Supporting Information

Acidochromism-Enabled Aerobic Oxidative Cross-coupling of Quinoxalinones with Indoles and Fluorescence of Products

Jie Huang, Wenkai Yuan, Long Wang and Xiang-Ying Tang*

Key Laboratory of Material Chemistry for Energy Conversion and Storage, Ministry of Education, Hubei Engineering Research Center for Biomaterials and Medical Protective Materials, Hubei Key Laboratory of Bioinorganic Chemistry & Materia Medica, Semiconductor chemistry center, School of Chemistry and Chemical Engineering, School of Chemistry and Chemical Engineering, Huazhong University of Science and Technology (HUST), Wuhan 430074, People's Republic of China

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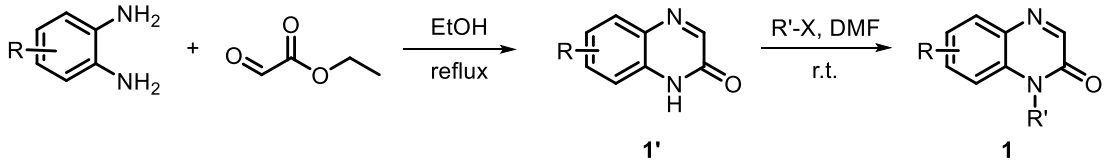
1. General experimental information

^{1}H NMR and ^{13}C NMR spectra were recorded on an Agilent DD2 400-MR spectrometer in $CDCl_3$ or DMSO-d_6 with tetramethylsilane (TMS) as the internal standard; Chemical shifts (δ) are expressed in ppm and *J*-values are in Hz. UV-Vis absorption spectra were recorded by using Shimadzu UV-2600 UV/Vis spectrometer. Fluorescence Spectra were recorder by using RF-5301PC for all experiments. HRMS was measured on a TOF-Q mass spectrometer equipped with an ESI source. Melting point was measured with SGWX-4 Microscopic Melting Point Tester. The solvents and chemicals were purchased and used as reveived. All reactions were monitored by TLC with Huanghai GF254 silica gel coated plates. Flash column chromatography was carried out using 300-400 mesh silica gel at increased pressure.

2. Preparation of starting materials

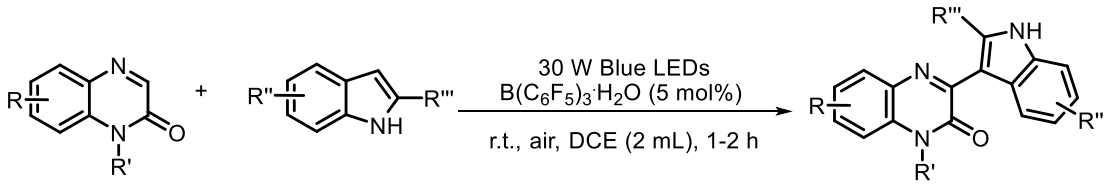
2.1 General procedure for the synthesis of quinoxalin-2-ones[1]



1' 1

To ethanol (1 mol/L) were added *o*-arylenediamine (1 equiv.) and ethyl 2-oxoacetate (1.1 equiv.). The reaction mixture was stirred at reflux for 1h, then at room temperature overnight. The precipitate was filtered and washed with ethanol, then dried to give quinoxalinone **1'**. To a suspension of quinoxalinone **1'** (1 equiv.) in DMF was added potassium carbonate (1.2 equiv.) and the corresponding halides (R'-X) (1.6 equiv.). The mixture was stirred at room temperature overnight. Ethyl acetate and water were added. The aqueous layer was extracted twice with EtOAc. The combined organic layers were washed with a saturated solution of NH_4Cl then brine, dried over $MgSO_4$, filtered and evaporated under reduced pressure. The residue is purified by flash chromatography over silica gel to afford the desired product **1**.

2.2 General procedure for the synthesis of methylquinoxalin-2(1H)-one with Indoles

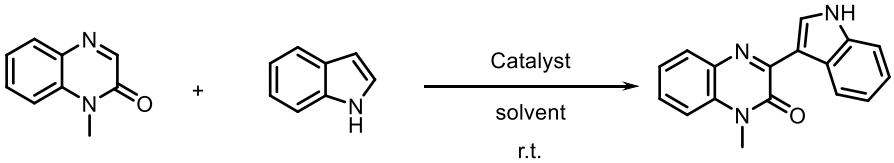


1 2 3

To a mixture of **1** (0.2 mmol) and **2** (0.3 mmol) in DCE (2.0 mL) was added $B(C_6F_5)_3 \cdot H_2O$ (5 mol%, 5.1 mg) at room temperature, the reaction mixture was irradiated by a 30 W blue LEDs lamp (approximately 1 cm away from the reaction vessel). After completion (checked by TLC), the mixture was concentrated under reduced pressure and the crude product was purified by silica gel column chromatography using petroleum ether and ethyl acetate (PE: EA= 2:1) as eluent to afford the corresponding products **3**.

3. Optimization of reaction conditions

Table S1 Optimization of experimental conditions [a]



1a **2a** **3aa**

Entry	Catalyst (5 mol %)	Indole (equiv.)	Solvent	Yield (%) [b]
1	$B(C_6F_5)_3 \cdot H_2O$ + EosinY	1.5	THF	50
2	$B(C_6F_5)_3 \cdot H_2O$	1.5	THF	55
3	---	1.5	THF	Trace
4	$B(C_6F_5)_3 \cdot H_2O$	1.5	DCM	90
5	**$B(C_6F_5)_3 \cdot H_2O$**	**1.5**	**DCE**	**94**
6	$B(C_6F_5)_3 \cdot H_2O$	1.5	CH_3CN	72
7	$B(C_6F_5)_3 \cdot H_2O$	1.5	Toluene	91
8	$B(C_6F_5)_3 \cdot H_2O$	1.5	EA	55
9	$B(C_6F_5)_3 \cdot H_2O$	1.0	DCE	62
10	$B(C_6F_5)_3 \cdot H_2O$	1.2	DCE	87
11	TsOH	1.5	DCE	67
12	HCl	1.5	DCE	72
13	$Yb(OTf)_3$	1.5	DCE	82
14	$Sc(OTf)_3$	1.5	DCE	78
15[c]	$B(C_6F_5)_3 \cdot H_2O$	1.5	DCE	89
16[d]	$B(C_6F_5)_3 \cdot H_2O$	1.5	DCE	Trace
17[e]	$B(C_6F_5)_3 \cdot H_2O$	1.5	DCE	Trace

[a]Reaction conditions: 0.2 mmol scale, catalyst (5.0 mol%), solvent (2.0 mL), r.t., air, Blue LEDs (455-460 nm, 30W) for 1 h. [b]Isolated yield. [c]Oxygen atmosphere. [d]Nitrogen atmosphere. [e]In darkness.

4. Control experiments

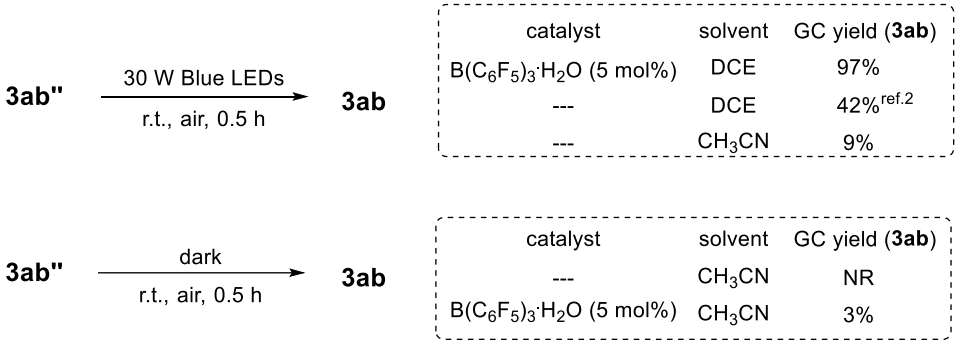
4.1 To get the intermediate 3ab' in the nitrogen atmosphere

To a mixture of **1a** (0.2 mmol) and **2b** (0.3 mmol) in DCE (2.0 mL) was added $B(C_6F_5)_3 \cdot H_2O$ (5 mol%, 5.1 mg) at room temperature in the nitrogen atmosphere. The reaction mixture was irradiated by a 30 W blue LEDs lamp (approximately 1 cm away from the reaction vessel). After completion (checked by TLC), the mixture was concentrated under reduced pressure and the crude product was purified by silica gel column chromatography petroleum ether and ethyl acetate (PE: EA= 2:1) as eluent to afford the corresponding product **3ab'**.

The following reaction was carried out in general procedure: To a mixture of **3ab'** (0.2 mmol) in solvent (2.0 mL) was added catalyst (5 mol%) at room temperature. The

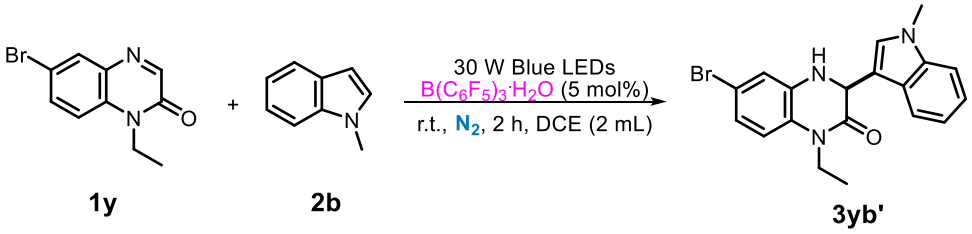
reaction mixture was irradiated by a 30 W blue LEDs lamp (approximately 1 cm away from the reaction vessel). After completion, the yields of **3ab** were determined by GC.

Scheme S1 Control experiments

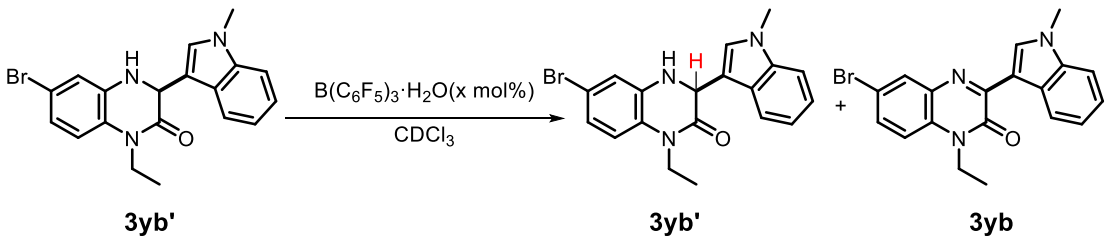


4.2 NMR verification of intermediate 3yb'

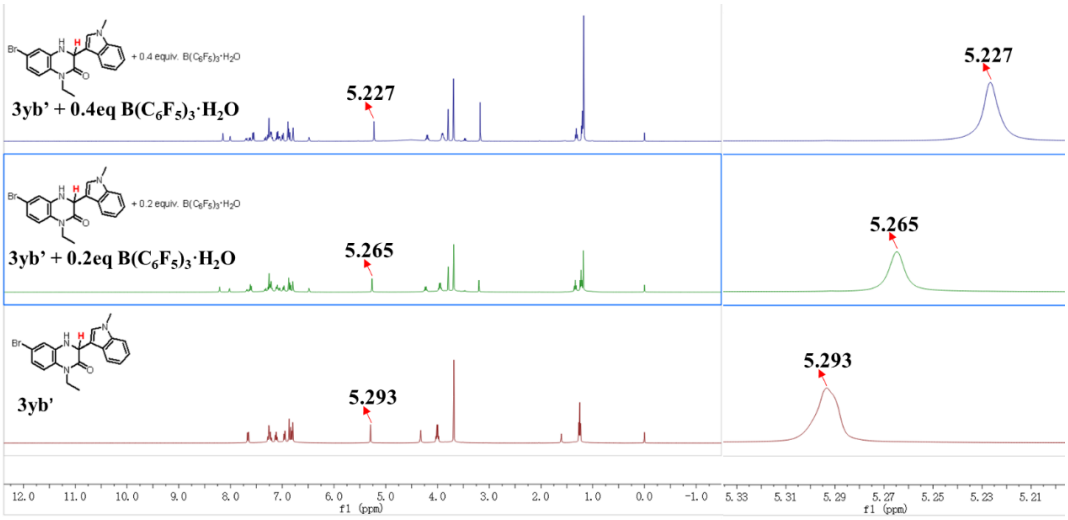
To a mixture of **3y** (0.2 mmol) and **2b** (0.3 mmol) in DCE (2.0 mL) was added $B(C_6F_5)_3·H_2O$ (5 mol%, 5.1 mg) at room temperature in the nitrogen atmosphere. The reaction mixture was irradiated by a 30 W blue LEDs lamp (approximately 1 cm away from the reaction vessel). After completion, the mixture was concentrated under reduced pressure and the crude product was purified by column chromatography (neutral Al_2O_3) using petroleum ether and ethyl acetate (PE: EA= 2:1) as eluent to afford the corresponding product **3yb'**.



The following reaction was carried out in general procedure: To a mixture of **3yb'** (0.1 mmol) in $CDCl_3$ (0.7 mL) at room temperature was added $B(C_6F_5)_3·H_2O$ (20 mol%, 10.2 mg). There are two compounds **3yb'** and **3yb**. And it was finally added $B(C_6F_5)_3·H_2O$ (20 mol%, 10.2 mg) to test ^{1}HNMR. There are also two compounds **3yb'** and **3yb**.

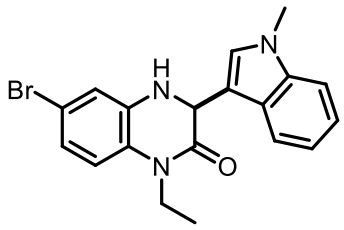


The C'-H chemical shift of intermediate **3yb'** is 5.293 ppm, then 5.265 ppm and 5.265 ppm with the addition of 0.2 equiv. $B(C_6F_5)_3 \cdot H_2O$ and another 0.2 equiv.

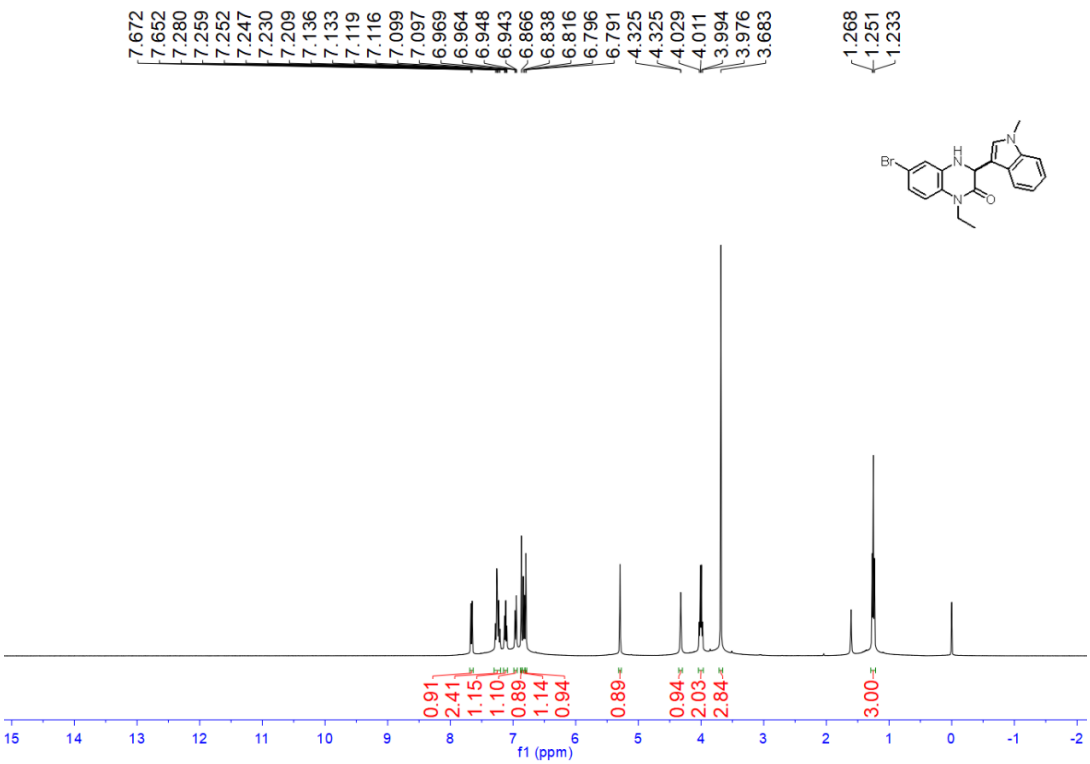


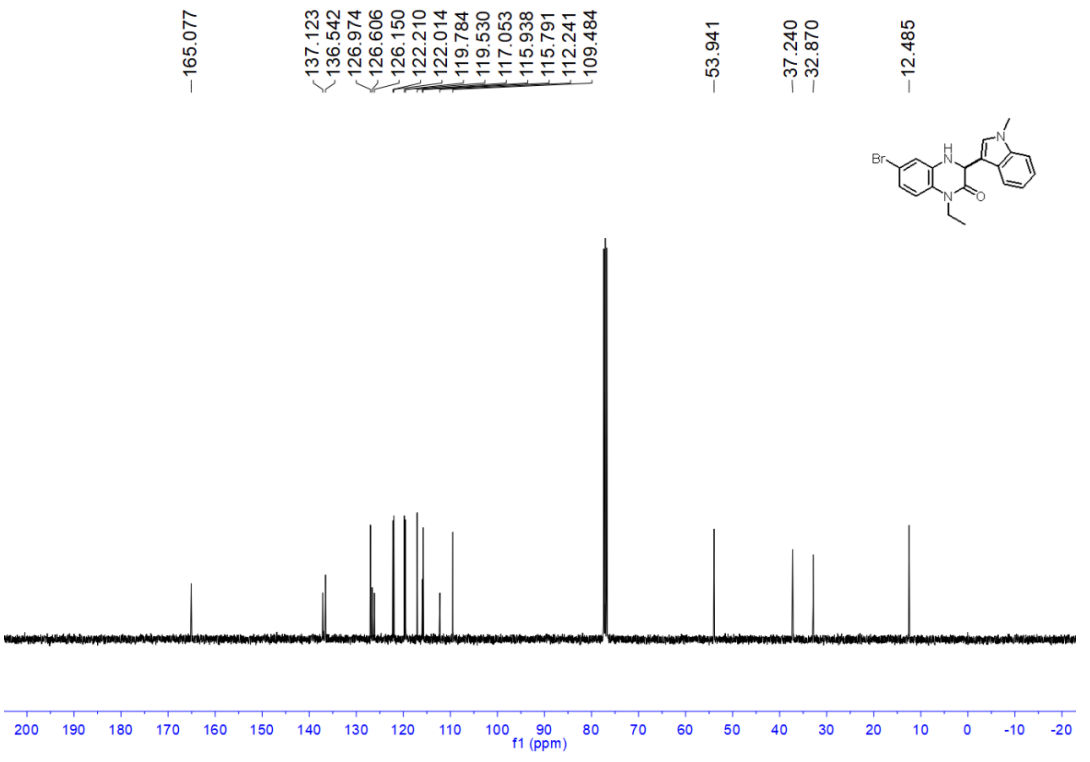
$B(C_6F_5)_3 \cdot H_2O$, indicating that the C-H is more electron rich to be oxidized in the presence of $B(C_6F_5)_3 \cdot H_2O$.

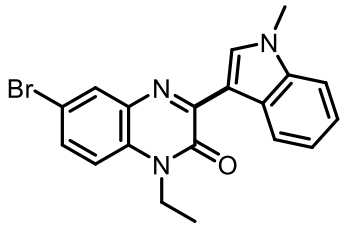
Figure S1 ^{1}HNMR spectra of **3yb'**, **3yb**+$B(C_6F_5)_3 \cdot H_2O$ in $CDCl_3$



6-bromo-1-ethyl-3-(1-methyl-1*H*-indol-3-yl)-3,4-dihydroquinoxalin-2(1*H*)-one (3yb'). White solid, 42.5 mg, yield 22%. m.p.: 173.4-174.1 °C. ^{1}H NMR (400 MHz, $CDCl_3$, TMS) δ 7.66 (d, J = 8.0 Hz, 1H), 7.30 – 7.19 (m, 2H), 7.15 – 7.09 (m, 1H), 6.99 – 6.93 (m, 1H), 6.87 (s, 1H), 6.83 (d, J = 8.6 Hz, 1H), 6.81 – 6.78 (m, 1H), 5.29 (br, 1H), 4.33 (s, 1H), 4.00 (q, J = 7.1 Hz, 2H), 3.68 (s, 3H), 1.25 (t, J = 7.1 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$, TMS) δ 165.1, 137.1, 136.5, 127.0, 126.6, 126.2, 122.2, 122.0, 119.8, 119.5, 117.1, 115.9, 115.8, 112.2, 109.5, 53.9, 37.2, 32.9, 12.5. HRMS (ESI, *m/z*) calcd for $C_{19}H_{19}BrN_3O^+$ $[M+H]^+$: 384.0706, found 384.0709.

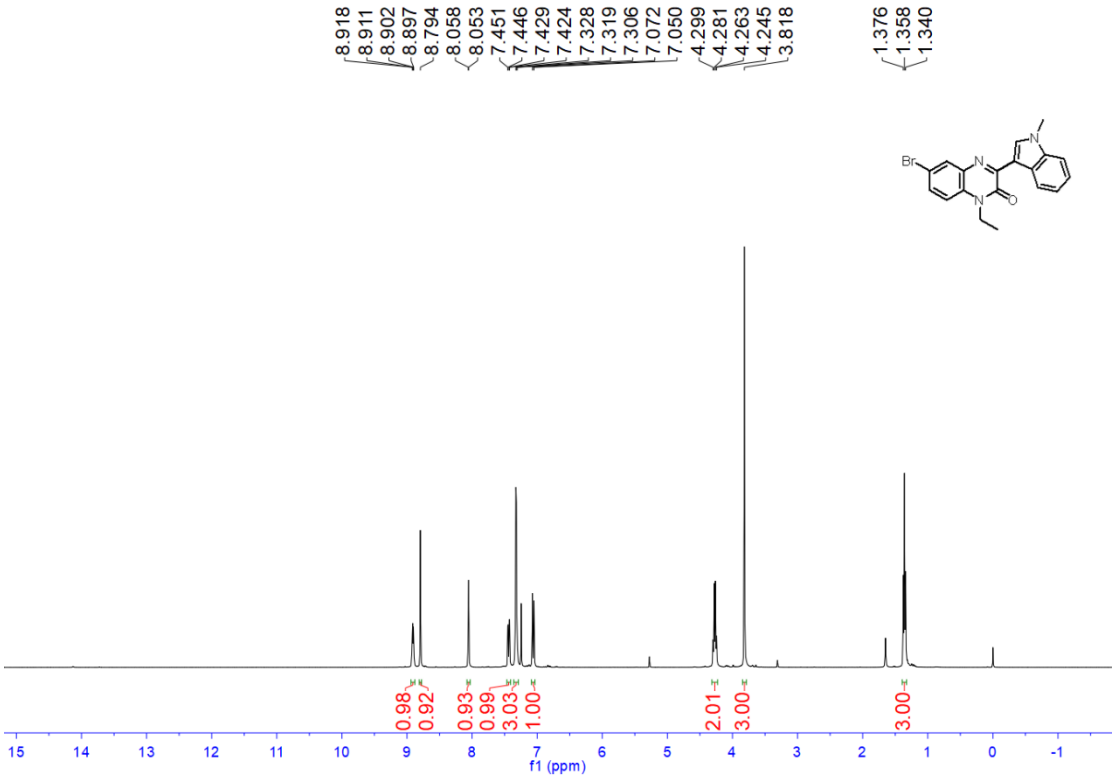


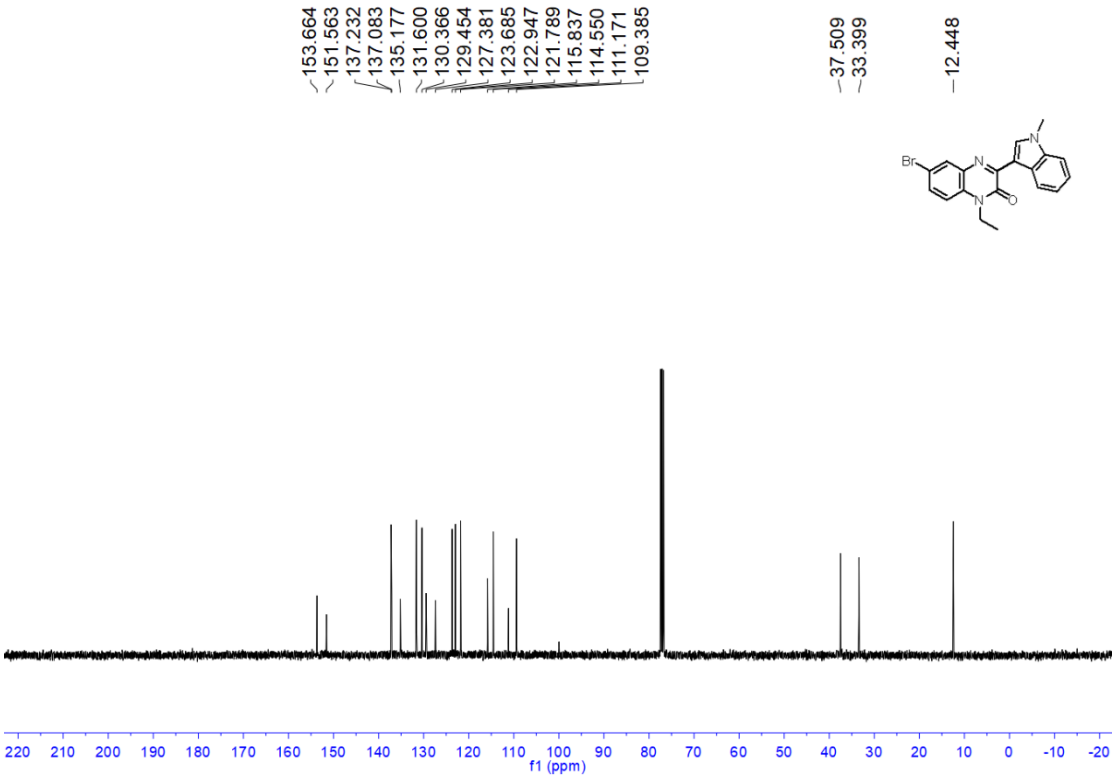




6-bromo-1-ethyl-3-(1-methyl-1*H*-indol-3-

yl)quinoxalin-2(1H)-one (3yb). Yellow solid, 69.0 mg, yield 90%. m.p.: 208.5-208.9 ℃. ^{1}H NMR (400 MHz, $CDCl_3$, TMS) δ 8.94 – 8.88 (m, 1H), 8.79 (s, 1H), 8.06 (d, *J* = 2.1 Hz, 1H), 7.47 – 7.41 (m, 1H), 7.36 – 7.29 (m, 3H), 7.06 (d, *J* = 8.9 Hz, 1H), 4.27 (q, *J* = 7.1 Hz, 2H), 3.82 (s, 3H), 1.36 (t, *J* = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$, TMS) δ 153.7, 151.6, 137.2, 137.1, 135.2, 131.6, 130.4, 129.5, 127.4, 123.7, 123.0, 121.8, 115.8, 114.6, 111.2, 109.4, 37.5, 33.4, 12.5. HRMS (ESI, *m/z*) calcd for $C_{19}H_{17}BrN_3O^+$ $[M+H]^+$: 382.0550, found 382.0555.





4.3 Emission quenching experiments under nitrogen and oxygen atomsphere

Emission intensities were recorded using a SHIMADZU RF-5301PC luminescence spectrophotometer. **PC** solutions were excited at 390 nm and the emission intensity was collected at 460 nm. In a typical experiment, to a 2×10^{-6} M solution of **PC** in DCE under nitrogen (black line) and oxygen atmosphere of a quencher (red line) in a quartz cuvette. The relative luminescence intensity was quenched by oxygen.

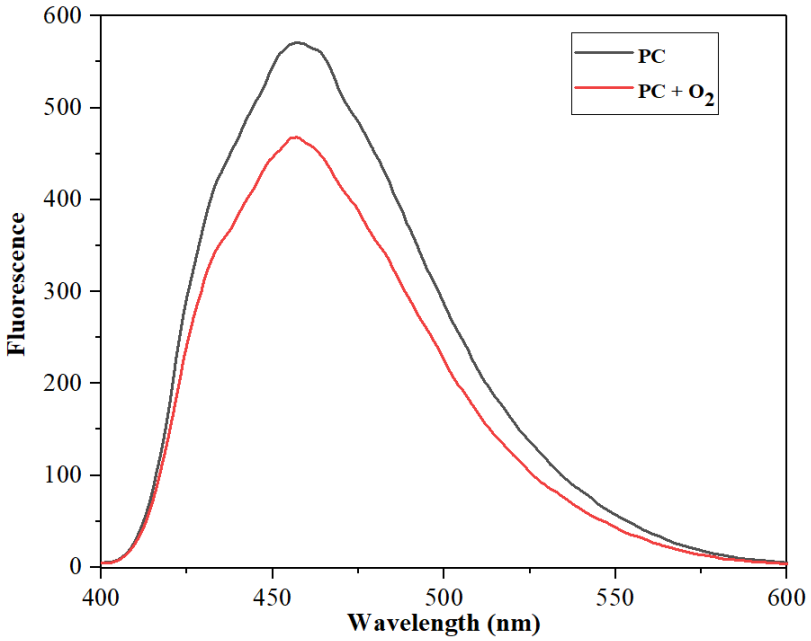


Figure S2 Fluorescence quenching under nitrogen and oxygen atmosphere.

4.4 UV/visible absorption spectra of 3ab'

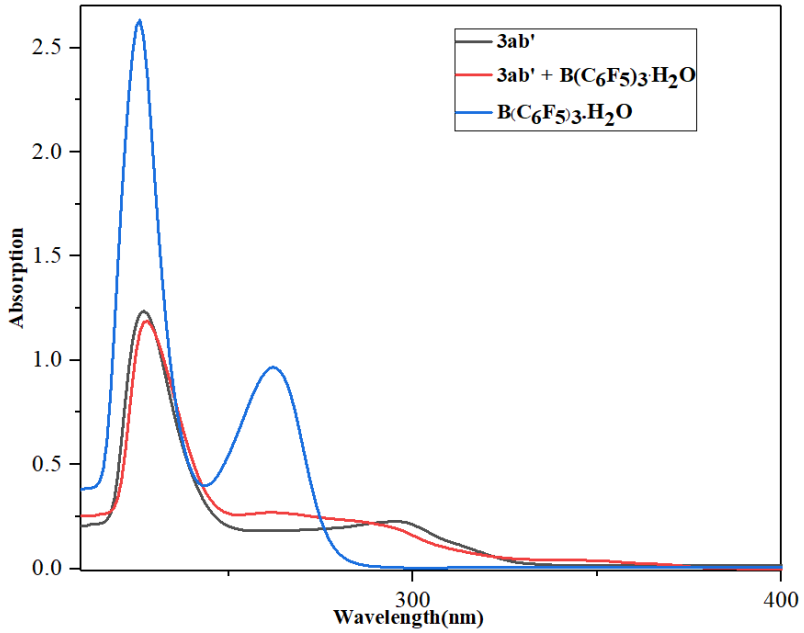


Figure S3 UV/visible absorption spectra of **3ab'**, **$B(C_6F_5)_3 \cdot H_2O$** and **3ab'** + **$B(C_6F_5)_3 \cdot H_2O$** in DCE at the concentration 2×10^{-5} M.

4.5 Cyclic voltammogram experiment and the estimation of excited state reduction potential of 3ab and PC

Cyclic voltammogram was recorded using a Gamry Interface 5000E potentiostat. Cyclic voltammogram measurement was performed with a glassy carbon working electrode, an Ag/AgCl, KCl (saturated) reference electrode and a Pt sheet auxiliary electrode at room temperature in nitrogen degassed MeCN solution (10 mL) of

tetrabutylammonium hexafluorophosphate (0.1 M), containing **3ab** (0.025 M), scan rate = 50 $mV \cdot s^{-1}$.

Cyclic voltammogram was recorded using a Gamry Interface 5000E potentiostat. Cyclic voltammogram measurement was performed with a glassy carbon working electrode, an Ag/AgCl, KCl (saturated) reference electrode and a Pt sheet auxiliary electrode at room temperature in nitrogen degassed MeCN solution (10 mL) of tetrabutylammonium hexafluorophosphate (0.1 M), containing **PC** (**3ab** + **$B(C_6F_5)_3 \cdot H_2O$**) (0.025 M), scan rate = 50 $mV \cdot s^{-1}$.

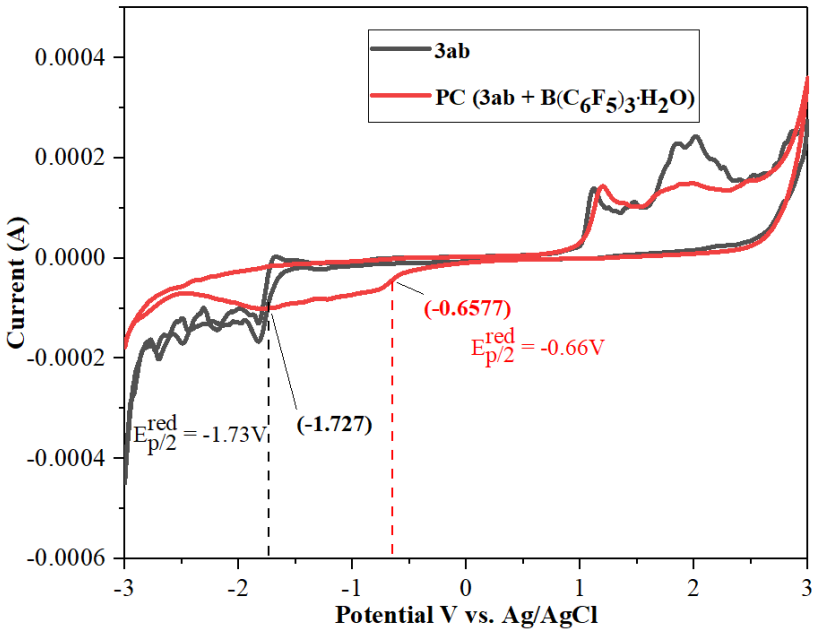


Figure S4: Cyclic voltammetry of **3ab** (black line) and **PC** (red line).

3ab (black line): $E^{red}_{1/2}$ = -1.73 V vs Ag/AgCl, KCl (sat'd)

$E^{S1}_{0,0}$ = (3.24 eV (383 nm) + 2.70 eV (449 nm))/2 = 3.00eV

$E^{red*}_{1/2}$ = -1.73 V + 3.00 eV = 1.27 V vs Ag/AgCl, KCl (sat'd)

$E^{red*}_{1/2}$ = 1.27 V – 0.045 V = 1.23V vs SCE

PC (red line).: $E^{red}_{1/2}$ = -0.66 V vs Ag/AgCl, KCl (sat'd)

$E^{S1}_{0,0}$ = (2.59+ eV (479 nm) + 2.76 eV (458nm))/2 = 2.65 eV

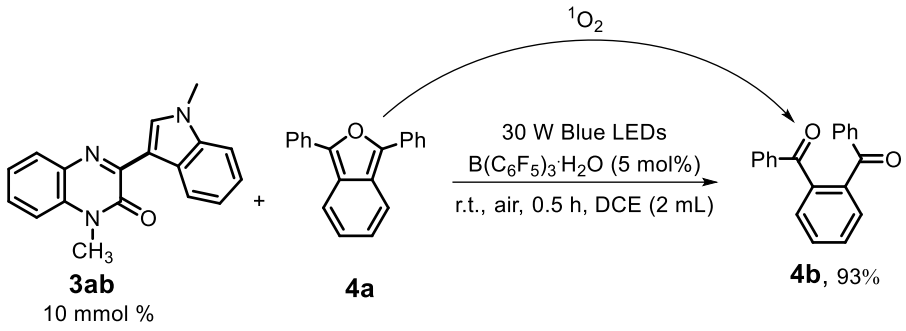
$E^{red*}_{1/2}$ = -0.66 V + 2.65 eV = 1.99 V vs Ag/AgCl, KCl (sat'd)

$E^{red*}_{1/2}$ = 1.99 V – 0.045 V = 1.95 V vs SCE

5. Determination of singlet oxygen species[3]

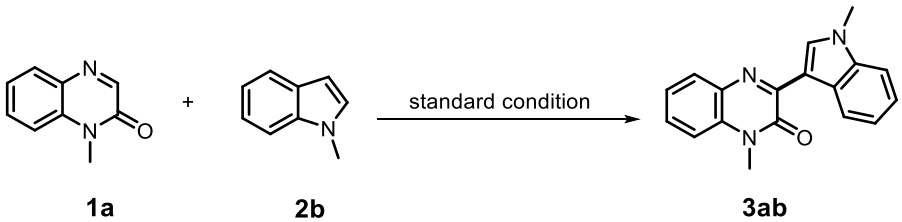
1,3-Diphenylbenzo[c]furan (DPBF, 0.2 mmol, 54.0 mg), $B(C_6F_5)_3 \cdot H_2O$ (5 mol%, 5.1 mg), and 1-methyl-3-(1-methyl-1H-indol-3-yl)quinoxalin-2(1H)-one (3ab, 10mol%), were added into 2.0 mL 1,2-dichloroethane. The resulting solution was stirred at room temperature under air and blue LEDs for 0.5 h. Then, the reaction mixture was filtered, and the solvent was evaporated in vacuum. The crude product was purified by flash column chromatography on silica gel using petroleum ether and ethyl acetate (PE: EA= 20:1) as eluent.

Scheme S2 Determination of singlet oxygen species



6. Light on/off experiments

The light on/off experiment following the standard condition: A 10 mL reaction vial equipped with a stir bar was charged with **1a** (32.0 mg, 0.2 mmol), indole **2b** (39.4 mg, 0.3 mmol), $B(C_6F_5)_3 \cdot H_2O$ (5.1 mg, 5mol%), and DCE (2 mL). The reaction mixture was irradiated by a 30 W blue LED lamp (approximately 1 cm away from the reaction vessel) at room temperature for corresponding time. Afterwards, the product **3ab** was detected by GC. These results demonstrated that light is necessary for the reaction.



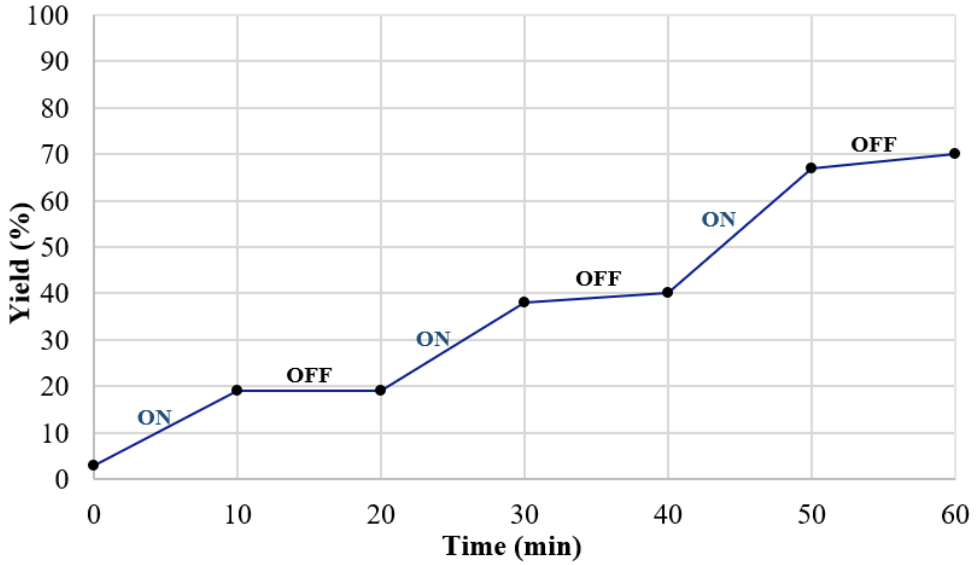
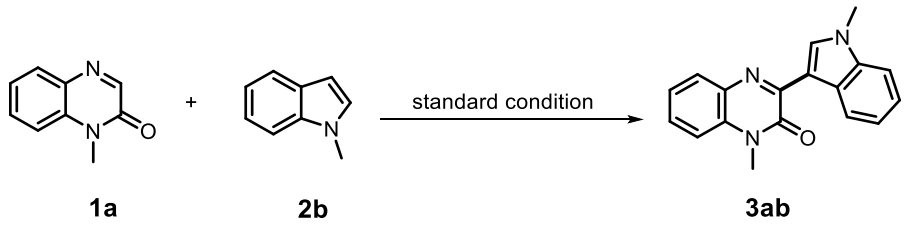


Figure S5 Light on/off experiment with $B(C_6F_5)_3 \cdot H_2O$-catalyzed photoredox coupling reaction of **1a** and **2b**.

7. Reaction profiles

The experimental time plot following the standard condition:A 10 mL reaction vial equipped with a stir bar was charged with **1a** (32.0 mg, 0.2 mmol), indole **2b** (39.4 mg, 0.3 mmol), $B(C_6F_5)_3 \cdot H_2O$ (5.1 mg, 5mol%), and DCE (2 mL). The reaction mixture was irradiated by a 30 W blue LED lamp (approximately 1 cm away from the reaction vessel) at room temperature for corresponding time. Afterwards, the product **3ab** was detected by GC. As the reaction time proceeds, the reaction rate is gradually accelerated. These results demonstrated that product 3 was able to catalyze the reaction under standard conditions. (for example: **1a** and **2b** in figure S3)



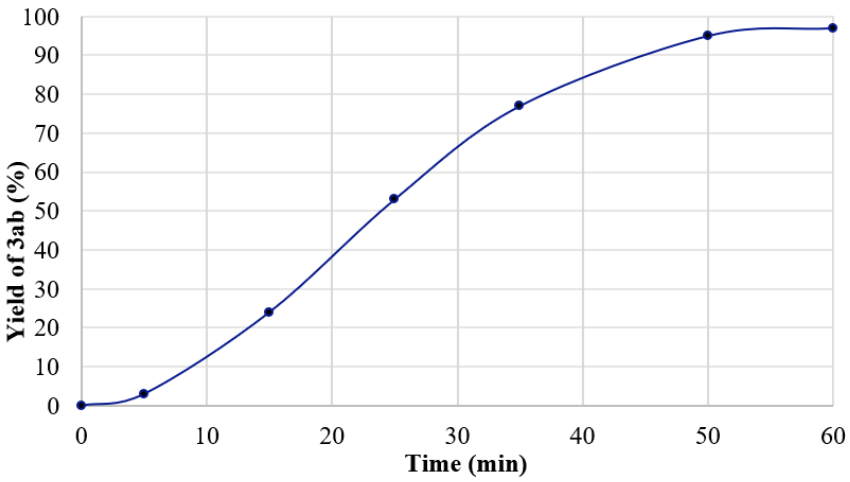


Figure S6 Reaction profiles of $B(C_6F_5)_3 \cdot H_2O$-catalyzed photoredox coupling reaction of **1a** and **2b**.

8. UV−Vis absorption spectra

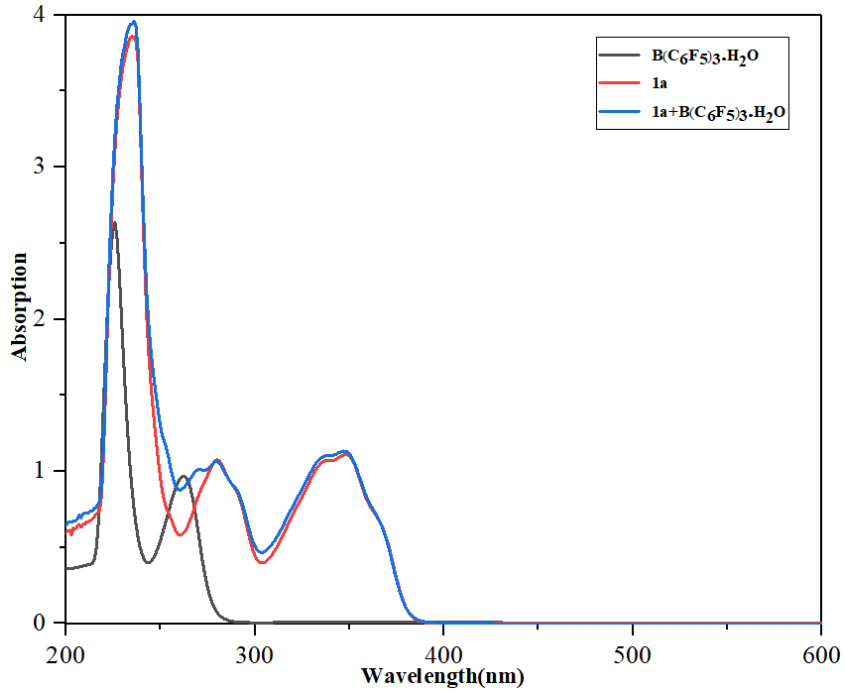


Figure S7 Absorption spectra of **1a**, $B(C_6F_5)_3 \cdot H_2O$, and **1a**+ $B(C_6F_5)_3 \cdot H_2O$ in DCE

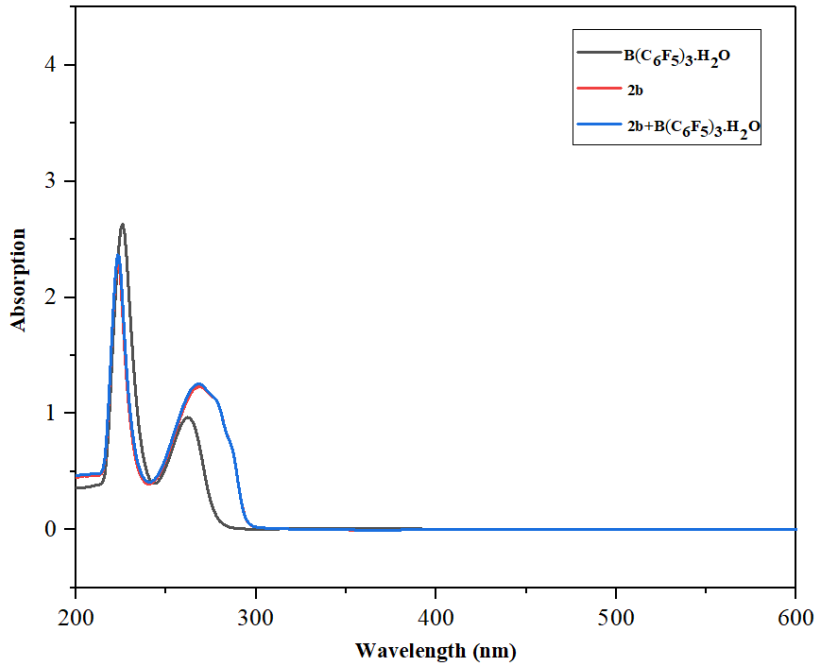


Figure S8 Absorption spectra of **2b**, $B(C_6F_5)_3 \cdot H_2O$, and **2b** + $B(C_6F_5)_3 \cdot H_2O$ in DCE

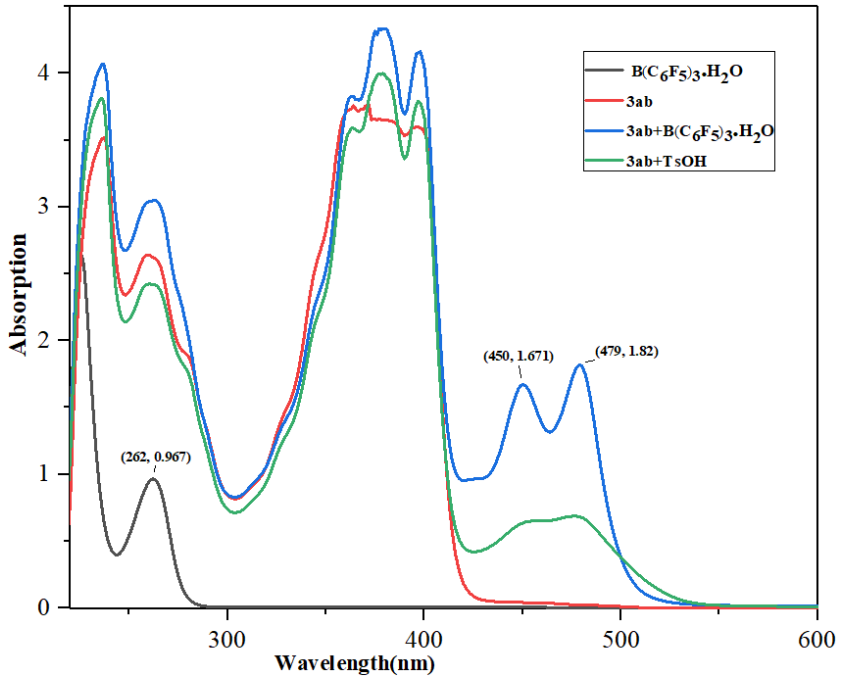


Figure S9 Absorption spectra of **3ab**, $B(C_6F_5)_3 \cdot H_2O$, **3ab** + $B(C_6F_5)_3 \cdot H_2O$ and **3ab** + TsOH in DCE

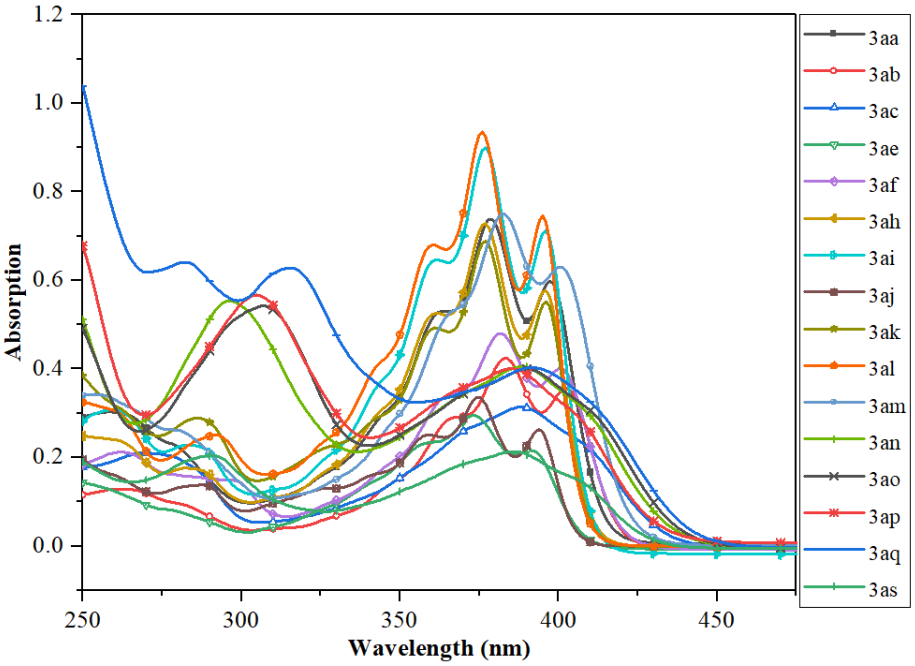


Figure S10 Absorption spectra of **3ab-3as** in EA at the concentration 2 × 10^{-5} M

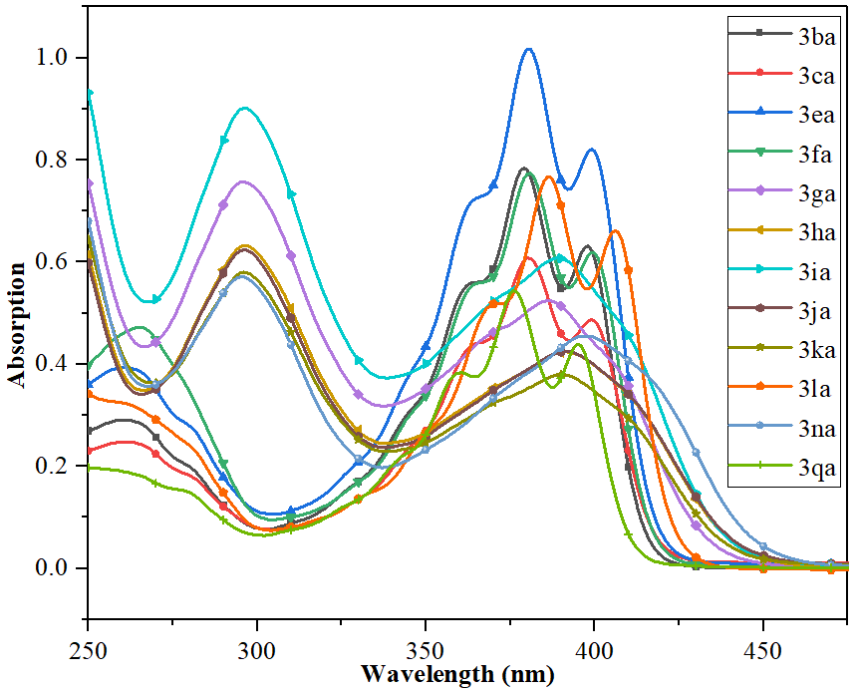


Figure S11 Absorption spectra of **3ba-3na** in EA at the concentration 2 × 10^{-5} M

9. Fluorescence spectra

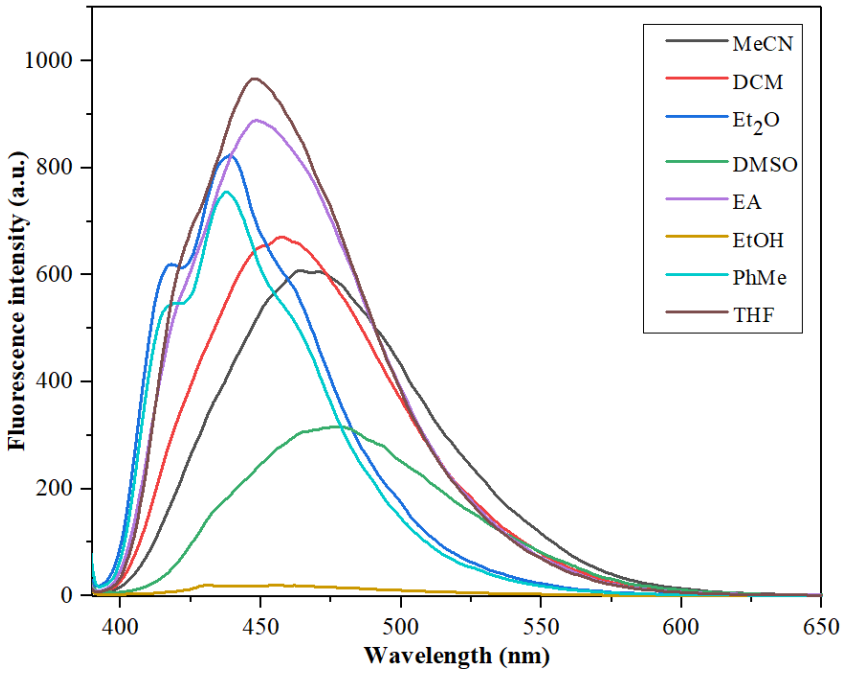


Figure S12 Fluorescence spectra of **3aa** in different solvents at the concentration 2 × 10^{-7} M

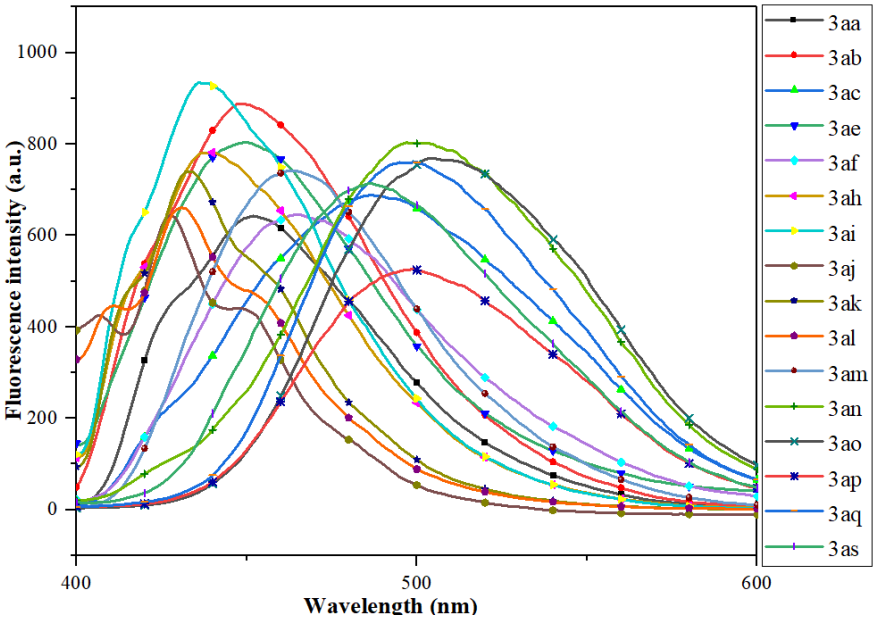


Figure S13 Fluorescence spectra of **3aa-3as** in EA at the concentration 2 × 10^{-6} M

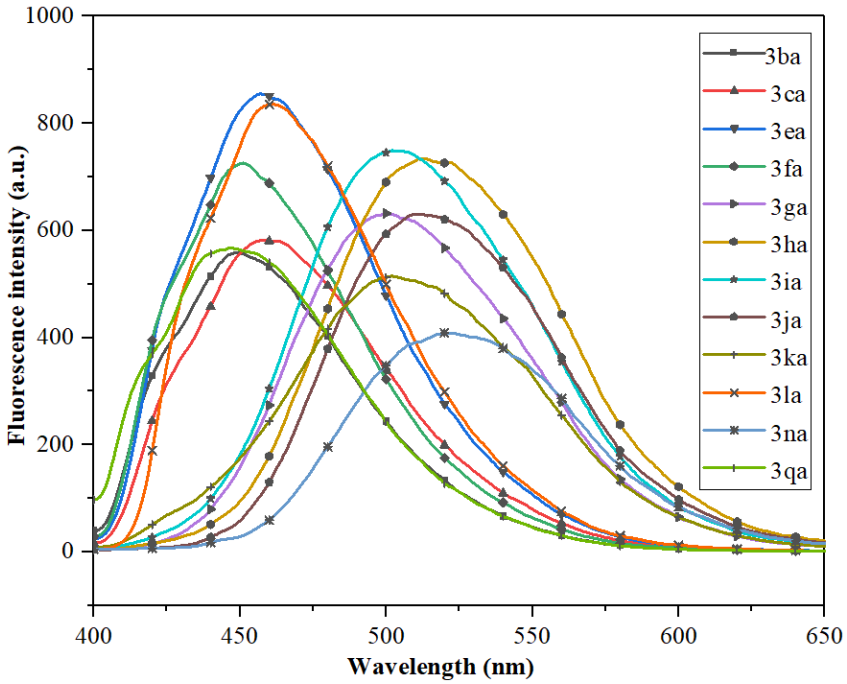


Figure S14 Fluorescence spectra of **3ba-3qa** in EA at the concentration 2 × 10^{-6} M.

10. Spectroscopic properties of fluorophores 3[6]

Table S2 Summary of the measured photophysical properties of selected 3

entry	product	$\lambda_{abs}{}^{a}$ (nm)	$\lambda_{em}{}^{b}$ (nm)	stokes shift (nm/cm^{-1})	$\Phi_F{}^{c}$ (%)
1	**3aa**	379	449	70/4113	28
2	**3ab**	383	452	69/3986	46
3	**3ae**	373	449	76/4538	10
4	**3ai**	377	436	59/3589	32
5	**3ak**	377	432	55/3377	20
6	**3al**	376	431	55/3394	30
7	**3an**	391	499	108/5535	3
8	**3ba**	379	450	71/4163	38
9	**3ca**	380	459	79/4530	51
10	**3ea**	380	456	76/4386	48
11	**3fa**	381	451	70/4074	44
12	**3ga**	386	500	114/5907	2
13	**3la**	386	460	74/4168	29
14	**3na**	398	519	121/5858	2

[a]Absorption maximum. [b]Emission maximum. [c]Relative quantum yields determined by an integrating sphere system in ethyl acetate.

The calculation formula of quantum yield was adopted as follows:

$$\Phi_s = \frac{F_s}{F_r} \times \frac{A_r}{A_s} \times \frac{n_s^2}{n_r^2} \times \Phi_r$$

Where, s and r represent sample and reference respectively. A is the absorbance. F is the relative integrated fluorescence intensity, and n is the refractive index of the solvent. The reference material in this paper is quinine, whose luminescence quantum yield in aqueous 0.5 M H_2SO_4 solution is 0.546.[7]

11. References

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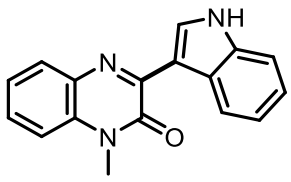
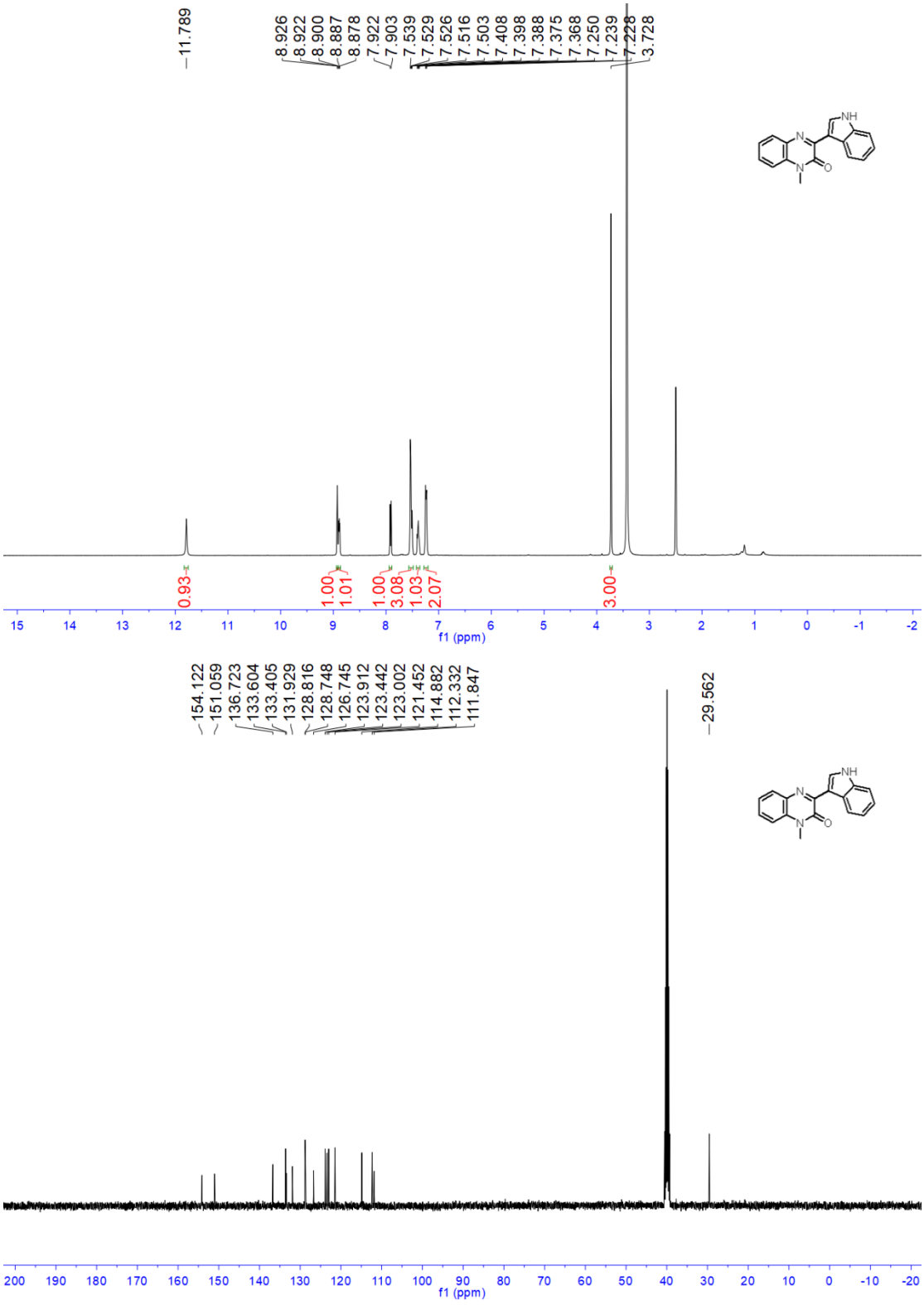
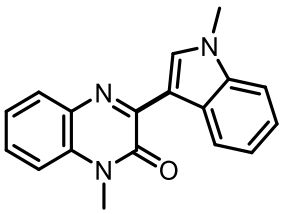
12. Characterization data for the products



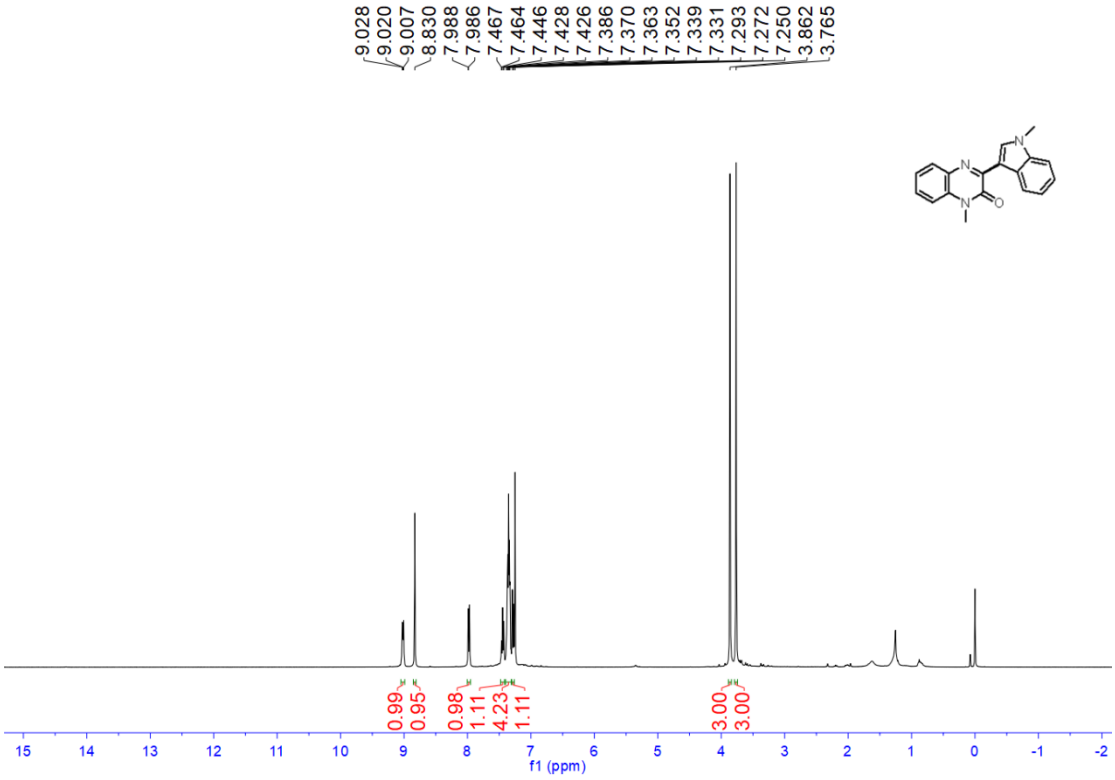
3-(1*H*-indol-3-yl)-1-methylquinoxalin-2-one (3aa). A known compound.[4] Orange solid, 51.7 mg, yield 94%. ^{1}H NMR (400 MHz, DMSO-d_6): δ 11.79

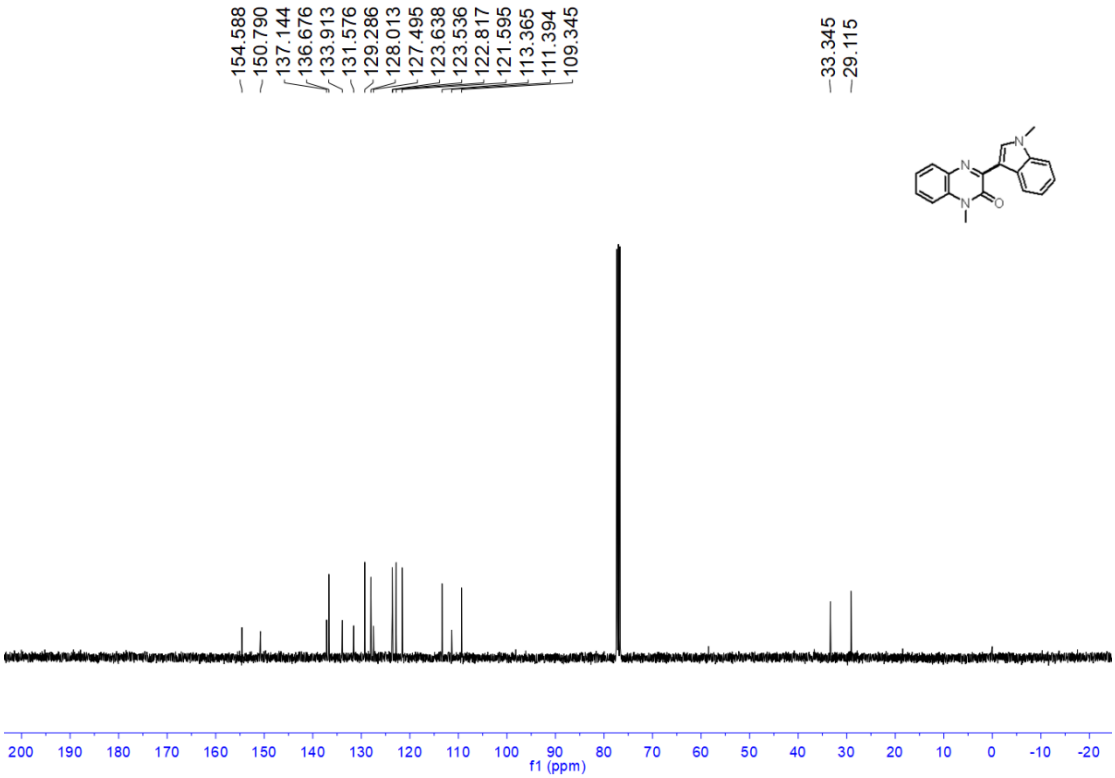
(s, 1H), 8.95 – 8.86 (m, 3H), 7.91 (d, J = 7.9 Hz, 1H), 7.59 – 7.47 (m, 3H), 7.44 – 7.35 (m, 1H), 7.29 – 7.19 (m, 2H), 3.73 (s, 3H); ^{13}C NMR (101 MHz, DMSO-d_6) δ 154.1, 151.1, 136.7, 133.6, 133.4, 131.9, 128.8, 128.7, 126.7, 123.9, 123.4, 123.0, 121.4, 114.8, 112.3, 111.9, 29.6.

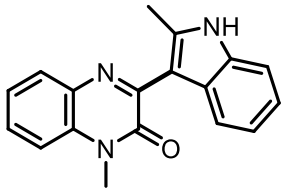




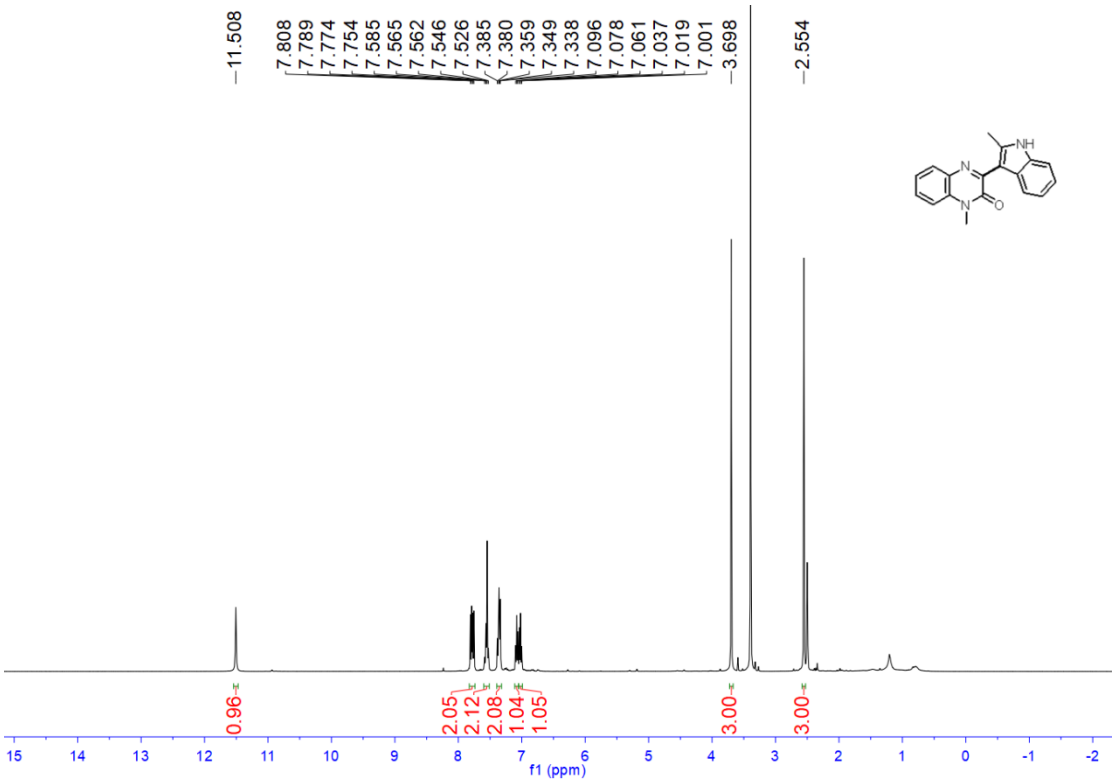
1-methyl-3-(1-methyl-1*H*-indol-3-yl)quinoxalin-2(1*H*)-one (3ab). Orange solid, 52.6 mg, yield 91%. m.p.: 232.9-223.8 ℃. ^{1}H NMR (400 MHz, ($CDCl_3$, TMS): δ 9.05 – 8.99 (m, 1H), 8.83 (s, 1H), 8.00 – 7.95 (m, 1H), 7.48 – 7.42 (m, 1H), 7.40 – 7.31 (m, 4H), 7.30 – 7.26 (d, J = 8.2 Hz, 1H), 3.86 (s, 3H), 3.77 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$, TMS): δ 154.6, 150.8, 137.1, 136.7, 133.9, 131.6, 129.3, 128.0, 127.5, 123.64 , 123.5, 122.8, 121.5, 33.3, 29.1. HRMS (ESI, *m/z*) calcd for $C_{18}H_{16}N_3O^+$ $[M+H]^+$: 290.1288, found 290.1288.

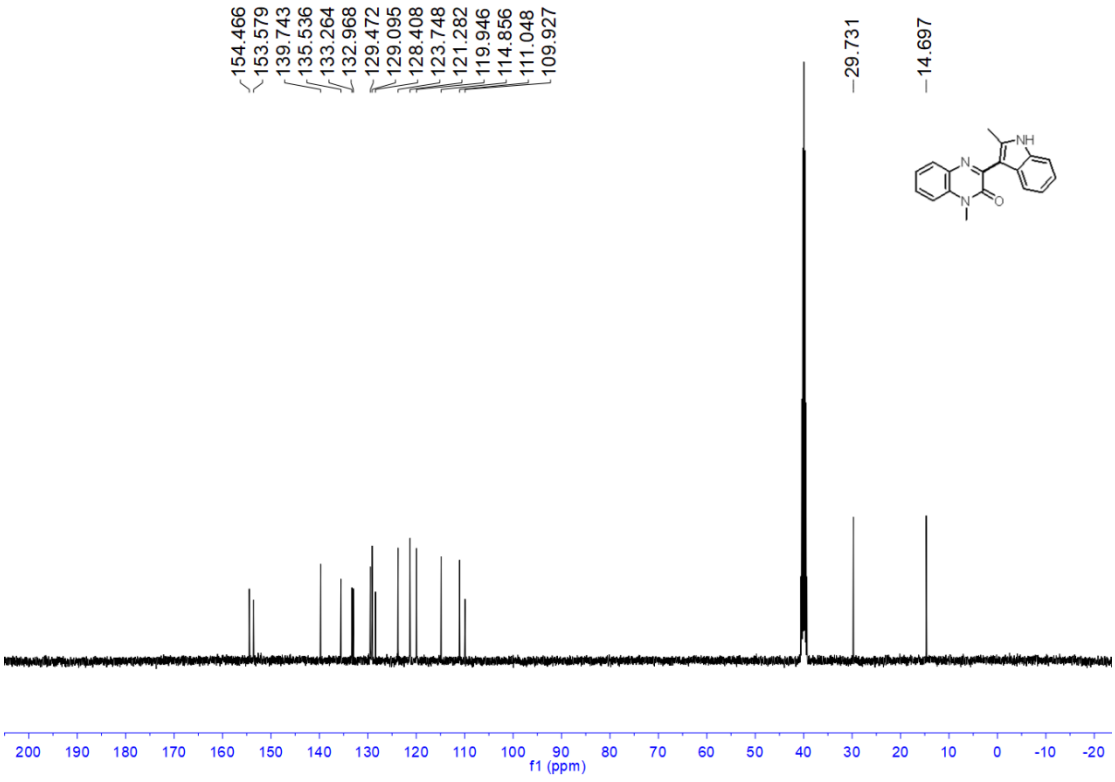


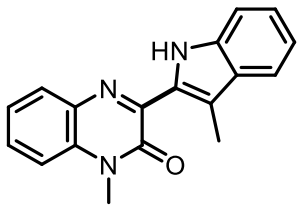




1-methyl-3-(2-methyl-1H-indol-3-yl)quinoxalin-2(1H)-one (3ac). A known compound.[4] Orange solid, 54.7 mg, yield 94%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.51 (s, 1H), 7.83 – 7.74 (m, 2H), 7.61 – 7.50 (m, 2H), 7.40 – 7.32 (m, 2H), 7.11 – 7.05 (m, 1H), 7.05 – 6.99 (m, 1H), 3.70 (s, 3H), 2.55 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 154.5, 153.6, 139.7, 135.5, 133.3, 133.0, 129.5, 129.1, 128.4, 123.8, 121.3, 120.0, 114.9, 111.1, 109.9, 29.7, 14.7.

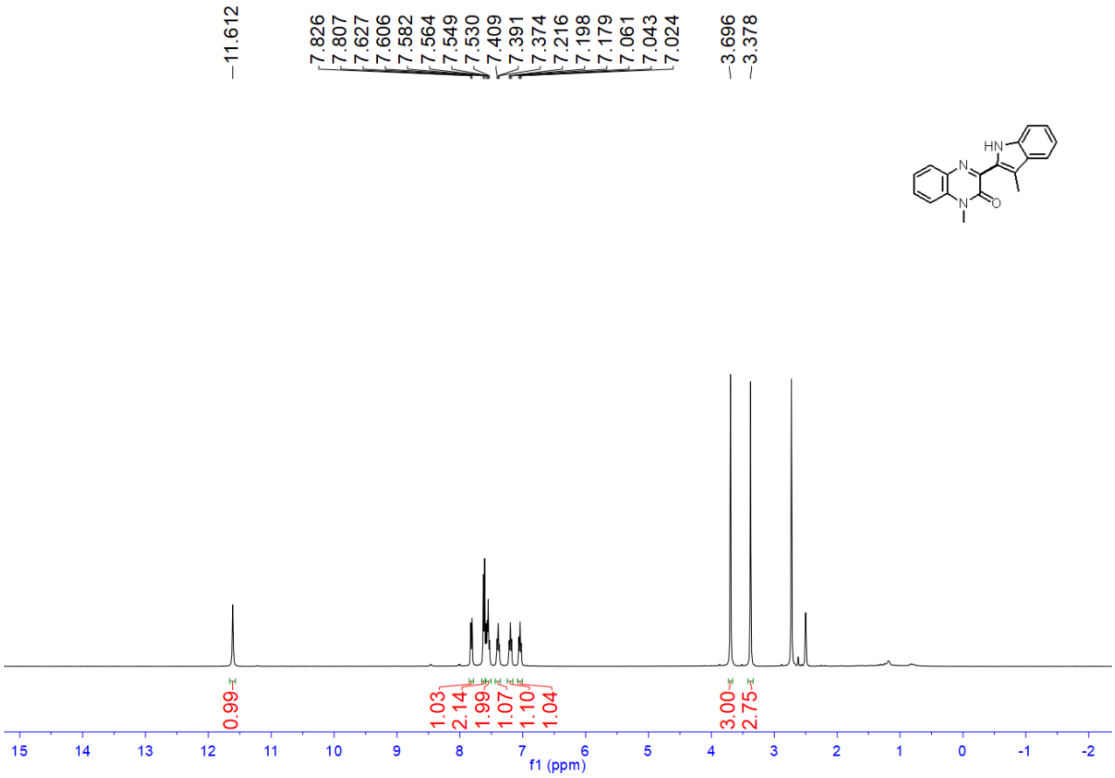


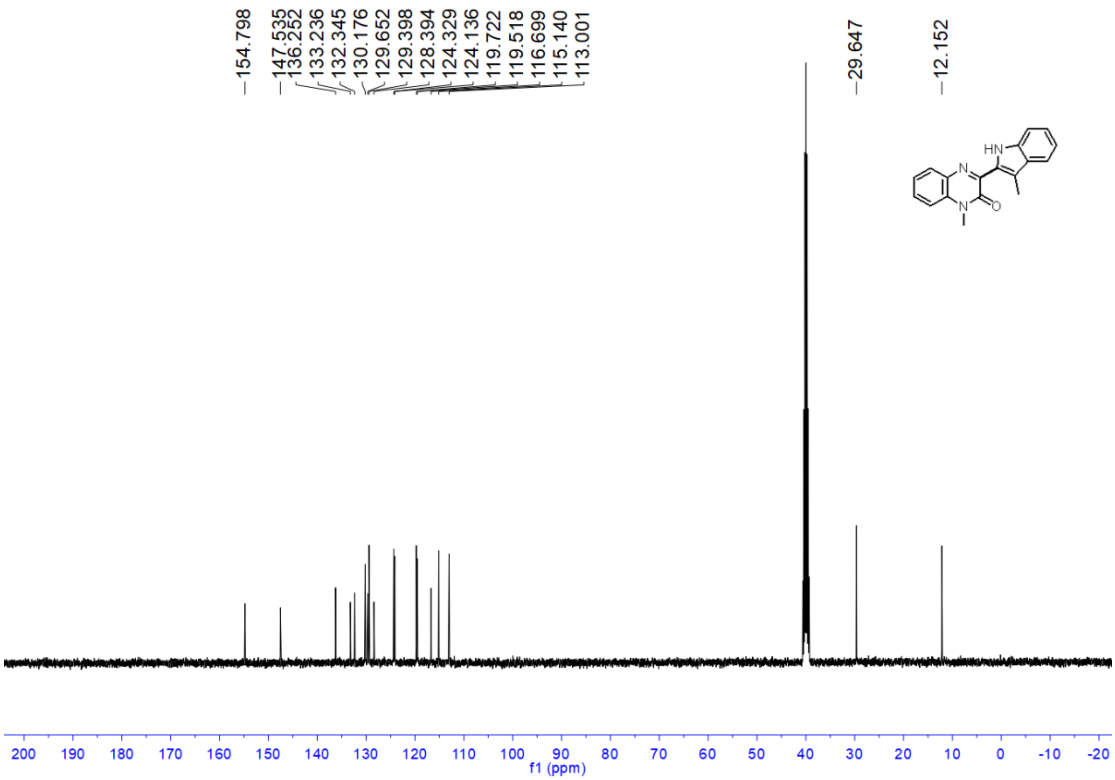


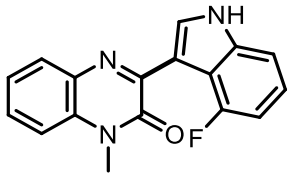


1-methyl-3-(3-methyl-1*H*-indol-2-yl)quinoxalin-2(1*H*)-one

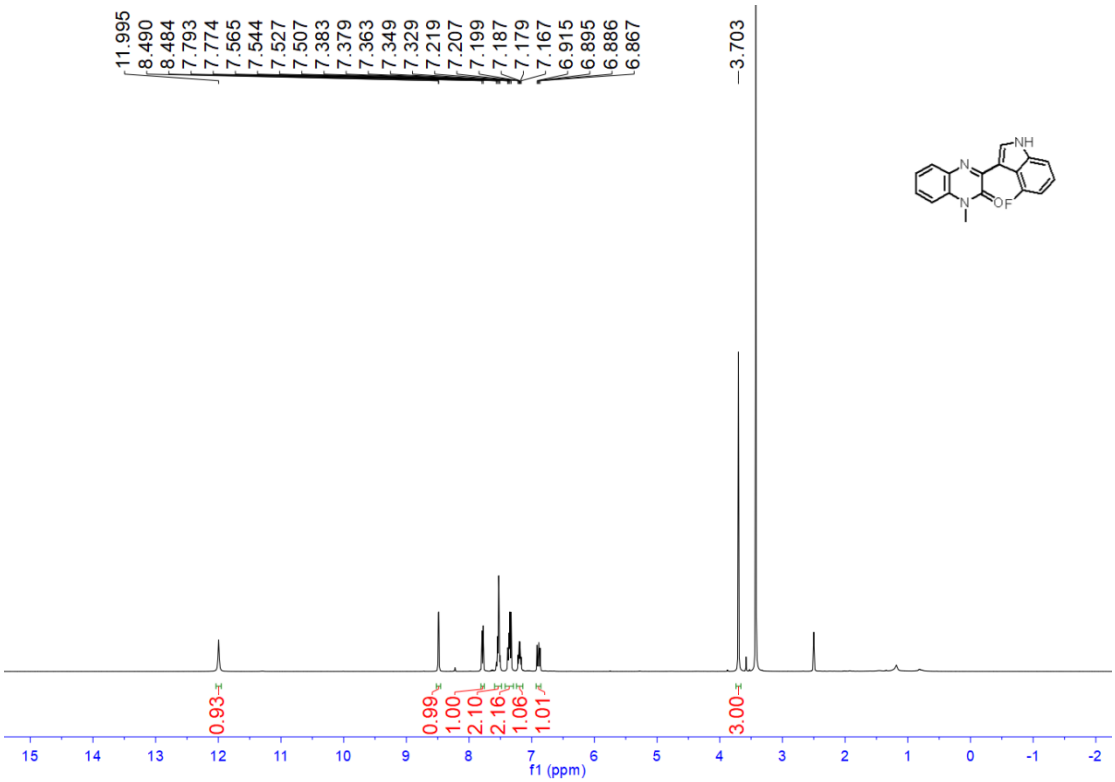
(3ad). Yellow solid, 55.6 mg, yield 96%. m.p.: 281.3-281.9 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.61 (s, 1H), 7.82 (d, J = 7.8 Hz, 1H), 7.65 – 7.60 (m, 2H), 7.59 – 7.51 (m, 2H), 7.39 (dd, $J_1 = J_2$ = 7.1 Hz, 1H), 7.20 (dd, $J_1 = J_2$ = 7Hz, 1H), 7.04 (dd, $J_1 = J_2$ = 7.5 Hz, 1H), 3.70 (s, 3H), 3.38 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 154.8, 147.5, 136.3, 133.2, 132.4, 130.2, 129.7, 129.40, 128.39, 124.3, 124.1, 119.7, 119.5, 116.7, 115.1, 113.0, 29.7, 12.2. HRMS (ESI, *m/z*) calcd for $C_{18}H_{16}N_3O^+$ [M+H]$^+$: 290.1288, found 290.1290.







3-(4-fluoro-1*H*-indol-3-yl)-1-methylquinoxalin-2(1*H*)-one (3ae). Orange solid, 49.7 mg, yield 85%. m.p.: 237.9-238.6 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.99 (s, 1H), 8.49 (d, J = 2.4 Hz, 1H), 7.78 (d, J = 7.7 Hz, 1H), 7.58 – 7.49 (m, 2H), 7.40 – 7.31 (m, 2H), 7.23 – 7.16 (m, 1H), 6.93 – 6.86 (m, 1H), 3.70 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 156.6 (d, J = 250.7 Hz), 154.3 (d, J = 1.7 Hz), 150.2, 139.6 (d, J = 10.9 Hz), 133.2, 132.5, 132.2, 129.4, 129.2, 123.9, 123.5 (d, J = 7.8 Hz), 114.9, 114.7 (d, J = 19.1 Hz), 111.8 (d, J = 4.6 Hz), 108.8 (d, J = 3.6 Hz), 106.9 (d, J = 21.5 Hz), 29.6. ^{19}F NMR (376 MHz, DMSO-d_6) δ -107.86 to-107.90. HRMS (ESI, *m/z*) calcd for $C_{17}H_{13}FN_3O^+$ $[M+H]^+$: 294.1037, found 294.1040.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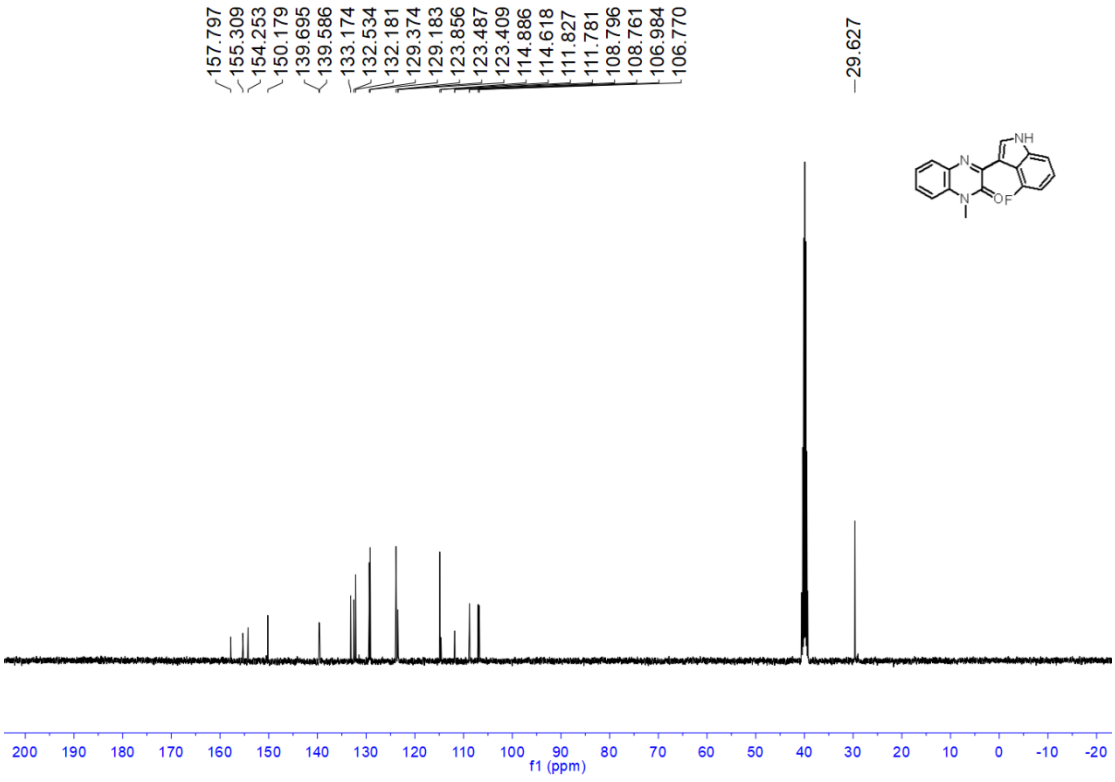
8.484
7.793
7.774
7.565
7.544
7.527
7.507
7.383
7.379
7.363
7.349
7.329
7.219
7.207
7.199
7.187
7.179
7.167
6.915
6.895
6.886
6.867
3.703
NH
N
N
O
F
0.93
0.99
1.00
2.10
2.16
1.06
1.01
3.00
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 -1 -2
f1 (ppm)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139.695
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114.618
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108.761
106.984
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NH
N
N
O
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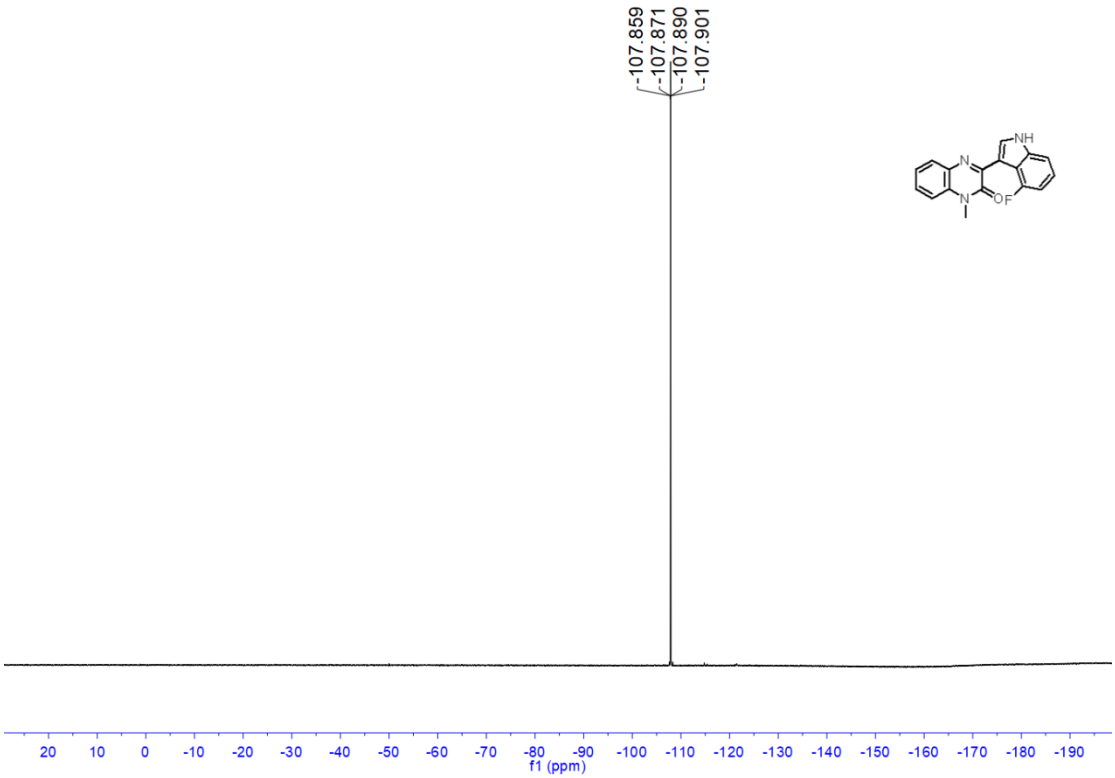
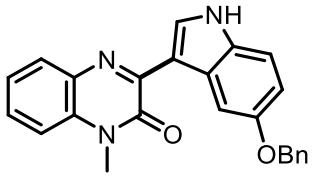
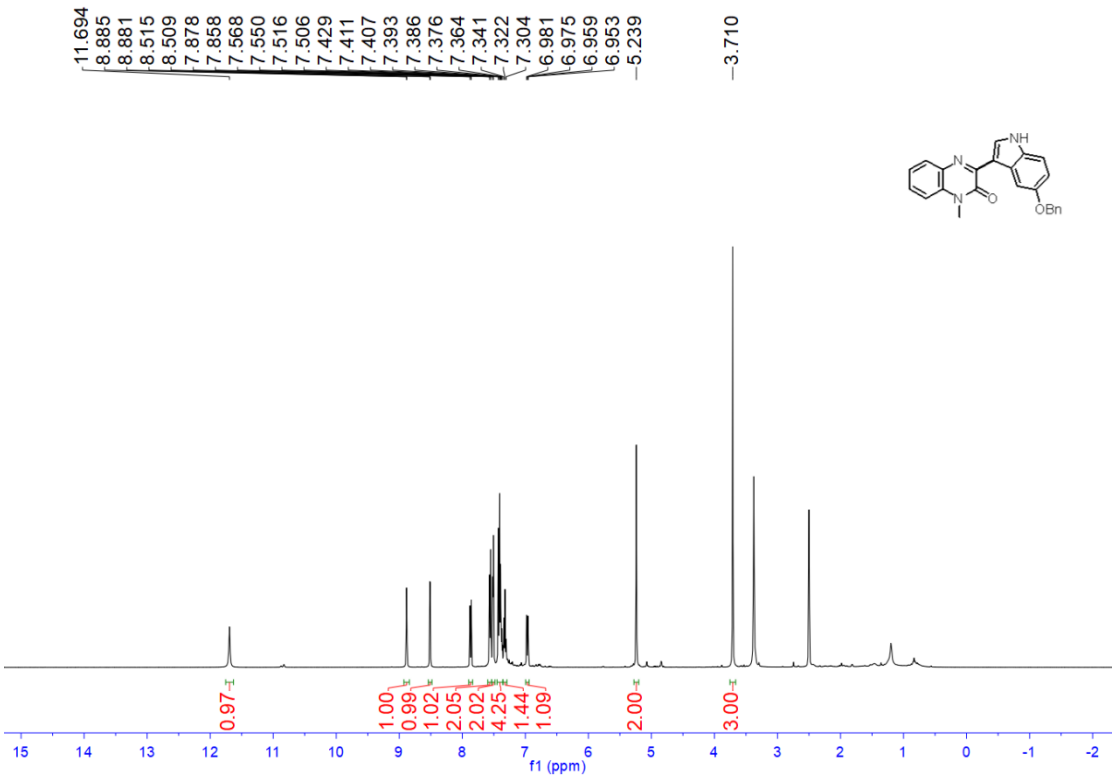
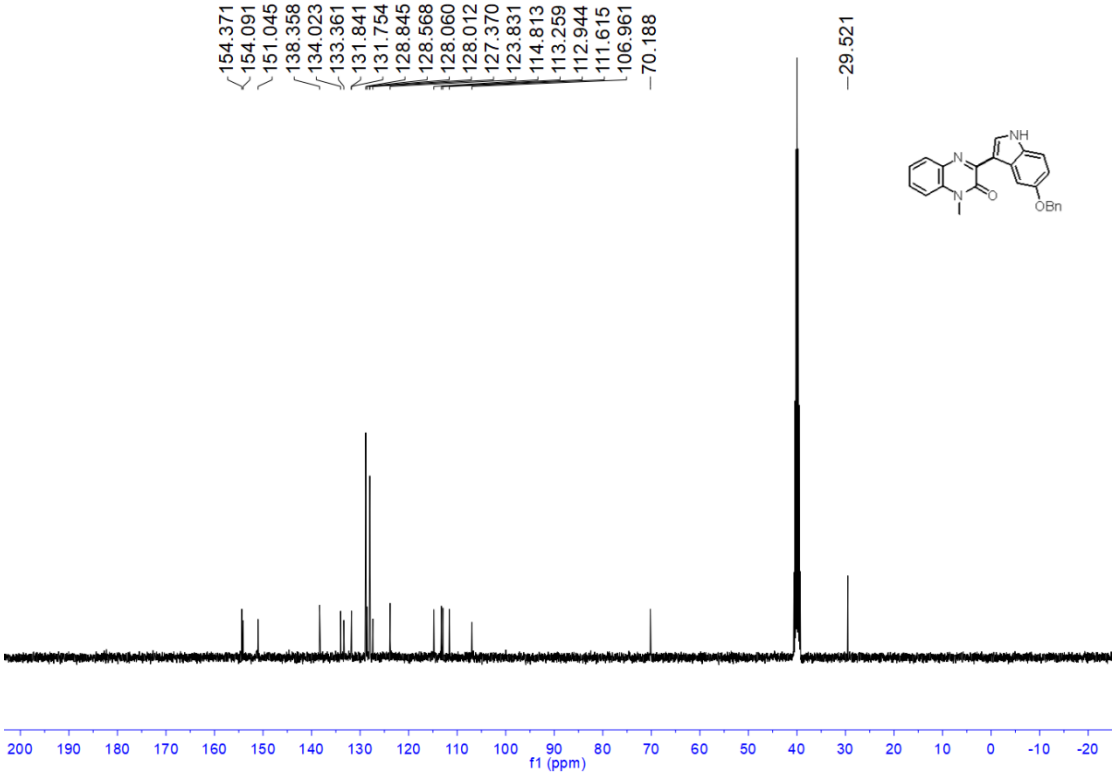
f1 (ppm)

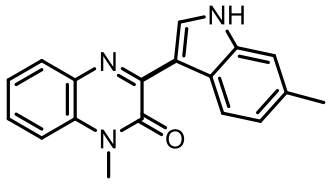




3-(5-(benzyloxy)-1*H*-pyrrolo[2,3-b]pyridin-3-yl)-1-methylquinoxalin-2(1*H*)-one (3af). A known compound.[4] Orange solid, 72.8 mg, yield 95%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.69 (s, 1H), 8.99 – 8.74 (m, 1H), 8.51 (d, J = 2.4 Hz, 1H), 7.87 (d, J = 7.8 Hz, 1H), 7.56 (d, J = 7.3 Hz, 2H), 7.51 (d, J = 3.8 Hz, 2H), 7.46 – 7.36 (m, 4H), 7.32 (t, J = 7.3 Hz, 2H), 6.97 (dd, J = 8.7, 2.5 Hz, 1H), 5.24 (s, 2H), 3.71 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 154.4, 154.1, 151.1, 138.4, 134.0, 133.3, 131.8, 131.8, 128.9, 128.6, 128.1, 128.0, 127.4, 123.8, 114.8, 113.3, 112.9, 111.6, 107.0, 70.2, 29.5.

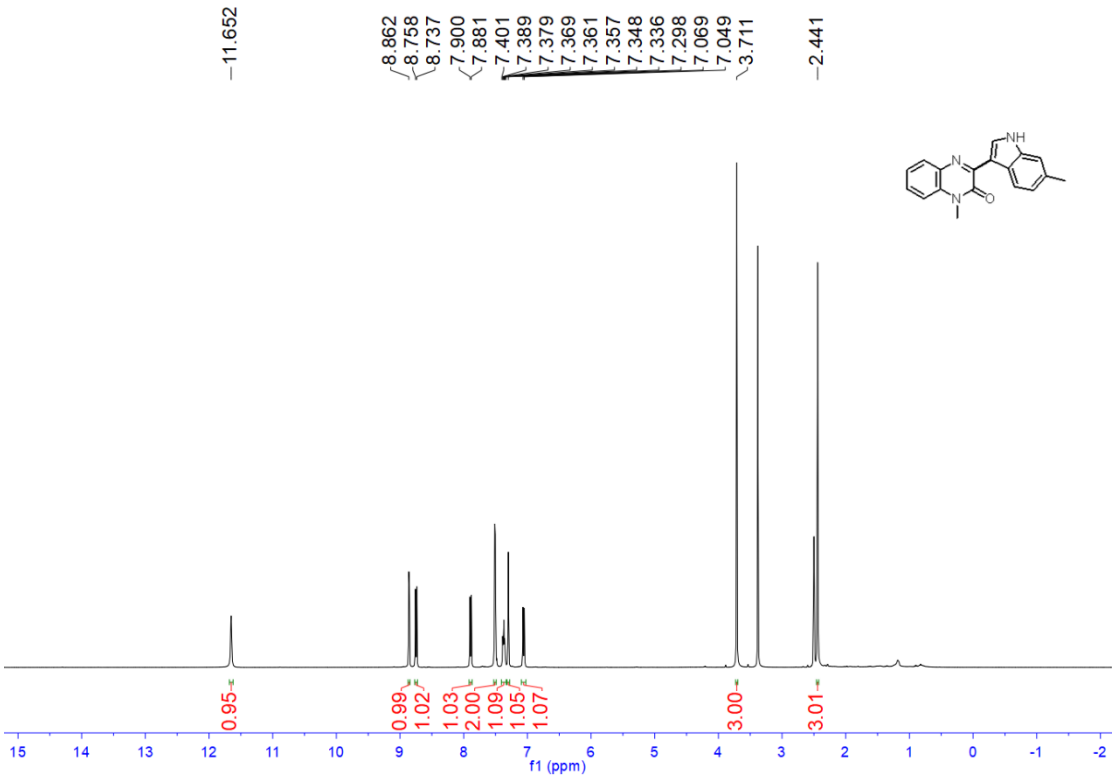


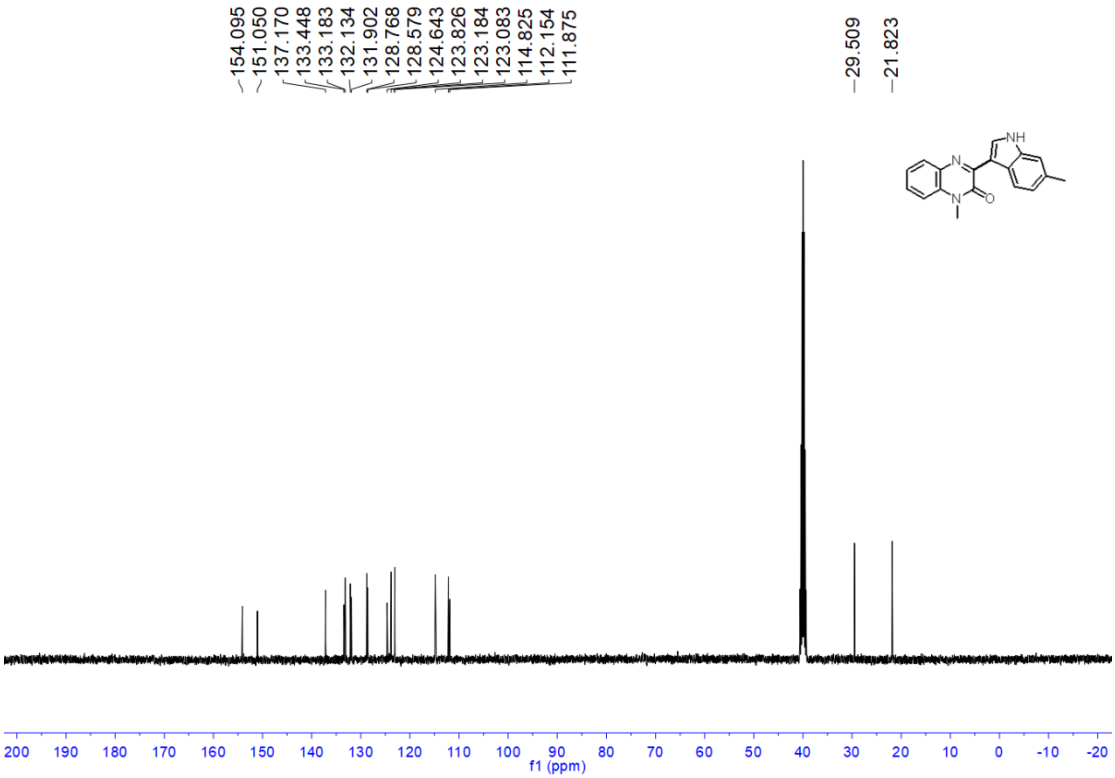


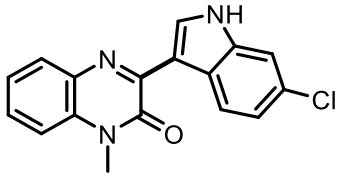


1-methyl-3-(6-methyl-1*H*-indol-3-yl)quinoxalin-2(1*H*)-one (3ag). Orange solid, 54.2 mg, yield 94%. m.p.: 241.7-242.3 °C. ^{1}H NMR (400 MHz,

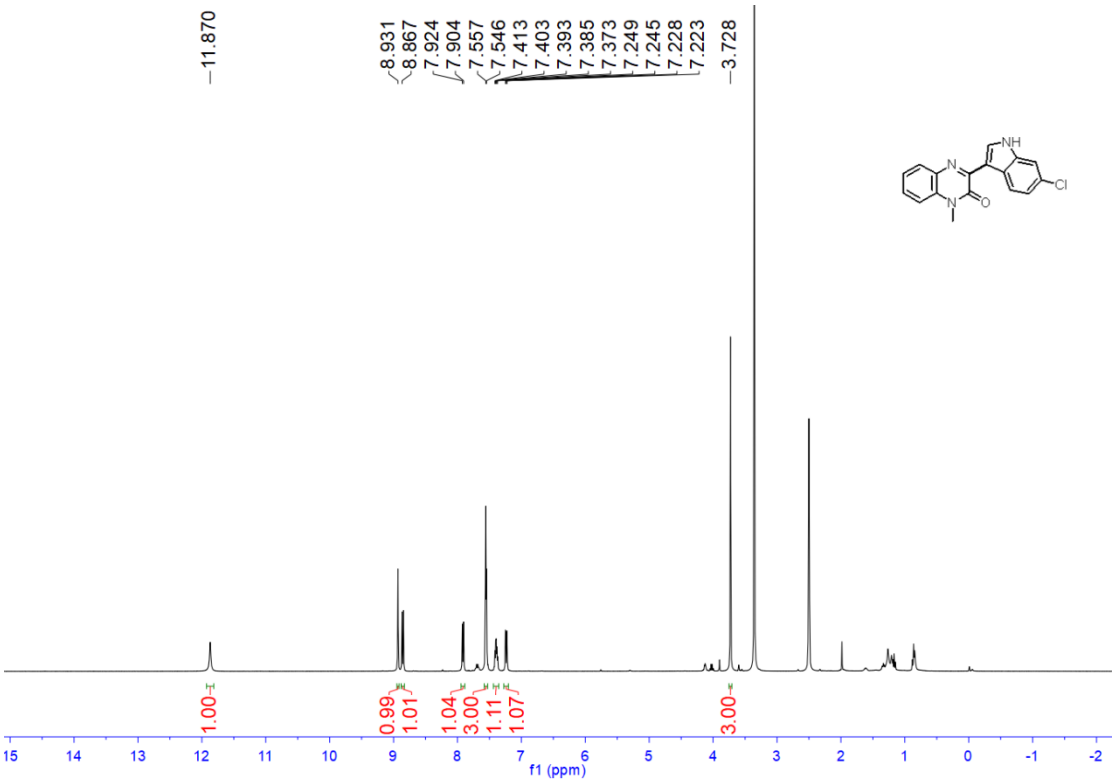
DMSO-d_6): δ 11.65 (s, 1H), 8.86 (d, J = 2.7 Hz, 1H), 8.75 (d, J = 8.1 Hz, 1H), 7.89 (d, J = 7.8 Hz, 1H), 7.54 – 7.48 (m, 2H), 7.41 – 7.33 (m, 1H), 7.30 (s, 1H), 7.06 (d, J = 8.1 Hz, 1H), 3.71 (s, 3H), 2.44 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ: 154.1, 151.0, 137.2, 133.5, 133.2, 132.1, 131.9, 128.8, 128.6, 124.6, 123.8, 123.2, 123.1, 29.5, 21.8. HRMS (ESI, *m/z*) calcd for $C_{18}H_{16}N_3O^+$ [M+H]$^+$: 290.1288, found 290.1290.

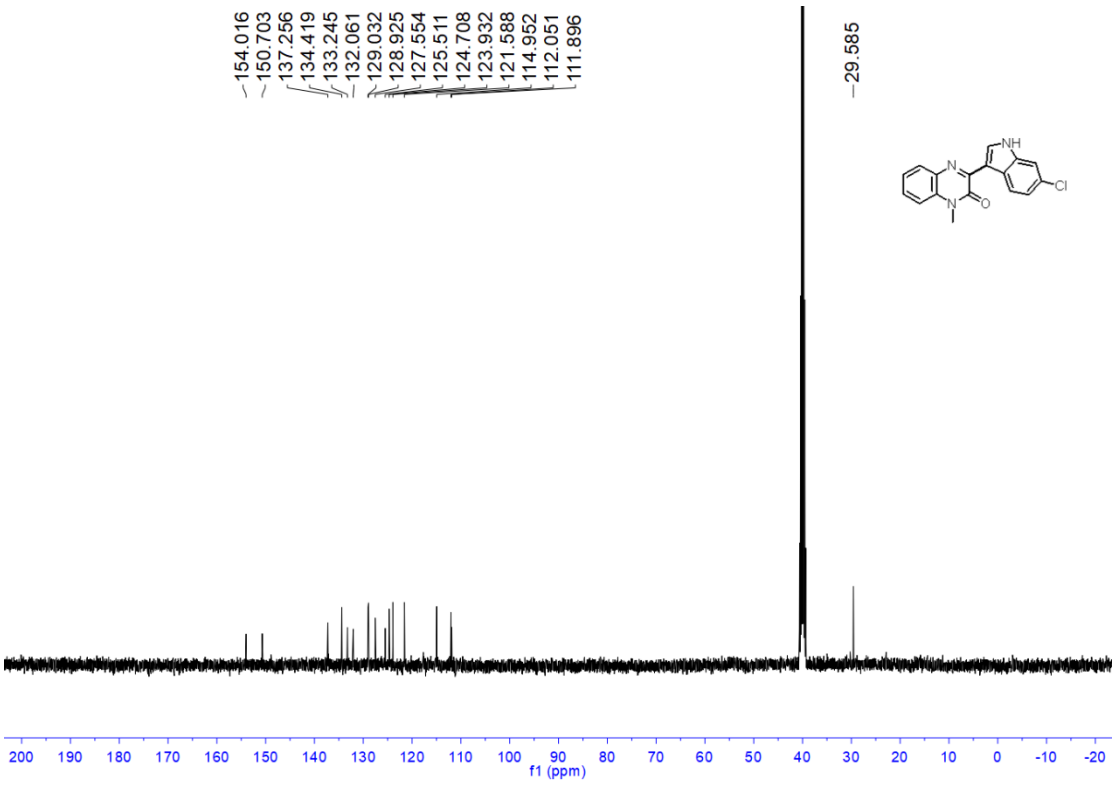


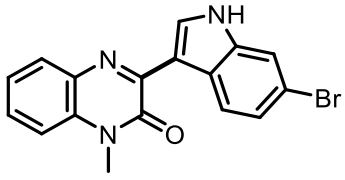




3-(6-chloro-1*H*-indol-3-yl)-1-methylquinoxalin-2(1*H*)-one (3ah). Yellow solid, 60.3 mg, yield 97%. m.p.: 270.0-271.5 ℃. ^{1}H NMR (400 MHz, DMSO-d_6): δ 11.87 (s, 1H), 8.93 (s, 1H), 8.86 (d, J = 8.6 Hz, 1H), 7.91 (d, J = 7.9 Hz, 1H), 7.60 – 7.52 (m, 3H), 7.44 –.35 (m, 1H), 7.24 (dd, J = 8.6, 1.8 Hz, 1H), 3.73 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6): δ 154.0, 150.7, 137.3, 134.4, 133.2, 132.1, 129.0, 128.9, 127.6, 125.5, 124.7, 123.9, 121.6, 115.0, 112.1, 111.9, 29.6. HRMS (ESI, *m/z*) calcd for $C_{17}H_{12}ClN_3NaO^+$ $[M+Na]^+$: 332.0561, found 332.0565.

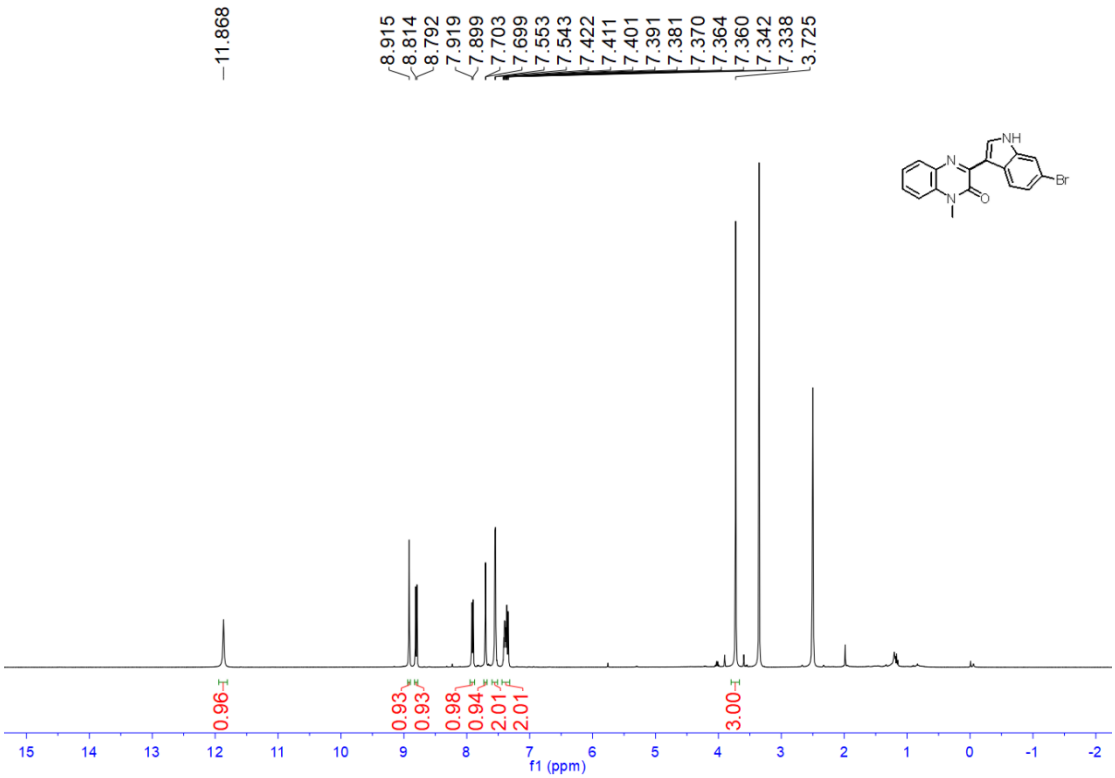


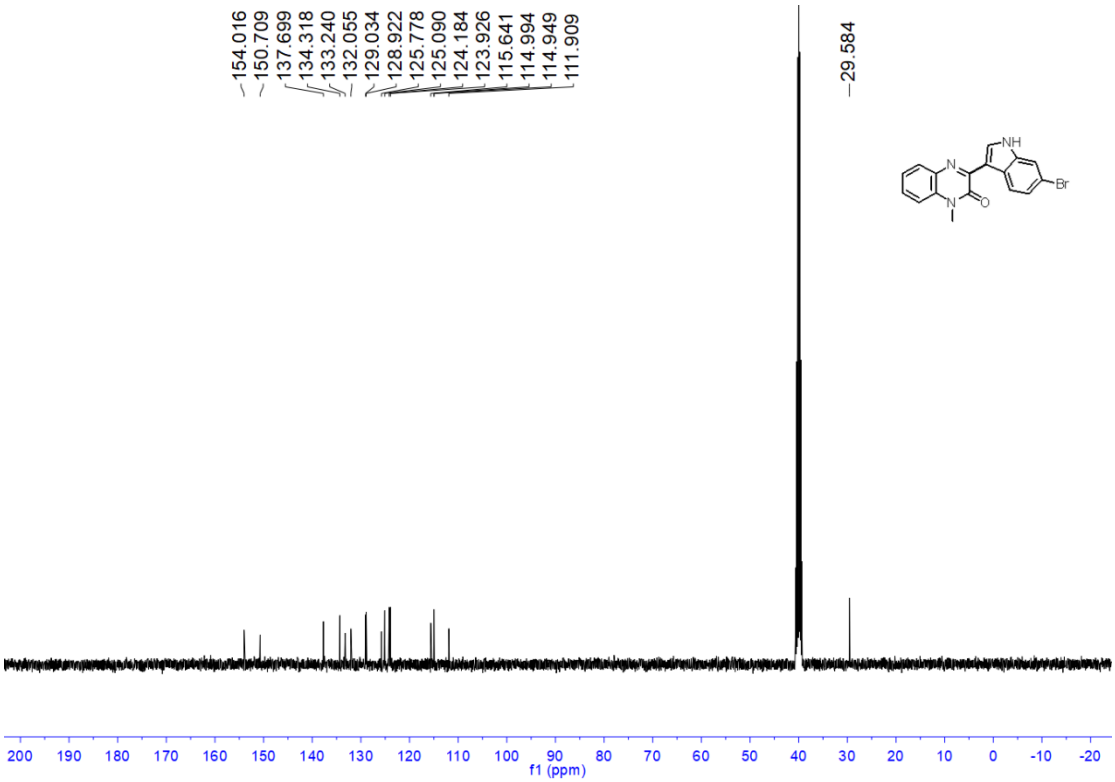


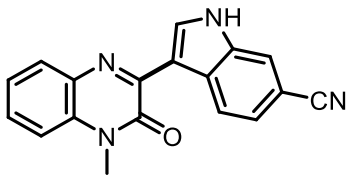


3-(6-bromo-1*H*-indol-3-yl)-1-methylquinoxalin-2(1*H*)-

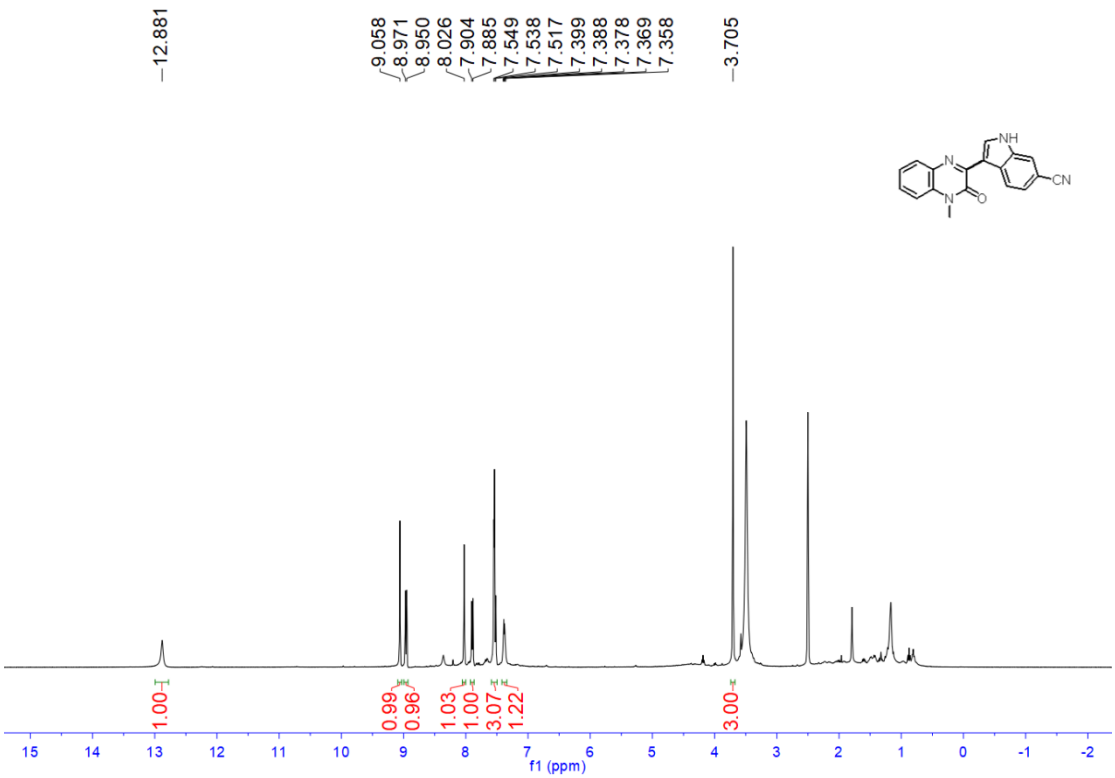
one (3ai). Yellow solid, 63.0 mg, yield 89%. m.p.: 286.7-287.4 ℃. ^{1}H NMR (400 MHz, DMSO-d_6): δ 11.87 (s, 1H), 8.92 (s, 1H), 8.80 (d, J = 8.6 Hz, 1H), 7.91 (d, J = 7.9 Hz, 1H), 7.70 (d, J = 1.4 Hz, 1H), 7.55 (d, J = 3.8 Hz, 2H), 7.44 – 7.32 (m, 2H), 3.73 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6): δ 154.0, 150.7, 137.7, 134.3, 133.2, 132.1, 129.0, 128.9, 125.8, 125.1, 124.2, 123.9, 115.6, 115.0, 114.95, 111.9, 29.6. HRMS (ESI, *m/z*) calcd for $C_{17}H_{12}BrN_3NaO^+$ $[M+Na]^+$: 376.0056, found 376.0060.

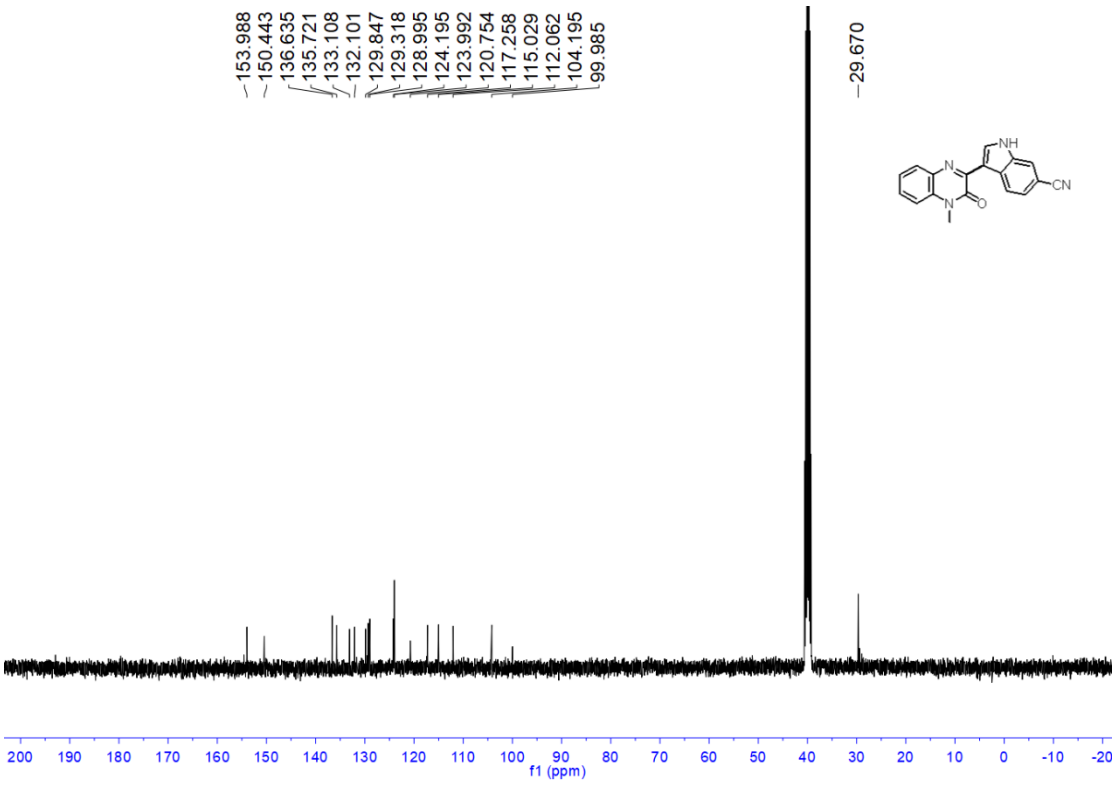


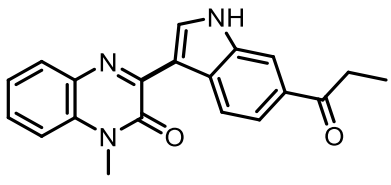




3-(4-methyl-3-oxo-3,4-dihydroquinoxalin-2-yl)-1*H*-indole-6-carbonitrile (3aj). Brown solid, 42.7 mg, yield 71%. m.p.: 321.4-323.7 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.88 (s, 1H), 9.06 (s, 1H), 8.96 (d, J = 8.3 Hz, 1H), 8.03 (s, 1H), 7.89 (d, J = 7.8 Hz, 1H), 7.60 – 7.49 (m, 3H), 7.42 – 7.34 (m, 1H), 3.70 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 154.0, 150.4, 136.6, 135.7, 133.1, 132.1, 129.9, 129.3, 129.0, 124.2, 124.0, 120.8, 117.3, 115.0, 112.1, 104.1, 100.0, 29.7. HRMS (ESI, *m/z*) calcd for $C_{18}H_{12}N_4NaO^+$ $[M+Na]^+$: 323.0903, found 323.0903.

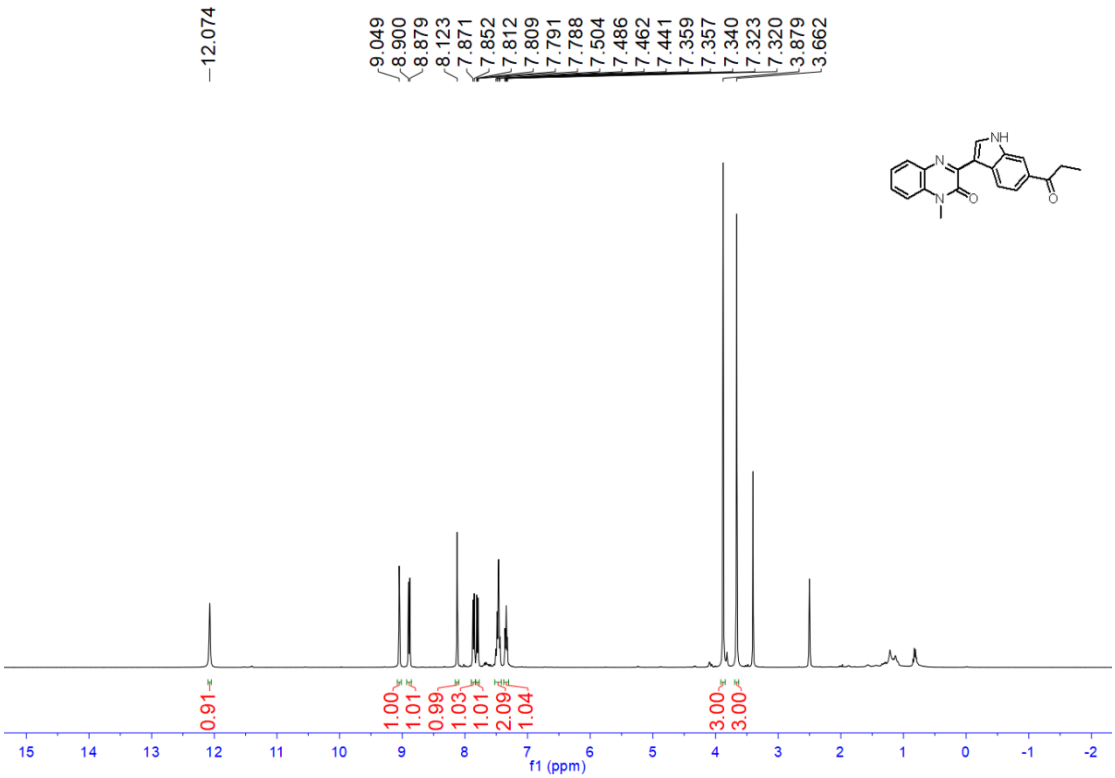


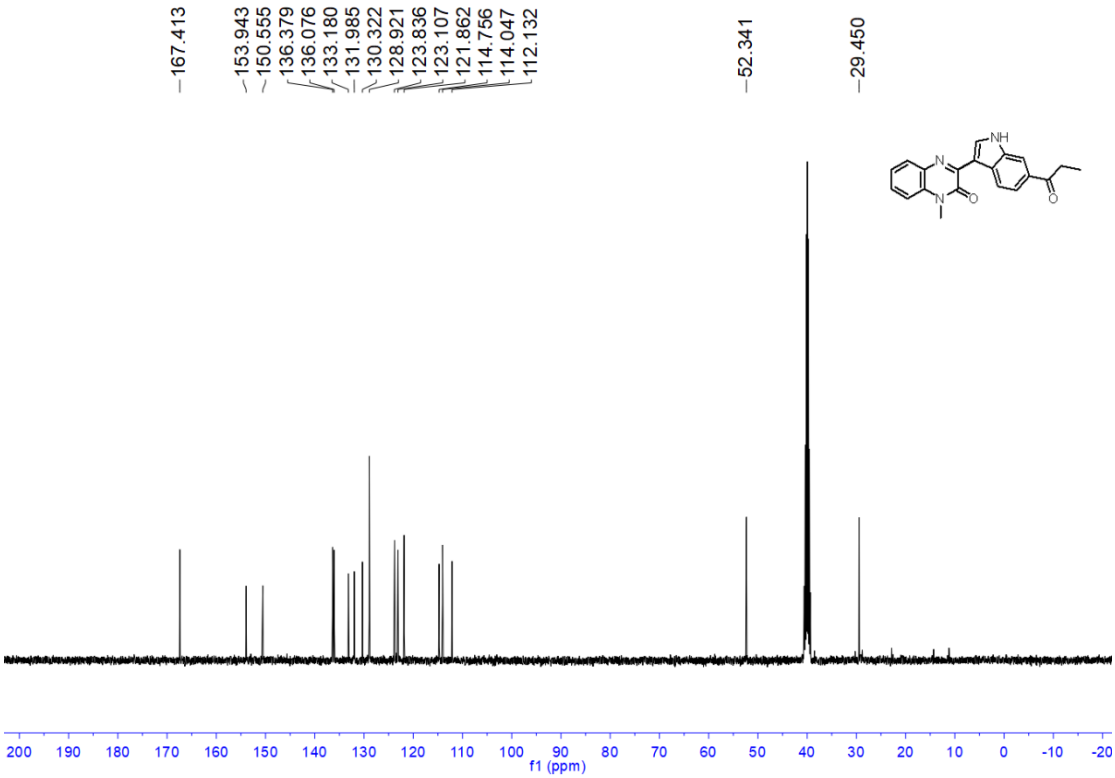


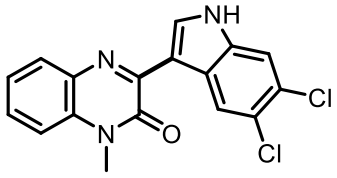


Methyl 3-(4-methyl-3-oxo-3,4-dihydroquinoxalin-2-yl)-1*H*-indole-6-carboxylate (3ak). Yellow solid, 64.6 mg, yield 97%. m.p.: 238.6-

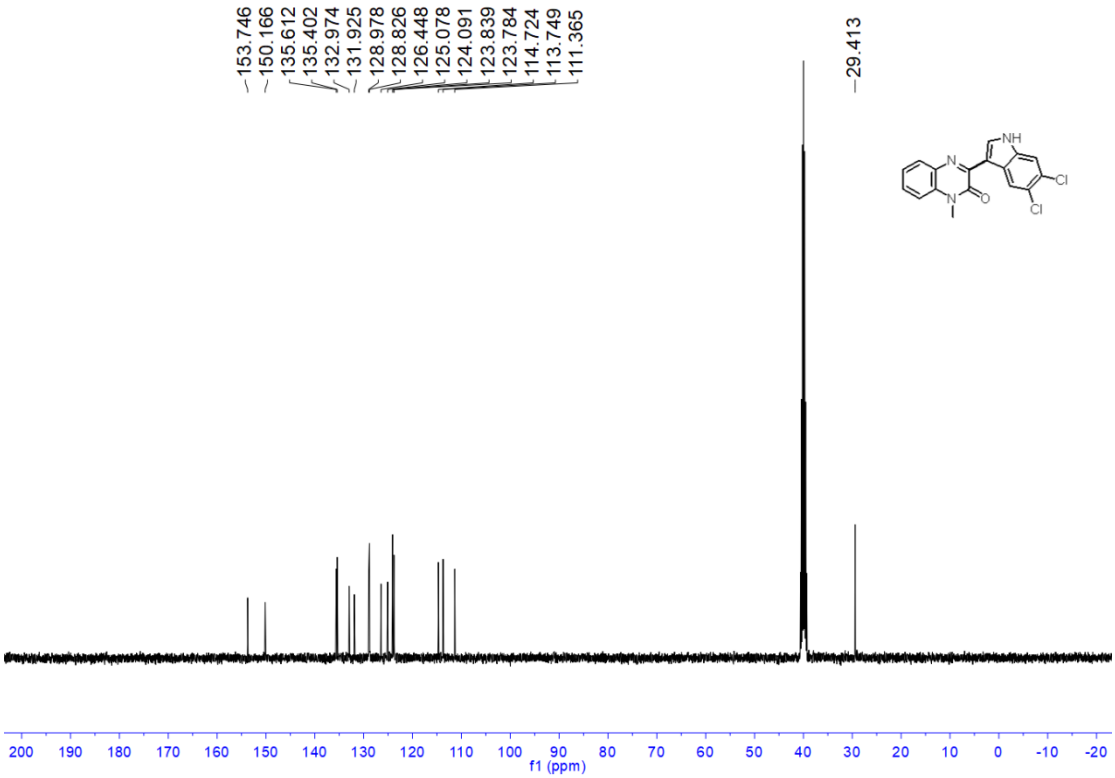
269.6 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.07 (s, 1H), 9.05 (d, J = 2.0 Hz, 1H), 8.89 (d, J = 8.5 Hz, 1H), 8.12 (s, 1H), 7.86 (d, J = 7.7 Hz, 1H), 7.83 – 7.77 (m, 1H), 7.52 – 7.42 (m, 2H), 7.38 – 7.30 (m, 1H), 3.88 (s, 3H), 3.66 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 167.4, 153.9, 150.6, 136.4, 136.1, 133.2, 132.0, 130.3, 128.9, 123.84, 123.78, 123.1, 121.9, 114.8, 114.1, 112.1, 52.3, 29.5. HRMS (ESI, *m/z*) calcd for $C_{19}H_{16}N_3O_3^+$ $[M+H]^+$: 334.1186, found 334.1189.

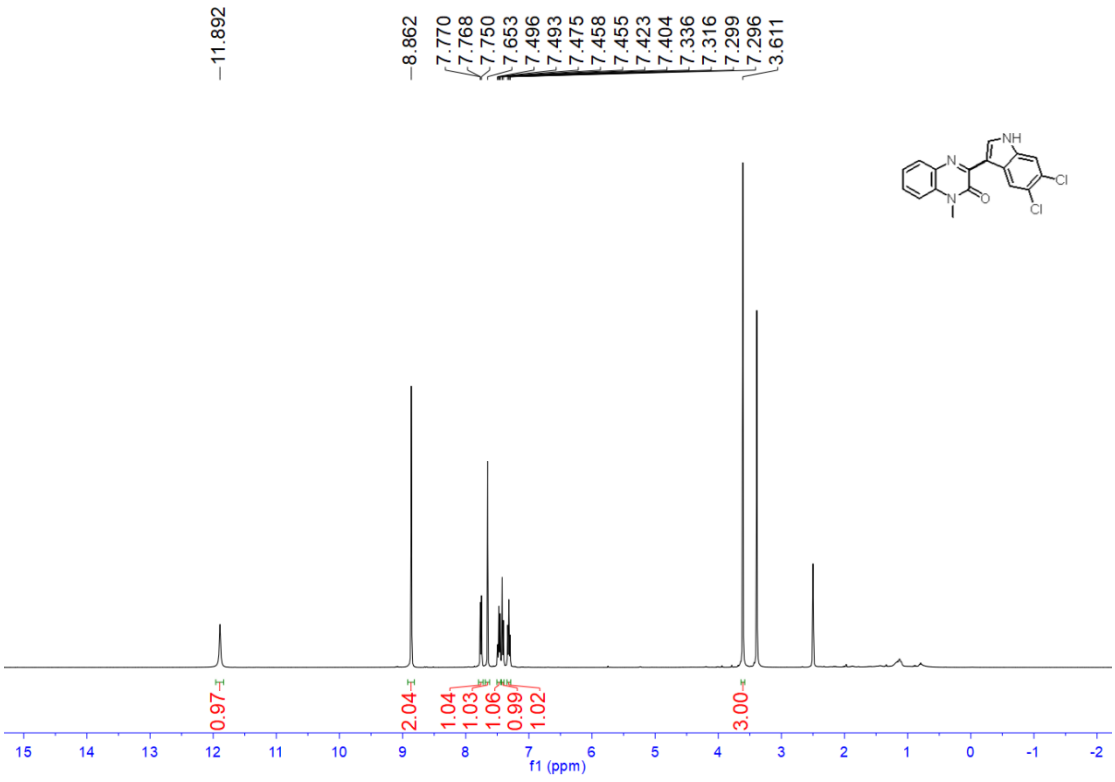


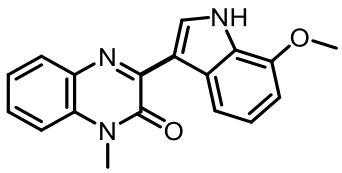




3-(5,6-dichloro-1*H*-indol-3-yl)-1-methylquinoxalin-2(1*H*)-one (3al). Orange solid, 67.4 mg, yield 98%. m.p.: 256.3-257.6 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.89 (s, 1H), 8.86 (s, 2H), 7.79 – 7.73 (m, 1H), 7.65 (s, 1H), 7.51 – 7.44 (m, 1H), 7.44 – 7.39 (m, 1H), 7.36 – 7.28 (m, 1H), 3.61 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 153.8, 150.2, 135.6, 135.4, 133.0, 131.9, 129.0, 128.8, 126.5, 125.1, 124.1, 123.8, 123.8, 114.7, 113.8, 111.4, 29.4. HRMS (ESI, *m/z*) calcd for $C_{17}H_{11}Cl_2N_3NaO^+$ $[M+Na]^+$: 366.0171, found 366.0175.

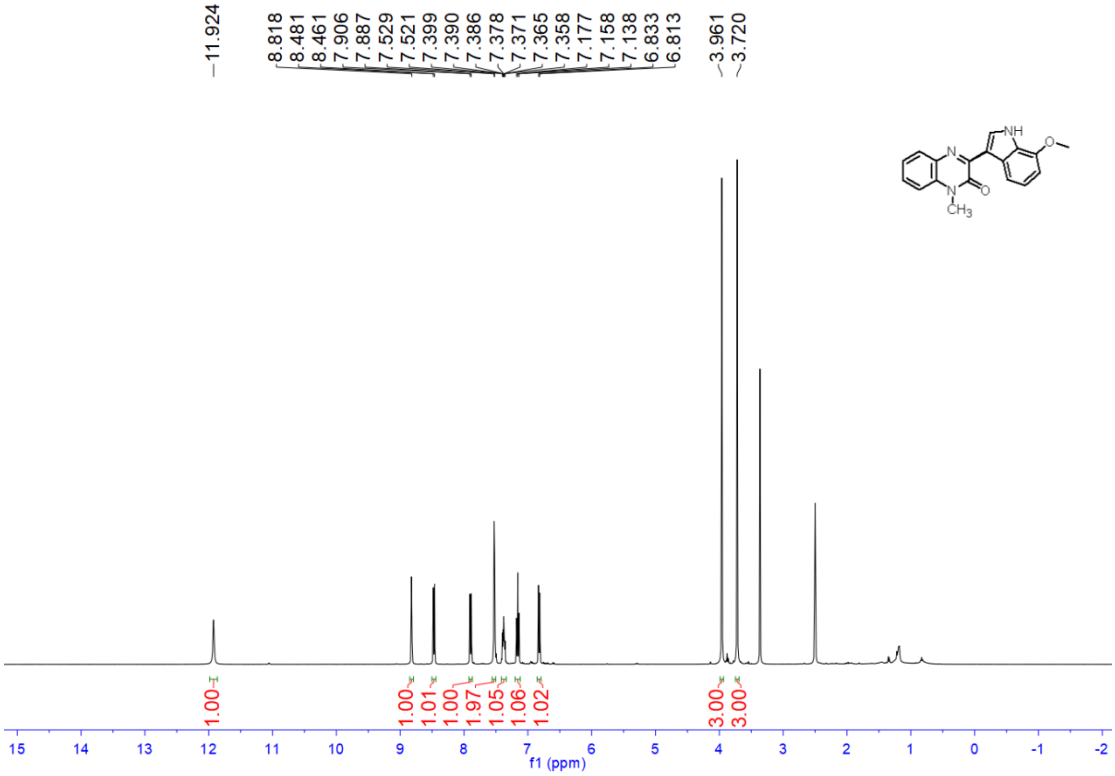


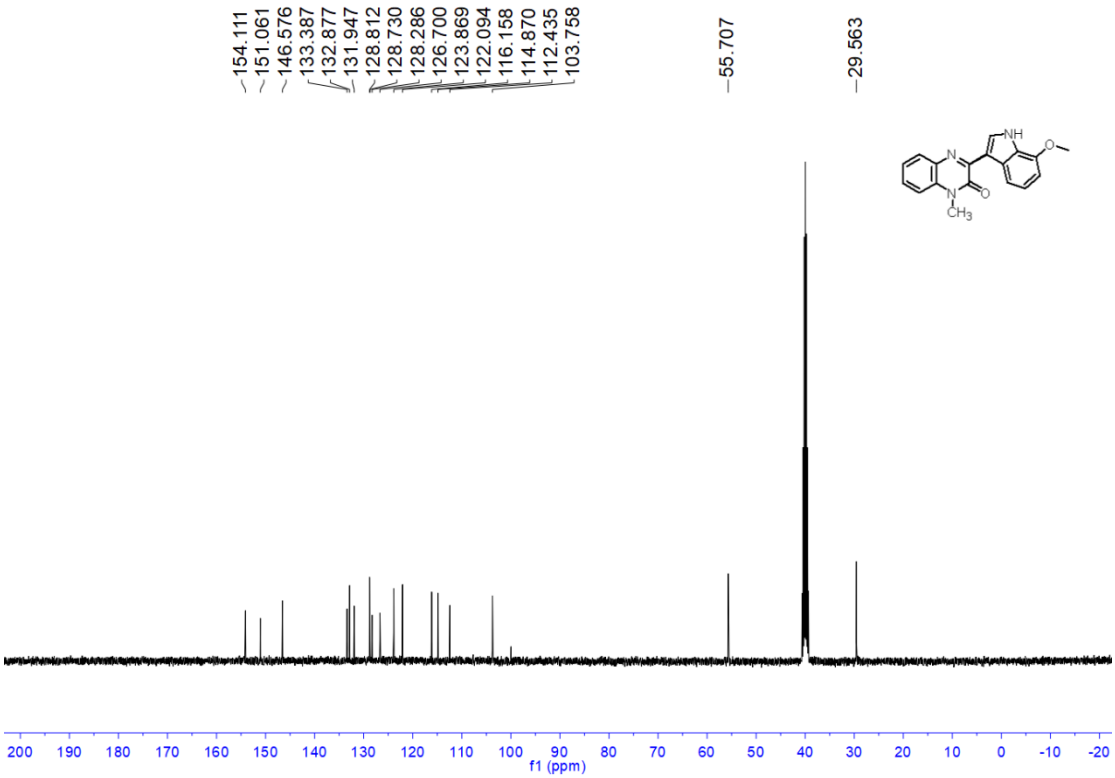


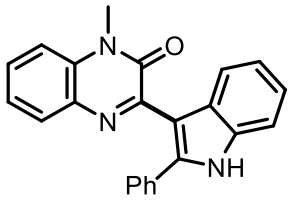


3-(7-methoxy-1*H*-indol-3-yl)-1-methylquinoxalin-2(1*H*)-

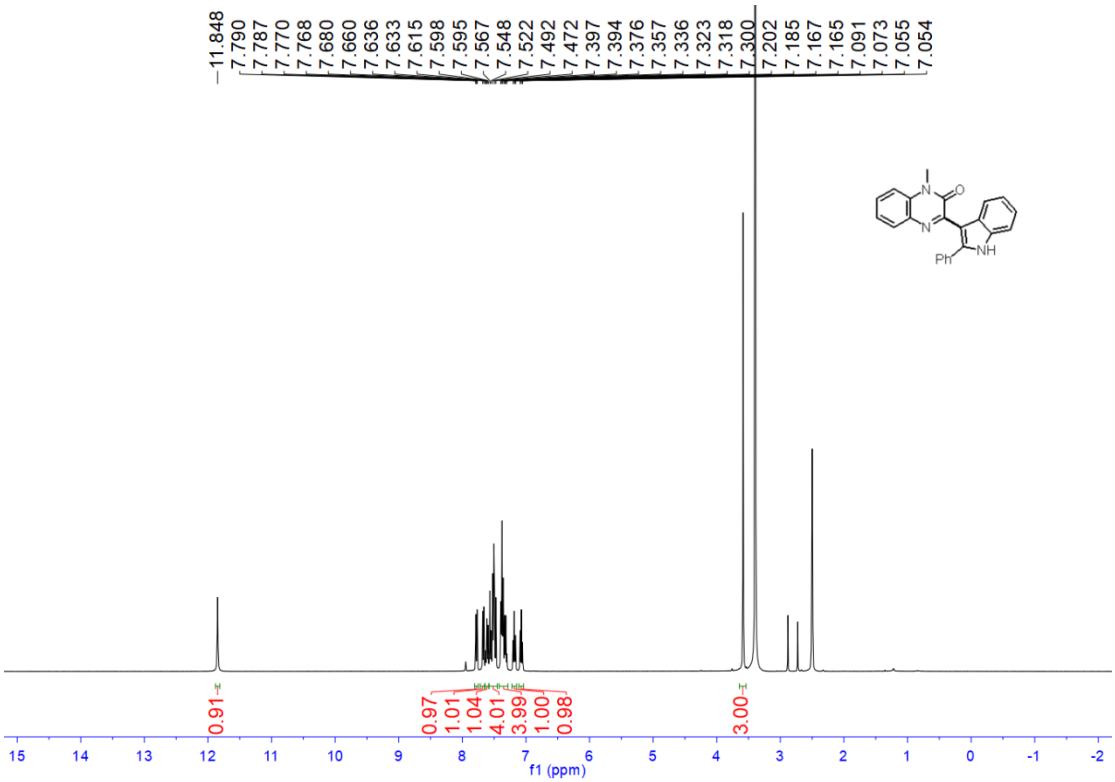
one (3am). Yellow solid, 59.9 mg, yield 98%. m.p.: 266.7-267.2 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.92 (s, 1H), 8.82 (d, J = 2.3 Hz, 1H), 8.47 (d, J = 8.0 Hz, 1H), 7.90 (d, J = 7.8 Hz, 1H), 7.56 – 7.50 (m, 2H), 7.42 – 7.35 (m, 1H), 7.16 (dd, J_1 = J_2 = 7.9 Hz, 1H), 6.82 (d, J = 7.7 Hz, 1H), 3.96 (s, 3H), 3.72 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6): δ 154.1, 151.1, 146.6, 133.4, 132.9, 132.0, 128.8, 128.7, 128.3, 126.7, 123.9, 122.1, 116.2, 114.9, 112.4, 103.8, 55.7, 29.6. HRMS (ESI, *m/z*) calcd for $C_{18}H_{16}N_3O_2^+$ [M+H]$^+$: 306.1237, found 306.1239.

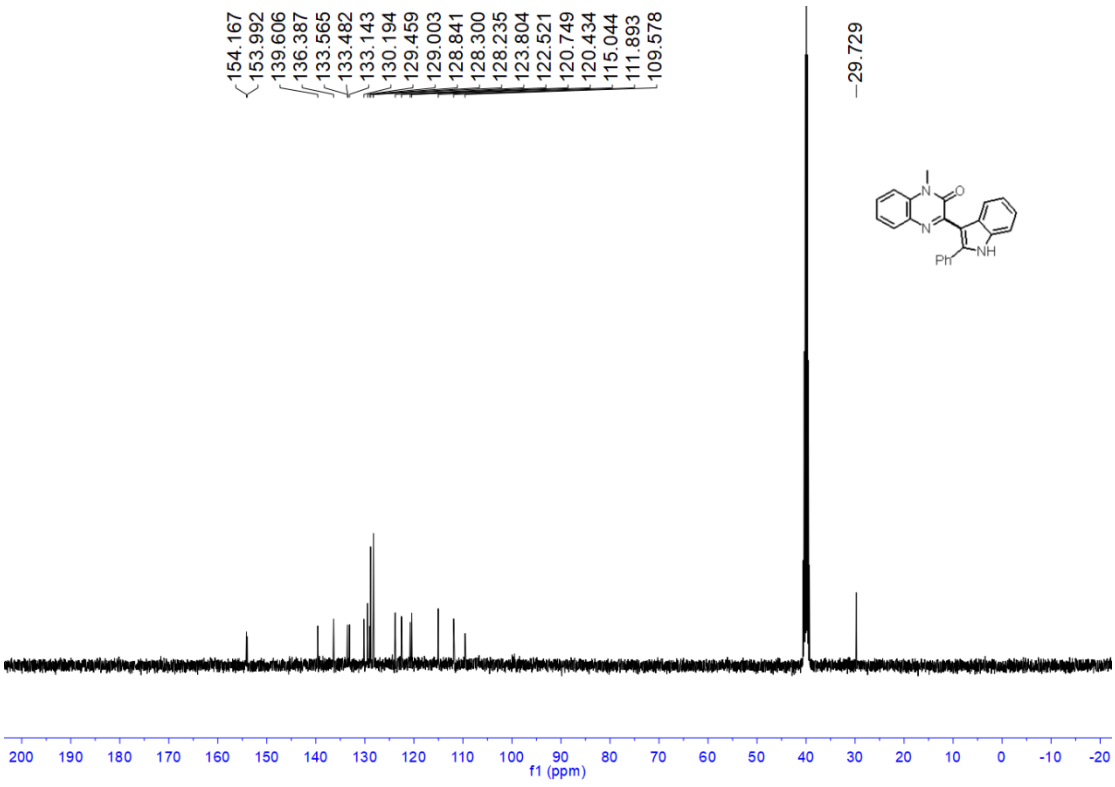


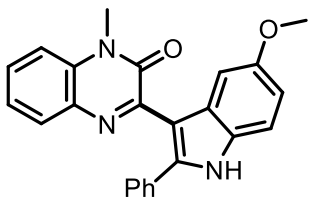




1-methyl-3-(2-phenyl-1*H*-indol-3-yl)quinoxalin-2(1*H*)-one (3an). Yellow solid, 68.9 mg, yield 98%. m.p.: 210.3-211.4 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.85 (s, 1H), 7.81 – 7.75 (m, 1H), 7.67 (d, J = 8.0 Hz, 1H), 7.65 – 7.59 (m, 1H), 7.59- – 7.45 (m, 4H), 7.42 – 7.28 (m, 4H), 7.23 – 7.15 (m, 1H), 7.11 – 7.04 (m, 1H), 3.59 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 154.2, 154.0, 139.6, 136.4, 133.6, 133.5, 133.1, 130.2, 129.5, 129.0, 128.8, 128.3, 128.2, 123.8, 122.5, 120.8, 120.4, 115.0, 111.9, 109.6, 29.7. HRMS (ESI, *m/z*) calcd for $C_{23}H_{18}N_3O^+$ $[M+H]^+$: 352.1444, found 352.1447.

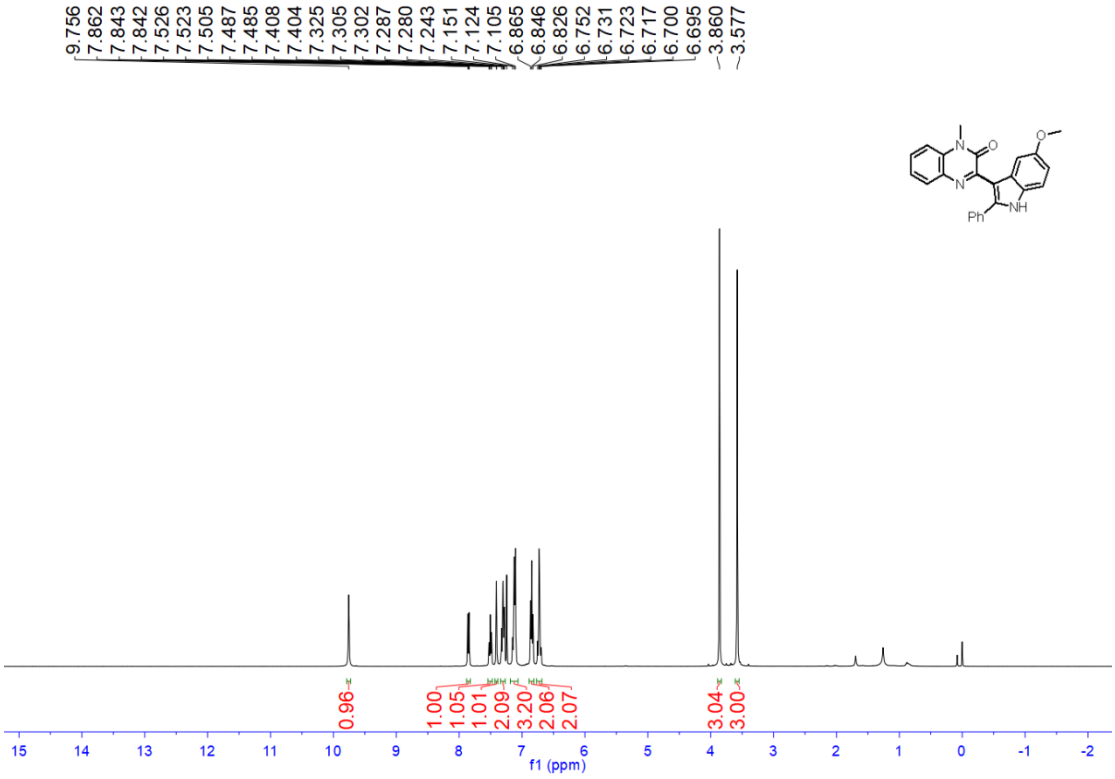


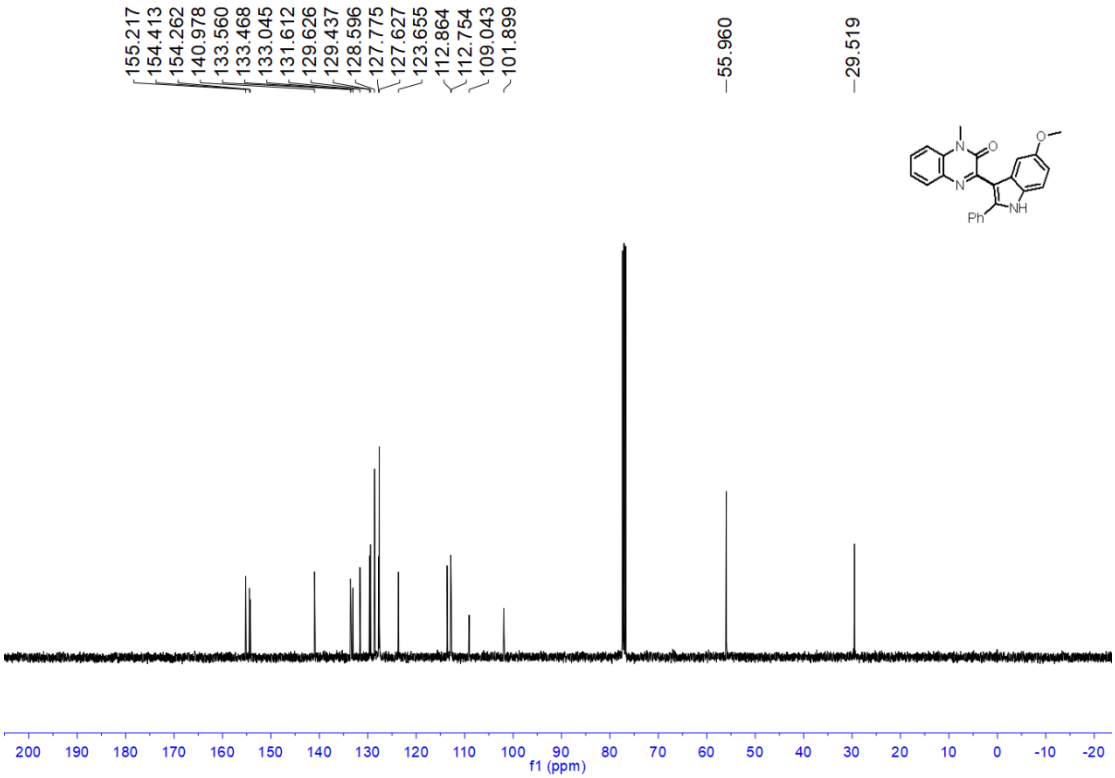


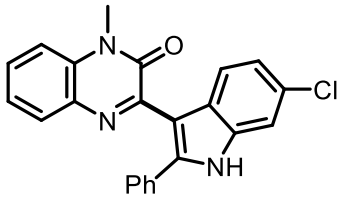


3-(5-methoxy-2-phenyl-1*H*-indol-3-yl)-1-

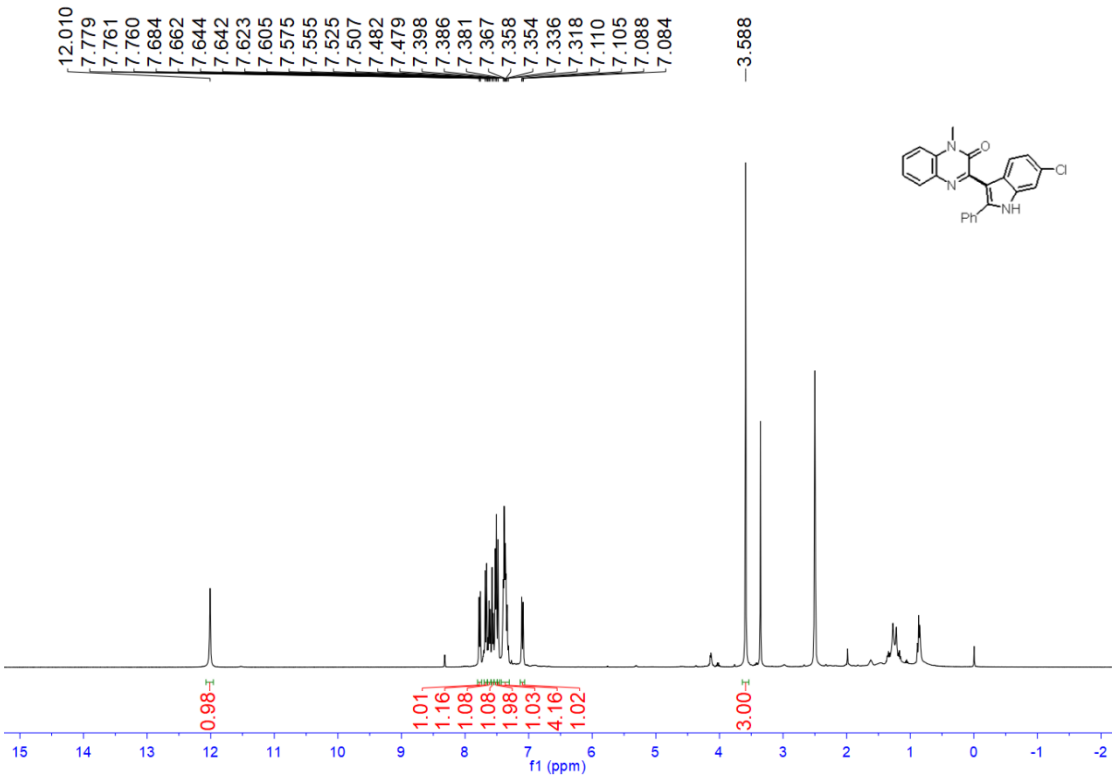
methylquinoxalin-2(1*H*)-one (3ao). Yellow solid, 65.9 mg, yield 86%. m.p.: 146.4-147.3 ℃. ^{1}H NMR (400 MHz, $CDCl_3$, TMS) δ 9.76 (s, 1H), 7.88 – 7.82 (m, H), 7.55 – 7.47 (m, 1H), 7.44 – 7.38 (m, 1H), 7.34 – 7.27 (m, 2H), 7.19 – 7.10 (m, 3H), 6.85 (dd, J_1 = J_2 = 7.7 Hz, 2H), 6.78 – 6.68 (m, 2H), 3.86 (s, 3H), 3.58 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$, TMS) δ 155.2, 154.4, 154.3, 141.0, 133.6, 133.5, 133.1, 131.6, 129.6, 129.4, 128.6, 127.8, 127.6, 123.7, 113.6, 112.9, 112.8, 109.0, 101.9, 56.0, 29.5. HRMS (ESI, *m/z*) calcd for $C_{24}H_{20}N_3O_2^+$ $[M+H]^+$: 382.1550, found 382.1553.







3-(6-chloro-2-phenyl-1*H*-indol-3-yl)-1-methylquinoxalin-2(1*H*)-one (3ap). Yellow solid, 61.0 mg, yield 79%. m.p.: 246.6-247.8 °C. ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.01 (s, 1H), 7.81 – 7.74 (m, 1H), 7.67 (d, J = 8.5 Hz, 1H), 7.65 – 7.59 (m, 1H), 7.59-7.54(m, 1H), 7.54 – 7.49 (m, 2H), 7.48 (d, J = 1.5 Hz, 2H), 7.43 – 7.31 (m, 4H), 7.10 (dd, J = 8.6, 1.7 Hz, 1H), 3.59 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 154.1, 153.4, 140.5, 136.8, 133.6, 133.1, 130.4, 129.5, 128.9, 128.6, 128.3, 127.8, 127.0, 123.8, 122.3, 120.8, 115.1, 111.4, 109.7, 100.0, 29.8. HRMS (ESI, *m/z*) calcd for $C_{23}H_{17}ClN_3NaO^+$ $[M+Na]^+$: 408.0874, found 408.0876.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7.761
7.760
7.684
7.662
7.644
7.642
7.623
7.605
7.575
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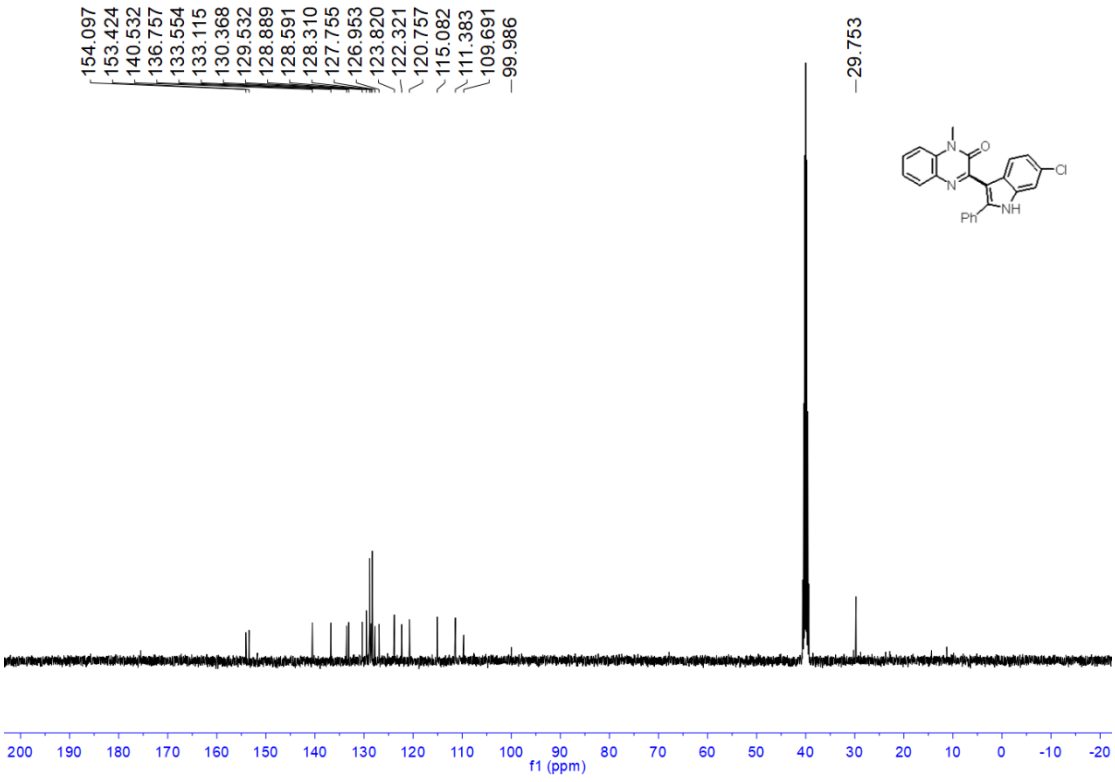
7.525
7.507
7.482
7.479
7.398
7.386
7.381
7.367
7.358
7.354
7.336
7.318
7.110
7.105
7.088
7.084
3.588
0.98
1.01
1.16
1.08
1.08
1.98
1.03
4.16
1.02
3.00
f1 (ppm)


154.097
153.424
140.532
136.757
133.554
133.115
130.368
129.532
128.889
128.591
128.310
127.755
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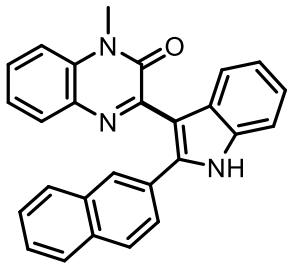
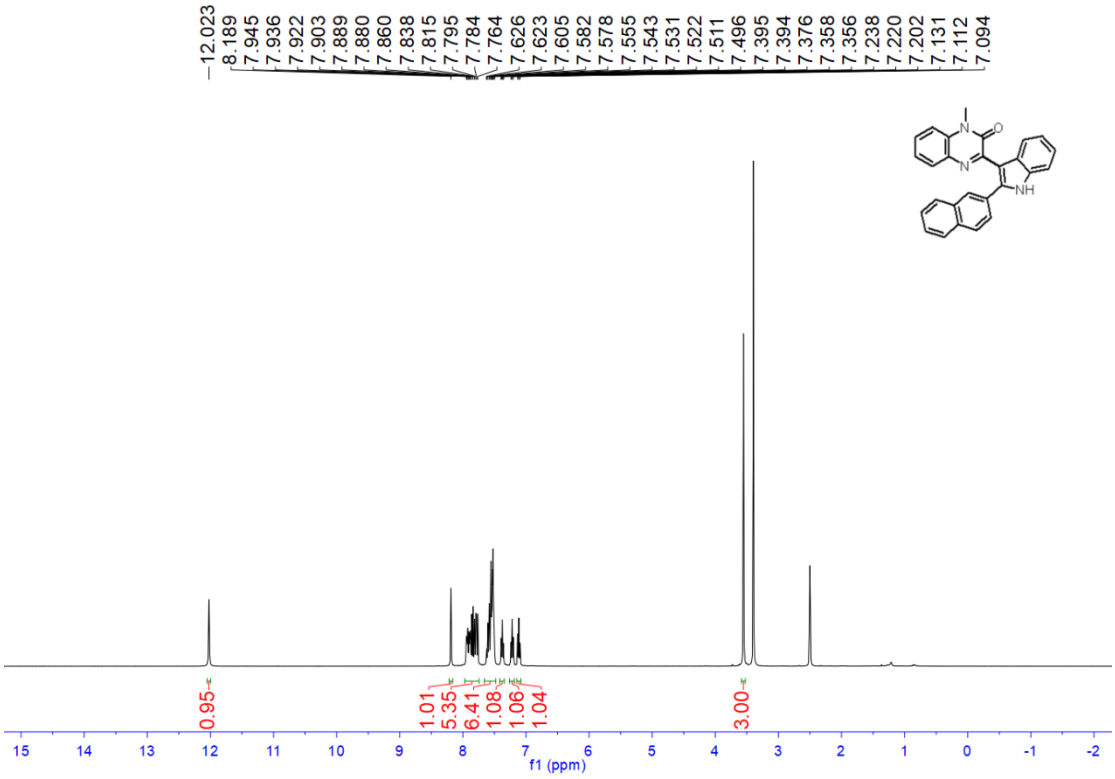
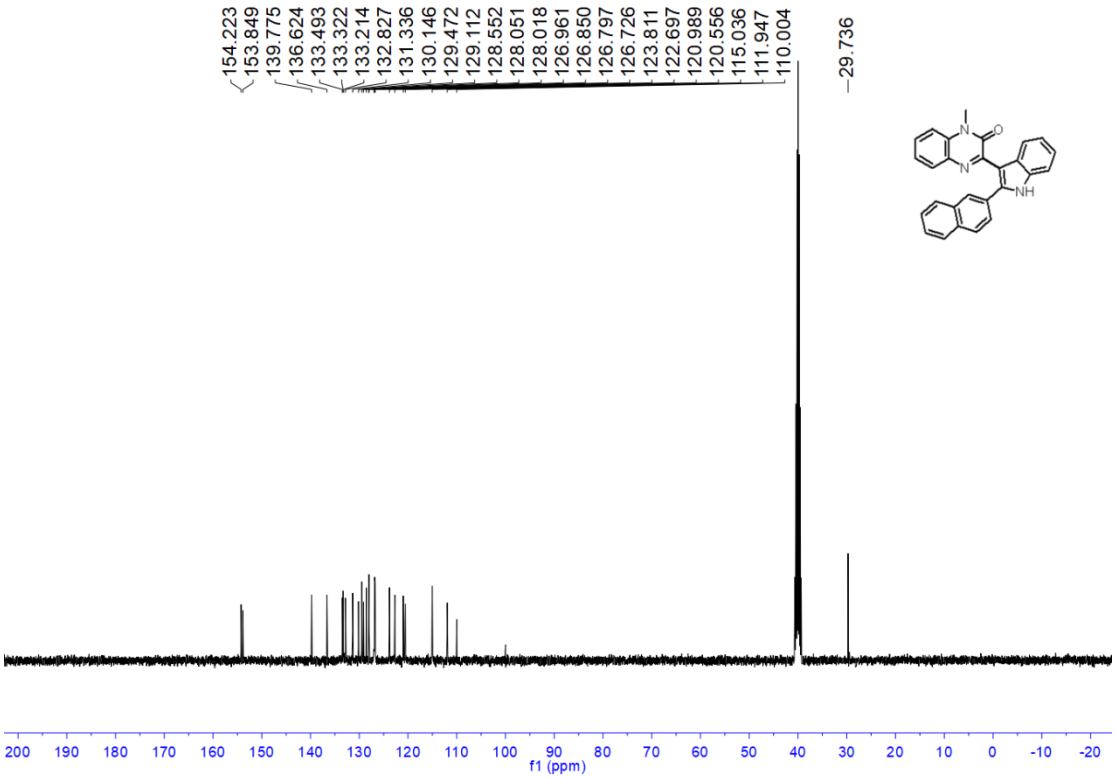
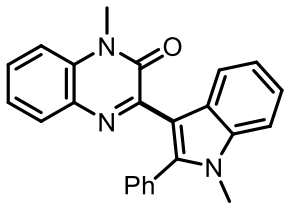
111.383
109.691
99.986
29.753
f1 (ppm)



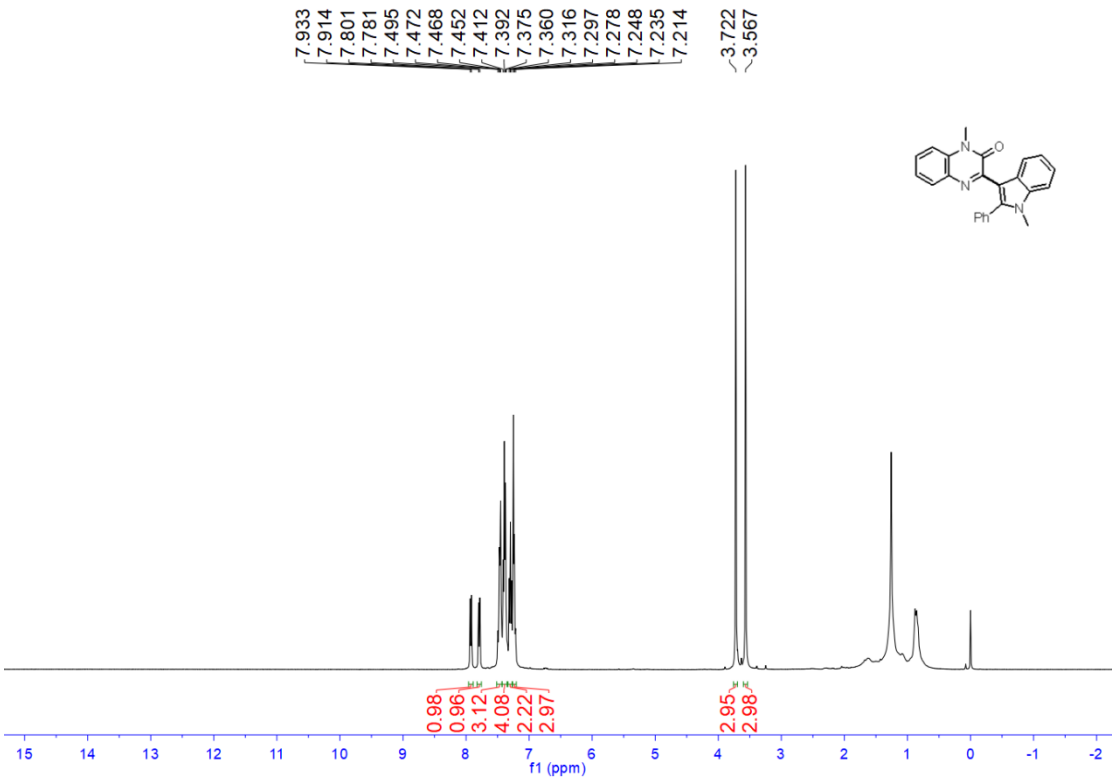
1-methyl-3-(2-(naphthalen-2-yl)-1*H*-indol-3-yl)quinoxalin-2(1*H*)-one (3aq). Yellow solid, 78.3 mg, yield 98%, m.p.: 193.3-194.6℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.02 (s, 1H), 8.19 (s, 1H), 7.98 – 7.74 (m, 5H), 7.65 – 7.48 (m, 6H), 7.42 – 7.34 (m, 1H), 7.22 (dd, $J_1 = J_2 = 7.2$ Hz, 1H), 7.11 (dd, $J_1 = J_2 = 7.4$ Hz, 1H), 3.55 (s, 3H). ^{13}C NMR (101 MHz, DMSO- d_6) δ 154.2, 153.9, 139.8, 136.6, 133.5, 133.3, 133.2, 132.8, 131.3, 130.2, 129.5, 129.1, 128.6, 128.1, 128.0, 127.0, 126.9, 126.8, 126.7, 123.8, 122.7, 121.0, 120.6, 115.0, 112.0, 110.0, 29.7. HRMS (ESI, *m/z*) calcd for $C_{27}H_{20}N_3O^+$ [M+H]$^+$: 402.1601, found 402.1602.

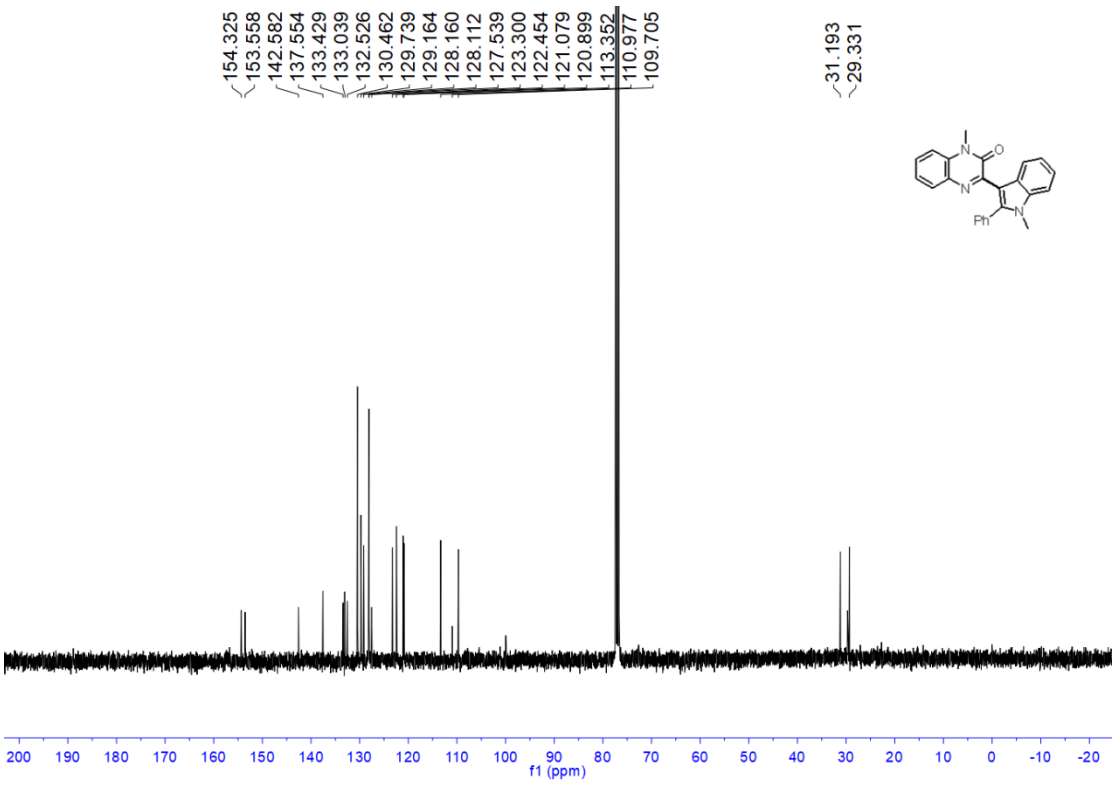


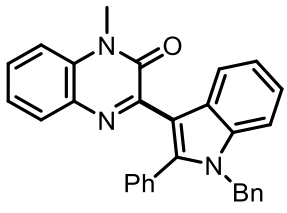




1-methyl-3-(1-methyl-2-phenyl-1*H*-indol-3-yl)quinoxalin-2(1*H*)-one (3ar). Orange solid, 60.3 mg, yield 82%. m.p.: 221.5-222.7 ℃. ^{1}H NMR (400 MHz, $CDCl_3$, TMS) δ 7.92 (d, *J* = 7.8 Hz, 1H), 7.79 (d, *J* = 7.8 Hz, 1H), 7.51-7.43(m, 3H), 7.43 – 7.35 (m, 4H), 7.30 (t, *J* = 7.5 Hz, 2H), 7.5 – 7.20 (m, 2H), 3.72 (s, 3H), 3.57 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$, TMS) δ 154.3, 153.6, 142.6, 137.6, 133.4, 133.1, 132.5, 130.5, 129.7, 129.2, 128.1, 128.2, 127.5, 123.3, 122.5, 121.1, 120.9, 113.4, 111.0, 109.7, 31.2, 29.3. HRMS (ESI, *m/z*) calcd for $C_{24}H_{20}N_3O^+$ $[M+H]^+$: 366.1601, found 366.1605.

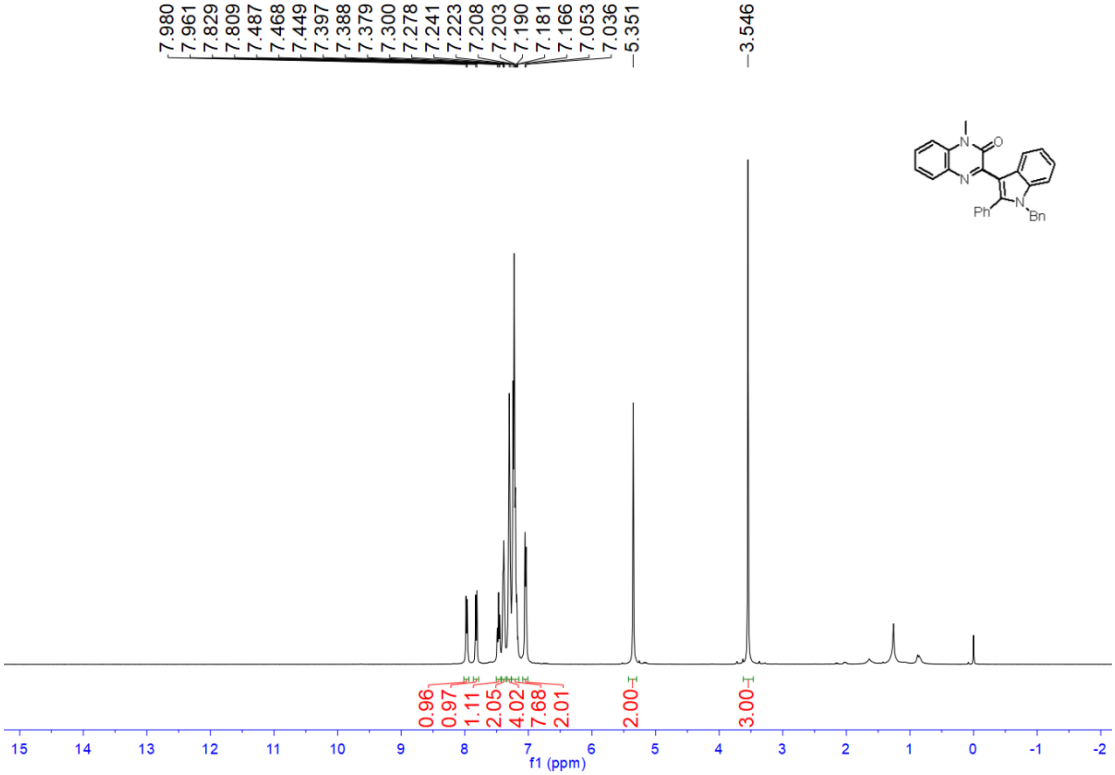


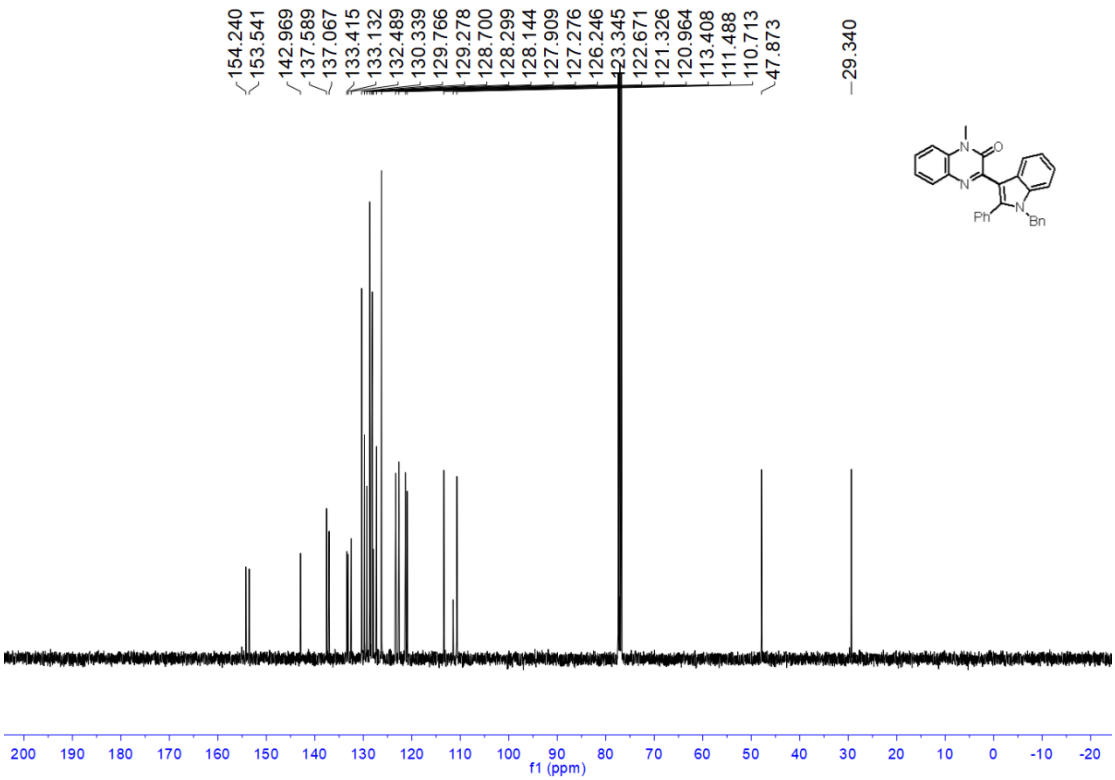


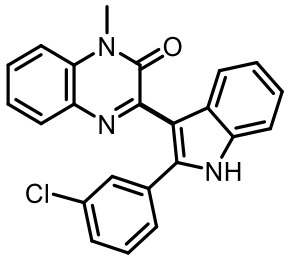


3-(1-benzyl-2-phenyl-1*H*-indol-3-yl)-1-

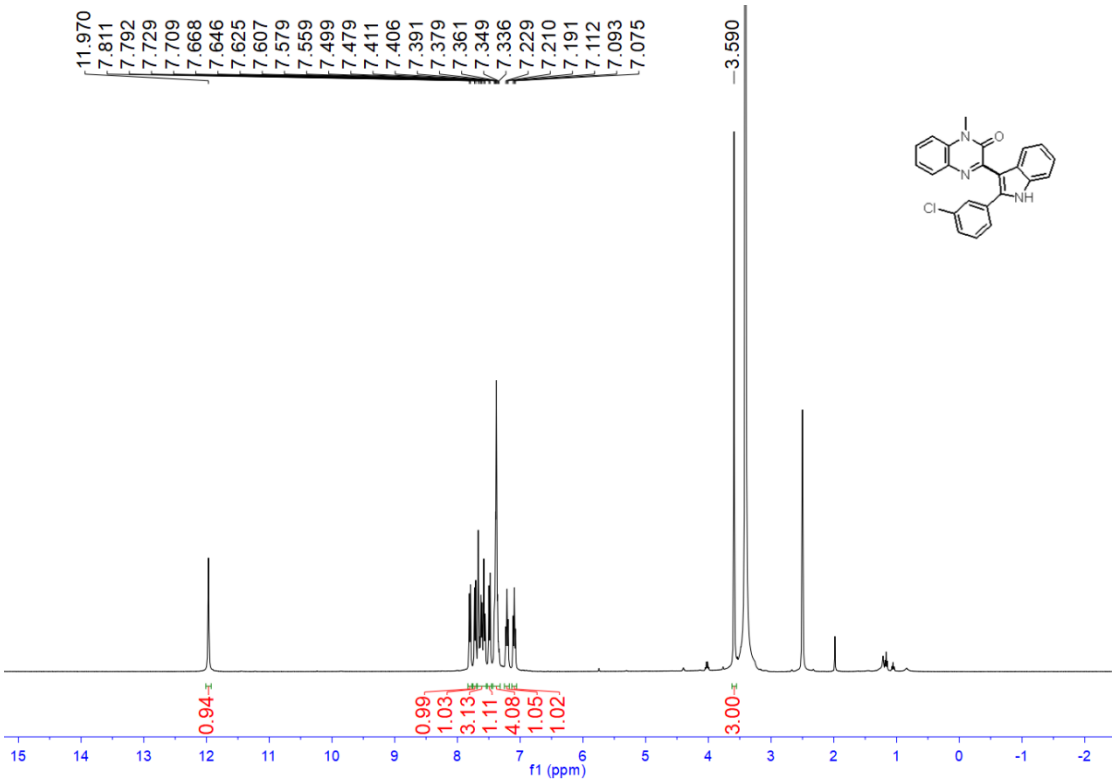
methylquinoxalin-2(1*H*)-one (3as). Yellow solid, 83.7 mg, yield 95%, m.p.: 244.2-245.1 °C. ^{1}H NMR (400 MHz, $CDCl_3$, TMS) δ 7.97 (d, *J* = 7.4 Hz, 1H), 7.82 (d, *J* = 7.7 Hz, 1H), 7.47 (t, *J* = 7.5 Hz, 1H), 7.42 – 7.36 (m, 3H), 7.29 (d, *J* = 9.0 Hz, 4H), 7.27 – 7.16 (m, 9H), 7.04 (d, *J* = 6.8 Hz, 2H), 5.35 (s, 2H), 3.55 (s, 2H). ^{13}C NMR (101 MHz, $CDCl_3$, TMS) δ 154.2, 153.5, 143.0, 137.6, 137.1, 133.4, 133.1, 132.5, 130.3, 129.8, 129.3, 128.7, 128.3, 128.1, 127.9, 127.3, 126.3, 123.3, 122.7, 121.3, 121.0, 113.4, 111.5, 110.7, 47.9, 29.3. HRMS (ESI, *m/z*) calcd for $C_{30}H_{24}N_3O^+$ $[M+H]^+$: 442.1914, found 442.1915.

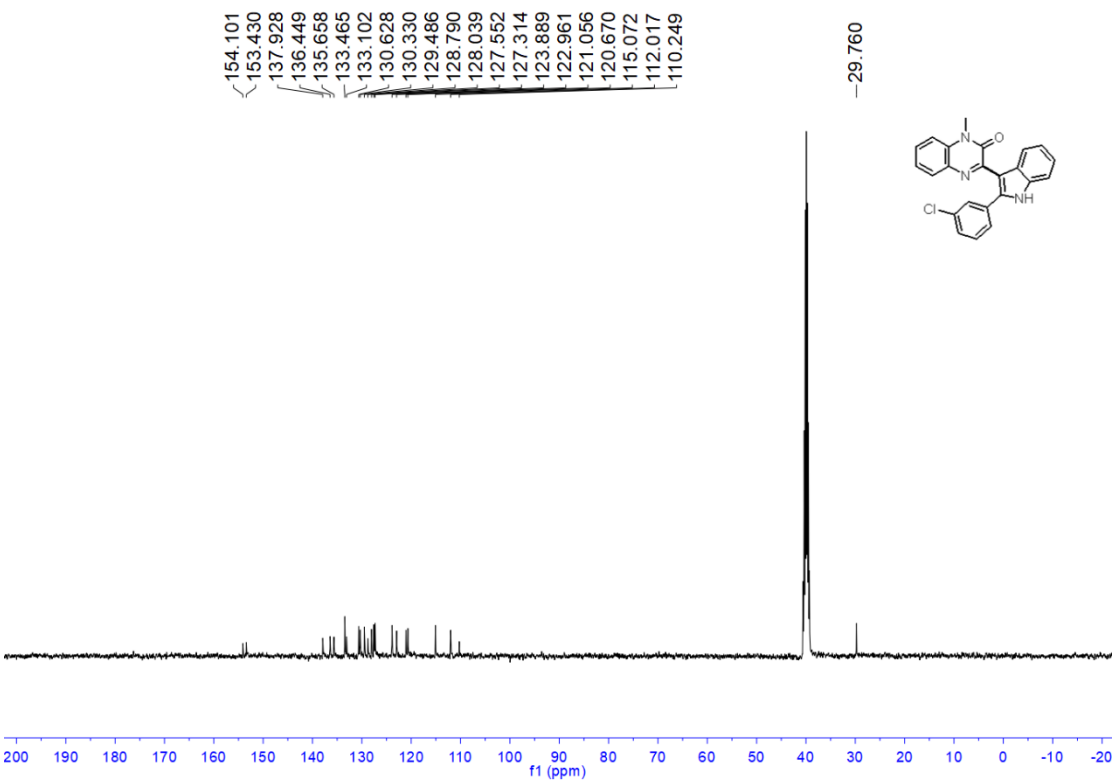


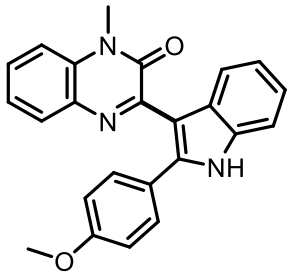




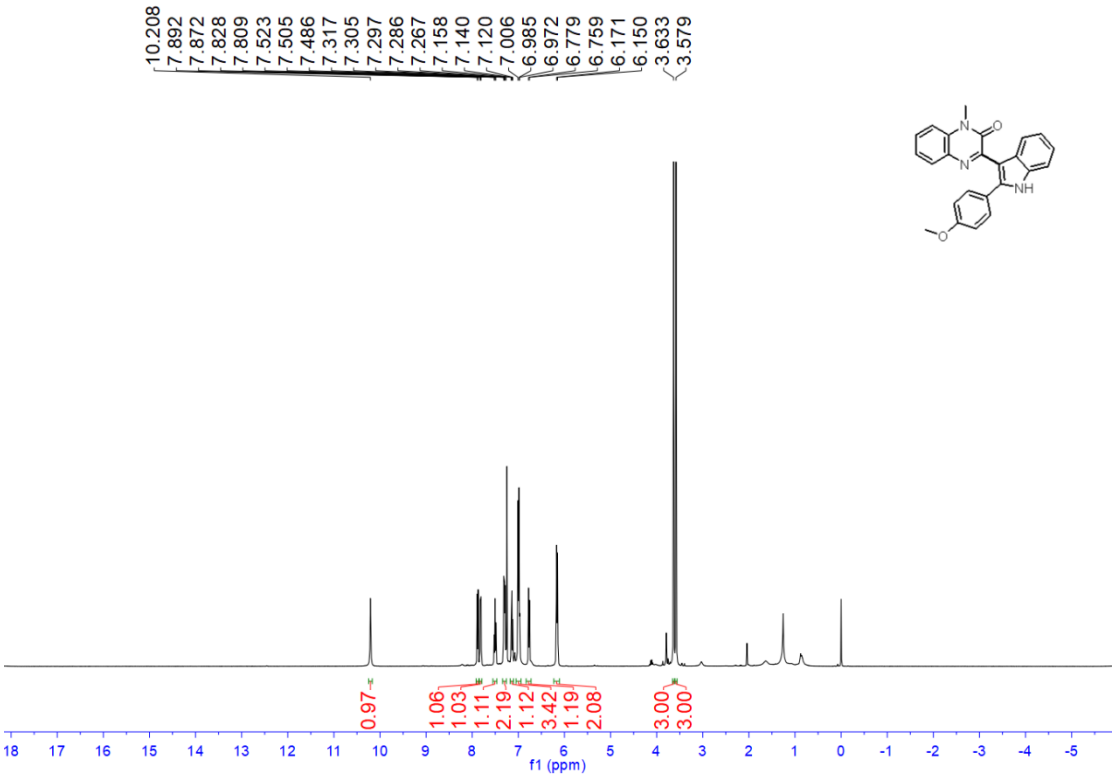
3-(2-(3-chlorophenyl)-1*H*-indol-3-yl)-1-methylquinoxalin-2(1*H*)-one (3at). Yellow solid, 64.1 mg, yield 83%. m.p.: 270.0-271.9 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.97 (s, 1H), 7.80 (d, J = 7.4 Hz, 1H), 7.72 (d, J = 8.0 Hz, 1H), 7.67 – 7.54 (m, 3H), 7.49 (d, J = 8.1 Hz, 1H), 7.44 – 7.32 (m, 4H), 7.21 (t, J = 7.5 Hz, 1H), 7.09 (t, J = 7.5 Hz, 1H), 3.59 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 154.1, 153.5, 138.0, 136.5, 135.7, 133.5, 133.1, 130.6, 130.3, 129.5, 128.8, 128.0, 127.6, 127.4, 123.9, 123.0, 121.1, 120.7, 115.1, 112.0, 110.3, 29.8. HRMS (ESI, *m/z*) calcd for $C_{23}H_{16}ClN_3NaO^+$ $[M+Na]^+$: 408.0874, found 408.0876.

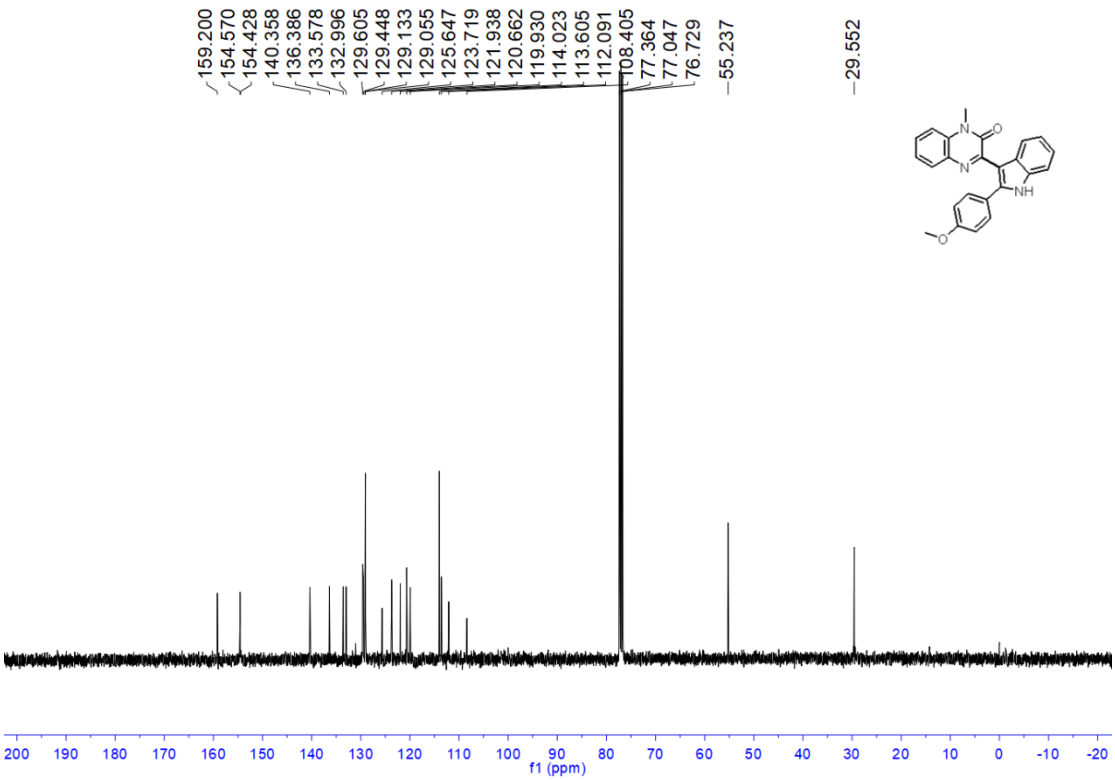

11.970
7.811
7.792
7.729
7.709
7.668
7.646
7.625
7.607
7.579
7.559
7.499
7.479
7.411
7.406
7.391
7.379
7.361
7.349
7.336
7.229
7.210
7.191
7.112
7.093
7.075
3.590
0.94
0.99
1.03
3.13
1.11
4.08
1.05
1.02
3.00
f1 (ppm)

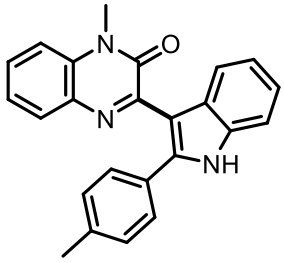

154.101
153.430
137.928
136.449
135.658
133.465
133.102
130.628
130.330
129.486
128.790
128.039
127.552
127.314
123.889
122.961
121.056
120.670
115.072
112.017
110.249
29.760
f1 (ppm)



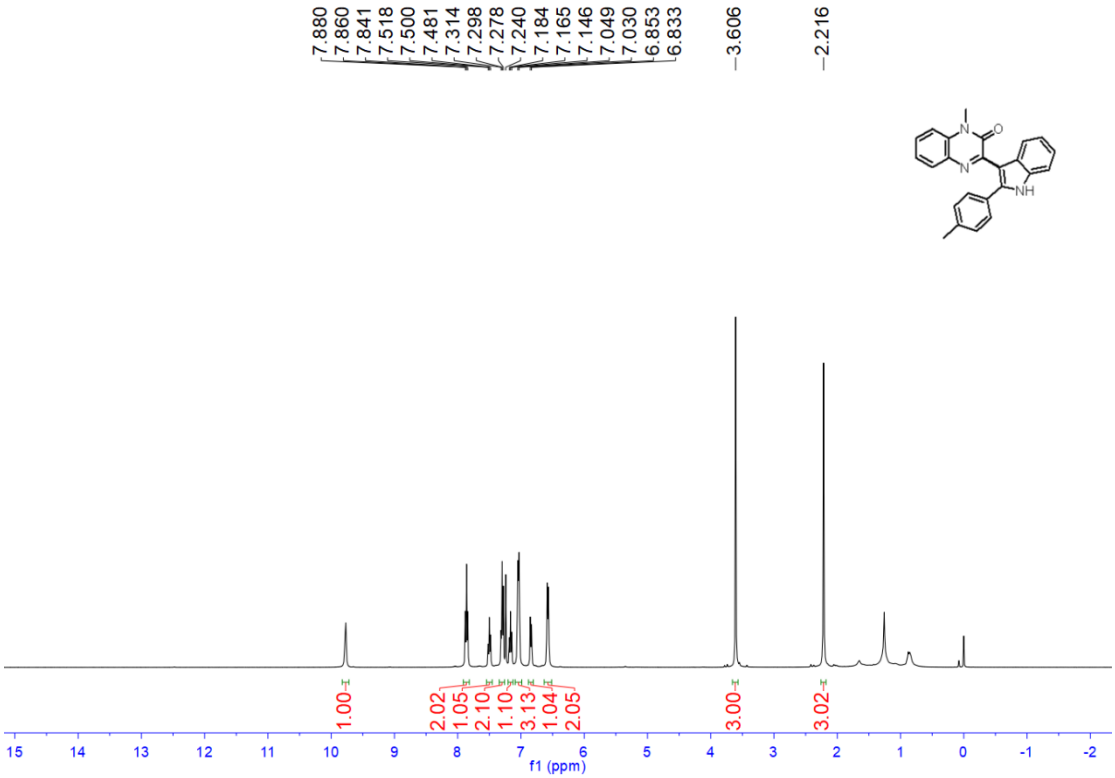
3-(2-(4-methoxyphenyl)-1*H*-indol-3-yl)-1-methylquinoxalin-2(1*H*)-one (3au). Yellow solid, 68.7 mg, yield 90%. m.p.: 218.4-218.7 ℃. ^{1}H NMR (400 MHz, $CDCl_3$, TMS) δ 10.21 (s, 1H), 7.88 (d, J = 8.0 Hz, 1H), 7.82 (d, J = 7.8 Hz, 1H), 7.55 – 7.47 (m, 1H), 7.35 – 7.26 (m, 2H), 7.14 (dd, J_1 = J_2 = 7.5 Hz, 1H), 7.04 – 6.95 (m, 3H), 6.77 (d, J = 8.1 Hz, 1H), 6.16 (d, J = 8.5 Hz, 2H), 3.63 (s, 3H), 3.58 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$, TMS) δ 159.2, 154.6, 154.4, 140.4, 136.4, 133.6, 133.0, 129.6, 129.5, 129.1, 129.1, 125.7, 123.7, 121.9, 120.7, 119.9, 114.0, 113.6, 112.1, 108.4, 55.2, 29.6. HRMS (ESI, *m/z*) calcd for $C_{24}H_{20}N_3O_2^+$ $[M+H]^+$: 382.1550, found 382.1552.







1-methyl-3-(2-(*p*-tolyl)-1*H*-indol-3-yl)quinoxalin-2(1*H*)-one (3av). Yellow solid, 65.1 mg, yield 89%. m.p.: 198.7-199.2 ℃. ^{1}H NMR (400 MHz, $CDCl_3$, TMS) δ 9.78 (br, 1H), 7.86 (dd, $J_1 = J_2 = 7.8$ Hz, 2H), 7.50 (dd, $J_1 = J_2 = 7.5$ Hz, 1H), 7.34 – 7.26 (m, 2H), 7.17 (dd, $J_1 = J_2 = 7.5$ Hz, 1H), 7.0 – 6.99 (m, 3H), 6.84 (d, $J = 8.0$ Hz, 1H), 6.58 (d, $J = 7.7$ Hz, 2H), 3.61 (s, 3H), 2.22 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$, TMS) δ 154.5, 154.3, 140.4, 137.6, 136.3, 133.6, 133.1, 130.4, 129.7, 129.43, 129.37, 129.1, 127.6, 123.6, 122.2, 120.8, 120.1, 113.6, 111.8, 108.9, 29.5, 21.2. HRMS (ESI, *m/z*) calcd for $C_{24}H_{20}N_3O^+$ $[M+H]^+$: 366.1601, found 366.1604.


7.880
7.860
7.841
7.518
7.500
7.481
7.314
7.298
7.278
7.240
7.184
7.165
7.146
7.049
7.030
6.853
6.833
3.606
2.216
1.00
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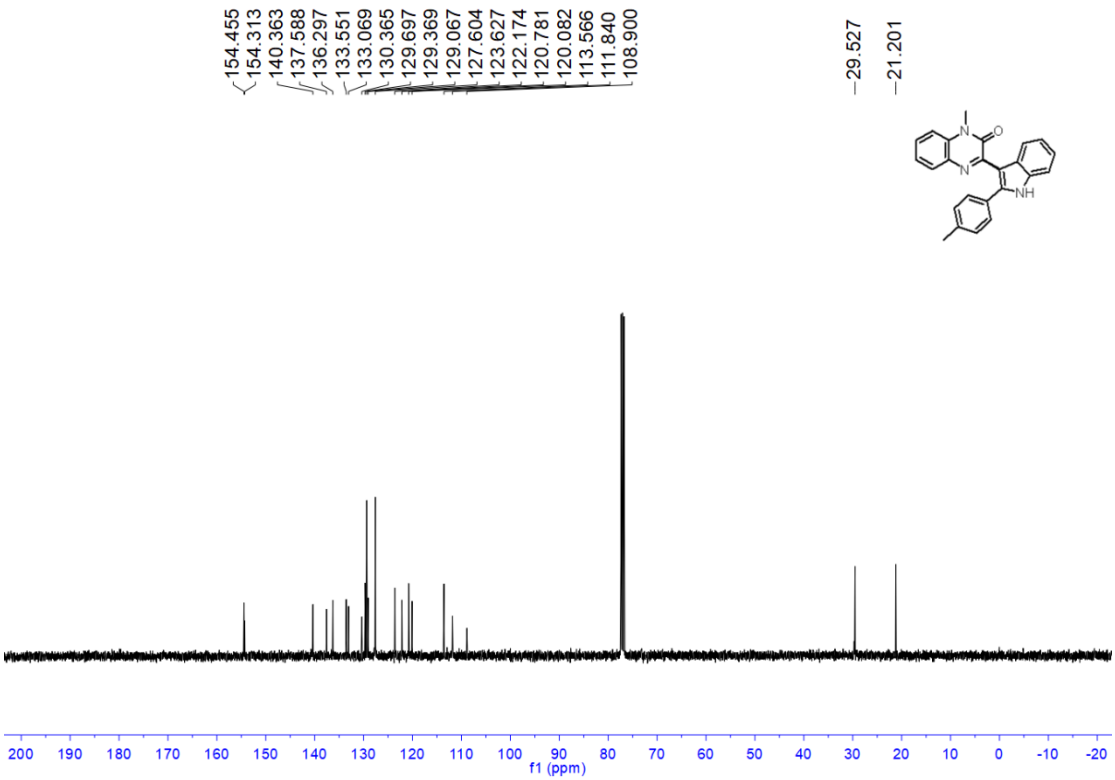
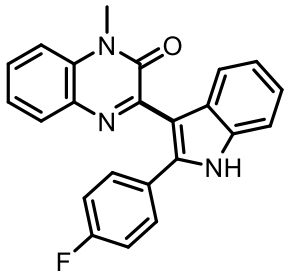
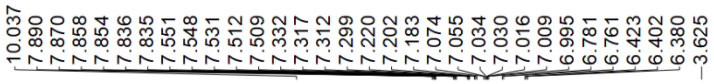
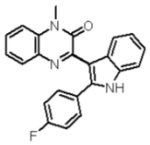
1.05
2.10
1.10
3.13
1.04
2.05
3.00
3.02
f1 (ppm)

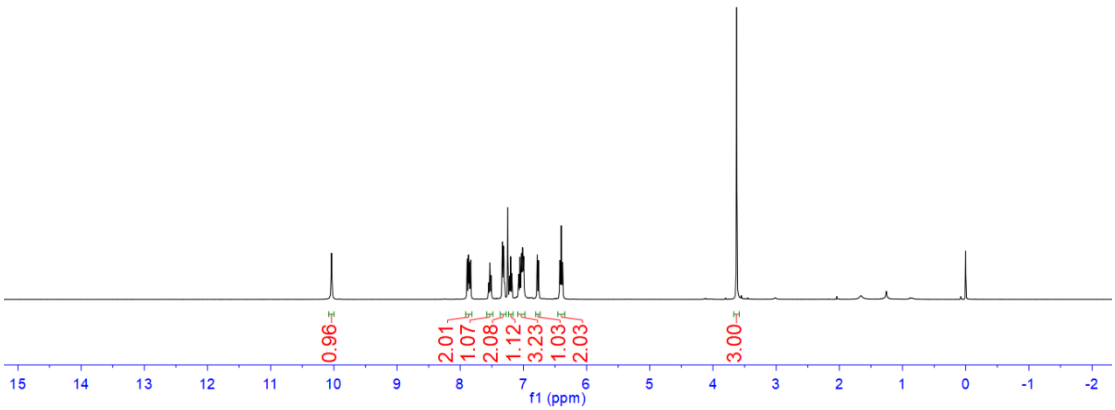

154.455
154.313
140.363
137.588
136.297
133.551
133.069
130.365
129.697
129.369
129.067
127.604
123.627
122.174
120.781
120.082
113.566
111.840
108.900
29.527
21.201
f1 (ppm)

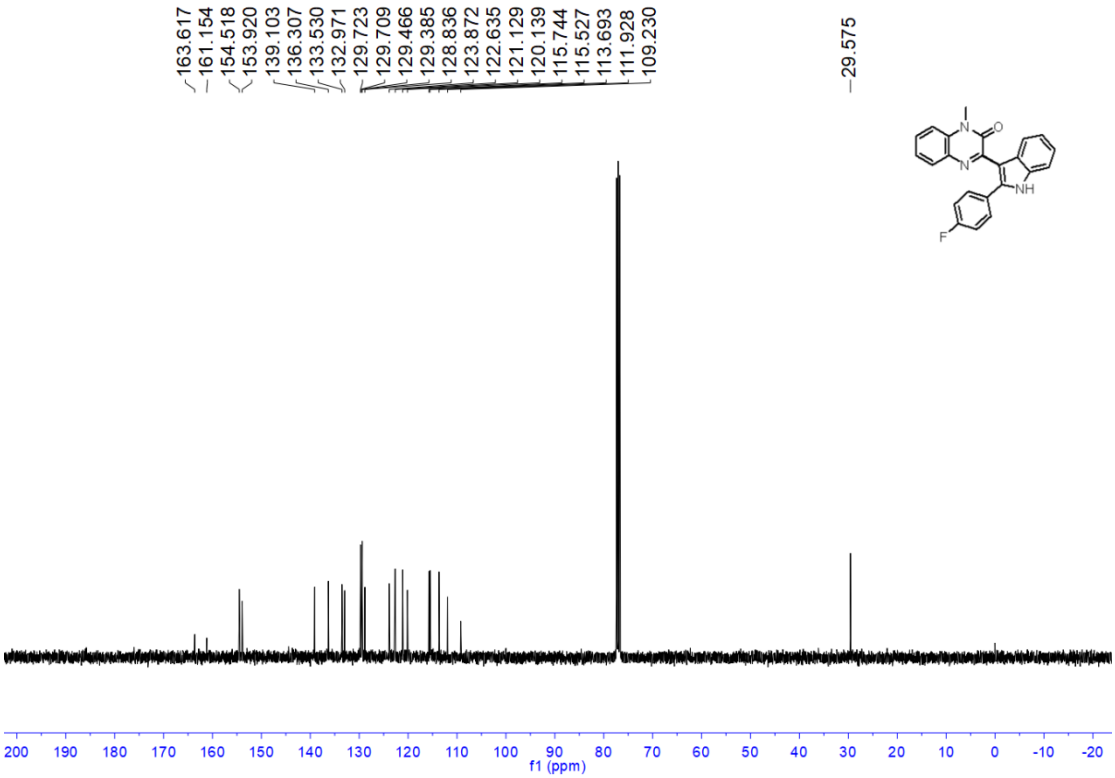


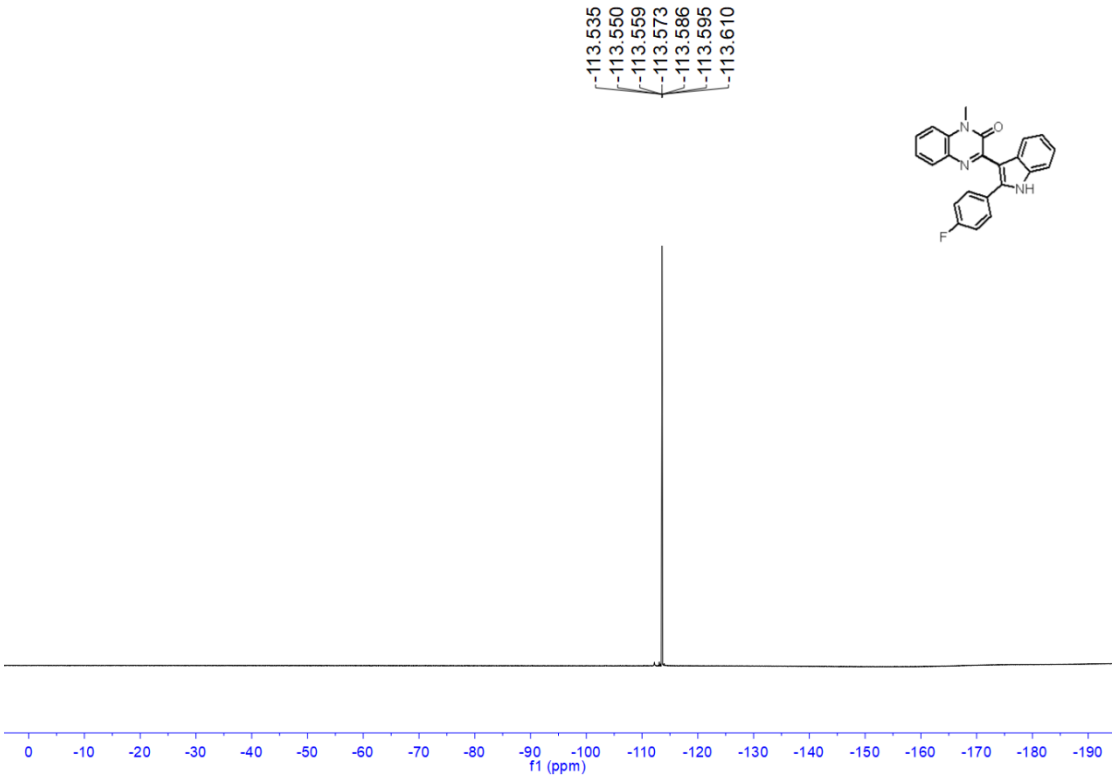
3-(2-(4-fluorophenyl)-1*H*-indol-3-yl)-1-methylquinoxalin-2(1*H*)-one (3aw). Yellow solid, 69.4 mg, yield 94%. m.p.: 218.8-220.4 ℃. ^{1}H NMR (400 MHz, $CDCl_3$, TMS) δ 10.04 (s, 1H), 7.92 – 7.81 (m, 2H), 7.58 – 7.48 (m, 1H), 7.36 – 7.28 (m, 2H), 7.20 (dd, $J_1 = J_2 = 7.5$ Hz, 1H), 7.10 – 6.97 (m, 3H), 6.77 (d, $J = 8.1$ Hz, 1H), 6.40 (dd, $J_1 = J_2 = 8.6$ Hz, 2H), 3.62 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$, TMS) δ 162.4(d, $J = 247.8$ Hz), 154.5, 153.9, 139.1, 136.3, 133.5, 133.0, 129.72, 129.71, 129.43 (d, $J = 8.2$ Hz), 129.39 (br), 128.8, 123.9, 122.6, 121.1, 120.1, 115.6 (d, $J = 21.8$ Hz), 113.7, 111.9, 109.2, 29.6. ^{19}F NMR (376 MHz, $CDCl_3$, TMS) δ -113.52 to -113.63 (m). HRMS (ESI, *m/z*) calcd for $C_{23}H_{17}FN_3O^+$ $[M+H]^+$: 370.1350, found 370.1353.

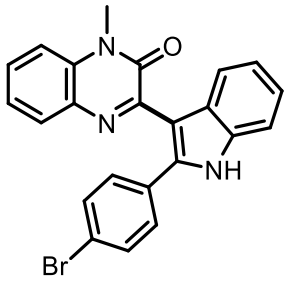




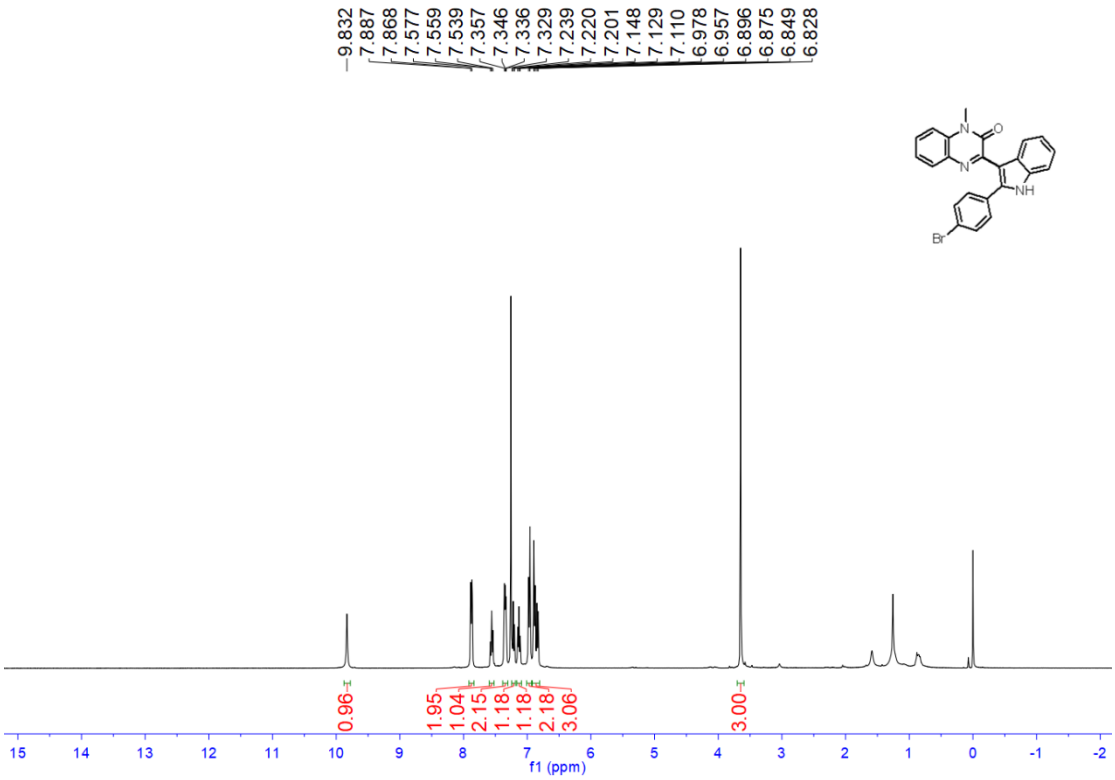


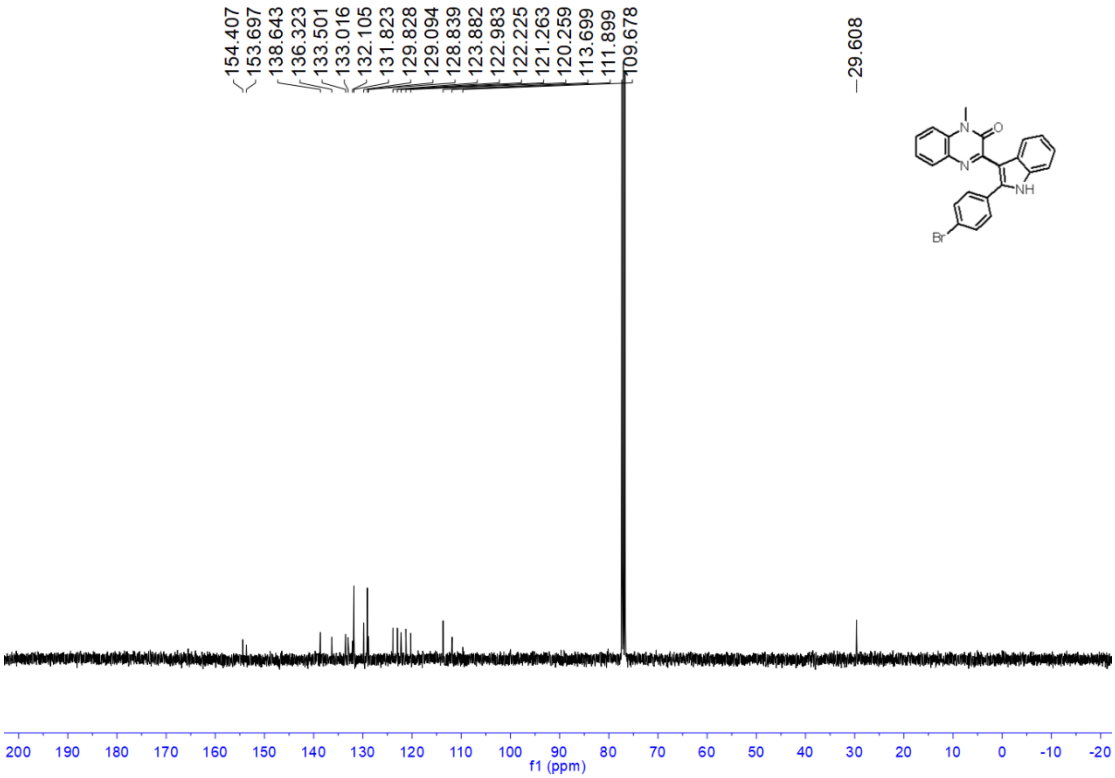

163.617
161.154
154.518
153.920
139.103
136.307
133.530
132.971
129.723
129.709
129.466
129.385
128.836
123.872
122.635
121.129
120.139
115.744
115.527
113.693
111.928
109.230
29.575
O
N
N
NH
F
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)

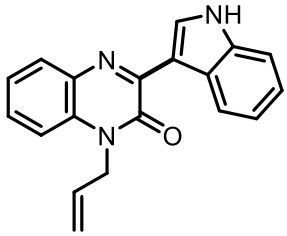

-113.535
-113.550
-113.559
-113.573
-113.586
-113.595
-113.610
O
N
N
NH
F
0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190
f1 (ppm)



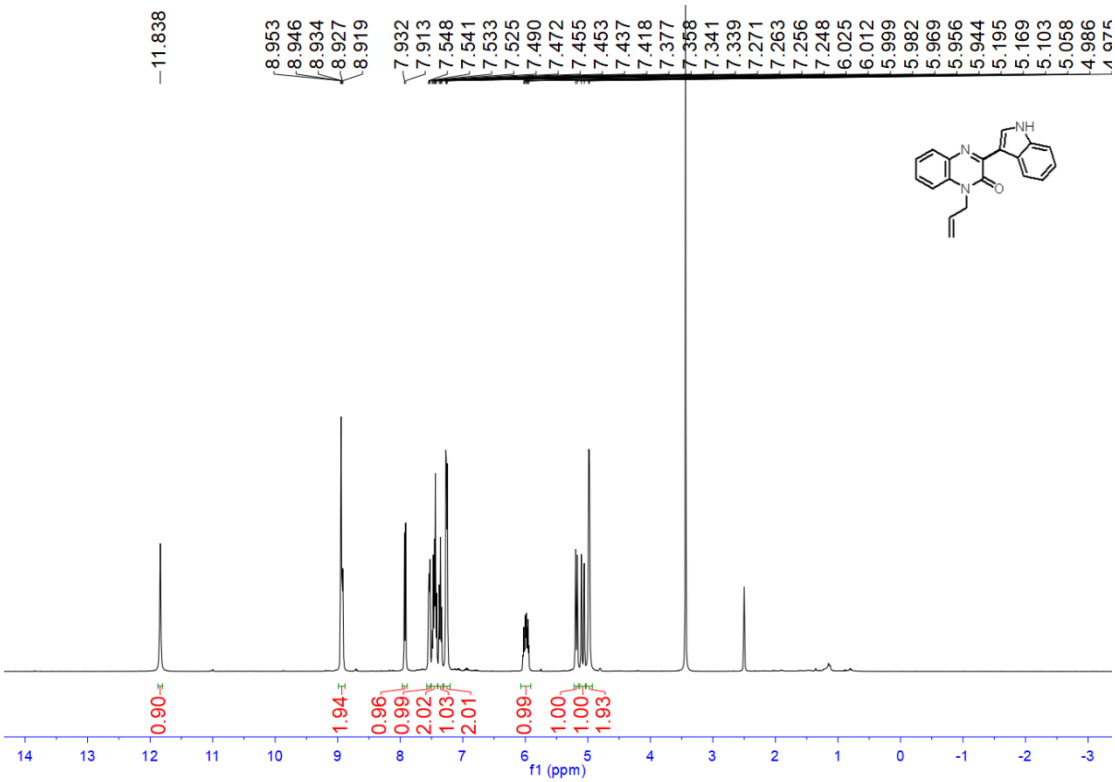
3-(2-(4-bromophenyl)-1*H*-indol-3-yl)-1-methylquinoxalin-2(1*H*)-one (3ax). Yellow solid, 82.7 mg, yield 96%, m.p.: 251.3-252.4 ℃. ^{1}H NMR (400 MHz, $CDCl_3$, TMS) δ 9.83 (s, 1H), 7.88 (d, J = 7.4 Hz, 2H), 7.56 (t, J = 7.5 Hz, 1H), 7.39 – 7.31 (m, 2H), 7.22 (t, J = 7.6 Hz, 1H), 7.13 (dd, J_1 = J_2 = 7.5 Hz, 1H), 6.97 (d, J = 8.3 Hz, 2H), 6.89 (d, J = 8.2 Hz, 2H), 6.84 (d, J = 8.1 Hz, 1H), 3.65 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$, TMS) δ 154.4, 153.7, 138.6, 136.3, 133.5, 133.0, 132.1, 131.8, 129.83, 129.80, 129.1, 128.8, 123.9, 123.0, 122.2, 121.3, 120.3, 113.7, 111.9, 109.7, 29.6. HRMS (ESI, *m/z*) calcd for $C_{23}H_{16}BrN_3NaO^+$ $[M+Na]^+$: 452.0369, found 452.0373.







1-allyl-3-(1*H*-indol-3-yl)quinoxalin-2(1*H*)-one (3ba). A known compound.[4] Yellow solid, 53.9 mg, yield 89%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.84 (s, 1H), 9.00 – 8.89 (m, 2H), 7.92 (d, J = 7.6 Hz, 1H), 7.54 (dd, J = 5.9, 2.9 Hz, 1H), 7.51 – 7.40 (m, 2H), 7.39 – 7.33 (m, 1H), 7.26 (dd, J = 6.0, 3.2 Hz, 2H), 6.06 – 5.93 (m, 1H), 5.18 (d, J = 10.4 Hz, 1H), 5.08 (d, J = 17.9 Hz, 1H), 4.98 (d, J = 4.2 Hz, 2H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 153.7, 151.1, 136.8, 133.7, 133.6, 132.3, 131.0, 129.0, 128.6, 126.8, 123.9, 123.5, 123.0, 121.5, 117.4, 115.1, 112.4, 111.8, 44.4.


11.838
8.953
8.946
8.934
8.927
8.919
7.932
7.913
7.548
7.541
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7.490
7.472
7.455
7.453
7.437
7.418
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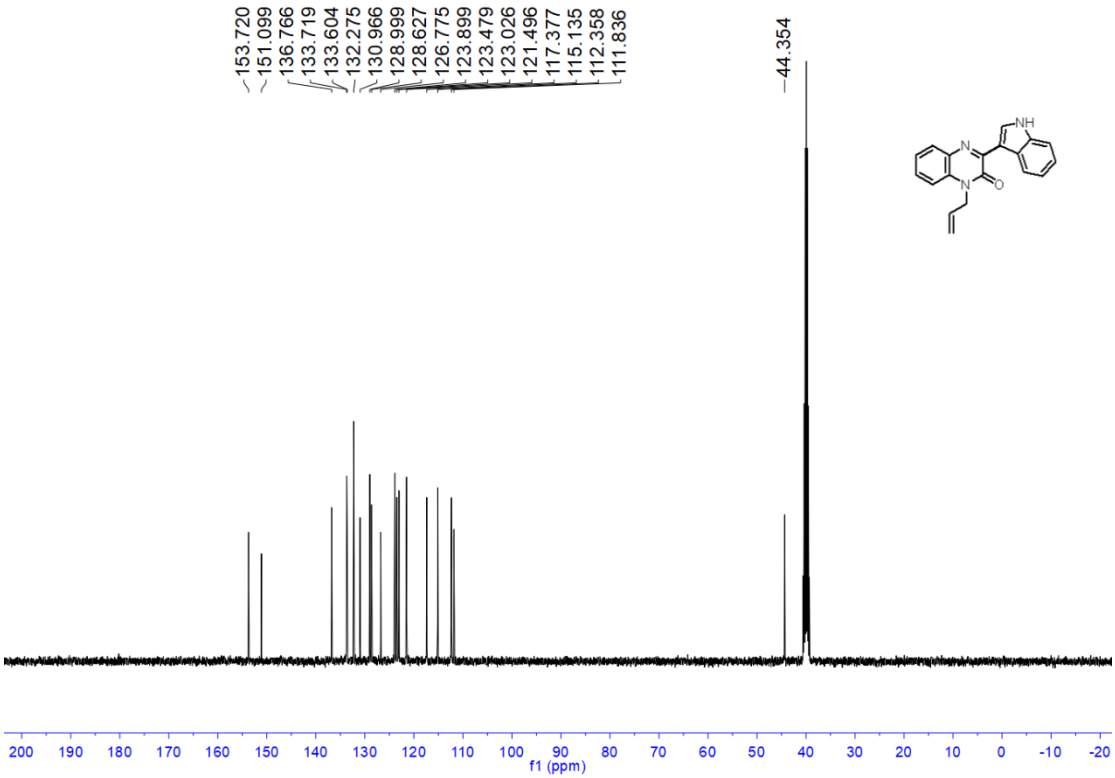
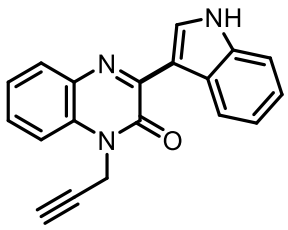
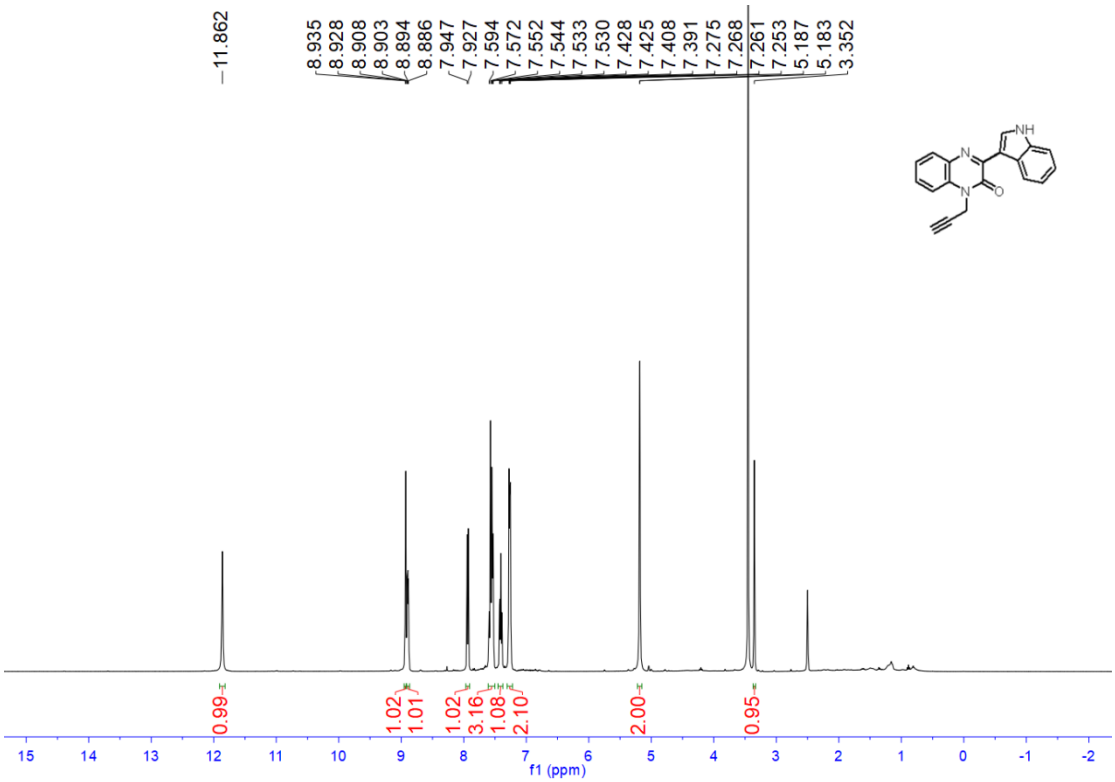
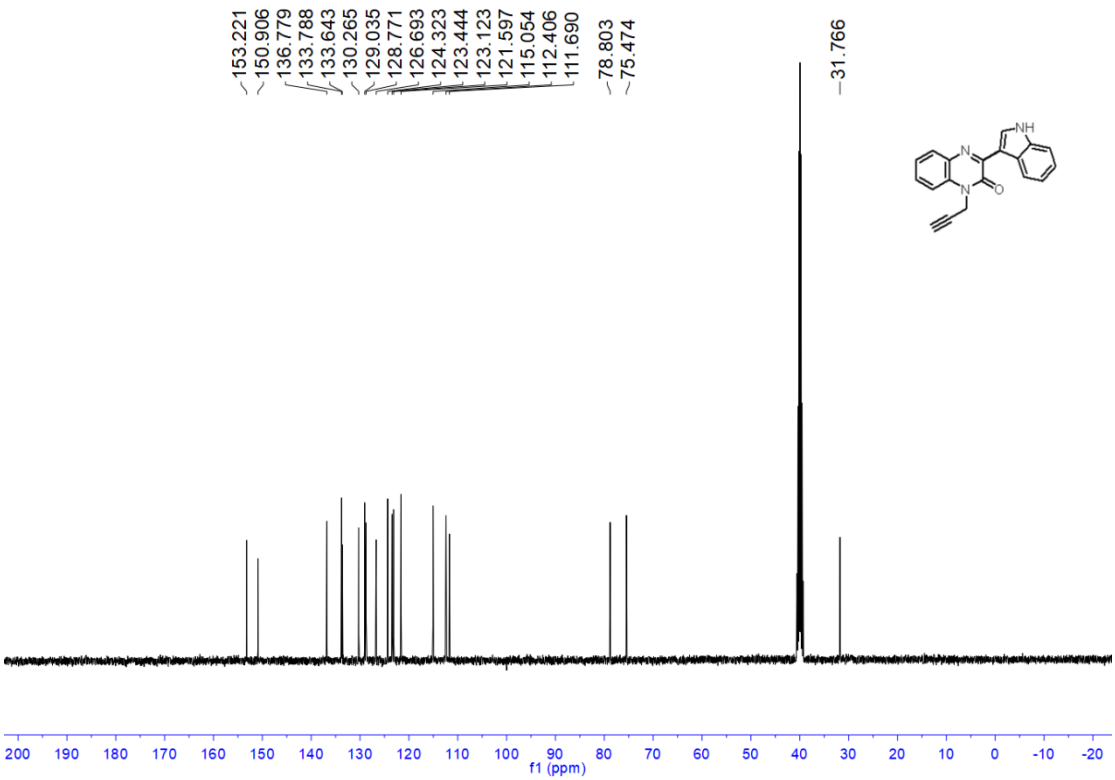
7.271
7.263
7.256
7.248
6.025
6.012
5.999
5.982
5.969
5.956
5.944
5.195
5.169
5.103
5.058
4.986
0.90
1.94
0.96
0.99
2.02
1.03
2.01
0.99
1.00
1.00
1.93
f1 (ppm)

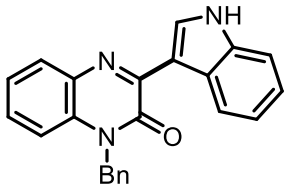

153.720
151.099
136.766
133.719
133.604
132.275
130.966
128.999
128.627
126.775
123.899
123.479
123.026
121.496
117.377
115.135
112.358
111.836
44.354
f1 (ppm)



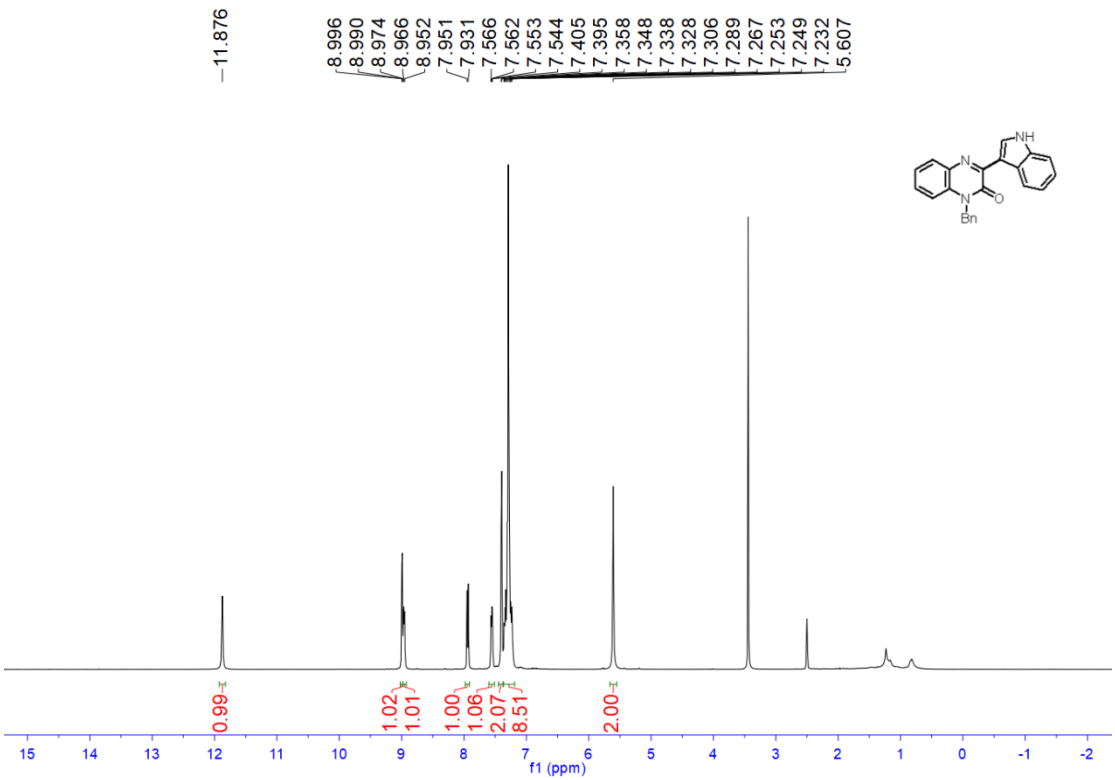
3-(1*H*-indol-3-yl)-1-(prop-2-yn-1-yl)quinoxalin-2(1*H*)-one (3ca). Brown solid, 53.5 mg, yield 89%, m.p.: 228.1-228.7 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.86 (s, 1H), 8.93 (d, J = 2.7 Hz, 1H), 8.92 – 8.86 (m, 1H), 7.94 (d, J = 7.8 Hz, 1H), 7.62 – 7.50 (m, 3H), 7.45 – 7.38 (m, 1H), 7.31 – 7.23 (m, 2H), 5.18 (d, J = 1.6 Hz, 2H), 3.35 (s, 1H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 153.2, 150.9, 136.8, 133.8, 133.6, 130.3, 129.0, 128.8, 126.7, 124.3, 123.4, 123.1, 121.6, 115.1, 112.4, 111.7, 78.8, 75.5, 31.8. HRMS (ESI, *m/z*) calcd for $C_{19}H_{14}N_3O^+$ [M+H]$^+$: 300.1131, found 300.1134.

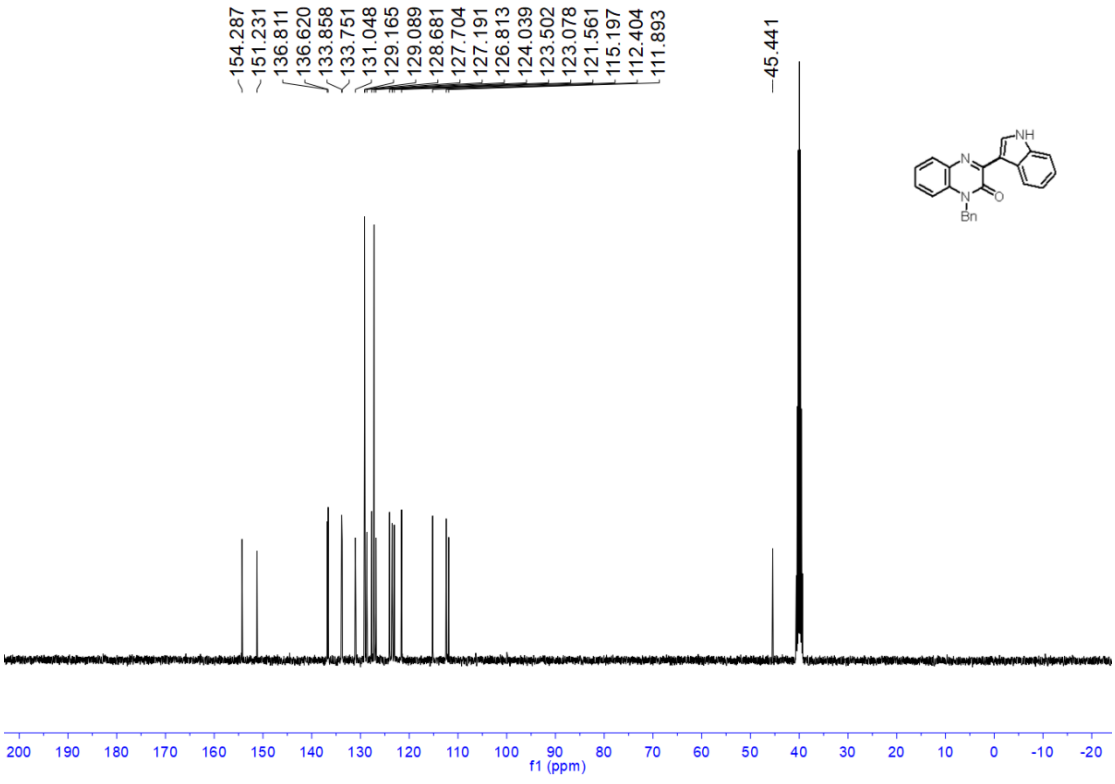


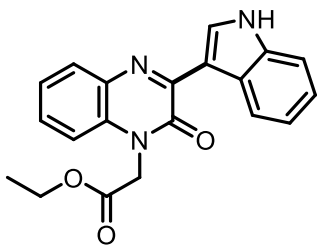




1-benzyl-3-(1*H*-indol-3-yl)quinoxalin-2(1*H*)-one (3da). A known compound.[4] Yellow solid, 69.4 mg, yield 99%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.88 (s, 1H), 8.99 (d, J = 2.4 Hz, 1H), 8.98 – 8.93 (m, 1H), 7.94 (d, J = 7.7 Hz, 1H), 7.60 – 7.51(m, 1H), 7.40 (d, J = 3.7 Hz, 2H), 7.37 – 7.19 (m, 8H), 5.61 (s, 2H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 154.3, 151.2, 136.8, 136.6, 133.9, 133.8, 131.1, 129.2, 129.1, 128.7, 127.7, 127.2, 126.8, 124.0, 123.5, 123.1, 121.6, 115.2, 112.4, 111.9, 45.4.

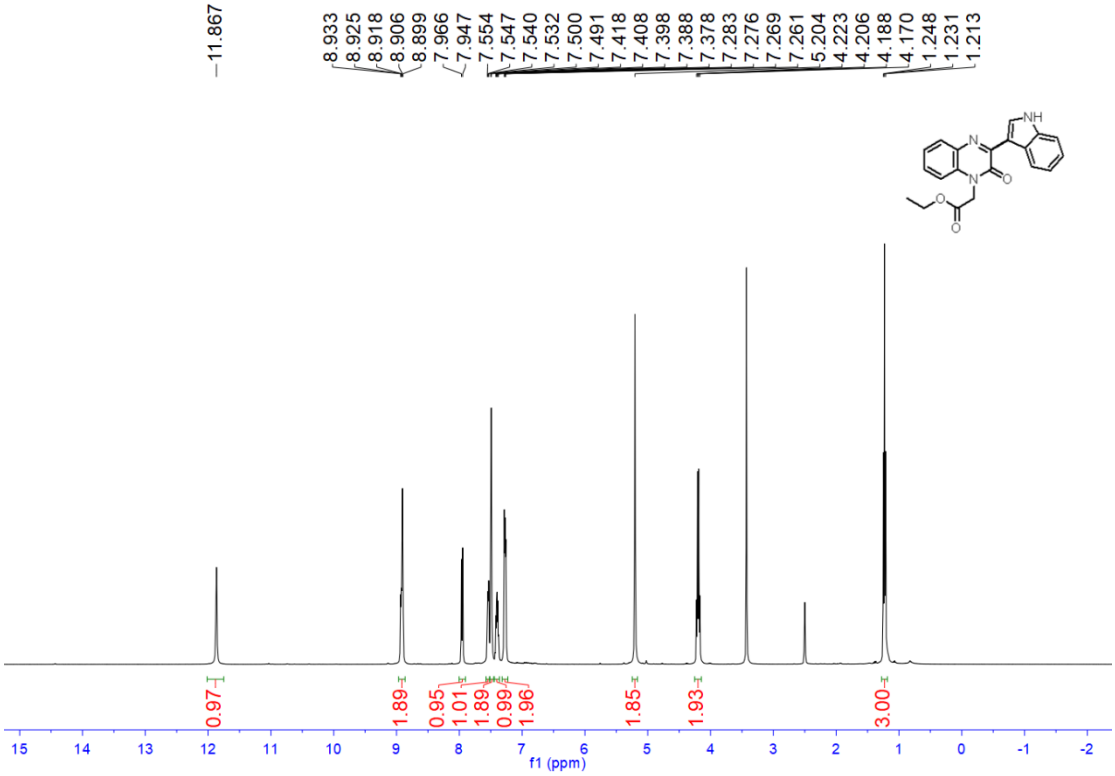


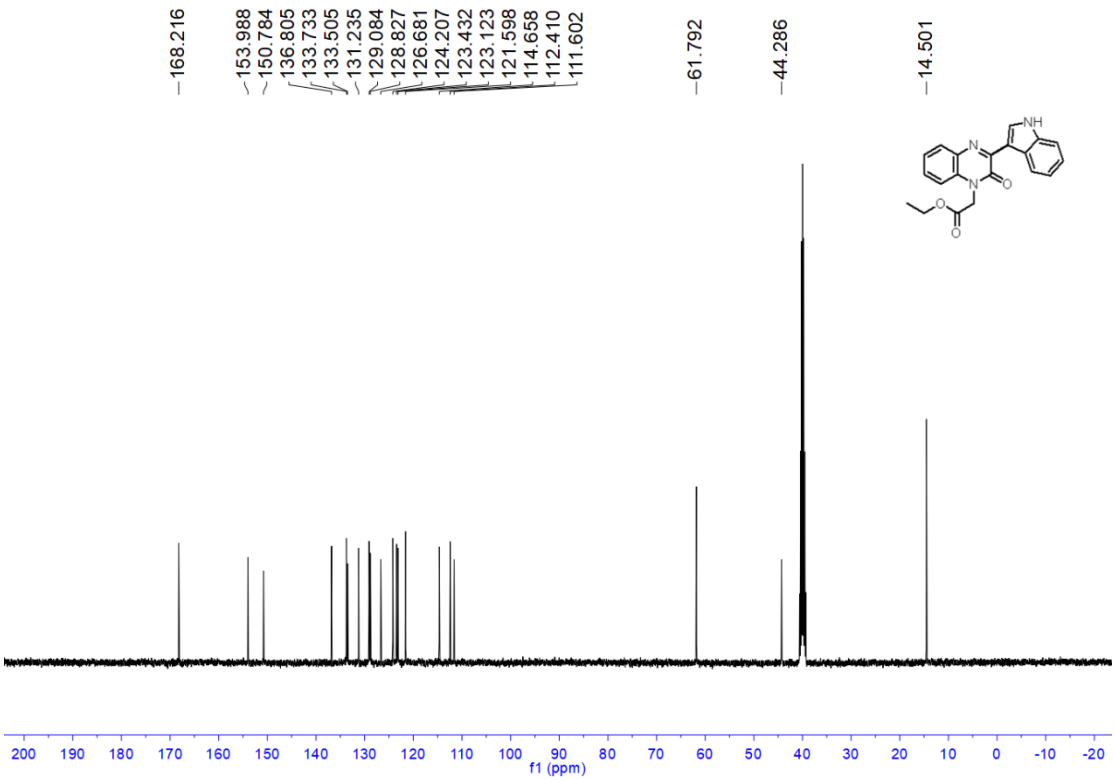


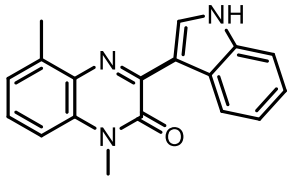


Ethyl 2-(3-(1*H*-indol-3-yl)-2-oxoquinoxalin-1(2*H*)-

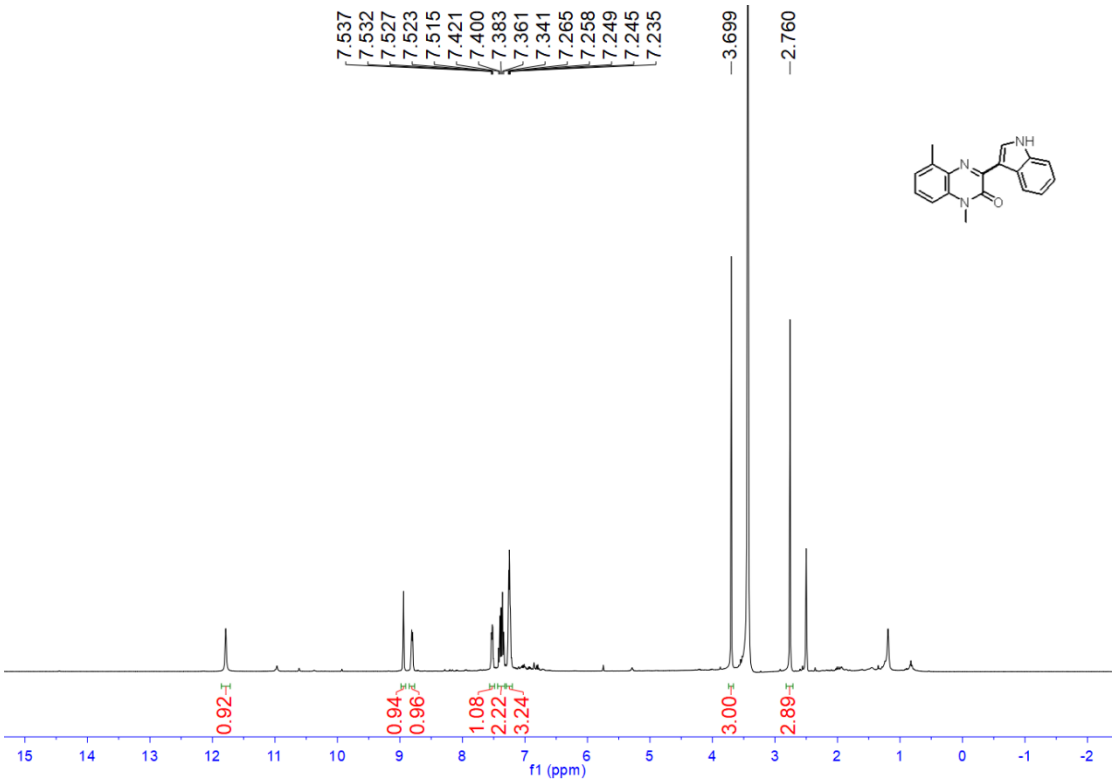
yl)acetate (3ea). Orange solid, 64.4 mg, yield 93%. m.p.: 214.1-215.6 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.87 (s, 1H), 9.00 – 8.86 (m, 2H), 7.96 (d, J = 7.9 Hz, 1H), 7.54 (dd, J = 5.9, 3.0 Hz, 1H), 7.50 (d, J = 3.7 Hz, 2H), 7.40 (dt, J = 8.1, 4.1 Hz, 1H), 7.27 (dd, J = 6.0, 3.1 Hz, 2H), 5.20 (s, 2H), 4.20 (q, J = 7.1 Hz, 2H), 1.23 (t, J = 7.1 Hz, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 168.2, 154.0, 150.8, 136.8, 133.7, 133.5, 131.2, 129.1, 128.8, 126.7, 124.2, 123.4, 123.1, 121.6, 114.7, 112.4, 111.6, 61.8, 44.3, 14.5. HRMS (ESI, *m/z*) calcd for $C_{20}H_{17}N_3NaO_3^+$ [M+Na]$^+$: 370.1162, found 370.1163.

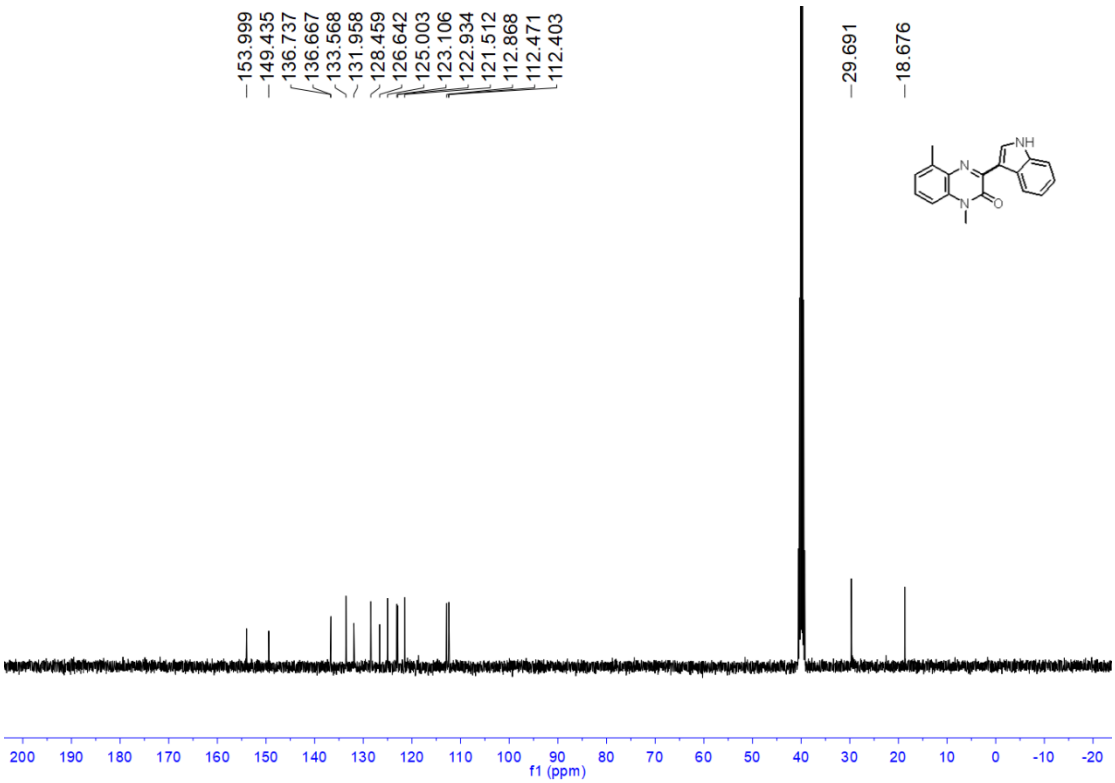


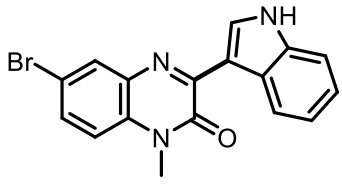




3-(1*H*-indol-3-yl)-1,6-dimethylquinoxalin-2(1*H*)-one (3fa). Orange solid, 54.7 mg, yield 94%, m.p.: 284.5-285.7 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.91 – 11.69 (m, 1H), 8.95 (d, J = 2.7 Hz, 1H), 8.86 – 8.77 (m, 1H), 7.56 – 7.49 (m, 1H), 7.44 – 7.32 (m, 2H), 7.29 – 7.21 (m, 3H), 3.70 (s, 3H), 2.76 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 154.0, 149.4, 136.74, 136.67, 133.6, 132.0, 128.5, 126.6, 125.0, 123.1, 122.9, 121.5, 112.9, 112.5, 112.4, 29.7, 18.7. HRMS (ESI, *m/z*) calcd for $C_{18}H_{16}N_3O^+$ $[M+H]^+$: 290.1288, found 290.1289.

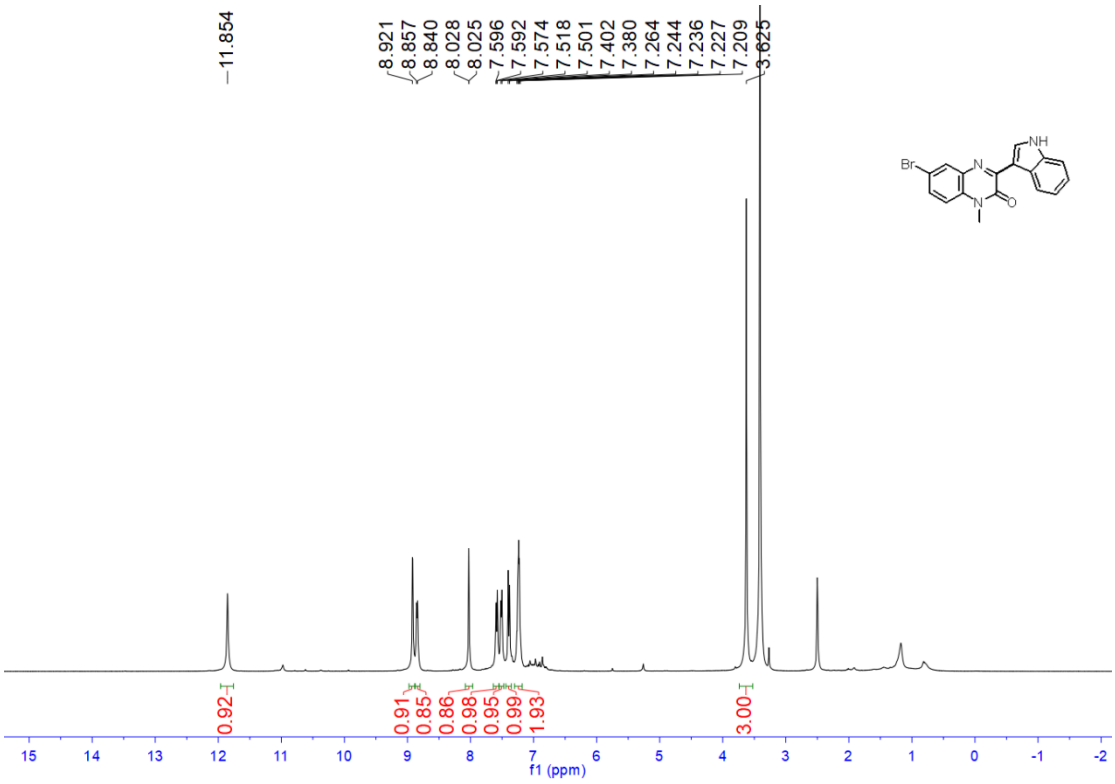


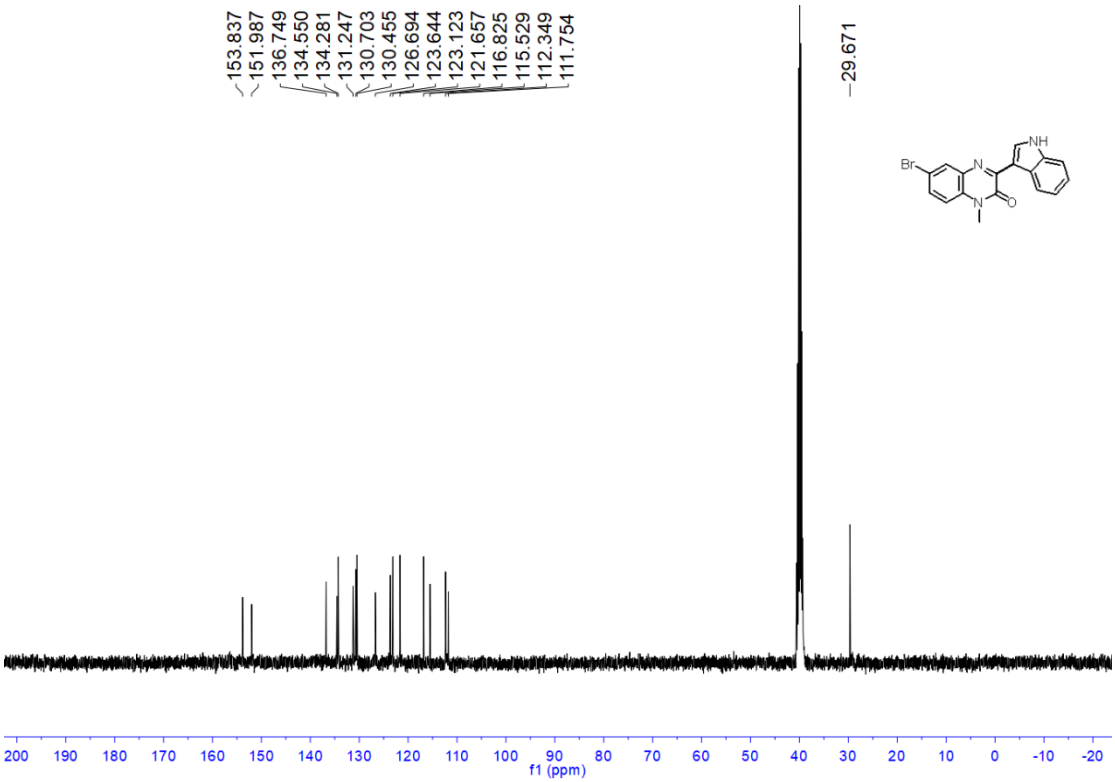


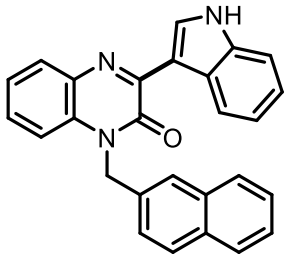


6-bromo-3-(1*H*-indol-3-yl)-1-methylquinoxalin-2(1*H*)-one (3ga). Orange solid, 68.4 mg, yield 97%. m.p.: 289.2-290.1 ℃. ^{1}H NMR (400 MHz,

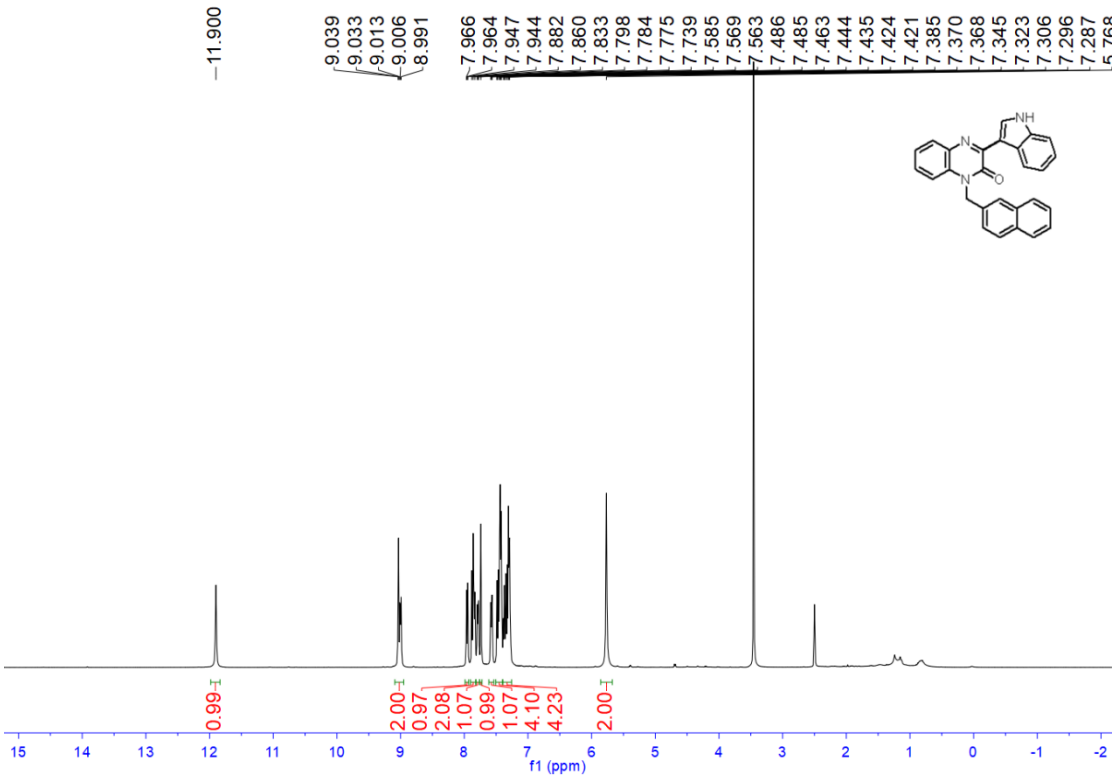
DMSO-d_6) δ 11.85 (s, 1H), 8.92 (d, J = 2.4 Hz, 1H), 8.85 (d, J = 6.7 Hz, 1H), 8.11 – 7.96 (m, 1H), 7.65 – 7.55 (m, 1H), 7.51 (d, J = 6.7 Hz, 1H), 7.39 (d, J = 8.9 Hz, 1H), 7.29 – 7.17 (m, 2H), 3.63 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 153.8, 152.0, 136.8, 134.6, 134.3, 131.3, 130.7, 130.5, 126.7, 123.6, 123.1, 121.7, 116.8, 115.5, 112.4, 111.8, 29.7. HRMS (ESI, *m/z*) calcd for $C_{17}H_{12}BrN_3NaO^+$ [M+Na]$^+$: 376.0056, found 376.0060.

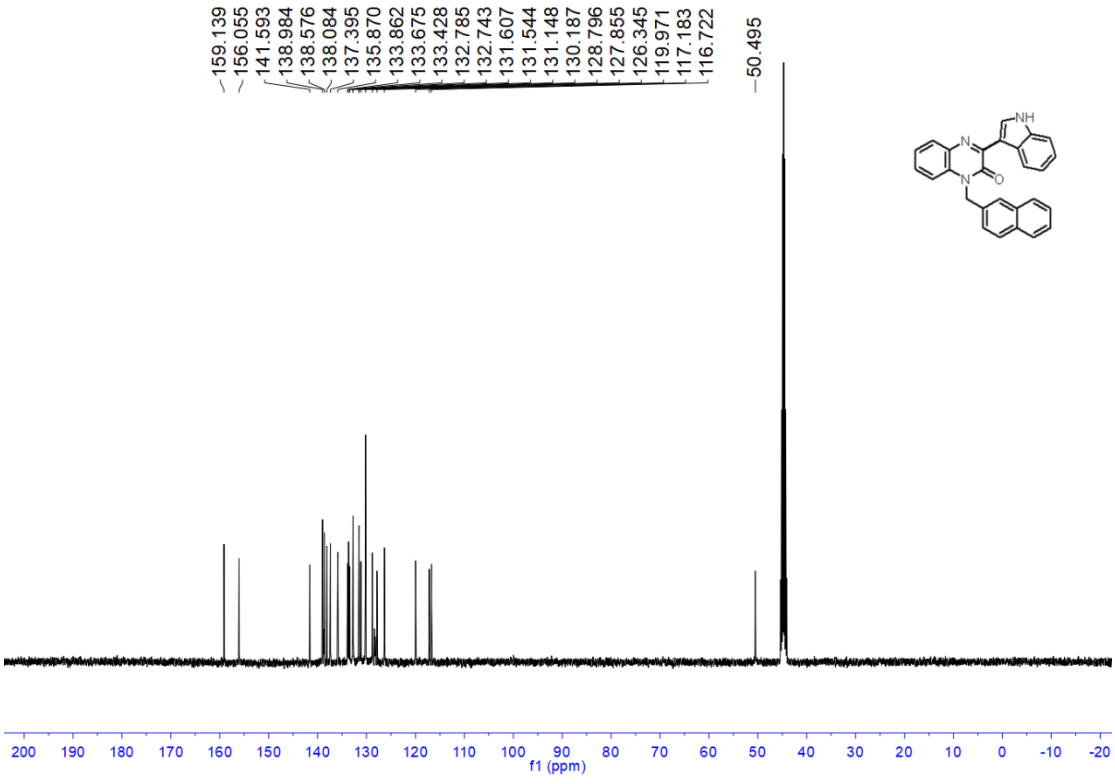


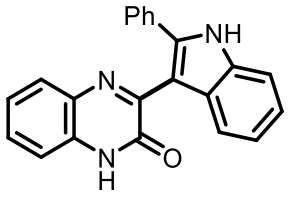




3-(1*H*-indol-3-yl)-1-(naphthalen-2-ylmethyl)quinoxalin-2(1*H*)-one (3ha). Yellow solid, 73.8 mg, yield 92%. m.p.: 191.3-192.7 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.90 (s, 1H), 9.04 (d, J = 2.4 Hz, 1H), 9.02 – 8.97 (m, 1H), 7.96 (J = 7.6, 1.2 Hz, 1H), 7.90 – 7.82 (m, 2H), 7.81 – 7.76 (m, 1H), 7.74 (s, 1H), 7.61 – 7.54 (m, 1H), 7.50 – 7.40 (m, 4H), 7.40 – 7.25 (m, 4H), 5.77 (s, 2H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 159.1, 156.1, 141.6, 139.0, 138.8, 138.6, 138.1, 137.4, 135.9, 133.9, 133.7, 133.4, 132.8, 132.7, 131.6, 131.5, 131.2, 130.2, 128.8, 128.4, 128.2, 127.9, 126.3, 120.0, 117.2, 116.7, 50.5. HRMS (ESI, *m/z*) calcd for $C_{27}H_{20}N_3O^+$ $[M+H]^+$: 402.1601, found 402.1603.

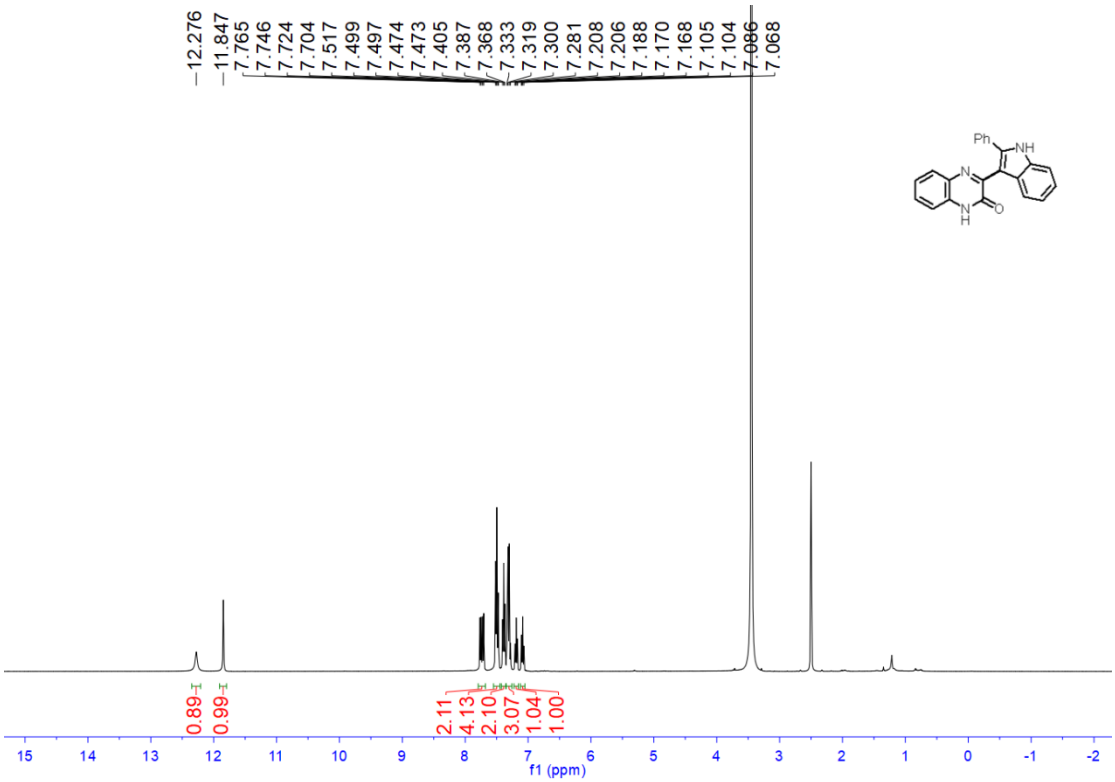


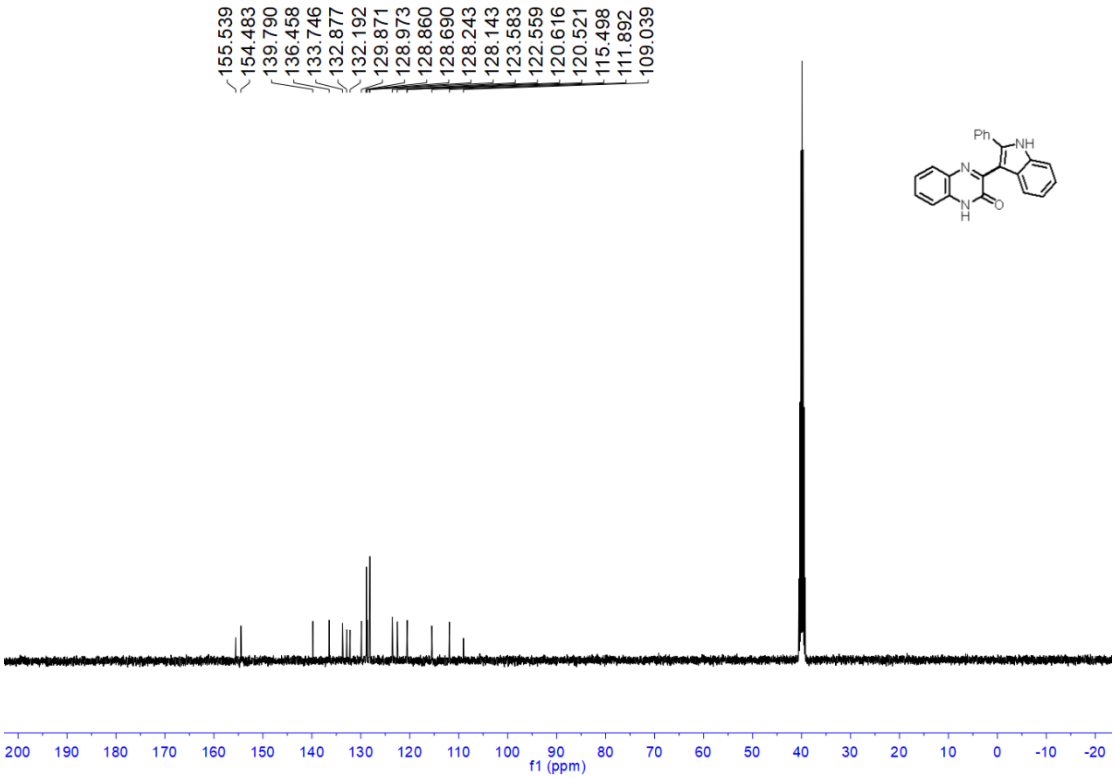


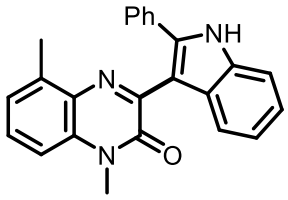


3-(2-phenyl-1*H*-indol-3-yl)quinoxalin-2(1*H*)-one

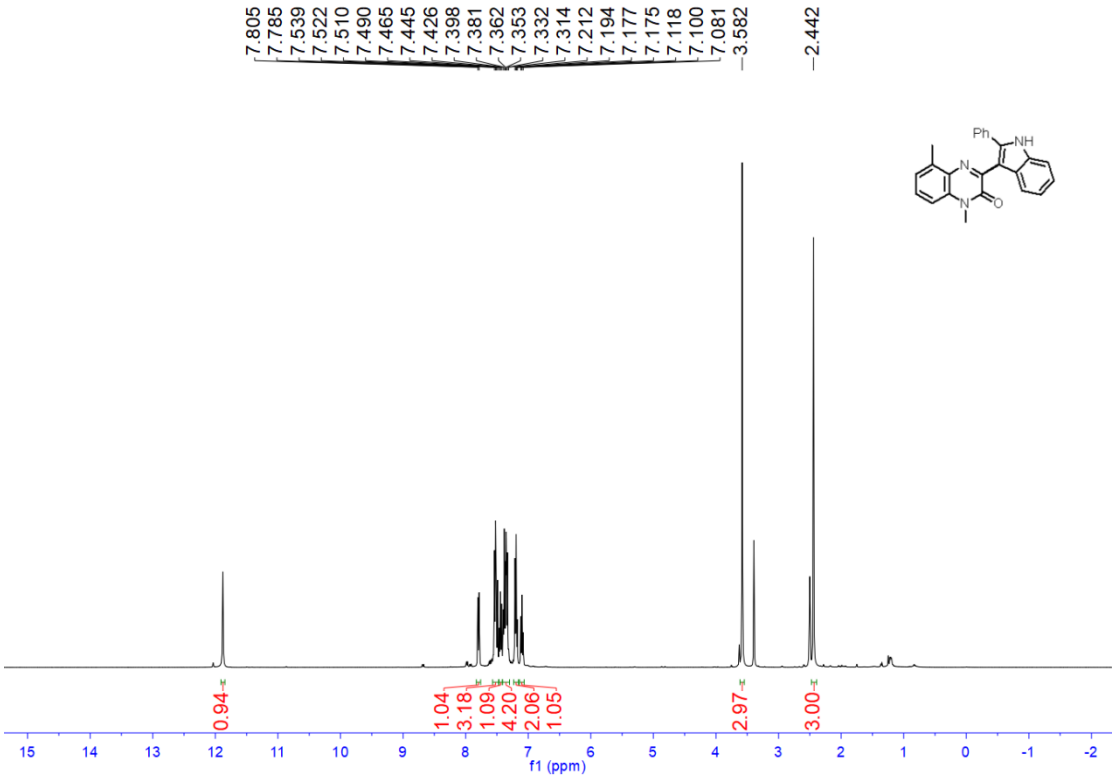
(3ia). Yellow solid, 46.3 mg, yield 69%. m.p.: 167.2-168.9 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.28 (br, 1H), 11.85 (s, 1H), 7.79 – 6.69 (m, 2H), 7.57 – 7.44 (m, 4H), 7.43 – 7.35 (m, 2H), 7.35 – 7.25 (m, 3H), 7.23 – 7.15 (m, 1H), 7.13 – 7.05 (m, 1H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 155.5, 154.5, 139.8, 136.5, 133.8, 132.9, 132.2, 129.9, 129.0, 128.9, 128.7, 128.2, 128.1, 123.6, 122.6, 120.6, 120.5, 115.5, 111.9, 109.0. HRMS (ESI, *m/z*) calcd for $C_{22}H_{15}N_3NaO^+$ [M+Na]$^+$: 360.1107, found 360.1108.







1,6-dimethyl-3-(2-phenyl-1*H*-indol-3-yl)quinoxalin-2(1*H*)-one (3ja). Yellow solid, 68.7 mg, yield 94%. m.p.: 252.3-253.1 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.88 (s, 1H), 7.79 (d, J = 7.9 Hz, 1H), 7.56 – 7.48 (m, 3H), 7.47 – 7.42 (m, 1H), 7.41 – 7.30 (m, 4H), 7.24 – 7.16 (m, 2H), 7.14 – 7.07 (m, 1H), 3.58 (s, 3H), 2.44 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 154.1, 151.9, 140.3, 137.6, 136.4, 133.8, 133.5, 131.6, 129.8, 128.8, 128.7, 128.6, 128.2, 124.8, 122.5, 121.1, 120.5, 112.9, 111.9, 110.2, 29.8, 17.6. HRMS (ESI, *m/z*) calcd for $C_{24}H_{20}N_3O^+$ $[M+H]^+$: 366.1601, found 366.1602.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7.539
7.522
7.510
7.490
7.465
7.445
7.426
7.398
7.381
7.362
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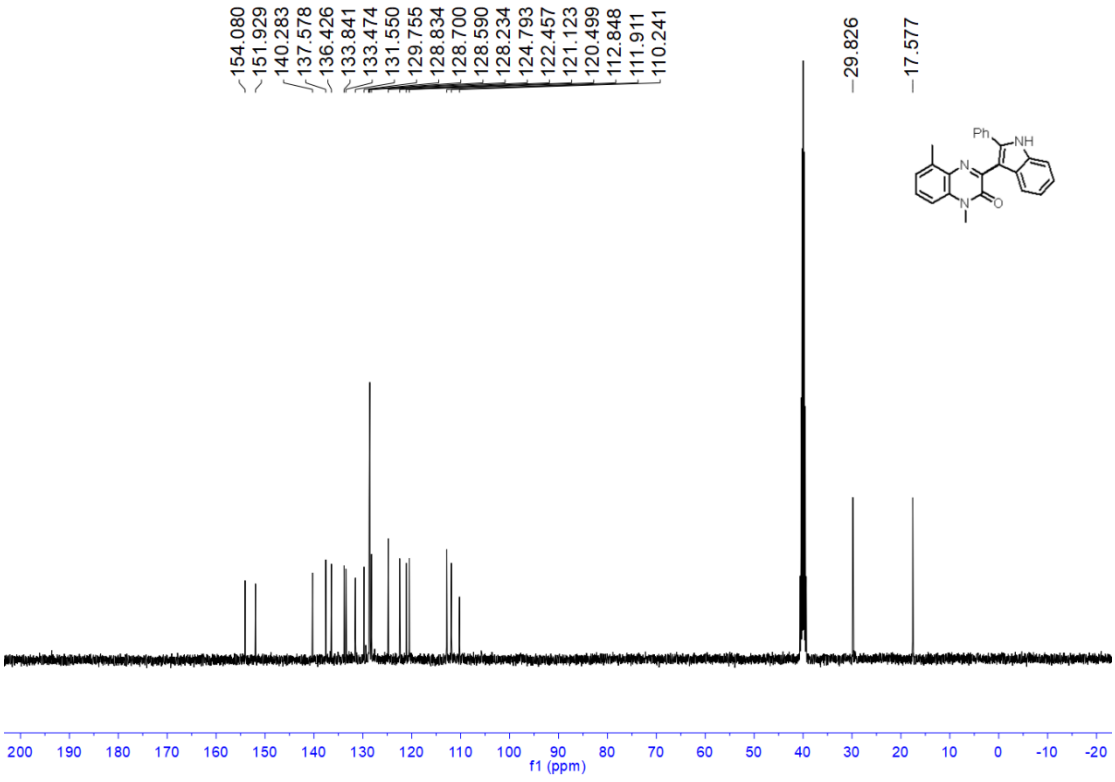
7.332
7.314
7.212
7.194
7.177
7.175
7.118
7.100
7.081
3.582
2.442
Ph
NH
N
O
N
0.94
1.04
3.18
1.09
4.20
2.06
1.05
2.97
3.00
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 -1 -2
f1 (ppm)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133.841
133.474
131.550
129.755
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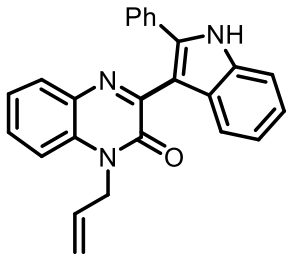
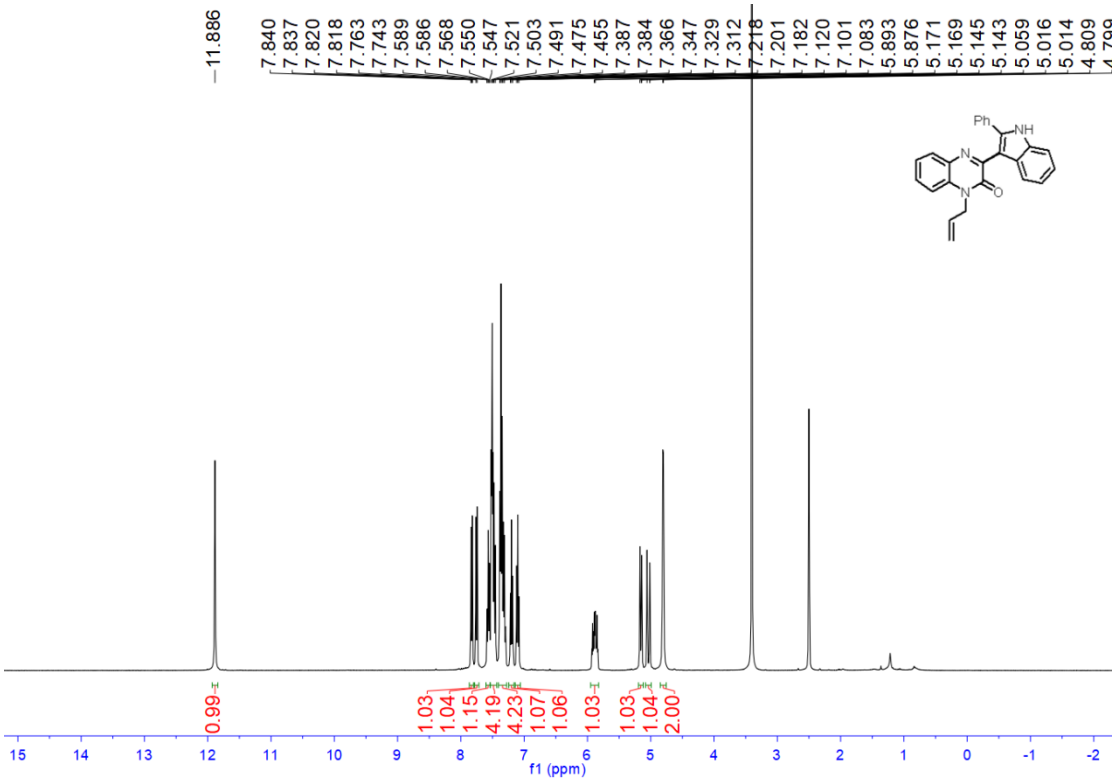
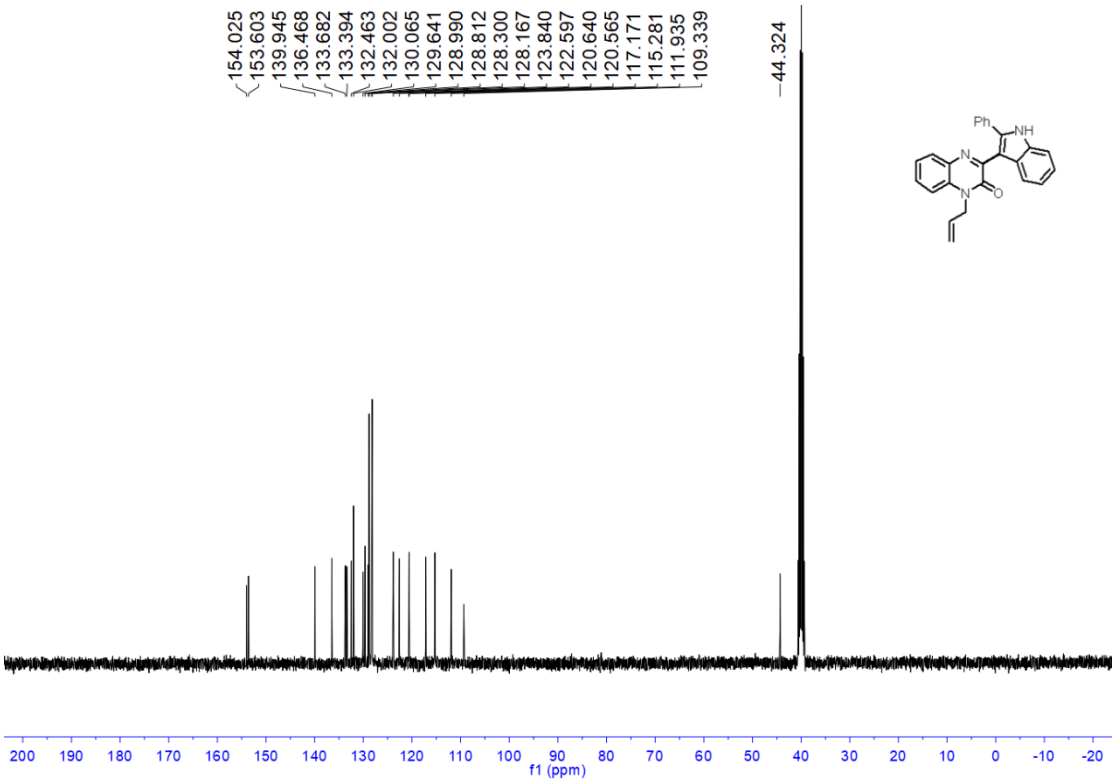
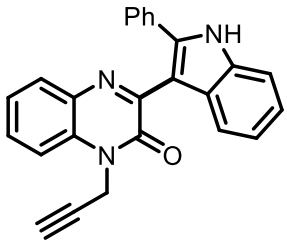
128.590
128.234
124.793
122.457
121.123
120.499
112.848
111.911
110.241
29.826
17.577
Ph
NH
N
O
N
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)



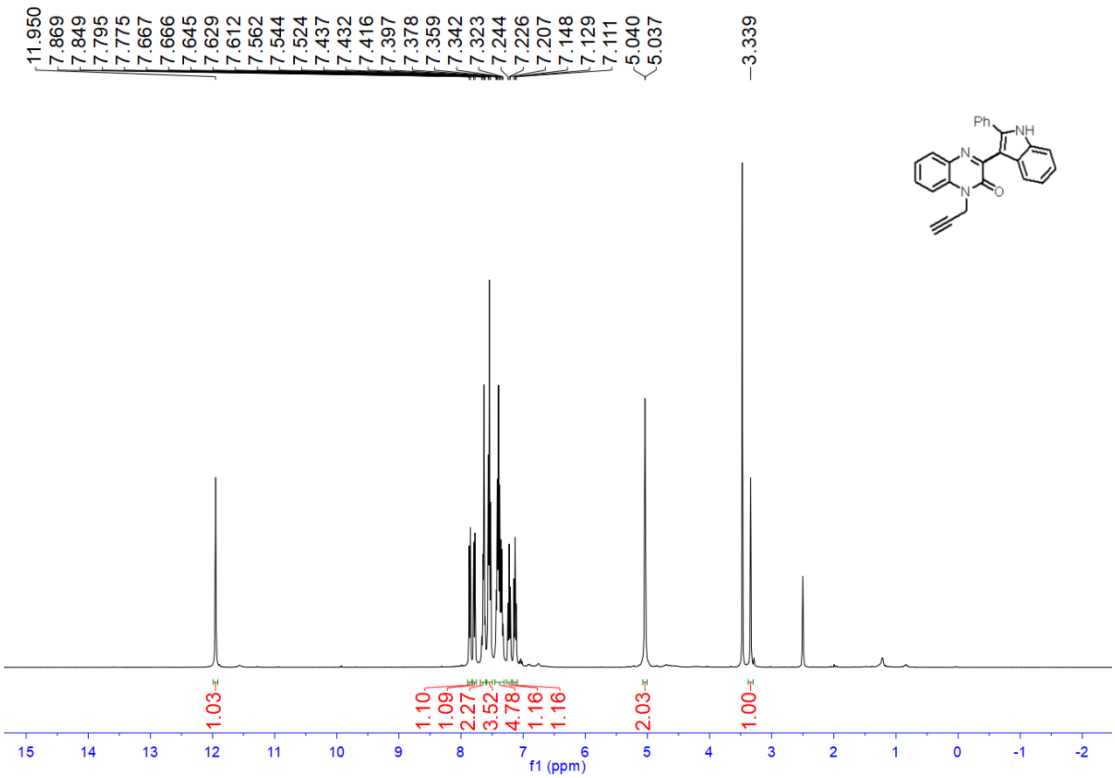
1-allyl-3-(2-phenyl-1*H*-indol-3-yl)quinoxalin-2(1*H*)-one (3ka). Yellow solid, 74.0 mg, yield 98%. m.p.: 233.6-234.0 °C. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.89 (s, 1H), 7.86 – 7.80 (m, 1H), 7.75 (d, J = 7.9 Hz, 1H), 7.60 – 7.54 (m, 1H), 7.54 – 7.43 (m, 4H), 7.41 – 7.28 (m, 4H), 7.24 – 7.16 (m, 1H), 7.14 – 7.07 (m, 1H), 5.95 – 5.82 (m, 1H), 5.19 – 5.12 (m, 1H), 5.08 – 4.99 (m, 1H), 4.85 – 4.76 (m, 2H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 154.0, 153.6, 139.9, 136.5, 133.7, 133.4, 132.5, 132.0, 130.1, 129.6, 129.0, 128.8, 128.3, 128.2, 123.8, 122.6, 120.64, 120.57, 117.2, 115.3, 111.9, 109.3, 44.3. HRMS (ESI, *m/z*) calcd for $C_{25}H_{20}N_3O^+$ $[M+H]^+$: 378.1601, found 378.1604.







3-(2-phenyl-1*H*-indol-3-yl)-1-(prop-2-yn-1-yl)quinoxalin-2(1*H*)-one (3la). Yellow solid, 74.5 mg, yield 99%. m.p.: 203.1-204.3 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.95 (s, 1H), 7.86 (d, J = 7.8 Hz, 1H), 7.79 (d, J = 8.0 Hz, 1H), 7.69 – 7.60 (m, 2H), 7.58 – 7.51 (m, 3H), 7.46 – 7.31 (m, 4H), 7.27 – 7.19 (m, 1H), 7.16 – 7.10 (m, 1H), 5.08 – 5.00 (m, 2H), 3.36 – 3.2 (m, 1H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 153.9, 153.2, 140.2, 136.5, 133.6, 133.4, 131.8, 130.2, 129.7, 129.0, 128.9, 128.4, 128.3, 124.3, 122.7, 120.74, 120.68, 115.2, 112.0, 109.2, 78.6, 75.4, 31.9. HRMS (ESI, *m/z*) calcd for $C_{25}H_{17}N_3NaO^+$ $[M+Na]^+$: 398.1264, found 398.1265.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7.869
7.849
7.795
7.775
7.667
7.666
7.645
7.629
7.612
7.562
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7.524
7.437
7.432
7.416
7.397
7.378
7.359
7.342
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7.207
7.148
7.129
7.111
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5.037
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Ph
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N
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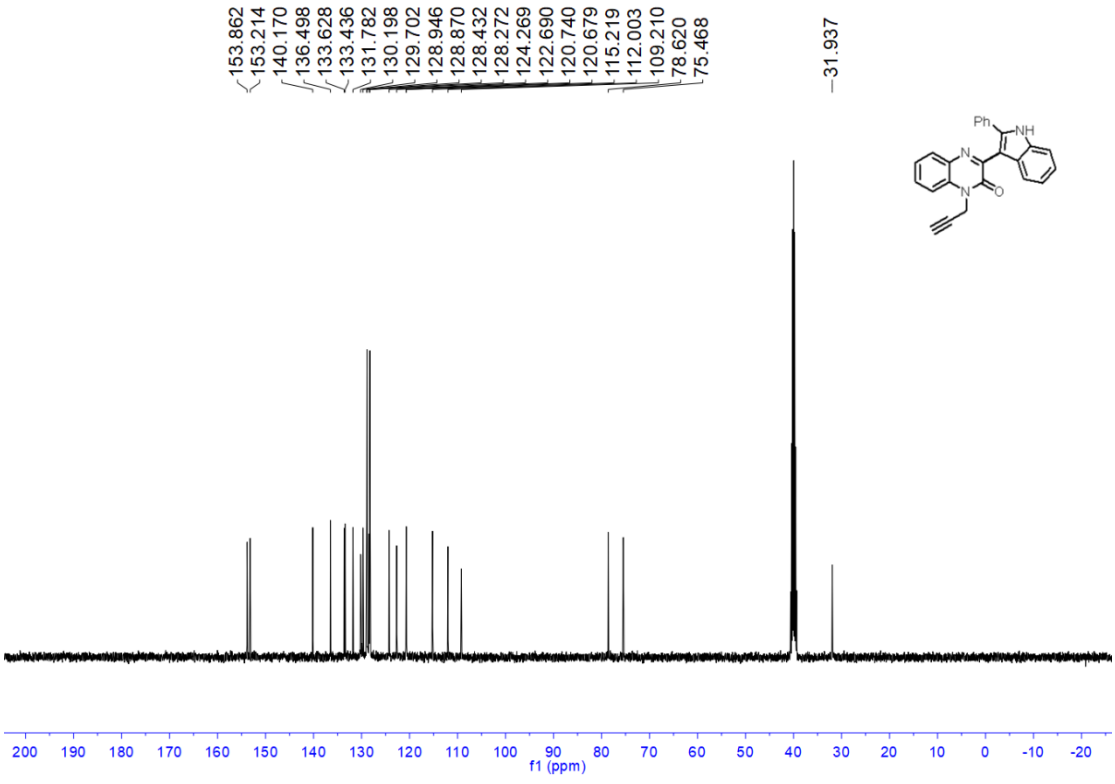
1.16
1.16
2.03
1.00
f1 (ppm)


153.862
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140.170
136.498
133.628
133.436
131.782
130.198
129.702
128.946
128.870
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124.269
122.690
120.740
120.679
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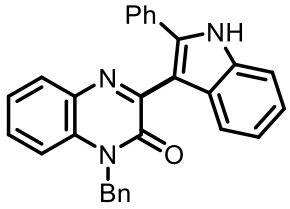
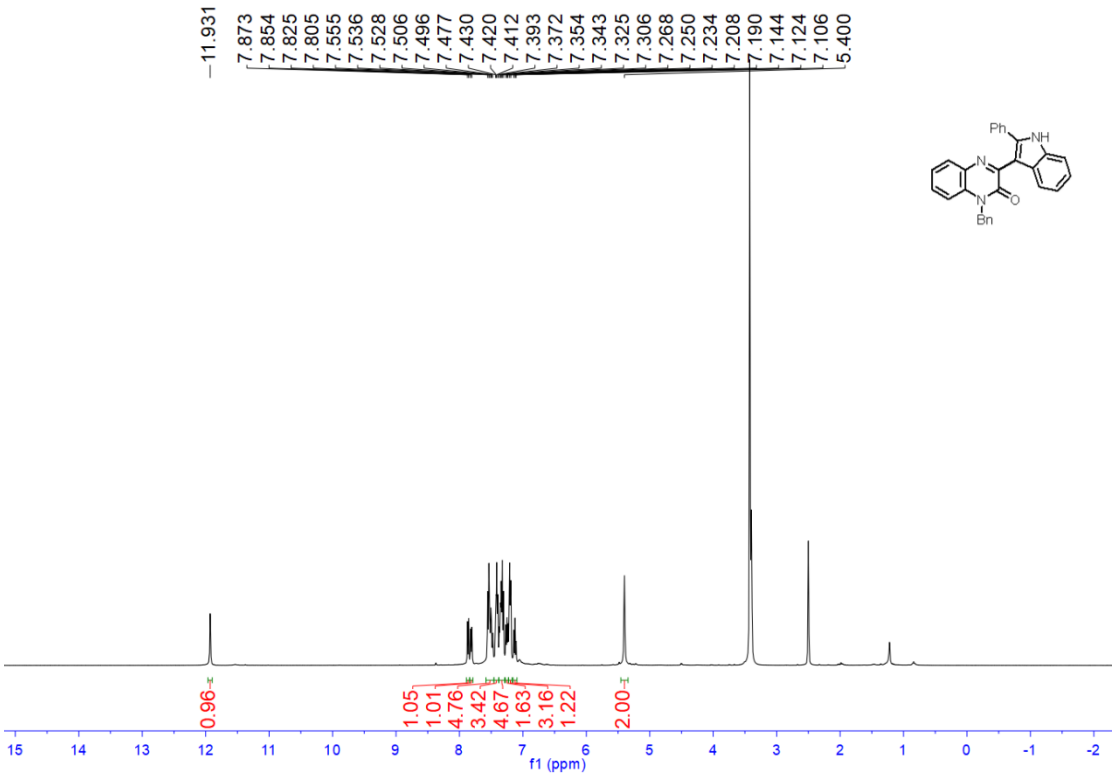
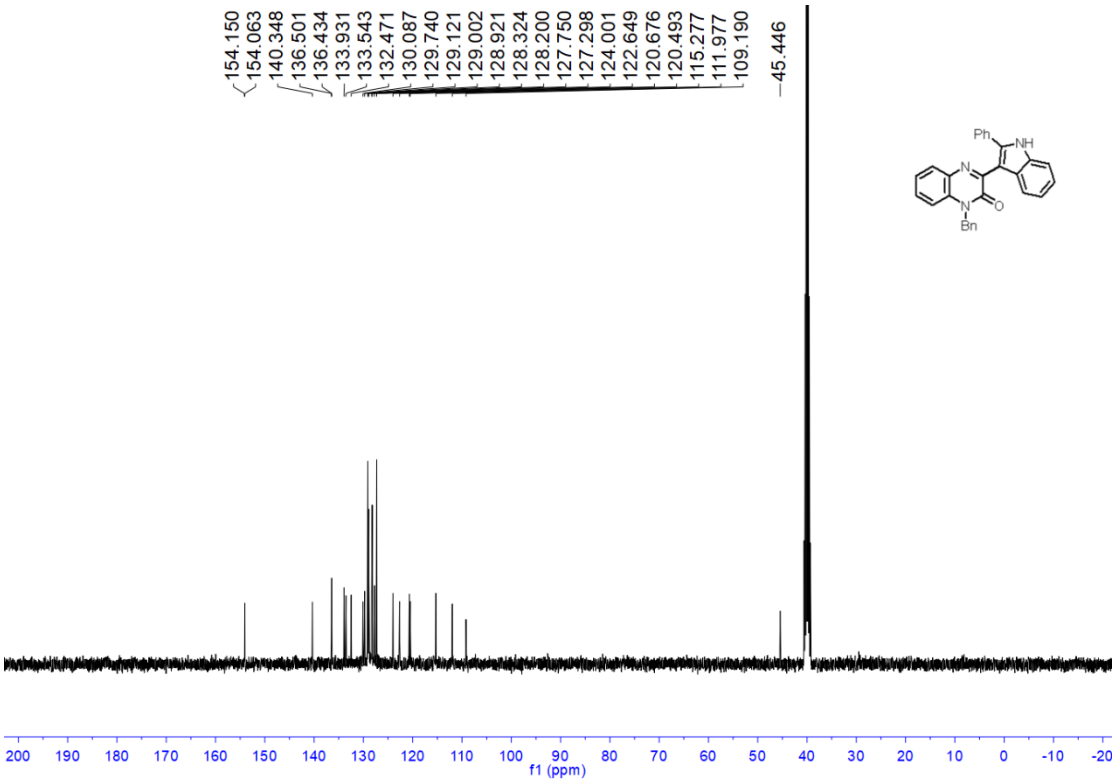
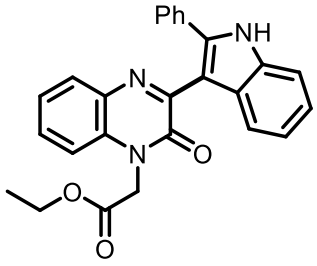
112.003
109.210
78.620
75.468
31.937
Ph
NH
N
N
O
f1 (ppm)



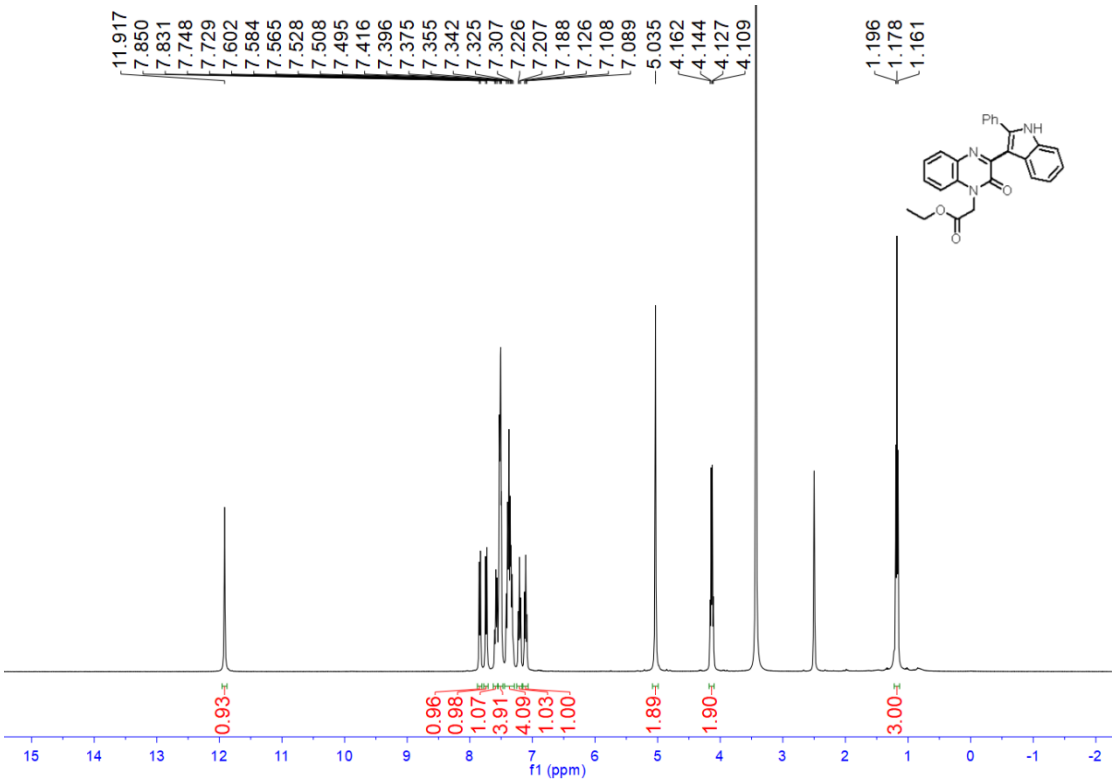
1-benzyl-3-(2-phenyl-1*H*-indol-3-yl)quinoxalin-2(1*H*)-one (3ma). Yellow solid, 72.3 mg, yield 85%. m.p.: 194.1-194.9 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.93 (s, 1H), 7.86 (d, J = 7.8 Hz, 1H), 7.81 (d, J = 7.9 Hz, 1H), 7.56 – 7.47 (m, 4H), 7.45 – 7.38 (m, 3H), 7.38 – 7.29 (m, 4H), 7.28 – 7.22 (m, 1H), 7.22 – 7.18 (m, 3H), 7.15 – 7.10 (m, 1H), 5.40 (s, 2H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 154.2, 154.1, 140.4, 136.5, 136.4, 133.9, 133.5, 132.5, 130.1, 129.7, 129.1, 129.0, 128.9, 128.3, 128.2, 127.8, 127.3, 124.0, 122.7, 120.7, 120.5, 115.3, 112.0, 109.2, 45.5. HRMS (ESI, *m/z*) calcd for $C_{29}H_{21}N_3NaO^+$ [M+Na]$^+$: 450.1577, found 450.1577.

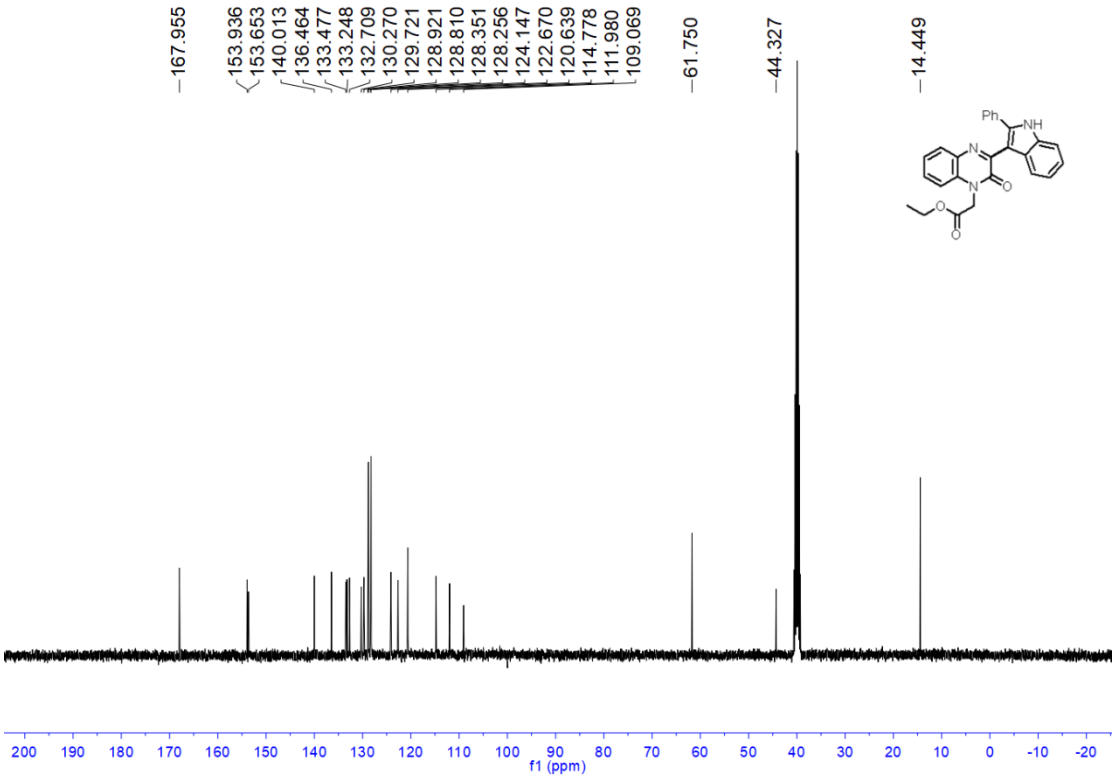


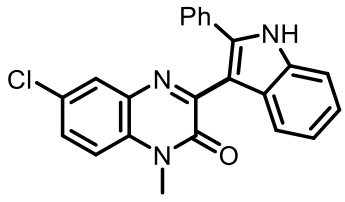




Ethyl 2-(2-oxo-3-(2-phenyl-1*H*-indol-3-yl)quinoxalin-1(2*H*)-yl)acetate (3na). Yellow solid, 83.8 mg, yield 99%. m.p.: 208.7-209.2 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.92 (s, 1H), 7.84 (d, J = 7.7 Hz, 1H), 7.74 (d, J = 7.9 Hz, 1H), 7.62 – 7.55 (m, 1H), 7.55 – 7.47 (m, 4H), 7.44 – 7.29 (m, 4H), 7.21 (dd, J_1 = J_2 = 7.4 Hz, 1H), 7.11 (dd, J_1 = J_2 = 7.4 Hz, 1H), 5.04 (s, 2H), 4.14 (q, J = 7.0 Hz, 2H), 1.18 (t, J = 7.0 Hz, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 168.0, 153.9, 153.7, 140.0, 136.5, 133.5, 133.3, 132.7, 130.3, 129.7, 128.9, 128.8, 128.4, 128.3, 124.2, 122.7, 120.6, 114.8, 112.0, 109.1, 61.8, 44.3, 14.5. HRMS (ESI, *m/z*) calcd for $C_{26}H_{21}N_3NaO_3^+$ $[M+Na]^+$: 446.1475, found 446.1475.

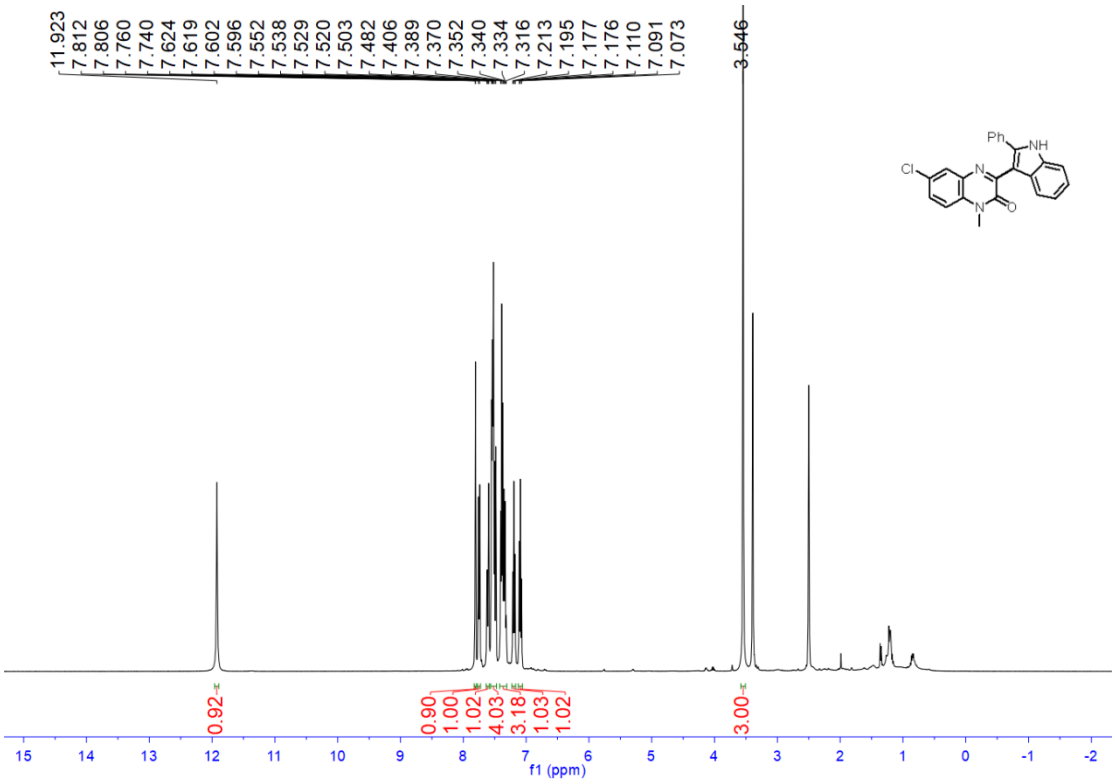


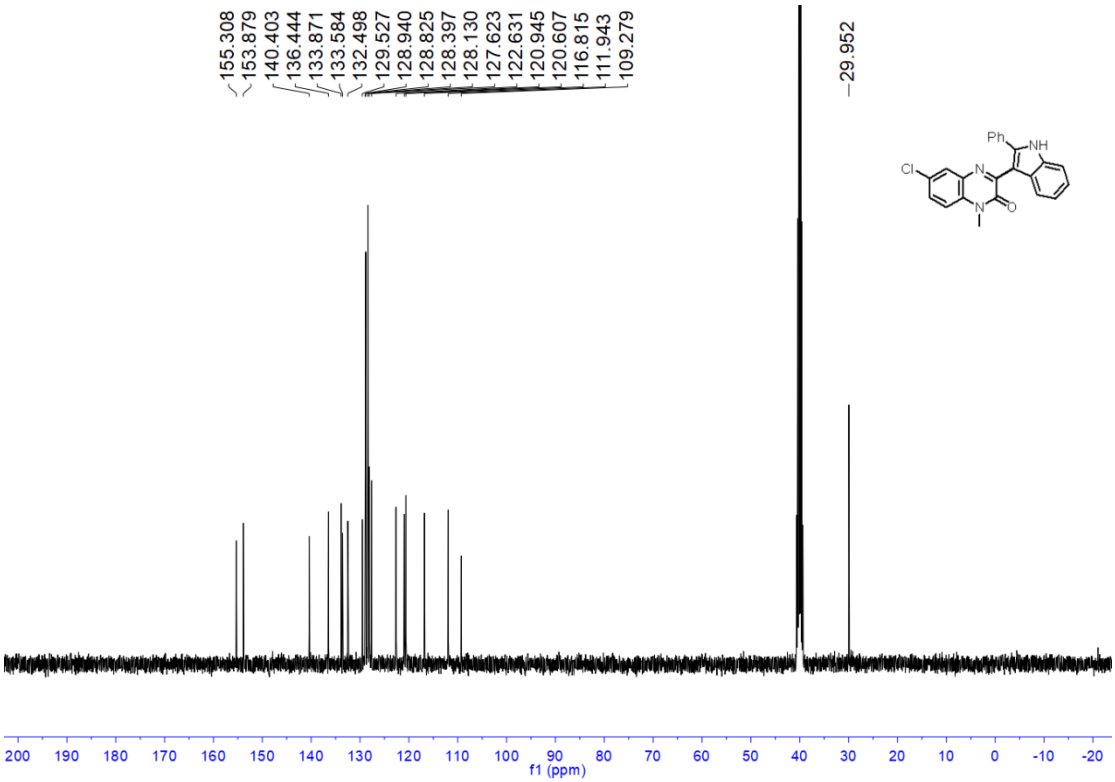


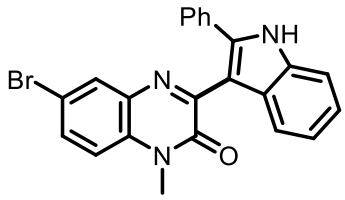


6-chloro-1-methyl-3-(2-phenyl-1*H*-indol-3-

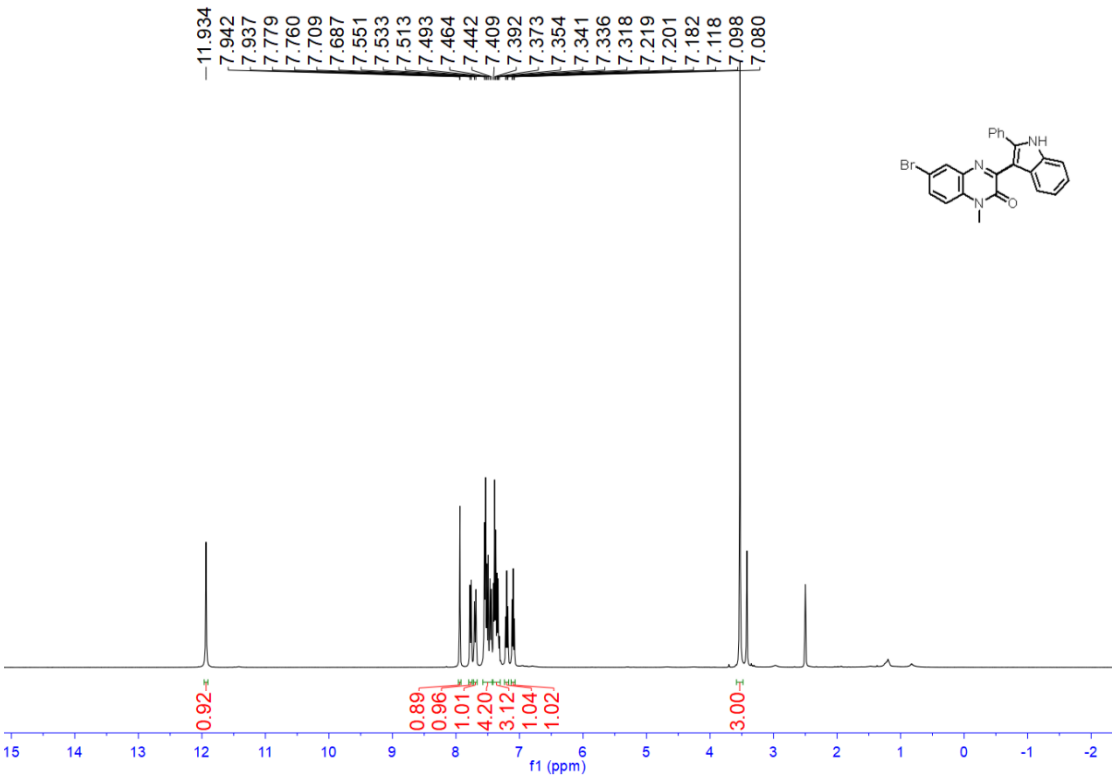
yl)quinoxalin-2(1*H*)-one (3oa). Yellow solid, 71.8 mg, yield 93%. m.p.: 253.4-254.1 °C. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.92 (s, 1H), 7.81 (d, J = 2.3 Hz, 1H), 7.75 (d, J = 8.0 Hz, 1H), 7.64 – 7.58 (m, 1H), 7.57 – 7.47 (m, 4H), 7.43 – 7.30 (m, 3H), 7.23 – 7.16 (m, 1H), 7.13 – 7.06 (m, 1H), 3.55 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 155.3, 153.9, 140.4, 136.4, 133.9, 133.6, 132.5, 129.5, 128.9, 128.8, 128.4, 128.1, 127.6, 122.6, 120.9, 120.6, 116.8, 111.9, 109.3, 30.0. HRMS (ESI, *m/z*) calcd for $C_{23}H_{16}ClN_3NaO^+$ [M+Na]$^+$: 408.0874, found 408.0875.







6-bromo-1-methyl-3-(2-phenyl-1*H*-indol-3-yl)quinoxalin-2(1*H*)-one (3pa). Yellow solid, 83.5 mg, yield 97%. m.p.: 271.2-273.7 ℃. ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.93 (s, 1H), 7.94 (d, J = 2.2 Hz, 1H), 7.77 (d, J = 8.0 Hz, 1H), 7.73 – 7.67 (m, 1H), 7.57 – 7.43 (m, 4H), 7.43 – 7.30 (m, 3H), 7.20 (dd, J_1 = J_2 = 7.2 Hz, 1H), 7.10 (dd, J_1 = J_2 = 7.5 Hz, 1H), 3.53 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 155.2, 153.9, 140.4, 136.5, 134.2, 133.6, 132.9, 132.2, 131.1, 129.0, 128.8, 128.4, 122.6, 121.0, 120.6, 117.1, 115.3, 112.0, 109.3, 29.9. HRMS (ESI, *m/z*) calcd for $C_{23}H_{16}BrN_3NaO^+$ $[M+Na]^+$: 452.0369, found 452.0372.


11.934
7.942
7.937
7.779
7.760
7.709
7.687
7.551
7.533
7.513
7.493
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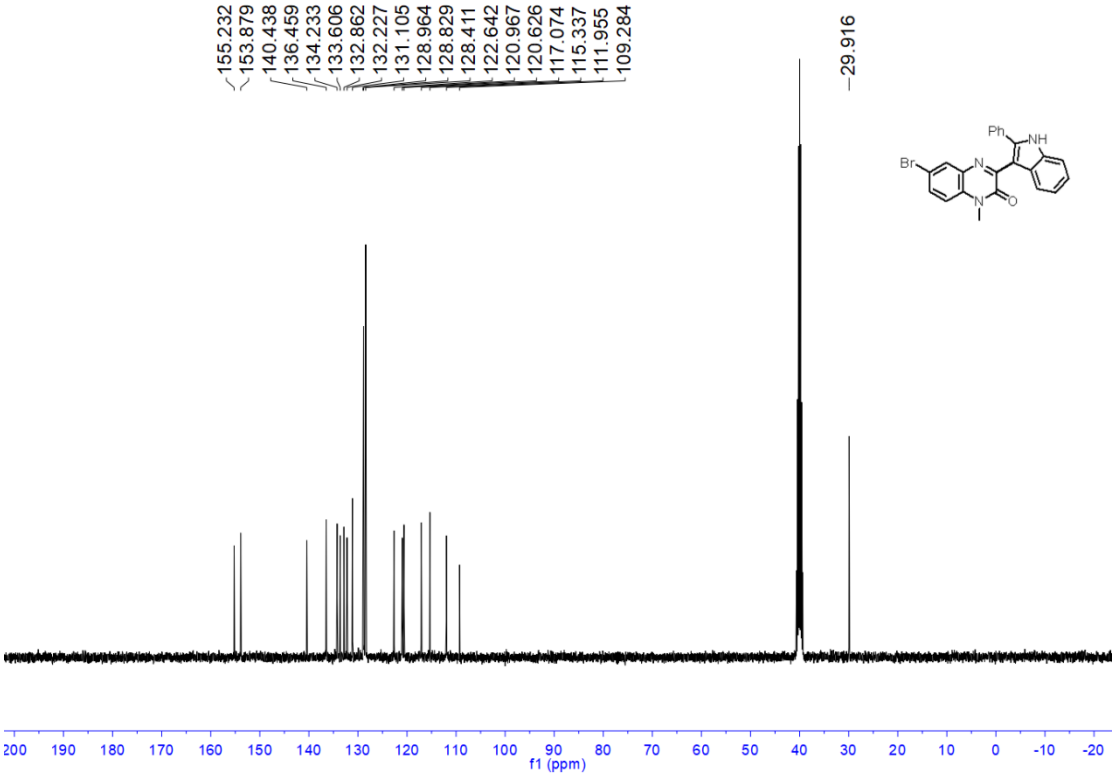
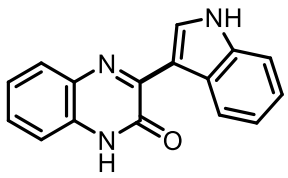
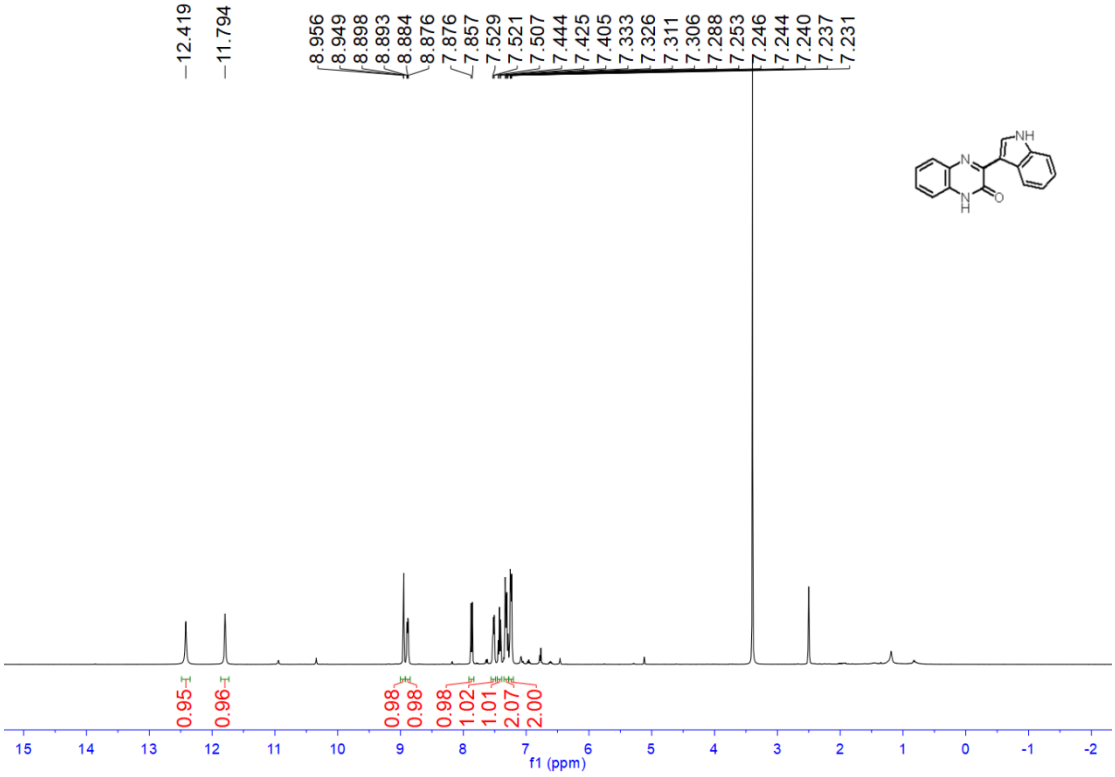
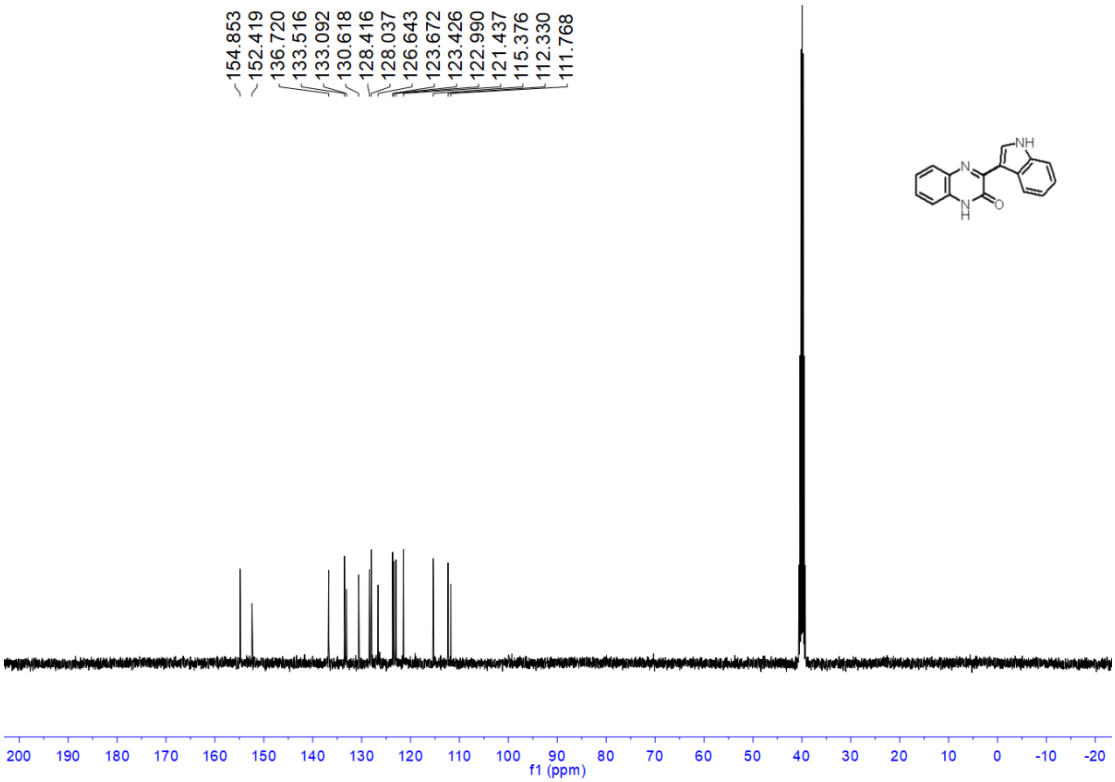
7.442
7.409
7.392
7.373
7.354
7.341
7.336
7.318
7.219
7.201
7.182
7.118
7.098
7.080
Ph
NH
Br
N
O
N
0.92
0.89
0.96
1.01
4.20
3.12
1.04
1.02
3.00
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 -1 -2
f1 (ppm)

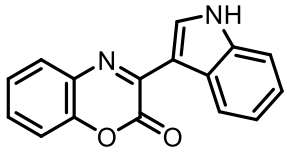

155.232
153.879
140.438
136.459
134.233
133.606
132.862
132.227
131.105
128.964
128.829
128.411
122.642
120.967
120.626
117.074
115.337
111.955
109.284
29.916
Ph
NH
Br
N
O
N
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)



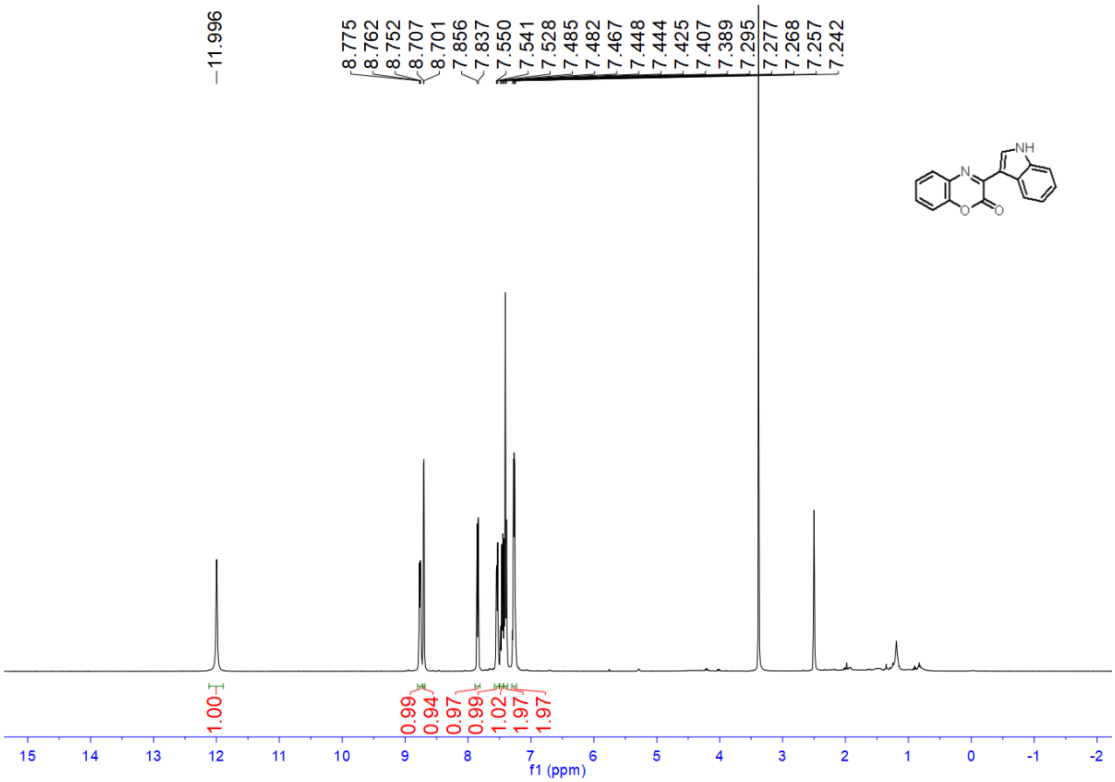
3-(1*H*-indol-3-yl)quinoxalin-2(1*H*)-one (3qa). A known compound.[5] Orange solid, 30.1 mg, yield 58%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.42 (s, 1H), 11.79 (s, 1H), 8.95 (d, J = 2.7 Hz, 1H), 8.92 – 8.85 (m, 1H), 7.87 (d, J = 7.9 Hz, 1H), 7.56 – 7.48 (m, 1H), 7.46 – 7.39 (m, 1H), 7.36 – 7.28 (m, 2H), 7.27 – 7.21 (m, 2H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 154.9, 152.4, 136.7, 133.5, 133.1, 130.6, 128.4, 128.0, 126.6, 123.7, 123.4, 123.0, 121.4, 115.4, 112.3, 111.8.

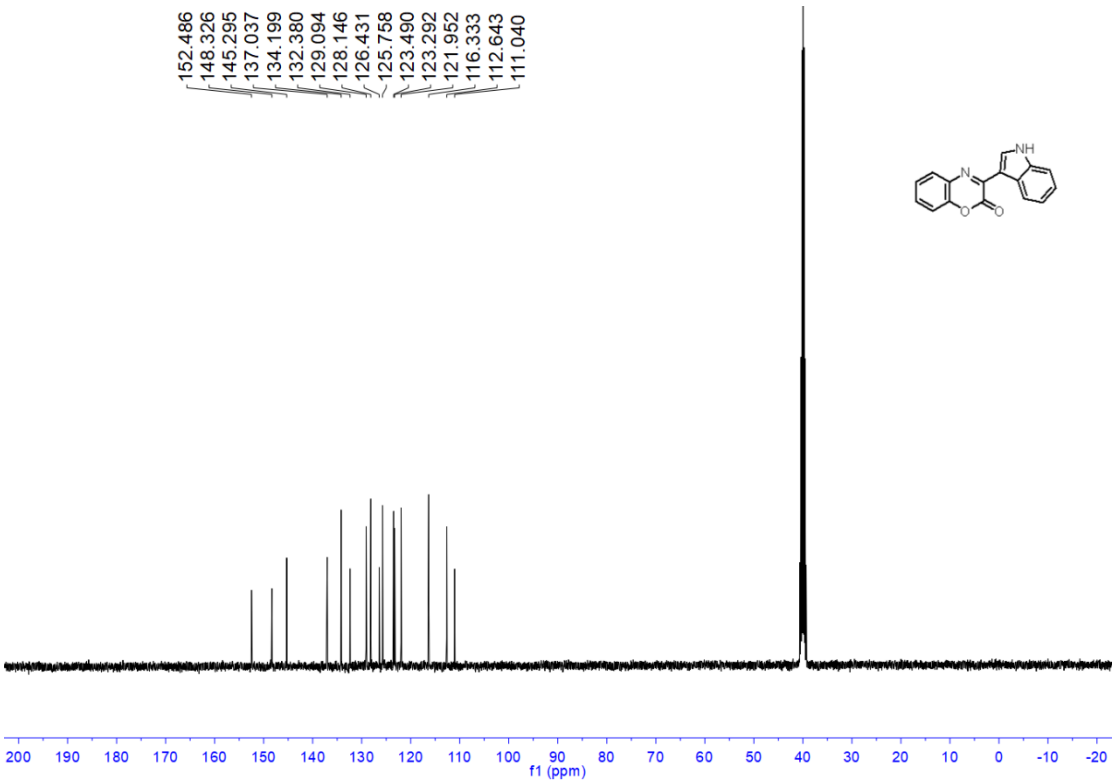


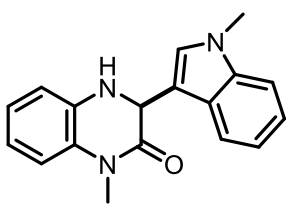




3-(1*H*-indol-3-yl)-2*H*-benzo[*b*][1,4]oxazin-2-one (3ra). A known compound.[5] Yellow solid, 43.6 mg, yield 83%. ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.00 (s, 1H), 8.80 – 8.73 (m, 1H), 8.70 (d, J = 2.3 Hz, 1H), 7.88 – 7.82 (m, 1H), 7.58 – 7.51 (m, 1H), 7.50 – 7.44 (m, 1H), 7.44 – 7.37 (m, 2H), 7.31 – 7.23 (m, 2H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 152.5, 148.3, 145.3, 137.0, 134.2, 132.4, 129.1, 128.2, 126.4, 125.8, 123.5, 123.3, 122.0, 116.3, 112.6, 111.0.

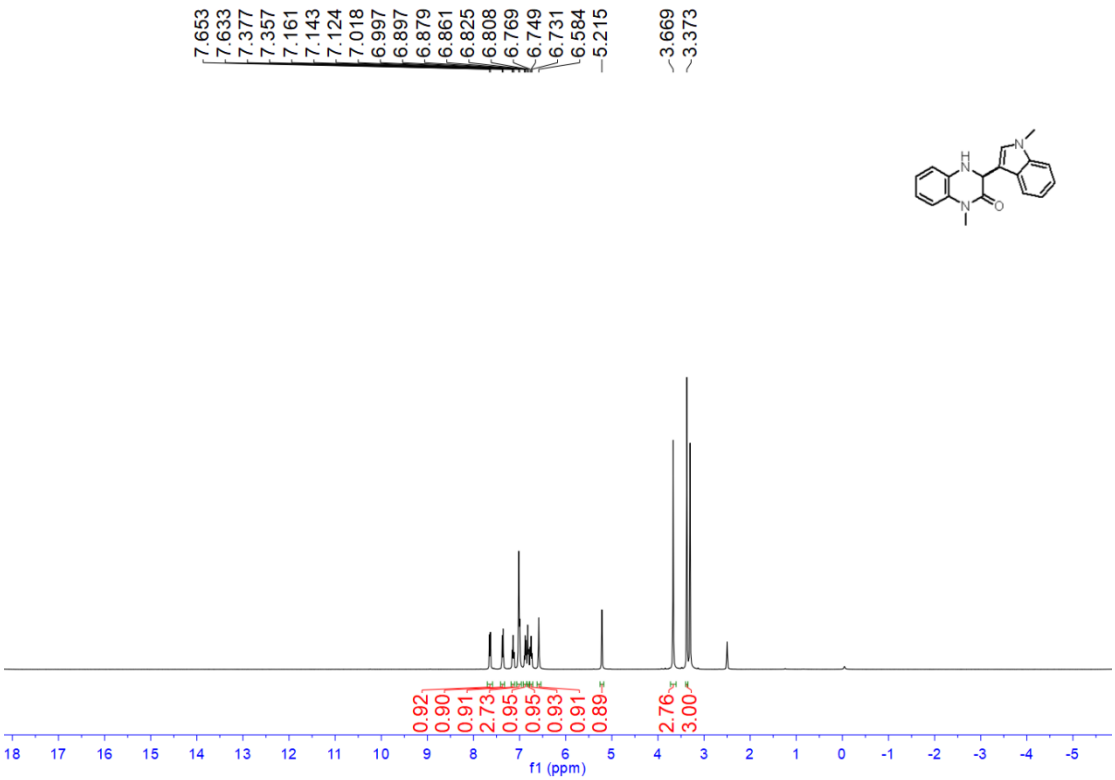


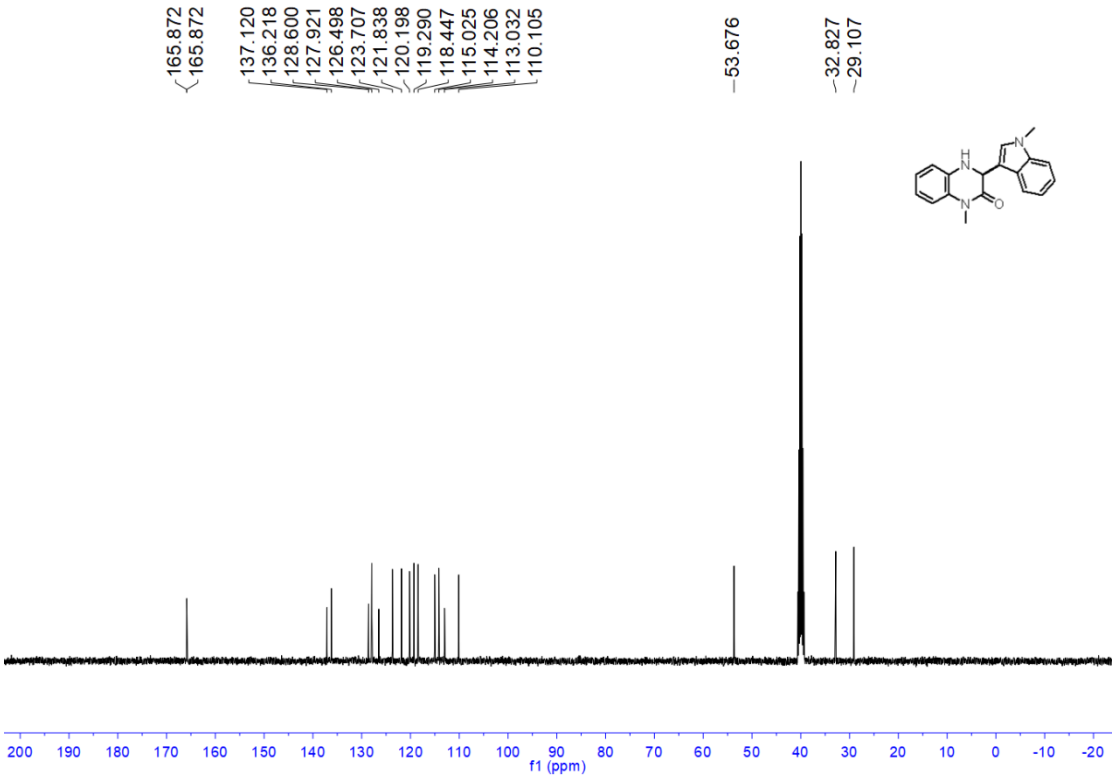


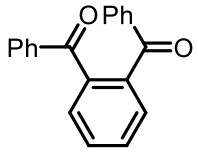


1-methyl-3-(1-methyl-1H-indol-3-yl)-3,4-dihydroquinoxalin-2(1H)-one (3ab'). White solid, 55.4 mg, yield 95%. m.p.: 208.3-

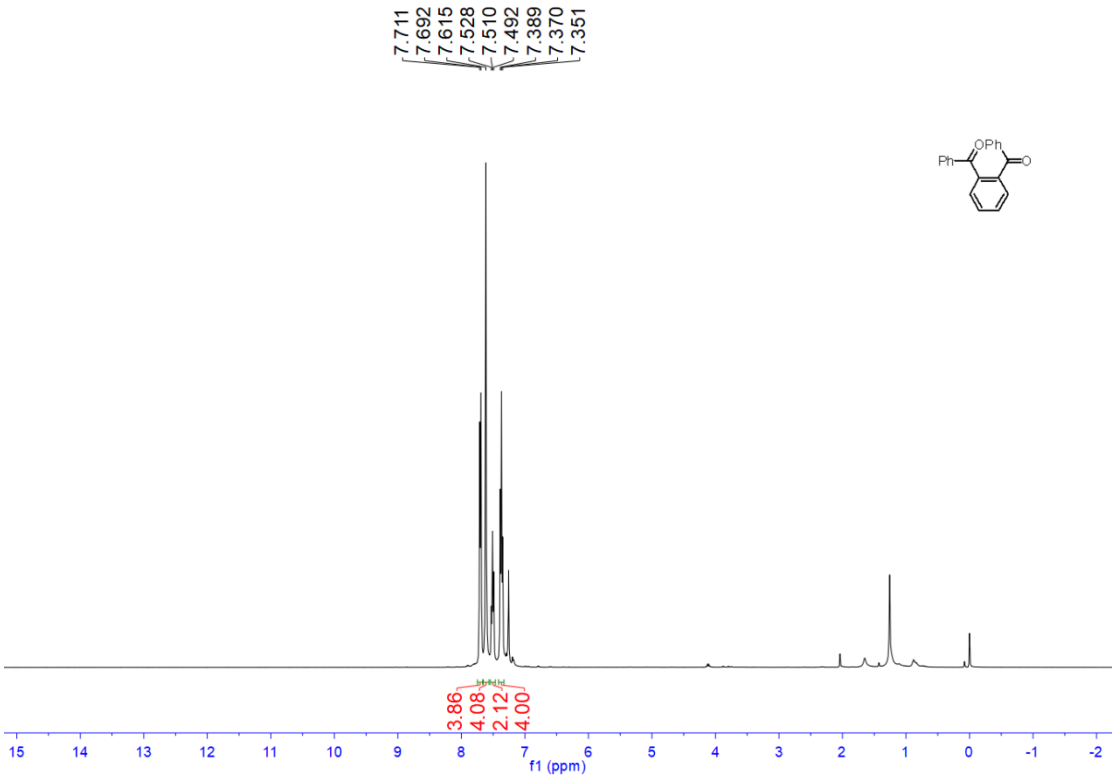
209.1 °C. ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.64 (d, J = 7.9 Hz, 1H), 7.37 (d, J = 8.2 Hz, 1H), 7.14 (t, J = 7.5 Hz, 1H), 7.06 – 6.97 (m, 2H), 6.92 – 6.85 (m, 1H), 6.84 – 6.80 (m, 1H), 6.78 – 6.71 (m, 1H), 6.58 (s, 1H), 5.22 (s, 1H), 3.67 (s, 3H), 3.37 (s, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 165.9, 137.1, 136.2, 128.6, 127.9, 126.5, 123.7, 121.8, 120.2, 119.3, 118.5, 115.0, 114.2, 113.0, 110.1, 53.7, 32.8, 29.1. HRMS (ESI, *m/z*) calcd for $C_{18}H_{17}N_3ONa^+$ [M+Na]$^+$: 314.1264, found 314.1268.







Cyclohexa-3,5-diene-1,2-diylbis(phenylmethanone) (4b) A known compound.[2] Yollow solid, 53.7 mg, yield 93%. ^{1}H NMR (400 MHz, $CDCl_3$, TMS) δ 7.70 (d, J = 7.6 Hz, 4H), 7.61 (s, 4H), 7.67 – 7.54 (m, 2H), 7.41 – 7.33 (m, 4H). ^{13}C NMR (101 MHz, $CDCl_3$, TMS) δ 196.6, 140.0, 137.2, 133.0, 130.4, 129.8, 129.7, 128.3.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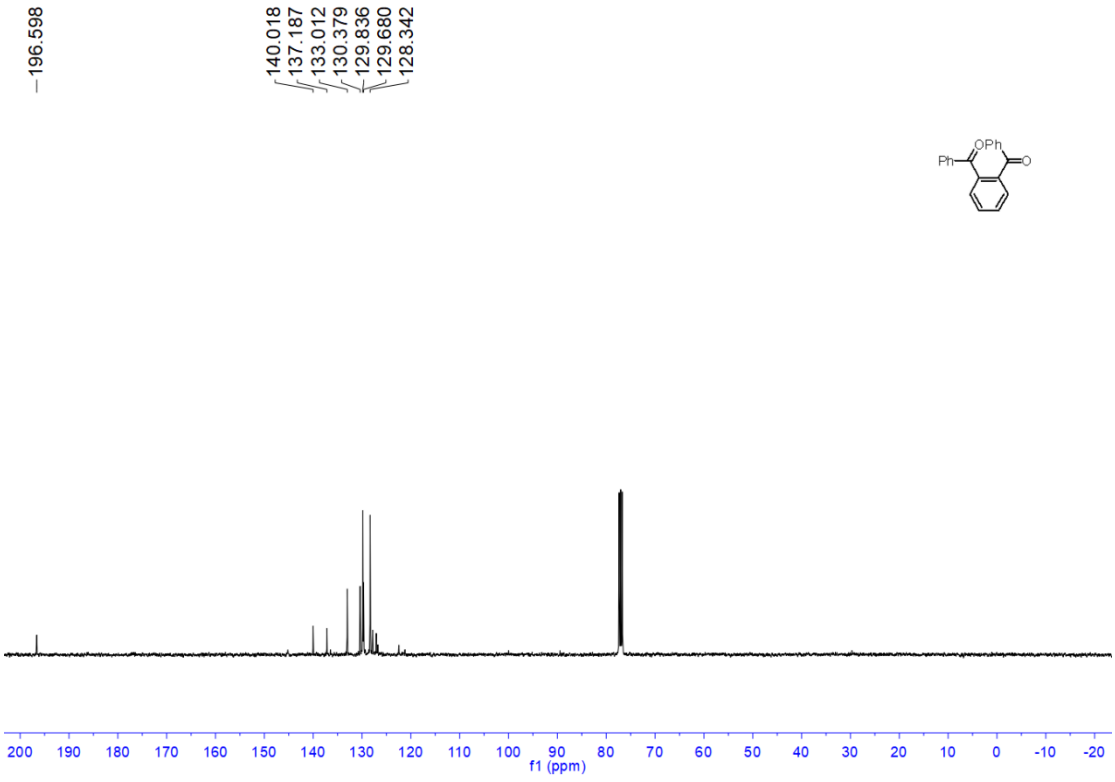
7.528
7.510
7.492
7.389
7.370
7.351
OPh
Ph
O
3.86
4.08
2.12
4.00
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 -1 -2
f1 (ppm)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133.012
130.379
129.836
129.680
128.342
OPh
Ph
O
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)