Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Supporting Information

$K_2S_2O_8$-Mediated Direct C-H Functionalization to Synthesize Quinoxalin-2(1*H*)-one Derivatives in Water

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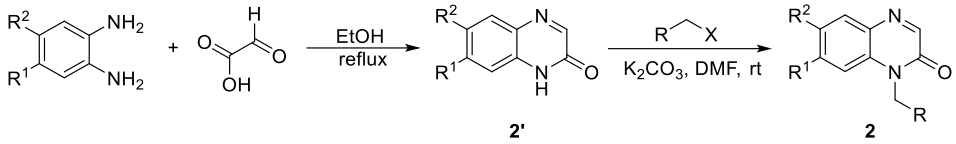
1. General information

Unless stated otherwise, all reactions for preparing compound **3a-aj** were carried out under an air atmosphere. All reagents and solvents were of commercial quality and were used without further purification. Purification was carried out according to standard laboratory methods[1]. All reactions were monitored by TLC analysis with silica gel-coated plates with fluorescent indicator UV254. ^{1}H and ^{13}C NMR spectra were obtained on either a Bruker AV 400 at 400 MHz and 100 MHz, respectively. Chemical shifts are reported in ppm and coupling constants are reported in Hz with TMS at 0.0 ppm (^{1}H and ^{13}C) and DMSO-d_6 referenced at 2.50 (^{1}H) and 39.5 (^{13}C). Mass spectra were measured with an Orbitrap Exploris™ 120 mass spectrometer using ESI ionization.

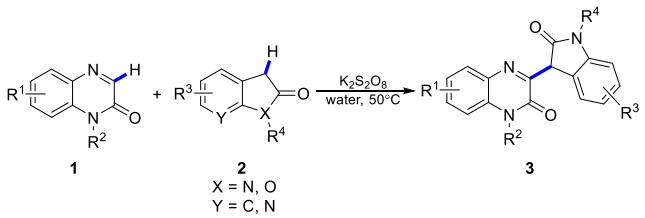
2. General procedure for the synthesis of starting materials[2]



2' 2

Glyoxylic acid (1.1 equiv.) was added into a suspension of *o*-arylenediamine (1. 0 equiv.) in ethanol (1 mol/L). The reaction mixture was stirred and heated at reflux in an oil bath for 2 h, then at room temperature for 1 h until the reaction completed. The precipitated solid was filtered and washed with ethanol, then dried to give quinoxalinone **2'**. For alkylation, the corresponding alkyl halide (1.6 equiv.) was added to a suspension of quinoxalinone **2'** (1 equiv.) and potassium carbonate (1.2 equiv.) in DMF. The reaction mixture was stirred at room temperature overnight. When TLC analysis indicated that the quinoxalinone disappeared, the reaction mixture was washed with saturated solution of ammonium chloride, ethyl acetate and water. The organic layer was separated and the aqueous layer was extracted twice with ethyl acetate. The combined organic layers were dried with anhydrous $MgSO_4$, filtered and concentrated under reduced pressure. The resulting organic residue was purified by column chromatography over silica gel to afford the desired product **2**.

3. General procedure for the synthesis of target compounds



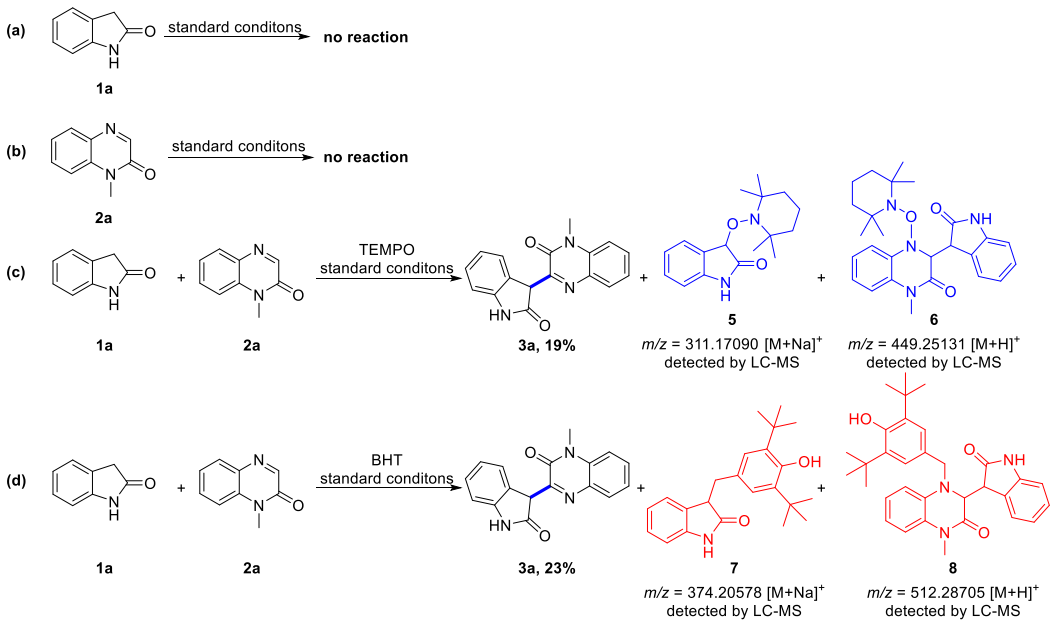
1 2 3

X = N, O
Y = C, N

Different substituted quinoxalin-2-one **1** (0.2 mmol, 1.0 equiv.) and various oxindole **2** (0.24 mmol, 1.2 equiv.) was added into 2 ml water (H_2O) and was treated with $K_2S_2O_8$ (0.2 mmol, 1.0 equiv.) at 50°C under air atmosphere in a 10 mL thick-walled ground test tube. Then mixture was stirred until the reaction completed. The progress of the reaction was monitored by TLC. After that, the reaction mixture was centrifuged with 75% ethanol for three time to obtain precipitate which was further purified through preparative TLC plate to obtain the desired product **3**.

4. The mechanistic studies

4.1 The control experiments about synthesis of 3a



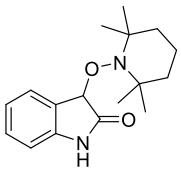
(a) Oxindole (**1a**, 0.2 mmol) and $K_2S_2O_8$ (0.4 mmol, 2.0 equiv.) were added to a 10 mL thick-walled ground test tube with a magnetic stirring bar, then the reaction solution was stirred at 50°C. No new product was detected via TLC plate.

(b) 1-Methylquinoxalin-2-one (**2a**, 0.2 mmol, 1.2 equiv.) and $K_2S_2O_8$ (0.4 mmol, 2.0 equiv.) were added to a 10 mL thick-walled ground test tube with a magnetic stirring bar, then the reaction solution was stirred at 50°C until the reaction complete. No new product was detected via TLC plate.

(c) Oxindole (**1a**, 0.2 mmol), 1-methylquinoxalin-2-one (**2a**, 0.24 mmol, 1.2 equiv.), $K_2S_2O_8$ (0.4 mmol, 2.0 equiv.) and 2,2,6,6-tetramethyl-1-piperidinyloxy (TEMPO, 0.4 mmol, 2.0 equiv.) were added to a 10 mL thick-walled ground test tube with a magnetic stirring bar, then the reaction mixture was stirred at rt until the reaction completed. the desired product **3a** was obtained in 19% yield. Furthermore, two free radical-trapping adducts **5** and **6** were detected by HRMS from the reaction solution, indicating that the reaction mechanism might be a radical reaction pathway.

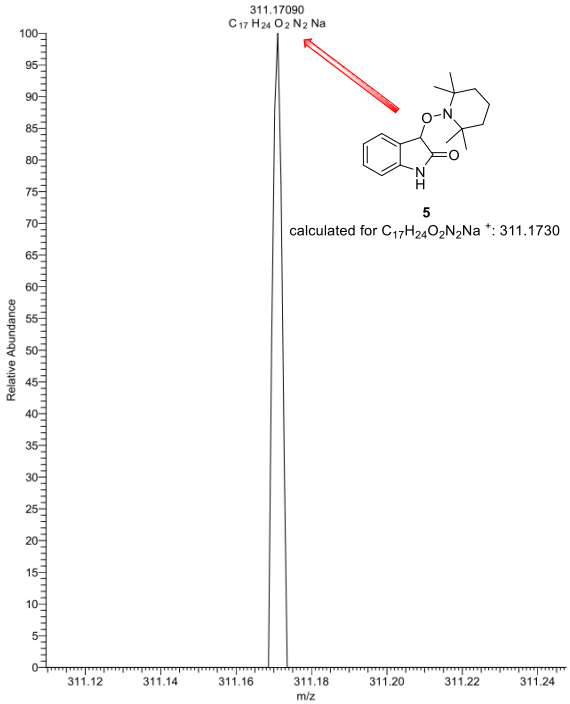
(d) Oxindole (**1a**, 0.2 mmol), 1-methylquinoxalin-2-one (**2a**, 0.24 mmol, 1.2 equiv.), $K_2S_2O_8$ (0.4 mmol, 2.0 equiv.) and Butylated hydroxytoluene (BHT, 0.4 mmol, 2.0 equiv.) were added to a 10 mL thick-walled ground test tube with a magnetic stirring bar, then the reaction mixture was stirred at rt until the reaction completed. the desired product **3a** was obtained in 23% yield. Furthermore, two free radical-trapping adducts **7** and **8** were detected by HRMS from the reaction solution, indicating that the reaction mechanism might be a radical reaction pathway.

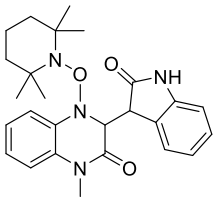
4.2 The HRMS spectra of compounds 5-8 in first set of control experiments



5

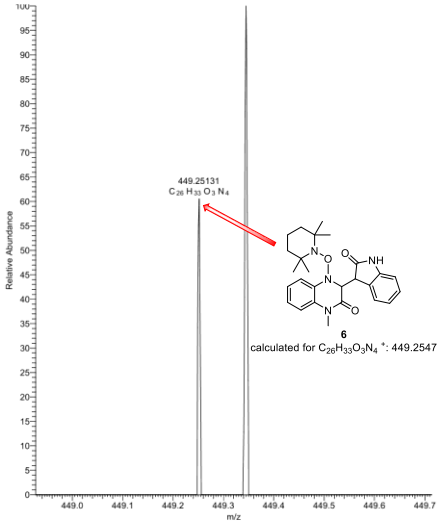
Compound 6: HRMS (m/z) [ESI]: calculated for $C_{17}H_{24}O_2N_2Na^+$ $[M+Na]^+$: 311.1730, found 311.17090.

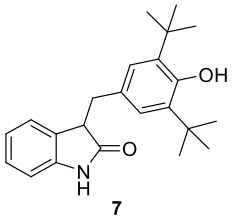




6

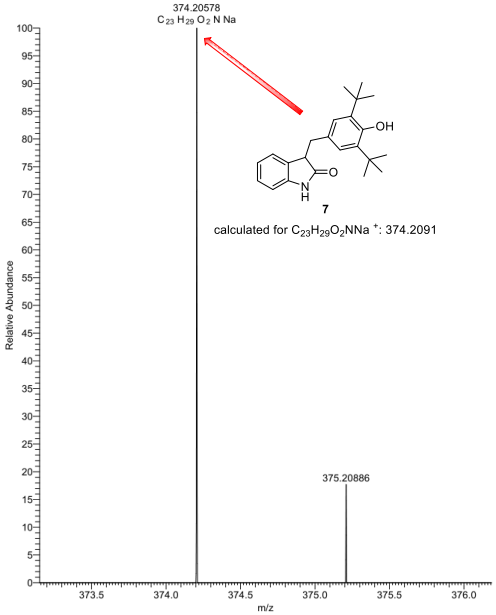
Compound 6: HRMS (m/z) [ESI]: calculated for $C_{26}H_{33}O_3N_4^+$ [M+H] $^+$: 449.2547, found 449.25131.

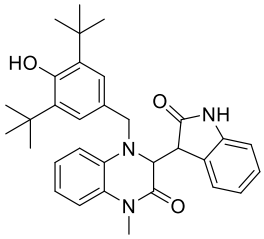




7

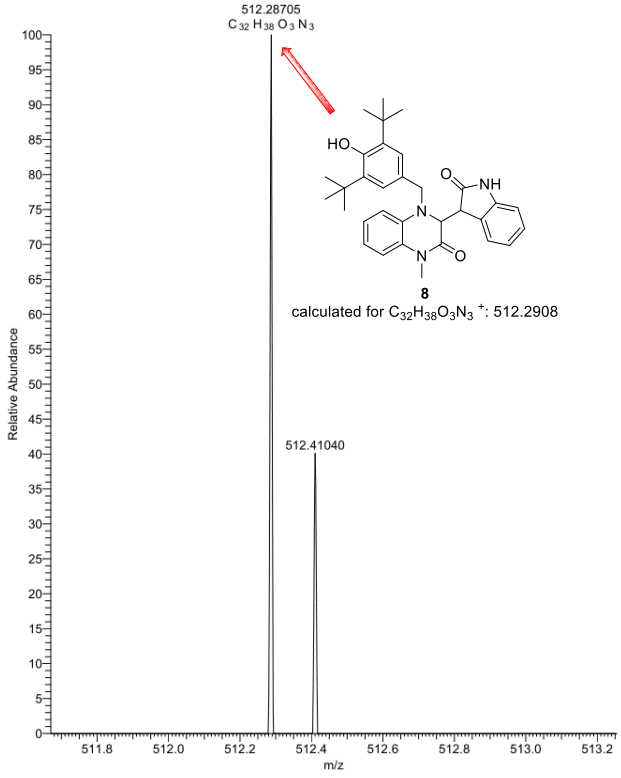
Compound 7: HRMS (m/z) [ESI]: calculated for $C_{23}H_{29}O_2NNa^+$ [M+Na] $^+$: 374.2091, found 374.20578.



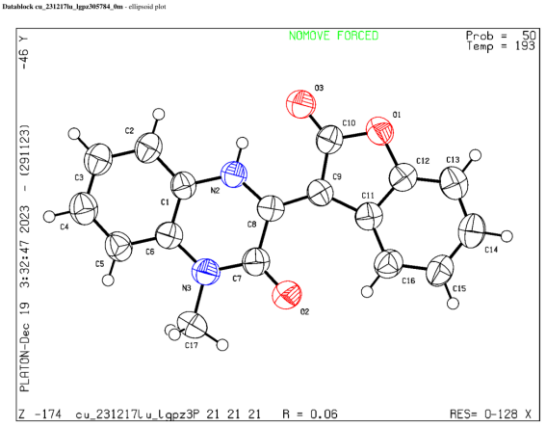


8

Compound 8: HRMS (m/z) [ESI]: calculated for $C_{32}H_{38}O_3N_3^+$ [M+H] $^+$: 512.2908, found 512.28750.



5. X-ray Structure and Data of 3m



cu_231217LU_LGPZ305784_0m

Table 1 Crystal data and structure refinement for cu_231217LU_LGPZ305784_0m.

Identification code	cu_231217LU_LGPZ305784_0m
Empirical formula	$C_{17}H_{12}N_2O_3$
Formula weight	292.29
Temperature/K	193.00
Crystal system	orthorhombic
Space group	$P2_12_12_1$
a/Å	4.7263(17)
b/Å	15.850(6)
c/Å	17.689(7)
α/°	90
β/°	90
γ/°	90
Volume/Å^3	1325.1(9)
Z	4
ρ_{calc}g/cm^3	1.465
μ/mm^{-1}	0.843
F(000)	608.0
Crystal size/mm^3	0.13 × 0.11 × 0.09
Radiation	CuKα (λ = 1.54178)
2Θ range for data collection/°	7.488 to 158.524
Index ranges	-4 ≤ h ≤ 5, -16 ≤ k ≤ 18, -20 ≤ l ≤ 21
Reflections collected	12691
Independent reflections	2499 [R_{int} = 0.0972, R_{sigma} = 0.0727]
Data/restraints/parameters	2499/0/201
Goodness-of-fit on F^2	1.038
Final R indexes [I>=2σ (I)]	R_1 = 0.0619, wR_2 = 0.1488
Final R indexes [all data]	R_1 = 0.1231, wR_2 = 0.2033
Largest diff. peak/hole / e Å^{-3}	0.28/-0.23
Flack parameter	-0.1(4)

Table 2 Fractional Atomic Coordinates (×10^4) and Equivalent Isotropic Displacement Parameters (Å^2×10^3) for cu_231217LU_LGPZ305784_0m. U_{eq} is defined as 1/3 of the trace of the orthogonalised U_{IJ} tensor.

Atom	*x*	*y*	*z*	U(eq)
O(3)	4109(9)	5521(3)	7730(2)	65.1(12)
O(2)	3510(9)	3557(3)	5414(2)	69.6(14)
O(1)	798(9)	4568(3)	8037(2)	63.7(12)
N(2)	6304(10)	5329(3)	6382(3)	54.0(13)
N(3)	7077(11)	4444(4)	5078(3)	59.6(15)
C(1)	8224(11)	5637(4)	5856(3)	50.2(15)
C(2)	9720(12)	6370(4)	5995(4)	59.2(17)
C(3)	11653(13)	6663(5)	5469(4)	66.3(19)
C(4)	12097(15)	6213(5)	4812(4)	67.5(19)
C(5)	10616(13)	5473(5)	4671(3)	60.9(17)
C(6)	8649(13)	5178(4)	5192(3)	53.1(16)
C(7)	4998(12)	4167(4)	5565(3)	56.4(16)
C(8)	4657(12)	4643(4)	6285(3)	49.9(15)
C(9)	2795(12)	4398(4)	6856(3)	50.5(15)
C(10)	2738(13)	4899(4)	7542(3)	55.1(16)
C(11)	762(12)	3720(4)	6974(3)	53.4(15)
C(12)	-374(13)	3860(4)	7692(4)	55.7(16)
C(13)	-2390(14)	3365(5)	8027(4)	66.0(19)
C(14)	-3362(14)	2681(5)	7626(4)	70(2)
C(15)	-2338(14)	2517(4)	6911(4)	68.2(19)
C(16)	-323(14)	3038(4)	6577(4)	63.1(18)
C(17)	7530(16)	3927(4)	4396(3)	75(2)

Table 3 Anisotropic Displacement Parameters ($Å^2 \times 10^3$) for cu_231217LU_LGPZ305784_0m. The Anisotropic displacement factor exponent takes the form: $-2\pi^2[h^2a^{*2}U_{11}+2hka^*b^*U_{12}+...]$.

Atom	U_{11}	U_{22}	U_{33}	U_{23}	U_{13}	U_{12}
O(3)	63(3)	69(3)	63(2)	-7(2)	2(2)	-2(3)
O(2)	65(3)	72(4)	72(3)	-12(3)	4(3)	-11(3)
O(1)	57(2)	75(3)	58(2)	-6(2)	8(2)	-4(3)
N(2)	46(3)	60(4)	55(3)	-6(3)	1(2)	-3(3)
N(3)	57(3)	63(4)	58(3)	-8(3)	2(2)	-1(3)
C(1)	38(3)	58(4)	55(3)	2(3)	-1(2)	2(3)
C(2)	45(3)	62(5)	71(4)	3(3)	-4(3)	-1(3)
C(3)	52(4)	70(5)	77(4)	3(4)	-1(4)	-3(3)
C(4)	56(4)	79(6)	68(4)	7(4)	1(3)	0(4)
C(5)	51(3)	74(5)	58(3)	1(4)	3(3)	0(4)
C(6)	46(3)	59(4)	55(3)	-2(3)	-4(3)	3(3)
C(7)	45(3)	62(5)	63(4)	-3(3)	-1(3)	1(3)
C(8)	45(3)	53(4)	51(3)	-2(3)	-4(3)	5(3)
C(9)	46(3)	53(4)	53(3)	1(3)	1(3)	5(3)
C(10)	49(3)	57(5)	60(3)	4(3)	-5(3)	-1(3)
C(11)	42(3)	59(4)	59(3)	0(3)	-6(3)	4(3)
C(12)	49(3)	55(4)	63(3)	0(3)	-4(3)	4(3)
C(13)	52(4)	82(6)	64(4)	10(4)	0(3)	7(4)
C(14)	54(4)	76(6)	82(5)	11(4)	1(4)	-7(4)
C(15)	58(4)	64(5)	83(4)	1(4)	1(3)	-12(4)
C(16)	56(4)	64(5)	69(4)	-3(4)	-3(3)	-4(4)
C(17)	81(5)	84(6)	58(4)	-17(4)	15(4)	-8(4)

Table 4 Bond Lengths for cu_231217LU_LGPZ305784_0m.

Atom	Atom	Length/Å	Atom	Atom	Length/Å
O(3)	C(10)	1.226(7)	C(4)	C(5)	1.389(9)
O(2)	C(7)	1.225(7)	C(5)	C(6)	1.390(8)
O(1)	C(10)	1.373(7)	C(7)	C(8)	1.489(8)
O(1)	C(12)	1.393(7)	C(8)	C(9)	1.395(8)
N(2)	C(1)	1.387(7)	C(9)	C(10)	1.450(9)
N(2)	C(8)	1.348(7)	C(9)	C(11)	1.457(8)
N(3)	C(6)	1.395(8)	C(11)	C(12)	1.397(8)
N(3)	C(7)	1.379(7)	C(11)	C(16)	1.387(8)
N(3)	C(17)	1.474(8)	C(12)	C(13)	1.369(9)
C(1)	C(2)	1.382(8)	C(13)	C(14)	1.374(10)
C(1)	C(6)	1.397(8)	C(14)	C(15)	1.380(9)
C(2)	C(3)	1.384(8)	C(15)	C(16)	1.392(9)
C(3)	C(4)	1.380(9)			

Table 5 Bond Angles for cu_231217LU_LGPZ305784_0m.

Atom	Atom	Atom	Angle/°	Atom	Atom	Atom	Angle/°
C(10)	O(1)	C(12)	107.1(5)	N(2)	C(8)	C(9)	119.8(5)
C(8)	N(2)	C(1)	125.1(5)	C(9)	C(8)	C(7)	123.1(5)
C(6)	N(3)	C(17)	120.3(5)	C(8)	C(9)	C(10)	117.7(5)
C(7)	N(3)	C(6)	123.7(5)	C(8)	C(9)	C(11)	136.5(6)
C(7)	N(3)	C(17)	116.0(5)	C(10)	C(9)	C(11)	105.8(5)
N(2)	C(1)	C(6)	118.4(6)	O(3)	C(10)	O(1)	119.2(6)
C(2)	C(1)	N(2)	120.8(6)	O(3)	C(10)	C(9)	131.1(6)
C(2)	C(1)	C(6)	120.9(6)	O(1)	C(10)	C(9)	109.7(5)
C(1)	C(2)	C(3)	120.1(6)	C(12)	C(11)	C(9)	105.4(5)
C(4)	C(3)	C(2)	119.5(7)	C(16)	C(11)	C(9)	138.3(6)
C(3)	C(4)	C(5)	120.8(6)	C(16)	C(11)	C(12)	116.2(6)
C(4)	C(5)	C(6)	120.1(6)	O(1)	C(12)	C(11)	112.0(5)
N(3)	C(6)	C(1)	118.6(5)	C(13)	C(12)	O(1)	123.3(6)
C(5)	C(6)	N(3)	122.8(6)	C(13)	C(12)	C(11)	124.8(6)
C(5)	C(6)	C(1)	118.6(6)	C(12)	C(13)	C(14)	117.4(6)
O(2)	C(7)	N(3)	121.6(6)	C(13)	C(14)	C(15)	120.3(7)
O(2)	C(7)	C(8)	121.6(5)	C(14)	C(15)	C(16)	121.2(7)
N(3)	C(7)	C(8)	116.8(6)	C(11)	C(16)	C(15)	120.0(6)
N(2)	C(8)	C(7)	117.1(5)				

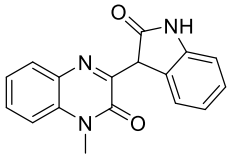
Table 6 Torsion Angles for cu_231217LU_LGPZ305784_0m.

A	B	C	D	Angle/°	A	B	C	D	Angle/°
O(2)	C(7)	C(8)	N(2)	-176.9(5)	C(8)	N(2)	C(1)	C(6)	-4.4(8)
O(2)	C(7)	C(8)	C(9)	4.8(9)	C(8)	C(9)	C(10)	O(3)	-1.2(10)
O(1)	C(12)	C(13)	C(14)	-179.7(6)	C(8)	C(9)	C(10)	O(1)	-180.0(5)
N(2)	C(1)	C(2)	C(3)	179.2(5)	C(8)	C(9)	C(11)	C(12)	179.6(6)
N(2)	C(1)	C(6)	N(3)	1.6(8)	C(8)	C(9)	C(11)	C(16)	-2.9(13)
N(2)	C(1)	C(6)	C(5)	-178.6(5)	C(9)	C(11)	C(12)	O(1)	-0.5(7)
N(2)	C(8)	C(9)	C(10)	-0.5(8)	C(9)	C(11)	C(12)	C(13)	179.8(6)
N(2)	C(8)	C(9)	C(11)	-179.2(6)	C(9)	C(11)	C(16)	C(15)	180.0(7)
N(3)	C(7)	C(8)	N(2)	3.3(8)	C(10)	O(1)	C(12)	C(11)	-0.1(7)
N(3)	C(7)	C(8)	C(9)	-175.0(5)	C(10)	O(1)	C(12)	C(13)	179.6(6)
C(1)	N(2)	C(8)	C(7)	1.9(8)	C(10)	C(9)	C(11)	C(12)	0.8(6)
C(1)	N(2)	C(8)	C(9)	-179.8(5)	C(10)	C(9)	C(11)	C(16)	178.4(7)
C(1)	C(2)	C(3)	C(4)	-0.7(9)	C(11)	C(9)	C(10)	O(3)	177.8(6)
C(2)	C(1)	C(6)	N(3)	-179.7(5)	C(11)	C(9)	C(10)	O(1)	-1.0(7)
C(2)	C(1)	C(6)	C(5)	0.1(9)	C(11)	C(12)	C(13)	C(14)	0.0(10)
C(2)	C(3)	C(4)	C(5)	0.3(10)	C(12)	O(1)	C(10)	O(3)	-178.3(5)
C(3)	C(4)	C(5)	C(6)	0.3(9)	C(12)	O(1)	C(10)	C(9)	0.7(7)
C(4)	C(5)	C(6)	N(3)	179.3(6)	C(12)	C(11)	C(16)	C(15)	-2.7(9)
C(4)	C(5)	C(6)	C(1)	-0.5(9)	C(12)	C(13)	C(14)	C(15)	-0.6(10)
C(6)	N(3)	C(7)	O(2)	174.0(6)	C(13)	C(14)	C(15)	C(16)	-0.4(10)
C(6)	N(3)	C(7)	C(8)	-6.2(8)	C(14)	C(15)	C(16)	C(11)	2.2(10)
C(6)	C(1)	C(2)	C(3)	0.5(9)	C(16)	C(11)	C(12)	O(1)	-178.6(5)
C(7)	N(3)	C(6)	C(1)	3.8(9)	C(16)	C(11)	C(12)	C(13)	1.7(9)
C(7)	N(3)	C(6)	C(5)	-176.0(6)	C(17)	N(3)	C(6)	C(1)	-177.9(6)
C(7)	C(8)	C(9)	C(10)	177.7(5)	C(17)	N(3)	C(6)	C(5)	2.3(9)
C(7)	C(8)	C(9)	C(11)	-0.9(10)	C(17)	N(3)	C(7)	O(2)	-4.3(9)
C(8)	N(2)	C(1)	C(2)	176.8(5)	C(17)	N(3)	C(7)	C(8)	175.5(5)

Table 7 Hydrogen Atom Coordinates (Å×10^4) and Isotropic Displacement Parameters (Å^2×10^3) for cu_231217LU_LGPZ305784_0m.

Atom	x	y	z	U(eq)
H(2)	6148.77	5603.91	6812.34	65
H(2A)	9419.99	6673.37	6450.79	71
H(3)	12667.65	7170.63	5559.89	80
H(4)	13430.96	6411.75	4451.87	81
H(5)	10948.45	5167.37	4217.22	73
H(13)	-3088.94	3489.68	8518.34	79
H(14)	-4746.92	2320.24	7842.88	85
H(15)	-3019.27	2039.79	6641.88	82
H(16)	309.58	2926.05	6077.03	76
H(17A)	6958.28	4247.13	3947.77	112
H(17B)	6396.42	3410.37	4431.28	112
H(17C)	9537.44	3778.06	4356.35	112

6. Characterization of products

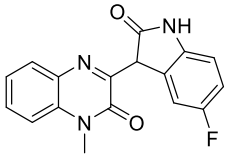


3-(2-oxoindolin-3-yl)-1-methylquinoxalin-2-one (3a)[3] orange solid, mp: 266-268 ℃, 56.6 mg, 91%;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.50 (s, 1H), 10.94 (s, 1H), 8.70 (dd, J = 1.16, 8.00 Hz, 1H), 7.35-7.37 (m, 1H), 7.26-7.29 (m, 1H), 7.16-7.20 (m, 2H), 7.05 (dt, J = 1.26, 7.50 Hz, 1H), 6.88-6.95 (m, 2H), 3.58 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.20, 156.43, 140.23, 137.49, 128.75, 125.91, 125.63, 125.17, 124.54, 124.04, 123.01, 121.01, 116.47, 115.28, 109.52, 97.82, 30.03.

HRMS (ESI-TOF) calcd for $C_{17}H_{14}N_3O_2$ $[M + H]^+$: 292.1081; found: 292.1076.

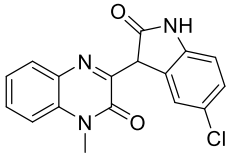


3-(5-Fluoro-2-oxoindolin-3-yl)-1-methylquinoxalin-2-one (3b) orange solid, mp: 254-256 ℃, 58.1 mg, 88% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.64 (s, 1H), 10.97 (s, 1H), 8.51 (dd, J = 2.18, 12.02 Hz, 1H), 7.40-7.42 (m, 1H), 7.32-7.34 (m, 1H), 7.20-7.23 (m, 2H), 6.83-6.86 (m, 2H), 3.60 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.25, 156.79-159.08 (d, $J_{C\text{-}F}$ = 171.70 Hz), 156.33, 141.02, 133.63, 128.86, 125.34, 124.62, 124.47, 116.80, 115.34, 112.12-112.40 (d, $J_{C\text{-}F}$ = 21.02 Hz), 111.01-111.25 (d, $J_{C\text{-}F}$ = 18.12 Hz), 109.59-109.68 (d, $J_{C\text{-}F}$ = 6.76 Hz), 97.32-97.35 (d, $J_{C\text{-}F}$ = 2.22 Hz), 30.11.

HRMS (ESI-TOF) calcd for $C_{17}H_{13}FN_3O_2$ $[M + H]^+$: 310.0986; found: 310.0982.

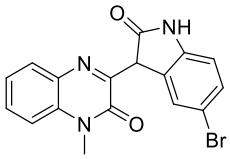


3-(5-Chloro-2-oxoindolin-3-yl)-1-methylquinoxalin-2-one (3c) orange solid, mp: 276-278 ℃, 51.4 mg, 74% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.63 (s, 1H), 11.08 (s, 1H), 8.75 (d, J = 2.15 Hz, 1H), 7.41-7.43 (m, 1H), 7.34-7.36 (m, 1H), 7.21-7.24 (m, 2H), 7.06 (dd, J = 2.27, 8.22 Hz, 1H), 6.88 (d, J = 8.25 Hz, 1H), 3.62 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.02, 156.32, 141.25, 135.91, 128.92, 125.27, 125.21, 125.04, 124.69, 124.64, 124.28, 116.90, 115.41, 110.59, 96.57, 30.19.

HRMS (ESI-TOF) calcd for $C_{17}H_{13}ClN_3O_2$ $[M + H]^+$: 326.0691; found: 326.0694.

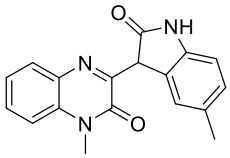


3-(5-Bromo-2-oxoindolin-3-yl)-1-methylquinoxalin-2-one (3d) orange solid, mp: 267-269 ℃, 56.4 mg, 71% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.62 (s, 1H), 11.08 (s, 1H), 8.88 (d, J = 2.04 Hz, 1H), 7.40-7.43 (m, 1H), 7.32-7.35 (m, 1H), 7.21-7.24 (m, 2H), 7.16-7.19 (m, 1H), 6.84 (d, J = 8.16 Hz, 1H), 3.58 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 176.38, 156.37, 141.33, 136.27, 130.53, 128.96, 127.81, 127.68, 127.08, 125.25, 124.71, 116.94, 115.46, 113.26, 111.18, 96.44, 30.23.

HRMS (ESI-TOF) calcd for $C_{17}H_{13}BrN_3O_2$ $[M + H]^+$: 370.0186; found: 370.0183.

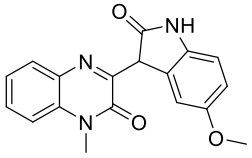


3-(5-Methyl-2-oxoindolin-3-yl)-1-methylquinoxalin-2-one (3e) orange solid, mp: 271-273 ℃, 45.5 mg, 70% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.54 (s, 1H), 10.85 (s, 1H), 8.55 (d, J = 1.76 Hz, 1H), 7.37-7.40 (m, 1H), 7.27-7.30 (m, 1H), 7.18-7.20 (m, 2H), 6.88 (dd, J = 1.76, 7.88 Hz, 1H), 6.78 (d, J = 7.80 Hz, 1H), 3.60 (s, 3H), 2.30 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 176.38, 156.37, 141.33, 136.27, 130.53, 128.96, 127.81, 127.68, 127.08, 125.25, 124.71, 116.94, 115.46, 113.26, 111.18, 96.44, 30.23.

HRMS (ESI-TOF) calcd for $C_{18}H_{16}N_3O_2$ $[M + H]^+$: 306.1237; found: 306.1233.

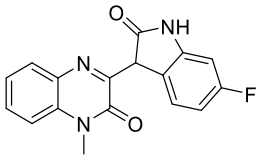


3-(5-Methoxy-2-oxoindolin-3-yl)-1-methylquinoxalin-2-one (3f) orange solid, mp: 268-270 ℃, 26.4 mg, 38% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.64 (s, 1H), 10.78 (s, 1H), 8.44 (d, J = 2.60 Hz, 1H), 7.39-7.41 (m, 1H), 7.30-7.32 (m, 1H), 7.19-7.21 (m, 2H), 6.72 (d, J = 2.45 Hz, 1H), 6.67-6.69 (m, 1H), 3.74 (s, 3H), 3.61 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 176.59, 156.54, 154.56, 140.50, 137.47, 131.65, 128.81, 127.54, 124.62, 124.12, 123.96, 115.37, 112.61, 111.91, 109.77, 98.18, 55.38, 30.14.

HRMS (ESI-TOF) calcd for $C_{18}H_{16}N_3O_3$ $[M + H]^+$: 322.1186; found: 322.1183.



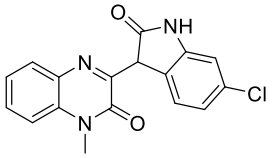
3-(6-Fluoro-2-oxoindolin-3-yl)-1-methylquinoxalin-2-one (3g) orange solid, mp: 252-254 ℃, 35.9 mg, 54% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.27 (s, 1H), 11.04 (s, 1H), 8.63-8.68 (m, 1H), 7.31-7.35 (m, 1H), 7.22-7.26 (m, 1H), 7.15-7.17 (m, 2H), 6.67-6.72 (m, 1H), 6.62-6.65 (m, 1H), 3.55 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.08, 159.39-161.78 (d, $J_{C\text{-}F}$ = 179.07 Hz), 156.39, 139.83, 138.52-138.64 (d, $J_{C\text{-}F}$ = 8.82 Hz), 128.63, 127.04, 127.12, 125.52, 124.53, 124.05, 119.39-119.42 (d, $J_{C\text{-}F}$ = 1.80 Hz), 116.44, 115.24, 107.10-107.31 (d, $J_{C\text{-}F}$ = 15.81 Hz), 97.09-97.15 (d, $J_{C\text{-}F}$ = 4.65

Hz), 29.99.

HRMS (ESI-TOF) calcd for $C_{17}H_{13}FN_3O_2$ $[M + H]^+$: 310.0986; found: 310.0984.

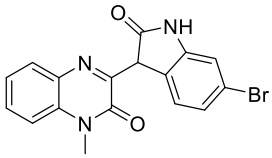


3-(6-Chloro-2-oxoindolin-3-yl)-1-methylquinoxalin-2-one (3h) orange solid, mp: 251-253 ℃, 61.3 mg, 89% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.44 (s, 1H), 11.06 (s, 1H), 8.65 (d, J = 8.70 Hz, 1H), 7.37-7.39 (m, 1H), 7.30-7.31 (m, 1H), 7.19-7.21 (m, 2H), 6.94 (dd, J = 2.20, 8.55 Hz, 1H), 6.86 (d, J = 2.15 Hz, 1H), 3.58 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.18, 156.33, 140.73, 138.43, 129.03, 128.86, 126.94, 125.38, 124.63, 124.44, 122.04, 120.63, 116.75, 115.38, 109.29, 96.71, 30.11.

HRMS (ESI-TOF) calcd for $C_{17}H_{13}ClN_3O_2$ $[M + H]^+$: 326.0691; found: 326.0692.

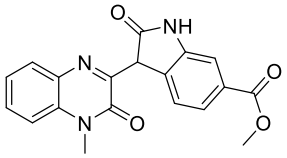


3-(6-Bromo-2-oxoindolin-3-yl)-1-methylquinoxalin-2-one (3i) orange solid, mp: 248-250 ℃, 51.3 mg, 65% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.50 (s, 1H), 11.08 (s, 1H), 8.63 (d, J = 8.65 Hz, 1H), 7.40-7.42 (m, 1H), 7.33-7.35 (m, 1H), 7.21-7.23 (m, 2H), 7.10 (dd, J = 2.05, 8.65 Hz, 1H), 7.02 (d, J = 2.00 Hz, 1H), 3.60 (s, 3H);

^{13}C NMR (125 MHz, DMSO-d_6): δ = 172.02, 156.34, 140.92, 138.65, 128.90, 127.31, 125.38, 124.66, 124.50, 123.49, 122.42, 117.25, 116.80, 115.41, 112.08, 96.69, 30.13.

HRMS (ESI-TOF) calcd for $C_{17}H_{13}BrN_3O_2$ $[M + H]^+$: 370.0186; found: 370.0184.

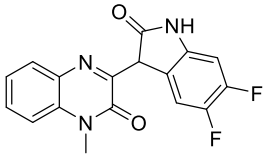


3-(1-Methylquinoxalin-2-one)-2-oxoindoline-6-carboxylate (3j) orange solid, mp: 284-286 ℃, 53.6 mg, 73% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.78 (s, 1H), 11.13 (s, 1H), 8.72 (d, J = 8.36 Hz, 1H), 7.32-7.39 (m, 4H), 7.20-7.24 (m, 2H), 3.81 (s, 3H), 3.58 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.08, 166.87, 155.87, 141.85, 136.75, 129.04, 127.83, 125.03, 124.96, 124.93, 124.83, 124.56, 122.07, 117.12, 115.28, 109.66, 96.61, 52.21, 30.09.

HRMS (ESI-TOF) calcd for $C_{19}H_{16}N_3O_4$ $[M + H]^+$: 350.1135; found: 350.1138.

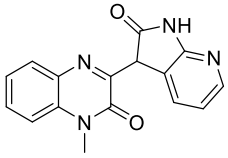


3-(5, 6-Difluoro-2-oxoindolin-3-yl)-1-methylquinoxalin-2-one (3k) orange solid, mp: 261-263 ℃, 52.4 mg, 74% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.44 (s, 1H), 11.07 (s, 1H), 8.65 (dd, J = 8.84, 13.92 Hz, 1H), 7.38-7.40 (m, 1H), 7.30-7.32 (m, 1H), 7.20-7.22 (m, 1H), 7.18-7.20 (m, 1H), 6.82 (dd, J = 7.36, 10.56 Hz, 1H), 3.59 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.31, 156.40, 140.69, 133.51, 128.78, 126.02, 125.28, 124.70, 124.56, 124.00, 123.67, 116.83, 115.85, 115.41-115.48 (d, $J_{C\text{-}F}$ = 5.46 Hz), 113.81-114.05 (d, $J_{C\text{-}F}$ = 17.49 Hz), 96.47, 30.11.

HRMS (ESI-TOF) calcd for $C_{17}H_{12}F_2N_3O_2$ $[M + H]^+$: 328.0892; found: 328.0896.

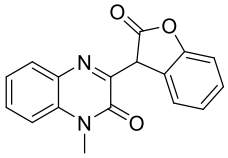


3-(1*H*-pyrrolo [2,3-b] pyridine-2-one)-1-methylquinoxalin-2-one (3l) orange solid, mp: 223-225 ℃, 63.0 mg, 98% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.35 (s, 1H), 11.71 (s, 1H), 8.95 (d, J = 7.40 Hz, 1H), 7.99 (dd, J = 1.55, 5.10 Hz, 1H), 7.42-7.47 (m, 2H), 7.23-7.30 (m, 2H), 7.04-7.06 (m, 1H), 3.63 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 171.66, 156.14, 140.31, 136.69, 133.34, 129.04, 125.09, 124.95, 124.75, 117.50, 117.19, 115.52, 30.20.

HRMS (ESI-TOF) calcd for $C_{16}H_{13}N_4O_2$ $[M + H]^+$: 293.1033; found: 293.1035.

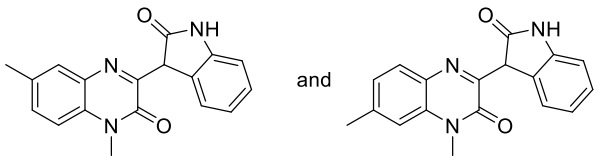


3-(Benzofuran-2-one)-1-ethylquinoxalin-2-one (3m) orange solid, mp: 124-126 ℃, 40.9 mg, 66% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 12.98 (s, 1H), 8.68 (dd, J = 1.45, 7.80 Hz, 1H), 7.57 (dd, J = 1.47, 7.92 Hz, 1H), 7.50 (d, J = 8.15 Hz, 1H), 7.32 (dt, J = 1.50, 7.70 Hz, 1H), 7.27 (dt, J = 1.35, 7.62 Hz, 1H), 7.14-7.23 (m, 3H), 3.65 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 176.03, 155.34, 150.08, 149.80, 132.46, 129.03, 126.01, 125.75, 124.81, 123.86, 117.43, 115.47, 111.50, 110.05, 81.02, 30.25.

HRMS (ESI-TOF) calcd for $C_{17}H_{13}N_2O_3$ $[M + H]^+$: 293.0921; found: 293.0924.



(regioisomeric mixture with 4:1 ratio)

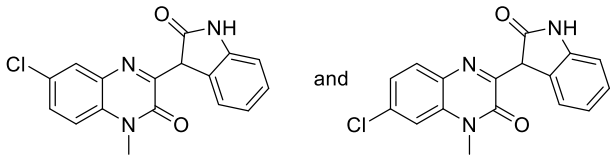
3-(2-oxoindolin-3-yl)-1, 6-dimethylquinoxalin-2-one

3-(2-oxoindolin-3-yl)-1, 7-dimethylquinoxalin-2-one (3ab) orange solid, mp: 239-241 ℃, 53.2 mg, 82% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.57 (s, 0.25H), 14.52 (s, 1H), 10.95 (s, 0.93H), 10.92 (s, 0.31H), 8.72 (d, J = 7.80 Hz, 1.02H), 8.69 (s, 0.19H), 7.29 (d, J = 8.40 Hz, 1.04H), 7.24 (s, 0.22H), 7.22 (d, J = 8.10 Hz, 0.31H), 7.13 (d, J = 1.85 Hz, 1.02H), 7.01-7.07 (m, 2.59H), 6.89-6.95 (m, 2.59H), 3.60 (s, 0.65H), 3.59 (s, 2.85H), 2.37 (s, 0.64H), 2.33 (s, 2.93H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.20, 156.26, 140.41, 137.35, 134.26, 126.61, 125.86, 125.16, 125.02, 123.02, 121.06, 116.60, 115.21, 109.58, 97.62, 30.06, 21.36, 20.65.

HRMS (ESI-TOF) calcd for $C_{18}H_{16}N_3O_2$ $[M + H]^+$: 306.1237; found: 306.1233.



(regioisomeric mixture with 2:1 ratio)

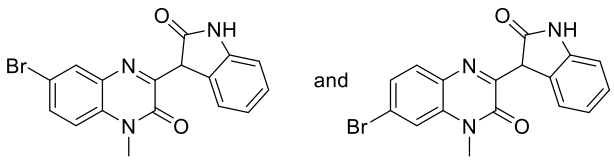
3-(2-oxoindolin-3-yl)-1-methyl-6-chloroquinoxalin-2-one

3-(2-oxoindolin-3-yl)-1-methyl-7-chloroquinoxalin-2-one (3ac) orange solid, mp: 255-257 ℃, 38.2 mg, 54% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.48 (s, 0.58H), 14.39 (s, 1H), 10.99 and 10.98 (s, 1.64H), 8.70 and 8.67 (m, 1.63H), 7.47 (m, 1.63H), 7.33-7.38 (m, 1.69H), 7.19-7.22 (m, 1.69H), 7.06-7.10 (m, 1.64H), 6.89-6.96 (m, 3.36), 3.58 (s, 4.87H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.17, 156.47, 156.34, 139.70, 137.86, 137.66, 129.98, 128.47, 127.82, 126.18, 125.97, 125.67, 125.47, 124.81, 124.11, 123.30, 122.75, 121.15, 117.83, 116.78, 115.89, 115.09, 109.63, 98.96, 98.36, 30.24, 30.20.

HRMS (ESI-TOF) calcd for $C_{17}H_{13}ClN_3O_2$ $[M + H]^+$: 326.0691; found: 326.0692.



(regioisomeric mixture with 4:1 ratio)

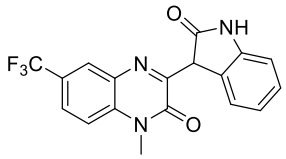
3-(2-oxoindolin-3-yl)-1-methyl-6-bromoquinoxalin-2-one

3-(2-oxoindolin-3-yl)-1-methyl-7-bromoquinoxalin-2-one (3ad) orange solid, mp: 268-270 ℃, 68.6 mg, 89% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.47 (s, 0.25H), 14.38 (s, 1H), 11.00 (s, 1.24H), 8.69 (d, J = 8.05 Hz, 1.25H), 7.57 (s, 1.26H), 7.24-7.27 (m, 1.19H), 7.06-7.14 (m, 2.19H), 6.89-6.96 (m, 2.42H), 3.57 (s, 3.53H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.15, 156.34, 139.70, 137.86, 128.20, 127.27, 126.17, 126.13, 125.66, 125.15, 123.22, 122.75, 121.58, 121.14, 118.64, 117.08, 116.24, 109.62, 98.97, 30.15.

HRMS (ESI-TOF) calcd for $C_{17}H_{13}BrN_3O_2$ $[M + H]^+$: 370.0186; found: 370.0182.

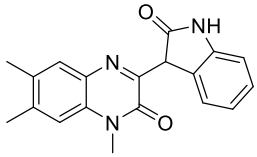


3-(2-oxoindolin-3-yl)-1-methyl-6-trifluoromethylquinoxalin-2-one (3ae) orange solid, mp: 291-293 ℃, 38.4 mg, 53% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.43 (s, 1H), 11.02 (s, 1H), 8.69 (d, J = 8.00 Hz, 1H), 7.71 (d, J = 2.00 Hz, 1H), 7.54 (d, J = 8.60 Hz, 1H), 7.48 (dd, J = 1.95, 8.65 Hz, 1H), 7.09 (dt, J = 1.25, 7.52 Hz, 1H), 6.95 (dt, J = 1.30, 7.60 Hz, 1H), 6.91 (dd, J = 1.30, 7.60 Hz, 1H), 3.61 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.17, 156.74, 139.59, 137.98, 131.65, 126.22, 125.80-126.16 (d, $J_{C\text{-}F}$ = 36.15 Hz), 124.85, 124.52, 123.10, 122.63, 121.17, 120.06, 115.90, 113.34, 109.63, 99.21, 30.25.

HRMS (ESI-TOF) calcd for $C_{18}H_{12}F_3N_3O_2$ $[M + H]^+$: 360.0954; found: 360.0951.

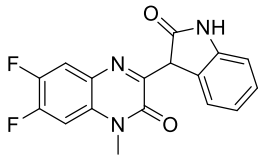


3-(2-oxoindolin-3-yl)-1, 6, 7-trimethylquinoxalin-2-one (3af) orange solid, mp: 244-246 ℃, 45.9 mg, 63% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.58 (s, 1H), 10.93 (s, 1H), 7.22 (s, 1H), 7.16 (s, 1H), 6.81 (d, J = 7.75 Hz, 1H), 6.74-6.76 (m, 1H), 3.60 (s, 3H), 2.28 (s, 3H), 2.24 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 176.87, 161.03, 144.11, 136.50, 127.90, 126.22, 124.84, 121.61, 120.95, 116.08, 114.81, 109.56, 96.94, 31.42, 19.75, 19.11.

HRMS (ESI-TOF) calcd for $C_{19}H_{18}N_3O_2$ $[M + H]^+$: 320.1394; found: 320.1395.

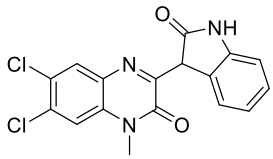


3-(2-oxoindolin-3-yl)-1-methyl-6, 7-difluoroquinoxalin-2-one (3ag) orange solid, mp: 274-276 ℃, 57.0 mg, 81% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.41 (s, 1H), 10.99 (s, 1H), 8.68 (d, J = 8.00 Hz, 1H), 7.63 (dd, J = 7.77, 10.92 Hz, 1H), 7.57 (dd, J = 7.55, 12.15 Hz, 1H), 7.07 (dt, J = 1.25, 7.60 Hz, 1H), 6.94 (dt, J = 1.30, 7.77 Hz, 1H), 6.90 (dd, J = 1.22, 7.67 Hz, 1H), 3.55 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 171.28, 156.31, 139.87, 137.69, 129.77, 126.00, 125.53, 122.81, 122.13, 109.62, 104.86-105.10 (d, $J_{C\text{-}F}$ = 23.70 Hz), 30.67.

HRMS (ESI-TOF) calcd for $C_{17}H_{12}F_2N_3O_2$ [M + H]$^+$: 328.0892; found: 328.0894.

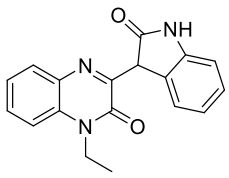


3-(2-oxoindolin-3-yl)-1-methyl-6, 7-dichloroquinoxalin-2-one (3ah) orange solid, mp: 259-261 ℃, 75.5 mg, 97% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.33 (s, 1H), 11.01 (s, 1H), 8.66 (d, J = 8.00 Hz, 1H), 7.67 (s, 1H), 7.59 (s, 1H), 7.08 (t, J = 7.55 Hz, 1H), 6.94 (t, J = 7.60 Hz, 1H), 6.90 (d, J = 7.65 Hz, 1H), 3.55 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 173.54, 156.43, 143.81, 138.03, 130.07, 128.92, 126.22, 125.93, 124.09, 121.57, 116.70, 110.05, 94.92, 30.42.

HRMS (ESI-TOF) calcd for $C_{17}H_{12}Cl_2N_3O_2$ [M + H]$^+$: 360.0301; found: 360.0304.

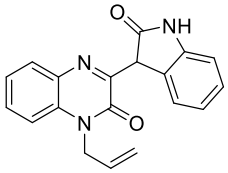


3-(2-oxoindolin-3-yl)-1-ethylquinoxalin-2-one (3ai) orange solid, mp: 259-261 ℃, 58.7 mg, 90% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.51 (s, 1H), 10.94 (s, 1H), 8.71 (d, J = 7.96 Hz, 1H), 7.40-7.43 (m, 1H), 7.28-7.31 (m, 1H), 7.15-7.21 (m, 2H), 7.05 (dt, J = 1.24, 7.44 Hz, 1H), 6.88-6.95 (m, 2H), 4.21-4.26 (q, J = 7.07 Hz, 2H), 1.27 (t, J = 7.04 Hz, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.19, 156.00, 140.26, 137.48, 127.44, 125.92, 125.88, 125.17, 124.49, 124.21, 123.01, 121.00, 116.89, 115.03, 109.52, 97.74, 37.82, 12.53.

HRMS (ESI-TOF) calcd for $C_{18}H_{16}N_3O_2$ [M + H]$^+$: 306.1237; found: 306.1231.

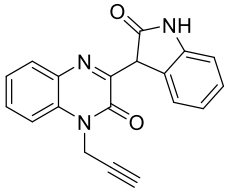


3-((2-oxoindolin-3-yl)-1-Allylquinoxalin-2-one (3aj) orange solid, mp: 257-259 ℃, 62.5 mg, 93% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.52 (s, 1H), 10.97 (s, 1H), 8.69 (d, J = 7.96 Hz, 1H), 7.28-7.32 (m, 2H), 7.14-7.18 (m, 2H), 7.06 (dt, J = 1.24, 7.48 Hz, 1H), 6.89-6.95 (m, 2H), 5.92-6.01 (m, 1H), 5.22-5.25 (m, 1H), 5.19-5.20 (m, 1H), 4.84-4.86 (m, 1H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.21, 156.29, 140.17, 137.55, 132.07, 127.75, 125.93, 125.28, 124.60, 123.97, 122.95, 121.04, 117.48, 116.72, 115.66, 109.56, 98.03, 44.86.

HRMS (ESI-TOF) calcd for $C_{19}H_{16}N_3O_2$ $[M + H]^+$: 318.1237; found: 318.1239.

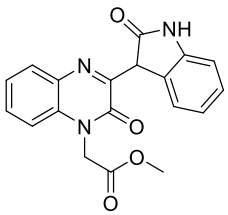


3-((2-oxoindolin-3-yl)-1-(2-propynyl) quinoxalin-2-one (3ak) orange solid, mp: 272-274 ℃, 44.2 mg, 64% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.45 (s, 1H), 11.01 (s, 1H), 8.68 (d, J = 8.00 Hz, 1H), 7.45-7.46 (m, 1H), 7.34-7.36 (m, 1H), 7.23-7.24 (m, 2H), 7.08 (t, J = 7.47 Hz, 1H), 6.92 (t, J = 7.67 Hz, 1H), 5.08 (d, J = 2.50 Hz, 1H), 3.46 (m, 1H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.69, 156.04, 138.89, 137.69, 130.35, 127.40, 125.87, 125.63, 125.17, 124.08, 123.28, 121.19, 118.23, 115.57, 112.70, 109.74, 78.64, 75.45, 32.31.

HRMS (ESI-TOF) calcd for $C_{19}H_{14}N_3O_2$ $[M + H]^+$: 316.1081; found: 316.1085.

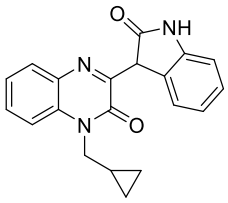


3-(2-oxoindolin-3-yl)-1-methylacetatequinoxalin-2-one (3al) orange solid, mp: 278-280 ℃, 72.2 mg, 94% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.46 (s, 1H), 11.02 (s, 1H), 8.63 (d, J = 7.48 Hz, 1H), 7.35-7.39 (m, 2H), 7.15-7.24 (m, 2H), 7.09 (dt, J = 1.24, 7.52 Hz, 1H), 6.90-6.96 (m, 2H), 5.10 (s, 2H), 3.74 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.17, 168.67, 156.78, 139.27, 137.77, 127.87, 125.84, 125.67, 125.64, 124.97, 124.11, 122.63, 121.14, 116.87, 115.18, 109.67, 98.51, 52.94, 44.59.

HRMS (ESI-TOF) calcd for $C_{19}H_{16}N_3O_4$ $[M + H]^+$: 350.1135; found: 350.1132.

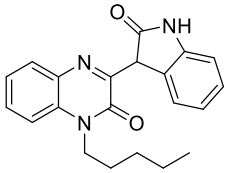


3-(2-oxoindolin-3-yl)-1-cyclopropylmethylquinoxalin-2-one (3am) orange solid, mp: 267-269 ℃, 63.8 mg, 91% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.53 (s, 1H), 10.96 (s, 1H), 8.67 (d, J = 8.05 Hz, 1H), 7.52-7.54 (m, 1H), 7.32-7.34 (m, 1H), 7.19-7.21 (m, 2H), 7.06 (t, J = 7.55 Hz, 1H), 6.94 (t, J = 7.67 Hz, 1H), 6.91 (d, J = 7.60 Hz, 1H), 4.19 (d, J = 6.95 Hz, 1H), 1.26-1.34 (m, 2H), 0.51-0.52 (m, 4H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.19, 156.59, 140.24, 137.51, 127.90, 125.95, 125.77, 125.25, 124.62, 124.21, 122.97, 121.07, 116.92, 115.58, 109.57, 97.89, 46.25, 9.98, 4.27.

HRMS (ESI-TOF) calcd for $C_{20}H_{18}N_3O_2$ $[M + H]^+$: 332.1394; found: 332.1392.

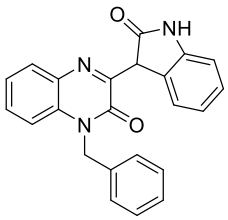


3-(2-oxoindolin-3-yl)-1-pentylmethylquinoxalin-2-one (3an) orange solid, mp: 231-233 ℃, 57.7 mg, 77% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.51 (s, 1H), 10.94 (s, 1H), 8.69 (dd, J = 1.20, 8.04 Hz, 1H), 7.35-7.38 (m, 1H), 7.27-7.29 (m, 1H), 7.16-7.18 (m, 2H), 7.05 (dt, J = 1.24, 7.48 Hz, 1H), 6.88-6.95 (m, 2H), 4.15 (t, J = 7.76 Hz, 1H), 1.62-1.70 (m, 2H), 1.33-1.42 (m, 4H), 3.32 (t, J = 6.94 Hz, 1H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.19, 156.19, 140.18, 137.48, 127.66, 125.92, 125.83, 125.17, 124.48, 124.17, 123.00, 121.01, 116.86, 115.12, 109.52, 97.78, 42.58, 28.93, 26.70, 22.40, 14.36.

HRMS (ESI-TOF) calcd for $C_{21}H_{22}N_3O_2$ $[M + H]^+$: 348.1707; found: 348.1702.

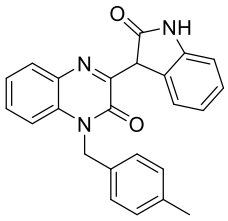


3-(2-oxoindolin-3-yl)-1-benzylquinoxalin-2-one (3ao) orange solid, mp: 293-295 ℃, 60.2 mg, 76% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.57 (s, 1H), 11.01 (s, 1H), 8.69 (d, J = 7.72 Hz, 1H), 7.34-7.36 (m, 4H), 7.22-7.30 (m, 3H), 7.16 (t, J = 6.98 Hz, 1H), 7.06-7.11 (m, 2H), 6.91-6.95 (m, 3H), 5.50 (s, 2H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.27, 157.00, 140.21, 137.63, 136.36, 129.18, 128.92, 127.86, 127.72, 127.13, 126.00, 125.40, 124.75, 123.99, 122.96, 121.09, 116.83, 115.74, 109.62, 98.28, 45.93.

HRMS (ESI-TOF) calcd for $C_{23}H_{18}N_3O_2$ $[M + H]^+$: 368.1394; found: 368.1392.

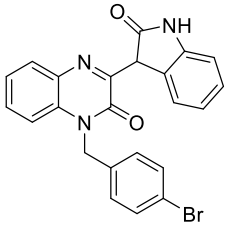


3-(2-oxoindolin-3-yl)-1-*p*-Methylphenylquinoxalin-2-one (3ap) orange solid, mp: 285-287 ℃, 38.6 mg, 47% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.57 (s, 1H), 10.99 (s, 1H), 8.70 (d, J = 7.95 Hz, 1H), 7.35 (dd, J = 1.37, 7.92 Hz, 1H), 7.24-7.26 (m, 3H), 7.14-7.16 (m, 3H), 7.06-7.10 (m, 2H), 6.91-6.95 (m, 2H), 5.46 (s, 2H), 2.26 (s, 3H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 170.95, 156.99, 140.41, 138.33, 131.28, 129.73, 127.82, 127.15, 124.74, 117.15, 110.18, 97.69, 15.66, 21.10.

HRMS (ESI-TOF) calcd for $C_{24}H_{20}N_3O_2$ $[M + H]^+$: 382.1550; found: 382.1552.

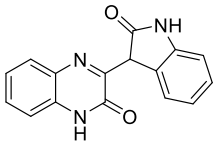


3-(2-oxoindolin-3-yl)-1-*p*-bromophenylquinoxalin-2-one (3aq) orange solid, mp: 300-301 ℃, 49.6 mg, 52% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.55 (s, 1H), 11.00 (s, 1H), 8.68 (d, J = 7.88 Hz, 1H), 7.54 (d, J = 8.32 Hz, 2H), 7.32-7.35 (m, 3H), 7.14-7.22 (m, 2H), 7.05-7.10 (m, 2H), 6.90-6.94 (m, 2H), 5.45 (s, 2H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.26, 157.04, 140.18, 137.63, 135.90, 132.02, 129.52, 127.75, 126.05, 125.98, 125.40, 124.80, 123.98, 122.93, 121.08, 120.80, 116.84, 115.61, 109.61, 98.30, 45.43.

HRMS (ESI-TOF) calcd for $C_{23}H_{17}BrN_3O_2$ $[M + H]^+$: 446.0499; found: 446.0451.



3-(2-oxoindolin-3-yl)-quinoxalin-2(1*H*)-one (3ar)[3] orange solid, mp: 408-410 ℃, 38.0 mg, 59% yield;

^{1}H NMR (400 MHz, DMSO-d_6): δ = 14.40 (s, 1H), 11.98 (s, 1H), 10.94 (s, 1H), 8.71 (dd, J = 1.12, 8.04 Hz, 1H), 7.27-7.30 (m, 1H), 7.10-7.16 (m, 3H), 7.06 (dt, J = 1.28, 7.56 Hz, 1H), 6.89-6.96 (m, 2H);

^{13}C NMR (100 MHz, DMSO-d_6): δ = 172.11, 157.10, 141.48, 137.48, 127.89, 127.33, 125.96, 125.19, 124.27, 124.01, 123.07, 121.03, 116.20, 115.42, 109.52, 97.96.

HRMS (ESI-TOF) calcd for $C_{16}H_{12}N_3O_2$ $[M + H]^+$: 278.0924; found: 278.0919.

7. Reference

[1] W. L. F. Armarego, C. Chai, in *Purification of Laboratory Chemicals (Seventh Edition)*, Butterworth-Heinemann, Boston, **2013**, pp. 103-554.

[2] J. Zhou, Q. Ren, N. Xu, C. Wang, S. Song, Z. Chen, J. Li, *Green Chem.* **2021**, *23*, 5753-5758.

[3] Y.-Y. Han, Z.-J. Wu, X.-M. Zhang, W.-C. Yuan, *Tetrahedron Lett.* **2010**, *51*, 2023-2028.

8. Copies of 1H NMR and 13C NMR Spectra

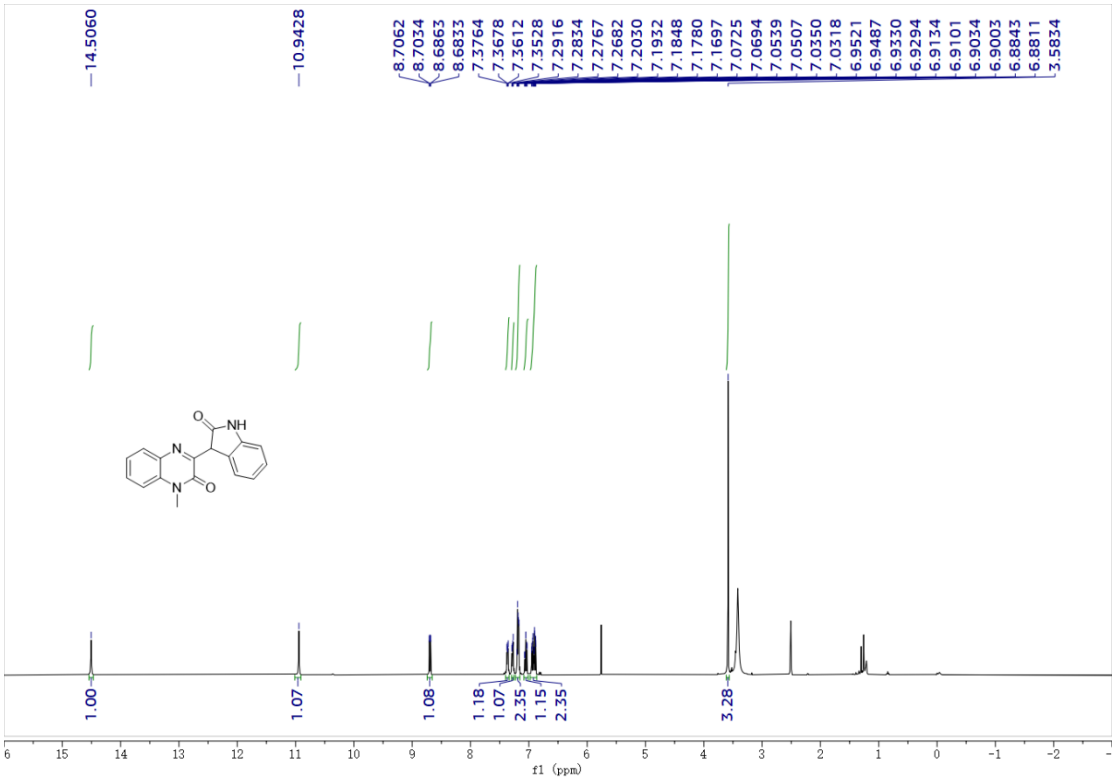


Figure S1 The ^{1}H NMR Spectrum of Compound **3a** in DMSO-d_6

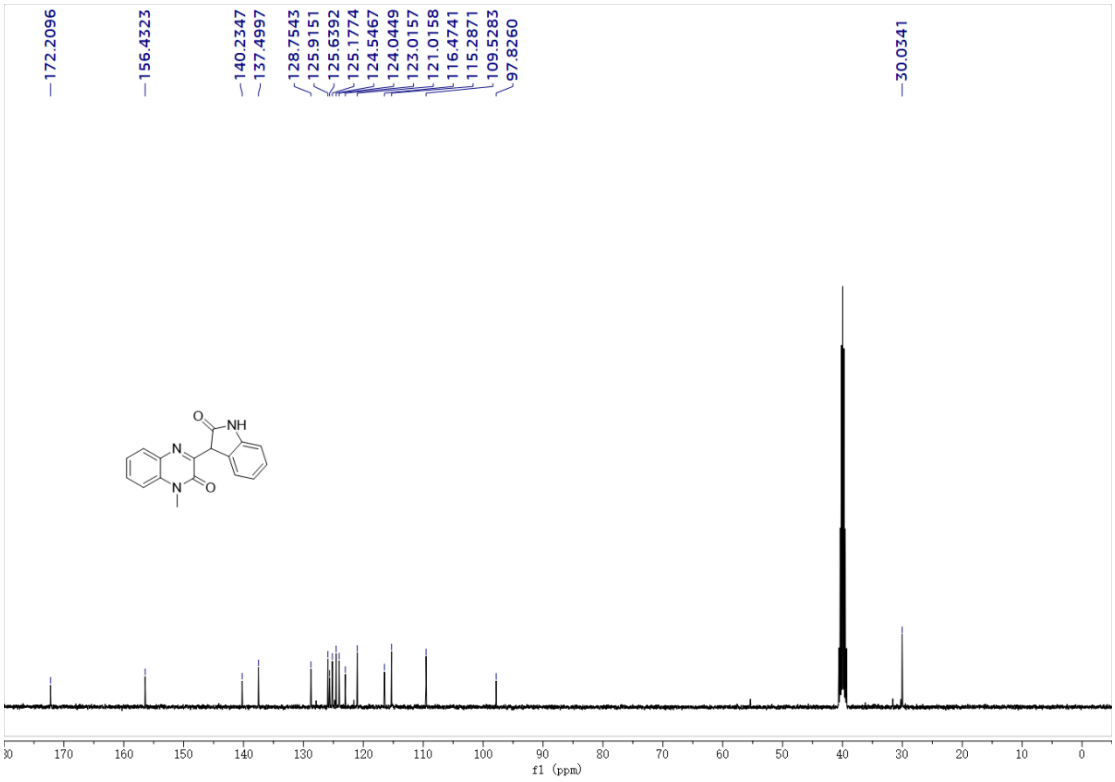


Figure S2 The ^{13}C NMR Spectrum of Compound **3a** in DMSO-d_6

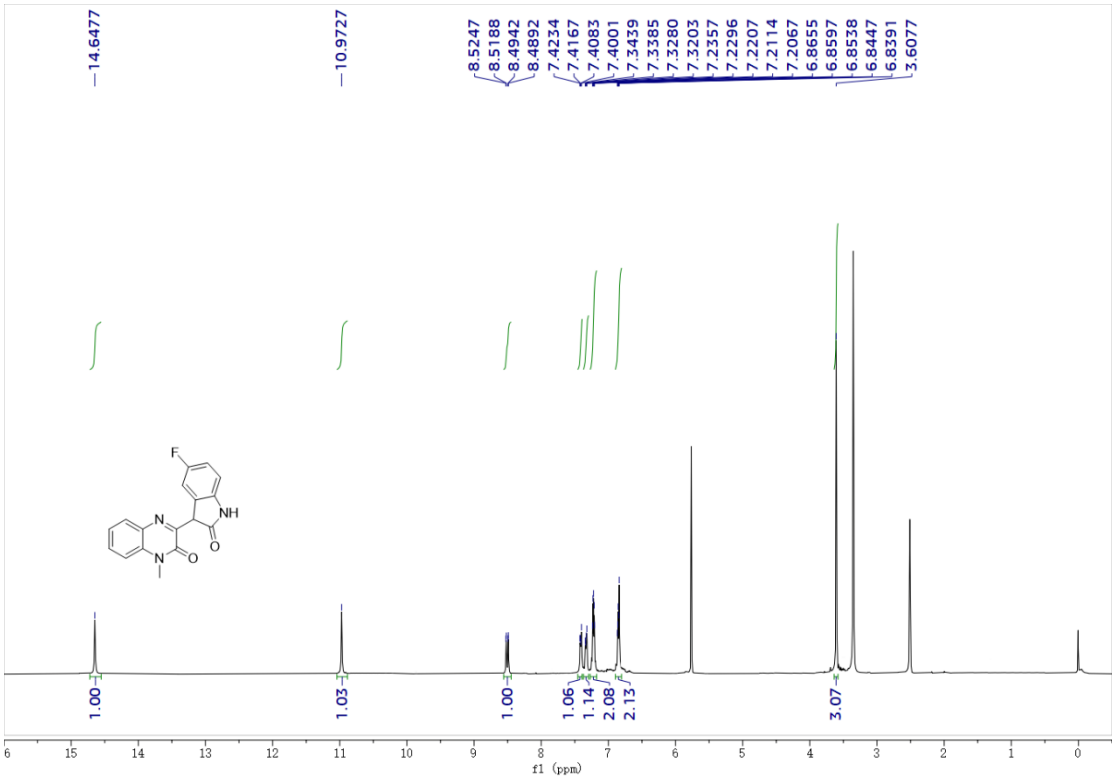


Figure S3 The ^{1}H NMR Spectrum of Compound **3b** in DMSO-d_6

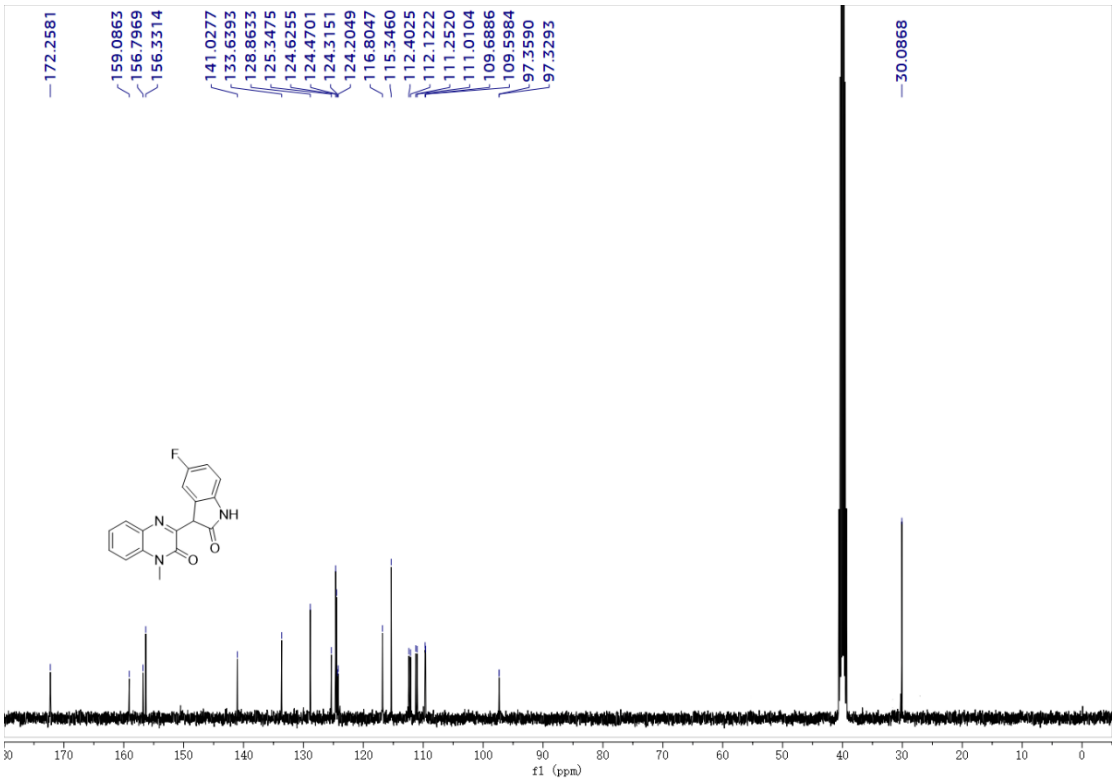


Figure S4 The ^{13}C NMR Spectrum of Compound **3b** in DMSO-d_6

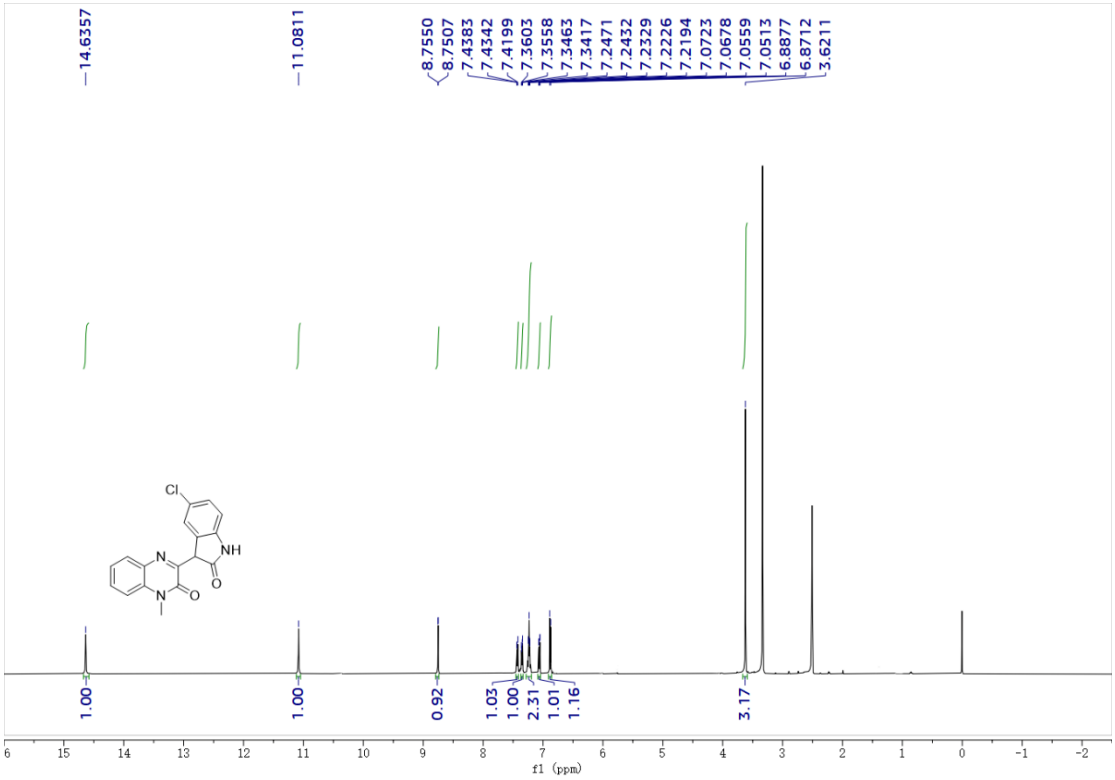


Figure S5 The ^{1}H NMR Spectrum of Compound **3c** in DMSO-d_6

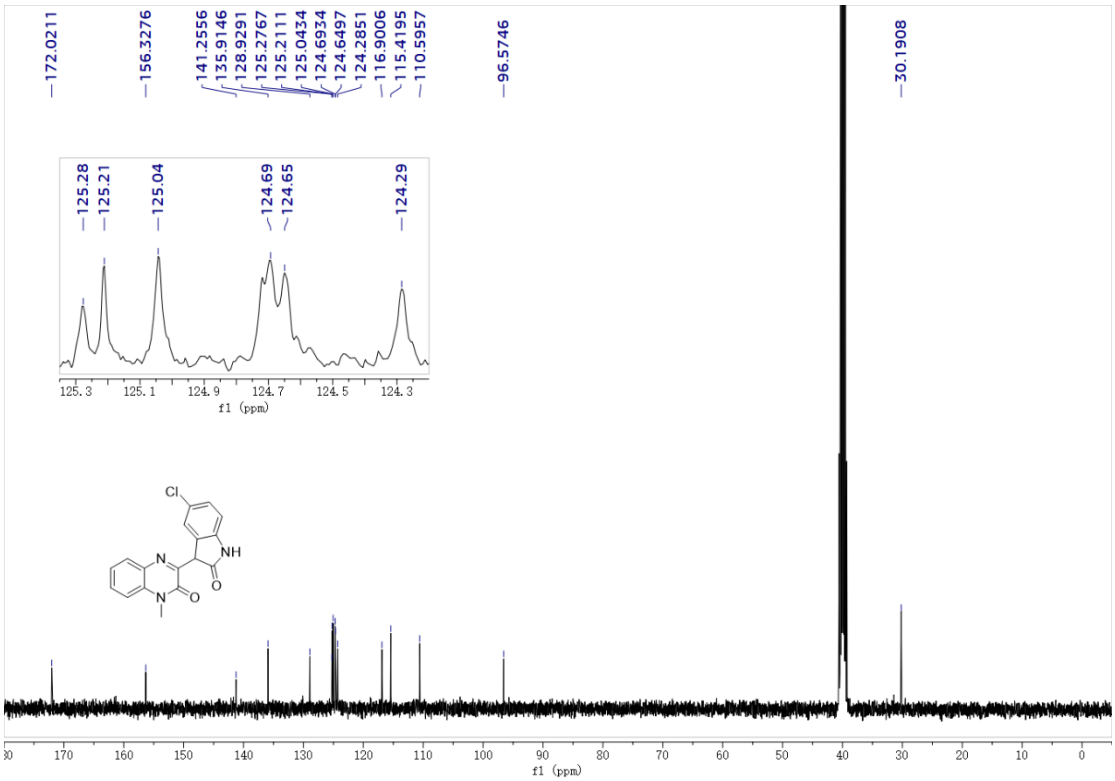


Figure S6 The ^{13}C NMR Spectrum of Compound **3c** in DMSO-d_6

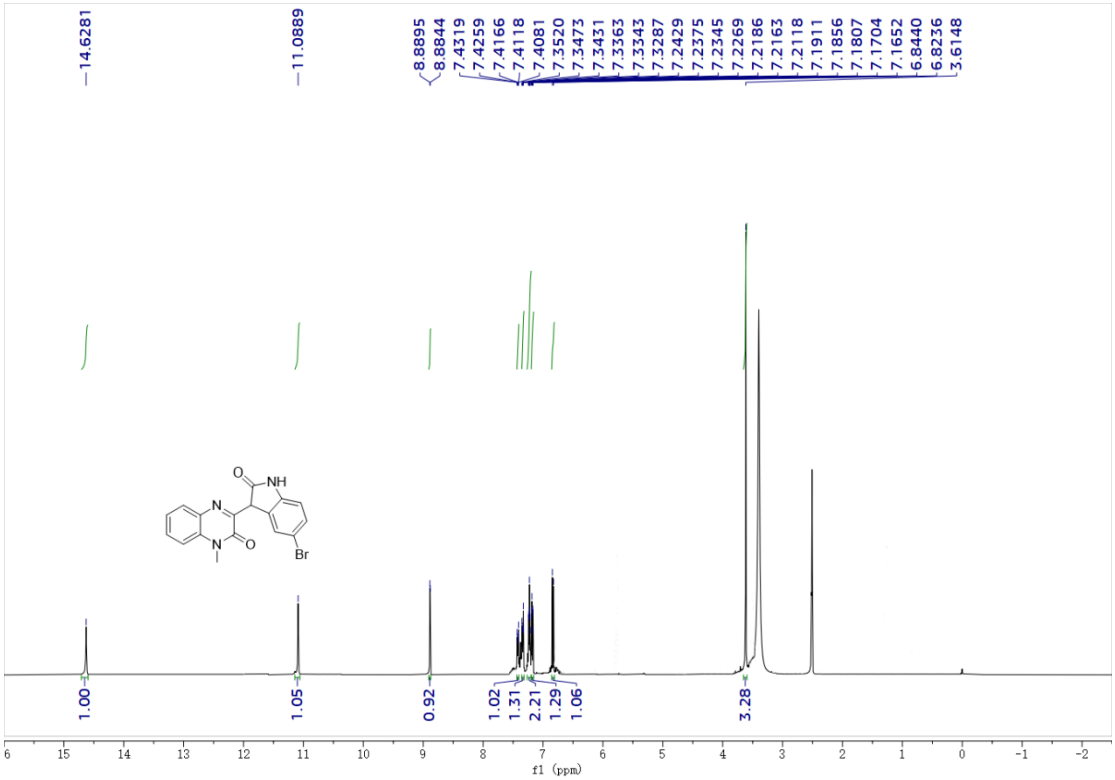


Figure S7 The ^{1}H NMR Spectrum of Compound **3d** in DMSO-d_6

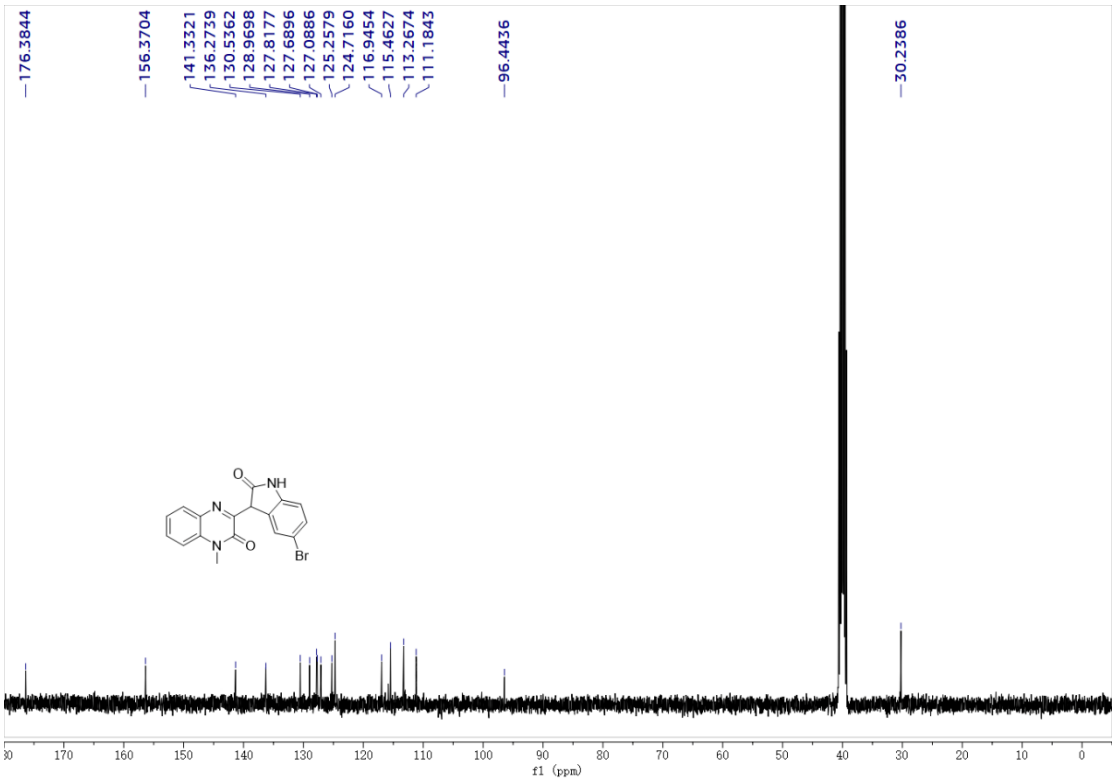


Figure S8 The ^{13}C NMR Spectrum of Compound **3d** in DMSO-d_6

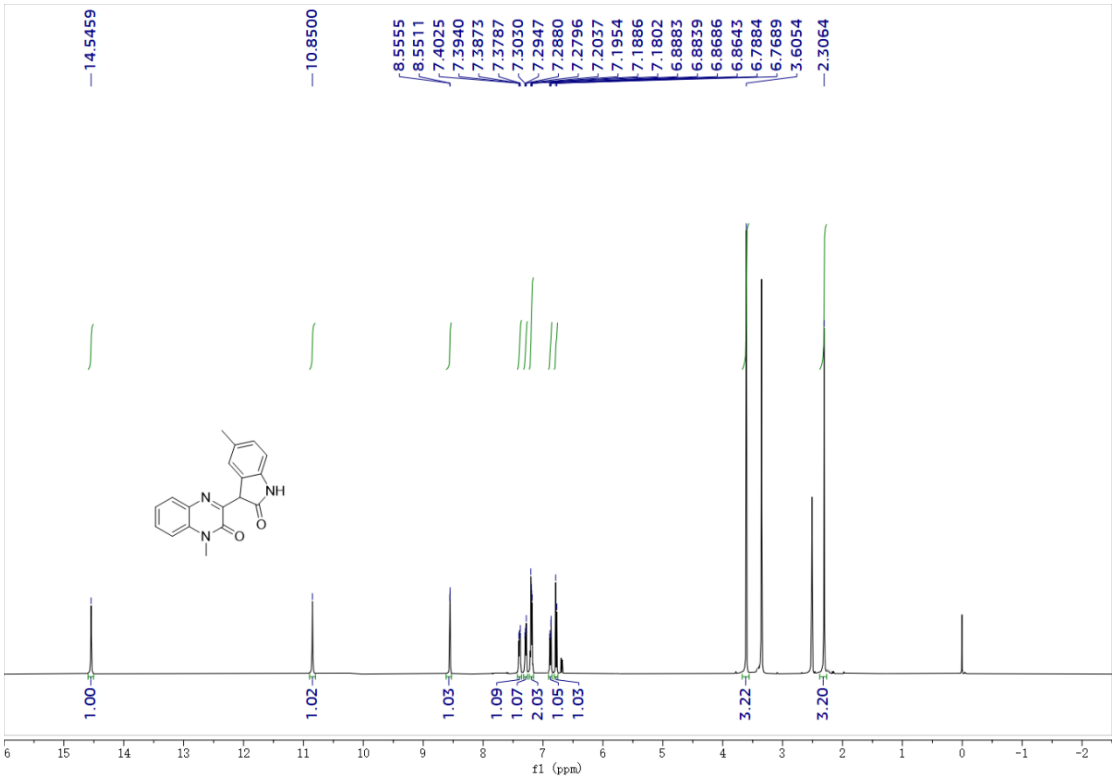


Figure S9 The ^{1}H NMR Spectrum of Compound **3e** in DMSO-d_6

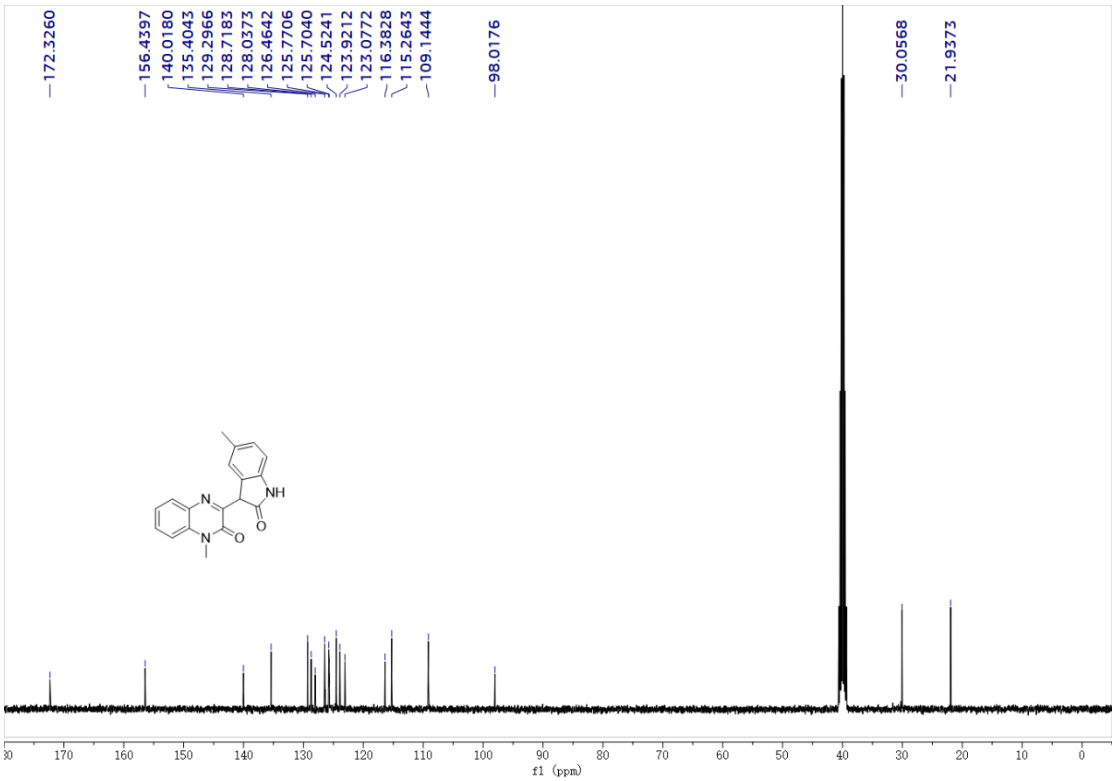


Figure S10 The ^{13}C NMR Spectrum of Compound **3e** in DMSO-d_6

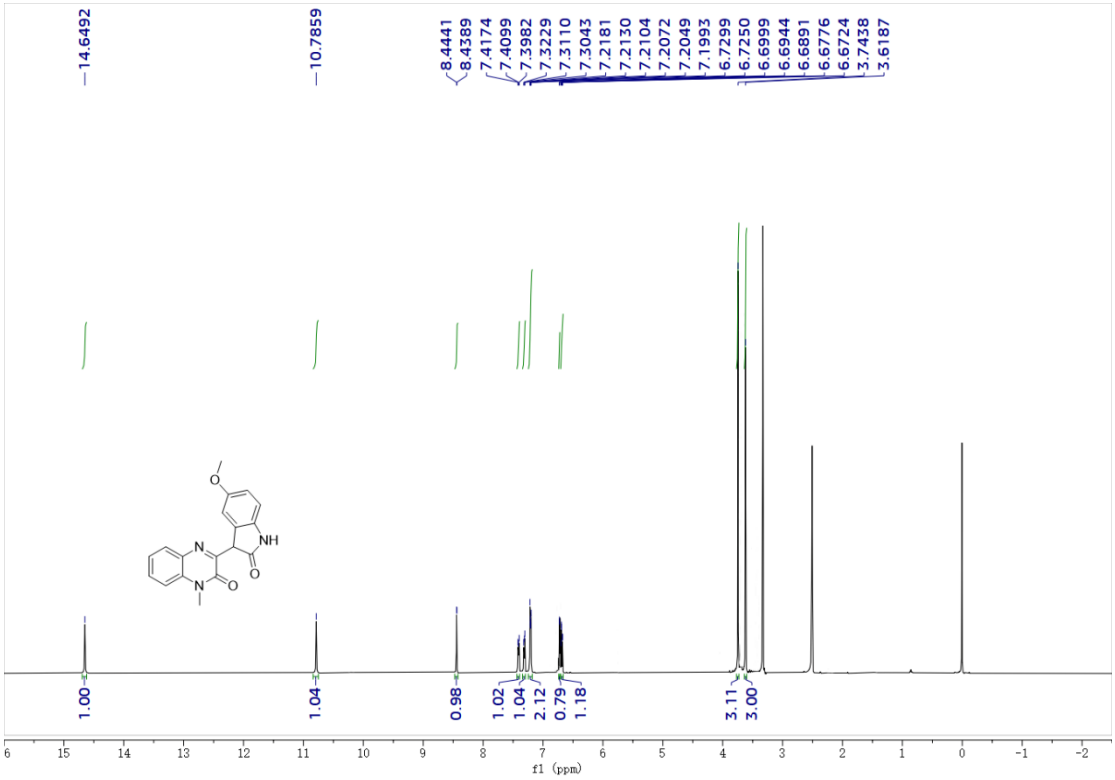


Figure S11 The ^{1}H NMR Spectrum of Compound **3f** in DMSO-d_6

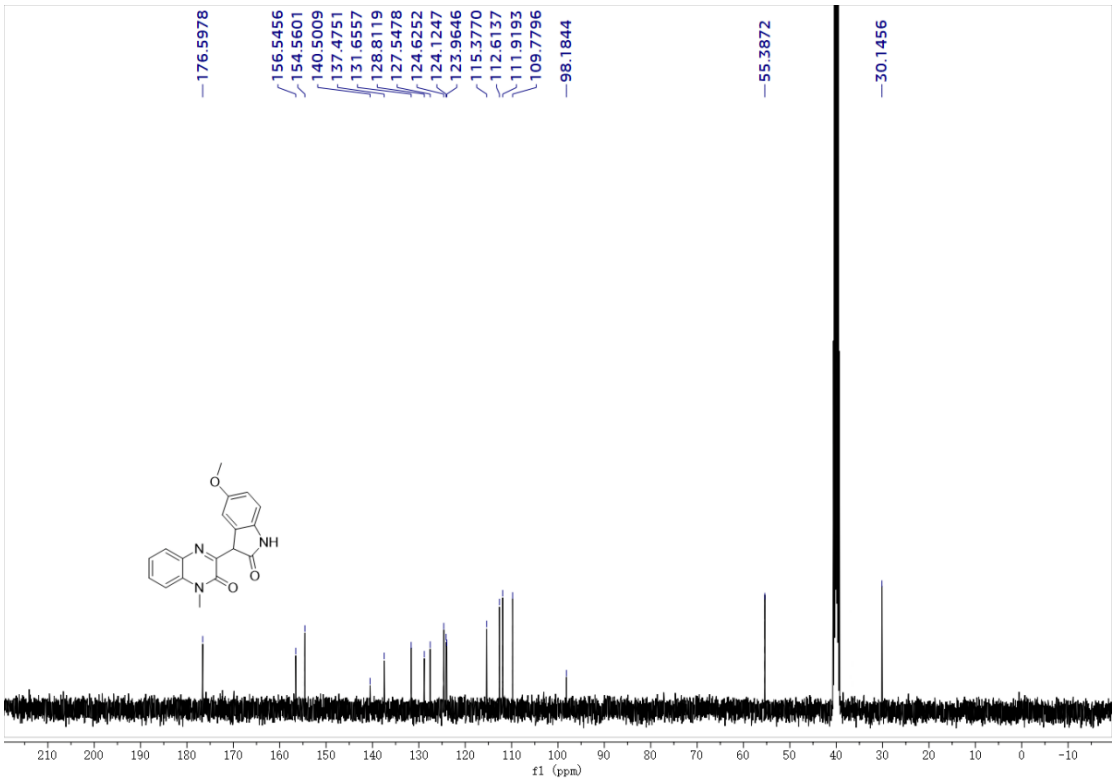


Figure S12 The ^{13}C NMR Spectrum of Compound **3f** in DMSO-d_6

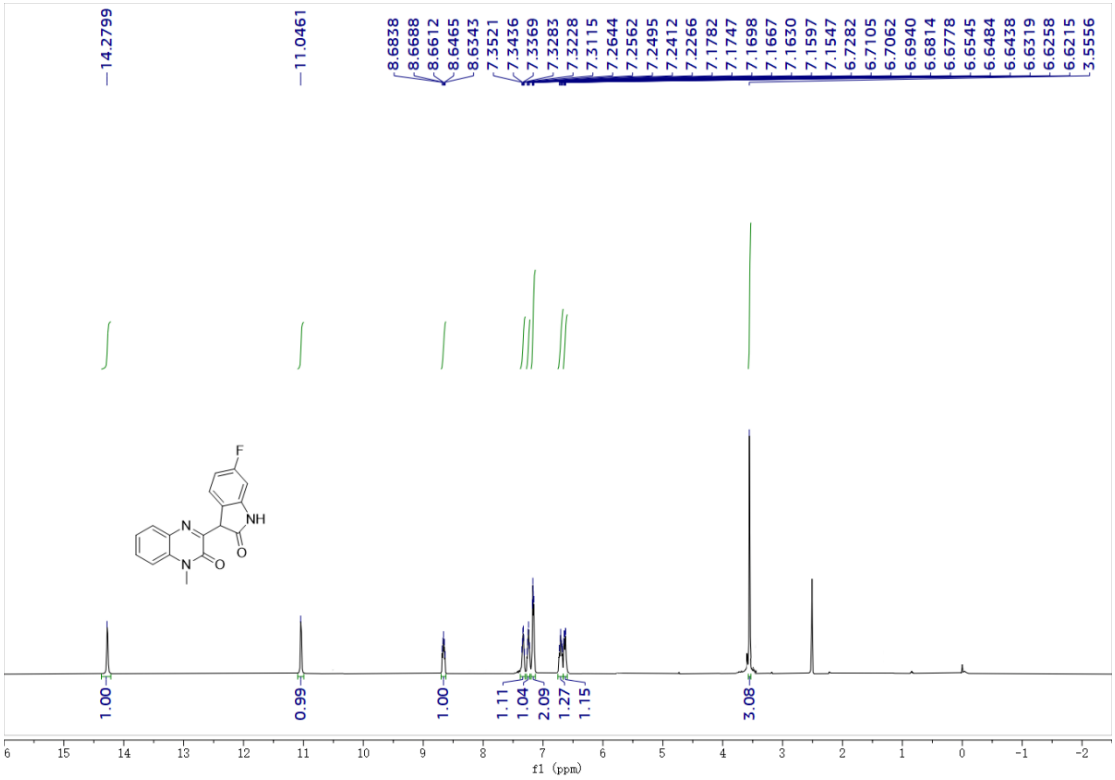


Figure S13 The ^{1}H NMR Spectrum of Compound **3g** in DMSO-d_6

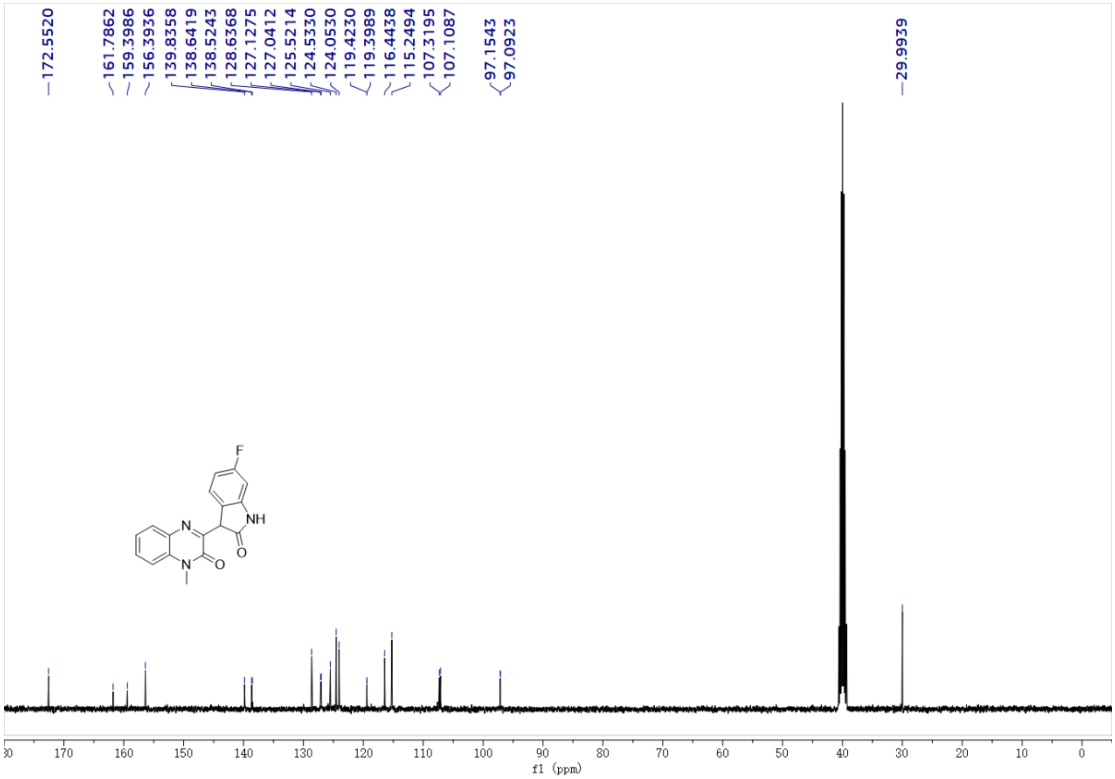


Figure S14 The ^{13}C NMR Spectrum of Compound **3g** in DMSO-d_6

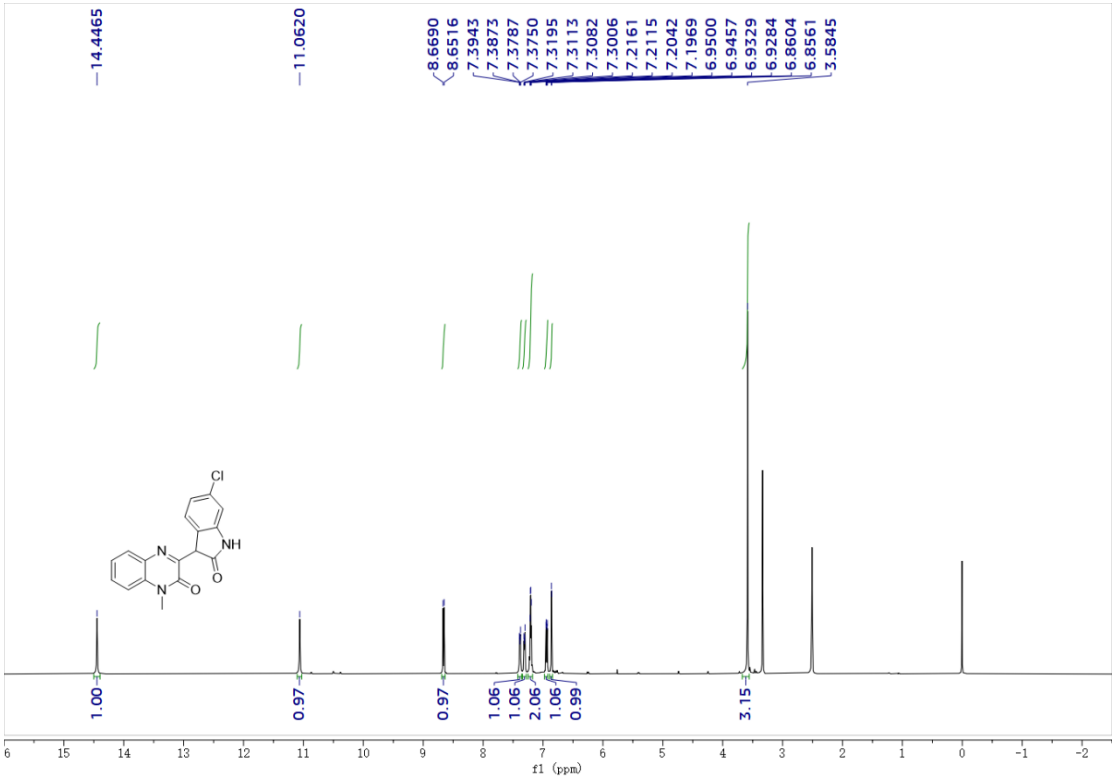


Figure S15 The ^{1}H NMR Spectrum of Compound **3h** in DMSO-d_6

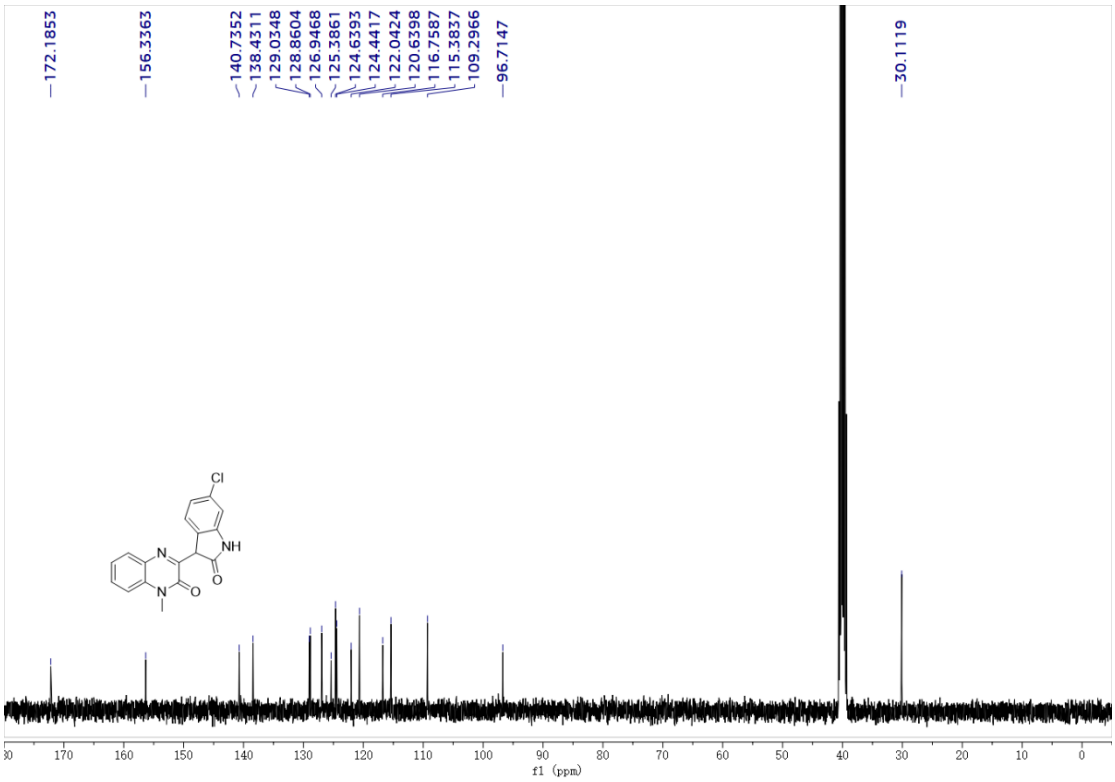


Figure S16 The ^{13}C NMR Spectrum of Compound **3h** in DMSO-d_6

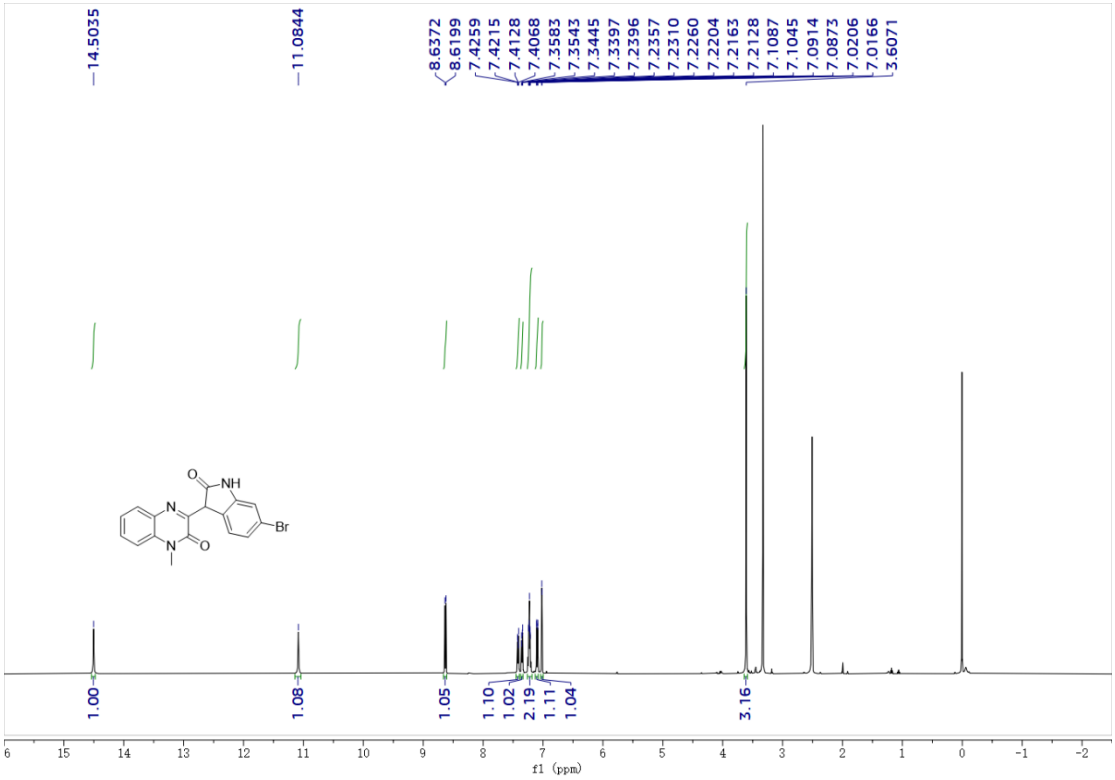


Figure S17 The ^{1}H NMR Spectrum of Compound **3i** in DMSO-d_6

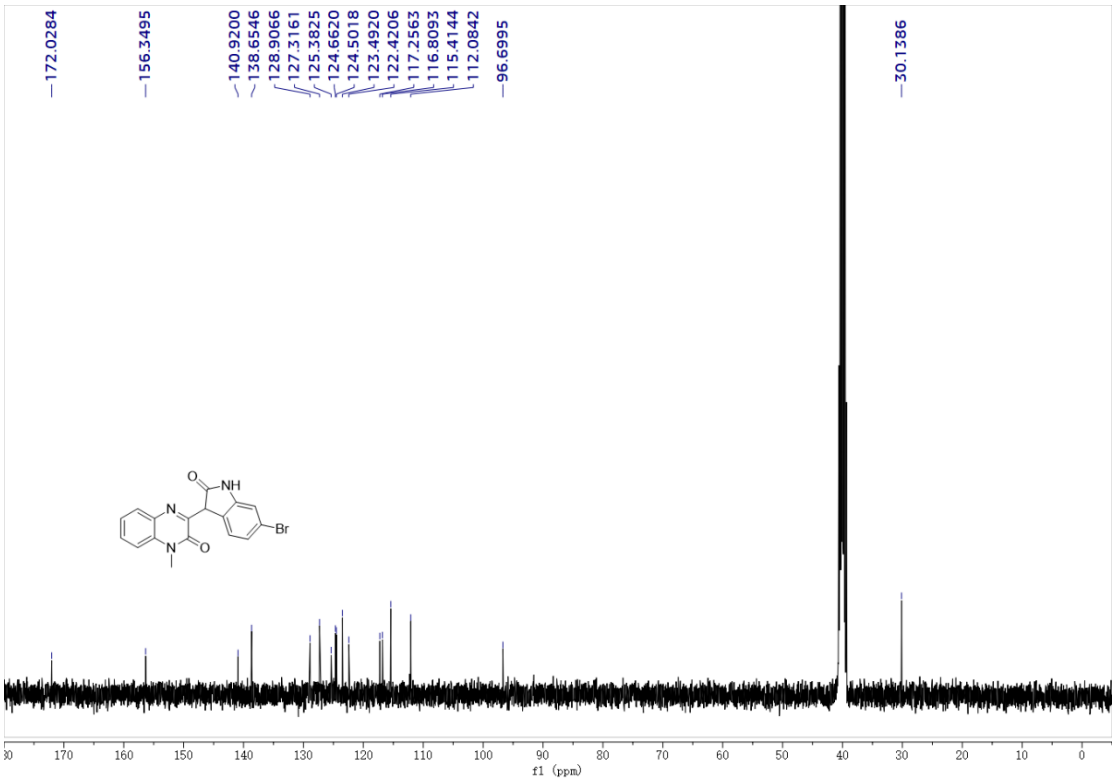


Figure S18 The ^{13}C NMR Spectrum of Compound **3i** in DMSO-d_6

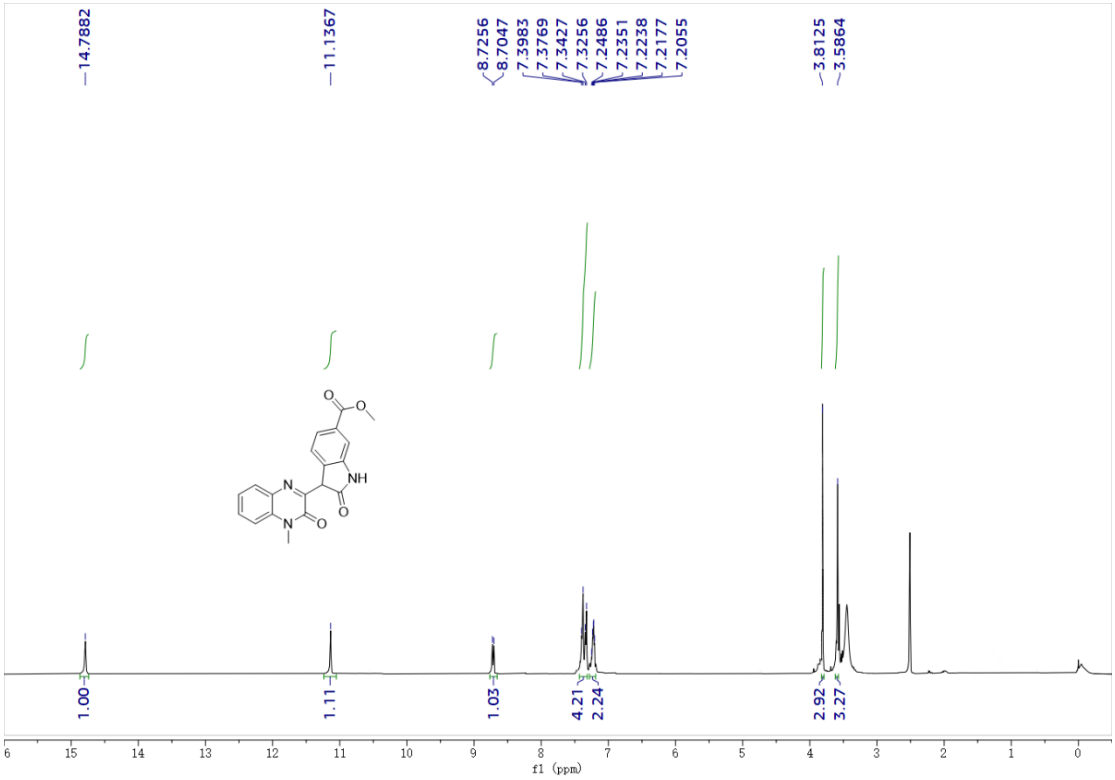


Figure S19 The ^{1}H NMR Spectrum of Compound **3j** in DMSO-d_6

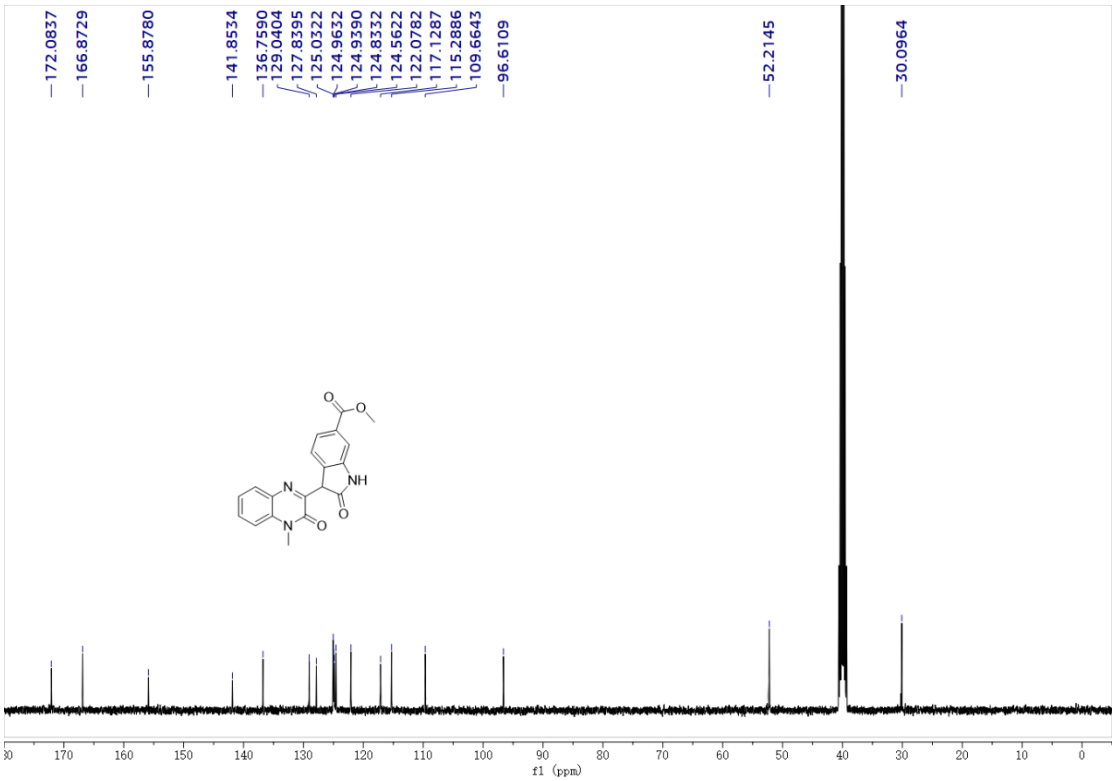


Figure S20 The ^{13}C NMR Spectrum of Compound **3j** in DMSO-d_6

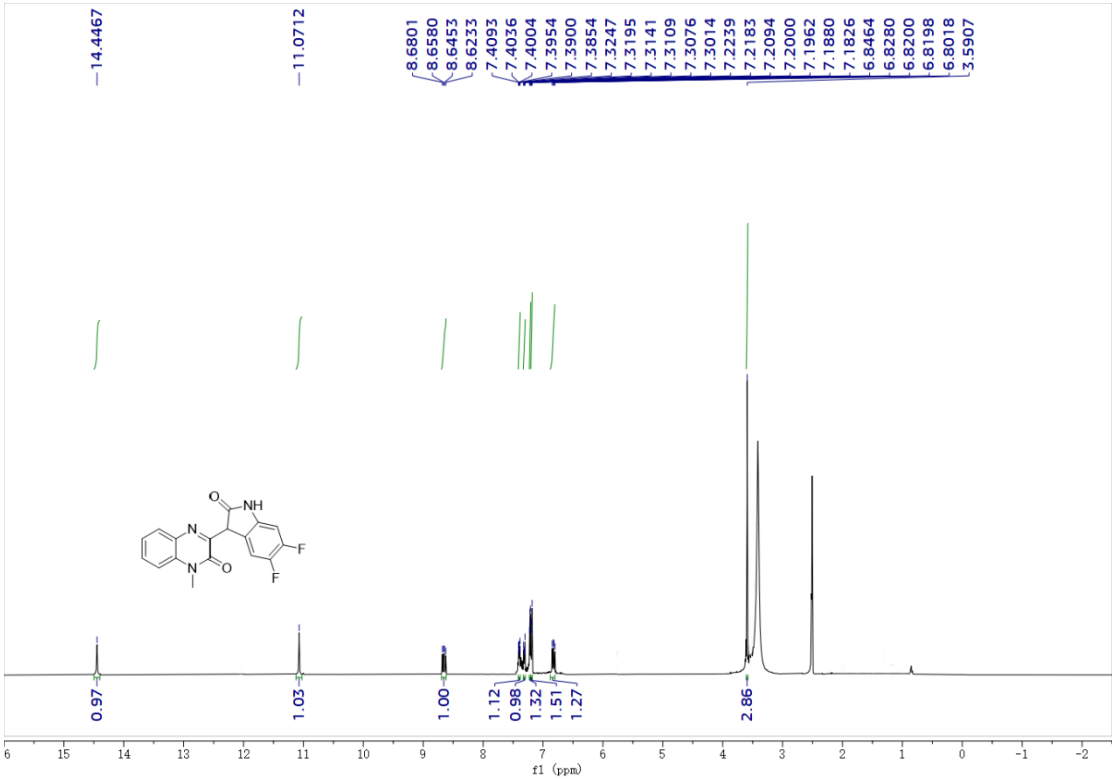


Figure S21 The ^{1}H NMR Spectrum of Compound **3k** in DMSO-d_6

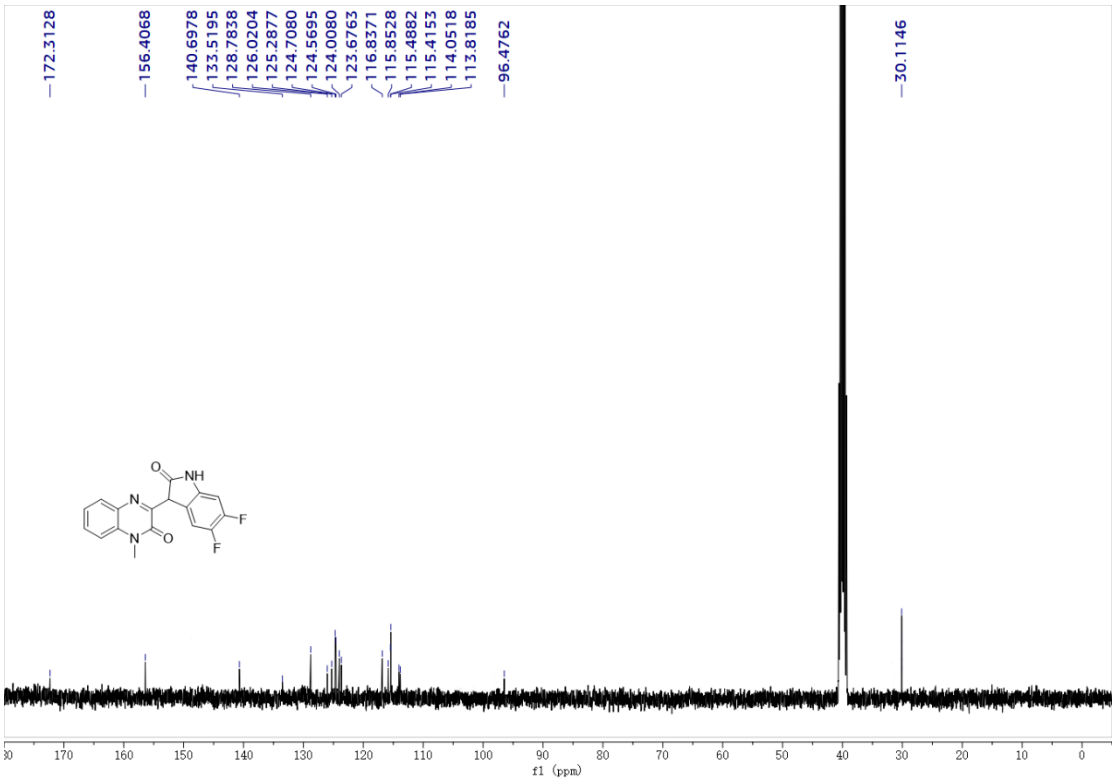


Figure S22 The ^{13}C NMR Spectrum of Compound **3k** in DMSO-d_6

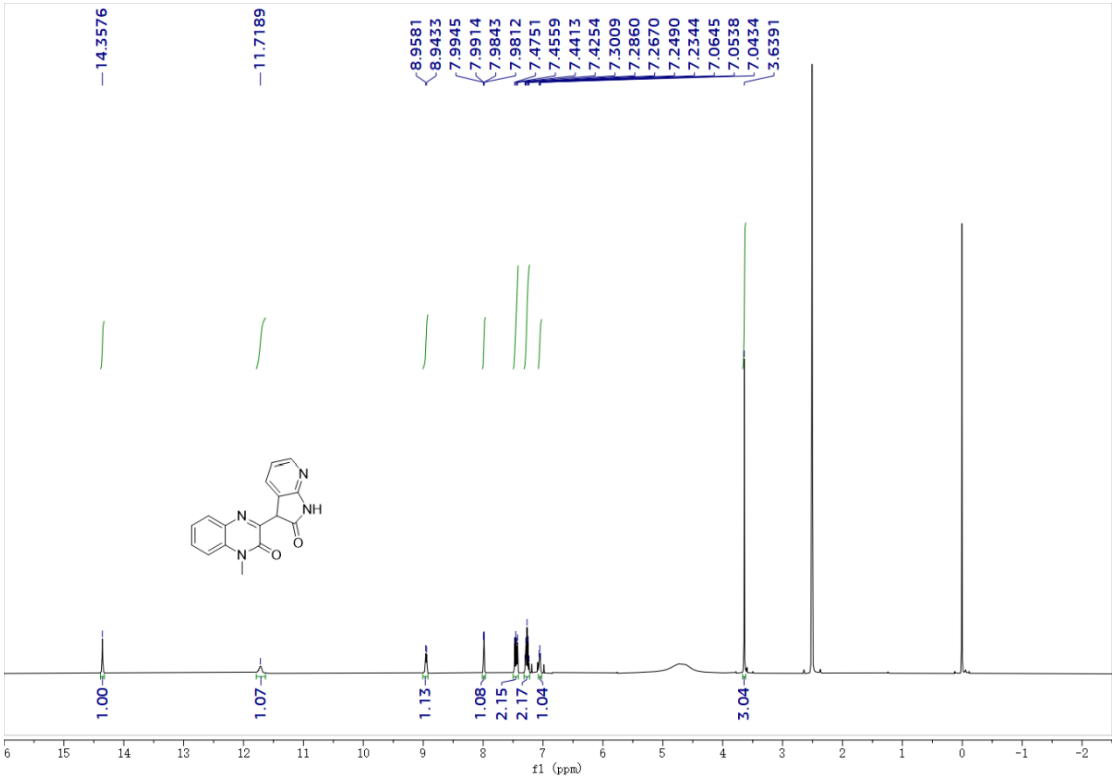


Figure S23 The ^{1}H NMR Spectrum of Compound **3l** in DMSO-d_6

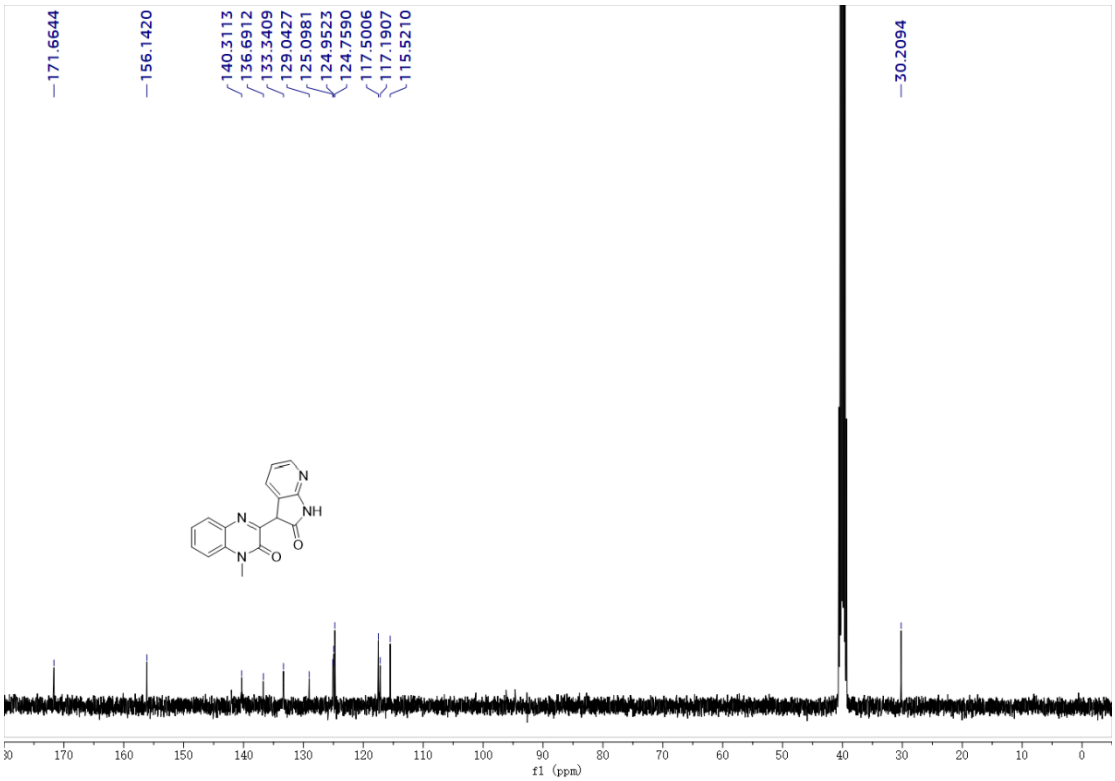


Figure S24 The ^{13}C NMR Spectrum of Compound **3l** in DMSO-d_6

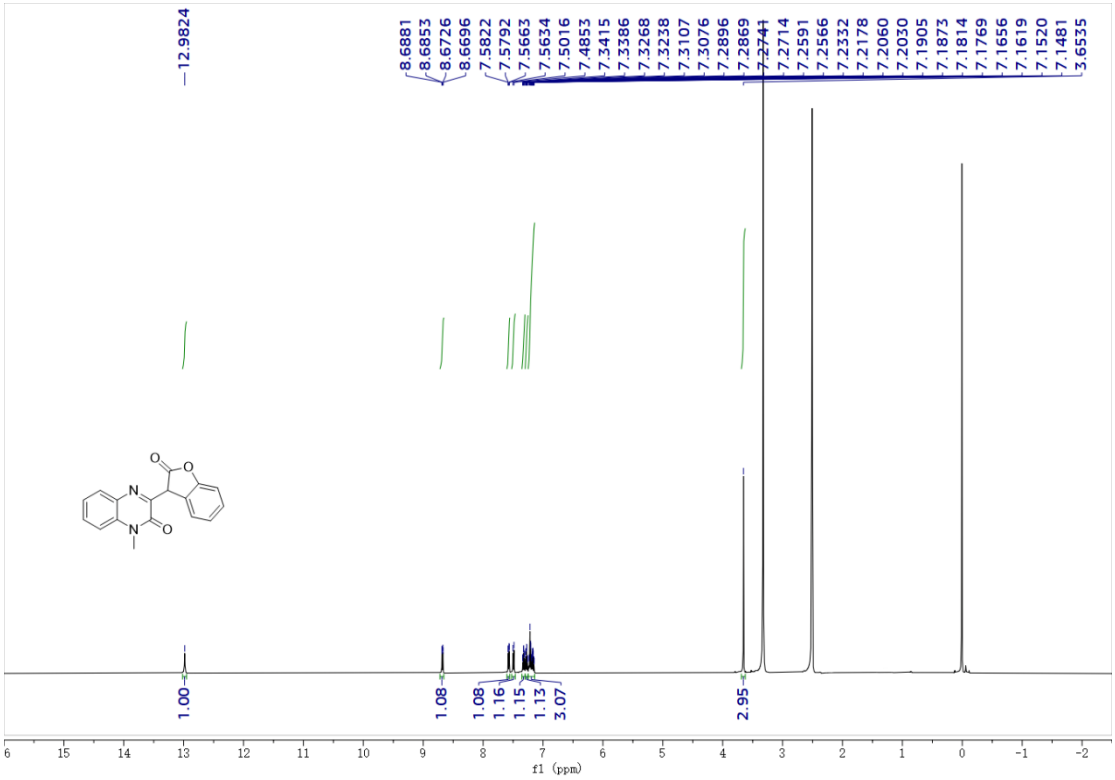


Figure S25 The ^{1}H NMR Spectrum of Compound **3m** in DMSO-d_6

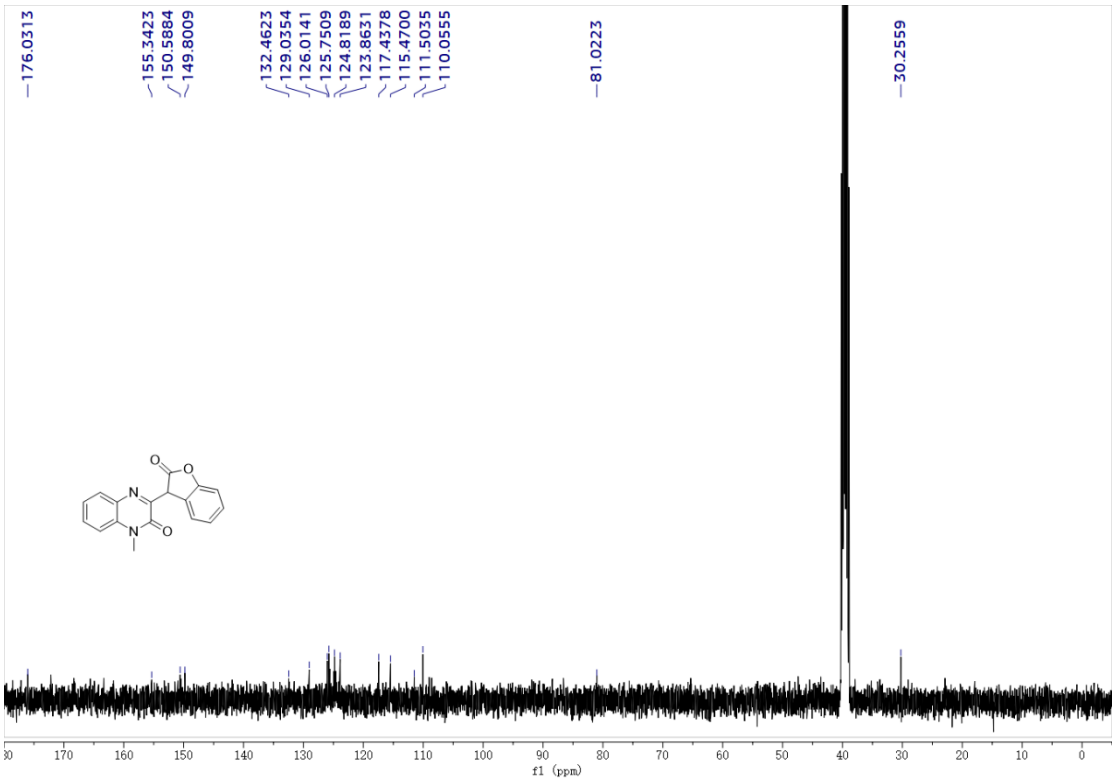


Figure S26 The ^{13}C NMR Spectrum of Compound **3m** in DMSO-d_6

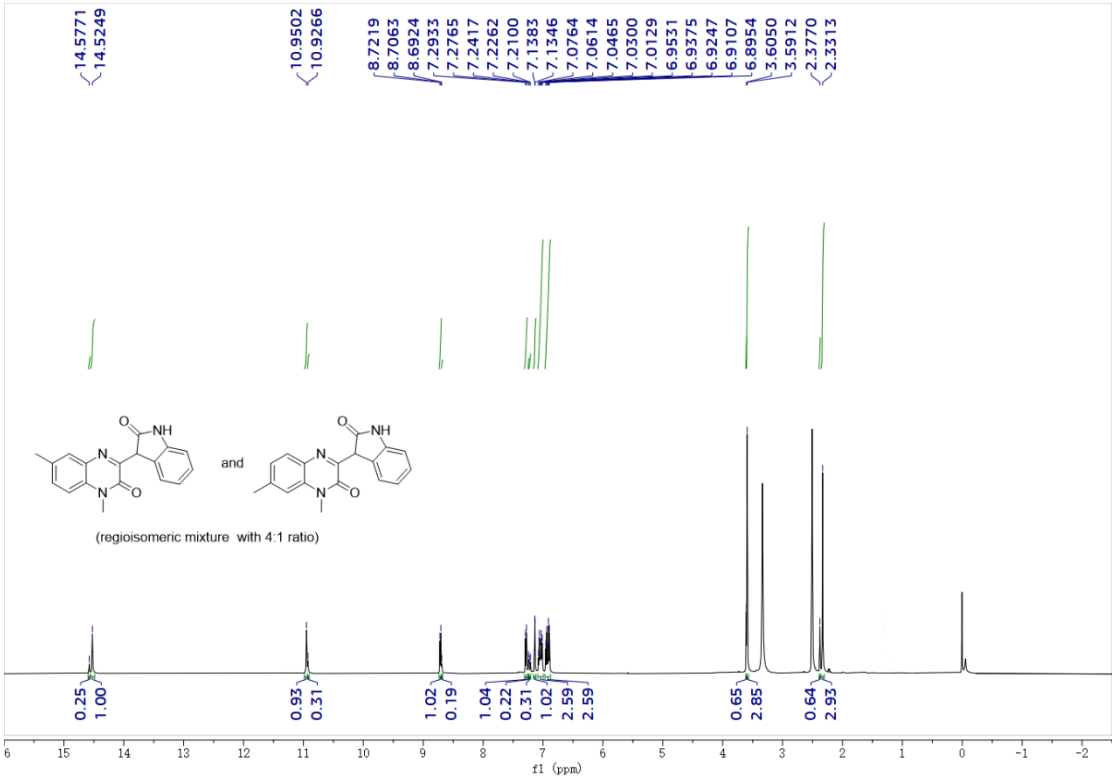


Figure S27 The ^{1}H NMR Spectrum of Compound **3ab** in DMSO-d_6

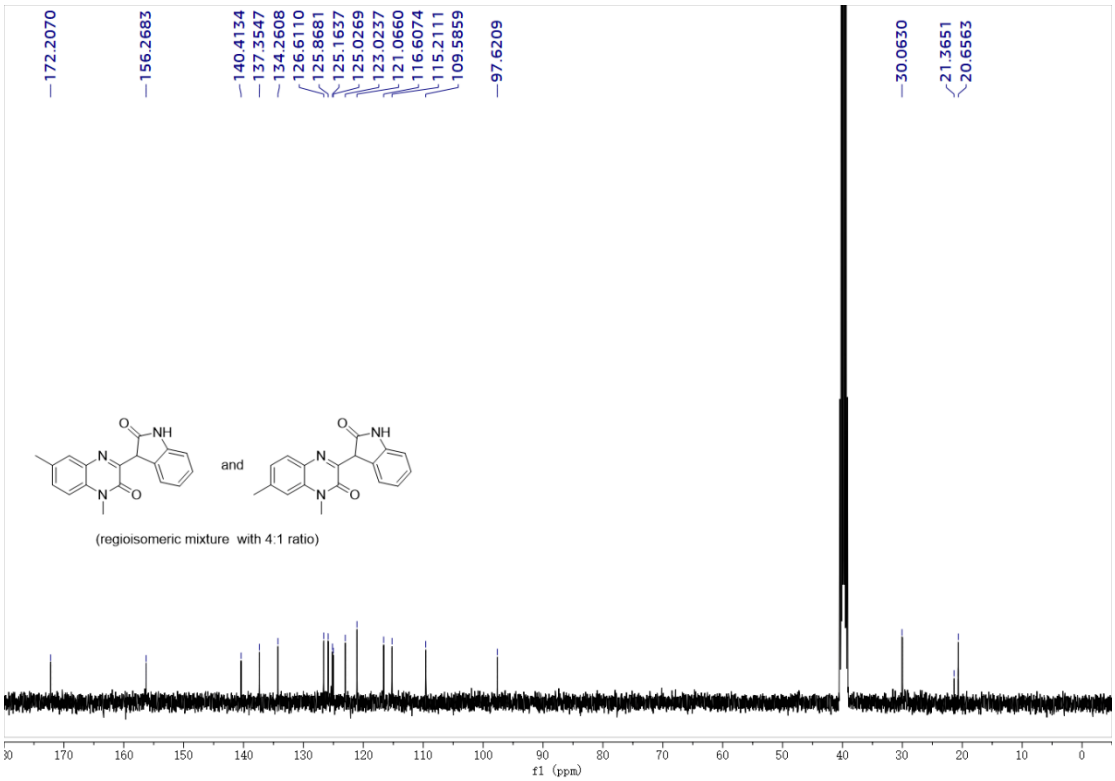


Figure S28 The ^{13}C NMR Spectrum of Compound **3ab** in DMSO-d_6

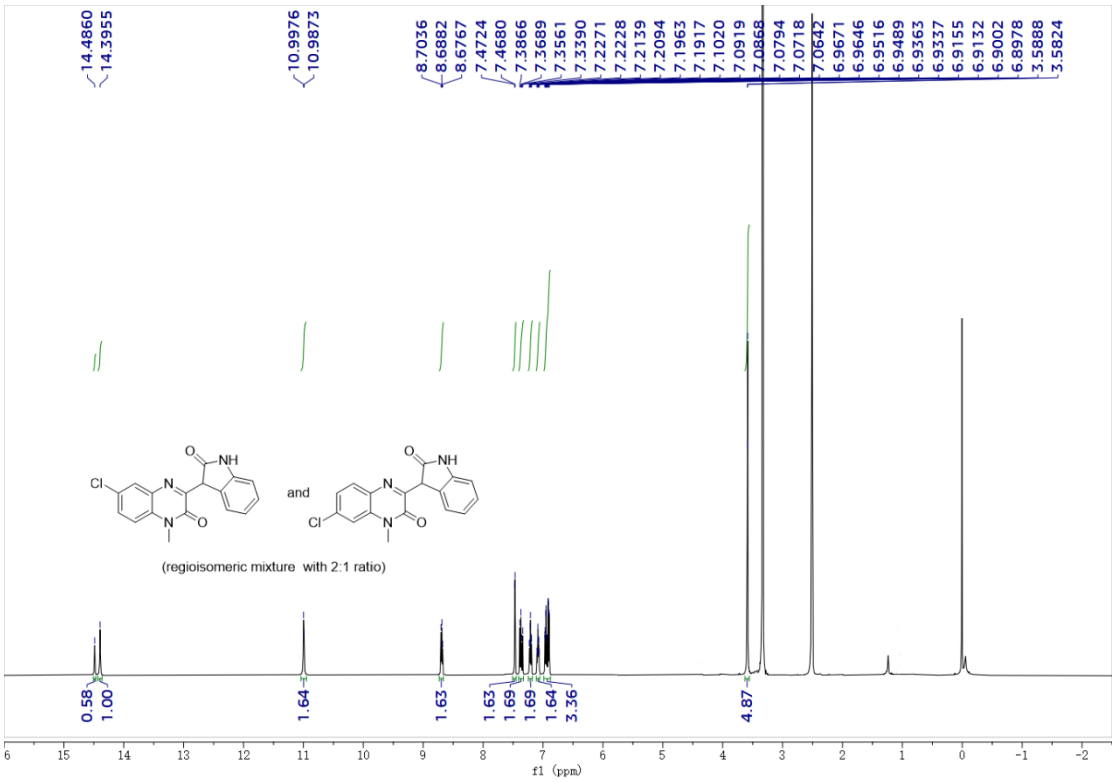


Figure S29 The ^{1}H NMR Spectrum of Compound **3ac** in DMSO-d_6

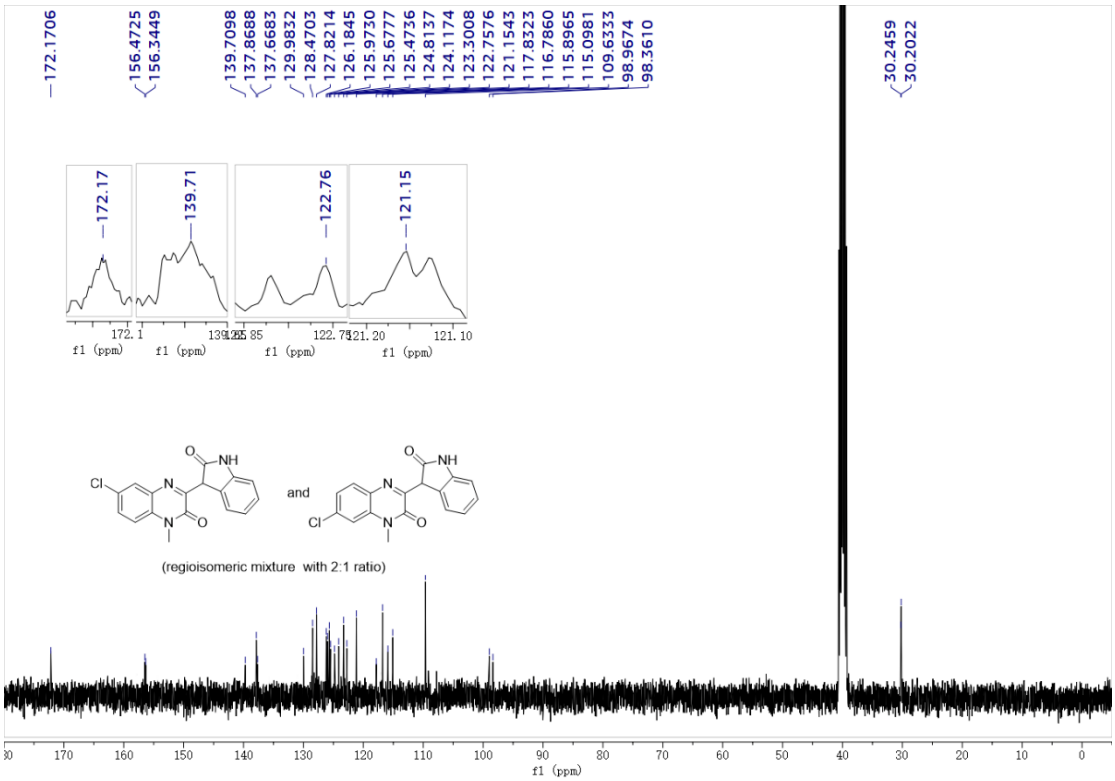


Figure S30 The ^{13}C NMR Spectrum of Compound **3ac** in DMSO-d_6

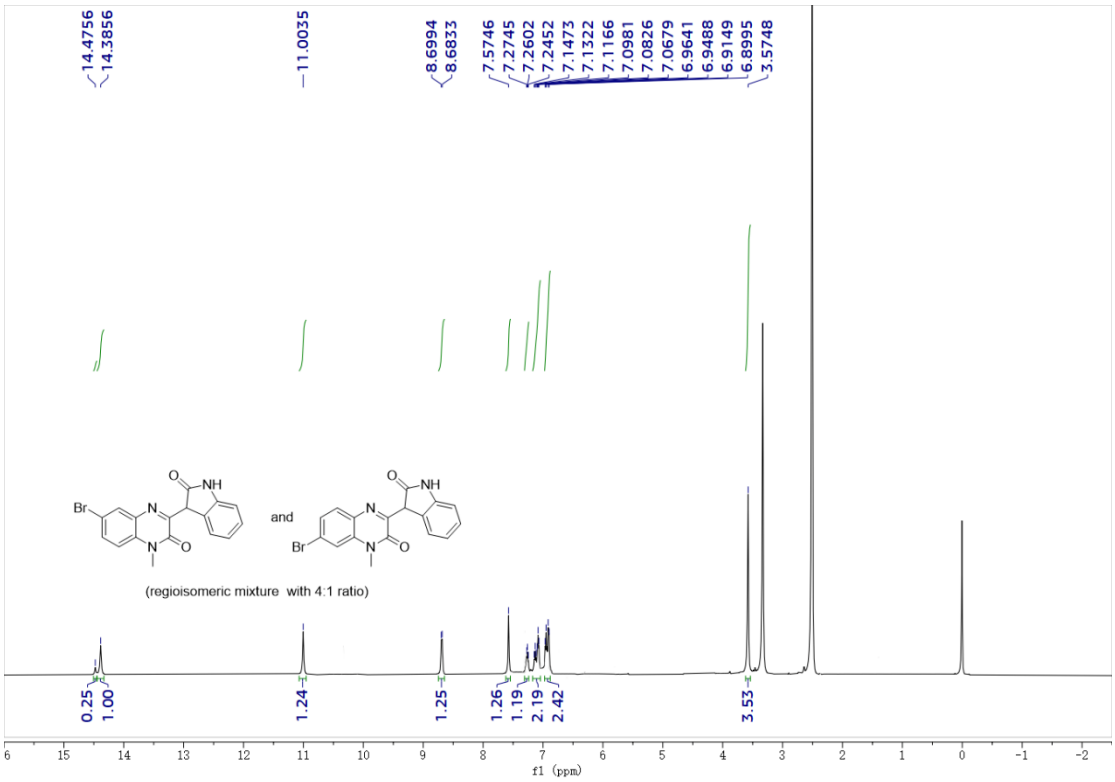


Figure S31 The ^{1}H NMR Spectrum of Compound **3ad** in DMSO-d_6

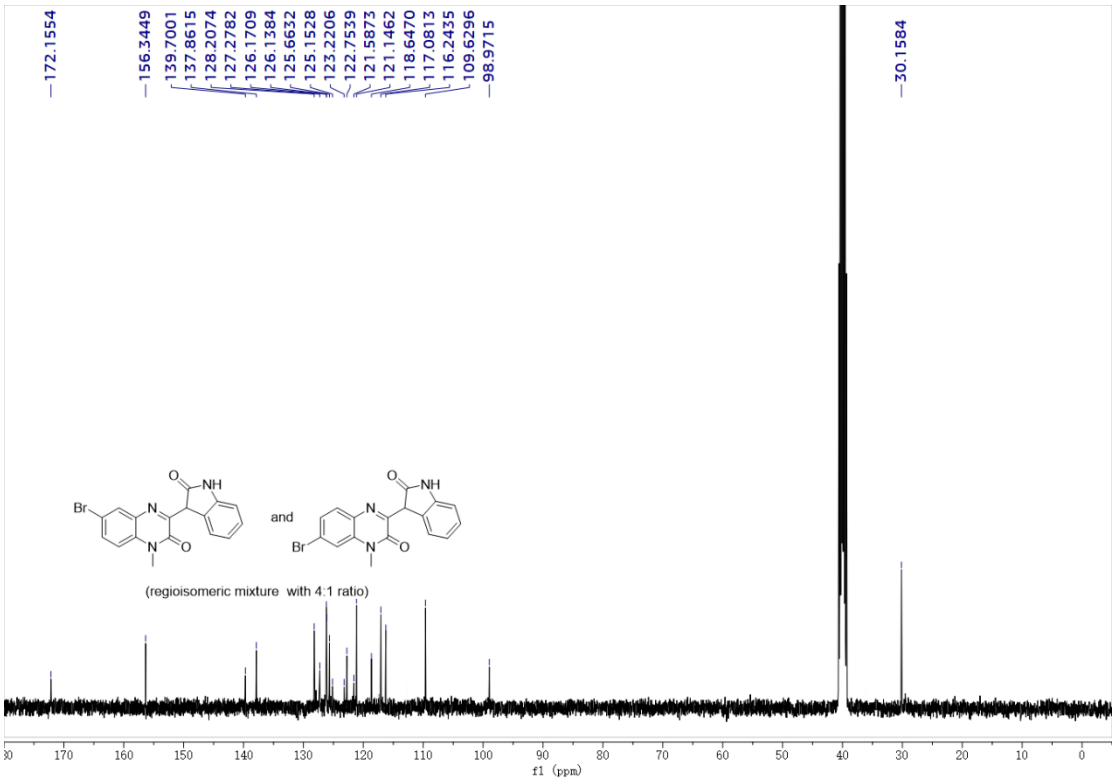


Figure S32 The ^{13}C NMR Spectrum of Compound **3ad** in DMSO-d_6

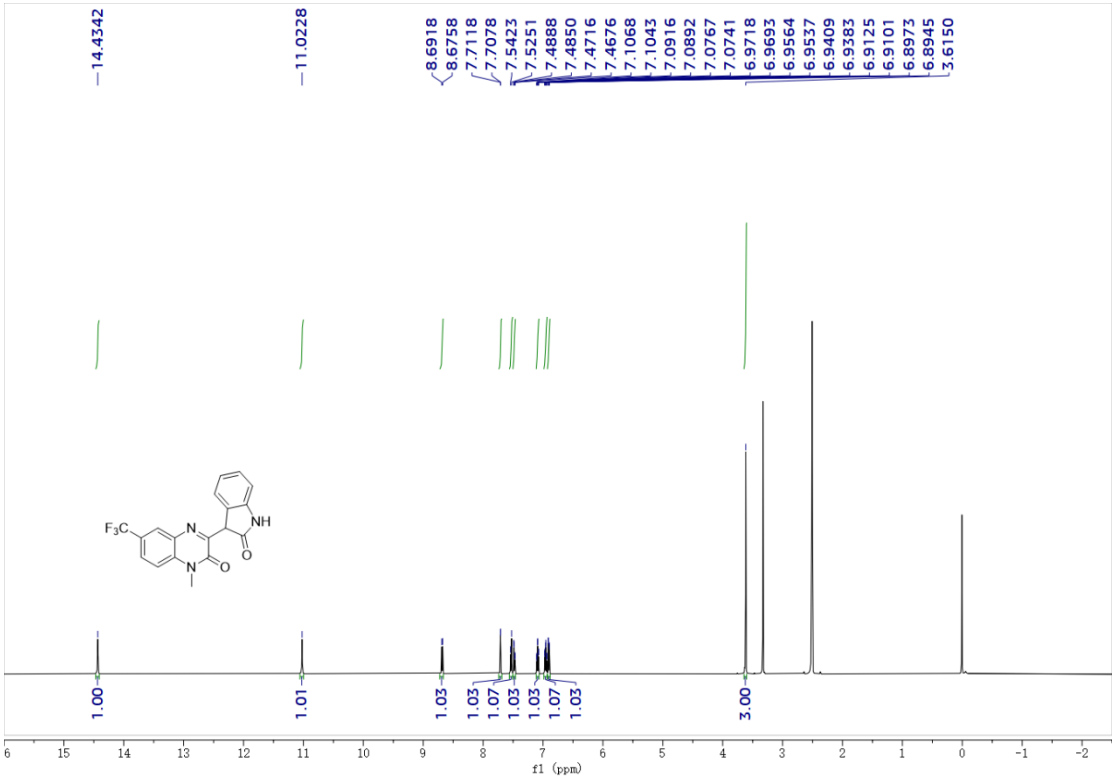


Figure S33 The ^{1}H NMR Spectrum of Compound **3ae** in DMSO-d_6

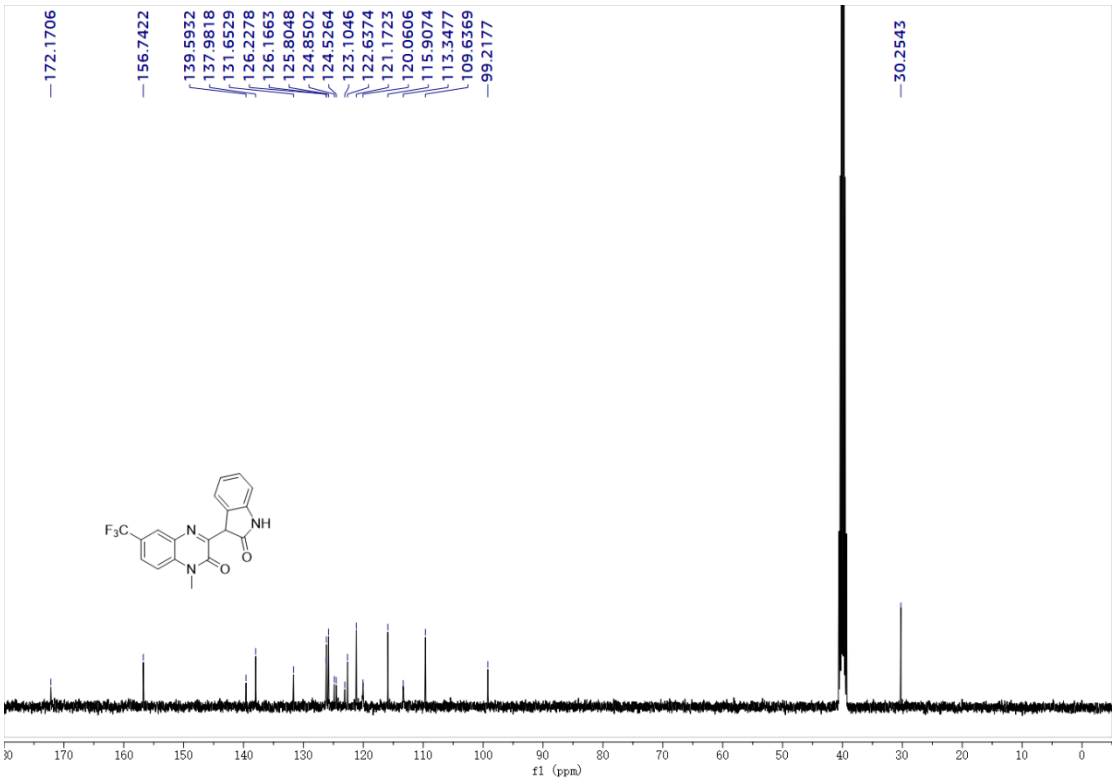


Figure S34 The ^{13}C NMR Spectrum of Compound **3ae** in DMSO-d_6

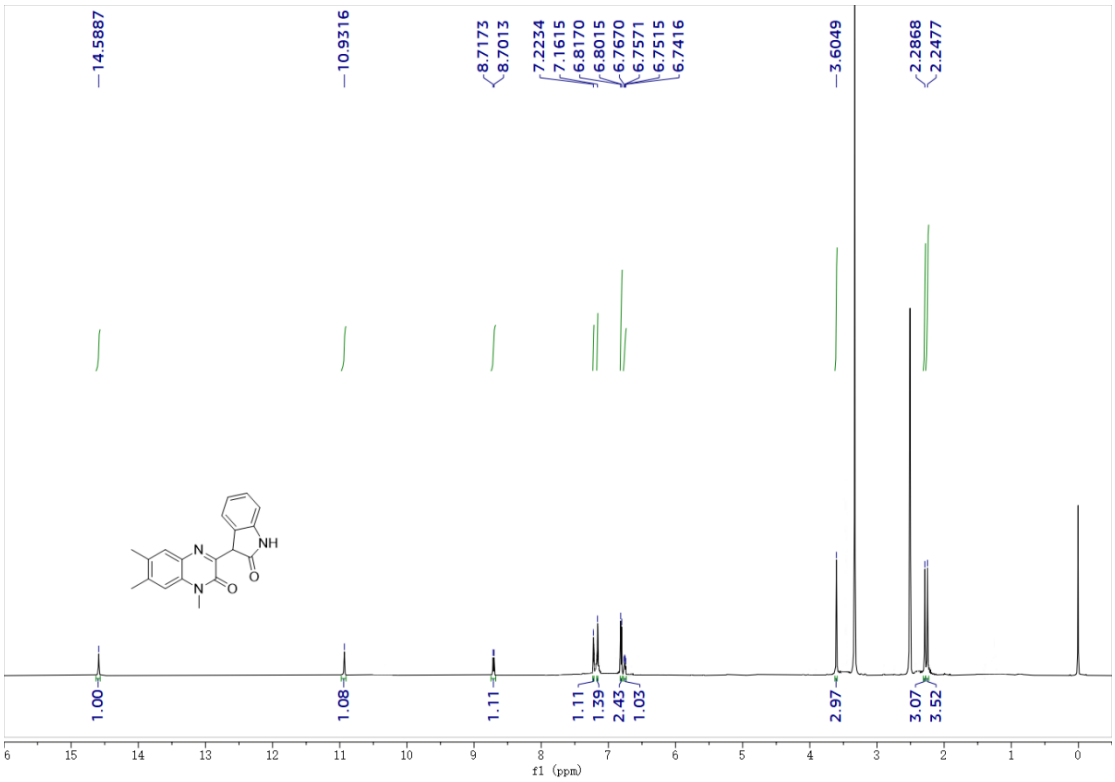


Figure S35 The ^{1}H NMR Spectrum of Compound **3af** in DMSO-d_6

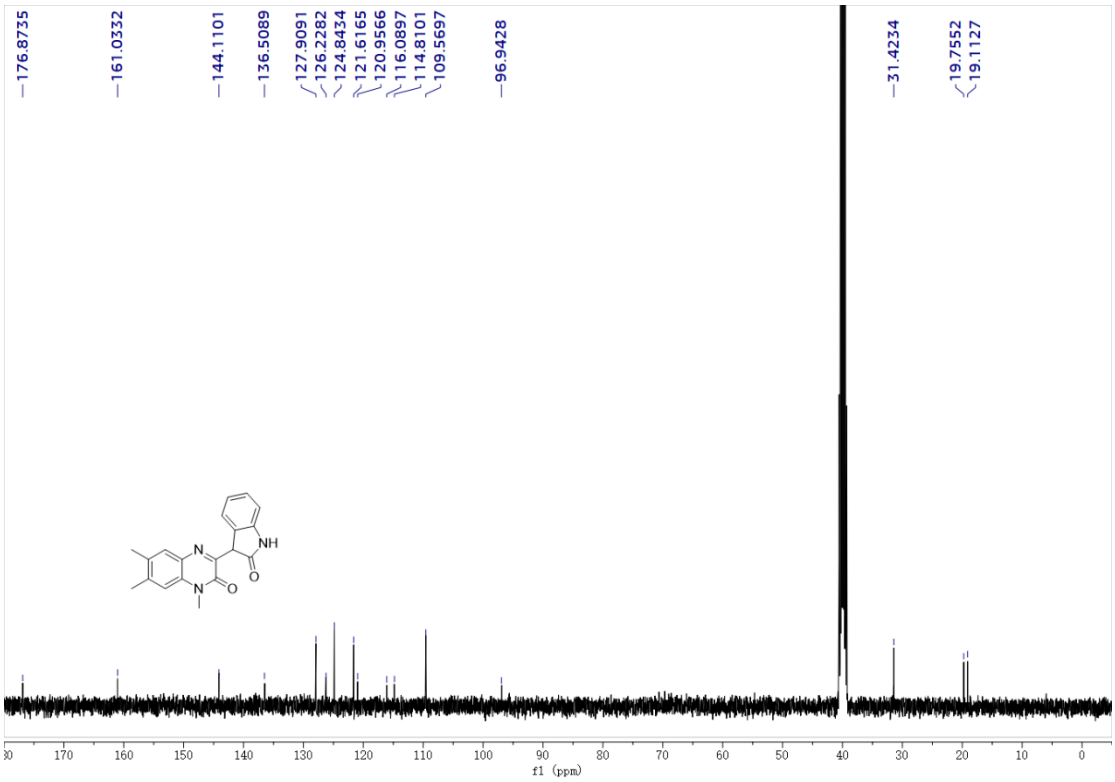


Figure S36 The ^{13}C NMR Spectrum of Compound **3af** in DMSO-d_6

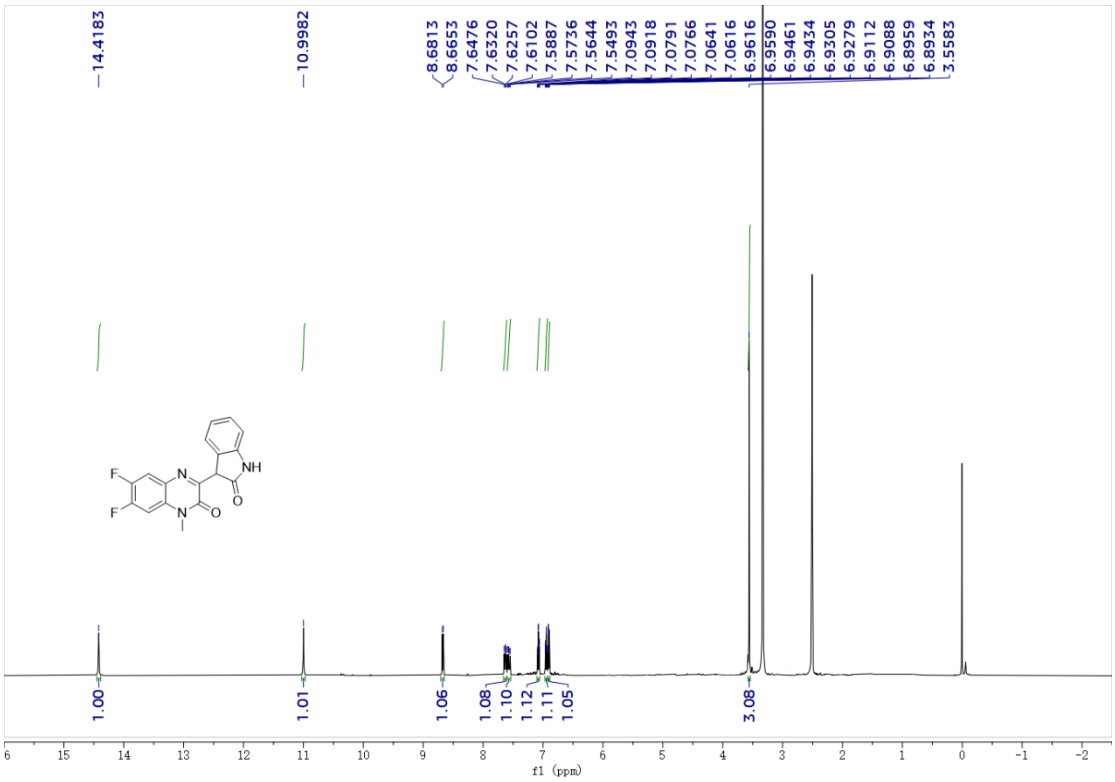


Figure S37 The ^{1}H NMR Spectrum of Compound **3ag** in DMSO-d_6

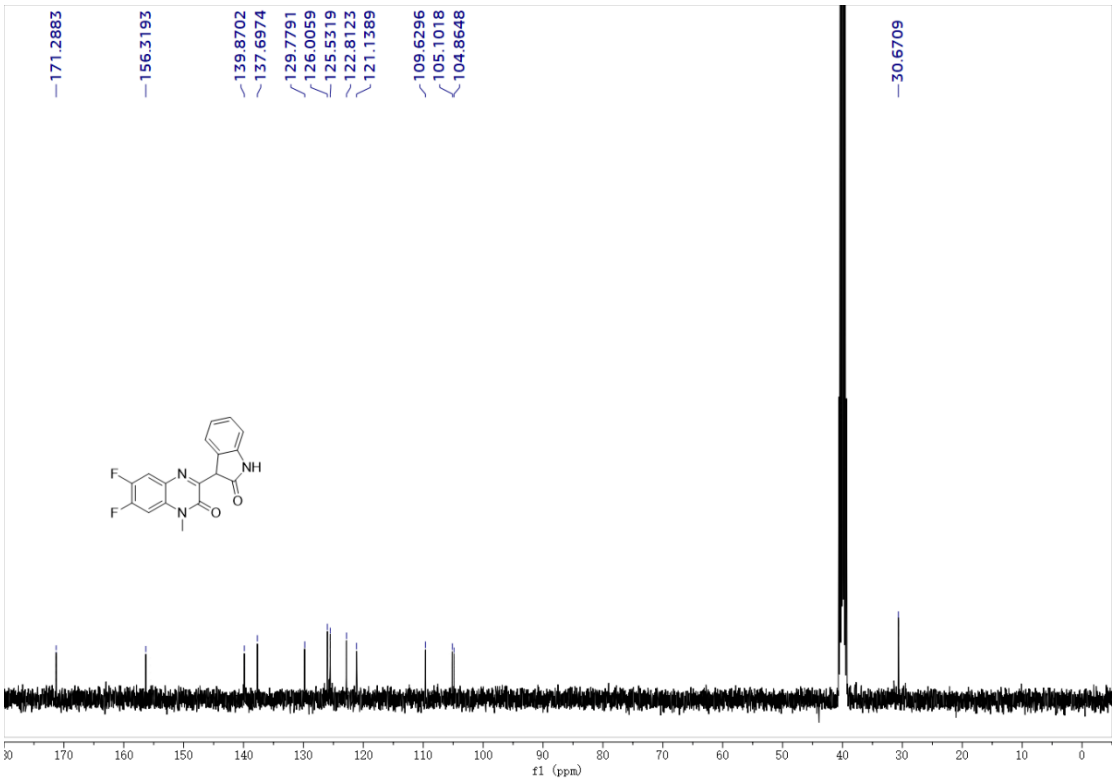


Figure S38 The ^{13}C NMR Spectrum of Compound **3ag** in DMSO-d_6

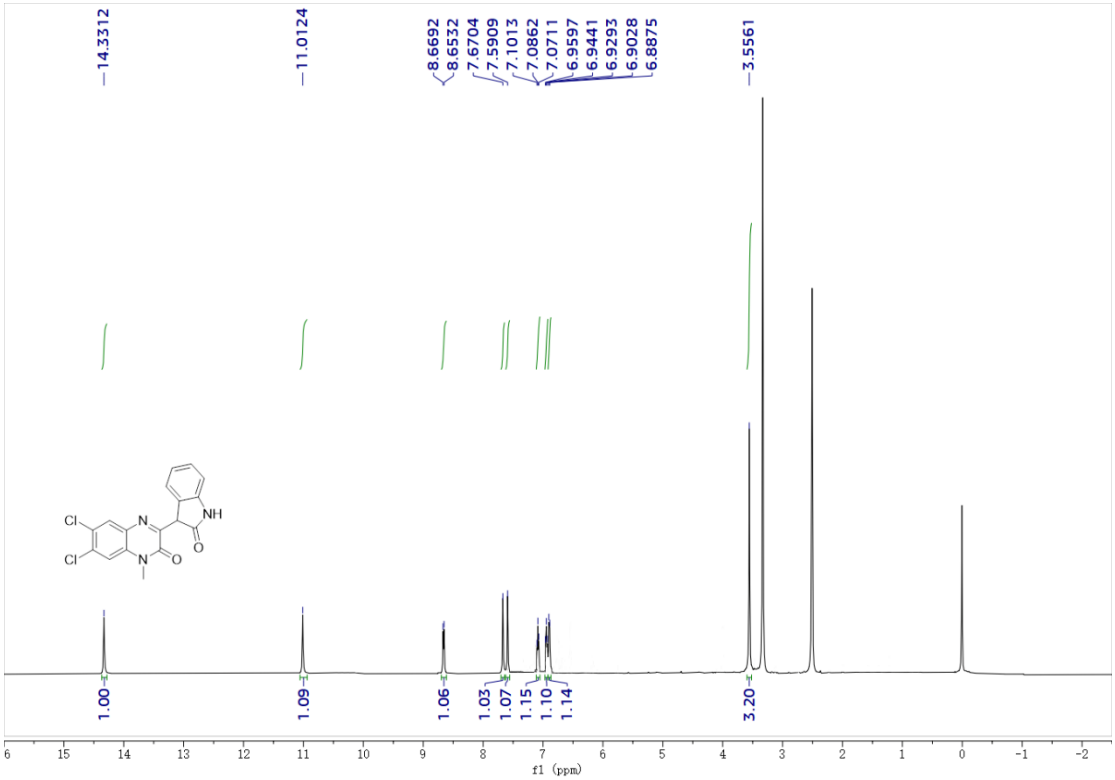


Figure S39 The ^{1}H NMR Spectrum of Compound **3ah** in DMSO-d_6

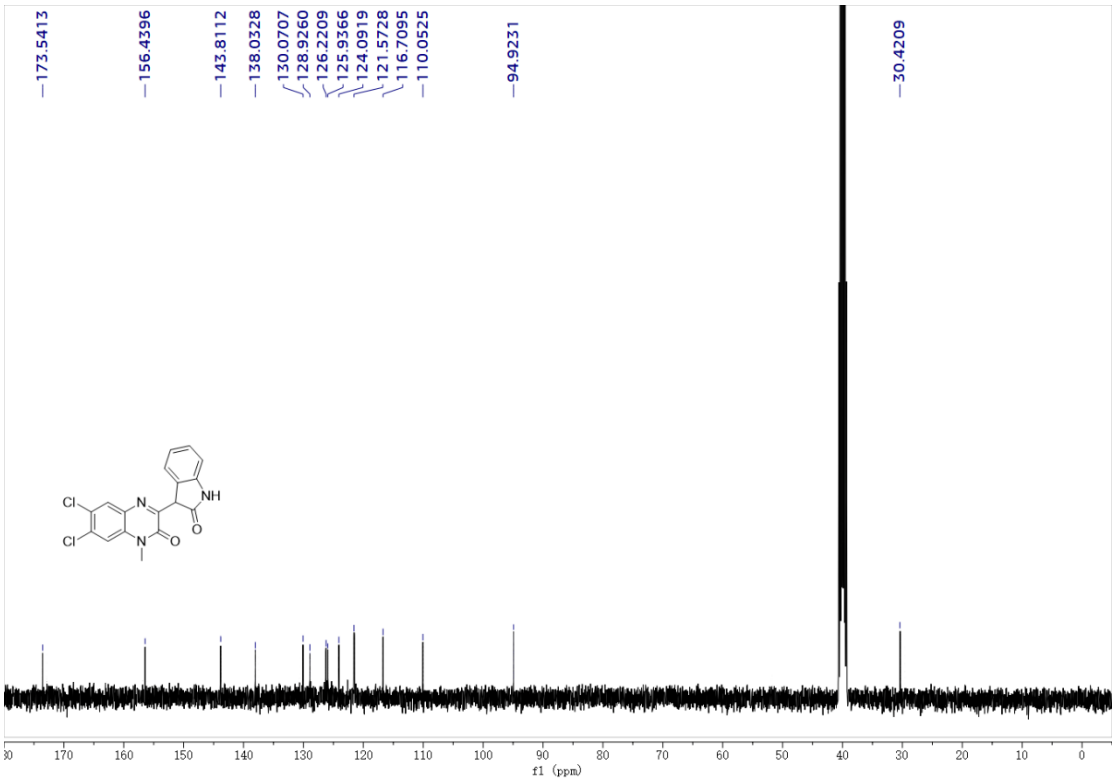


Figure S40 The ^{13}C NMR Spectrum of Compound **3ah** in DMSO-d_6

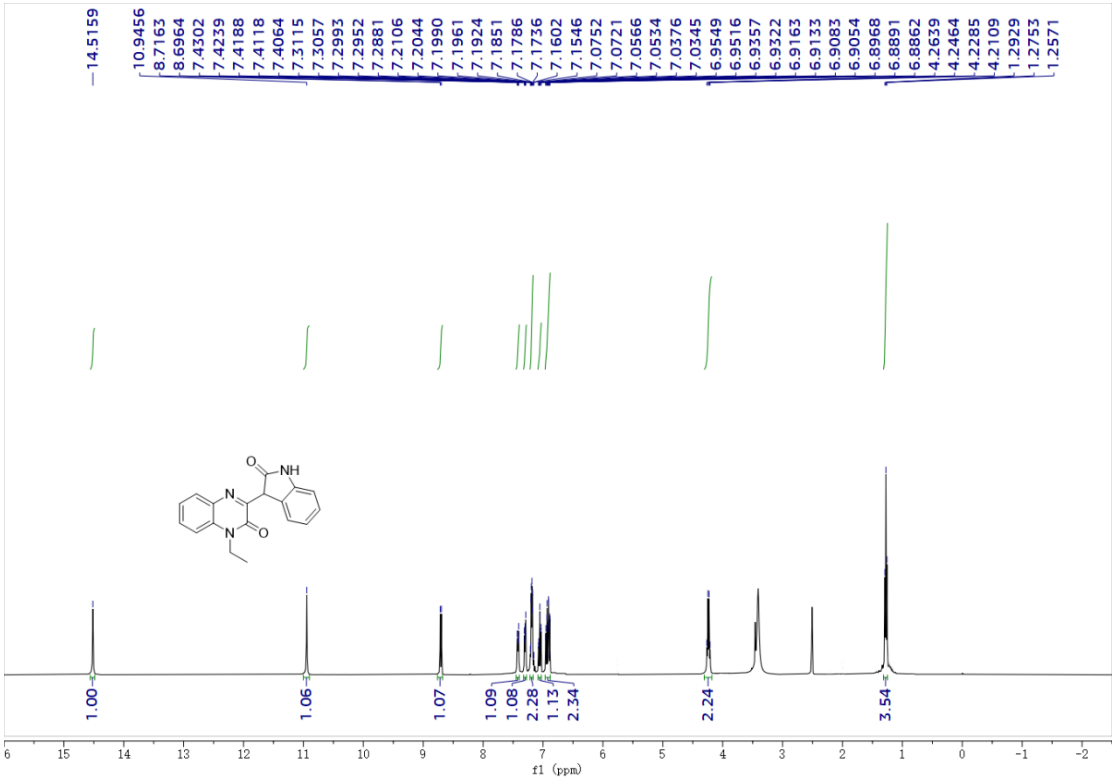


Figure S41 The ^{1}H NMR Spectrum of Compound **3ai** in DMSO-d_6

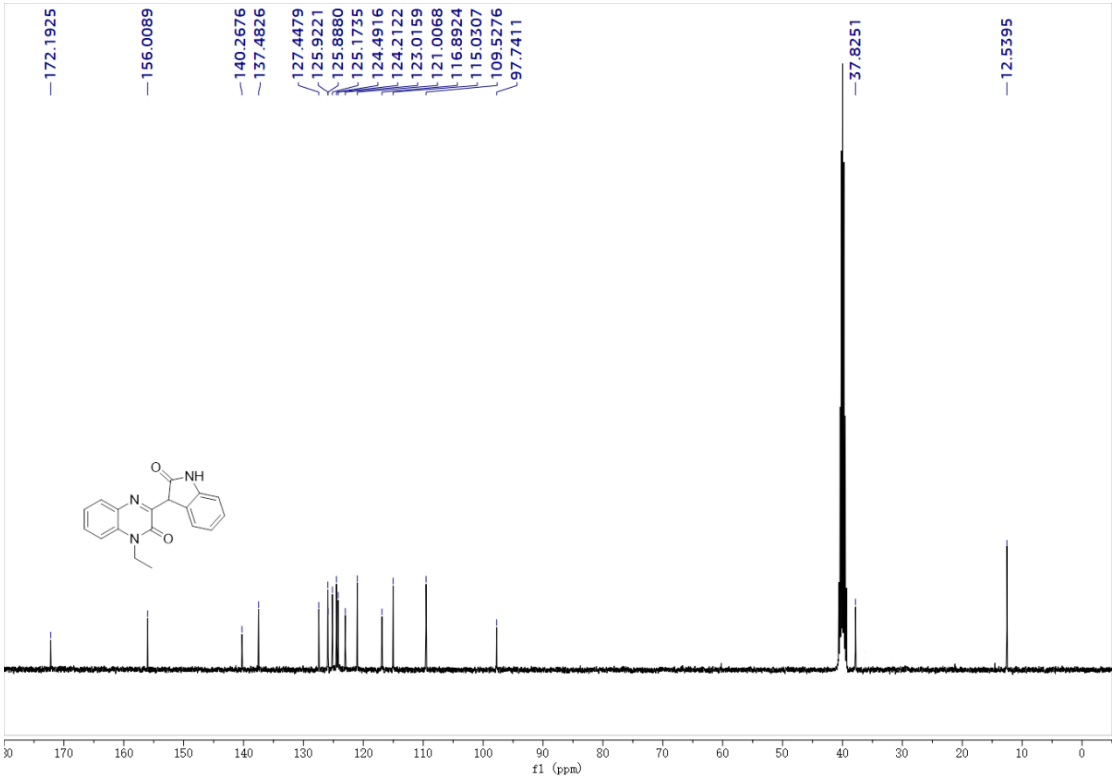


Figure S42 The ^{13}C NMR Spectrum of Compound **3ai** in DMSO-d_6

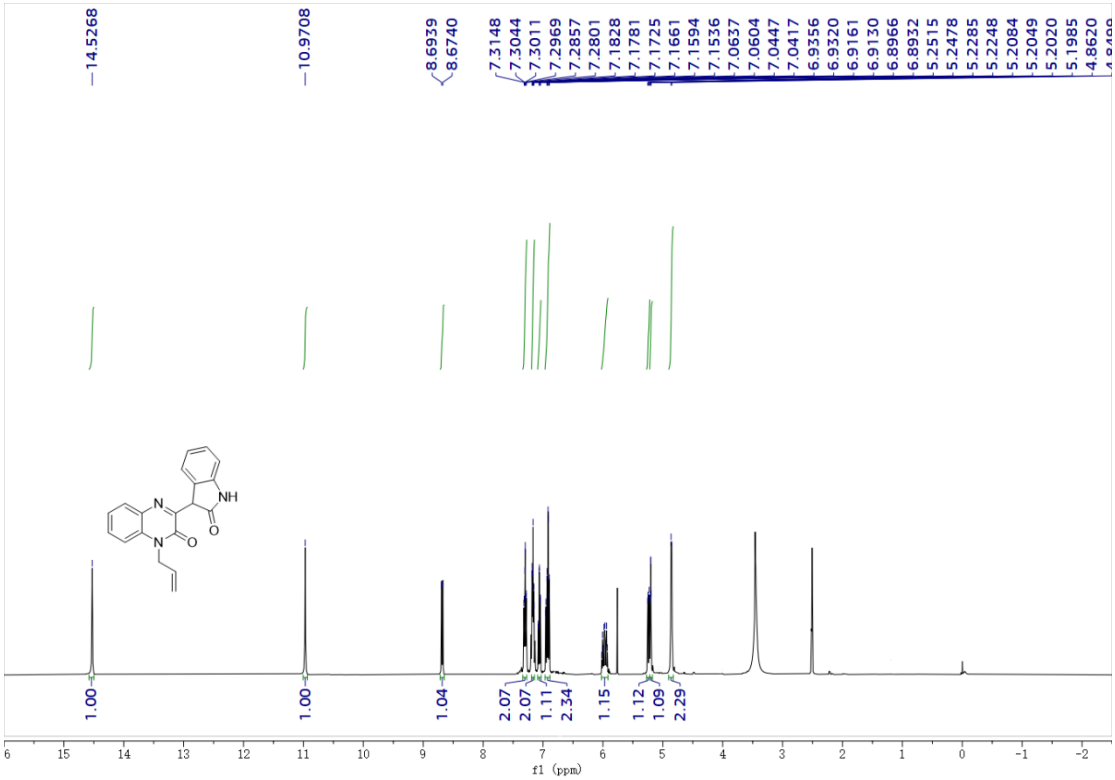


Figure S43 The ^{1}H NMR Spectrum of Compound **3aj** in DMSO-d_6

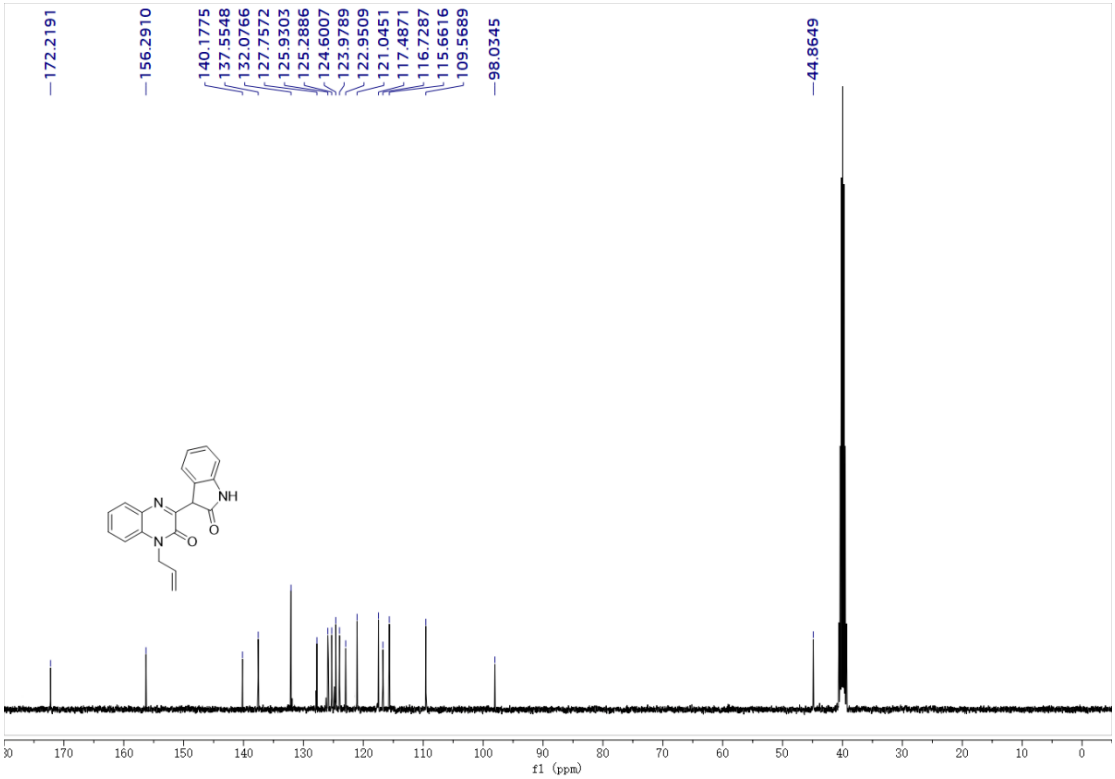


Figure S44 The ^{13}C NMR Spectrum of Compound **3aj** in DMSO-d_6

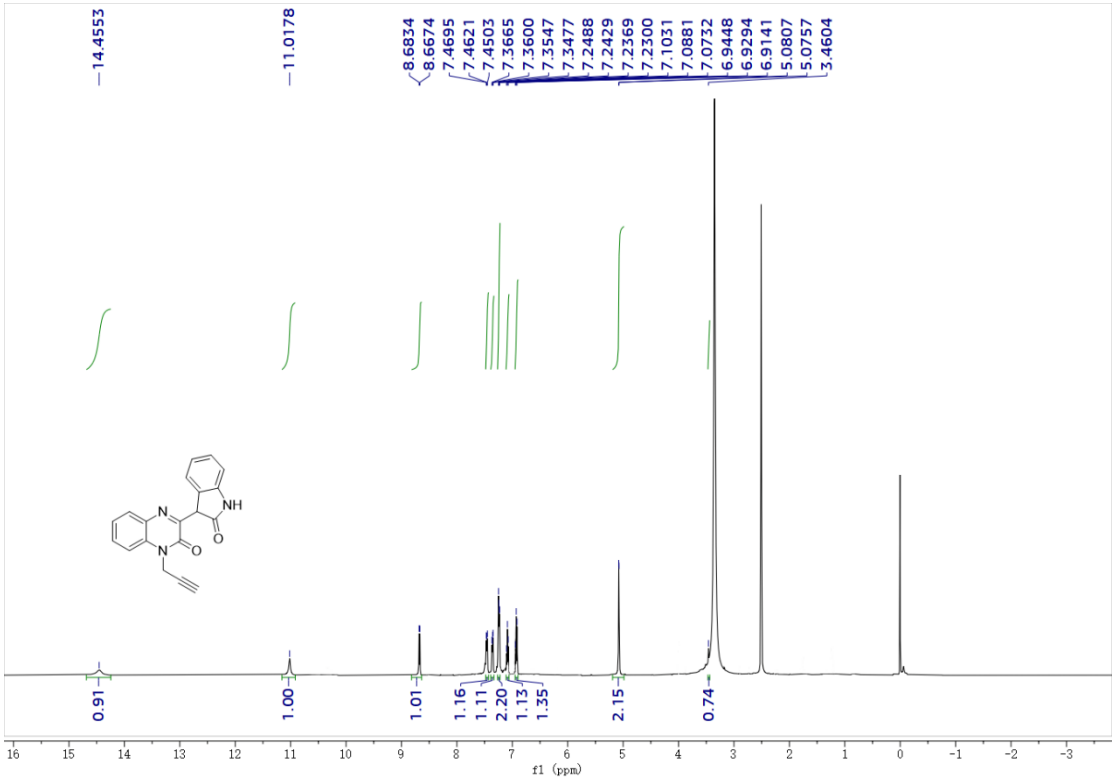


Figure S45 The ^{1}H NMR Spectrum of Compound **3ak** in DMSO-d_6

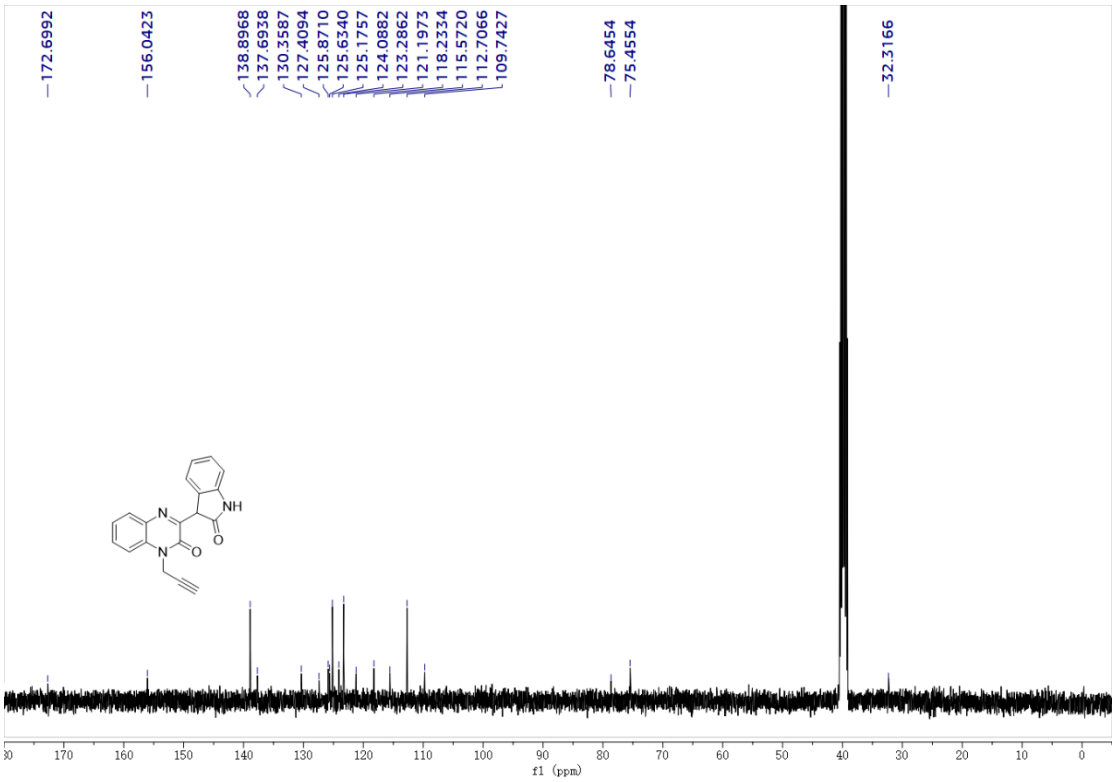


Figure S46 The ^{13}C NMR Spectrum of Compound **3ak** in DMSO-d_6

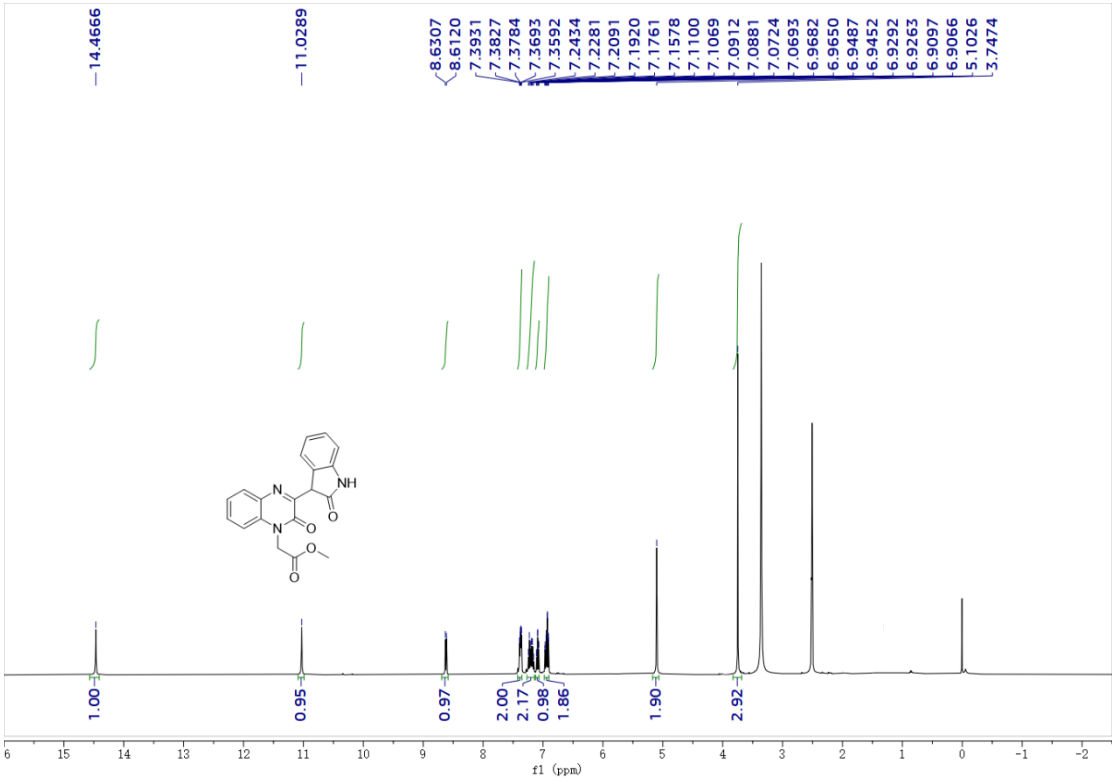


Figure S47 The ^{1}H NMR Spectrum of Compound **3al** in DMSO-d_6

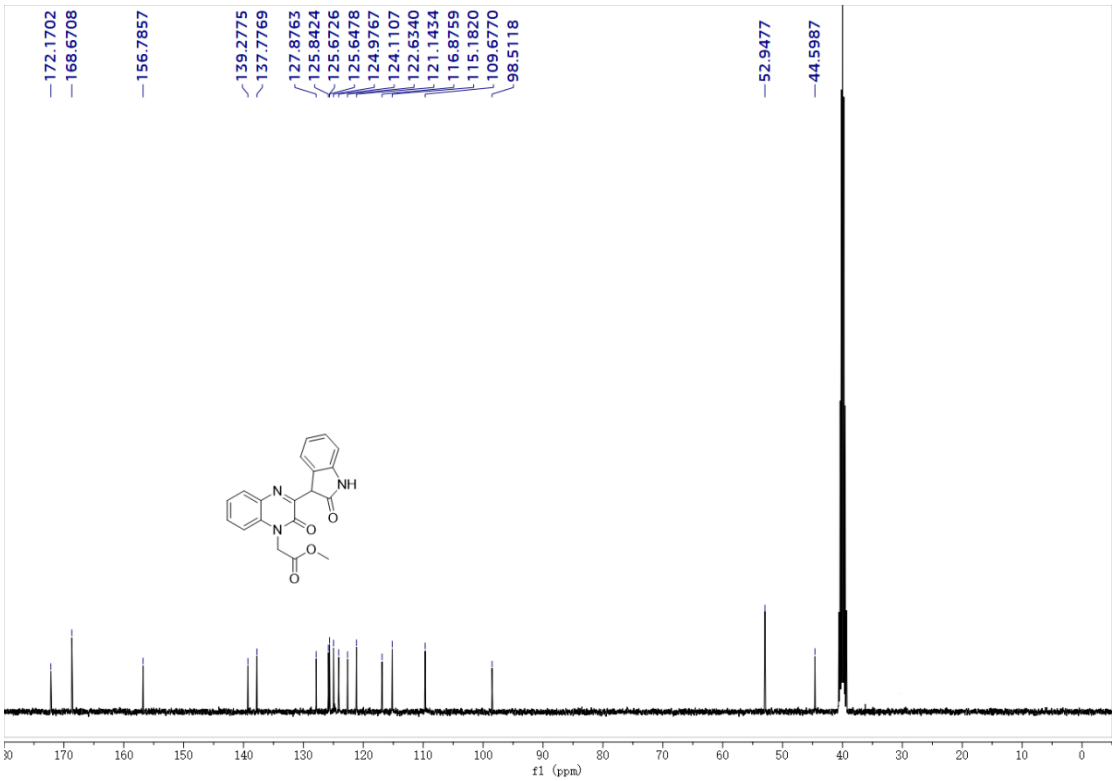


Figure S48 The ^{13}C NMR Spectrum of Compound **3al** in DMSO-d_6

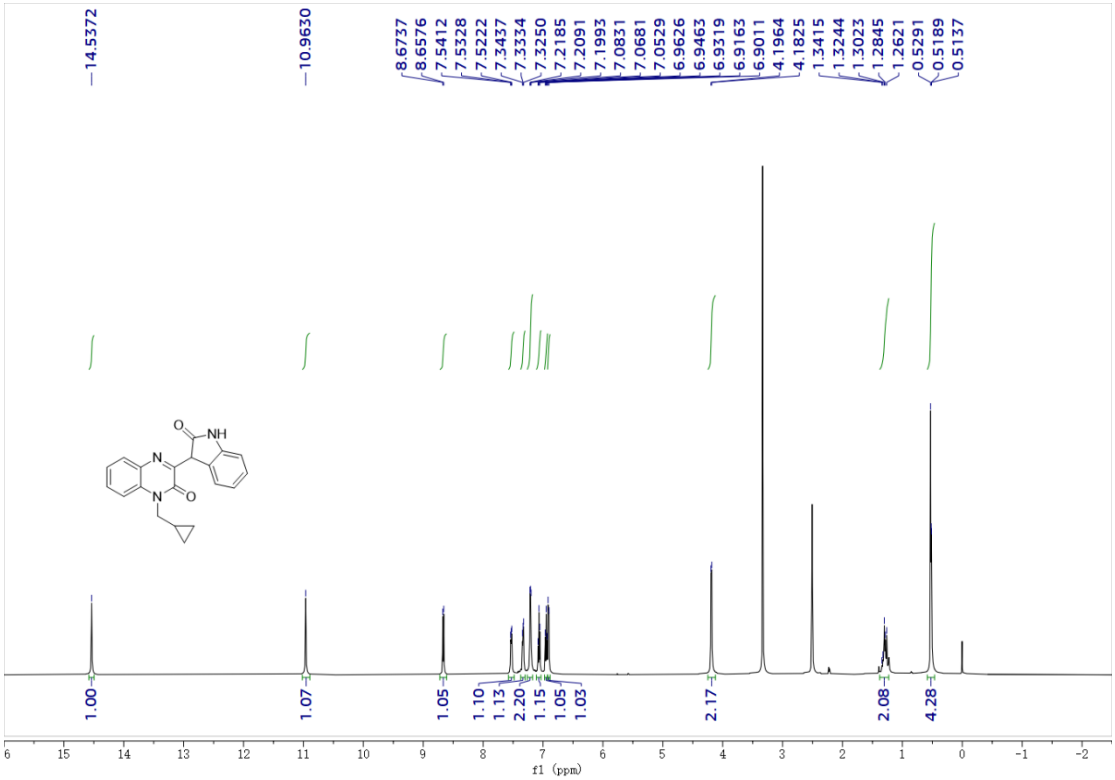


Figure S49 The ^{1}H NMR Spectrum of Compound **3am** in DMSO-d_6

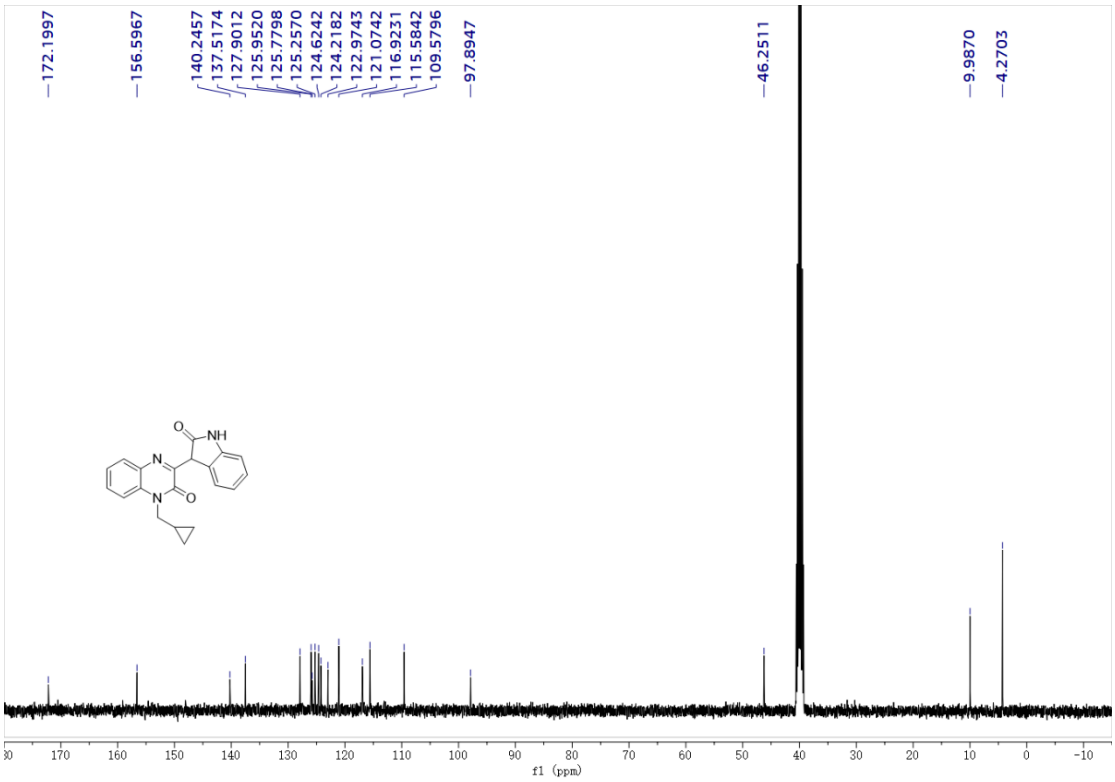


Figure S50 The ^{13}C NMR Spectrum of Compound **3am** in DMSO-d_6

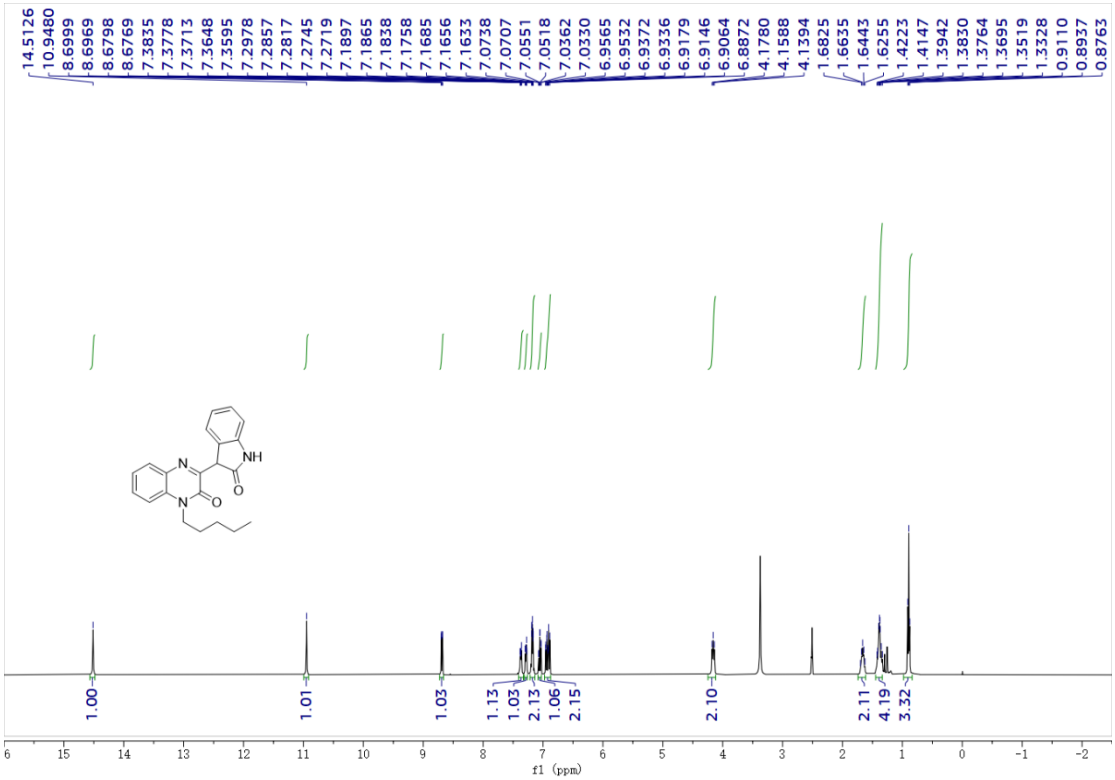


Figure S51 The ^{1}H NMR Spectrum of Compound **3an** in DMSO-d_6

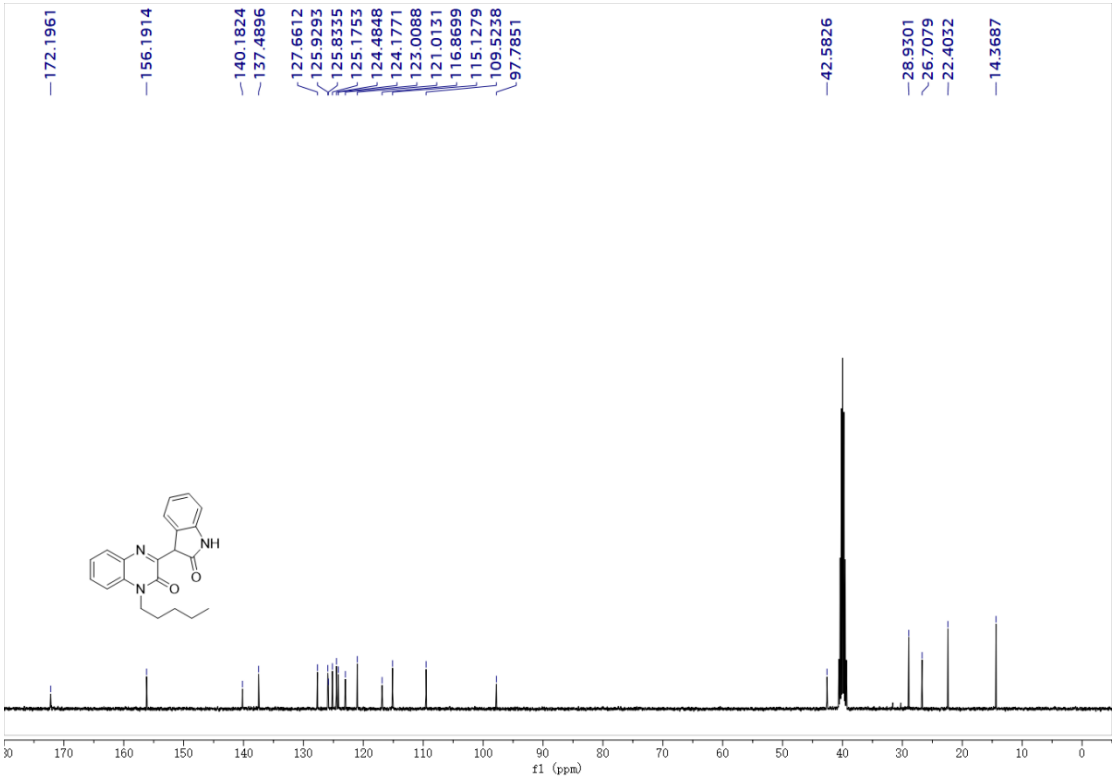


Figure S52 The ^{13}C NMR Spectrum of Compound **3an** in DMSO-d_6

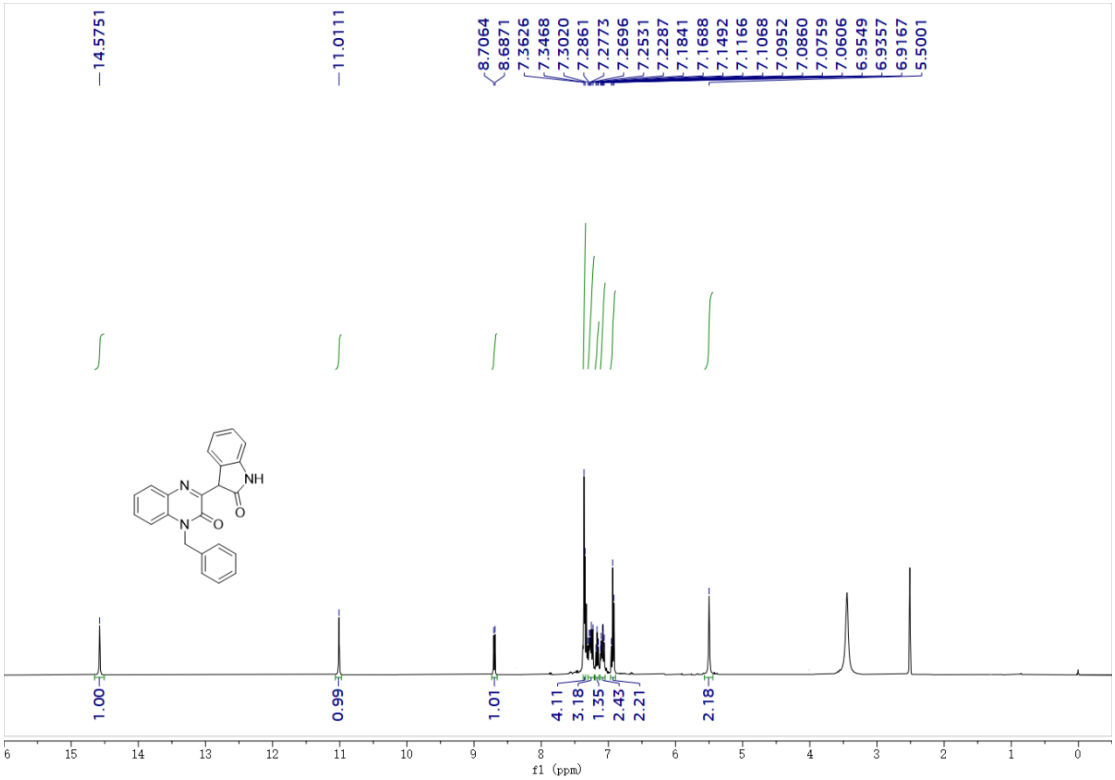


Figure S53 The ^{1}H NMR Spectrum of Compound **3ao** in DMSO-d_6

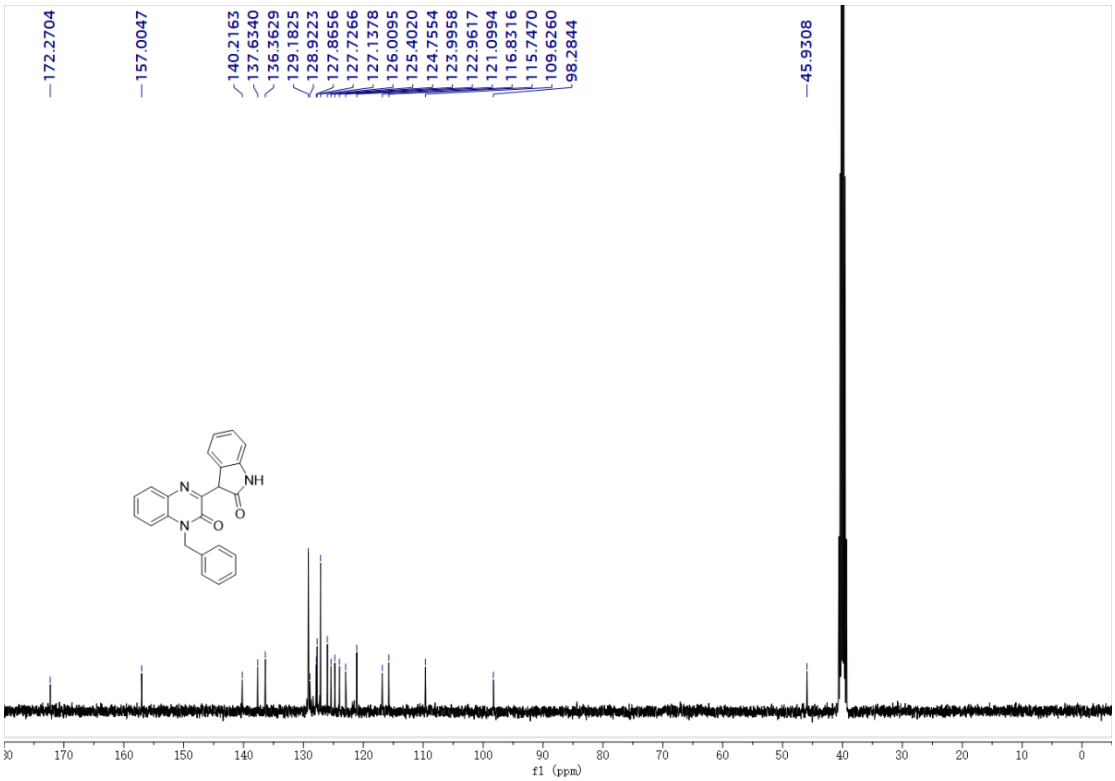


Figure S54 The ^{13}C NMR Spectrum of Compound **3ao** in DMSO-d_6

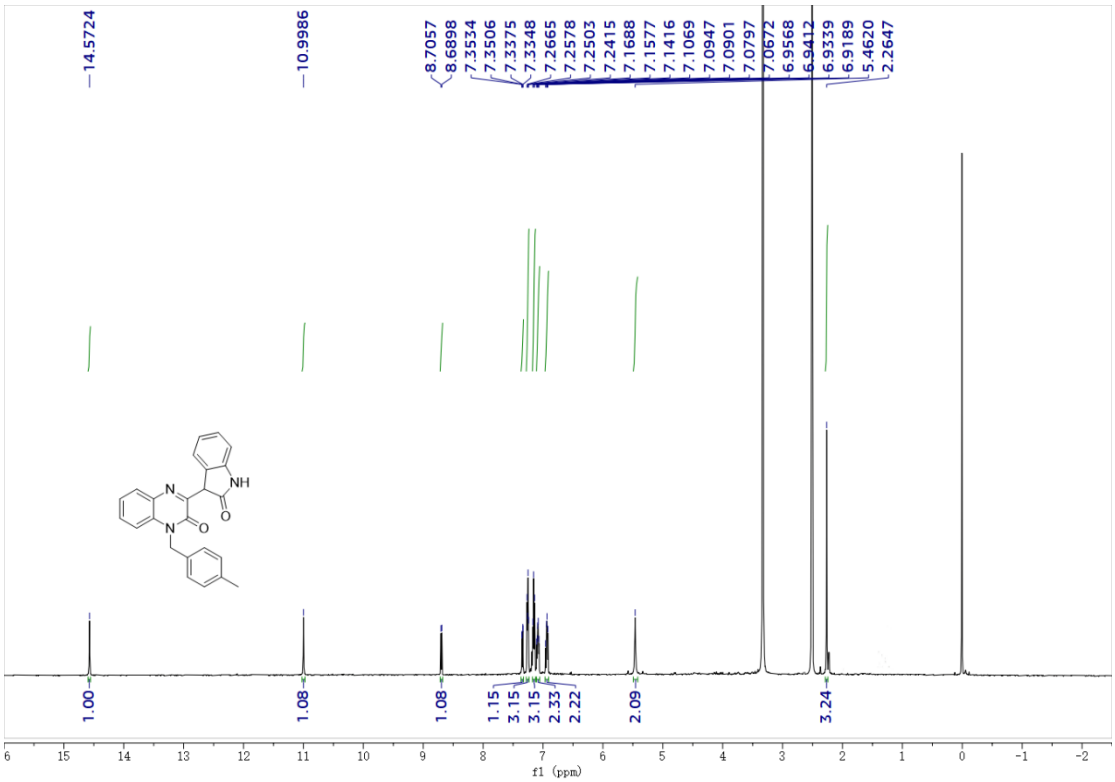


Figure S55 The ^{1}H NMR Spectrum of Compound **3ap** in DMSO-d_6

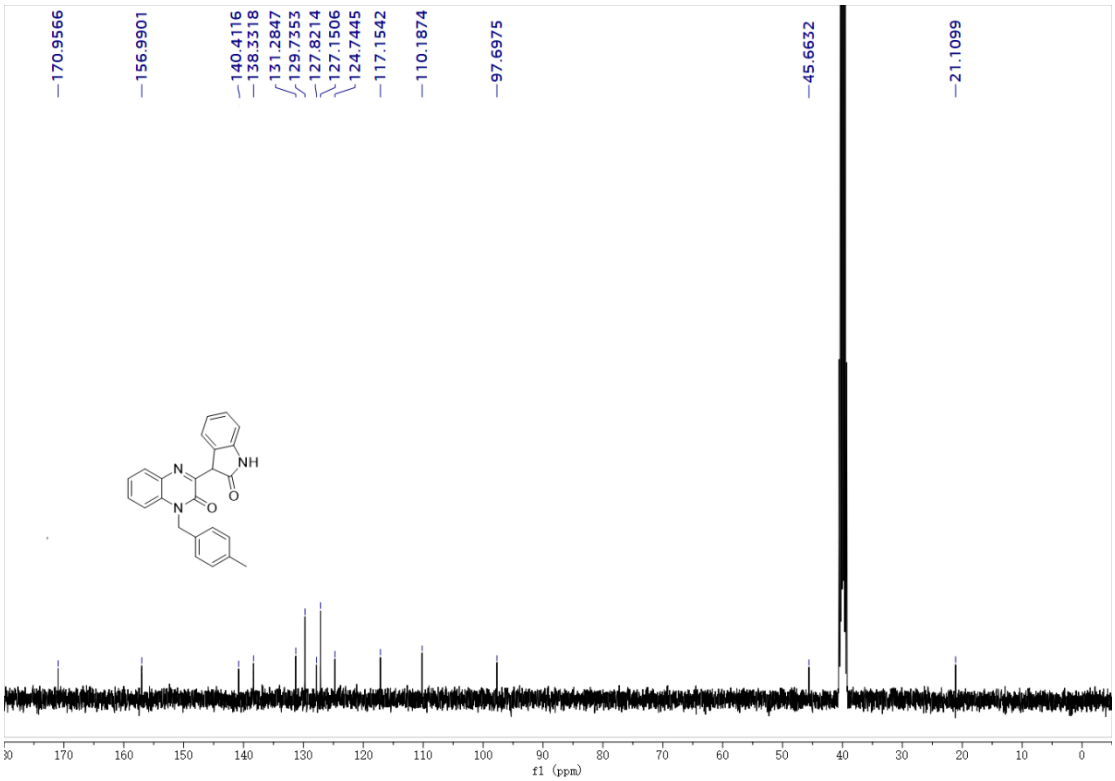


Figure S56 The ^{13}C NMR Spectrum of Compound **3ap** in DMSO-d_6

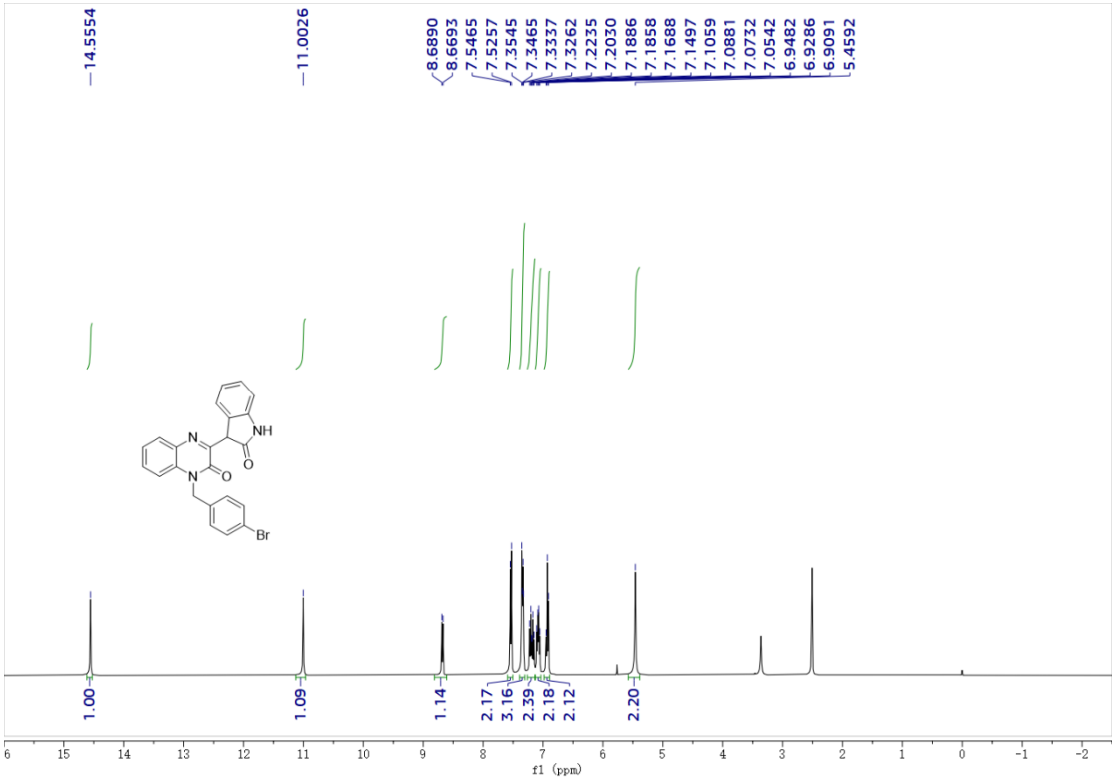


Figure S57 The ^{1}H NMR Spectrum of Compound **3aq** in DMSO-d_6

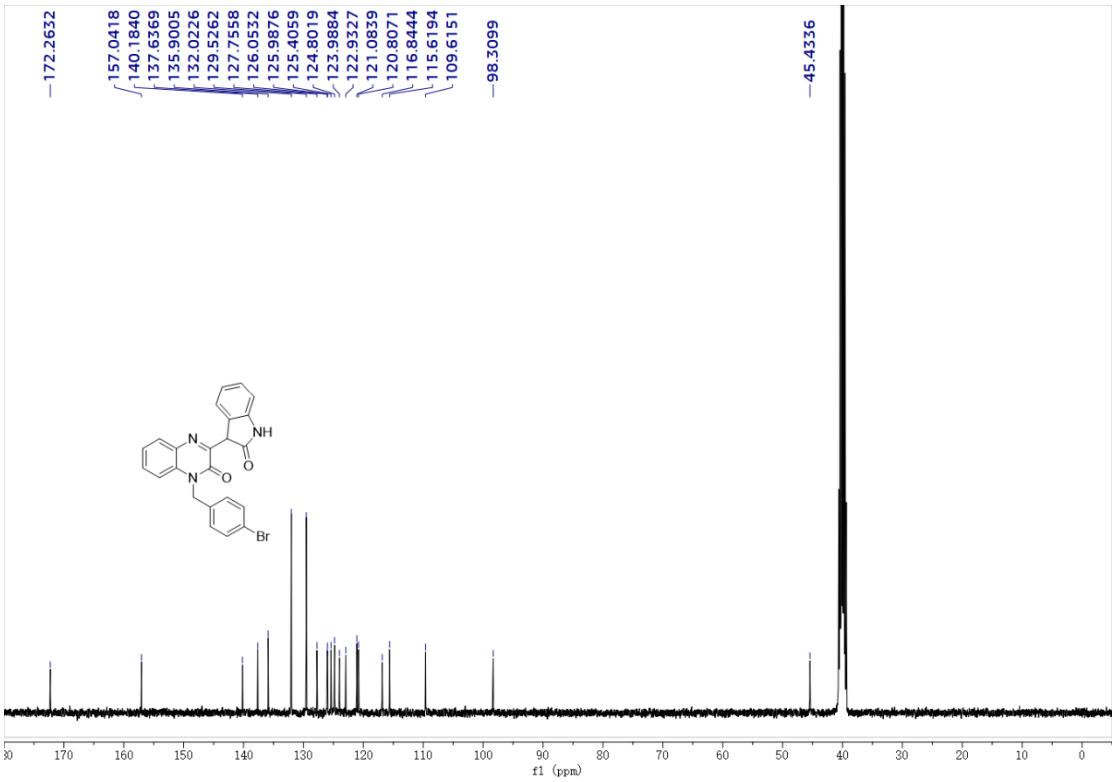


Figure S58 The ^{13}C NMR Spectrum of Compound **3aq** in DMSO-d_6

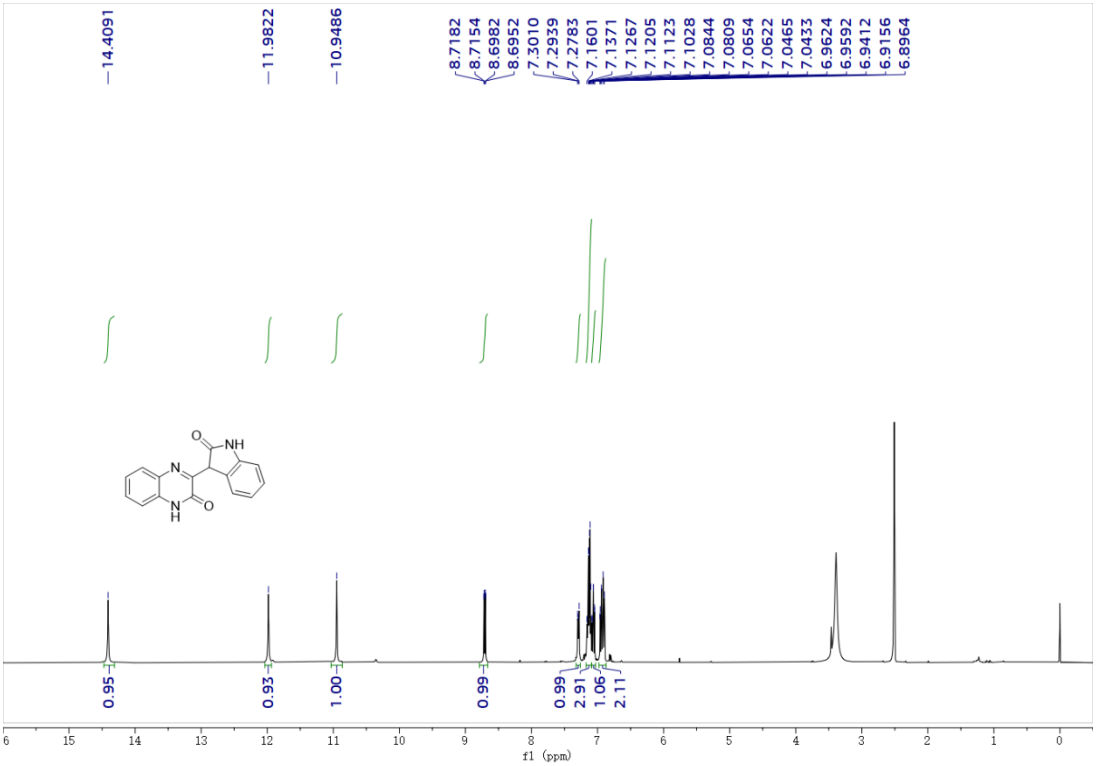


Figure S59 The ^{1}H NMR Spectrum of Compound **3ar** in DMSO-d_6

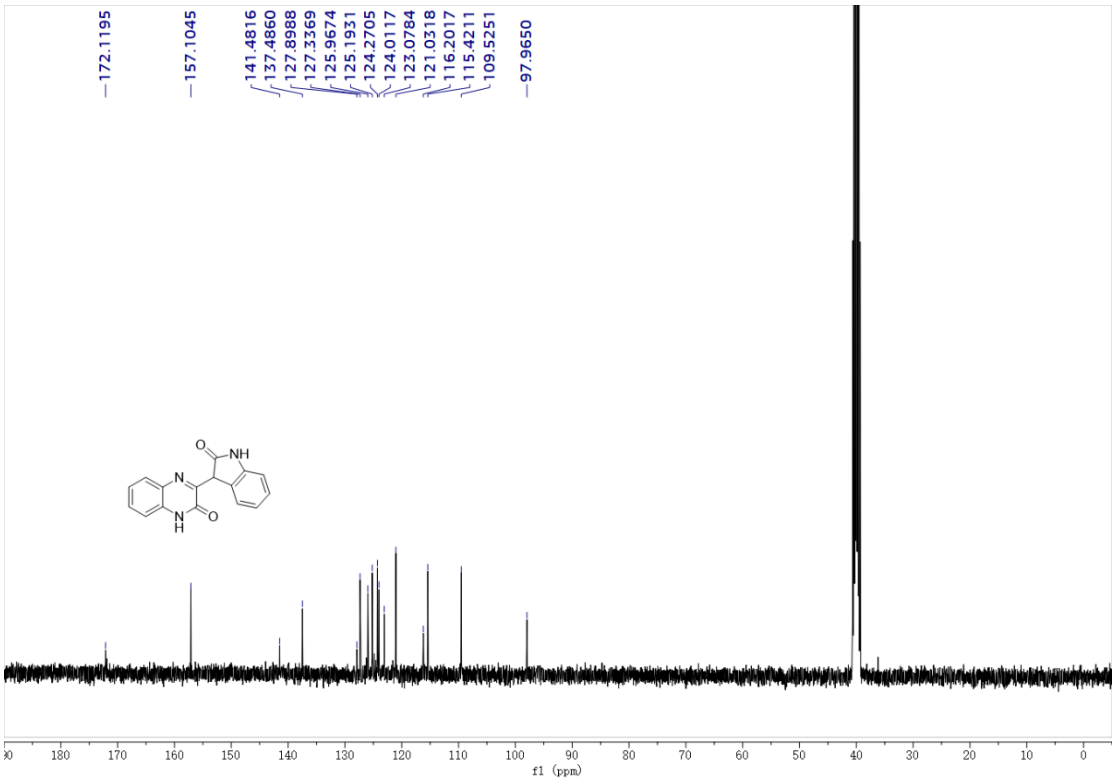


Figure S60 The ^{13}C NMR Spectrum of Compound **3ar** in DMSO-d_6