Electronic Supplementary Material (ESI) for ChemComm.

Supporting Information

Regioselective *peri*-C–H Selenylation of Aromatic Compounds with Weakly Coordinating Ketone Groups

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General information and materials:

Unless otherwise noted, all commercially available compounds were used as provided without further purification. Solvents for chromatography were technical grade. Column chromatography was performed using silica gel Merck 60 (particle size 0.040-0.063 mm). Solvent mixtures are understood as volume/volume.

^{1}H-NMR and^{13}C-NMRwere recorded on a *Bruker DRX400 (400 MHz)*, *DRX500 (500 MHz)*and *DRX600* (600 MHz) spectrometer in $CDCl_3$ (δ = 7.26 ppm for ^{1}H, δ = 77.00 ppm for ^{13}C) and in DMSO-d_6 (δ = 2.50 ppm for ^{1}H, δ = 39.43 ppm for ^{13}C). Data are reported in the following order: chemical shift (δ) in ppm; multiplicities areindicated s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet); coupling constants (*J*)are given in Hertz (Hz). High resolution mass spectra were recorded on a LTQ Orbitrap massspectrometer coupled to an *Acceka HPLC-System* (HPLC column: *Hypersyl GOLD*, 50 mm ×1 mm, 1.9 μm). Chemical yields refer to isolated pure substances.

General procedures for synthesis

1. General procedure for the synthesis of products 3:

A mixture of chromones **1** (0.2 mmol), diselenides **2** (0.24 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (10 mol%), $AgNTf_2$ (40 mol%), $Cu(OAc)_2$ (50 mol%), CuCl (2 equiv), and chlorobenzene (2 mL), was added in a 5 mL glass tube, which was stirred at 120 ℃ for 24–72 h in air. The reaction was stopped, and it was mixed with water and ethyl acetate. The reaction mixture was extracted three times with ethyl acetate. The combined organic layer was dried over anhydrous magnesium sulfate, and filtered. The filtrate was evaporated under a vacuum, and the residue was purified by flash column chromatography on silica gel (eluting with petroleum ether-ethyl acetate) to provide the desired product **3**.

2. General procedure for the synthesis of products 6:

A mixture of heteroarenes **1** (0.2 mmol), diselenides **2** (0.4 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (10 mol%), $AgNTf_2$ (40 mol%), $Cu(OAc)_2$ (50 mol%), CuCl (2 equiv), and chlorobenzene (2 mL), was added in a 5 mL glass tube, which was stirred at 120 ℃ for 24–45 h in air. The reaction was stopped, and it was mixed with water and ethyl acetate. The reaction mixture was extracted three times with ethyl acetate. The combined organic layer was dried over anhydrous magnesium sulfate, and filtered. The filtrate was evaporated under a vacuum, and the residue was purified by flash column chromatography on silica gel (eluting with petroleum ether-ethyl acetate) to provide the desired product **6**.

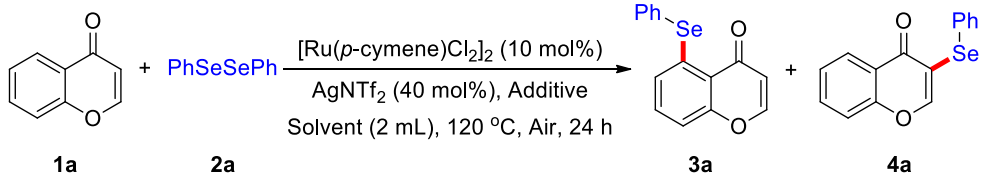
3. Procedure for the synthesis of product 7:

A mixture of **3a** (0.2 mmol), diphenyl diselenide **2a** (1.5 equiv) and PIFA (1 equiv.) in DCM (2

mL) was added in a 5 mL glass tube, which was stirred at room temperature for 0.5 h. When the reaction was completed, it was mixed with water and ethyl acetate. The reaction mixture was extracted three times with ethyl acetate. The combined organic layer was dried over anhydrous magnesium sulfate and filtered. The filtrate was evaporated under vacuum and the residue was purified by flash column chromatography on silica gel (eluting with petroleum ether-ethyl acetate) to provide the desired products **7**.

Optimization of reaction conditions

Table S1. Optimization of solvents and additives[a]

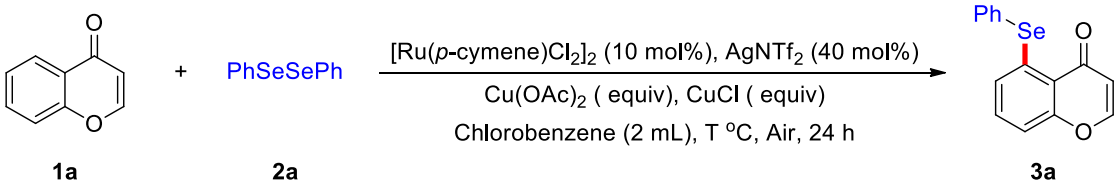


1a **2a** **3a** **4a**

Entry	Solvent	Additive	Yield (%)[b]	
			3a	**4a**
1	DMF	$Cu(OAc)_2$ (50 mol%) + CuCl (2 equiv)	-	75
2	Toluene	$Cu(OAc)_2$ (50 mol%) + CuCl (2 equiv)	25	-
3	TFE	$Cu(OAc)_2$ (50 mol%) + CuCl (2 equiv)	trace	45
4	1,4-Dioxane	$Cu(OAc)_2$ (50 mol%) + CuCl (2 equiv)	trace	34
5	MeCN	$Cu(OAc)_2$ (50 mol%) + CuCl (2 equiv)	-	-
6	t-AmOH	$Cu(OAc)_2$ (50 mol%) + CuCl (2 equiv)	-	-
7	DMSO	$Cu(OAc)_2$ (50 mol%) + CuCl (2 equiv)	-	trace
8	DCE	$Cu(OAc)_2$ (50 mol%) + CuCl (2 equiv)	66	-
9	**Chlorobenzene**	**$Cu(OAc)_2$ (50 mol%) + CuCl (2 equiv)**	**70**	**-**
10	Chlorobenzene	PivOH (50 mol%) + CuCl (2 equiv)	-	50
11	Chlorobenzene	Ag_2CO_3 (50 mol%) + CuCl (2 equiv)	trace	6
12	Chlorobenzene	$Cu(OTf)_2$ (50 mol%) + CuCl (2 equiv)	-	60
13	Chlorobenzene	CuO (50 mol%) + CuCl (2 equiv)	-	34
14	Chlorobenzene	KOAc (50 mol%) + CuCl (2 equiv)	trace	-
15	Chlorobenzene	$Cu(OAc)_2$ (50 mol%) + CuBr (2 equiv)	55	-
16	Chlorobenzene	-	-	trace
17	Chlorobenzene	$Cu(OAc)_2$ (50 mol%)	63	-
18	Chlorobenzene	CuCl (2 equiv)	-	40
19[c]	Chlorobenzene	$Cu(OAc)_2$ (50 mol%) + CuCl (2 equiv)	-	47

[a]Reaction conditions: **1a** (0.2 mmol), **2a** (1.2 equiv), $[Ru(p\text{-cymene})Cl_2]_2$ (10 mol%), $AgNTf_2$ (40 mol%), additive in solvent (2 mL), at 120 °C in air. [b]Yield refers to isolated products after column chromatograph. [c]$[Ru(p\text{-cymene})Cl_2]_2$ was replaced with $[Cp^*IrCl_2]_2$.

Table S2. Optimization of amounts of catalyst, additives and temperature[a]

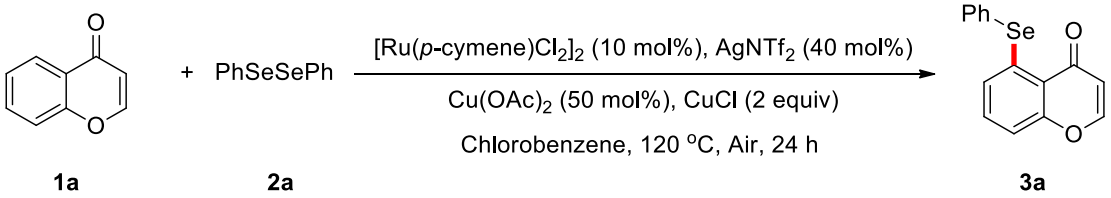


Entry	Amount of $Cu(OAc)_2$ (equiv)	Amount of CuCl (equiv)	T (^oC)	Yield (%)[b]
1	**0.5**	**2**	**120**	**70**
2	1	2	120	58
3	0.5	1	120	55
4	0.5	3	120	69
5	0.5	2	100	64
6[c]	0.5	2	120	60
7[d]	0.5	2	120	51

[a]Reaction conditions: **1a** (0.2 mmol), **2a** (1.2 equiv), $[Ru(p\text{-cymene})Cl_2]_2$ (10 mol%), $AgNTf_2$ (40 mol%), $Cu(OAc)_2$ (mol%), CuCl (equiv), in chlorobenzene (2 mL) at T ^oC in air. [b]Yield refers to isolated products after column chromatography. [c]$[Ru(p\text{-cymene})Cl_2]_2$ (7.5 mol%) and $AgNTf_2$ (30 mol%) were used. [d]The reaction was performed in nitrogen.

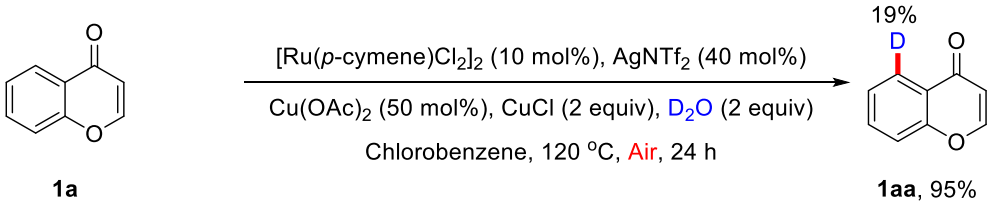
Study on reaction mechanism

1. Radical trapping experiments



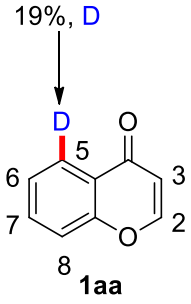
Entry	Additive (4 equiv)	Recovered **1a**	Yield of **3a**	
1	-	8%	70%	
2	TEMPO	92%	-	
3	BHT	94%	-	
4	1,1-diphenylethylene	90%	-	Ph, SePh, Ph **8**, 60%

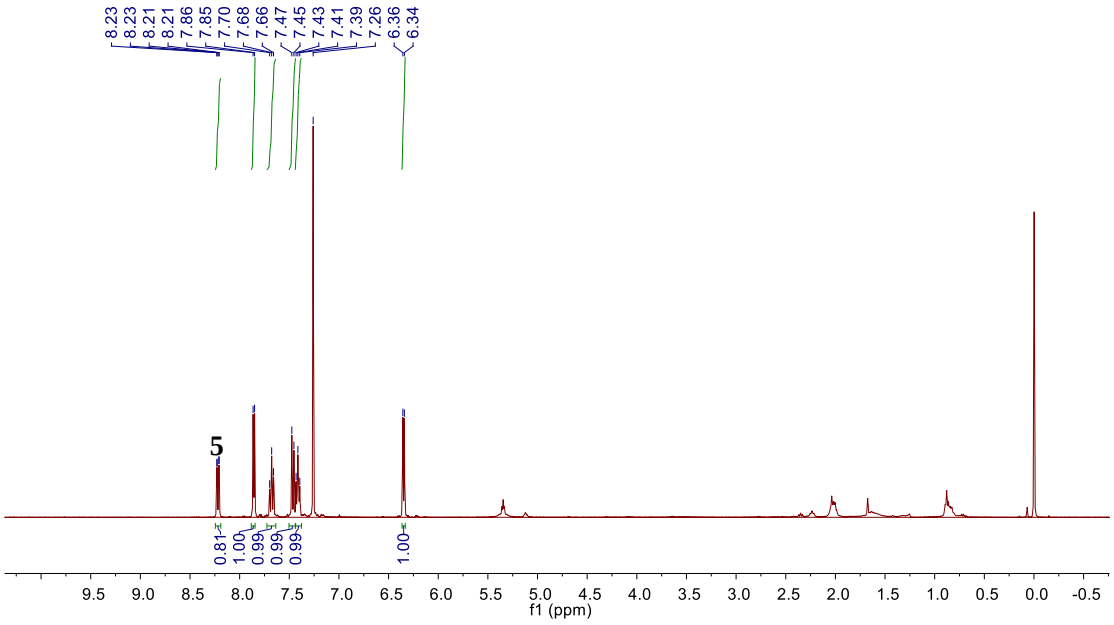
2. Deuterium labeling experiments

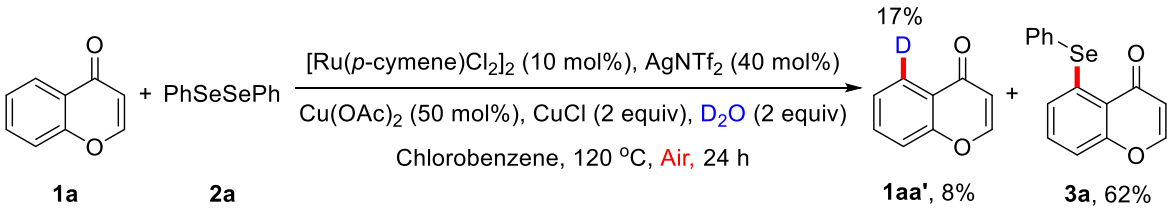


1a **1aa**, 95%

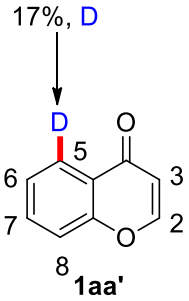
A mixture of chromone **1a** (0.2 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (10 mol%), $AgNTf_2$ (40 mol%), $Cu(OAc)_2$ (50 mol%), CuCl (2 equiv), D_2O (2 equiv.) and chlorobenzene (2 mL), was added in a 5 mL glass tube, which was stirred at 120 ℃ for 24 h in air. The reaction was stopped, and it was mixed with water and ethyl acetate. The reaction mixture was extracted three times with ethyl acetate. The combined organic layer was dried over anhydrous magnesium sulfate, and filtered. The filtrate was evaporated under a vacuum, and the residue was purified by flash column chromatography on silica gel (eluting with petroleum ether-ethyl acetate) to afford the recovered starting material **1aa** in 95% yield. The analysis by ^{1}H NMR showed deuterium incorporation at the C5-position of **1aa**.

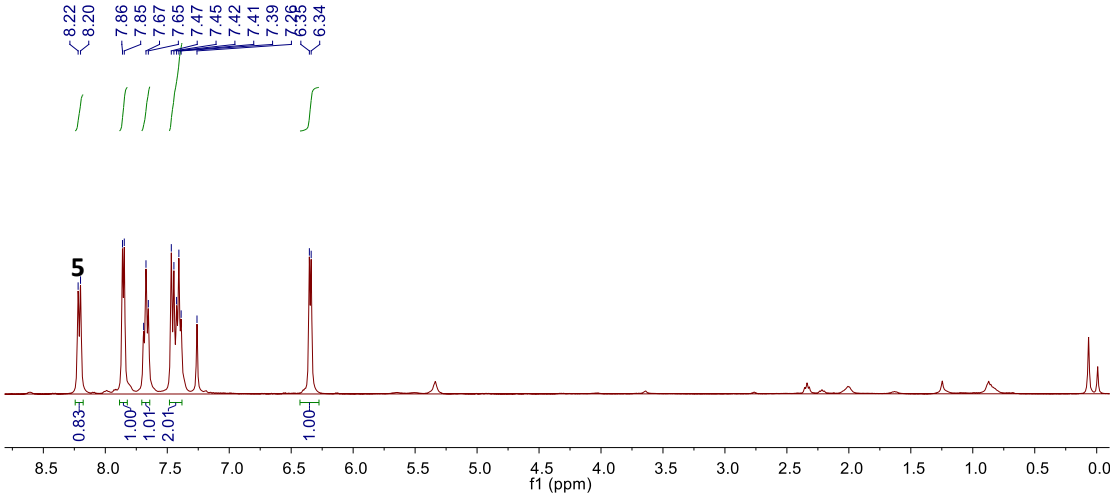


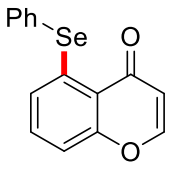




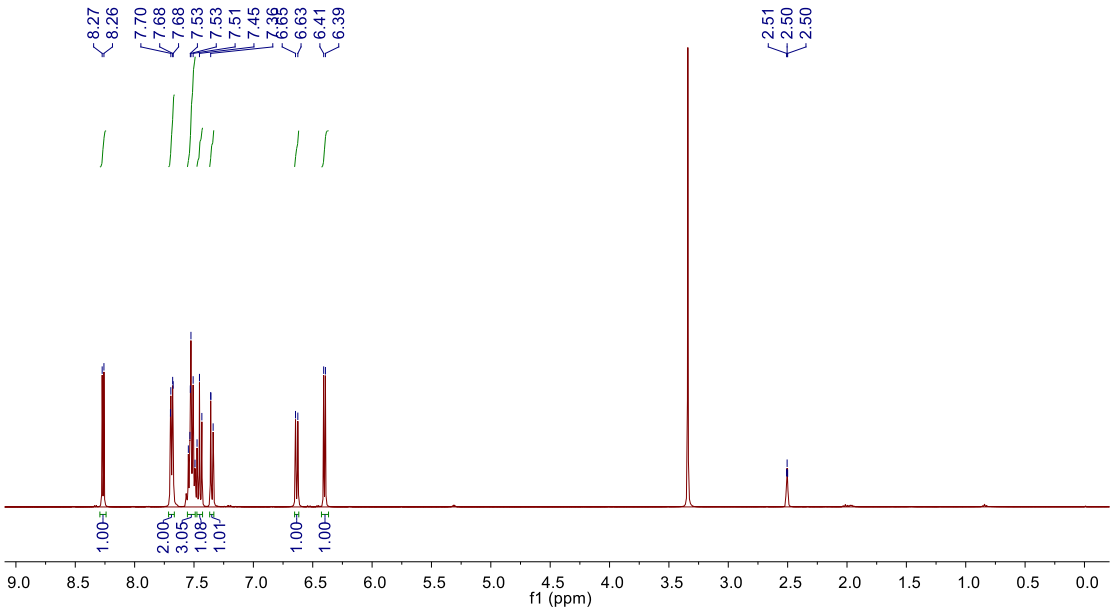
A mixture of chromone **1a** (0.2 mmol), diphenyl diselenide **2a** (1.2 equiv), [Ru(*p*-cymene)Cl_2]$_2$ (10 mol%), $AgNTf_2$ (40 mol%), $Cu(OAc)_2$ (50 mol%), CuCl (2 equiv), D_2O (2 equiv.) and chlorobenzene (2 mL), was added in a 5 mL glass tube, which was stirred at 120 ℃ for 24 h in air. The reaction was stopped, and it was mixed with water and ethyl acetate. The reaction mixture was extracted three times with ethyl acetate. The combined organic layer was dried over anhydrous magnesium sulfate, and filtered. The filtrate was evaporated under a vacuum, and the residue was purified by flash column chromatography on silica gel (eluting with petroleum ether-ethyl acetate) to afford the recovered starting material **1aa′** and the product **3a** in 8% and 62% yields, respectively. The analysis by ^{1}H NMR showed deuterium incorporation at the C5-position of **1aa′**. The analysis by ^{1}H NMR showed no deuterium incorporation on the ring of **3a**.





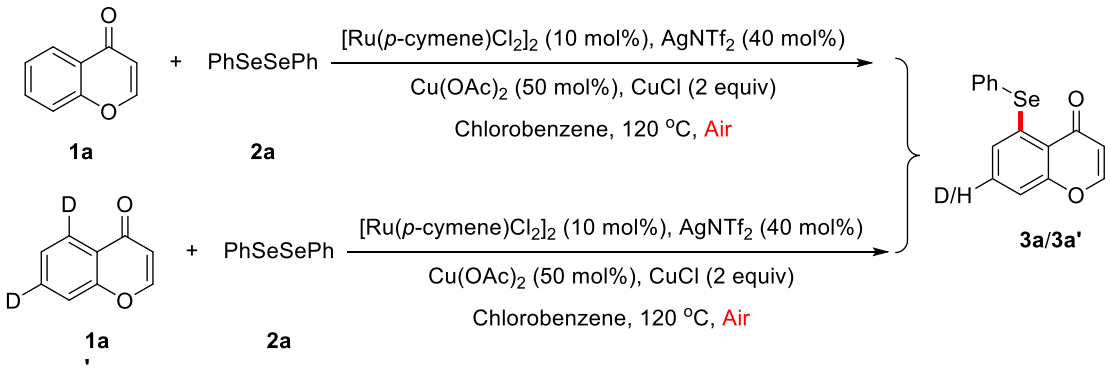


3a



3. Kinetic isotope experiment:

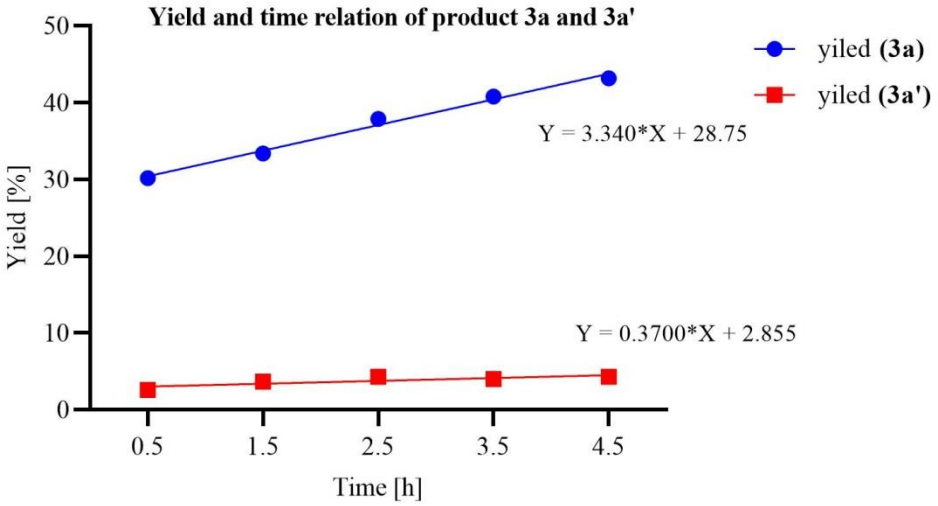
(a) Parallel reaction



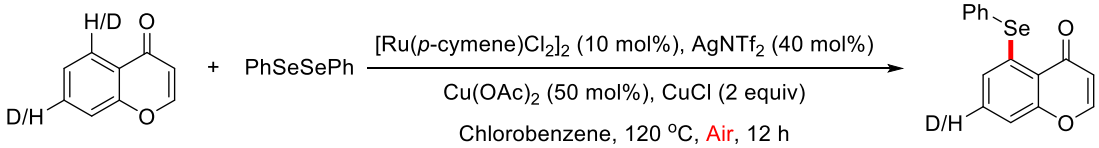
Diphenyl diselenide **2a** with chromone **1a** or chromone-*d*2 **1a'** respectively were performed to determine the KIE value. **1a** (0.2 mmol) or **1a'** (0.2 mmol), **2a** (0.24 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (10 mol%), $AgNTf_2$ (40 mol%), $Cu(OAc)_2$ (50 mol%), CuCl (2 equiv) and chlorobenzene (2 mL) were added in a 10 mL glass tube, which was stirred at 120 ℃ for 0.5 h, 1.5 h, 2.5 h, 3.5 h, 4.5 h in air, respectively. Then the reaction mass in two tubes was combined and was mixed with water and dichloromethane. The reaction mixturewas extracted three times with dichloromethane. The

combined organic layer waswashed two times with a little amount of water, dried over anhydrous magnesium sulfate andfiltered. The filtrate was evaporated under vacuum and the residue was purified by flash column chromatography on silica gel (elutig with petroleum ether-ethyl acetate). The yields of **3a** and **3a'** were obtained by ^{1}H NMR analysis of the mixture. The KIE was determined as $\boldsymbol{k_H/k_D}$ = 9.03.

t [h]	0.5	1.5	2.5	3.5	4.5
3a [%]	30.2	33.4	37.9	40.8	43.2
3a' [%]	2.6	3.7	4.3	4.0	4.3

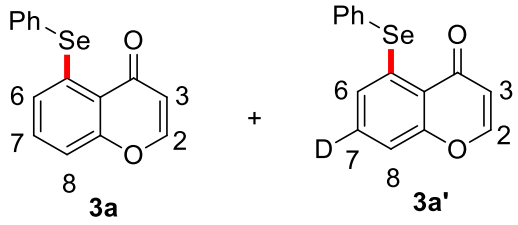


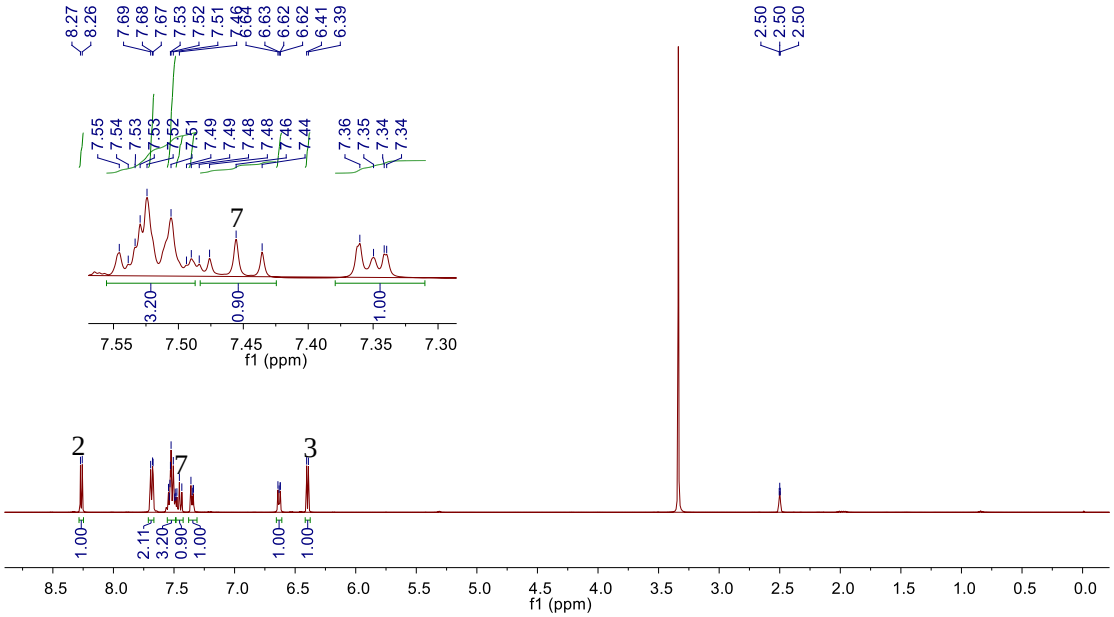
(b) Competition reaction



1a/1a' **2a** **3a/3a'**, 58%

A mixture of chromone **1a** (0.2 mmol), chromone-*d*2 **1a'** (0.2 mmol), diphenyl diselenide **2a** (0.48 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (10 mol%), $AgNTf_2$ (40 mol%), $Cu(OAc)_2$ (50 mol%), CuCl (2 equiv) and chlorobenzene (4 mL), was added in a 10 mL glass tube, which was stirred at 120 ℃ for 12 h in air. The reaction was stopped, and it was mixed with water and ethyl acetate. The reaction mixture was extracted three times with ethyl acetate. The combined organic layer was dried over anhydrous magnesium sulfate, and filtered. The filtrate was evaporated under a vacuum, and the residue was purified by flash column chromatography on silica gel (eluting with petroleum ether-ethyl acetate). KIE ($\boldsymbol{k_H/k_D}$ = 9.00) was determined from ^{1}H NMR.


Ph
Se
O
6
3
7
2
O
8
3a
+
Ph
Se
O
6
3
D
7
2
O
8
3a'


8.27
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7.68
7.67
7.53
7.52
7.51
7.46
6.64
6.63
6.62
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6.41
6.39
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2.50
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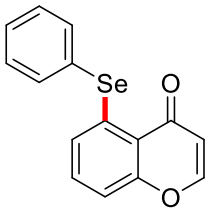
7.49
7.49
7.48
7.48
7.46
7.44
7.36
7.35
7.34
7.34
7
3.20
0.90
1.00
7.55
7.50
7.45
7.40
7.35
7.30
f1 (ppm)
2
7
3
1.00
2.11
3.20
0.90
1.00
1.00
1.00
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

X-ray structure of 3a



3a

(CCDC 2178078)

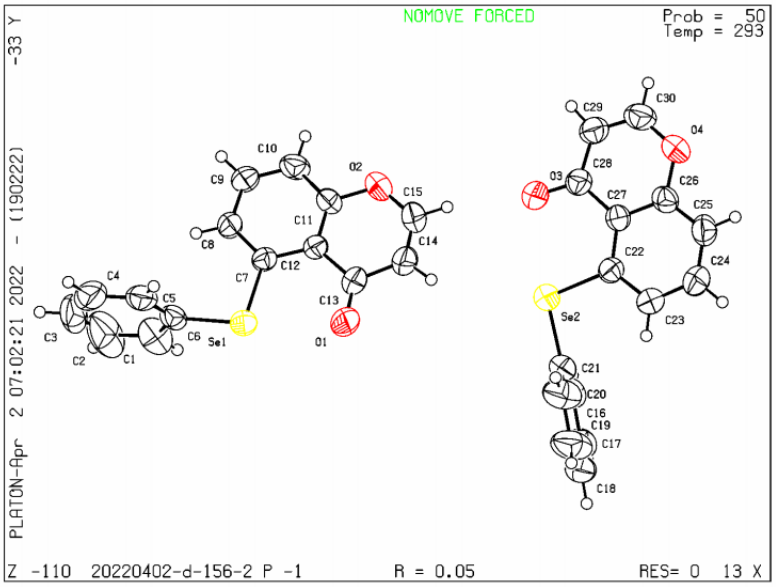


Figure S1. Single crystal structure of **3a**

Table S3. X-ray crystallographic data of **3a**

Bond precision:	C-C = 0.0070 A	Wavelength=0.71073	
Cell:	a=7.9033(5)	b=11.9615(7)	c=14.6472(9)
	alpha=73.300(5)	alpha=73.300(5)	gamma=74.420(5)
Temperature:	293 K		
	Calculated	Reported	
Volume	1276.68(14)	1276.68(14)	
Space group	P -1	P -1	
Hall group	-P 1	-P 1	
Moiety formula	C_{15} H_{10} O_2 Se	C_{15} H_{10} O_2 Se	
Sum formula	C_{15} H_{10} O_2 Se	C_{15} H_{10} O_2 Se	

Mr	301.19	301.19
Dx,g cm- 3	1.567	1.567
Z	4	4
Mu (mm-1)	2.931	2.931
F000	600.0	600.0
F000′	599.88	
h,k, lmax	10,16,20	10,16,19
Nref	6819	5792
Tmin, Tmax	0.362,0.380	0.787,1.000
Tmin′	0.335	

Correction method= # Reported T Limits: Tmin=0.787 Tmax=1.000
AbsCorr = MULTI-SCAN

Data completeness= 0.849 Theta (max)= 29.059

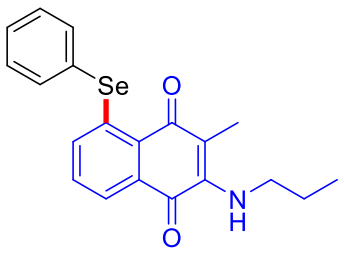
R (reflections)= 0.0476(3696) wR2 (reflections)=0.1093(5792)

S = 1.044 Npar= 325

Information of preparation of single crystal 3a:

3a (25 mg) with 1.2 mL *N*,*N*-dimethylformamide in a bottle and with 0.8 mL hexane on the upper layer of *N*,*N*-dimethylformamide. Subsequently, seal with sealing film. Place the bottle at room temperature to give the single crystal **3a** in 3 days.

X-ray structure of 6h



6h

(CCDC 2205235)

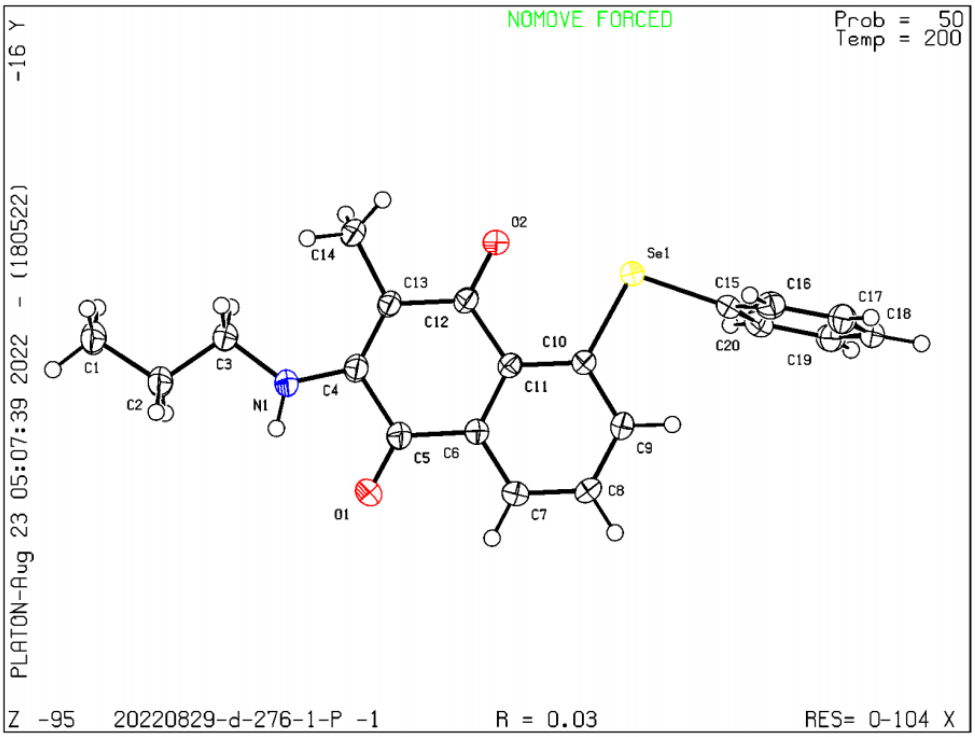


Figure S2. Single crystal structure of **6h**

Table S4. X-ray crystallographic data of **6h**

Bond precision:	C-C = 0.0030 A	Wavelength=0.71073	
Cell:	a=8.0338(3)	b=8.4987(4)	c=13.3369(5)
	alpha=74.087(4)	alpha=74.630(3)	gamma=81.377(4)
Temperature:	200 K		
	Calculated	Reported	
Volume	841.45(6)	841.45(6)	
Space group	P -1	P -1	
Hall group	-P 1	-P 1	
Moiety formula	C_{20} H_{19} N O_2 Se	C_{20} H_{19} N O_2 Se	
Sum formula	C_{20} H_{19} N O_2 Se	C_{20} H_{19} N O_2 Se	
Mr	384.32	384.32	
Dx,g cm- 3	1.517	1.517	
Z	2	2	
Mu (mm-1)	2.243	2.243	
F000	392.0	392.0	
F000′	391.96		

h,k, lmax	10, 11, 18	10, 11, 18
Nref	4508	3985
Tmin, Tmax	0.450, 0.488	0.962, 1.000
Tmin′	0.442	

Correction method= # Reported T Limits: Tmin=0.962 Tmax=1.000
AbsCorr = MULTI-SCAN

Data completeness= 0.884 Theta (max)= 29.101

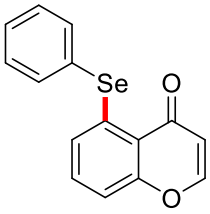
R (reflections)= 0.0312(3500) wR2 (reflections)=0.0708(3985)

S = 1.078 Npar= 219

Information of preparation of single crystal 6h:

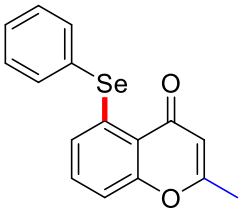
6h (25mg) with 1.2 mL *N*,*N*-dimethylformamide in a bottle and with 0.8 mL hexane on the upper layer of *N*,*N*-dimethylformamide. Subsequently, seal with sealing film. Place the bottle at 4^{o}C to give the single crystal **6h** in 3 days.

Characterization of products 3, 6 and 7



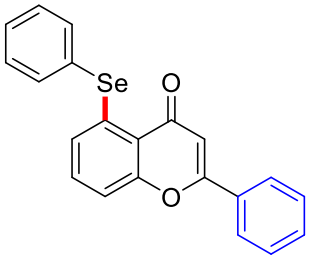
5-(Phenylselanyl)-4*H*-chromen-4-one (3a)

Faint Yellow solid; mp 107.1-108.2 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.80 (d, *J* = 4.9 Hz, 1H), 7.74 (d, *J* = 7.2 Hz, 2H), 7.50 – 7.44 (m, 3H), 7.28 – 7.25 (m, 1H), 7.17 – 7.16 (m, 1H), 6.75 (d, *J* = 7.9 Hz, 1H), 6.37 (d, *J* = 5.3 Hz, 1H) ppm; ^{13}C NMR (151 MHz, $CDCl_3$) δ 178.82, 158.05, 154.44, 140.07, 137.55, 132.69, 129.83, 129.23, 128.92, 124.36, 122.50, 113.91, 112.88 ppm; HRMS: calc.for $C_{15}H_{11}O_2Se^+$ $[M+H]^+$: 302.9924, found: 302.9917.



2-Methyl-5-(phenylselanyl)-4*H*-chromen-4-one (3b)

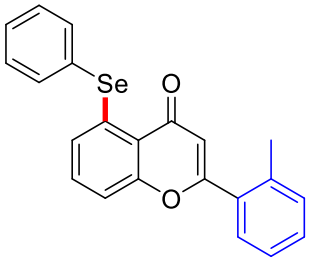
Faint Yellow solid; mp 142.2-142.7 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 – 7.71 (m, 2H), 7.48 – 7.40 (m, 3H), 7.22 (t, *J* = 8.1 Hz, 1H), 7.10 (d, *J* = 8.2 Hz, 1H), 6.69 (d, *J* = 7.9 Hz, 1H), 6.17 (s, 1H), 2.35 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.46, 165.28, 158.00, 139.72, 137.61, 132.43, 129.79, 129.16, 129.13, 124.07, 121.22, 113.61, 110.44, 20.26 ppm; HRMS: calc.for $C_{16}H_{13}O_2Se^+$ $[M+H]^+$: 317.0081, found: 317.0074.



2-Phenyl-5-(phenylselanyl)-4*H*-chromen-4-one (3c)

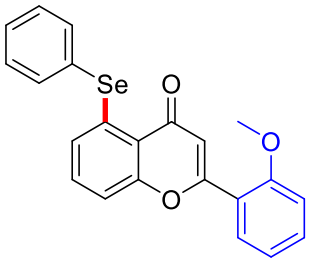
Faint Yellow solid; mp 157.4-158.1 ^{o}C; R_f = 0.5 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92 – 7.90 (m, 2H), 7.75 – 7.74 (m, 2H), 7.53 – 7.48 (m, 3H), 7.46 – 7.42 (m, 3H), 7.30 – 7.24 (m, 2H), 6.82 (s, 1H), 6.74 (dd, *J* = 6.6, 2.2 Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.50, 162.40, 157.68, 139.84, 137.54, 132.65, 131.57, 131.28, 129.77, 129.15, 128.99,

128.95, 126.15, 124.23, 121.54, 113.77, 107.27 ppm; HRMS: calc.for $C_{21}H_{15}O_2Se^+$ $[M+H]^+$: 379.0237, found: 379.0231.



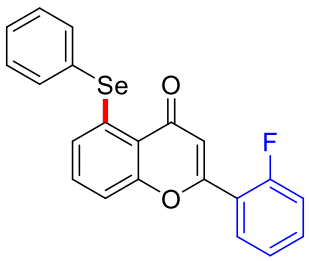
5-(Phenylselanyl)-2-(o-tolyl)-4*H*-chromen-4-one (3d)

Faint Yellow solid; mp 158.9-159.7 ^oC; R_f = 0.3 (20% EtOAc in petroleum ether); ^1H NMR (400 MHz, $CDCl_3$) δ 7.76 – 7.74 (m, 2H), 7.55 – 7.53 (m, 1H), 7.49 – 7.41 (m, 4H), 7.34 – 7.26 (m, 3H), 7.19 (d, *J* = 7.9 Hz, 1H), 6.76 (d, *J* = 7.8 Hz, 1H), 6.50 (s, 1H), 2.49 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.47, 165.16, 158.02, 140.03, 137.61, 136.81, 132.73, 132.25, 131.27, 130.77, 129.83, 129.21, 129.14, 129.07, 126.21, 124.33, 121.47, 113.78, 111.79, 20.55 ppm; HRMS: calc.for $C_{22}H_{17}O_2Se^+$ $[M+H]^+$: 393.0394, found: 393.0386.



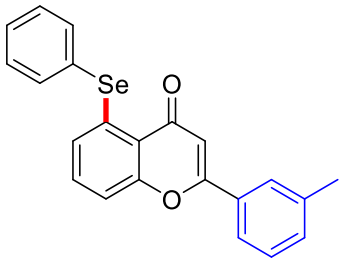
2-(2-Methoxyphenyl)-5-(phenylselanyl)-4*H*-chromen-4-one (3e)

Faint Yellow solid; mp 139.1-140.1 ^oC; R_f = 0.3 (20% EtOAc in petroleum ether); ^1H NMR (400 MHz, $CDCl_3$) δ 7.89 (dd, *J* = 7.8, 1.6 Hz, 1H), 7.75 (dd, *J* = 7.5, 1.5 Hz, 2H), 7.50 – 7.42 (m, 4H), 7.28 – 7.20 (m, 2H), 7.15 (s, 1H), 7.10 (t, *J* = 7.6 Hz, 1H), 7.04 (d, *J* = 8.4 Hz, 1H), 6.72 (dd, *J* = 7.5, 0.9 Hz, 1H), 3.94 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 180.02, 159.89, 158.06，157.95, 139.69, 137.62, 132.50, 132.42, 129.77, 129.25, 129.14, 129.12, 123.94, 121.50, 120.69, 120.44, 113.75, 112.48, 111.74, 55.67 ppm; HRMS: calc.for $C_{22}H_{17}O_3Se^+$ $[M+H]^+$: 409.0343, found: 409.0336.



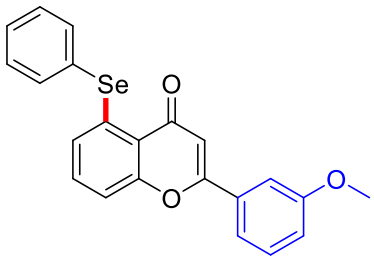
2-(2-Fluorophenyl)-5-(phenylselanyl)-4*H*-chromen-4-one (3f)

Yellow solid; mp 115.2-116.3 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92 (td, *J* = 7.7, 1.7 Hz, 1H), 7.74 (dd, *J* = 7.7, 1.6 Hz, 2H), 7.54 – 7.42 (m, 4H), 7.34 – 7.20 (m, 4H), 6.94 (s, 1H), 6.75 (dd, *J* = 7.6, 1.1 Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.50, 160.54 (d, *J* = 257.55), 157.85, 157.82, 140.04, 137.59, 132.90 (d, *J* = 9.09), 132.79, 129.82, 129.21, 128.99, 128.93, 124.59 (d, *J* = 3.6 Hz), 124.32, 121.47, 119.94 (d, *J* = 10.0 Hz), 116.93 (d, *J* = 23.23 Hz), 113.73, 112.20 (d, *J* = 11.8 Hz) ppm; HRMS: calc.for $C_{21}H_{14}FO_2Se^+$ $[M+H]^+$: 397.0143, found: 397.0136.



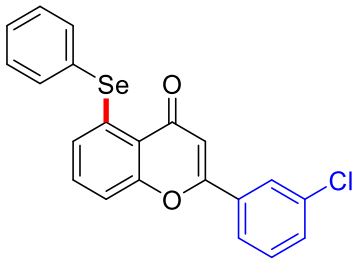
5-(Phenylselanyl)-2-(m-tolyl)-4*H*-chromen-4-one (3g)

Faint Yellow solid; mp 135.2-136.1 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 – 7.71 (m, 4H), 7.48 – 7.41 (m, 4H), 7.35 (d, *J* = 7.5 Hz, 1H), 7.27 (dd, *J* = 6.2, 3.0 Hz, 2H), 6.81 (s, 1H), 6.74 (dd, *J* = 5.7, 3.2 Hz, 1H), 2.46 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.60, 162.70, 157.78, 139.87, 138.82, 137.61, 132.65, 132.43, 131.32, 129.81, 129.19, 129.09, 128.90, 126.76, 124.25, 123.43, 121.64, 113.82, 107.31, 21.48 ppm; HRMS: calc.for $C_{22}H_{17}O_2Se^+$ $[M+H]^+$: 393.0394, found: 393.0386.



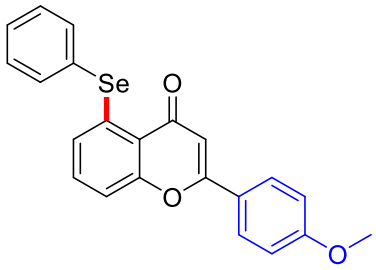
2-(3-Methoxyphenyl)-5-(phenylselanyl)-4*H*-chromen-4-one (3h)

Faint Yellow solid; mp 130.4-131.2 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (d, *J* = 7.4 Hz, 2H), 7.52 – 7.42 (m, 6H), 7.32 – 7.26 (m, 2H), 7.09 (d, *J* = 8.0 Hz, 1H), 6.82 (s, 1H), 6.75 (d, *J* = 6.5 Hz, 1H), 3.91 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.60, 162.25, 159.90, 157.69, 139.85, 137.58, 132.73, 132.64, 130.09, 129.82, 129.21, 128.93, 124.27, 121.56, 118.63, 117.13, 113.83, 111.63, 107.55, 55.47 ppm; HRMS: calc.for $C_{22}H_{17}O_3Se^+$ $[M+H]^+$: 409.0343, found: 409.0336.



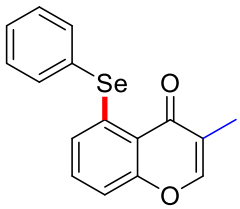
2-(3-Chlorophenyl)-5-(phenylselanyl)-4*H*-chromen-4-one (3i)

Faint Yellow solid; mp 105.3-106.7 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (t, *J* = 1.6 Hz, 1H), 7.79 – 7.77 (m, 1H), 7.74 (dd, *J* = 7.7, 1.5 Hz, 2H), 7.52 – 7.42 (m, 5H), 7.32 – 7.25 (m, 2H), 6.80 (s, 1H), 6.75 (dd, *J* = 7.1, 1.7 Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.35, 160.87, 157.69, 140.14, 137.59, 135.24, 133.18, 132.89, 131.53, 130.30, 129.86, 129.26, 128.90, 126.26, 124.50, 124.32, 121.58, 113.79, 107.95 ppm; HRMS: calc.for $C_{21}H_{14}ClO_2Se^+$ $[M+H]^+$: 412.9848, found: 412.9838.



2-(4-Methoxyphenyl)-5-(phenylselanyl)-4*H*-chromen-4-one (3j)

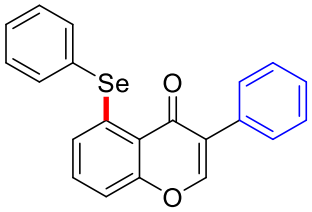
Faint Yellow solid; mp 137.2-138.1 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 (d, *J* = 8.9 Hz, 2H), 7.75 (dd, *J* = 7.6, 1.5 Hz, 2H), 7.49 – 7.40 (m, 3H), 7.28 – 7.22 (m, 2H), 7.02 (d, *J* = 8.9 Hz, 2H), 6.73 – 6.71 (m, 2H), 3.89 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.53, 162.50, 162.41, 157.66, 139.75, 137.62, 132.51, 129.79, 129.16, 127.94, 124.17, 123.61, 121.56, 114.43, 113.73, 105.94, 55.50 ppm; HRMS: calc.for $C_{22}H_{17}O_3Se^+$ $[M+H]^+$: 409.0343, found: 409.0336.



3-Methyl-5-(phenylselanyl)-4*H*-chromen-4-one (3k)

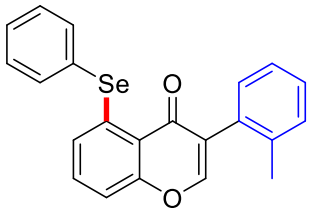
Faint Yellow solid; mp 161.3-162.2 ^{o}C; R_f = 0.3 (10% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 (d, *J* = 4.3 Hz, 3H), 7.47 – 7.41 (m, 3H), 7.22 (t, *J* = 8.1 Hz, 1H), 7.11 (d, *J* = 8.2 Hz, 1H), 6.71 (d, *J* = 7.8 Hz, 1H), 2.05 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.59,

158.18, 150.94, 139.85, 137.58, 132.32, 129.79, 129.18, 129.12, 123.92, 121.24, 120.56, 113.82, 11.00 ppm; HRMS: calc.for $C_{16}H_{13}O_2Se^+$ $[M+H]^+$: 317.0081, found: 317.0075.



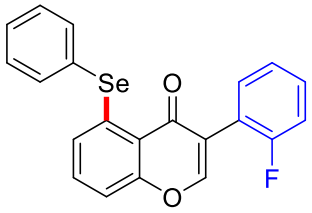
3-Phenyl-5-(phenylselanyl)-4*H*-chromen-4-one (3l)

Faint Yellow solid; mp 147.6-148.1 ^oC; R_f = 0.3 (10% EtOAc in petroleum ether); ^1H NMR (400 MHz, $CDCl_3$) δ 7.96 (s, 1H), 7.75 – 7.73 (m, 2H), 7.59 (d, *J* = 7.2 Hz, 2H), 7.50 – 7.40 (m, 6H), 7.28 (t, *J* = 8.0 Hz, 1H), 7.19 (d, *J* = 8.2 Hz, 1H), 6.78 (d, *J* = 7.8 Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 177.61, 157.85, 152.23, 140.82, 137.60, 132.61, 131.38, 129.85, 129.24, 128.99, 128.49, 128.27, 125.33, 124.47, 122.17, 113.83 ppm; HRMS: calc.for $C_{21}H_{15}O_2Se^+$ $[M+H]^+$: 379.0237, found: 379.0230.



5-(Phenylselanyl)-3-(o-tolyl)-4*H*-chromen-4-one (3m)

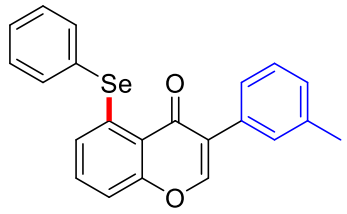
Faint Yellow solid; mp 69.8-70.6 ^oC; R_f = 0.3 (10% EtOAc in petroleum ether); ^1H NMR (400 MHz, $CDCl_3$) δ 7.83 (s, 1H), 7.75 – 7.73 (m, 2H), 7.48 – 7.42 (m, 3H), 7.34 – 7.20 (m, 6H), 6.79 (d, *J* = 7.8 Hz, 1H), 2.32 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 177.40, 158.03, 152.65, 140.79, 137.96, 137.57, 132.59, 131.04, 130.59, 130.21, 129.82, 129.24, 129.19, 128.68, 126.17, 125.78, 124.38, 121.98, 113.82, 20.15 ppm; HRMS: calc.for $C_{22}H_{17}O_2Se^+$ $[M+H]^+$: 393.0394, found: 393.0386.



3-(2-Fluorophenyl)-5-(phenylselanyl)-4*H*-chromen-4-one (3n)

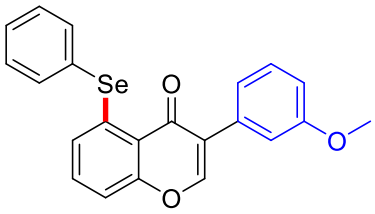
Faint Yellow solid; mp 134.7-135.2 ^oC; R_f = 0.3 (10% EtOAc in petroleum ether); ^1H NMR (400 MHz, $CDCl_3$) δ 7.99 (d, *J* = 1.0 Hz, 1H), 7.74 (dd, *J* = 7.5, 1.4 Hz, 2H), 7.55 (td, *J* = 7.5, 1.6 Hz, 1H), 7.50 – 7.36 (m, 4H), 7.31 – 7.16 (m, 4H), 6.78 (d, *J* = 7.8 Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 176.95, 160.20 (d, *J* = 248.26 Hz), 158.97, 157.85, 153.79 (d, *J* = 3.0 Hz), 140.86,

137.60, 132.73, 132.12 (d, *J* = 2.7 Hz), 130.18 (d, *J* = 8.2 Hz), 129.85, 129.25, 129.14, 124.58, 124.05 (d, *J* = 3.5 Hz), 122.01, 119.90, 118.95 (d, *J* = 14.9 Hz), 115.83 (d, *J* = 22.22 Hz), 113.85.ppm; HRMS: calc.for $C_{21}H_{14}FO_2Se^+$ $[M+H]^+$: 397.0143, found: 397.0137.



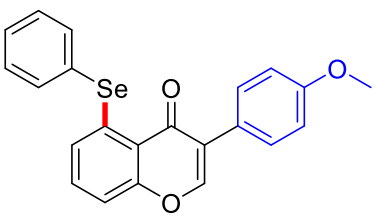
5-(Phenylselanyl)-3-(m-tolyl)-4*H*-chromen-4-one (3o)

Faint Yellow solid; mp 154.2-155.3 ^oC; R_f = 0.3 (10% EtOAc in petroleum ether); ^1H NMR (400 MHz, $CDCl_3$) δ 7.93 (s, 1H), 7.74 (dd, *J* = 7.5, 1.4 Hz, 2H), 7.48 – 7.43 (m, 4H), 7.37 – 7.32 (m, 2H), 7.27 (t, *J* = 8.0, 1H), 7.21 (d, *J* = 6.6 Hz, 1H), 7.18 (d, *J* = 8.2 Hz, 1H), 6.77 (dd, *J* = 7.8, 0.5 Hz, 1H), 2.42 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 177.64, 157.80, 152.19, 140.73, 138.07, 137.58, 132.54, 131.26, 129.82, 129.69, 129.26, 129.20, 129.05, 128.38, 125.99, 125.41, 124.39, 122.14, 113.80, 21.47 ppm; HRMS: calc.for $C_{22}H_{17}O_2Se^+$ $[M+H]^+$: 393.0394, found: 393.0386.



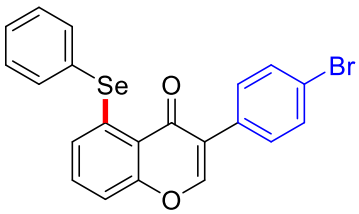
3-(3-Methoxyphenyl)-5-(phenylselanyl)-4*H*-chromen-4-one (3p)

Faint Yellow solid; mp 178.2-179.5 ^oC; R_f = 0.3 (10% EtOAc in petroleum ether); ^1H NMR (400 MHz, $CDCl_3$) δ 8.28 (dd, *J* = 8.0, 1.4 Hz, 1H), 7.80 (s, 1H), 7.70 – 7.66 (m, 1H), 7.56 (d, *J* = 8.6 Hz, 1H), 7.47 – 7.40 (m, 2H), 7.25 – 7.22 (m, 2H), 7.16 – 7.12 (m, 3H), 6.93 (d, *J* = 2.8 Hz, 1H), 6.88 (dd, *J* = 8.6, 2.9 Hz, 1H), 3.82 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 176.02, 159.77, 156.26, 153.56, 137.40, 136.98, 133.59, 133.40, 131.45, 129.06, 126.55, 126.47, 126.33, 125.18, 124.41, 122.69, 118.04, 116.93, 115.44, 55.40 ppm; HRMS: calc.for $C_{22}H_{17}O_3Se^+$ $[M+H]^+$: 409.0343, found: 409.0338.



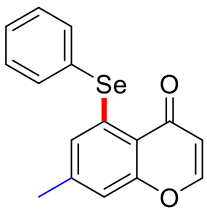
3-(4-Methoxyphenyl)-5-(phenylselanyl)-4*H*-chromen-4-one (3q)

Faint Yellow solid; mp 184.2-185.1 ^{o}C; R_f = 0.3 (10% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92 (s, 1H), 7.74 (d, *J* = 6.9 Hz, 2H), 7.53 (d, *J* = 8.3 Hz, 2H), 7.48 – 7.42 (m, 3H), 7.26 (t, *J* = 8.0 Hz, 1H), 7.17 (d, *J* = 8.2 Hz, 1H), 6.99 (d, *J* = 8.3 Hz, 2H), 6.76 (d, *J* = 7.8 Hz, 1H), 3.85 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 177.83, 159.66, 157.82, 151.68, 140.69, 137.59, 132.49, 130.15, 129.82, 129.30, 129.20, 124.89, 124.34, 123.65, 122.10, 113.98, 113.81, 55.32 ppm; HRMS: calc.for $C_{22}H_{17}O_3Se^+$ $[M+H]^+$: 409.0343, found: 409.0335.



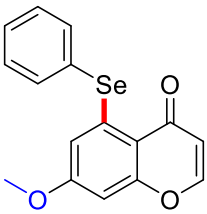
3-(4-Bromophenyl)-5-(phenylselanyl)-4*H*-chromen-4-one (3r)

Faint Yellow solid; mp 134.7-135.2 ^{o}C; R_f = 0.3 (10% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.95 (s, 1H), 7.73 (d, *J* = 6.4 Hz, 2H), 7.58 (d, *J* = 8.4 Hz, 2H), 7.49 – 7.42 (m, 5H), 7.28 (t, *J* = 8.0 Hz, 1H), 7.18 (d, *J* = 8.1 Hz, 1H), 6.78 (d, *J* = 7.8 Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 177.29, 157.84, 152.17, 140.90, 137.58, 132.76, 131.67, 130.54, 130.33, 129.89, 129.31, 129.09, 124.64, 124.29, 122.53, 122.04, 113.85 ppm; HRMS: calc.for $C_{21}H_{14}BrO_2Se^+$ $[M+H]^+$: 456.9342, found: 456.9333.



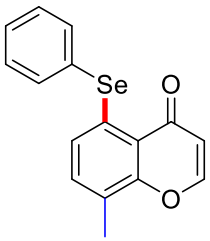
7-Methyl-5-(phenylselanyl)-4*H*-chromen-4-one (3s)

Faint Yellow solid; mp 140.2-141.3 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 – 7.71 (m, 3H), 7.47 – 7.41 (m, 3H), 6.94 (s, 1H), 6.52 (s, 1H), 6.30 (d, *J* = 5.9 Hz, 1H), 2.19 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 178.57, 158.03, 154.16, 144.01, 139.58, 137.50, 129.75, 129.17, 128.95, 125.41, 120.38, 114.15, 112.77, 21.74 ppm; HRMS: calc.for $C_{16}H_{13}O_2Se^+$ $[M+H]^+$: 317.0081, found: 317.0075.



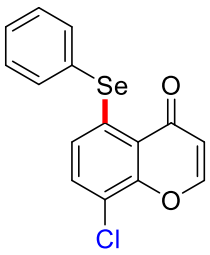
7-Methoxy-5-(phenylselanyl)-4*H*-chromen-4-one (3t)

Faint Yellow solid; mp 161.1-162.9 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.72 – 7.67 (m, 3H), 7.46 – 7.43 (m, 3H), 6.57 (s, 1H), 6.27 (d, *J* = 2.2 Hz, 2H), 3.64 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 177.96, 162.91, 159.44, 153.92, 141.62, 137.55, 129.84, 129.33, 128.90, 116.83, 112.82, 112.76, 97.39, 55.39 ppm; HRMS: calc.for $C_{16}H_{13}O_3Se^+$ $[M+H]^+$: 333.0030, found: 333.0022.



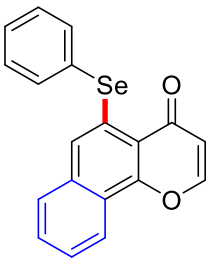
8-Methyl-5-(phenylselanyl)-4*H*-chromen-4-one (3u)

Faint Yellow solid; mp 98.2-99.1 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (d, *J* = 5.9 Hz, 1H), 7.72 – 7.70 (m, 2H), 7.47 – 7.39 (m, 3H), 7.10 (d, *J* = 8.0 Hz, 1H), 6.61 (d, *J* = 8.0 Hz, 1H), 6.34 (d, *J* = 5.9 Hz, 1H), 2.32 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.07, 156.34, 154.29, 137.54, 136.37, 134.01, 129.72, 129.15, 129.06, 123.77, 123.08, 122.38, 112.67, 15.25 ppm; HRMS: calc.for $C_{16}H_{13}O_2Se^+$ $[M+H]^+$: 317.0081, found: 317.0074.



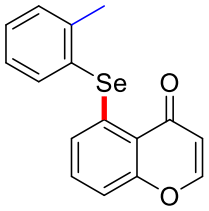
8-Chloro-5-(phenylselanyl)-4*H*-chromen-4-one (3v)

Faint Yellow solid; mp 102.1-103.1 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 (d, *J* = 5.9 Hz, 1H), 7.70 (d, *J* = 6.9 Hz, 2H), 7.50 – 7.42 (m, 3H), 7.31 (d, *J* = 8.6 Hz, 1H), 6.66 (d, *J* = 8.6 Hz, 1H), 6.41 (d, *J* = 5.9 Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 178.22, 154.36, 153.38, 138.98, 137.50, 132.97, 129.98, 129.47, 128.53, 124.34, 123.47, 118.63, 113.15 ppm; HRMS: calc.for $C_{15}H_{10}ClO_2Se^+$ $[M+H]^+$: 336.9535, found: 336.9527.



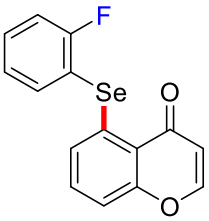
5-(Phenylselanyl)-4*H*-benzo[*h*]chromen-4-one (3w)

Faint Yellow solid; mp 137.4-138 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.33 (d, *J* = 7.7 Hz, 1H), 8.00 (d, *J* = 5.8 Hz, 1H), 7.79 – 7.78 (m, 2H), 7.56 – 7.41 (m, 6H), 7.02 (s, 1H), 6.54 (d, *J* = 5.8 Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 178.66, 155.22, 153.83, 137.71, 135.30, 133.01, 129.85, 129.73, 129.35, 129.21, 126.83, 125.94, 123.07, 122.30, 121.61, 120.00, 114.39 ppm; HRMS: calc.for $C_{19}H_{13}O_2Se^+$ $[M+H]^+$: 353.0081, found: 353.0074.



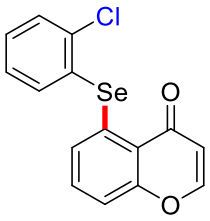
5-(O-Tolylselanyl)-4*H*-chromen-4-one (3x)

Faint Yellow solid; mp 109.3-110.4 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (d, *J* = 5.9 Hz, 1H), 7.75 (d, *J* = 7.5 Hz, 1H), 7.40 – 7.38 (m, 2H), 7.25 – 7.21 (m, 2H), 7.14 (dd, *J* = 8.2, 0.7 Hz, 1H), 6.59 (d, *J* = 7.8 Hz, 1H), 6.36 (d, *J* = 5.9 Hz, 1H), 2.44 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 178.83, 158.19, 154.39, 143.76, 139.18, 138.71, 132.80, 130.45, 130.06, 129.67, 127.24, 123.71, 122.69, 113.90, 112.99, 22.54 ppm; HRMS: calc.for $C_{16}H_{13}O_2Se^+$ $[M+H]^+$: 317.0081, found: 317.0075.



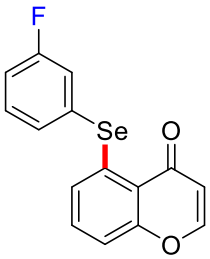
5-((2-Fluorophenyl)selanyl)-4*H*-chromen-4-one (3y)

Faint Yellow solid; mp 113.2-114.9 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (d, *J* = 5.8 Hz, 1H), 7.73 (t, *J* = 6.7 Hz, 1H), 7.49 (dd, *J* = 12.7, 6.5 Hz, 1H), 7.28 (t, *J* = 8.0 Hz, 1H), 7.23 – 7.16 (m, 3H), 6.70 (d, *J* = 7.7 Hz, 1H), 6.36 (d, *J* = 5.8 Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 178.76, 163.61 (d, *J* = 246.3 Hz), 158.04, 154.64, 139.34 (d, *J* = 1.8 Hz), 138.09, 132.89, 132.12 (d, *J* = 7.8 Hz), 125.42 (d, *J* = 3.6 Hz), 124.08, 122.64, 116.01 (d, *J* = 24.3 Hz), 113.50 (d, *J* = 148.0 Hz) ppm; HRMS: calc.for $C_{15}H_{10}FO_2Se^+$ $[M+H]^+$: 320.9830, found: 320.9823.



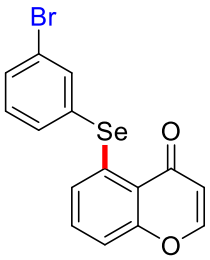
5-((2-Chlorophenyl)selanyl)-4*H*-chromen-4-one (3z)

Faint Yellow solid; mp 147.2-148.1 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 (dd, *J* = 7.6, 1.6 Hz, 1H), 7.79 (d, *J* = 5.9 Hz, 1H), 7.59 (dd, *J* = 8.0, 1.2 Hz, 1H), 7.43 (td, *J* = 7.7, 1.6 Hz, 1H), 7.32 – 7.27 (m, 2H), 7.18 (dd, *J* = 8.3, 0.8 Hz, 1H), 6.62 (dd, *J* = 7.9, 0.6 Hz, 1H), 6.37 (d, *J* = 5.9 Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 178.83, 158.07, 154.61, 141.11, 139.77, 138.16, 132.93, 131.21, 130.10, 129.47, 127.89, 123.95, 122.53, 114.20, 112.82 ppm; HRMS: calc.for $C_{15}H_{10}ClO_2Se^+$ $[M+H]^+$: 336.9535, found: 336.9527.



5-((3-Fluorophenyl)selanyl)-4*H*-chromen-4-one (3aa)

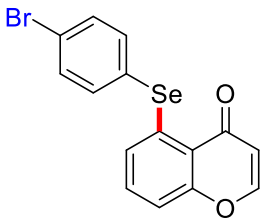
Faint Yellow solid; mp 118.3-119.5 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (d, *J* = 5.9 Hz, 1H), 7.50 (d, *J* = 7.5 Hz, 1H), 7.45 – 7.38 (m, 2H), 7.28 (t, *J* = 8.0, 1H), 7.17 – 7.13 (m, 2H), 6.72 (d, *J* = 7.9 Hz, 1H), 6.35 (d, *J* = 5.9 Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 178.76, 162.94 (d, *J* = 250.8 Hz), 158.02, 154.57, 139.33, 133.19 (d, *J* = 3.0 Hz), 132.85, 131.17 (d, *J* = 7.7 Hz), 130.62 (d, *J* = 6.0 Hz), 124.25, 124.18 (d, *J* = 21.21 Hz), 122.46, 116.45 (d, *J* = 21.0 Hz), 114.20, 112.80 ppm; HRMS: calc.for $C_{15}H_{10}FO_2Se^+$ $[M+H]^+$: 320.9830, found: 320.9823.



5-((3-Bromophenyl)selanyl)-4*H*-chromen-4-one (3ab)

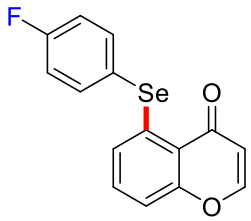
Faint Yellow solid; mp 133.1-134.2 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88 (s, 1H), 7.79 (d, *J* = 5.9 Hz, 1H), 7.65 (d, *J* = 7.6 Hz, 1H), 7.60 (d, *J* = 8.1 Hz, 1H), 7.33 – 7.28 (m, 2H), 7.17 (d, *J* = 8.2 Hz, 1H), 6.71 (d, *J* = 7.8 Hz, 1H), 6.35 (d, *J* = 5.9 Hz,

1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 178.75, 158.02, 154.59, 139.89, 139.29, 136.06, 132.91, 132.38, 131.25, 131.01, 124.32, 123.36, 122.45, 114.24, 112.82 ppm; HRMS: calc.for $C_{15}H_{10}BrO_2Se^+$ $[M+H]^+$: 380.9029, found: 380.9019.



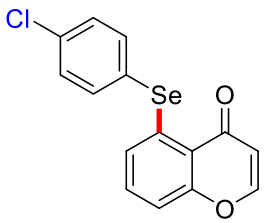
5-((4-Bromophenyl)selanyl)-4*H*-chromen-4-one (3ac)

Faint Yellow solid; mp 188.1-189.1 ^oC; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (d, *J* = 5.9 Hz, 1H), 7.59 – 7.54 (m, 4H), 7.28 (t, *J* = 8.0 Hz, 1H), 7.17 (d, *J* = 8.2 Hz, 1H), 6.70 (d, *J* = 7.8 Hz, 1H), 6.35 (d, *J* = 5.9 Hz, 1H) ppm; ^{13}C NMR (101 MHz,$CDCl_3$) δ 178.75, 158.03, 154.56, 139.43, 139.18, 133.07, 132.82, 127.87, 124.24, 124.09, 122.49, 114.18, 112.84 ppm; HRMS: calc.for $C_{15}H_{10}BrO_2Se^+$ $[M+H]^+$: 380.9029, found: 380.9020.



5-((4-Fluorophenyl)selanyl)-4*H*-chromen-4-one (3ad)

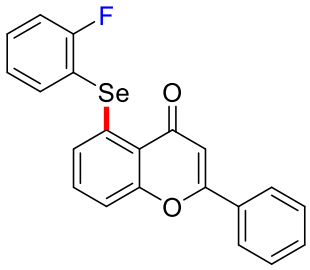
Faint Yellow solid; mp 153.1-154.4 ^oC; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (d, *J* = 5.9 Hz, 1H), 7.70 – 7.66 (m, 2H), 7.27 (t, *J* = 8.0 Hz, 1H), 7.17 – 7.11 (m, 3H), 6.68 (d, *J* = 7.9 Hz, 1H), 6.35 (d, *J* = 5.9 Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 178.81, 163.58 (d, *J* = 249.7 Hz), 158.07, 154.52, 140.00, 139.64 (d, *J* = 8.1 Hz), 132.77, 124.16, 123.92 (d, *J* = 3.5 Hz), 122.51, 117.16 (d, *J* = 21.3 Hz), 114.08, 112.87 ppm; HRMS: calc.for $C_{15}H_{10}FO_2Se^+$ $[M+H]^+$: 320.9830, found: 320.9823.



5-((4-Chlorophenyl)selanyl)-4*H*-chromen-4-one (3ae)

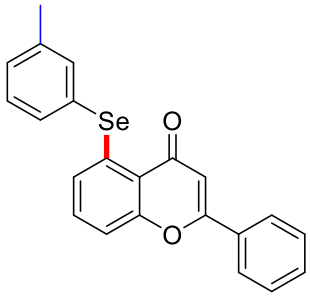
Faint Yellow solid; mp 127.1-128.3 ^oC; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.79 (d, *J* = 5.9 Hz, 1H), 7.65 – 7.63 (m, 2H), 7.42 – 7.40 (m, 2H), 7.28 (t, *J* = 11.2, 4.9 Hz, 1H), 7.17 (dd, *J* = 8.3, 0.8 Hz, 1H), 6.70 (dd, *J* = 7.9, 0.6 Hz, 1H), 6.36 (d, *J* = 5.9

Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 178.76, 158.05, 154.55, 139.57, 138.93, 135.76, 132.81, 130.13, 127.23, 124.22, 122.50, 114.17, 112.85 ppm; HRMS: calc.for $C_{15}H_{10}ClO_2Se^+$ $[M+H]^+$: 336.9535, found: 336.9527.



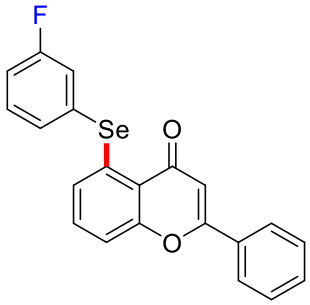
5-((2-Fluorophenyl)selanyl)-2-phenyl-4*H*-chromen-4-one (3af)

Faint Yellow solid; mp 140.1-141.2 ^oC; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92 (d, *J* = 6.4 Hz, 2H), 7.76 (t, *J* = 6.7 Hz, 1H), 7.54 – 7.47 (m, 4H), 7.34 – 7.28 (m, 2H), 7.22 (t, *J* = 7.7 Hz, 2H), 6.83 (s, 1H), 6.72 (d, *J* = 6.7 Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.55, 163.65 (d, *J* = 246.44 Hz), 162.73, 157.74, 139.39 (d, *J* = 2.0 Hz), 137.93, 132.90, 132.07 (d, *J* = 7.8 Hz), 131.68, 131.31, 129.02, 126.23, 125.40 (d, *J* = 3.7 Hz), 124.01, 121.78, 116.11 (d, *J* = 24.24 Hz), 116.01 (d, *J* = 24.24 Hz), 114.12, 107.22 ppm; HRMS: calc.for $C_{21}H_{14}FO_2Se^+$ $[M+H]^+$: 397.0143, found: 397.0139.



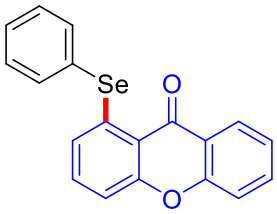
2-Phenyl-5-(*m*-tolylselanyl)-4*H*-chromen-4-one (3ag)

Faint Yellow solid; mp 136.1-137.2 ^oC; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.94 – 7.92 (m, 2H), 7.59 (s, 1H), 7.56 – 7.53 (m, 4H), 7.35 (t, *J* = 7.5 Hz, 1H), 7.29 (d, *J* = 7.5 Hz, 3H), 6.83 (s, 1H), 6.78 (d, *J* = 6.3 Hz, 1H), 2.41 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.56, 162.43, 157.75, 140.09, 139.65, 138.10, 134.54, 132.68, 131.60, 131.39, 129.99, 129.60, 129.00, 128.76, 126.21, 124.36, 121.61, 113.72, 107.37, 21.29 ppm; HRMS: calc.for $C_{22}H_{17}O_2Se^+$ $[M+H]^+$: 393.0394, found: 393.0386.



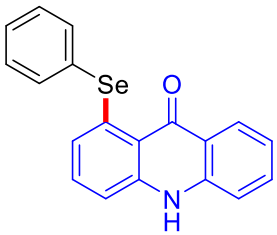
5-((3-Fluorophenyl)selanyl)-2-phenyl-4*H*-chromen-4-one (3ah)

Faint Yellow solid; mp 131.2-132.1 ^{o}C; R_f = 0.3 (20% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92 (d, *J* = 6.1 Hz, 2H), 7.53 (d, *J* = 6.6 Hz, 4H), 7.54 – 7.40 (m, 2H), 7.34 – 7.28 (m, 2H), 7.17 (t, *J* = 7.8 Hz, 1H), 6.83 (s, 1H), 6.74 (d, *J* = 6.7 Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.58, 162.96 (d, *J* = 252.5 Hz), 162.70, 157.74, 139.18, 133.24 (d, *J* = 2.9 Hz), 132.88, 131.71, 131.30, 131.15 (d, *J* = 7.8 Hz), 130.74 (d, *J* = 6.0 Hz), 129.04, 126.25, 124.24 (d, *J* = 20.2 Hz), 124.20, 121.59, 116.43 (d, *J* = 21.0 Hz), 114.10, 107.28 ppm; HRMS: calc.for $C_{21}H_{14}FO_2Se^+$ $[M+H]^+$: 397.0143, found: 397.0137.



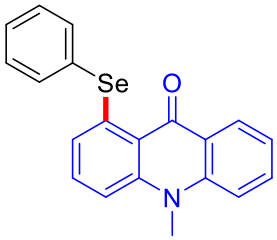
1-(Phenylselanyl)-9*H*-xanthen-9-one (6a)

Yellow solid; mp 156.5-157.3 ^{o}C; R_f = 0.3 (4% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.34 (dd, *J* = 8.0, 1.6 Hz, 1H), 7.76 (dd, *J* = 7.6, 1.5 Hz, 2H), 7.73 – 7.69 (m, 1H), 7.51 – 7.43 (m, 4H), 7.39 – 7.35 (m, 1H), 7.30 (t, *J* = 8.1 Hz, 1H), 7.19 (dd, *J* = 8.2, 0.5 Hz, 1H), 6.73 (dd, *J* = 7.8, 0.5 Hz, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 178.13, 157.78, 155.39, 141.53, 137.60, 134.82, 133.56, 129.82, 129.26, 129.07, 126.74, 124.00, 123.28, 121.59, 119.49, 117.53, 113.76 ppm; HRMS: calc.for $C_{19}H_{13}O_2Se^+$ $[M+H]^+$: 353.0081, found: 353.0074.



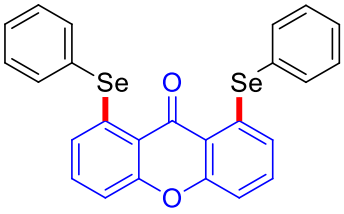
1-(Phenylselanyl)acridin-9(10*H*)-one (6b)

Yellow solid; mp 139.1-140.5 ^{o}C; R_f = 0.3 (50% DCM in petroleum ether); ^{1}H NMR (400 MHz, DMSO) δ 11.78 (brs, 1H), 8.21 (d, *J* = 7.7 Hz, 1H), 7.75 – 7.69 (m, 3H), 7.53 – 7.47 (m, 4H), 7.36 (t, *J* = 8.0 Hz, 1H), 7.29 – 7.24 (m, 2H), 6.43 (d, *J* = 7.6 Hz, 1H) ppm; ^{13}C NMR (101 MHz, DMSO) δ 177.84, 142.77, 140.27, 139.74, 137.26, 133.69, 132.70, 130.01, 129.69, 129.22, 125.97, 121.33, 120.32, 119.51, 118.22, 117.03, 113.35 ppm; HRMS: calc.for $C_{19}H_{14}NOSe^+$ $[M+H]^+$: 352.0241, found: 352.0234.



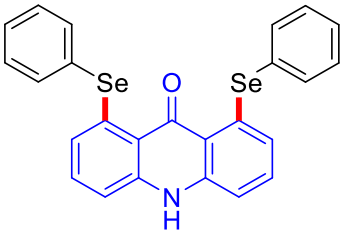
10-Methyl-1-(phenylselanyl)acridin-9(10*H*)-one (6c)

Yellow solid; mp 190.1-191.1 ^{o}C; R_f = 0.3 (50% DCM in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.55 (dd, *J* = 8.0, 1.3 Hz, 1H), 7.77 (dd, *J* = 7.3, 1.7 Hz, 2H), 7.73 – 7.69 (m, 1H), 7.50 – 7.42 (m, 4H), 7.32 – 7.27 (m, 2H), 7.20 (d, *J* = 8.5 Hz, 1H), 6.69 (d, *J* = 7.7 Hz, 1H), 3.85 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 178.92, 144.65, 142.94, 142.02, 137.63, 133.83, 132.49, 130.86, 129.69, 128.94, 127.87, 122.46, 121.49, 121.16, 120.28, 114.51, 110.68, 34.34 ppm; HRMS: calc.for $C_{20}H_{16}NOSe^{+}$ $[M+H]^{+}$: 366.0397, found: 366.0391.



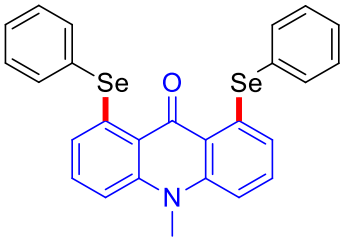
1,8-Bis(phenylselanyl)-9*H*-xanthen-9-one (6d)

Faint Yellow solid; mp 230.2-230.1 ^{o}C; R_f = 0.3 (30% DCM in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.77 (d, *J* = 6.3 Hz, 4H), 7.49 –7.44 (m, 6H), 7.29 (t, *J* = 8.1 Hz, 2H), 7.15 (d, *J* = 8.1 Hz, 2H), 6.73 (d, *J* = 7.9 Hz, 2H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.12, 157.08, 141.73, 137.62, 133.56, 129.83, 129.24, 129.17, 123.37, 119.43, 113.31 ppm; HRMS: calc.for $C_{25}H_{16}O_2Se_2^{+}$ $[M+H]^{+}$: 508.9559, found: 508.9562.



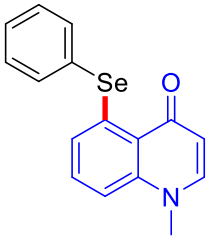
1,8-Bis(phenylselanyl)acridin-9(10*H*)-one (6e)

Yellow solid; mp 228.2-228.5 ^{o}C; R_f = 0.3 (50% DCM in petroleum ether); ^{1}H NMR (400 MHz, DMSO) δ 11.81 (brs, 1H), 7.76 – 7.66 (m, 4H), 7.58 – 7.48 (m, 6H), 7.36 (t, *J* = 8.0 Hz, 2H), 7.22 (d, *J* = 8.0 Hz, 2H), 6.45 (d, *J* = 7.6 Hz, 2H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 180.31, 142.02, 141.54, 137.66, 132.54, 130.15, 129.69, 128.95, 121.13, 119.38, 111.88 ppm; HRMS: calc.for $C_{25}H_{17}ONSe_2^{+}$ $[M+H]^{+}$: 507.9719, found: 507.9718.



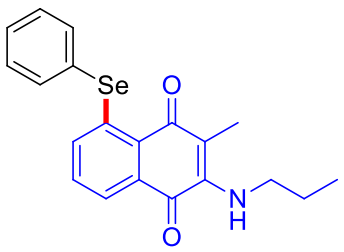
10-Methyl-1,8-bis(phenylselanyl)acridin-9(10*H*)-one (6f)

Yellow solid; mp 280.2-281.1 ^{o}C; R_f = 0.5 (50% DCM in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 – 7.76 (m, 4H), 7.46 – 7.42 (m, 6H), 7.26 (t, *J* = 8.1 Hz, 2H), 7.14 (d, *J* = 8.5 Hz, 2H), 6.67 (d, *J* = 7.8 Hz, 2H), 3.79 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.79, 144.11, 143.01, 137.61, 132.44, 130.86, 129.68, 128.90, 121.30, 120.36, 110.44, 35.14 ppm; HRMS: calc.for $C_{26}H_{19}NOSe_2^+$ $[M+H]^+$: 521.9875, found: 521.9859.



1-Methyl-5-(phenylselanyl)quinolin-4(1*H*)-one (6g)

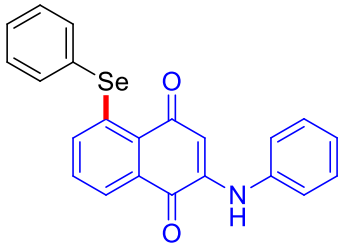
White solid; mp 195.4-196.1 ^{o}C; R_f = 0.4 (4% MeOH in dichloromethane ether); ^{1}H NMR (400 MHz, DMSO) δ 7.94 (d, *J* = 7.6 Hz, 1H), 7.66 – 7.64 (m, 2H), 7.47 (d, *J* = 6.6 Hz, 3H), 7.37 – 7.30 (m, 2H), 6.59 (d, *J* = 7.3 Hz, 1H), 6.07 (d, *J* = 7.6 Hz, 1H), 3.75 (s, 3H) ppm; ^{13}C NMR (101 MHz, DMSO) δ 178.05, 144.79, 142.47, 139.07, 137.26, 131.49, 130.50, 130.15, 129.24, 123.99, 122.18, 112.81, 108.62, 40.82 ppm; HRMS: calc.for $C_{16}H_{14}NOSe^+$ $[M+H]^+$: 316.0241, found: 316.0234.



2-Methyl-5-(phenylselanyl)-3-(propylamino)naphthalene-1,4-dione (6h)

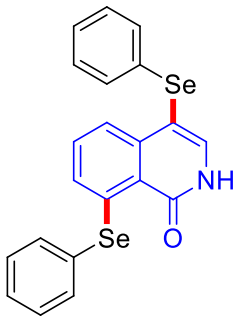
Red solid; mp 185.2-186.7 ^{o}C; R_f = 0.3 (10% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (dd, *J* = 7.3, 0.8 Hz, 1H), 7.73 – 7.71 (m, 2H), 7.49 – 7.40 (m, 3H), 7.21 (t, *J* = 7.8 Hz, 1H), 7.14 – 7.12 (m, 1H), 5.68 (brs, 1H), 3.51 (m, 2H), 2.29 (s, 3H), 1.71 – 1.62 (m, 2H), 1.00 (t, *J* = 7.4 Hz, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 184.92, 182.21, 145.45, 140.05, 137.57,

134.59, 131.89, 130.84, 129.78, 129.68, 129.19, 129.05, 124.04, 112.44, 47.19, 24.13, 11.24, 11.17 ppm; HRMS: calc.for $C_{20}H_{20}NO_2Se^+$ $[M+H]^+$: 386.0659, found: 386.0653.



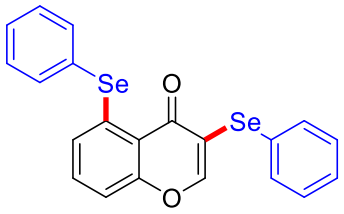
3-(Phenylamino)-8-(phenylselanyl)naphthalene-1,4-dione (6i)

Red brown solid; mp 173.7-174.5 ^oC; R_f = 0.3 (10% EtOAc in petroleum ether); ^1H NMR (400 MHz, $CDCl_3$) δ 8.13 (dd, *J* = 13.1, 7.5 Hz, 2H), 7.82 (brs, 1H), 7.73 (t, *J* = 7.4 Hz, 1H), 7.67 (t, *J* = 7.4 Hz, 1H), 7.17 (t, *J* = 7.7 Hz, 2H), 7.12 – 7.05 (m, 2H), 7.01 (t, *J* = 7.6 Hz, 2H), 6.90 (d, *J* = 7.4 Hz, 2H), 6.69 (d, *J* = 7.8 Hz, 2H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 181.62, 180.33, 143.43, 136.65, 134.66, 133.25, 132.80, 131.36, 130.45, 129.57, 128.52, 127.97, 127.06, 126.82, 126.66, 124.19, 122.29, 114.21 ppm; HRMS: calc.for $C_{22}H_{14}NO_2Se^+$ $[M+H]^+$: 406.03463, found: 406.0341.



4,8-Bis(phenylselanyl)isoquinolin-1(2*H*)-one (6j)

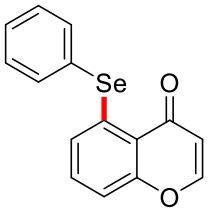
White solid; mp 260.5-261.1 ^oC; R_f = 0.3 (25% EtOAc in petroleum ether); ^1H NMR (400 MHz, DMSO) δ 11.84 (d, *J* = 5.7 Hz, 1H), 7.74 (d, *J* = 6.0 Hz, 1H), 7.67 (d, *J* = 6.3 Hz, 2H), 7.55 (d, *J* = 8.0 Hz, 1H), 7.52 – 7.47 (m, 3H), 7.33 (t, *J* = 8.0 Hz, 1H), 7.27 – 7.14 (m, 5H), 6.69 (d, *J* = 7.8 Hz, 1H) ppm; ^{13}C NMR (101 MHz, DMSO) δ 162.80, 140.31, 140.15, 138.15, 137.26, 132.49, 131.77, 130.14, 129.42, 128.73, 126.33, 125.79, 123.47, 123.43, 102.15 ppm; HRMS: calc.for $C_{21}H_{15}NOSe_2^+$ $[M+H]^+$: 457.9562, found: 457.9555.



3,5-Bis(phenylselanyl)-4*H*-chromen-4-one (7)

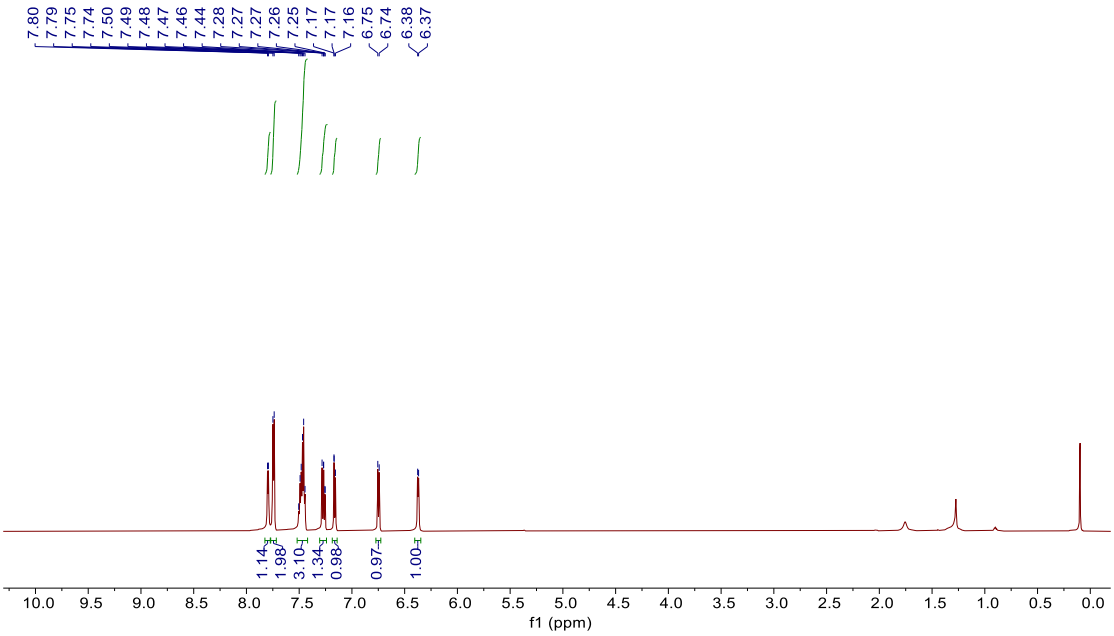
Faint Yellow solid; mp 126.2-127.3 ^{o}C; R_f = 0.5 (10% EtOAc in petroleum ether); ^{1}H NMR (400 MHz, CDCl3) δ 7.73 (s, 1H), 7.72 (dd, *J* = 7.7, 1.5 Hz, 2H), 7.62 (dd, J = 6.5, 3.0 Hz, 2H), 7.47 – 7.41 (m, 3H), 7.34 – 7.31 (m, 3H), 7.24 (t, J = 8.0 Hz, 1H), 7.11 (dd, J = 8.2, 0.6 Hz, 1H), 6.76 – 6.74 (m, 1H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ 176.40, 157.93, 154.66, 140.83, 137.47, 134.02, 132.70, 129.86, 129.58, 129.27, 128.93, 128.18, 127.85, 124.64, 120.68, 117.84, 113.75 ppm; HRMS: calc.for $C_{21}H_{15}O_2Se_2^+$ $[M+H]^+$: 458.9403, found: 458.9398.

Copies of ^{1}H and ^{13}C NMR spectra of products 3, 6 and 7

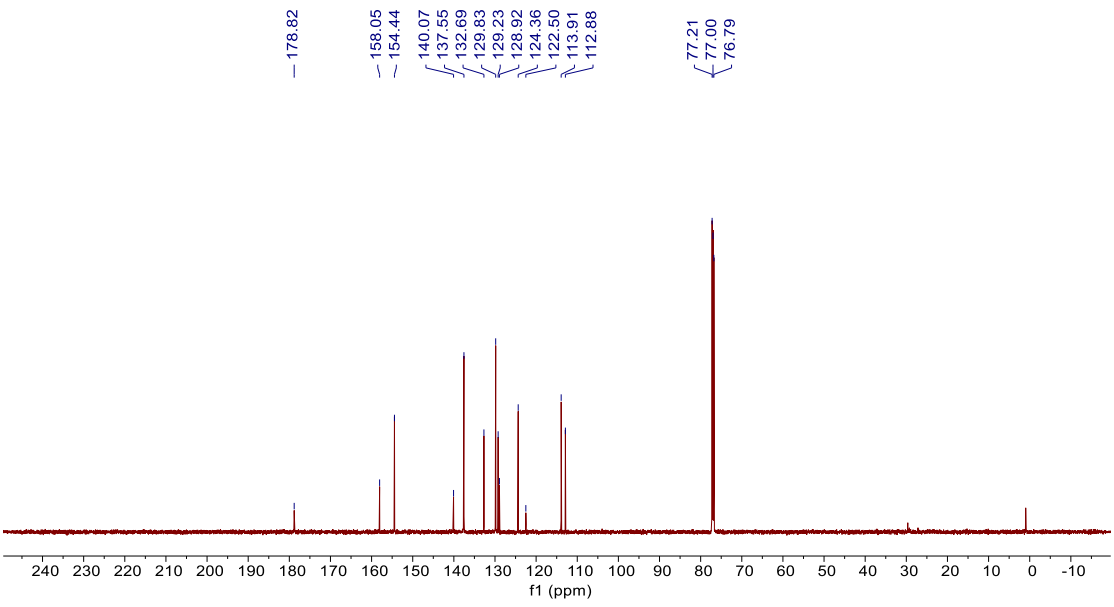


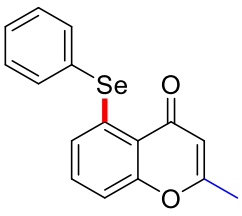
3a

^{1}H NMR



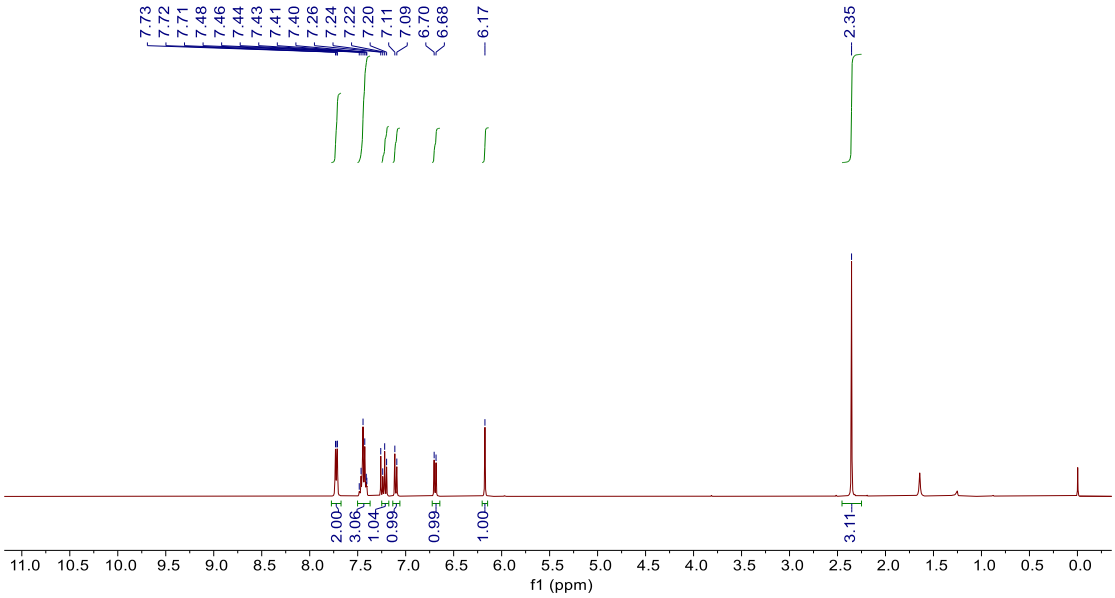
^{13}C NMR



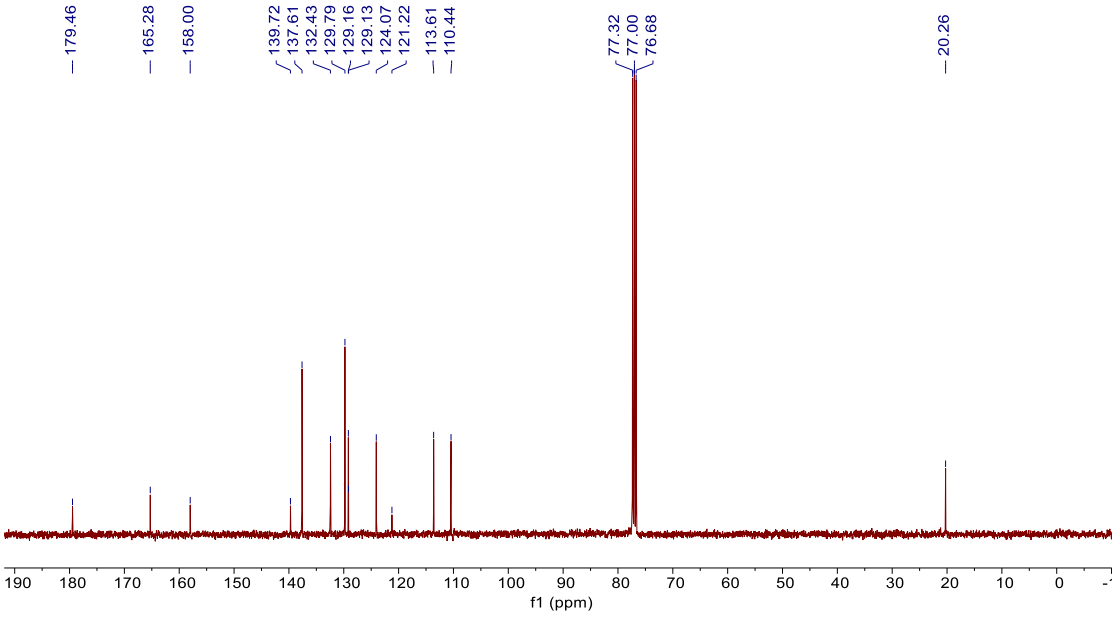


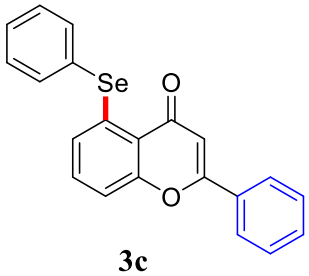
3b

^{1}H NMR



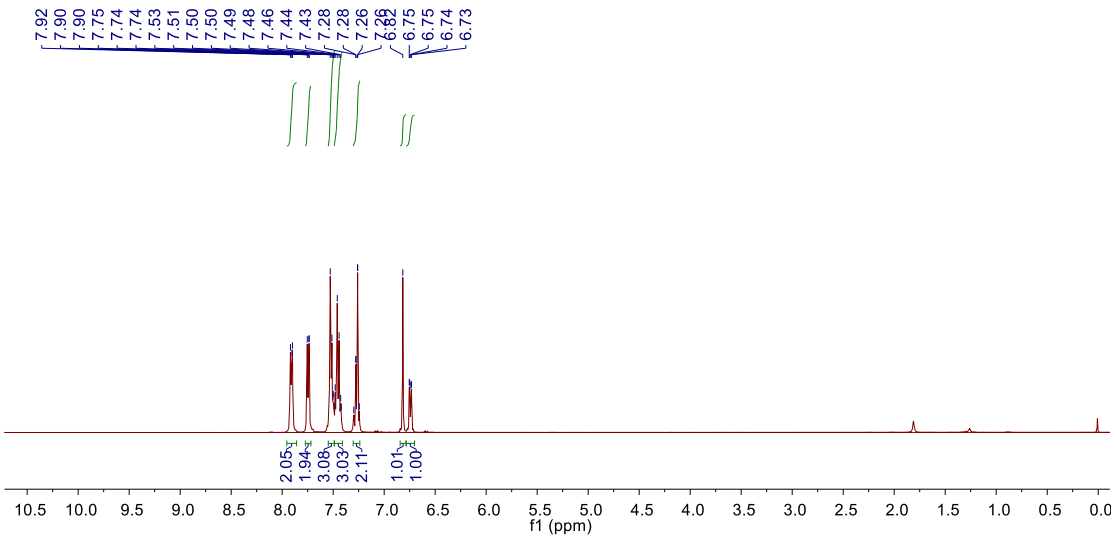
^{13}C NMR



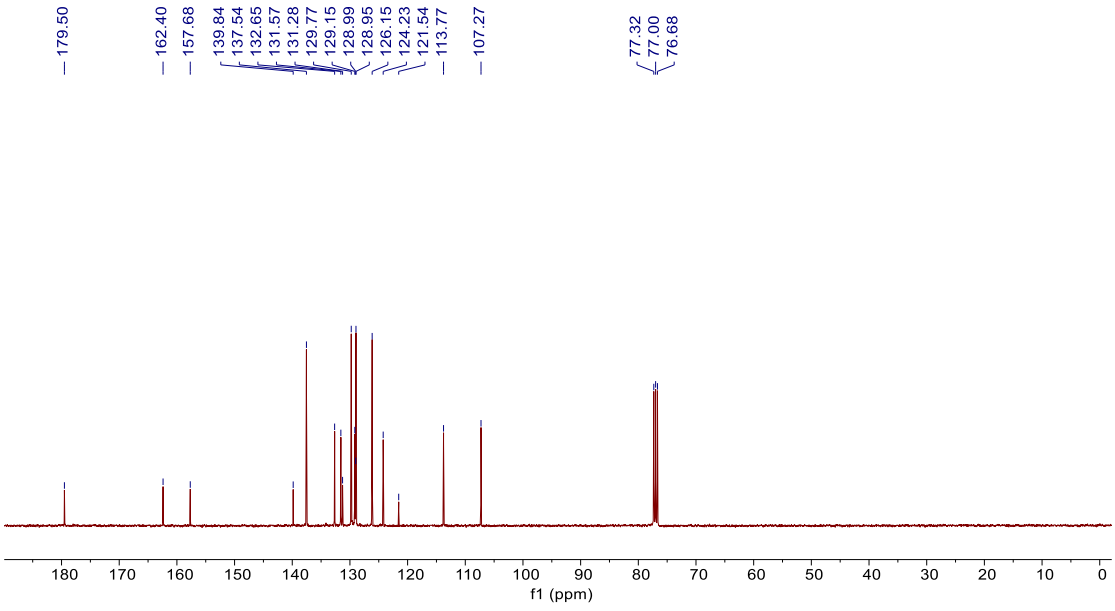


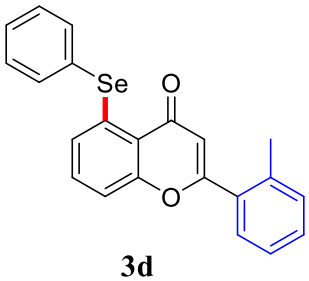
3c

^{1}H NMR



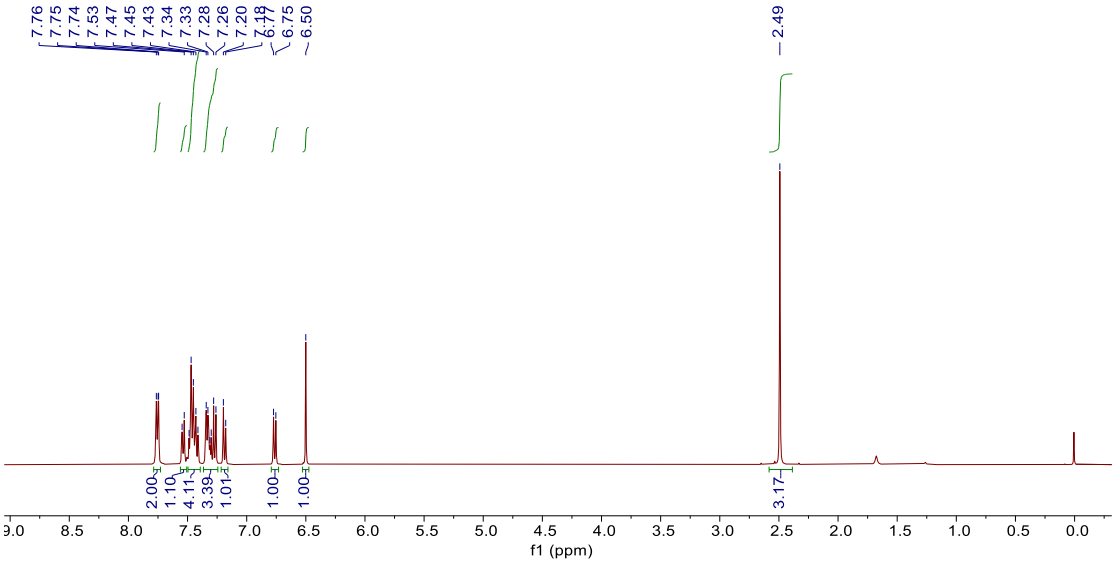
^{13}C NMR



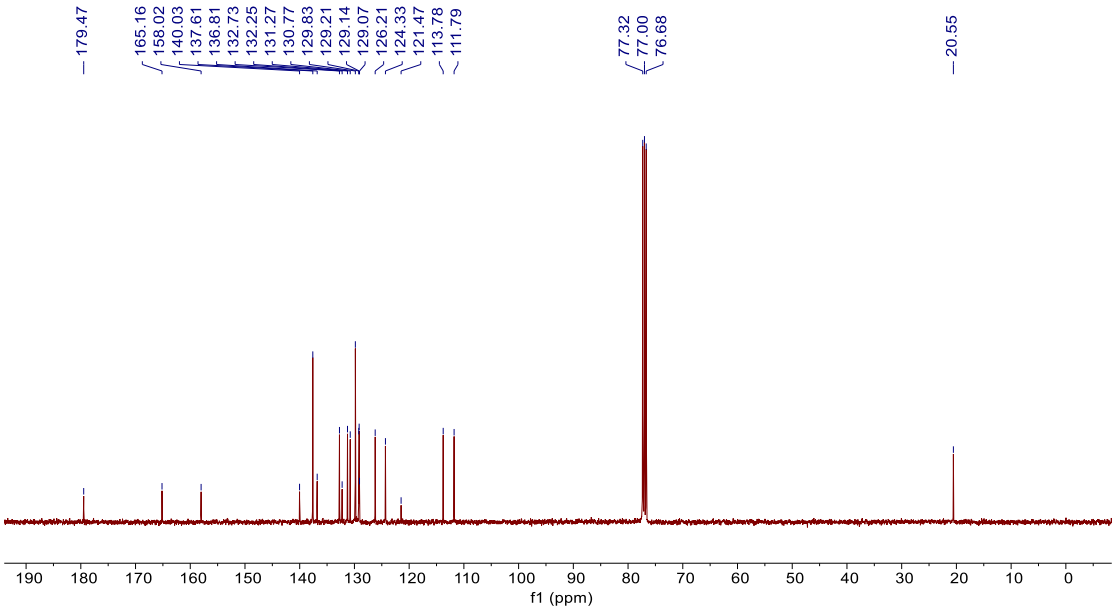


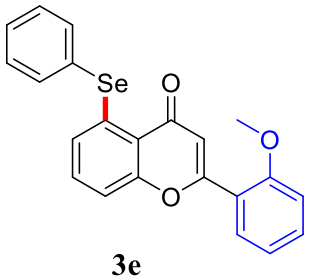
3d

^{1}H NMR



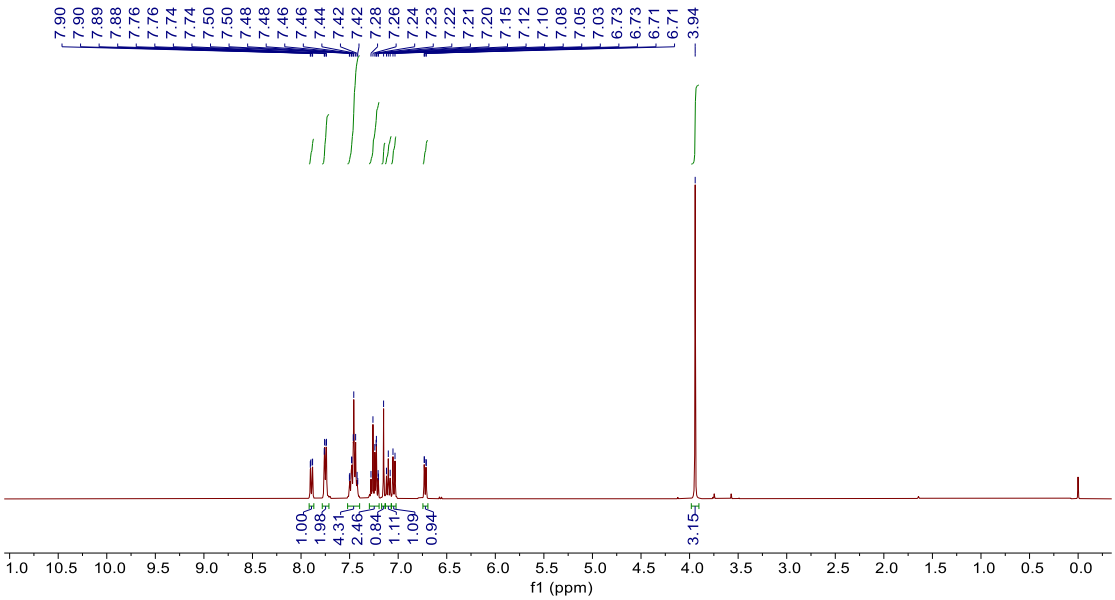
^{13}C NMR



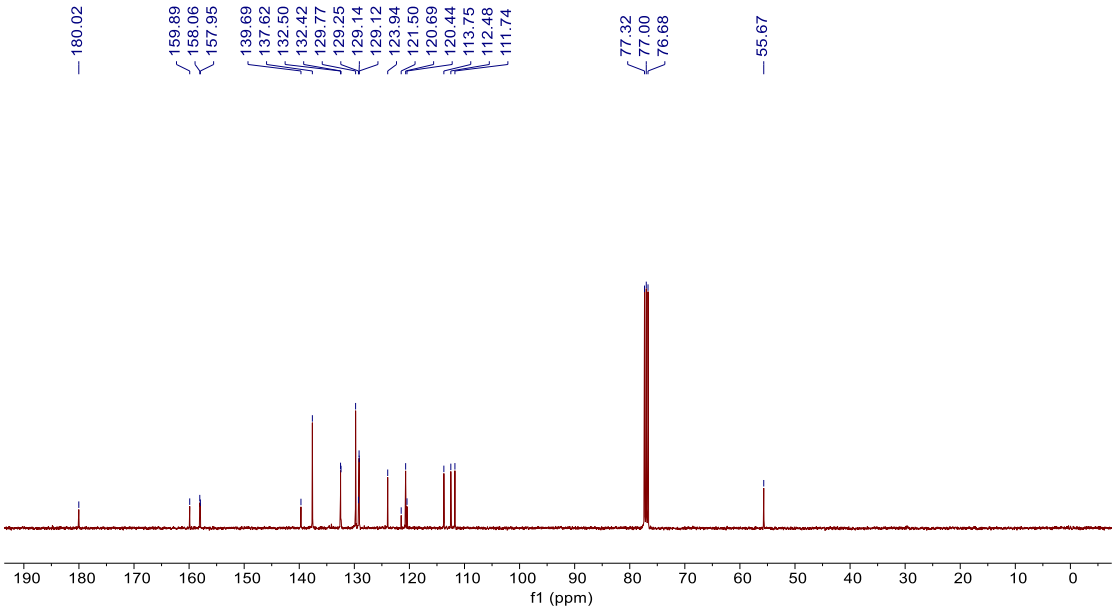


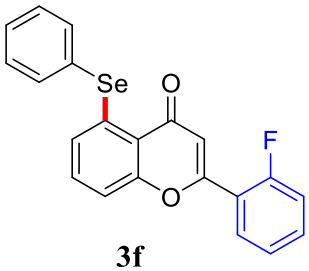
3e

^{1}H NMR



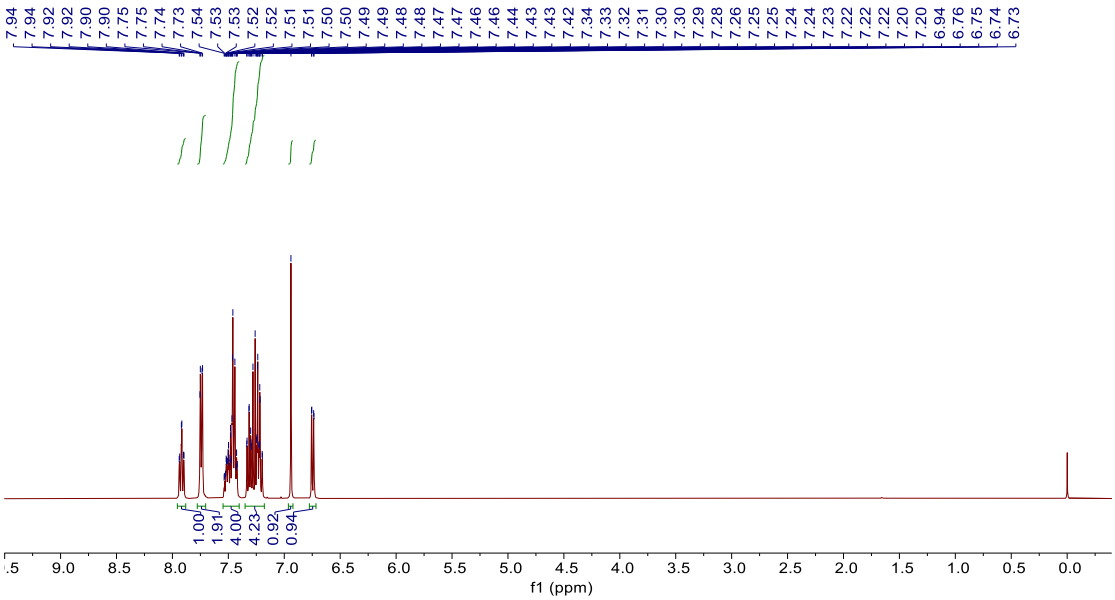
^{13}C NMR



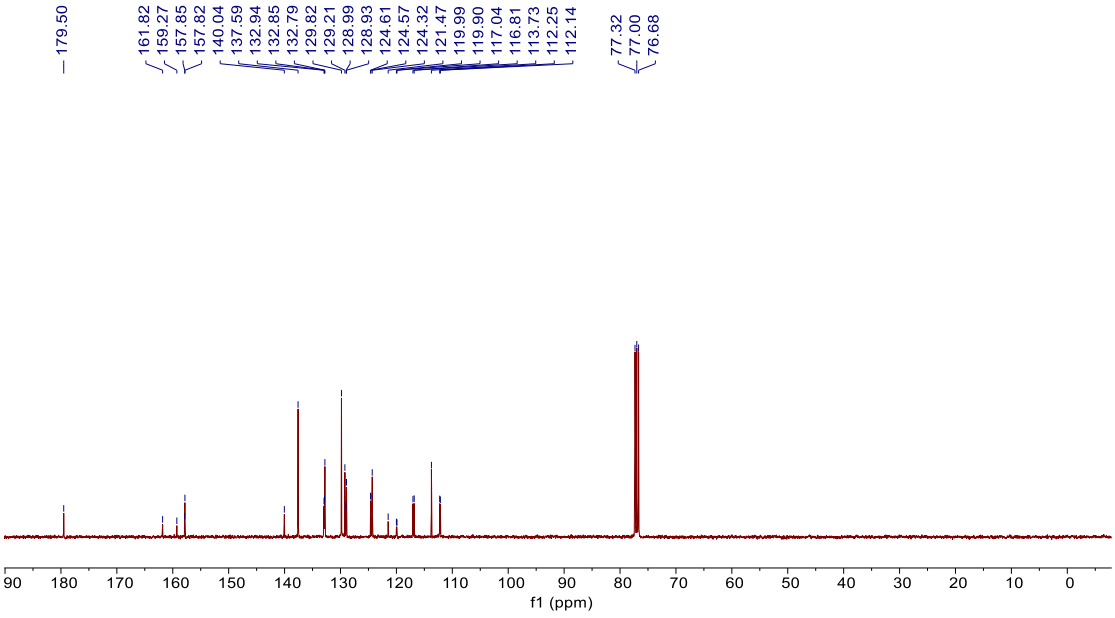


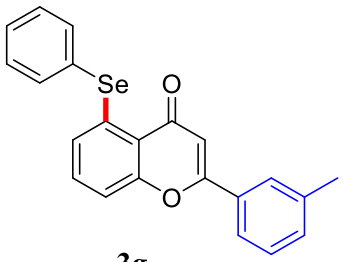
3f

^{1}H NMR



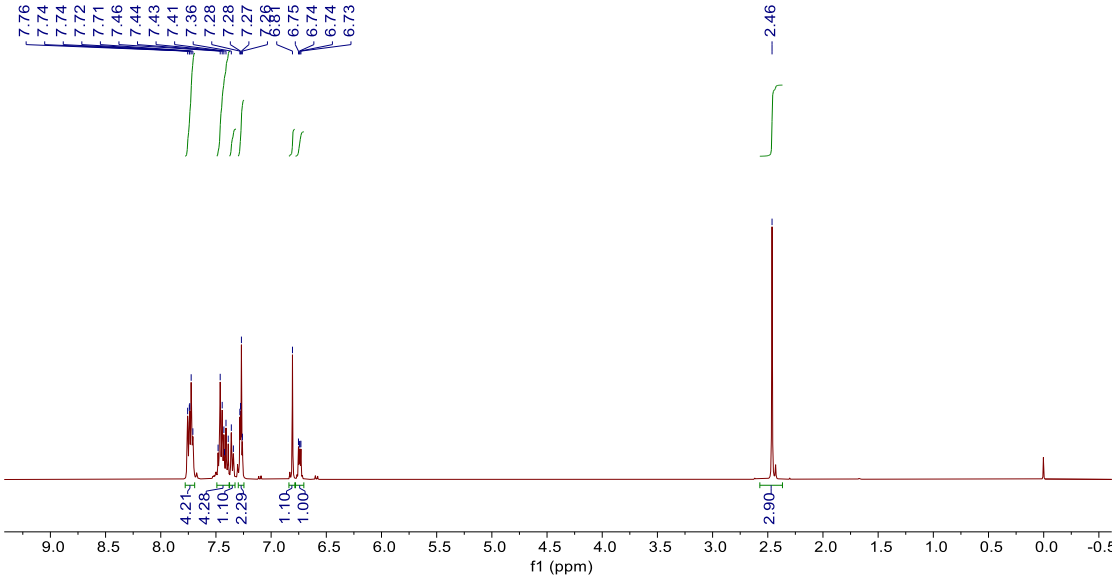
^{13}C NMR



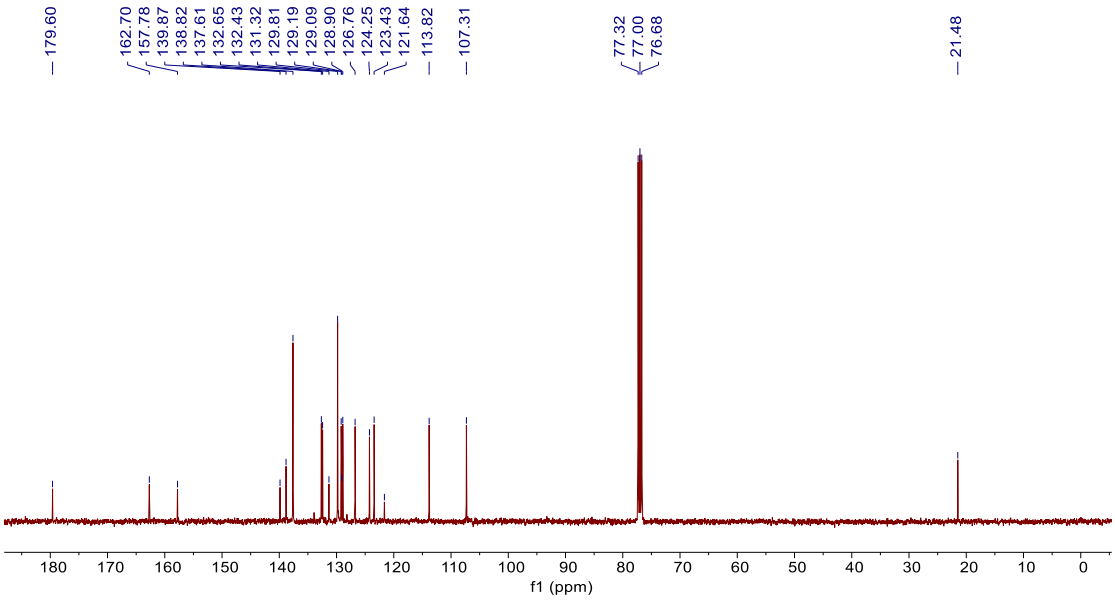


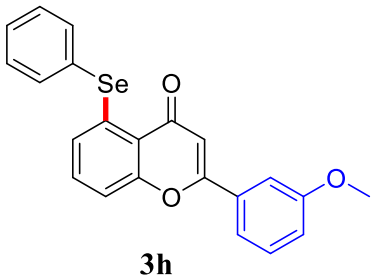
3g

^{1}H NMR



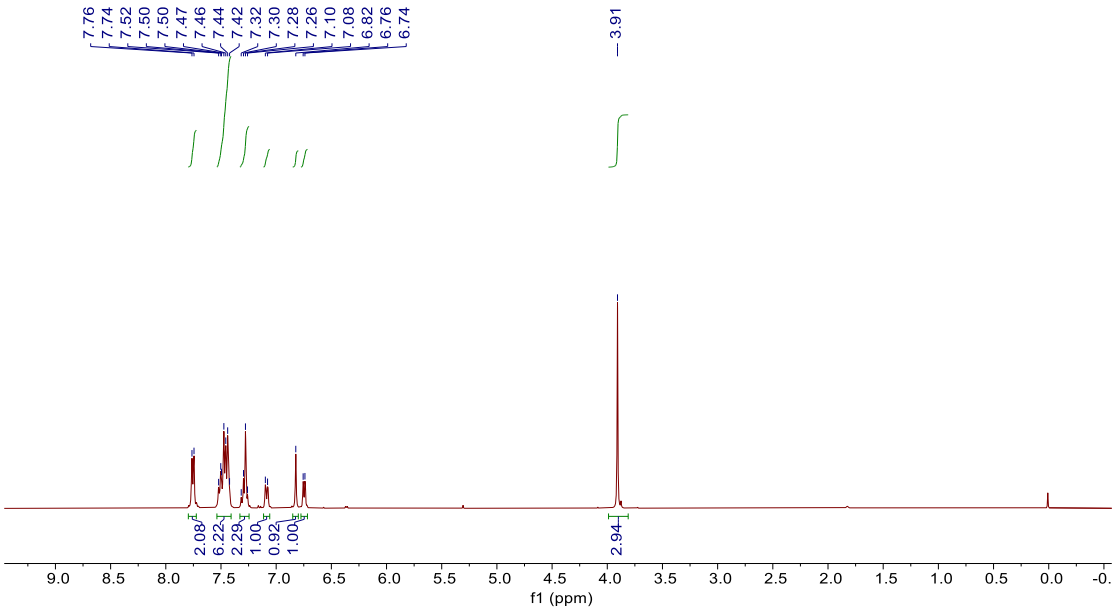
^{13}C NMR



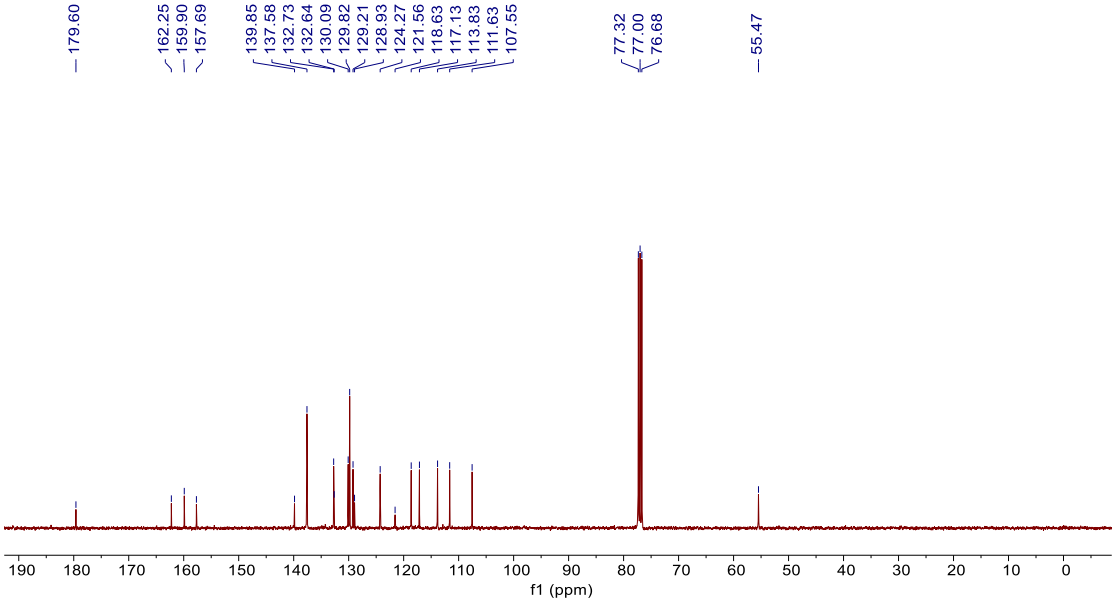


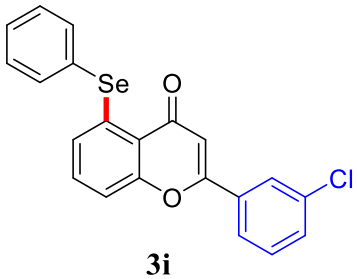
3h

^{1}H NMR



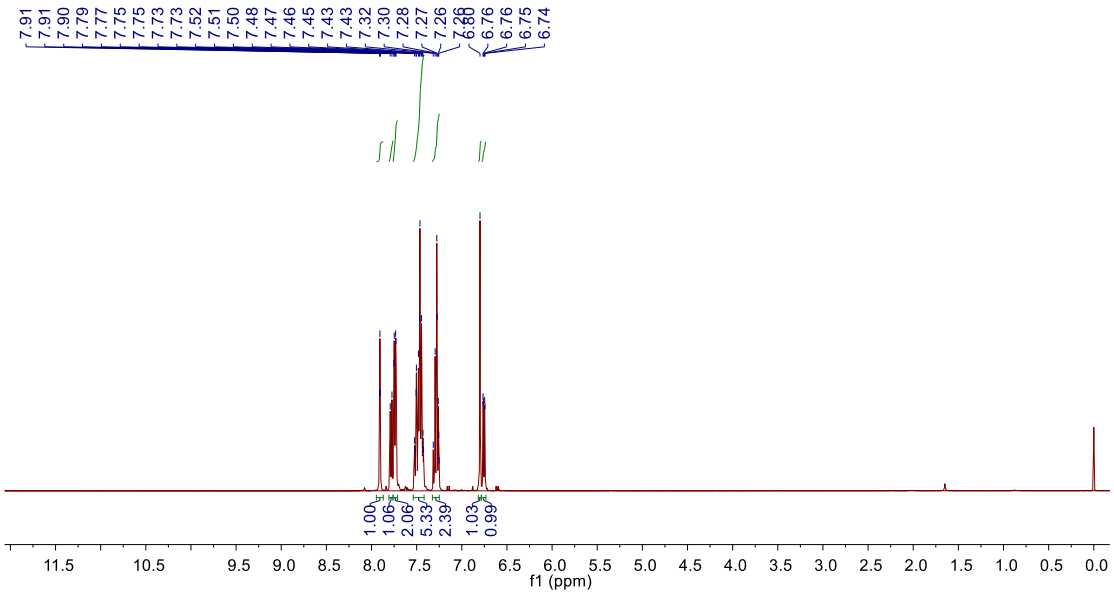
^{13}C NMR



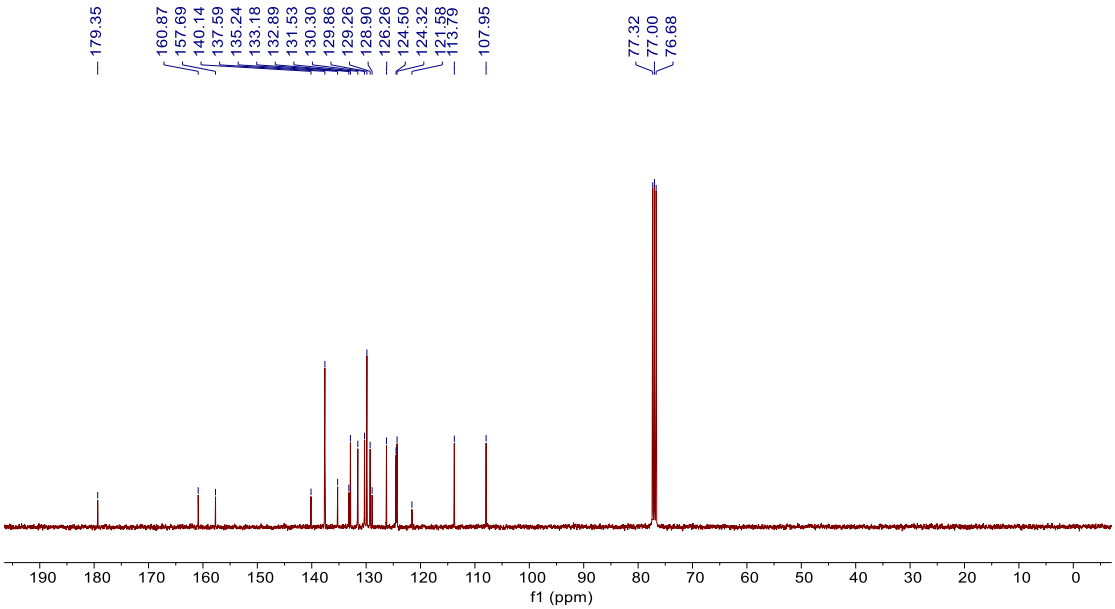


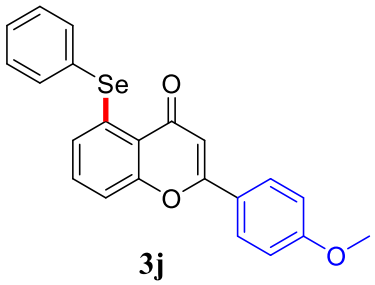
3i

^{1}H NMR



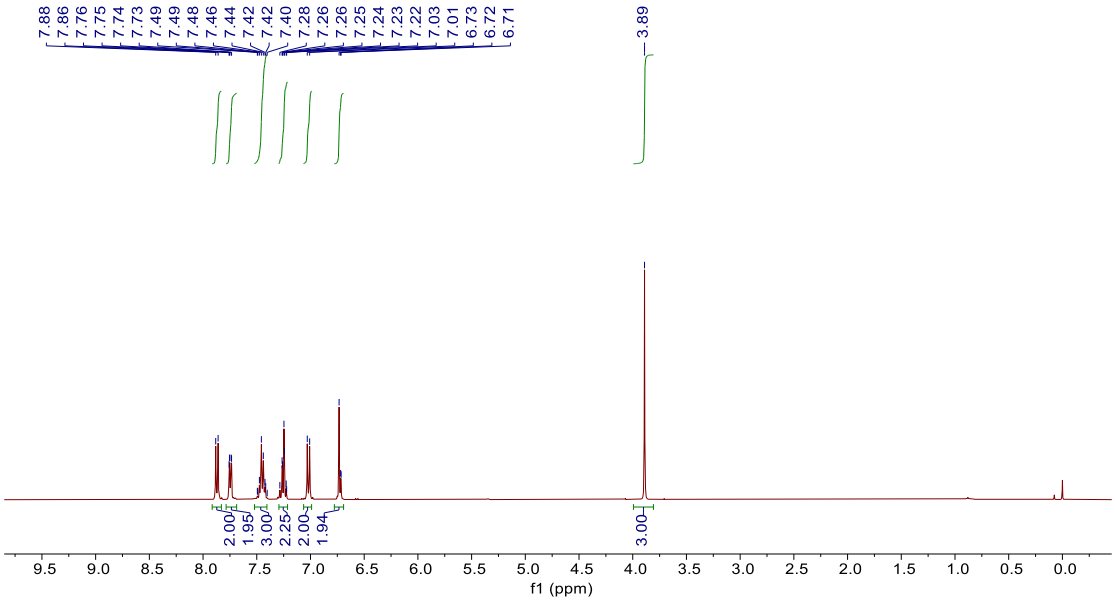
^{13}C NMR



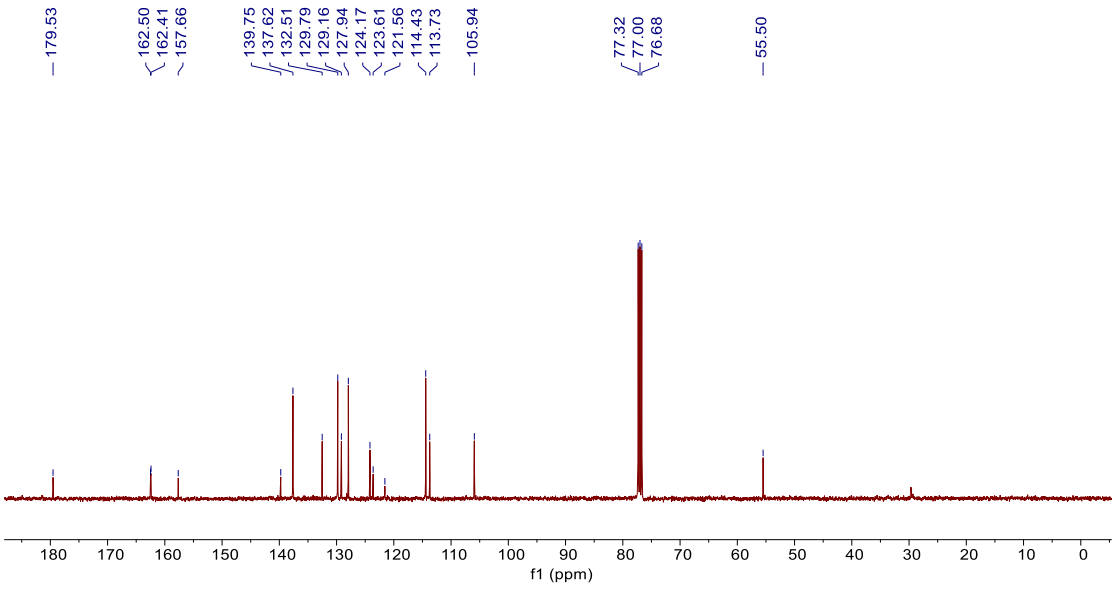


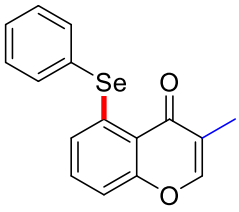
3j

^{1}H NMR



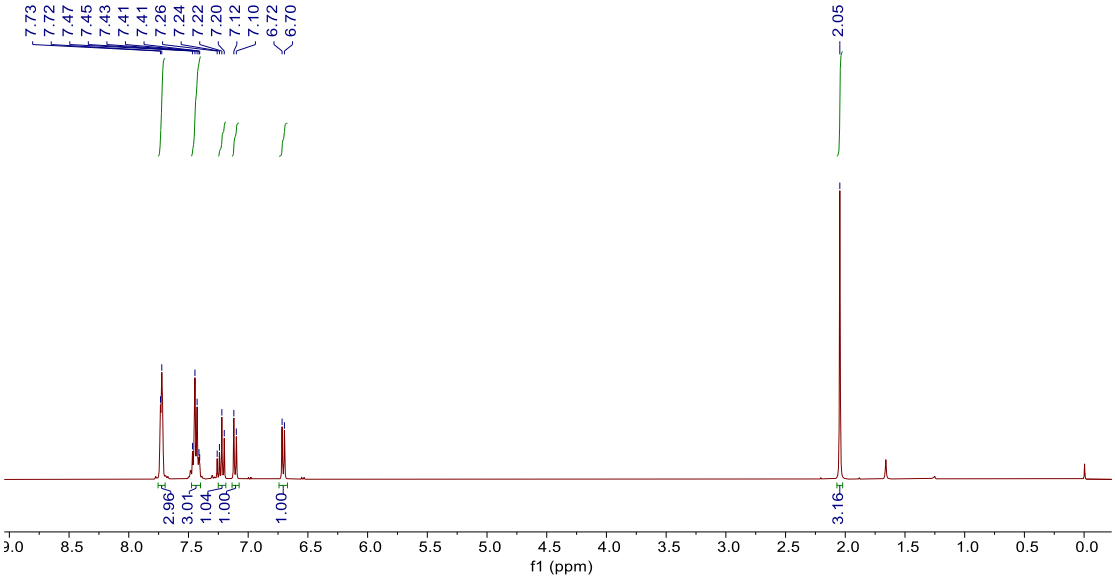
^{13}C NMR





3k

^{1}H NMR



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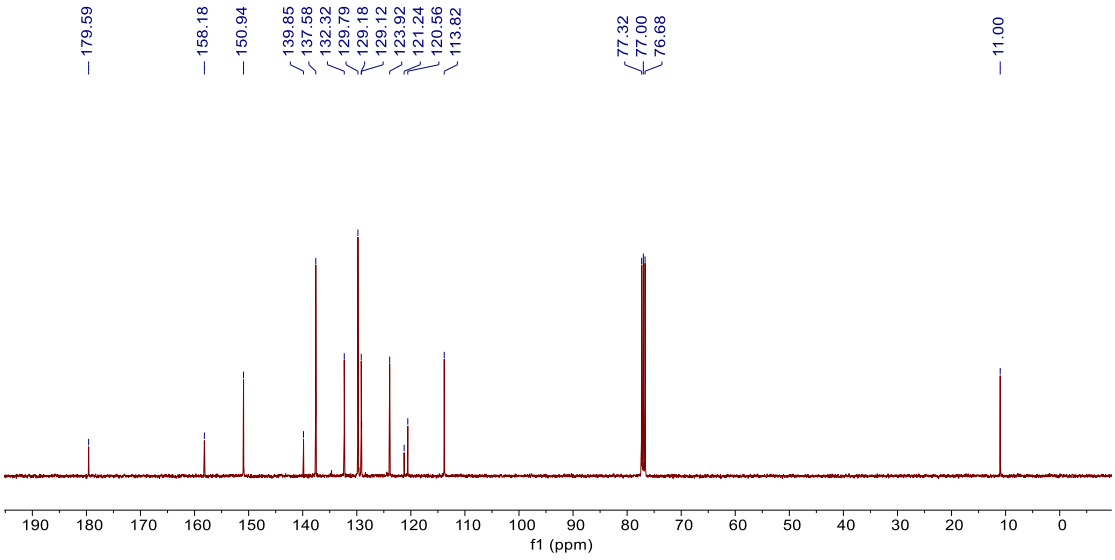
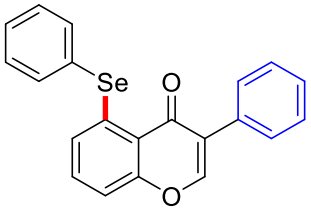
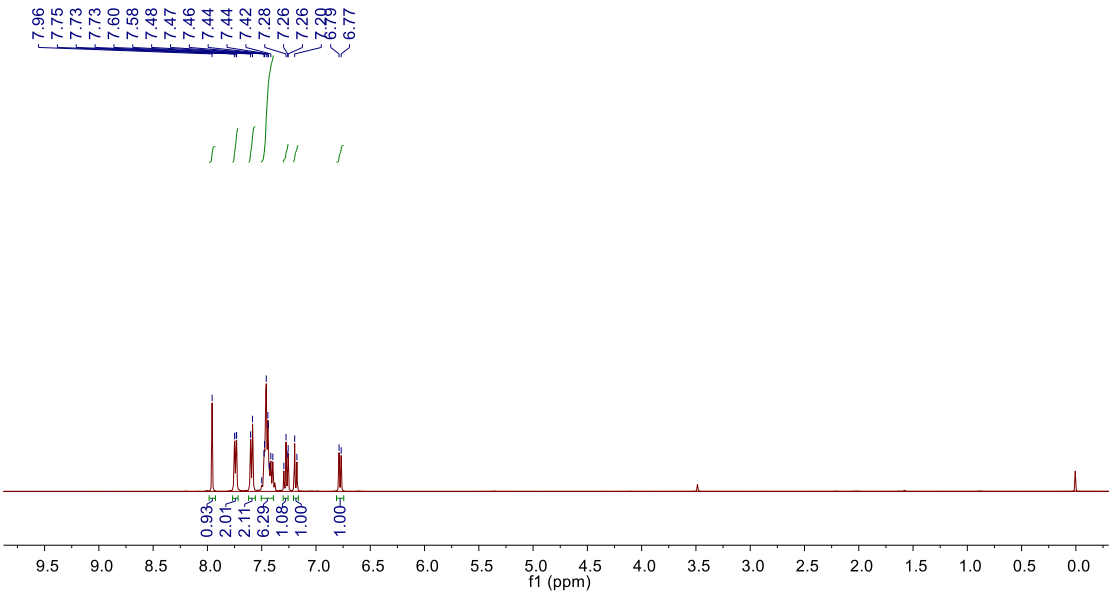


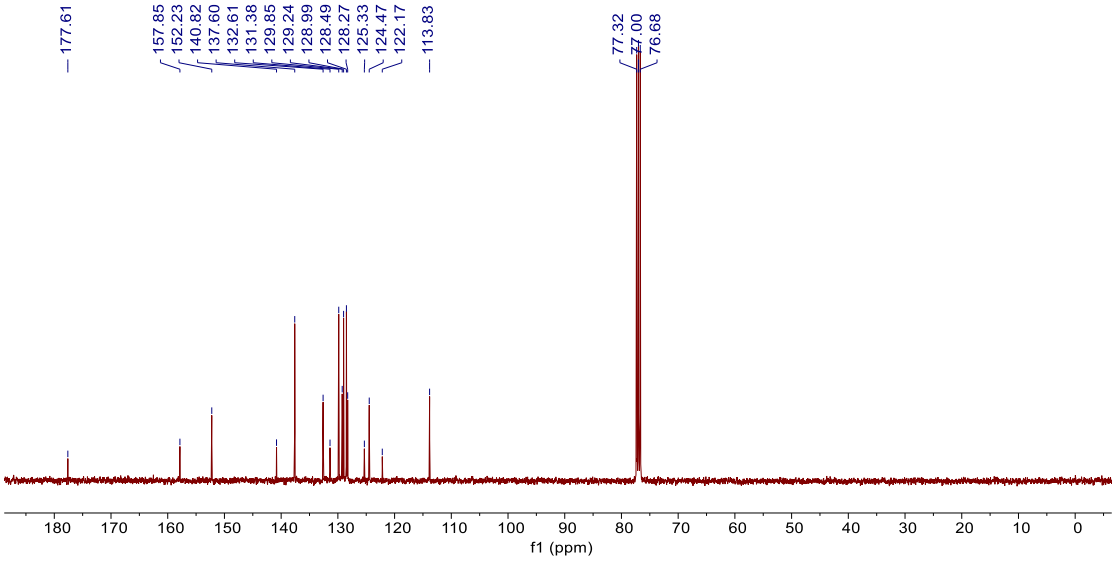


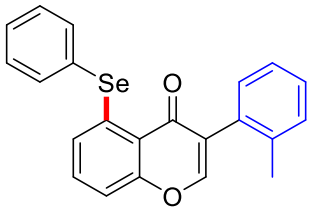
3l

^{1}H NMR



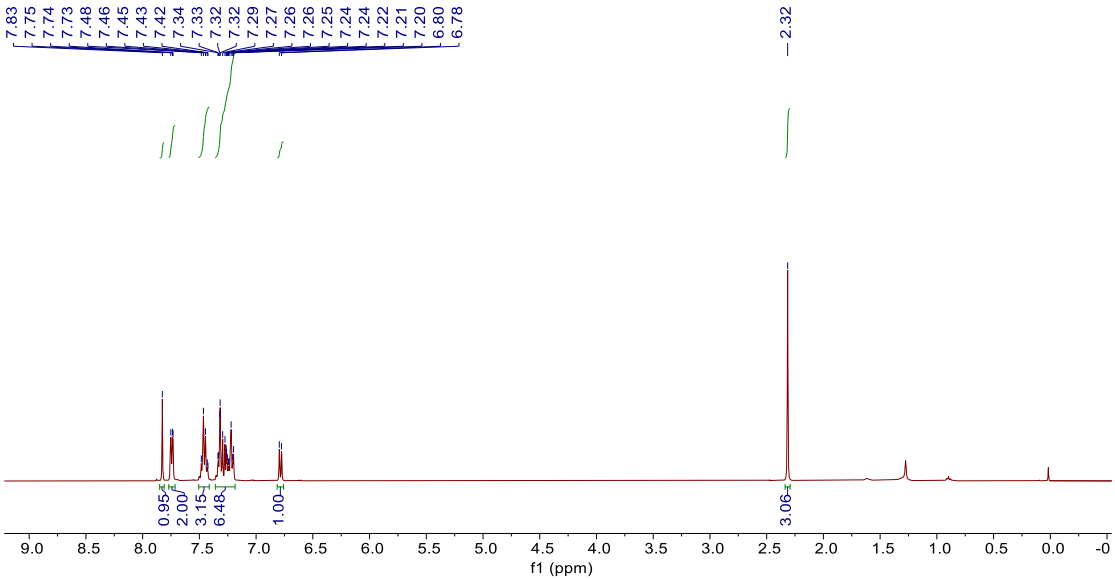
^{13}C NMR



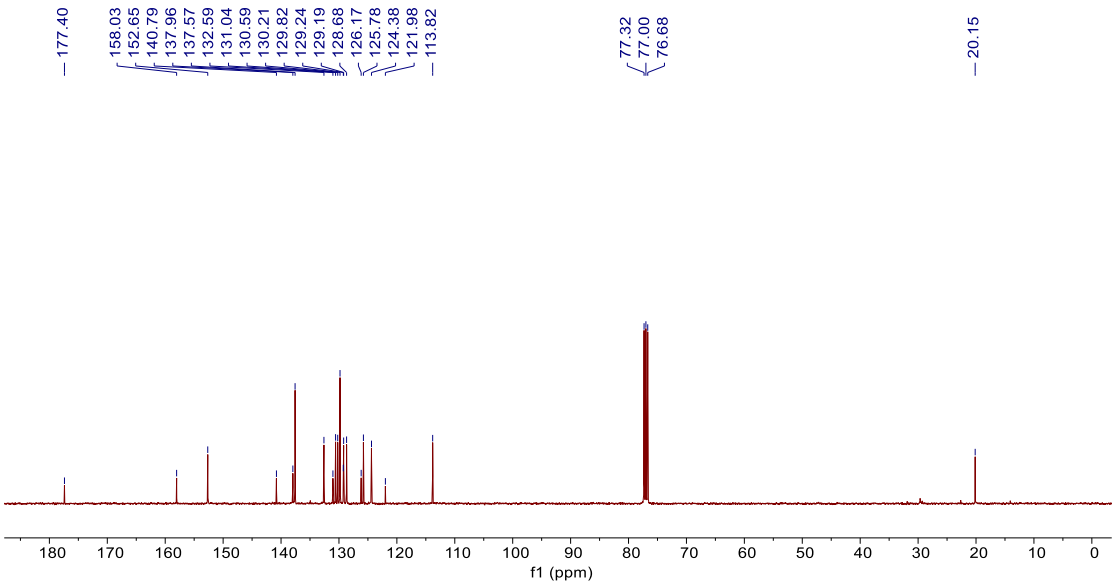


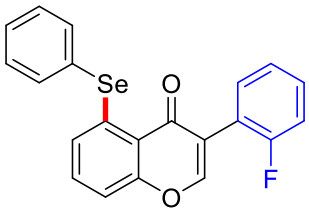
3m

^{1}H NMR



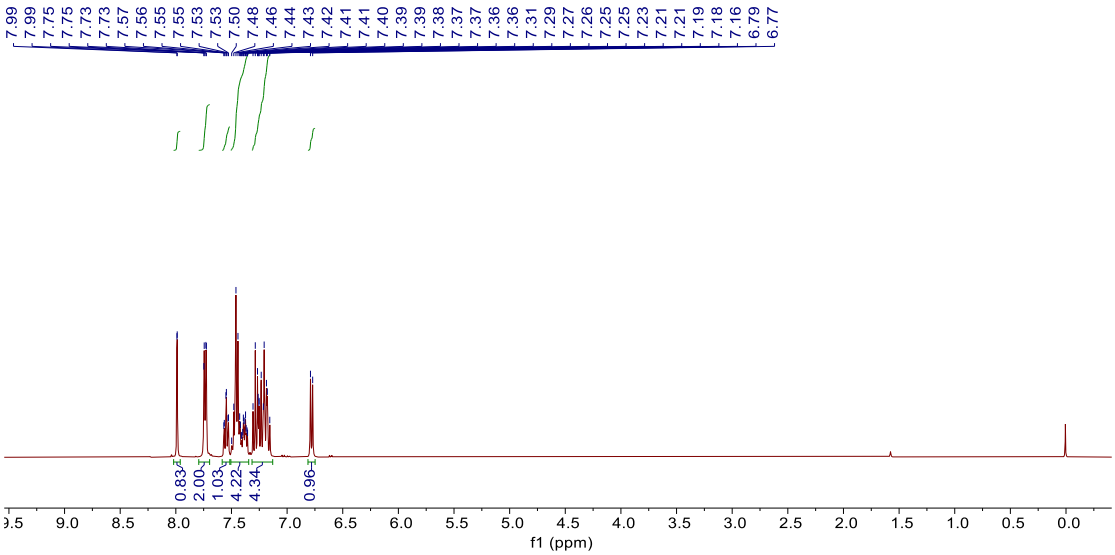
^{13}C NMR





3n

^{1}H NMR



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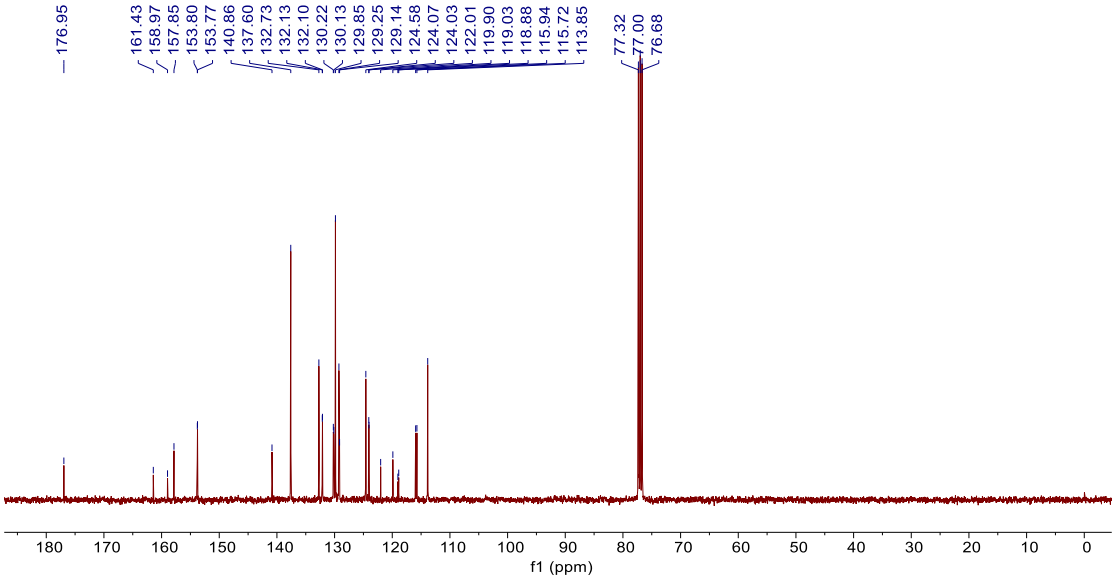
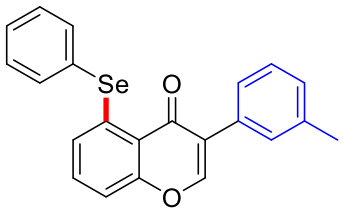
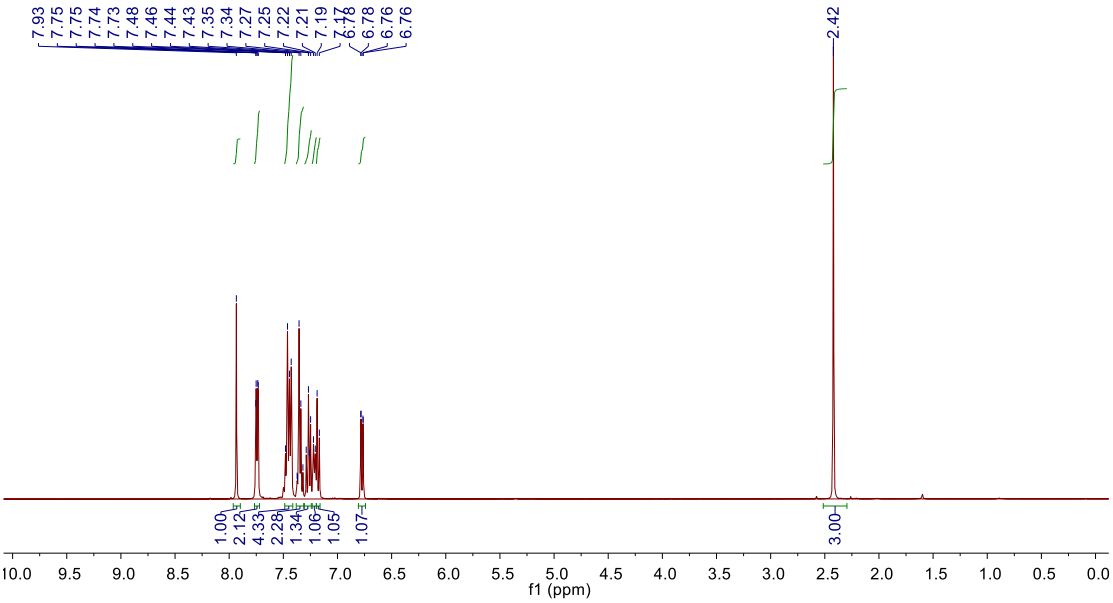


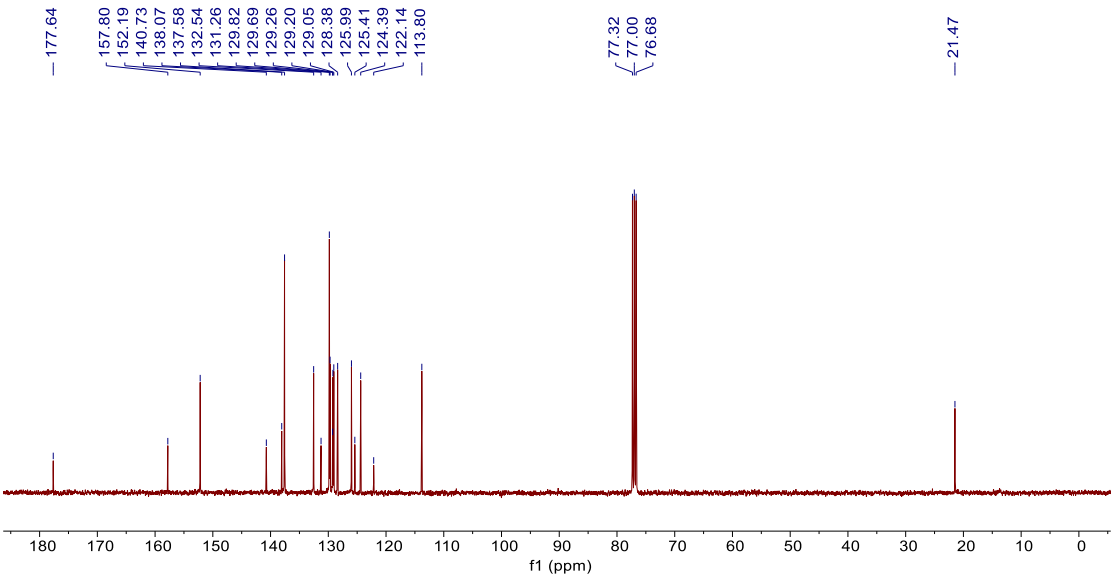


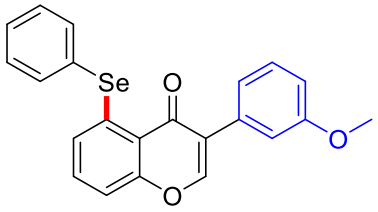
3o

^{1}H NMR



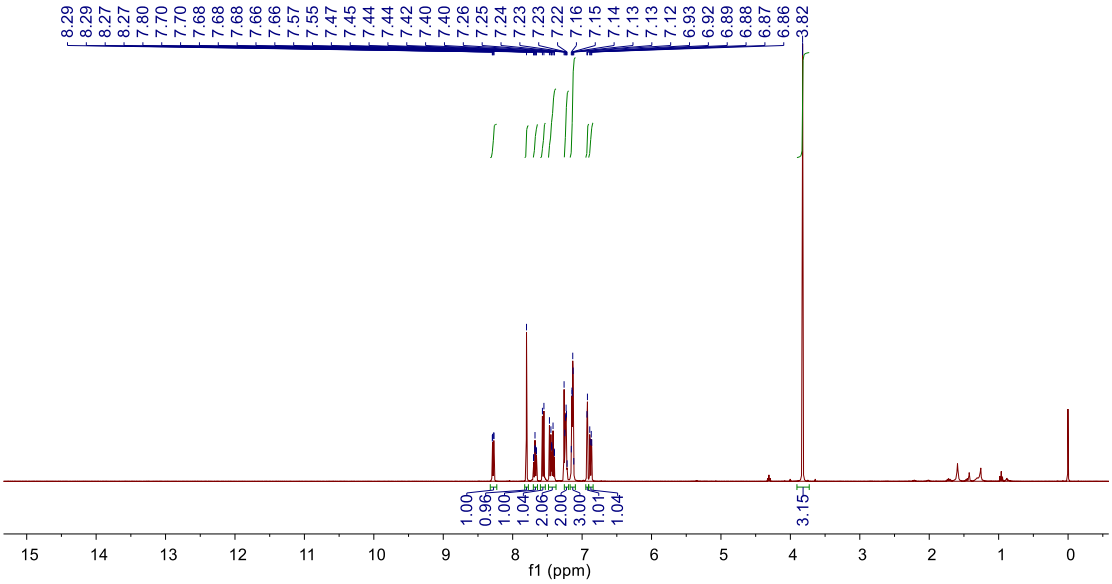
^{13}C NMR



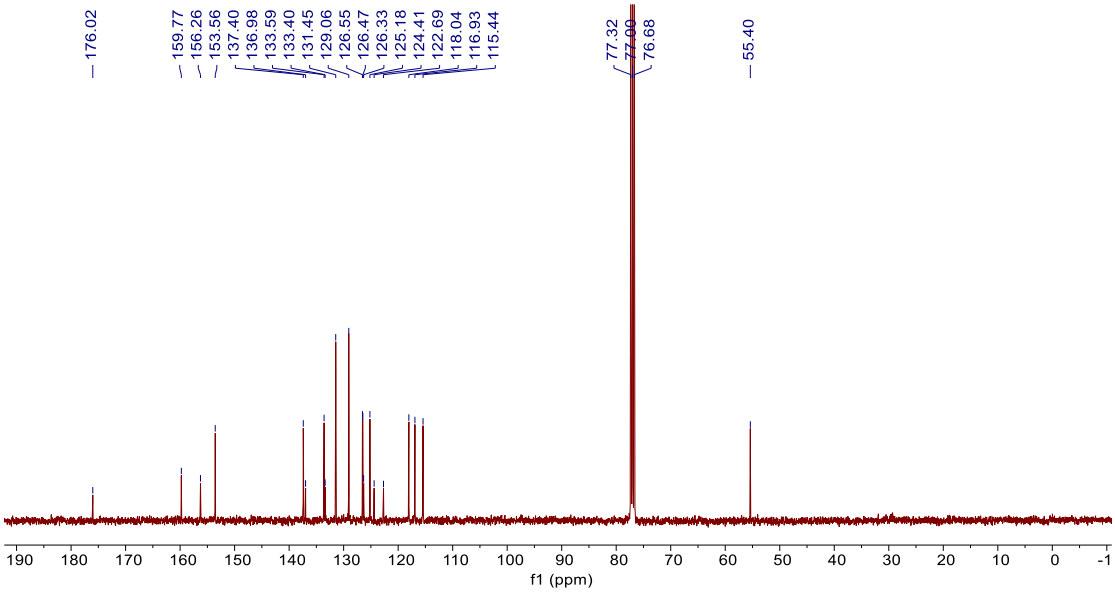


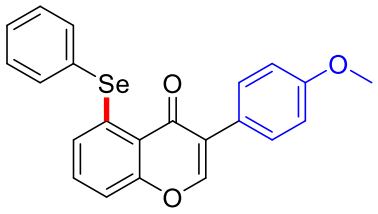
3p

^{1}H NMR



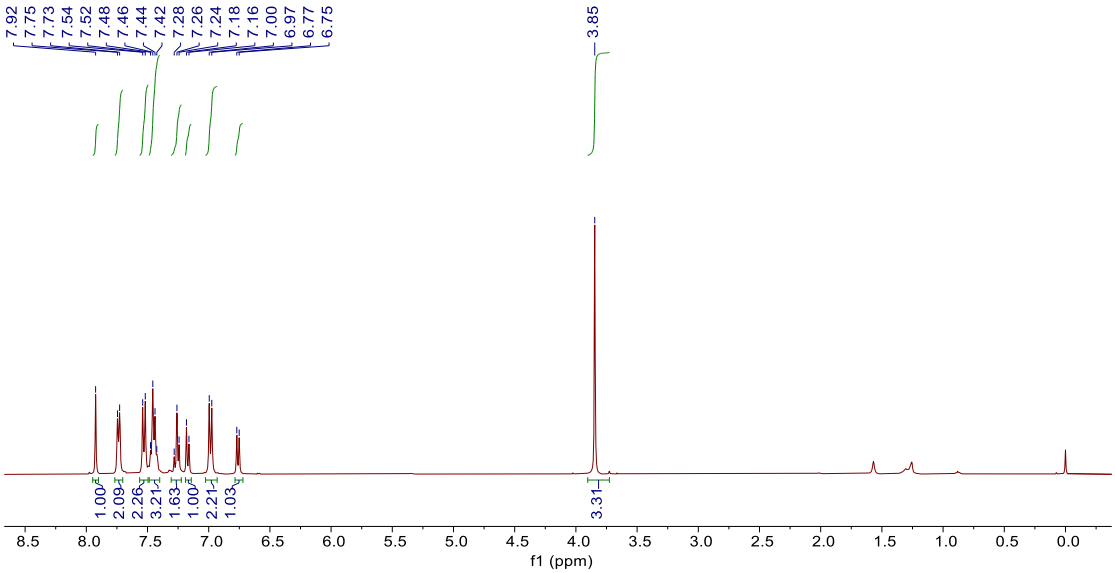
^{13}C NMR





3q

^{1}H NMR



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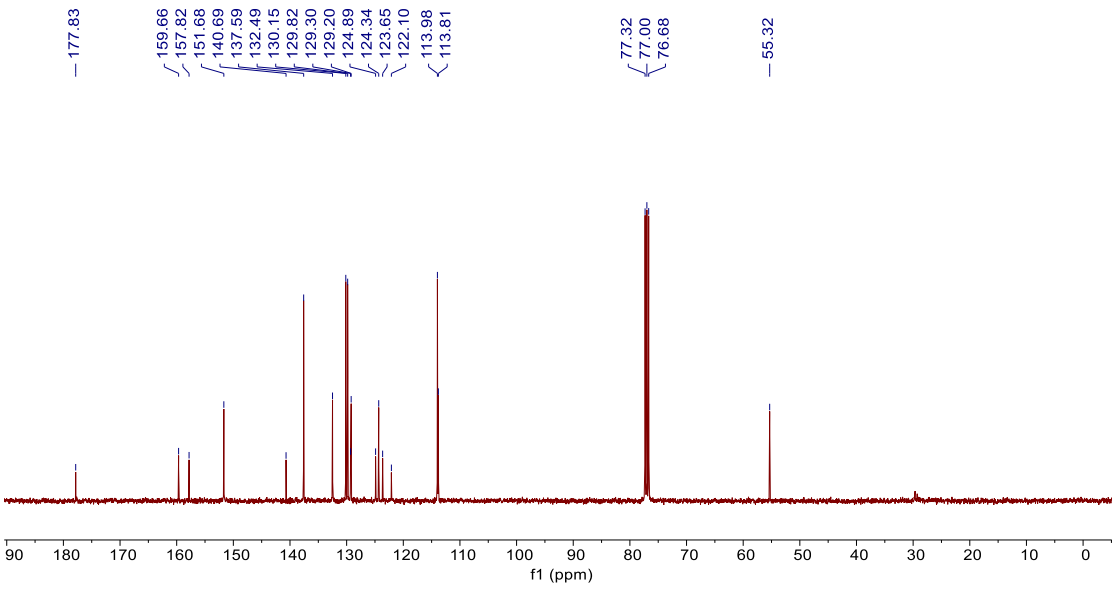
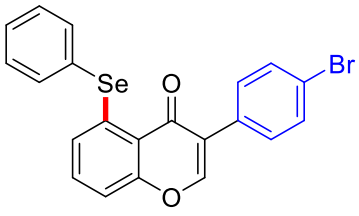
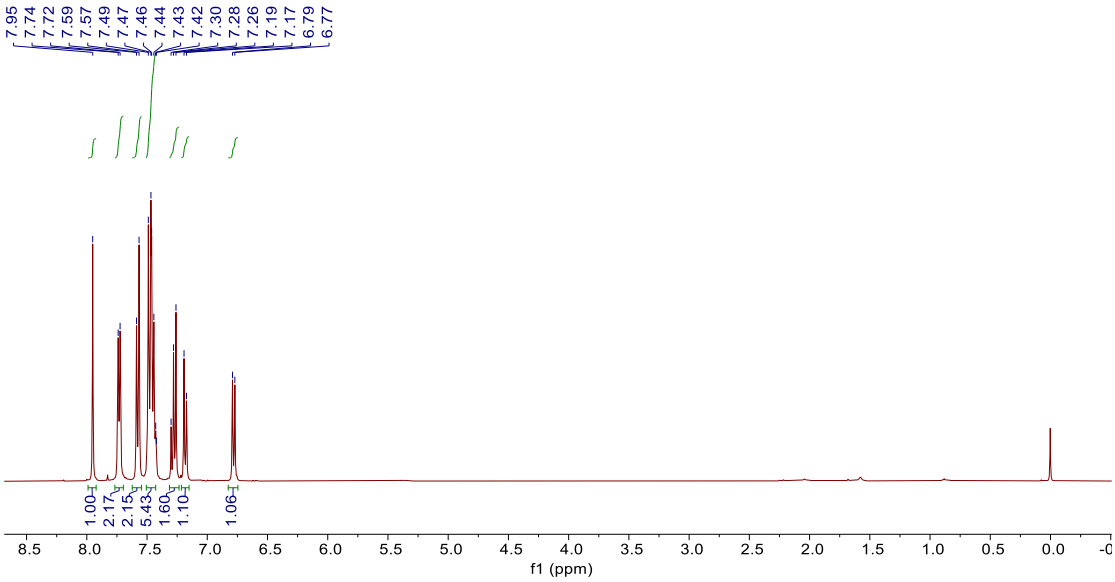


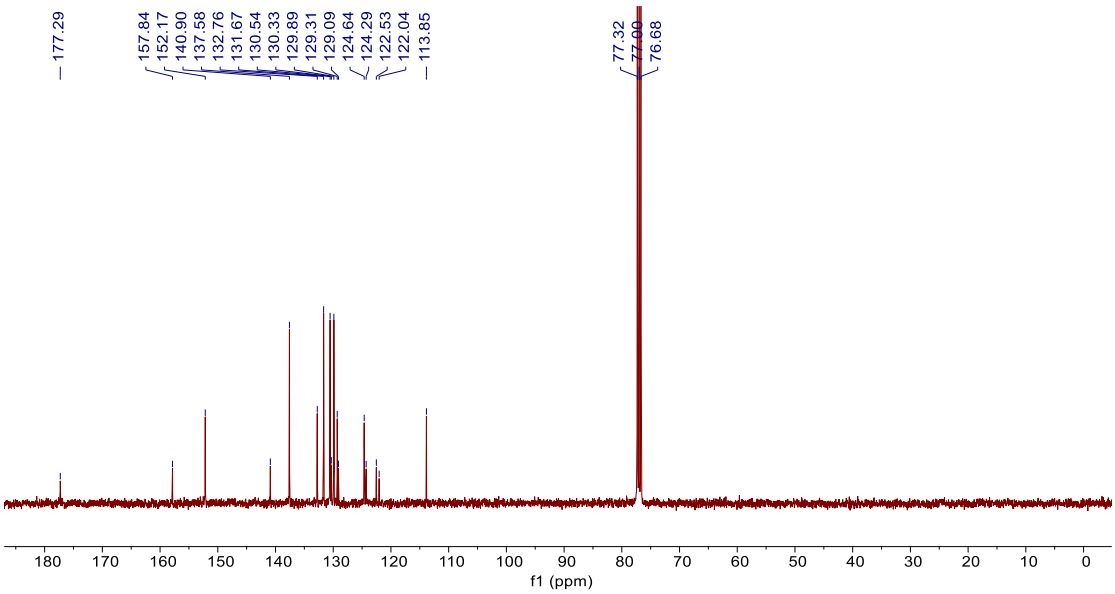


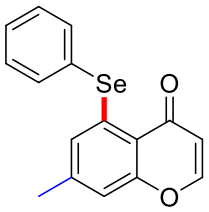
3r

^{1}H NMR



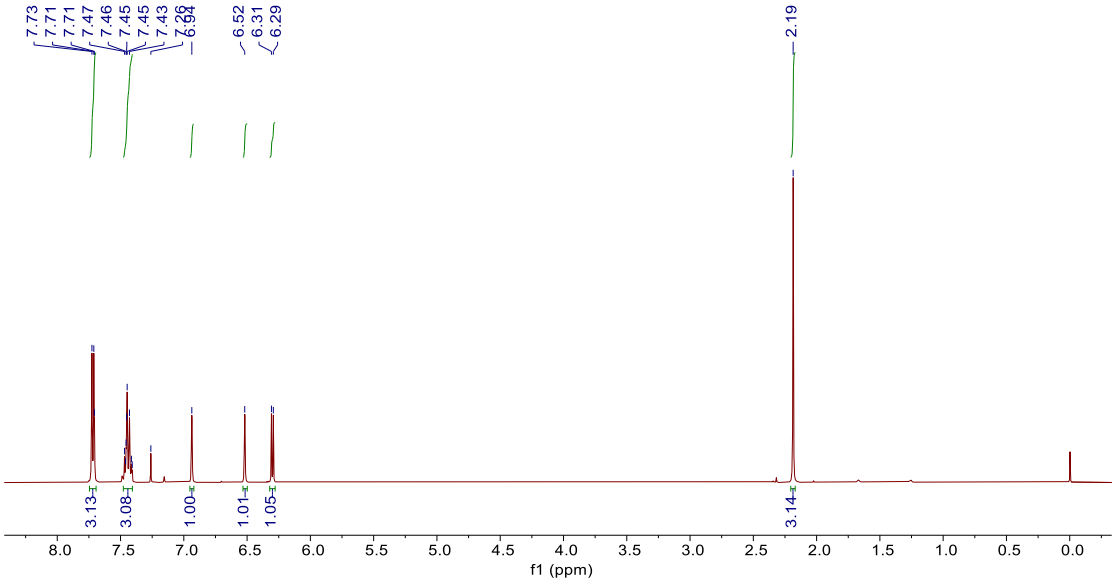
^{13}C NMR





3s

^{1}H NMR



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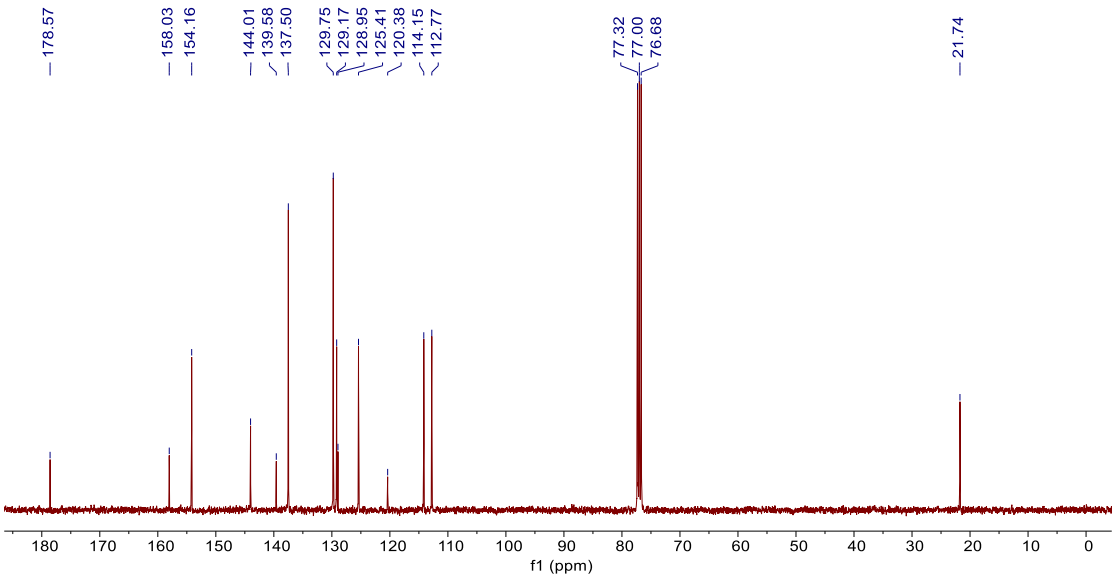
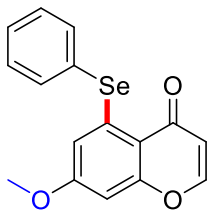
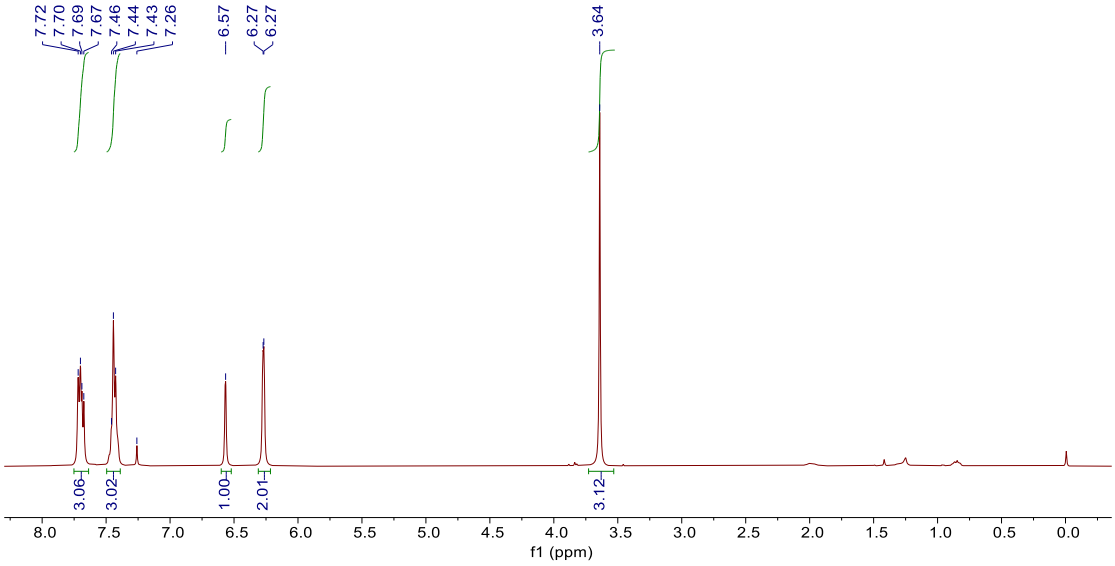




3t

^{1}H NMR



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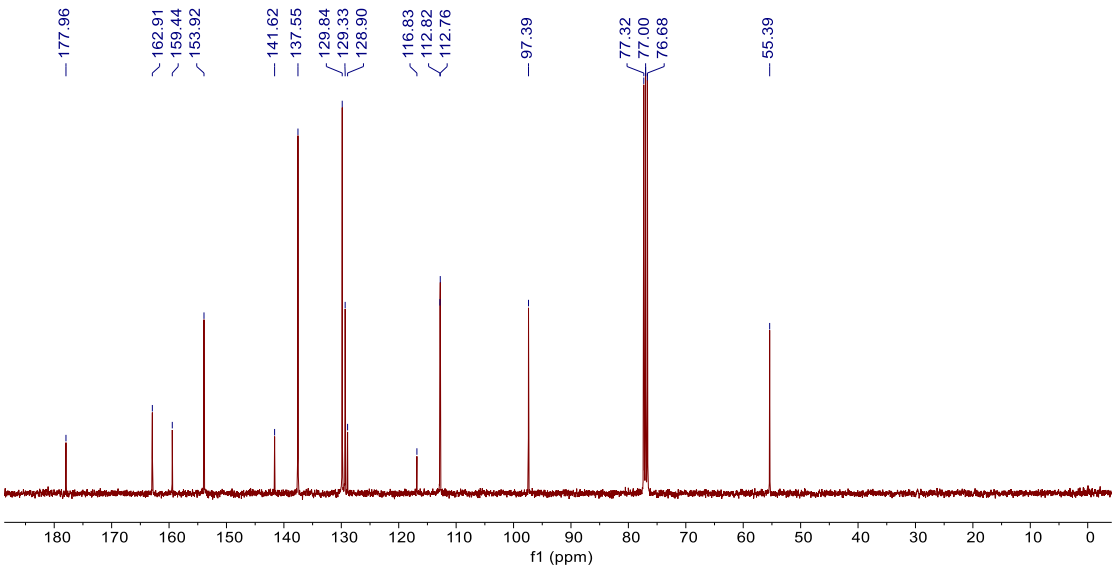
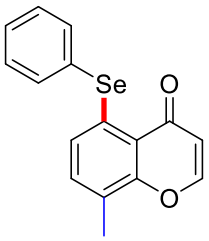
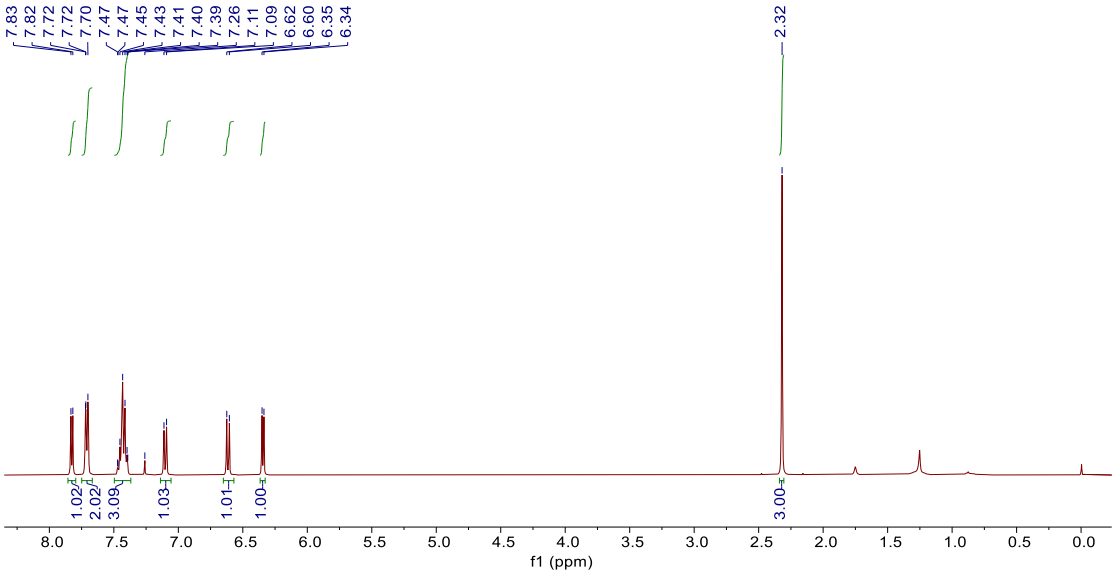




3u

^{1}H NMR



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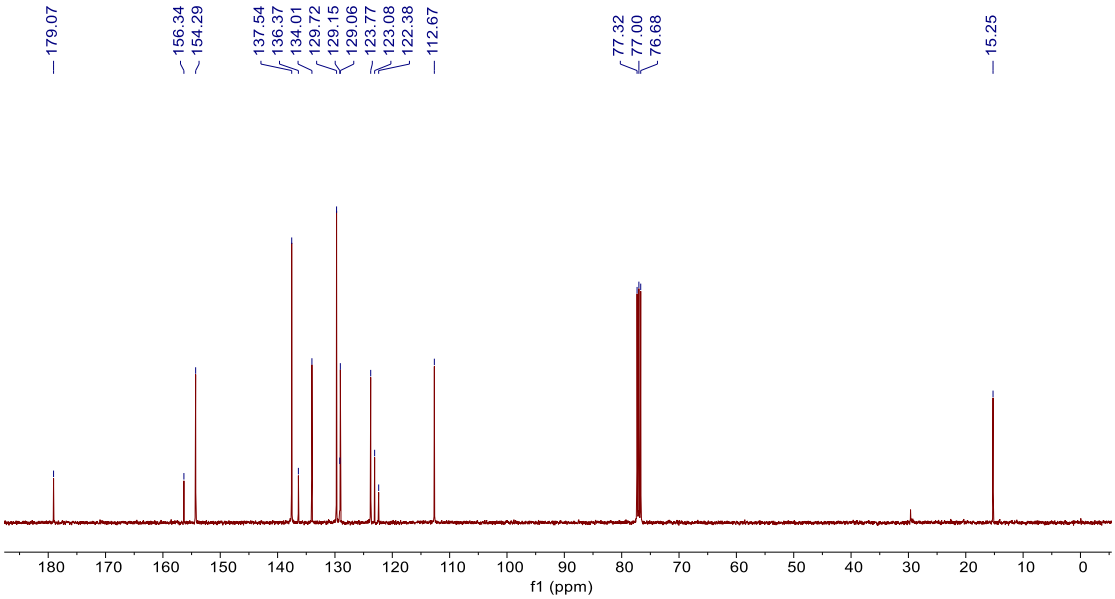
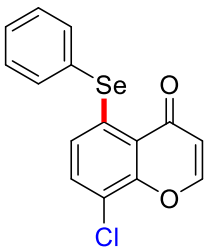
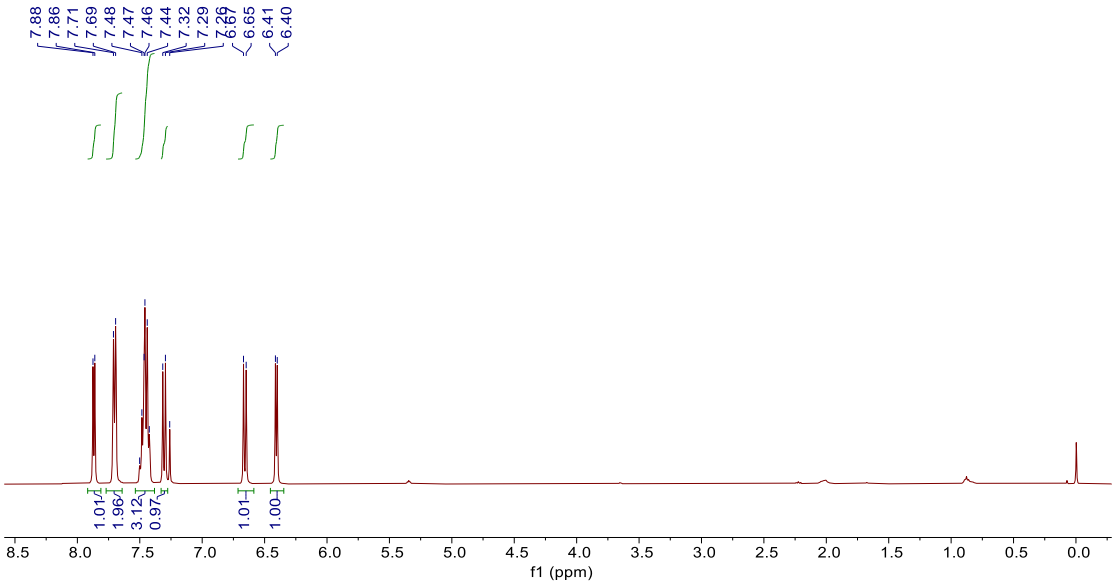


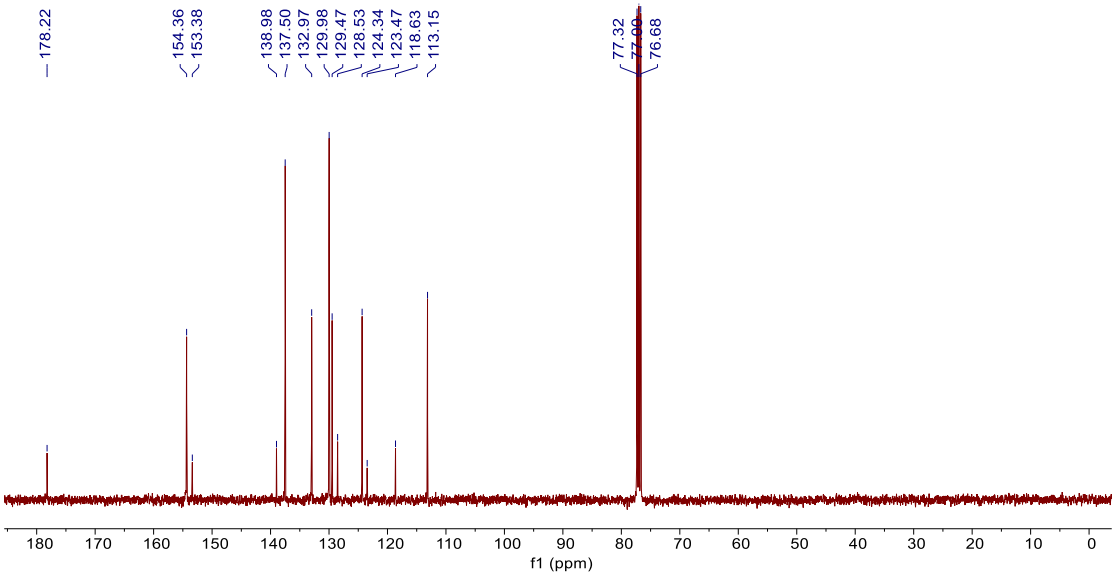


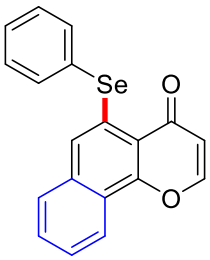
3v

^{1}H NMR



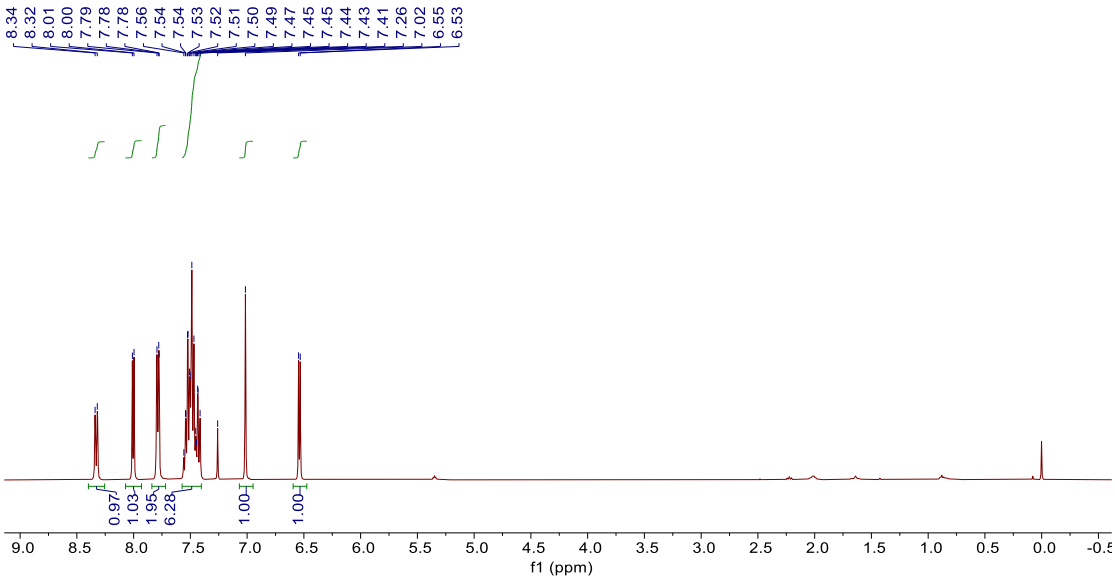
^{13}C NMR



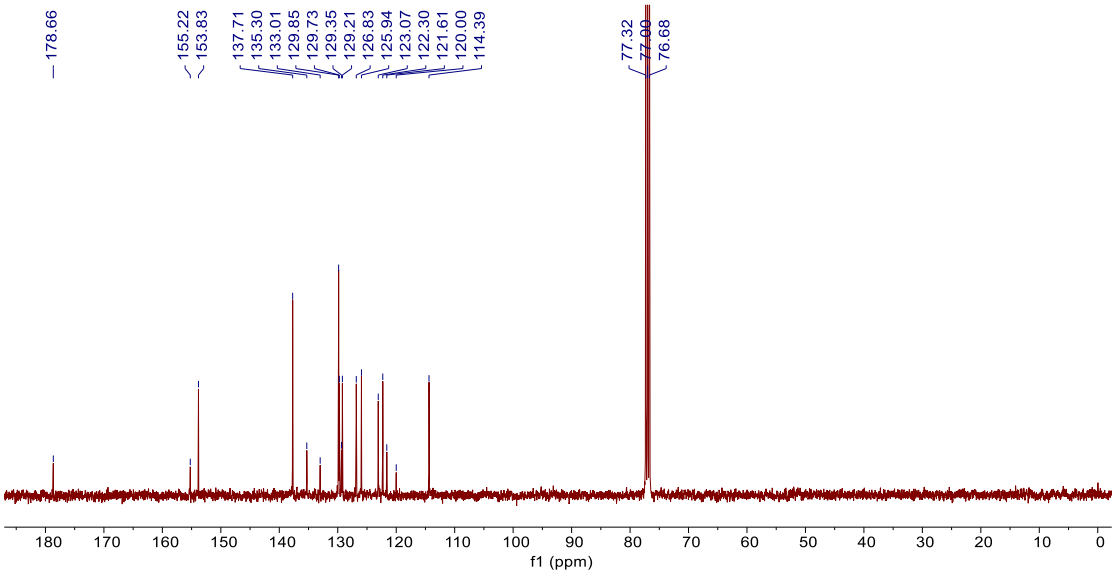


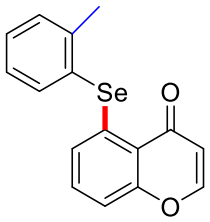
3w

^{1}H NMR



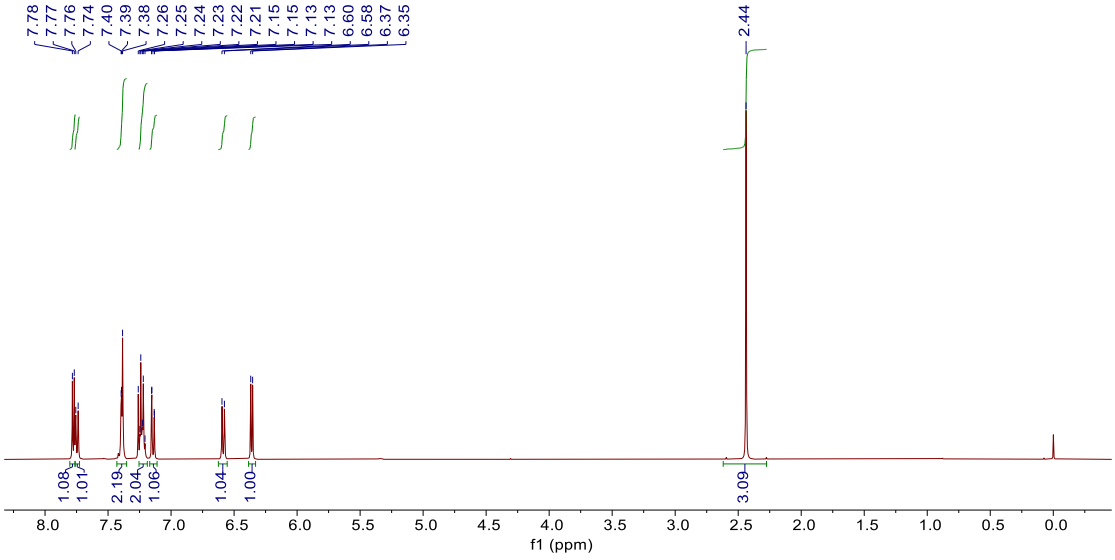
^{13}C NMR



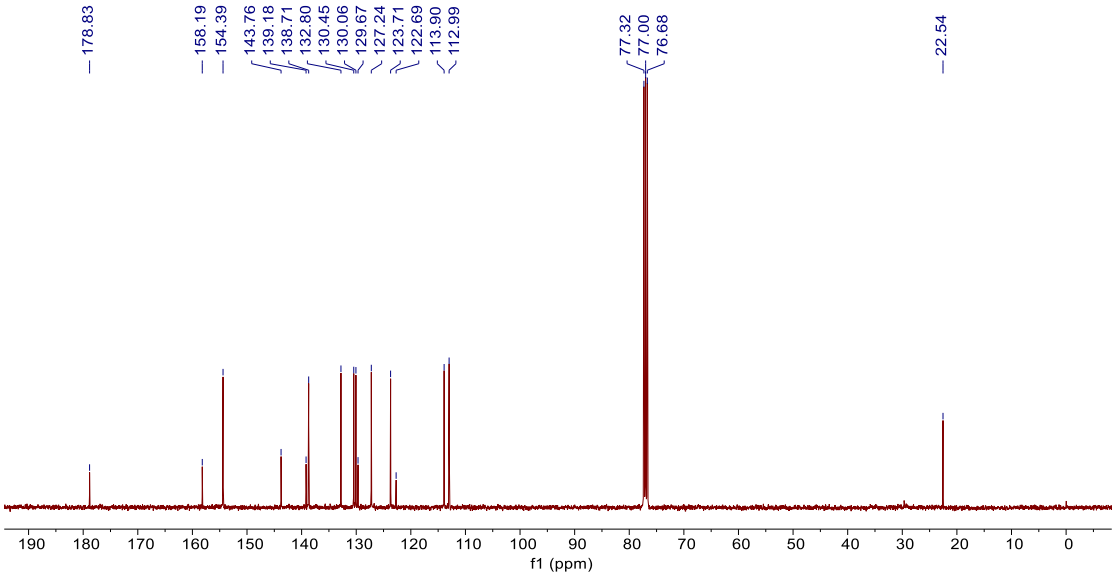


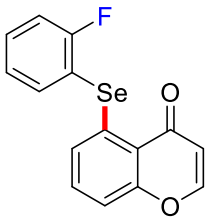
3x

^{1}H NMR



^{13}C NMR





3y

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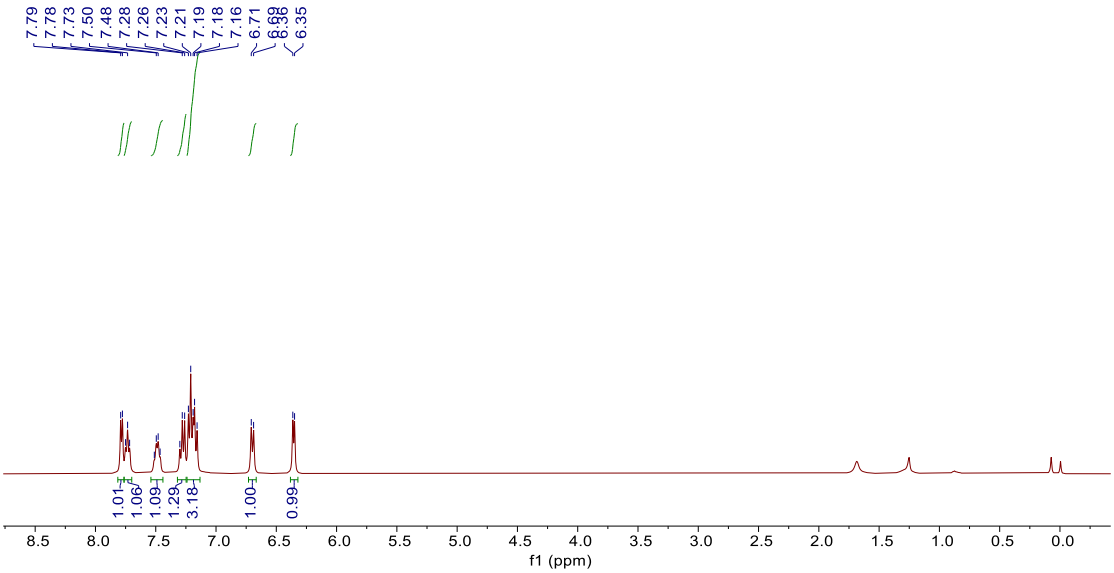

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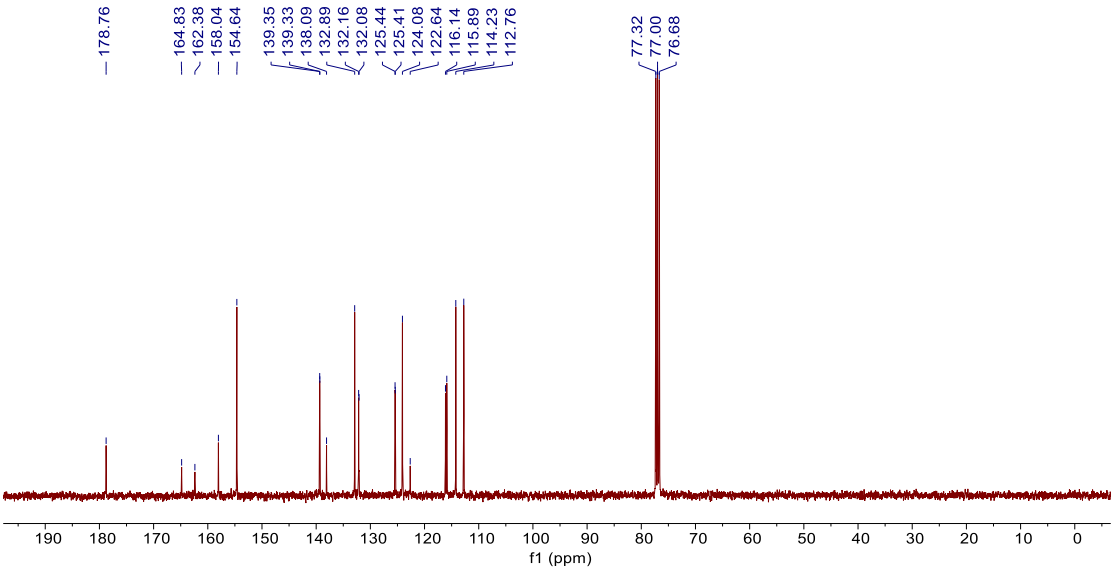
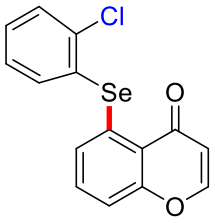
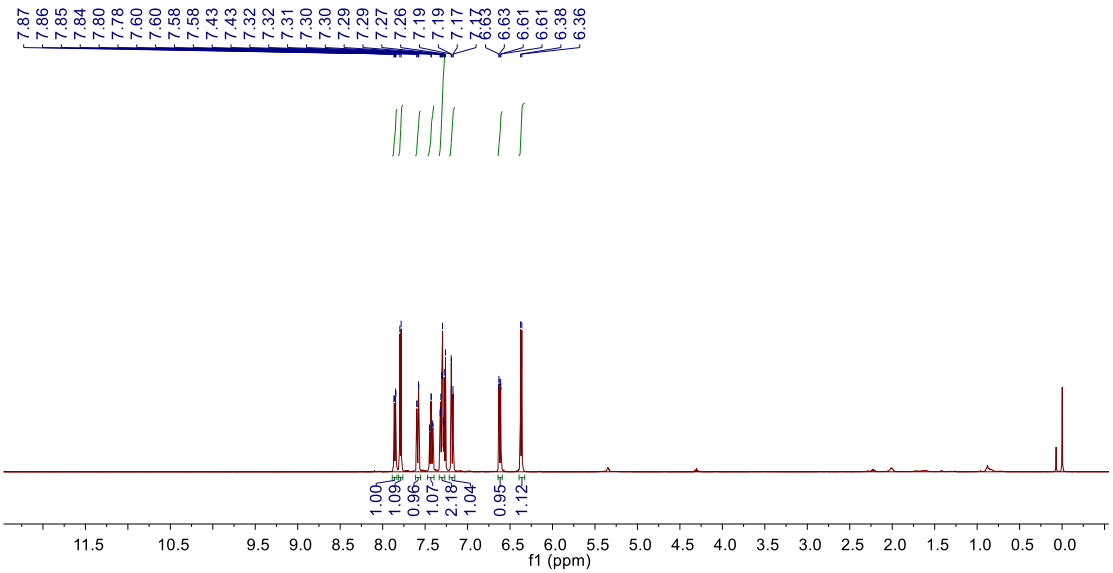


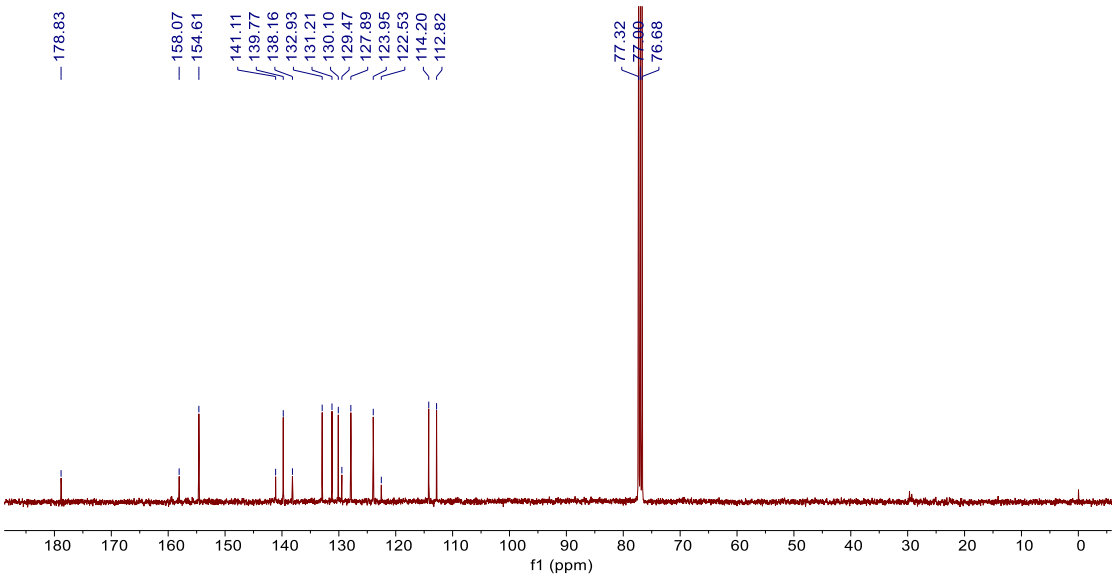


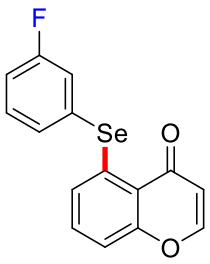
3z

^{1}H NMR



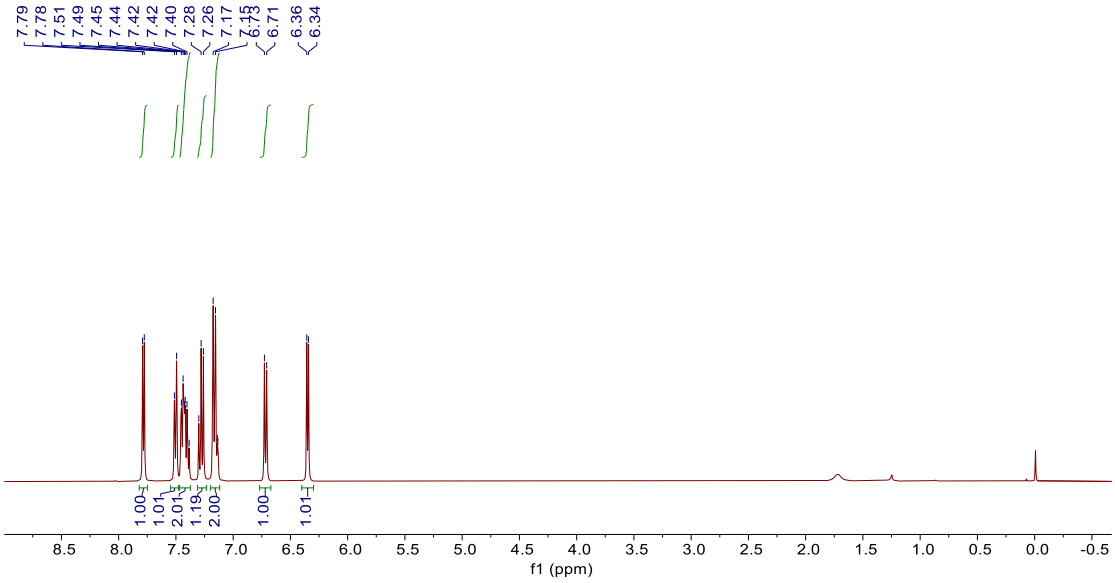
^{13}C NMR



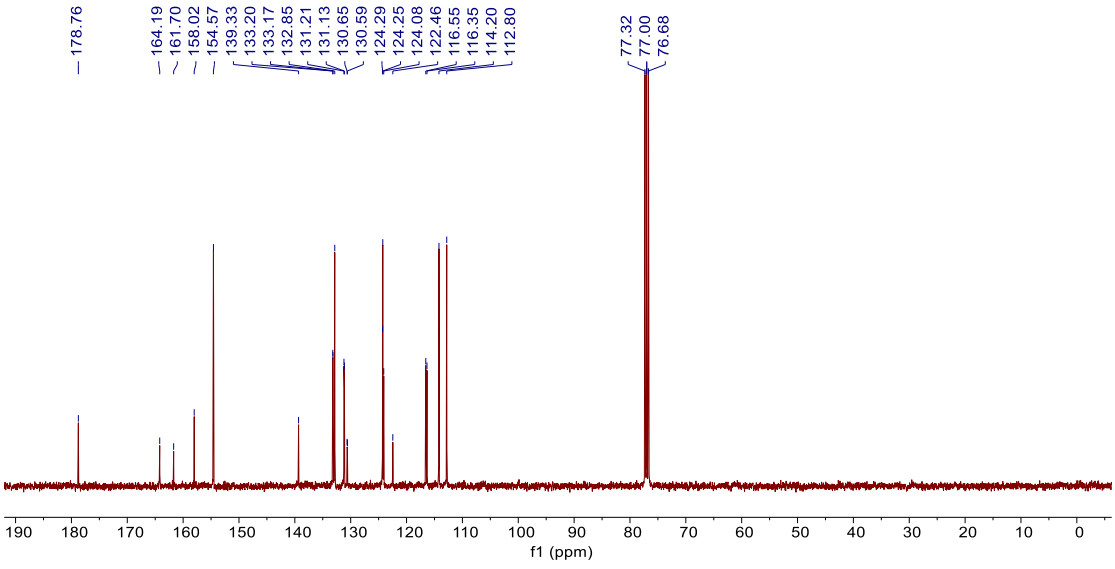


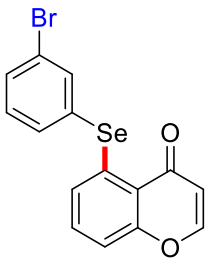
3aa

^{1}H NMR



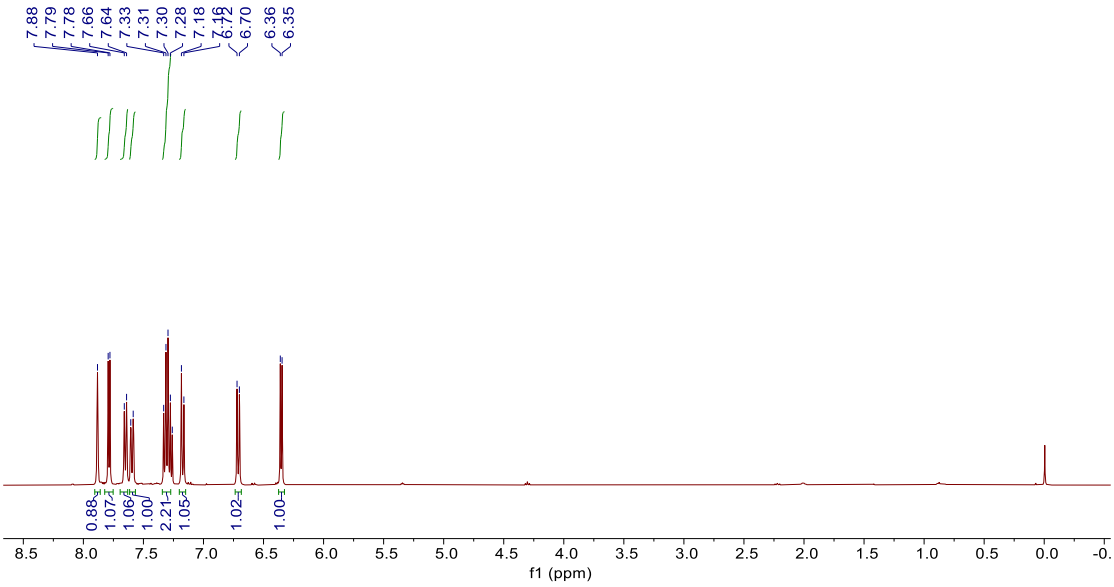
^{13}C NMR



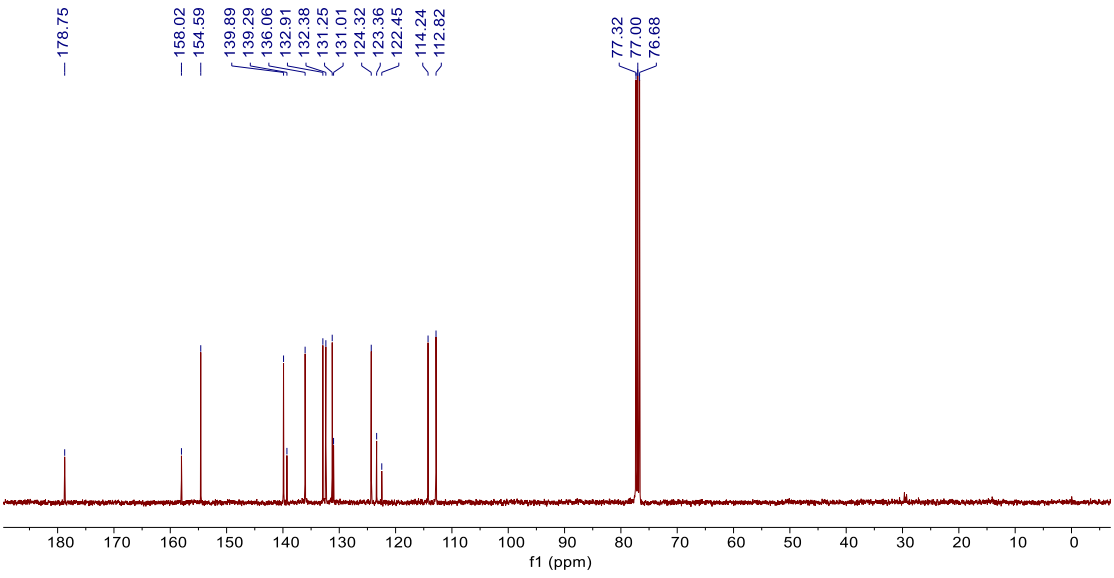


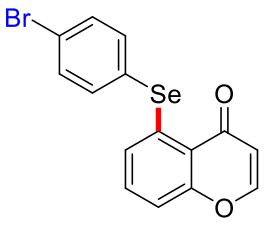
3ab

^{1}H NMR



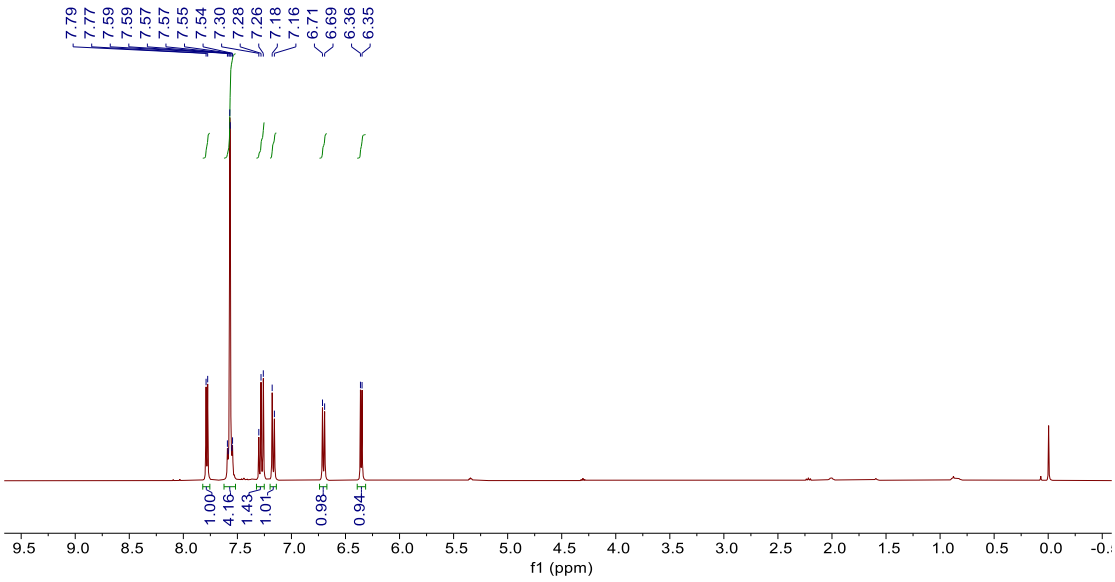
^{13}C NMR



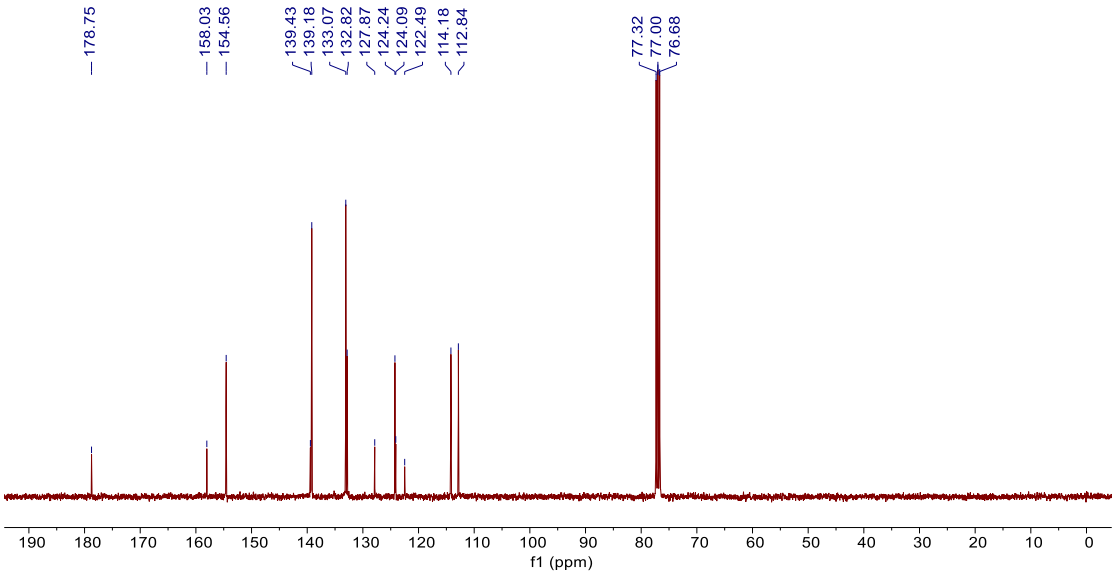


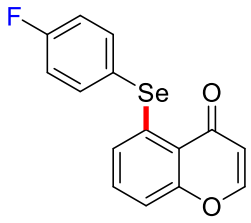
3ac

^{1}H NMR



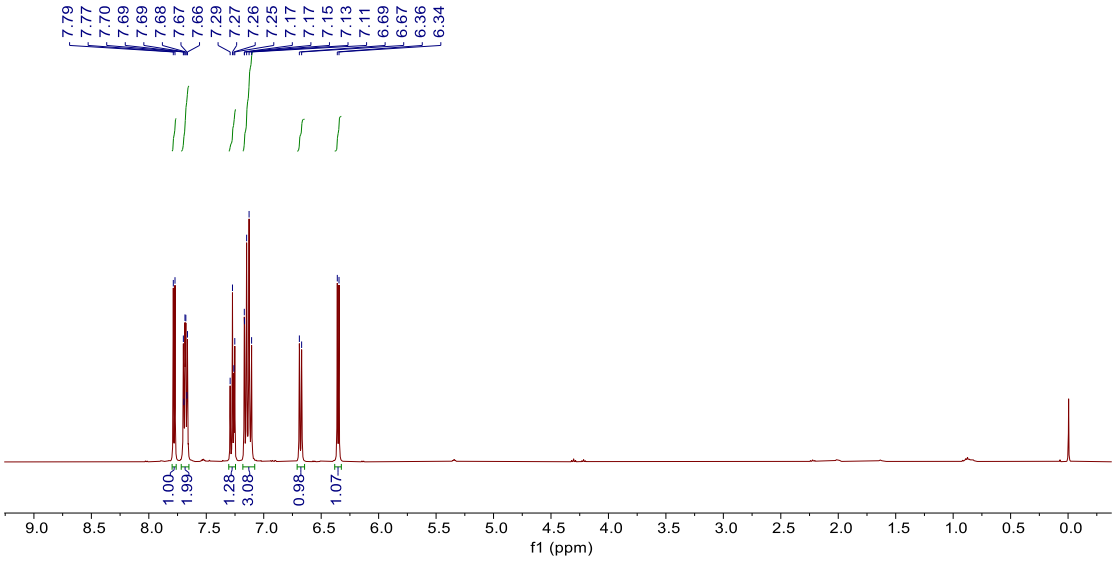
^{13}C NMR



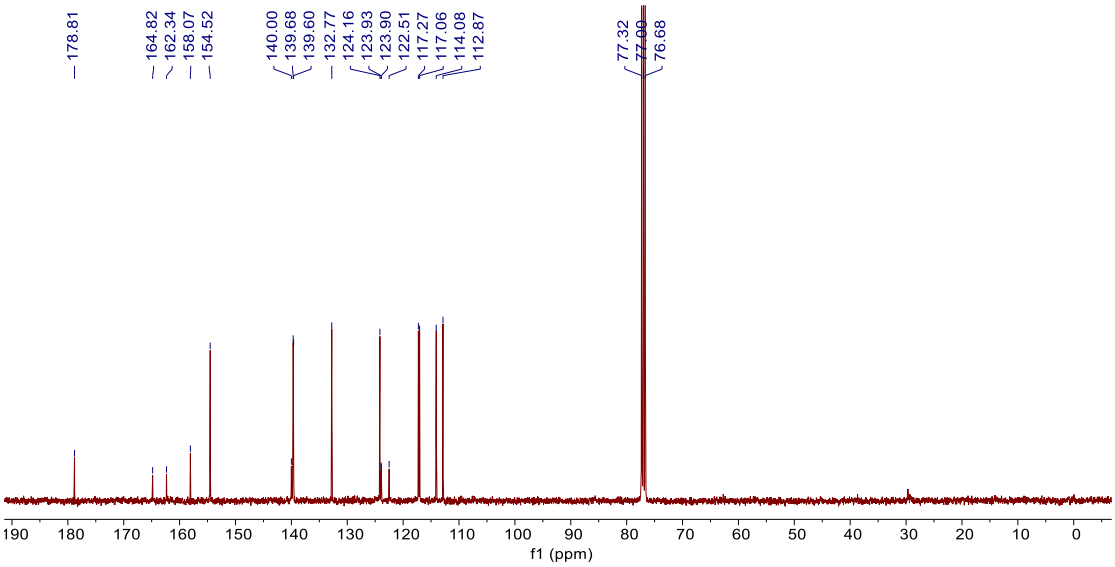


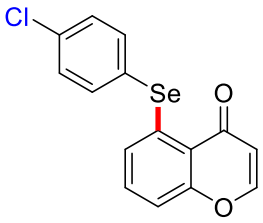
3ad

^{1}H NMR



^{13}C NMR





3ae

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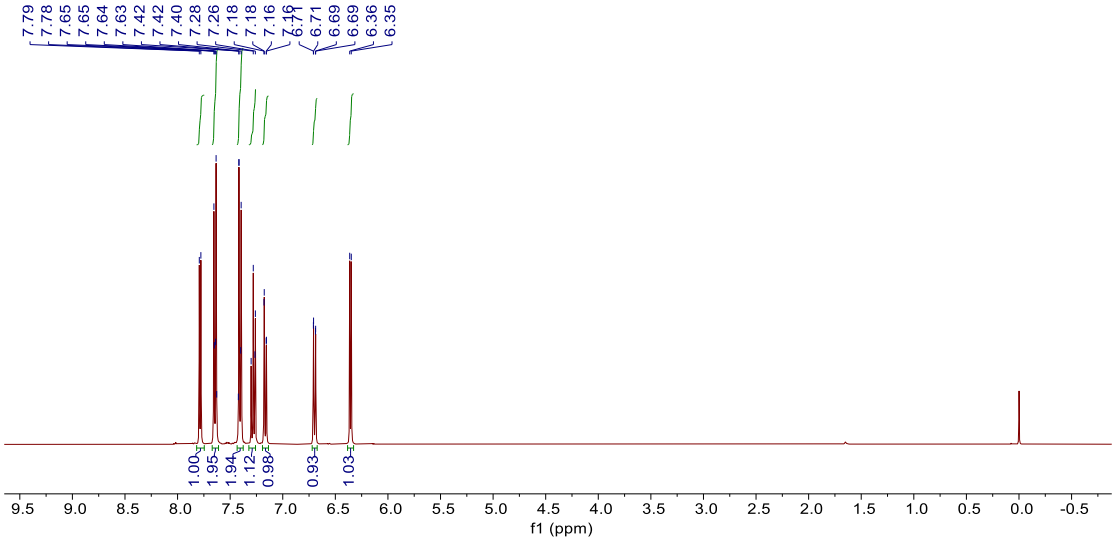

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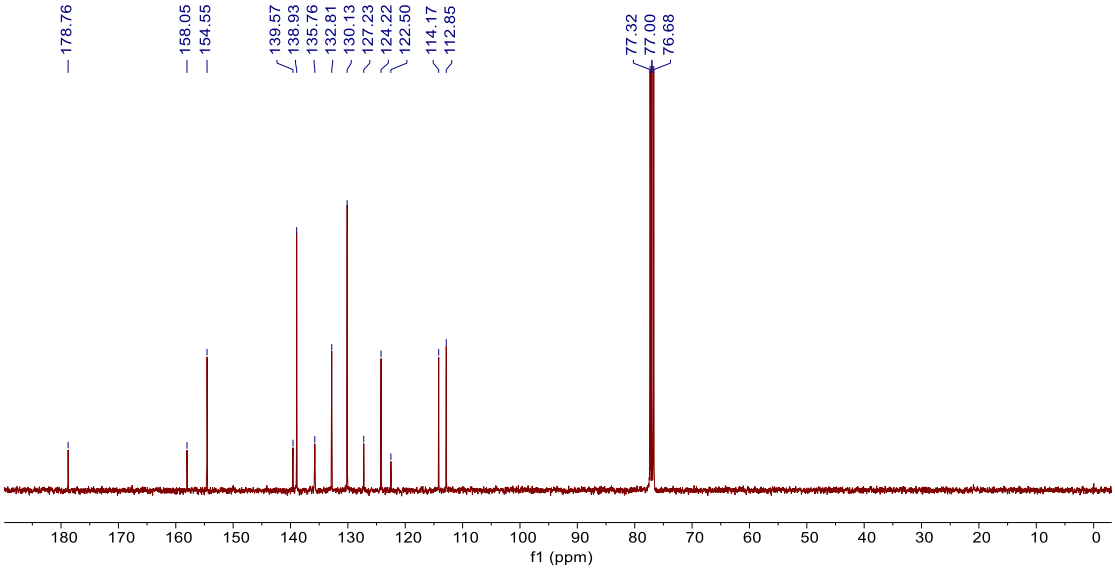

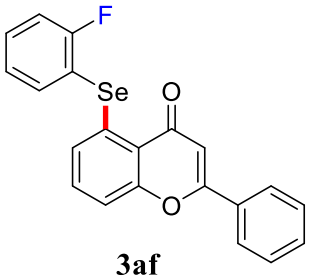

3af

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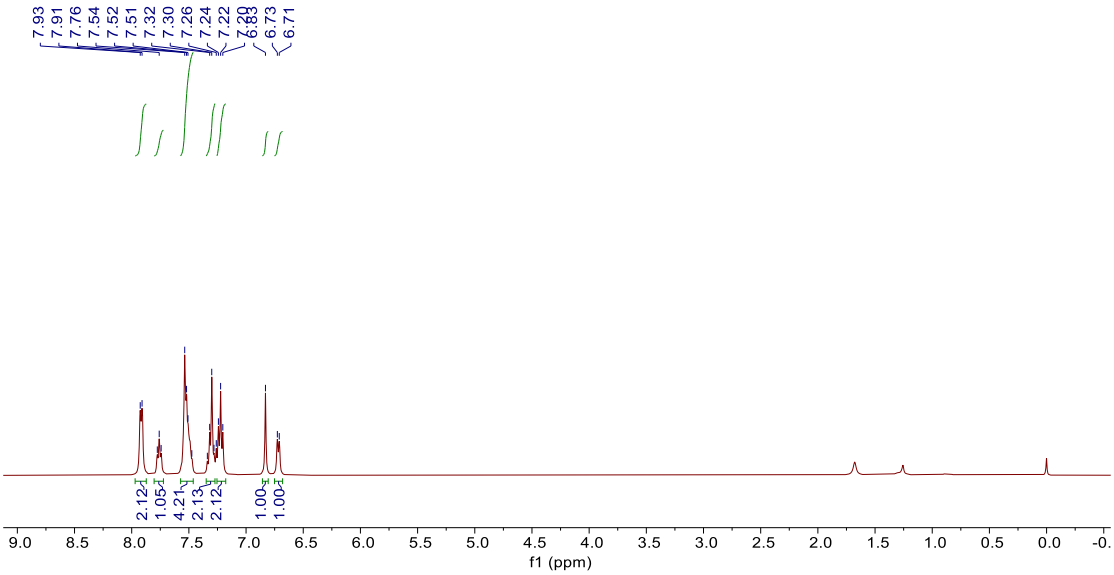

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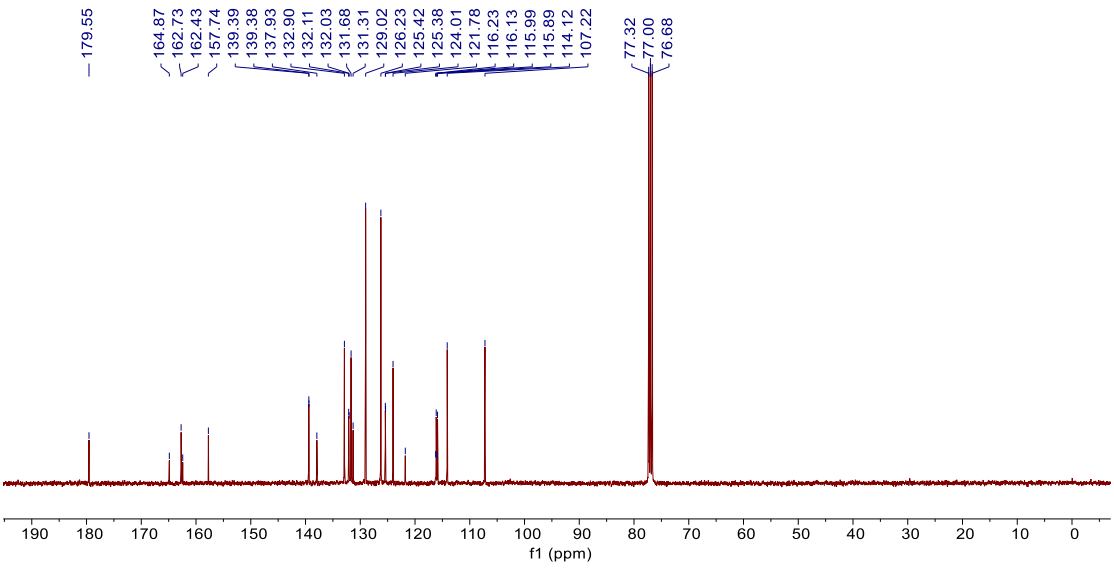

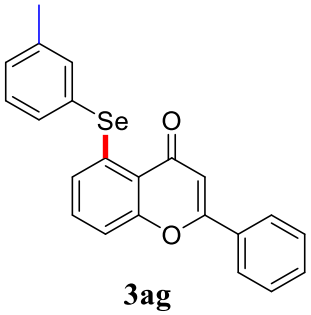

3ag

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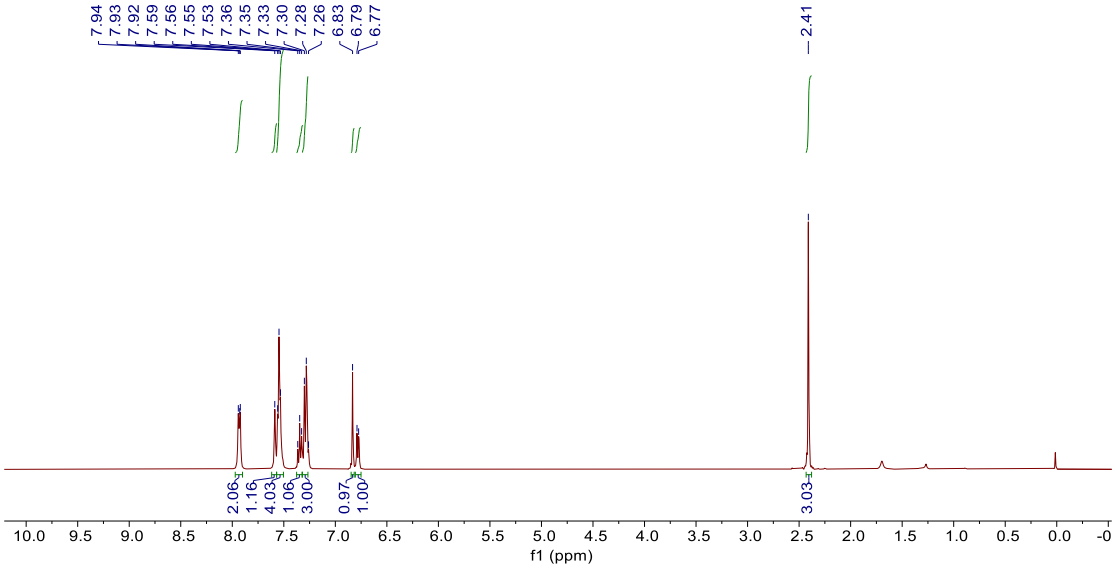

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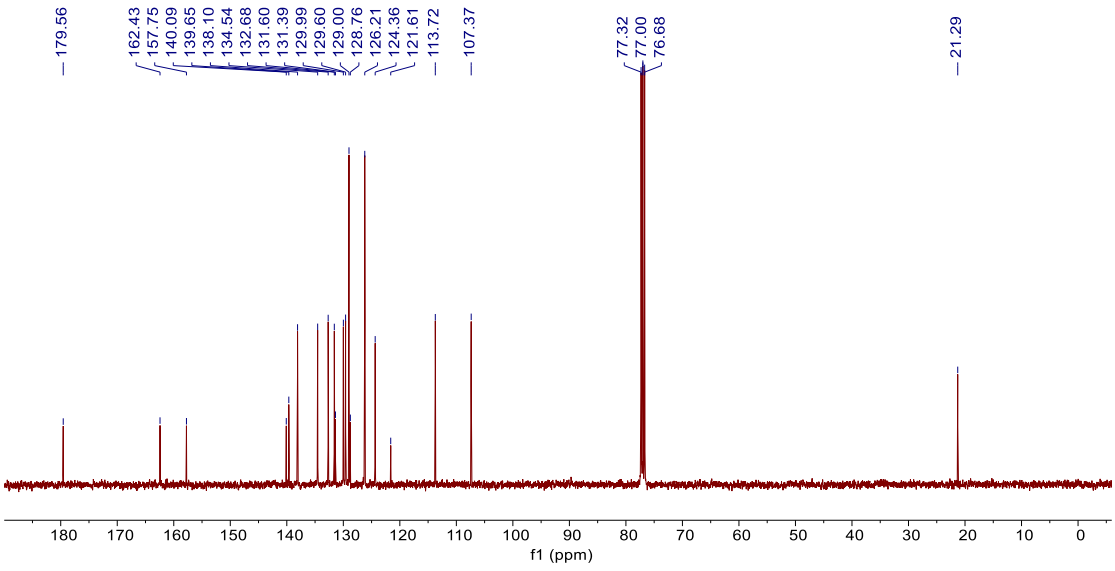
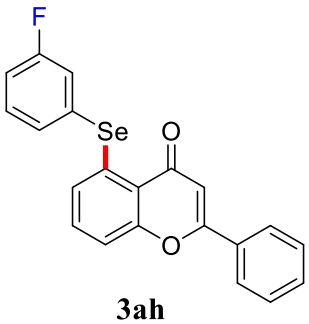
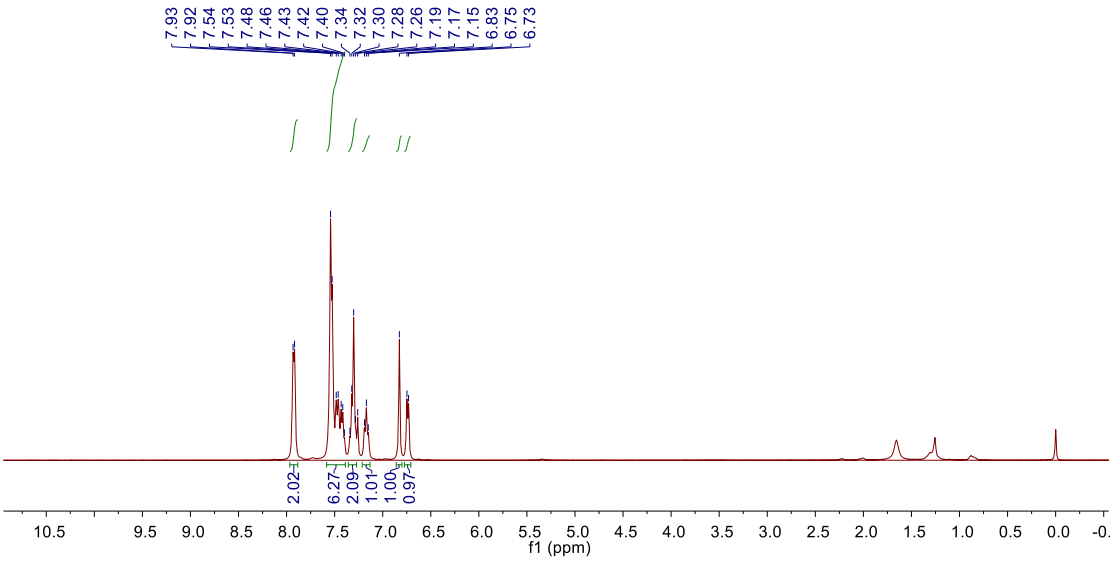




3ah

^{1}H NMR



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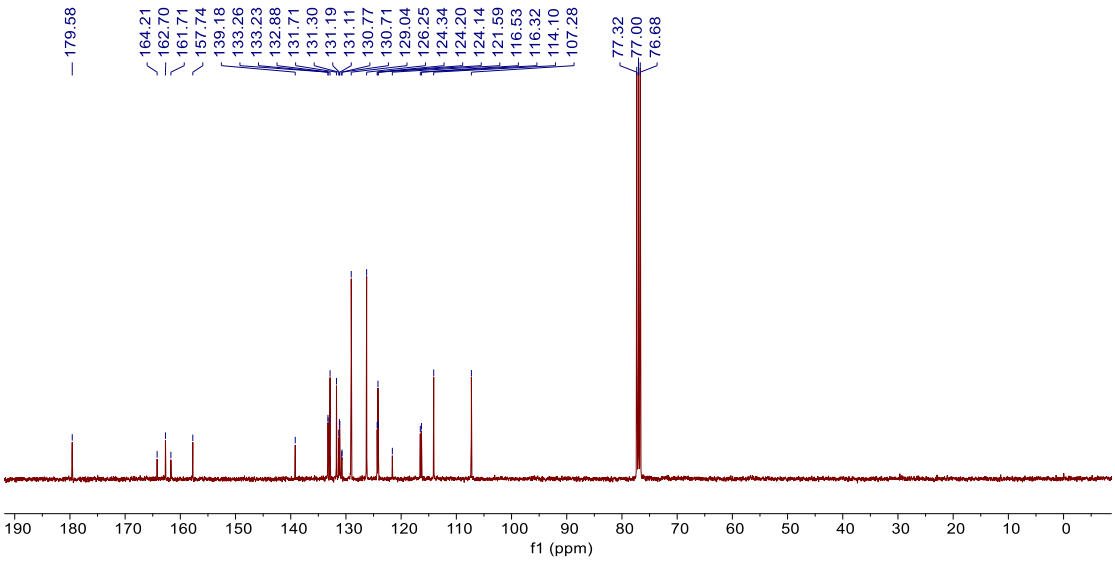
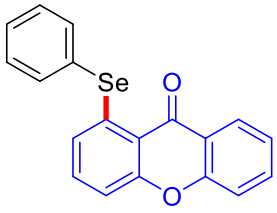
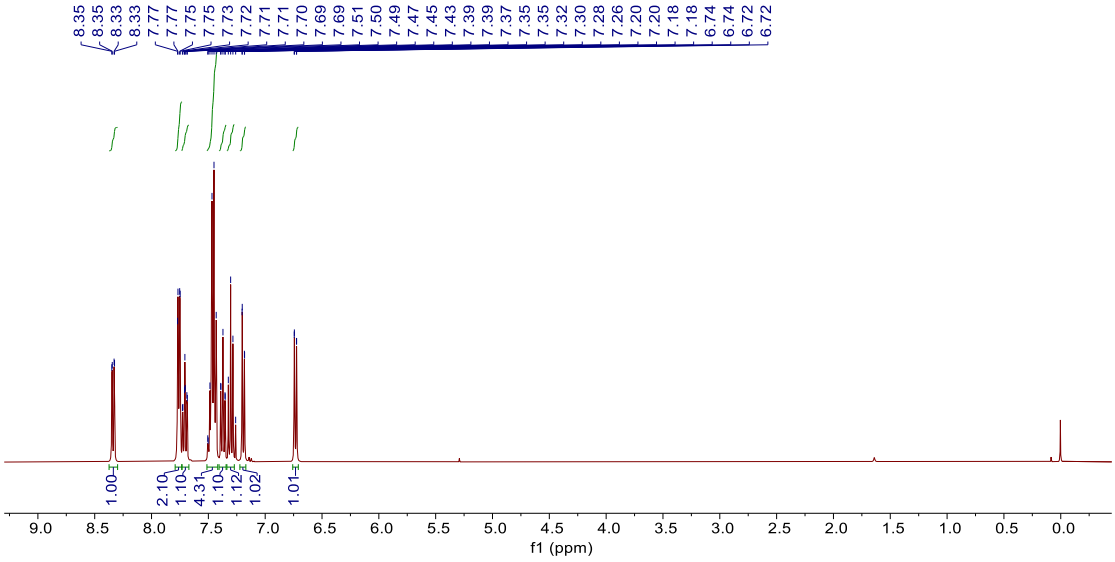


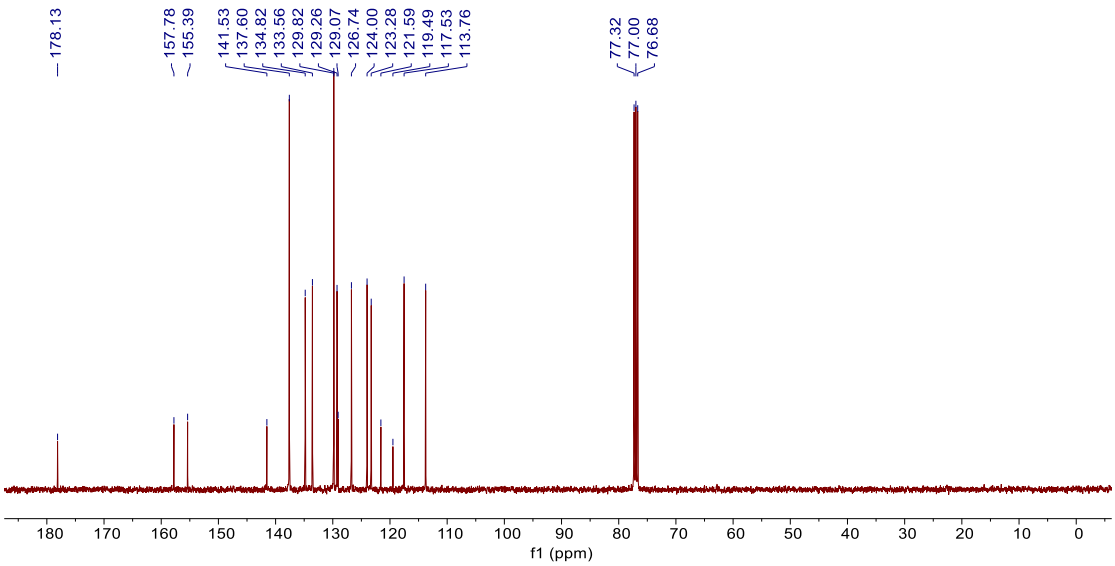


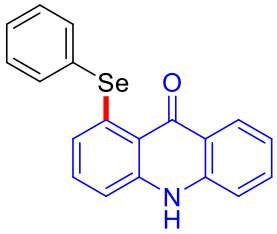
6a

^{1}H NMR



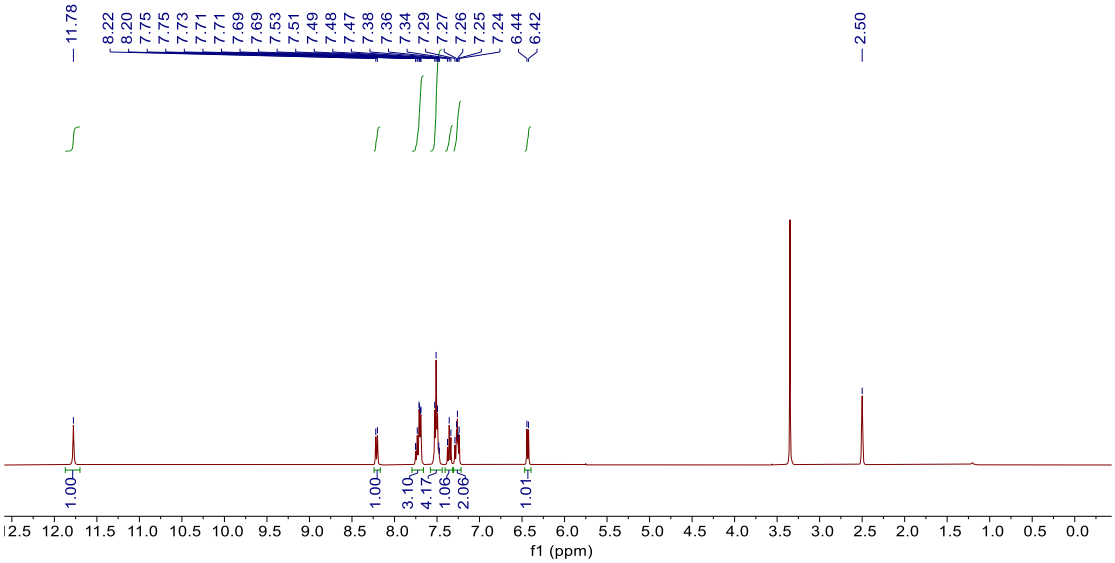
^{13}C NMR





6b

^{1}H NMR



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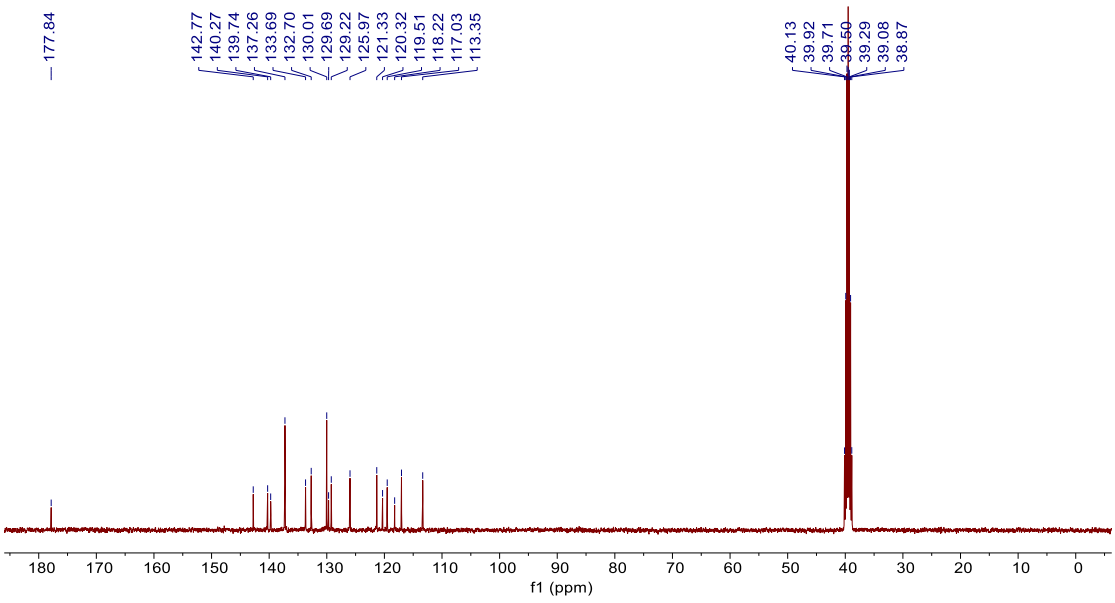
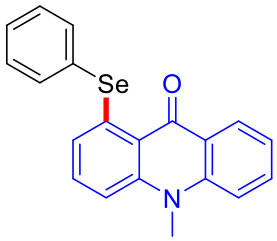
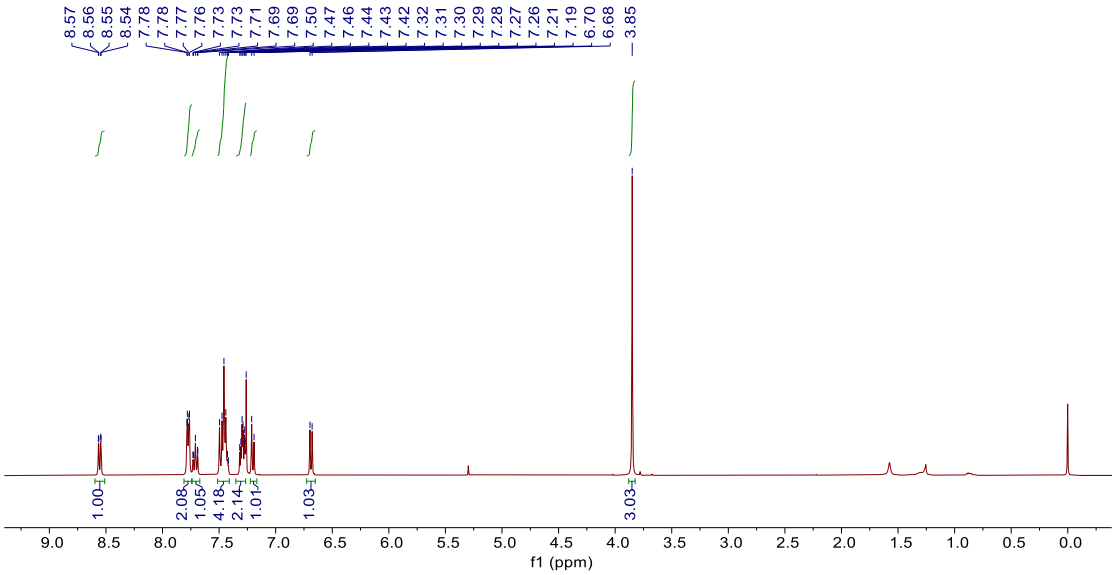




6c

^{1}H NMR



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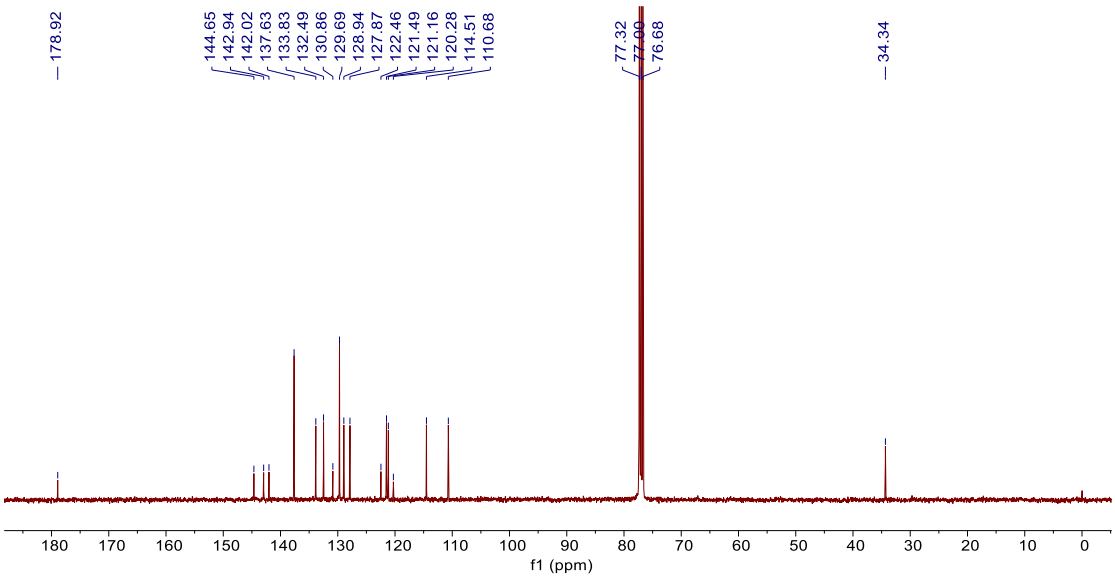
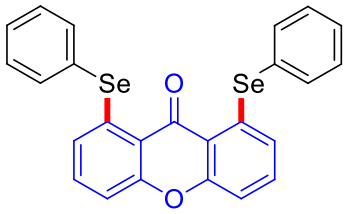
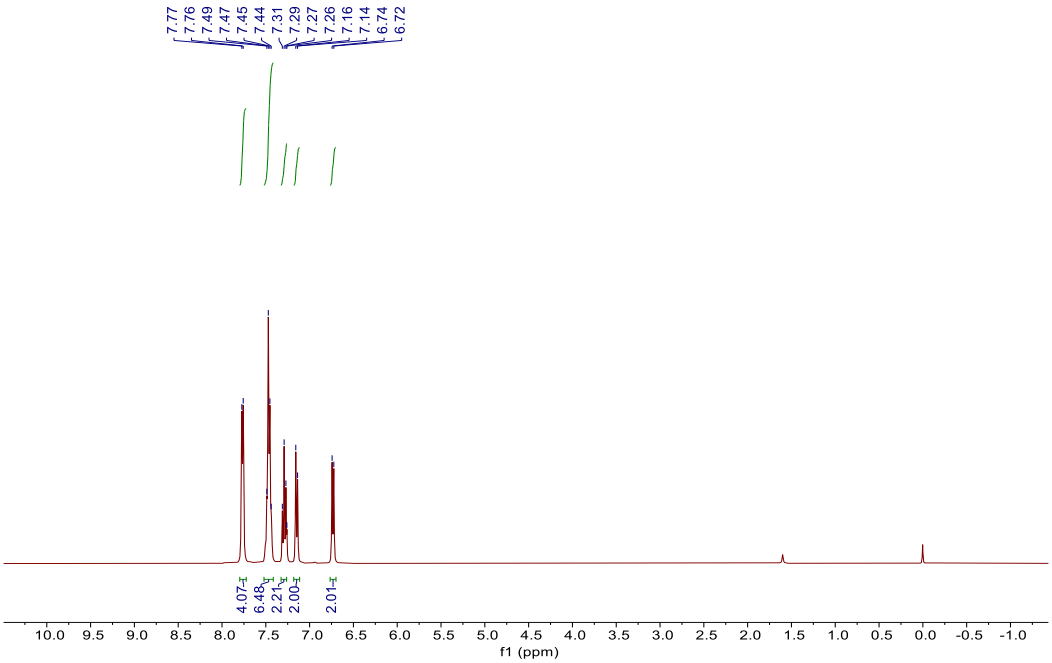




6d

^{1}H NMR



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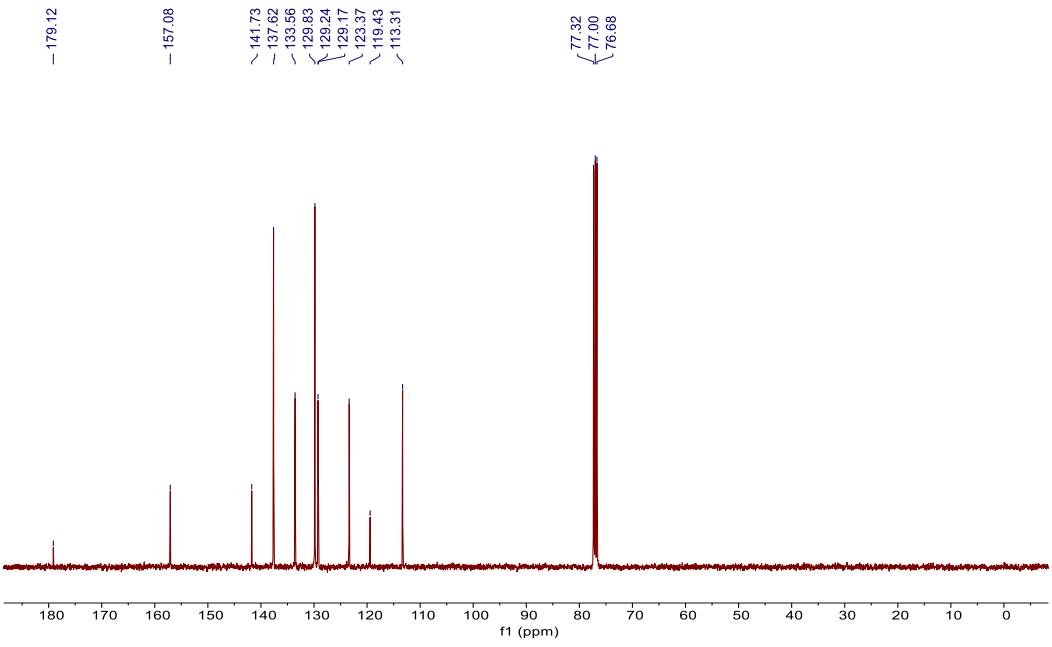

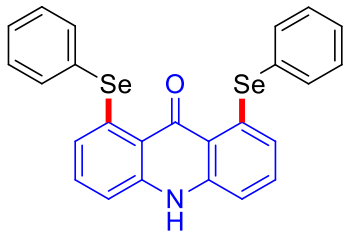

6e

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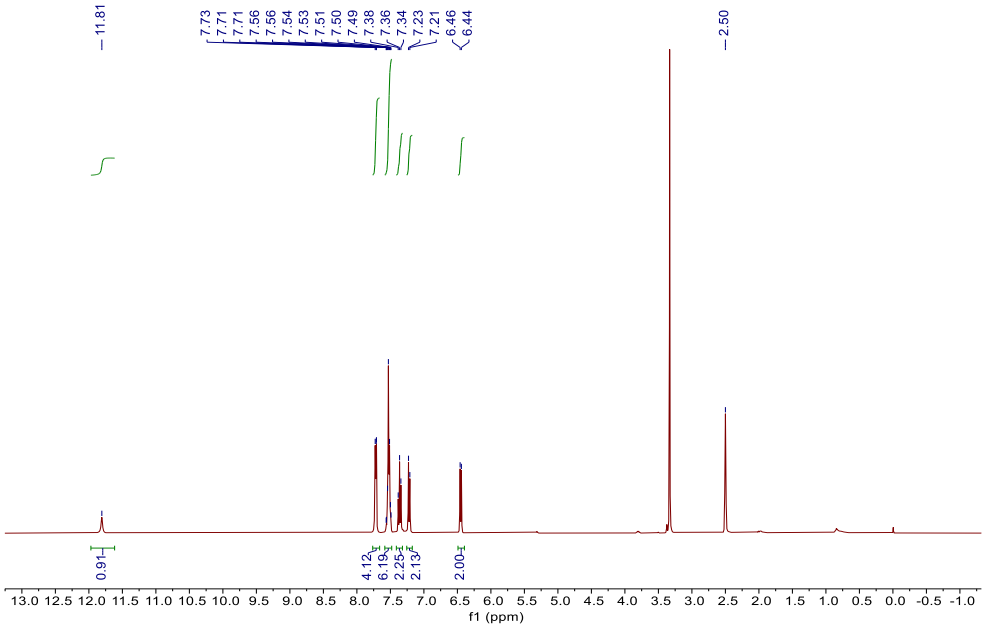

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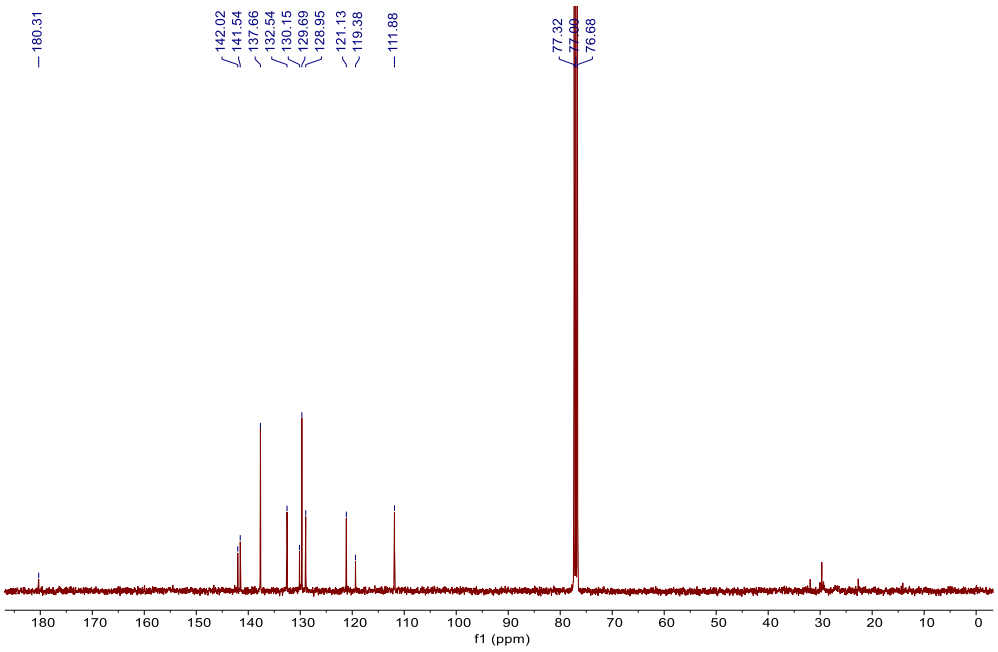
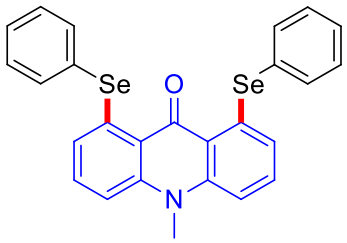
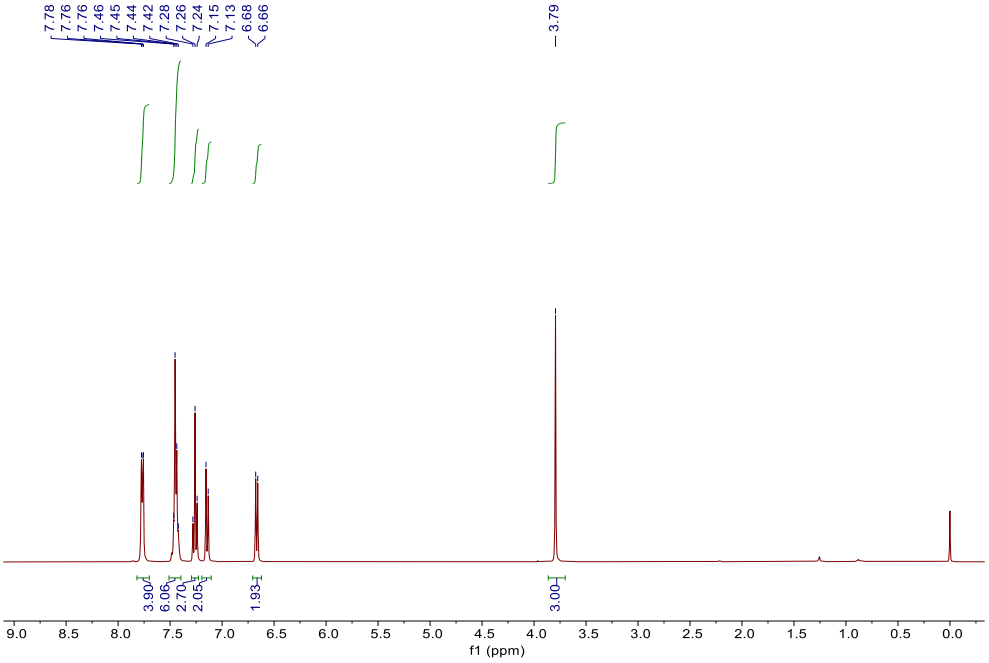


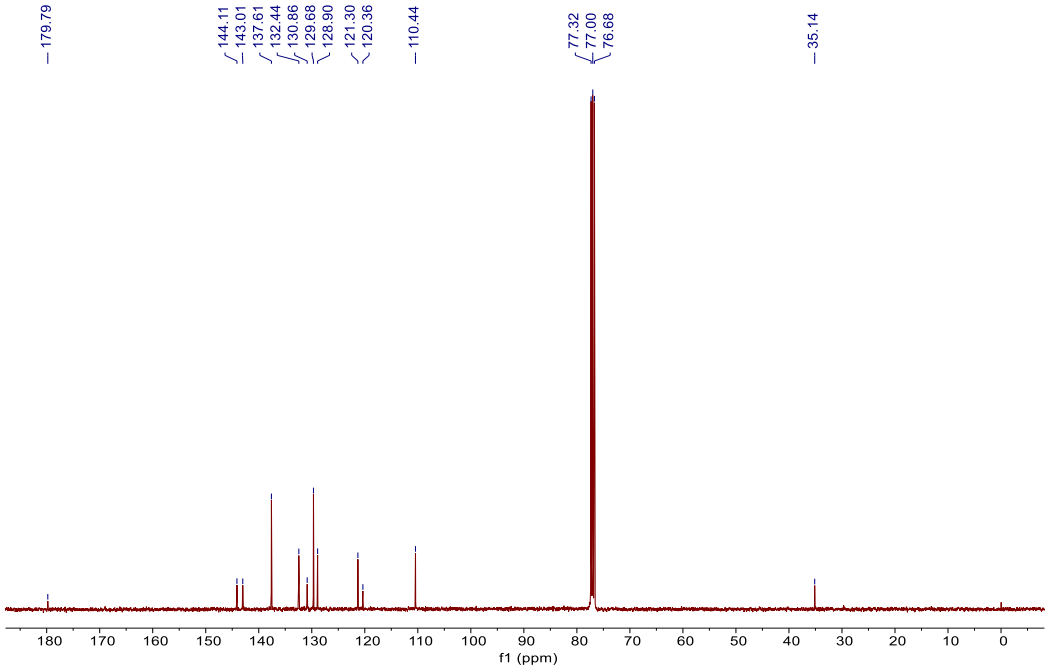


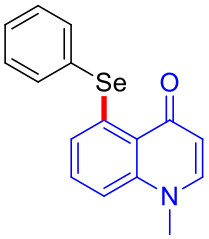
6f

^{1}H NMR



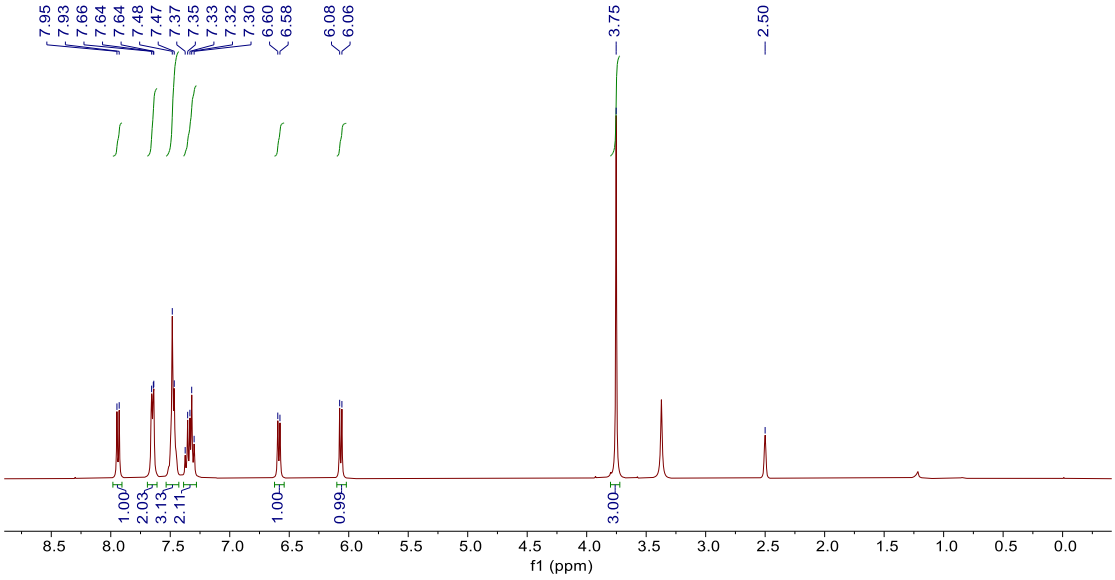
^{13}C NMR





6g

^{1}H NMR



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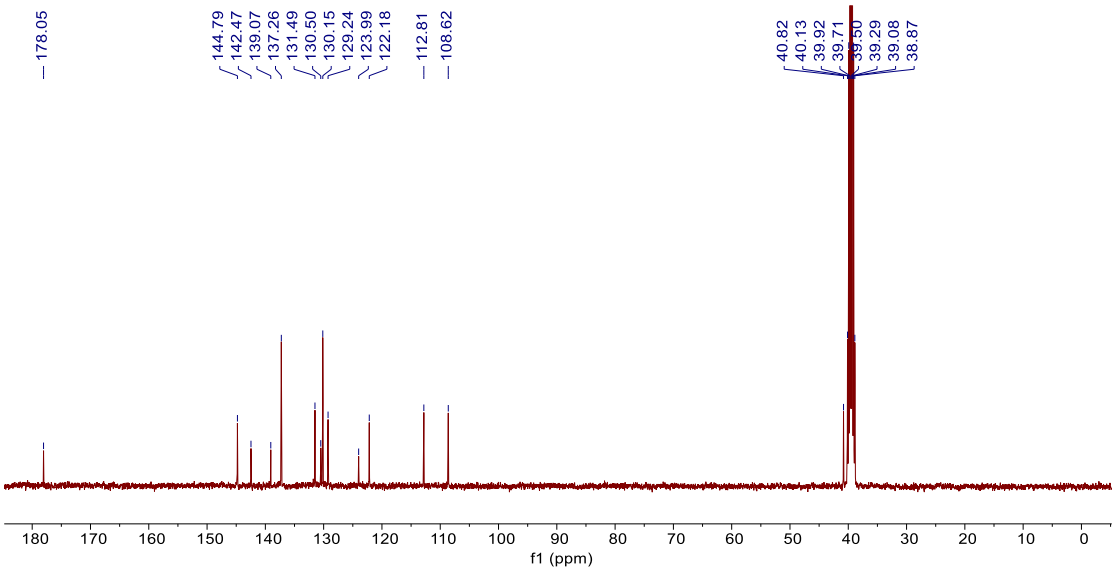
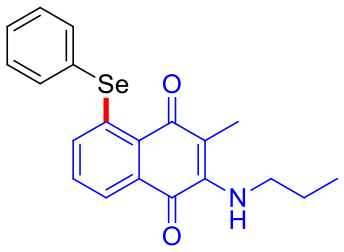
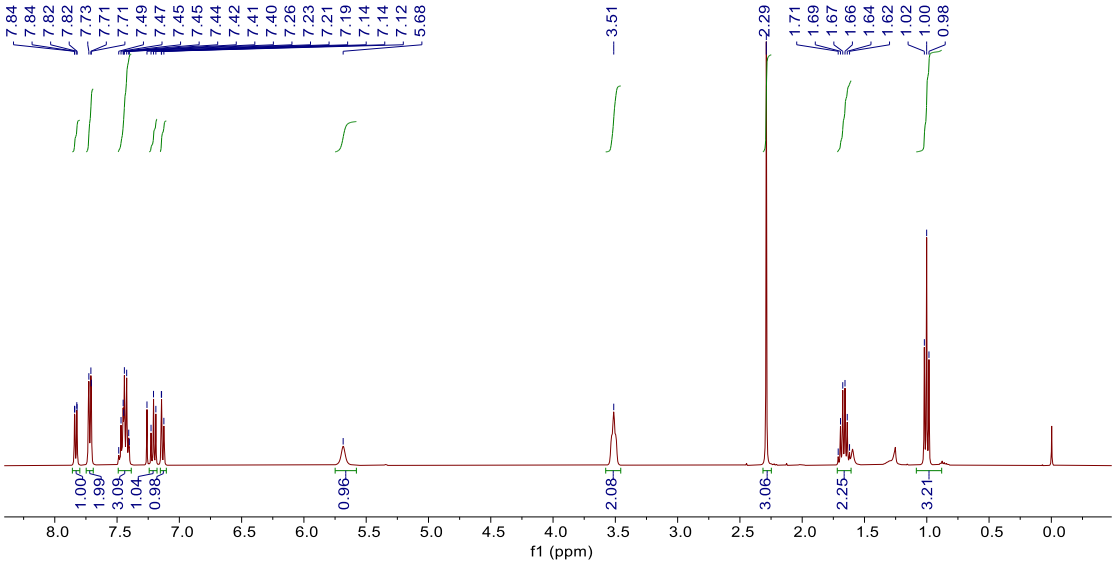


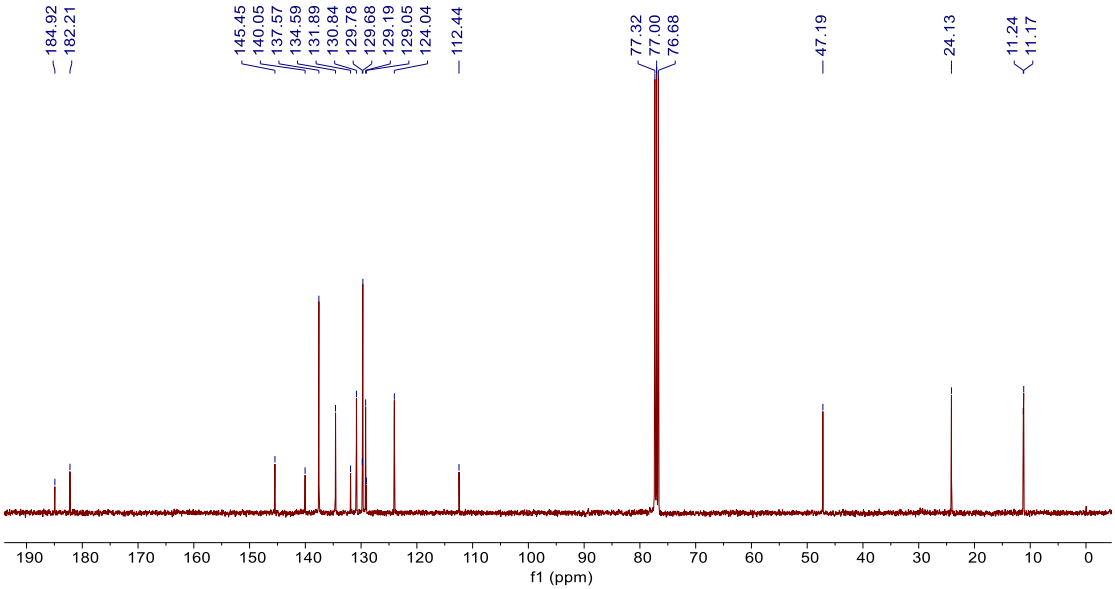


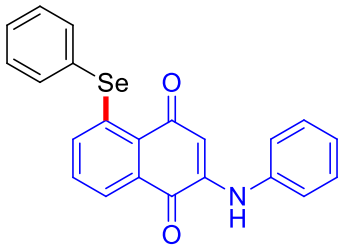
6h

^{1}H NMR



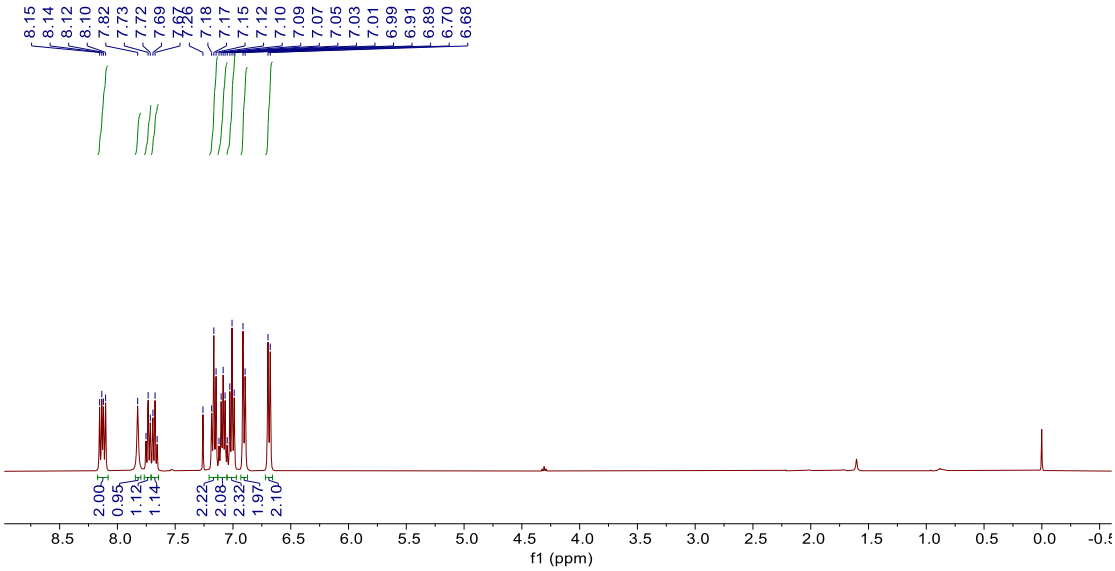
^{13}C NMR



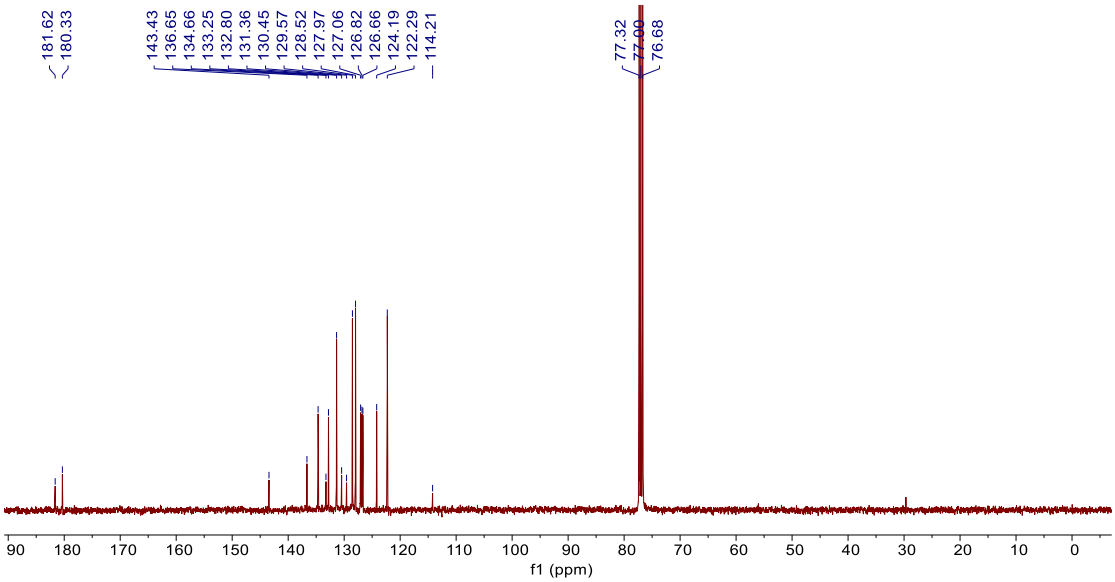


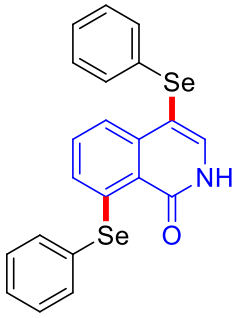
6i

^{1}H NMR



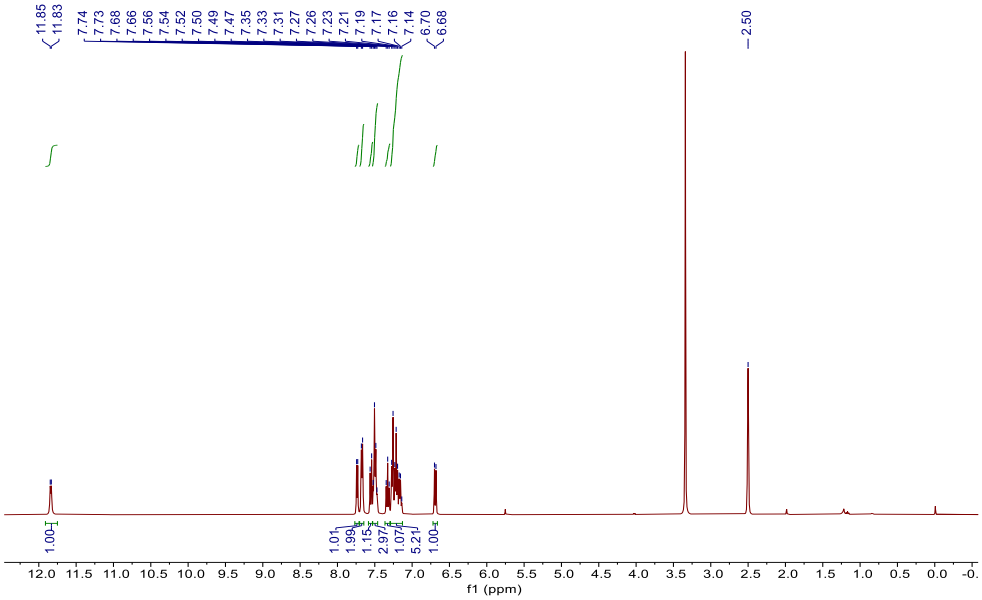
^{13}C NMR





6j

^{1}H NMR



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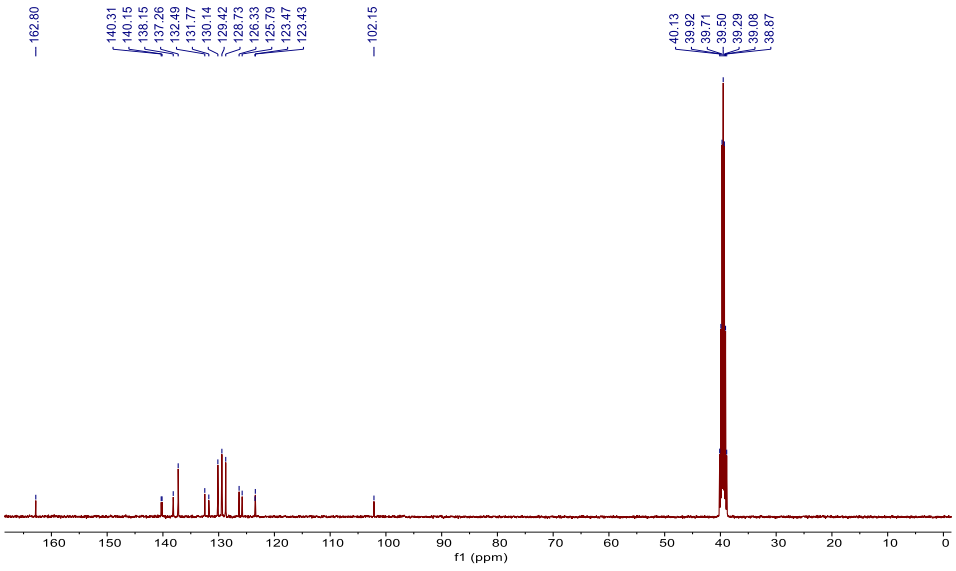
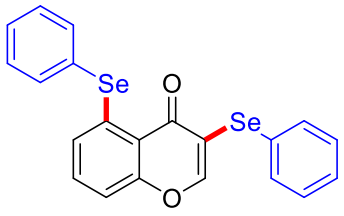
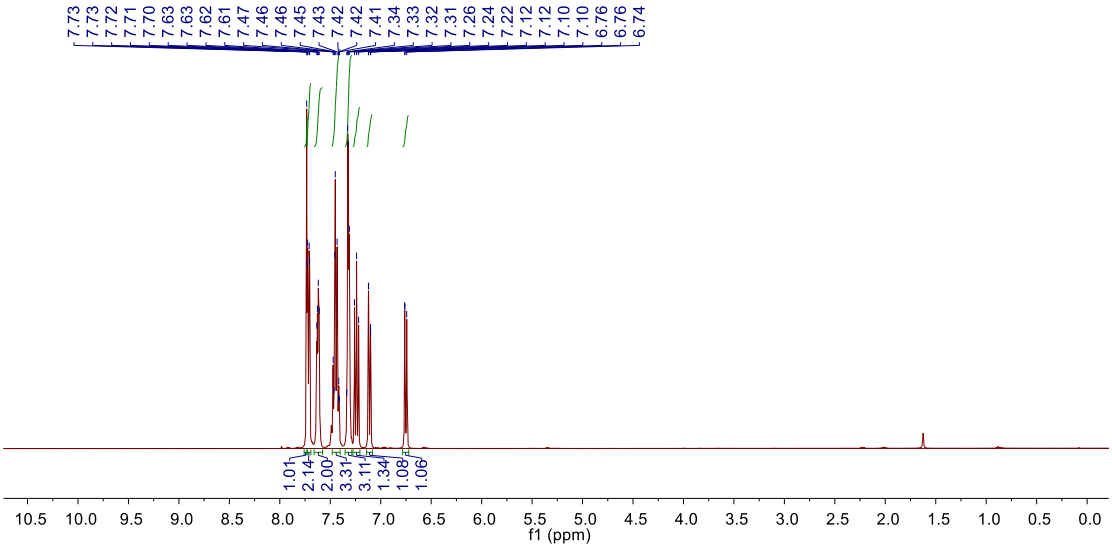




7

^{1}H NMR



^{13}C NMR