Electronic Supplementary Material (ESI) for MedChemComm.

Supplementary Information

for

Rational Design and Optimization of Selenophenes with Basic Side Chains as Novel Potent Selective Estrogen Receptor Modulators (SERMs) for Breast Cancer Therapy

Junjie Luo[†a], Zhiye Hu[†a], Yuan Xiao[a], Tongxin Yang[a], Chune Dong[a,c], Jian Huang[b], Hai-Bing Zhou[a,*]

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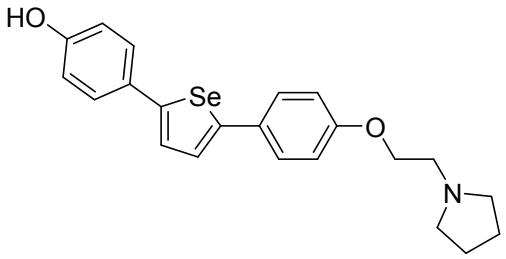
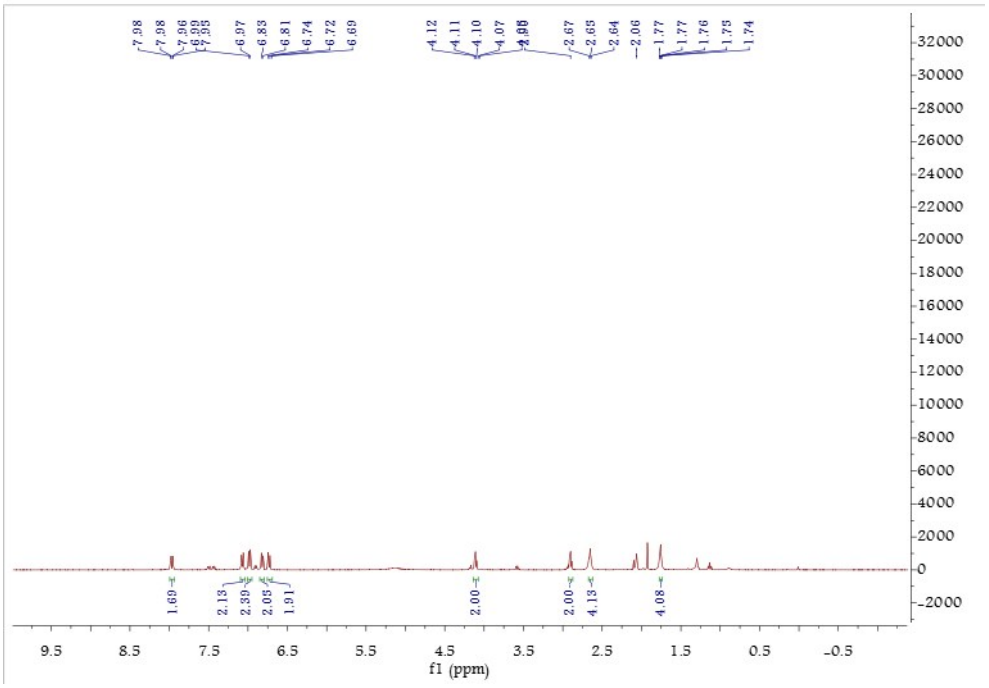
PART I. Analytical techniques

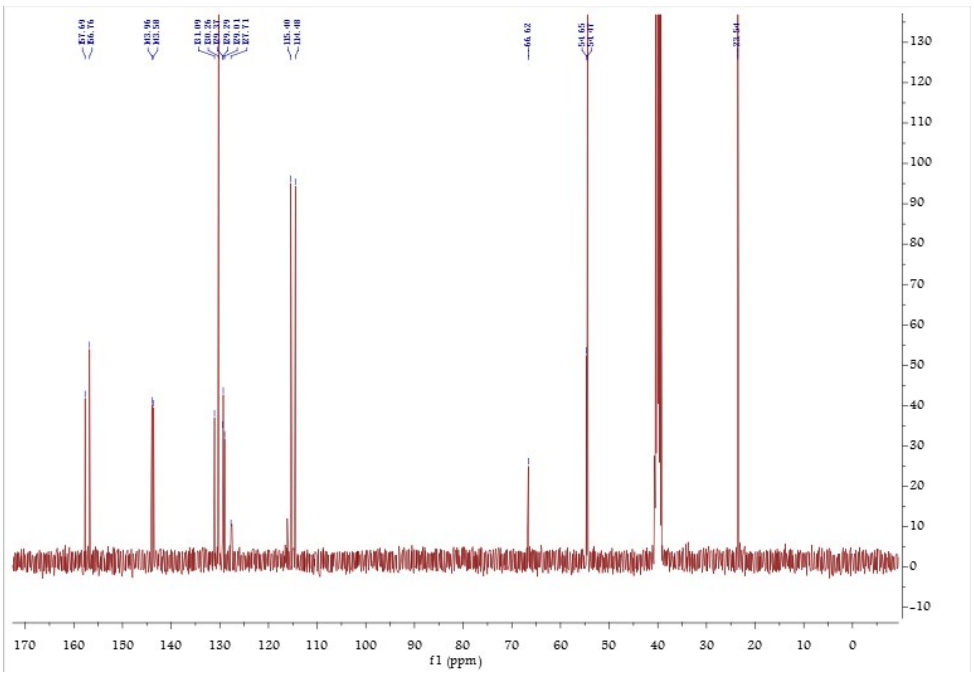
^{1}H NMR and ^{13}C NMR spectra were recorded on a Bruker AVANCE III 400 spectrometer (400 MHz, ^{1}H NMR; 101 MHz, ^{13}C NMR) at room temperature. NMR spectra were calibrated to the solvent signals of $CDCl_3$ (δ 7.26 and 77.00), Acetone-d_6 (δ 2.05 and 29.84, 206.26), CD_3OD (δ3.31 and 49.00) or DMSO-d_6 (δ 2.50 and 39.43). The chemical shifts are provided in ppm and the coupling constants in Hz. The following abbreviations for multiplicities are used: s, singlet; d, doublet; t, triplet; m, multiplet. Glassware was oven-dried, assembled while hot, and cooled under an inert atmosphere. Unless otherwise noted, all reactions were conducted in an atmosphere. Reaction progress was monitored using analytical thin-layer chromatography (TLC). Visualization was achieved by UV light (254 nm). Chromatography was performed with silica gel (0.040-0.063 mm) packing. High resolution mass spectra (HRMS) were measured on IonSpec 4.7 Tesla FTMS using MALDI/DHB. Melting points were obtained on X-4 melting point apparatus (Beijing TECH Instruments, Co., Ltd.) and are uncorrected.

PART II. ^{1}H NMR and ^{13}C NMR Spectra of final compounds

9a







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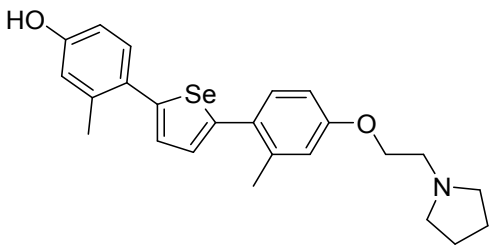
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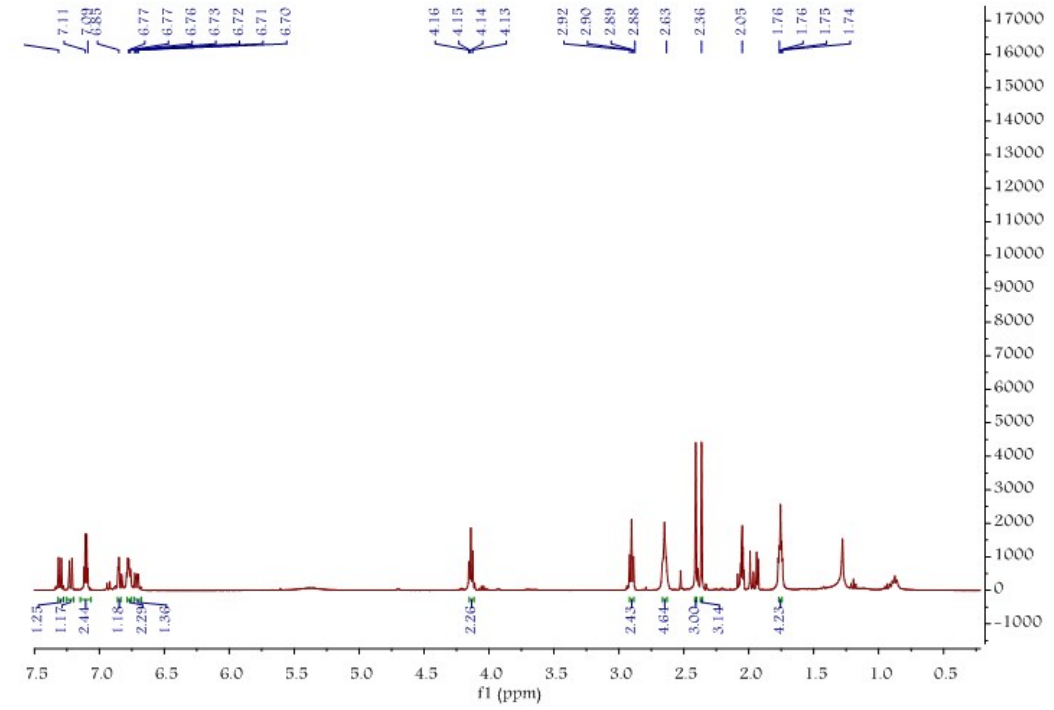
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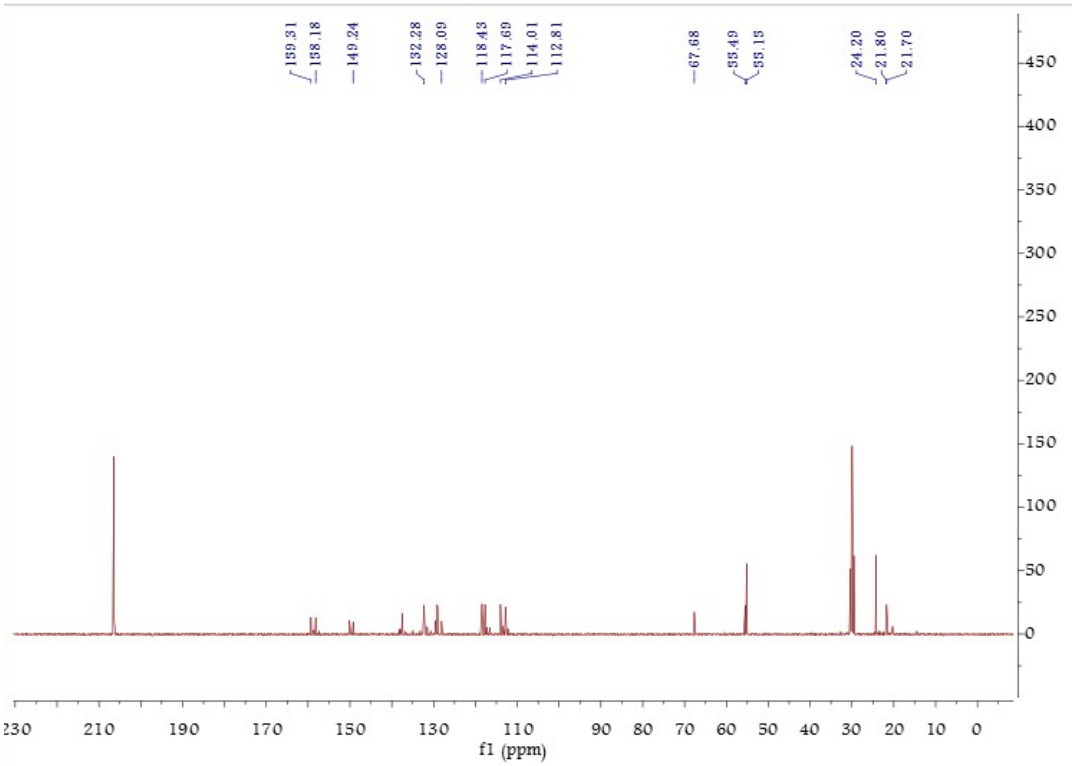
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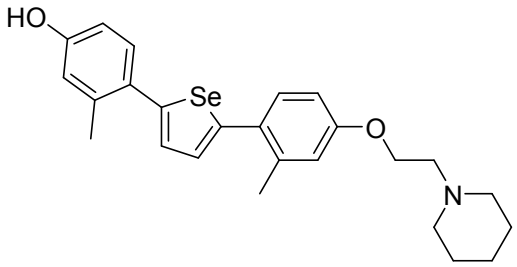
9c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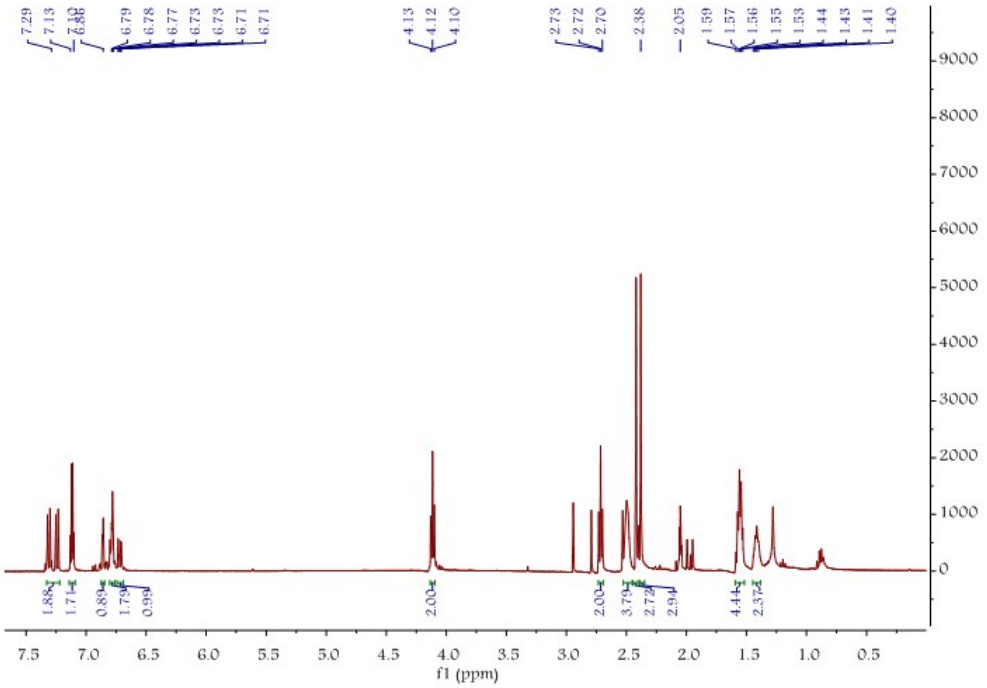
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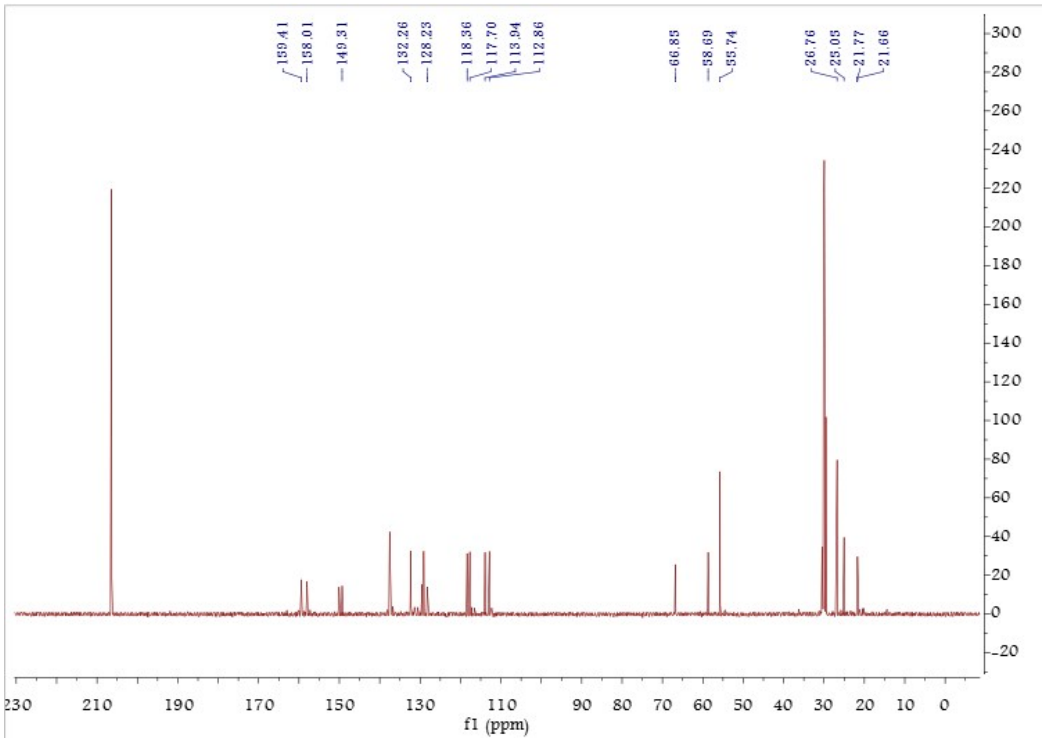
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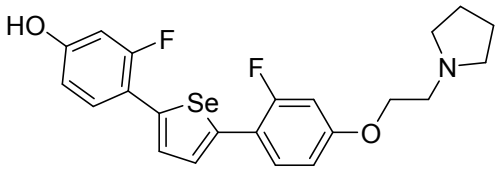
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F
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O
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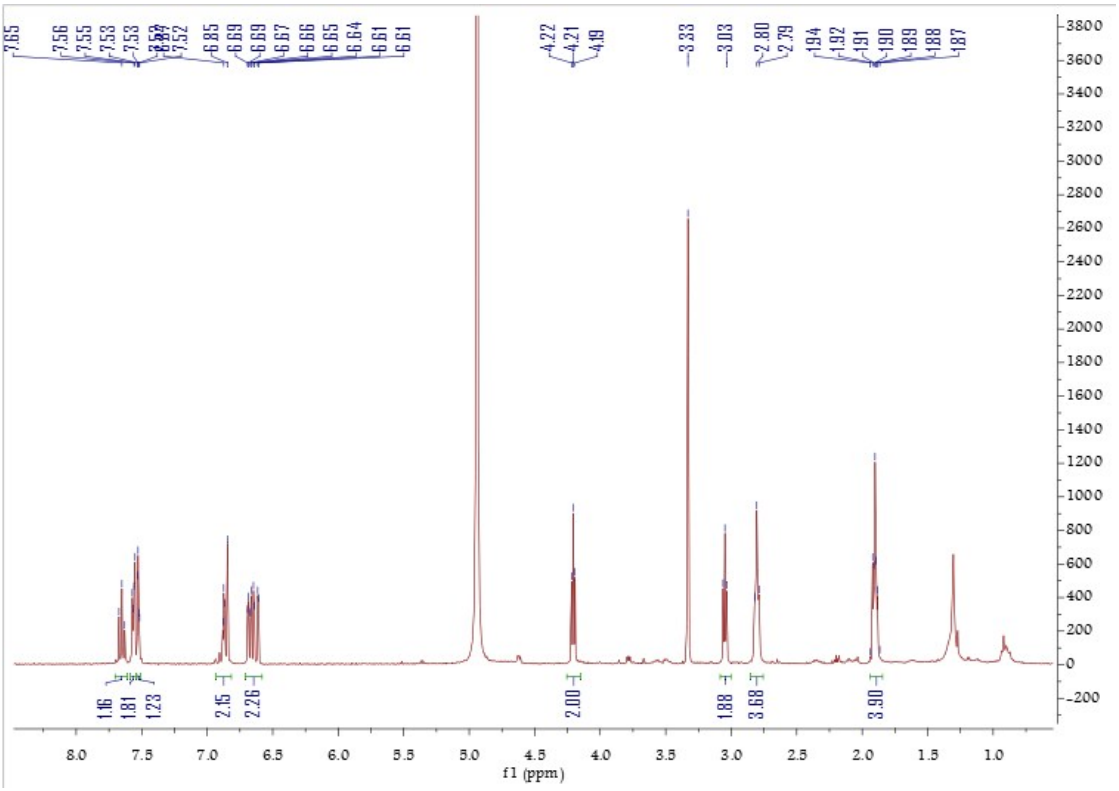
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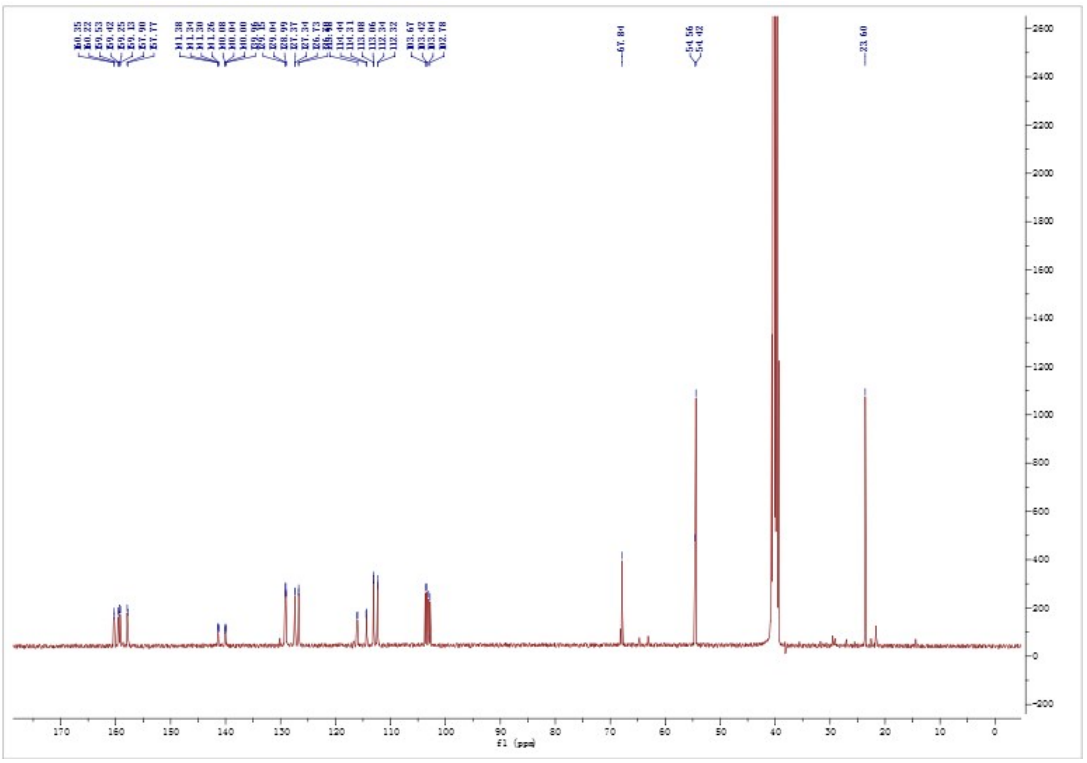
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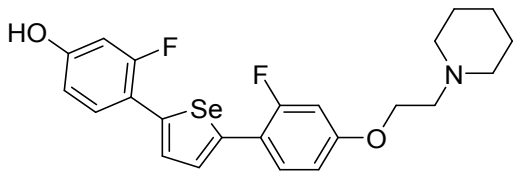
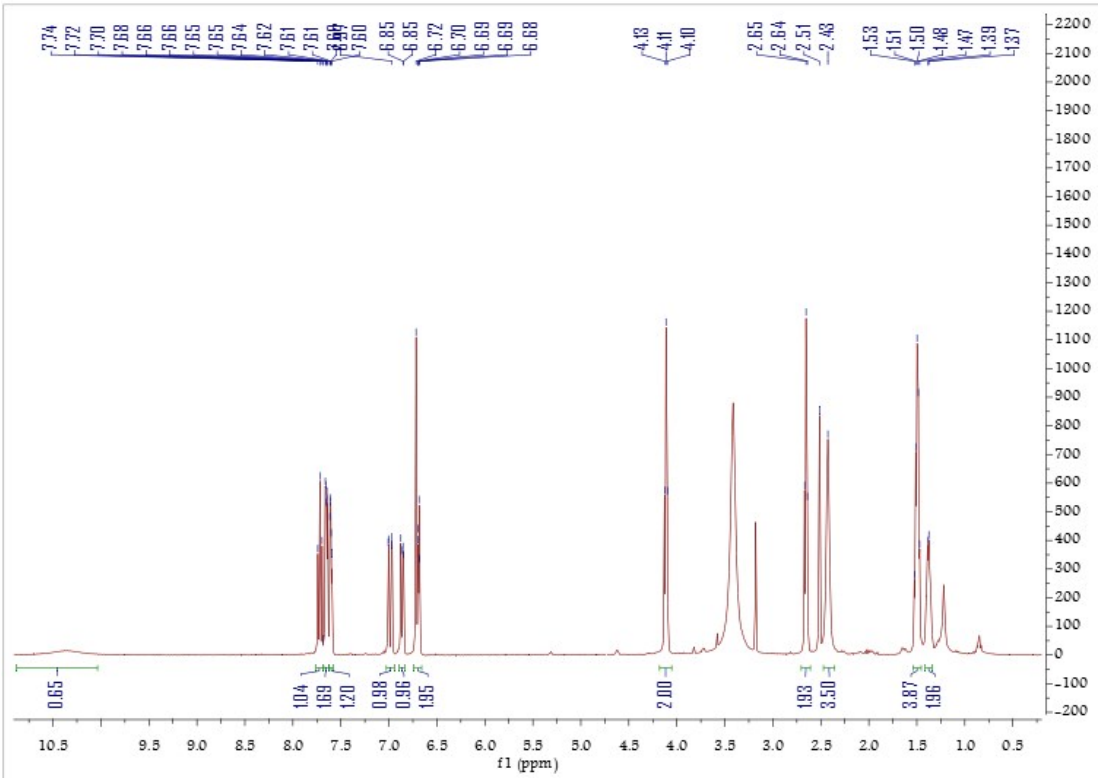
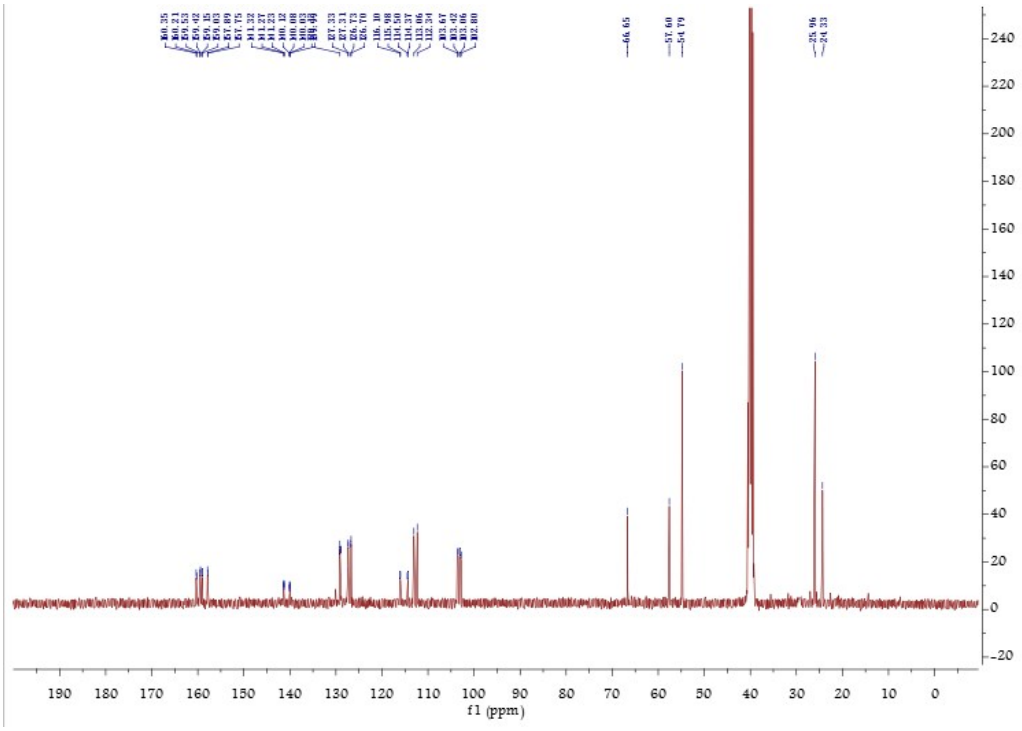
9e







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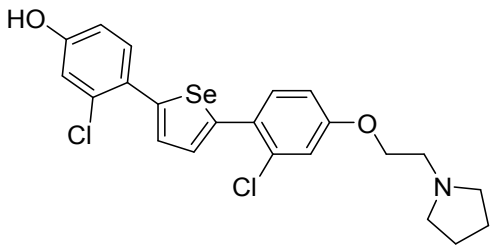
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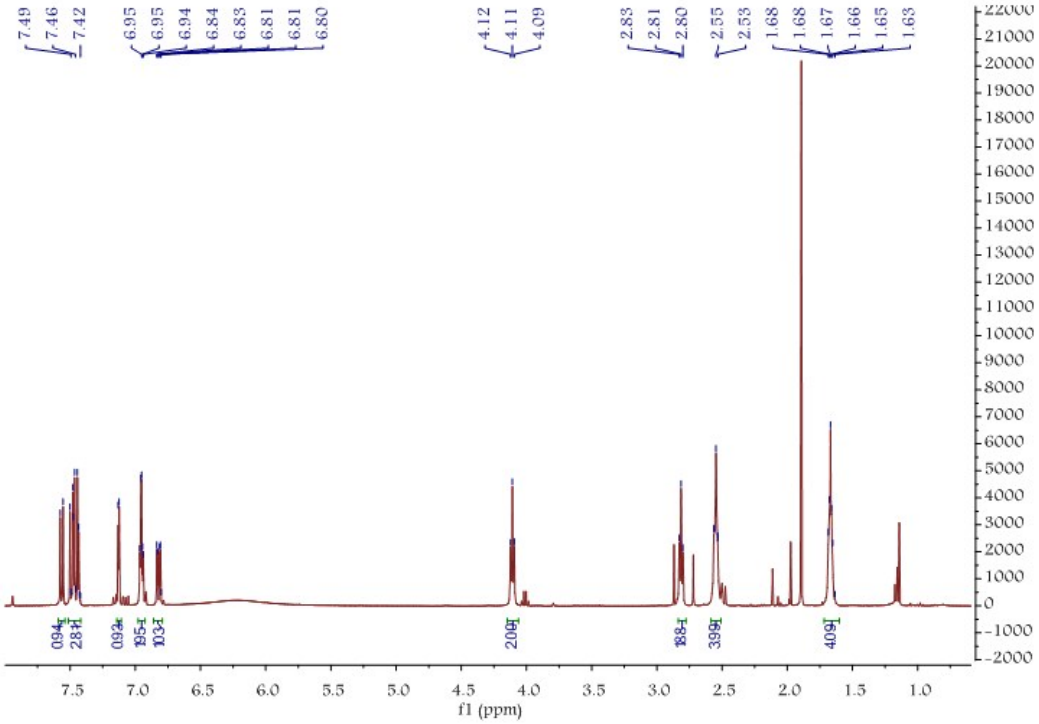
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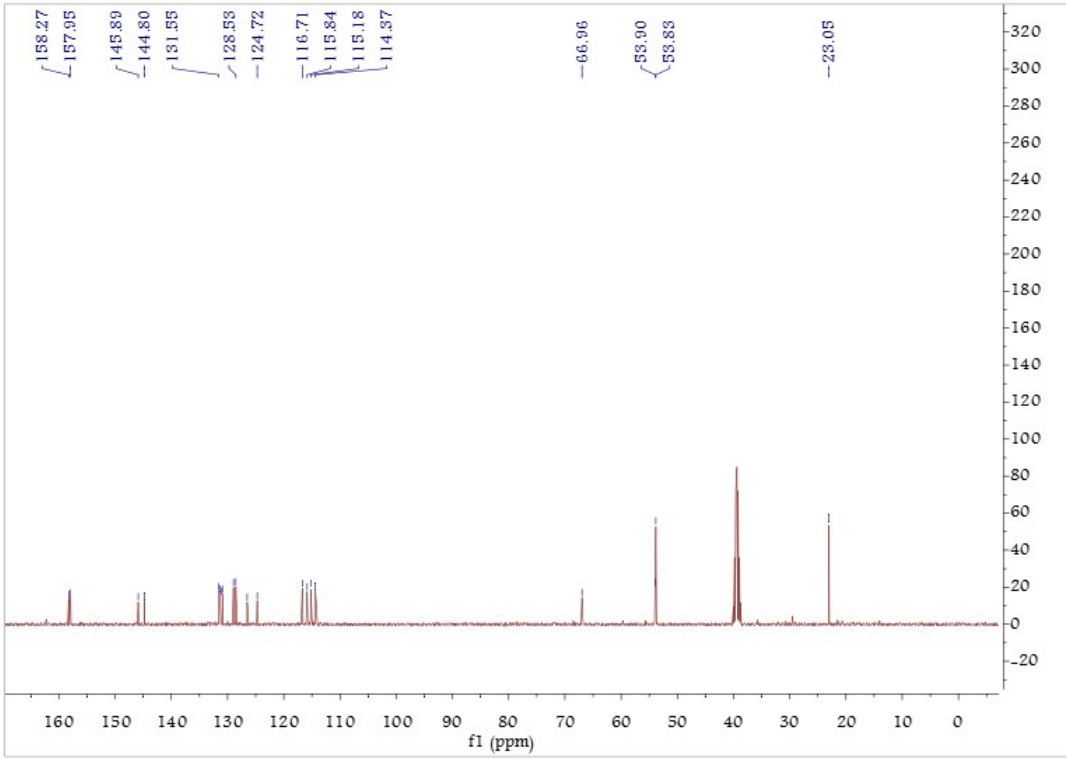
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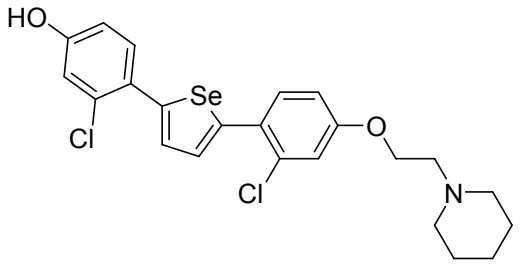
9g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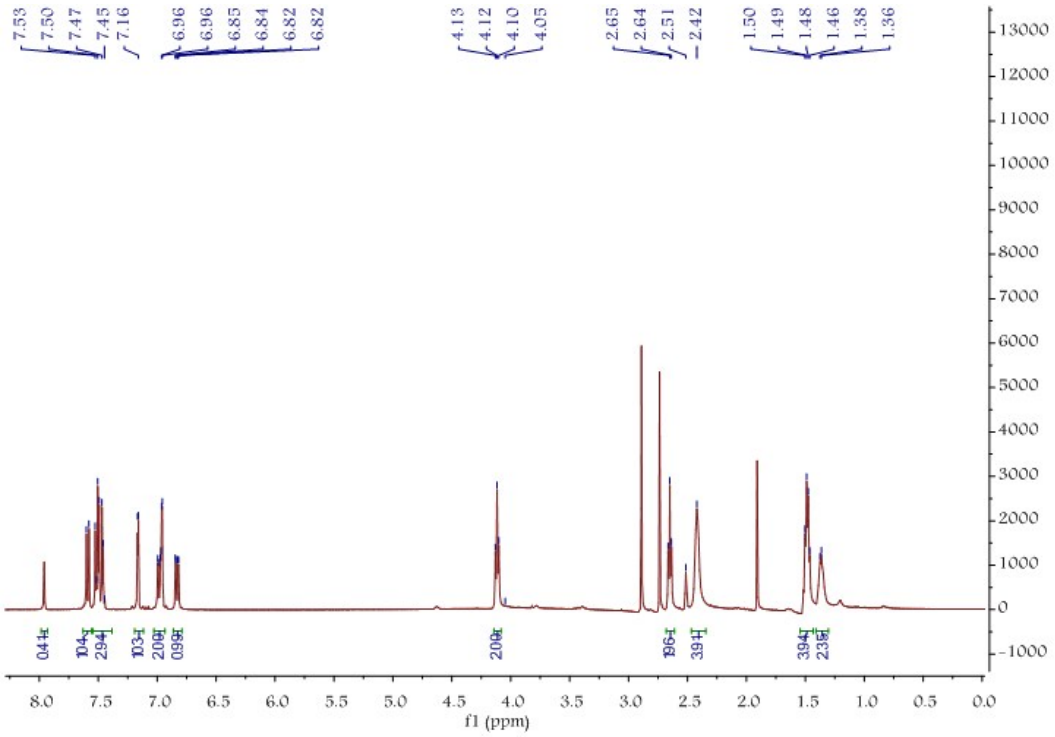
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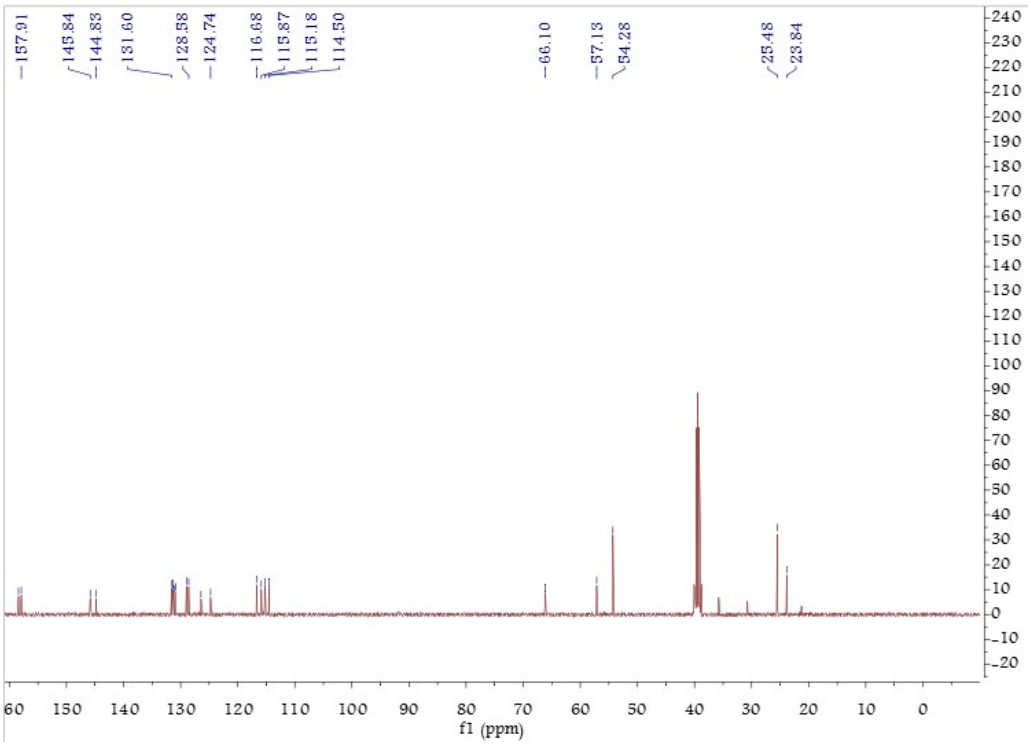
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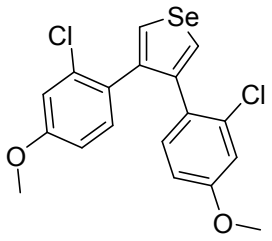
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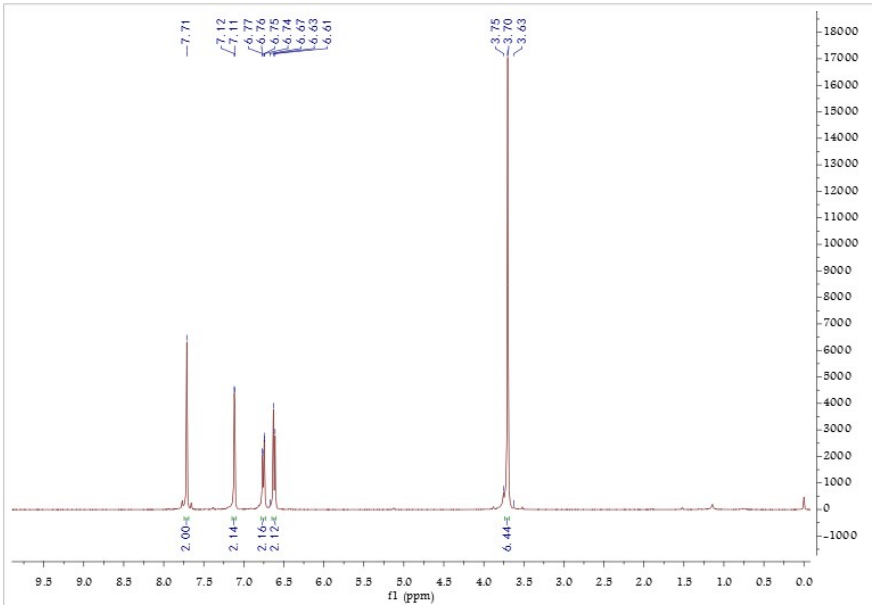
Se
Cl
O
O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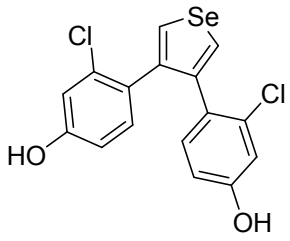
11e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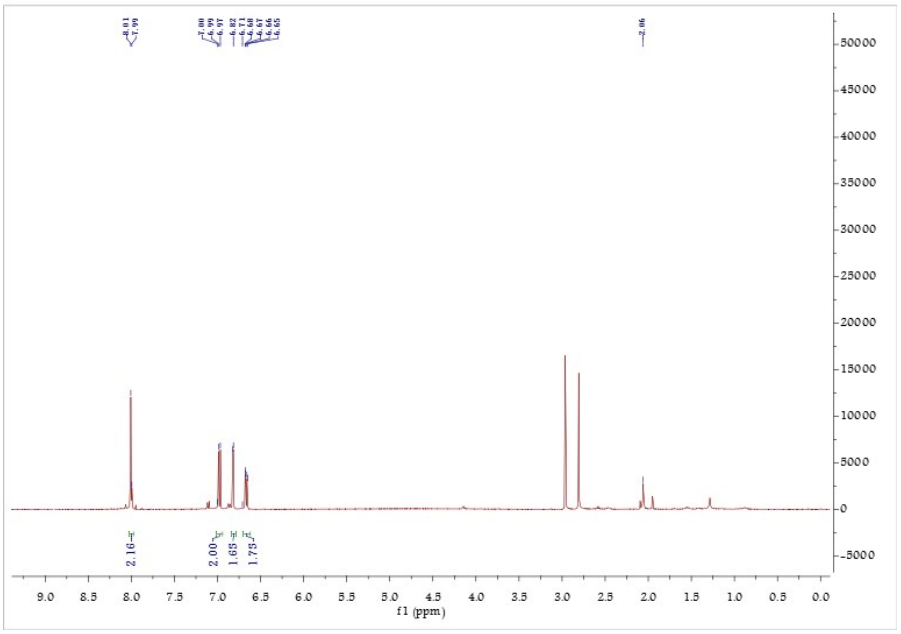
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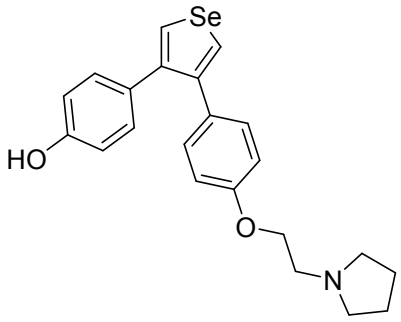
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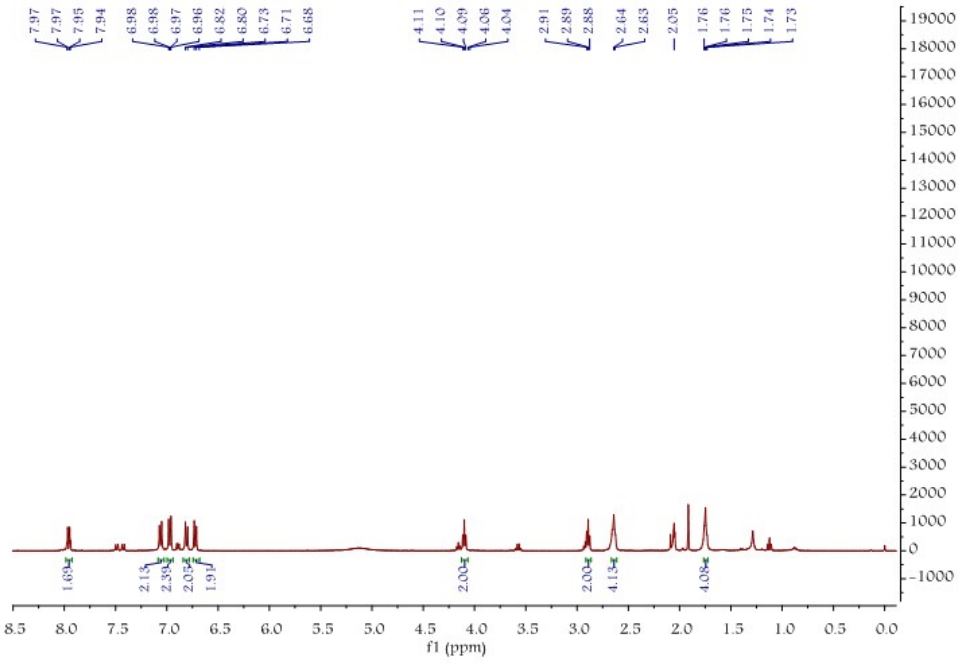
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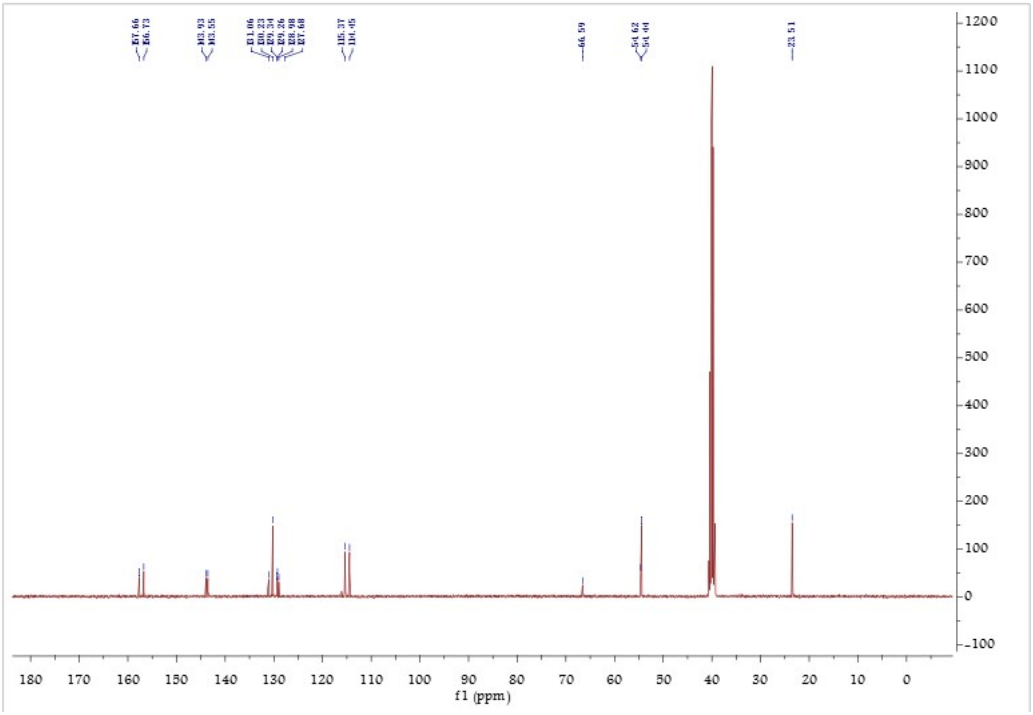
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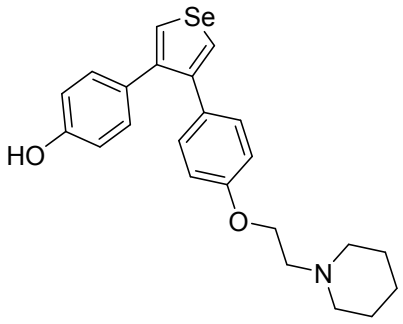
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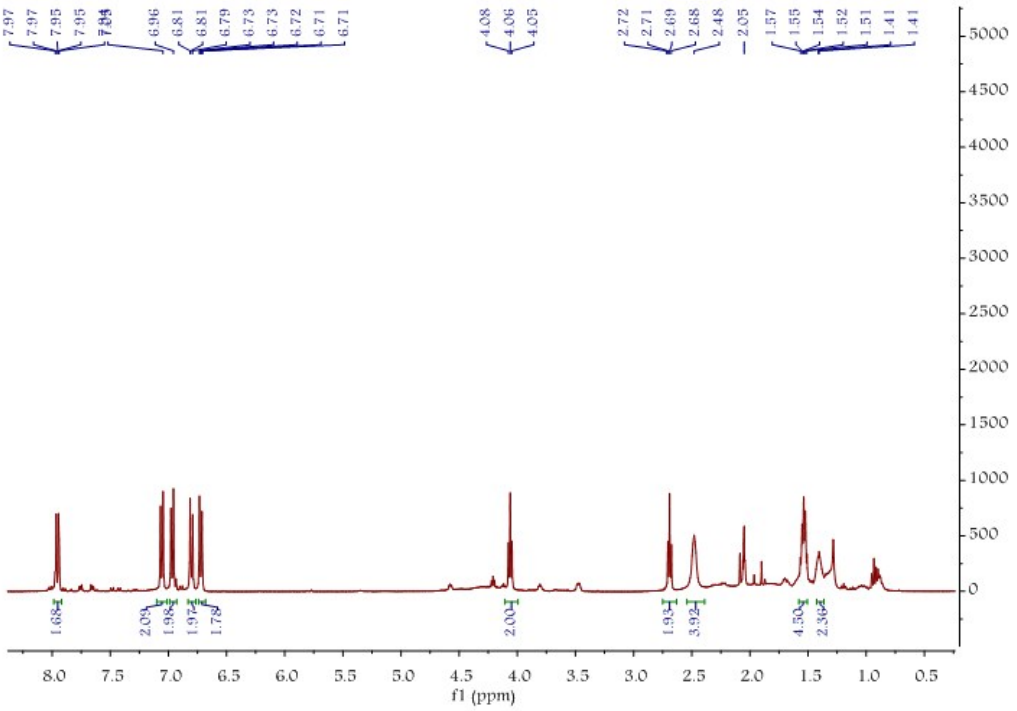
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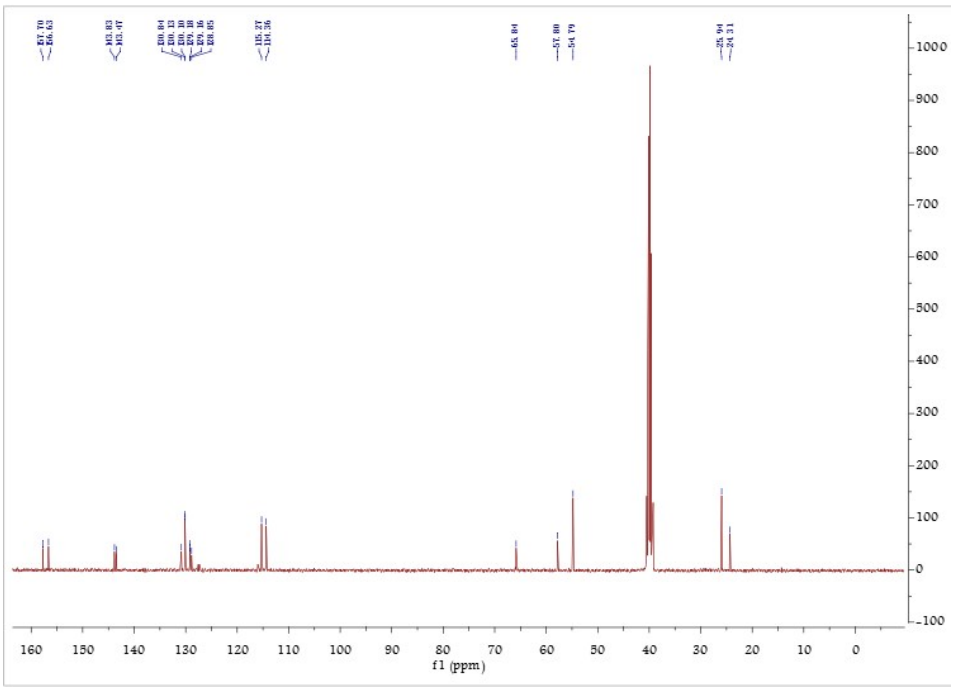
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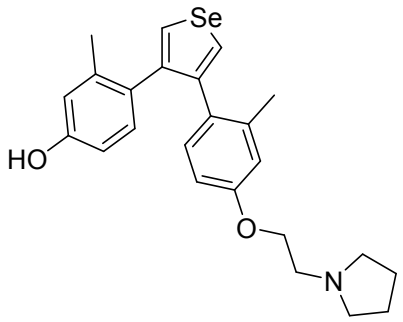
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HO
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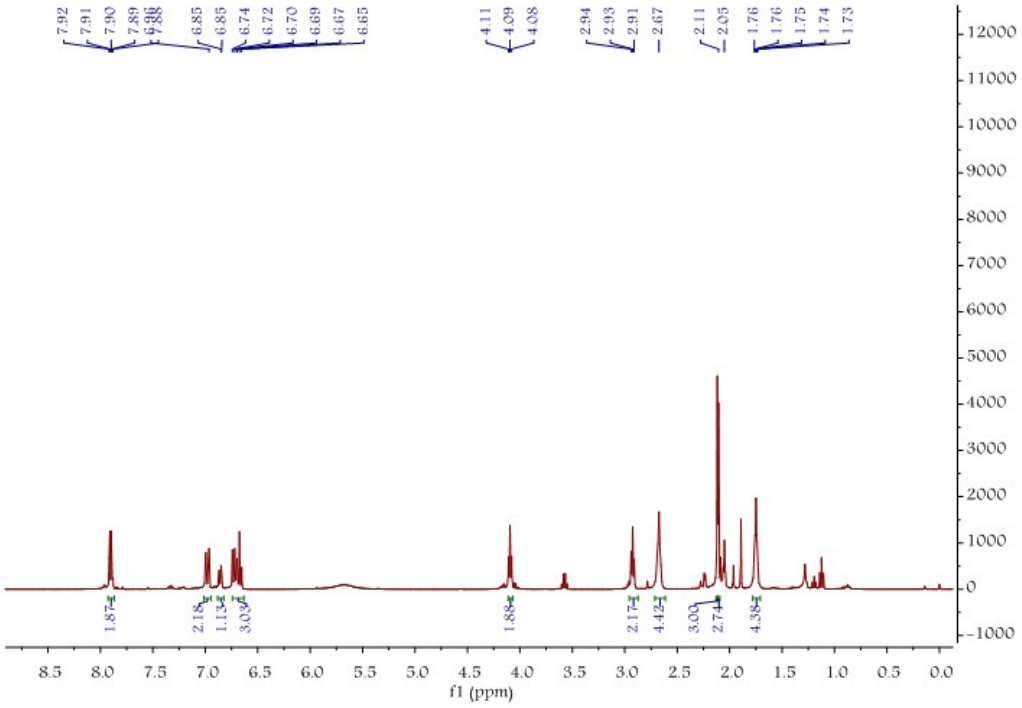
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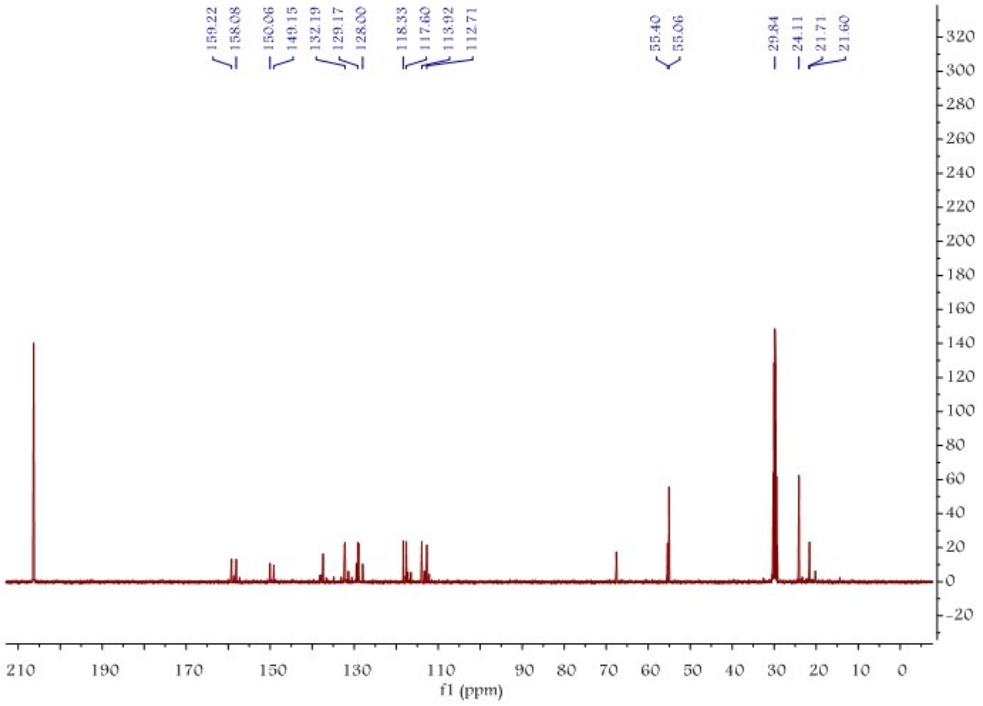
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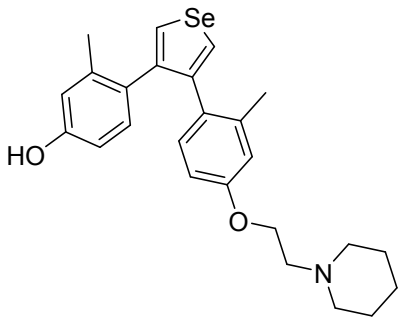
12d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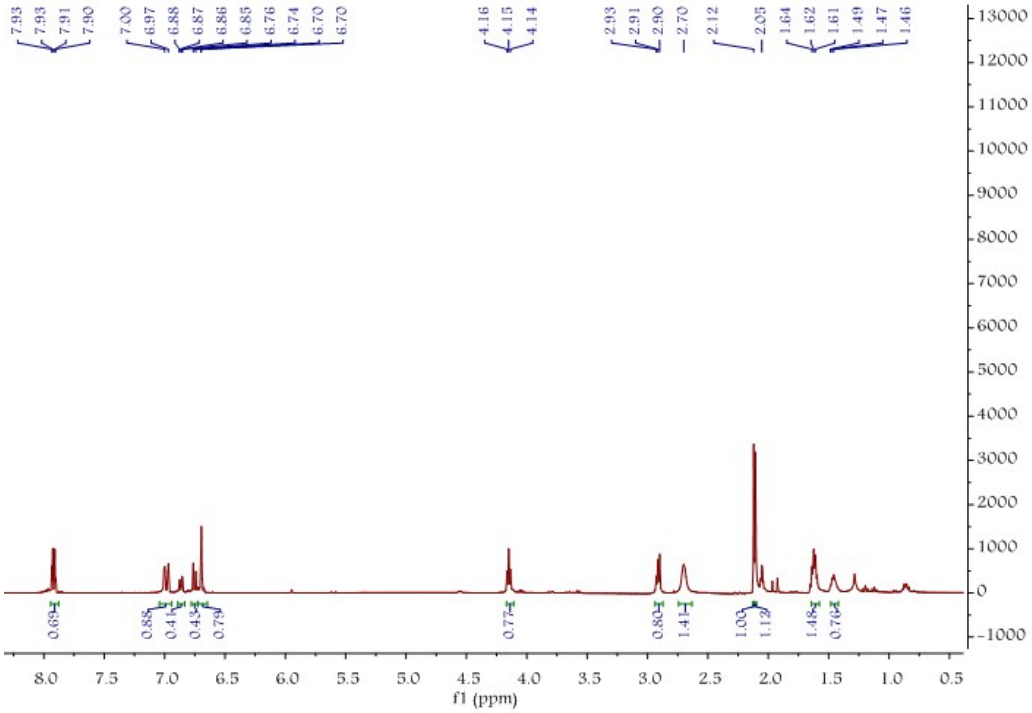
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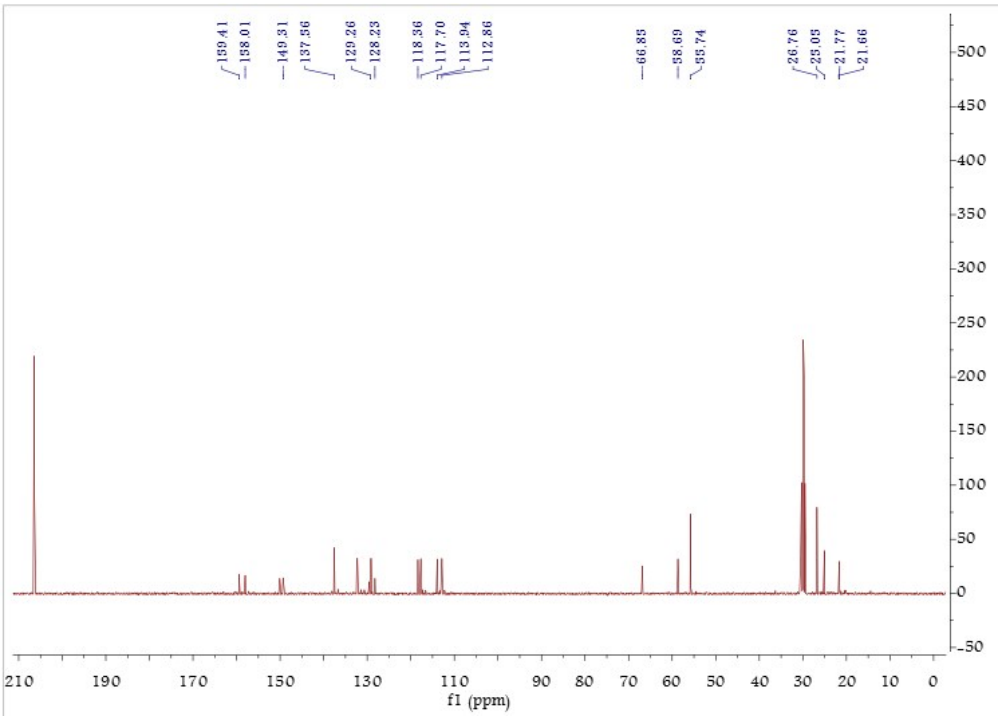
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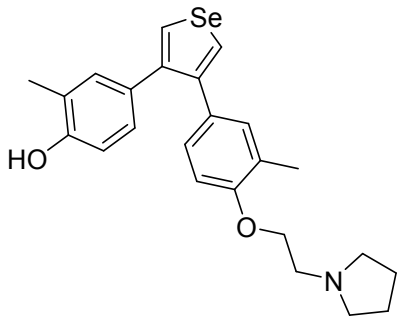
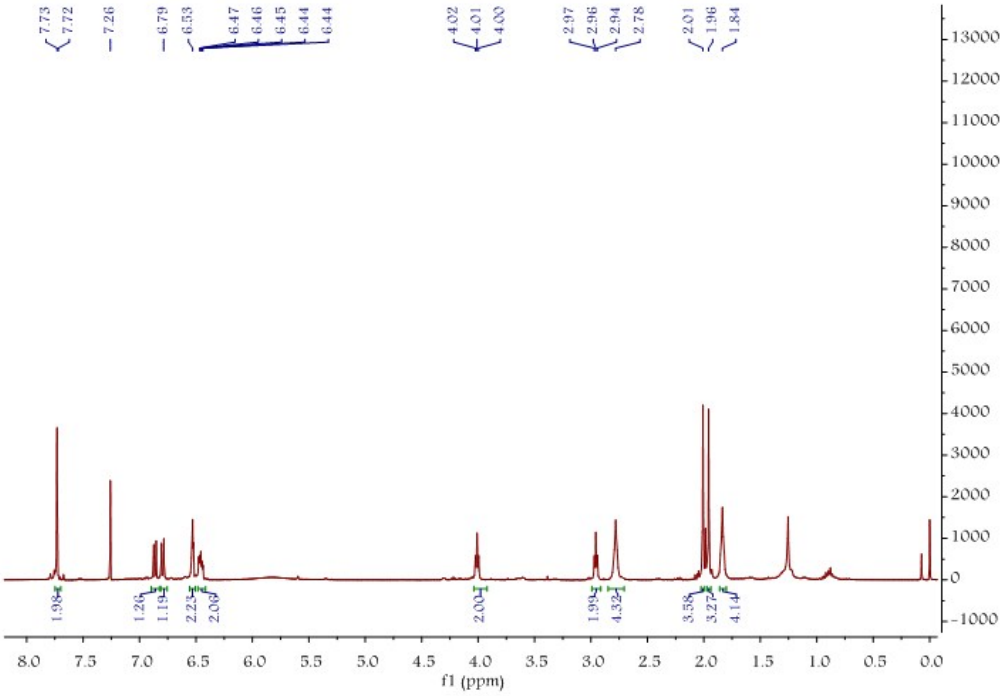
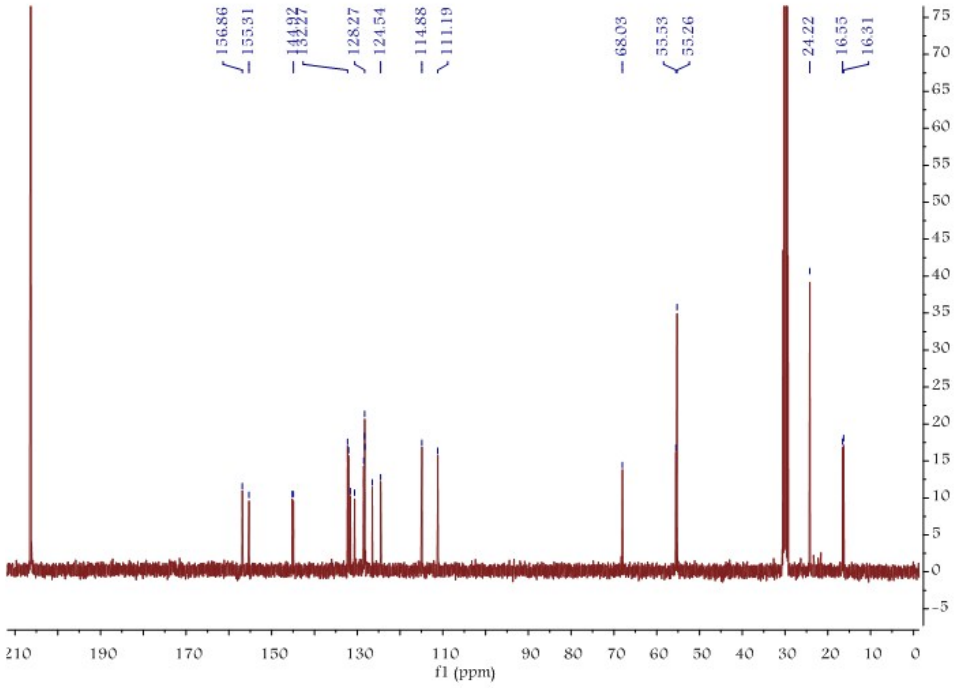
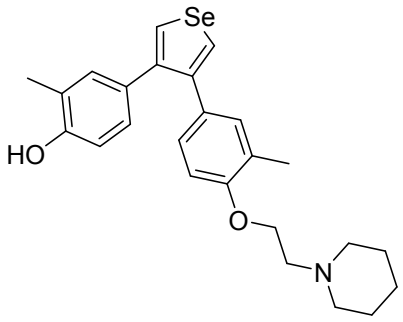
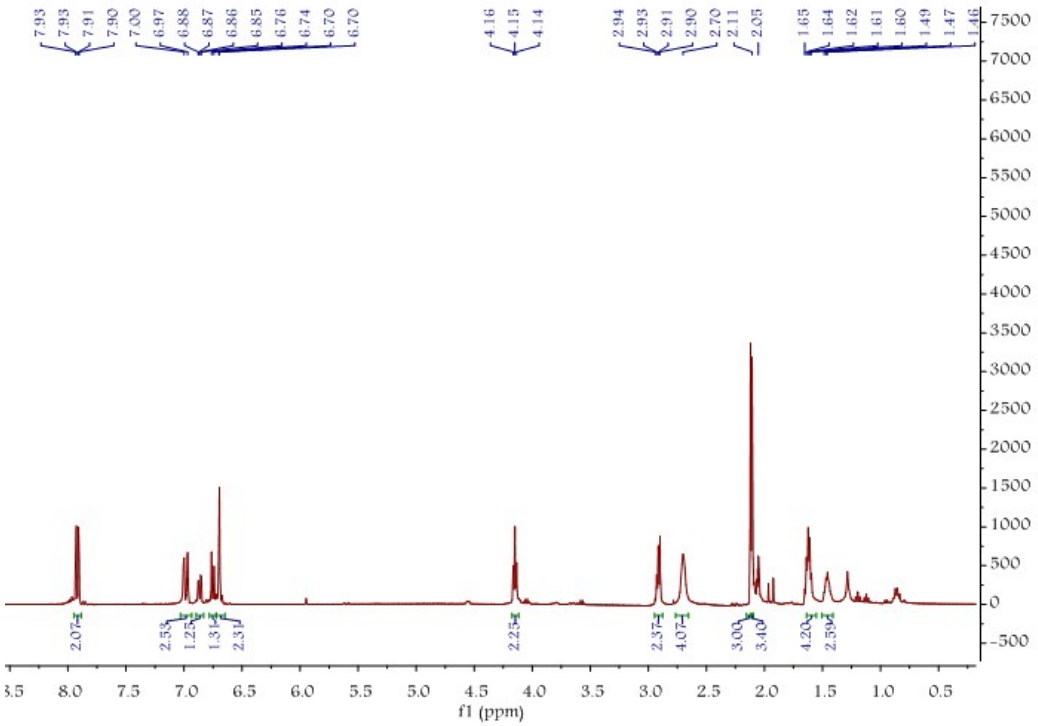

Se
HO
O
N

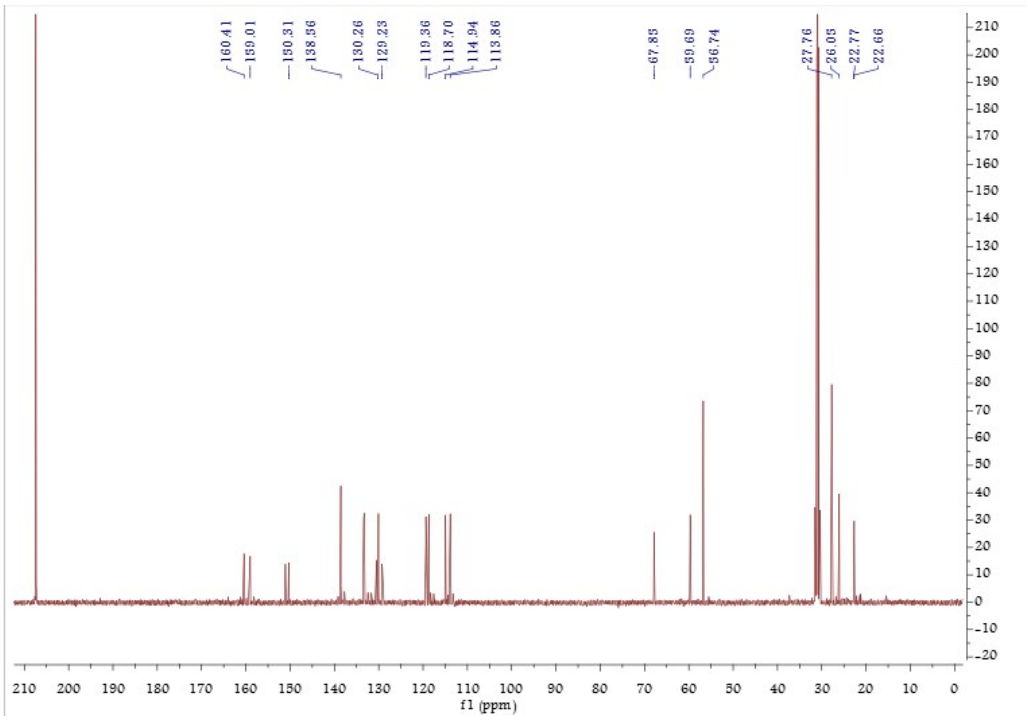

7.73
7.72
7.26
6.79
6.53
6.47
6.46
6.45
6.44
6.44
4.02
4.01
4.00
2.97
2.96
2.94
2.78
2.01
1.96
1.84
1.98
1.26
1.19
2.23
2.08
2.00
1.99
4.32
3.58
3.27
4.14
f1 (ppm)


156.86
155.31
144.92
142.27
128.27
124.54
114.88
111.19
68.03
55.53
55.26
24.22
16.55
16.31
f1 (ppm)

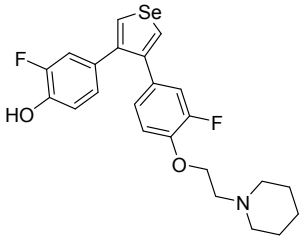
12f

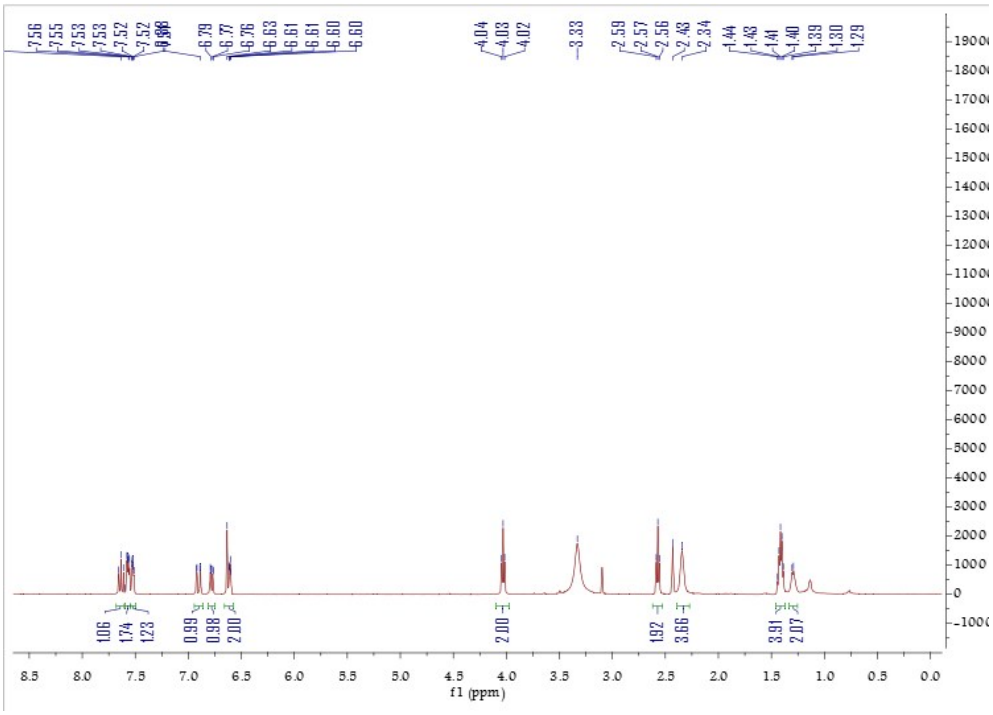

Se
HO
O
N

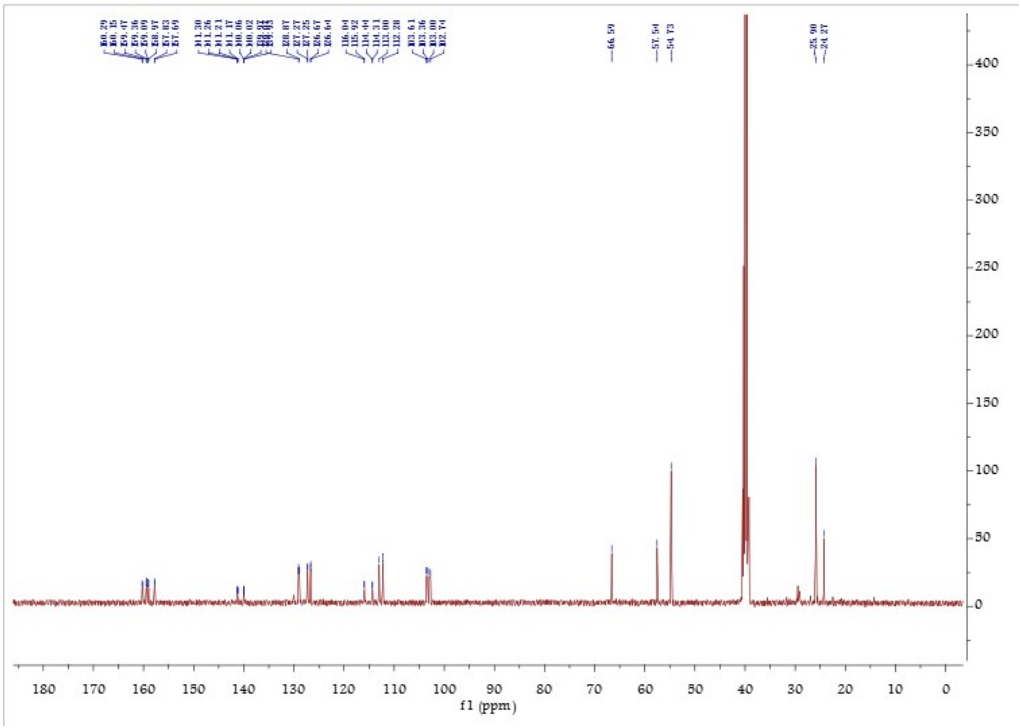

7.93
7.93
7.91
7.90
7.00
6.97
6.88
6.87
6.86
6.85
6.76
6.74
6.70
4.16
4.15
4.14
2.94
2.93
2.91
2.90
2.70
2.11
2.05
1.65
1.64
1.62
1.61
1.60
1.49
1.47
1.46
2.07
2.53
1.25
1.31
2.31
2.25
2.37
4.07
3.00
3.40
4.20
2.59
f1 (ppm)


160.41
159.01
150.31
138.56
130.26
129.23
119.36
118.70
114.94
113.86
67.85
59.69
56.74
27.76
26.05
22.77
22.66
f1 (ppm)

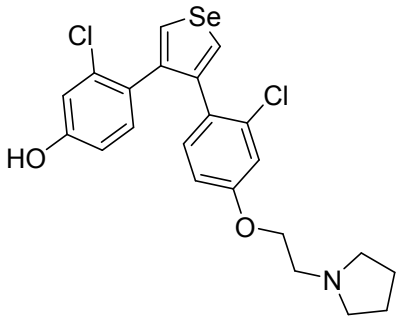
12g

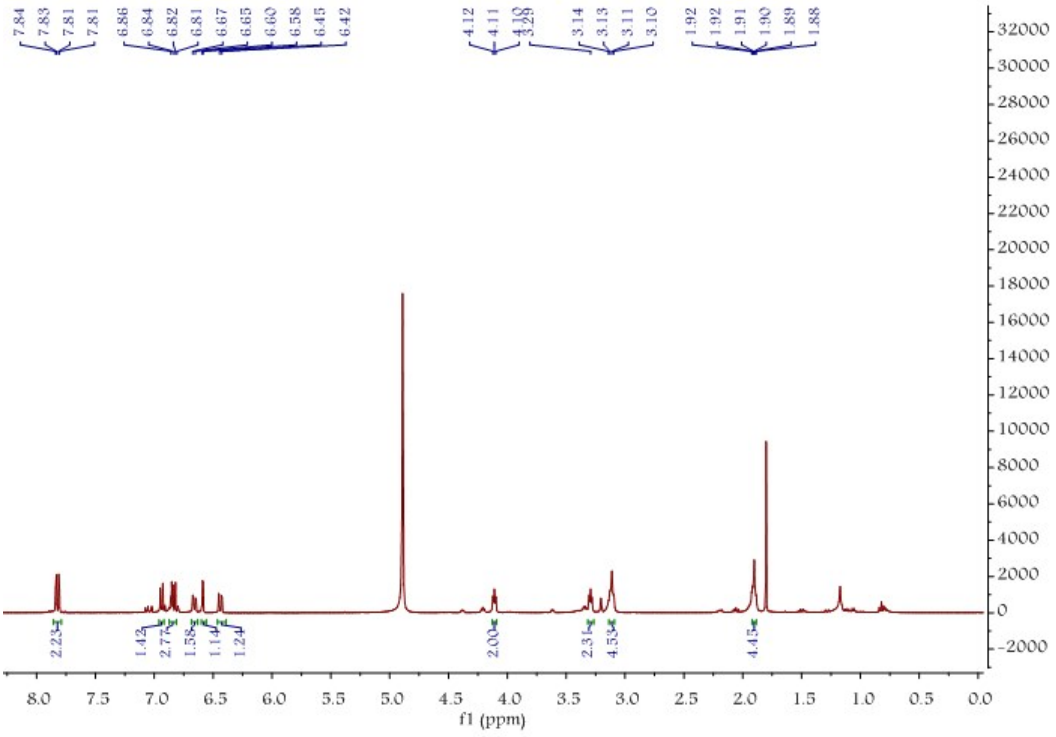

Se
F
HO
F
O
N

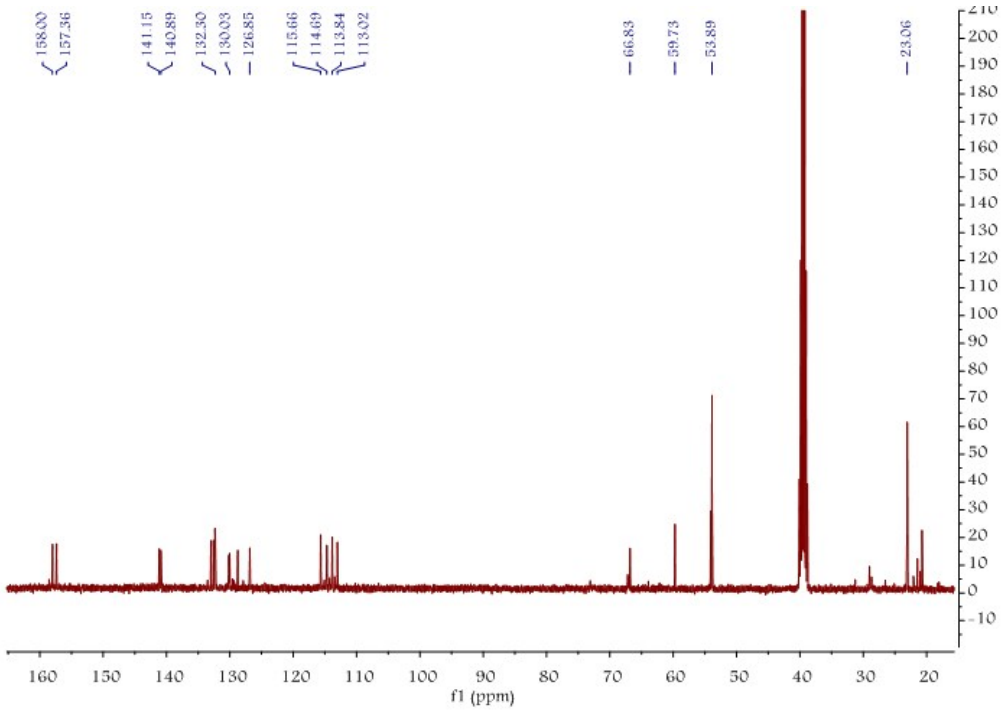

7.56
7.55
7.53
7.53
7.52
7.52
6.79
6.77
6.76
6.63
6.61
6.61
6.60
6.60
4.04
4.03
4.02
3.33
2.59
2.57
2.56
2.43
2.34
1.44
1.43
1.41
1.40
1.39
1.30
1.29
1.06
1.74
1.23
0.99
0.98
2.00
2.00
1.92
3.66
3.91
2.07
f1 (ppm)


66.99
57.94
54.73
25.90
24.27
f1 (ppm)

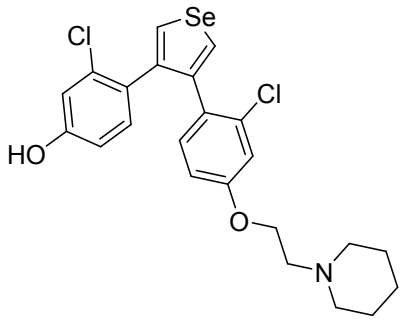
12h

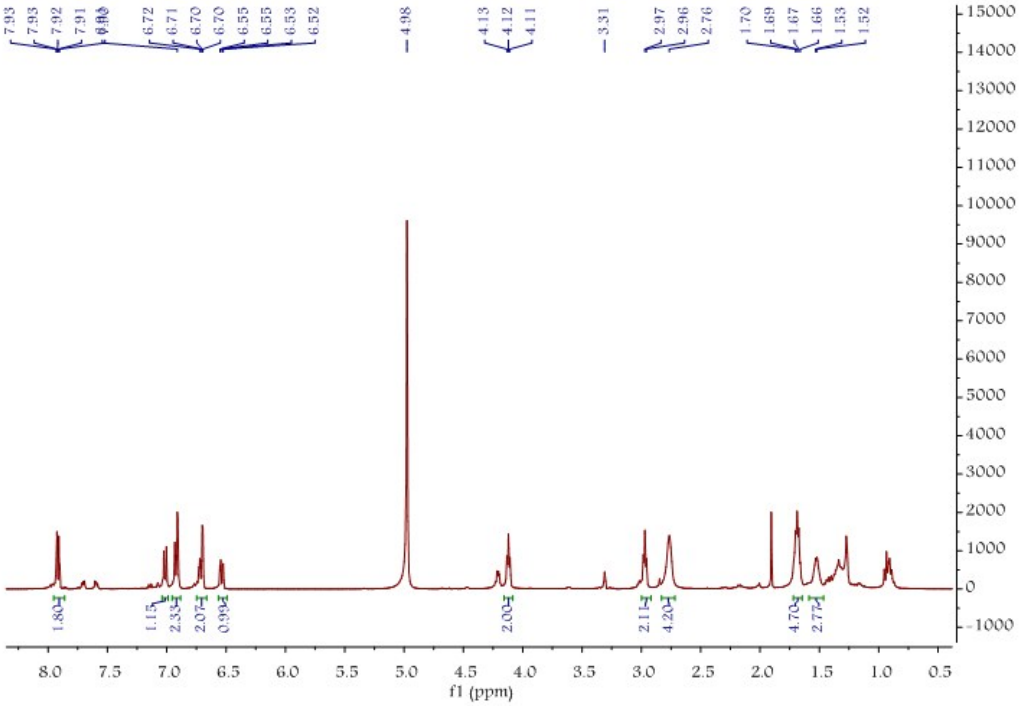

Cl
Se
Cl
HO
O
N

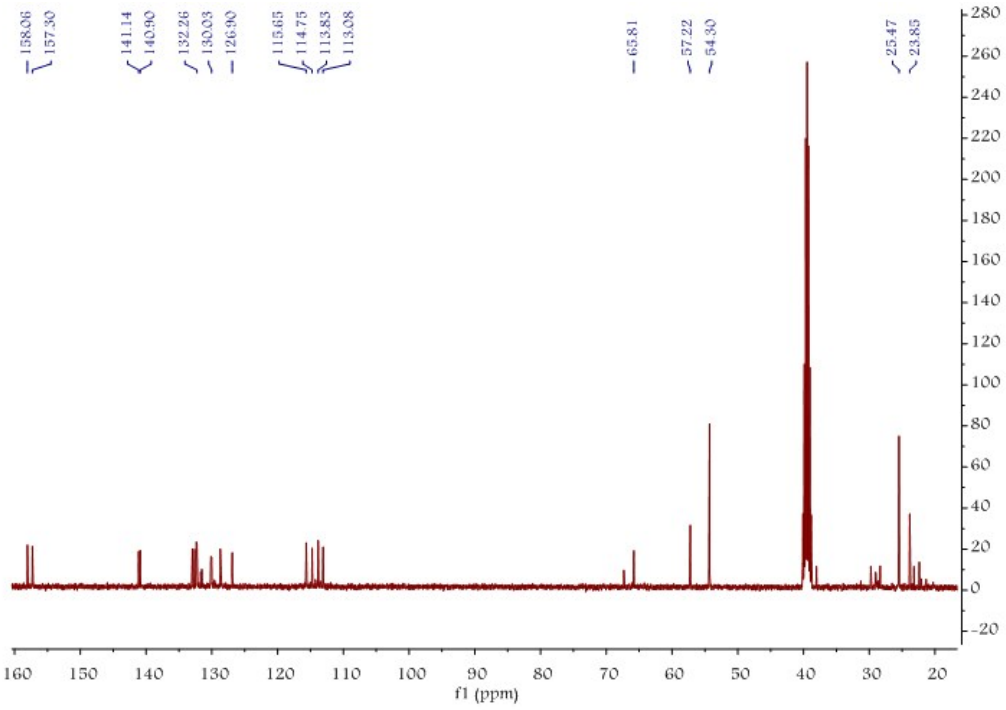

7.84
7.83
7.81
7.81
6.86
6.84
6.82
6.81
6.67
6.65
6.60
6.58
6.45
6.42
4.12
4.11
4.10
3.28
3.14
3.13
3.11
3.10
1.92
1.92
1.91
1.90
1.89
1.88
2.23
1.42
2.77
1.58
1.14
1.24
2.00
2.31
4.53
4.45
f1 (ppm)


158.00
157.36
141.15
140.89
132.30
130.03
126.85
115.66
114.69
113.84
113.02
66.83
59.73
53.89
23.06
f1 (ppm)

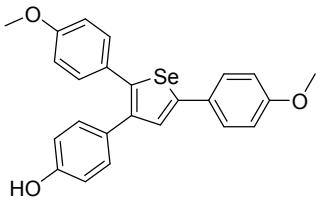
12i

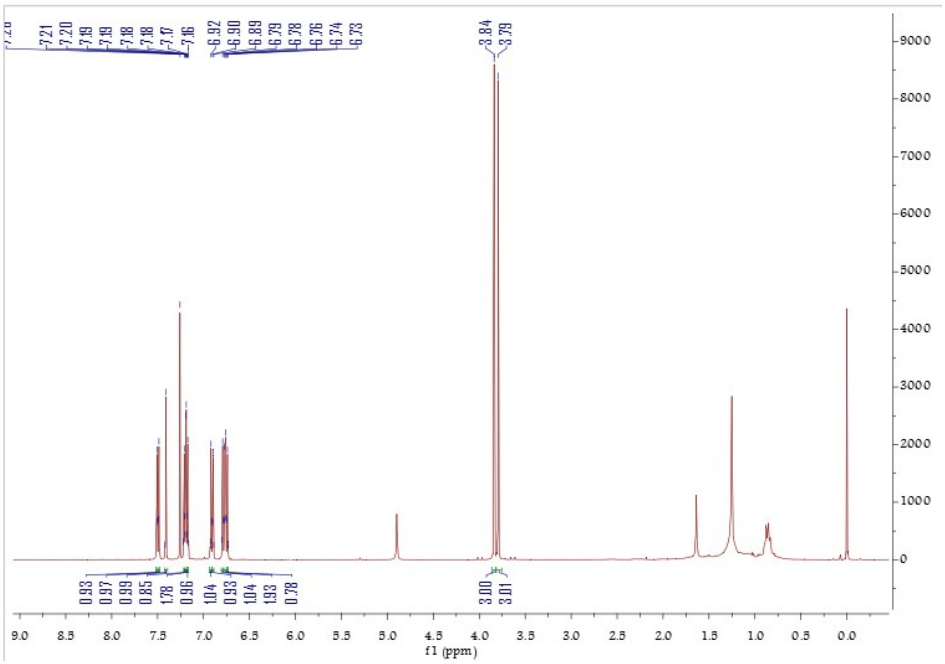

Cl
Se
Cl
HO
O
N


7.93
7.93
7.92
7.91
6.72
6.71
6.70
6.70
6.55
6.55
6.53
6.52
4.98
4.13
4.12
4.11
3.31
2.97
2.96
2.76
1.70
1.69
1.67
1.66
1.53
1.52
1.80
1.15
2.33
2.07
0.99
2.00
2.11
4.20
4.70
2.77
f1 (ppm)

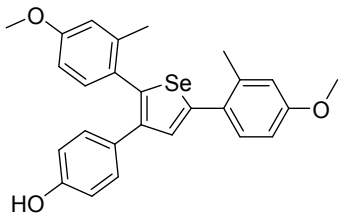

158.06
157.30
141.14
140.90
132.26
130.03
126.90
115.65
114.75
113.83
113.08
65.81
57.22
54.30
25.47
23.85
f1 (ppm)

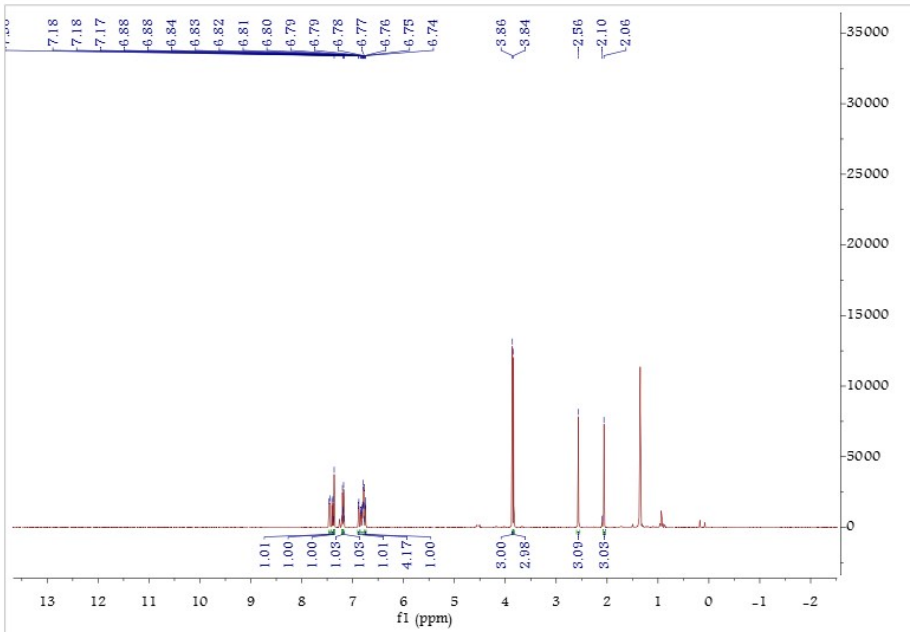
14a


O
Se
O
HO

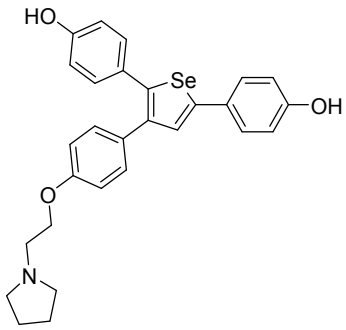

7.21
7.20
7.19
7.19
7.18
7.18
7.17
7.16
6.92
6.90
6.89
6.79
6.78
6.76
6.74
6.73
3.84
3.79
0.93
0.97
0.99
0.85
1.78
0.96
1.04
0.93
1.04
1.93
0.78
3.00
3.01
f1 (ppm)

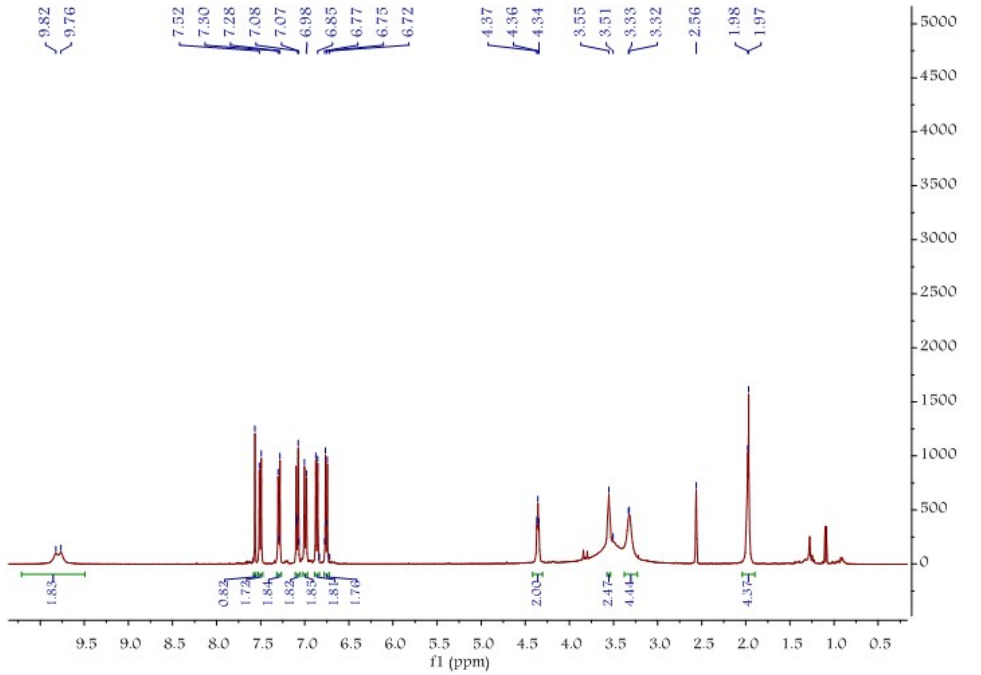
14b


O
Se
O
HO


7.18
7.18
7.17
6.88
6.88
6.84
6.83
6.82
6.81
6.80
6.79
6.79
6.78
6.77
6.76
6.75
6.74
3.86
3.84
2.56
2.10
2.06
1.01
1.00
1.00
1.03
1.03
1.01
4.17
1.00
3.00
2.98
3.09
3.03
f1 (ppm)

16a


HO
Se
OH
O
N


9.82
9.76
7.52
7.30
7.28
7.08
7.07
6.98
6.85
6.77
6.75
6.72
4.37
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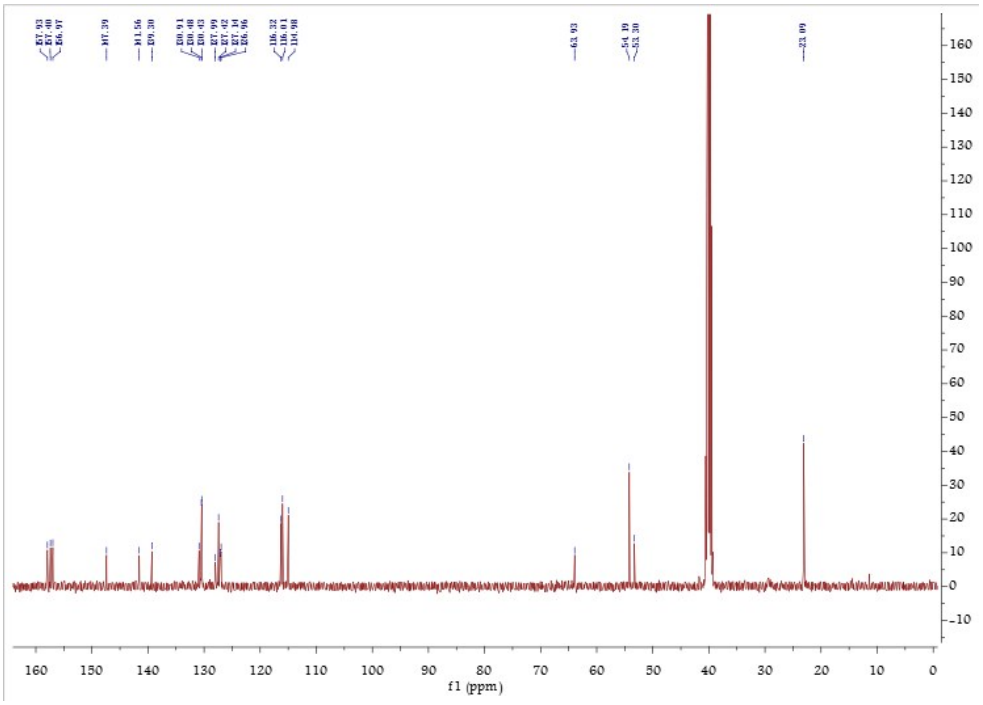
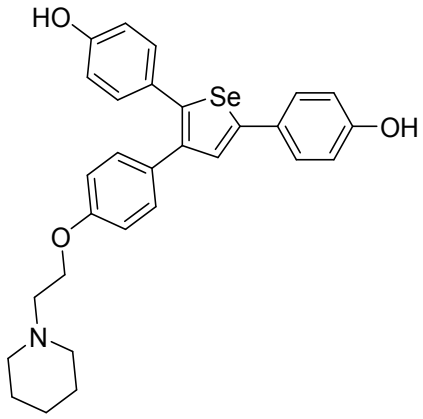
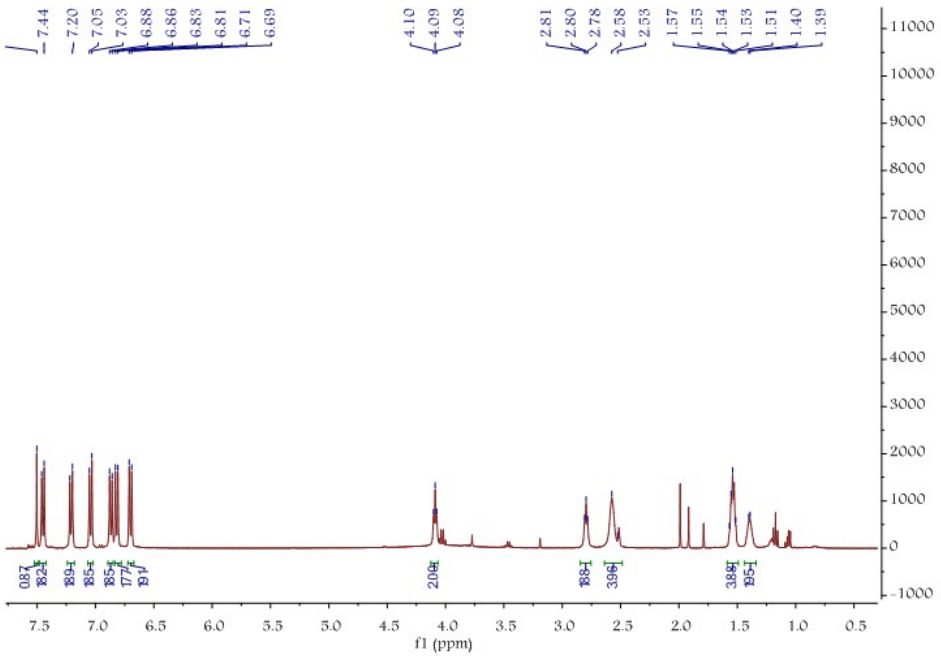
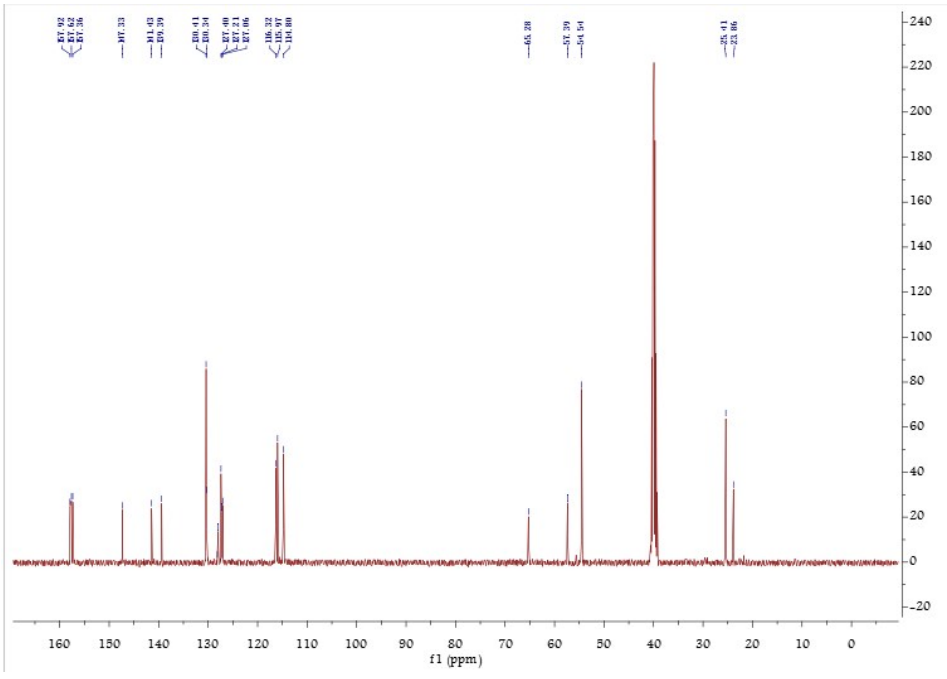
4.34
3.55
3.51
3.33
3.32
2.56
1.98
1.97
f1 (ppm)


f1 (ppm)

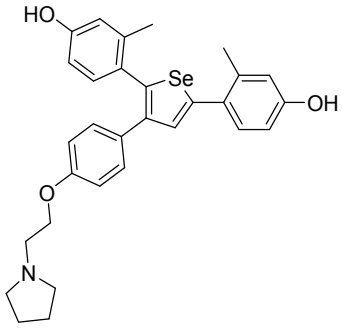
16b

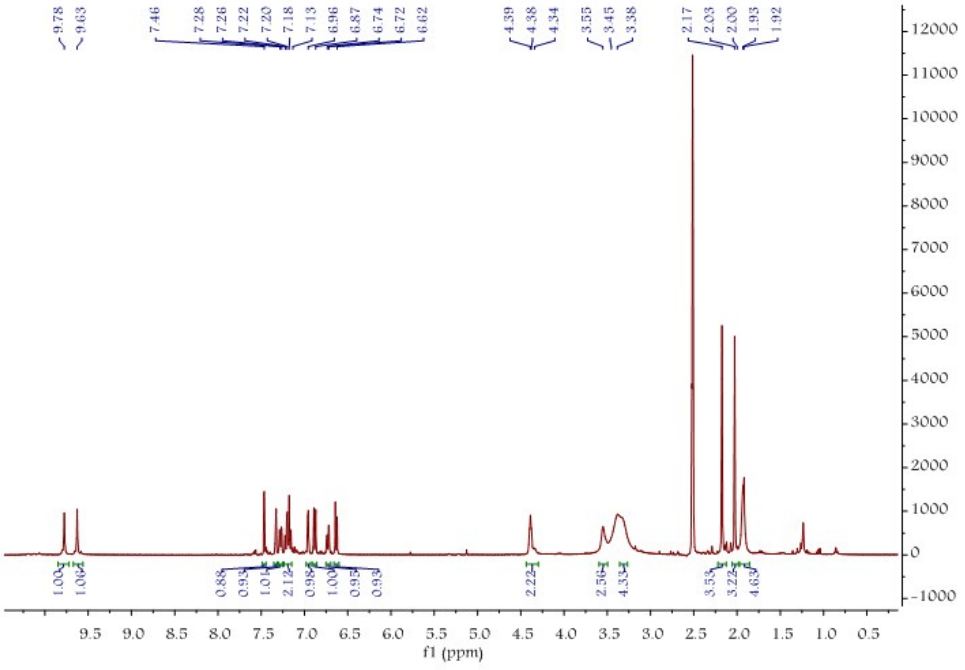

HO
Se
OH
O
N

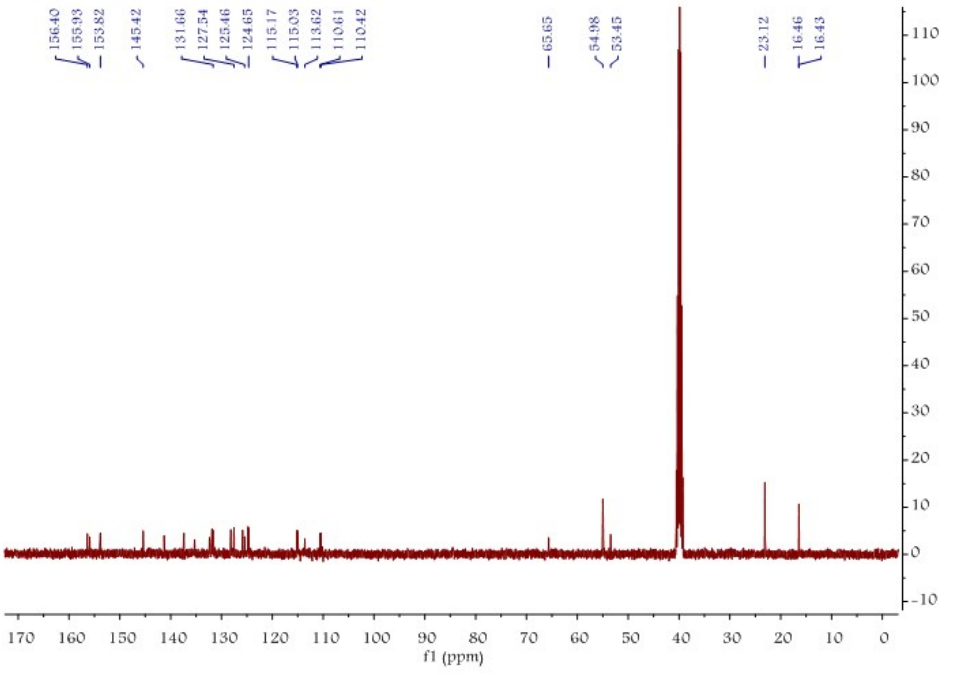

7.44
7.20
7.05
7.03
6.88
6.86
6.83
6.81
6.71
6.69
4.10
4.09
4.08
2.81
2.80
2.78
2.58
2.53
1.57
1.55
1.54
1.53
1.51
1.40
1.39
f1 (ppm)


f1 (ppm)

16c


HO
Se
OH
O
N


9.78
9.63
7.46
7.28
7.26
7.22
7.20
7.18
7.13
6.96
6.87
6.74
6.72
6.62
4.39
4.38
4.34
3.55
3.45
3.38
2.17
2.03
2.00
1.93
1.92
f1 (ppm)


156.40
155.93
153.82
145.42
131.66
127.54
125.46
124.65
115.17
115.03
113.62
110.61
110.42
65.65
54.98
53.45
23.12
16.46
16.43
f1 (ppm)