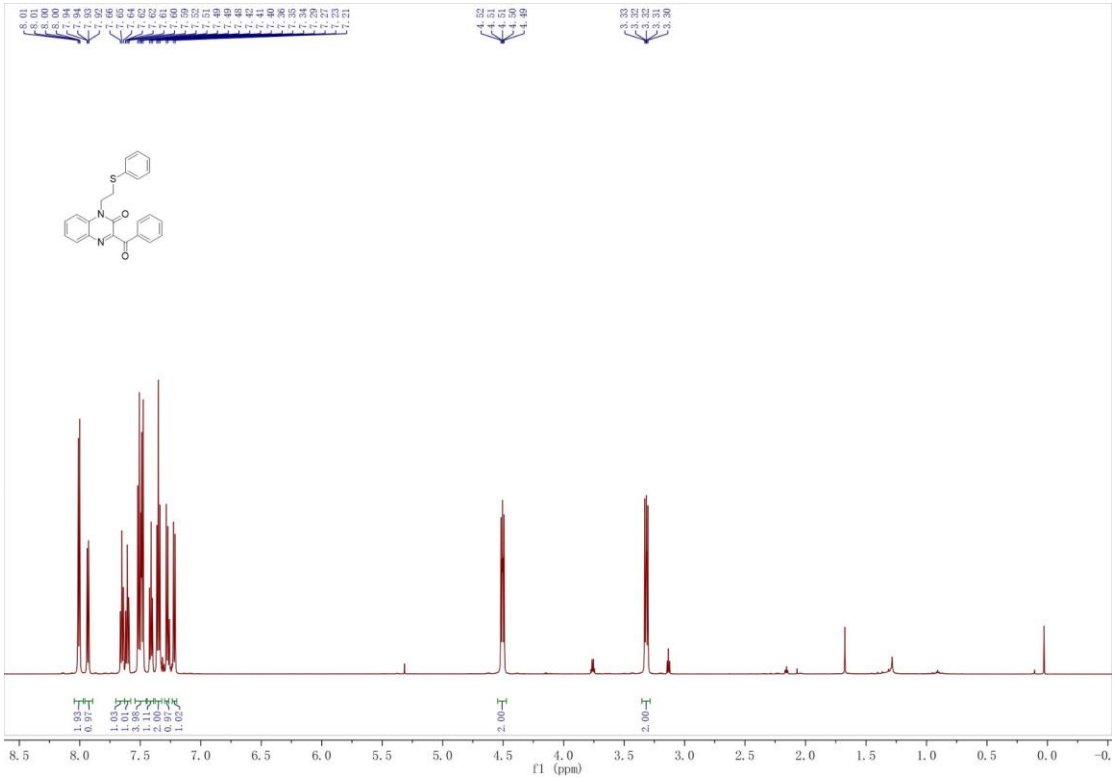
^{1}H NMR spectra of 3-benzoyl-1-(3-methoxypropyl)quinoxalin-2(1H)-one(3ca)



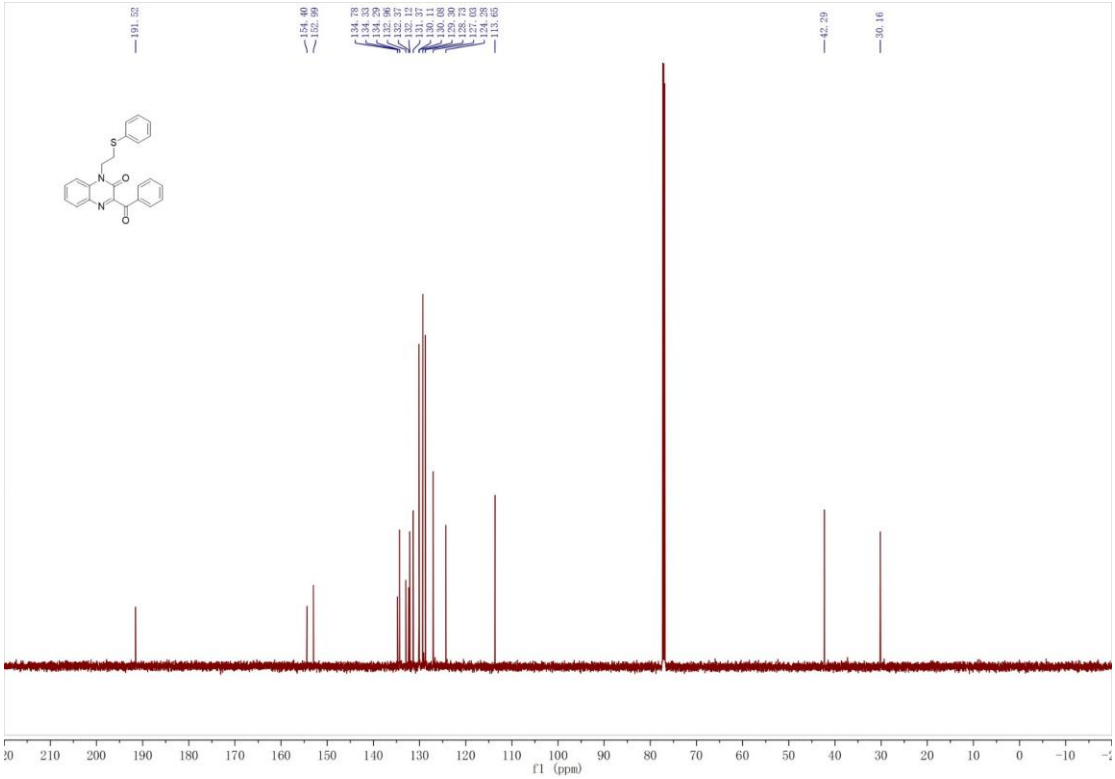
^{13}C NMR spectra of 3-benzoyl-1-(3-methoxypropyl)quinoxalin-2(1H)-one(3ca)



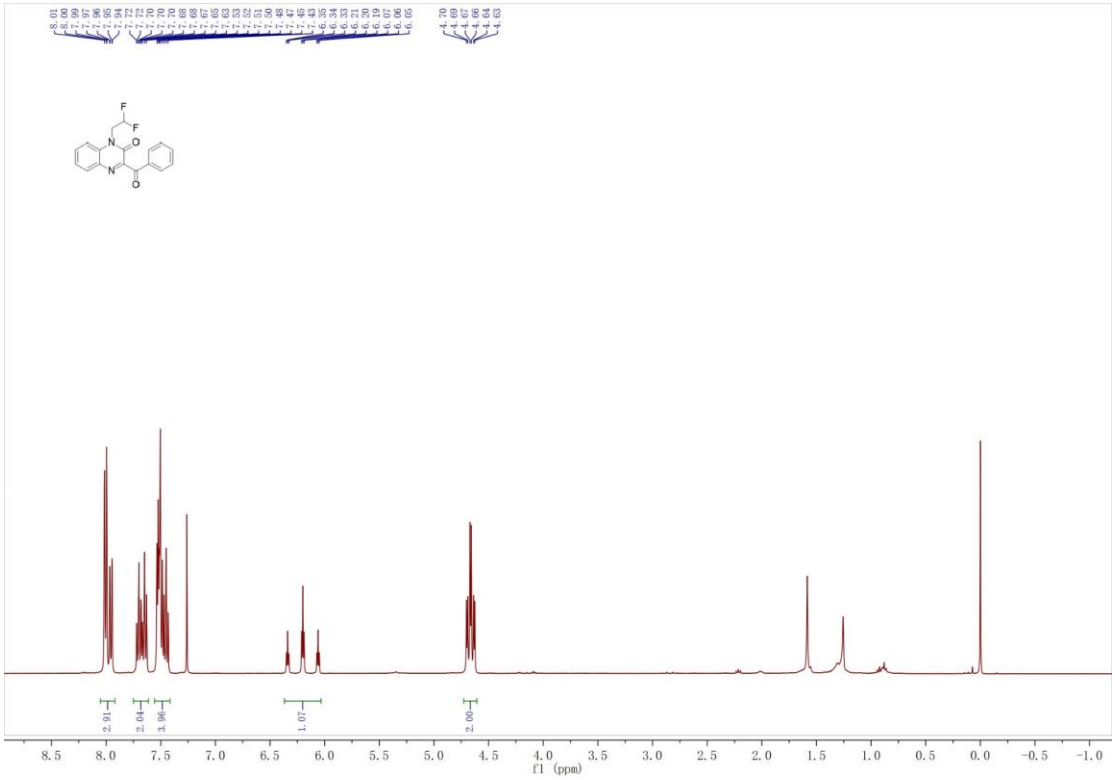
^{1}H NMR spectra of 3-benzoyl-1-(2-(phenylthio)ethyl)quinoxalin-2(1H)-one(3da)



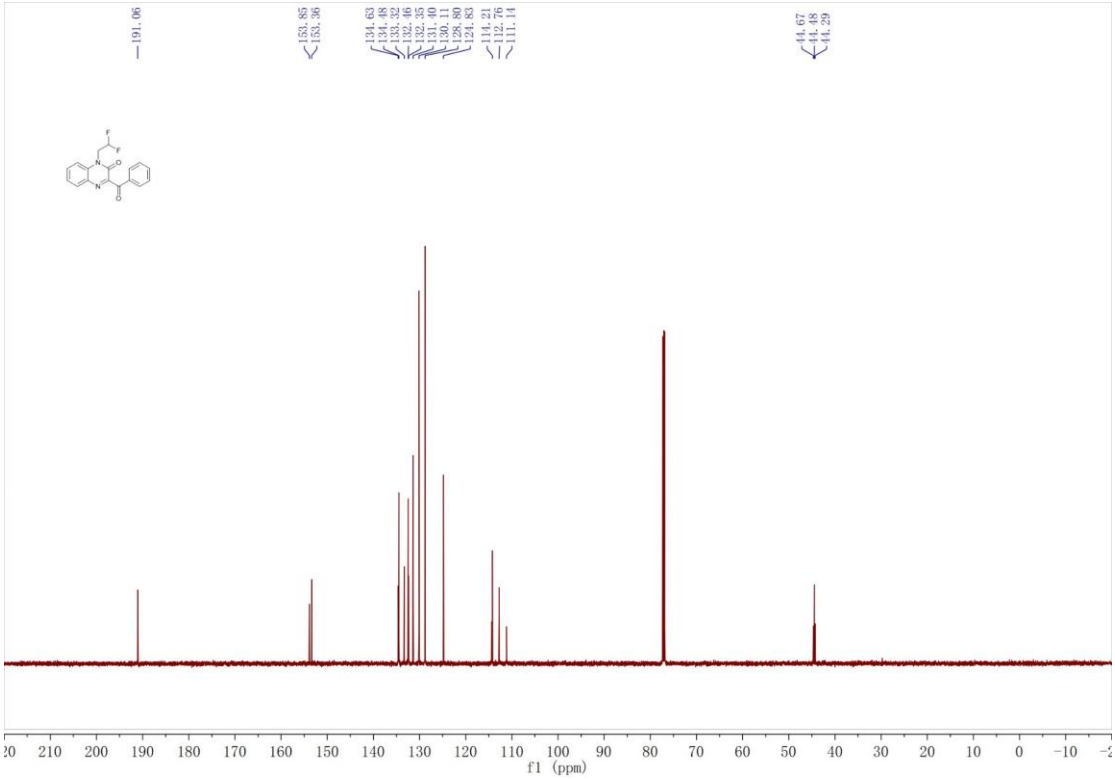
^{13}C NMR spectra of 3-benzoyl-1-(2-(phenylthio)ethyl)quinoxalin-2(1H)-one(3da)



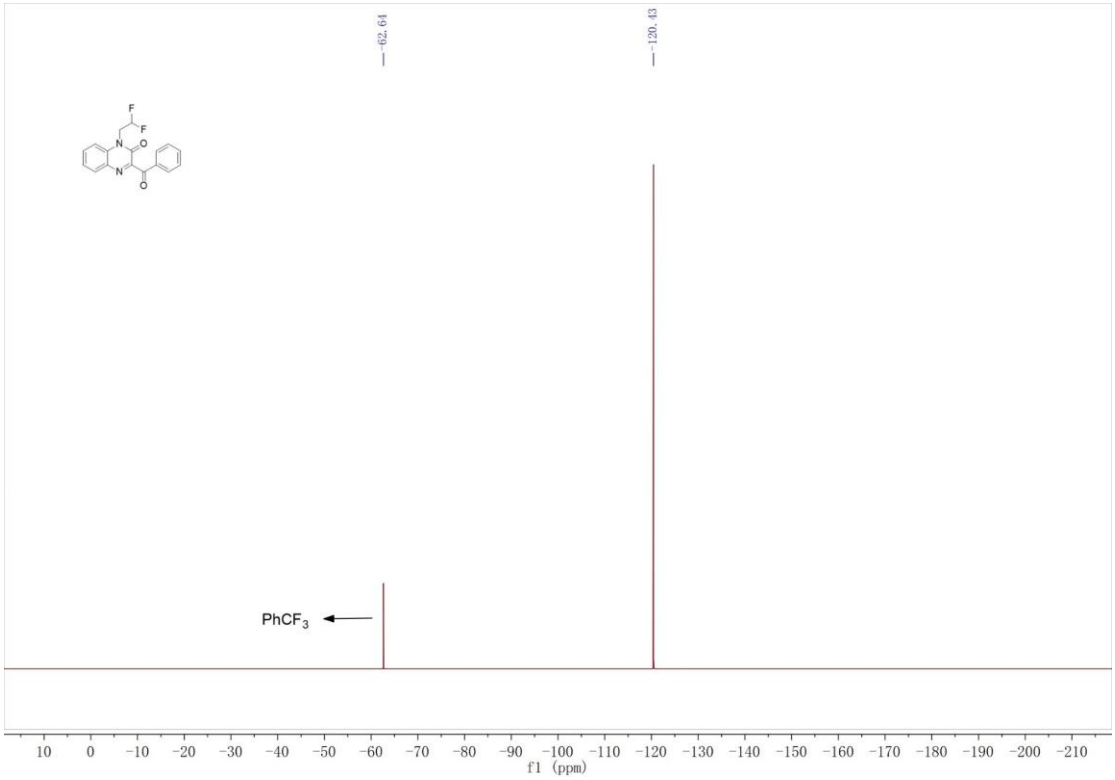
^{1}H NMR spectra of 3-benzoyl-1-(2,2-difluoroethyl)quinoxalin-2(1H)-one(3ea)



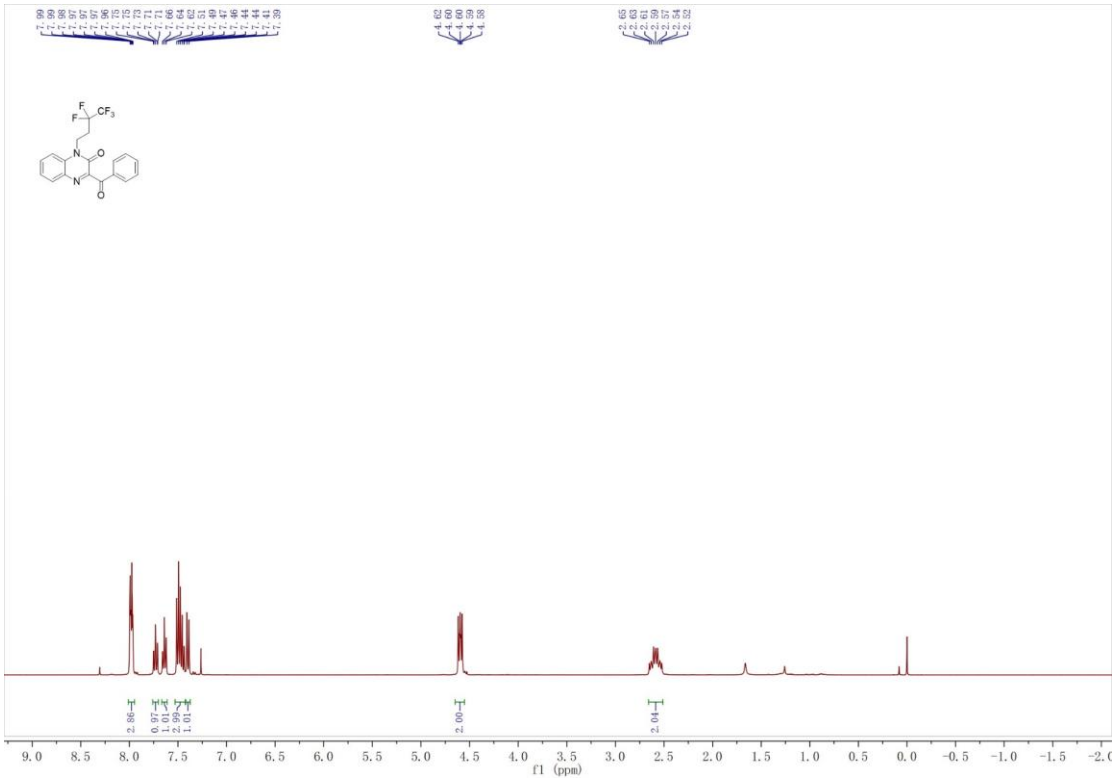
^{13}C NMR spectra of 3-benzoyl-1-(2,2-difluoroethyl)quinoxalin-2(1H)-one(3ea)



^{19}F NMR spectra of 3-benzoyl-1-(2,2-difluoroethyl)quinoxalin-2(1H)-one(3ea)

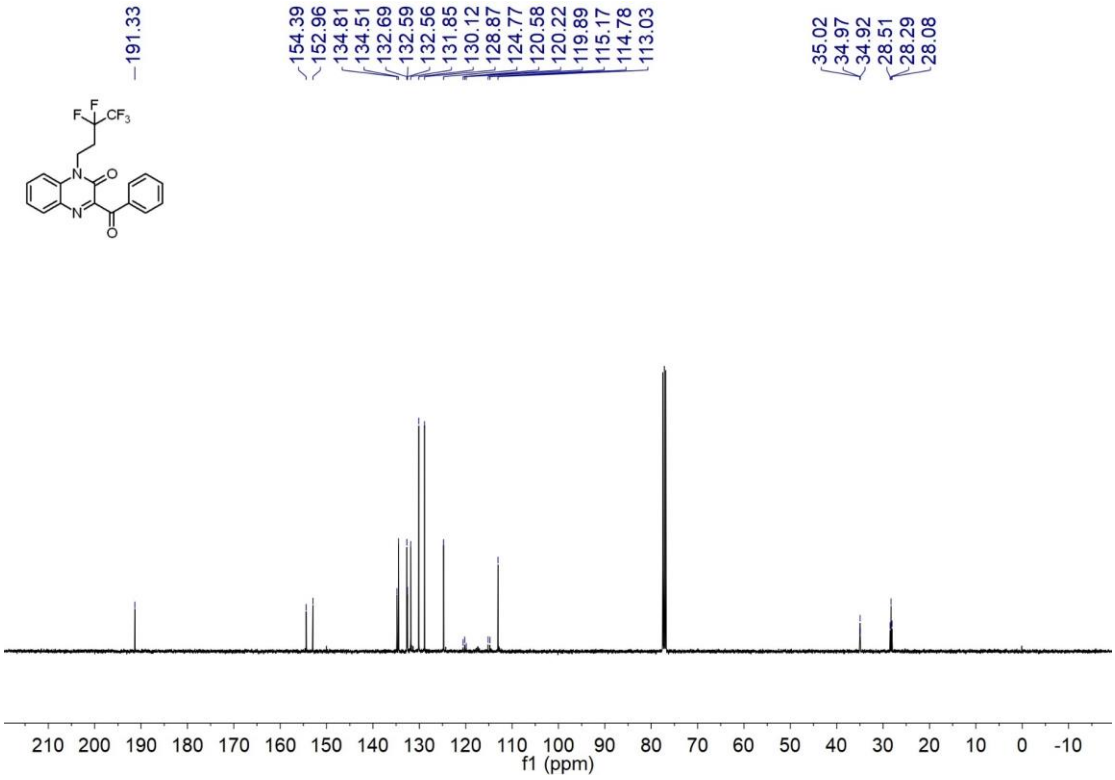


^{1}H NMR spectra of 3-benzoyl-1-(3,3,4,4,4-pentafluorobutyl)quinoxalin-2(1H)-one(3fa)

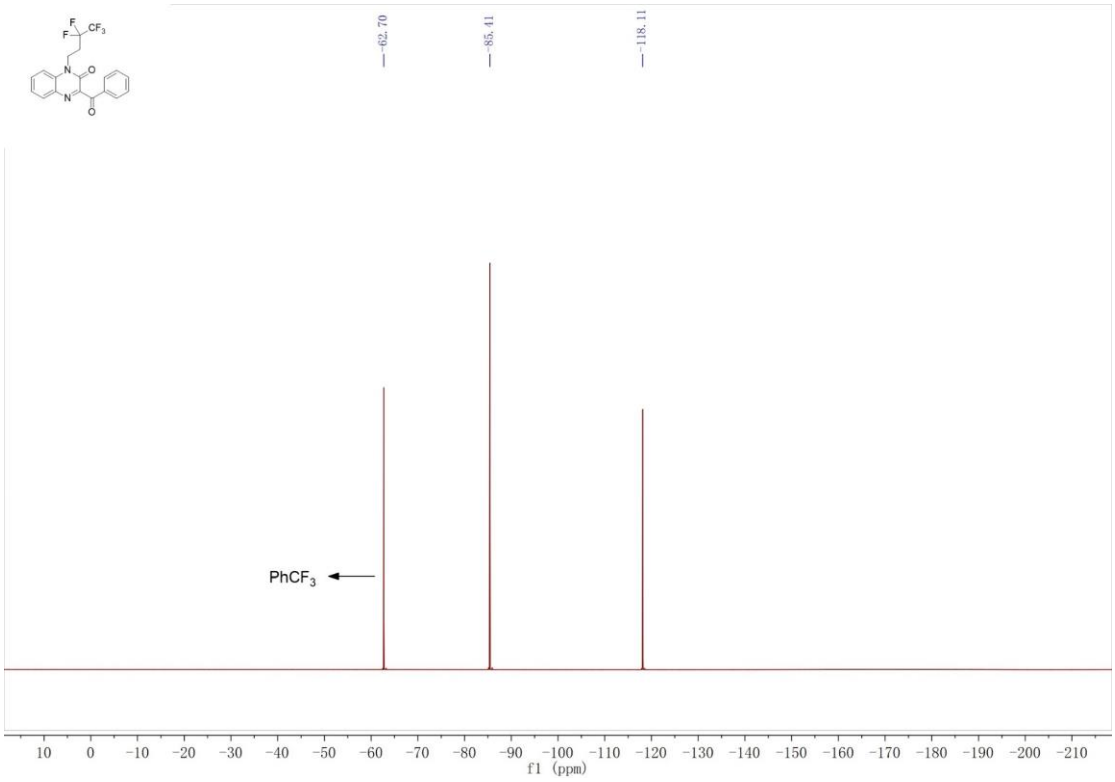


^{13}C NMR spectra of 3-benzoyl-1-(3,3,4,4,4-pentafluorobutyl)quinoxalin-2(1H)-

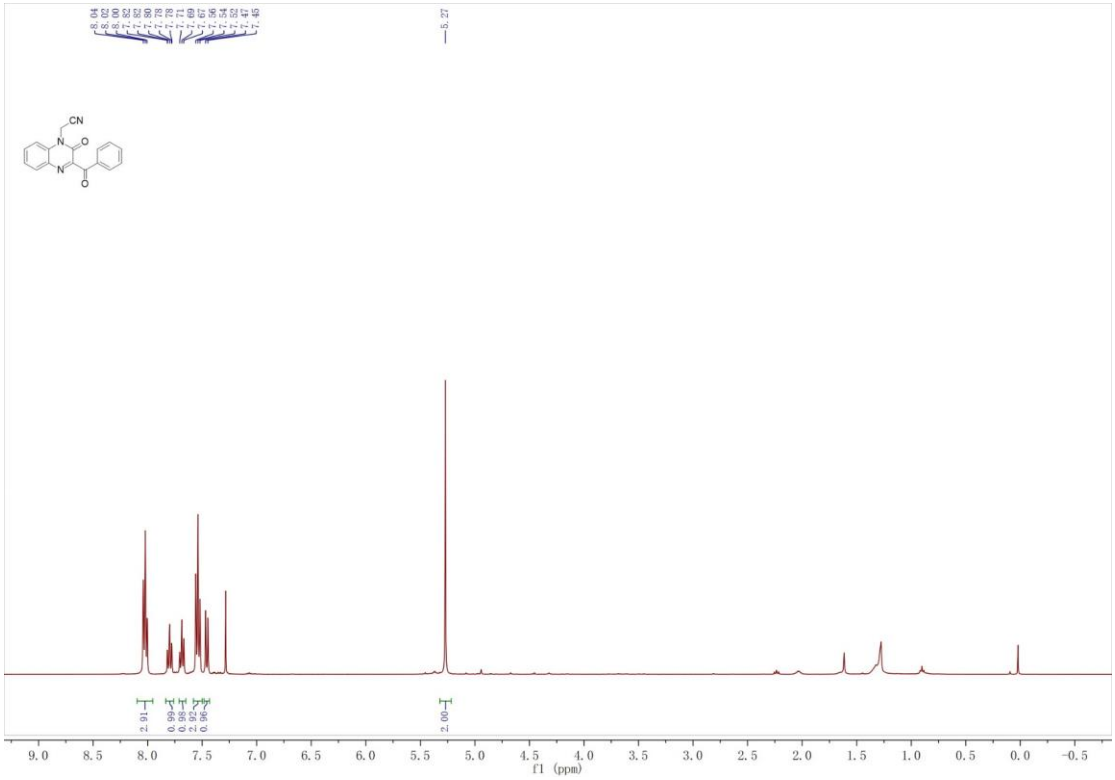
one(3fa)



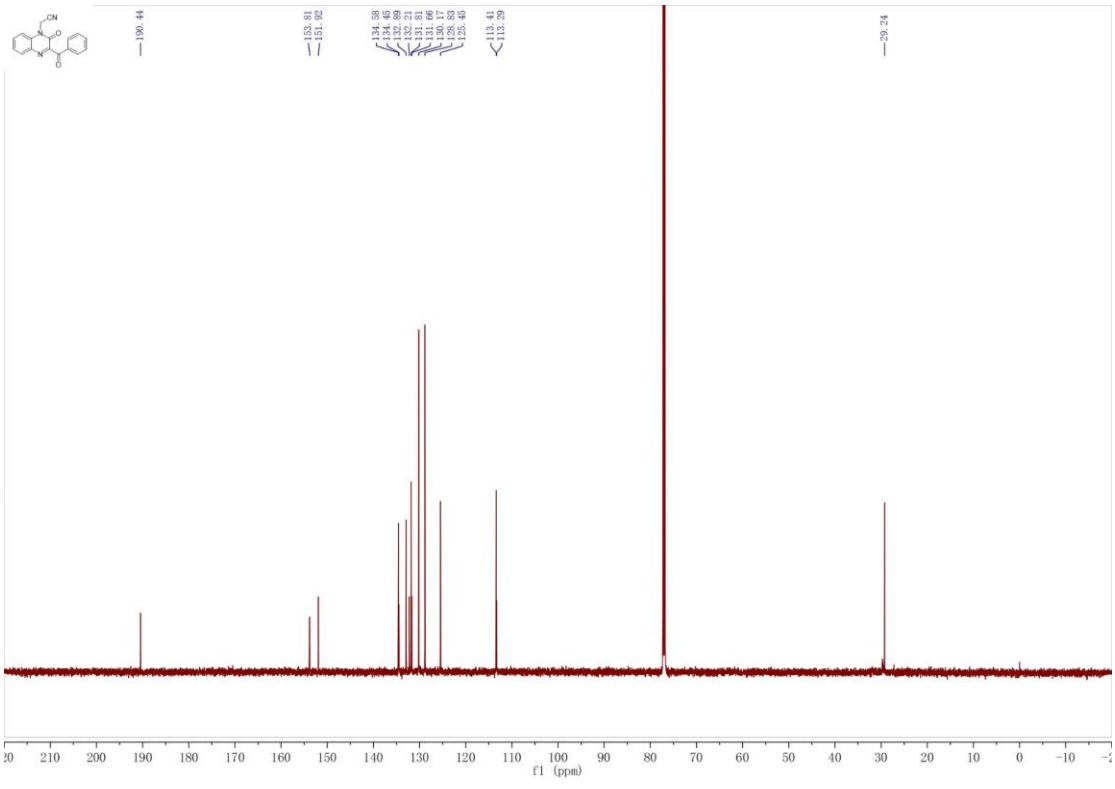
^{19}F NMR spectra of 3-benzoyl-1-(3,3,4,4,4-pentafluorobutyl)quinoxalin-2(1H)-one(3fa)



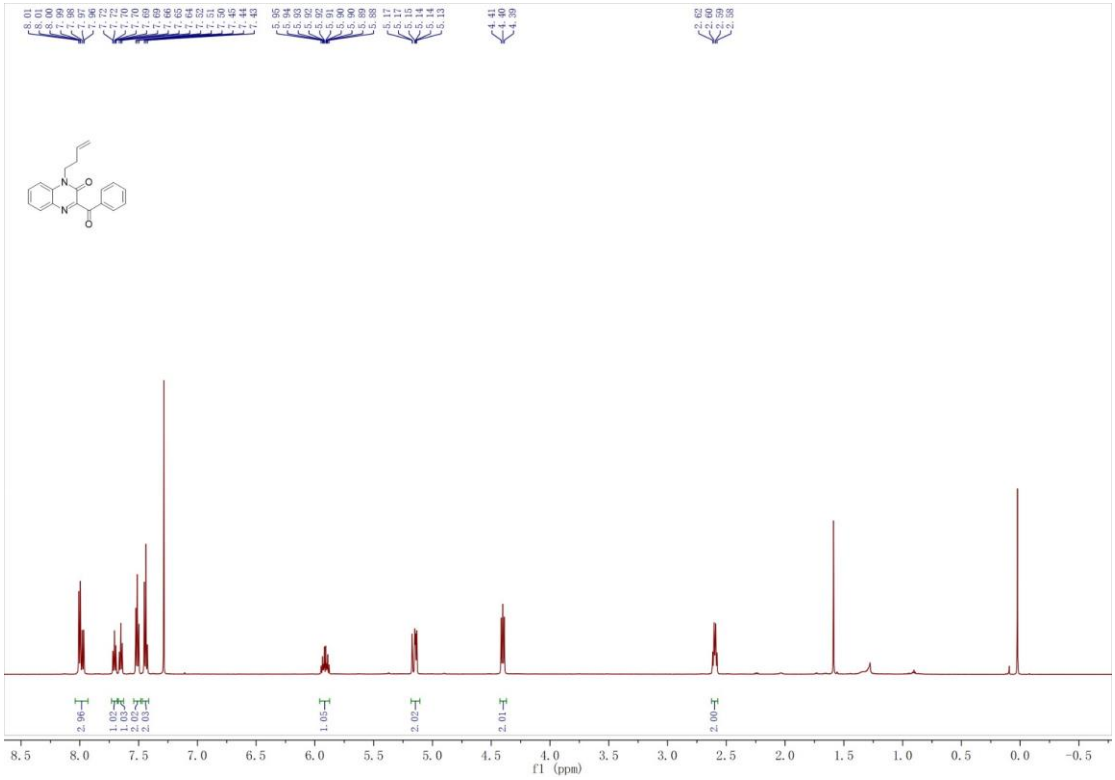
^{1}H NMR spectra of 2-(3-benzoyl-2-oxoquinoxalin-1(2H)-yl)acetonitrile(3ga)



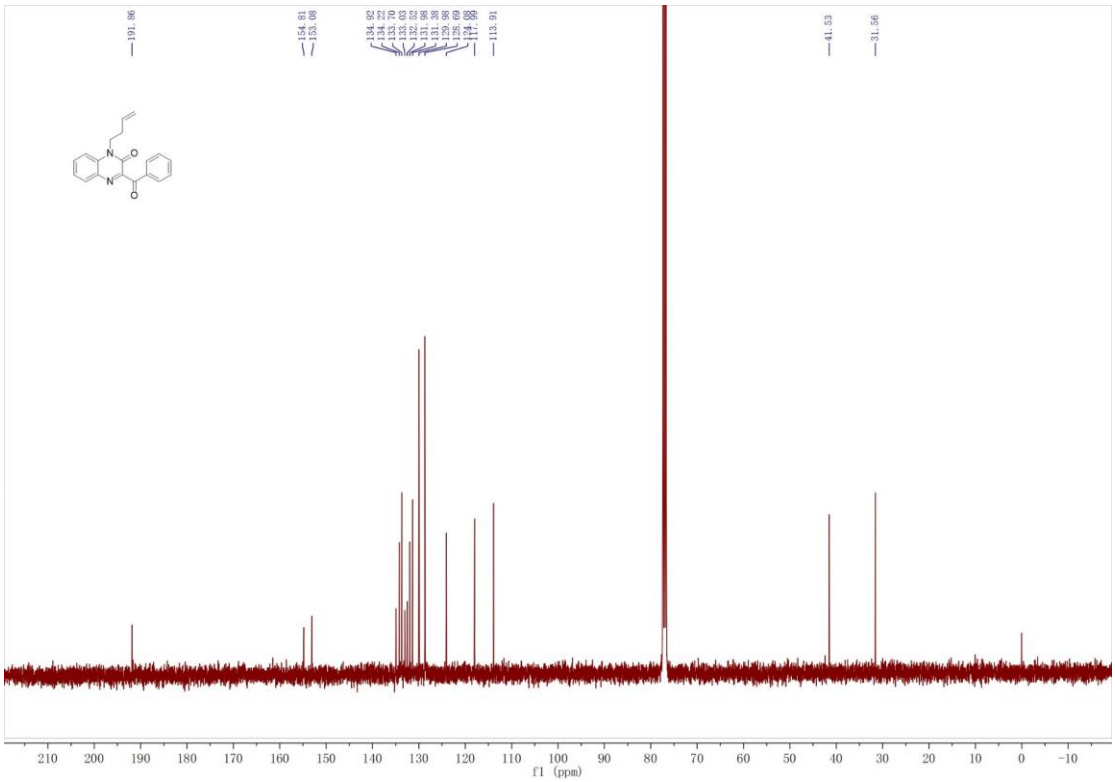
^{13}C NMR spectra of 2-(3-benzoyl-2-oxoquinoxalin-1(2H)-yl)acetonitrile(3ga)



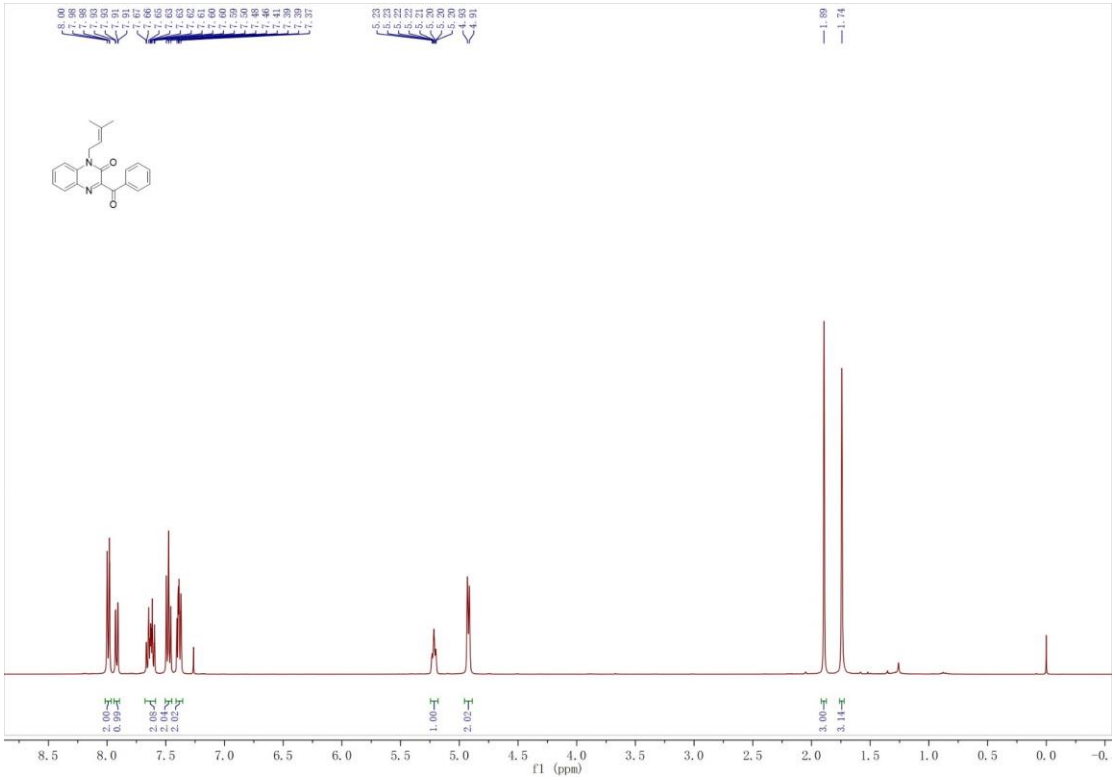
^{1}H NMR spectra of 3-benzoyl-1-(but-3-en-1-yl)quinoxalin-2(1H)-one(3ha)



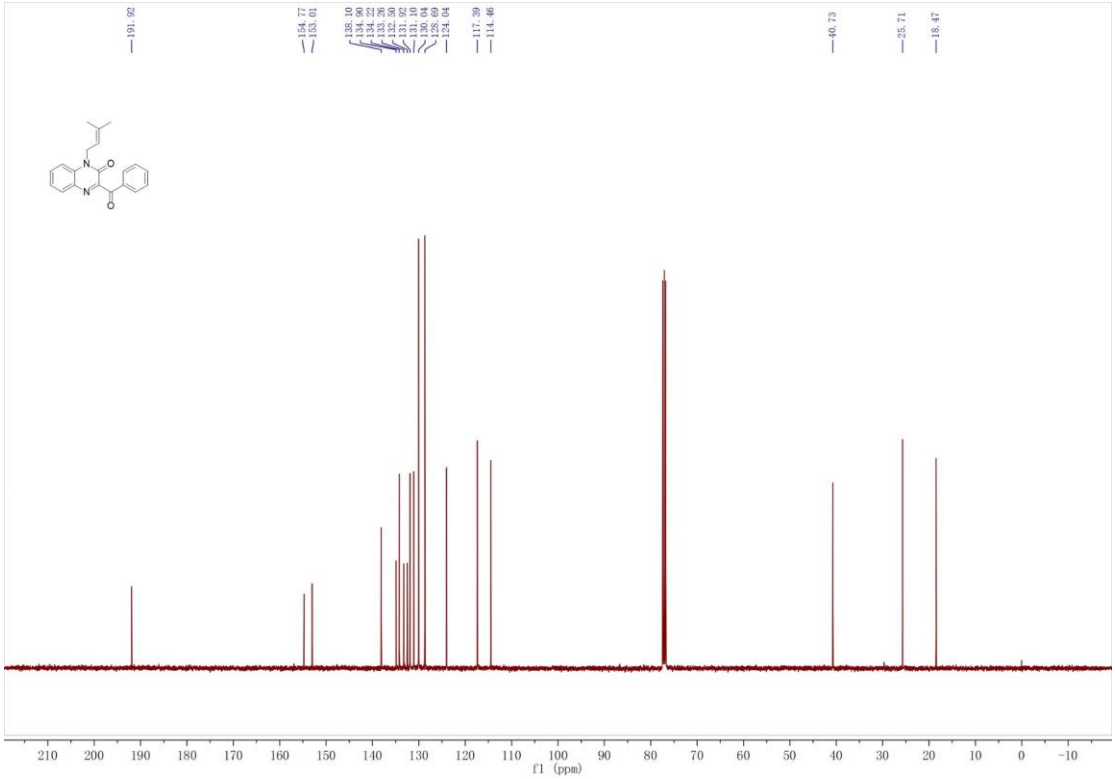
^{13}C NMR spectra of 3-benzoyl-1-(but-3-en-1-yl)quinoxalin-2(1H)-one(3ha)



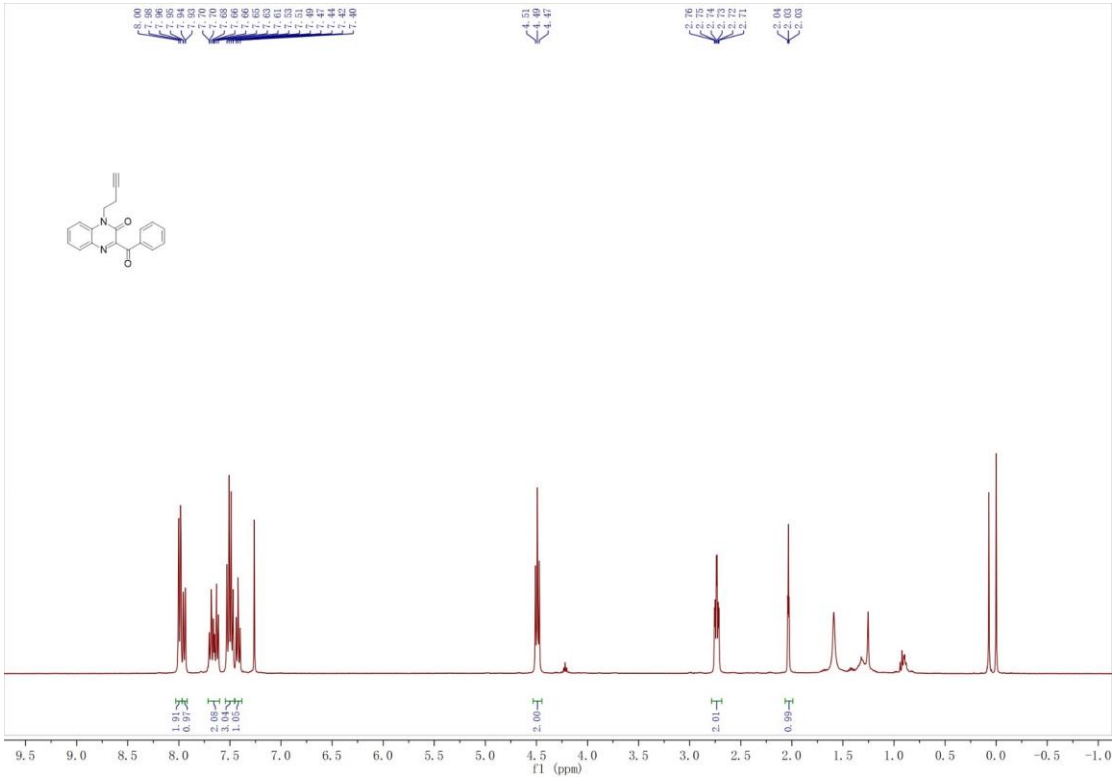
^{1}H NMR spectra of 3-benzoyl-1-(3-methylbut-2-en-1-yl)quinoxalin-2(1H)-one(3ia)



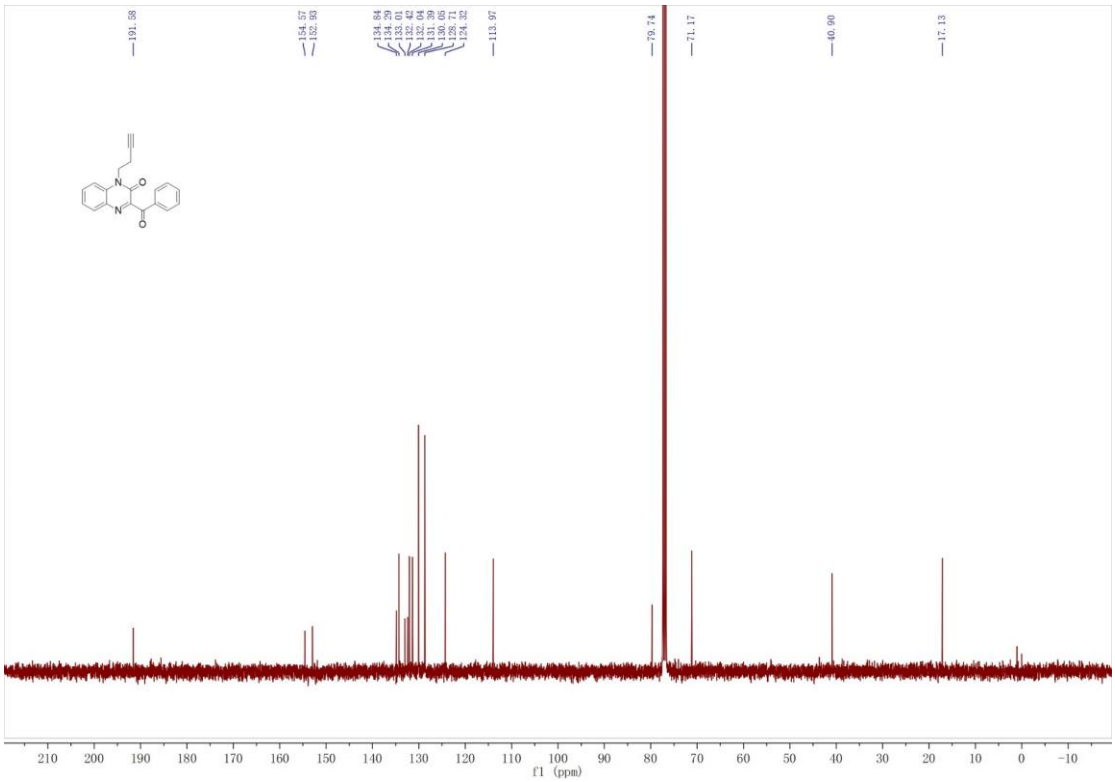
^{13}C NMR spectra of 3-benzoyl-1-(3-methylbut-2-en-1-yl)quinoxalin-2(1H)-one(3ia)



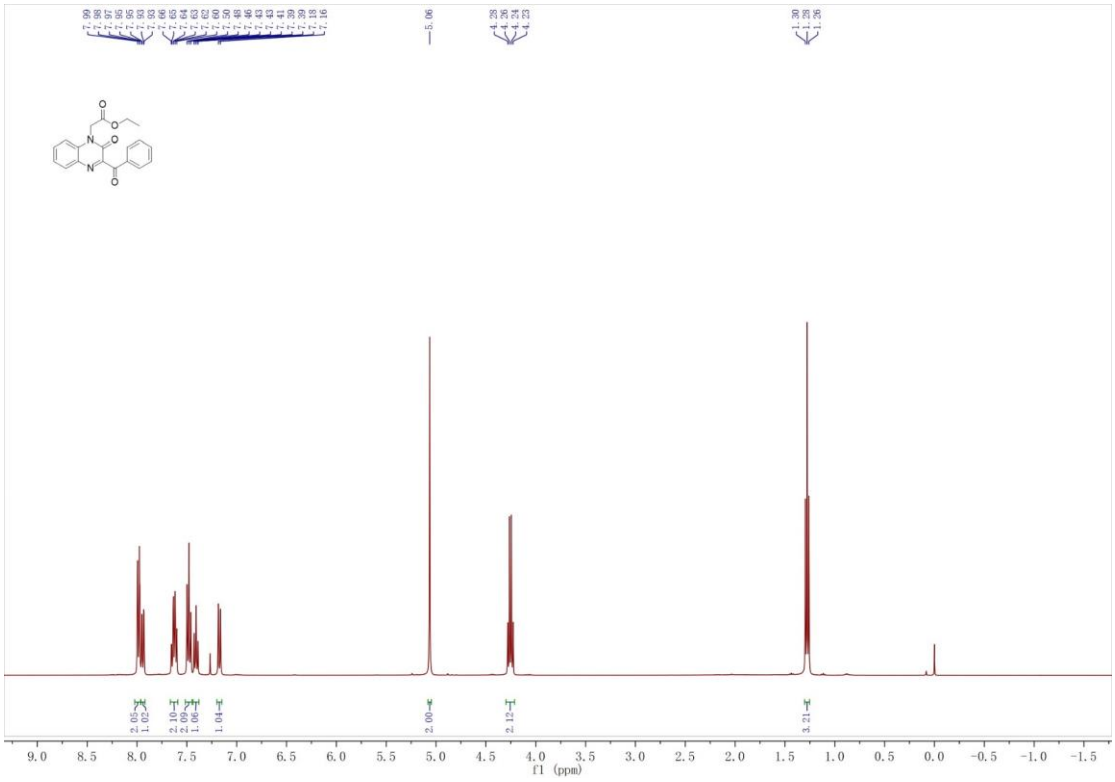
^{1}H NMR spectra of 3-benzoyl-1-(but-3-yn-1-yl)quinoxalin-2(1H)-one(3ga)



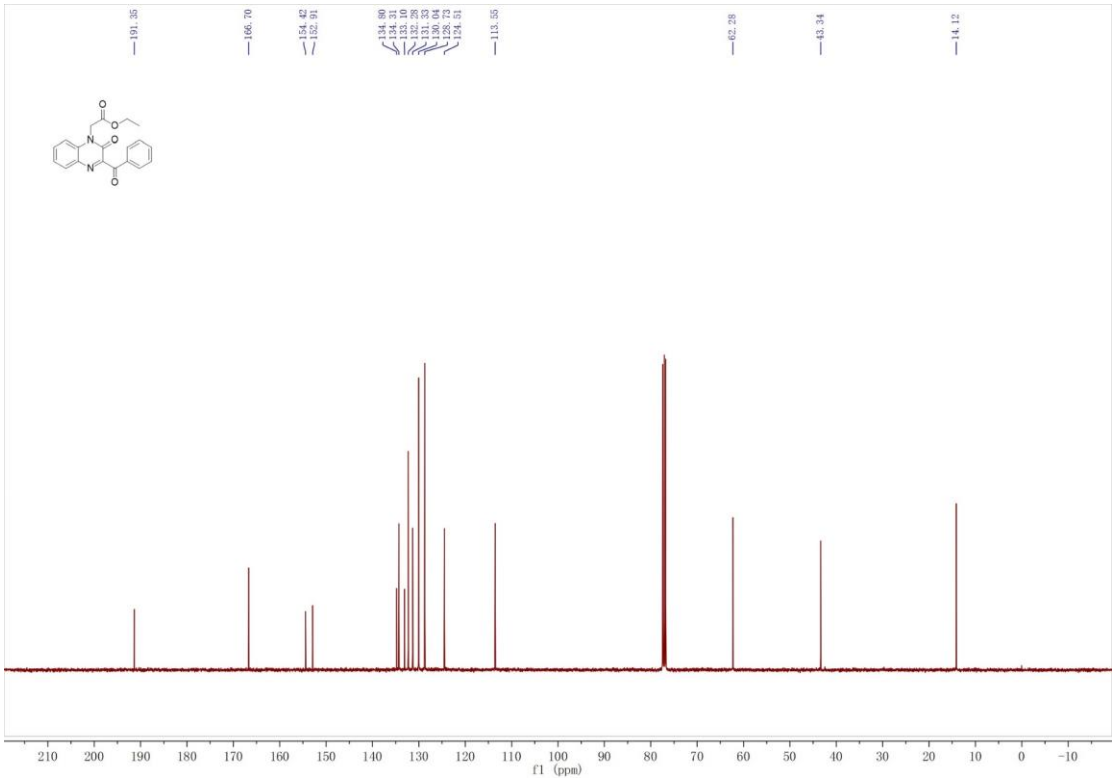
^{13}C NMR spectra of 3-benzoyl-1-(but-3-yn-1-yl)quinoxalin-2(1H)-one(3ga)



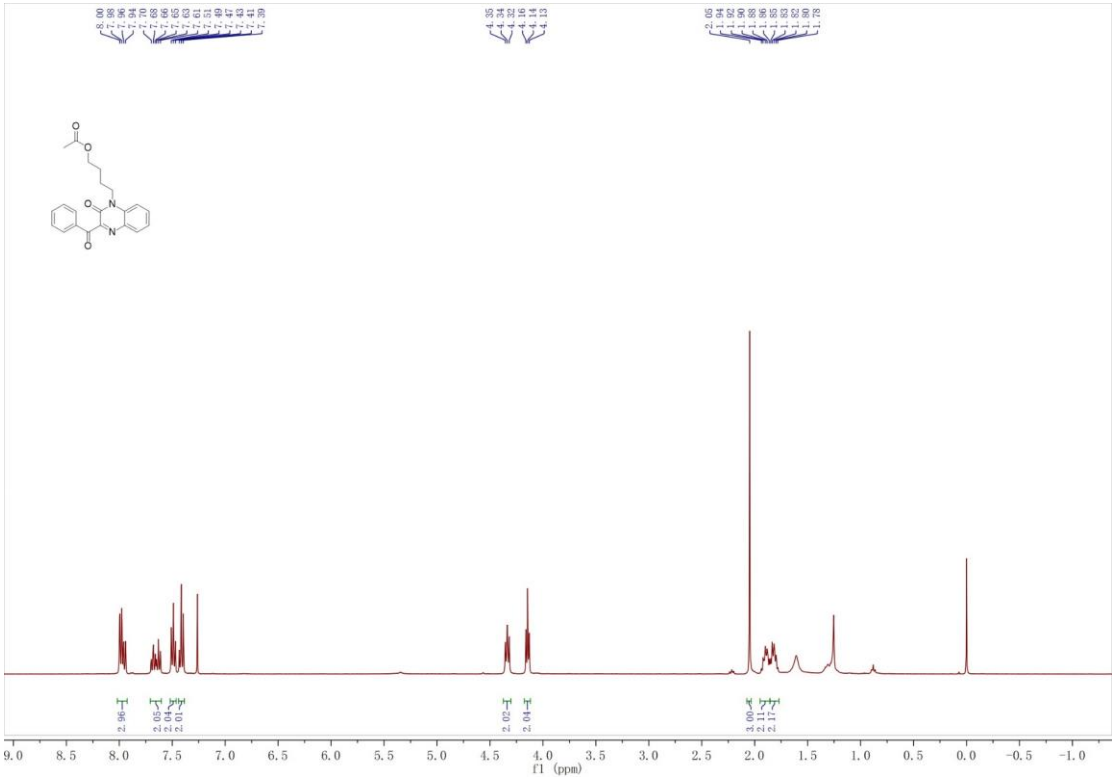
^{1}H NMR spectra of ethyl 2-(3-benzoyl-2-oxoquinoxalin-1(2H)-yl)acetate(3ka)



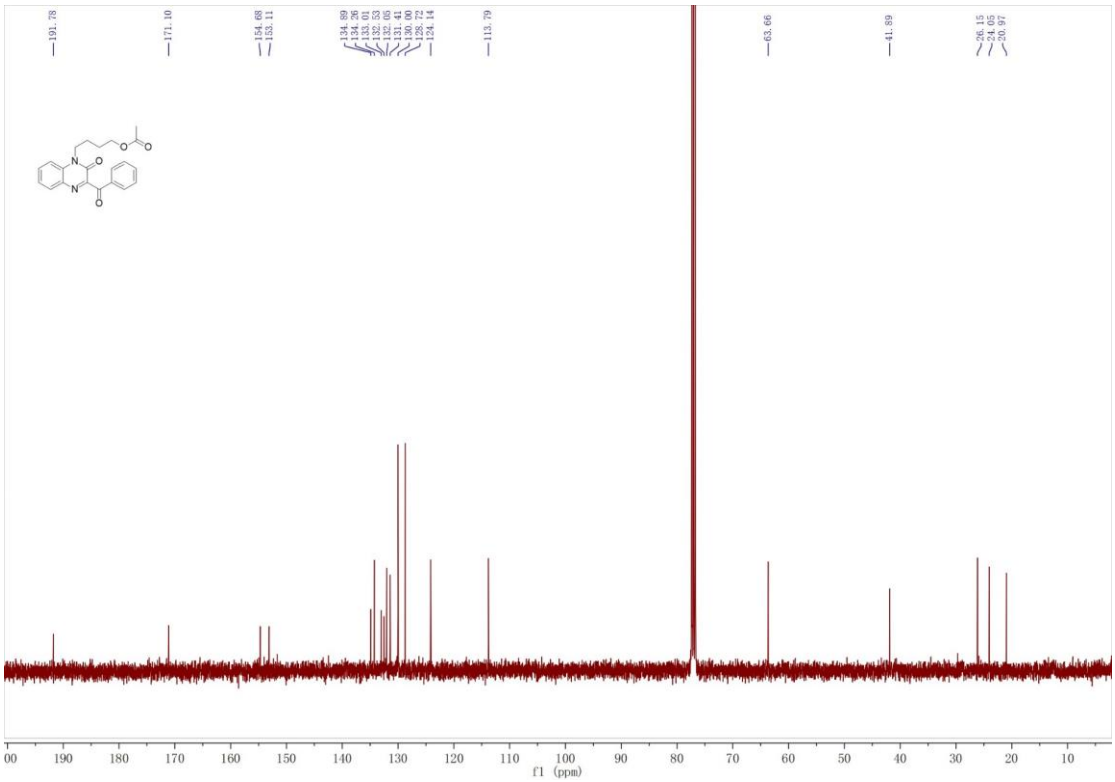
^{13}C NMR spectra of ethyl 2-(3-benzoyl-2-oxoquinoxalin-1(2H)-yl)acetate(3ka)



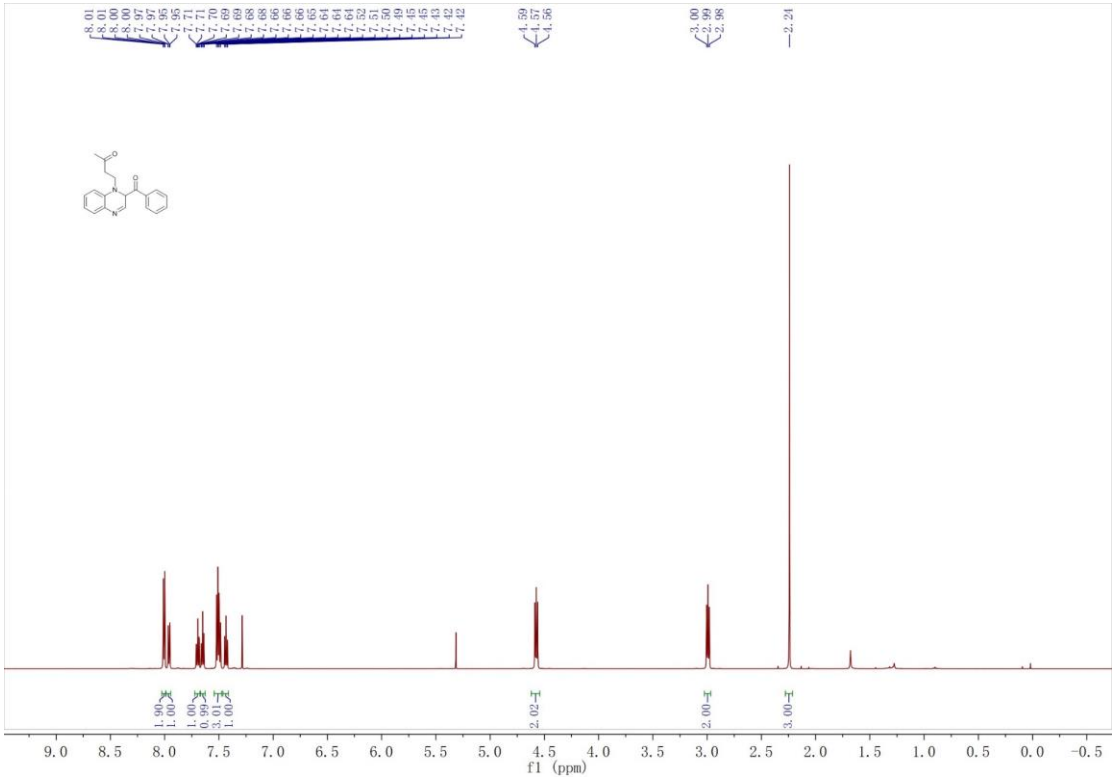
^{1}H NMR spectra of 4-(3-benzoyl-2-oxoquinoxalin-1(2H)-yl)butyl acetate(3la)



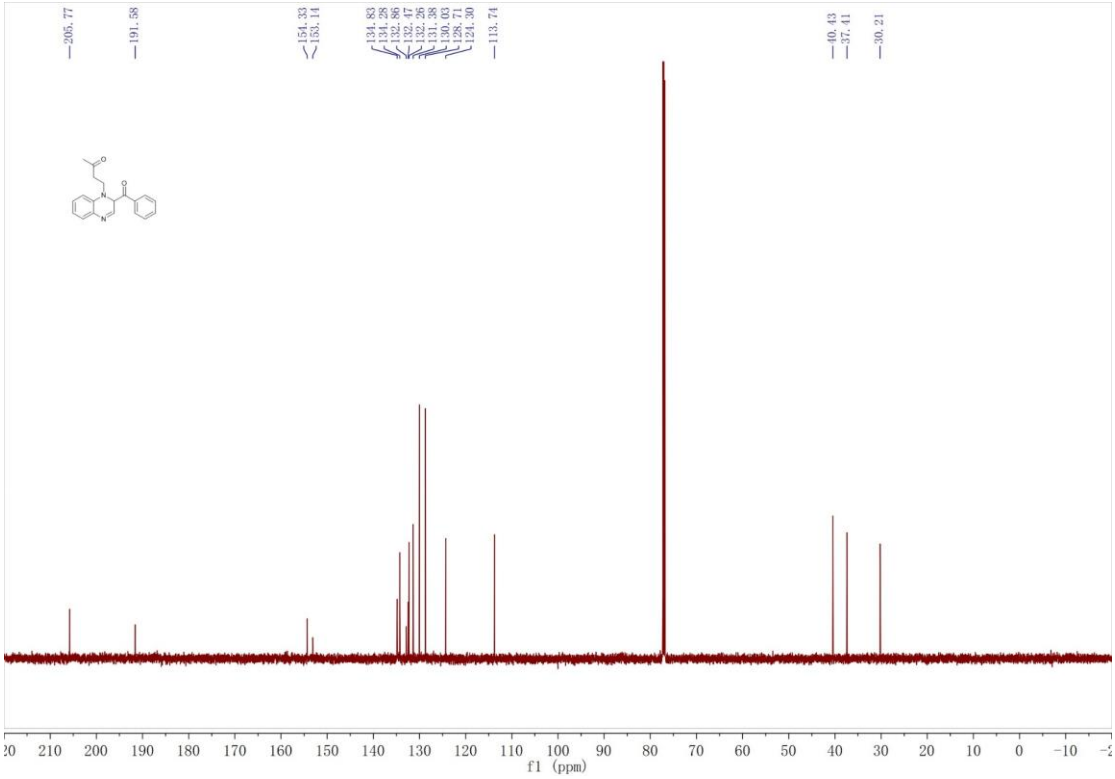
^{13}C NMR spectra of 4-(3-benzoyl-2-oxoquinoxalin-1(2H)-yl)butyl acetate(3la)



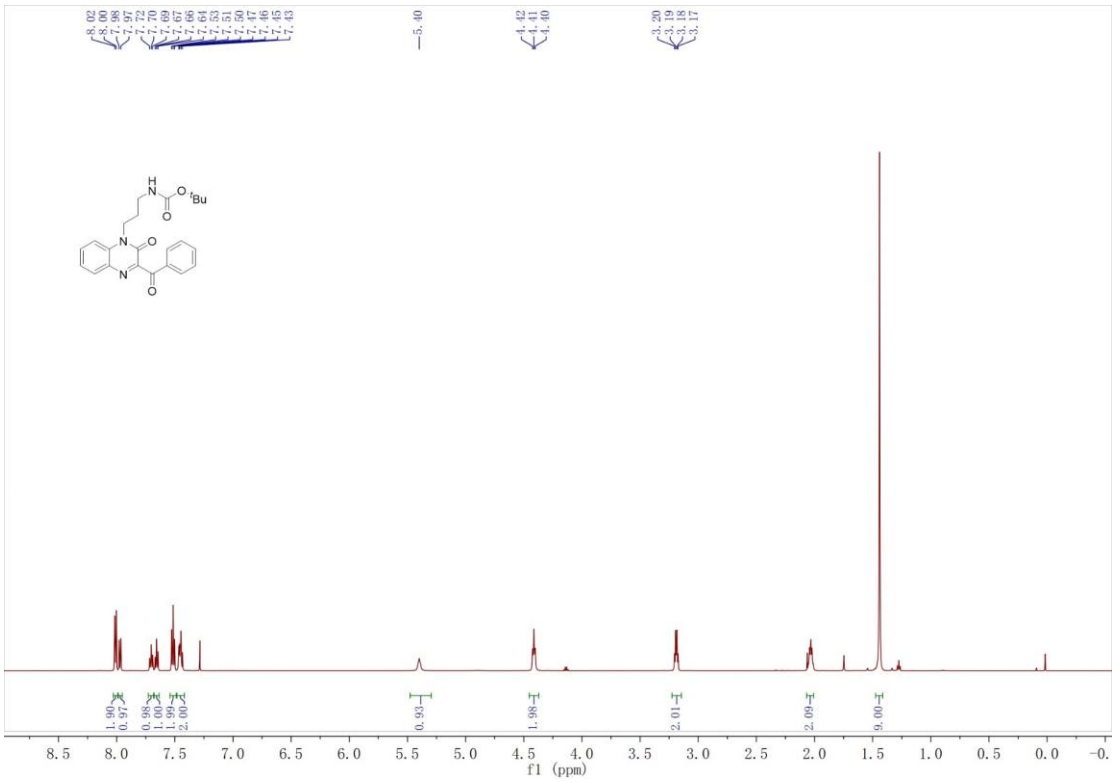
^{1}H NMR spectra of 3-benzoyl-1-(3-oxobutyl)quinoxalin-2(1H)-one(3ma)



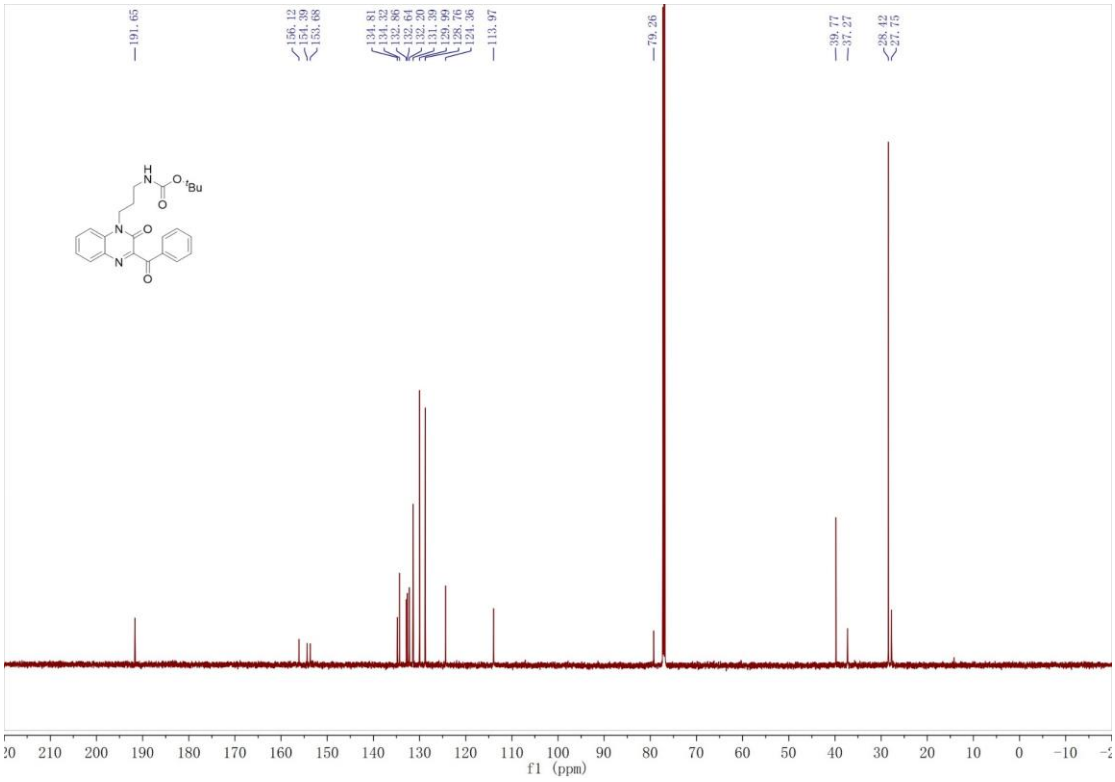
^{13}C NMR spectra of 3-benzoyl-1-(3-oxobutyl)quinoxalin-2(1H)-one(3ma)



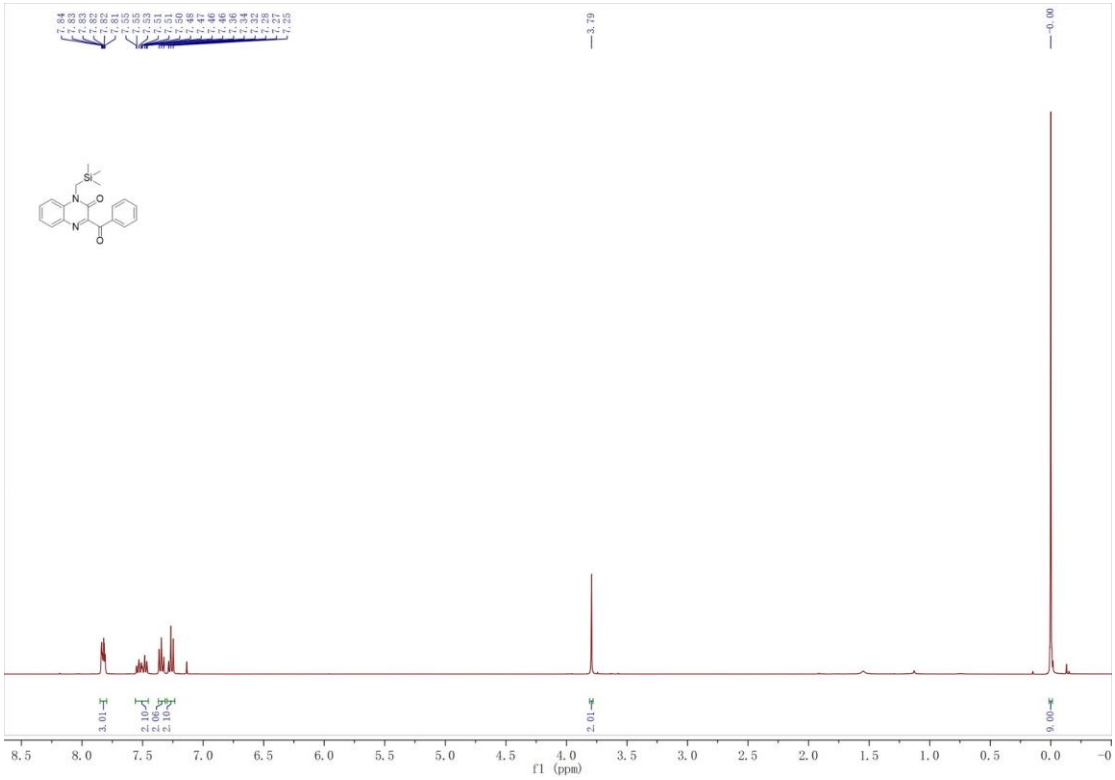
^{1}H NMR spectra of tert-butyl(3-(3-benzoyl-2-oxoquinoxalin-1(2H)-yl)propyl)carbamate(3na)



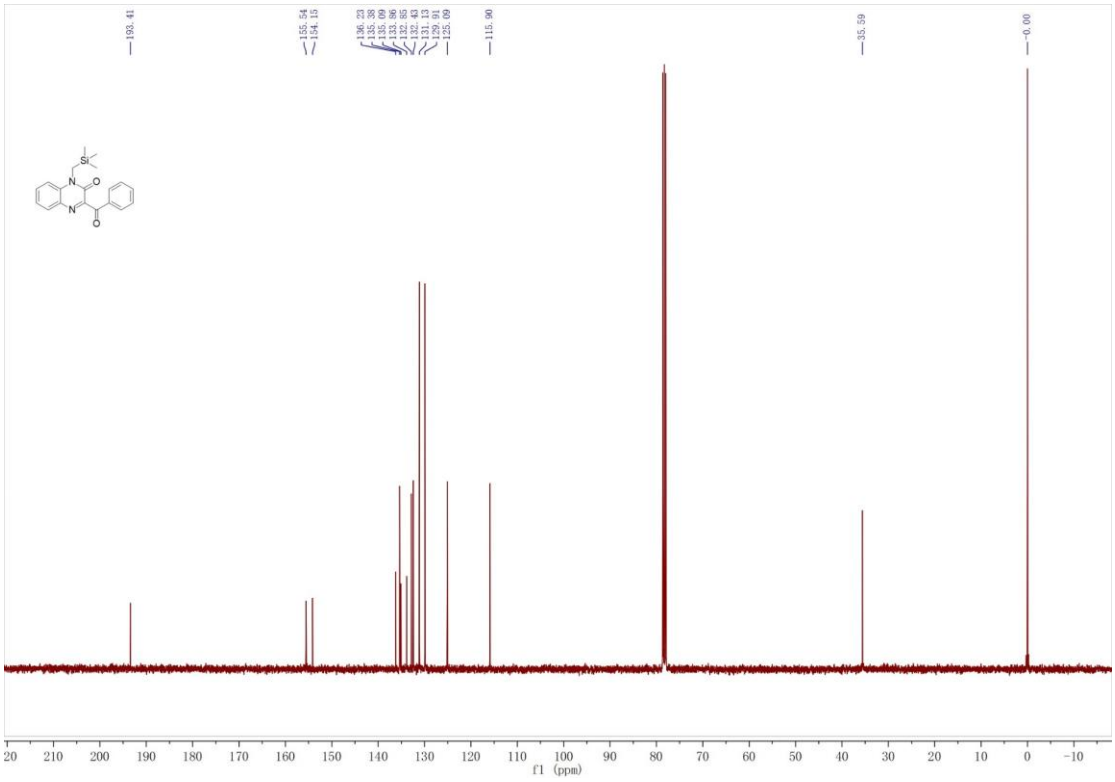
^{13}C NMR spectra of tert-butyl(3-(3-benzoyl-2-oxoquinoxalin-1(2H)-yl)propyl)carbamate(3na)



^{1}H NMR spectra of 3-benzoyl-1-((trimethylsilyl)methyl)quinoxalin-2(1H)-one(3oa)

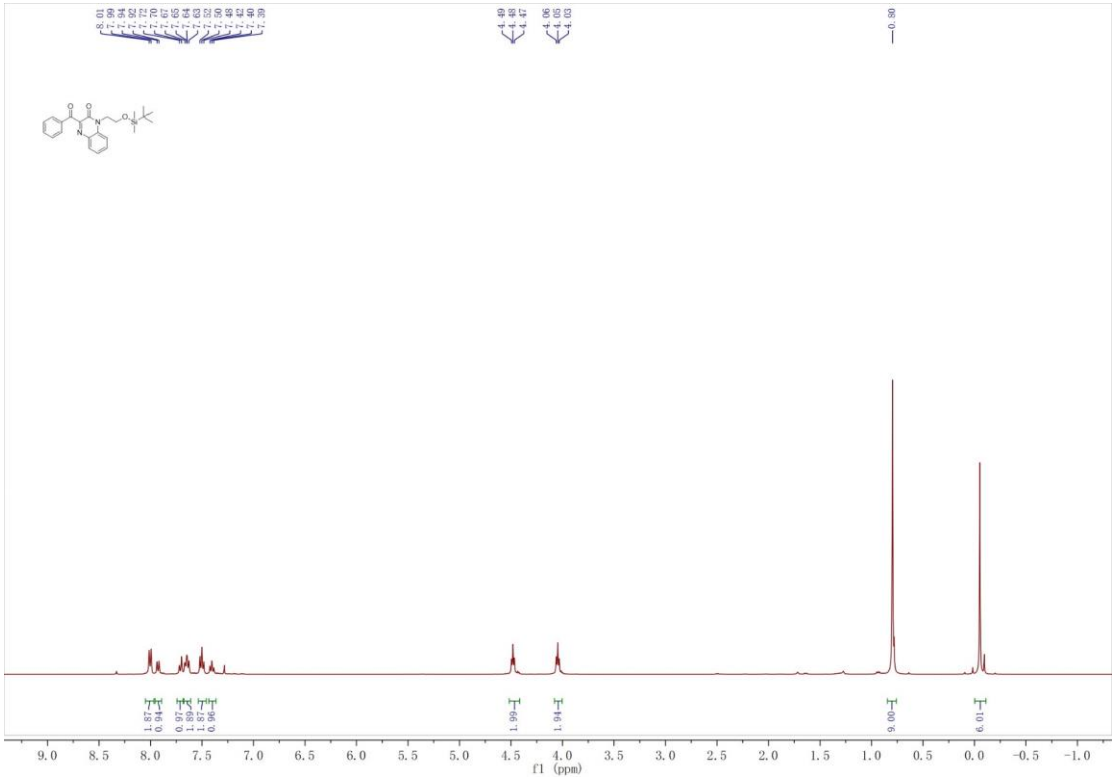


^{13}C NMR spectra of 3-benzoyl-1-((trimethylsilyl)methyl)quinoxalin-2(1H)-one(3oa)

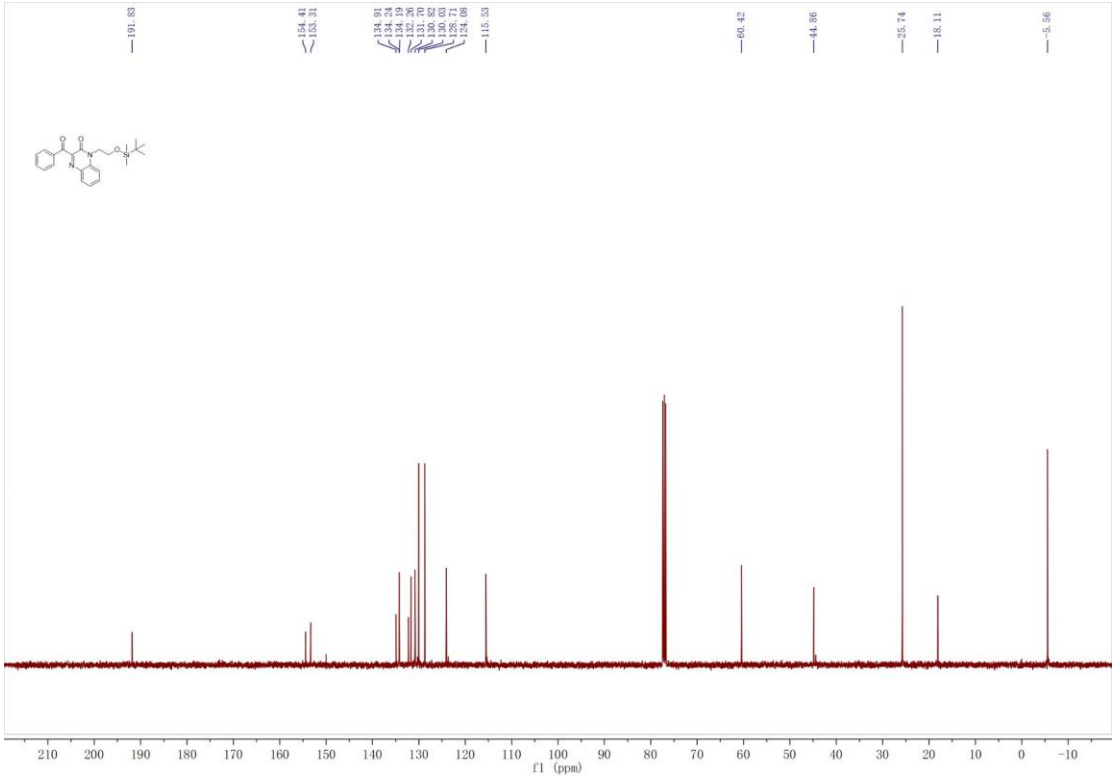


^{1}H NMR spectra of 3-benzoyl-1-(3-((tert-

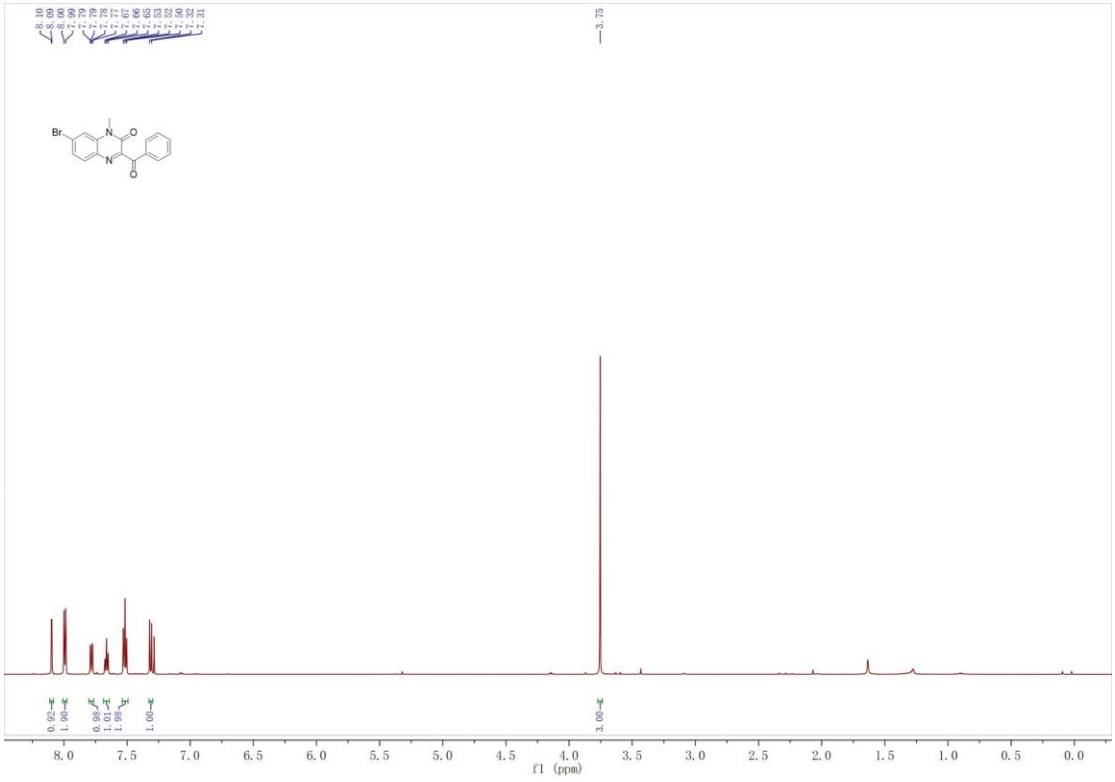
butyldimethylsilyl)oxy)propyl)quinoxalin-2(1H)-one(3pa)



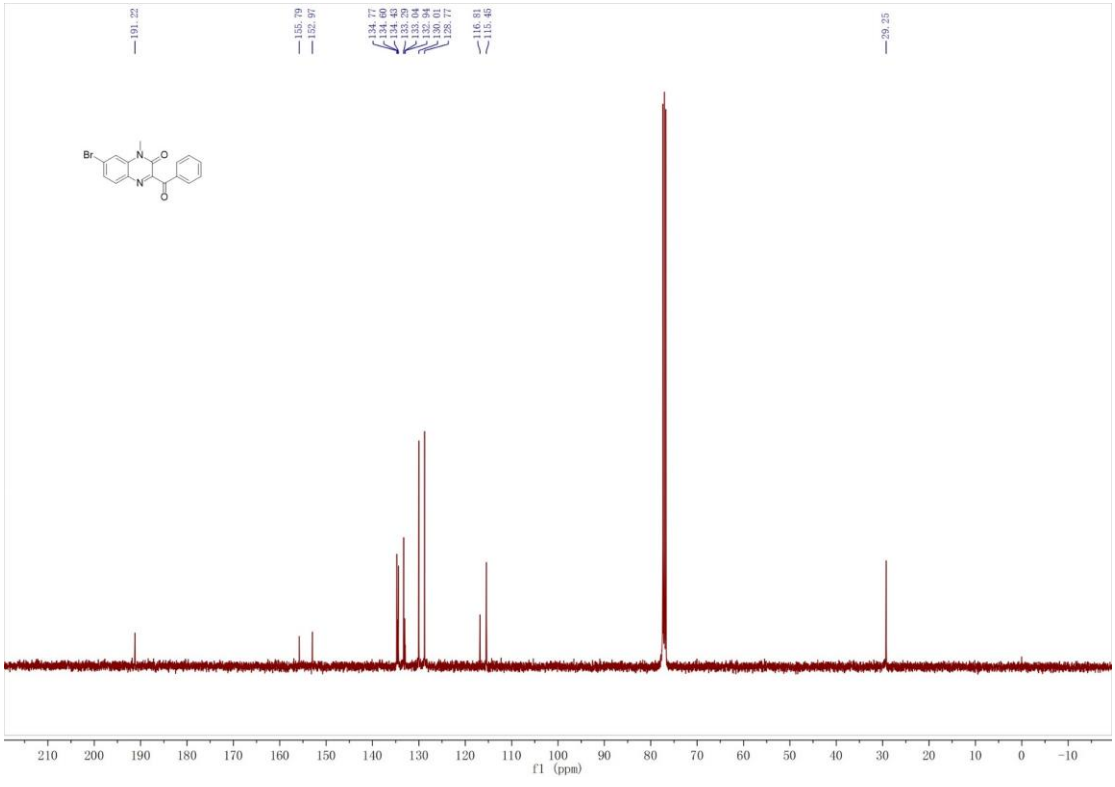
^{13}C NMR spectra of 3-benzoyl-1-(3-((tert-butyldimethylsilyl)oxy)propyl)quinoxalin-2(1H)-one(3pa)



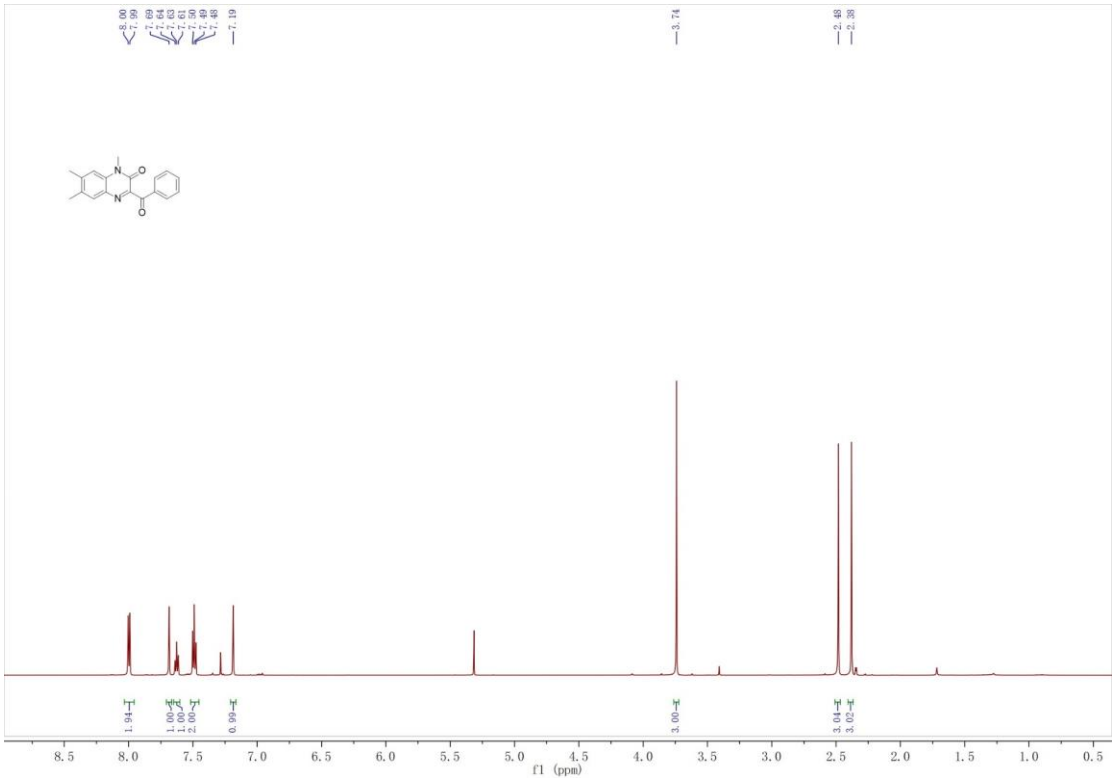
^{1}H NMR spectra of 33-benzoyl-7-bromo-1-methylquinoxalin-2(1H)-one(3qa)



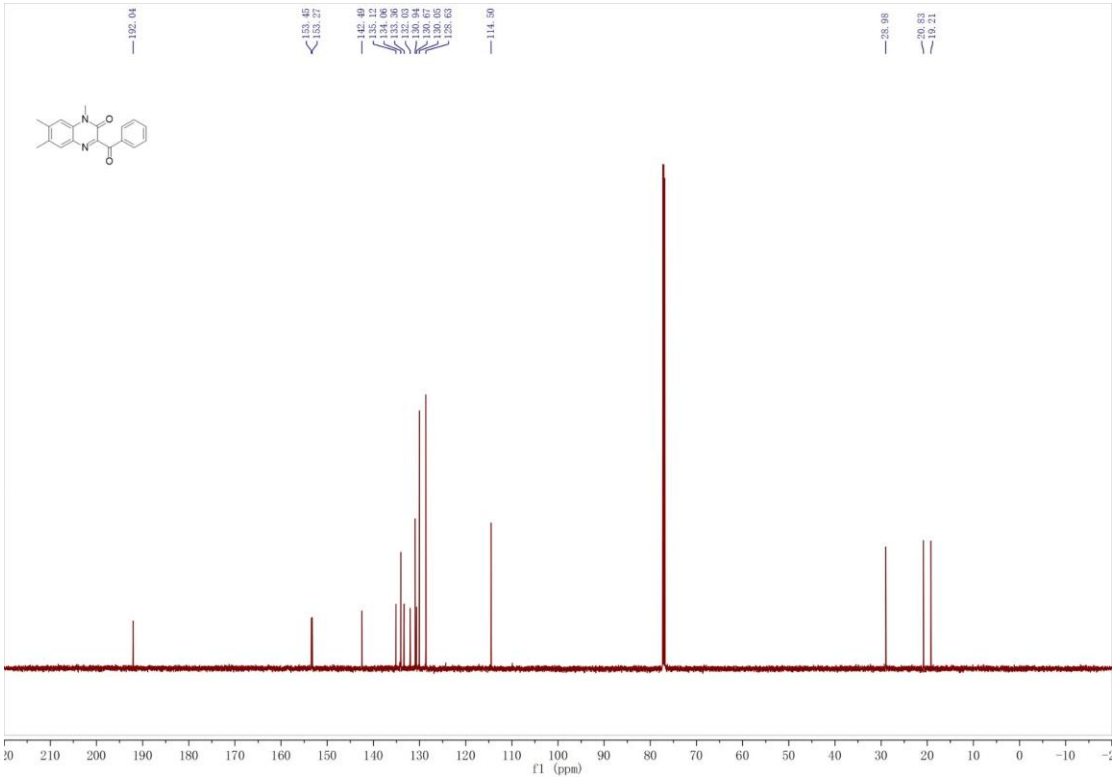
^{13}C NMR spectra of 33-benzoyl-7-bromo-1-methylquinoxalin-2(1H)-one(3qa)



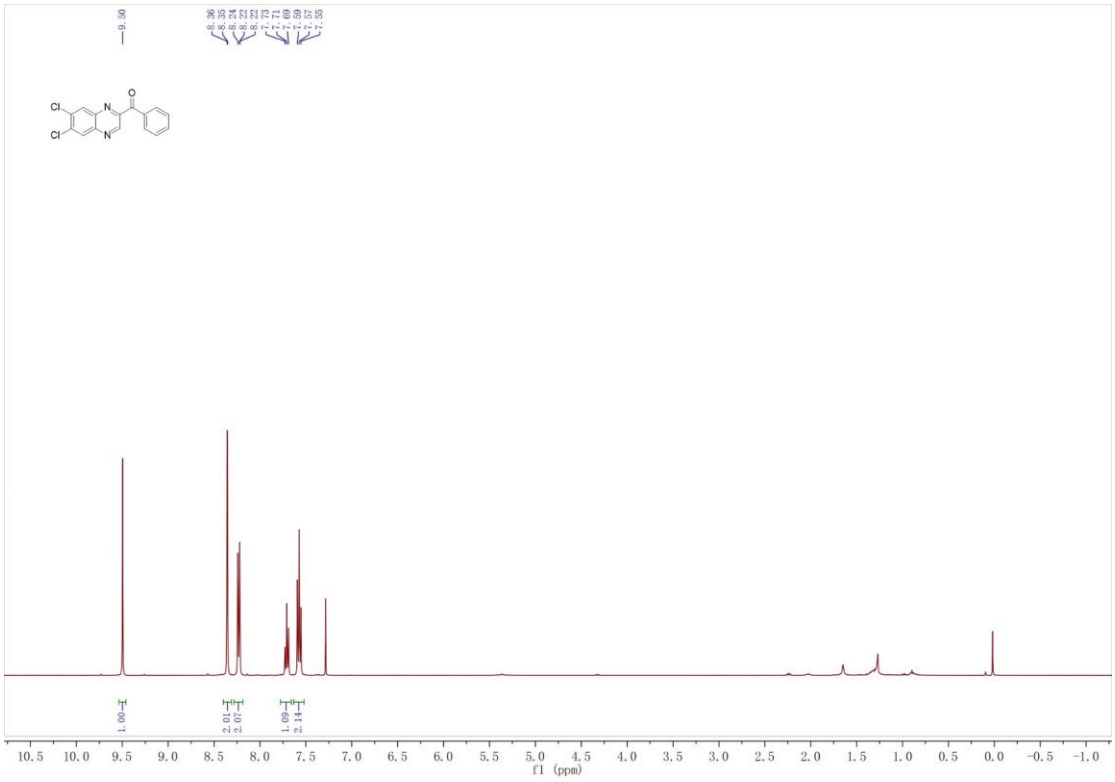
^{1}H NMR spectra of 3-benzoyl-1,6,7-trimethylquinoxalin-2(1H)-one(3ia)



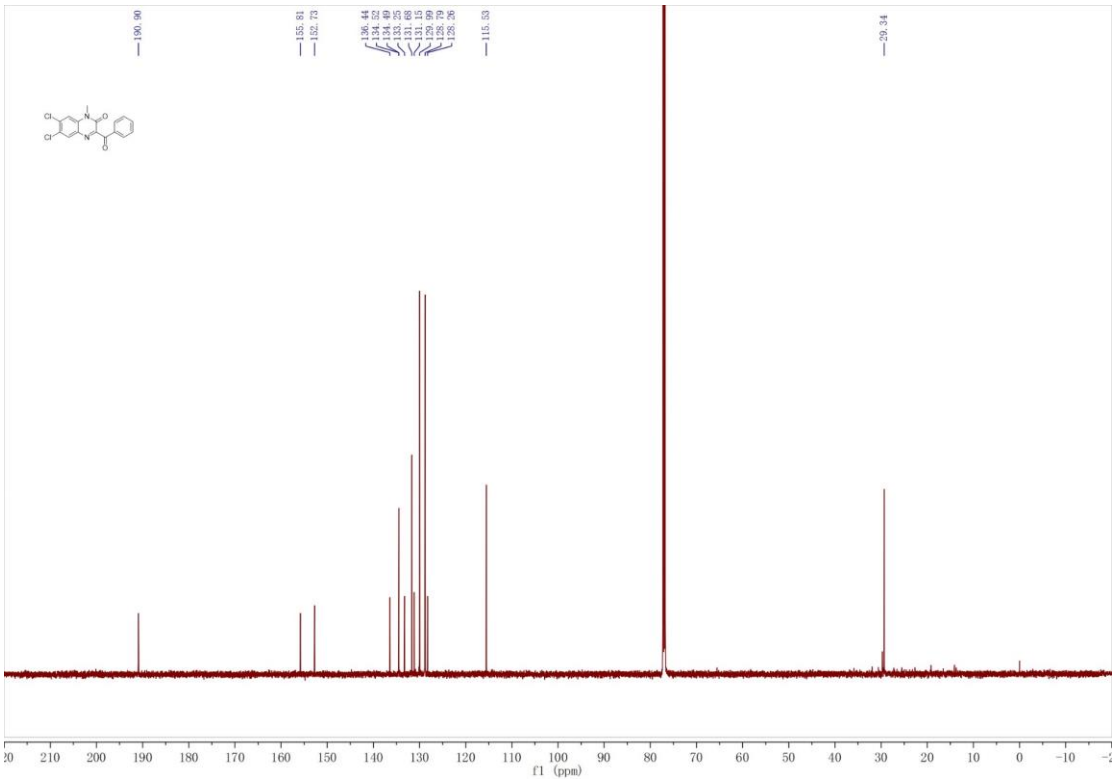
^{13}C NMR spectra of 3-benzoyl-1,6,7-trimethylquinoxalin-2(1H)-one(3ia)



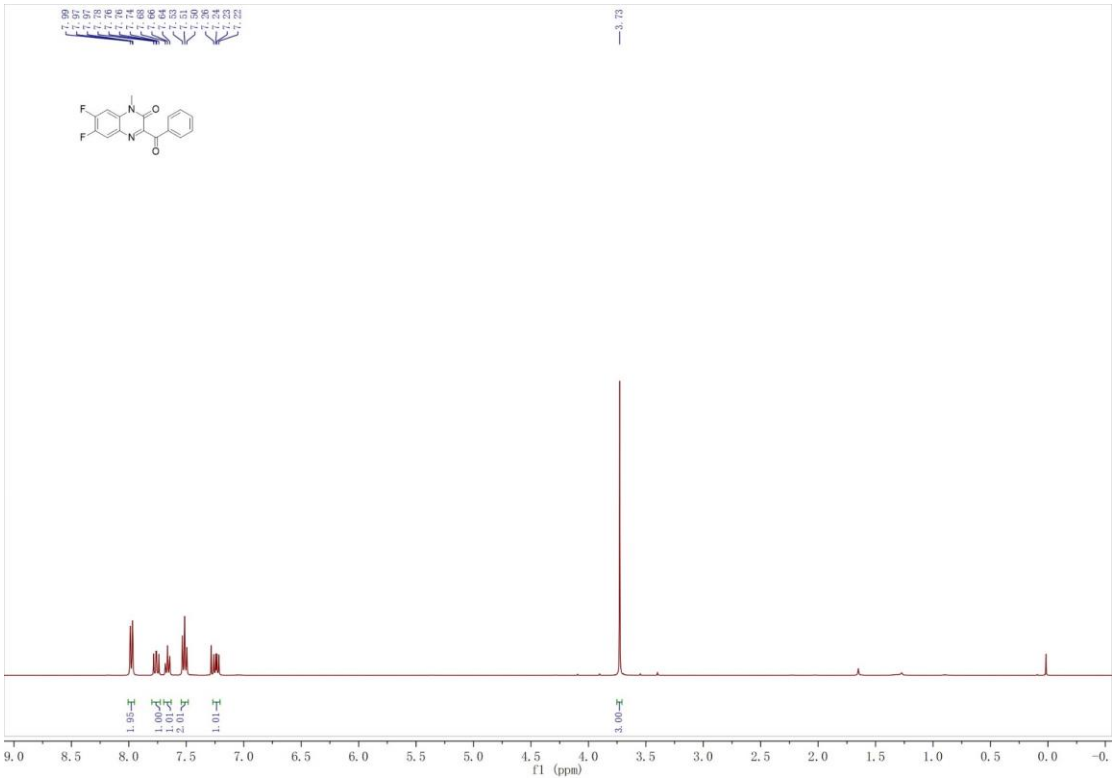
^{1}H NMR spectra of 3-benzoyl-6,7-dichloro-1-methylquinoxalin-2(1H)-one(3sa)



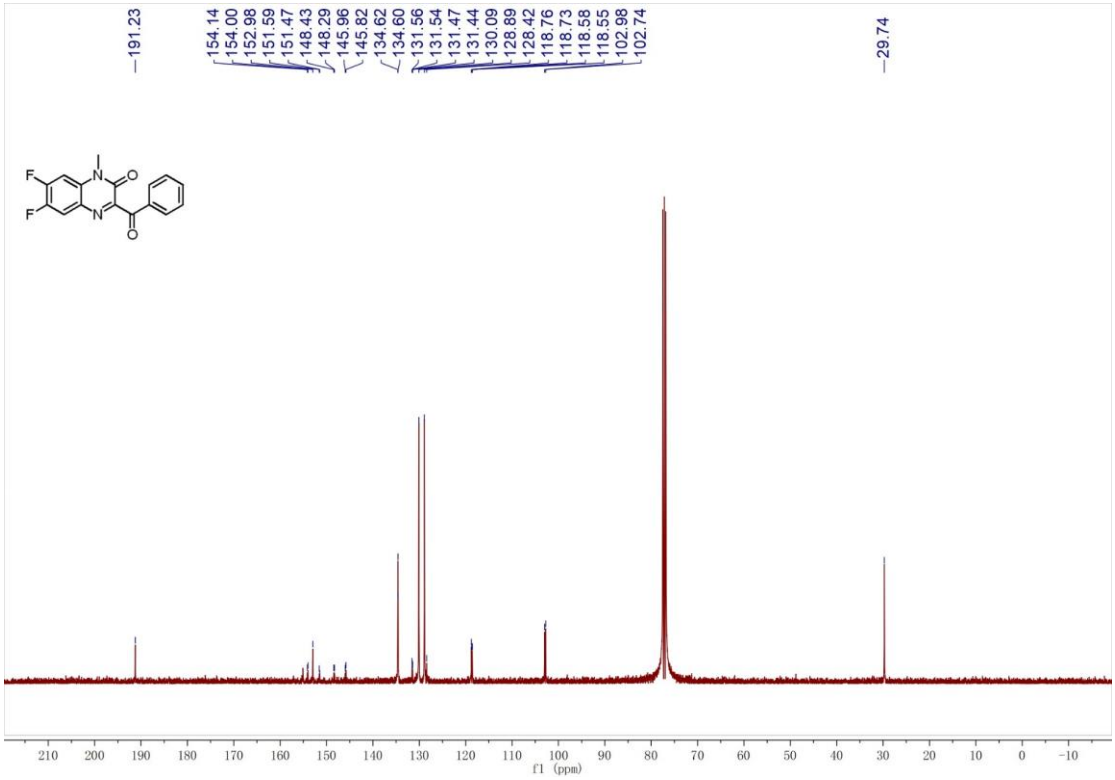
^{13}C NMR spectra of 3-benzoyl-6,7-dichloro-1-methylquinoxalin-2(1H)-one(3sa)



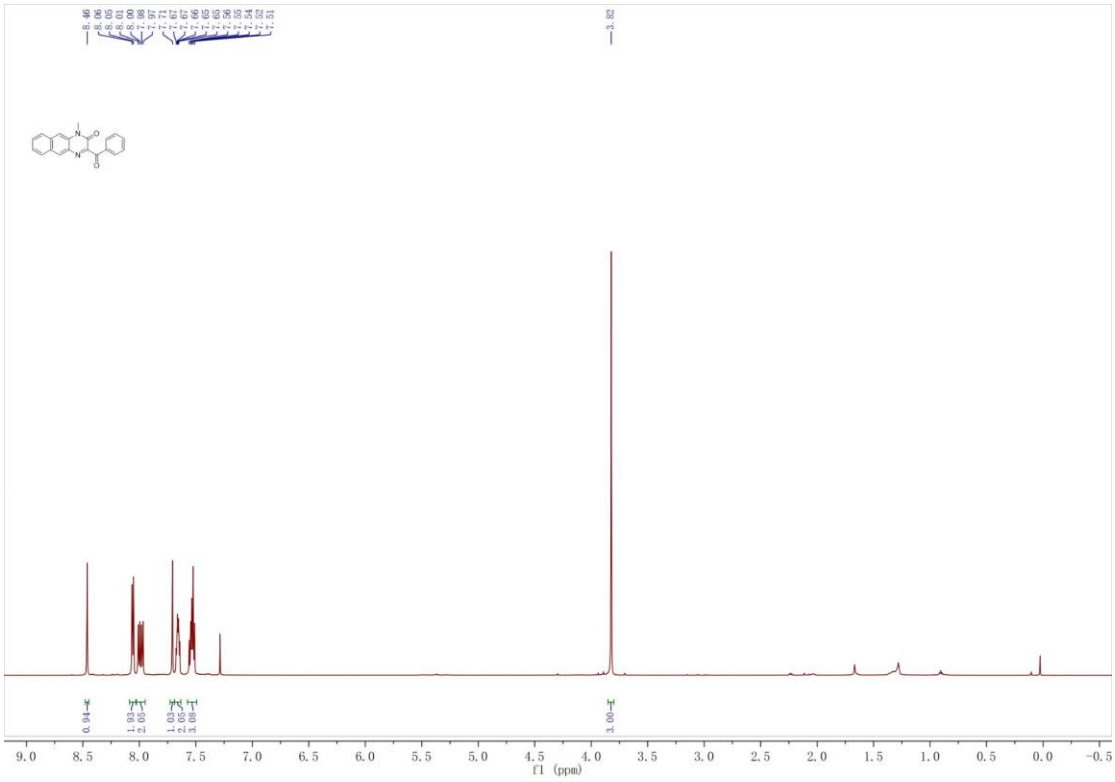
^{1}H NMR spectra of 3-benzoyl-6,7-difluoro-1-methylquinoxalin-2(1H)-one(3ta)



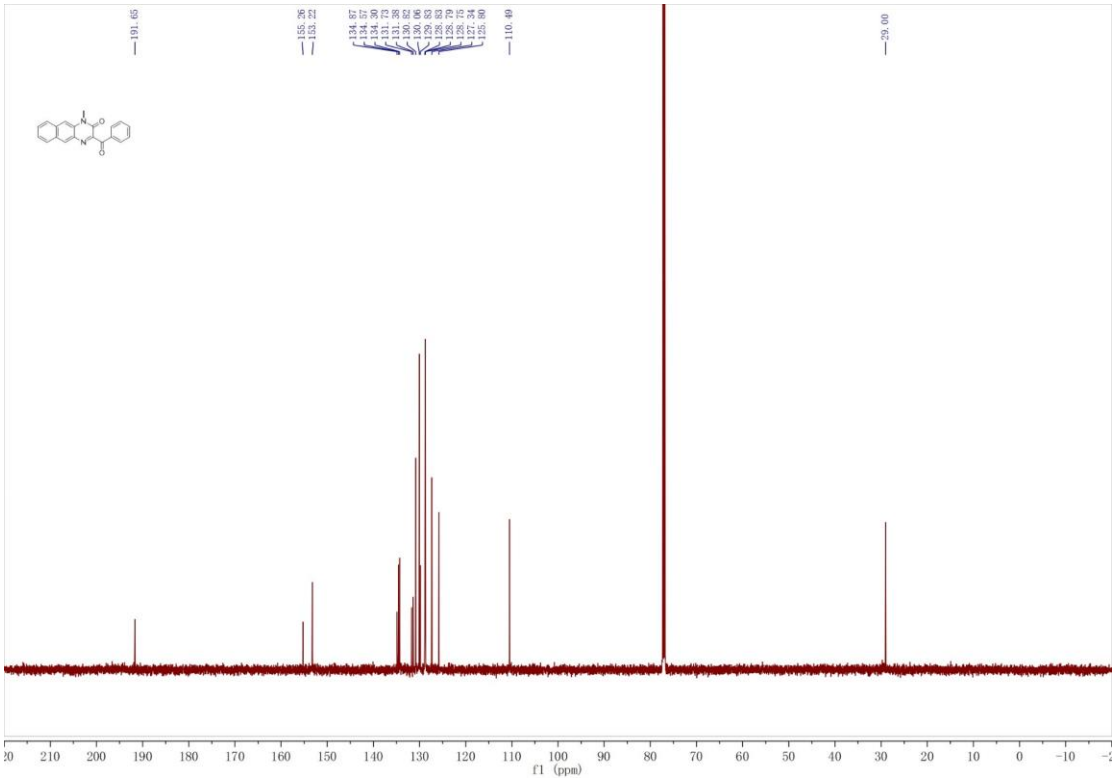
^{13}C NMR spectra of 3-benzoyl-6,7-difluoro-1-methylquinoxalin-2(1H)-one(3ta)



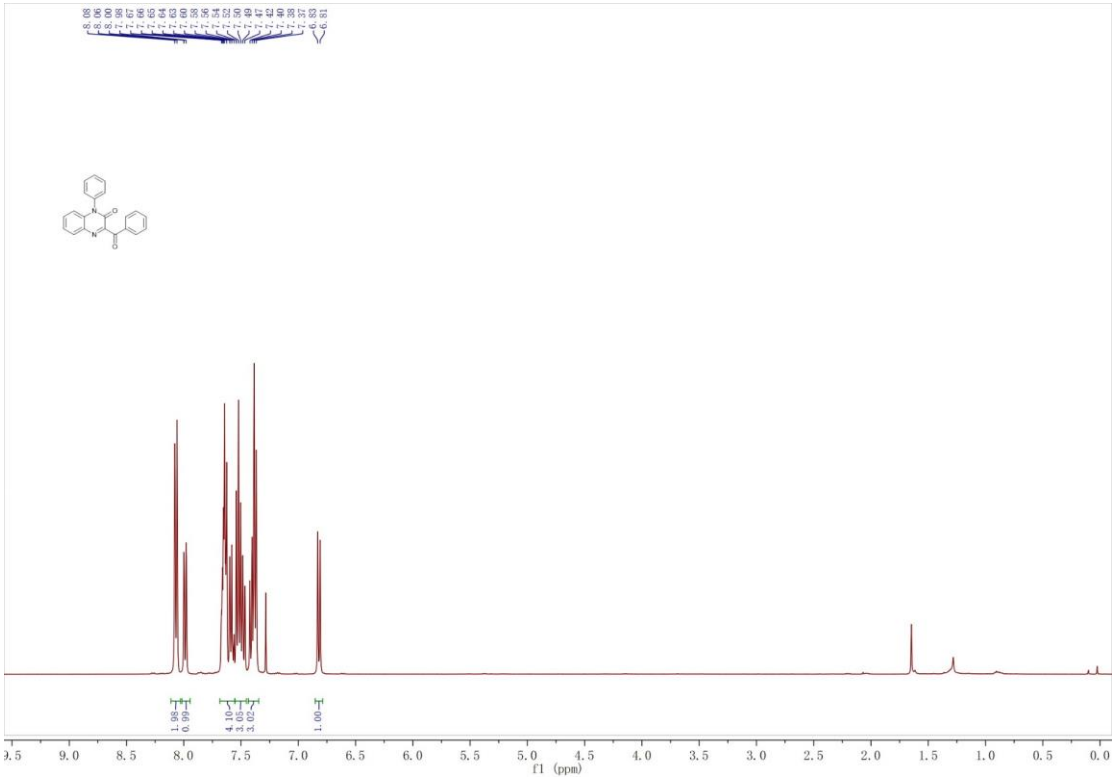
^{1}H NMR spectra of 3-benzoyl-1-methylbenzo[g]quinoxalin-2(1H)-one(3ua)



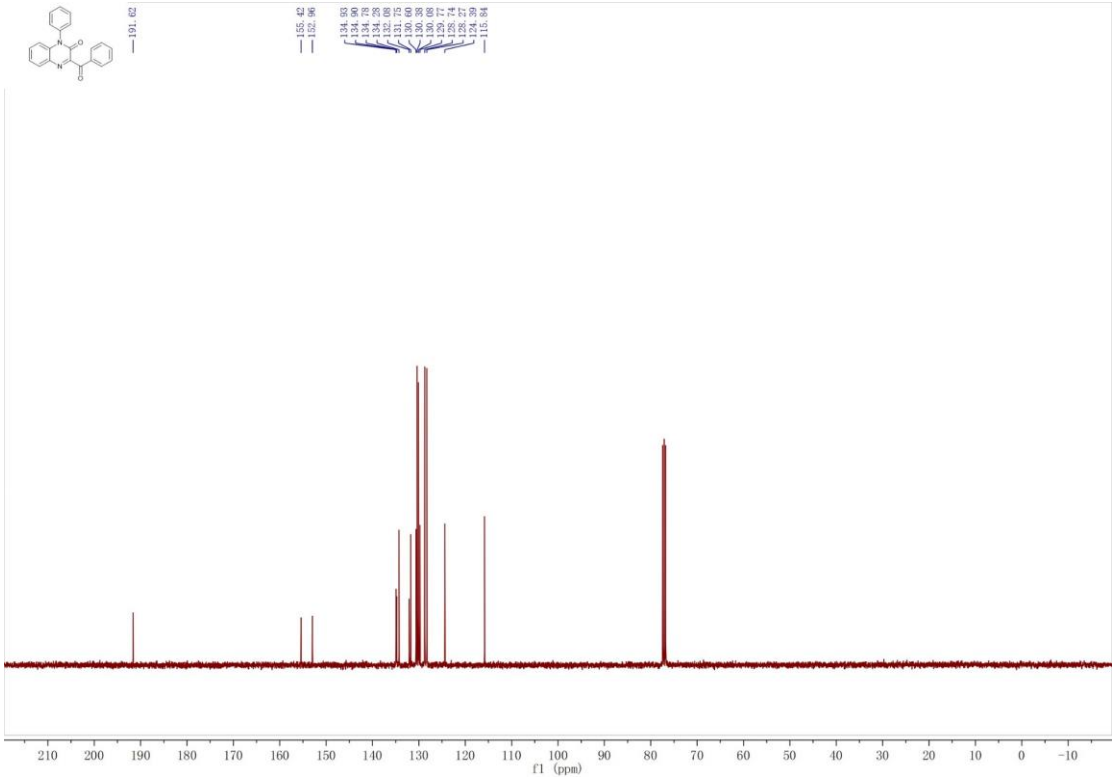
^{13}C NMR spectra of 3-benzoyl-1-methylbenzo[g]quinoxalin-2(1H)-one(3ua)



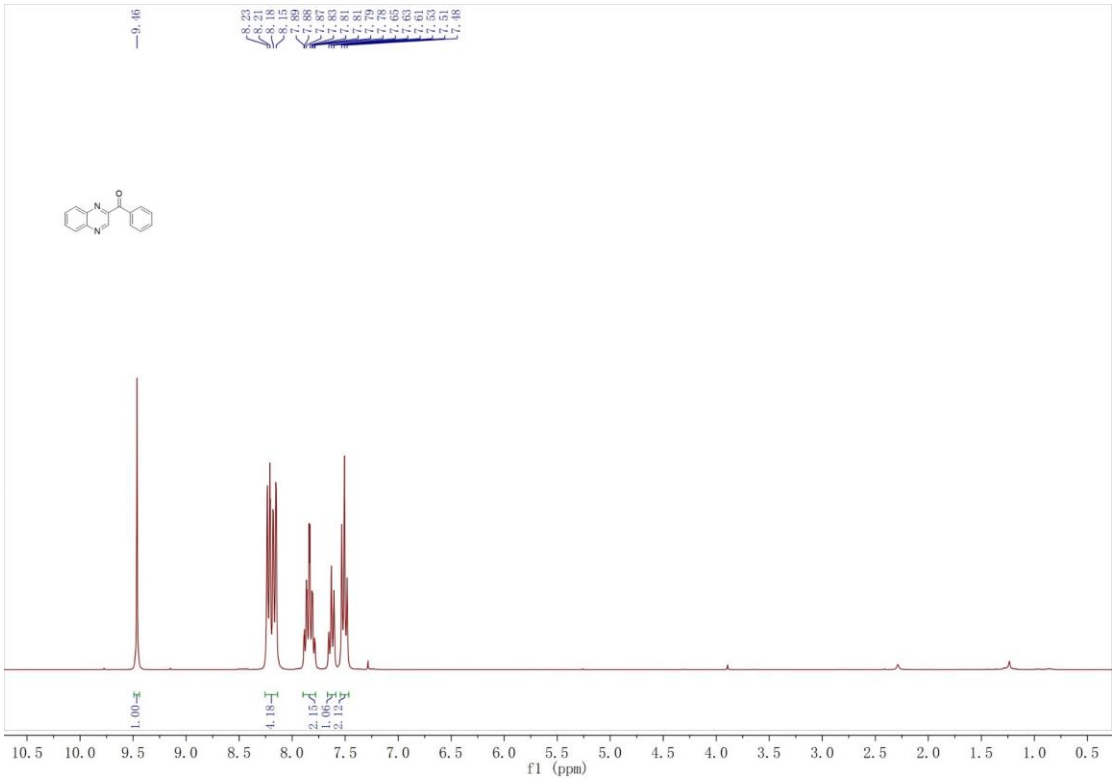
^{1}H NMR spectra of 3-benzoyl-1-phenylquinoxalin-2(1H)-one(3va)



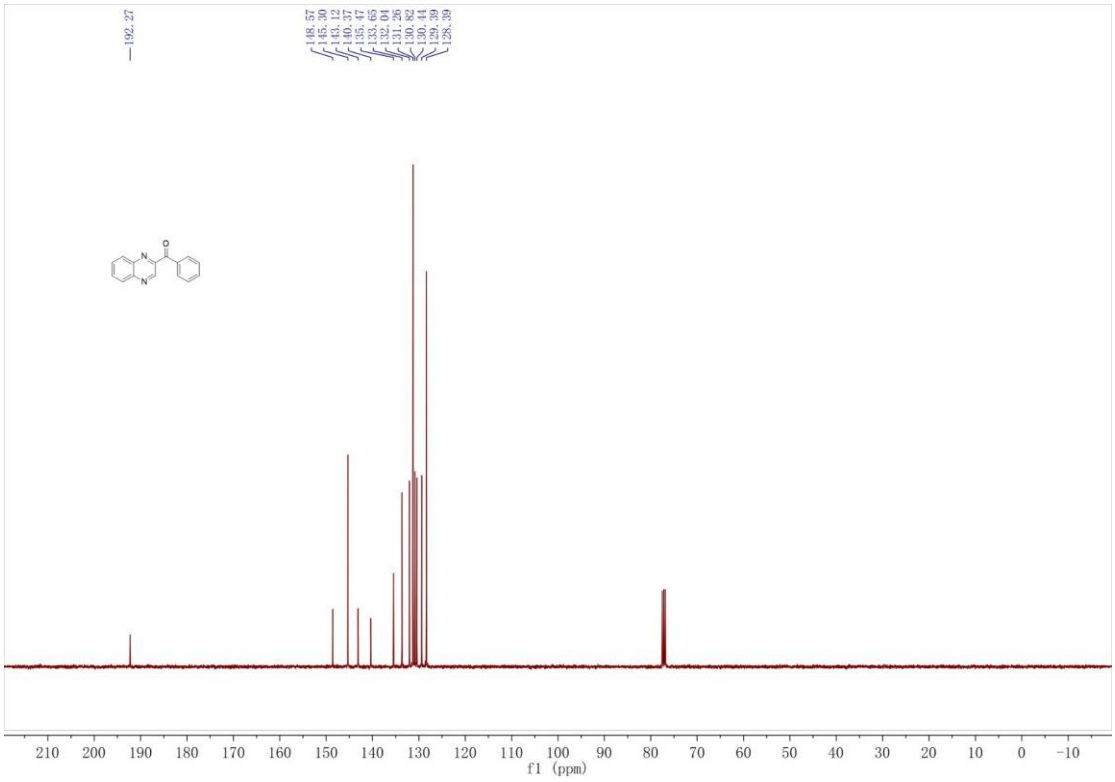
^{13}C NMR spectra of 3-benzoyl-1-phenylquinoxalin-2(1H)-one(3va)



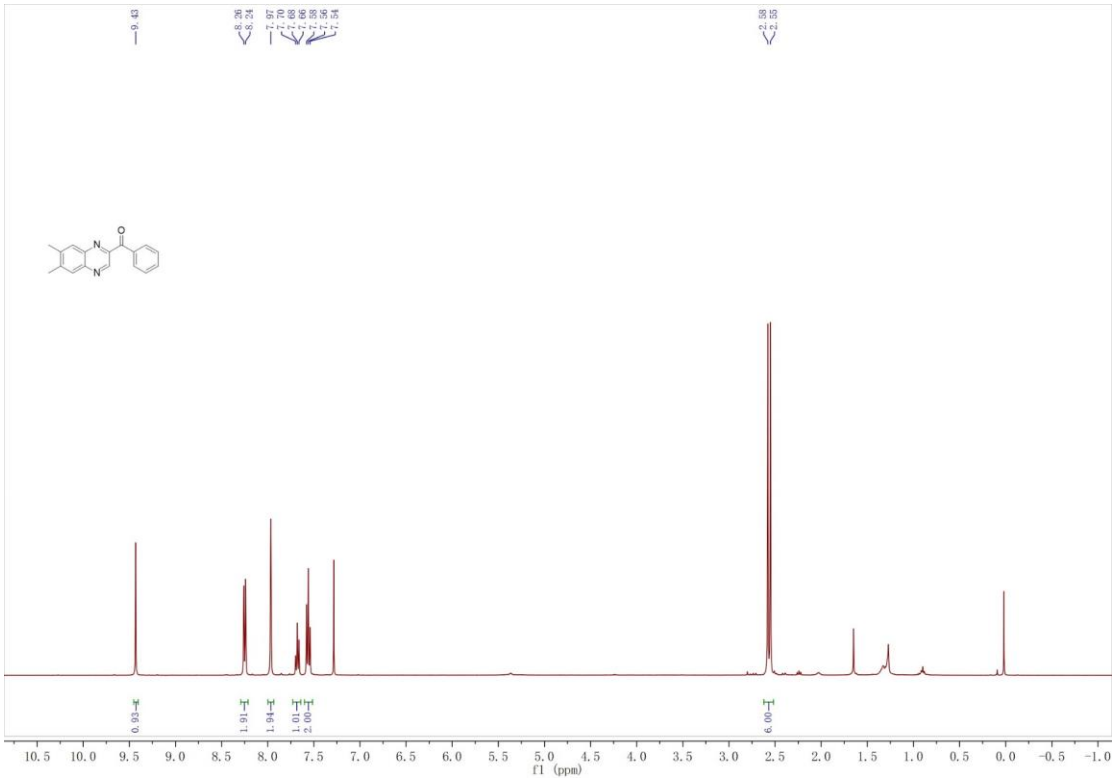
^{1}H NMR spectra of phenyl(quinoxalin-2-yl)methanone(3wa)



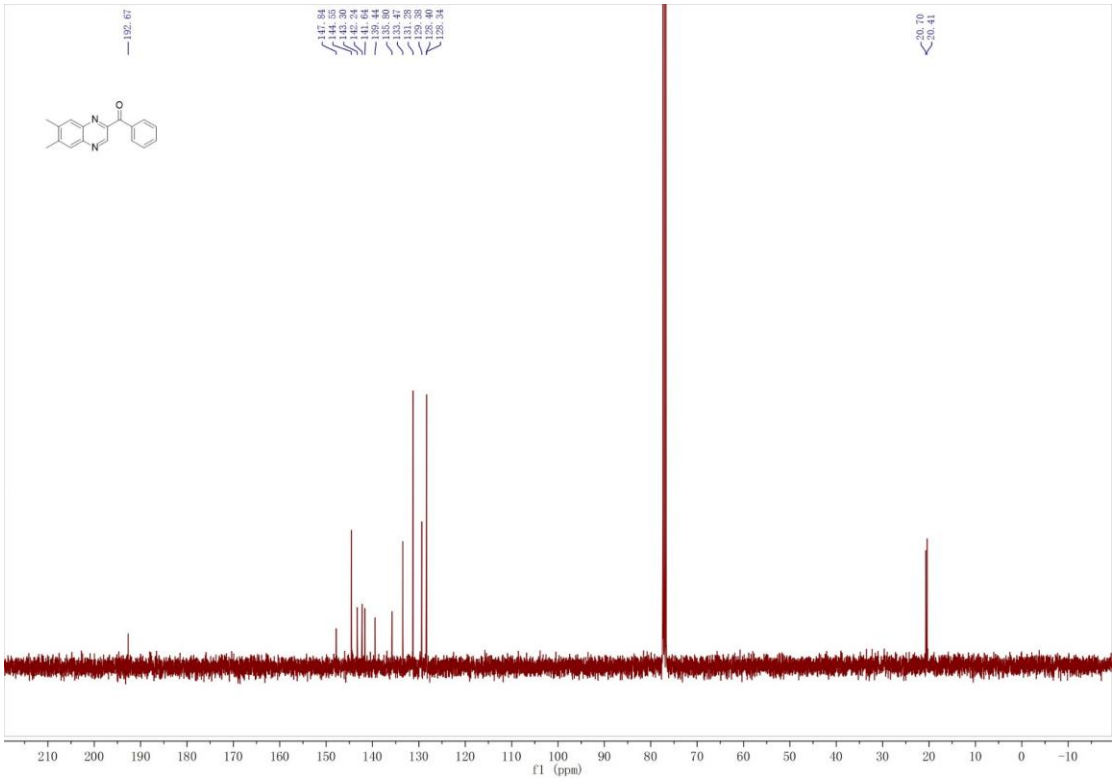
^{13}C NMR spectra of phenyl(quinoxalin-2-yl)methanone(3wa)



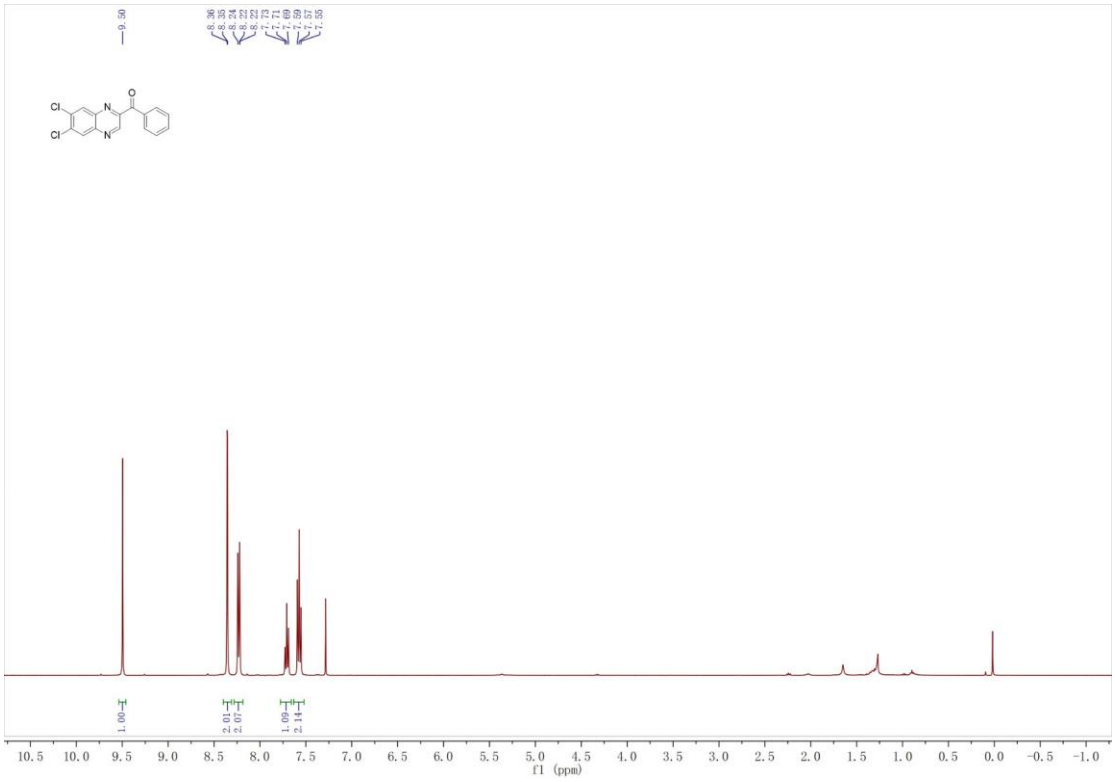
^{1}H NMR spectra of (6,7-dimethylquinoxalin-2-yl)(phenyl)methanone(3xa)



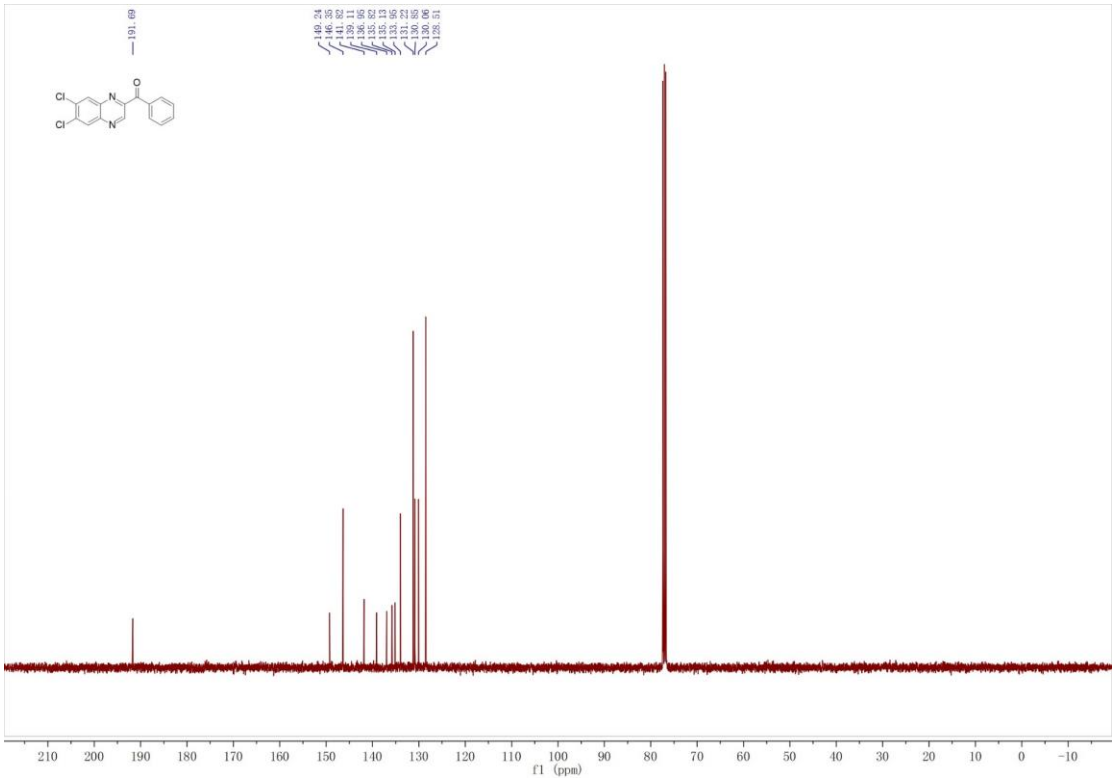
^{13}C NMR spectra of (6,7-dimethylquinoxalin-2-yl)(phenyl)methanone(3xa)



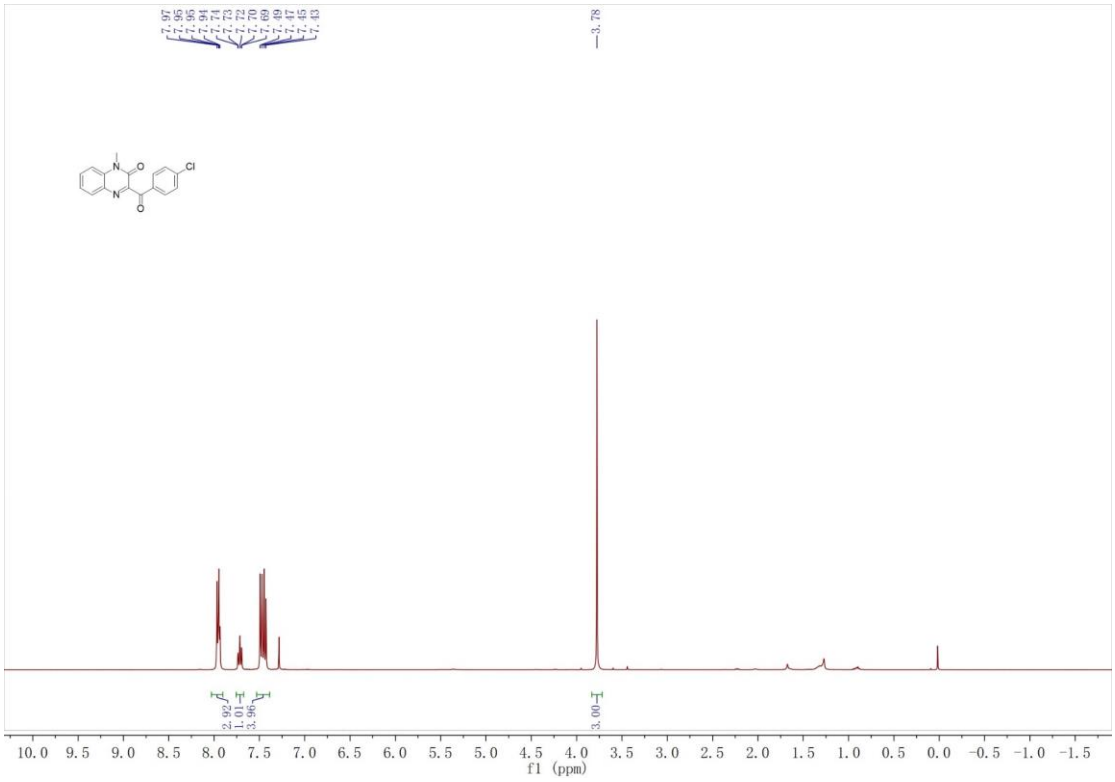
^{1}H NMR spectra of (6,7-dichloroquinoxalin-2-yl)(phenyl)methanone(3ya)



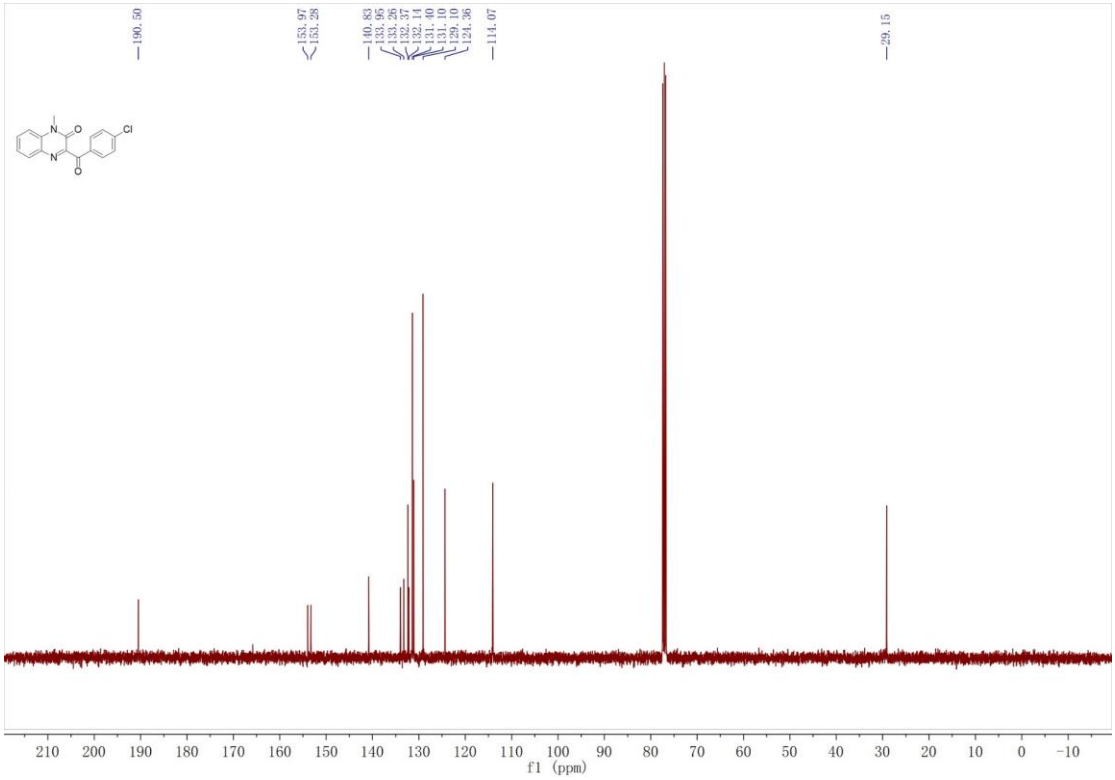
^{13}C NMR spectra of (6,7-dichloroquinoxalin-2-yl)(phenyl)methanone(3ya)



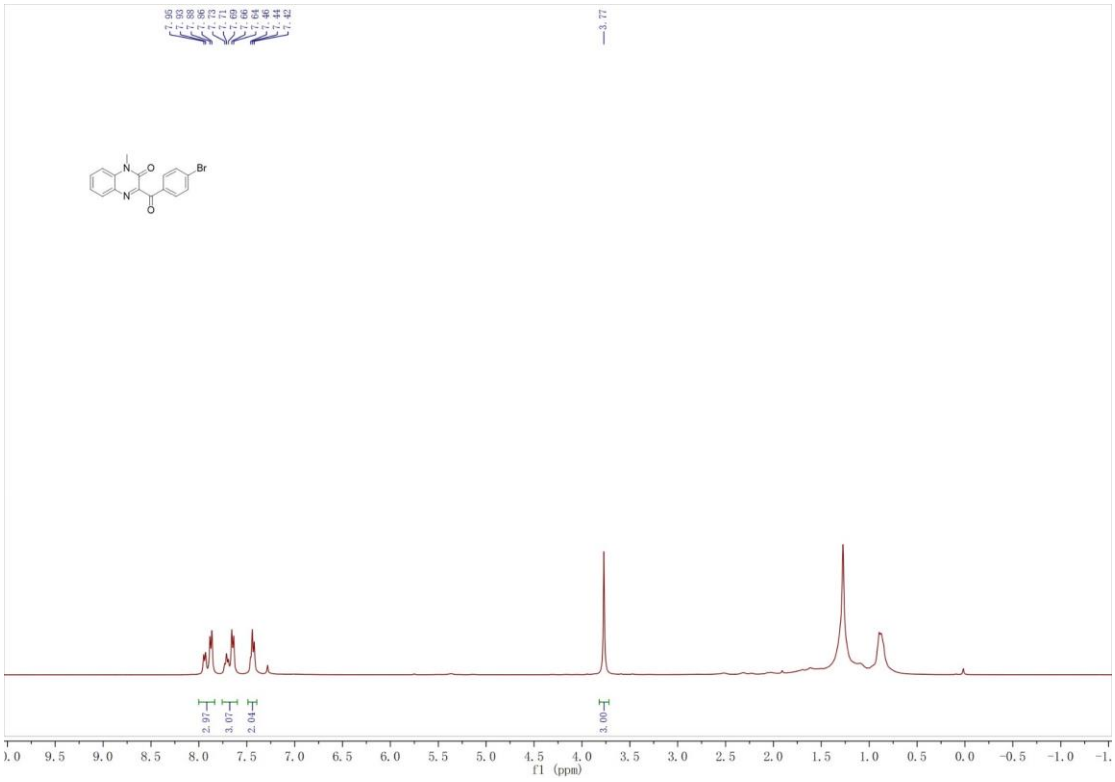
^{1}H NMR spectra of 3-(4-chlorobenzoyl)-1-methylquinoxalin-2(1H)-one(3ab)



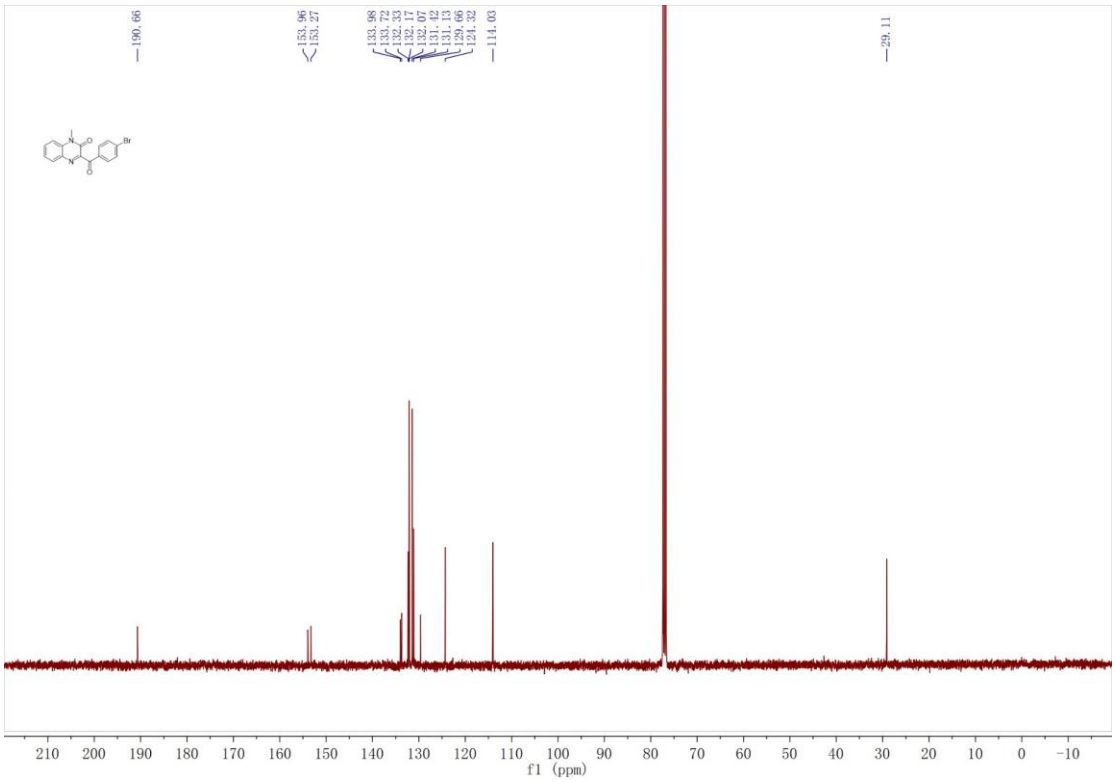
^{13}C NMR spectra of 3-(4-chlorobenzoyl)-1-methylquinoxalin-2(1H)-one(3ab)



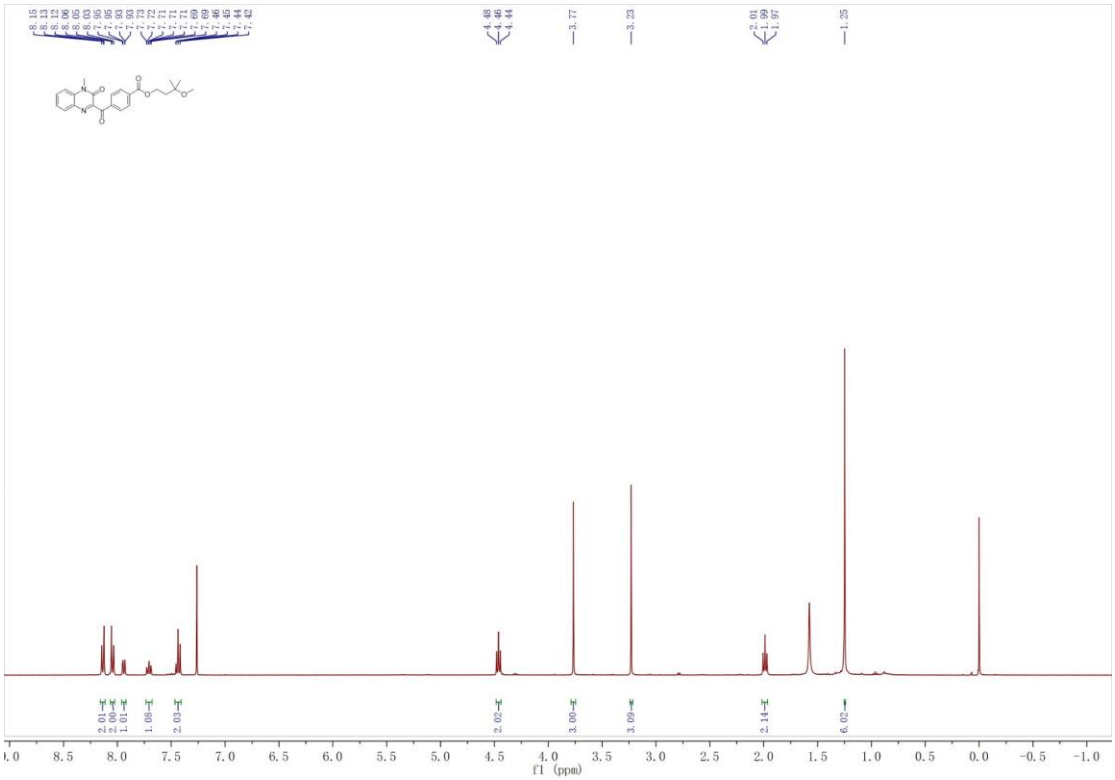
^{1}H NMR spectra of 3-(4-bromobenzoyl)-1-methylquinoxalin-2(1H)-one(3ac)



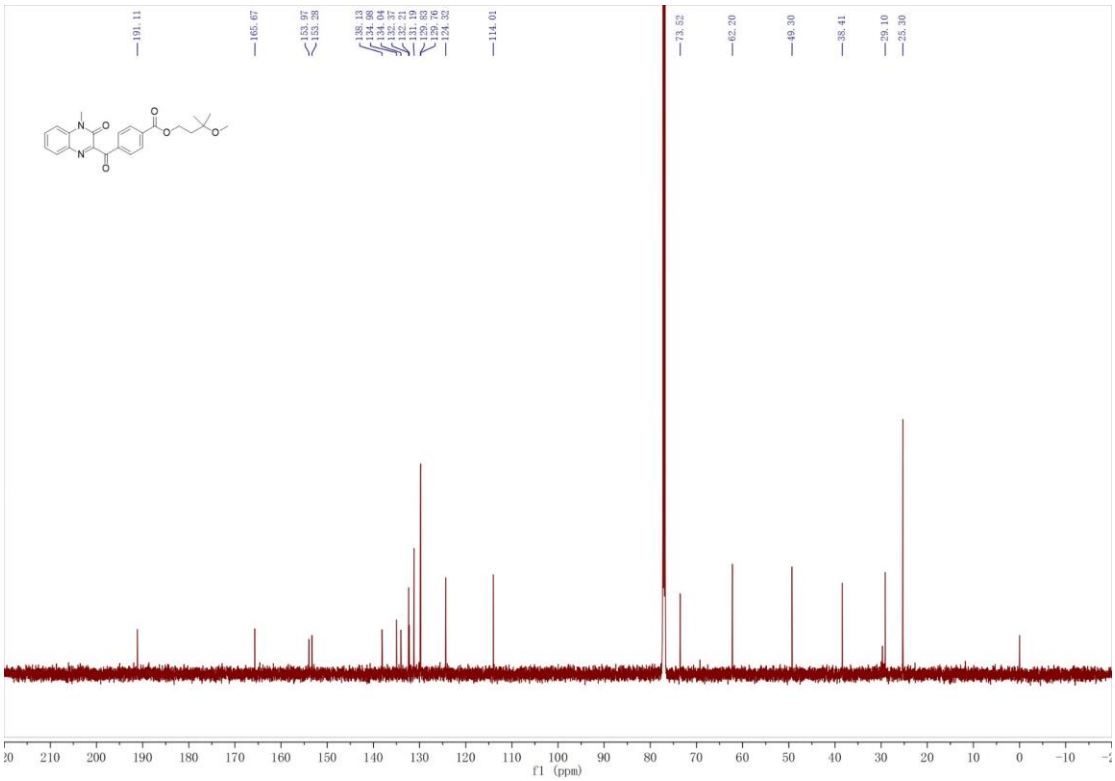
^{13}C NMR spectra of 3-(4-bromobenzoyl)-1-methylquinoxalin-2(1H)-one(3ac)



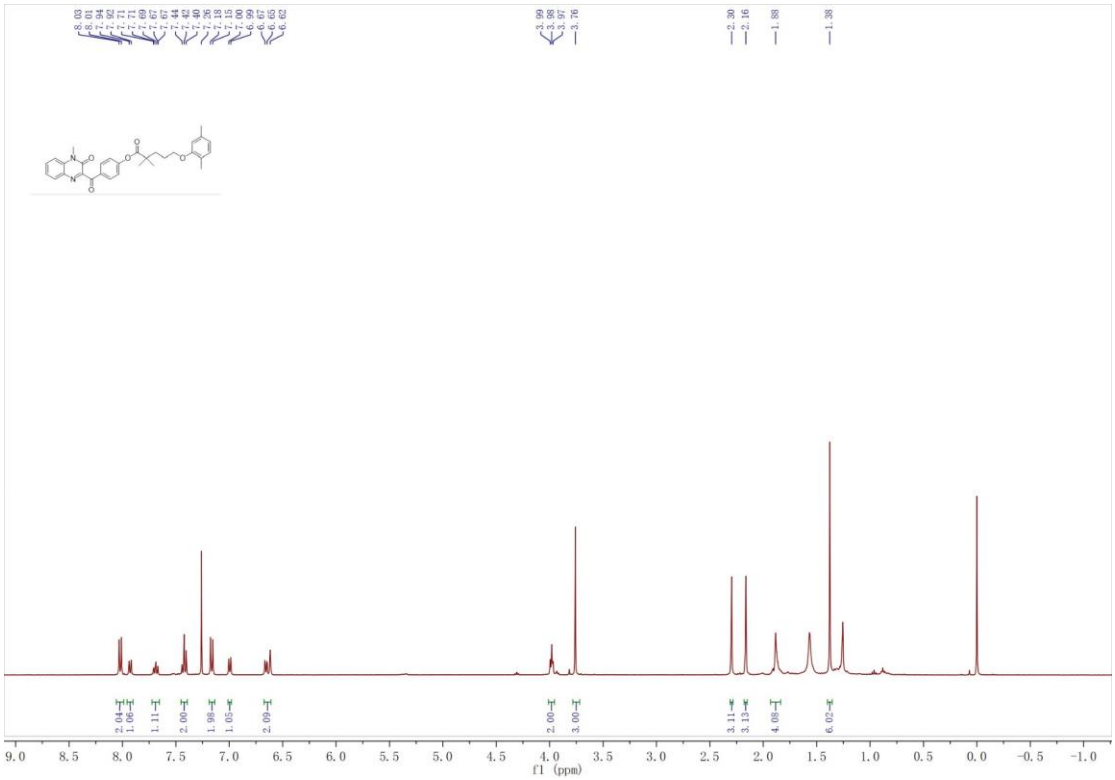
^{1}H NMR spectra of 3-methoxy-3-methylbutyl4-(4-methyl-3-oxo-3,4-dihydroquinoxaline-2-carbonyl)benzoate(3ad)



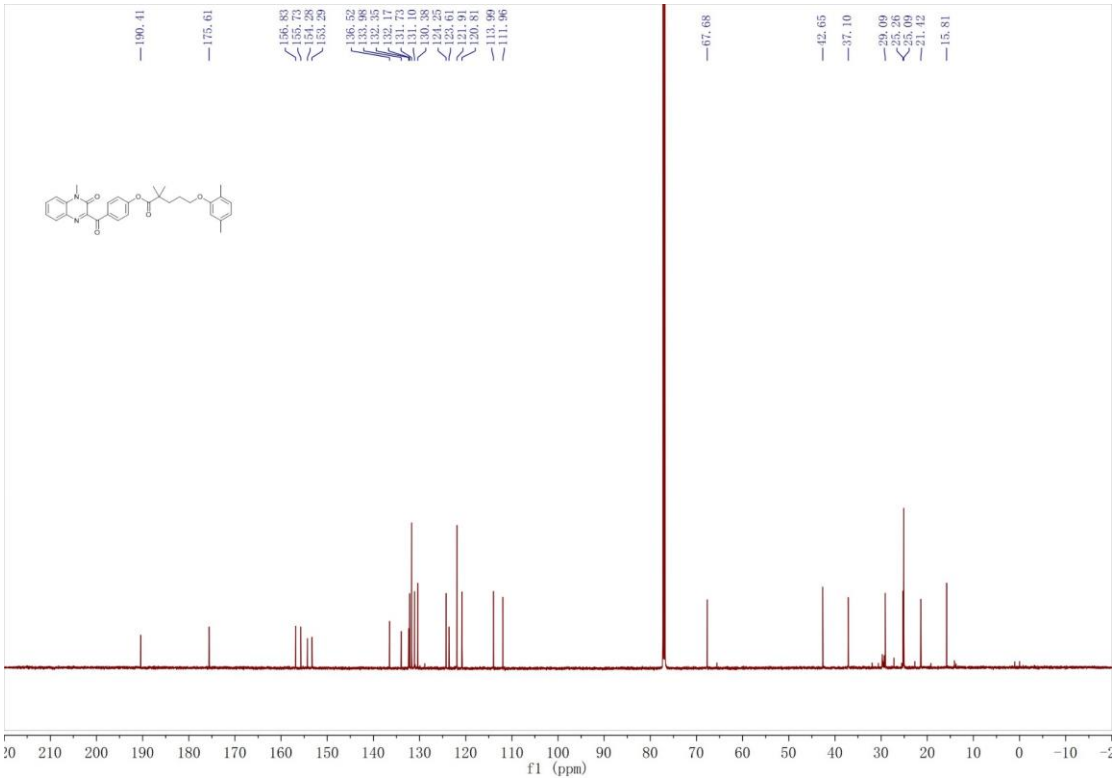
^{13}C NMR spectra of 3-methoxy-3-methylbutyl4-(4-methyl-3-oxo-3,4-dihydroquinoxaline-2-carbonyl)benzoate(3ad)



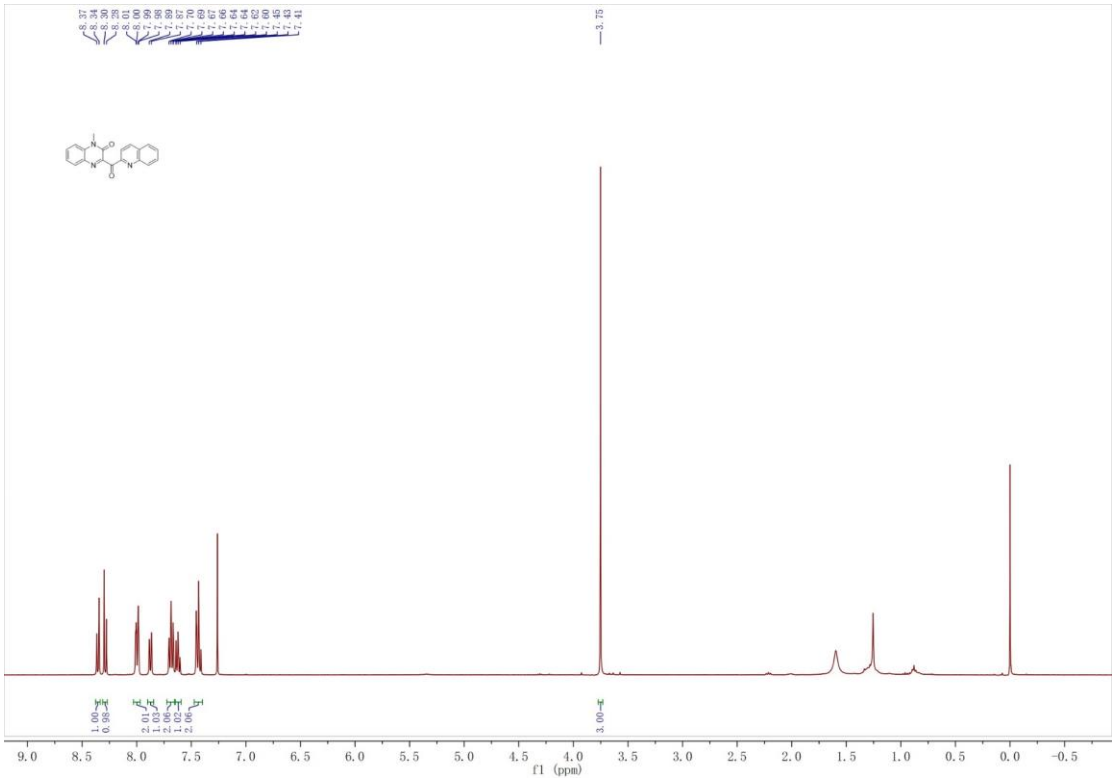
^{1}H NMR spectra of 4-(4-methyl-3-oxo-3,4-dihydroquinoxaline-2-carbonyl)phenyl5-(2,5-dimethylphenoxy)-2,2-dimethylpentanoate(3ae)



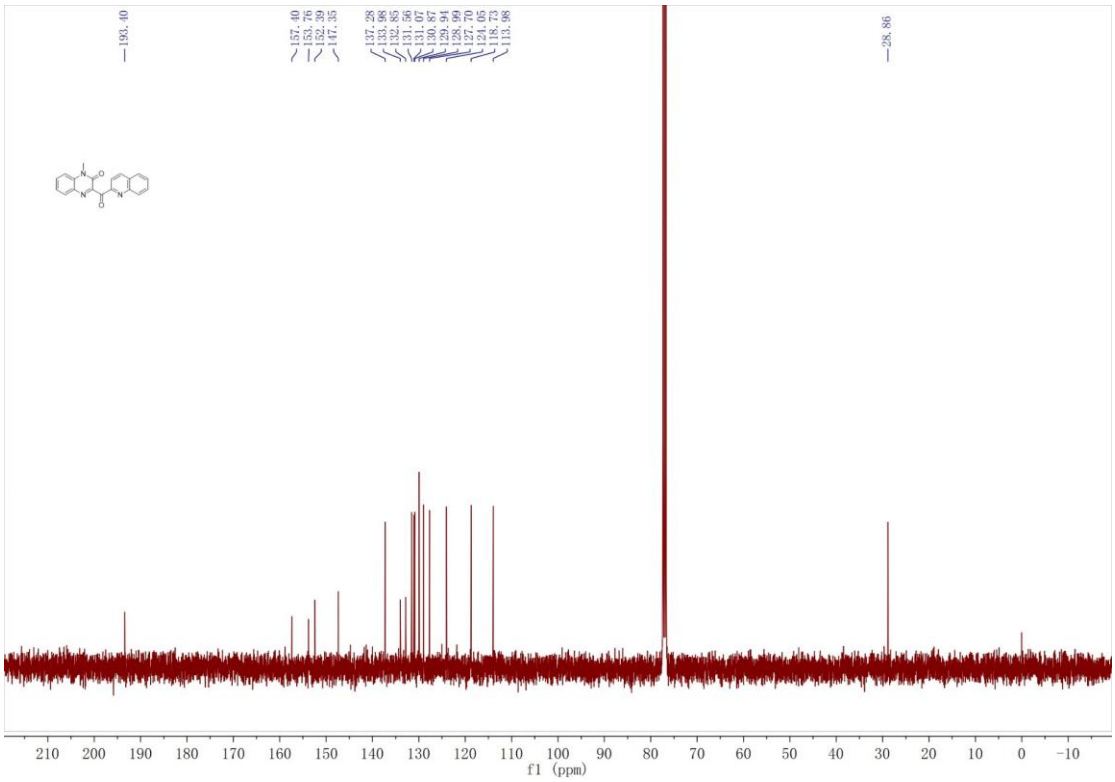
^{13}C NMR spectra of 4-(4-methyl-3-oxo-3,4-dihydroquinoxaline-2-carbonyl)phenyl5-(2,5-dimethylphenoxy)-2,2-dimethylpentanoate(3ae)



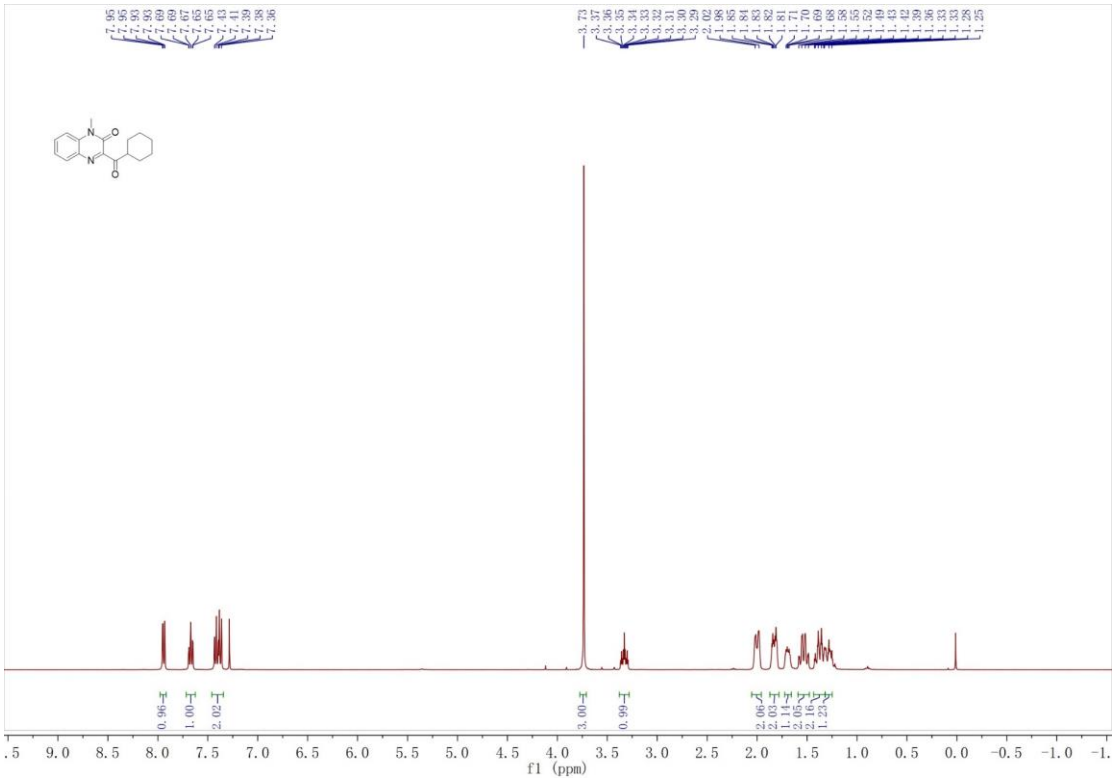
^{1}H NMR spectra of 1-methyl-3-(quinoline-2-carbonyl)quinoxalin-2(1H)-one(3af)



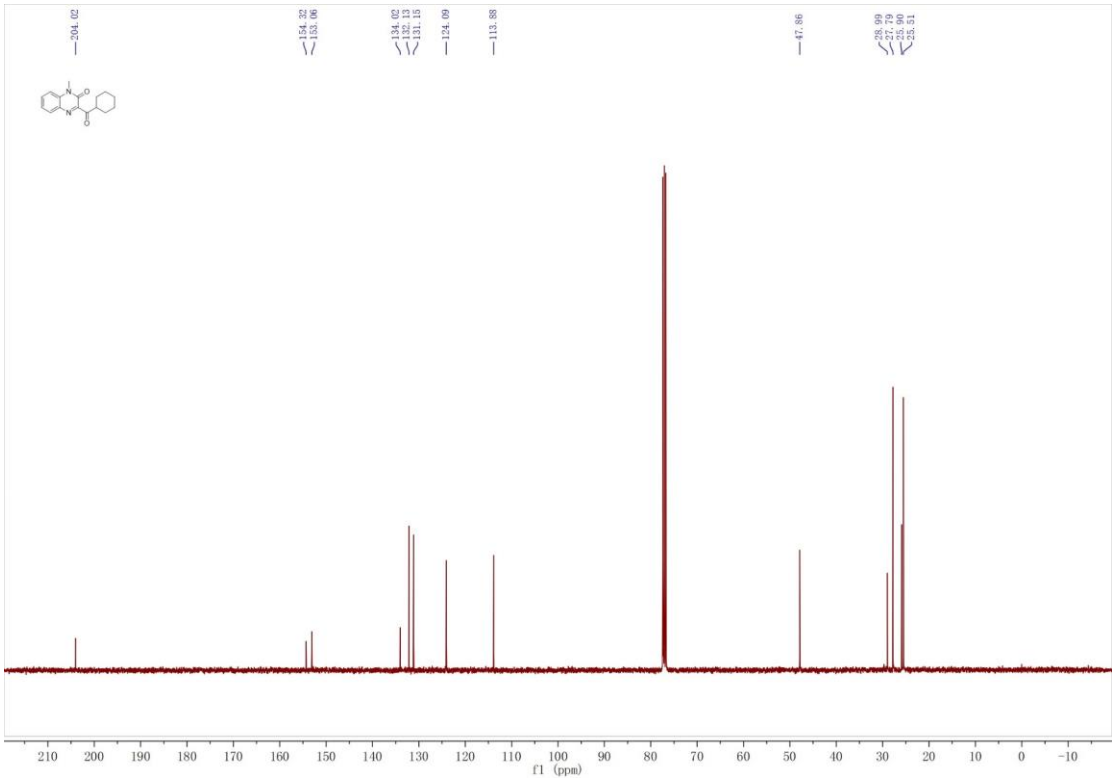
^{13}C NMR spectra of 1-methyl-3-(quinoline-2-carbonyl)quinoxalin-2(1H)-one(3af)



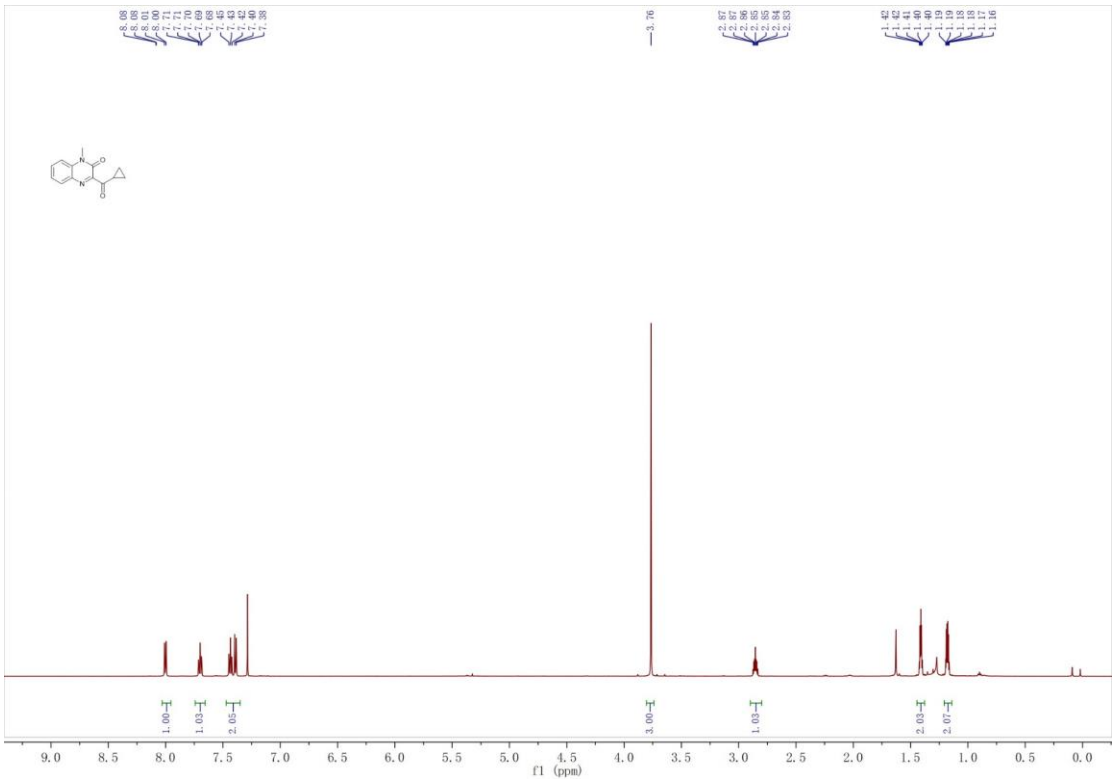
^{1}H NMR spectra of 3-(cyclohexanecarbonyl)-1-methylquinoxalin-2(1H)-one(3ag)



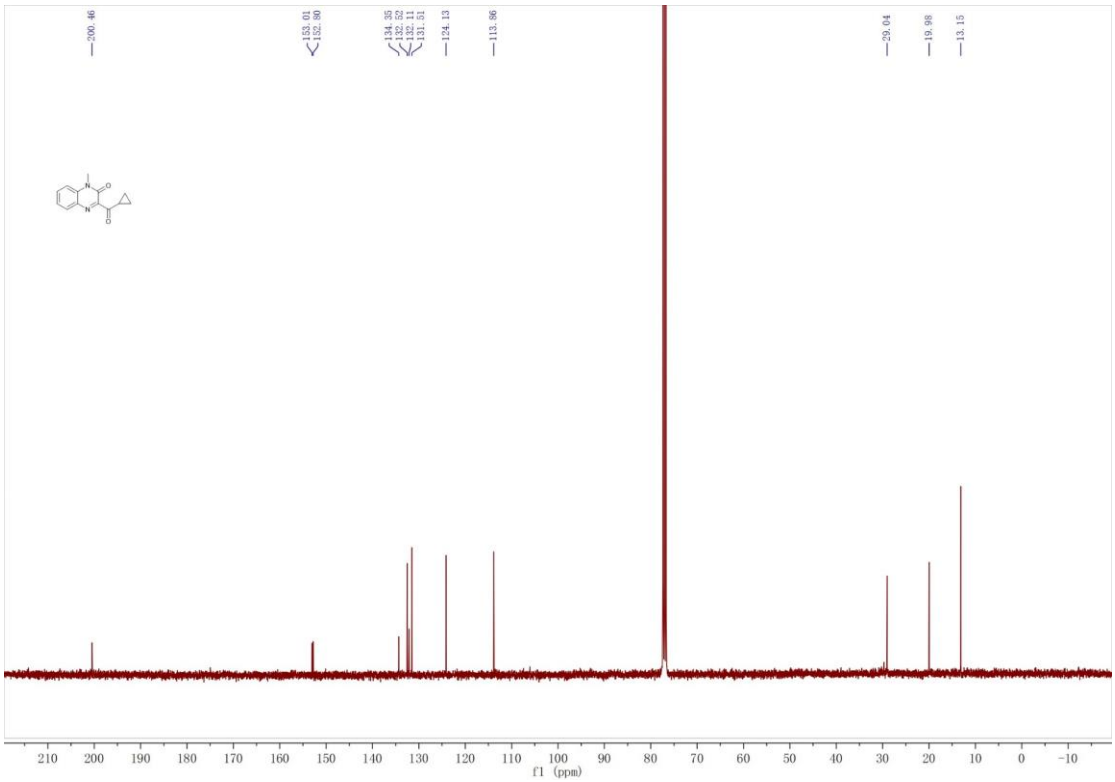
^{13}C NMR spectra of 3-(cyclohexanecarbonyl)-1-methylquinoxalin-2(1H)-one(3ag)



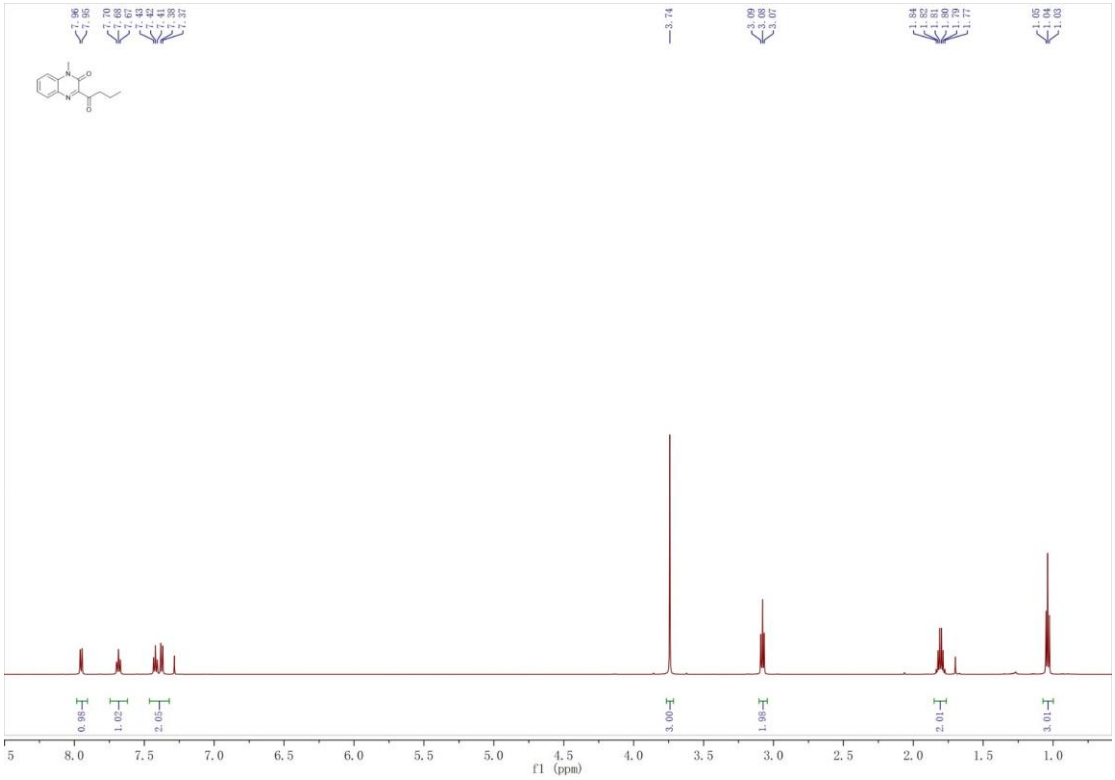
^{1}H NMR spectra of 3-(cyclopropanecarbonyl)-1-methylquinoxalin-2(1H)-one(3ah)



^{13}C NMR spectra of 3-(cyclopropanecarbonyl)-1-methylquinoxalin-2(1H)-one(3ah)



^{1}H NMR spectra of 3-butyryl-1-methylquinoxalin-2(1H)-one(3ai)



^{13}C NMR spectra of 3-butyryl-1-methylquinoxalin-2(1H)-one(3ai)