Electronic Supplementary Material (ESI) for RSC Advances.

Intramolecular Cyclization of *N*-Cyano Sulfoximines by N-CN Bond Activation

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Supporting information

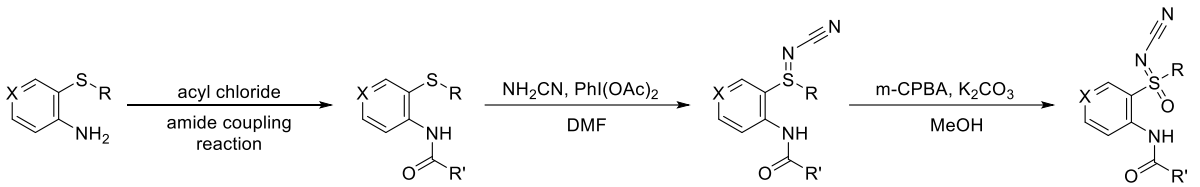
Contents

General method

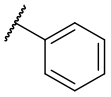
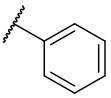
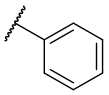
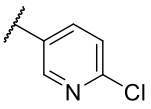
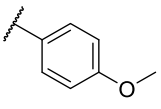
Analytical thin-layer chromatography (TLC) was performed on Kieselgel 60 F254 glass plates precoated with a 0.2 mm thickness of silica gel. The TLC plates were visualized by UV (254 nm) Flash chromatography was carried out with Kieselgel 60 (230−400 mesh) on a silica gel. Melting points: Barnstead/Electrothermal 9300, measurements were performed in open glass capillaries. NMR spectra: Bruker AV 300 MHz (^{1}H NMR: 300 MHz, ^{13}C NMR: 75 MHz), AV 400 MHz (^{1}H NMR: 400 MHz, ^{13}C NMR: 100 MHz), AV 500 MHz (^{1}H NMR: 500 MHz, ^{13}C NMR: 125 MHz), and AV2 500 MHz (^{19}F NMR: 470 MHz), and the spectra were recorded in $CDCl_3$, MeOD, and DMSO-d6 using TMS as internal standard and are reported in ppm. ^{1}H NMR data are reported as follows: [s = singlet, d = doublet, t = triplet, q = quartet, dd = doublet of doublet, td = doublet of triplet, and m = multiplet; coupling constant(s) J is given in Hz; integration, proton assignment]. High-resolution ma s spectra (HRMS): JEOL JMS-700. X-ray crystallography: Bruker SMART APEX II X-ray diffractometer. All solvents were purified using the column filter solvent purification system before use unless otherwise indicated. Reagents were purchased and used without further purification.

Experimental section

Synthesis of *N*-Cyano sulfoximines

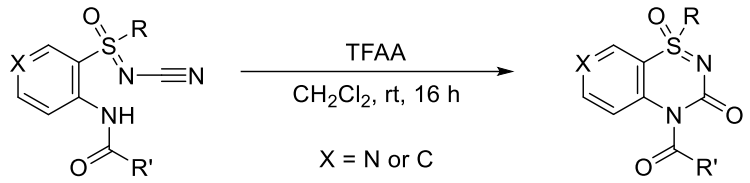


1

	X	**R**	**R′**
1a	C	Me	
1b	C	Ph	
1c	N	Me	
1d	C	Me	
1e	C	Me	

For the preparation of *N*-Cyano sulfoximine **1**, please see our previous publication (*ACS Omega*, **2022**, *7*, 2160-2169).

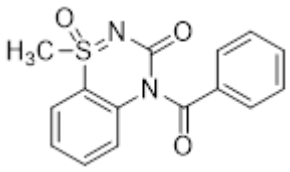
Synthetic procedure for Intramolecular cyclization



1a-1e **2a-2e**

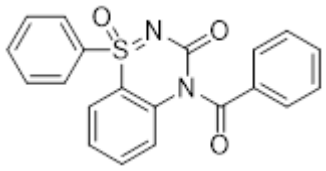
A solution of an sulfoximine **1** (50 mg) was then re-dissolved in 3 mL dry CH_2Cl_2 and added dropwise to trifluoroacetic anhydride (6 eq) at 0 ℃. After stirring for 16 hours at ambient temperature, the reaction mixture was extracted with EtOAc and washed with brine. The organic layer was dried over $MgSO_4$, filtered and concentrated under reduced pressure. The residue was purified by flash chromatography on a silica gel (EtOAc/hexane = 2:1) to give the desired product **2**.

4-benzoyl-1-methyl-1λ^4-benzo[*e*][1,2,4]thiadiazin-3(4*H*)-one 1-oxide (**2a**).



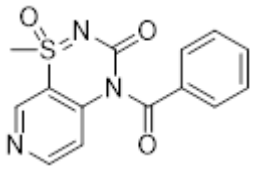
Following the general oxidation method, the reaction of *N*-(2-(*N*-cyano-*S*-methylsulfonimidoyl)-phenyl)benzamide **1a** (50 mg, 0.17 mmol) with trifluoroacetic anhydride (0.14 mL, 1.0 mmol) in CH_2Cl_2 (3 mL) gives the desired Thiadiazinone 1-oxide **2a** as a white solid (36 mg, 89% yield). m.p 149-150 ℃; ^{1}H NMR (500 MHz, $CDCl_3$) : δ 8.00−7.98 (m, 2H), 7.85 (dd, J = 1.5 Hz, J = 8.0 Hz, 1H), 7.67−7.64 (m, 1H), 7.67−7.57 (m, 1H), 7.52−7.48 (m, 2H), 7.35−7.31 (m, 1H), 7.06−7.04 (m, 1H) 3.56 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ 171.1, 149.1, 138.3, 136.1, 135.0, 132.6, 130.5, 129.3, 125.2, 124.0, 116.5, 114.0, 46.0; HRMS (EI): calcd for $C_{15}H_{12}N_2O_3S$ [M^+] 300.0569; found, 300.0563.

4-benzoyl-1-phenyl-1λ^4-benzo[*e*][1,2,4]thiadiazin-3(4*H*)-one 1-oxide (**2b**).



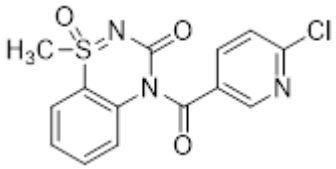
Following the general oxidation method, the reaction of *N*-(2-(*N*-cyanophenylsulfonimidoyl)-phenyl)benzamide **1b** (50 mg, 0.14 mmol) with trifluoroacetic anhydride (0.12 mL, 0.83 mmol) in CH_2Cl_2 (3 mL) gives the desired Thiadiazinone 1-oxide **2b** as a Yellow solid (39 mg, 78% yield). m.p 129-130 ℃; ^{1}H NMR (300 MHz, $CDCl_3$) : δ 8.10−8.04 (m, 4H), 7.78−7.73 (m, 1H), 7.70−7.64 (m, 3H), 7.56−7.47 (m, 3H), 7.44−7.41 (m, 1H), 7.19−7.13 (m, 1H), 7.07 (d, J = 8.6 Hz 1H); ^{13}C NMR (100 MHz, DMSO) : δ 167.8, 150.8, 140.2, 139.5, 136.1, 135.0, 133.3, 131.2, 130.4, 129.7, 129.0, 128.6, 126.0, 123.3, 117.1, 113.5.

4-benzoyl-1-methyl-1λ⁴-pyrido[4,3-*e*][1,2,4]thiadiazin-3(4*H*)-one 1-oxide (**2c**).



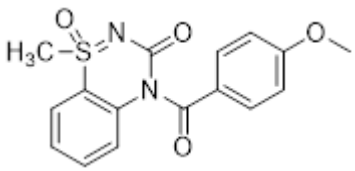
Following the general oxidation method, the reaction of *N*-(3-(*N*-cyano-*S*-methylsulfonimidoyl)-pyridin-4-yl)benzamide **1c** (50 mg, 0.17 mmol) with trifluoroacetic anhydride (0.14 mL, 1.0 mmol) in CH_2Cl_2 (3 mL) gives the desired Thiadiazinone 1-oxide **2c** as a white solid (31 mg, 62% yield). m.p 249-250 ℃; ^{1}H NMR (300 MHz, $CDCl_3$) : δ 9.09 (s, 1H), 8.62 (d, J = 6.1 Hz, 1H), 7.96 (d, J = 7.4 Hz, 2H), 7.70 (t, J = 7.6 Hz, 1H), 7.53 (t, J = 7.7 Hz, 2H), 6.99 (d, J = 6.1 Hz, 1H), 3.67 (s, 3H); ^{13}C NMR (100 MHz, DMSO) : δ 170.9, 155.4, 148.4, 148.0, 143.7, 136.0, 132.3, 130.8, 130.0, 111.9, 110.0, 45.0; HRMS (EI): calcd for $C_{14}H_{11}N_3O_3S$, 301.0521; found, 301.0515.

4-(6-chloronicotinoyl)-1-methyl-1λ⁴-benzo[*e*][1,2,4]thiadiazin-3(4*H*)-one 1-oxide (**2d**).



Following the general oxidation method, the reaction of 6-chloro-*N*-(2-(*N*-cyano-*S*-methyl-sulfonimidoyl)phenyl)nicotinamide **1d** (50 mg, 0.15 mmol) with trifluoroacetic anhydride (0.13 mL, 0.90 mmol) in CH_2Cl_2 (3 mL) gives the desired Thiadiazinone 1-oxide **2d** as a white solid (44 mg, 88% yield). m.p 121-122 ℃; ^{1}H NMR (300 MHz, $CDCl_3$) : δ 8.93 (d, J = 2.5 Hz, 1H), 8.16 (dd, J = 2.5 Hz, J = 8.4 Hz, 1H), 7.87 (d, J = 8.0 Hz, 1H), 7.66 (t, J = 8.1 Hz, 1H), 7.47 (d, J = 8.4 Hz, 1H), 7.40 (t, J = 7.7 Hz, 1H), 7.23 (d, J = 7.7 Hz, 1H), 3.57 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ 169.5, 156.9, 151.4, 149.2, 139.7, 137.7, 136.3, 128.4, 125.2, 124.9, 124.8, 117.0, 115.1, 45.7; HRMS (EI): calcd for $C_{14}H_{10}ClN_3O_3S$ [M$^+$] 335.0131; found, 335.0131.

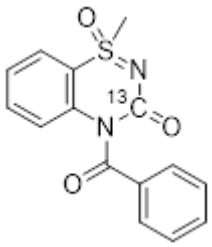
4-(4-methoxybenzoyl)-1-methyl-1λ⁴-benzo[*e*][1,2,4]thiadiazin-3(4*H*)-one 1-oxide (**2e**).



Following the general oxidation method, the reaction of *N*-(2-(*N*-cyano-*S*-methyl-sulfonimidoyl)phenyl)-4-methoxybenzamide **1e** (50 mg, 0.15 mmol) with trifluoroacetic anhydride (0.13 mL, 0.9 mmol) in CH_2Cl_2 (3 mL) gives the desired Thiadiazinone 1-oxide **2e** as a white solid (33 mg, 66% yield). m.p 262-263 ℃; 1H NMR (300 MHz, CDCl3) : δ 7.96 (d, J = 8.9 Hz, 2H), 7.83 (dd, J = 1.5 Hz, J = 8.0 Hz, 1H), 7.60−7.54 (m, 1H), 7.30 (t, J = 8.2 Hz, 1H), 7.00−6.94 (m, 3H), 3,88 (s, 3H), 3.55 (s, 3H); 13C NMR (100 MHz, CDCl3) : δ 169.9, 165.4 149.0, 138.7, 136.1 133.4, 125.3, 125.1, 123.9, 116.7, 114.8, 113.9, 55.9, 46.3; HRMS (EI): calcd for $C_{16}H_{14}N_2O4S$ [M$^+$] 330.0674; found, 330.0671.

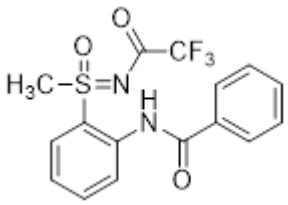
Synthetic procedure for Mechanism study

4-benzoyl-1-methyl-1λ⁴-benzo[*e*][1,2,4]thiadiazin-3(4*H*)-one-3-*^{13}C* 1-oxide ([^{13}C]**2a**)



A solution of *N*-(2-(*N*-(cyano-^{13}*C*)-*S*-methylsulfonimidoyl)phenyl)benzamide [^{13}C]**1a** (50 mg, 0.17 mmol) in CH_2Cl_2 (3.0 mL) was added trifluoroacetic anhydride (0.14 mL, 1.0 mmol) at 0 ℃. After stirring for 40 mins at ambient temperature, the reaction mixture was extracted with EtOAc and washed with brine. The organic layer was dried over $MgSO_4$, filtered and concentrated under reduced pressure. The residue was purified by flash chromatography on a silica gel (EtOAc/hexane = 2:1) to give the desired compound [^{13}C]**2a** as a white solid (42 mg, 83% yield). m.p. 149-150 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) : δ 7.97 (d, J = 7.8 Hz, 2H), 7.85 (d, J = 7.9 Hz, 1H), 7.64 (t, J = 7.3 Hz, 1H), 7.57 (t, J = 8.6 Hz, 1H), 7.49 (t, J = 7.8 Hz, 2H), 7.32 (t, J = 8.1 Hz, 1H), 7.02 (d, J = 8.6 Hz, 1H) 3.55 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ 171.1, 149.0, 138.4 (d, J = 1.6 Hz), 136.1, 135.0, 132.6, 130.5, 129.3, 125.2, 124.0, 116.6 (d, J = 2.7 Hz), 114.0 (d, J = 3.7 Hz), 46.0 (d, J = 2.3 Hz, CH_3); HRMS (EI): calcd for $^{12}C_{14}{}^{13}CH_{12}N_2O_3S$ [M^+] 301.0602; found, 301.0607.

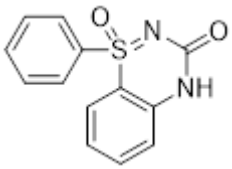
N-(2-(S-methyl-*N*-(2,2,2-trifluoroacetyl)sulfonimidoyl)phenyl)benzamide (**1ac**)



A solution of *N*-(2-(*N*-cyano-*S*-methylsulfonimidoyl)phenyl)benzamide [^{13}C]**1a** (50 mg, 0.17 mmol) in CH_2Cl_2 (3.0 mL) was added trifluoroacetic anhydride (0.14 mL, 1.0 mmol) at -20 ℃. The reaction mixture was stirred at -20 ℃ to -10 ℃ for 40 min and quenched with water. The reaction mixture was extracted with EtOAc and washed with brine. The organic layer was dried over $MgSO_4$, filtered and concentrated under reduced pressure. The residue was purified by flash chromatography on a silica gel (EtOAc/hexane = 1:2) to give the desired compound as a white solid (24.6 mg, 40% yield). m.p. 115-116 ℃; ^{1}H NMR (500 MHz, $CDCl_3$) : δ 10.05 (s, 1H), 8.61 (d, J = 11.3 Hz, 1H), 7.99-7.93 (m, 3H) 7.82-7.76 (m, 1H), 7.65-7.59 (m, 1H), 7.57-7.50 (m, 2H), 7.43-7.37 (m, 1H), 3.52 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ 165.4, 164.7, 164.3, 164.0, 163.6, 137.7, 136.4, 133.2, 133.0, 129.1, 128.6, 127.3, 125.0, 124.8, 123.7, 120.1, 117.2, 114.4, 111.5, 43.5; ^{19}F NMR (376 MHz, $CDCl_3$) : -75.6; HRMS (EI): calcd for $C_{16}H_{13}F_3N_2O_3S$ [M^+] 370.0599; found, 370.0607.

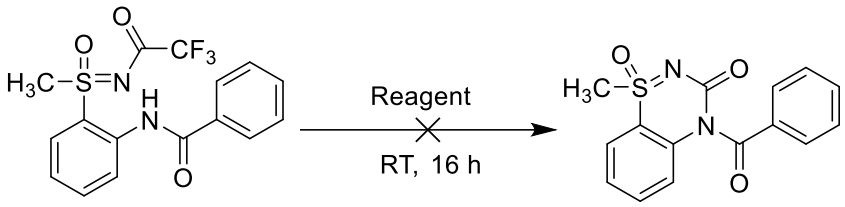
Synthesis of compound **2b'**

N-(2-(*S*-methyl-*N*-(2,2,2-trifluoroacetyl)sulfonimidoyl)phenyl)benzamide (**2b'**).



A solution of 4-benzoyl-1-phenyl-1λ^4-benzo[*e*][1,2,4]thiadiazin-3(4*H*)-one 1-oxide **2b** (10.0 mg, 0.028 mmol) in EtOH (1.0 mL) was added 1 N sodium hydroxide (0.5 mL) at rt. The reaction mixture was stirred at rt for overnight and quenched with water and saturated ammonium chloride. The reaction mixture was extracted with EtOAc and washed with brine. The organic layer was dried over $MgSO_4$, filtered and concentrated under reduced pressure. The residue was purified by flash chromatography on a silica gel (EtOAc/hexane = 2:1) to give the desired compound as a white solid (3.0 mg, 41% yield). m.p 205-206 ℃; 1H NMR (400 MHz, CDCl3) : δ 11.48 (s, 1H), 8.00-7.97 (m, 2H), 7.70-7.65 (m, 1H) 7.62-7.58 (m, 2H), 7.53-7.49 (m, 1H), 7.37-7.32 (m, 2H), 7.09-7.05 (m, 1H); 13C NMR (100 MHz, CDCl3) : δ 153.9, 139.6, 139.3, 135.4, 134.3, 129.5, 128.4, 125.5, 123.4, 117.8, 113.5; HRMS (EI): calcd for $C_8H_8N_2O_2S$ [M^+] 196.0306; found, 196.0298.

Unsuccessful attempts for the intramolecular cyclization of compound **1ac**

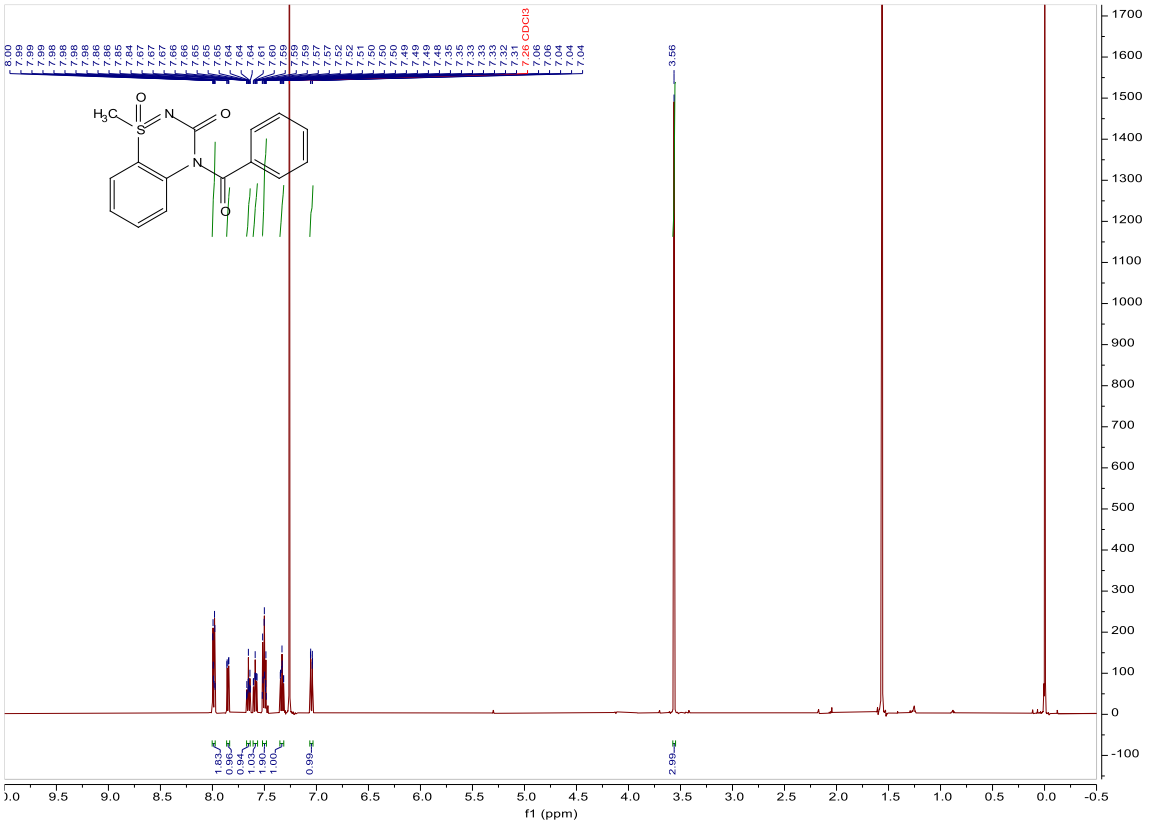


Entry	Reagent	Solvent	Yield, %
1	K_2CO_3	CH_2Cl_2	-[a]
2	K_2CO_3	MeOH	-[a]
3	K_2CO_3	DMF	-[a]
4	NaH	DMF	-[a]
5	Sodium trifluoroacetate	CH_2Cl_2	-[a]
6	2,2,2-trifluoroacetyl isocyanate	CH_2Cl_2	-[a]
7	Trifluoroacetic anhydride	CH_2Cl_2	-[a]
8	PIDA, DMF	DMF	-[a]
9	PIFA, DMF	DMF	-[a]
10	HCl in dioxane (4N)	CH_2Cl_2	-[a]
11	2,2,2-trifluoroacetic acid	CH_2Cl_2	-[a]

[a]No reaction

NMR spectroscopies of Product

Figure S1. ^{1}H and ^{13}C NMR spectroscopy of **2a**



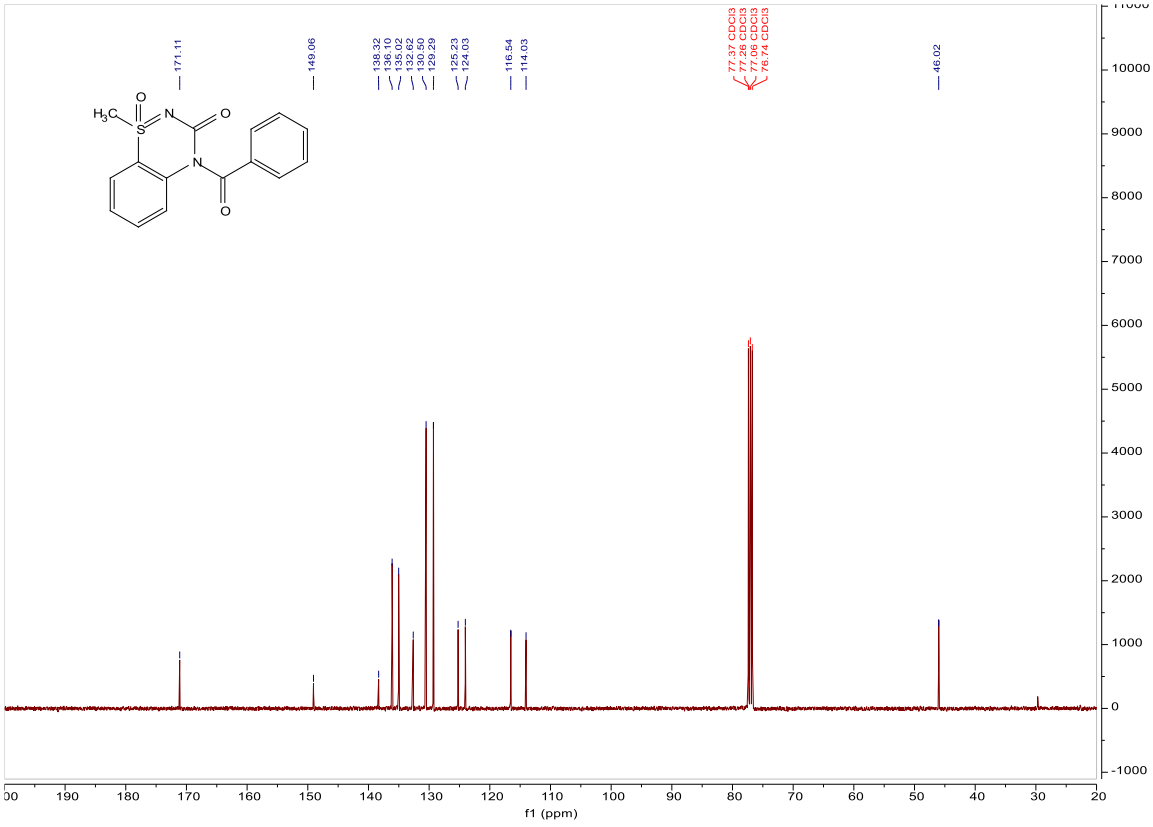


Figure S2. ^{1}H and ^{13}C NMR spectroscopy of **2b**

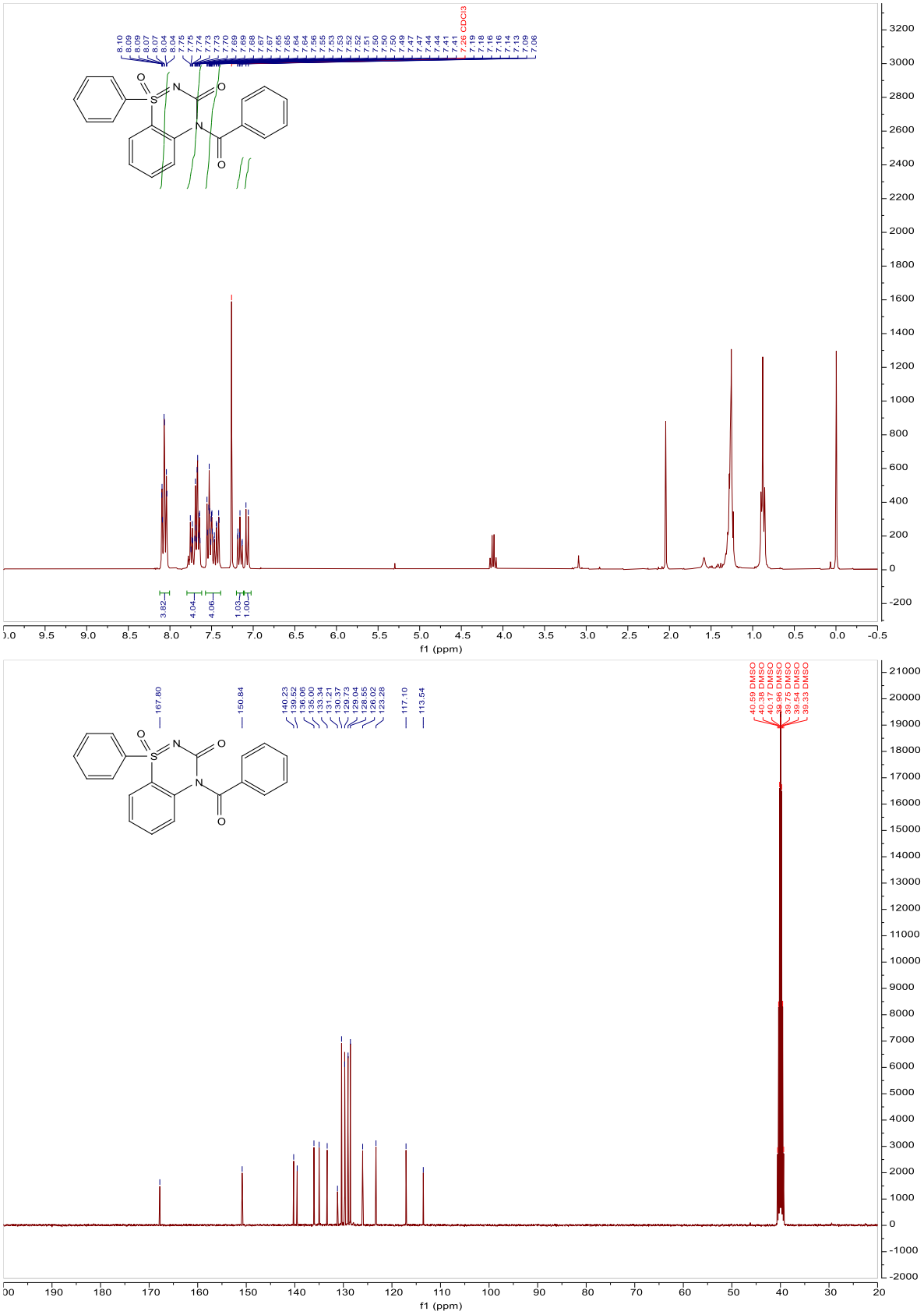
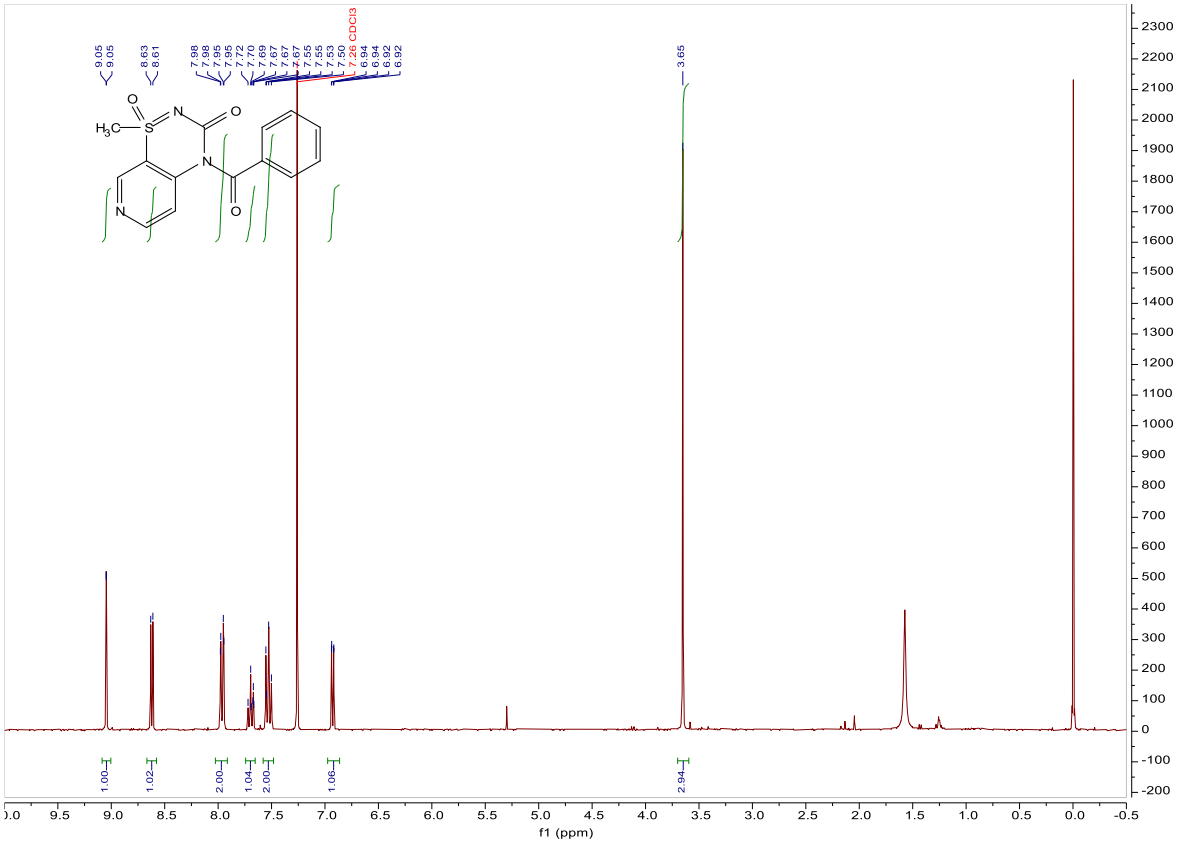


Figure S3. ^{1}H and ^{13}C NMR spectroscopy of **2c**



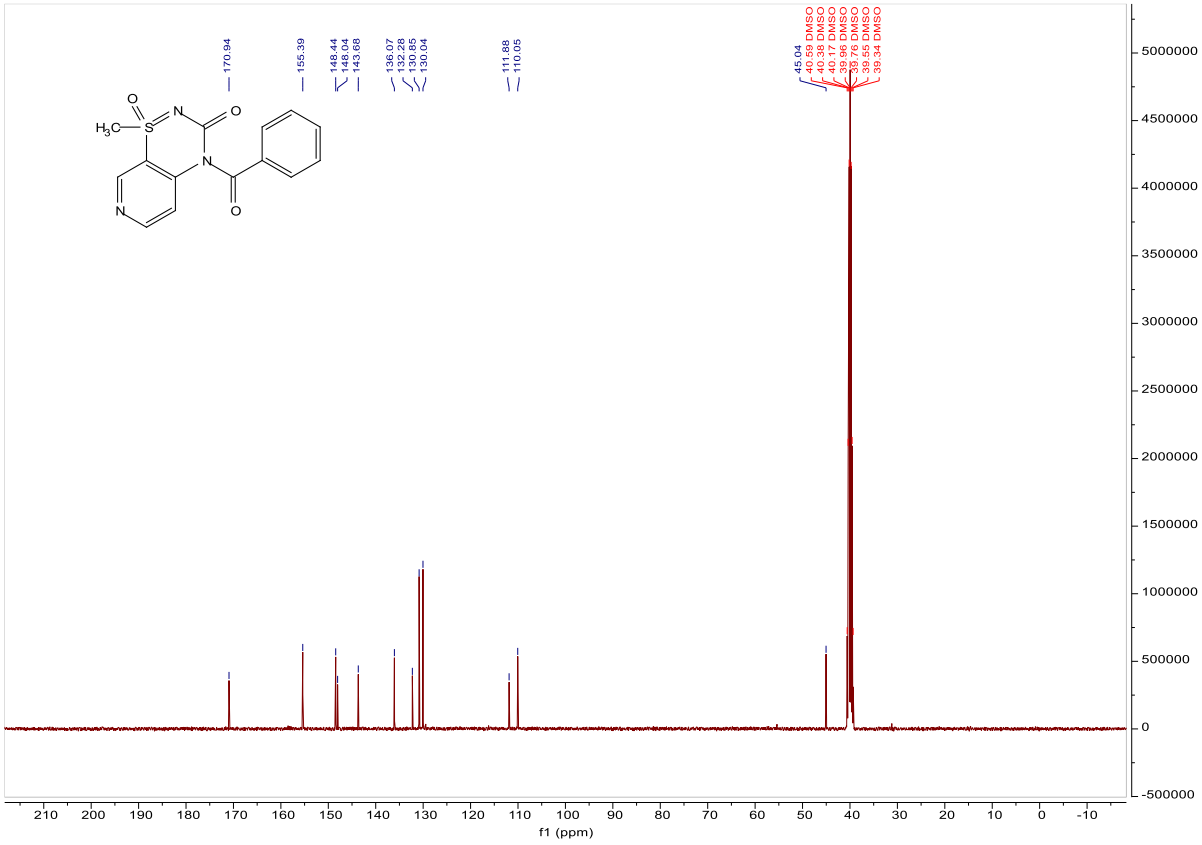
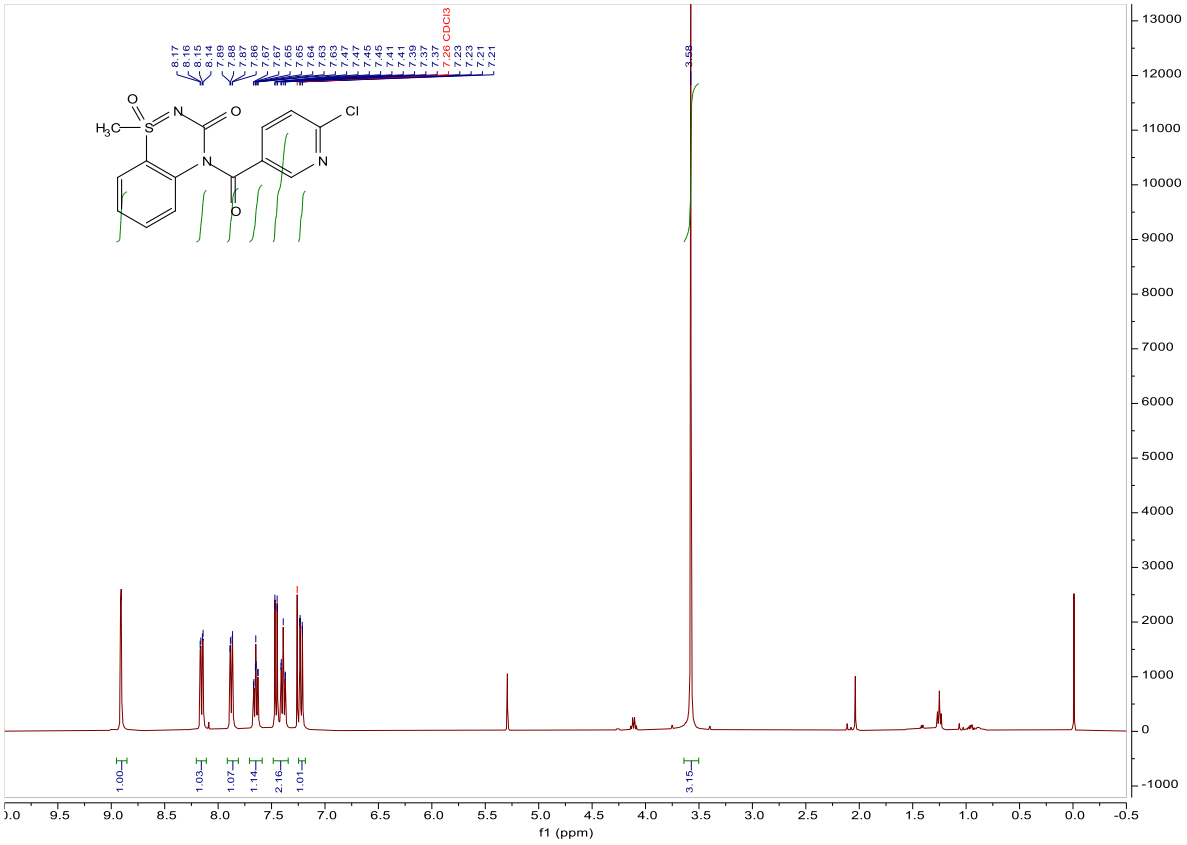


Figure S4. ^{1}H and ^{13}C NMR spectroscopy of **2d**



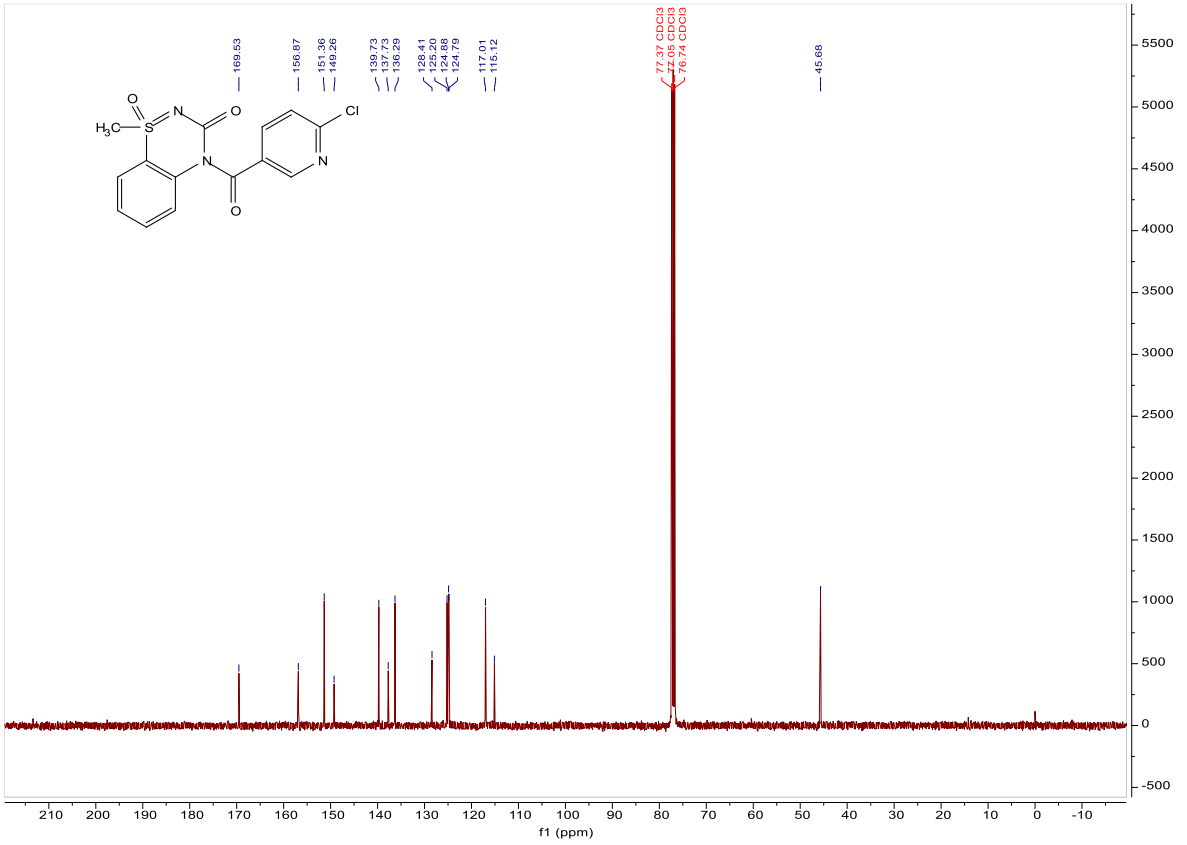
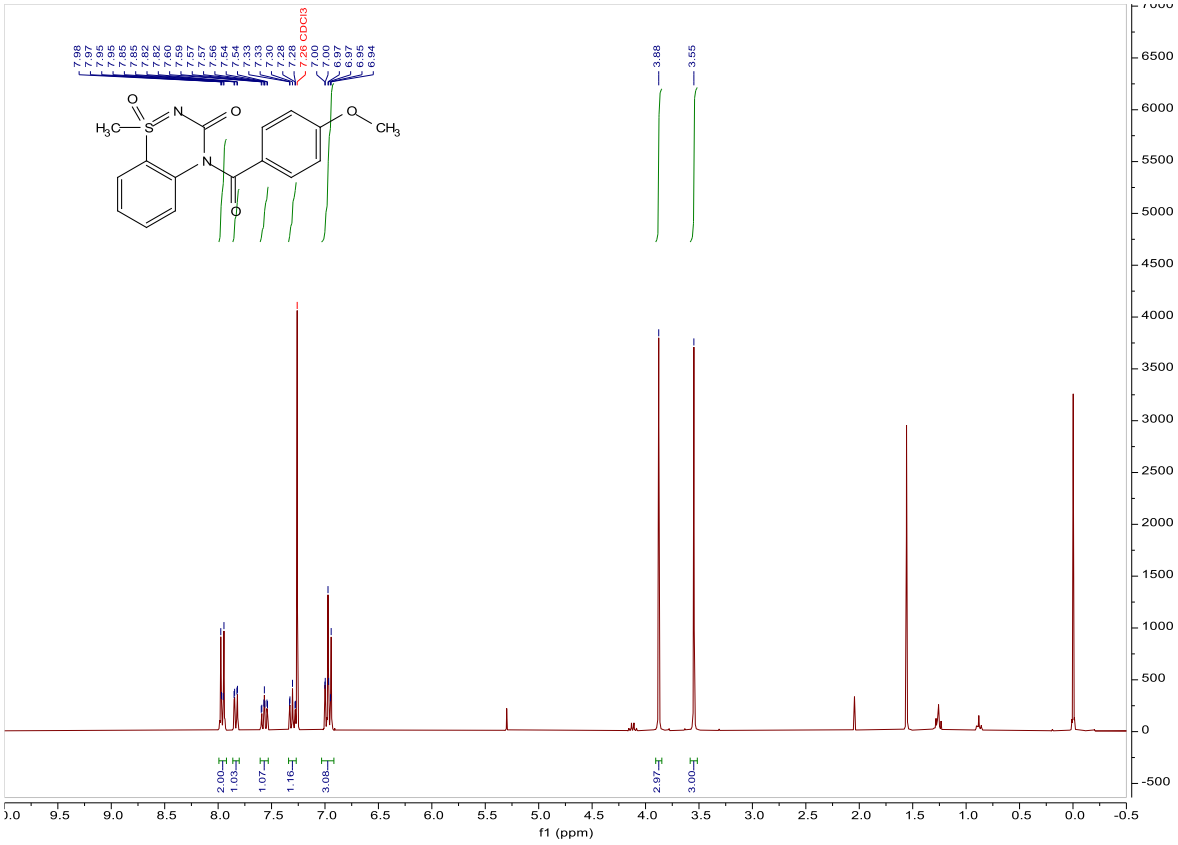


Figure S5. ^{1}H and ^{13}C NMR spectroscopy of **2e**



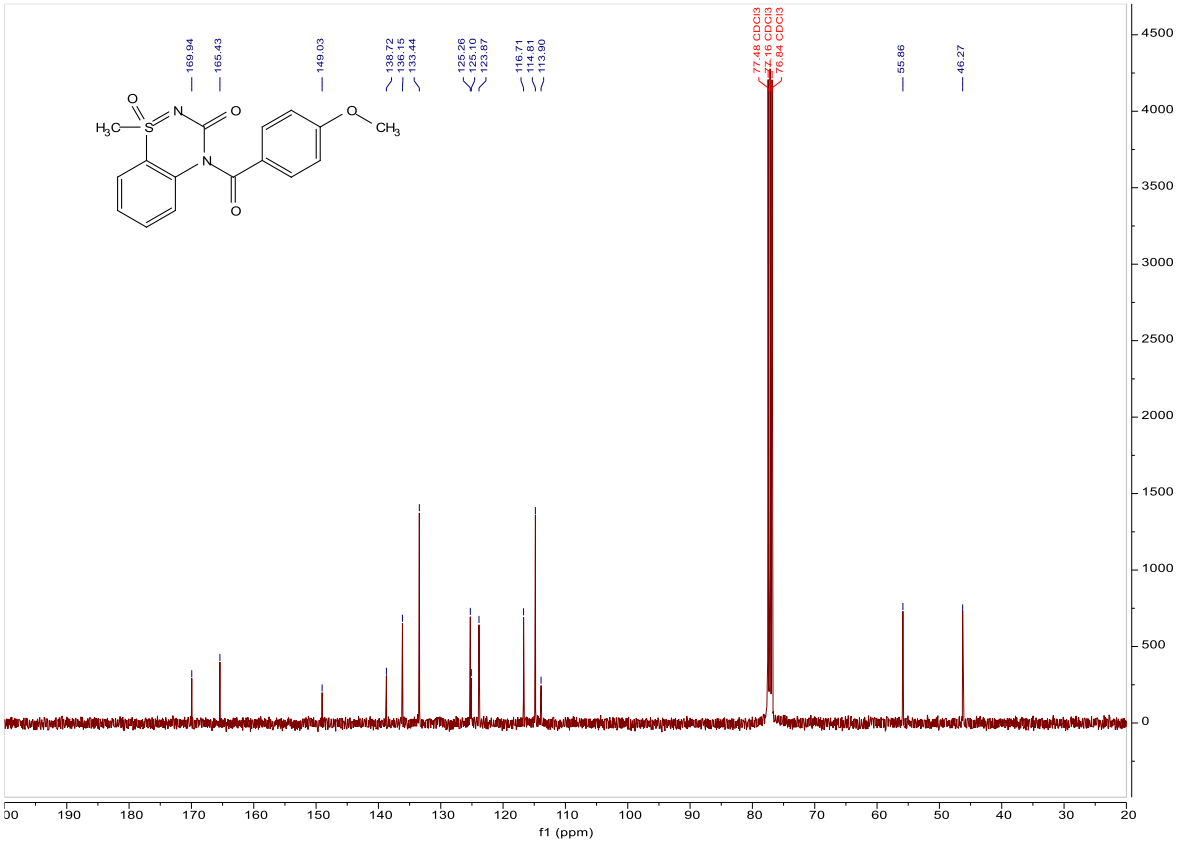
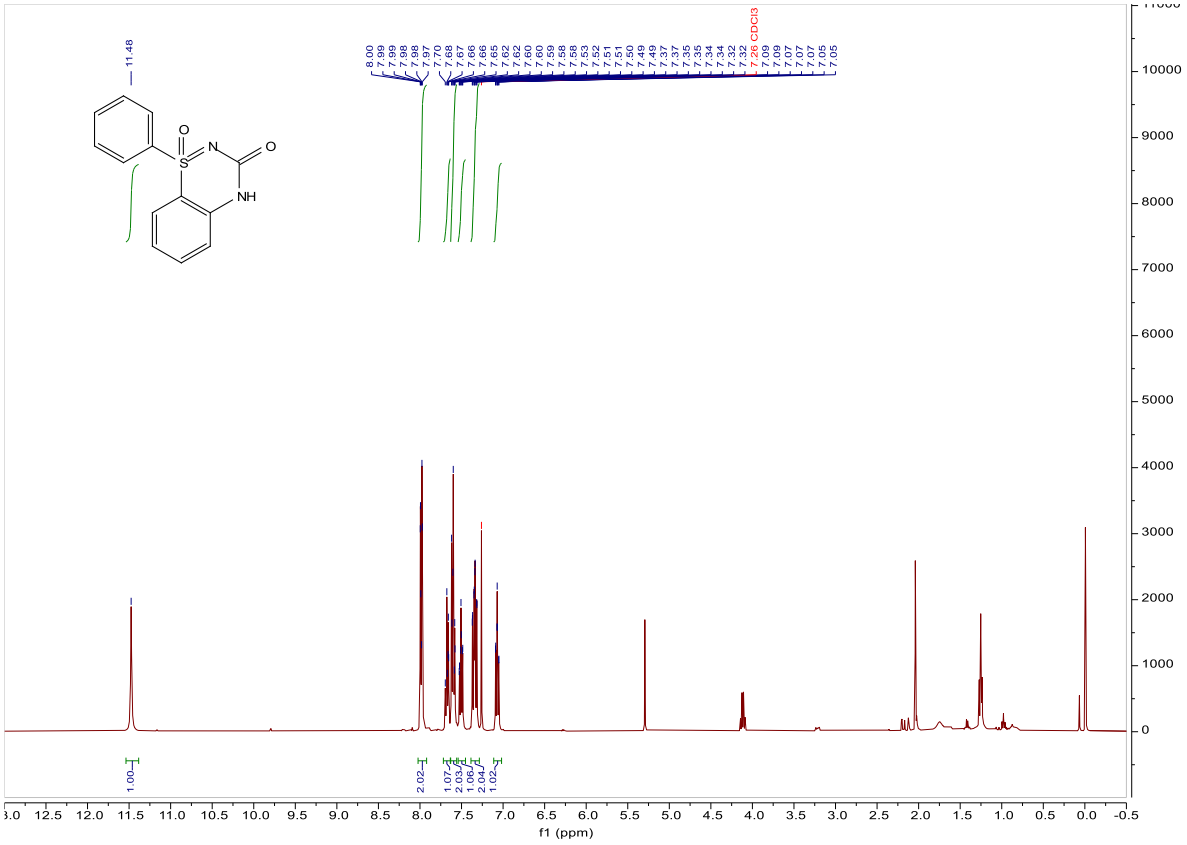


Figure S6. ^{1}H and ^{13}C NMR spectroscopy of **2b'**



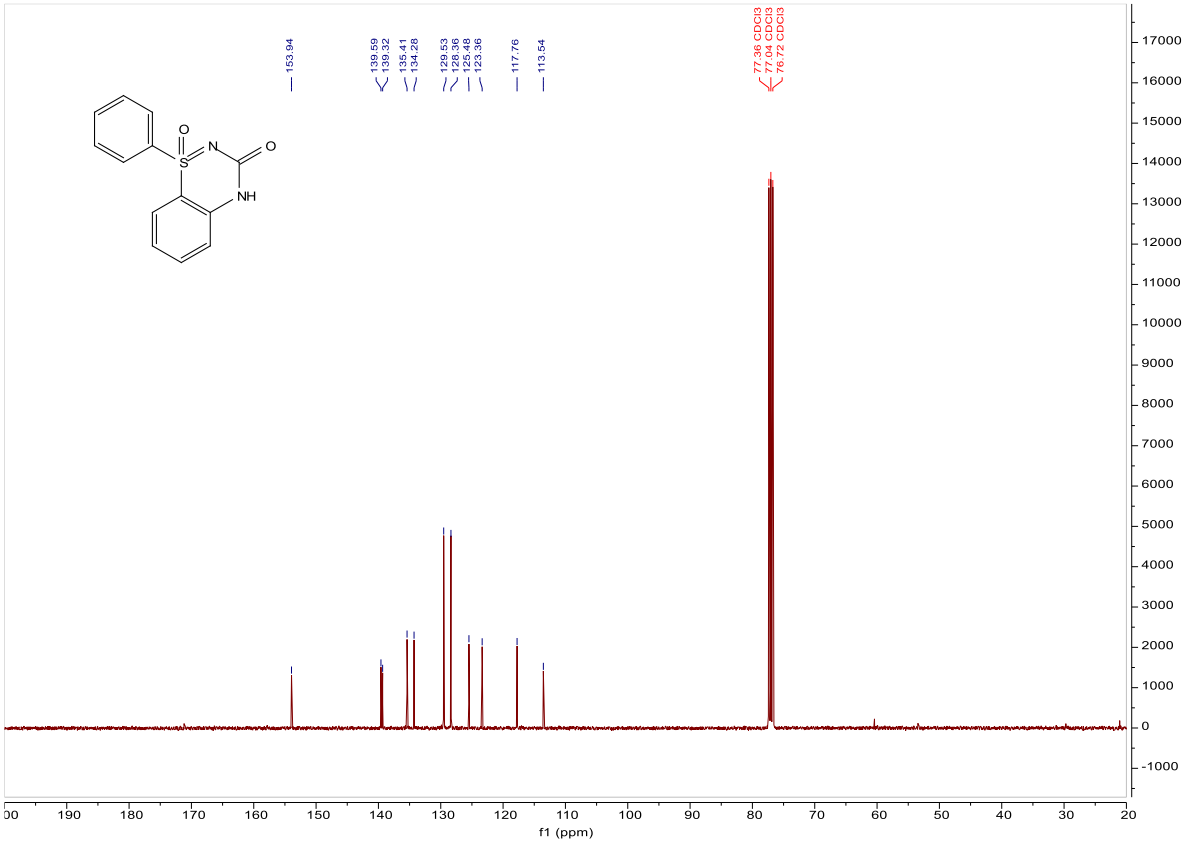
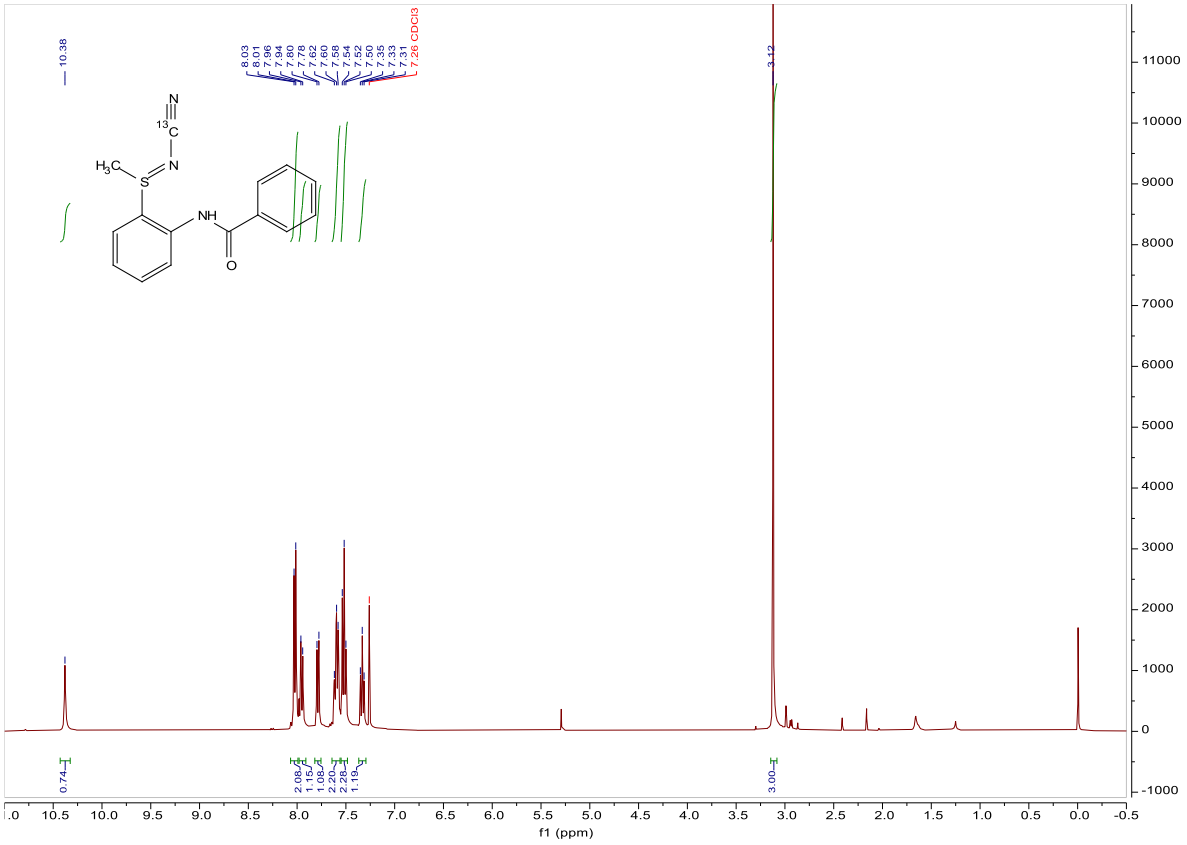


Figure S7. ^{1}H and ^{13}C NMR spectroscopy of sulfilimine of [^{13}C]**1a**



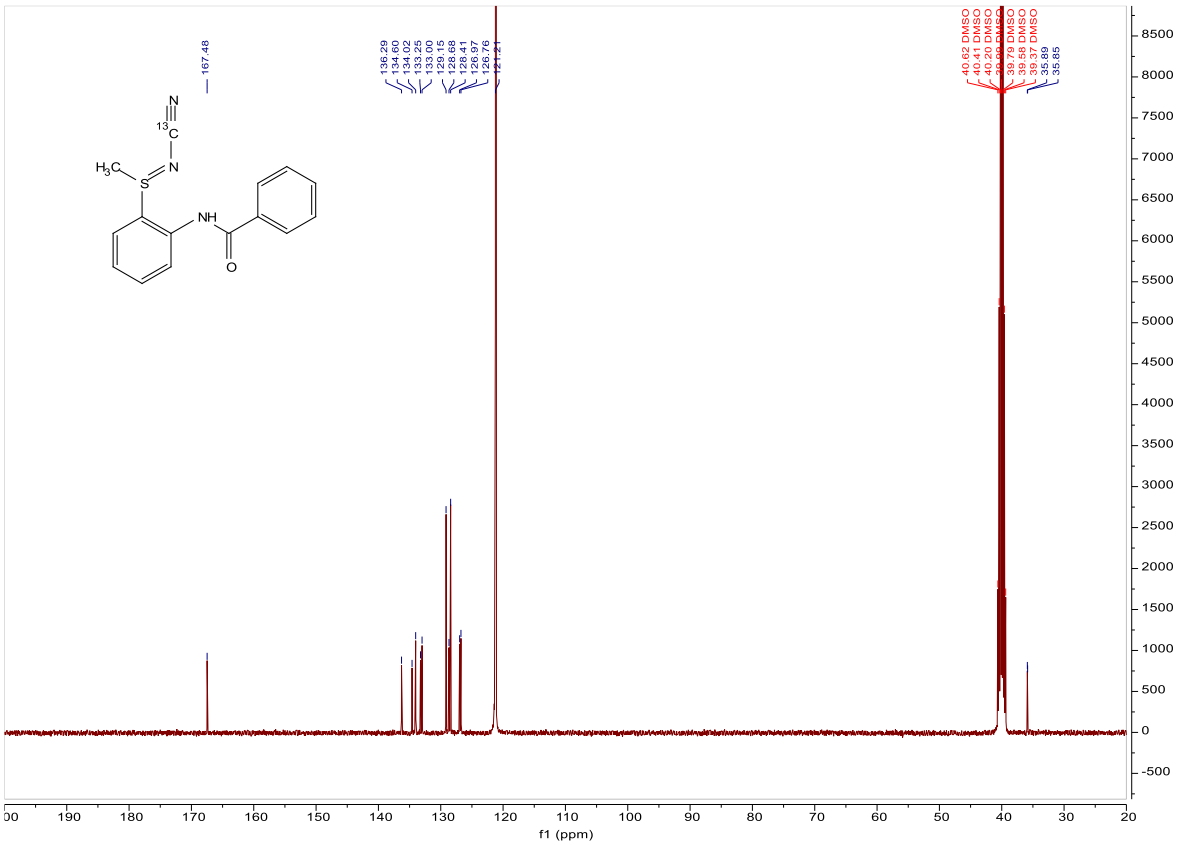
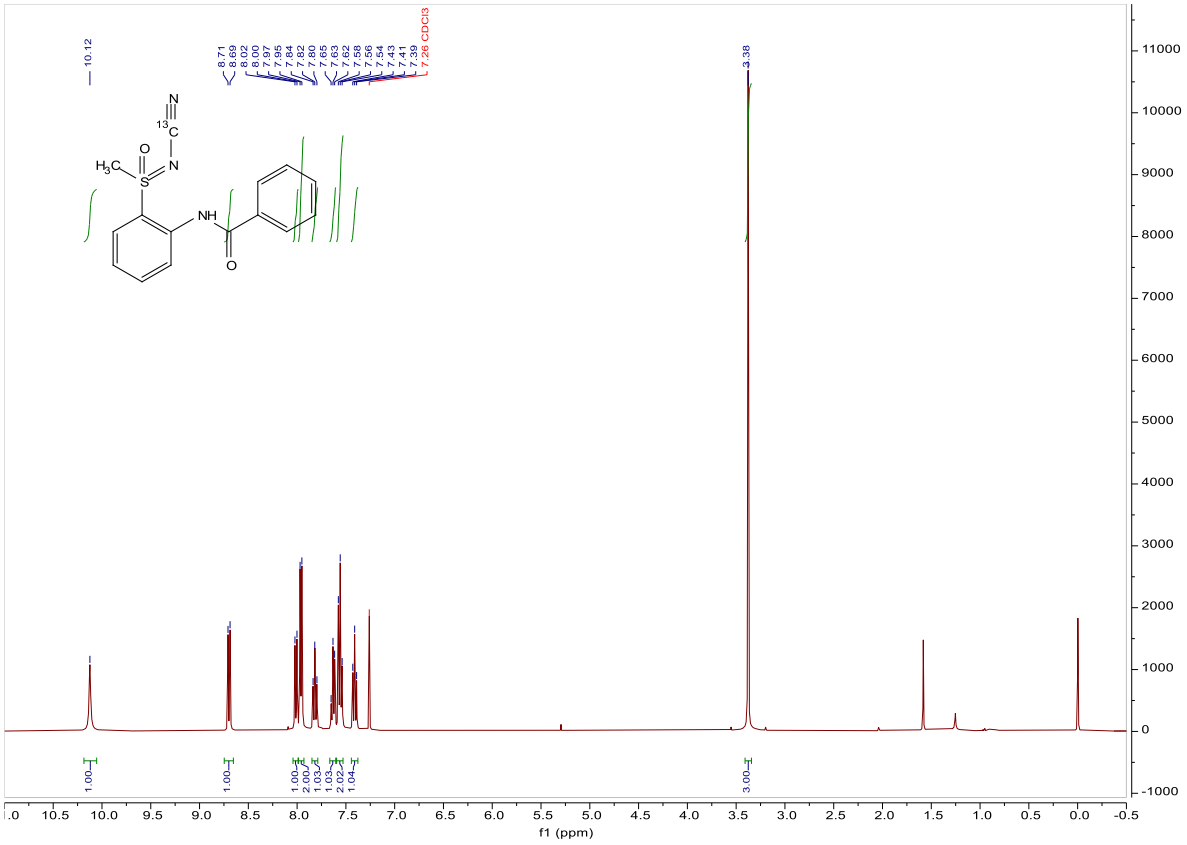


Figure S7-1. ^{1}H and ^{13}C NMR spectroscopy of [^{13}C]**1a**



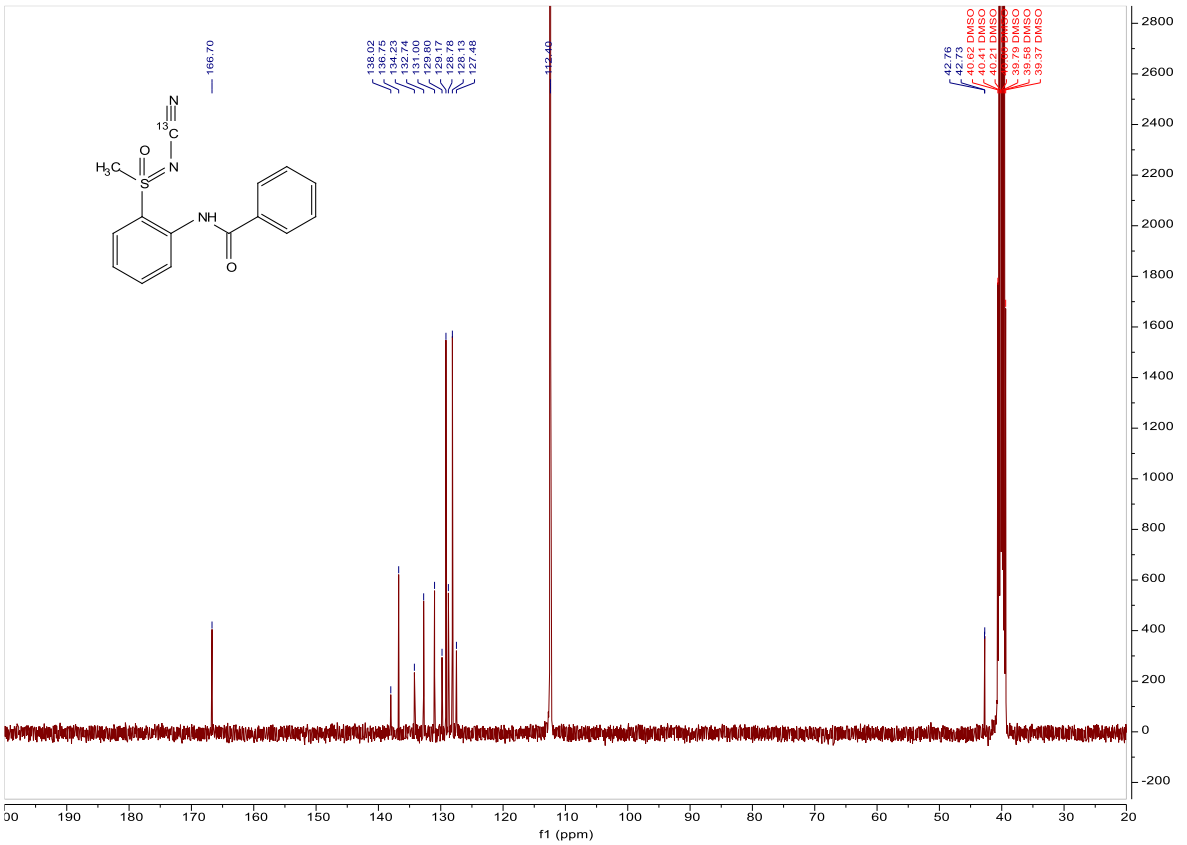
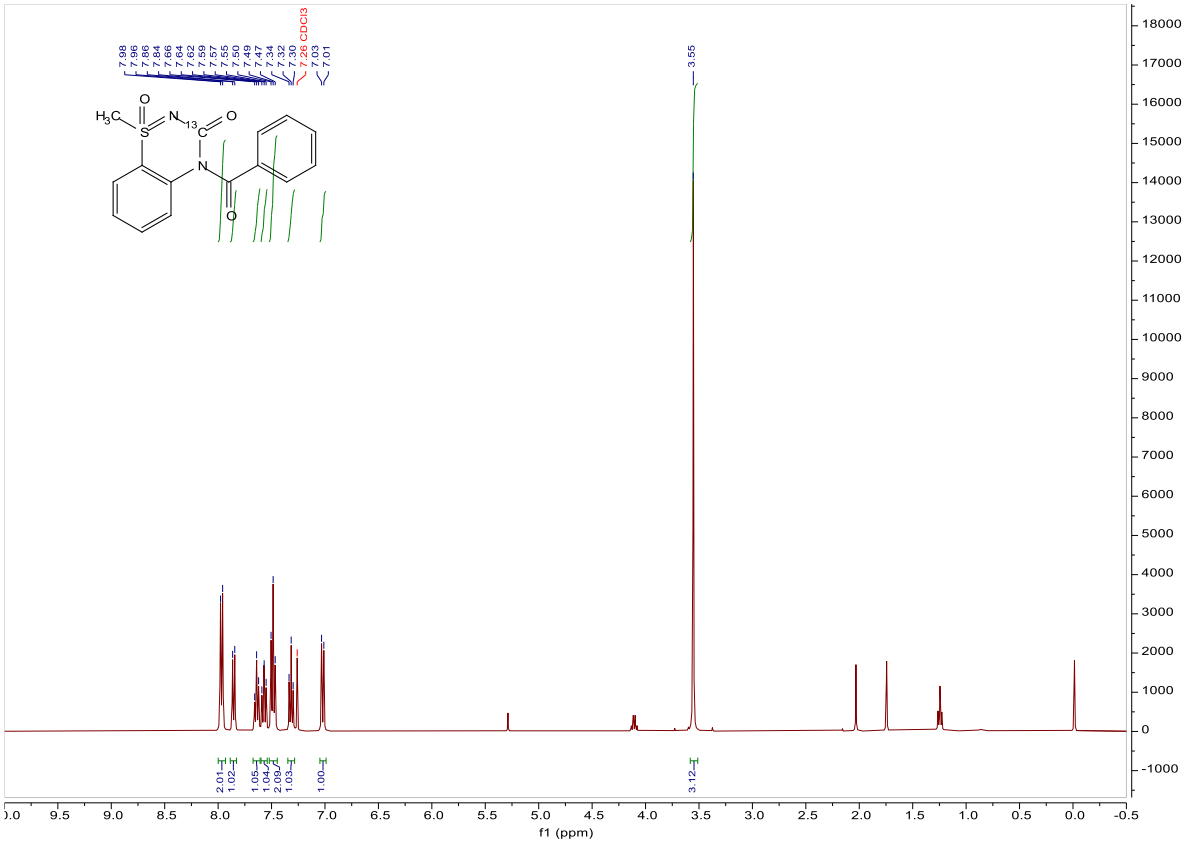


Figure S8. ^{1}H and ^{13}C NMR spectroscopy of [^{13}C]**2a**



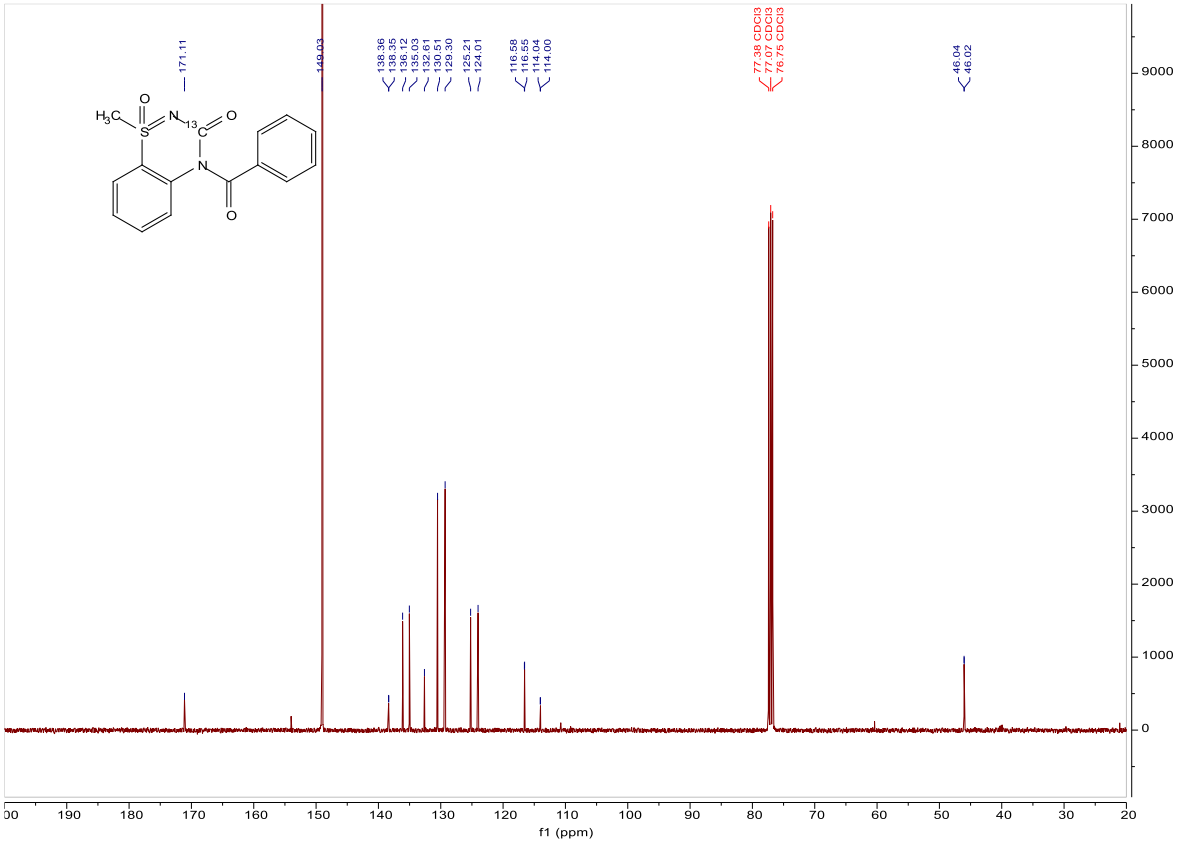
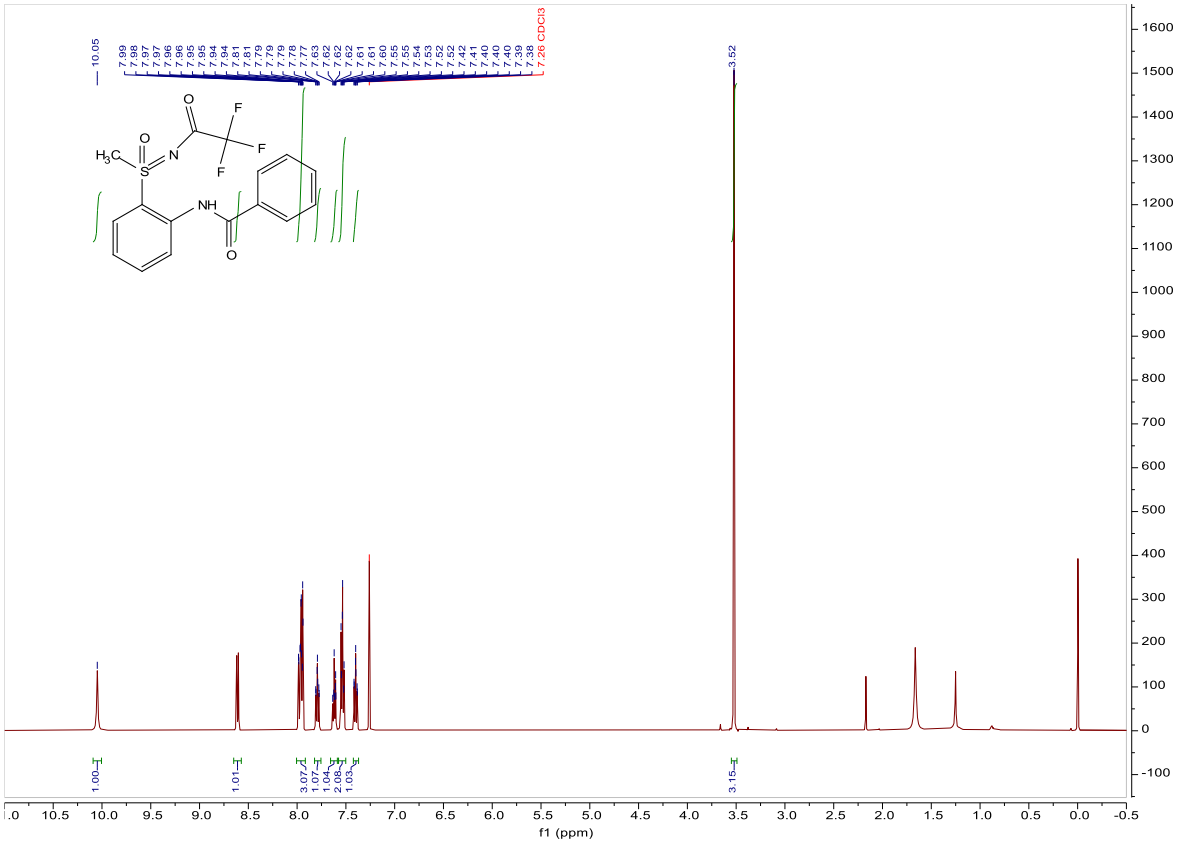
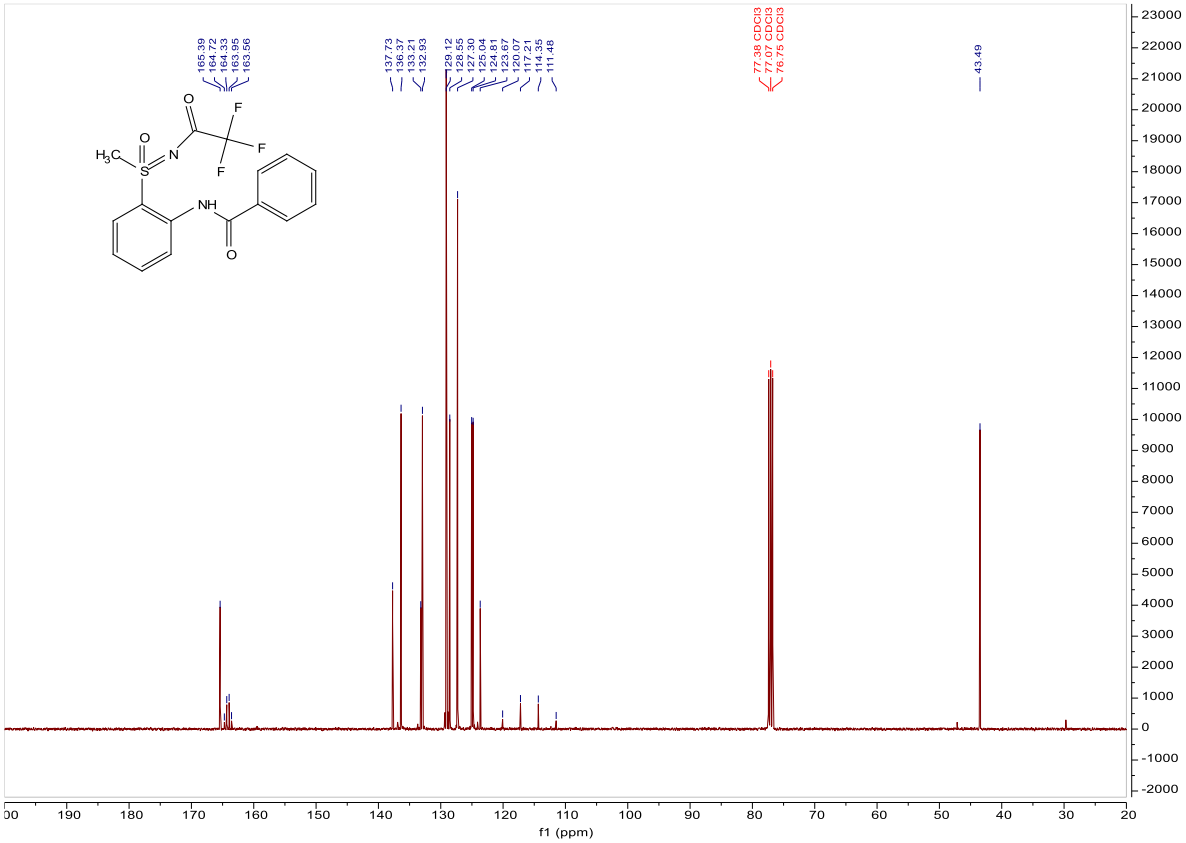
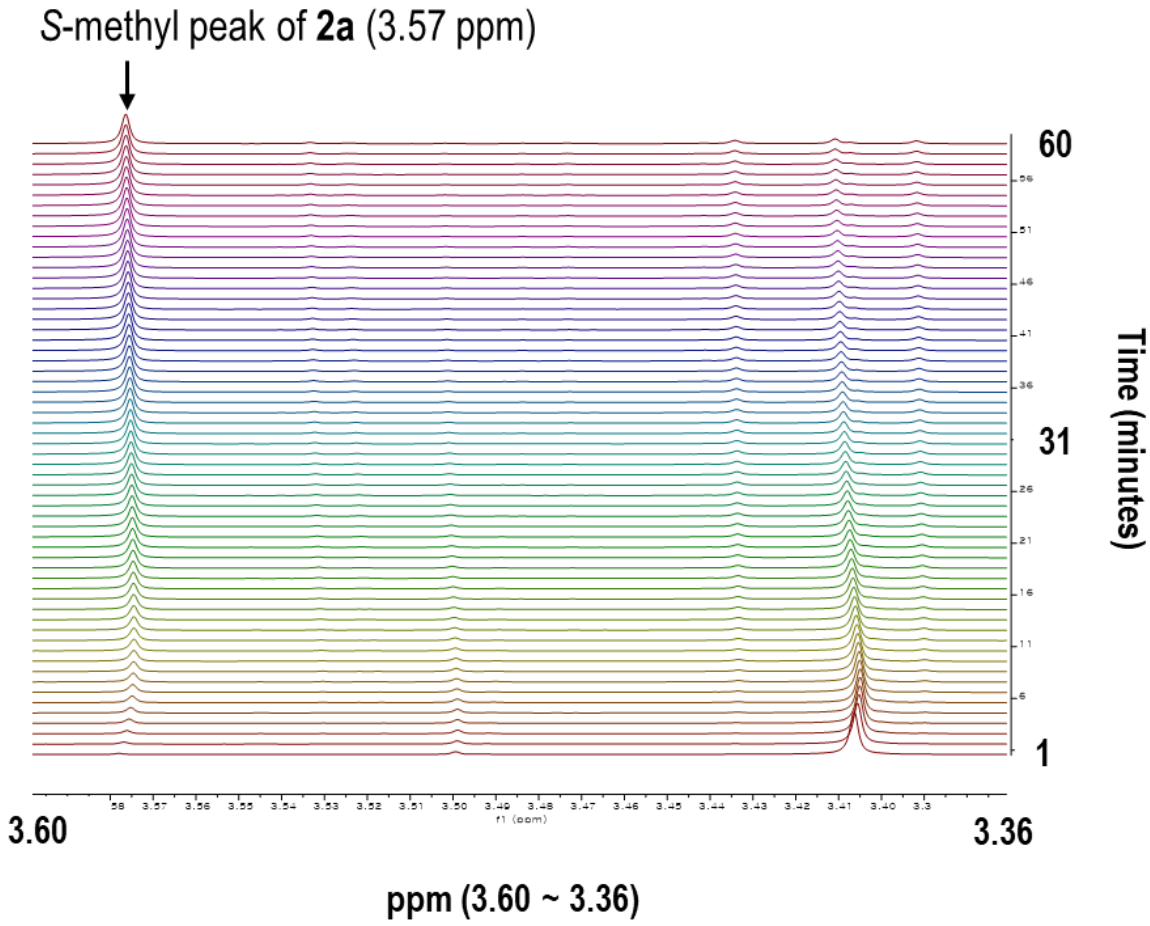


Figure S9. ^{1}H and ^{13}C NMR spectroscopy of **1ac**



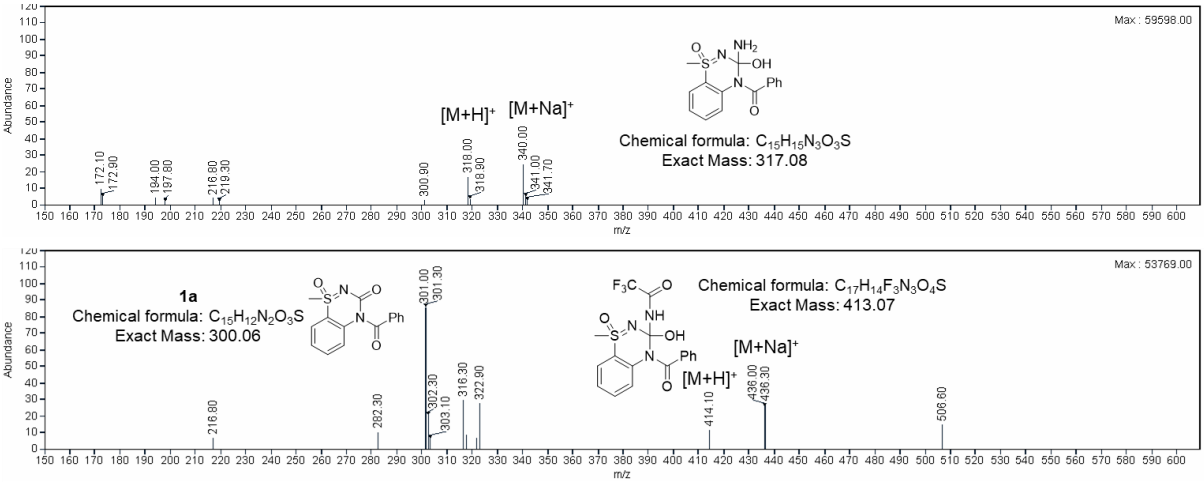


Time-resolved NMR spectroscopy



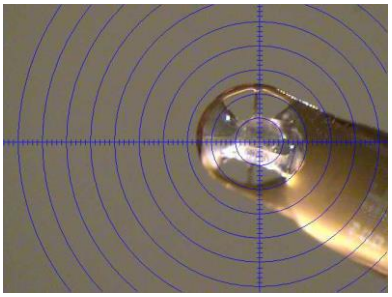
LC/MS analyses of reaction intermediates **1ad**.

To a stirred solution of **1a** (50 mg, 1 equiv.) in CH_2Cl_2 (3 mL) trifluoroacetic anhydride (TFAA, 52.6 mg, 1.5 equiv.) was added at 0 °C. After stirring for 1 h at room temperature, the small portion of reaction mixture (3 μL) was aliquoted and diluted with HPLC grade CH_2Cl_2 (3 mL). LC/MS analysis of reaction intermediates was performed under gradient of 5–100% CH_3CN (0.1% formic acid) in water (0.1% formic acid) over 8 min.



Chemical Analysis Report for X-ray crystallography

1 Sample Information

Sample name	'OIS-S-2021-152'
Empirical formula	C_{13} H_{10} N_2 O_2 S
Formula weight	258.29
Crystal color	silver
Crystal size	0.240 x 0.200 x 0.180 mm³
Crystal shape	block
Crystal image	

2 Instrument Information

2.1 Instrument

Instrument and model	Bruker SMART APEX-II
Source	Mo Kα (λ= 0.71073Å)
Operation voltage / current	50kV/30mA
Monochromator	Graphite crystal
Detector	Charge-Coupled Device (CCD)
Exposure time	10 sec/picture
Operating temperature	Low Temperature 100(1) K
Theta range for data collection	2.530 to 30.507
Total data collection time	14hr

2.2 Software

Data collection	Bruker APEX II
Cell refinement	Bruker SAINT
Data reduction	Bruker SAINT
Absorption correction	SADABS-2016/2
Solve structure	SHELXT 2018/2 (Sheldrick, 2018)
Refine structure	SHELXL-2018/3 (Sheldrick, 2018)
Molecular graphics	XP

3 X-ray Crystallographic Results

3.1 X-ray Crystallographic Data

3.1.1 Crystal data and structure refinement for 'OIS-S-2021-152'.

Identification code	20220501LT_0m	
Empirical formula	C13 H10 N2 O2 S	
Formula weight	258.29	
Temperature	100(1) K	
Wavelength	0.71073 Å	
Crystal system	Orthorhombic	
Space group	Pna21	
Unit cell dimensions	a = 8.3198(2) Å	α= 90°
	b = 9.8246(2) Å	β= 90°
	c = 14.0426(3) Å	γ = 90°
Volume	1147.82(4) Å³	
Z	4	
Density (calculated)	1.495 Mg/m³	
Absorption coefficient	0.276 mm⁻¹	
F(000)	536	
Crystal size	0.240 x 0.200 x 0.180 mm³	
Theta range for data collection	2.530 to 30.507°	
Index ranges	-11<=h<=9, -13<=k<=13, -19<=l<=18	
Reflections collected	19508	
Independent reflections	3293 [R(int) = 0.0227]	
Completeness to theta = 25.242°	100.0 %	
Absorption correction	Semi-empirical from equivalents	
Max. and min. transmission	0.95 and 0.87	
Refinement method	Full-matrix least-squares on F²	
Data / restraints / parameters	3293 / 1 / 163	
Goodness-of-fit on F²	1.034	
Final R indices [I>2sigma(I)]	R1 = 0.0287, wR2 = 0.0777	
R indices (all data)	R1 = 0.0293, wR2 = 0.0780	
Absolute structure parameter	-0.003(15)	

Extinction coefficient	n/a
Largest diff. peak and hole	0.389 and -0.249 e.Å^{-3}

3.1.2 Atomic coordinates (x 10^4) and equivalent isotropic displacement parameters ($Å^2$x 10^3) for 'OIS-S-2021-152'.

U(eq) is defined as one third of the trace of the orthogonalized U^{ij} tensor

	x	y	z	U(eq)
S(1)	1959(1)	4599(1)	4624(1)	13(1)
O(1)	1024(2)	5821(1)	4458(1)	18(1)
O(2)	2603(2)	2396(2)	2527(1)	20(1)
N(1)	1807(2)	3437(2)	3886(1)	18(1)
N(2)	4419(2)	3788(2)	3231(1)	16(1)
C(1)	2926(2)	3181(2)	3185(1)	15(1)
C(2)	4973(2)	4599(2)	3972(1)	14(1)
C(3)	6575(2)	5051(2)	3978(2)	18(1)
C(4)	7125(2)	5860(2)	4713(2)	19(1)
C(5)	6120(2)	6246(2)	5470(2)	19(1)
C(6)	4537(2)	5837(2)	5467(1)	17(1)
C(7)	3973(2)	5017(2)	4717(1)	14(1)
C(8)	1346(2)	3905(2)	5717(1)	15(1)
C(9)	1644(3)	2542(2)	5927(2)	20(1)
C(10)	1175(3)	2045(2)	6812(2)	24(1)
C(11)	441(3)	2900(2)	7471(2)	24(1)
C(12)	167(3)	4260(2)	7252(2)	23(1)
C(13)	610(2)	4776(2)	6372(2)	19(1)

3.1.3 Bond lengths [Å] and angles [°] for 'OIS-S-2021-152'.

S(1)-O(1)	1.4490(14)
S(1)-N(1)	1.5470(18)
S(1)-C(7)	1.7298(17)
S(1)-C(8)	1.7552(19)
O(2)-C(1)	1.233(2)
N(1)-C(1)	1.378(2)
N(2)-C(1)	1.379(2)
N(2)-C(2)	1.389(2)
N(2)-H(2)	0.8800
C(2)-C(7)	1.398(3)
C(2)-C(3)	1.405(3)
C(3)-C(4)	1.380(3)
C(3)-H(3)	0.9500
C(4)-C(5)	1.405(3)
C(4)-H(4)	0.9500
C(5)-C(6)	1.377(3)
C(5)-H(5)	0.9500
C(6)-C(7)	1.407(3)
C(6)-H(6)	0.9500
C(8)-C(9)	1.393(3)
C(8)-C(13)	1.398(3)
C(9)-C(10)	1.391(3)
C(9)-H(9)	0.9500
C(10)-C(11)	1.392(3)
C(10)-H(10)	0.9500
C(11)-C(12)	1.390(3)
C(11)-H(11)	0.9500
C(12)-C(13)	1.386(3)
C(12)-H(12)	0.9500
C(13)-H(13)	0.9500

O(1)-S(1)-N(1)	117.39(9)
O(1)-S(1)-C(7)	109.58(8)
N(1)-S(1)-C(7)	107.73(9)
O(1)-S(1)-C(8)	107.87(9)
N(1)-S(1)-C(8)	105.97(9)
C(7)-S(1)-C(8)	107.93(9)
C(1)-N(1)-S(1)	123.92(14)
C(1)-N(2)-C(2)	125.55(16)
C(1)-N(2)-H(2)	117.2
C(2)-N(2)-H(2)	117.2
O(2)-C(1)-N(1)	120.16(17)
O(2)-C(1)-N(2)	120.07(17)
N(1)-C(1)-N(2)	119.76(17)
N(2)-C(2)-C(7)	122.08(17)
N(2)-C(2)-C(3)	120.06(17)
C(7)-C(2)-C(3)	117.84(17)
C(4)-C(3)-C(2)	120.10(18)
C(4)-C(3)-H(3)	120.0
C(2)-C(3)-H(3)	120.0
C(3)-C(4)-C(5)	121.59(17)
C(3)-C(4)-H(4)	119.2
C(5)-C(4)-H(4)	119.2
C(6)-C(5)-C(4)	119.21(18)
C(6)-C(5)-H(5)	120.4
C(4)-C(5)-H(5)	120.4
C(5)-C(6)-C(7)	119.23(18)
C(5)-C(6)-H(6)	120.4
C(7)-C(6)-H(6)	120.4
C(2)-C(7)-C(6)	122.00(16)
C(2)-C(7)-S(1)	116.78(14)
C(6)-C(7)-S(1)	121.01(14)
C(9)-C(8)-C(13)	121.83(17)
C(9)-C(8)-S(1)	120.46(15)

C(13)-C(8)-S(1)	117.67(15)
C(10)-C(9)-C(8)	118.45(19)
C(10)-C(9)-H(9)	120.8
C(8)-C(9)-H(9)	120.8
C(9)-C(10)-C(11)	120.4(2)
C(9)-C(10)-H(10)	119.8
C(11)-C(10)-H(10)	119.8
C(12)-C(11)-C(10)	120.3(2)
C(12)-C(11)-H(11)	119.8
C(10)-C(11)-H(11)	119.8
C(13)-C(12)-C(11)	120.4(2)
C(13)-C(12)-H(12)	119.8
C(11)-C(12)-H(12)	119.8
C(12)-C(13)-C(8)	118.61(19)
C(12)-C(13)-H(13)	120.7
C(8)-C(13)-H(13)	120.7

Symmetry transformations used to generate equivalent atoms:

3.1.4 Anisotropic displacement parameters ($Å^2 x\ 10^3$) for 'OIS-S-2021-152'.

The anisotropic displacement factor exponent takes the form: $-2\pi^2[h^2a^{*2}U^{11} + ... + 2hka^*b^*U^{12}]$

	U^{11}	U^{22}	U^{33}	U^{23}	U^{13}	U^{12}
S(1)	13(1)	16(1)	11(1)	-1(1)	0(1)	0(1)
O(1)	16(1)	20(1)	19(1)	1(1)	-1(1)	3(1)
O(2)	27(1)	19(1)	13(1)	-4(1)	2(1)	-4(1)
N(1)	17(1)	22(1)	15(1)	-4(1)	0(1)	-2(1)
N(2)	17(1)	18(1)	13(1)	-2(1)	2(1)	1(1)
C(1)	19(1)	13(1)	12(1)	2(1)	0(1)	0(1)
C(2)	16(1)	11(1)	14(1)	1(1)	0(1)	2(1)
C(3)	15(1)	18(1)	21(1)	1(1)	2(1)	0(1)
C(4)	15(1)	18(1)	25(1)	1(1)	-1(1)	-2(1)
C(5)	20(1)	18(1)	20(1)	-1(1)	-3(1)	-1(1)
C(6)	20(1)	16(1)	16(1)	-1(1)	-1(1)	0(1)
C(7)	12(1)	16(1)	13(1)	2(1)	0(1)	-1(1)
C(8)	14(1)	18(1)	13(1)	0(1)	2(1)	-2(1)
C(9)	26(1)	17(1)	17(1)	-2(1)	1(1)	-1(1)
C(10)	31(1)	20(1)	20(1)	2(1)	1(1)	-2(1)
C(11)	26(1)	30(1)	17(1)	0(1)	2(1)	-7(1)
C(12)	24(1)	28(1)	16(1)	-4(1)	5(1)	-2(1)
C(13)	19(1)	22(1)	17(1)	-3(1)	3(1)	0(1)

3.1.5 Hydrogen coordinates (x 10^4) and isotropic displacement parameters $Å^2$x 10^3 for 'OIS-S-2021-152'.

	x	y	z	U(eq)
H(2)	5076	3650	2749	19
H(3)	7281	4800	3476	22
H(4)	8209	6163	4706	23
H(5)	6528	6783	5979	23
H(6)	3833	6106	5966	21
H(9)	2156	1965	5476	24
H(10)	1357	1116	6967	28
H(11)	126	2553	8075	29
H(12)	-328	4839	7708	27
H(13)	418	5703	6217	23

3.1.6 Torsion angles [°] for 'OIS-S-2021-152'.

O(1)-S(1)-N(1)-C(1)	101.12(17)
C(7)-S(1)-N(1)-C(1)	-23.06(19)
C(8)-S(1)-N(1)-C(1)	-138.37(16)
S(1)-N(1)-C(1)-O(2)	-167.62(15)
S(1)-N(1)-C(1)-N(2)	13.4(3)
C(2)-N(2)-C(1)-O(2)	-174.46(18)
C(2)-N(2)-C(1)-N(1)	4.5(3)
C(1)-N(2)-C(2)-C(7)	-7.7(3)
C(1)-N(2)-C(2)-C(3)	173.80(18)
N(2)-C(2)-C(3)-C(4)	179.81(18)
C(7)-C(2)-C(3)-C(4)	1.2(3)
C(2)-C(3)-C(4)-C(5)	0.4(3)
C(3)-C(4)-C(5)-C(6)	-1.7(3)
C(4)-C(5)-C(6)-C(7)	1.4(3)
N(2)-C(2)-C(7)-C(6)	179.92(17)
C(3)-C(2)-C(7)-C(6)	-1.5(3)
N(2)-C(2)-C(7)-S(1)	-5.3(2)
C(3)-C(2)-C(7)-S(1)	173.23(14)
C(5)-C(6)-C(7)-C(2)	0.2(3)
C(5)-C(6)-C(7)-S(1)	-174.33(14)
O(1)-S(1)-C(7)-C(2)	-110.28(15)
N(1)-S(1)-C(7)-C(2)	18.50(17)
C(8)-S(1)-C(7)-C(2)	132.51(15)
O(1)-S(1)-C(7)-C(6)	64.52(17)
N(1)-S(1)-C(7)-C(6)	-166.71(16)
C(8)-S(1)-C(7)-C(6)	-52.69(18)
O(1)-S(1)-C(8)-C(9)	159.83(16)
N(1)-S(1)-C(8)-C(9)	33.32(19)
C(7)-S(1)-C(8)-C(9)	-81.86(18)
O(1)-S(1)-C(8)-C(13)	-22.43(17)
N(1)-S(1)-C(8)-C(13)	-148.94(15)

C(7)-S(1)-C(8)-C(13)	95.88(16)
C(13)-C(8)-C(9)-C(10)	0.7(3)
S(1)-C(8)-C(9)-C(10)	178.32(16)
C(8)-C(9)-C(10)-C(11)	-0.7(3)
C(9)-C(10)-C(11)-C(12)	0.1(3)
C(10)-C(11)-C(12)-C(13)	0.5(3)
C(11)-C(12)-C(13)-C(8)	-0.4(3)
C(9)-C(8)-C(13)-C(12)	-0.1(3)
S(1)-C(8)-C(13)-C(12)	-177.83(15)

Symmetry transformations used to generate equivalent atoms:

3.1.7 Hydrogen bonds [Å and °] for 'OIS-S-2021-152'.

D-H...Å	d(D-H)	d(H...Å)	d(D...Å)	<(DHÅ)
N(2)-H(2)...O(2)#1	0.88	2.36	3.058(2)	136.2
C(3)-H(3)...O(2)#1	0.95	2.55	3.266(3)	132.3

Symmetry transformations used to generate equivalent atoms:

#1 x+1/2,-y+1/2,z

3.2 X-ray Crystallographic Structure.

3.2.1 Crystal structure.

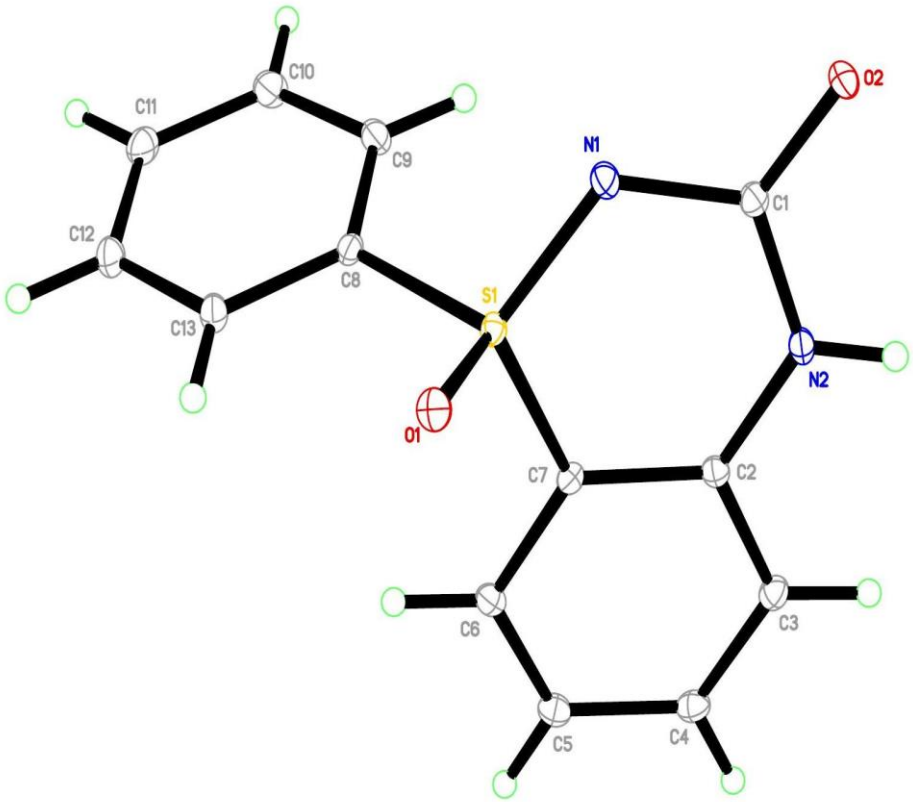


Figure 1. Crystal structure of 'OIS-S-2021-152'. Thermal ellipsoids for non-H atoms are shown at the 25% probability level.

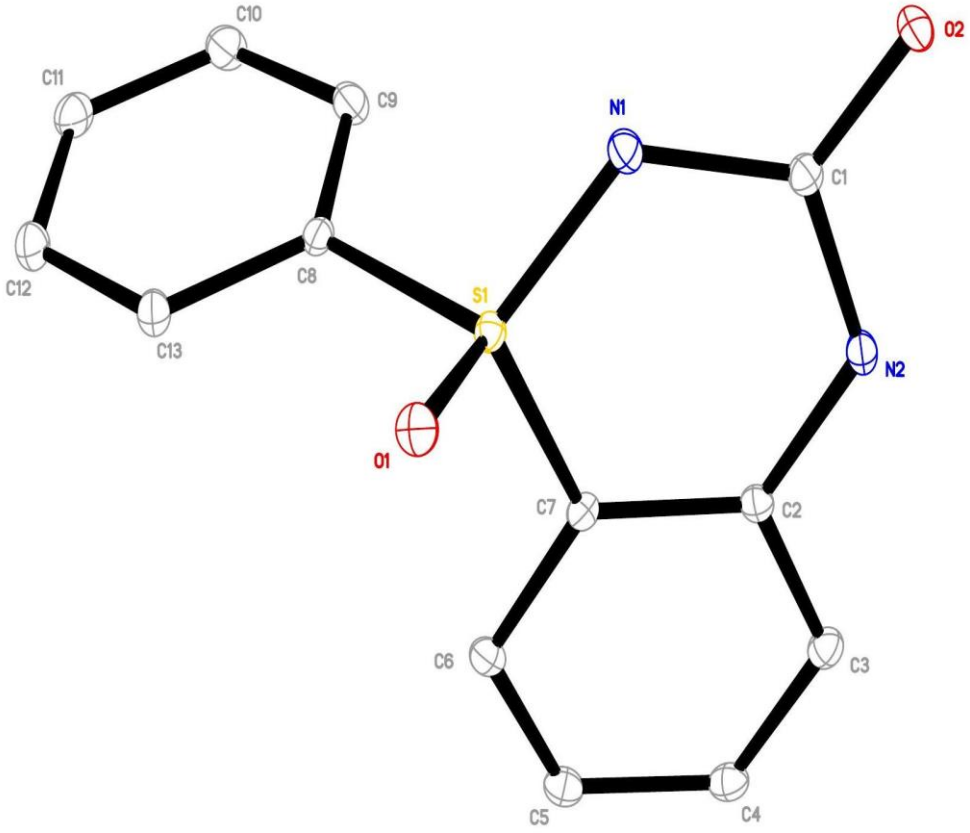


Figure 2. Crystal structure of 'OIS-S-2021-152'. Thermal ellipsoids for non-H atoms are shown at the 25% probability level. For clarity, hydrogen atoms are omitted.

3.2.2 Packing crystal structure.

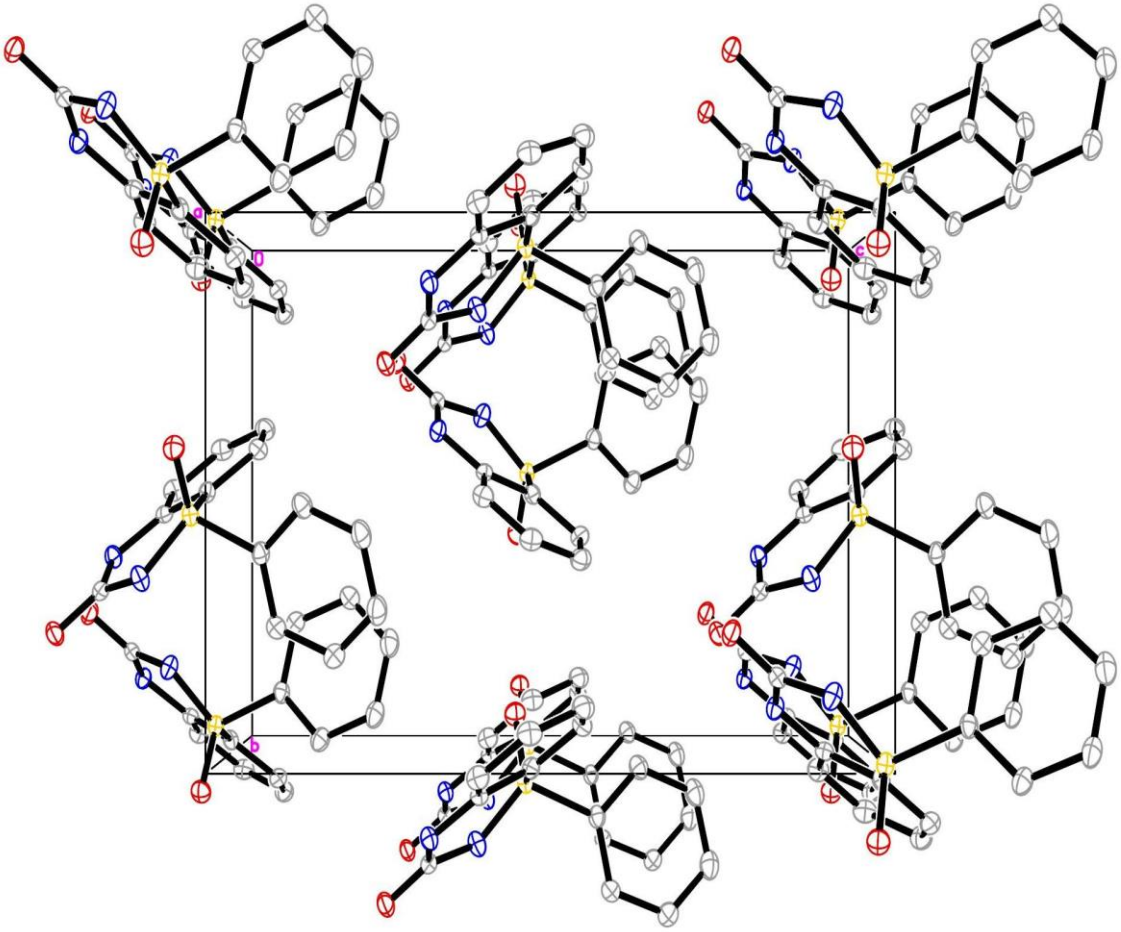


Figure 3. The packing crystal structure showing the view along the a axis.

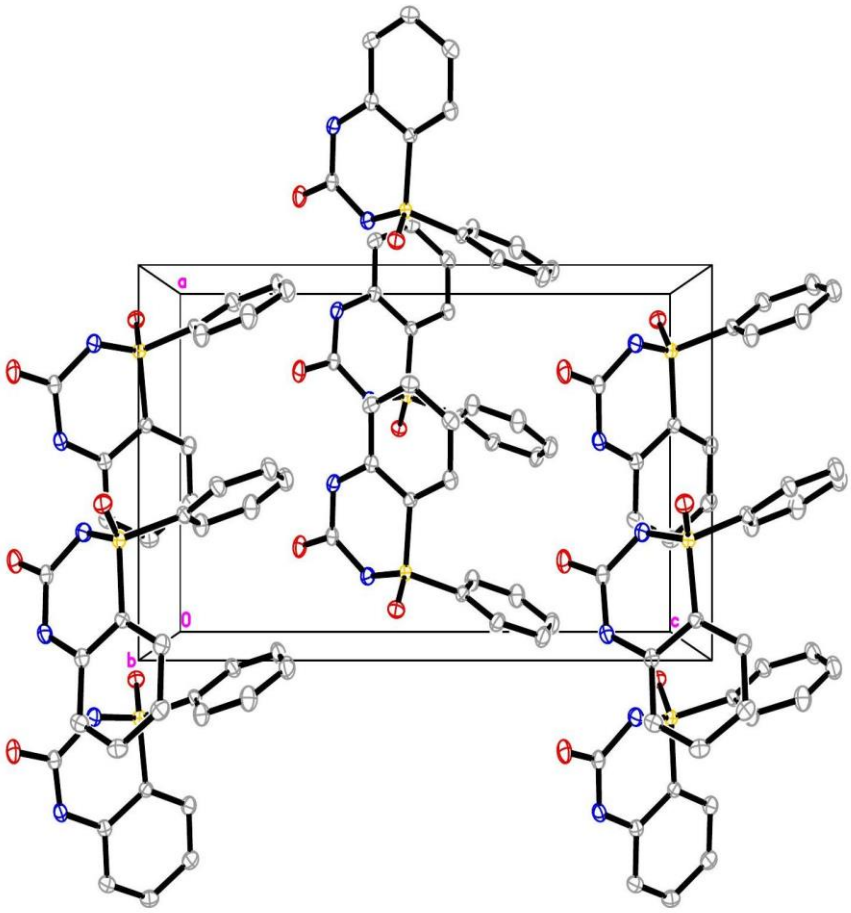


Figure 4. The packing crystal structure showing the view along the b axis.

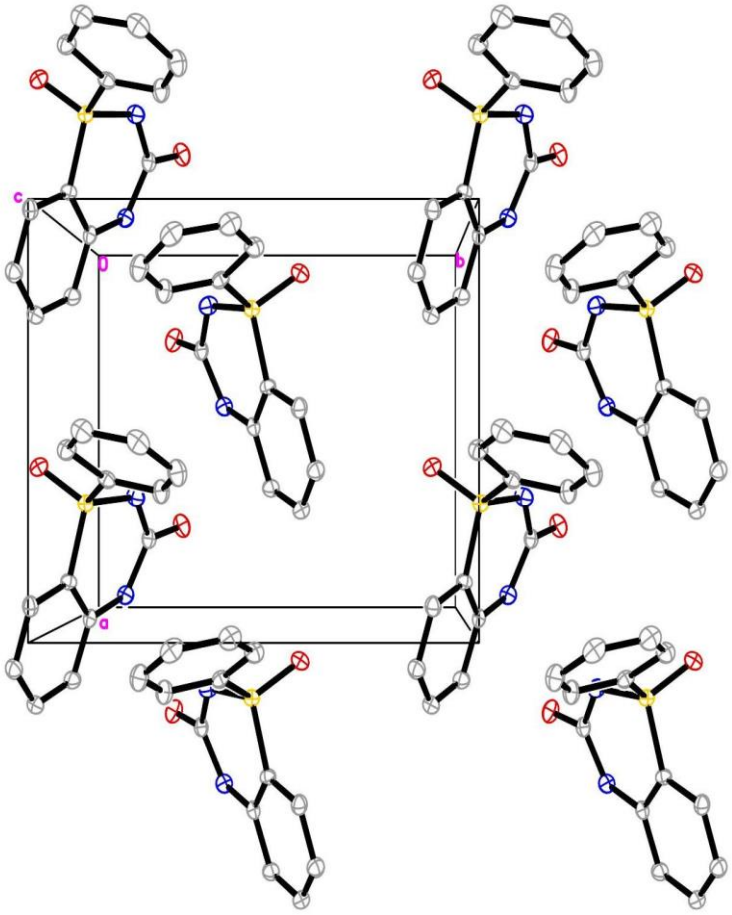
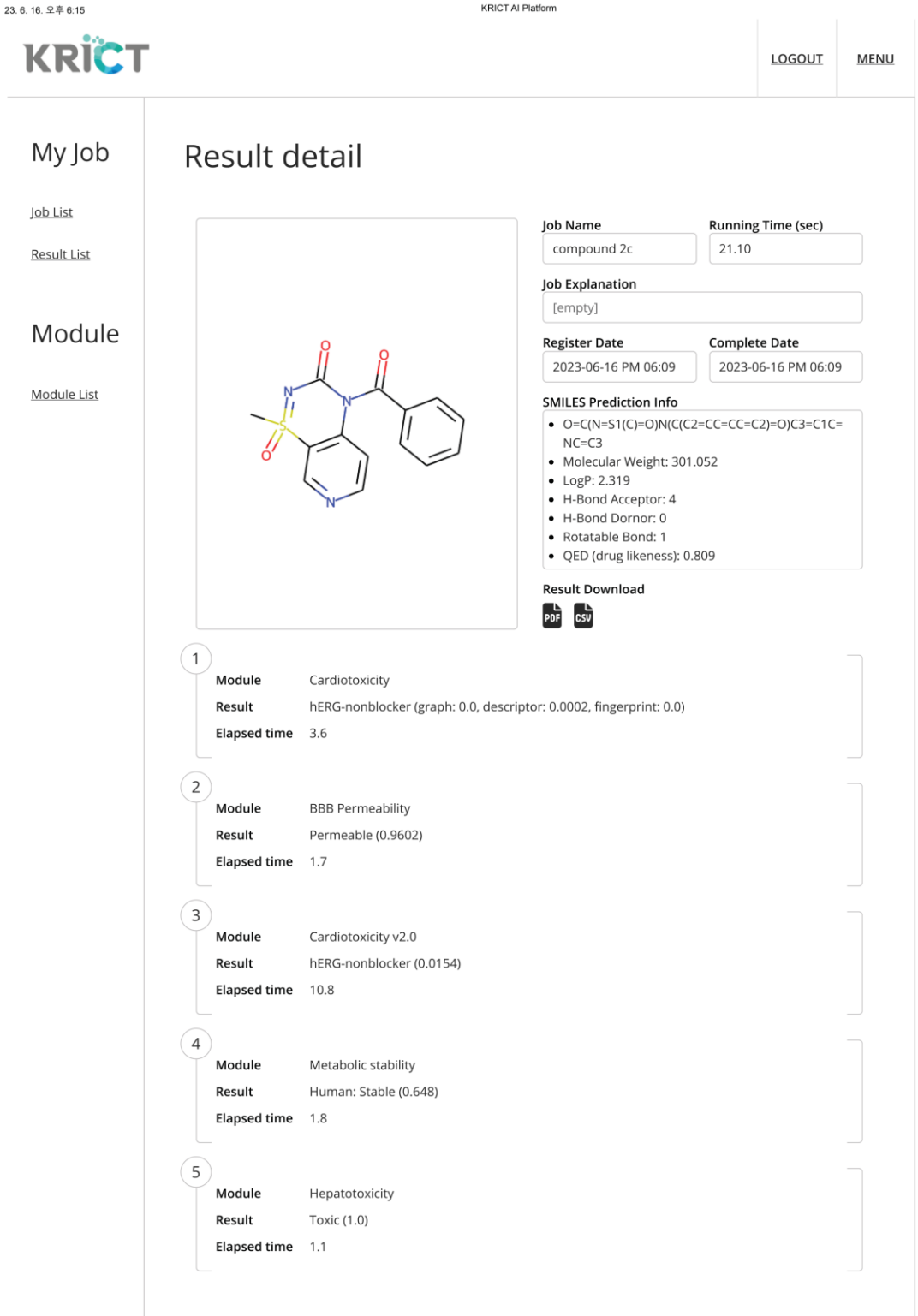


Figure 5. The packing crystal structure showing the view along the c axis.

The ADMET predicted data of compound **2c** and **2d** by the KRICT AI platform



Elapsed time 2.0

7

Module PredAOT

Result Exception!

TOP

KRICT

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LOGOUT MENU

My Job

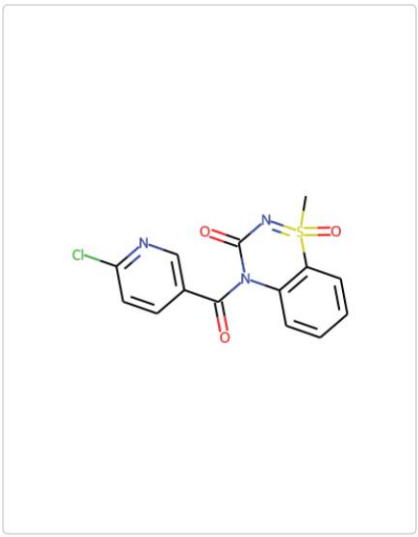
Job List

Result List

Module

Module List

Result detail



Job Name compound 2d

Running Time (sec) 21.83

Job Explanation [empty]

Register Date 2023-06-16 PM 06:11

Complete Date 2023-06-16 PM 06:11

SMILES Prediction Info

- O=S(C1=C2C=CC=C1)(C)=NC(N2C(C3=CN=C(Cl)C=C3)=O)=O
- Molecular Weight: 335.013
- LogP: 2.972
- H-Bond Acceptor: 4
- H-Bond Dornor: 0
- Rotatable Bond: 1
- QED (drug likeness): 0.750

Result Download PDF CSV

1

Module Cardiotoxicity
Result hERG-nonblocker (graph: 0.0003, descriptor: 0.0008, fingerprint: 0.0001)
Elapsed time 3.5

2

Module BBB Permeability
Result Permeable (0.8368)
Elapsed time 1.6

3

Module Cardiotoxicity v2.0
Result hERG-nonblocker (0.0264)
Elapsed time 11.3

4

Module Metabolic stability
Result Human: Stable (0.618)
Elapsed time 2.0

5

Module Hepatotoxicity
Result Toxic (1.0)
Elapsed time 1.2

Elapsed time 2.0

7

Module PredAOT

Result Exception!

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