

# Radical Selenation of C(*sp*<sup>3</sup>)–H Bonds to Asymmetric Selenides and Mechanism Study

Xin Wang,<sup>a</sup> Jia Lei,<sup>a</sup> Sa Guo,<sup>a</sup> Yan Zhang,<sup>a</sup> Yong Ye,<sup>b</sup> Shi Tang,<sup>c</sup> Kai

Sun<sup>\*a</sup>

<sup>a</sup> College of Chemistry and Chemical Engineering, Yantai University, Yantai, 264005, Shandong, P. R. China. E-mail: sunk468@nenu.edu.cn.

<sup>b</sup> College of Chemistry, Zhengzhou University, Zhengzhou, 450001, P. R. China.

<sup>c</sup> College of Chemistry and Chemical Engineering, Jishou University, Jishou, 416000, China.

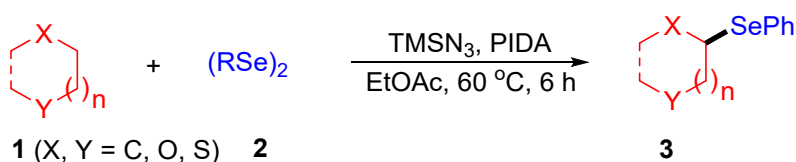
## Supporting Information

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## I. General Conditions

All reagents were purchased from commercial sources and used without further purification.  $^1\text{H}$  NMR,  $^{13}\text{C}$  NMR spectra were recorded on a Bruker Ascend<sup>TM</sup> 400 or Bruker Ascend<sup>TM</sup> 500 or a Bruker Ascend<sup>TM</sup> 600 spectrometer in deuterated solvents containing TMS as an internal reference standard. All high-resolution mass spectra (HRMS) were measured on a mass spectrometer by using electrospray ionization orthogonal acceleration time-of-flight (ESI-OA-TOF), and the purity of all samples used for HRMS (>95%) was confirmed by  $^1\text{H}$  NMR and  $^{13}\text{C}$  NMR spectroscopic analysis. Melting points were measured on a melting point apparatus equipped with a thermometer and were uncorrected. All the reactions were monitored by thin-layer chromatography (TLC) using GF254 silica gel-coated TLC plates. Purification by flash column chromatography was performed over  $\text{SiO}_2$  (silica gel 200–300 mesh).

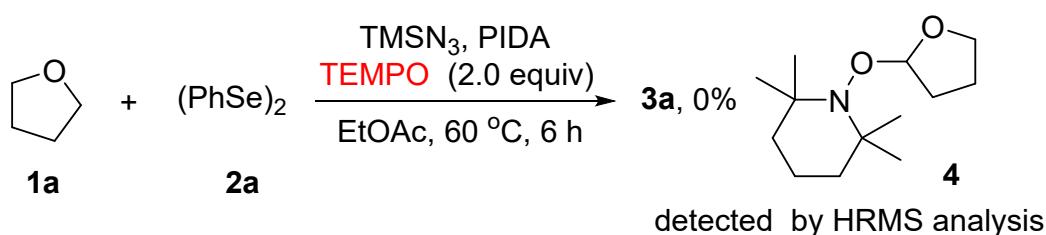
## II. Typical Experimental Procedures



To a reaction tube, substrates **1** (5 equiv, 1.5 mmol), diphenyl diselenides **2** (1.0 equiv, 0.3 mmol),  $\text{TMSN}_3$  (3.0 equiv, 0.9 mmol), PIDA (2.0 equiv, 0.4 mmol) were mixed in EtOAc (1 mL). The mixture was stirred at 60 °C for 6 h. After the completion of the reaction, the mixture was quenched with water, extracted with ethyl acetate (30×3 ml), and dried over anhydrous  $\text{Na}_2\text{SO}_4$ . Then the organic solvent was concentrated in vacuo. The residue was purified by flash column chromatography with Petroleum ether as eluent to give **3**.

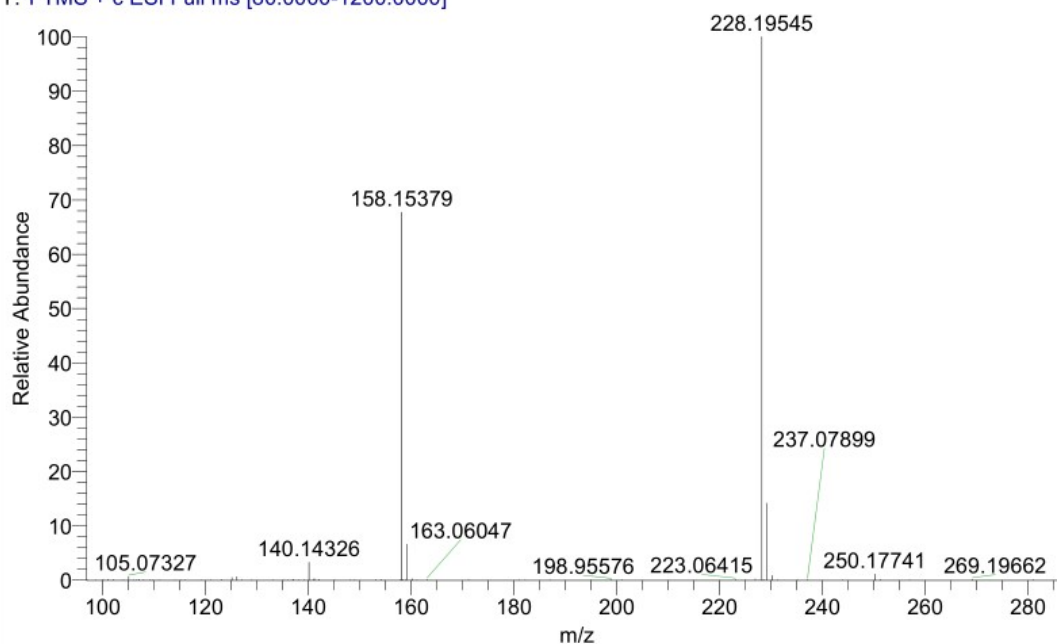
## III. Control Experiments

### 3.1 Control experiment in the presence of TEMPO

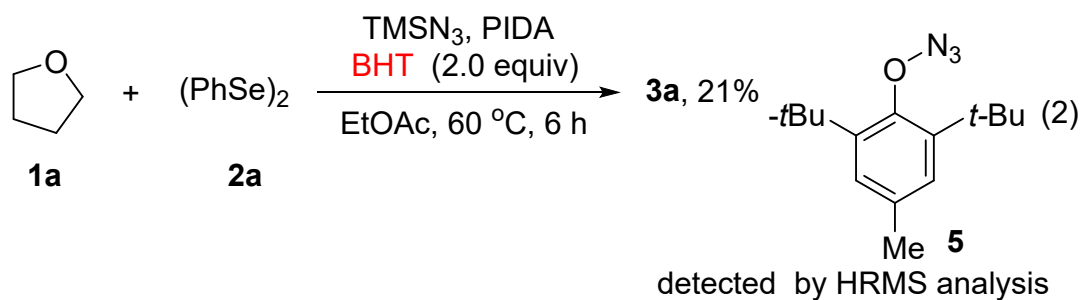


To a reaction tube, tetrahydrofuran **1a** (5.0 equiv, 1 mmol), diphenyl diselenide **2a** (1.0 equiv, 0.2 mmol),  $\text{TMSN}_3$  (3.0 equiv, 0.6 mmol), PIDA (2.0 equiv, 0.4 mmol), and the radical scavenger TEMPO (2.0 equiv, 0.4 mmol) were mixed in EtOAc (1 mL). Then the mixture was stirred at 60 °C for 6 h, and the adduct **4** was successfully detected by HRMS analysis. HRMS (ESI) calcd for  $\text{C}_{14}\text{H}_{27}\text{NO}$   $[\text{M}+\text{H}]^+$ : 228.1958, found: 228.1954.

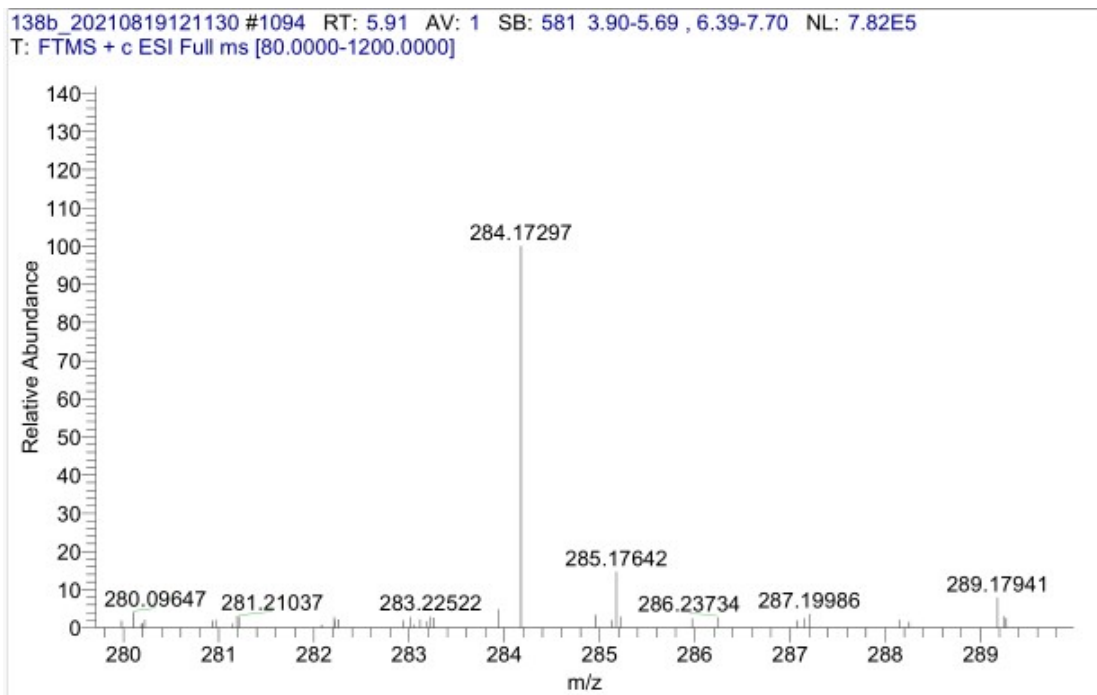
138a #858 RT: 4.63 AV: 1 NL: 4.34E9  
T: FTMS + c ESI Full ms [80.0000-1200.0000]



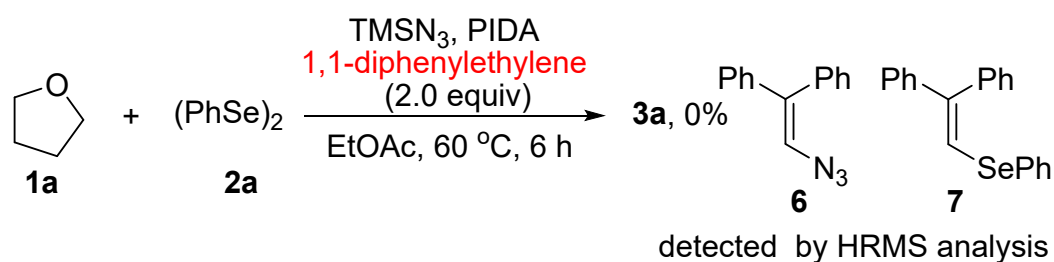
### 3.2 Control experiment in the presence of BHT



To a reaction tube, tetrahydrofuran **1a** (5.0 equiv, 1 mmol), diphenyl diselenide **2a** (1.0 equiv, 0.2 mmol), TMSN<sub>3</sub> (3.0 equiv, 0.6 mmol), PIDA (2.0 equiv, 0.4 mmol), and the radical scavenger BHT (2.0 equiv, 0.4 mmol) were mixed in EtOAc (1 mL). Then the mixture was stirred at 60 °C for 6 h, and the adduct **5** was successfully detected by HRMS analysis. HRMS (ESI) calcd for C<sub>15</sub>H<sub>23</sub>N<sub>3</sub>O [M+Na]<sup>+</sup>: 284.1733, found: 284.1729.

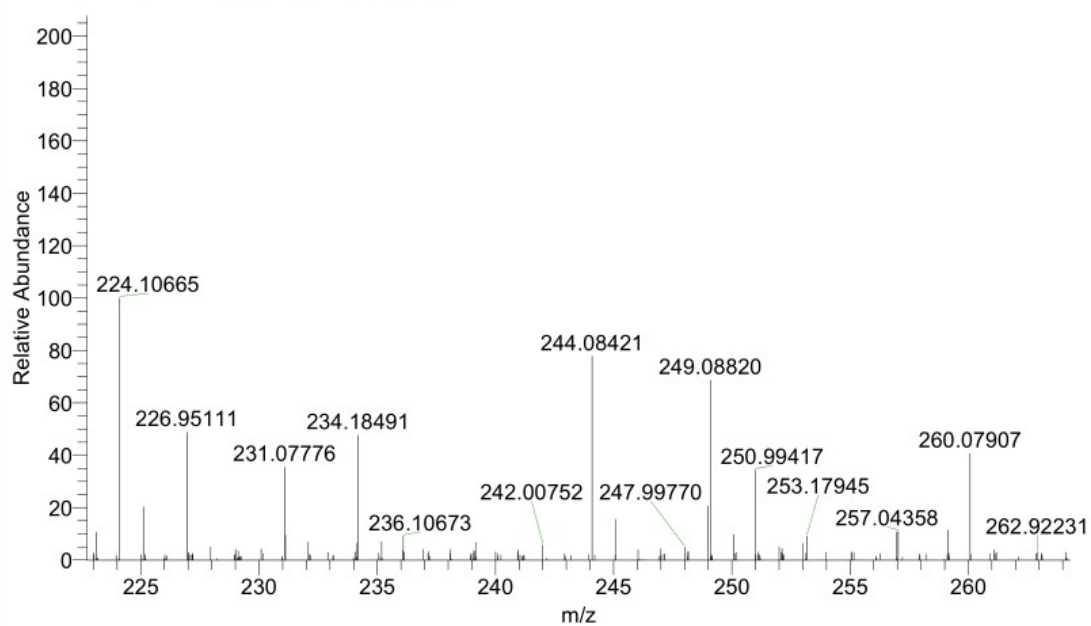


### 3.3 Control experiment in the presence of 1,1-diphenylethylene

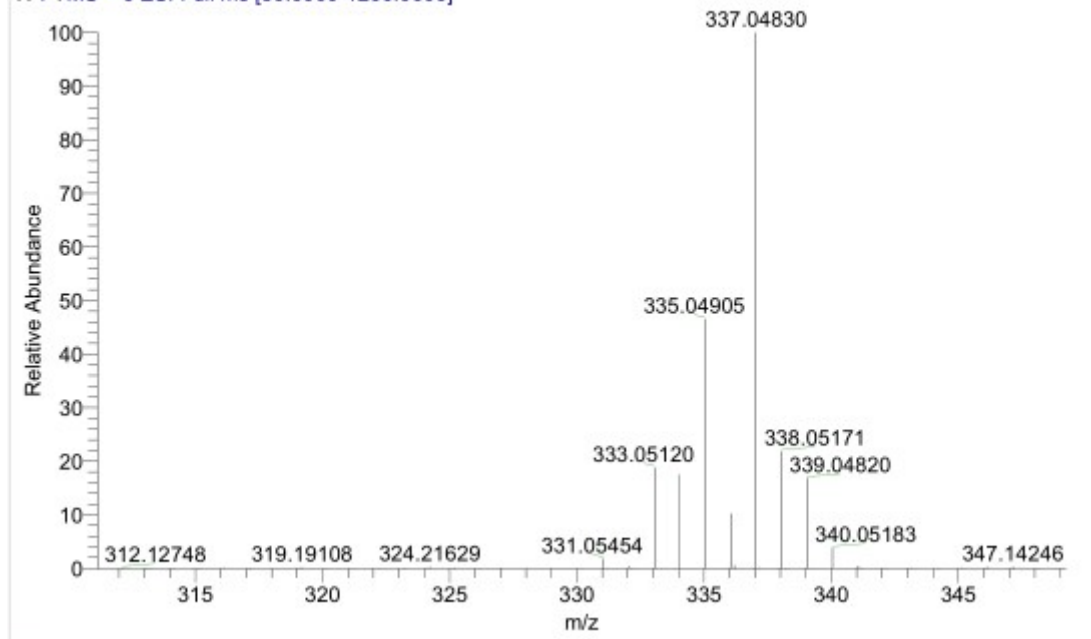


To a reaction tube, tetrahydrofuran **1a** (5.0 equiv, 1 mmol), diphenyl diselenide **2a** (1.0 equiv, 0.2 mmol),  $\text{TMSN}_3$  (3.0 equiv, 0.6 mmol), PIDA (2.0 equiv, 0.4 mmol), and the radical scavenger 1,1-diphenylethylene (2.0 equiv, 0.4 mmol) were mixed in EtOAc (1 mL). Then the mixture was stirred at 60 °C for 6 h, we successfully detected the expected **6** and **7** by HRMS analysis. HRMS (ESI) calcd for **6**  $\text{C}_{14}\text{H}_{11}\text{N}_3$   $[\text{M}+\text{Na}]^+$ : 224.0845, found: 224.0842. HRMS (ESI) calcd for **7**  $\text{C}_{20}\text{H}_{16}\text{Se}$   $[\text{M}+\text{H}]^+$ : 337.0490, found: 337.0483.

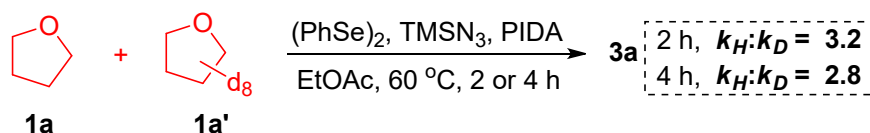
138c #491 RT: 2.65 AV: 1 SB: 347 1.77-2.49 , 2.94-4.03 NL: 1.96E6  
T: FTMS + c ESI Full ms [80.0000-1200.0000]



138c #709-740 RT: 3.81-3.97 AV: 32 SB: 494 1.99-3.45 , 4.42-5.56 NL: 1.21E8  
T: FTMS + c ESI Full ms [80.0000-1200.0000]

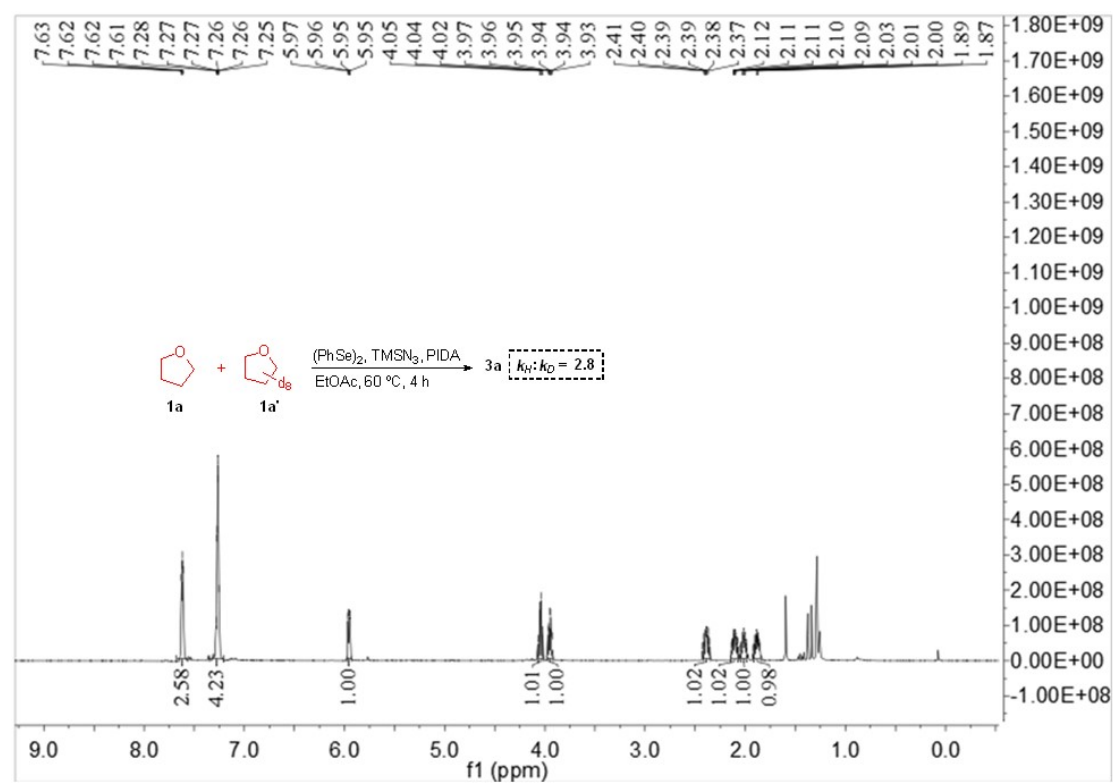
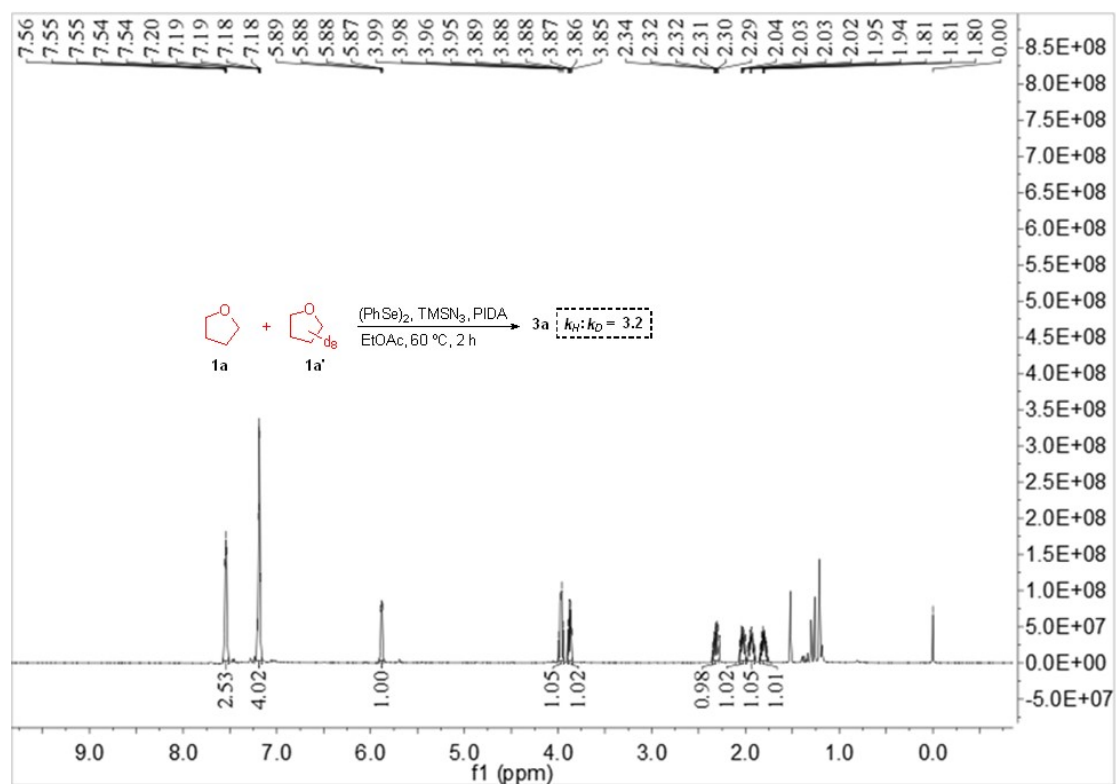


### 3.3 KIE Experiment between tetrahydrofuran and d<sub>8</sub>-tetrahydrofuran

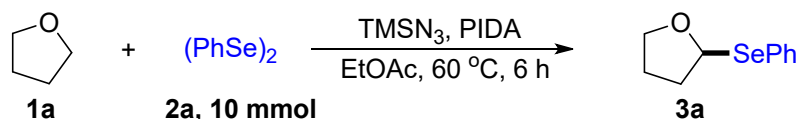


To a reaction tube, tetrahydrofuran **1a** (2.5 equiv, 0.5 mmol) and d<sub>8</sub>-tetrahydrofuran **1a'** (2.5 equiv, 0.5 mmol), diphenyl diselenide **2a** (1.0 equiv, 0.2 mmol), TMSN<sub>3</sub> (3.0 equiv., 0.6 mmol), PIDA (2.0 equiv, 0.4 mmol) were mixed in EtOAc (1 mL). The mixture was stirred at 60 °C for 2 h or 4 h, quenched with water, extracted with ethyl acetate (5×3 mL), and

dried over anhydrous  $\text{Na}_2\text{SO}_4$ . Then the organic solvent was concentrated in vacuo. The residue was purified by flash column chromatography with petroleum ether as eluent to give product **3a**, which was characterized by  $^1\text{H}$  NMR spectra.



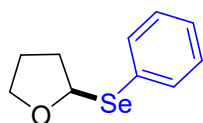
#### IV. Gram scale-up reactions



To a reaction tube, tetrahydrofuran **1a** (5 equiv, 50 mmol), diphenyl diselenide **2a** (1.0 equiv, 10 mmol), TMSN<sub>3</sub> (3.0 equiv, 30 mmol), PIDA (2.0 equiv, 20 mmol) were mixed in EtOAc (20 mL). The mixture was stirred at 60 °C for 6 h. After the completion of the reaction, the mixture was quenched with water, extracted with ethyl acetate (30×3 ml), and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>. Then the organic solvent was concentrated in vacuo. The residue was purified by flash column chromatography with Petroleum ether as eluent to give **3a** (3.781 g, 83% yield).

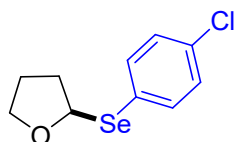
#### V. Products Characterization

##### 2-(phenylselanyl)tetrahydrofuran (**3a**)



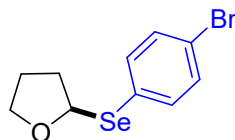
Colorless liquid (117.5 mg, 86% yield). *R<sub>f</sub>*(Petroleum ether): 0.4. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.65–7.59 (m, 2H), 7.29–7.25 (m, 3H), 5.96 (m, 1H), 4.05 (m, 1H), 3.95 (m, 1H), 2.39 (m, 1H), 2.11 (m, 1H), 2.06–1.96 (m, 1H), 1.94–1.82 (m, 1H). <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 133.85, 130.60, 128.96, 127.26, 84.55, 67.56, 33.66, 24.59. HRMS (ESI) calcd for C<sub>10</sub>H<sub>12</sub>OSe [M+Na]<sup>+</sup>: 250.9946, found: 250.9942

##### 2-((4-chlorophenyl)selanyl)tetrahydrofuran (**3b**)



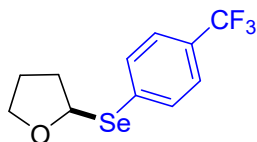
Colorless liquid (130.7 mg, 83% yield). *R<sub>f</sub>*(Petroleum ether): 0.5. <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.57–7.52 (m, 2H), 7.25–7.20 (m, 2H), 5.92 (m, 1H), 4.03 (m, 1H), 3.95 (m, 1H), 2.38 (m, 1H), 2.13–1.96 (m, 2H), 1.93–1.82 (m, 1H). <sup>13</sup>C NMR (125 MHz, CDCl<sub>3</sub>) δ 135.16, 133.54, 129.08, 128.88, 84.78, 67.56, 33.59, 24.56. HRMS (ESI) calcd for C<sub>10</sub>H<sub>11</sub>ClOSe [M+Na]<sup>+</sup>: 284.9556, found: 284.9552

##### 2-((4-bromophenyl)selanyl)tetrahydrofuran (**3c**)



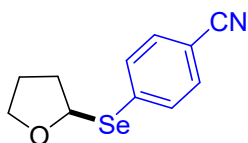
Colorless liquid (146.4 mg, 81% yield). *R<sub>f</sub>*(Petroleum ether): 0.5. <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.50–7.45 (m, 2H), 7.40–7.36 (m, 2H), 5.93 (m, 1H), 4.03 (m, 1H), 3.95 (m, 1H), 2.39 (m, 1H), 2.12–1.97 (m, 2H), 1.94–1.84 (m, 1H). <sup>13</sup>C NMR (125 MHz, CDCl<sub>3</sub>) δ 135.38, 132.01, 129.56, 121.66, 84.72, 67.58, 33.58, 24.54. HRMS (ESI) calcd for C<sub>10</sub>H<sub>11</sub>BrOSe [M+Na]<sup>+</sup>: 328.9051, found: 328.9047.

##### 2-((4-(trifluoromethyl)phenyl)selanyl)tetrahydrofuran (**3d**)



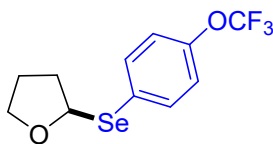
Colorless liquid (134.9 mg, 76% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.71 (d,  $J = 8.0$  Hz, 2H), 7.50 (d,  $J = 8.2$  Hz, 2H), 6.06 (m, 1H), 4.05 (m, 1H), 3.99 (m, 1H), 2.48–2.39 (m, 1H), 2.08 (m, 2H), 1.97–1.87 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  136.37, 132.83, 128.99 (q,  $J = 32.6$  Hz), 125.58 (q,  $J = 3.7$  Hz), 124.20 (q,  $J = 271.8$  Hz) 84.51, 67.61, 33.52, 24.51.  $^{19}\text{F NMR}$  (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -62.63. HRMS (ESI) calcd for  $\text{C}_{11}\text{H}_{11}\text{F}_3\text{O}_2\text{Se}$   $[\text{M}+\text{Na}]^+$ : 318.9819, found: 318.9815.

#### 4-((tetrahydrofuran-2-yl)selanyl)benzonitrile (3e)



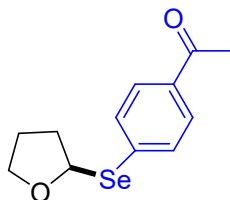
Colorless liquid (127.2 mg, 84% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.68 (d,  $J = 8.3$  Hz, 2H), 7.49 (d,  $J = 8.3$  Hz, 2H), 6.09 (m, 1H), 4.07–3.96 (m, 2H), 2.50–2.39 (m, 1H), 2.14–2.00 (m, 2H), 1.99–1.88 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  139.32, 132.32, 132.11, 118.91, 109.98, 84.47, 67.69, 33.43, 24.49. HRMS (ESI) calcd for  $\text{C}_{11}\text{H}_{11}\text{NOSe}$   $[\text{M}+\text{Na}]^+$ : 275.9898, found: 275.9893.

#### 2-((4-(trifluoromethoxy)phenyl)selanyl)tetrahydrofuran (3f)



Colorless liquid (152.1 mg, 81% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.67–7.61 (m, 2H), 7.14–7.09 (m, 2H), 5.95 (m, 1H), 4.04 (m, 1H), 3.96 (m, 1H), 2.44–2.36 (m, 1H), 2.12–1.98 (m, 2H), 1.94–1.86 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  148.68, 135.19, 129.04, 121.45, 120.11 (t,  $J = 386.0$  Hz), 119.43, 117.38, 84.79, 67.52, 33.54, 24.52.  $^{19}\text{F NMR}$  (471 MHz,  $\text{CDCl}_3$ )  $\delta$  -57.88. HRMS (ESI) calcd for  $\text{C}_{11}\text{H}_{11}\text{F}_3\text{O}_2\text{Se}$   $[\text{M}+\text{Na}]^+$ : 334.9769, found: 334.9765.

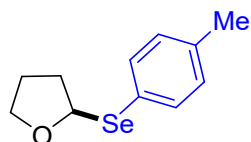
#### 1-(4-((tetrahydrofuran-2-yl)selanyl)phenyl)ethan-1-one (3g)



Colorless liquid (129.6 mg, 80% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.78 (d,  $J = 8.2$  Hz, 2H), 7.63 (d,  $J = 8.2$  Hz, 2H), 6.05 (m, 1H), 4.03–3.91 (m, 2H), 2.52 (s, 3H), 2.39 (m, 1H), 2.10–1.96 (m, 2H), 1.92–1.84 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  197.50, 139.03, 135.26, 131.96, 128.60, 84.26, 67.63, 33.50, 26.51, 24.53. HRMS (ESI) calcd for  $\text{C}_{12}\text{H}_{14}\text{O}_2\text{Se}$   $[\text{M}+\text{Na}]^+$ : 293.0051, found: 293.0046.

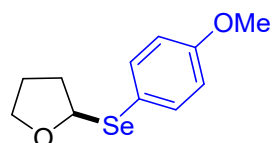
#### 2-(p-tolylselanyl)tetrahydrofuran (3h)





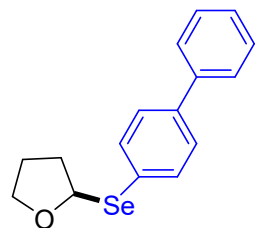
Colorless liquid (126.6 mg, 87% yield).  $R_f$  (Petroleum ether): 0.4.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.52 (d,  $J = 8.0$  Hz, 2H), 7.10 (d,  $J = 7.9$  Hz, 2H), 5.90 (m, 1H), 4.04 (m, 1H), 3.94 (m, 1H), 2.40–2.35 (m, 1H), 2.33 (s, 3H), 2.14–2.07 (m, 1H), 2.06–1.97 (m, 1H), 1.87 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  137.35, 134.35, 129.80, 126.63, 84.61, 67.55, 33.64, 24.60, 21.18. HRMS (ESI) calcd for  $\text{C}_{11}\text{H}_{14}\text{OSe}$   $[\text{M}+\text{Na}]^+$ : 265.0102, found: 265.0098.

### 2-((4-methoxyphenyl)selanyl)tetrahydrofuran (3i)



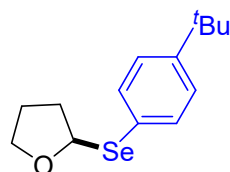
Colorless liquid (138 mg, 89% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.55 (d,  $J = 8.6$  Hz, 2H), 6.83 (d,  $J = 8.6$  Hz, 2H), 5.81 (m, 1H), 4.02 (q,  $J = 7.8$  Hz, 1H), 3.92 (m, 1H), 3.79 (s, 3H), 2.39–2.30 (m, 1H), 2.12–2.04 (m, 1H), 1.98 (m, 1H), 1.91–1.81 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  159.53, 136.50, 120.28, 114.66, 84.76, 67.56, 55.27, 33.55, 24.59. HRMS (ESI) calcd for  $\text{C}_{11}\text{H}_{14}\text{O}_2\text{Se}$   $[\text{M}+\text{Na}]^+$ : 281.0051, found: 281.0043.

### 2-([1,1'-biphenyl]-4-ylselanyl)tetrahydrofuran (3j)



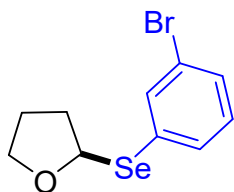
Colorless liquid (163.4 mg, 90% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.69 (d,  $J = 8.3$  Hz, 2H), 7.58 (d,  $J = 7.3$  Hz, 2H), 7.50 (d,  $J = 8.2$  Hz, 2H), 7.44 (t,  $J = 7.6$  Hz, 2H), 7.34 (t,  $J = 7.3$  Hz, 1H), 6.01 (m, 1H), 4.08 (d,  $J = 8.0$  Hz, 1H), 4.01–3.95 (m, 1H), 2.47–2.38 (m, 1H), 2.19–2.10 (m, 1H), 2.04 (m, 1H), 1.95–1.85 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  140.62, 140.23, 134.18, 129.68, 128.81, 127.67, 127.39, 127.02, 84.63, 67.59, 33.66, 24.60. HRMS (ESI) calcd for  $\text{C}_{16}\text{H}_{16}\text{OSe}$   $[\text{M}+\text{Na}]^+$ : 327.0259, found: 327.0263.

### 2-((4-(tert-butyl)phenyl)selanyl)tetrahydrofuran (3k)



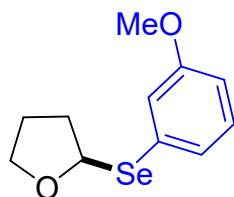
Colorless liquid (146.6 mg, 86% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.56 (d,  $J = 8.4$  Hz, 2H), 7.31 (d,  $J = 8.4$  Hz, 2H), 5.94 (m, 1H), 4.06 (m, 1H), 3.95 (m, 1H), 2.39 (m, 1H), 2.15–2.08 (m, 1H), 2.07–1.99 (m, 1H), 1.89 (m, 1H), 1.32 (s, 9H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  150.46, 133.89, 126.90, 126.09, 84.54, 67.51, 34.56, 33.66, 31.31, 24.61. HRMS (ESI) calcd for  $\text{C}_{14}\text{H}_{20}\text{OSe}$   $[\text{M}+\text{Na}]^+$ : 307.0572, found: 307.0564.

### 2-((3-bromophenyl)selanyl)tetrahydrofuran (3l)



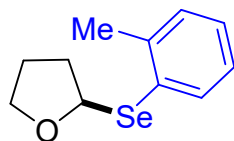
Colorless liquid (149.9 mg, 82% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.78 (t,  $J = 1.5$  Hz, 1H), 7.53 (d,  $J = 7.7$  Hz, 1H), 7.38 (m, 1H), 7.13 (t,  $J = 7.9$  Hz, 1H), 5.99 (m, 1H), 4.04 (m, 1H), 3.97 (m, 1H), 2.40 (m, 1H), 2.12–2.05 (m, 1H), 2.05–1.98 (m, 1H), 1.94–1.86 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  135.83, 132.85, 131.96, 130.25, 130.18, 122.69, 84.80, 67.61, 33.60, 24.55. HRMS (ESI) calcd for  $\text{C}_{11}\text{H}_{14}\text{BrOSe}$   $[\text{M}+\text{Na}]^+$ : 328.9051, found: 328.9045.

### 2-((3-methoxyphenyl)selanyl)tetrahydrofuran (3m)



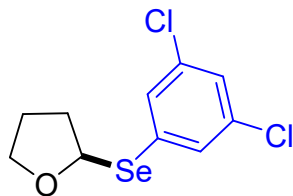
Colorless liquid (128.2 mg, 83% yield).  $R_f$  (Petroleum ether): 0.2.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.14–7.07 (m, 3H), 6.72 (m, 1H), 5.90 (m, 1H), 3.96 (q,  $J = 7.8$  Hz, 1H), 3.86 (m, 1H), 3.71 (s, 3H), 2.31 (m, 1H), 2.02 (m, 1H), 1.98–1.88 (m, 1H), 1.85–1.74 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  159.64, 131.65, 129.70, 125.86, 118.88, 113.16, 84.56, 67.58, 55.28, 33.66, 24.60. HRMS (ESI) calcd for  $\text{C}_{11}\text{H}_{14}\text{O}_2\text{Se}$   $[\text{M}+\text{Na}]^+$ : 281.0051, found: 281.0044

### 2-(o-tolylselanyl)tetrahydrofuran (3n)



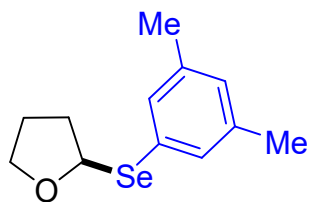
Colorless liquid (123.8 mg, 85% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.73–7.70 (m, 1H), 7.22–7.11 (m, 3H), 5.98 (m, 1H), 4.05 (m, 1H), 3.96 (m, 1H), 2.43 (s, 3H), 2.42–2.37 (m, 1H), 2.18–2.11 (m, 1H), 2.10–2.01 (m, 1H), 1.95–1.85 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  139.84, 133.47, 132.00, 129.87, 127.24, 126.52, 83.68, 67.58, 33.70, 24.65, 22.86. HRMS (ESI) calcd for  $\text{C}_{11}\text{H}_{14}\text{OSe}$   $[\text{M}+\text{Na}]^+$ : 265.0102, found: 265.0097.

### 2-((3,5-dichlorophenyl)selanyl)tetrahydrofuran (3o)



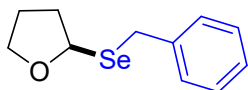
Colorless liquid (119.4 mg, 67% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.49 (d,  $J = 1.8$  Hz, 2H), 7.23 (t,  $J = 1.8$  Hz, 1H), 6.02 (m, 1H), 4.07–3.96 (m, 2H), 2.47–2.36 (m, 1H), 2.12–1.98 (m, 2H), 1.96–1.86 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  134.91, 133.91, 130.87, 127.14, 84.92, 67.64, 33.50, 24.48. HRMS (ESI) calcd for  $\text{C}_{20}\text{H}_{19}\text{F}_2\text{NO}_3$   $[\text{M}+\text{Na}]^+$ : 318.9166, found: 318.9162.

### 2-((3,5-dimethylphenyl)selanyl)tetrahydrofuran (3p)



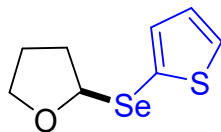
Colorless liquid (122.6 mg, 80% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.18 (d,  $J = 6.1$  Hz, 2H), 6.81 (s, 1H), 5.88 (m, 1H), 3.97 (m, 1H), 3.87 (m, 1H), 2.31 (m, 1H), 2.21 (s, 6H), 2.09–1.99 (m, 1H), 1.99–1.90 (m, 1H), 1.86–1.75 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  138.50, 131.32, 130.12, 129.12, 84.46, 67.54, 33.70, 24.62, 21.20. HRMS (ESI) calcd for  $\text{C}_{12}\text{H}_{16}\text{OSe}$   $[\text{M}+\text{Na}]^+$ : 279.0259, found: 279.0254.

### 2-(benzylselanyl)tetrahydrofuran (3q)



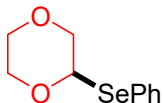
Colorless liquid (122.2 mg, 84% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.35 (t,  $J = 7.0$  Hz, 2H), 7.31 (m, 2H), 7.22 (t,  $J = 7.3$  Hz, 1H), 5.64 (m, 1H), 4.05–3.92 (m, 3H), 3.87–3.80 (m, 1H), 2.31–2.21 (m, 1H), 2.02 (m, 1H), 1.99–1.91 (m, 1H), 1.91–1.81 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  139.93, 128.92, 128.51, 126.54, 79.63, 67.10, 33.09, 27.20, 24.70. HRMS (ESI) calcd for  $\text{C}_{11}\text{H}_{14}\text{OSe}$   $[\text{M}+\text{Na}]^+$ : 265.0102, found: 265.0096.

### 2-(thiophen-2-ylselanyl)tetrahydrofuran (3r)



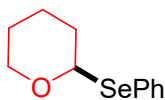
Colorless liquid (111 mg, 79% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.40 (m, 1H), 7.23 (m, 1H), 7.00 (m, 1H), 5.80 (m, 1H), 4.05 (m, 1H), 3.95 (m, 1H), 2.33 (m, 1H), 2.11 (m, 1H), 2.04–1.96 (m, 1H), 1.89 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  135.97, 131.05, 128.08, 123.45, 86.38, 68.00, 33.27, 24.34. HRMS (ESI) calcd for  $\text{C}_8\text{H}_{10}\text{OSse}$   $[\text{M}+\text{Na}]^+$ : 256.9510, found: 256.9503.

### 2-(thiophen-2-ylselanyl)tetrahydrofuran (3s)



Colorless liquid (128.4 mg, 88% yield).  $R_f$  (Petroleum ether): 0.3.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.59 (m, 2H), 7.28–7.22 (m, 3H), 5.48–5.44 (m, 1H), 4.31–4.24 (m, 1H), 3.98 (m, 1H), 3.86 (m, 1H), 3.74–3.66 (m, 2H), 3.64–3.59 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  133.85, 129.51, 129.13, 127.56, 81.93, 71.15, 66.80, 63.56. HRMS (ESI) calcd for  $\text{C}_{10}\text{H}_{12}\text{O}_2\text{Se}$   $[\text{M}+\text{Na}]^+$ : 266.9895, found: 266.9890.

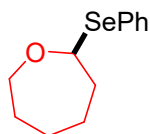
### 2-(phenylselanyl)tetrahydro-2H-pyran (3t)



Colorless liquid (124.4 mg, 86% yield).  $R_f$  (Petroleum ether): 0.4.  $^1\text{H NMR}$  (600 MHz,  $\text{CDCl}_3$ )  $\delta$  7.60–7.56 (m, 2H), 7.26–7.22 (m, 3H), 5.69 (t,  $J = 4.1$  Hz, 1H), 4.18–4.13 (m, 1H), 3.69–3.64 (m,

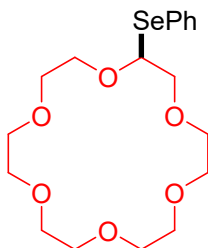
1H), 2.11 (m, 1H), 2.03–1.96 (m, 1H), 1.82–1.73 (m, 1H), 1.72–1.61 (m, 3H). <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 133.55, 130.49, 128.96, 127.12, 84.77, 64.33, 32.79, 25.73, 21.49. HRMS (ESI) calcd for C<sub>11</sub>H<sub>14</sub>OSe [M+Na]<sup>+</sup>: 265.0102, found: 265.0095.

### 2-(phenylselanyl)oxepane (3u)



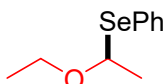
Colorless liquid (124.7 mg, 81% yield). R<sub>f</sub> (Petroleum ether): 0.5. <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.59 (m, 2H), 7.24 (m, 3H), 5.65 (m, 1H), 3.92–3.84 (m, 1H), 3.70–3.62 (m, 1H), 2.38 (m, 1H), 1.84 (m, 2H), 1.78–1.70 (m, 2H), 1.69–1.59 (m, 1H), 1.49 (m, 1H), 1.36–1.26 (m, 1H). <sup>13</sup>C NMR (125 MHz, CDCl<sub>3</sub>) δ 133.77, 130.74, 128.87, 127.13, 86.58, 64.20, 37.02, 29.94, 29.22, 25.77. HRMS (ESI) calcd for C<sub>12</sub>H<sub>16</sub>OSe [M+Na]<sup>+</sup>: 279.0259, found: 279.0254.

### 2-(phenylselanyl)-1,4,7,10,13,16-hexaoxacyclooctadecane (3v)



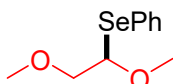
Colorless liquid (187.7 mg, 74% yield). R<sub>f</sub> (Petroleum ether: ethyl acetate=10:3): 0.5. <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.53 (m, 2H), 7.26–7.18 (m, 3H), 5.21 (m, 1H), 4.02–3.94 (m, 1H), 3.86 (m, 1H), 3.69–3.59 (m, 20H). <sup>13</sup>C NMR (125 MHz, CDCl<sub>3</sub>) δ 135.50, 128.95, 127.85, 127.77, 90.71, 86.71, 74.62, 72.34, 70.91 (d, *J* = 3.1 Hz), 70.82 (d, *J* = 3.0 Hz), 70.72 (d, *J* = 2.1 Hz), 70.67 (d, *J* = 2.8 Hz), 70.53 (d, *J* = 3.7 Hz), 69.94, 69.50, 68.47. HRMS (ESI) calcd for C<sub>18</sub>H<sub>18</sub>O<sub>6</sub>Se [M+Na]<sup>+</sup>: 443.0943, found: 443.0933.

### (1-ethoxyethyl)(phenyl)selane (3w)



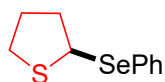
Colorless liquid (98.2 mg, 71% yield). R<sub>f</sub> (Petroleum ether): 0.5. <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.58 (m, 2H), 7.30–7.24 (m, 3H), 5.14 (q, *J* = 6.2 Hz, 1H), 3.98–3.90 (m, 1H), 3.49–3.41 (m, 1H), 1.68 (d, *J* = 6.2 Hz, 3H), 1.23 (t, *J* = 7.0 Hz, 3H). <sup>13</sup>C NMR (125 MHz, CDCl<sub>3</sub>) δ 135.72, 128.86, 128.41, 127.63, 82.92, 64.96, 24.50, 14.75. HRMS (ESI) calcd for C<sub>10</sub>H<sub>14</sub>OSe [M+Na]<sup>+</sup>: 253.0102, found: 253.0097

### (1,2-dimethoxyethyl)(phenyl)selane (3x)



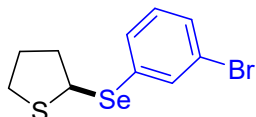
Colorless liquid (96.9 mg, 66% yield). R<sub>f</sub> (Petroleum ether): 0.3. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.62–7.57 (m, 2H), 7.29 (m, 3H), 5.01 (m, 1H), 3.75 (m, 1H), 3.64 (m, 1H), 3.53 (s, 3H), 3.37 (s, 3H). <sup>13</sup>C NMR (150 MHz, CDCl<sub>3</sub>) δ 135.57, 129.04, 127.92, 87.78, 75.98, 59.07, 57.70. HRMS (ESI) calcd for C<sub>10</sub>H<sub>14</sub>O<sub>2</sub>Se [M+Na]<sup>+</sup>: 269.0051, found: 269.0046.

### 2-(phenylselanyl)tetrahydrothiophene (3y)



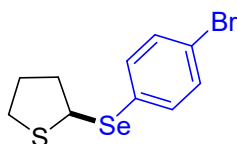
Colorless liquid (116.5 mg, 80% yield).  $R_f$  (Petroleum ether): 0.4.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.61–7.54 (m, 2H), 7.34–7.25 (m, 3H), 4.90–4.83 (m, 1H), 3.04 (m, 1H), 2.86 (m, 1H), 2.28–2.16 (m, 3H), 2.08 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  134.23, 131.61, 129.12, 127.75, 48.78, 39.30, 33.40, 28.67. HRMS (ESI) calcd for  $\text{C}_{10}\text{H}_{12}\text{SSe}$   $[\text{M}+\text{Na}]^+$ : 266.9717, found: 266.9713.

### 2-((3-bromophenyl)selanyl)tetrahydrothiophene (3z)



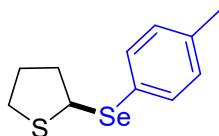
Colorless liquid (136.9 mg, 71% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.72 (s, 1H), 7.48 (d,  $J = 7.7$  Hz, 1H), 7.44–7.39 (m, 1H), 7.16 (t,  $J = 7.8$  Hz, 1H), 4.88 (t,  $J = 3.9$  Hz, 1H), 3.05 (m, 1H), 2.90–2.83 (m, 1H), 2.26–2.20 (m, 3H), 2.14–2.06 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  136.30, 133.65, 132.38, 130.71, 130.47, 122.83, 49.11, 39.26, 33.37, 28.62. HRMS (ESI) calcd for  $\text{C}_{10}\text{H}_{11}\text{BrSSe}$   $[\text{M}+\text{Na}]^+$ : 344.8822, found: 344.8829.

### 2-((4-bromophenyl)selanyl)tetrahydrothiophene (3aa)



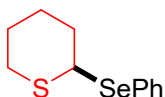
Colorless liquid (144.5 mg, 75% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.45–7.38 (m, 4H), 4.83 (t,  $J = 4.0$  Hz, 1H), 3.03 (m, 1H), 2.86 (m, 1H), 2.23–2.17 (m, 3H), 2.12–2.03 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  135.87, 132.21, 130.35, 122.24, 49.10, 39.19, 33.41, 28.67. HRMS (ESI) calcd for  $\text{C}_{10}\text{H}_{11}\text{BrSSe}$   $[\text{M}+\text{Na}]^+$ : 344.8822, found: 344.8814.

### 2-(*p*-tolylselanyl)tetrahydrothiophene (3ab)



Colorless liquid (117.6 mg, 76% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.49 (d,  $J = 8.0$  Hz, 2H), 7.11 (d,  $J = 7.9$  Hz, 2H), 4.80 (m, 1H), 3.06–3.00 (m, 1H), 2.89–2.82 (m, 1H), 2.34 (s, 3H), 2.21 (m, 3H), 2.10–2.02 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  137.93, 134.76, 129.91, 127.78, 48.93, 39.22, 33.40, 28.62, 21.22. HRMS (ESI) calcd for  $\text{C}_{10}\text{H}_{14}\text{SSe}$   $[\text{M}+\text{Na}]^+$ : 280.9874, found: 280.9881.

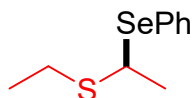
### 2-(phenylselanyl)tetrahydro-2H-thiopyran (3ac)



Colorless liquid (108.4 mg, 70% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H NMR}$  (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.62 (m, 2H), 7.32–7.24 (m, 3H), 4.36 (m, 1H), 2.88–2.80 (m, 1H), 2.60–2.52 (m, 1H), 2.26–2.18 (m, 1H), 1.96–1.83 (m, 2H), 1.83–1.76 (m, 2H), 1.56–1.46 (m, 1H).  $^{13}\text{C NMR}$  (125 MHz,  $\text{CDCl}_3$ )  $\delta$  134.89, 129.60, 129.05, 127.97, 44.02, 34.43, 29.03, 26.69, 24.59. HRMS (ESI) calcd for

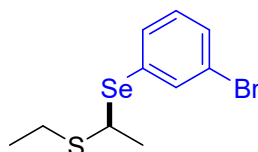
C<sub>11</sub>H<sub>14</sub>SSe [M+Na]<sup>+</sup>: 280.9874, found: 280.9869.

**ethyl(1-(phenylselanyl)ethyl)sulfane (3ad)**



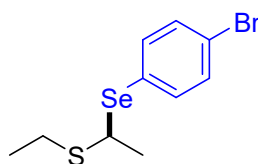
Colorless liquid (109.6 mg, 74% yield). *R<sub>f</sub>* (Petroleum ether): 0.5. <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.55–7.48 (m, 2H), 7.25–7.14 (m, 3H), 4.21 (q, *J* = 7.0 Hz, 1H), 2.70 (m, 1H), 2.66–2.57 (m, 1H), 1.65–1.60 (m, 3H), 1.20 (t, *J* = 7.4 Hz, 3H). <sup>13</sup>C NMR (125 MHz, CDCl<sub>3</sub>) δ 135.42, 129.53, 128.98, 128.06, 42.89, 26.78, 24.02, 14.39. HRMS (ESI) calcd for C<sub>10</sub>H<sub>12</sub>SSe [M+Na]<sup>+</sup>: 268.9874, found: 268.9869.

**(1-((3-bromophenyl)selanyl)ethyl)(ethyl)sulfane (3ae)**



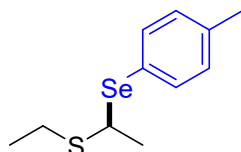
Colorless liquid (132.1 mg, 68% yield). *R<sub>f</sub>* (Petroleum ether): 0.5. <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.75 (s, 1H), 7.51 (d, *J* = 7.7 Hz, 1H), 7.43 (d, *J* = 8.0 Hz, 1H), 7.15 (t, *J* = 7.8 Hz, 1H), 4.32 (q, *J* = 6.9 Hz, 1H), 2.74 (m, 2H), 1.72 (d, *J* = 7.0 Hz, 3H), 1.29 (t, *J* = 7.4 Hz, 3H). <sup>13</sup>C NMR (125 MHz, CDCl<sub>3</sub>) δ 137.42, 133.57, 131.55, 131.03, 130.32, 122.63, 43.37, 26.81, 24.03, 14.39. HRMS (ESI) calcd for C<sub>10</sub>H<sub>13</sub>BrSSe [M+Na]<sup>+</sup>: 346.8979, found: 346.8972.

**(1-(4-bromophenyl)propan-2-yl)(ethyl)sulfane (3af)**



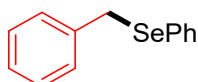
Colorless liquid (156.1 mg, 80% yield). *R<sub>f</sub>* (Petroleum ether): 0.5. <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.46 (d, *J* = 8.4 Hz, 2H), 7.41 (d, *J* = 8.4 Hz, 2H), 4.28 (d, *J* = 7.0 Hz, 1H), 2.73 (m, 2H), 1.70 (d, *J* = 7.0 Hz, 3H), 1.28 (t, *J* = 7.4 Hz, 3H). <sup>13</sup>C NMR (125 MHz, CDCl<sub>3</sub>) δ 136.00, 131.04, 127.09, 121.66, 42.14, 25.71, 22.84, 13.27. HRMS (ESI) calcd for C<sub>11</sub>H<sub>13</sub>BrSSe [M+Na]<sup>+</sup>: 346.8979, found: 346.8983.

**ethyl(1-(p-tolylselanyl)ethyl)sulfane (3ag)**



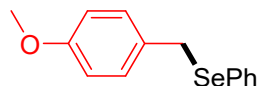
Colorless liquid (127.9 mg, 82% yield). *R<sub>f</sub>* (Petroleum ether): 0.5. <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.50 (d, *J* = 7.9 Hz, 2H), 7.11 (d, *J* = 7.8 Hz, 2H), 4.24 (q, *J* = 6.9 Hz, 1H), 2.75 (m, 2H), 2.35 (s, 3H), 1.70 (d, *J* = 7.0 Hz, 3H), 1.29 (t, *J* = 7.4 Hz, 3H). <sup>13</sup>C NMR (125 MHz, CDCl<sub>3</sub>) δ 138.23, 135.83, 129.78, 125.62, 42.83, 26.74, 23.91, 21.25, 14.36. HRMS (ESI) calcd for C<sub>11</sub>H<sub>16</sub>SSe [M+Na]<sup>+</sup>: 283.0030, found: 283.0024.

**benzyl(phenyl)selane (3ah)**



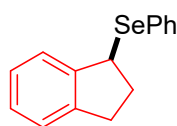
Colorless liquid (96.8 mg, 65% yield).  $R_f$  (Petroleum ether): 0.7.  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.39–7.35 (m, 2H), 7.19–7.14 (m, 5H), 7.14–7.09 (m, 3H), 4.03 (s, 2H).  $^{13}\text{C}$  NMR (125 MHz,  $\text{CDCl}_3$ )  $\delta$  138.66, 133.58, 130.46, 129.02, 128.89, 128.47, 127.34, 126.90, 32.27. HRMS (ESI) calcd for  $\text{C}_{13}\text{H}_{12}\text{Se}$   $[\text{M}+\text{Na}]^+$ : 270.9996, found: 270.9991.

**(4-methoxybenzyl)(phenyl)selane (3ai)**



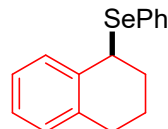
Colorless liquid (136.9 mg, 82% yield).  $R_f$  (Petroleum ether): 0.7.  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.36 (m, 2H), 7.14 (m, 3H), 7.04 (d,  $J = 8.6$  Hz, 2H), 6.69 (d,  $J = 8.6$  Hz, 2H), 3.99 (s, 2H), 3.67 (s, 3H).  $^{13}\text{C}$  NMR (125 MHz,  $\text{CDCl}_3$ )  $\delta$  158.58, 133.49, 130.70, 130.60, 129.98, 129.01, 127.23, 113.90, 55.29, 31.76. HRMS (ESI) calcd for  $\text{C}_{14}\text{H}_{14}\text{OSe}$   $[\text{M}+\text{Na}]^+$ : 301.0102, found: 301.0097.

**(2,3-dihydro-1H-inden-1-yl)(phenyl)selane (3aj)**



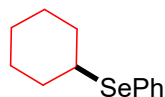
Colorless liquid (129.3 mg, 79% yield).  $R_f$  (Petroleum ether): 0.7.  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.50–7.46 (m, 2H), 7.27–7.18 (m, 4H), 7.18–7.08 (m, 3H), 4.85 (m, 1H), 2.95 (m, 1H), 2.77 (m, 1H), 2.50 (m, 1H), 2.25 (m, 1H).  $^{13}\text{C}$  NMR (125 MHz,  $\text{CDCl}_3$ )  $\delta$  143.80, 143.70, 134.63, 130.50, 129.00, 127.56, 126.53, 124.93, 124.73, 47.32, 34.16, 31.04. HRMS (ESI) calcd for  $\text{C}_{15}\text{H}_{14}\text{Se}$   $[\text{M}+\text{Na}]^+$ : 297.0153, found: 297.0148.

**phenyl(1,2,3,4-tetrahydronaphthalen-1-yl)selane (3ak)**



Colorless liquid (143.5 mg, 83% yield).  $R_f$  (Petroleum ether): 0.5.  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  7.62 (m, 2H), 7.38–7.34 (m, 1H), 7.33–7.29 (m, 3H), 7.15–7.05 (m, 3H), 4.80 (t,  $J = 3.2$  Hz, 1H), 2.83 (m, 2H), 2.33–2.22 (m, 1H), 2.11–2.01 (m, 2H), 1.80 (m, 1H).  $^{13}\text{C}$  NMR (125 MHz,  $\text{CDCl}_3$ )  $\delta$  137.16, 136.38, 134.76, 131.14, 130.51, 129.32, 129.09, 127.63, 126.85, 125.67, 44.59, 29.19, 29.05, 19.17. HRMS (ESI) calcd for  $\text{C}_{16}\text{H}_{16}\text{Se}$   $[\text{M}+\text{Na}]^+$ : 311.0309, found: 311.0304.

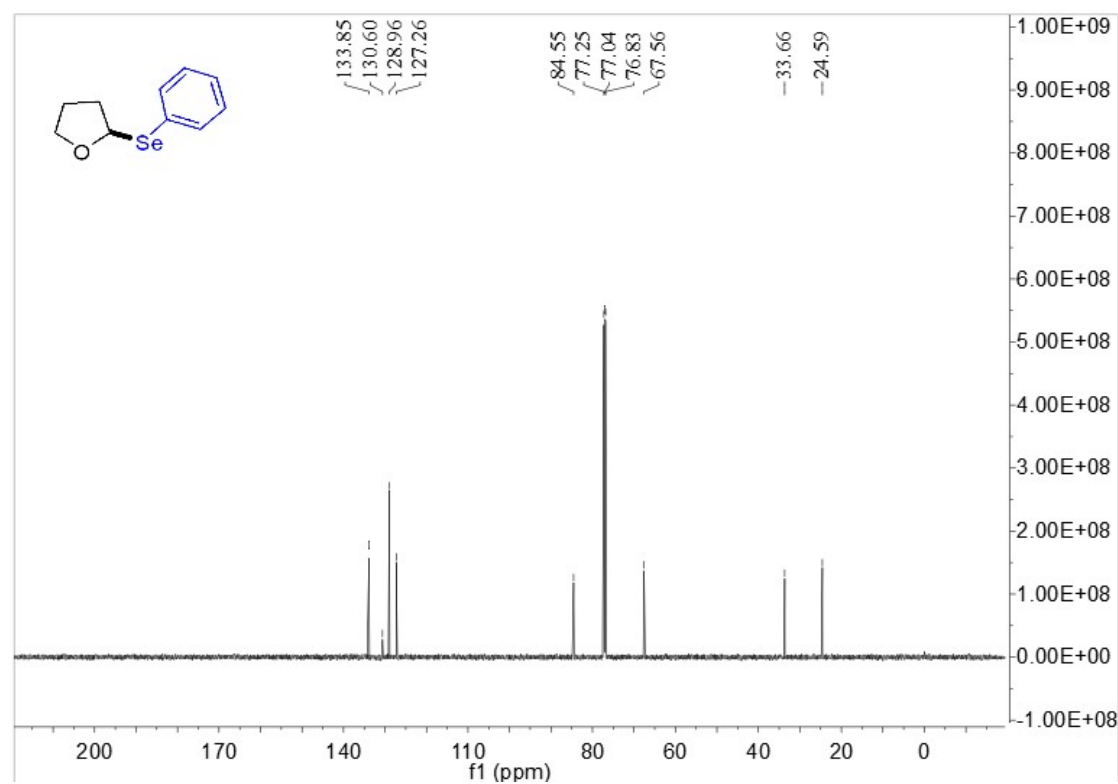
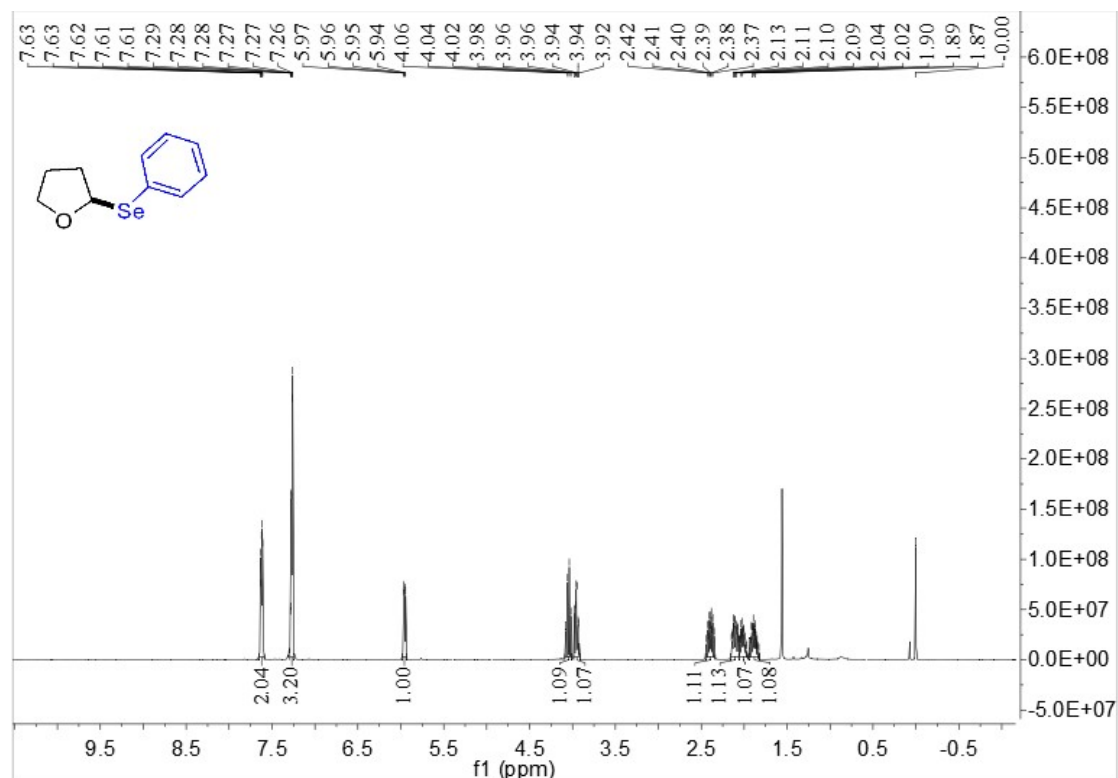
**cyclohexyl(phenyl)selane (3al)**



Colorless liquid (27.6 mg, 19% yield).  $R_f$  (Petroleum ether): 0.7.  $^1\text{H}$  NMR (600 MHz,  $\text{CDCl}_3$ )  $\delta$  7.54 (m, 2H), 7.27–7.22 (m, 3H), 3.25 (m, 1H), 2.05–1.99 (m, 2H), 1.76–1.70 (m, 2H), 1.62–1.49 (m, 3H), 1.35–1.24 (m, 3H).  $^{13}\text{C}$  NMR (150 MHz,  $\text{CDCl}_3$ )  $\delta$  134.74, 129.38, 128.87, 127.23, 43.28, 34.27, 26.91, 25.80. HRMS (ESI) calcd for  $\text{C}_{12}\text{H}_{16}\text{Se}$   $[\text{M}+\text{Na}]^+$ : 263.0309, found: 263.0305.

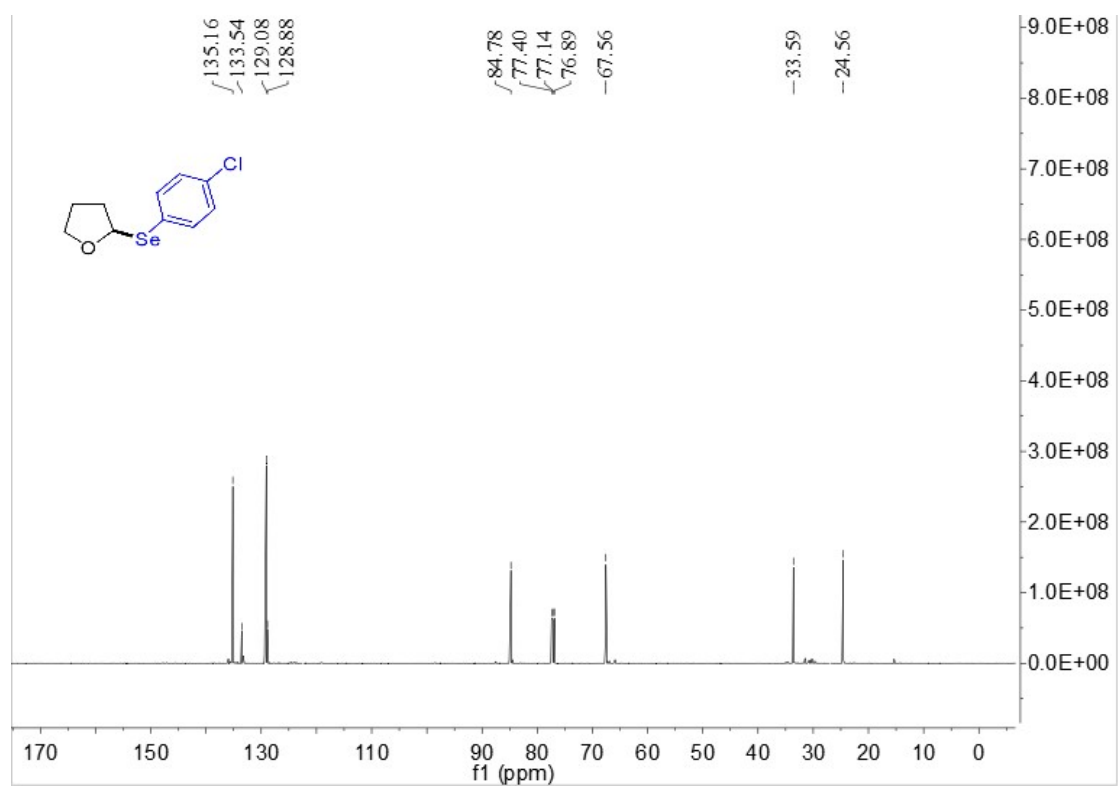
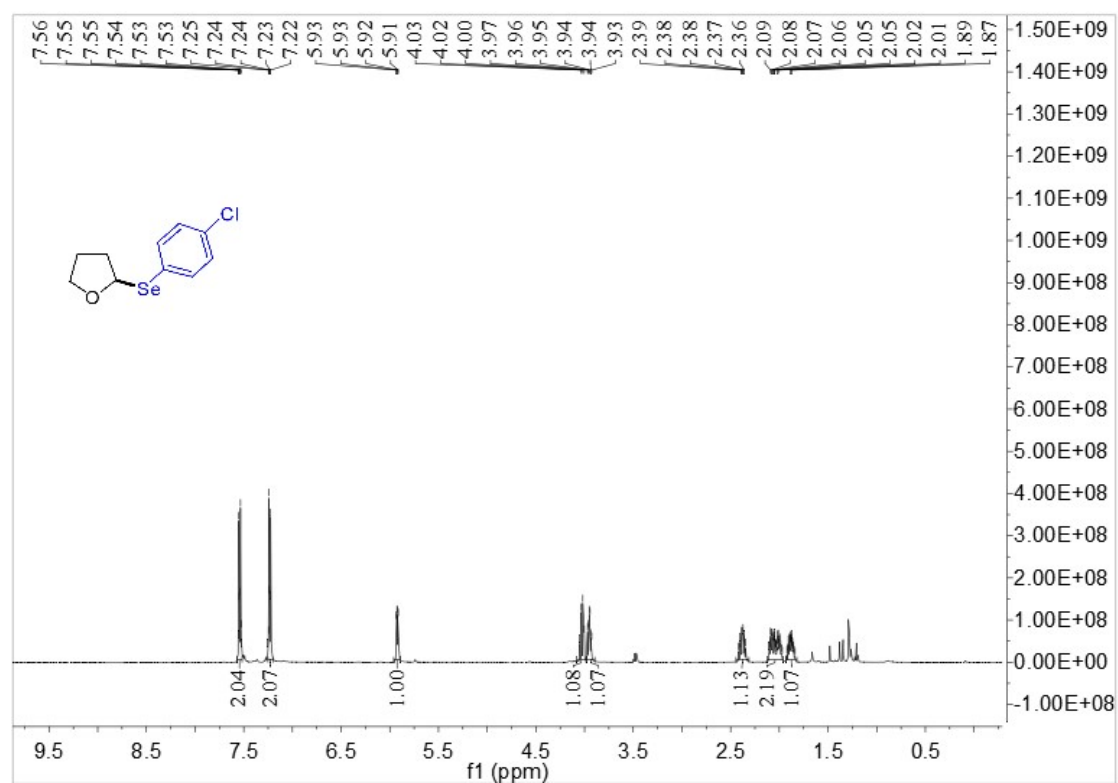
## VI. $^1\text{H}$ NMR, $^{13}\text{C}$ NMR and $^{19}\text{F}$ NMR spectra copies of compounds 3

### Compound 3a

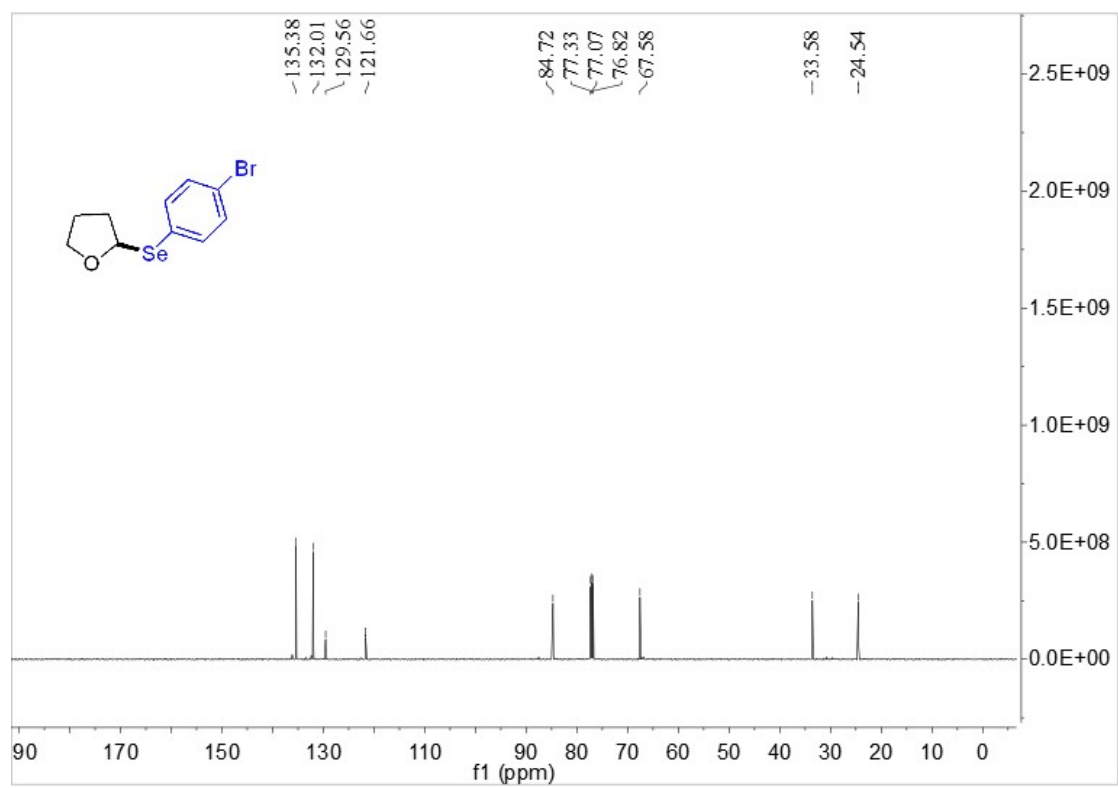
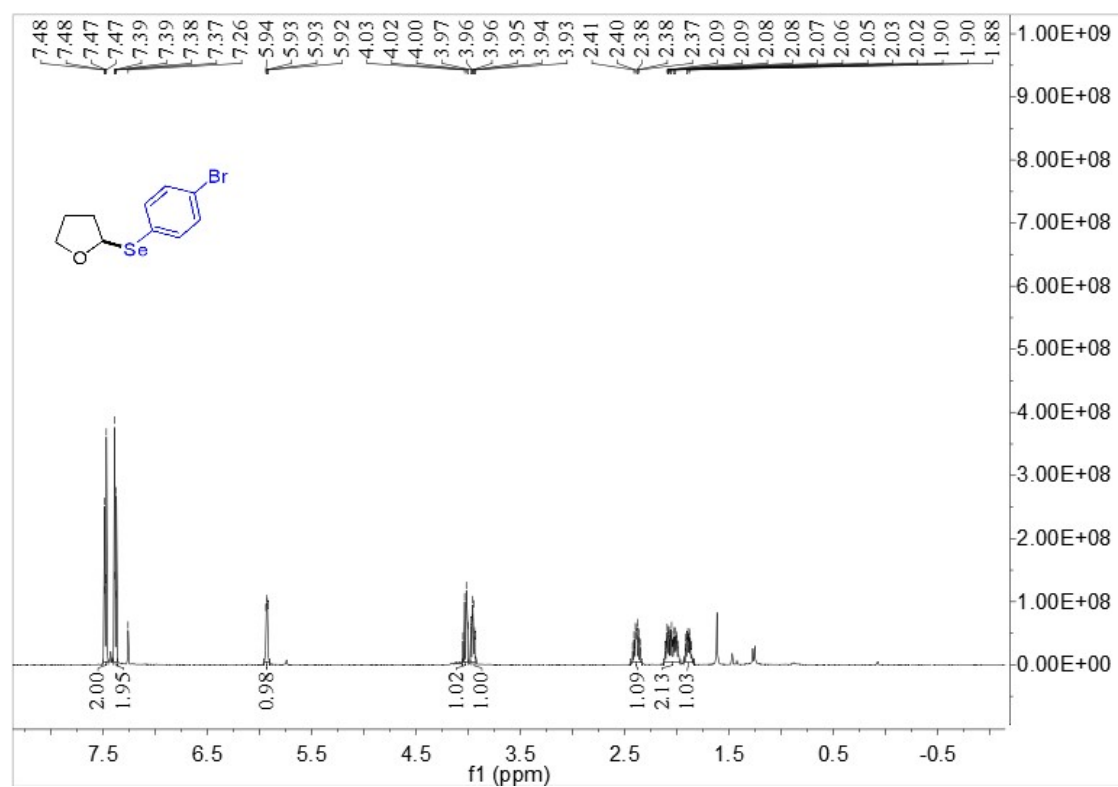




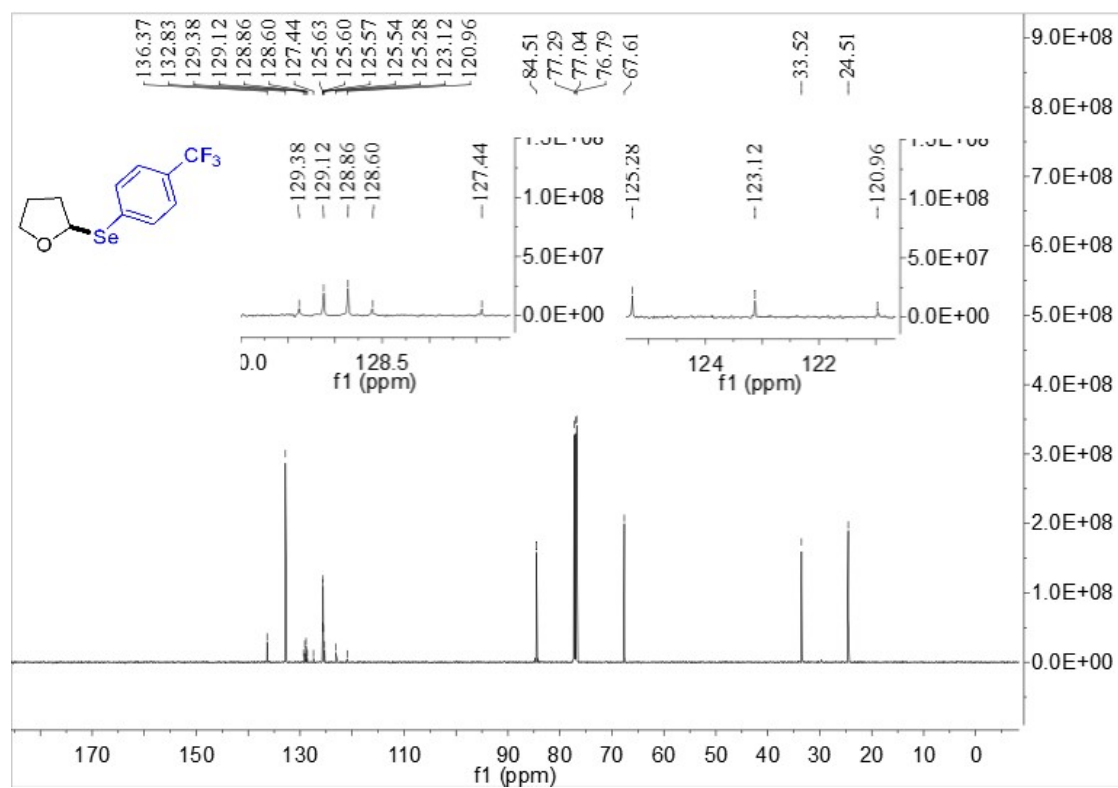
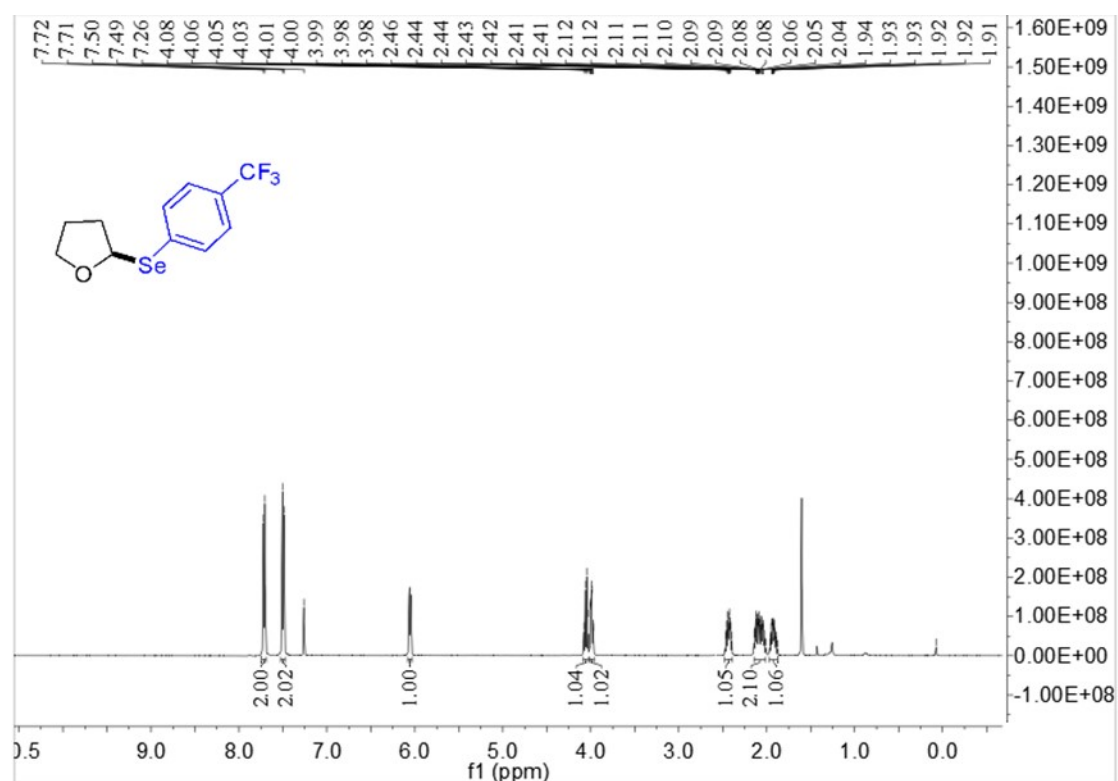
**Compound 3b**

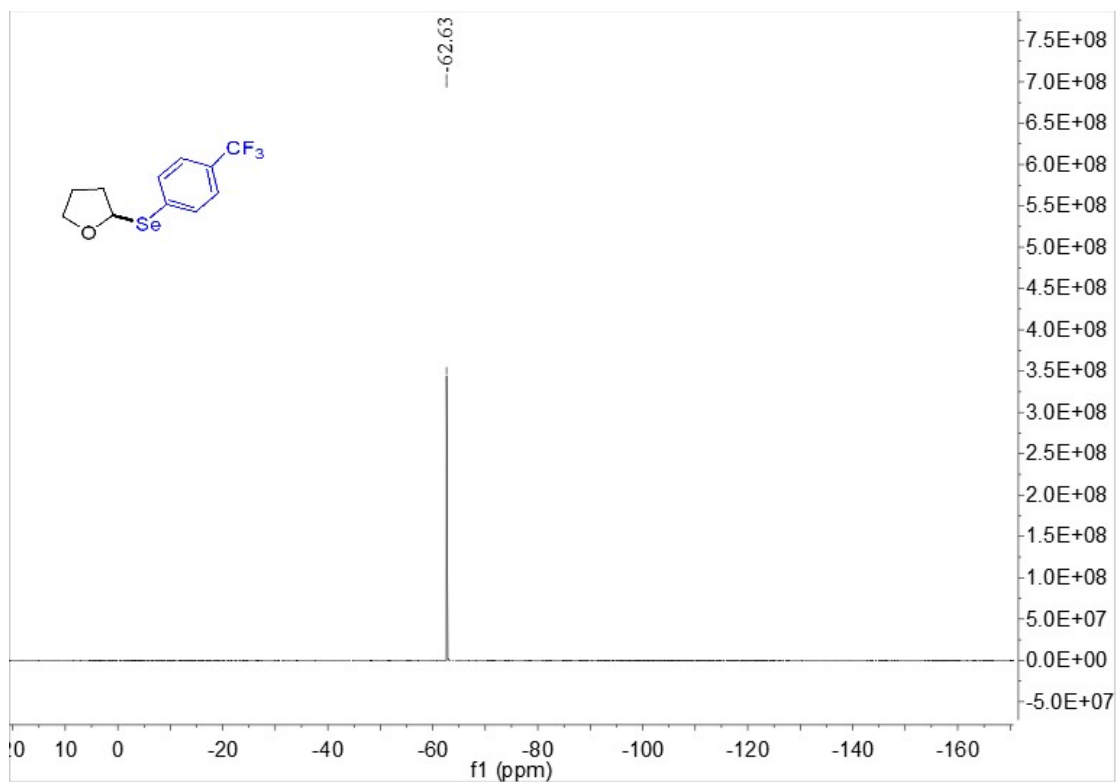


### Compound 3c

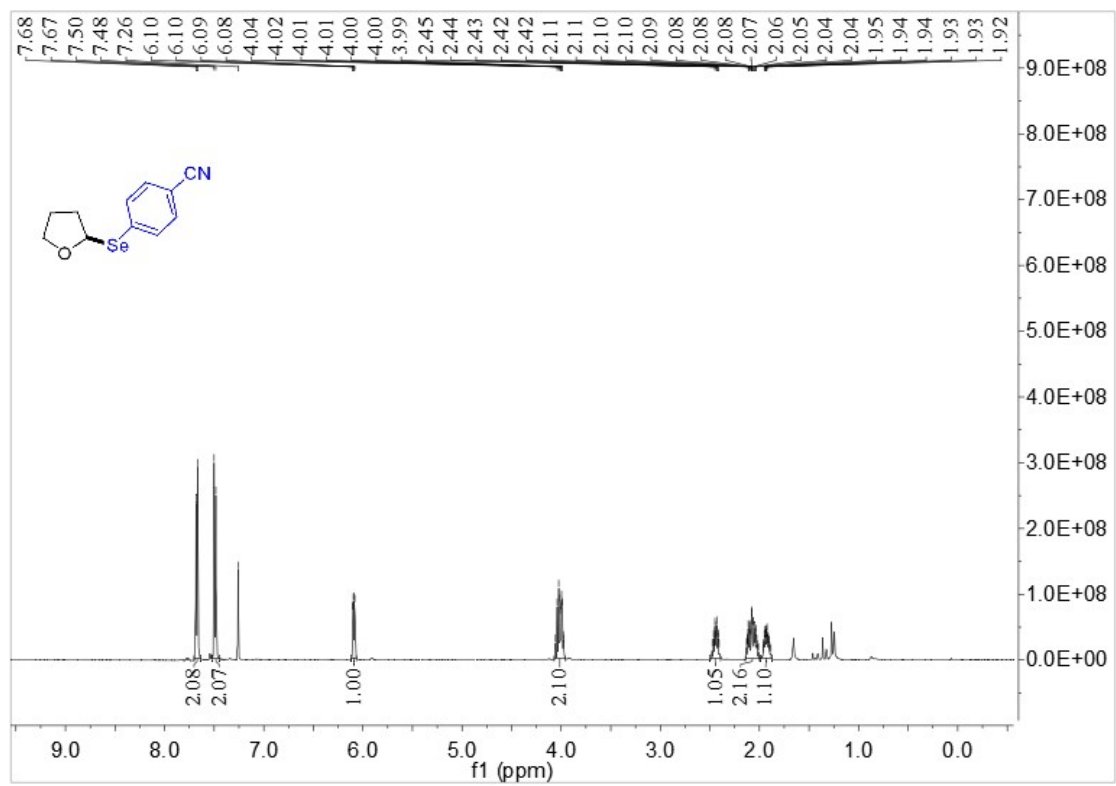


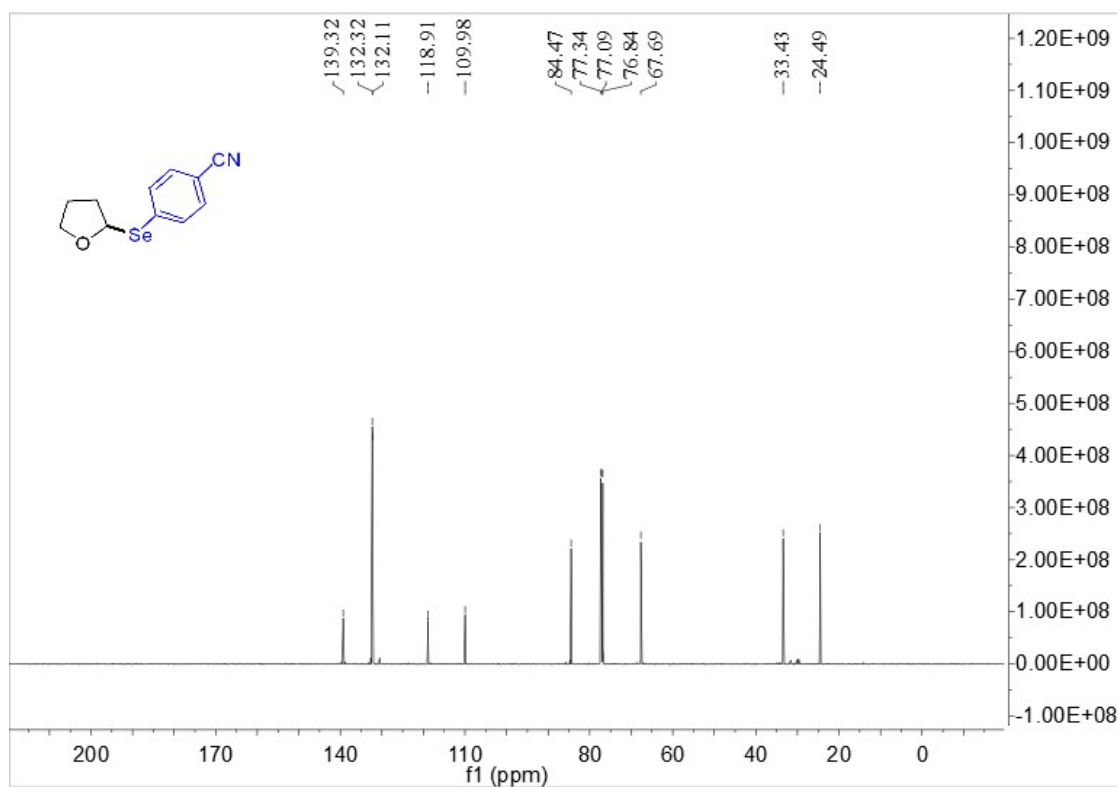
**Compound 3d**



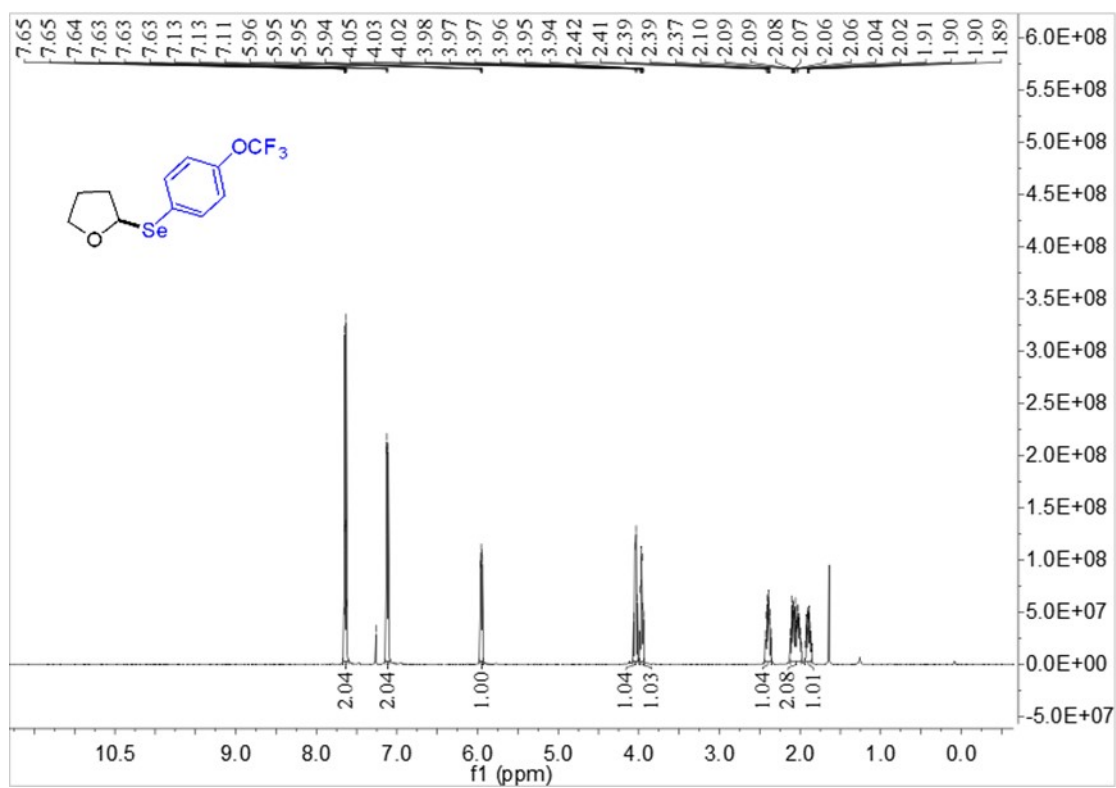


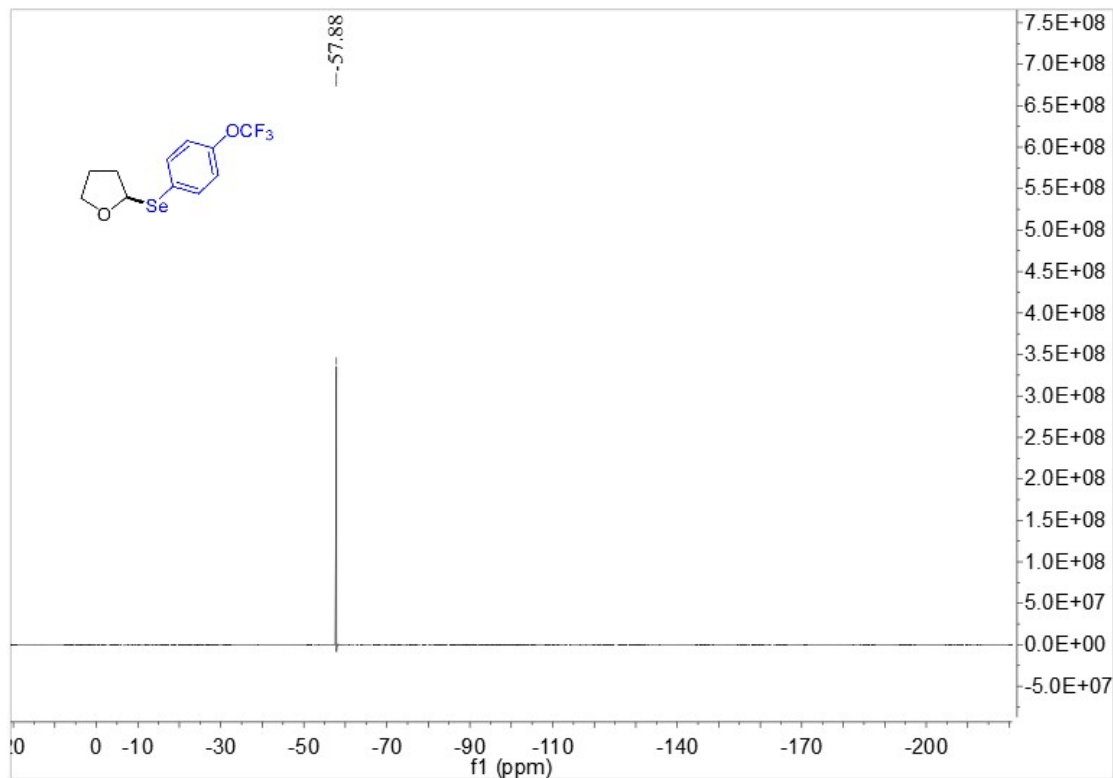
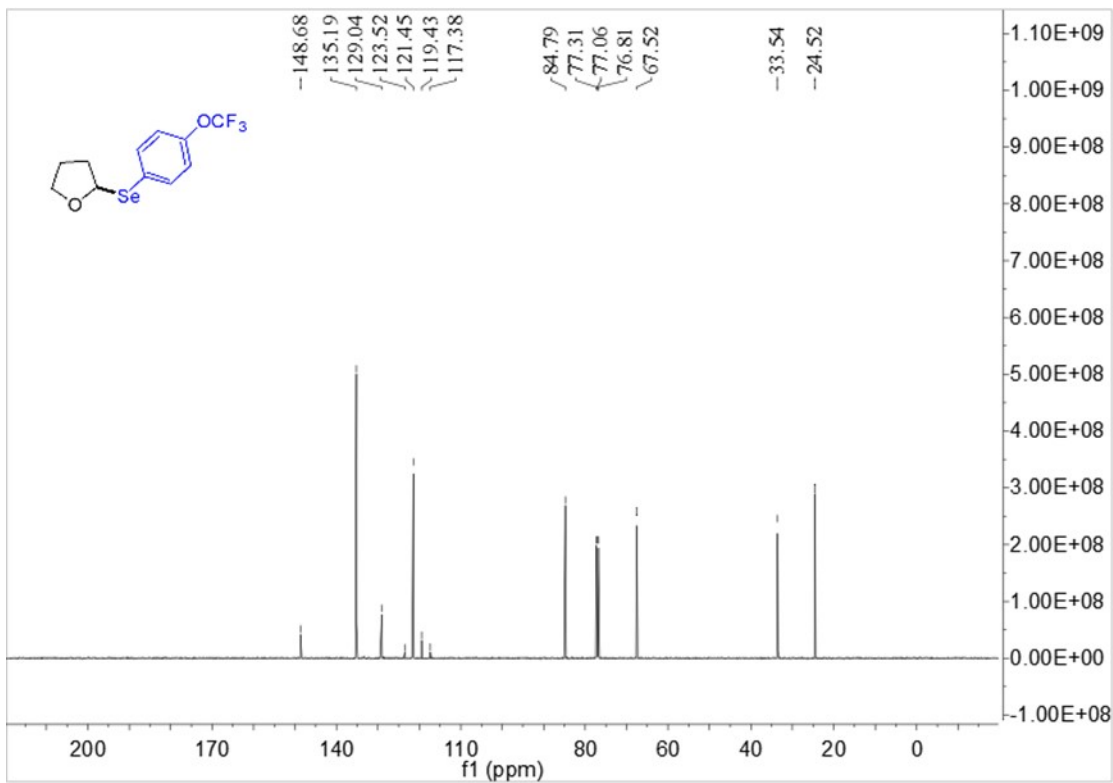
### Compound 3e



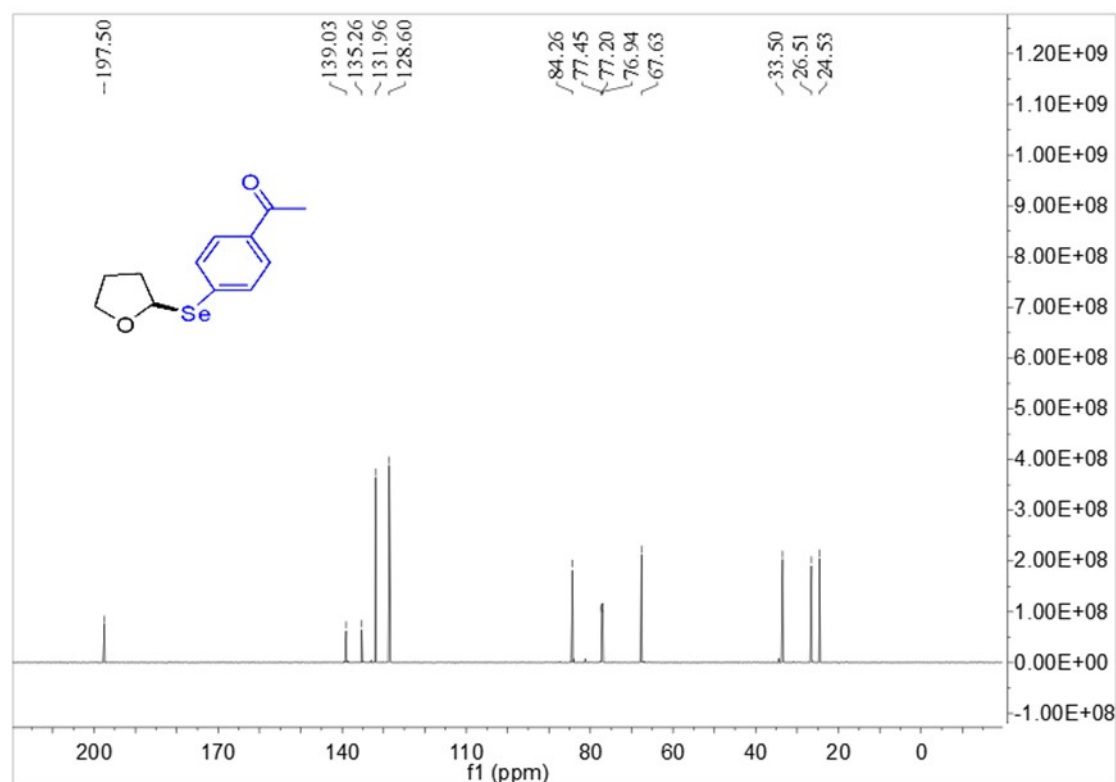
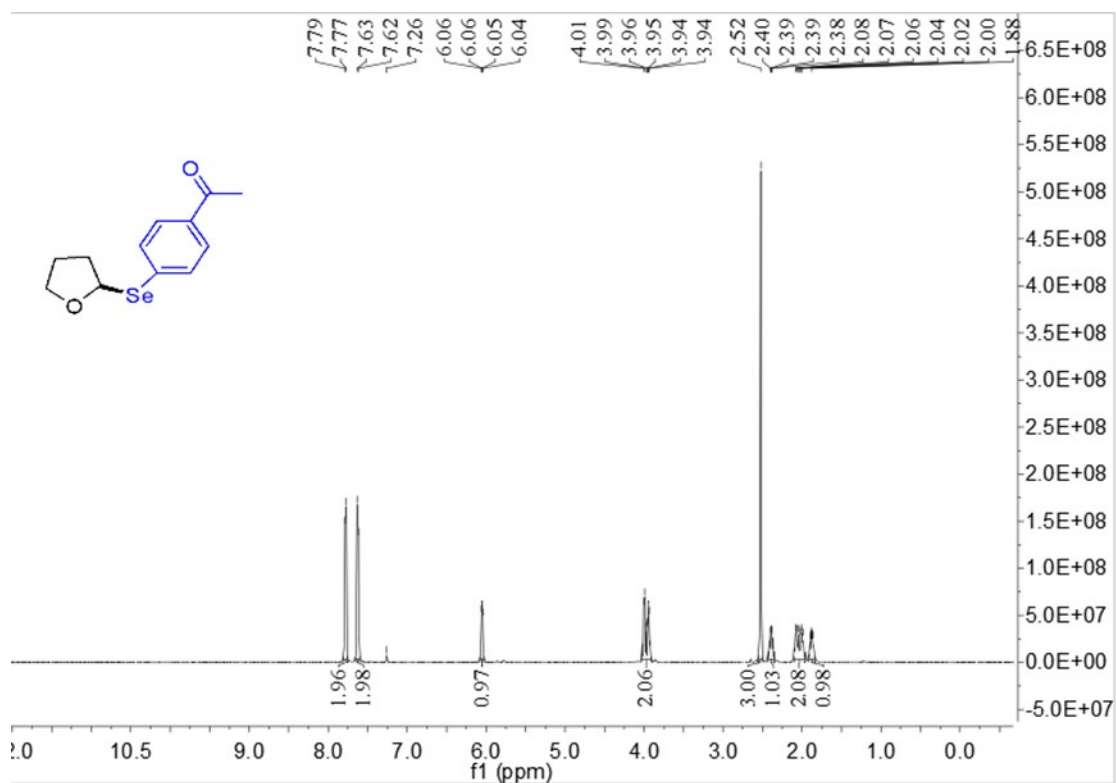


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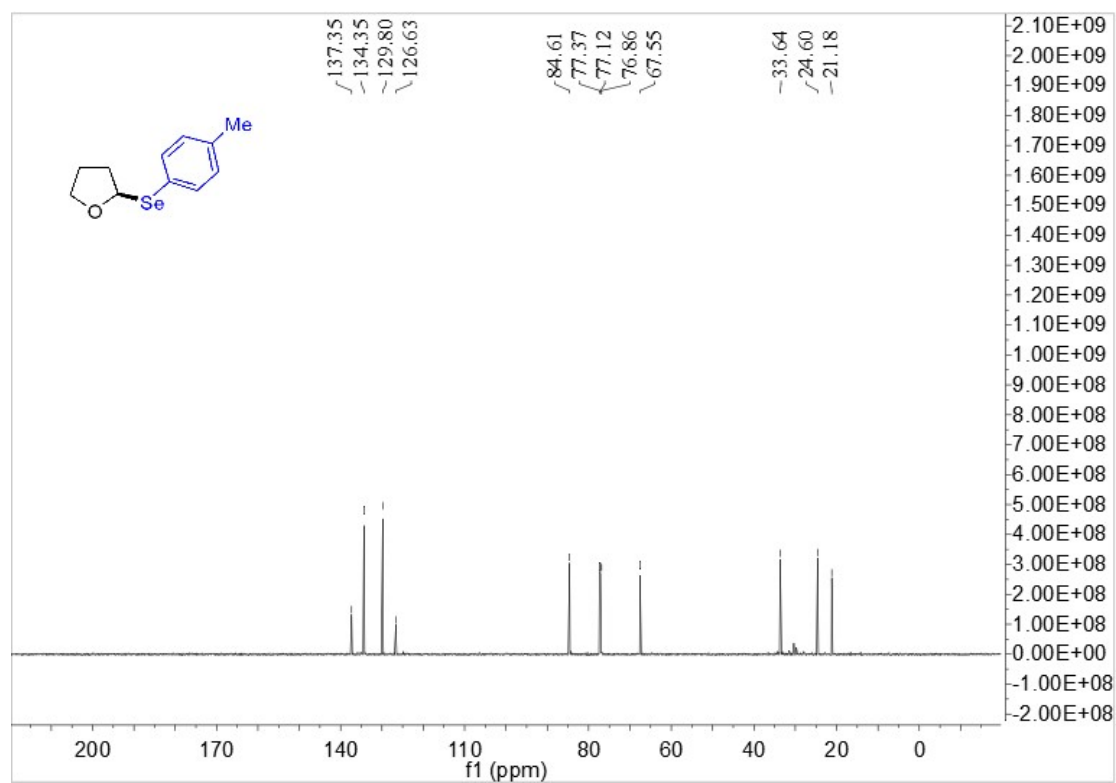
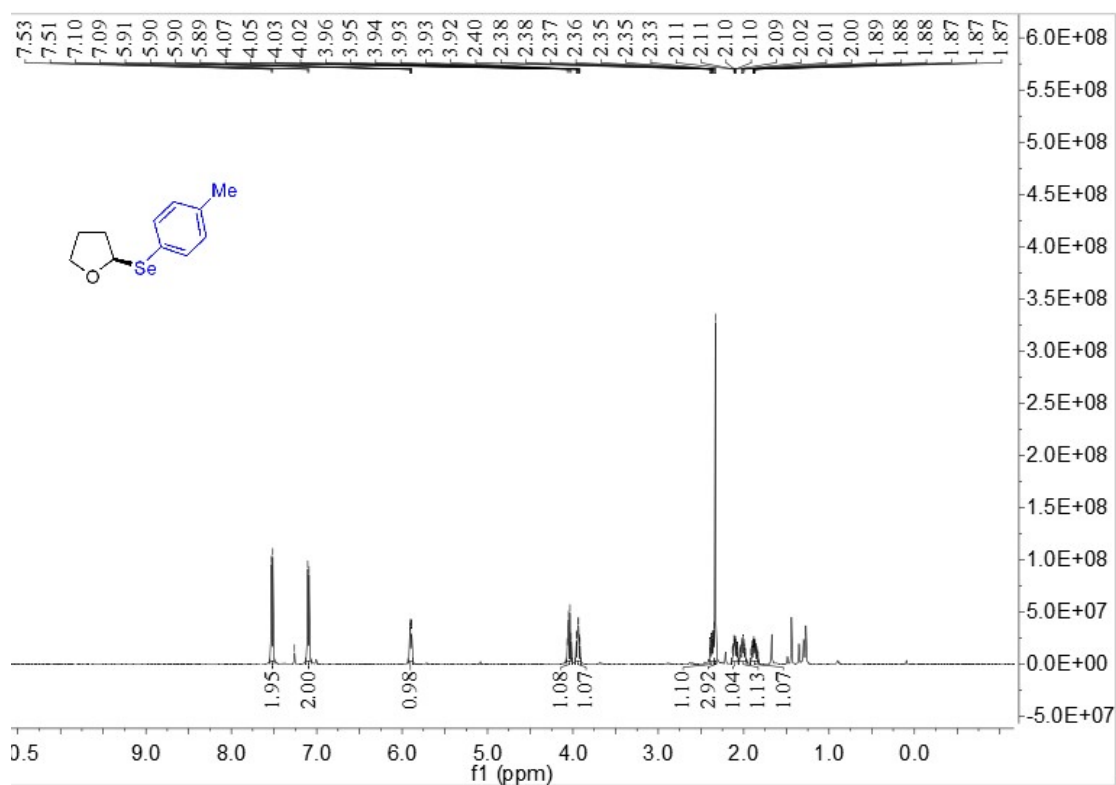




**Compound 3g**

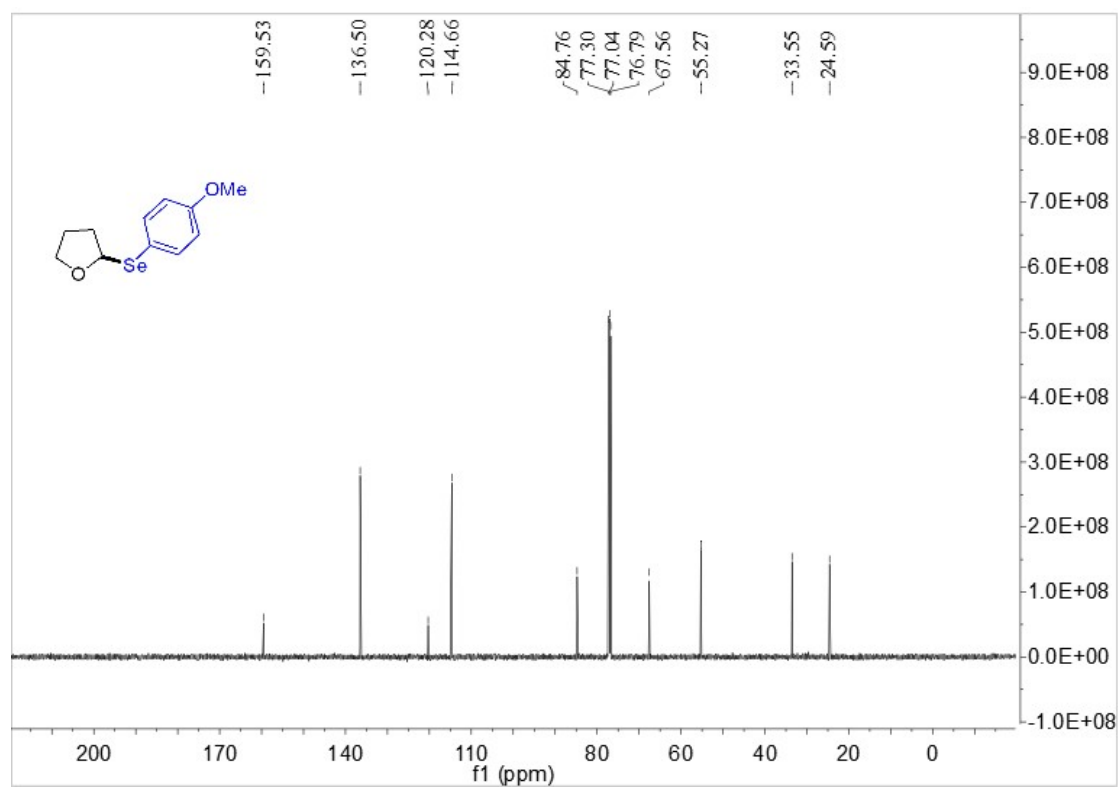
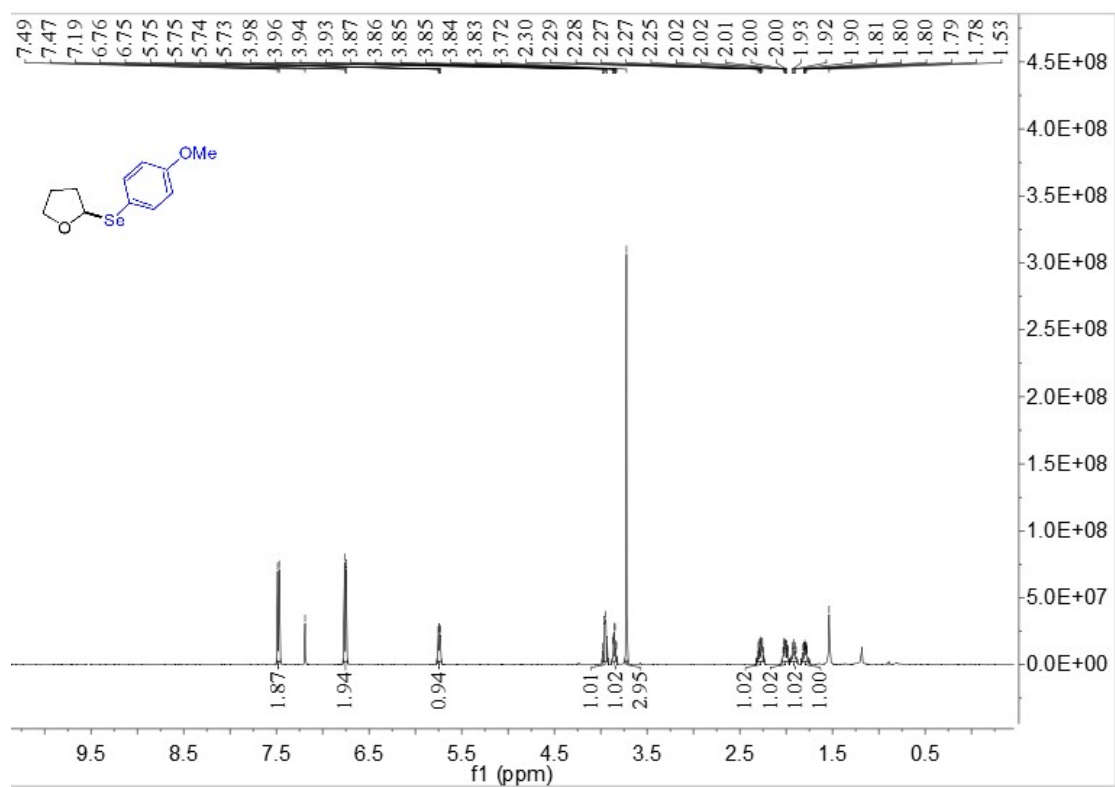


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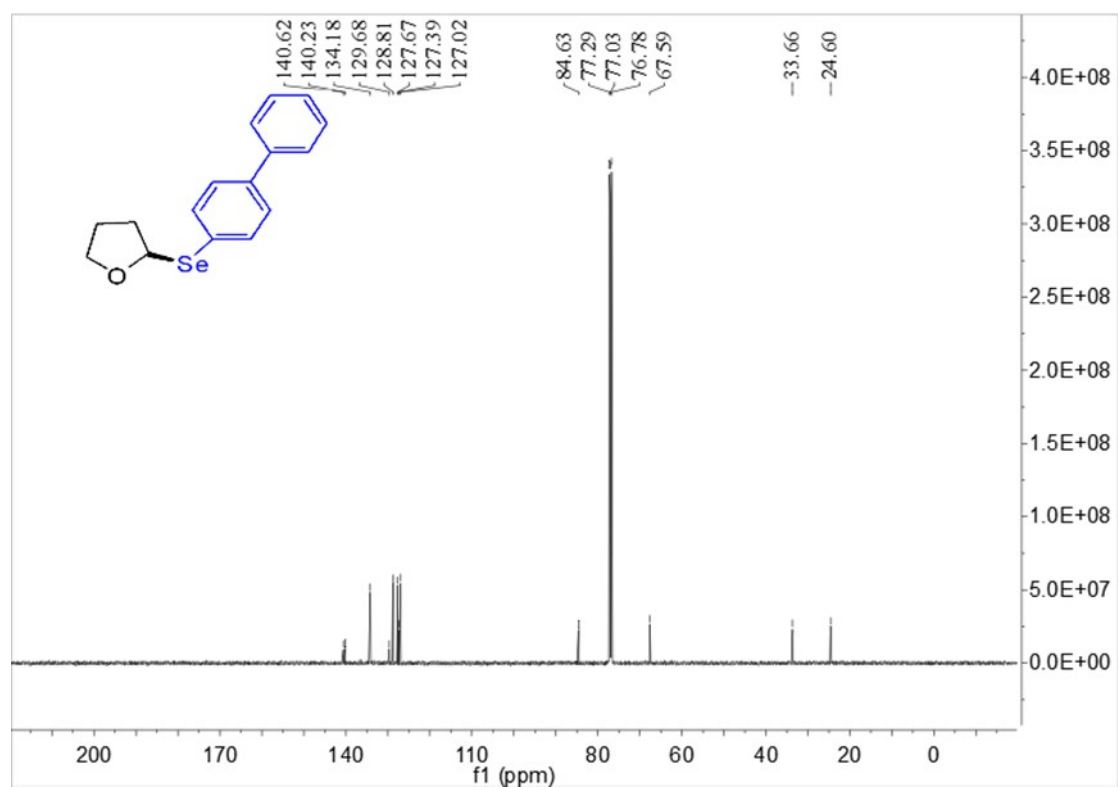
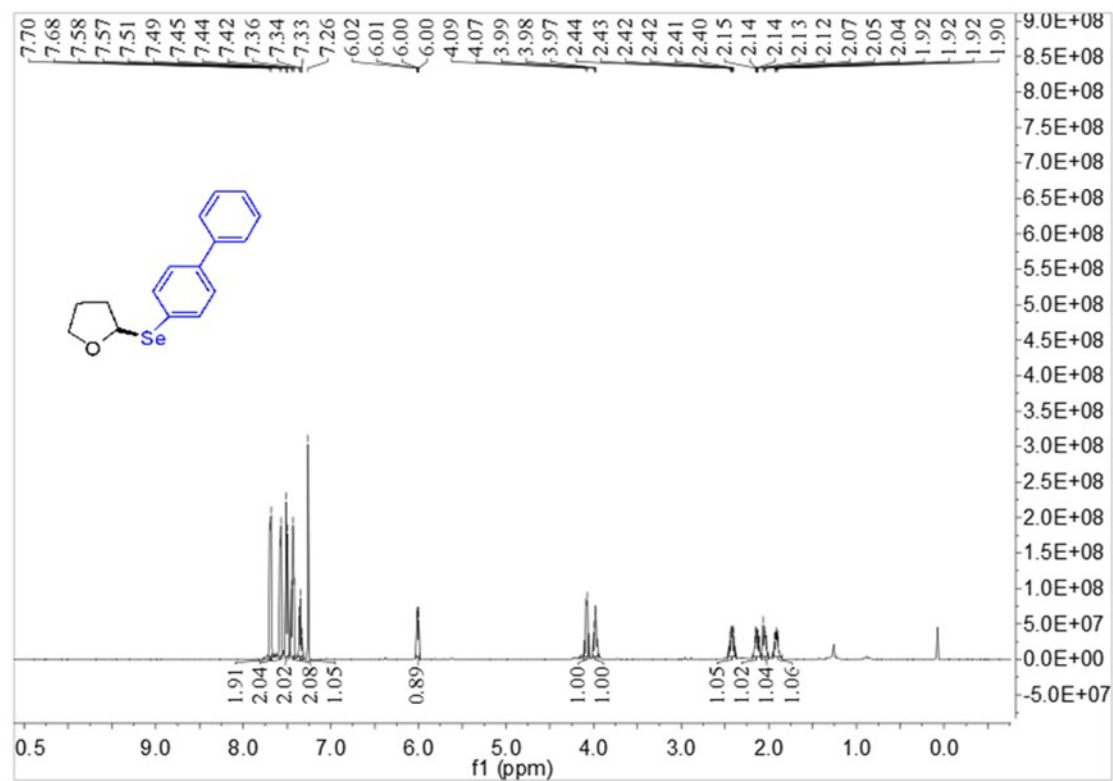




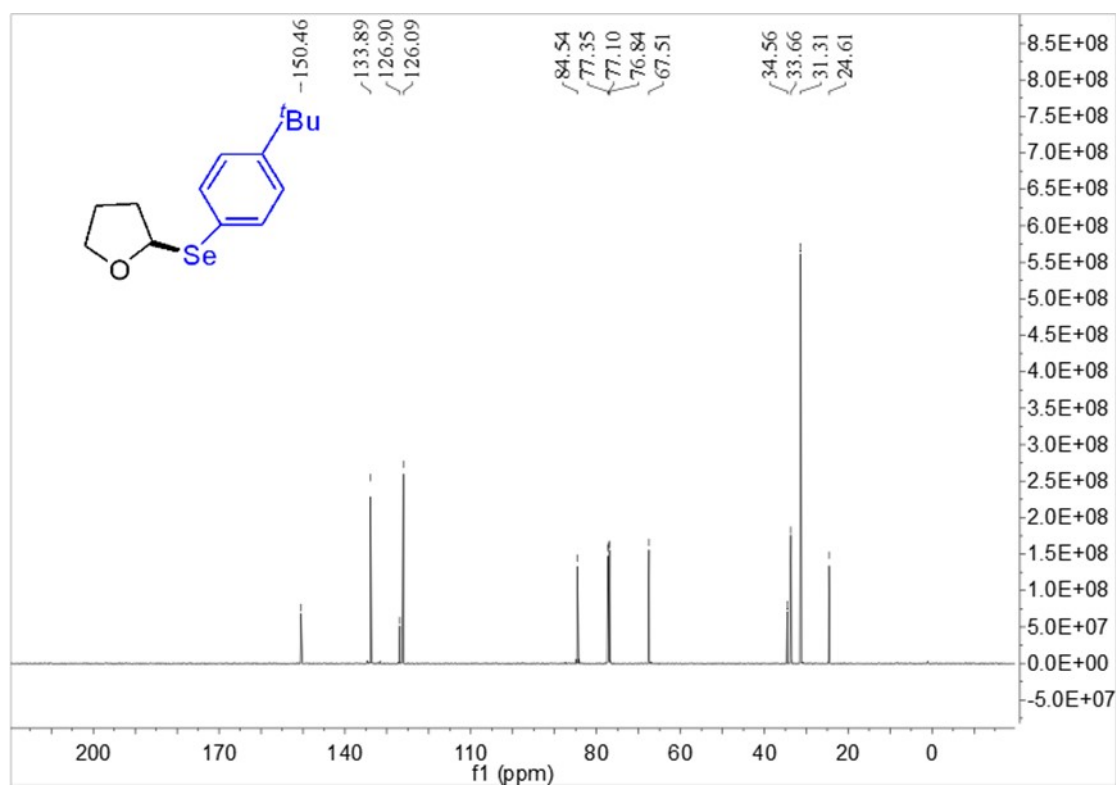
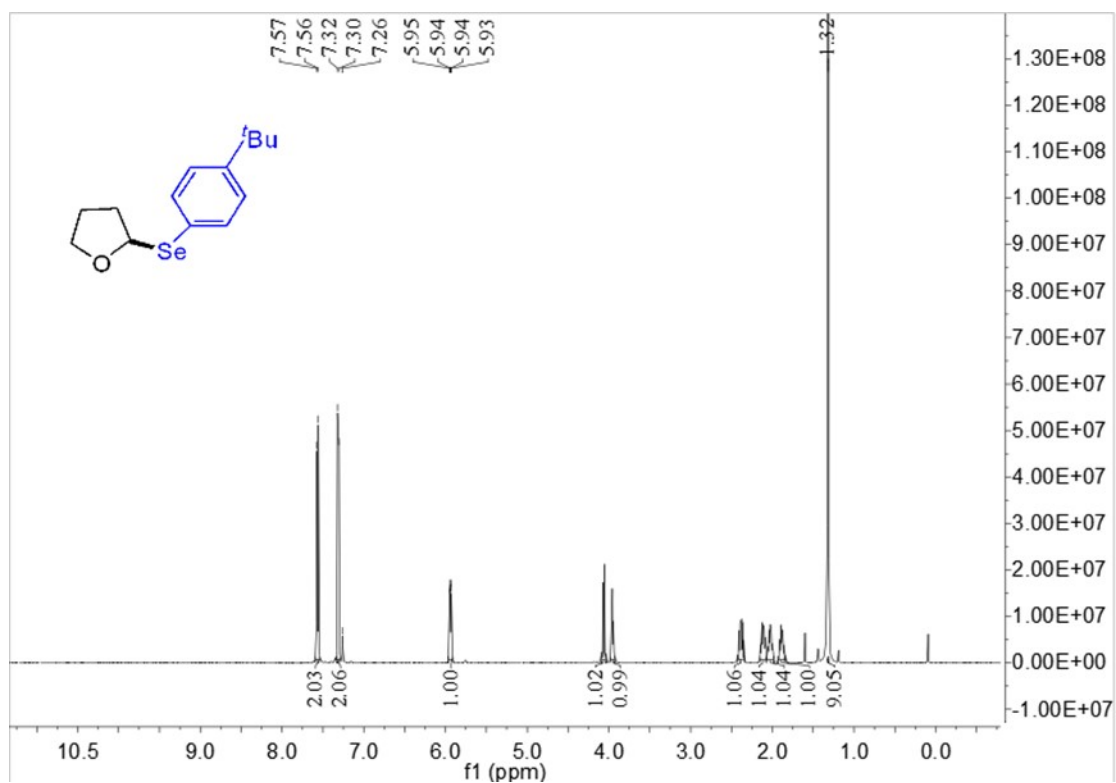
### Compound 3i



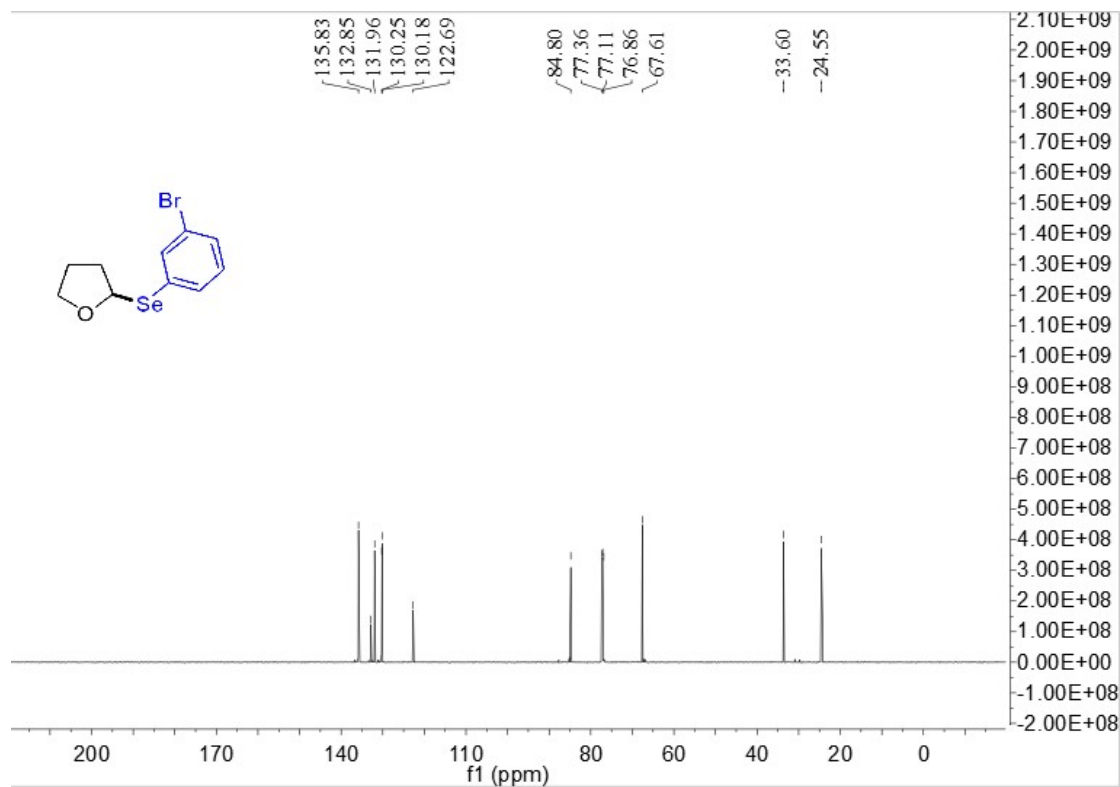
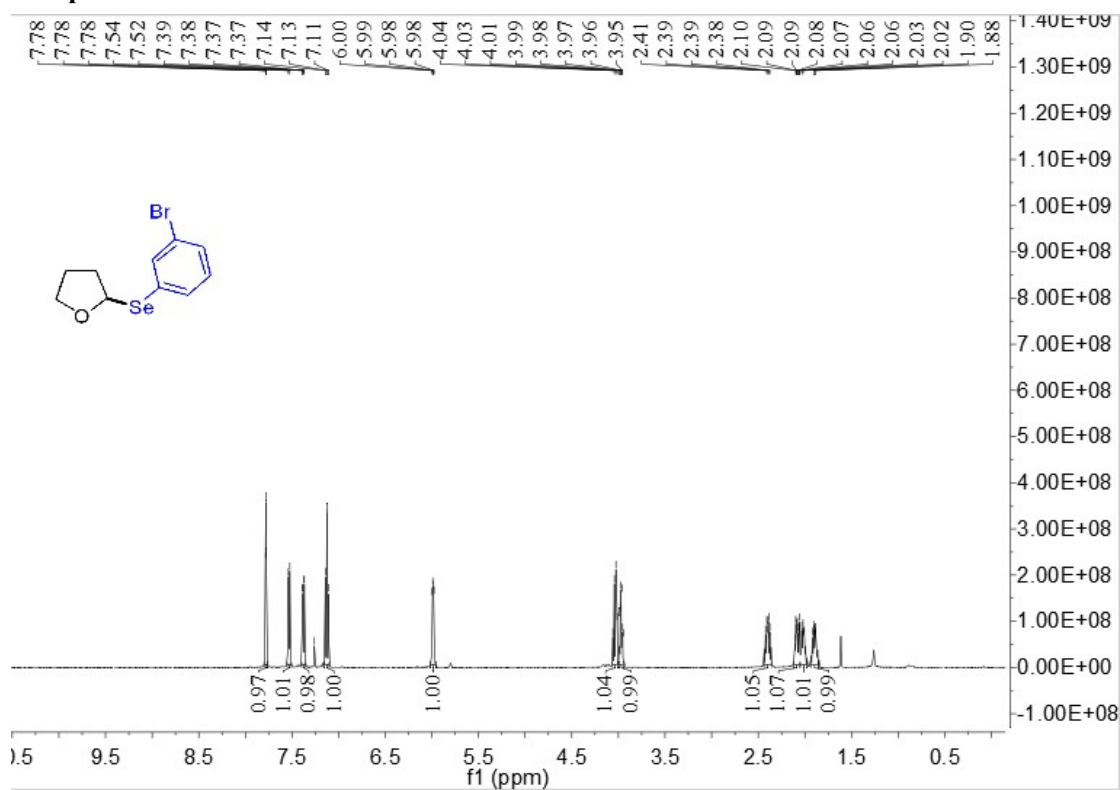
**Compound 3j**



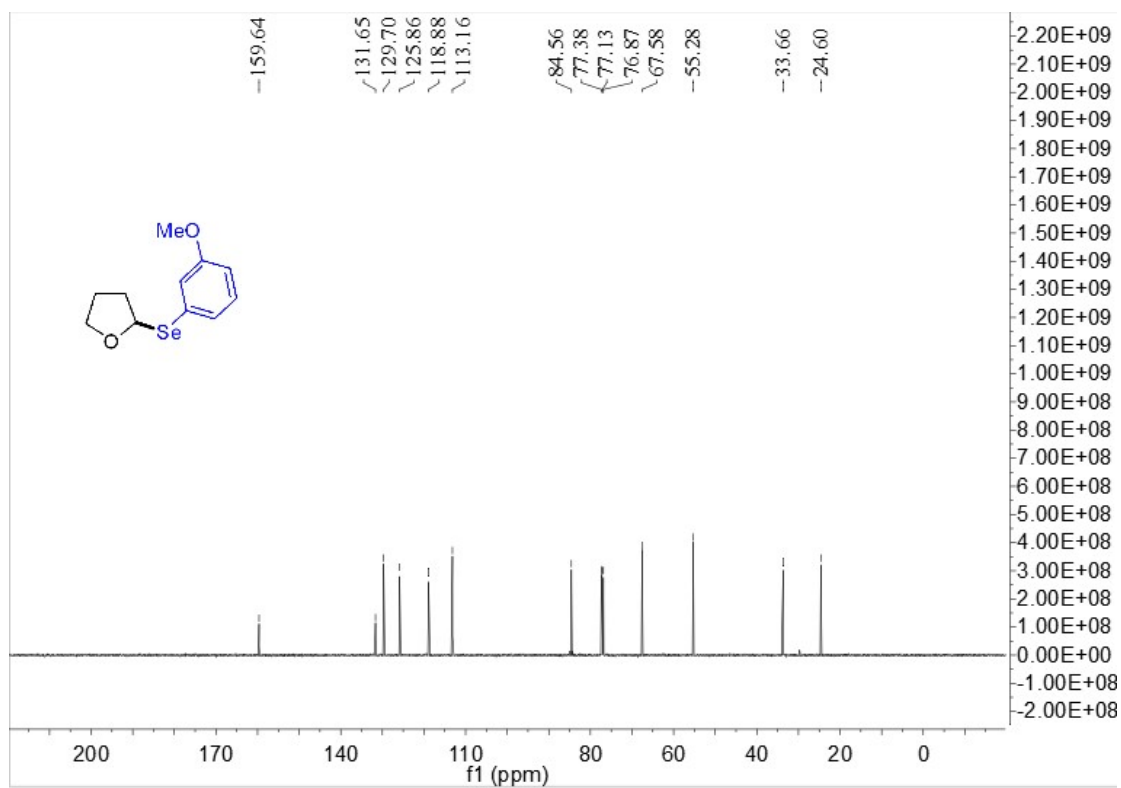
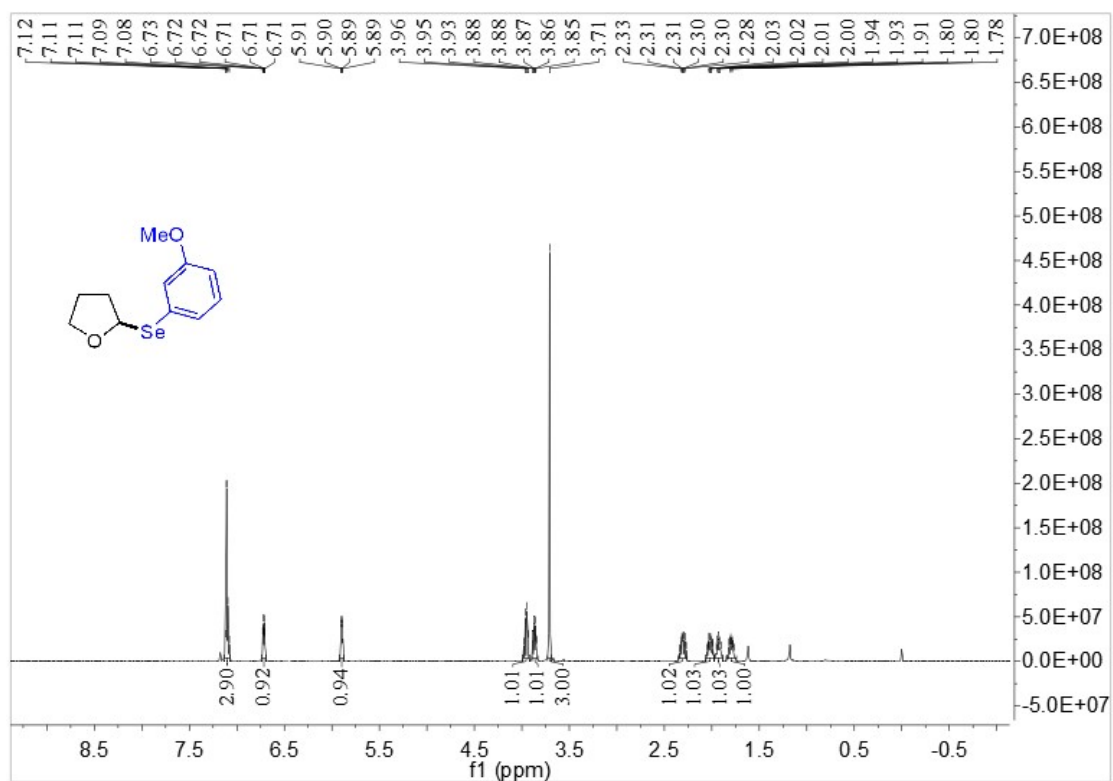
**Compound 3k**



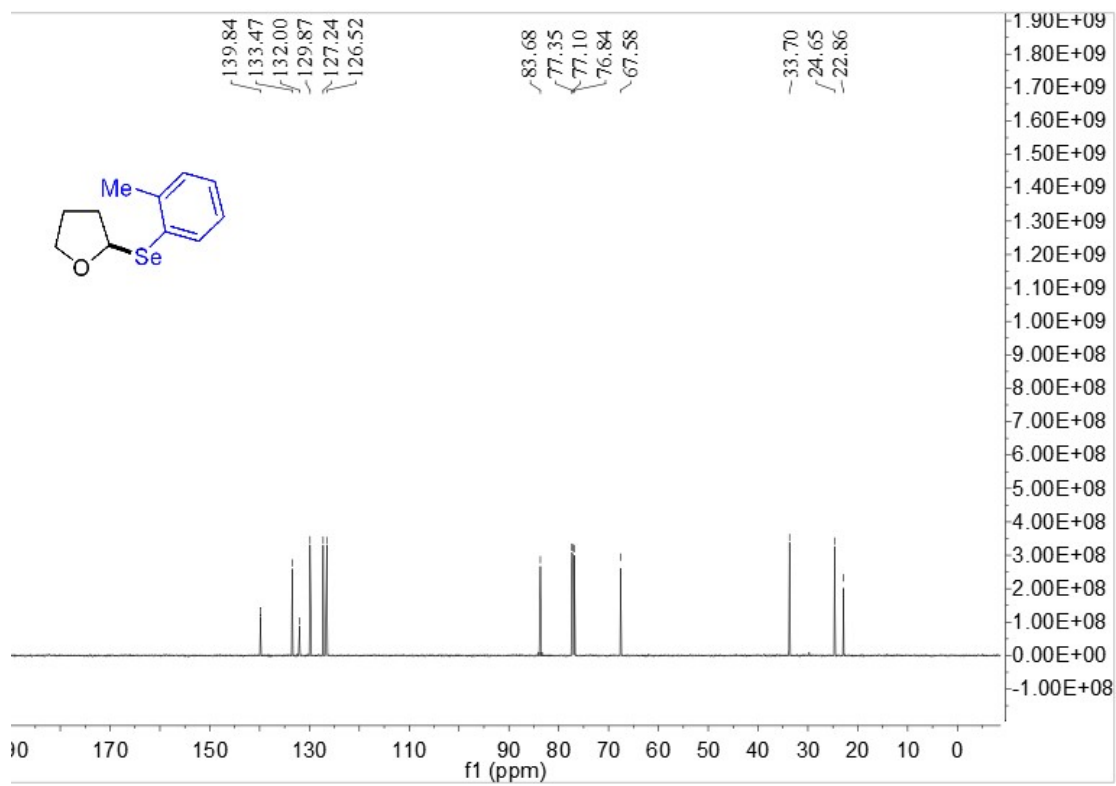
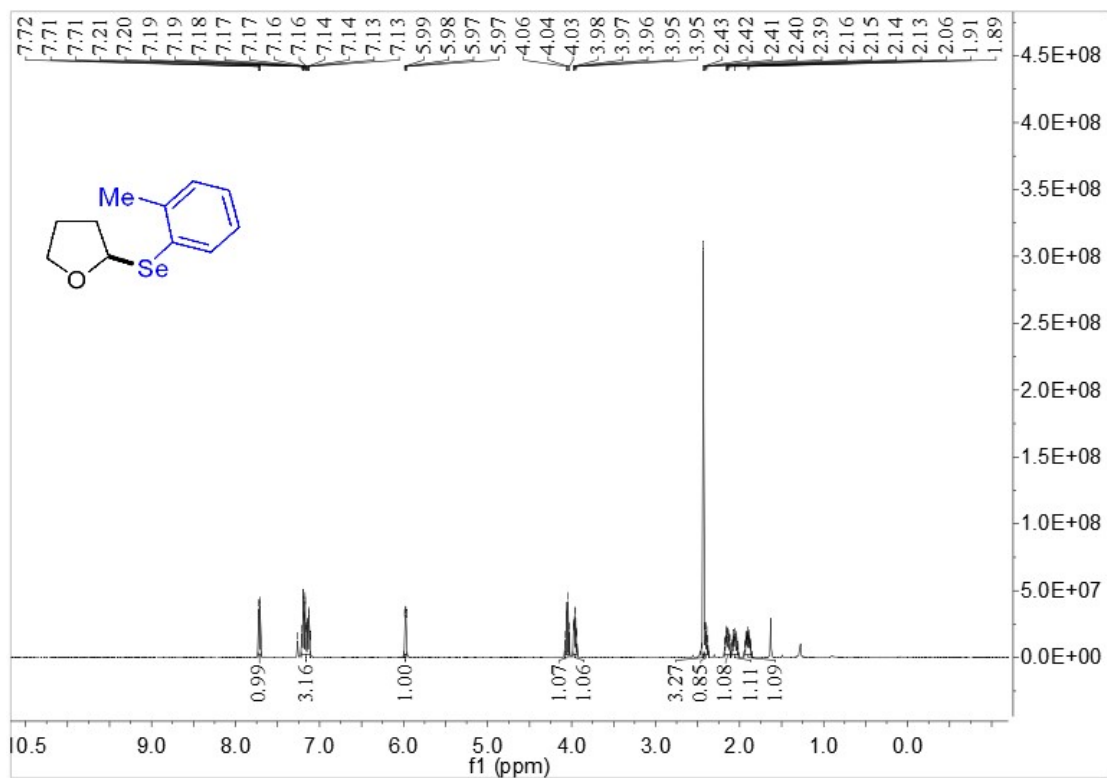
**Compound 3l**



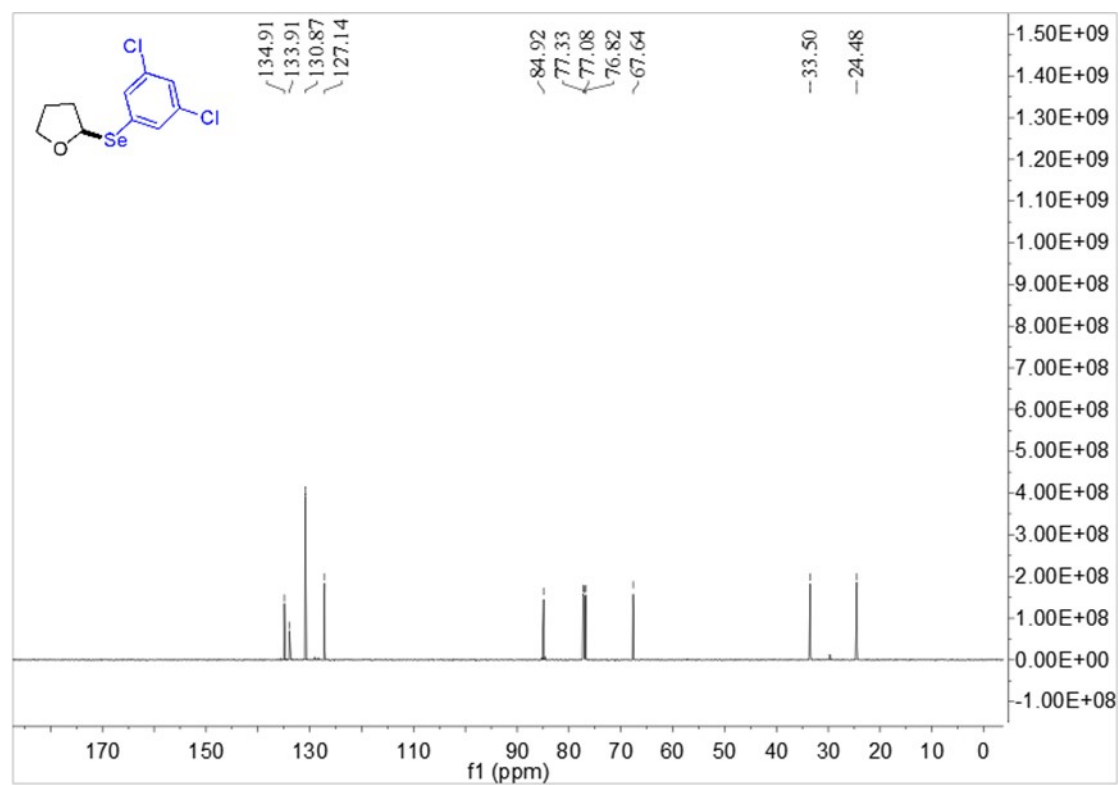
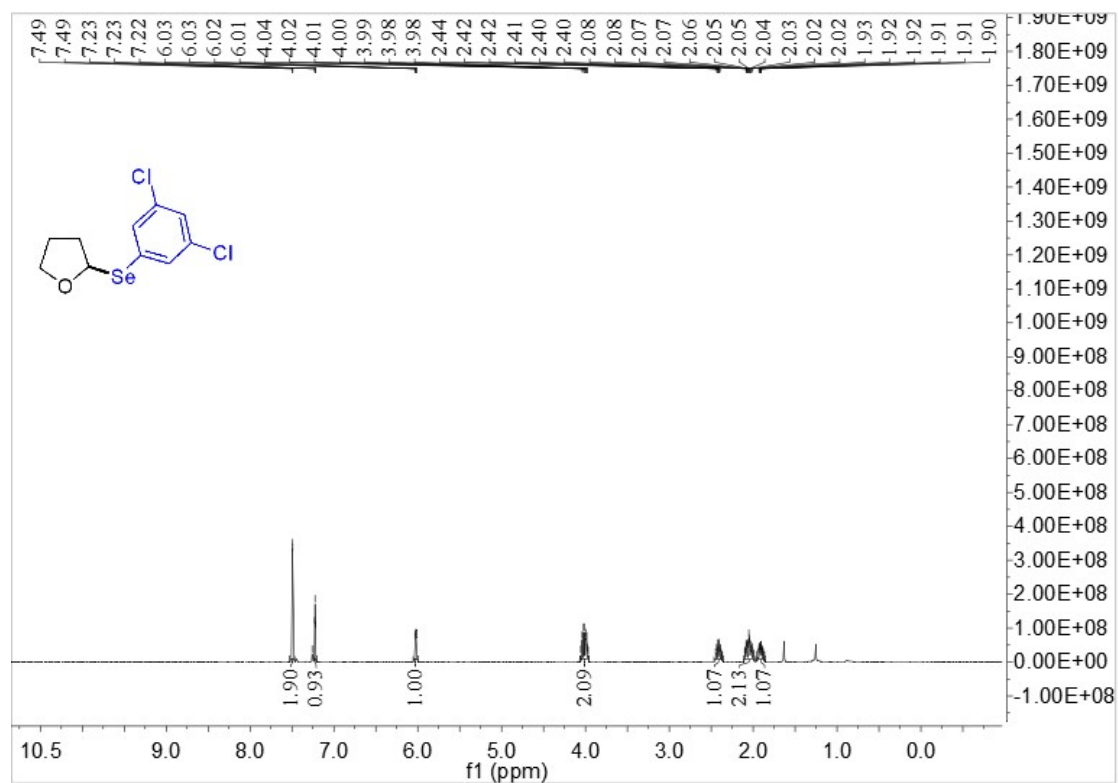
**Compound 3m**



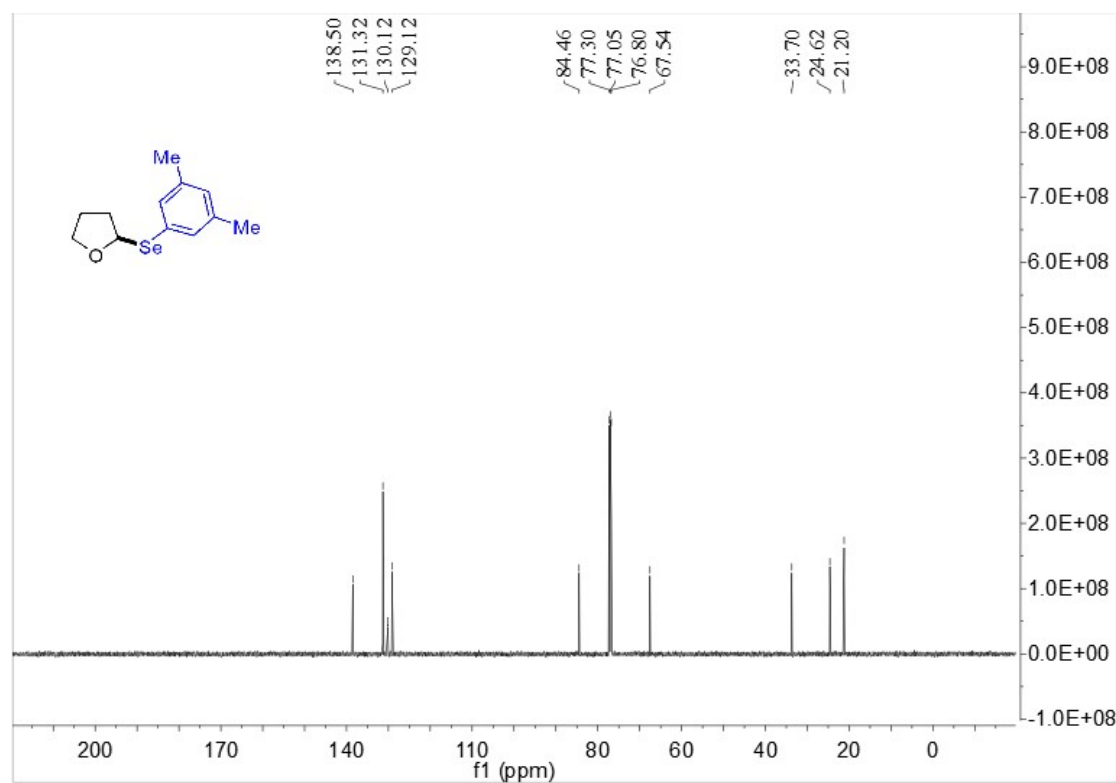
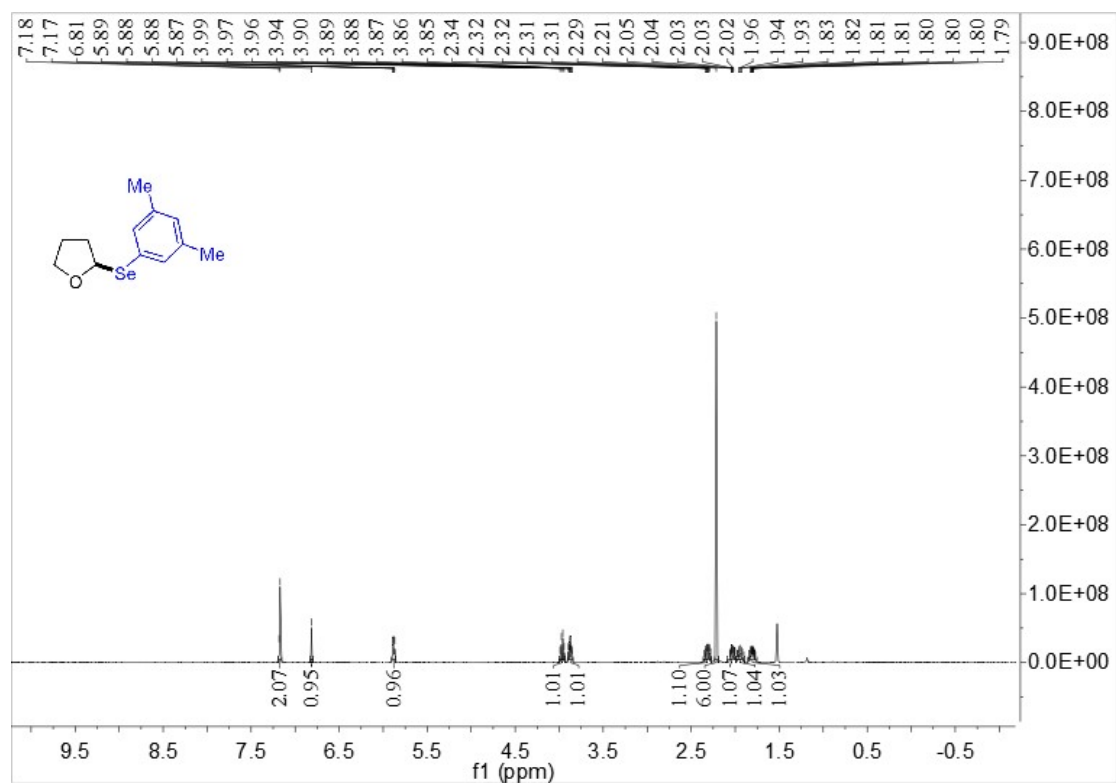
**Compound 3n**



**Compound 3o**

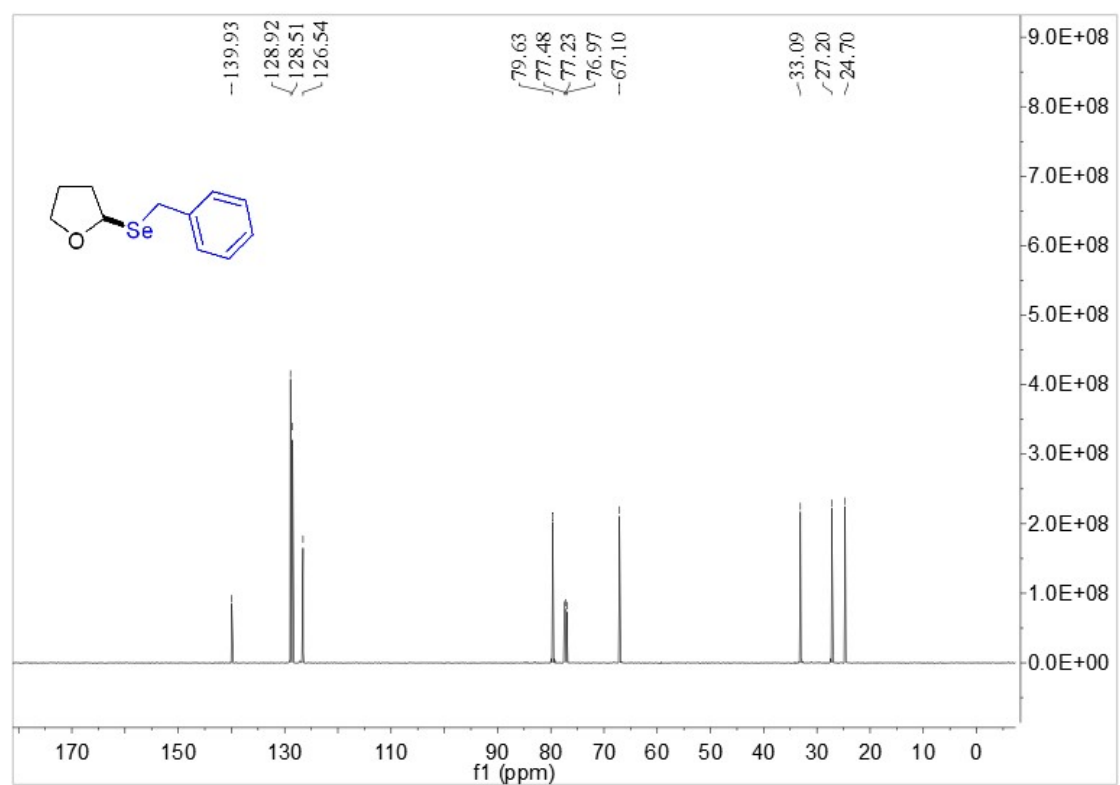
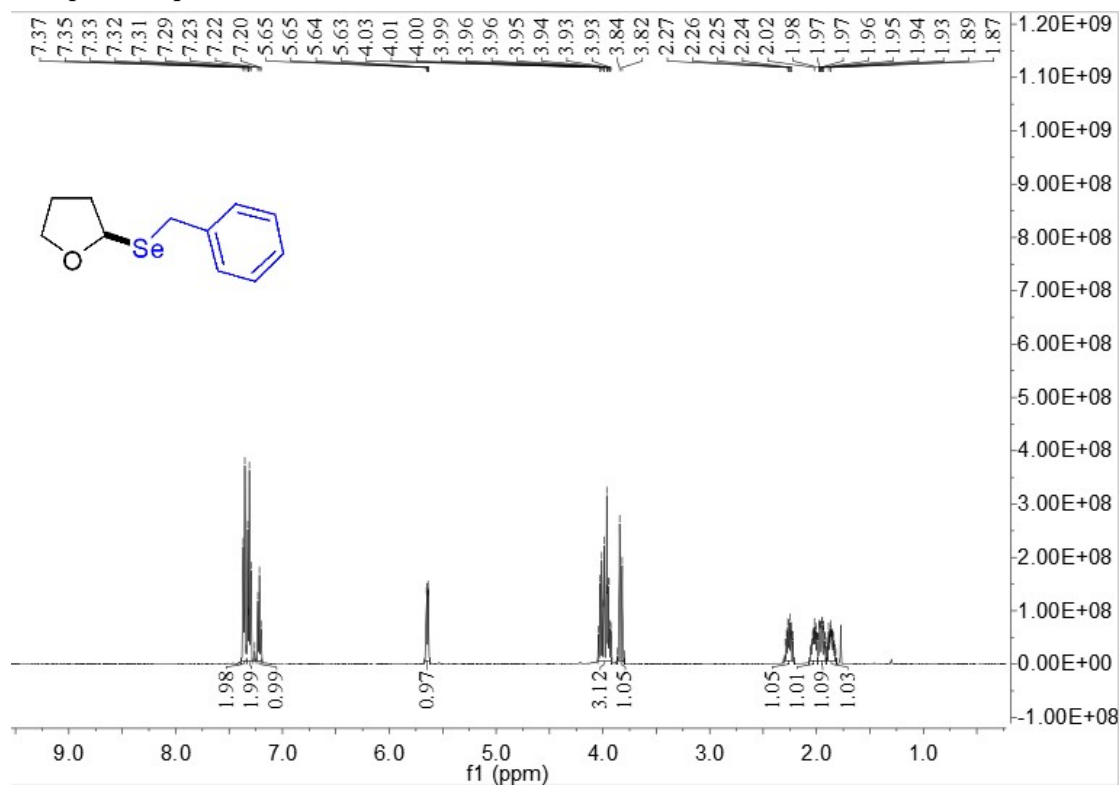


**Compound 3p**

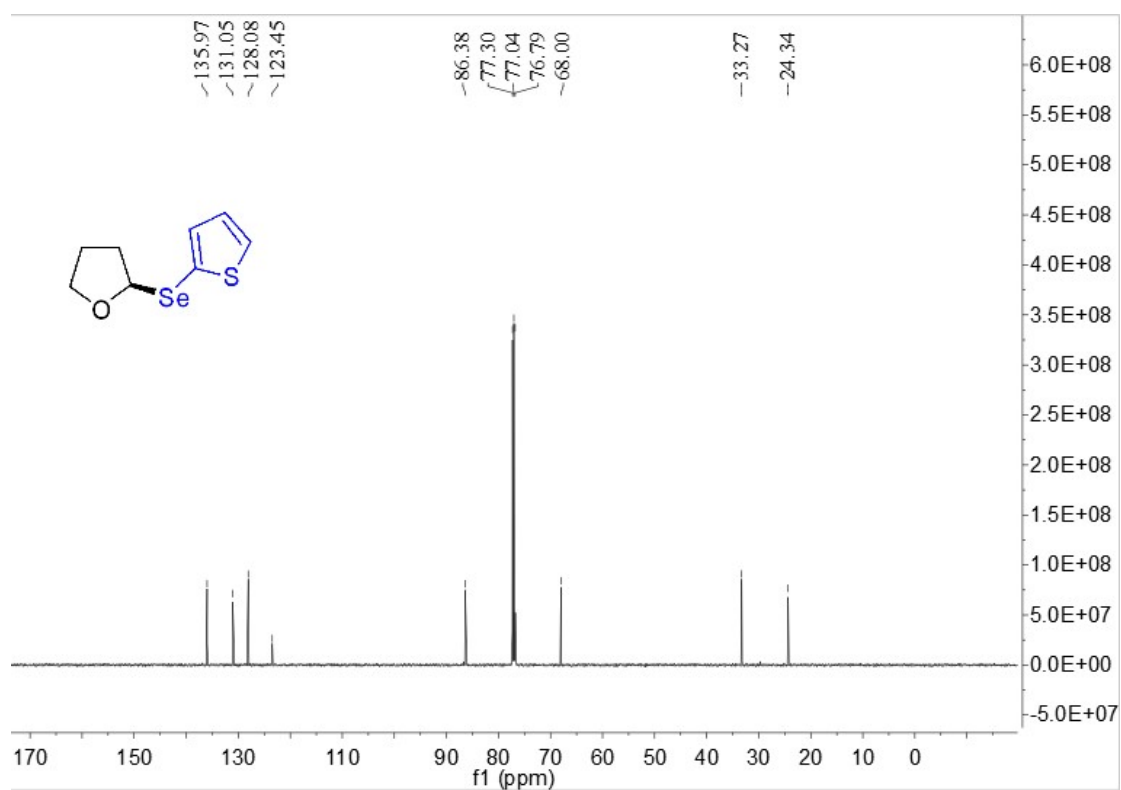
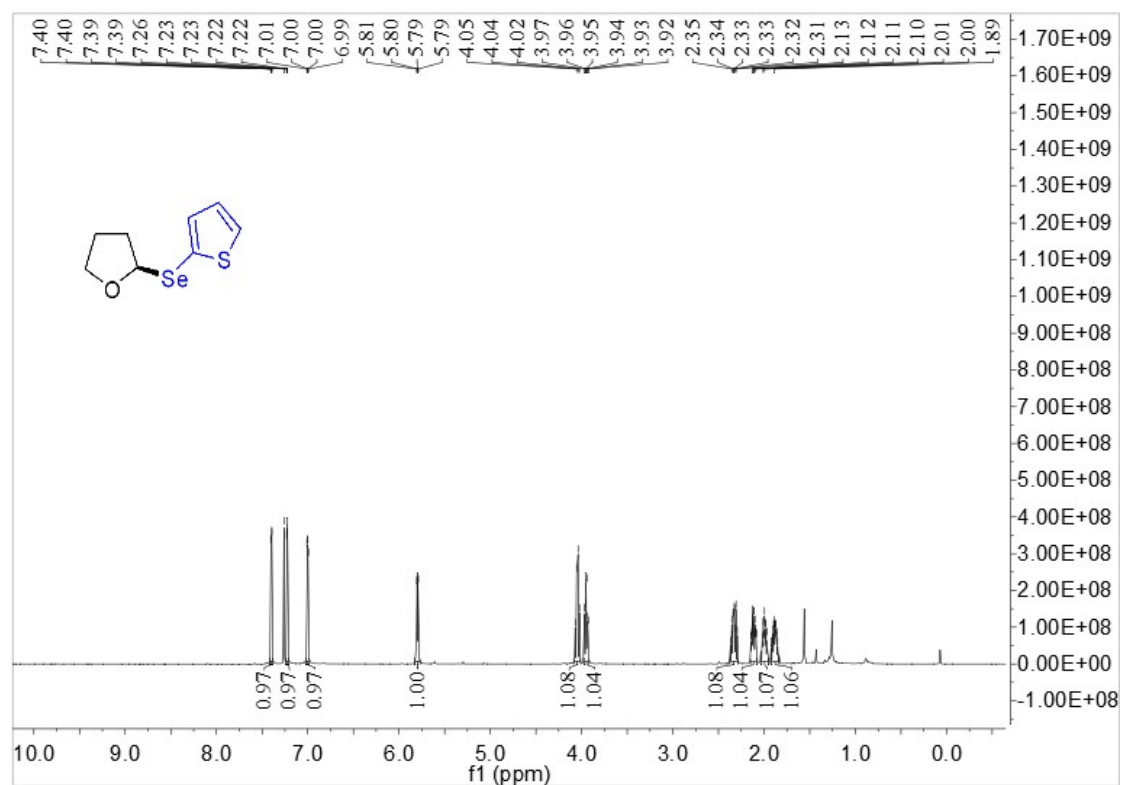




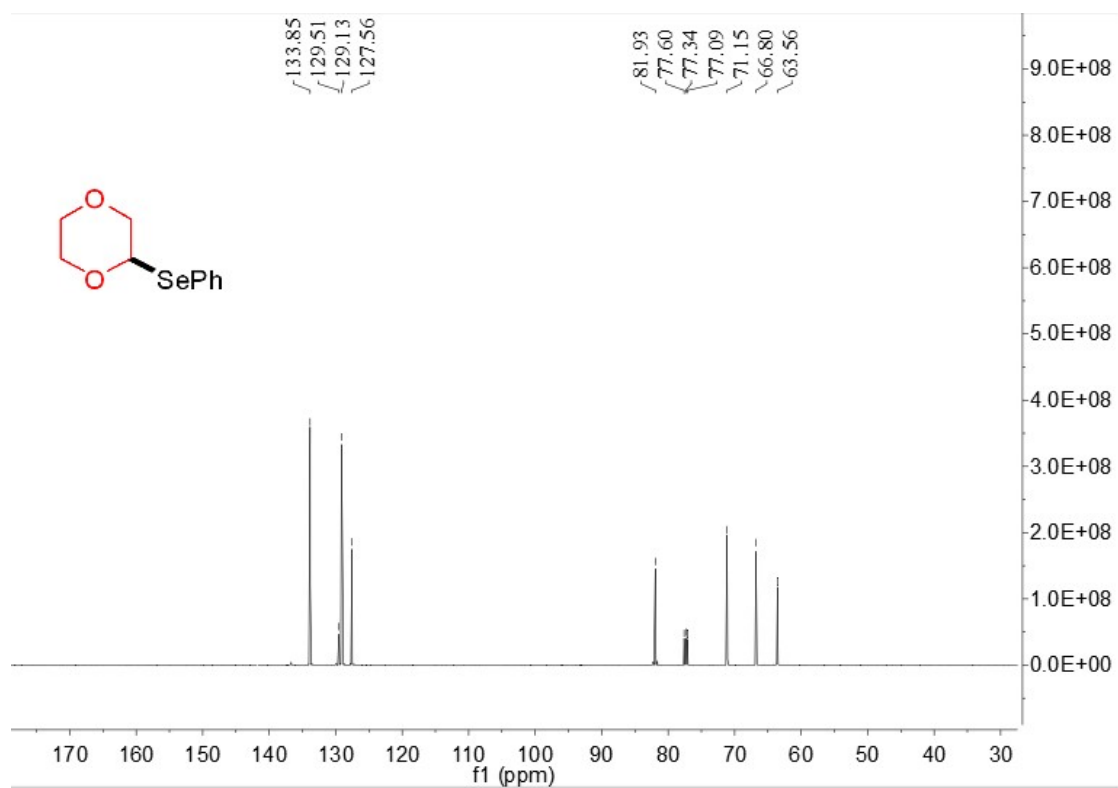
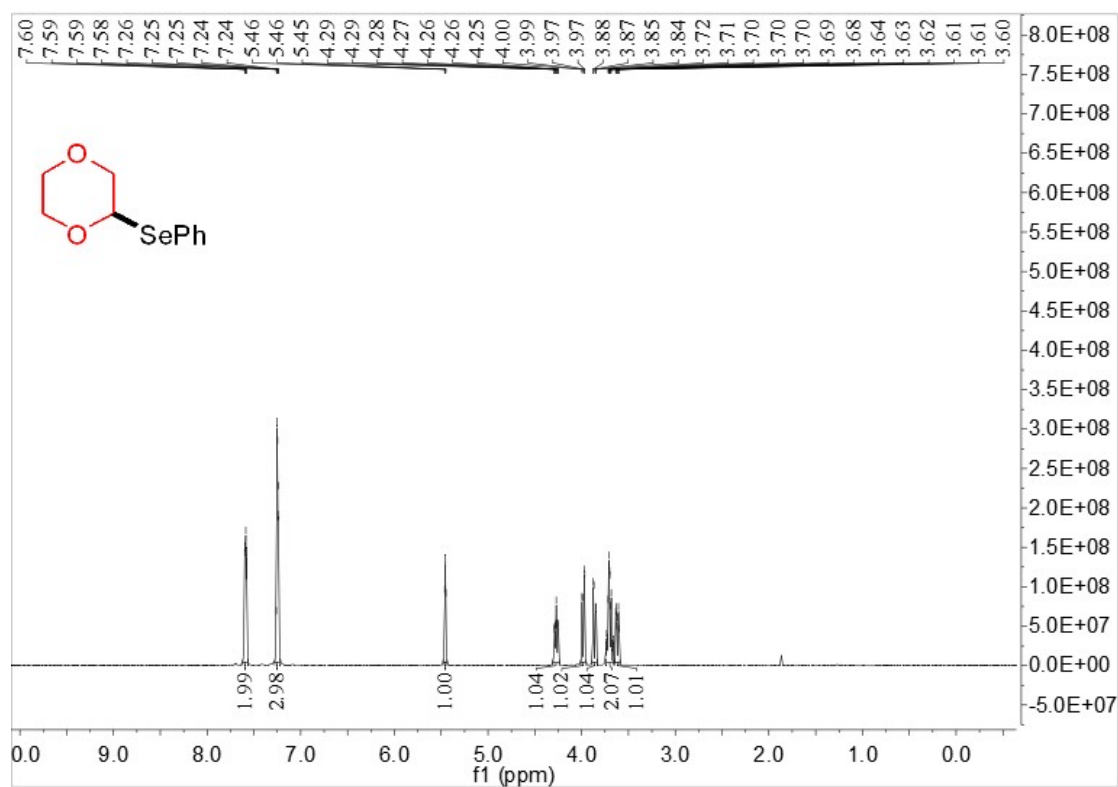
**Compound 3q**



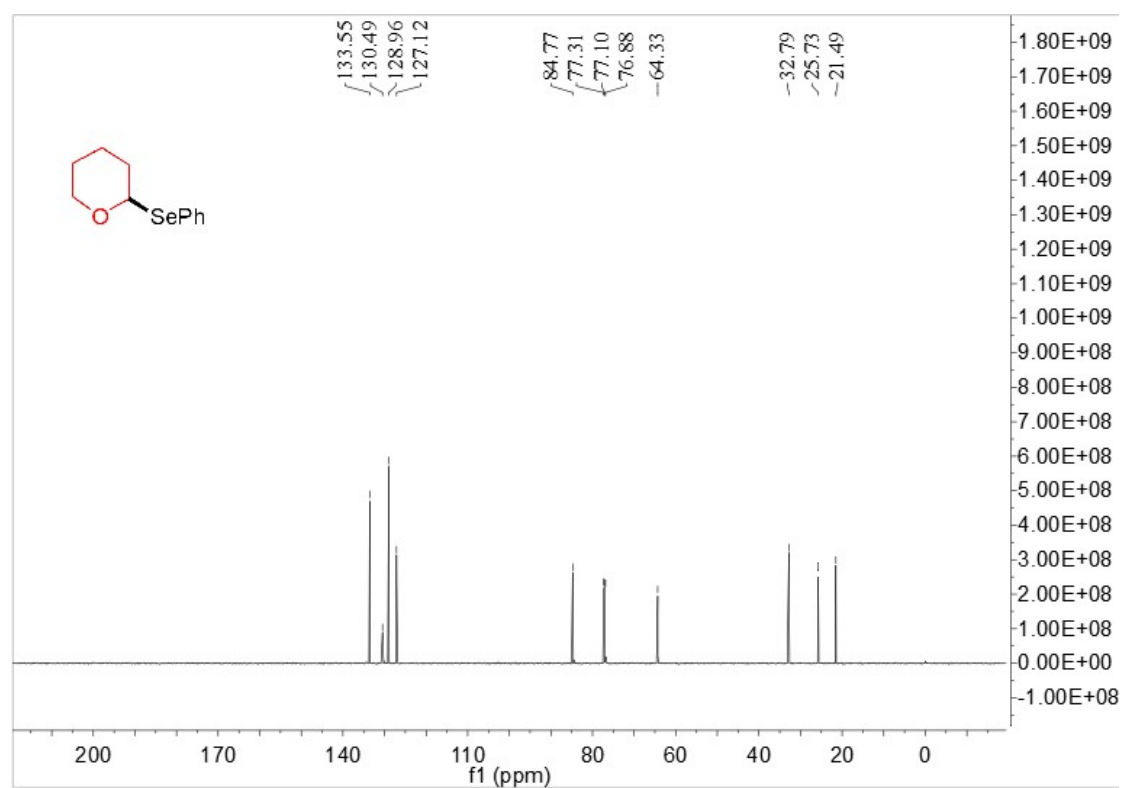
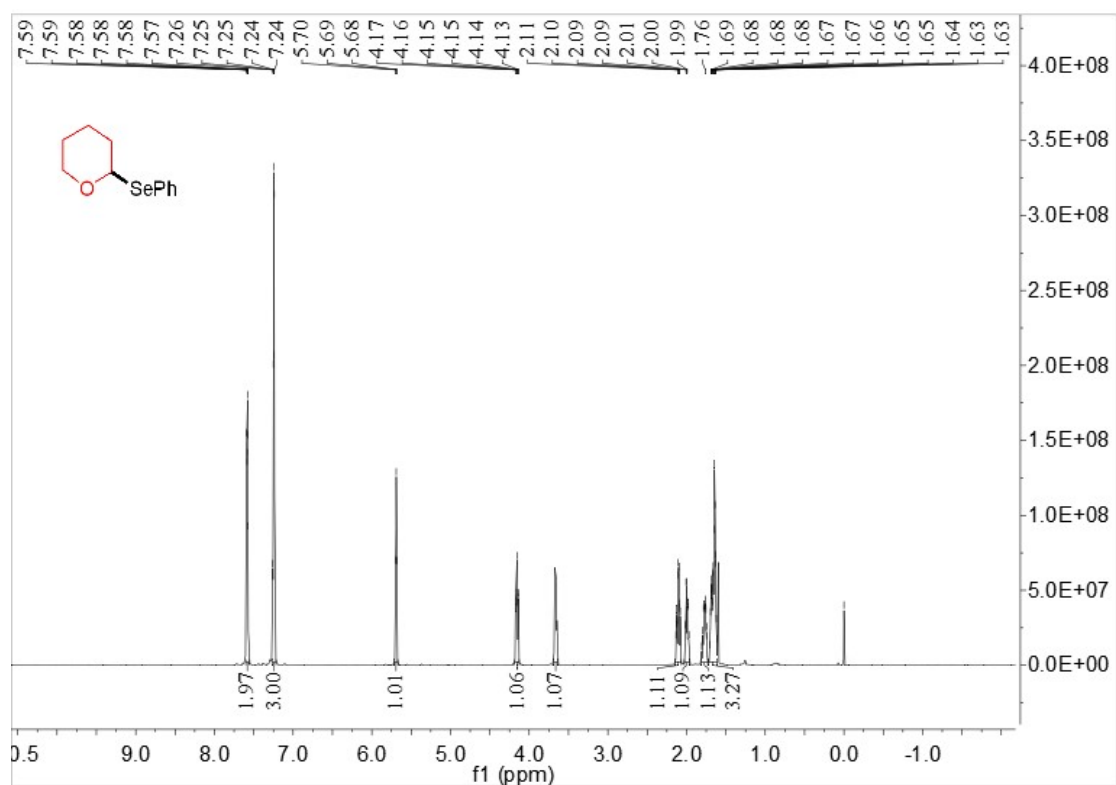
**Compound 3r**



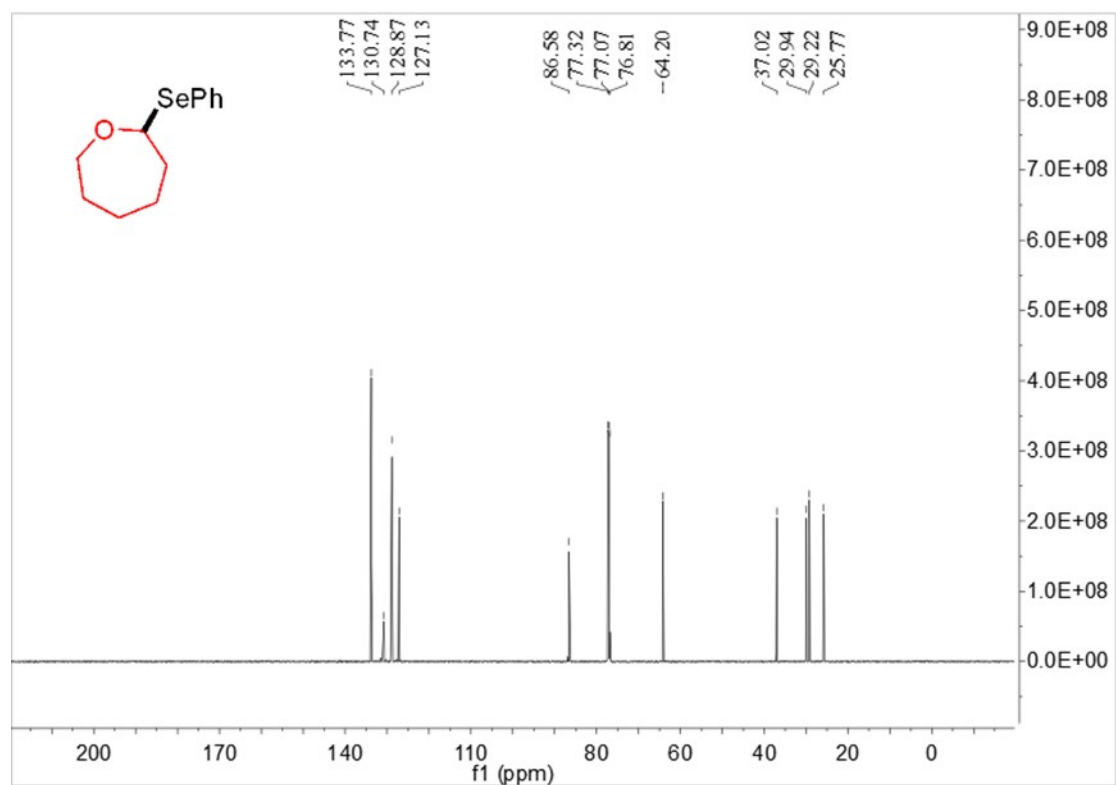
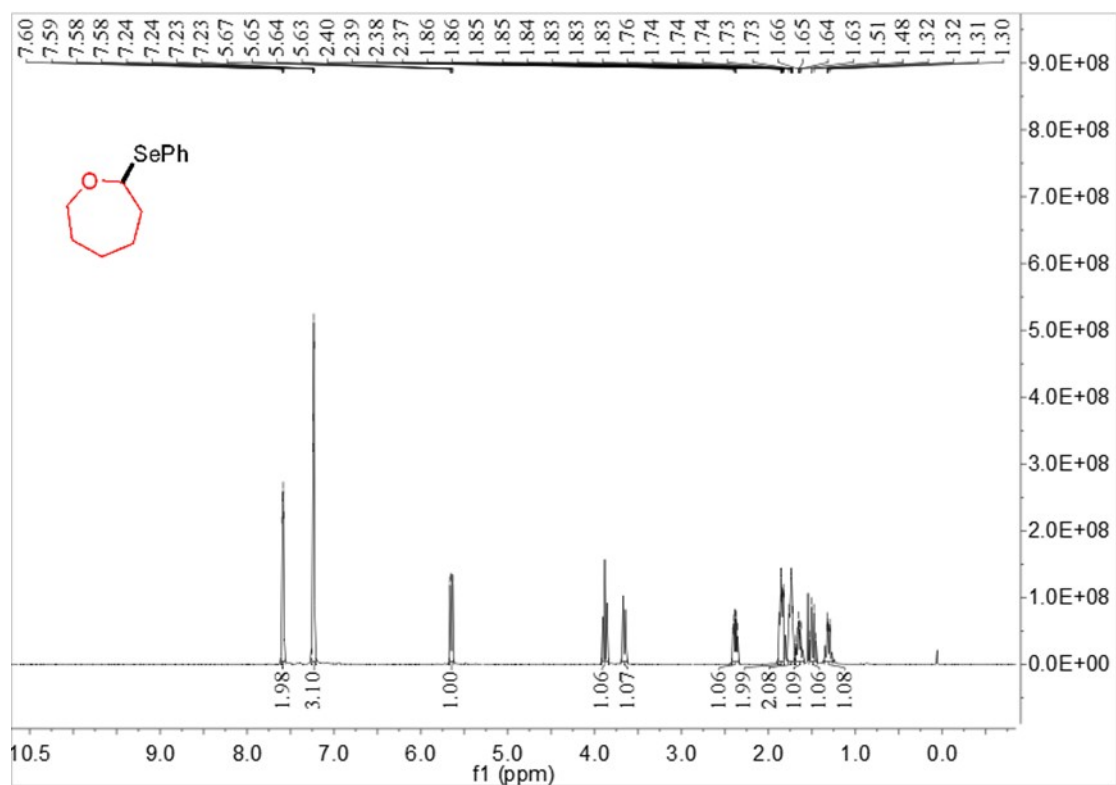
**Compound 3s**



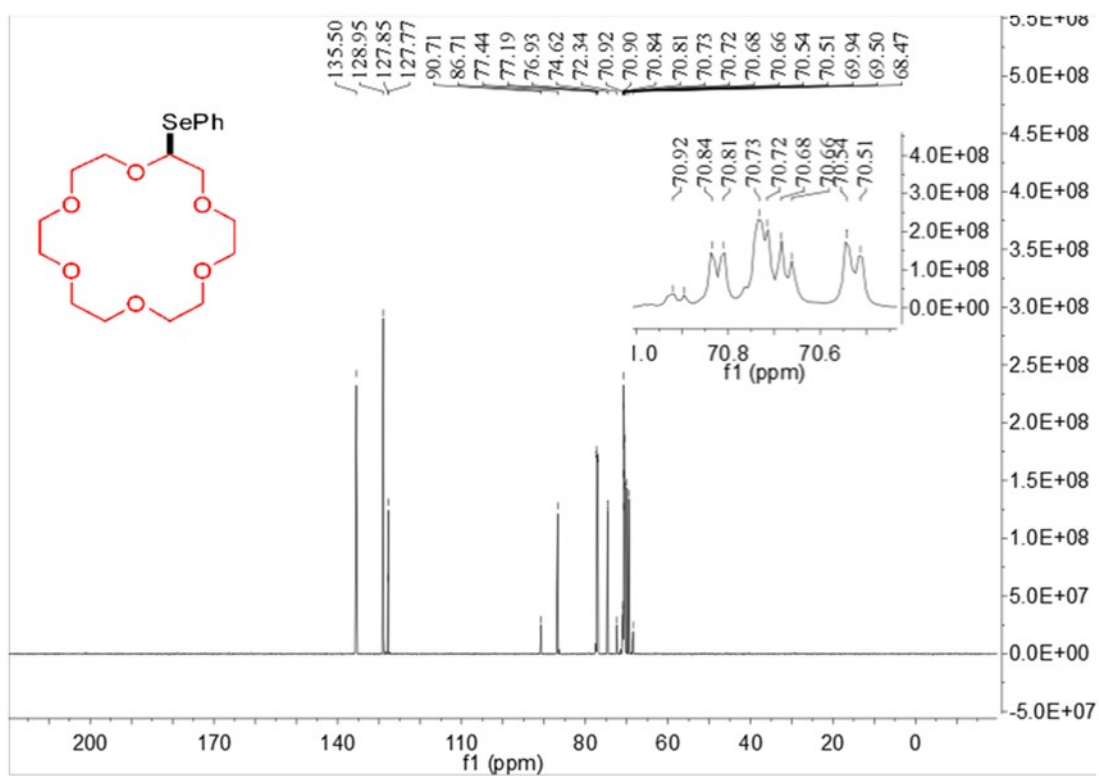
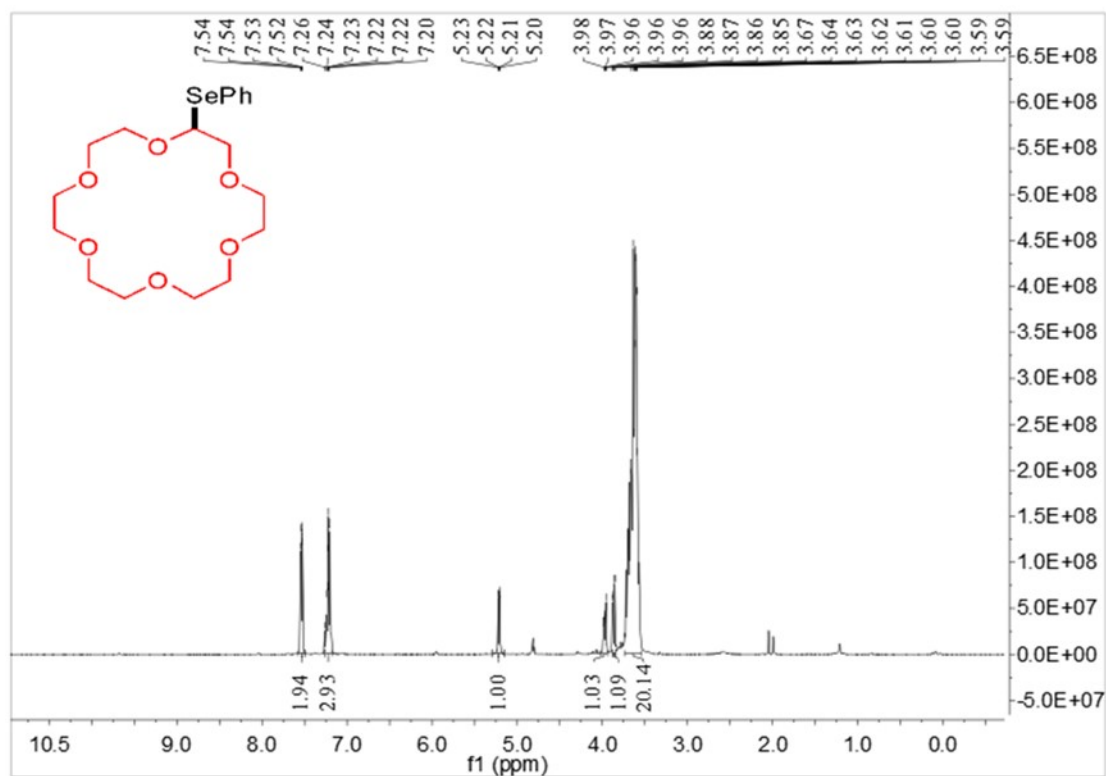
**Compound 3t**



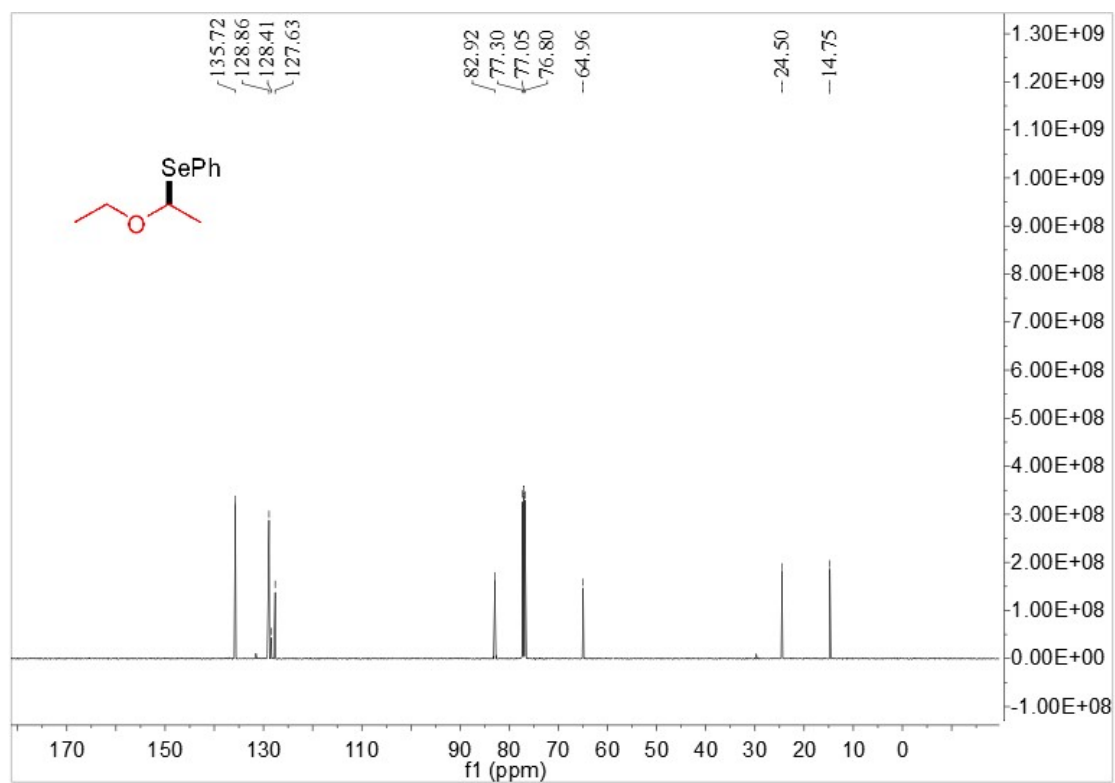
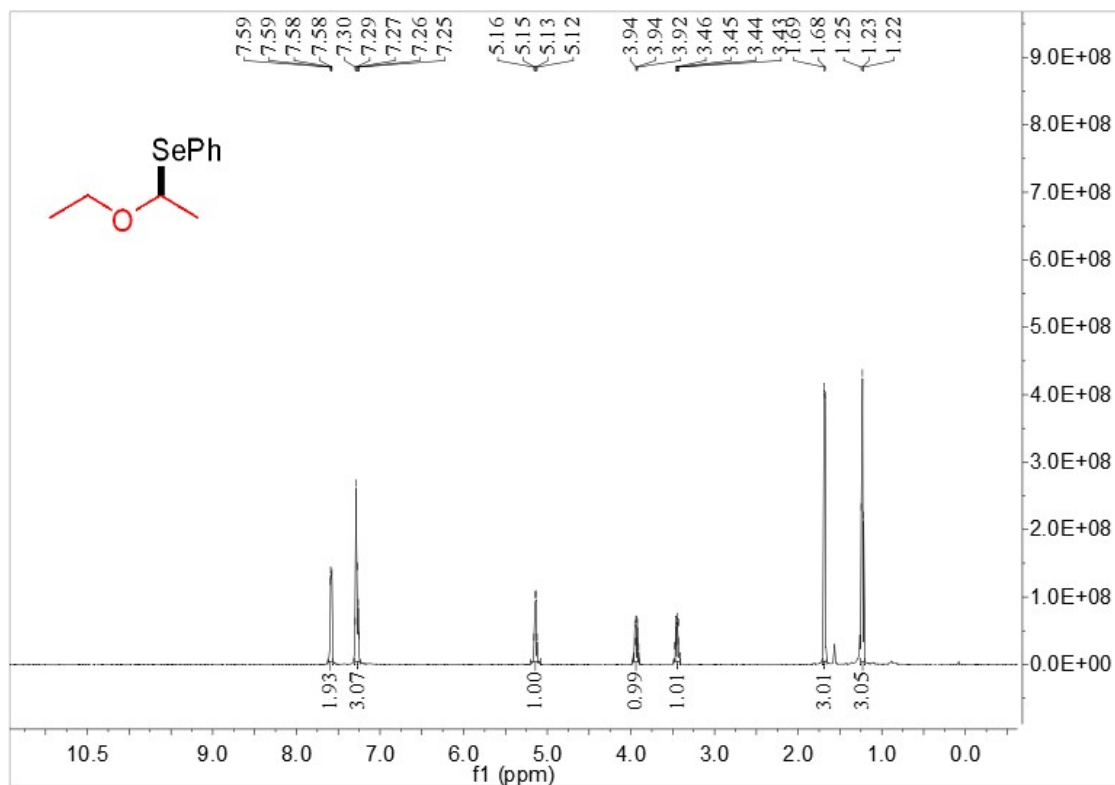
**Compound 3u**



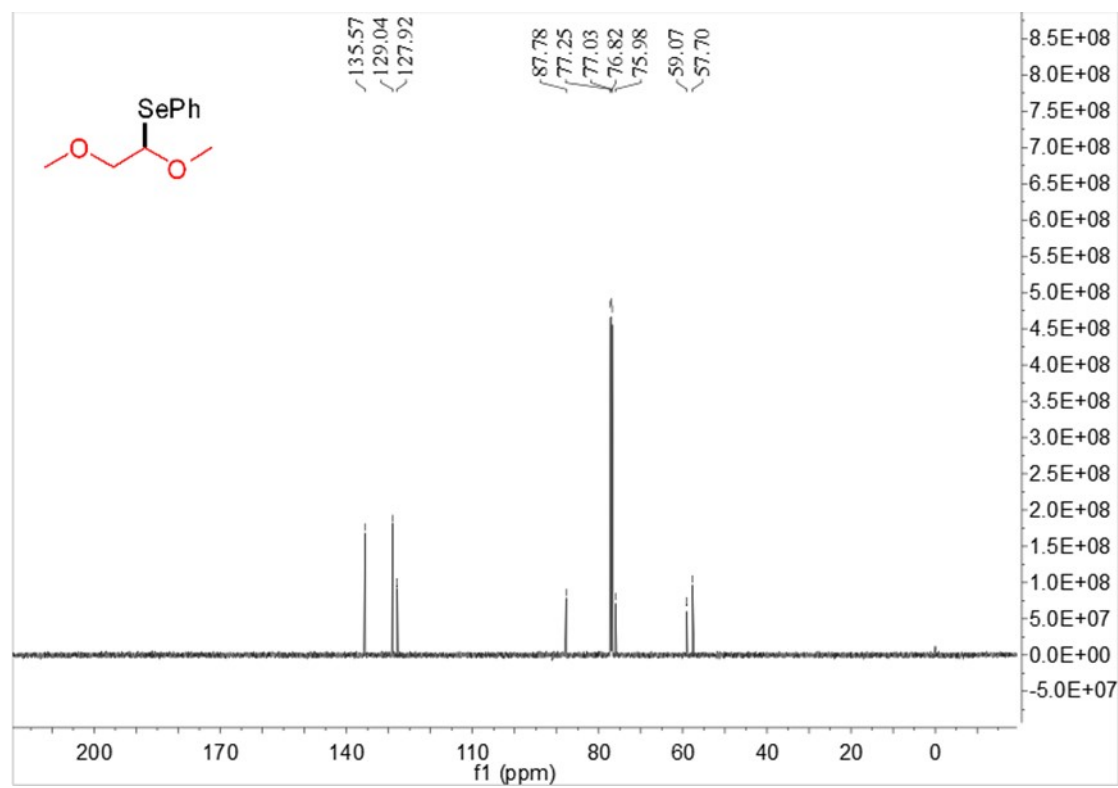
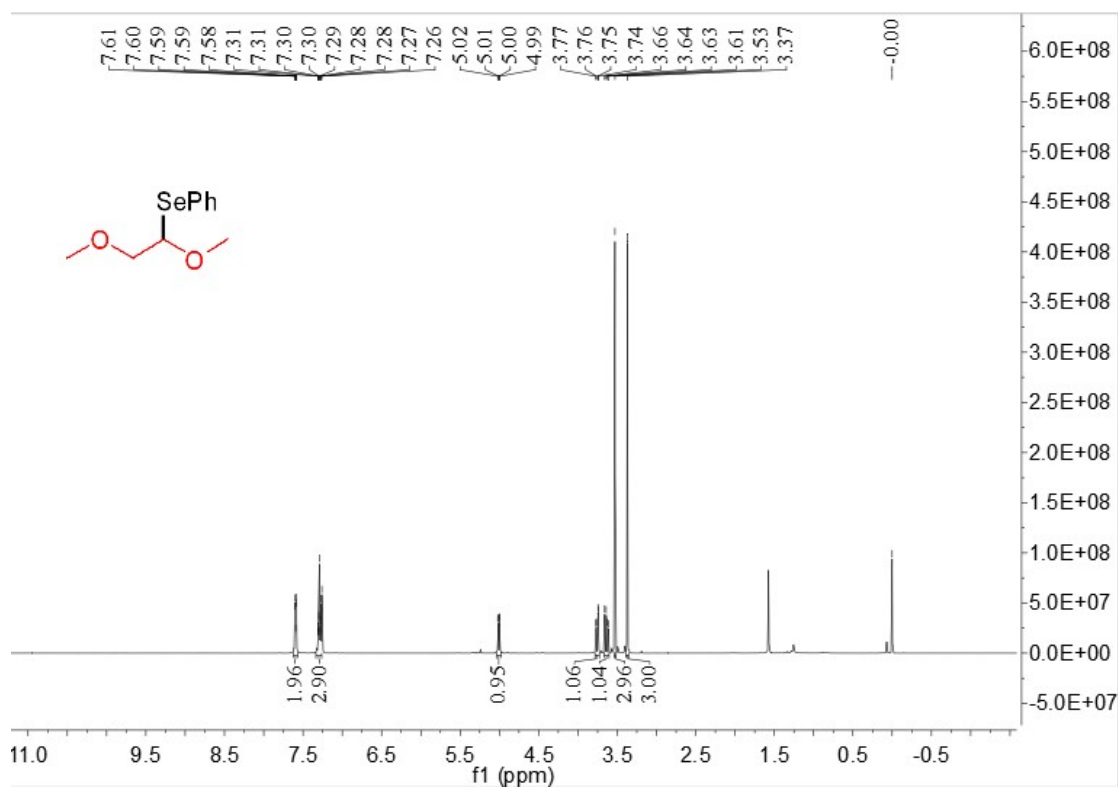
**Compound 3v**



**Compound 3w**

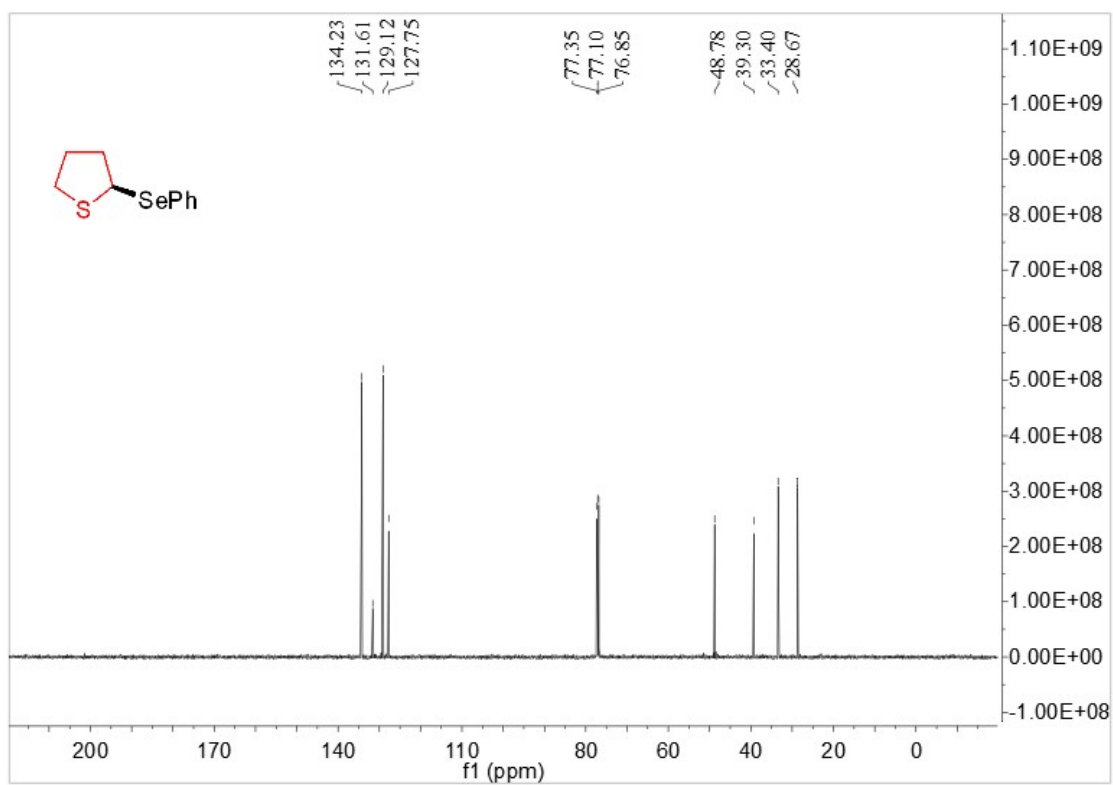
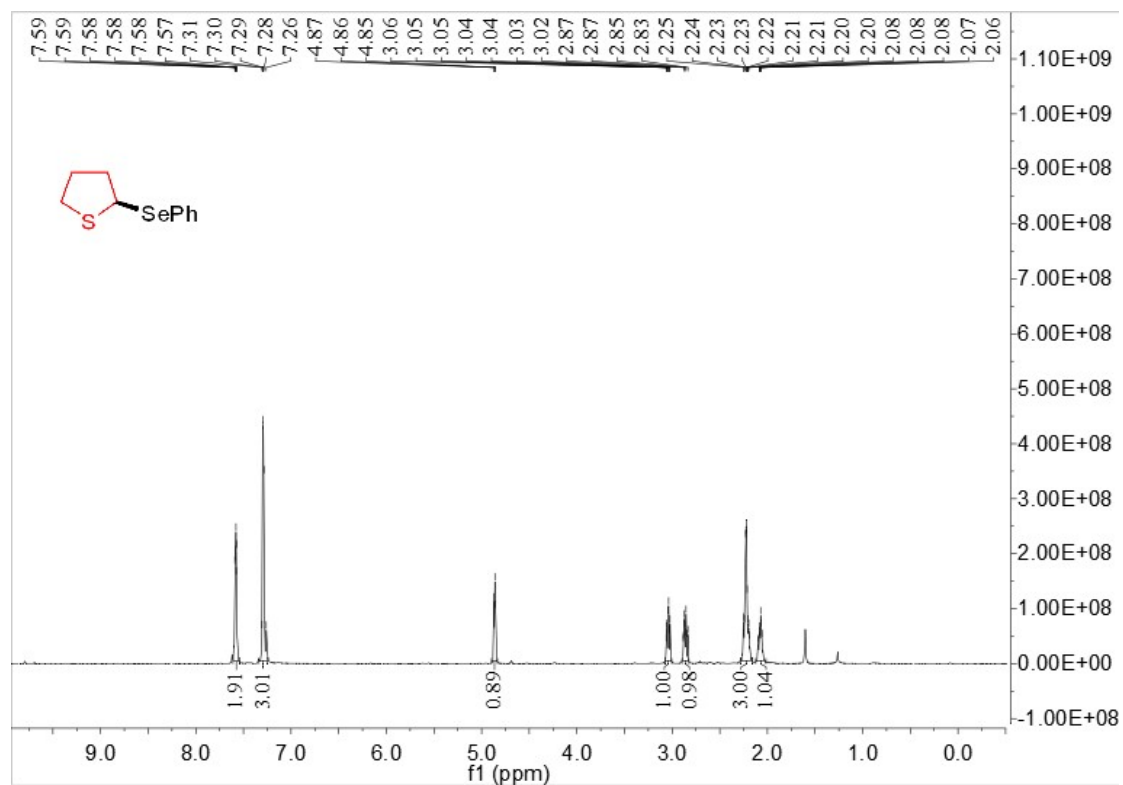


**Compound 3x**

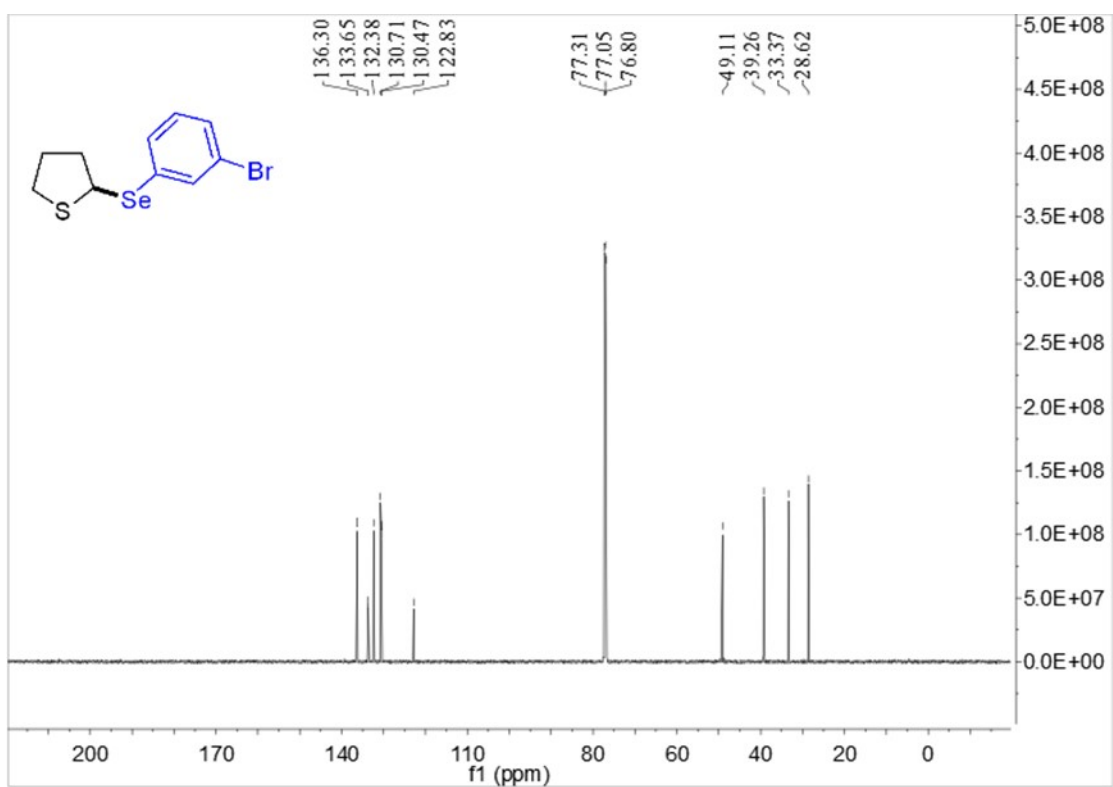
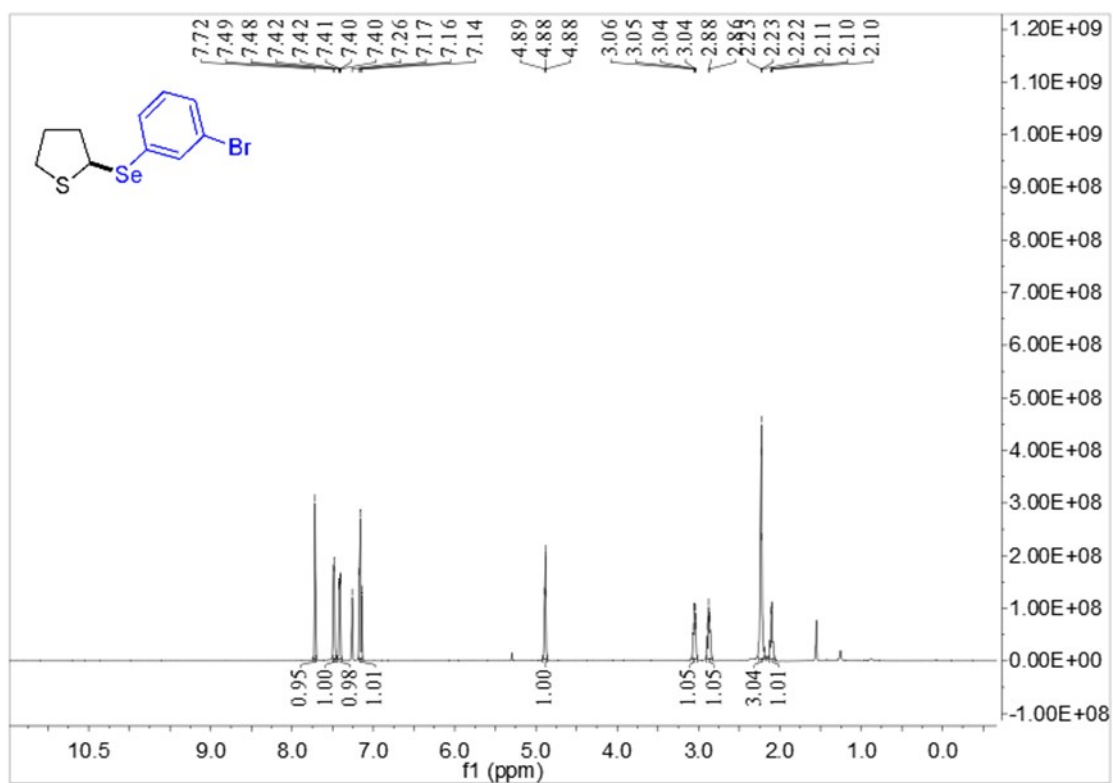




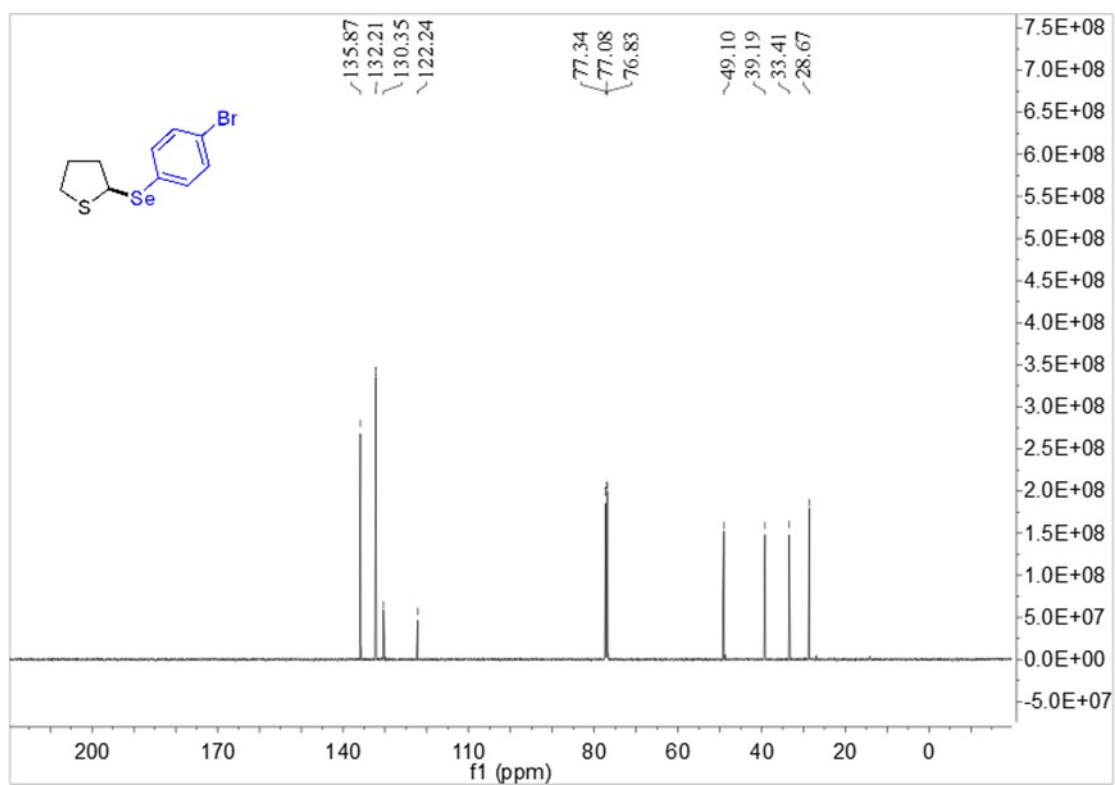
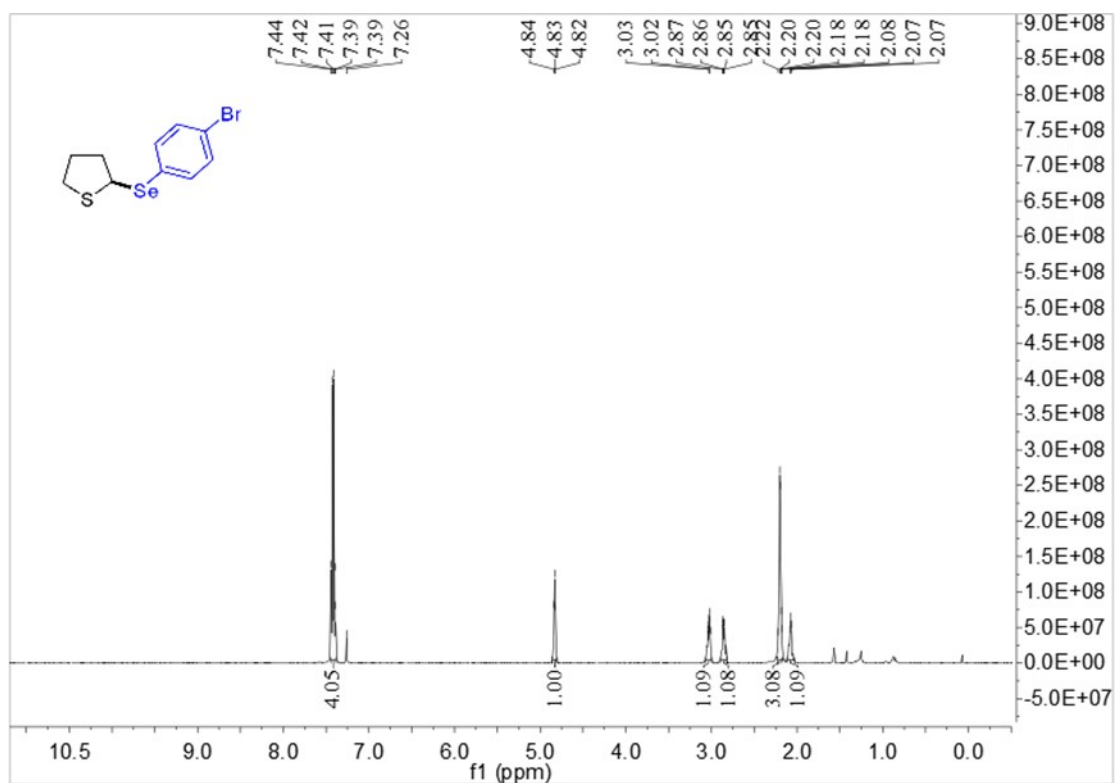
**Compound 3y**



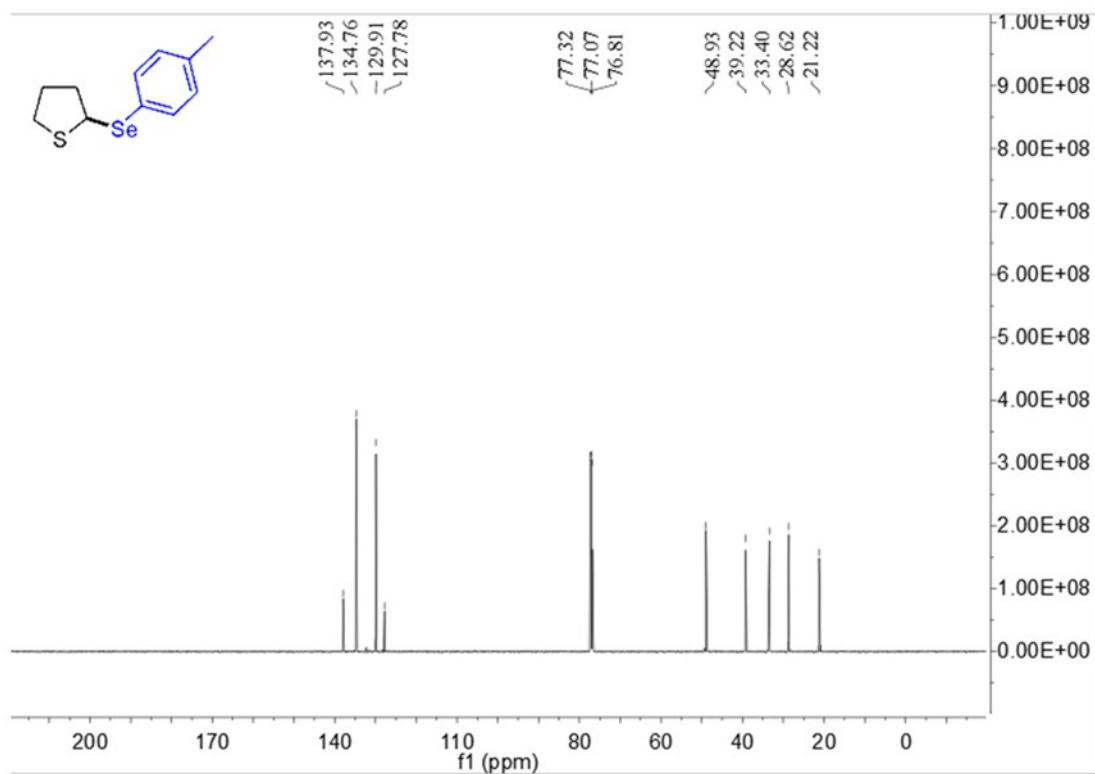
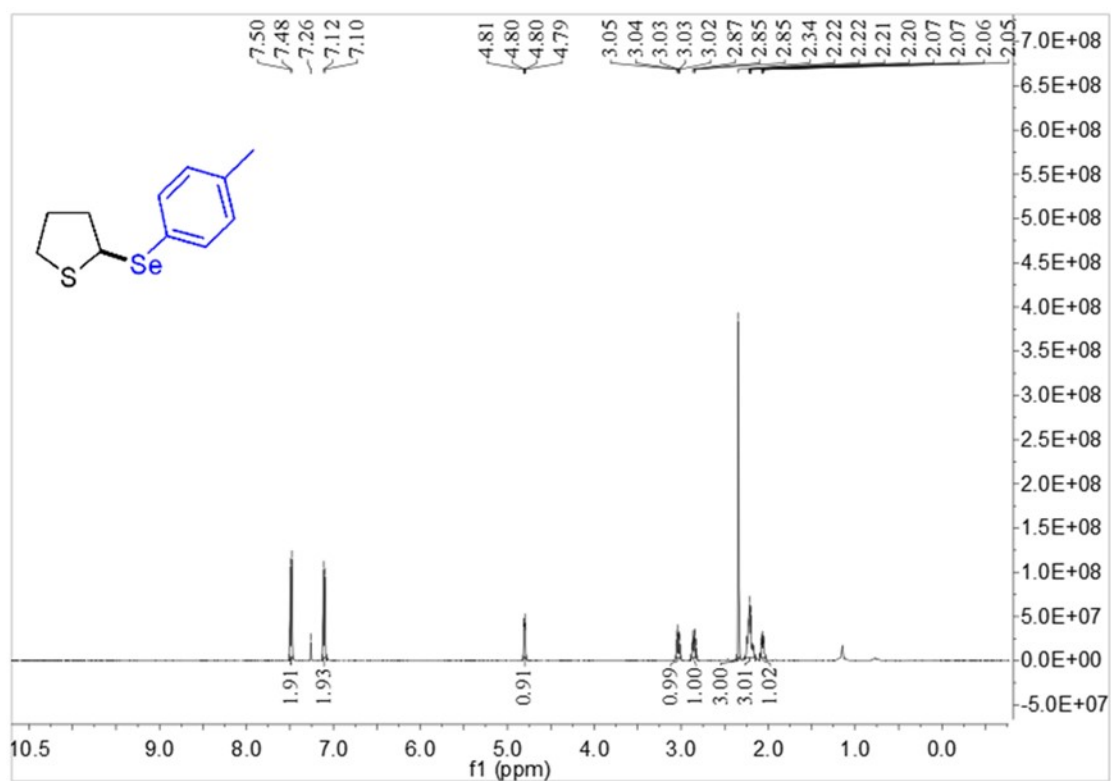
### Compound 3z



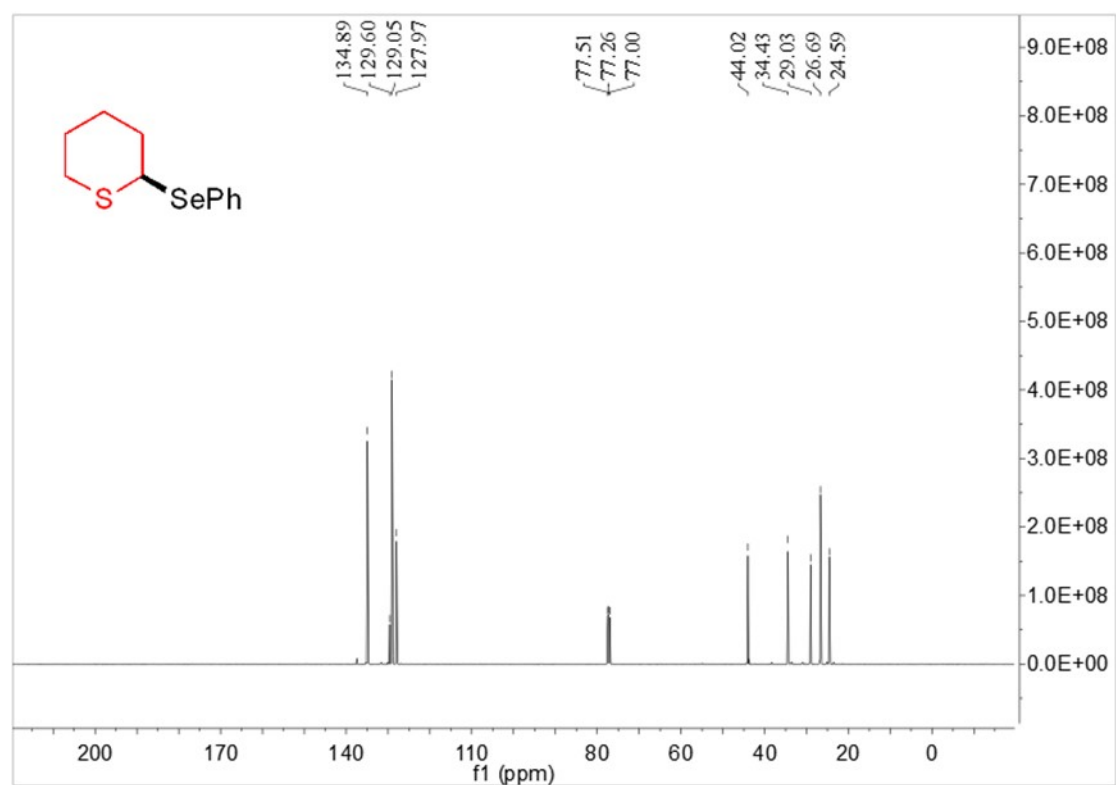
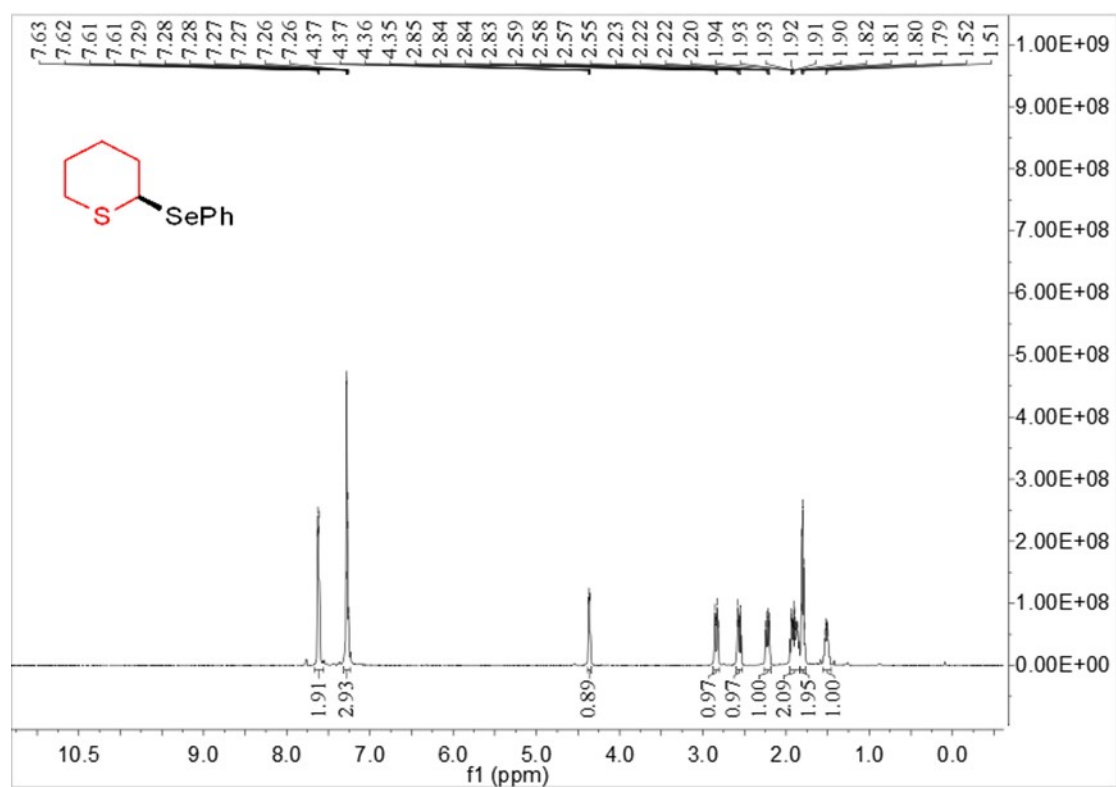
**Compound 3aa**



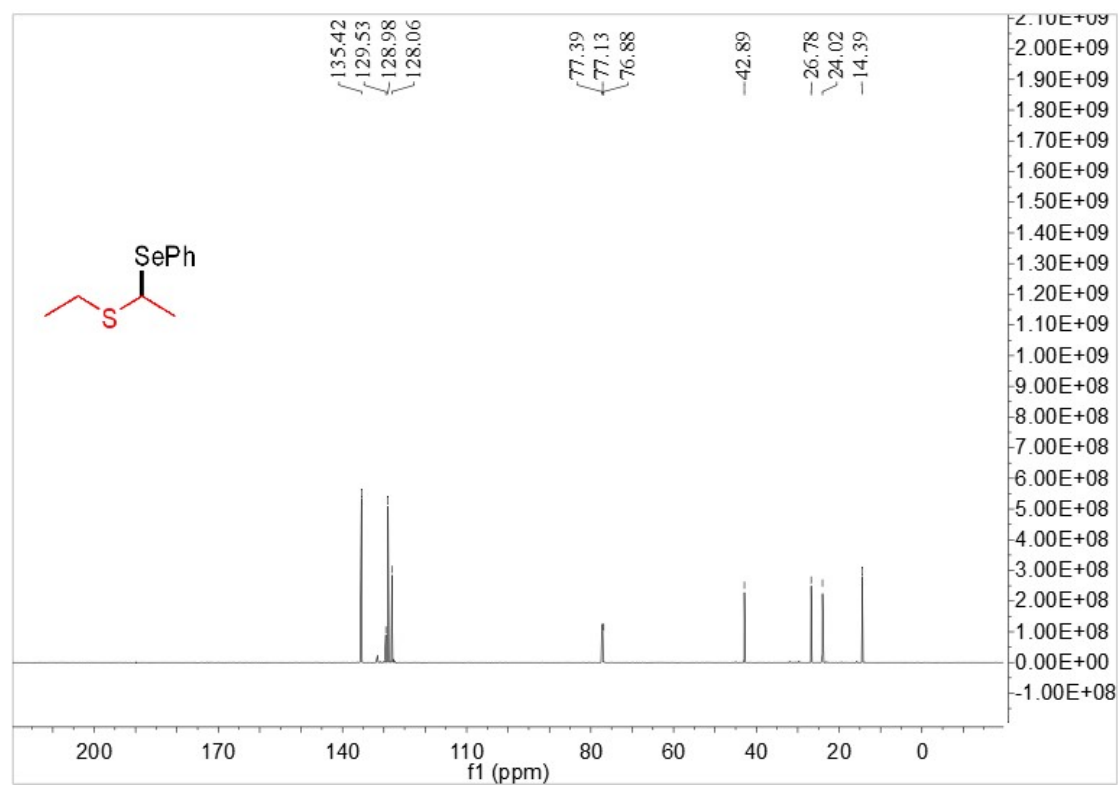
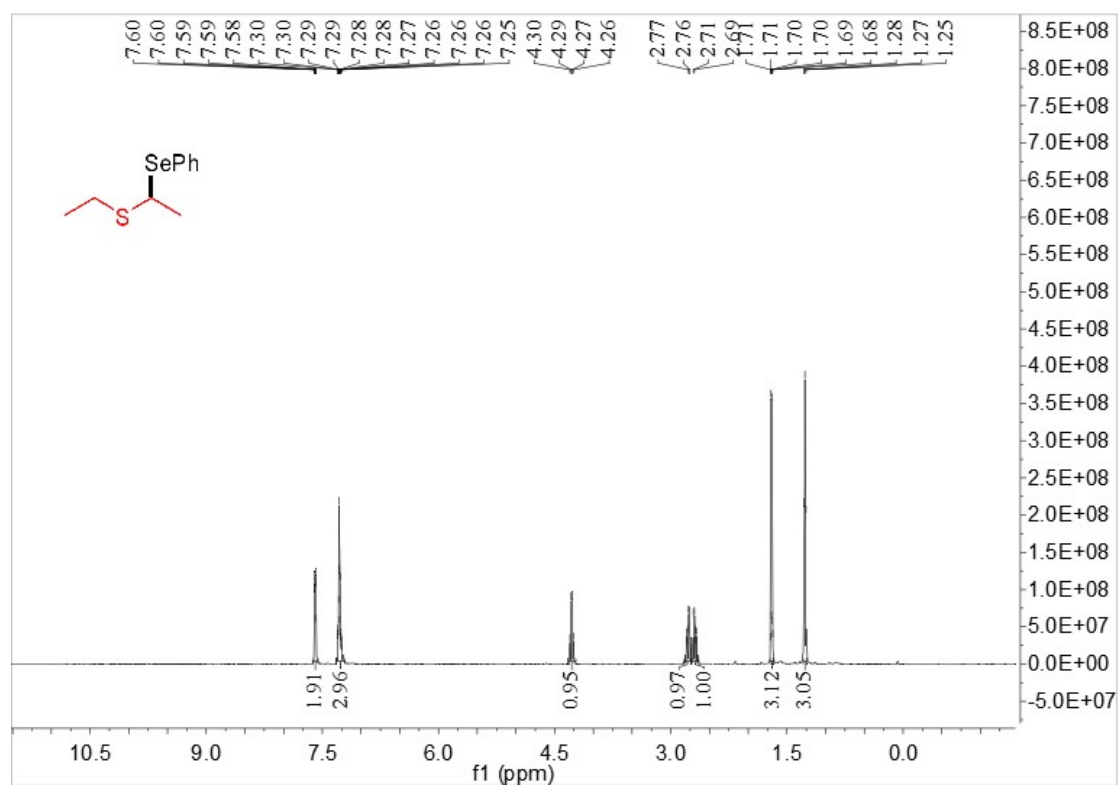
**Compound 3ab**



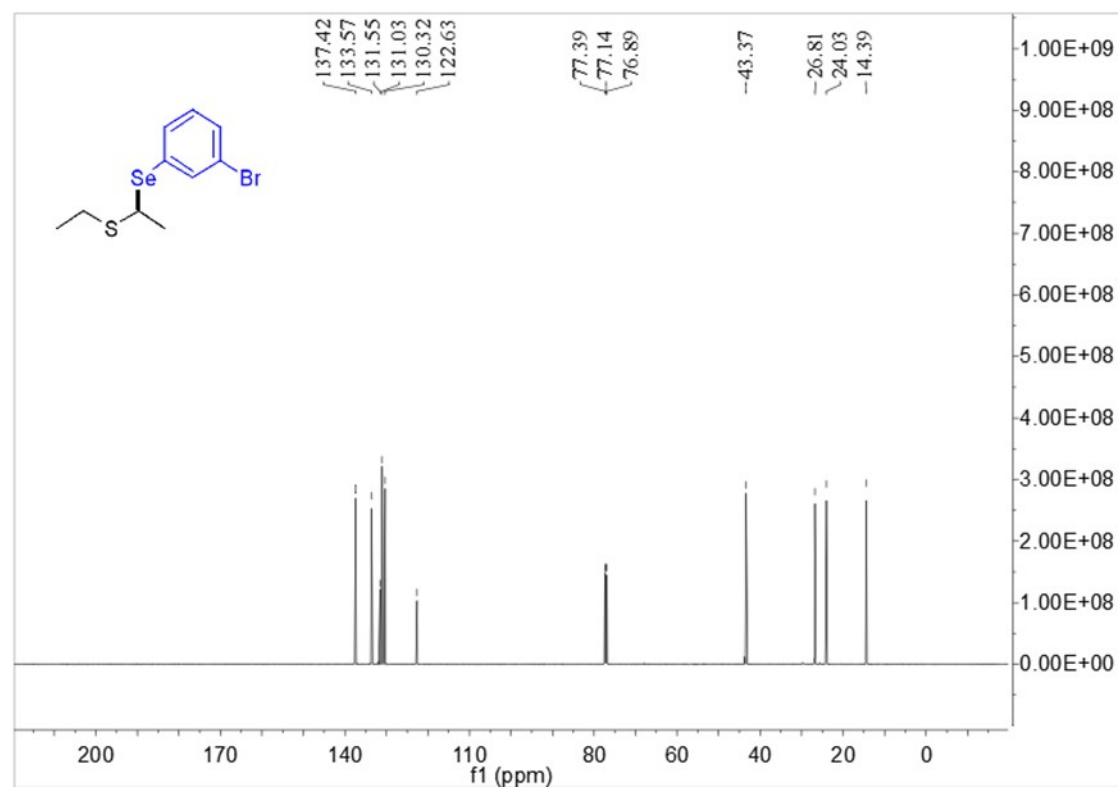
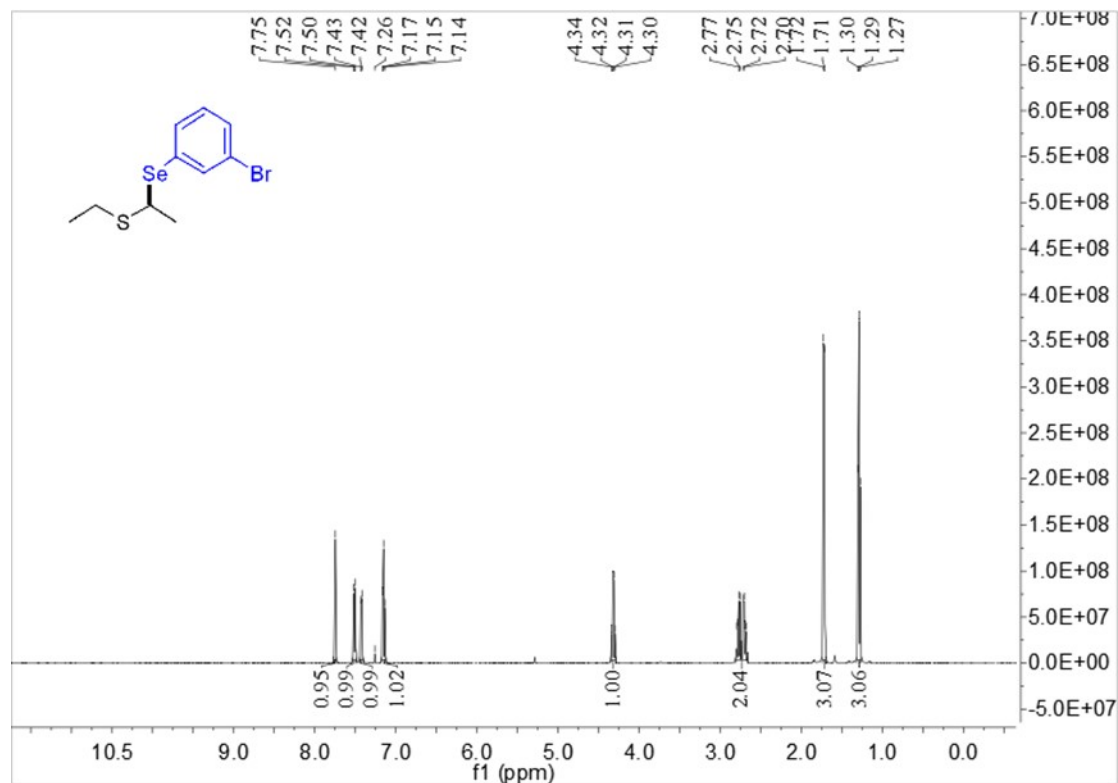
### Compound 3ac



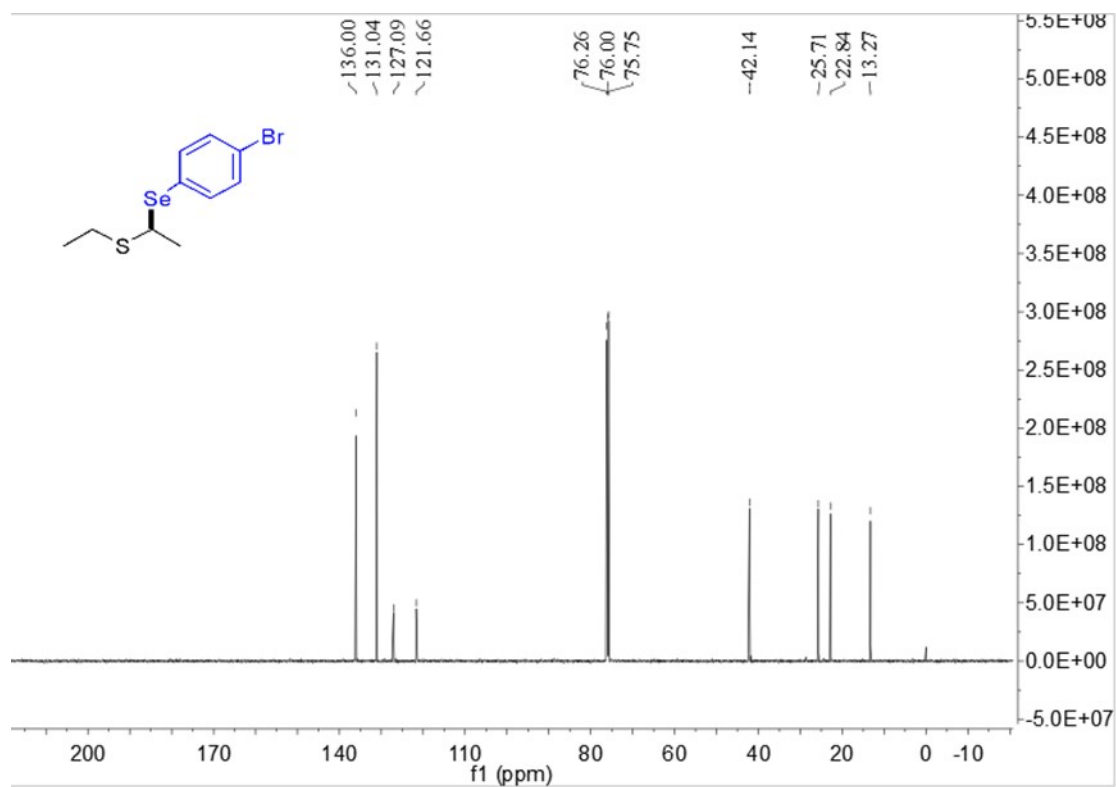
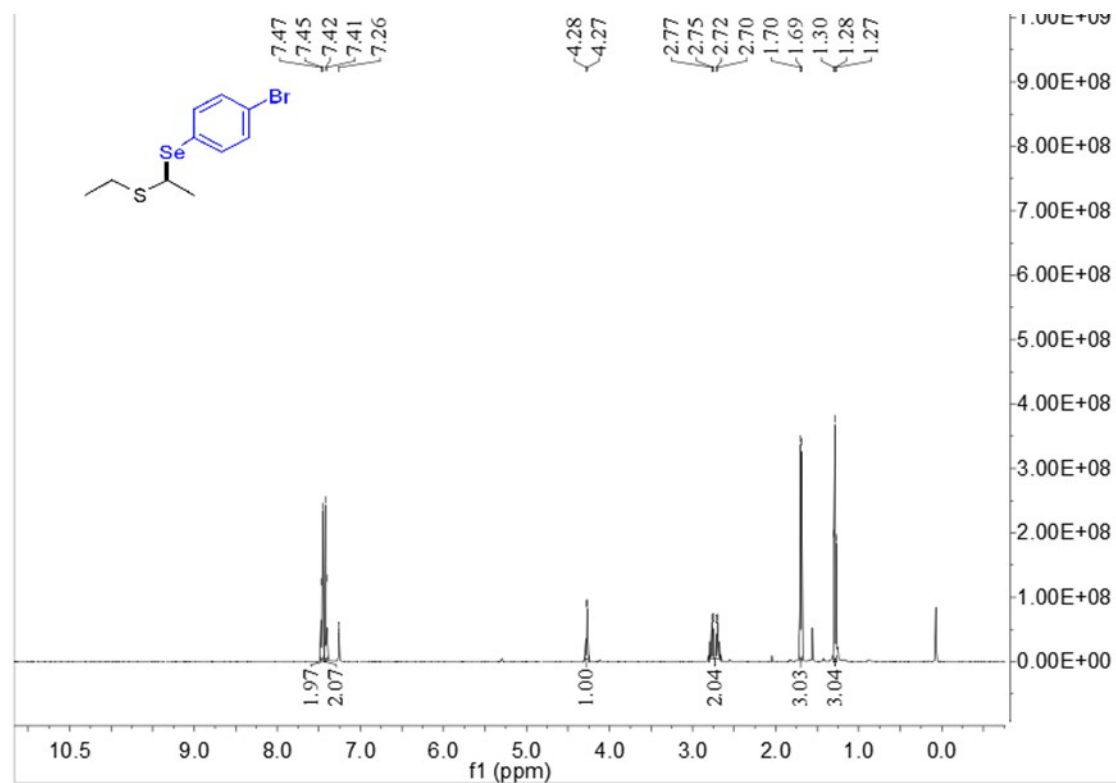
**Compound 3ad**



**Compound 3ae**

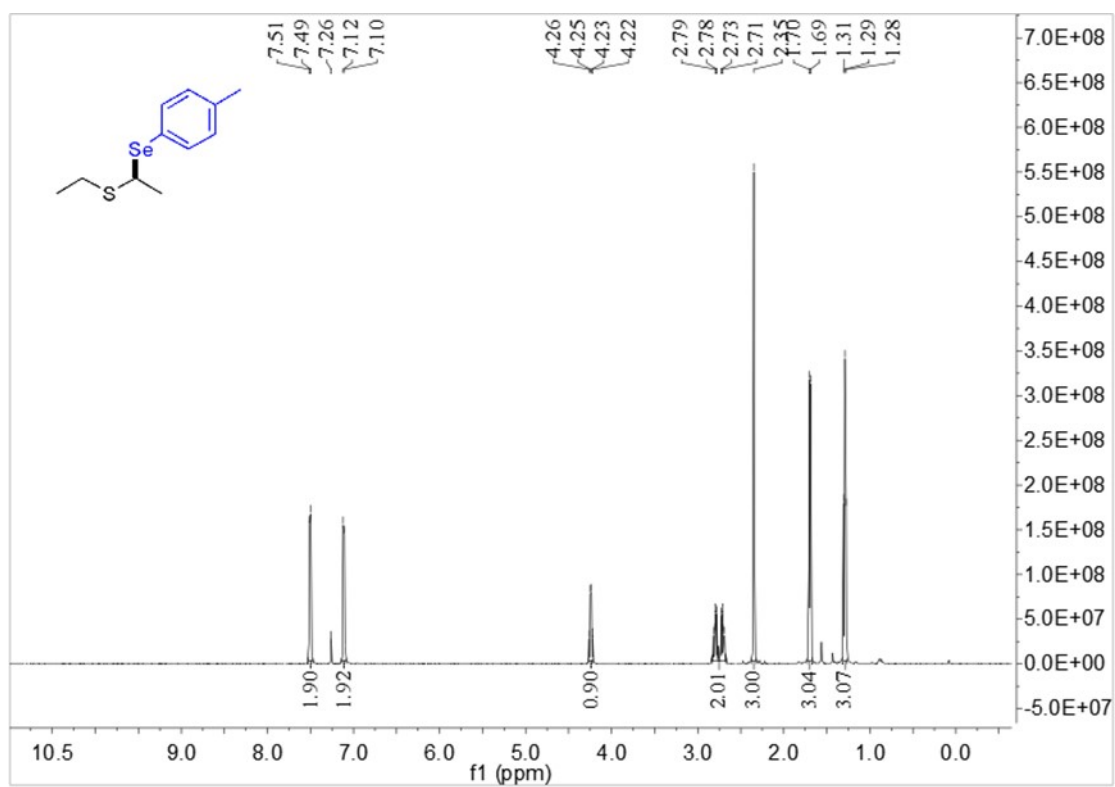
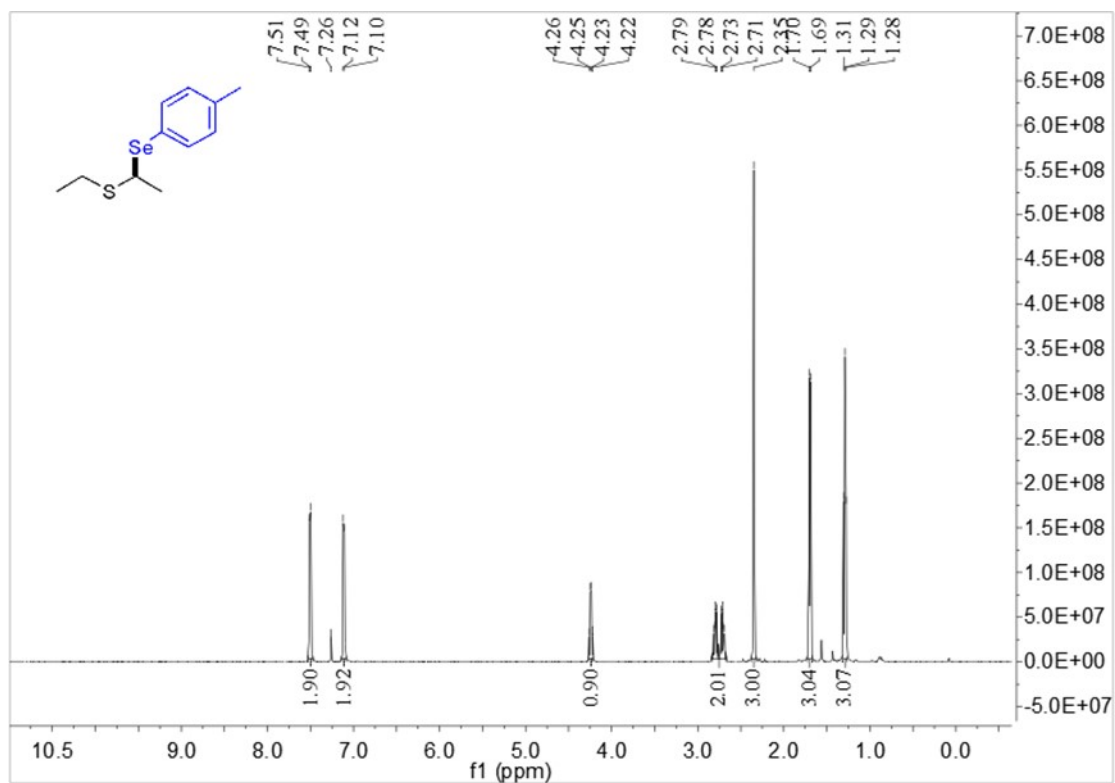


**Compound 3af**

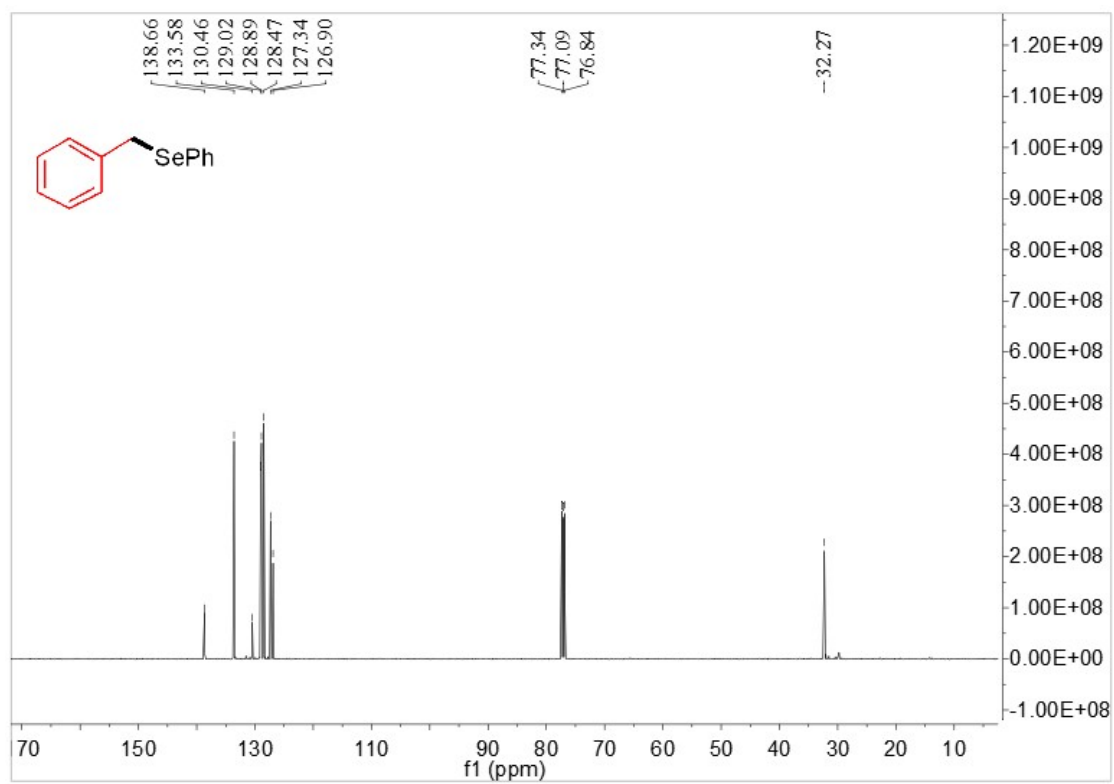
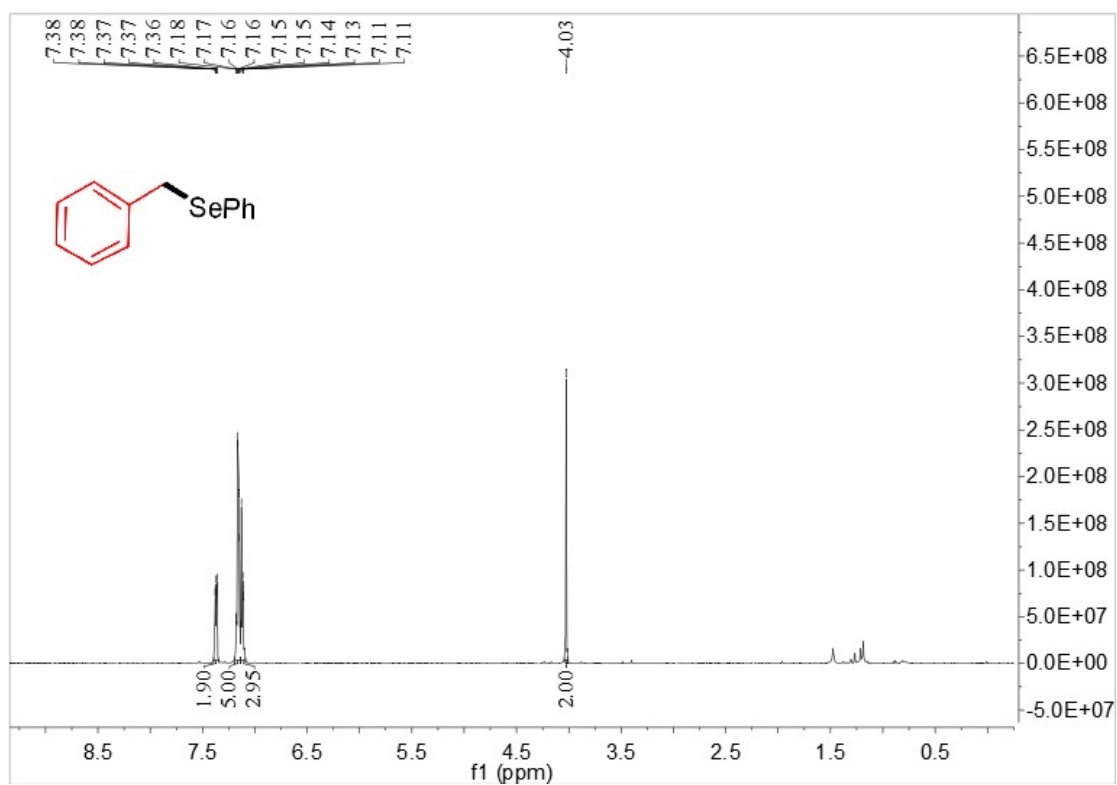




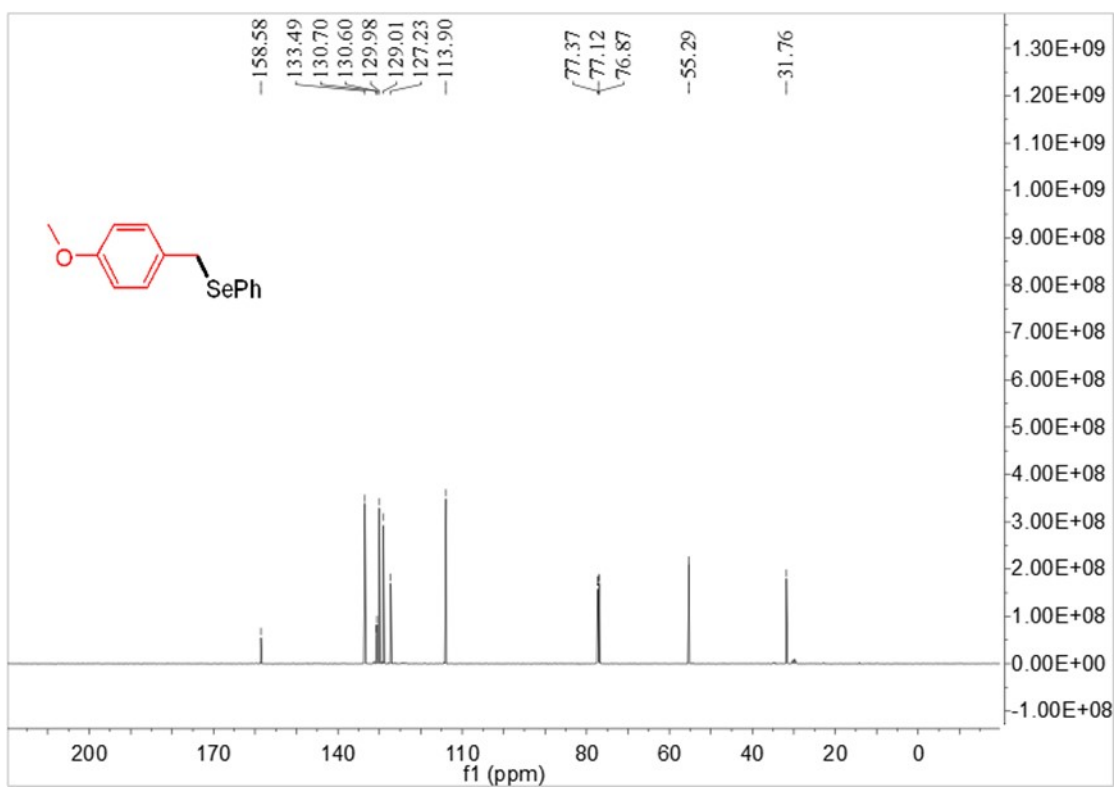
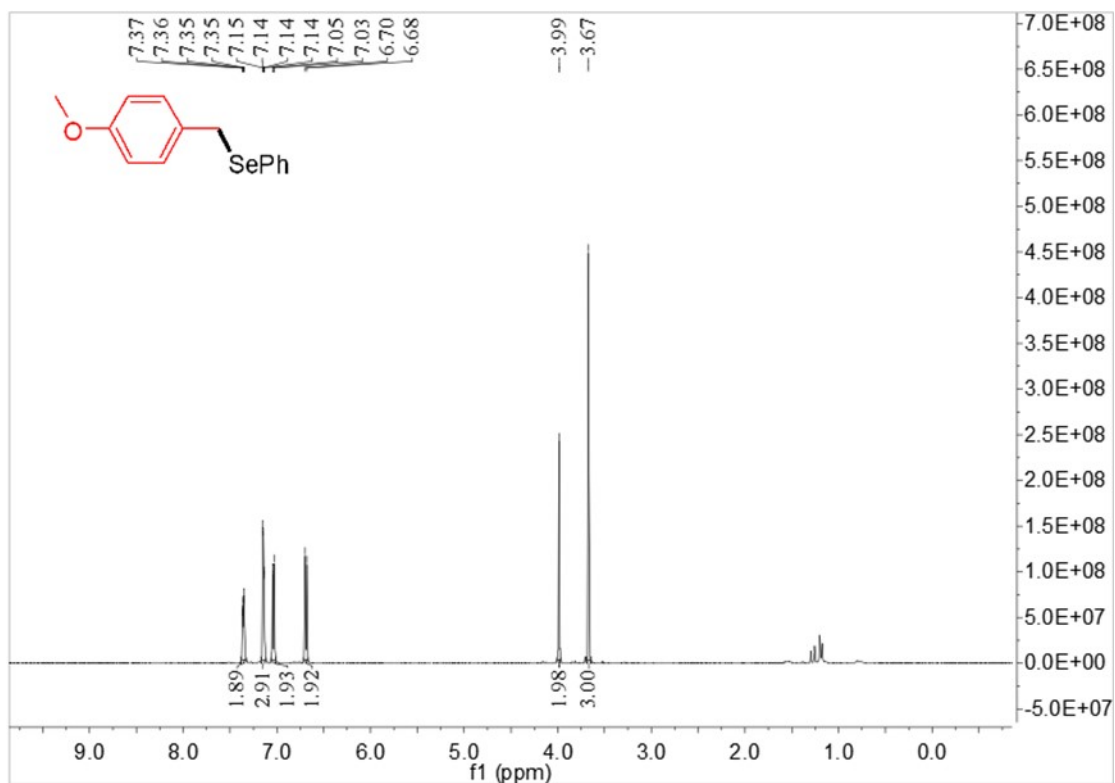
### Compound 3ag



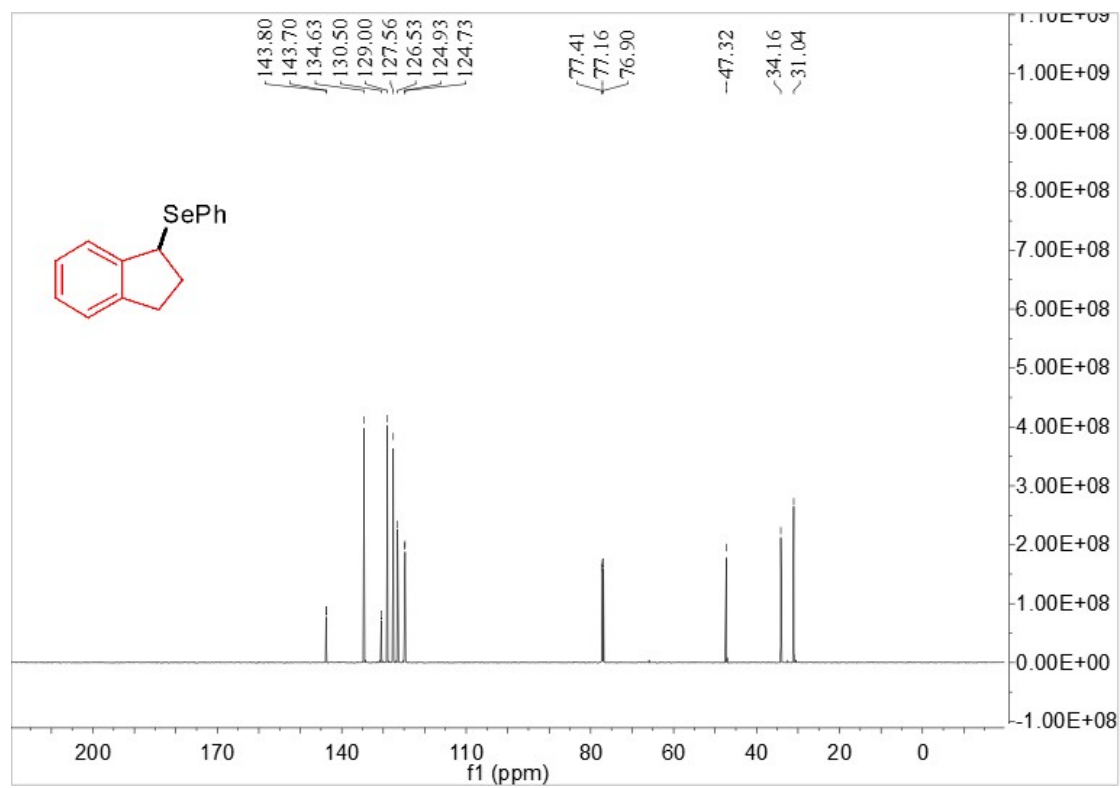
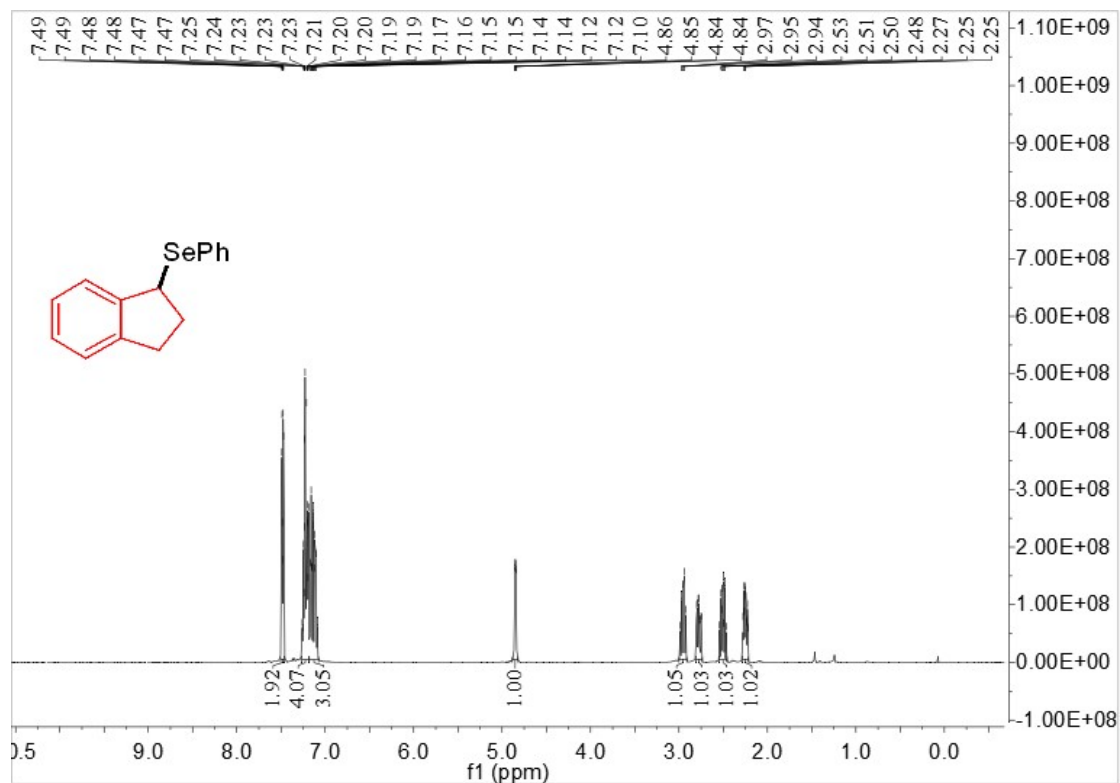
### Compound 3ah



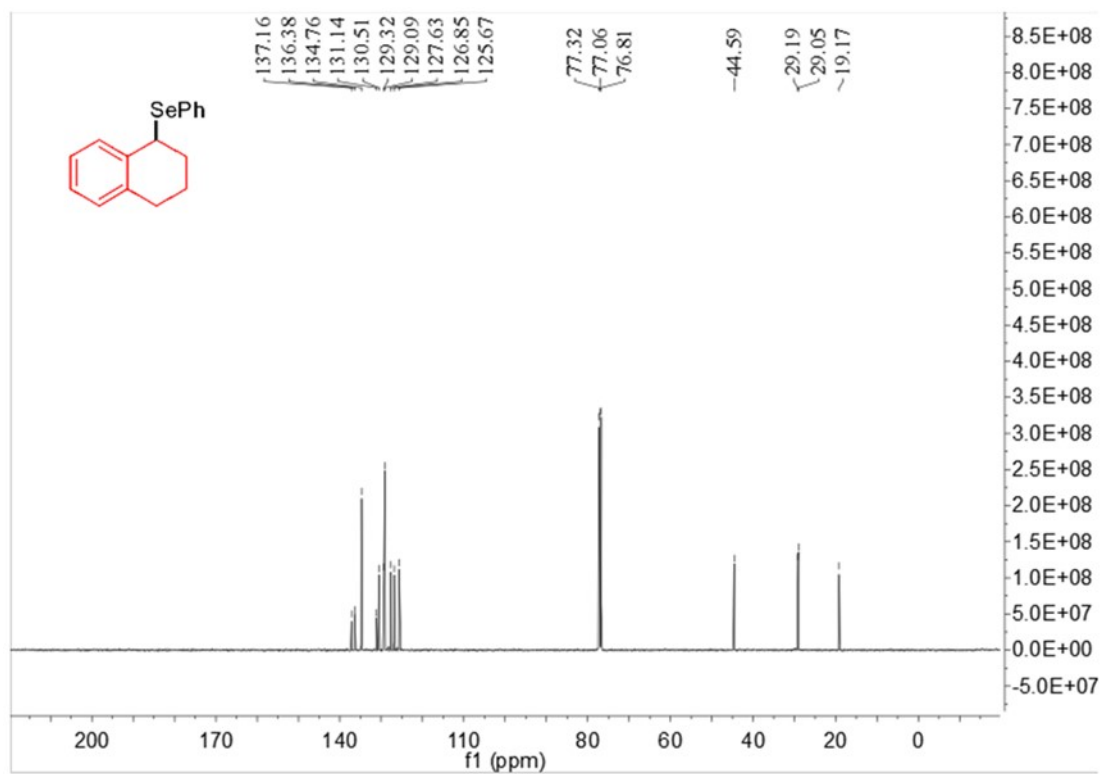
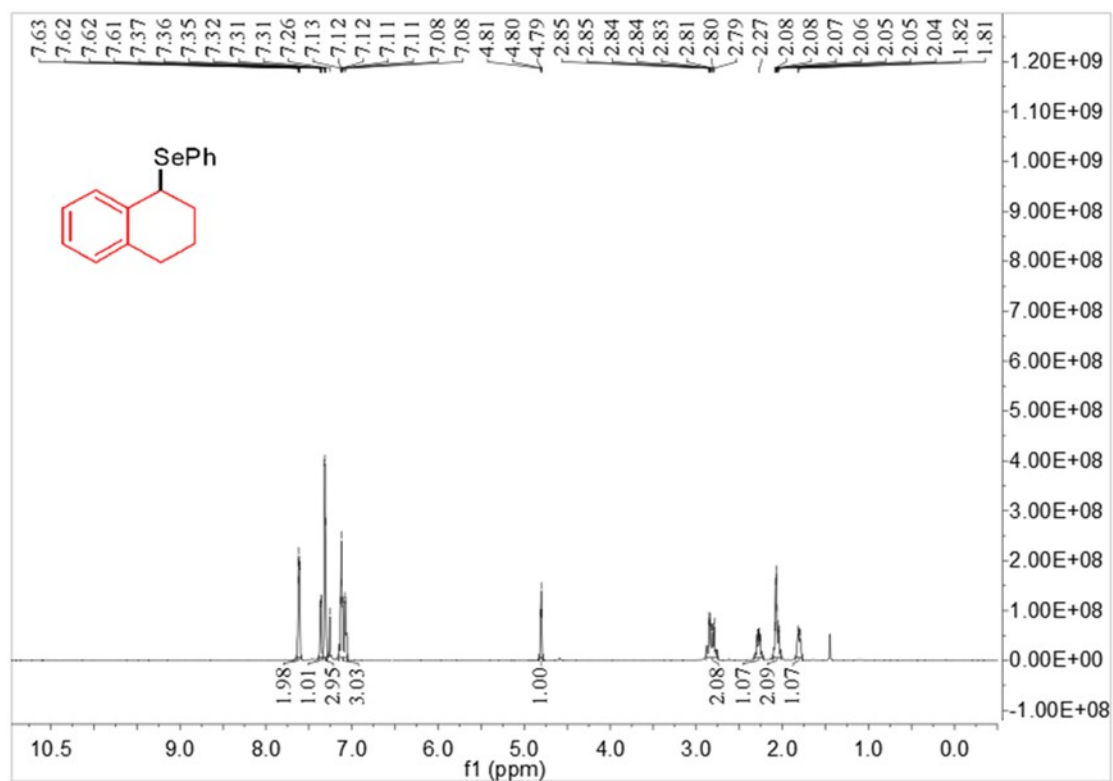
**Compound 3ai**



**Compound 3aj**



**Compound 3ak**



### Compound 3al

