

# Design, synthesis, and biological evaluation of novel hydroxamic acid-based organoselenium hybrids

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## **1.1. The biological assays**

### **1.1.1. The anticancer activity**

The breast adenocarcinoma (MCF-7), Hepatocellular carcinoma (HEPG-2), and normal fibroblast (WI-38) cells were obtained from ATCC via Holding company for biological products and vaccines (VACSERA), Cairo, Egypt. The reagents RPMI-540 medium, MTT, DMSO, and fetal bovine serum was obtained from Sigma Aldrich. Dulbecco's modified Eagle's medium was used as the culture medium for the cells, and the cytotoxicity was evaluated using the reported MTT assay. Doxorubicin was used as the positive reference, and the IC<sub>50</sub> values were obtained from the corresponding dose-response curve.

#### **MTT assay[1-3]**

This colorimetric assay is based on converting the yellow tetrazolium bromide (MTT) to a purple formazan derivative by mitochondrial succinate dehydrogenase in viable cells. Cell lines were cultured in RPMI-540 medium with 10% fetal bovine serum. Antibiotics added were 100 units/ml penicillin and 100µg/ml streptomycin at 37 C in a 5% Co<sub>2</sub> incubator. The cell lines were seeded in a 96-well plate at a density of  $1.0 \times 10^4$  cells/well. at 37 C for 48 h under 5% Co<sub>2</sub>. After incubation, the cells were treated with different concentrations of compounds and incubated for 13 h. After 13 h of drug treatment, 9 µl of MTT solution at 5mg/ml was added and incubated for 4 h. Finally, dimethyl sulfoxide (DMSO) in the volume of 100 µl is added to each well to dissolve the purple formazan formed. The colorimetric assay is measured and recorded at an absorbance of 570 nm using a plate reader (EXL 800, USA). The percentage of the relative cell viability was calculated as (A<sub>570</sub> of treated samples/A<sub>570</sub> of the untreated sample) X 100.

### **1.1.2. The antimicrobial activity**

The antimicrobial activities of the OSe compounds were evaluated against *C. albicans* yeast as well as *E. coli* gram-negative and *S. aureus* gram-positive bacteria employing the agar well diffusion assay [4].

Briefly, a concentration of 1 mM was prepared for each compound by dissolving in DMSO. Paper discs of standard size (5cm) were sterilized in an autoclave and soaked in 9  $\mu$ L of the test compounds, and placed in the Petri dishes, which in turn contain a nutrient media (agar 9 g, peptone 5 g, and beef extract 3 g) seeded with the dedicated strain. Incubation lasted for 13 h at 36  $^{\circ}$ C. Experiments were replicated three times and the antifungal clotrimazole and antibiotic ampicillin were used as standards. The % activity index for the complex was determined and depicted in table 2.

Furthermore, the MICs (in  $\mu$ M) were determined by the microdilution method according to the reported protocol.

### **1.1.3. The antioxidant activity**

#### **1.1.3.1. The DPPH bioassay**

The hydrogen atom or electron donation ability of the corresponding compounds was measured by estimating the bleaching of the purple color of a methanolic solution of DPPH [5]. This spectrophotometric assay uses stable DPPH $\cdot$  reagent. The sample was prepared by adding 90 mL of the OSe compounds (1 mM in methanol) to 400 mL DPPH in methanol. After 30 min of incubation in the dark, the absorbance was read against a blank at 560 nm. Ascorbic acid (vitamin C) and ebselen were used as standard antioxidants (positive control). A blank sample was run without DPPH. A negative control sample was run using methanol instead of the sample. The radical scavenging activity was calculated

using the following equation:

$$\text{Inhibition\%} = (A_{\text{blank}} - A_{\text{sample}}) / (A_{\text{blank}}) * 100.$$

#### **1.1.3.2. The ABTS bioassay**

The antioxidant activity of the investigated compounds was assessed using 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid (ABTS) method [6]. The radical cation derived from ABTS was

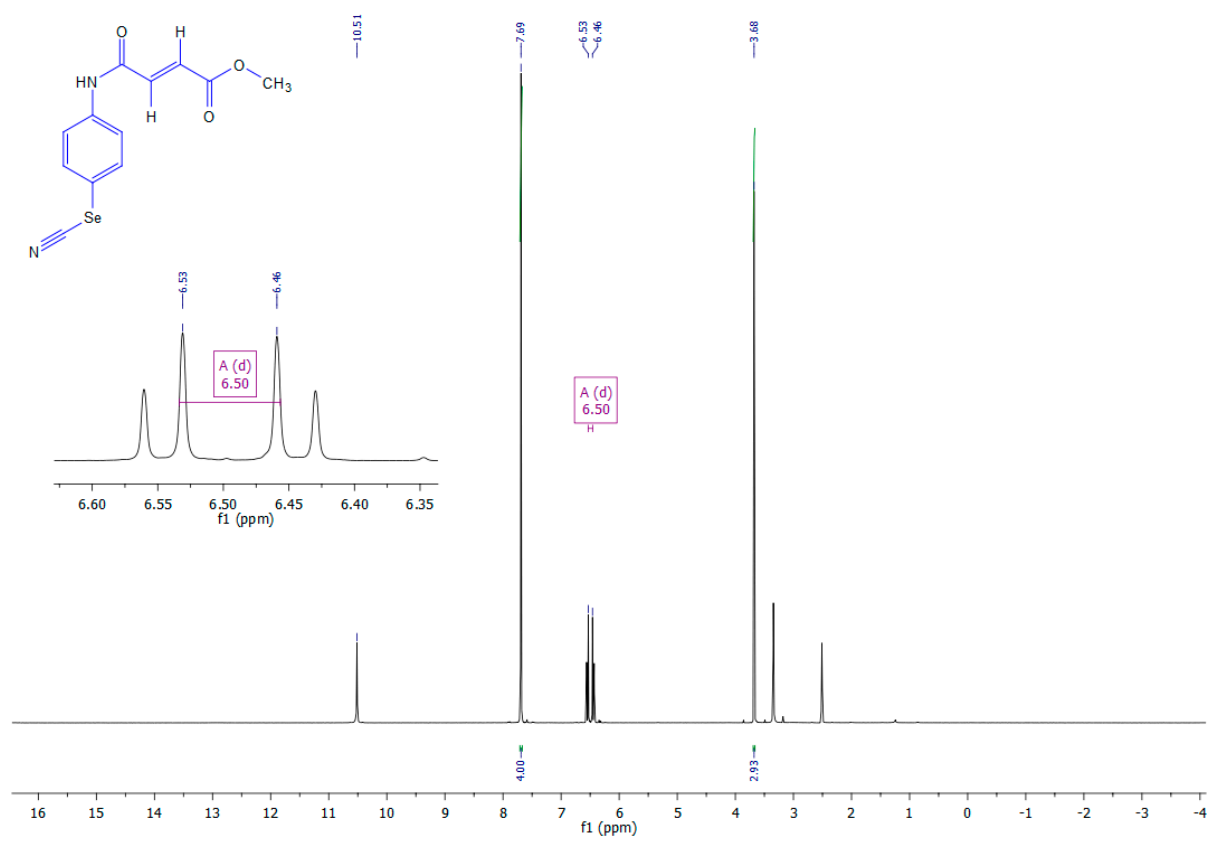
prepared by the reaction of 60 mM ABTS solution with 0.3 M manganese dioxide solution in 0.1M phosphate buffer, pH 7. Then, the mixture was shaken, centrifuged, filtered, and the absorbance ( $A_{\text{control}}$ ) of the resulting green-blue solution (ABTS radical solution) was measured at wavelength 734 nm. Then, 50 mL of 1 mg/ml test compound in phosphate-buffered methanol was added. The absorbance ( $A_{\text{test}}$ ) was measured. The reduction in color intensity was expressed as % inhibition. The % inhibition for each compound is calculated from the following equation

$$\text{Inhibition\%} = (A_{\text{control}} - A_{\text{sample}}) / (A_{\text{control}}) * 100$$

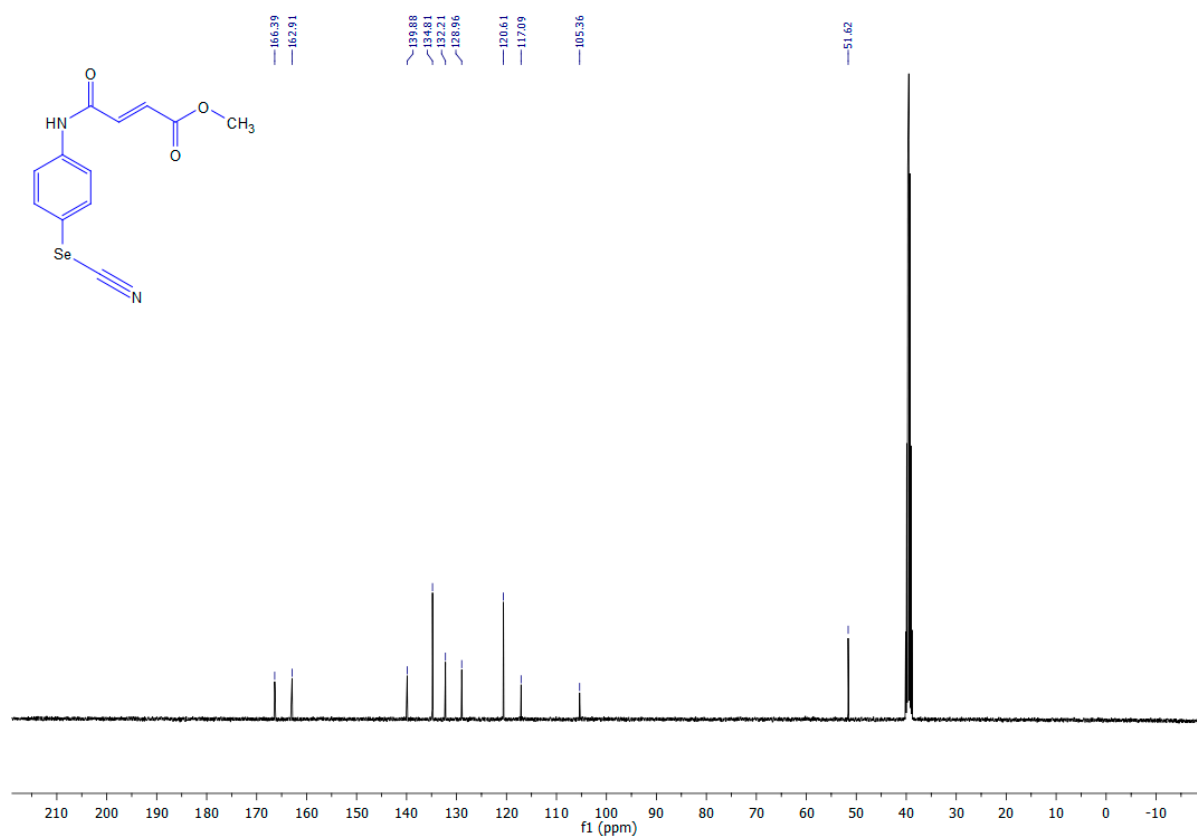
Ascorbic acid (vitamin C) was used as a standard antioxidant (positive control). A blank sample was run without ABTS and using MeOH/phosphate buffer (1:1) instead of the sample. A negative control sample was run with MeOH/phosphate buffer (1:1) instead of a tested compound.



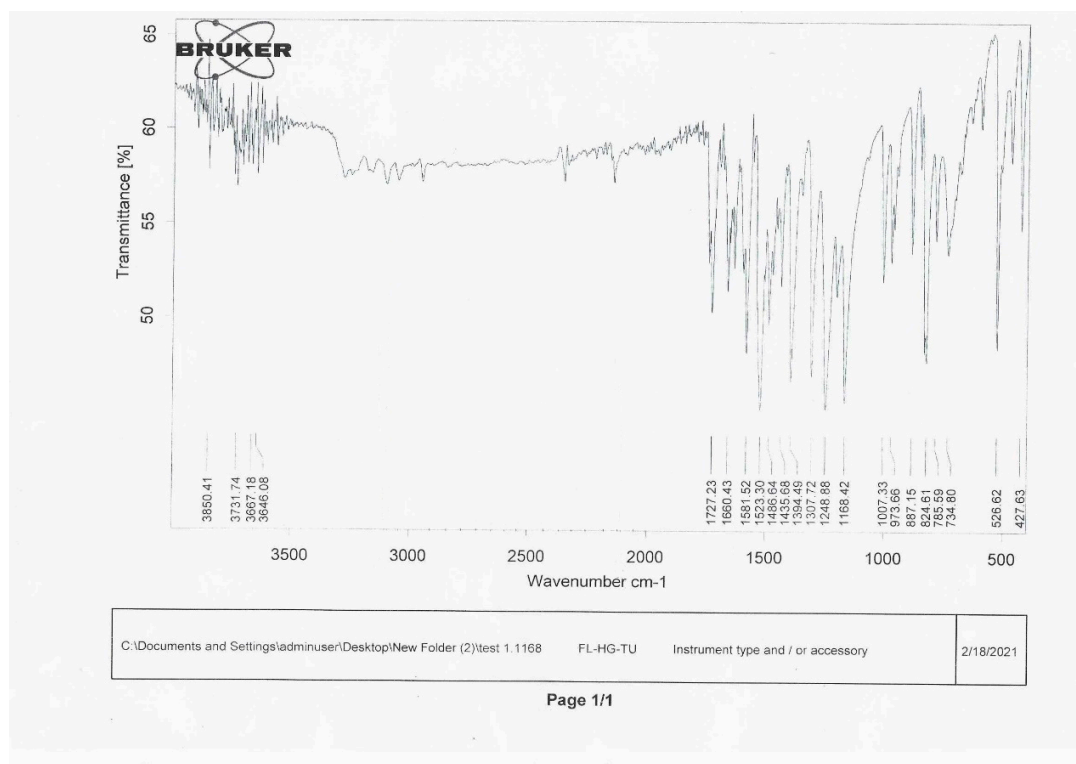
*Synthesis of methyl (Z)-4-oxo-4-((4-selenocyanatophenyl)amino)but-2-enoate (4)*



<sup>1</sup>H NMR chart of compound 4



$^{13}\text{C}$ NMR chart of compound 4



IR chart of compound 4

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## DI Analysis Shimadzu Qp-2010 Plus

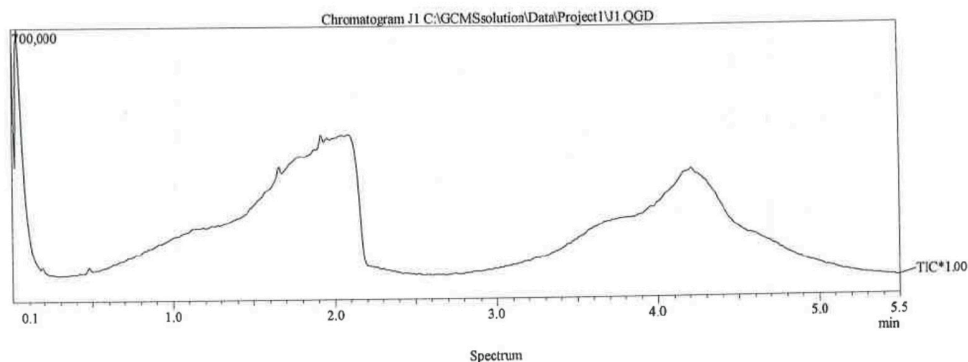
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 Analyzed : 03/01/2007 08:51:36  
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 Customer Name : Dr. Mohamed Soliman - Science - Cairo  
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 Modified : 03/01/2007 08:57:09

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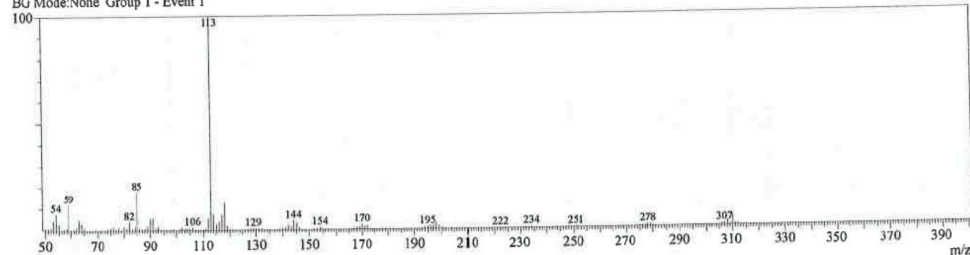
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 Ionization Mode : EI

C:\GCMSolution\Data\Project1\U1.QGD



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 RawMode:Single 2.0(240) BasePeak:113(133438)  
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### Mass Table

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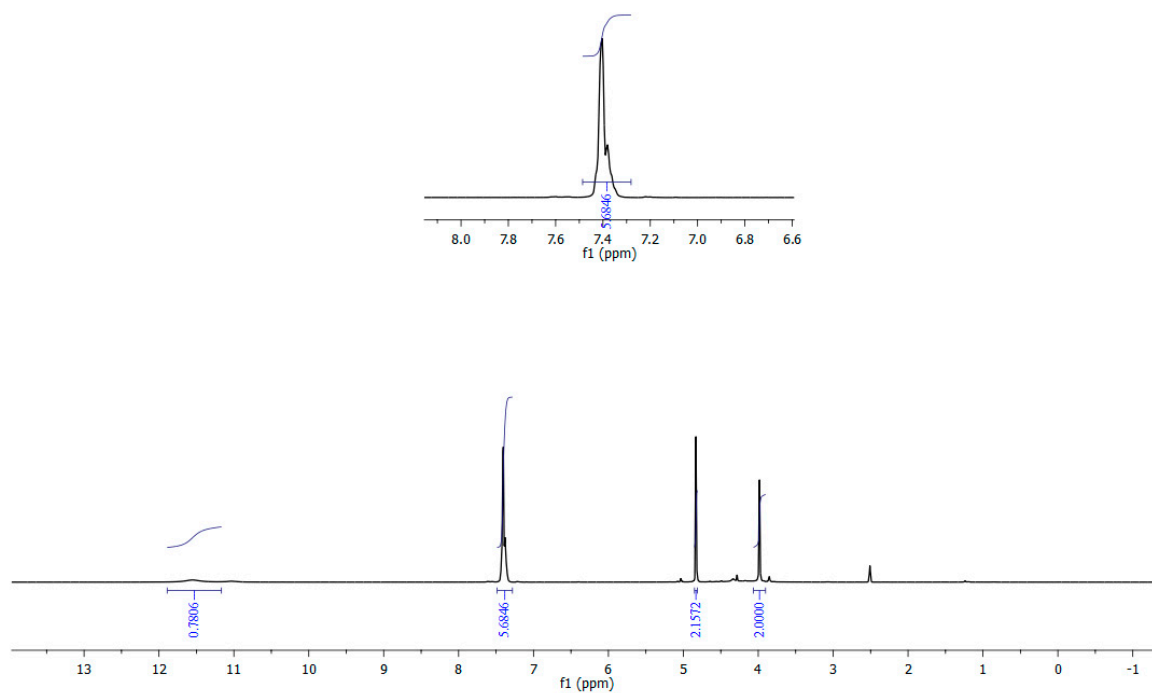
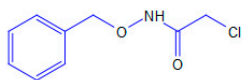
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2	51.00	1282	0.96	5	54.00	10129	7.59	8	57.05	1217	0.91
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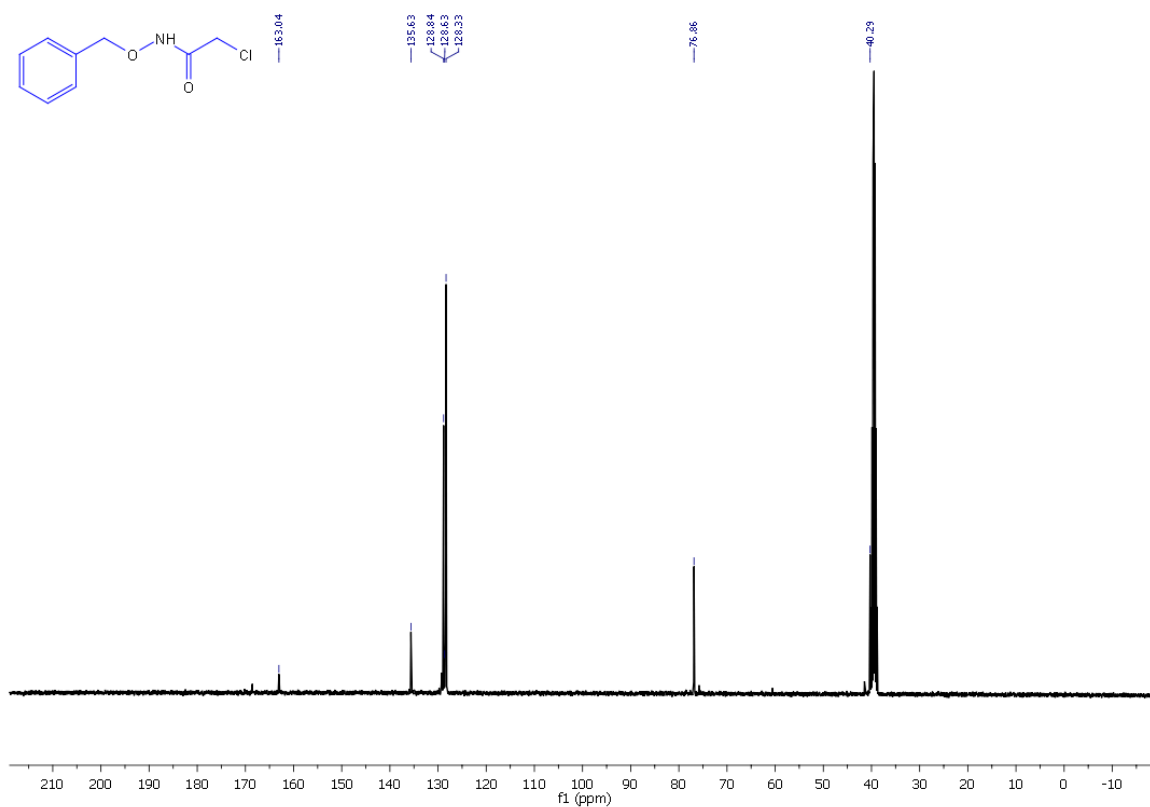
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11	60.00	737	0.55	59	108.10	354	0.27	107	179.00	231	0.17
12	61.05	850	0.64	60	109.10	270	0.20	108	181.00	303	0.23
13	62.05	1990	1.49	61	110.10	246	0.18	109	182.00	334	0.25
14	63.05	6812	5.10	62	111.15	1169	0.88	110	193.05	505	0.38
15	64.00	4215	3.16	63	112.15	7205	5.40	111	193.95	1133	0.85
16	65.00	1766	1.32	64	113.10	133438	100.00	112	195.00	1498	1.12
17	66.00	300	0.22	65	114.05	9392	7.04	113	196.00	1766	1.32
18	67.00	425	0.32	66	115.05	3720	2.79	114	197.05	2120	1.59
19	67.95	417	0.31	67	116.10	5118	3.84	115	198.05	3479	2.61
20	69.05	728	0.55	68	117.10	9236	6.92	116	199.05	1893	1.42
21	70.15	370	0.28	69	118.10	16642	12.47	117	200.00	705	0.53
22	71.10	572	0.43	70	119.05	2337	1.75	118	201.00	201	0.15
23	72.00	327	0.25	71	120.05	602	0.45	119	204.25	486	0.36
24	73.05	547	0.41	72	125.10	303	0.23	120	208.20	217	0.16
25	73.95	1081	0.81	73	126.00	294	0.22	121	222.20	263	0.20
26	75.05	1471	1.10	74	127.00	534	0.40	122	223.20	215	0.16
27	76.05	1933	1.45	75	128.05	909	0.68	123	224.20	306	0.23
28	77.05	790	0.59	76	129.05	992	0.74	124	230.20	218	0.16
29	78.00	1801	1.35	77	130.05	675	0.51	125	231.20	310	0.23
30	79.05	630	0.47	78	131.10	550	0.41	126	232.05	454	0.34
31	80.00	2382	1.79	79	132.10	753	0.56	127	233.05	416	0.31
32	81.05	1265	0.95	80	133.10	313	0.23	128	234.05	866	0.65
33	82.00	5273	3.95	81	135.10	244	0.18	129	235.10	201	0.15
34	83.10	1170	0.88	82	138.05	301	0.23	130	236.10	215	0.16
35	84.15	1921	1.44	83	139.05	602	0.45	131	248.10	319	0.24
36	85.05	23847	17.87	84	140.05	914	0.68	132	249.10	337	0.25
37	86.05	1449	1.09	85	141.05	1361	1.02	133	250.10	314	0.24
38	87.10	958	0.72	86	142.05	3143	2.36	134	250.95	406	0.30
39	88.15	1154	0.86	87	143.15	1966	1.47	135	252.05	488	0.37
40	89.10	2473	1.85	88	144.05	5600	4.20	136	274.10	308	0.23
41	90.10	6863	5.14	89	145.10	4322	3.24	137	275.05	385	0.29
42	91.05	7573	5.68	90	146.05	1295	0.97	138	276.10	783	0.59
43	92.05	1342	1.01	91	152.00	276	0.21	139	277.10	551	0.41
44	93.00	2266	1.70	92	153.05	630	0.47	140	278.10	1300	0.97
45	94.00	276	0.21	93	154.10	1449	1.09	141	279.10	1209	0.91
46	95.00	578	0.43	94	154.90	623	0.47	142	280.10	402	0.30
47	96.00	238	0.18	95	155.90	487	0.36	143	281.10	310	0.23
48	97.20	383	0.29	96	156.90	297	0.22	144	284.10	313	0.23
49	98.15	378	0.28	97	165.00	212	0.16	145	285.10	226	0.17
50	99.10	862	0.65	98	166.00	582	0.44	146	306.15	1105	0.83
51	100.05	330	0.25	99	167.00	921	0.69	147	307.10	1156	0.87
52	101.15	799	0.60	100	168.00	1546	1.16	148	308.10	2849	2.14
53	102.05	1604	1.20	101	169.05	1438	1.08	149	309.15	596	0.45
54	103.00	1105	0.83	102	170.00	3001	2.25	150	310.10	5922	4.44
55	104.00	1129	0.85	103	171.00	1598	1.20	151	311.05	1075	0.81
56	105.00	1108	0.83	104	172.00	2441	1.83	152	312.10	1116	0.84
57	106.00	1822	1.37	105	172.95	652	0.49	153	313.10	287	0.22

# Mass chart of compound 4

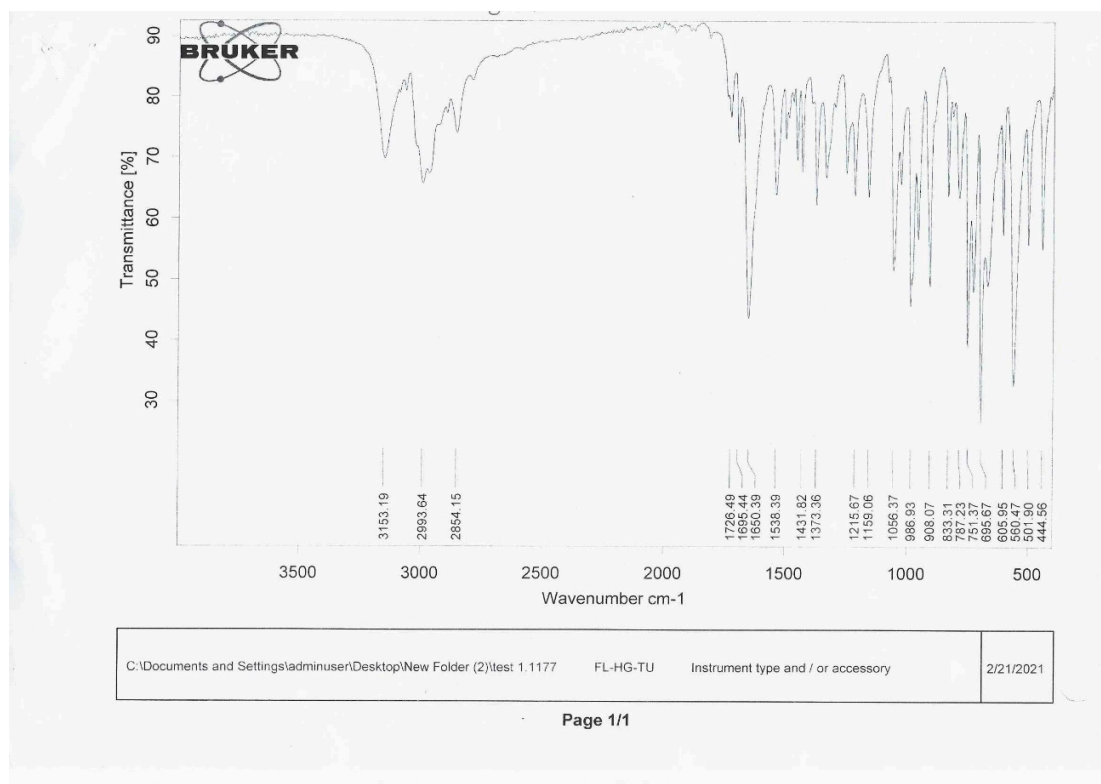
*Synthesis of N-(benzyloxy)-2-chloroacetamide (7)*



$^1\text{H}$ NMR chart of compound **7**



$^{13}\text{C}$ NMR chart of compound 7



IR chart of compound 7



# **Cairo University Micro Analytical Center**

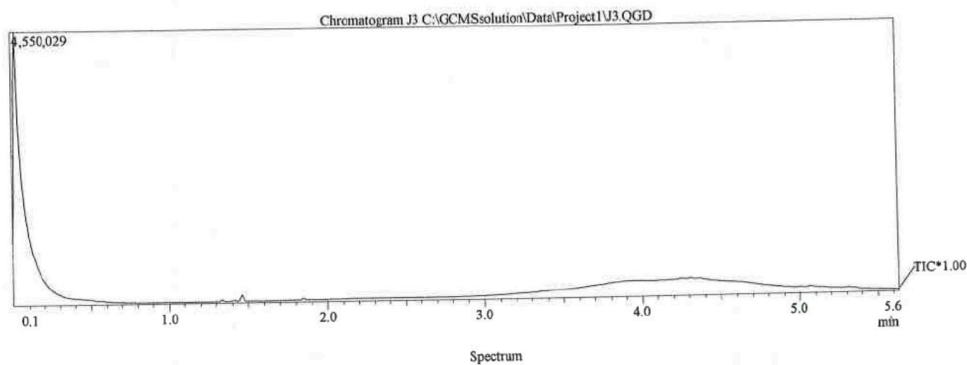
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 Sample ID :  
 Customer Name : Dr. Mohamed Soliman - Science - Cairo  
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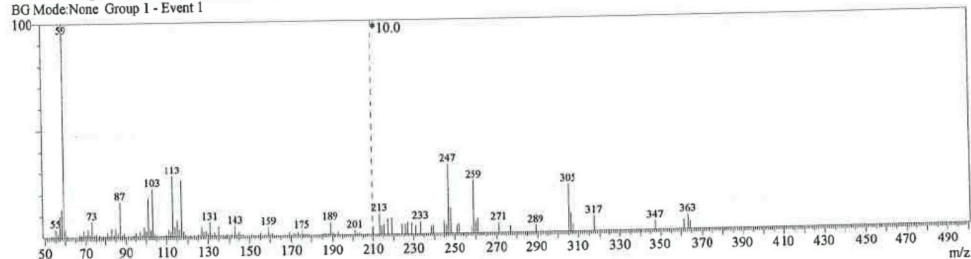
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### Mass Table

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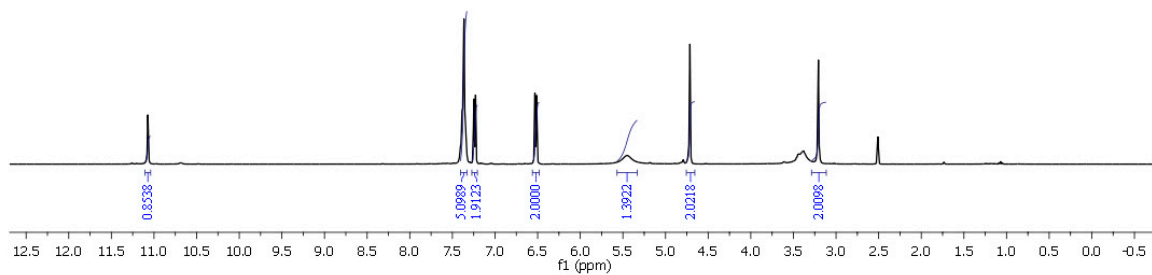
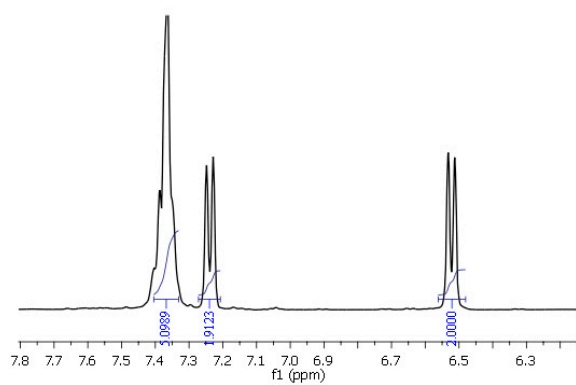
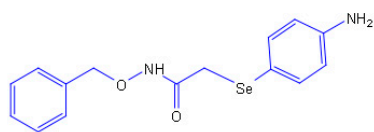
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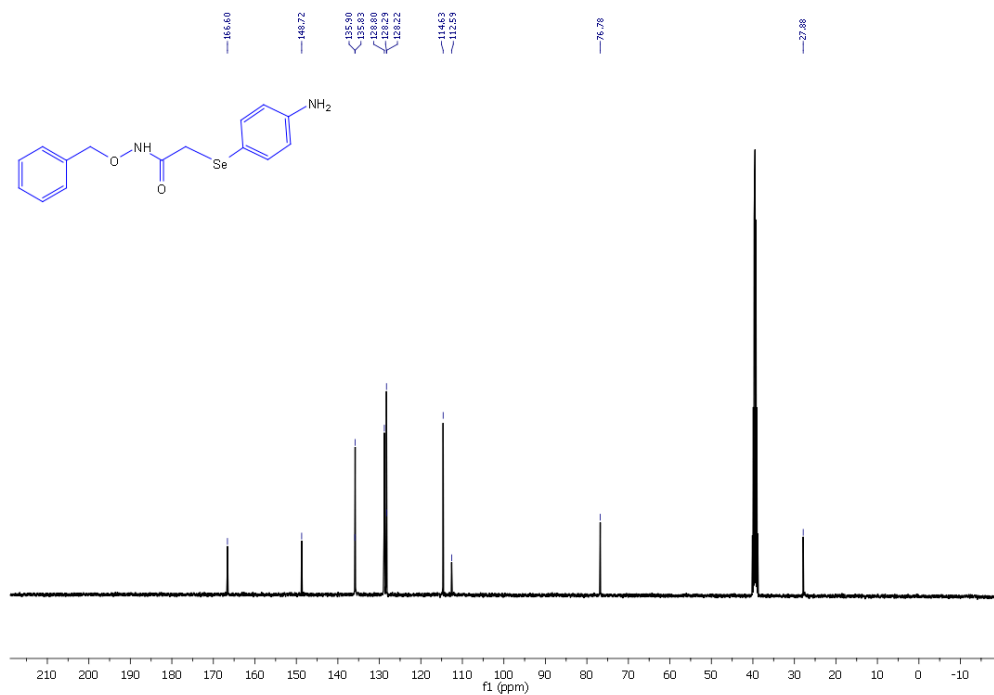
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2	53.95	403	0.62	5	57.05	6546	9.99	8	60.00	2690	4.11
3	55.05	2596	3.96	6	58.05	8638	13.18	9	61.05	657	1.00

#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
10	67.05	711	1.09	58	121.10	356	0.54	106	186.10	486	0.74
11	68.05	522	0.80	59	123.10	460	0.70	107	187.05	471	0.72
12	69.05	2365	3.61	60	125.10	647	0.99	108	188.25	412	0.63
13	70.10	977	1.49	61	126.15	638	0.97	109	189.15	3802	5.80
14	71.05	2607	3.98	62	127.15	2971	4.53	110	190.15	605	0.92
15	72.05	959	1.46	63	128.15	1431	2.18	111	191.20	274	0.42
16	73.05	4814	7.35	64	129.15	1760	2.69	112	193.15	935	1.43
17	74.05	598	0.91	65	130.15	778	1.19	113	195.20	209	0.32
18	75.05	1157	1.77	66	131.15	4233	6.46	114	201.15	1311	2.00
19	77.05	602	0.92	67	132.15	618	0.94	115	202.20	409	0.62
20	79.10	321	0.49	68	133.20	1233	1.88	116	203.20	546	0.83
21	80.10	265	0.40	69	134.25	462	0.71	117	204.20	210	0.32
22	81.05	1455	2.22	70	135.15	3046	4.65	118	207.20	220	0.34
23	82.15	523	0.80	71	136.20	358	0.55	119	210.20	233	0.36
24	83.10	2743	4.19	72	137.20	298	0.45	120	213.30	615	0.94
25	84.15	845	1.29	73	139.10	641	0.98	121	214.30	233	0.36
26	85.05	2722	4.15	74	140.10	302	0.46	122	215.30	297	0.45
27	86.15	1354	2.07	75	141.10	759	1.16	123	217.20	462	0.71
28	87.10	10878	16.60	76	142.15	312	0.48	124	219.20	487	0.74
29	88.05	731	1.12	77	143.10	3119	4.76	125	224.20	295	0.45
30	89.05	1478	2.26	78	144.15	579	0.88	126	226.20	287	0.44
31	91.15	410	0.63	79	145.10	1303	1.99	127	227.20	356	0.54
32	93.25	385	0.59	80	146.15	522	0.80	128	229.20	329	0.50
33	94.15	375	0.57	81	147.10	537	0.82	129	231.20	247	0.38
34	95.15	1540	2.35	82	151.10	694	1.06	130	233.40	367	0.56
35	96.15	636	0.97	83	152.10	270	0.41	131	238.40	217	0.33
36	97.10	1817	2.77	84	153.10	314	0.48	132	239.40	260	0.40
37	98.15	866	1.32	85	154.10	330	0.50	133	245.10	375	0.57
38	99.15	2961	4.52	86	155.10	929	1.42	134	246.20	260	0.40
39	100.15	1932	2.95	87	157.15	521	0.80	135	247.25	2116	3.23
40	101.10	12030	18.36	88	158.15	307	0.47	136	248.25	754	1.15
41	102.15	2166	3.31	89	159.10	2626	4.01	137	251.20	241	0.37
42	103.10	14703	22.44	90	160.05	499	0.76	138	252.20	294	0.45
43	104.10	1009	1.54	91	161.00	743	1.13	139	258.30	212	0.32
44	105.10	391	0.60	92	166.00	212	0.32	140	259.25	1589	2.43
45	107.10	305	0.47	93	167.00	311	0.47	141	260.30	350	0.53
46	108.20	212	0.32	94	169.15	1046	1.60	142	261.10	444	0.68
47	109.15	598	0.91	95	170.20	214	0.33	143	271.10	302	0.46
48	110.15	475	0.72	96	171.15	742	1.13	144	277.10	209	0.32
49	111.10	2210	3.37	97	172.15	491	0.75	145	289.10	201	0.31
50	112.15	1595	2.43	98	173.15	985	1.50	146	305.30	1431	2.18
51	113.10	18516	28.26	99	174.25	366	0.56	147	306.25	547	0.83
52	114.15	3014	4.60	100	175.15	1449	2.21	148	307.30	214	0.33
53	115.15	5055	7.72	101	176.15	347	0.53	149	317.40	449	0.69
54	116.15	2239	3.42	102	177.20	385	0.59	150	347.40	263	0.40
55	117.15	17215	26.27	103	177.80	276	0.42	151	361.40	284	0.43
56	118.20	1753	2.68	104	178.80	340	0.52	152	363.35	436	0.67
57	119.15	810	1.24	105	185.15	377	0.58	153	364.40	246	0.38

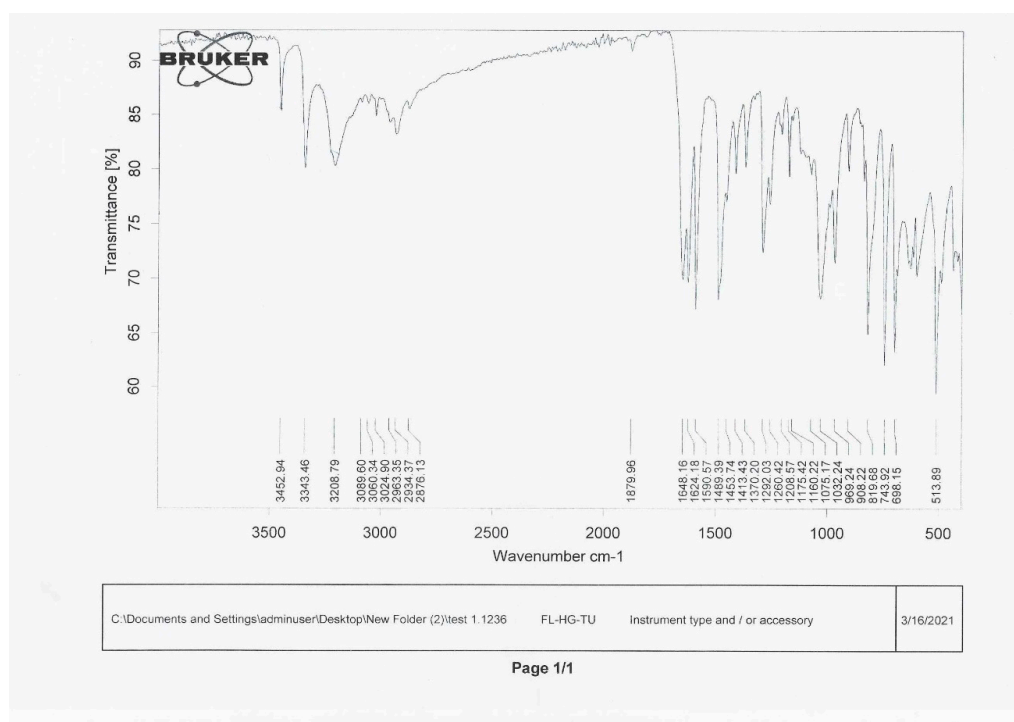
*Synthesis of 2-((4-aminophenyl)selanyl)-N-(benzyloxy)acetamide (8)*



<sup>1</sup>H NMR chart of compound **8**



<sup>13</sup>CNMR chart of compound 8



IR chart of compound 8

06-Jan-07 18:00:54

# Cairo University Micro Analytical Center

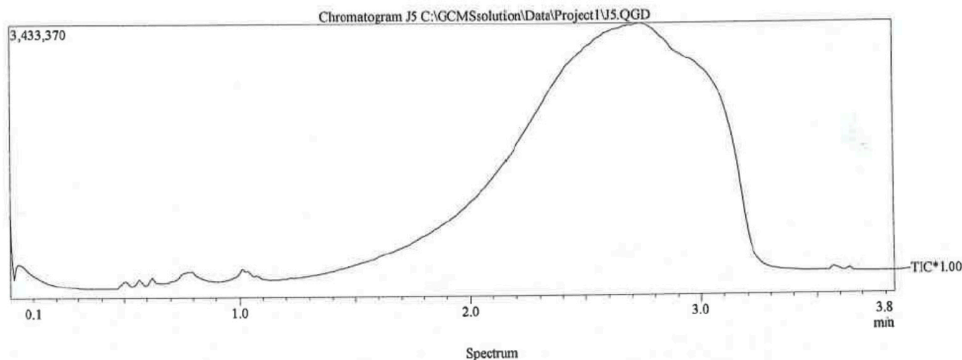
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Sample Name : J5  
Sample ID :  
Customer Name : Dr. Mohamed Soliman - Science - Cairo  
Data File : C:\GCMSolution\Data\Project\U5.QGD  
Org Data File : C:\GCMSolution\Data\Project\U5.QGD  
Method File : C:\GCMSolution\Data\Project\High Temperature Op  
Org Method File : C:\GCMSolution\Data\Project\High Temperature Op  
Report File :  
Tuning File : C:\GCMSolution\System\Tune1\\_default.qgt  
SEnd\Modified by : Dr. Mai Younis  
Modified : 06/01/2007 05:54:37

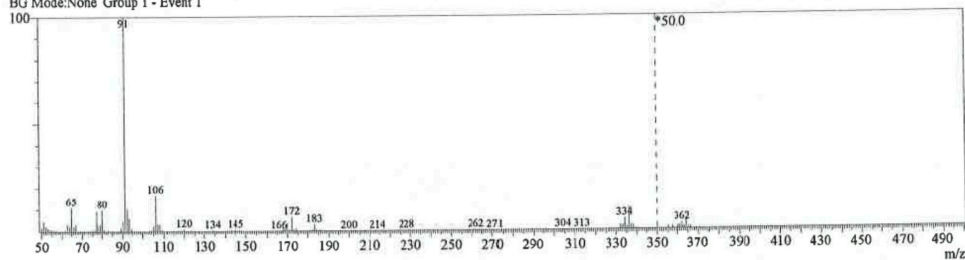
Method  
Analytical Line 1  
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[MS Table]  
--Group 1 - Event 1--  
Start Time :0.00min  
End Time :10.00min  
Scan :  
ACQ Mode :0.50sec  
Event Time :1000  
Scan Speed :50.00  
Start m/z :510.00  
End m/z :  
Electron Voltage :70 eV  
Ionization Mode :EI



C:\GCMSolution\Data\Project\U5.QGD



Line#:1 R.Time:2.4(Scan#:285)  
MassPeaks:182  
RawMode:Single 2.4(285) BasePeak:91(960460)  
BG Mode:None Group 1 - Event 1

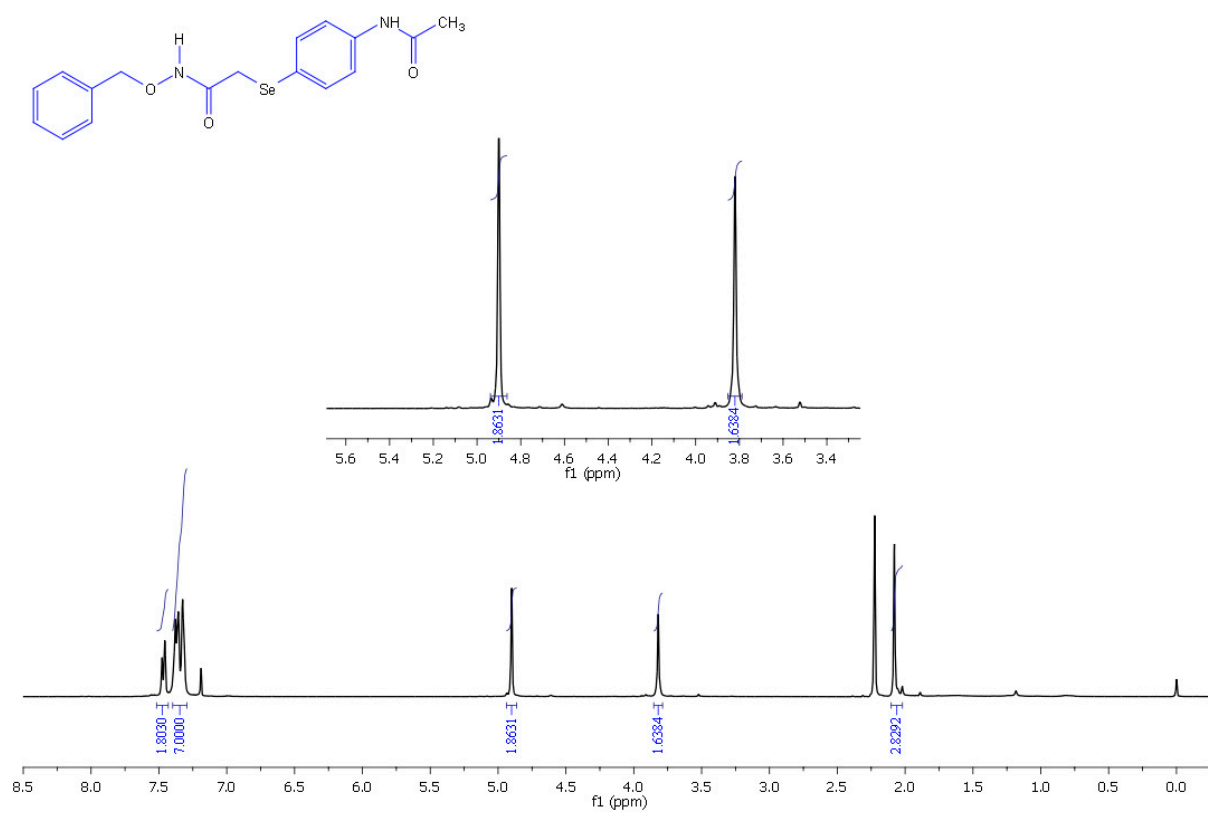


Mass Table  
Line#:1 R.Time:2.4(Scan#:285)  
MassPeaks:182  
RawMode:Single 2.4(285) BasePeak:91(960460)  
BG Mode:None Group 1 - Event 1

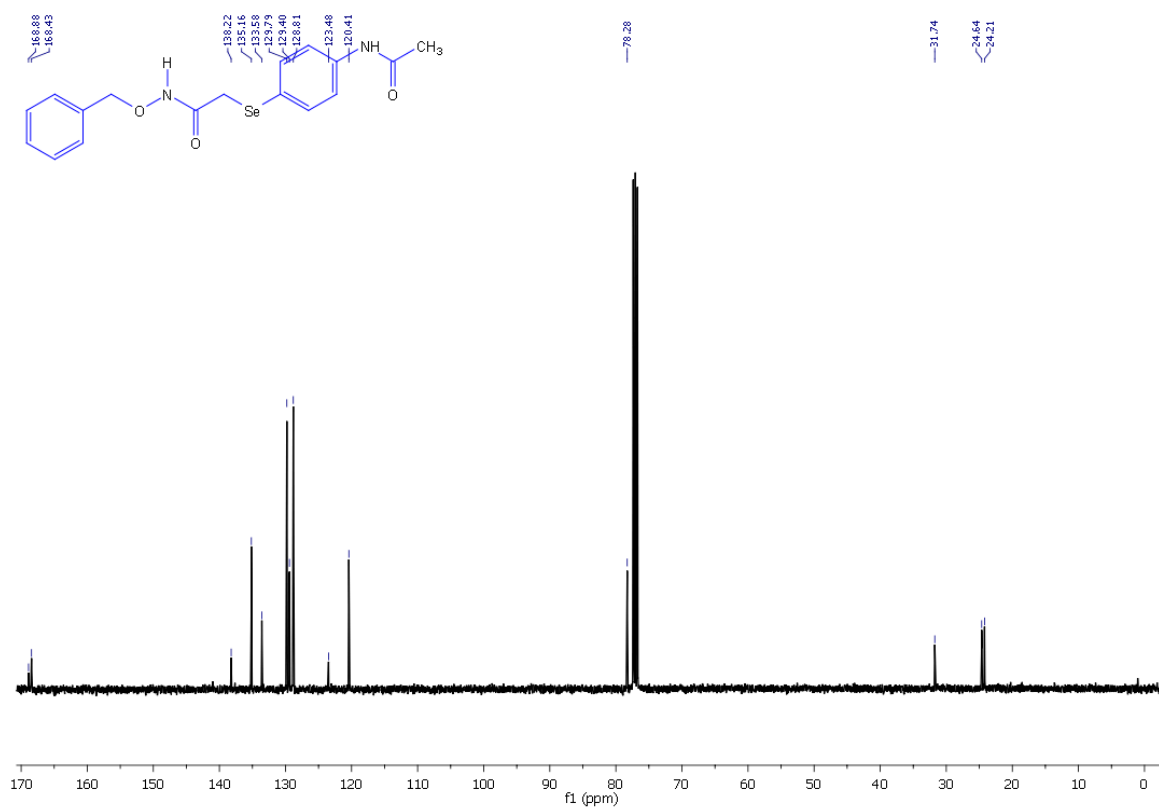
#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
1	50.05	15768	1.64	4	53.05	15780	1.64	7	56.05	4677	0.49
2	51.05	43235	4.50	5	54.05	9148	0.95	8	57.05	7827	0.81
3	52.05	21915	2.28	6	55.05	8837	0.92	9	58.10	1159	0.12

#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
10	59.05	3823	0.40	68	117.05	4301	0.45	126	183.15	28298	2.95
11	60.05	3004	0.31	69	118.05	2899	0.30	127	184.15	7005	0.73
12	61.10	2431	0.25	70	119.10	2788	0.29	128	185.05	1633	0.17
13	62.10	7174	0.75	71	120.10	10220	1.06	129	186.00	5919	0.62
14	63.05	32170	3.35	72	121.15	2539	0.26	130	187.10	1247	0.13
15	64.15	21067	2.19	73	122.15	937	0.10	131	188.05	1063	0.11
16	65.05	106060	11.04	74	123.15	4636	0.48	132	200.10	298	0.03
17	66.10	17980	1.87	75	124.15	1292	0.13	133	210.10	201	0.02
18	67.05	30605	3.19	76	125.15	799	0.08	134	212.10	222	0.02
19	68.10	2798	0.29	77	126.10	564	0.06	135	213.10	298	0.03
20	69.10	5318	0.55	78	127.10	922	0.10	136	214.10	382	0.04
21	70.10	2114	0.22	79	128.05	703	0.07	137	224.10	233	0.02
22	71.15	4248	0.44	80	129.10	1506	0.16	138	225.10	255	0.03
23	72.15	765	0.08	81	130.10	862	0.09	139	226.10	447	0.05
24	73.05	3984	0.41	82	131.05	786	0.08	140	227.10	241	0.03
25	74.05	5212	0.54	83	132.10	911	0.09	141	228.10	951	0.10
26	75.10	4412	0.46	84	133.15	1465	0.15	142	229.10	358	0.04
27	76.15	8246	0.86	85	134.15	4315	0.45	143	230.15	747	0.08
28	77.10	88946	9.26	86	135.10	1537	0.16	144	258.10	623	0.06
29	78.10	24337	2.53	87	136.05	482	0.05	145	259.15	627	0.07
30	79.15	30610	3.19	88	137.15	486	0.05	146	260.10	1359	0.14
31	80.10	95319	9.92	89	138.05	375	0.04	147	261.10	826	0.09
32	81.10	8633	0.90	90	139.05	677	0.07	148	262.10	2494	0.26
33	82.15	2120	0.22	91	140.05	723	0.08	149	263.10	1543	0.16
34	83.15	5500	0.57	92	141.05	2098	0.22	150	264.05	821	0.09
35	84.15	2638	0.27	93	142.05	2068	0.22	151	265.20	462	0.05
36	85.15	3189	0.33	94	143.05	3399	0.35	152	270.20	335	0.03
37	86.10	1175	0.12	95	144.05	2313	0.24	153	271.30	486	0.05
38	87.10	1695	0.18	96	145.00	5676	0.59	154	295.30	239	0.02
39	88.15	1354	0.14	97	146.05	875	0.09	155	302.30	242	0.03
40	89.10	15700	1.63	98	147.00	1714	0.18	156	304.20	569	0.06
41	90.15	44615	4.65	99	148.10	628	0.07	157	313.45	508	0.05
42	91.10	960460	100.00	100	149.10	572	0.06	158	319.40	210	0.02
43	92.10	98228	10.23	101	150.10	220	0.02	159	321.40	375	0.04
44	93.10	56674	5.90	102	151.10	303	0.03	160	330.20	1868	0.19
45	94.10	11602	1.21	103	152.00	396	0.04	161	331.25	952	0.10
46	95.10	4519	0.47	104	153.00	447	0.05	162	332.20	18135	1.89
47	96.15	2320	0.24	105	153.95	404	0.04	163	333.20	18686	1.95
48	97.15	3774	0.39	106	155.00	348	0.04	164	334.20	47150	4.91
49	98.15	2232	0.23	107	155.90	390	0.04	165	335.25	12104	1.26
50	99.15	1190	0.12	108	156.90	402	0.04	166	336.20	96114	10.01
51	100.15	506	0.05	109	158.00	492	0.05	167	337.15	18937	1.97
52	101.15	929	0.10	110	159.00	238	0.02	168	338.20	19132	1.99
53	102.10	990	0.10	111	160.00	217	0.02	169	339.15	3752	0.39
54	103.15	1634	0.17	112	165.05	553	0.06	170	340.15	624	0.06
55	104.15	7689	0.80	113	166.00	1567	0.16	171	341.25	362	0.04
56	105.15	24236	2.52	114	167.05	1160	0.12	172	342.20	281	0.03
57	106.15	160312	16.69	115	168.05	13576	1.41	173	344.20	388	0.04
58	107.15	32112	3.34	116	169.05	13380	1.39	174	355.20	238	0.02
59	108.10	29788	3.10	117	170.00	31930	3.32	175	357.20	249	0.03
60	109.15	6176	0.64	118	171.05	5744	0.60	176	360.20	282	0.03
61	110.15	1323	0.14	119	172.05	61287	6.38	177	361.20	292	0.03
62	111.15	1816	0.19	120	172.95	5359	0.56	178	362.20	513	0.05
63	112.15	1175	0.12	121	174.05	10628	1.11	179	363.20	212	0.02
64	113.10	1337	0.14	122	174.95	915	0.10	180	364.20	870	0.09
65	114.10	1284	0.13	123	180.20	590	0.06	181	365.20	207	0.02
66	115.05	2947	0.31	124	181.25	654	0.07	182	366.20	242	0.03
67	116.05	1880	0.20	125	182.25	5051	0.53				

*Synthesis of 2-((4-acetamidophenyl)selanyl)-N-(benzyloxy)acetamide (9)*

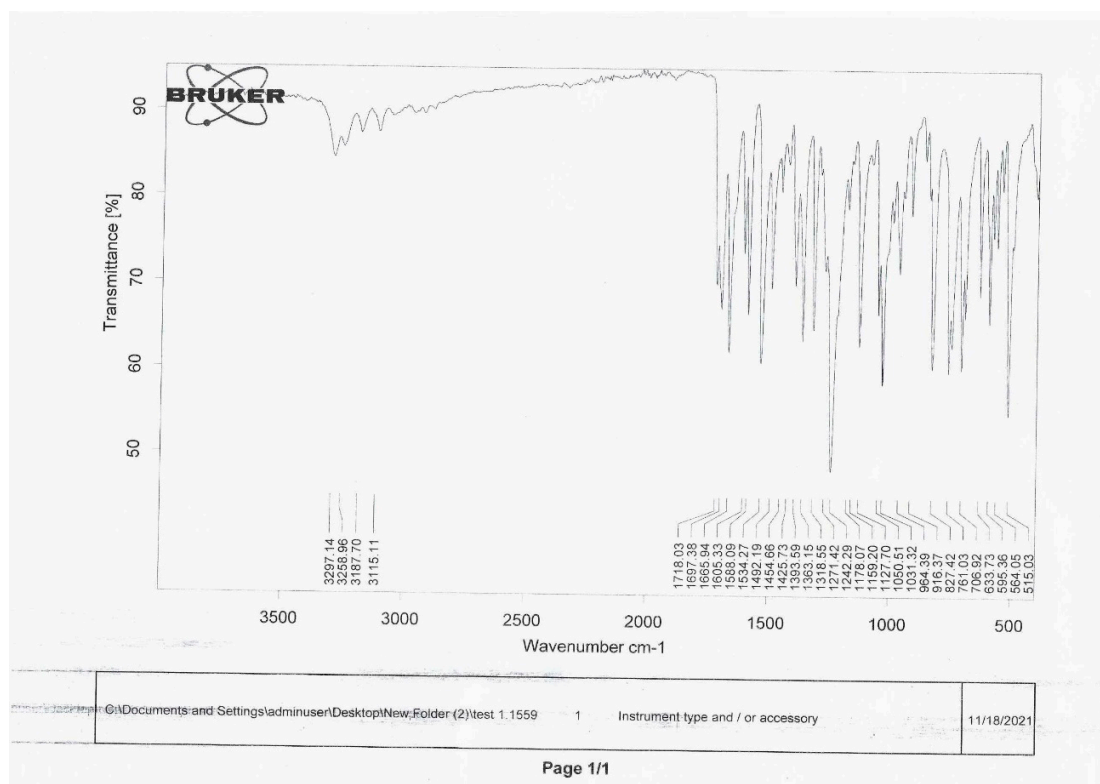


<sup>1</sup>H NMR chart of compound 9



$^{13}\text{C}$ NMR chart of compound 9





IR chart of compound 9

# Cairo University Micro Analytical Center

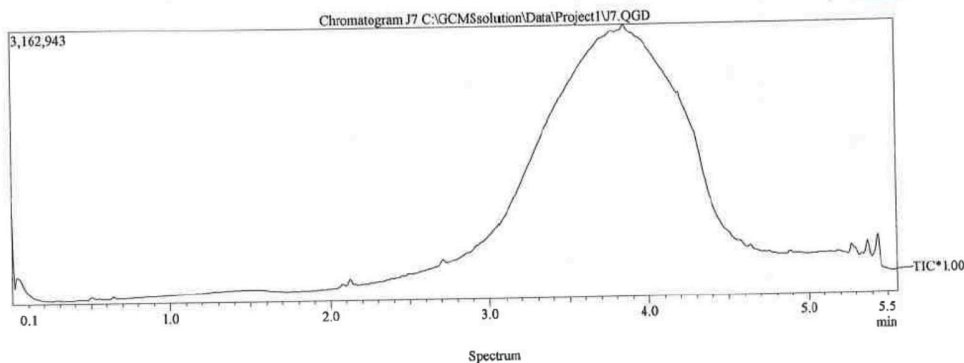
## DI Analysis Shimadzu Qp-2010 Plus

Sample Information  
 Analyzed by : Dr. Mai Younis  
 Analyzed : 06/01/2007 06:02:32  
 Sample Name : J7  
 Sample ID :  
 Customer Name : Dr. Mohamed Soliman - Science - Cairo  
 Data File : C:\GCMSSolution\Data\Project1\U7.QGD  
 Org Data File : C:\GCMSSolution\Data\Project1\U7.QGD  
 Method File : C:\GCMSSolution\Data\Project1\High Temperature Op  
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 Report File :  
 Tuning File : C:\GCMSSolution\System\Tune1\default.qgt  
 \$EndIf\$Modified by : Dr. Mai Younis  
 Modified : 06/01/2007 06:08:09

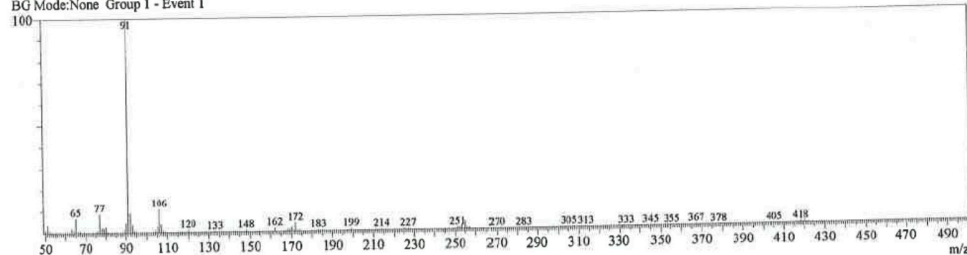
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 End Time : 10.00min  
 ACQ Mode : Scan  
 Event Time : 0.50sec  
 Scan Speed : 1000  
 Start m/z : 50.00  
 End m/z : 510.00  
 Electron Voltage : 70 eV  
 Ionization Mode : EI



C:\GCMSSolution\Data\Project1\U7.QGD



Line#1 R.Time:3.6(Scan#:434)  
 MassPeaks:264  
 RawMode:Single 3.6(434) BasePeak:91(1210535)  
 BG Mode:None Group 1 - Event 1



### Mass Table

Line#1 R.Time:3.6(Scan#:434)

MassPeaks:264

RawMode:Single 3.6(434) BasePeak:91(1210535)

BG Mode:None Group 1 - Event 1

#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
1	50.05	15477	1.28	4	53.05	7183	0.59	7	56.10	3204	0.26
2	51.05	45107	3.73	5	54.05	3209	0.27	8	57.10	8273	0.68
3	52.05	13698	1.13	6	55.05	7711	0.64	9	58.05	1463	0.12

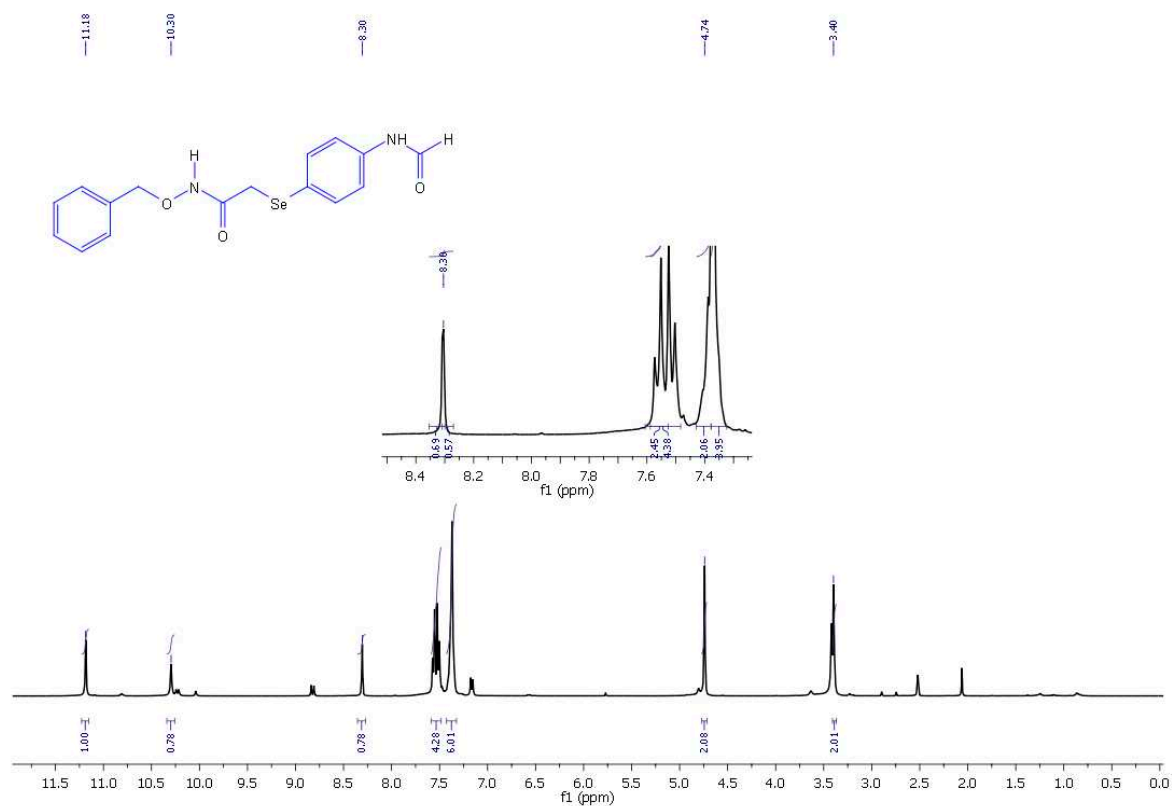
#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
10	59.05	1648	0.14	79	128.15	2296	0.19	148	211.10	2118	0.17
11	60.00	3386	0.28	80	129.15	1947	0.16	149	212.05	3257	0.27
12	61.05	1703	0.14	81	130.10	1274	0.11	150	213.15	1940	0.16
13	62.10	5530	0.46	82	131.20	1105	0.09	151	214.10	5497	0.45
14	63.05	26216	2.17	83	132.15	3370	0.28	152	215.10	1975	0.16
15	64.15	13903	1.15	84	133.15	4647	0.38	153	216.10	1086	0.09
16	65.05	81929	6.77	85	134.15	2904	0.24	154	217.10	279	0.02
17	66.10	8124	0.67	86	135.15	2204	0.18	155	223.20	972	0.08
18	67.10	11962	0.99	87	136.15	1953	0.16	156	224.20	2063	0.17
19	68.10	2002	0.17	88	137.15	871	0.07	157	225.15	4873	0.40
20	69.10	5015	0.41	89	138.05	415	0.03	158	226.10	2642	0.22
21	70.10	2759	0.23	90	139.05	1003	0.08	159	227.10	5913	0.49
22	71.10	4161	0.34	91	140.05	1472	0.12	160	228.10	3570	0.29
23	72.15	679	0.06	92	141.05	2462	0.20	161	229.10	1793	0.15
24	73.10	2354	0.19	93	142.05	2465	0.20	162	230.15	881	0.07
25	74.05	5066	0.42	94	143.05	3038	0.25	163	231.10	250	0.02
26	75.10	4806	0.40	95	144.05	3335	0.28	164	239.25	551	0.05
27	76.15	10571	0.87	96	145.05	3859	0.32	165	240.20	220	0.02
28	77.10	106641	8.81	97	146.10	1494	0.12	166	241.20	247	0.02
29	78.10	26940	2.23	98	147.15	2016	0.17	167	242.20	209	0.02
30	79.10	25310	2.09	99	148.15	9010	0.74	168	249.15	781	0.06
31	80.10	35786	2.96	100	149.15	1723	0.14	169	250.15	524	0.04
32	81.10	5642	0.47	101	150.15	1046	0.09	170	251.15	8107	0.67
33	82.15	1861	0.15	102	151.10	657	0.05	171	252.15	8960	0.74
34	83.15	4489	0.37	103	152.15	595	0.05	172	253.10	21750	1.80
35	84.15	2733	0.23	104	153.05	787	0.07	173	254.15	4718	0.39
36	85.15	3762	0.31	105	154.10	762	0.06	174	255.10	43601	3.60
37	86.15	1819	0.15	106	155.10	2196	0.18	175	256.05	8298	0.69
38	87.10	1862	0.15	107	156.10	2415	0.20	176	257.15	9296	0.77
39	88.15	2303	0.19	108	157.10	914	0.08	177	258.05	1894	0.16
40	89.10	18366	1.52	109	158.00	650	0.05	178	259.10	476	0.04
41	90.15	53112	4.39	110	159.00	378	0.03	179	260.15	669	0.06
42	91.10	121053	100.00	111	161.15	923	0.08	180	261.15	606	0.05
43	92.10	107703	8.90	112	162.10	20801	1.72	181	262.15	1108	0.09
44	93.10	42689	3.53	113	163.10	2178	0.18	182	263.15	853	0.07
45	94.10	8558	0.71	114	164.05	538	0.04	183	264.25	876	0.07
46	95.10	4926	0.41	115	165.05	997	0.08	184	265.20	550	0.05
47	96.20	1993	0.16	116	166.05	2864	0.24	185	266.15	374	0.03
48	97.15	3817	0.32	117	167.05	3483	0.29	186	267.15	389	0.03
49	98.15	3390	0.28	118	168.05	10991	0.91	187	268.15	723	0.06
50	99.15	1680	0.14	119	169.05	10983	0.91	188	269.15	466	0.04
51	100.10	3327	0.27	120	170.05	24761	2.05	189	270.10	1394	0.12
52	101.10	2022	0.17	121	171.05	10754	0.89	190	271.20	660	0.05
53	102.15	1829	0.15	122	172.05	46264	3.82	191	272.15	1298	0.11
54	103.15	3258	0.27	123	173.00	5638	0.47	192	273.05	516	0.04
55	104.15	10203	0.84	124	174.05	8057	0.67	193	274.00	450	0.04
56	105.15	32274	2.67	125	175.10	1546	0.13	194	275.20	390	0.03
57	106.15	132039	10.91	126	176.10	407	0.03	195	276.20	238	0.02
58	107.15	42954	3.55	127	180.15	742	0.06	196	281.20	337	0.03
59	108.10	9614	0.79	128	181.15	1412	0.12	197	283.10	562	0.05
60	109.15	3215	0.27	129	182.15	2914	0.24	198	284.10	273	0.02
61	110.20	1223	0.10	130	183.15	6155	0.51	199	285.20	428	0.04
62	111.20	1921	0.16	131	184.15	4073	0.34	200	287.20	241	0.02
63	112.15	1332	0.11	132	185.05	4157	0.34	201	293.20	346	0.03
64	113.15	1333	0.11	133	186.05	3933	0.32	202	294.15	368	0.03
65	114.10	1834	0.15	134	187.05	1321	0.11	203	295.15	746	0.06
66	115.10	3858	0.32	135	188.10	698	0.06	204	296.15	453	0.04
67	116.10	3359	0.28	136	189.10	278	0.02	205	297.20	1457	0.12
68	117.05	4485	0.37	137	193.10	220	0.02	206	298.15	822	0.07
69	118.10	4479	0.37	138	196.10	201	0.02	207	299.20	889	0.07
70	119.15	3593	0.30	139	197.25	338	0.03	208	300.15	770	0.06
71	120.10	14065	1.16	140	198.25	790	0.07	209	301.15	1391	0.11
72	121.15	2792	0.23	141	199.15	9156	0.76	210	302.20	1428	0.12
73	122.20	954	0.08	142	200.10	1450	0.12	211	303.20	2758	0.23
74	123.20	2657	0.22	143	206.20	2641	0.22	212	304.20	1407	0.12
75	124.20	1007	0.08	144	207.30	396	0.03	213	305.20	3174	0.26
76	125.20	844	0.07	145	208.30	354	0.03	214	306.15	874	0.07
77	126.15	784	0.06	146	209.15	350	0.03	215	307.20	607	0.05
78	127.15	1405	0.12	147	210.10	1562	0.13	216	310.50	337	0.03

06-Jan-07 18:09:45

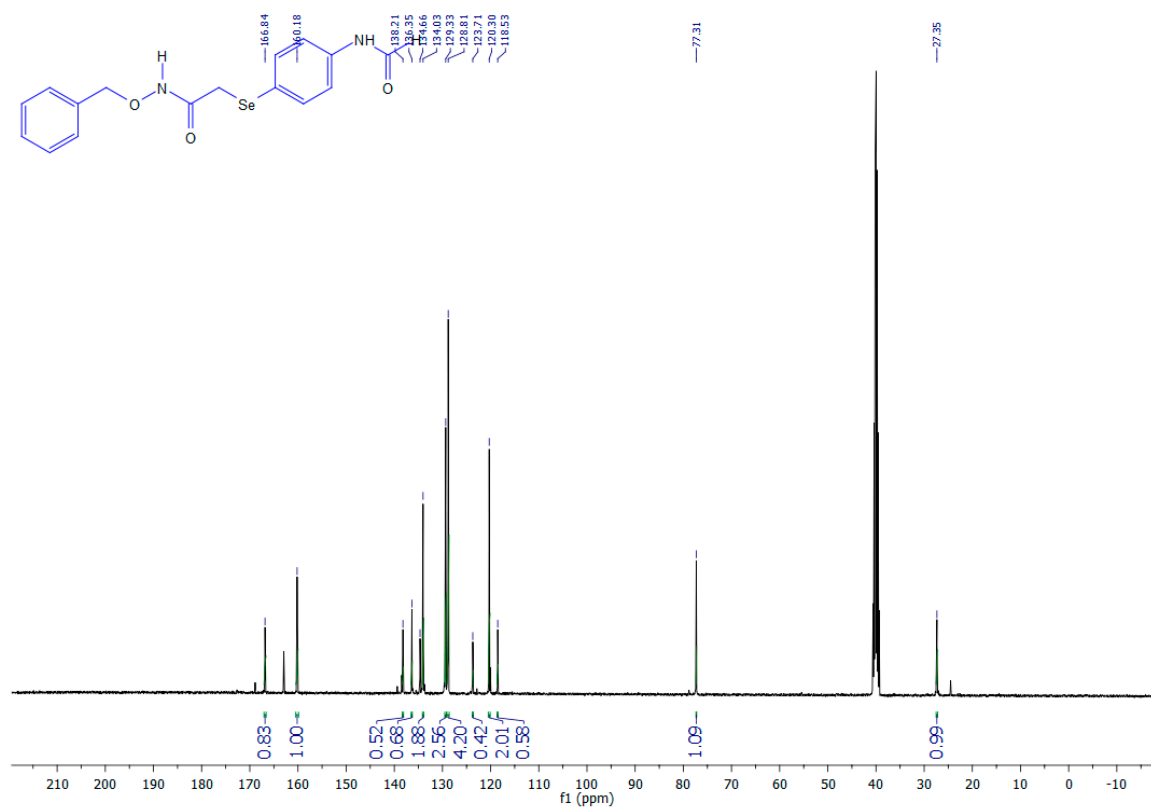
#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
217	311.45	424	0.04	233	344.25	389	0.03	249	380.20	218	0.02
218	312.45	517	0.04	234	345.20	1706	0.14	250	381.20	287	0.02
219	313.50	1609	0.13	235	346.20	561	0.05	251	383.20	215	0.02
220	314.45	916	0.08	236	347.25	485	0.04	252	390.20	209	0.02
221	315.25	566	0.05	237	348.30	214	0.02	253	404.25	530	0.04
222	316.25	555	0.05	238	353.30	204	0.02	254	405.25	900	0.07
223	317.20	849	0.07	239	354.30	222	0.02	255	406.30	270	0.02
224	318.20	660	0.05	240	355.45	482	0.04	256	414.30	212	0.02
225	319.20	295	0.02	241	366.35	412	0.03	257	416.25	2962	0.24
226	331.20	238	0.02	242	367.30	4286	0.35	258	417.25	2955	0.24
227	333.20	258	0.02	243	368.30	1478	0.12	259	418.20	7457	0.62
228	339.45	682	0.06	244	369.35	397	0.03	260	419.25	2100	0.17
229	340.20	218	0.02	245	375.30	207	0.02	261	420.20	14682	1.21
230	341.20	674	0.06	246	376.30	351	0.03	262	421.15	3707	0.31
231	342.25	627	0.05	247	377.30	220	0.02	263	422.20	3202	0.26
232	343.20	954	0.08	248	378.20	484	0.04	264	423.15	741	0.06

# Mass chart of compound 9

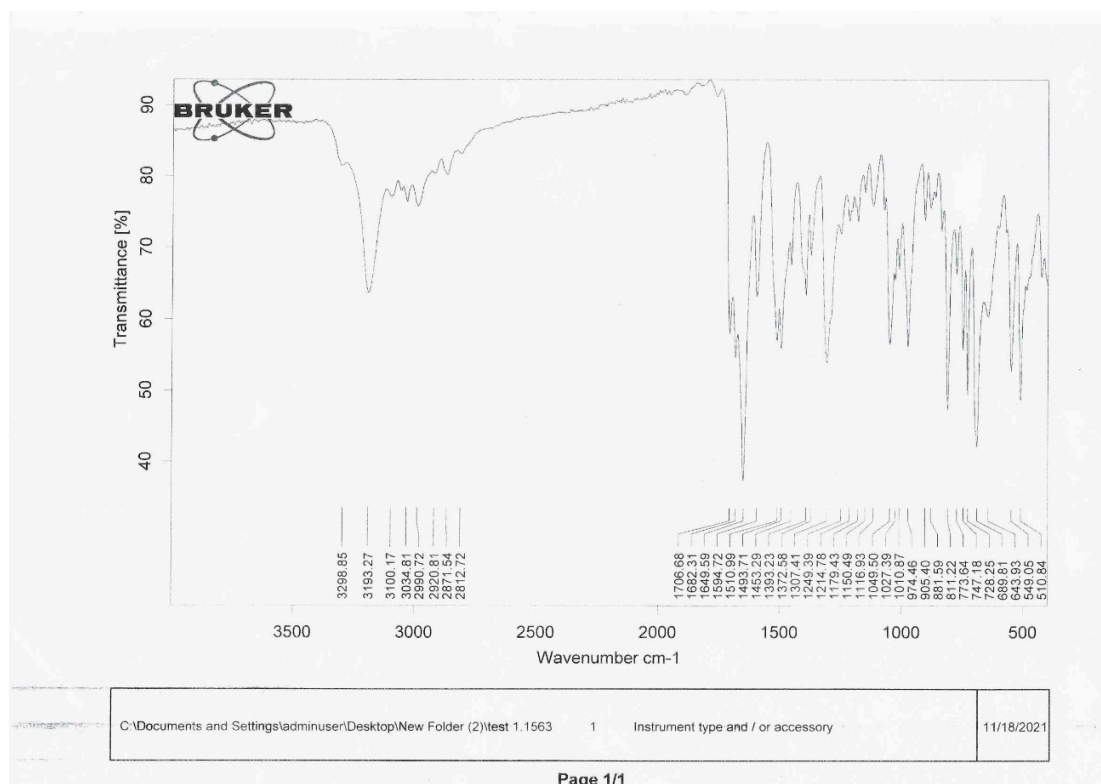
*Synthesis of N-(benzyloxy)-2-((4-formamidophenyl)selanyl)acetamide (10)*



<sup>1</sup>H NMR chart of compound 10



$^{13}\text{C}$ NMR chart of compound **10**



IR chart of compound of **10**

# Cairo University Micro Analytical Center

## DI Analysis Shimadzu Qp-2010 Plus

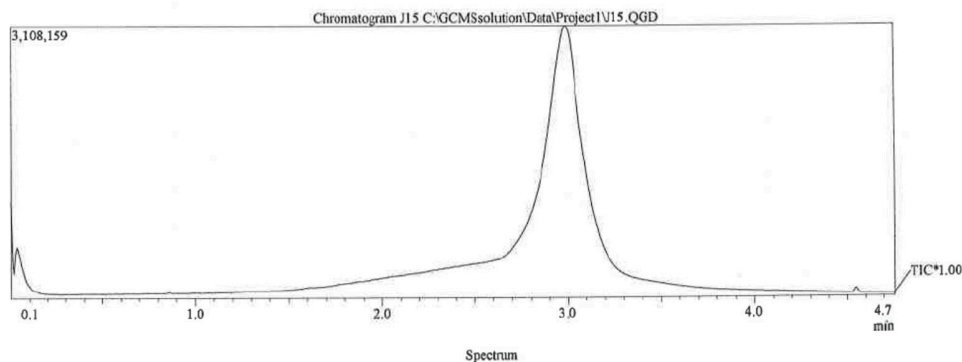
Sample Information  
 Analyzed by : Dr. Mai Younis  
 Analyzed : 06/01/2007 06:39:34  
 Sample Name : J15  
 Sample ID :  
 Customer Name : Dr. Mohamed Soliman - Science - Cairo  
 Data File : C:\GCMSSolution\Data\Project1\U15.QGD  
 Org Data File : C:\GCMSSolution\Data\Project1\U15.QGD  
 Method File : C:\GCMSSolution\Data\Project1\High Temperature Op  
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 Report File :  
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 Modified : 06/01/2007 06:44:23

### Method

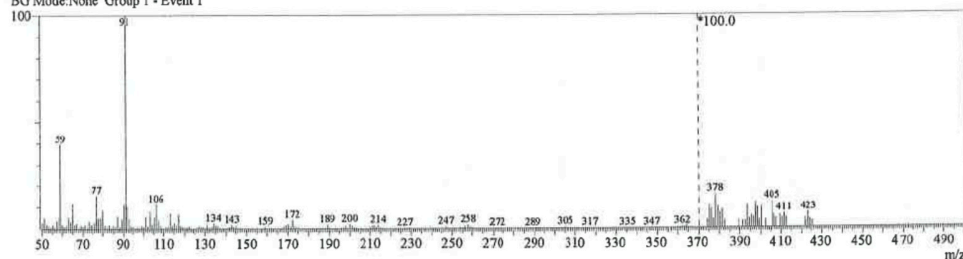
Analytical Line 1  
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 --Group 1 - Event 1--  
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 End Time : 10.00min  
 ACQ Mode : Scan  
 Event Time : 0.50sec  
 Scan Speed : 1000  
 Start m/z : 50.00  
 End m/z : 510.00  
 Electron Voltage : 70 eV  
 Ionization Mode : EI



C:\GCMSSolution\Data\Project1\U15.QGD



Line#:1 R.Time:3.0(Scan#:362)  
 MassPeaks:313(Peak Elimination m/z: 437.40, 455.40)  
 RawMode:Single 3.0(362) BasePeak:91(701185)  
 BG Mode:None Group 1 - Event 1



### Mass Table

Line#:1 R.Time:3.0(Scan#:362)

MassPeaks:313(Peak Elimination m/z: 437.40, 455.40)

RawMode:Single 3.0(362) BasePeak:91(701185)

BG Mode:None Group 1 - Event 1

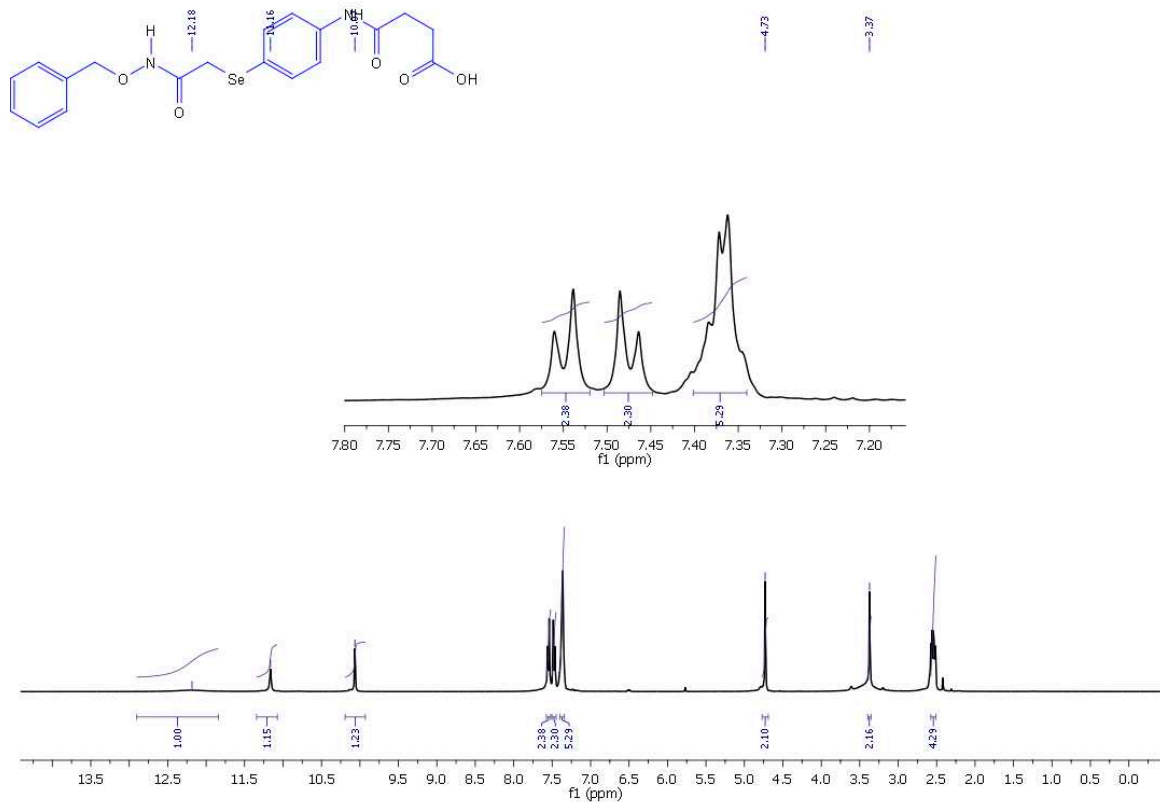
#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
1	50.05	18306	2.61	4	53.05	9508	1.36	7	56.05	5385	0.77
2	51.00	35108	5.01	5	54.10	4943	0.70	8	57.05	27181	3.88
3	52.05	14886	2.12	6	55.05	11963	1.71	9	58.05	36337	5.18



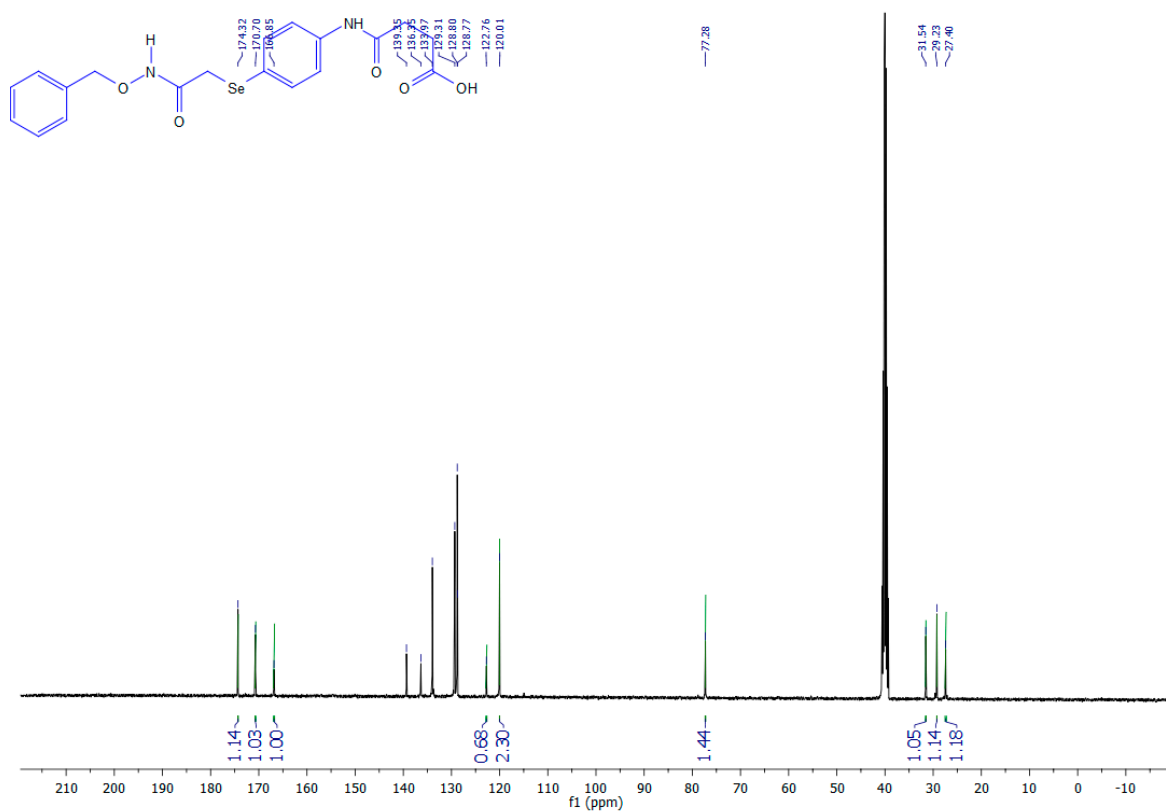
#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
10	59.05	277185	39.53	79	128.20	4665	0.67	148	197.05	3342	0.48
11	60.00	13026	1.86	80	129.20	5682	0.81	149	198.00	7778	1.11
12	61.05	6217	0.89	81	130.20	3086	0.44	150	199.05	2393	0.34
13	62.05	10649	1.52	82	131.15	12803	1.83	151	200.05	14081	2.01
14	63.05	36737	5.24	83	132.15	4696	0.67	152	201.15	7510	1.07
15	64.05	21412	3.05	84	133.25	5619	0.80	153	202.10	3604	0.51
16	65.05	80550	11.49	85	134.20	16919	2.41	154	203.15	2020	0.29
17	66.05	12945	1.85	86	135.20	10226	1.46	155	204.15	654	0.09
18	67.00	17186	2.45	87	136.20	8598	1.23	156	205.20	498	0.07
19	68.05	2987	0.43	88	137.15	3534	0.50	157	207.20	298	0.04
20	69.05	11276	1.61	89	138.10	1094	0.16	158	208.15	385	0.05
21	70.05	5218	0.74	90	139.15	2197	0.31	159	209.15	743	0.11
22	71.00	12086	1.72	91	140.10	1846	0.26	160	210.15	3949	0.56
23	72.05	4991	0.71	92	141.10	4375	0.62	161	211.15	9729	1.39
24	73.05	24750	3.53	93	142.15	3968	0.57	162	212.10	9746	1.39
25	74.05	13753	1.96	94	143.10	11502	1.64	163	213.15	4324	0.62
26	75.05	13118	1.87	95	144.10	5322	0.76	164	214.05	10691	1.52
27	76.15	18283	2.61	96	145.10	8807	1.26	165	215.10	2289	0.33
28	77.05	107829	15.38	97	146.10	2105	0.30	166	216.05	2100	0.30
29	78.05	32785	4.68	98	147.10	2425	0.35	167	217.15	1409	0.20
30	79.05	34505	4.92	99	148.10	1932	0.28	168	218.10	412	0.06
31	80.05	61428	8.76	100	149.15	927	0.13	169	219.20	799	0.11
32	81.05	10306	1.47	101	150.25	663	0.09	170	220.20	225	0.03
33	82.15	2853	0.41	102	151.20	2362	0.34	171	221.20	225	0.03
34	83.05	12014	1.71	103	152.15	1897	0.27	172	224.15	728	0.10
35	84.15	3523	0.50	104	153.15	1488	0.21	173	225.15	1328	0.19
36	85.10	10122	1.44	105	154.15	925	0.13	174	226.15	1083	0.15
37	86.15	6782	0.97	106	155.15	2770	0.40	175	227.15	1616	0.23
38	87.05	41037	5.85	107	156.15	1100	0.16	176	228.15	1472	0.21
39	88.15	5806	0.83	108	157.15	1736	0.25	177	229.20	1295	0.18
40	89.10	31284	4.46	109	158.25	1263	0.18	178	230.15	1025	0.15
41	90.15	78211	11.15	110	159.20	6394	0.91	179	231.15	896	0.13
42	91.10	701185	100.00	111	160.25	917	0.13	180	232.05	314	0.04
43	92.10	71798	10.24	112	161.20	1492	0.21	181	233.20	660	0.09
44	93.05	32658	4.66	113	162.15	984	0.14	182	234.30	311	0.04
45	94.05	9575	1.37	114	163.20	511	0.07	183	235.15	440	0.06
46	95.05	8204	1.17	115	164.05	304	0.04	184	236.20	212	0.03
47	96.10	2594	0.37	116	165.05	813	0.12	185	237.20	204	0.03
48	97.10	6538	0.93	117	166.05	1065	0.15	186	238.15	380	0.05
49	98.15	2925	0.42	118	167.05	1810	0.26	187	239.20	908	0.13
50	99.10	8266	1.18	119	168.05	6531	0.93	188	240.15	548	0.08
51	100.15	6500	0.93	120	169.05	10292	1.47	189	241.15	735	0.10
52	101.10	38386	5.47	121	170.05	15292	2.18	190	242.20	950	0.14
53	102.15	8334	1.19	122	171.15	8248	1.18	191	243.00	438	0.06
54	103.15	55677	7.94	123	172.05	27835	3.97	192	244.15	298	0.04
55	104.15	13353	1.90	124	173.10	7732	1.10	193	245.20	983	0.14
56	105.15	36003	5.13	125	174.05	5518	0.79	194	246.35	617	0.09
57	106.15	79678	11.36	126	175.20	4231	0.60	195	247.30	5943	0.85
58	107.15	25892	3.69	127	176.20	1100	0.16	196	248.20	1900	0.27
59	108.15	12012	1.71	128	177.20	1340	0.19	197	249.15	441	0.06
60	109.15	3212	0.46	129	178.20	316	0.05	198	251.15	428	0.06
61	110.15	1564	0.22	130	179.10	246	0.04	199	252.10	753	0.11
62	111.15	6034	0.86	131	180.15	574	0.08	200	253.15	677	0.10
63	112.25	6235	0.89	132	181.15	782	0.11	201	254.10	3342	0.48
64	113.15	49721	7.09	133	182.15	1297	0.18	202	255.15	2531	0.36
65	114.15	10159	1.45	134	183.15	1889	0.27	203	256.10	7935	1.13
66	115.15	17024	2.43	135	184.10	1881	0.27	204	257.15	1989	0.28
67	116.25	9691	1.38	136	185.15	1969	0.28	205	258.10	12047	1.72
68	117.20	47164	6.73	137	186.10	2553	0.36	206	259.25	6053	0.86
69	118.10	9286	1.32	138	187.15	2322	0.33	207	260.15	3195	0.46
70	119.10	6382	0.91	139	188.25	1370	0.20	208	261.20	927	0.13
71	120.15	3172	0.45	140	189.20	12263	1.75	209	262.40	513	0.07
72	121.20	4009	0.57	141	190.15	2145	0.31	210	263.35	485	0.07
73	122.15	6660	0.95	142	191.20	766	0.11	211	264.35	442	0.06
74	123.15	1954	0.28	143	192.25	316	0.05	212	265.30	562	0.08
75	124.15	714	0.10	144	193.25	2281	0.33	213	266.30	214	0.03
76	125.20	1495	0.21	145	194.10	905	0.13	214	268.05	363	0.05
77	126.25	2144	0.31	146	195.05	520	0.07	215	269.25	391	0.06
78	127.20	9042	1.29	147	196.05	3282	0.47	216	270.25	776	0.11

#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
217	271.25	754	0.11	250	321.30	521	0.07	283	376.35	613	0.09
218	272.15	1314	0.19	251	323.30	593	0.08	284	377.30	273	0.04
219	273.25	723	0.10	252	329.30	220	0.03	285	378.30	1097	0.16
220	274.15	465	0.07	253	331.30	476	0.07	286	379.40	678	0.10
221	275.20	356	0.05	254	332.30	209	0.03	287	380.40	484	0.07
222	276.20	276	0.04	255	333.45	408	0.06	288	381.50	585	0.08
223	277.30	554	0.08	256	334.50	286	0.04	289	382.50	222	0.03
224	285.30	580	0.08	257	335.50	602	0.09	290	389.50	250	0.04
225	286.35	372	0.05	258	336.50	238	0.03	291	391.50	207	0.03
226	287.30	478	0.07	259	337.50	201	0.03	292	392.60	217	0.03
227	288.30	394	0.06	260	339.40	582	0.08	293	393.60	735	0.10
228	289.25	1146	0.16	261	341.40	252	0.04	294	394.60	290	0.04
229	290.25	484	0.07	262	343.40	212	0.03	295	395.55	387	0.06
230	291.25	933	0.13	263	346.40	218	0.03	296	396.50	324	0.05
231	292.20	322	0.05	264	347.35	1144	0.16	297	397.50	818	0.12
232	293.25	414	0.06	265	348.35	355	0.05	298	398.45	644	0.09
233	299.30	268	0.04	266	349.25	481	0.07	299	399.20	255	0.04
234	300.30	297	0.04	267	351.30	292	0.04	300	400.20	676	0.10
235	301.40	378	0.05	268	353.30	268	0.04	301	402.20	255	0.04
236	302.35	448	0.06	269	355.30	250	0.04	302	405.45	851	0.12
237	303.35	950	0.14	270	358.30	206	0.03	303	406.50	409	0.06
238	304.35	948	0.14	271	359.25	346	0.05	304	407.50	302	0.04
239	305.35	4728	0.67	272	360.25	2084	0.30	305	409.50	404	0.06
240	306.30	1756	0.25	273	361.25	2545	0.36	306	410.50	303	0.04
241	307.25	488	0.07	274	362.20	4982	0.71	307	411.55	459	0.07
242	313.45	782	0.11	275	363.25	2971	0.42	308	412.55	313	0.04
243	314.50	314	0.04	276	364.25	10056	1.43	309	421.60	298	0.04
244	315.50	222	0.03	277	365.15	2555	0.36	310	422.40	202	0.03
245	316.35	407	0.06	278	366.20	1932	0.28	311	423.45	478	0.07
246	317.35	1606	0.23	279	367.30	900	0.13	312	424.40	265	0.04
247	318.15	573	0.08	280	368.30	241	0.03	313	425.40	207	0.03
248	319.15	451	0.06	281	374.40	263	0.04				
249	320.10	247	0.04	282	375.45	725	0.10				

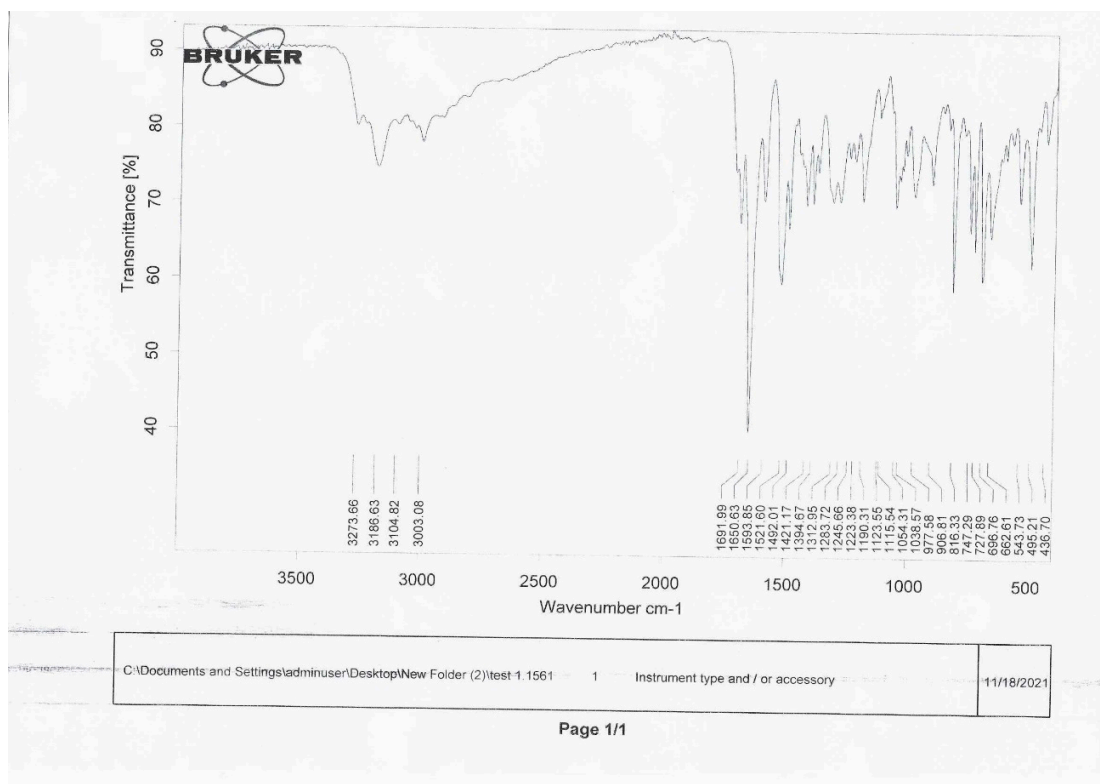
*Synthesis of 4-((4-((2-((benzyloxy)amino)-2-oxoethyl)selenanyl)phenyl)amino)-4-oxobutanoic acid (11)*



<sup>1</sup>H NMR chart of compound 11



<sup>1</sup>H NMR chart of compound 11



IR chart of compound 11

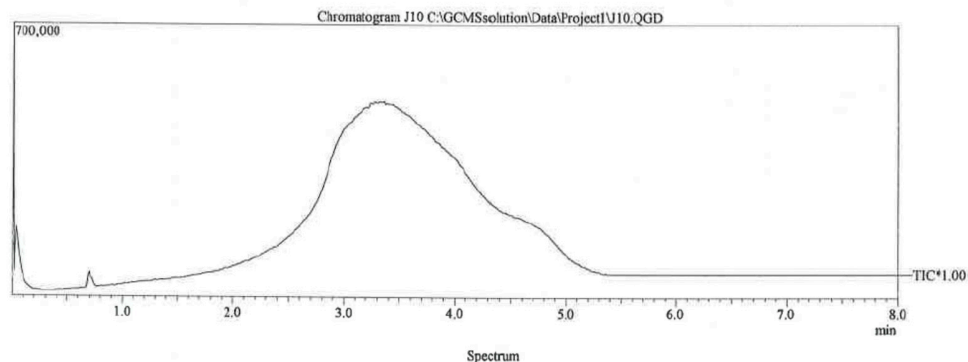
# Cairo University Micro Analytical Center

## DI Analysis Shimadzu Qp-2010 Plus

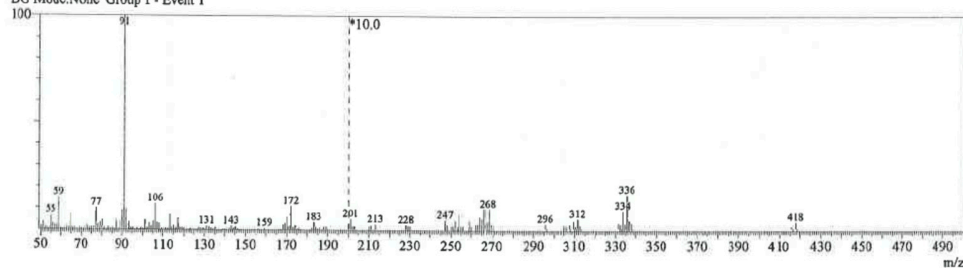
Sample Information  
 Analyzed by : Dr. Mai Younis  
 Analyzed : 03/01/2007 09:00:00  
 Sample Name : J10  
 Sample ID :  
 Customer Name : Dr. Mohamed Soliman - Science - Cairo  
 Data File : C:\GCMSsolution\Data\Project1\J10.QGD  
 Org Data File : C:\GCMSsolution\Data\Project1\J10.QGD  
 Method File : C:\GCMSsolution\Data\Project1\High Temperature Op  
 Org Method File : C:\GCMSsolution\Data\Project1\High Temperature Op  
 Report File :  
 Tuning File : C:\GCMSsolution\System\Tune1\default.qgt  
 \$EndIf\$Modified by : Dr. Mai Younis  
 Modified : 03/01/2007 09:05:28

Method  
 Analytical Line 1  
 IonSourceTemp : 250.00 °C  
 [MS Table]  
 --Group 1 - Event 1--  
 Start Time : 0.00min  
 End Time : 10.00min  
 ACQ Mode : Scan  
 Event Time : 0.50sec  
 Scan Speed : 1000  
 Start m/z : 50.00  
 End m/z : 510.00  
 Electron Voltage : 70 eV  
 Ionization Mode : EI

C:\GCMSsolution\Data\Project1\J10.QGD



Line#:1 R.Time:3.8(Scan#:457)  
 MassPeaks:181  
 RawMode:Single 3.8(457) BasePeak:91(115204)  
 BG Mode:None Group 1 - Event 1



Mass Table  
 Line#:1 R.Time:3.8(Scan#:457)  
 MassPeaks:181  
 RawMode:Single 3.8(457) BasePeak:91(115204)  
 BG Mode:None Group 1 - Event 1

#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
1	50.05	1945	1.69	4	53.05	1292	1.12	7	56.00	3238	2.81
2	51.00	4190	3.64	5	54.05	1117	0.97	8	57.05	2271	1.97
3	52.05	1636	1.42	6	55.00	7308	6.34	9	58.05	2379	2.07

#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
10	59.00	16964	14.73	68	117.15	6087	5.28	126	186.00	1239	1.08
11	60.00	849	0.74	69	118.05	1331	1.16	127	187.10	540	0.47
12	61.00	436	0.38	70	119.10	1262	1.10	128	188.05	1709	1.48
13	62.05	769	0.67	71	120.10	1086	0.94	129	189.15	1769	1.54
14	63.05	2693	2.34	72	121.15	360	0.31	130	190.05	773	0.67
15	64.05	1718	1.49	73	122.10	246	0.21	131	191.00	321	0.28
16	65.00	8239	7.15	74	123.10	633	0.55	132	193.00	209	0.18
17	66.05	1119	0.97	75	125.10	281	0.24	133	196.00	231	0.20
18	67.00	1436	1.25	76	126.25	325	0.28	134	198.00	418	0.36
19	68.00	274	0.24	77	127.20	1298	1.13	135	200.00	230	0.20
20	69.05	1175	1.02	78	128.15	883	0.77	136	201.10	598	0.52
21	70.05	615	0.53	79	129.15	915	0.79	137	202.10	210	0.18
22	71.05	1172	1.02	80	130.25	648	0.56	138	203.10	202	0.18
23	72.05	500	0.43	81	131.15	2109	1.83	139	210.10	207	0.18
24	73.05	2134	1.85	82	132.15	1716	1.49	140	211.10	226	0.20
25	74.05	1019	0.88	83	133.20	889	0.77	141	213.10	302	0.26
26	75.05	1291	1.12	84	134.15	605	0.53	142	228.10	263	0.23
27	76.05	1732	1.50	85	135.15	1346	1.17	143	229.10	212	0.18
28	77.05	11559	10.03	86	136.10	202	0.18	144	230.10	222	0.19
29	78.05	3103	2.69	87	139.20	382	0.33	145	247.20	534	0.46
30	79.05	3815	3.31	88	140.05	376	0.33	146	248.20	295	0.26
31	80.05	4986	4.33	89	141.05	691	0.60	147	250.20	238	0.21
32	81.05	1216	1.06	90	142.05	668	0.58	148	251.00	239	0.21
33	82.05	454	0.39	91	143.00	1937	1.68	149	251.95	486	0.42
34	83.10	1522	1.32	92	144.05	845	0.73	150	253.10	210	0.18
35	84.10	582	0.51	93	145.05	1680	1.46	151	254.10	846	0.73
36	85.10	1159	1.01	94	146.15	764	0.66	152	255.10	218	0.19
37	86.15	703	0.61	95	147.15	573	0.50	153	256.10	222	0.19
38	87.05	4634	4.02	96	148.20	258	0.22	154	259.20	506	0.44
39	88.15	749	0.65	97	149.20	242	0.21	155	260.20	236	0.20
40	89.15	4402	3.82	98	151.20	247	0.21	156	262.20	300	0.26
41	90.15	10221	8.87	99	153.10	356	0.31	157	263.10	329	0.29
42	91.05	115204	100.00	100	154.05	368	0.32	158	264.15	694	0.60
43	92.05	11047	9.59	101	155.10	348	0.30	159	265.15	589	0.51
44	93.05	4079	3.54	102	156.10	519	0.45	160	266.10	1119	0.97
45	94.05	1002	0.87	103	157.15	393	0.34	161	267.15	437	0.38
46	95.10	1118	0.97	104	158.10	351	0.30	162	268.10	1127	0.98
47	96.10	449	0.39	105	159.10	911	0.79	163	269.10	337	0.29
48	97.05	904	0.78	106	160.10	310	0.27	164	270.10	255	0.22
49	98.15	458	0.40	107	165.10	242	0.21	165	296.10	330	0.29
50	99.10	1004	0.87	108	166.05	539	0.47	166	305.10	279	0.24
51	100.15	865	0.75	109	167.05	580	0.50	167	306.10	233	0.20
52	101.10	5194	4.51	110	168.05	2882	2.50	168	308.10	305	0.26
53	102.15	981	0.85	111	169.05	3305	2.87	169	310.10	487	0.42
54	103.10	3543	3.08	112	170.00	6798	5.90	170	311.10	220	0.19
55	104.15	1784	1.55	113	171.05	1859	1.61	171	312.10	607	0.53
56	105.10	4430	3.85	114	172.00	12639	10.97	172	313.10	270	0.23
57	106.10	14001	12.15	115	172.95	1539	1.34	173	332.15	399	0.35
58	107.10	3910	3.39	116	174.00	2425	2.10	174	333.15	338	0.29
59	108.10	3198	2.78	117	175.10	649	0.56	175	334.15	1050	0.91
60	109.10	834	0.72	118	176.10	1036	0.90	176	335.25	356	0.31
61	110.15	298	0.26	119	177.10	318	0.28	177	336.15	1897	1.65
62	111.05	868	0.75	120	180.10	318	0.28	178	337.10	524	0.45
63	112.15	789	0.68	121	181.15	378	0.33	179	338.20	398	0.35
64	113.10	7921	6.88	122	182.10	1002	0.87	180	416.20	215	0.19
65	114.10	1380	1.20	123	183.10	4110	3.57	181	418.25	456	0.40
66	115.10	2383	2.07	124	184.05	1558	1.35				
67	116.15	1146	0.99	125	185.05	643	0.56				

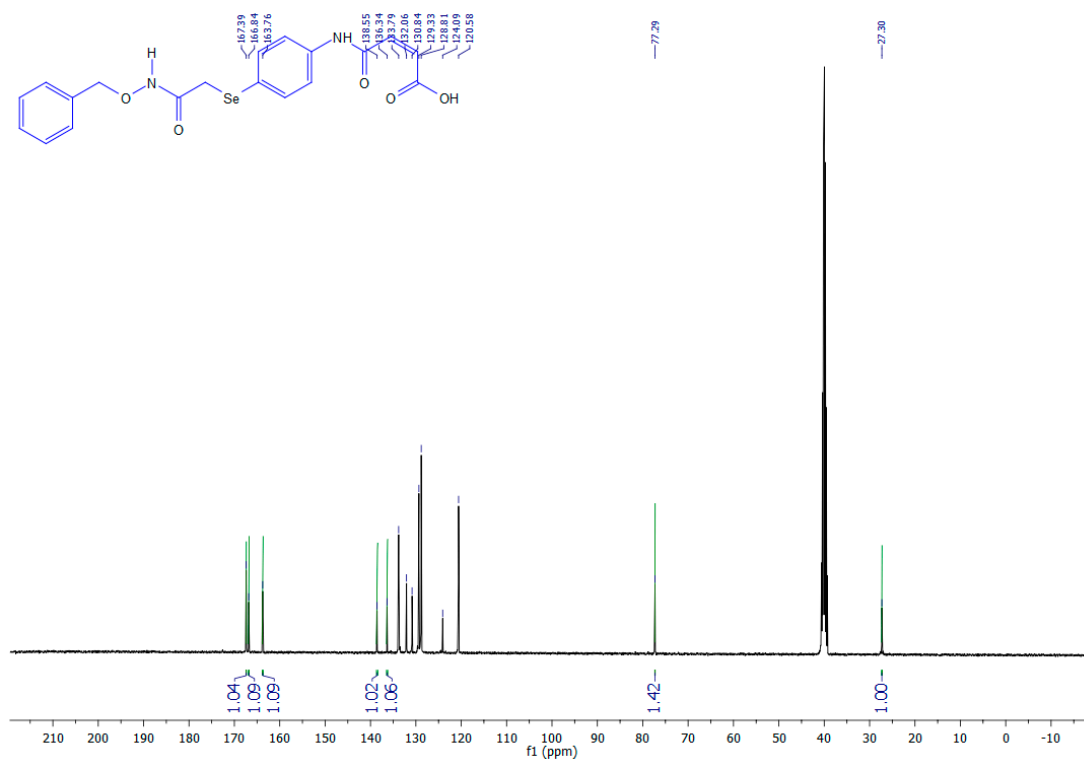
## Mass chart of compound 11

*Synthesis of 4-((4-((2-((benzyloxy)amino)-2-oxoethyl)selenanyl)phenyl)amino)-4-oxobut-2-enoic acid (12)*

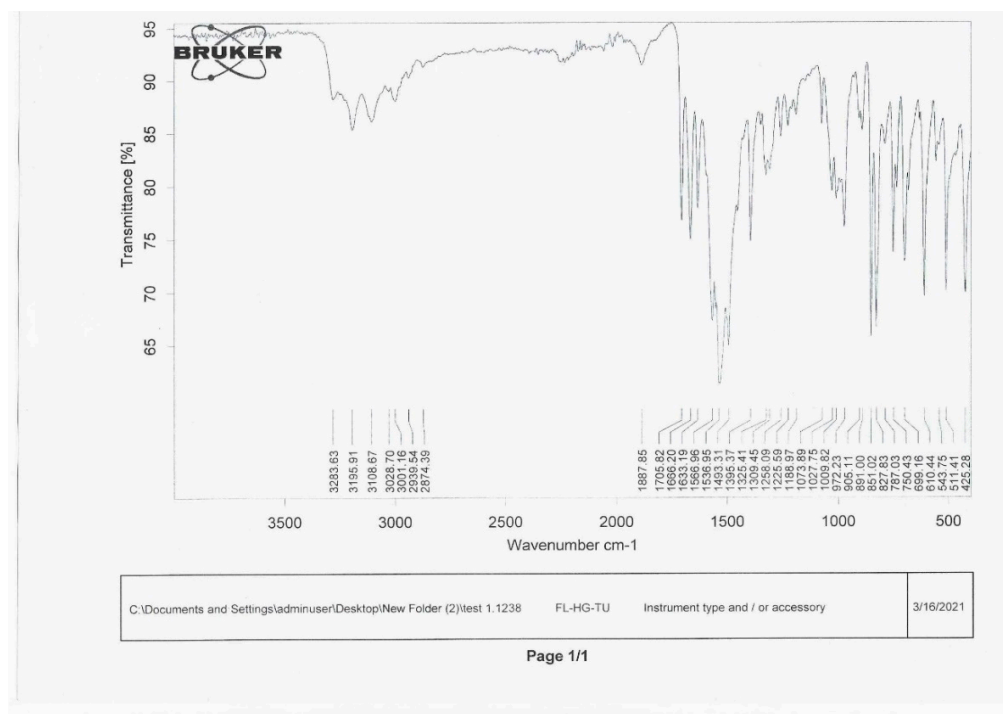


<sup>1</sup>H NMR chart of compound 12





<sup>13</sup>CNMR chart of compound 12



IR chart of compound 12

# Cairo University Micro Analytical Center

## DI Analysis Shimadzu Qp-2010 Plus

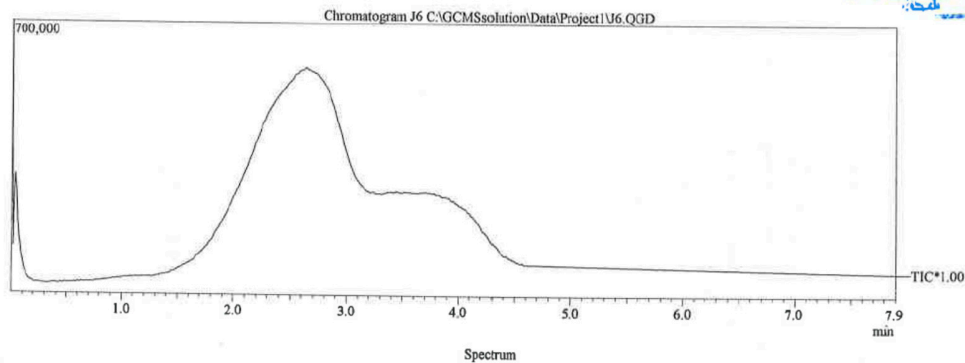
Sample Information  
 Analyzed by : Dr. Mai Younis  
 Analyzed : 03/01/2007 09:07:47  
 Sample Name : J6  
 Sample ID :  
 Customer Name : Dr. Mohamed Soliman - Science - Cairo  
 Data File : C:\GCMSsolution\Data\Project1\U6.QGD  
 Org Data File : C:\GCMSsolution\Data\Project1\U6.QGD  
 Method File : C:\GCMSsolution\Data\Project1\High Temperature Op  
 Org Method File : C:\GCMSsolution\Data\Project1\High Temperature Op  
 Report File :  
 Tuning File : C:\GCMSsolution\System\Tune1\default.qgt  
 \$EndIf\$ Modified by : Dr. Mai Younis  
 Modified : 03/01/2007 09:12:26

## Method

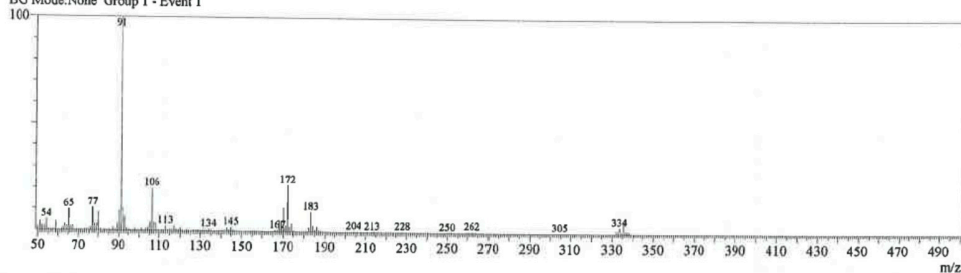
Analytical Line 1  
 IonSourceTemp : 250.00 °C  
 [MS Table]  
 --Group 1 - Event 1--  
 Start Time : 0.00min  
 End Time : 10.00min  
 ACQ Mode : Scan  
 Event Time : 0.50sec  
 Scan Speed : 1000  
 Start m/z : 50.00  
 End m/z : 510.00

Electron Voltage : 70 eV  
 Ionization Mode : EI

C:\GCMSsolution\Data\Project1\U6.QGD



Line#:1 R.Time:2.6(Scan#:318)  
 MassPeaks:155  
 RawMode:Single 2.6(318) BasePeak:91(160524)  
 BG Mode:None Group 1 - Event 1



## Mass Table

Line#:1 R.Time:2.6(Scan#:318)

MassPeaks:155

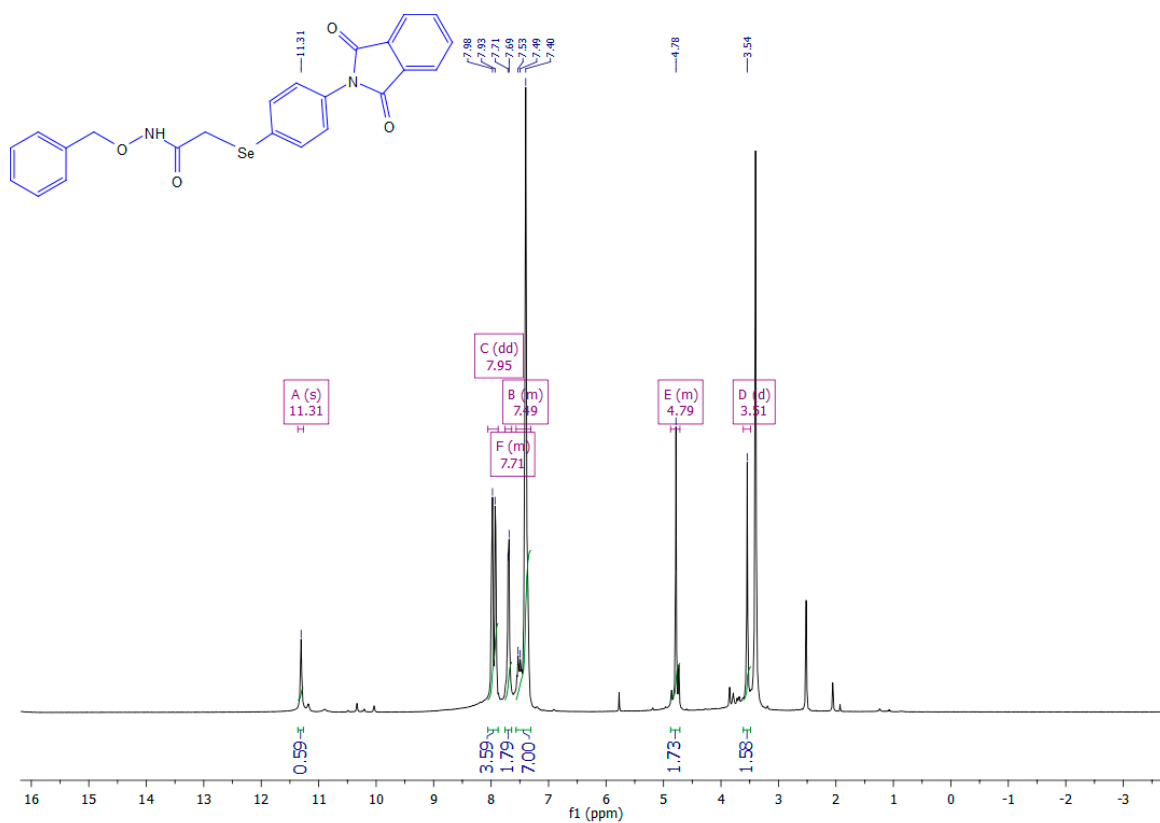
RawMode:Single 2.6(318) BasePeak:91(160524)

BG Mode:None Group 1 - Event 1

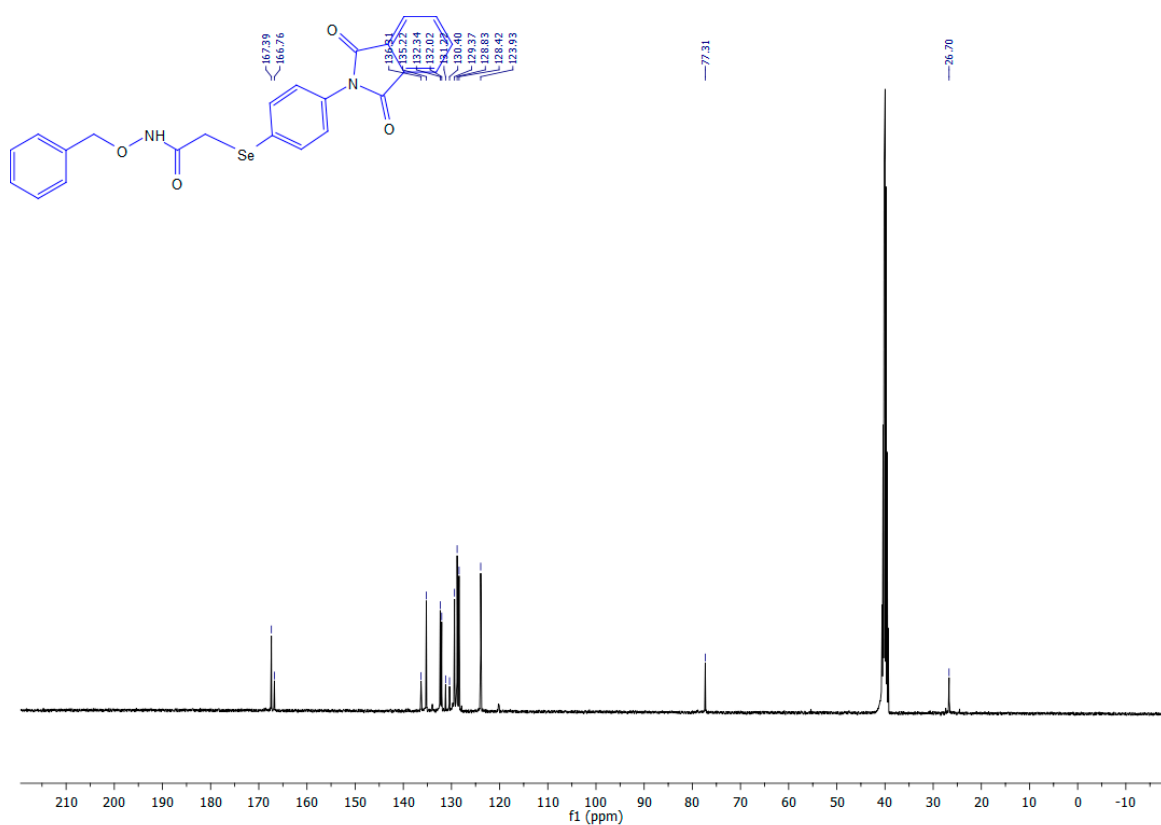
#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
1	50.00	2658	1.66	4	53.05	3473	2.16	7	56.05	550	0.34
2	51.00	6460	4.02	5	54.00	8020	5.00	8	57.05	1150	0.72
3	52.00	3343	2.08	6	55.00	1062	0.66	9	58.05	1191	0.74

#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
10	59.00	6412	3.99	59	108.10	5361	3.34	108	165.05	403	0.25
11	60.05	499	0.31	60	109.15	1139	0.71	109	166.00	958	0.60
12	61.05	407	0.25	61	110.20	305	0.19	110	167.05	986	0.61
13	62.05	1434	0.89	62	111.10	540	0.34	111	168.00	7663	4.77
14	63.00	4708	2.93	63	112.15	387	0.24	112	169.05	7641	4.76
15	64.05	3127	1.95	64	113.10	3642	2.27	113	170.00	17698	11.03
16	65.00	15834	9.86	65	114.10	929	0.58	114	171.05	4402	2.74
17	66.05	2618	1.63	66	115.05	1776	1.11	115	172.00	34906	21.75
18	67.05	2996	1.87	67	116.10	1247	0.78	116	172.95	3390	2.11
19	68.00	295	0.18	68	117.05	3574	2.23	117	174.00	6183	3.85
20	69.05	642	0.40	69	118.05	1225	0.76	118	174.95	781	0.49
21	70.05	500	0.31	70	119.05	1079	0.67	119	180.10	505	0.31
22	71.00	689	0.43	71	120.10	2570	1.60	120	181.15	596	0.37
23	72.05	405	0.25	72	121.10	591	0.37	121	182.15	3140	1.96
24	73.05	1073	0.67	73	122.10	236	0.15	122	183.10	14934	9.30
25	74.00	1164	0.73	74	123.10	1327	0.83	123	184.05	4336	2.70
26	75.05	1243	0.77	75	124.15	399	0.25	124	185.05	1336	0.83
27	76.05	2258	1.41	76	125.20	247	0.15	125	186.00	3825	2.38
28	77.05	17187	10.71	77	126.10	202	0.13	126	186.90	828	0.52
29	78.00	4534	2.82	78	127.05	737	0.46	127	187.95	821	0.51
30	79.05	4743	2.95	79	128.15	717	0.45	128	189.10	751	0.47
31	80.05	13542	8.44	80	129.10	815	0.51	129	204.20	516	0.32
32	81.00	1236	0.77	81	130.10	620	0.39	130	213.10	366	0.23
33	82.10	329	0.20	82	131.10	1158	0.72	131	214.00	358	0.22
34	83.10	711	0.44	83	132.10	758	0.47	132	226.00	281	0.18
35	84.05	368	0.23	84	133.15	806	0.50	133	228.00	572	0.36
36	85.10	649	0.40	85	134.10	1457	0.91	134	229.00	206	0.13
37	86.15	501	0.31	86	135.15	923	0.57	135	230.00	415	0.26
38	87.05	2214	1.38	87	139.10	342	0.21	136	250.00	231	0.14
39	88.15	823	0.51	88	140.00	332	0.21	137	252.00	313	0.19
40	89.15	5673	3.53	89	141.00	1113	0.69	138	259.20	471	0.29
41	90.15	14663	9.13	90	142.00	985	0.61	139	260.15	419	0.26
42	91.05	160524	100.00	91	143.05	2124	1.32	140	261.10	324	0.20
43	92.05	17009	10.60	92	144.05	1332	0.83	141	262.15	955	0.59
44	93.05	10578	6.59	93	145.00	2942	1.83	142	263.15	580	0.36
45	94.05	2029	1.26	94	146.10	1478	0.92	143	264.20	514	0.32
46	95.05	944	0.59	95	147.00	886	0.55	144	265.20	263	0.16
47	95.95	397	0.25	96	148.00	308	0.19	145	266.20	278	0.17
48	97.05	668	0.42	97	149.00	294	0.18	146	305.20	217	0.14
49	98.05	2091	1.30	98	151.00	228	0.14	147	330.20	210	0.13
50	99.10	718	0.45	99	152.00	241	0.15	148	332.20	1775	1.11
51	100.15	447	0.28	100	153.00	247	0.15	149	333.15	1844	1.15
52	101.10	2162	1.35	101	154.00	279	0.17	150	334.15	4462	2.78
53	102.05	672	0.42	102	155.00	318	0.20	151	335.20	1271	0.79
54	103.10	1687	1.05	103	156.00	302	0.19	152	336.15	8917	5.55
55	104.15	2403	1.50	104	157.00	351	0.22	153	337.15	1686	1.05
56	105.15	6490	4.04	105	158.00	441	0.27	154	338.15	1717	1.07
57	106.10	31970	19.92	106	159.20	439	0.27	155	339.05	308	0.19
58	107.10	5873	3.66	107	160.10	340	0.21				

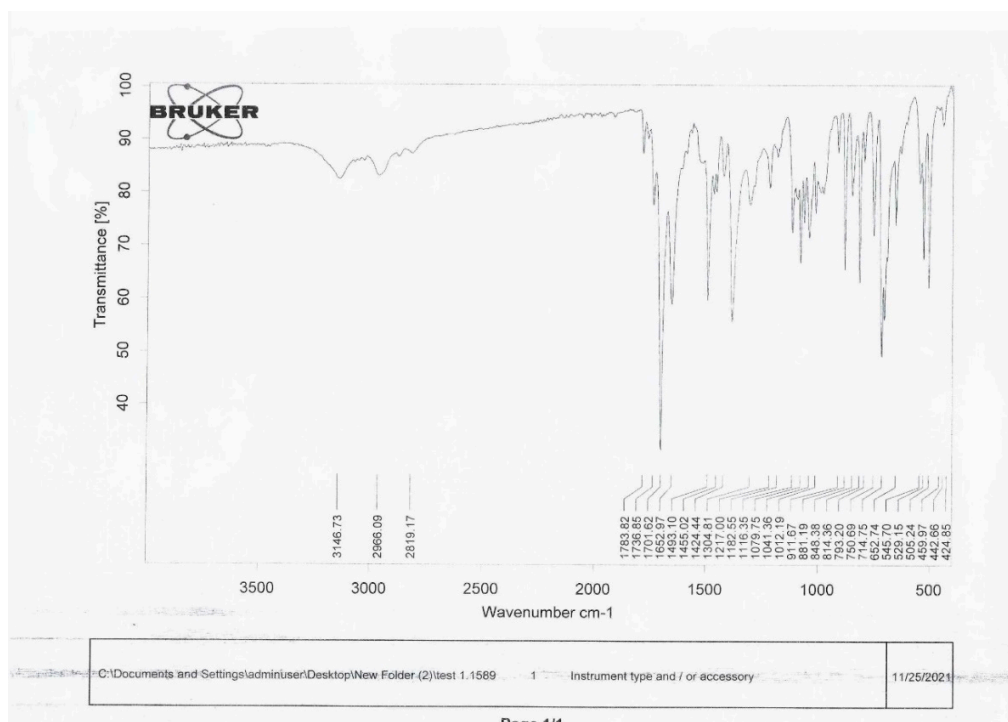
Synthesis of *N*-(benzyloxy)-2-((4-(1,3-dioxoisindolin-2-yl)phenyl)selanyl)acetamide (**13**)



<sup>1</sup>H NMR chart of compound **13**



<sup>13</sup>CNMR chart of compound 13



IR chart of compound 13

# **Cairo University Micro Analytical Center**

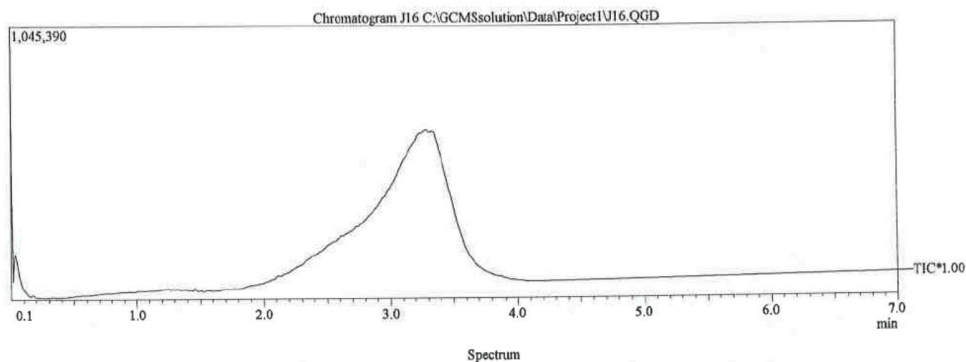
## **DI Analysis Shimadzu Qp-2010 Plus**

Sample Information  
 Analyzed by : Dr. Mai Younis  
 Analyzed : 06/01/2007 06:25:47  
 Sample Name : J16  
 Sample ID :  
 Customer Name : Dr. Mohamed Soliman - Science - Cairo  
 Data File : C:\GCMSsolution\Data\Project1\U16.QGD  
 Org Data File : C:\GCMSsolution\Data\Project1\U16.QGD  
 Method File : C:\GCMSsolution\Data\Project1\High Temperature Op  
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 Tuning File : C:\GCMSsolution\System\Tune1\\_default.qgt  
 \$EndIf\$ Modified by : Dr. Mai Younis  
 Modified : 06/01/2007 06:29:55

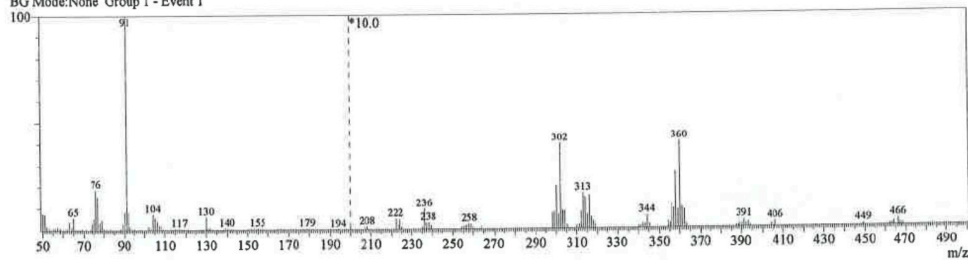
Method  
 Analytical Line 1  
 IonSourceTemp : 250.00 °C  
 [MS Table]  
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 Start Time : 0.00min  
 End Time : 10.00min  
 ACQ Mode : Scan  
 Event Time : 0.50sec  
 Scan Speed : 1000  
 Start m/z : 50.00  
 End m/z : 510.00  
 Electron Voltage : 70 eV  
 Ionization Mode : EI



C:\GCMSsolution\Data\Project1\U16.QGD



Line#:1 R.Time:3.3(Scan#:391)  
 MassPeaks:187  
 RawMode:Single 3.3(391) BasePeak:91(208863)  
 BG Mode:None Group 1 - Event 1



### Mass Table

Line#:1 R.Time:3.3(Scan#:391)

MassPeaks:187

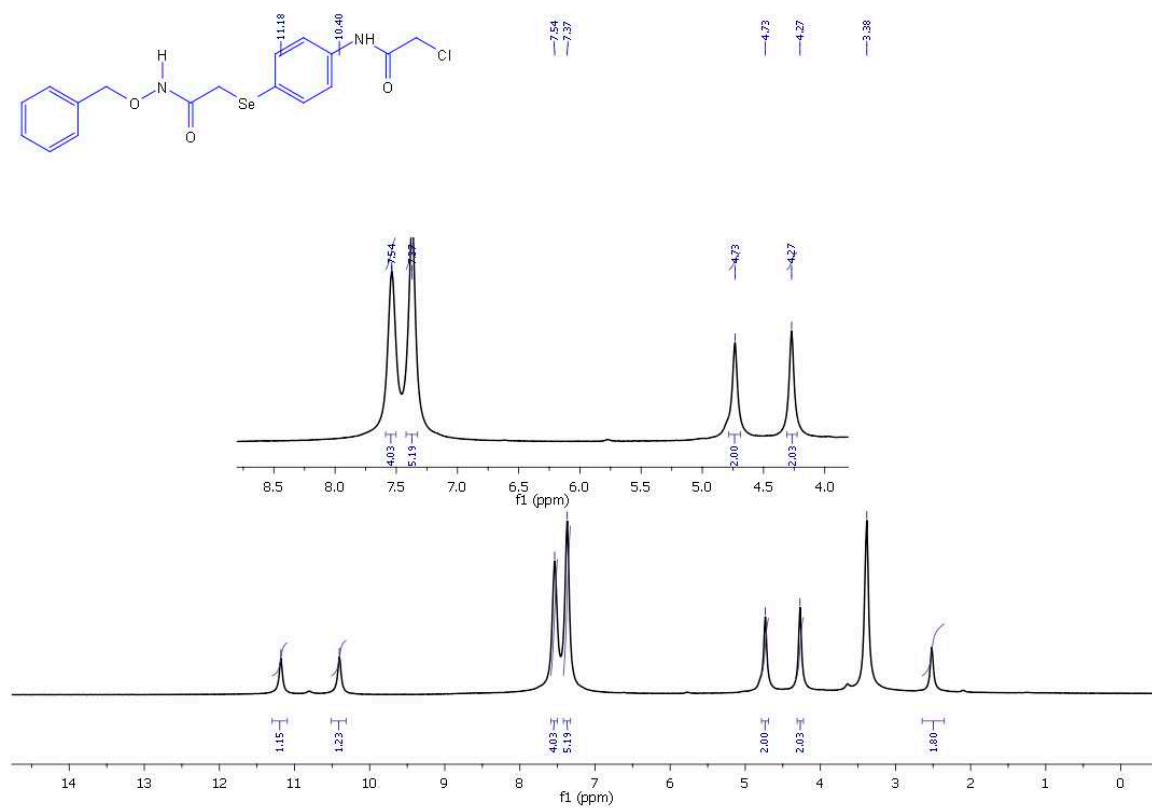
RawMode:Single 3.3(391) BasePeak:91(208863)

BG Mode:None Group 1 - Event 1

#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
1	50.00	16015	7.67	4	53.05	1982	0.95	7	56.05	1571	0.75
2	51.00	15266	7.31	5	54.05	690	0.33	8	57.05	2674	1.28
3	52.00	3894	1.86	6	55.05	2418	1.16	9	58.05	2004	0.96

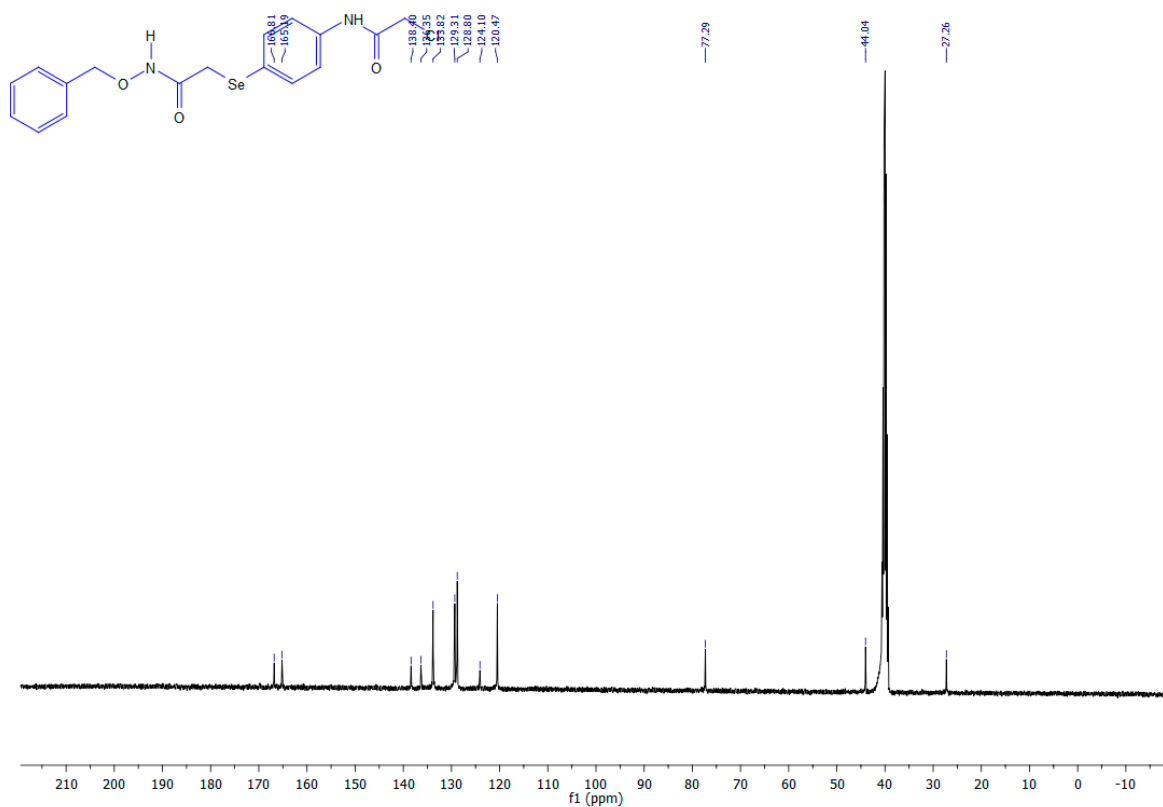
#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
10	59.00	1785	0.85	70	119.15	860	0.41	130	255.20	234	0.11
11	60.00	601	0.29	71	120.10	350	0.17	131	256.20	322	0.15
12	60.95	959	0.46	72	121.10	399	0.19	132	257.10	378	0.18
13	62.05	2054	0.98	73	122.10	281	0.13	133	258.15	495	0.24
14	63.05	7960	3.81	74	123.10	284	0.14	134	259.05	435	0.21
15	64.15	3136	1.50	75	125.10	313	0.15	135	260.00	209	0.10
16	65.05	12011	5.75	76	126.10	358	0.17	136	264.00	220	0.11
17	66.05	1062	0.51	77	127.10	554	0.27	137	298.15	1504	0.72
18	67.10	916	0.44	78	128.05	461	0.22	138	299.15	1564	0.75
19	68.15	438	0.21	79	129.15	937	0.45	139	300.15	4131	1.98
20	69.05	1671	0.80	80	130.15	12238	5.86	140	301.25	1352	0.65
21	70.10	559	0.27	81	131.10	1382	0.66	141	302.15	8270	3.96
22	71.10	1407	0.67	82	132.10	2113	1.01	142	303.15	1718	0.82
23	72.15	348	0.17	83	133.15	459	0.22	143	304.15	1691	0.81
24	73.15	1422	0.68	84	136.10	274	0.13	144	305.20	353	0.17
25	74.05	6208	2.97	85	137.10	343	0.16	145	310.20	268	0.13
26	75.15	10680	5.11	86	138.10	514	0.25	146	311.35	408	0.20
27	76.05	39161	18.75	87	139.10	1380	0.66	147	312.30	1612	0.77
28	77.05	32239	15.44	88	140.15	1312	0.63	148	313.30	3425	1.64
29	78.10	7353	3.52	89	141.10	398	0.19	149	314.25	2991	1.43
30	79.10	10062	4.82	90	142.10	282	0.14	150	315.25	1330	0.64
31	80.10	1535	0.73	91	143.05	426	0.20	151	316.20	3210	1.54
32	81.15	1056	0.51	92	144.10	295	0.14	152	317.15	1051	0.50
33	82.15	574	0.27	93	150.00	356	0.17	153	318.10	711	0.34
34	83.10	1401	0.67	94	151.05	814	0.39	154	319.10	354	0.17
35	84.20	702	0.34	95	152.05	1030	0.49	155	340.10	206	0.10
36	85.15	992	0.47	96	153.00	1066	0.51	156	341.10	238	0.11
37	86.15	456	0.22	97	154.05	610	0.29	157	342.20	420	0.20
38	87.15	779	0.37	98	155.00	1230	0.59	158	343.30	382	0.18
39	88.15	1219	0.58	99	156.05	680	0.33	159	344.30	1217	0.58
40	89.15	6416	3.07	100	157.05	367	0.18	160	345.30	372	0.18
41	90.15	17171	8.22	101	158.10	321	0.15	161	354.20	604	0.29
42	91.10	208863	100.00	102	164.15	551	0.26	162	355.25	440	0.21
43	92.10	16934	8.11	103	165.10	740	0.35	163	356.25	2236	1.07
44	93.00	3321	1.59	104	166.10	1158	0.55	164	357.25	1845	0.88
45	94.05	841	0.40	105	167.05	446	0.21	165	358.20	5396	2.58
46	95.10	1343	0.64	106	168.10	378	0.18	166	359.25	1724	0.83
47	96.15	528	0.25	107	168.95	305	0.15	167	360.20	8442	4.04
48	97.20	977	0.47	108	169.90	500	0.24	168	361.15	2023	0.97
49	98.15	896	0.43	109	170.90	215	0.10	169	362.20	1754	0.84
50	99.10	390	0.19	110	171.90	202	0.10	170	363.15	374	0.18
51	100.10	342	0.16	111	177.15	564	0.27	171	387.20	204	0.10
52	101.15	660	0.32	112	178.15	659	0.32	172	388.20	217	0.10
53	102.10	3724	1.78	113	179.15	992	0.47	173	389.10	410	0.20
54	103.15	2054	0.98	114	180.20	425	0.20	174	390.25	296	0.14
55	104.10	15006	7.18	115	193.20	303	0.15	175	391.20	708	0.34
56	105.10	11479	5.50	116	194.20	324	0.16	176	392.20	353	0.17
57	106.15	8538	4.09	117	198.20	222	0.11	177	393.25	511	0.24
58	107.15	4476	2.14	118	207.20	217	0.10	178	394.20	210	0.10
59	108.15	4944	2.37	119	208.20	258	0.12	179	404.20	295	0.14
60	109.20	892	0.43	120	222.15	999	0.48	180	406.20	508	0.24
61	110.20	335	0.16	121	223.15	408	0.20	181	449.20	220	0.11
62	111.15	662	0.32	122	224.15	905	0.43	182	462.20	220	0.11
63	112.15	366	0.18	123	225.20	242	0.12	183	463.20	220	0.11
64	113.10	798	0.38	124	235.20	250	0.12	184	464.20	406	0.19
65	114.15	572	0.27	125	236.15	1946	0.93	185	466.25	662	0.32
66	115.10	1082	0.52	126	237.15	577	0.28	186	467.30	231	0.11
67	116.15	748	0.36	127	238.15	643	0.31	187	468.30	218	0.10
68	117.10	1370	0.66	128	239.20	332	0.16				
69	118.10	487	0.23	129	254.20	210	0.10				

Synthesis of *N*-(benzyloxy)-2-((4-(2-chloroacetamido)phenyl)selanyl)acetamide (**14**)

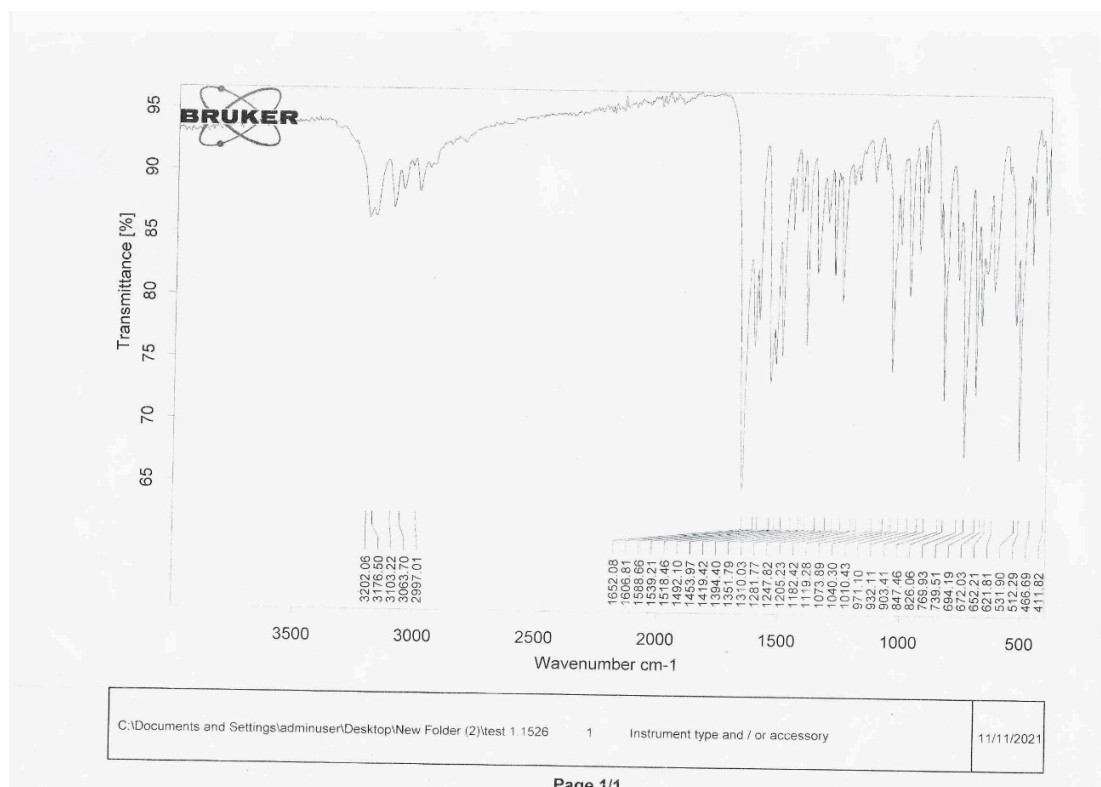


<sup>1</sup>H NMR chart of compound **14**





$^{13}\text{C}$ NMR chart of compound 14



IR chart of compound **14**

# **Cairo University Micro Analytical Center**

## **DI Analysis Shimadzu Qp-2010 Plus**

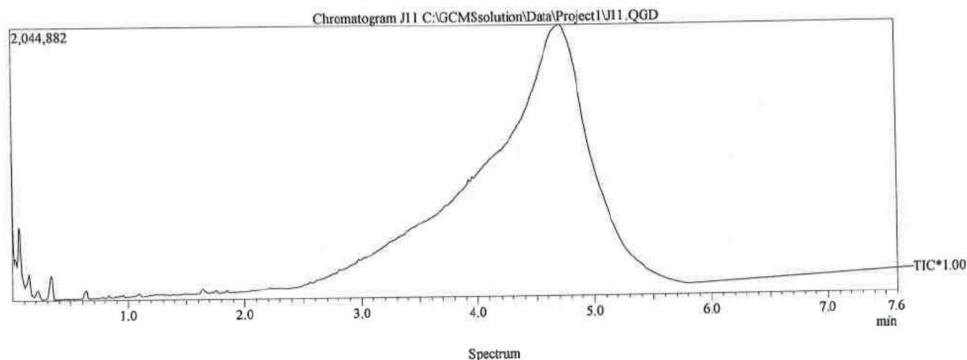
Sample Information  
 Analyzed by : Dr. Mai Younis  
 Analyzed : 06/01/2007 06:15:31  
 Sample Name : J11  
 Sample ID :  
 Customer Name : Dr. Mohamed Soliman - Science - Cairo  
 Data File : C:\GCMSsolution\Data\Project1\J11.QGD  
 Org Data File : C:\GCMSsolution\Data\Project1\J11.QGD  
 Method File : C:\GCMSsolution\Data\Project1\High Temperature Op  
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 Report File :  
 Tuning File : C:\GCMSsolution\System\Tune1\\_default.qgt  
 \$End1\$Modified by : Dr. Mai Younis  
 Modified : 06/01/2007 06:21:22

### Method

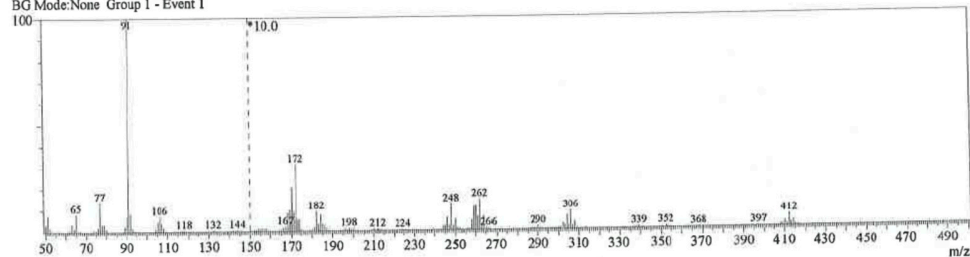
Analytical Line 1  
 IonSourceTemp : 250.00 °C  
 [MS Table]  
 ~Group 1 - Event 1--  
 Start Time : -0.00min  
 End Time : 10.00min  
 ACQ Mode : Scan  
 Event Time : 0.50sec  
 Scan Speed : 1000  
 Start m/z : 50.00  
 End m/z : 510.00  
 Electron Voltage : 70 eV  
 Ionization Mode : EI



C:\GCMSsolution\Data\Project1\J11.QGD



Line#:1 R.Time:4.7(Scan#:570)  
 MassPeaks:238  
 RawMode:Single 4.7(570) BasePeak:91(851255)  
 BG Mode:None Group 1 - Event 1



### Mass Table

Line#:1 R.Time:4.7(Scan#:570)

MassPeaks:238

RawMode:Single 4.7(570) BasePeak:91(851255)

BG Mode:None Group 1 - Event 1

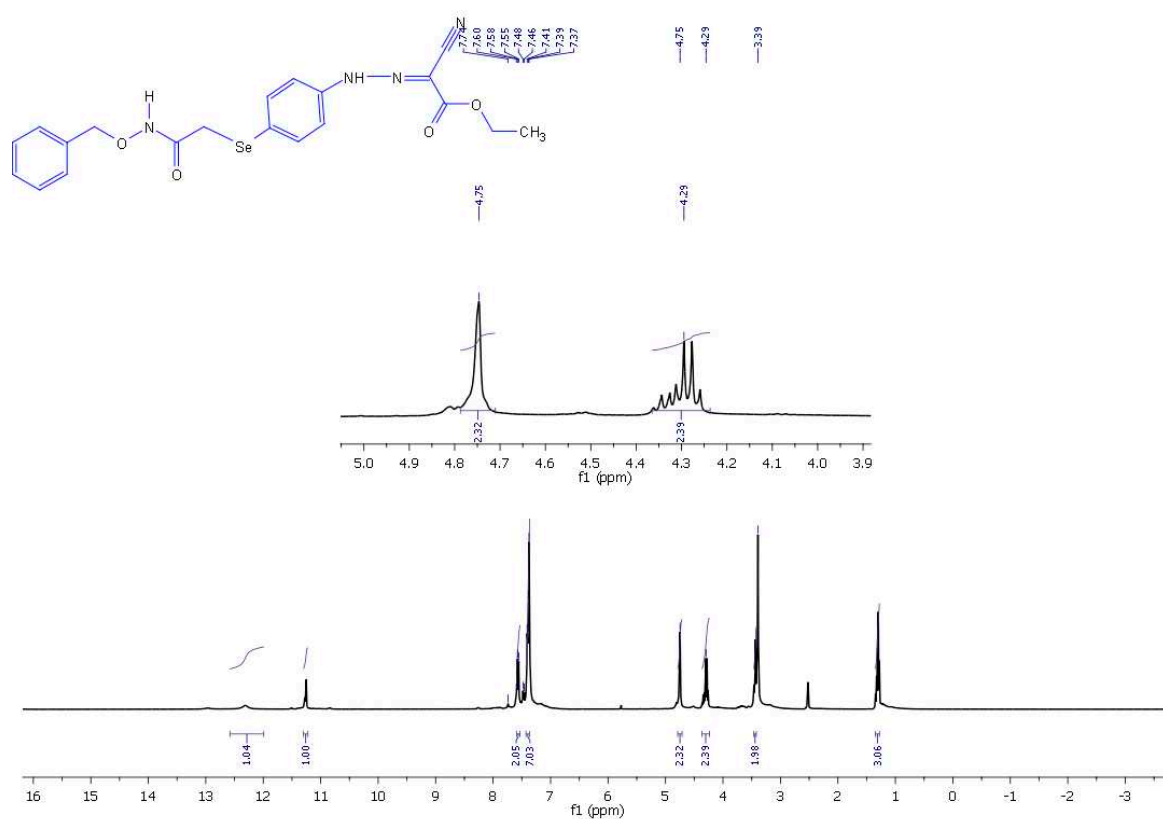
#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
1	50.05	26498	3.11	4	53.05	6330	0.74
2	51.00	62826	7.38	5	54.00	2010	0.24
3	52.05	16634	1.95	6	55.05	3162	0.37
				7	56.05	3355	0.39
				8	57.10	3425	0.40
				9	58.05	2314	0.27

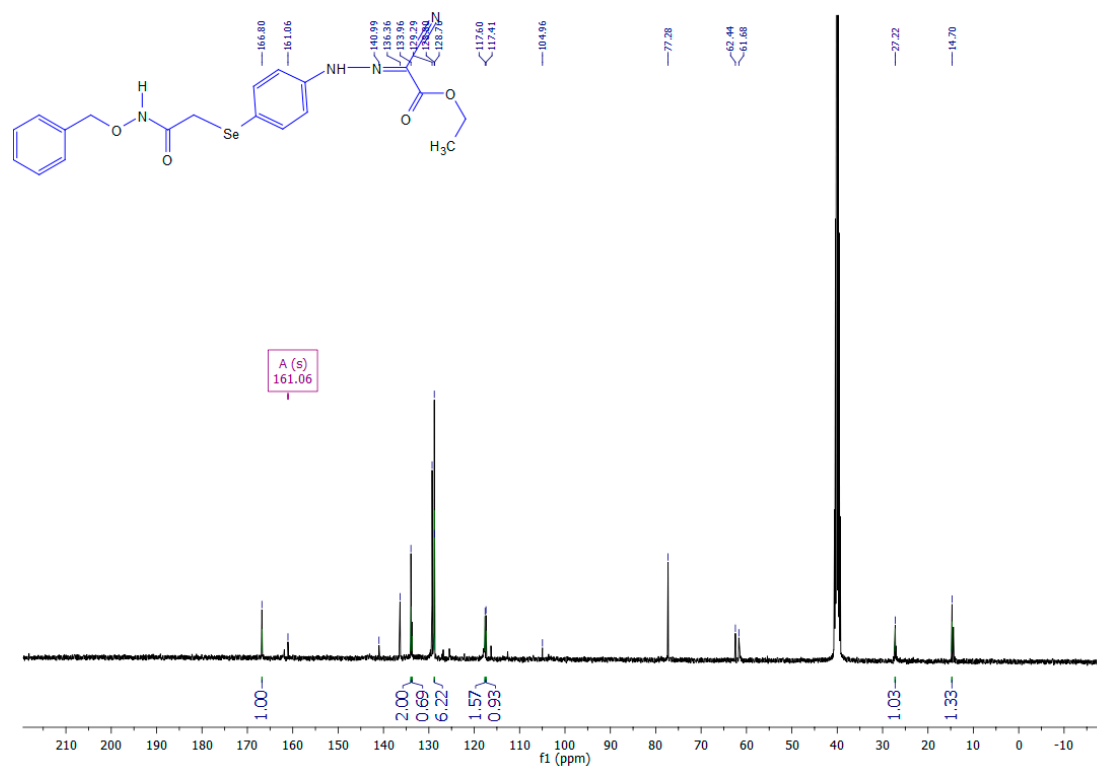
#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
10	59.00	2914	0.34	79	128.05	830	0.10	148	210.10	681	0.08
11	60.00	846	0.10	80	129.05	781	0.09	149	211.00	308	0.04
12	61.05	2677	0.31	81	130.05	1057	0.12	150	212.00	692	0.08
13	62.05	8432	0.99	82	131.25	855	0.10	151	212.90	433	0.05
14	63.05	30193	3.55	83	132.15	4499	0.53	152	213.90	295	0.03
15	64.05	14147	1.66	84	133.15	3408	0.40	153	224.40	366	0.04
16	65.05	69432	8.16	85	134.20	1378	0.16	154	225.40	268	0.03
17	66.05	5685	0.67	86	135.20	559	0.07	155	229.40	263	0.03
18	67.05	3844	0.45	87	136.20	476	0.06	156	239.40	620	0.07
19	68.00	850	0.10	88	137.20	385	0.05	157	240.40	220	0.03
20	69.00	1666	0.20	89	138.10	638	0.07	158	242.40	286	0.03
21	70.10	676	0.08	90	139.15	822	0.10	159	243.10	233	0.03
22	71.10	1313	0.15	91	140.05	1877	0.22	160	244.10	1740	0.20
23	72.00	567	0.07	92	141.10	2433	0.29	161	245.10	1831	0.22
24	73.05	1953	0.23	93	142.05	3545	0.42	162	246.10	4918	0.58
25	74.05	7741	0.91	94	143.05	2860	0.34	163	247.15	1825	0.21
26	75.10	6108	0.72	95	144.05	5590	0.66	164	248.05	10251	1.20
27	76.15	16573	1.95	96	145.00	3033	0.36	165	249.10	1668	0.20
28	77.05	117544	13.81	97	146.10	1969	0.23	166	250.10	4417	0.52
29	78.10	28295	3.32	98	147.10	1087	0.13	167	251.05	826	0.10
30	79.05	29940	3.52	99	148.10	410	0.05	168	252.15	699	0.08
31	80.10	12058	1.42	100	149.10	345	0.04	169	253.20	284	0.03
32	81.05	2067	0.24	101	150.10	300	0.04	170	255.20	297	0.03
33	82.05	503	0.06	102	151.10	356	0.04	171	256.20	447	0.05
34	83.10	1474	0.17	103	152.10	687	0.08	172	257.15	449	0.05
35	84.10	961	0.11	104	153.05	614	0.07	173	258.15	3861	0.45
36	85.10	1204	0.14	105	154.05	1135	0.13	174	259.15	9088	1.07
37	86.15	822	0.10	106	155.10	850	0.10	175	260.15	9463	1.11
38	87.05	1128	0.13	107	156.10	1455	0.17	176	261.15	5402	0.63
39	88.15	1785	0.21	108	157.00	878	0.10	177	262.10	12170	1.43
40	89.10	18943	2.23	109	158.00	1070	0.13	178	263.10	2558	0.30
41	90.15	59327	6.97	110	159.00	340	0.04	179	264.10	5287	0.62
42	91.10	851255	100.00	111	160.00	266	0.03	180	265.20	1114	0.13
43	92.10	72916	8.57	112	161.00	206	0.02	181	266.15	712	0.08
44	93.05	15277	1.79	113	162.00	274	0.03	182	267.20	252	0.03
45	94.05	4637	0.54	114	164.00	314	0.04	183	269.20	226	0.03
46	95.00	2529	0.30	115	165.05	614	0.07	184	272.20	212	0.02
47	96.05	827	0.10	116	166.00	1231	0.14	185	278.20	230	0.03
48	97.10	1162	0.14	117	167.05	1808	0.21	186	280.20	254	0.03
49	98.15	1043	0.12	118	168.05	7175	0.84	187	282.20	303	0.04
50	99.00	652	0.08	119	169.05	8355	0.98	188	283.20	212	0.02
51	100.10	204	0.02	120	170.05	17341	2.04	189	285.20	290	0.03
52	101.10	489	0.06	121	171.15	7406	0.87	190	286.20	407	0.05
53	102.10	1054	0.12	122	172.05	26661	3.13	191	287.00	452	0.05
54	103.15	2371	0.28	123	173.05	4747	0.56	192	288.10	612	0.07
55	104.15	10392	1.22	124	174.05	4511	0.53	193	289.10	527	0.06
56	105.15	38854	4.56	125	175.00	791	0.09	194	290.10	1241	0.15
57	106.15	60369	7.09	126	176.00	233	0.03	195	291.00	527	0.06
58	107.15	31898	3.75	127	178.00	207	0.02	196	292.05	599	0.07
59	108.15	15831	1.86	128	179.00	254	0.03	197	293.10	290	0.03
60	109.15	2705	0.32	129	180.05	754	0.09	198	294.10	327	0.04
61	110.10	751	0.09	130	181.15	1492	0.18	199	295.10	407	0.05
62	111.10	777	0.09	131	182.10	7746	0.91	200	296.10	358	0.04
63	112.15	775	0.09	132	183.10	2647	0.31	201	297.10	460	0.05
64	113.05	1096	0.13	133	184.05	6362	0.75	202	298.10	350	0.04
65	114.10	1684	0.20	134	185.05	2702	0.32	203	299.10	417	0.05
66	115.05	2828	0.33	135	186.05	2279	0.27	204	300.15	751	0.09
67	116.15	2603	0.31	136	186.95	1198	0.14	205	301.05	620	0.07
68	117.05	5078	0.60	137	187.95	307	0.04	206	302.10	2270	0.27
69	118.05	5122	0.60	138	189.00	295	0.03	207	303.10	1636	0.19
70	119.10	2842	0.33	139	194.00	290	0.03	208	304.10	5492	0.65
71	120.10	2775	0.33	140	195.10	271	0.03	209	305.05	1488	0.17
72	121.20	1481	0.17	141	196.10	839	0.10	210	306.10	7274	0.85
73	122.15	780	0.09	142	197.00	417	0.05	211	307.05	1272	0.15
74	123.10	1151	0.14	143	198.00	918	0.11	212	308.10	3009	0.35
75	124.30	729	0.09	144	199.05	516	0.06	213	309.05	553	0.06
76	125.30	647	0.08	145	200.10	906	0.11	214	310.10	318	0.04
77	126.05	519	0.06	146	202.10	218	0.03	215	311.10	228	0.03
78	127.05	590	0.07	147	209.10	314	0.04	216	313.40	556	0.07

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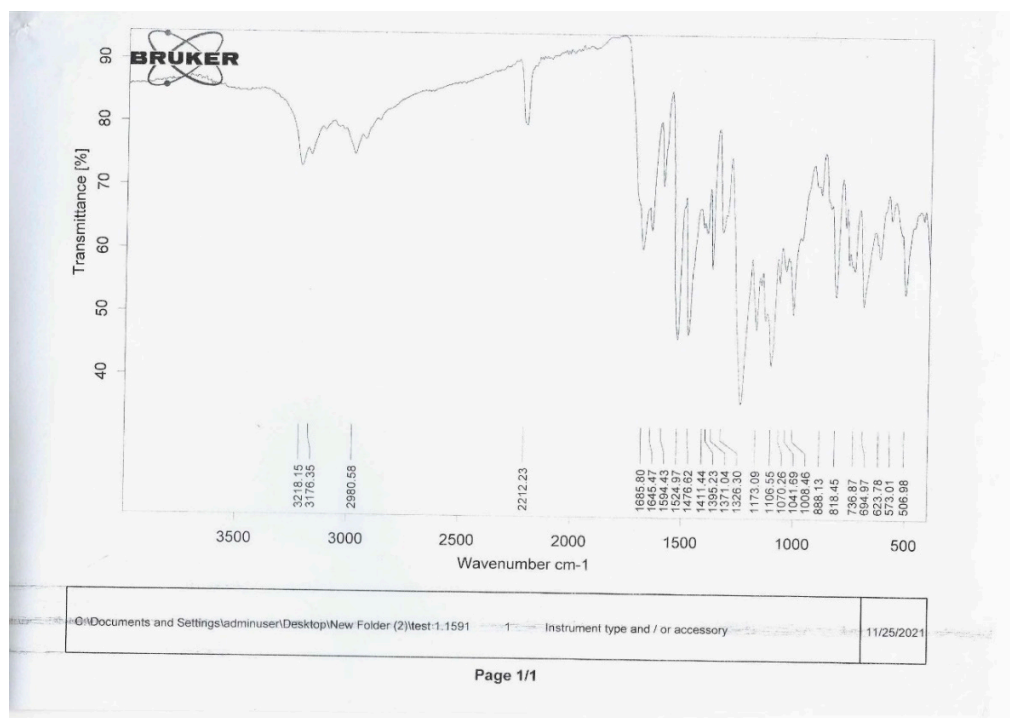
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218	337.25	437	0.05	226	368.30	201	0.02	234	412.20	4748	0.56
219	338.30	482	0.06	227	394.30	204	0.02	235	413.10	1244	0.15
220	339.30	622	0.07	228	396.30	209	0.02	236	414.10	2274	0.27
221	341.30	247	0.03	229	397.30	242	0.03	237	415.10	535	0.06
222	350.30	295	0.03	230	408.15	840	0.10	238	416.20	462	0.05
223	352.30	820	0.10	231	409.10	1046	0.12				
224	353.30	207	0.02	232	410.10	2286	0.27				

*Synthesis of ethyl 2-(2-(4-((2-((benzyloxy)amino)-2-oxoethyl)selenanyl)phenyl)hydrazineylidene)-2-cyanoacetate (**15**)*





$^{13}\text{C}$ NMR chart of compound 15



IR chart of compound 15

# Cairo University Micro Analytical Center

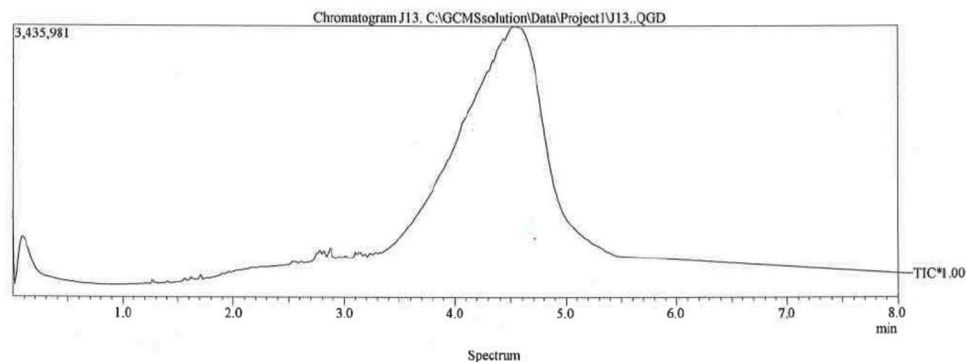
## DI Analysis Shimadzu Qp-2010 Plus

Sample Information  
 Analyzed by : Dr. Mai Younis  
 Analyzed : 09/01/2007 06:01:28  
 Sample Name : J13.  
 Sample ID :  
 Customer Name : Dr. Mohamed Soliman - Science - Cairo  
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 Org Data File : C:\GCMSolution\Data\Project\U13..QGD  
 Method File : C:\GCMSolution\Data\Project\High Temperature Op  
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 Report File :  
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 Modified : 09/01/2007 06:06:59

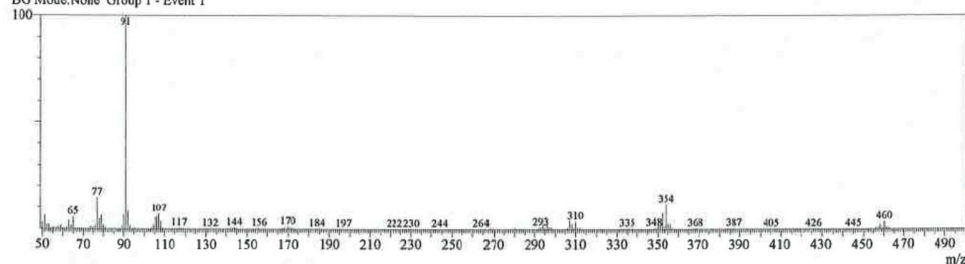
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 End Time : 10.00min  
 ACQ Mode : Scan  
 Event Time : 0.50sec  
 Scan Speed : 1000  
 Start m/z : 50.00  
 End m/z : 510.00

Electron Voltage : 70 eV  
 Ionization Mode : EI

C:\GCMSolution\Data\Project\U13..QGD



Line#:1 R.Time:4.5(Scan#:546)  
 MassPeaks:391  
 RawMode:Single 4.5(546) BasePeak:91(1088295)  
 BG Mode:None Group 1 - Event 1



Mass Table  
 Line#:1 R.Time:4.5(Scan#:546)  
 MassPeaks:391  
 RawMode:Single 4.5(546) BasePeak:91(1088295)  
 BG Mode:None Group 1 - Event 1

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2	51.00	69214	6.36	5	54.00	5132	0.47	8	57.05	7929	0.73
3	52.00	25001	2.30	6	55.05	8060	0.74	9	58.05	11656	1.07

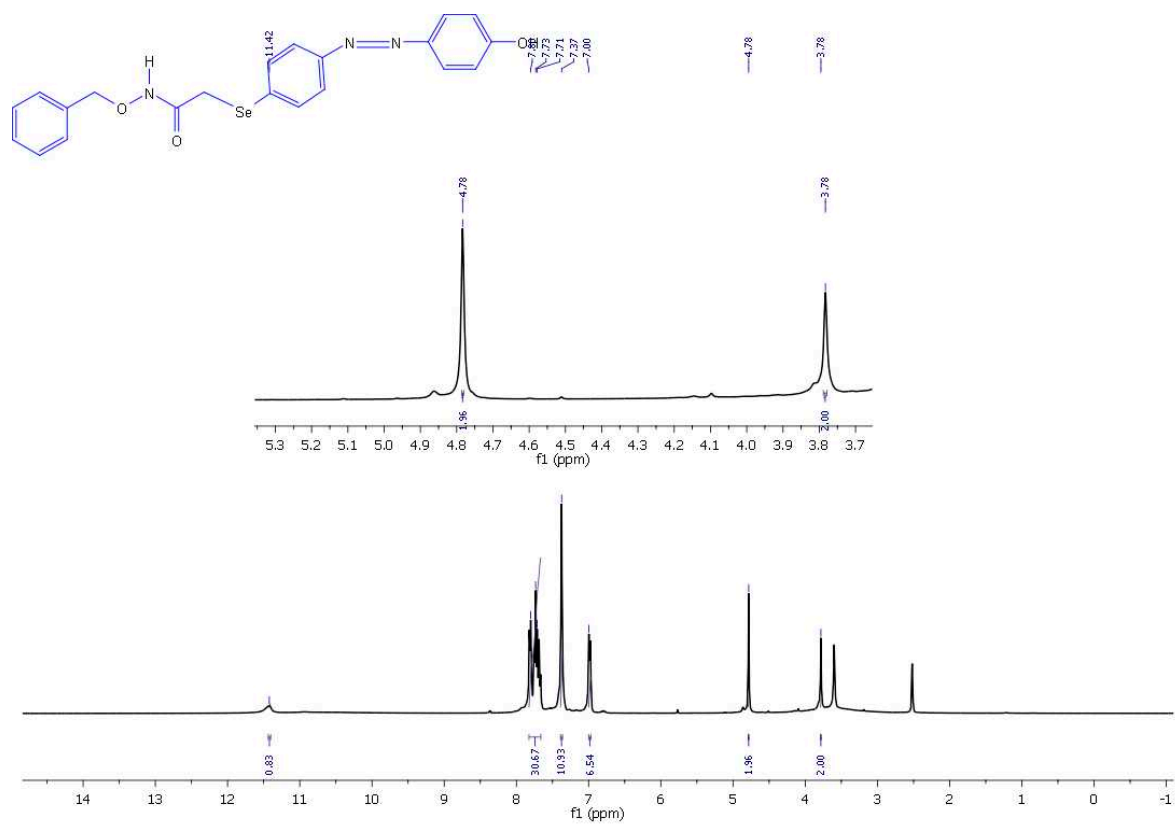


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11	60.00	3244	0.30	80	129.15	1449	0.13	149	203.00	254	0.02
12	61.00	4092	0.38	81	130.10	1578	0.14	150	218.80	241	0.02
13	62.05	10194	0.94	82	131.10	2001	0.18	151	219.80	438	0.04
14	63.05	43298	3.98	83	132.15	2207	0.20	152	222.05	1162	0.11
15	64.05	19782	1.82	84	133.20	1822	0.17	153	222.95	299	0.03
16	65.05	61036	5.61	85	134.20	1015	0.09	154	223.95	510	0.05
17	66.05	5760	0.53	86	135.15	882	0.08	155	225.00	340	0.03
18	67.05	5302	0.49	87	136.10	662	0.06	156	226.05	688	0.06
19	68.05	3181	0.29	88	137.15	839	0.08	157	227.05	670	0.06
20	69.05	5267	0.48	89	138.15	1015	0.09	158	228.05	1247	0.11
21	70.05	2000	0.18	90	139.05	1126	0.10	159	229.20	743	0.07
22	71.10	4175	0.38	91	140.00	2246	0.21	160	230.15	1767	0.16
23	72.05	1210	0.11	92	141.05	2955	0.27	161	231.25	612	0.06
24	73.05	5219	0.48	93	142.00	4098	0.38	162	232.20	641	0.06
25	74.00	12913	1.19	94	143.05	4491	0.41	163	233.20	614	0.06
26	75.05	9770	0.90	95	144.05	7770	0.71	164	234.25	626	0.06
27	76.15	18664	1.71	96	145.10	2374	0.22	165	235.25	319	0.03
28	77.05	159933	14.70	97	146.05	1764	0.16	166	236.25	838	0.08
29	78.05	51062	4.69	98	147.05	1009	0.09	167	237.20	388	0.04
30	79.05	70177	6.45	99	148.00	631	0.06	168	238.20	255	0.02
31	80.05	16860	1.55	100	149.00	385	0.04	169	239.30	546	0.05
32	81.05	9962	0.92	101	150.10	527	0.05	170	240.20	217	0.02
33	82.10	1934	0.18	102	151.05	583	0.05	171	241.20	594	0.05
34	83.10	3868	0.36	103	152.00	1183	0.11	172	242.20	258	0.02
35	84.05	3207	0.29	104	153.05	1318	0.12	173	243.25	319	0.03
36	85.10	3174	0.29	105	154.05	2062	0.19	174	244.20	1462	0.13
37	86.10	1415	0.13	106	155.05	1568	0.14	175	245.30	444	0.04
38	87.05	2226	0.20	107	156.05	4930	0.45	176	246.25	435	0.04
39	88.15	2736	0.25	108	157.00	2012	0.18	177	247.25	962	0.09
40	89.10	19423	1.78	109	158.05	2172	0.20	178	248.25	814	0.07
41	90.15	71749	6.59	110	159.05	1157	0.11	179	249.15	411	0.04
42	91.10	108829	100.00	111	160.00	542	0.05	180	250.15	989	0.09
43	92.10	91846	8.44	112	161.00	388	0.04	181	251.20	548	0.05
44	93.00	16750	1.54	113	162.00	466	0.04	182	252.25	500	0.05
45	94.05	4139	0.38	114	163.00	391	0.04	183	253.10	470	0.04
46	95.05	4899	0.45	115	163.95	512	0.05	184	254.20	462	0.04
47	96.10	1862	0.17	116	165.05	997	0.09	185	255.20	742	0.07
48	97.15	2742	0.25	117	166.00	2961	0.27	186	256.20	620	0.06
49	98.15	2858	0.26	118	167.05	4452	0.41	187	257.20	1009	0.09
50	99.10	1095	0.10	119	168.00	7623	0.70	188	258.20	1337	0.12
51	100.15	662	0.06	120	169.00	5490	0.50	189	259.20	721	0.07
52	101.15	1018	0.09	121	170.00	12964	1.19	190	260.15	755	0.07
53	102.15	2509	0.23	122	171.00	7519	0.69	191	261.15	517	0.05
54	103.15	5193	0.48	123	172.00	6023	0.55	192	262.10	1423	0.13
55	104.15	21665	1.99	124	172.95	1687	0.16	193	263.15	579	0.05
56	105.10	59895	5.50	125	174.00	924	0.08	194	264.10	2279	0.21
57	106.10	62922	5.78	126	175.00	489	0.04	195	265.15	1872	0.17
58	107.15	78472	7.21	127	176.00	415	0.04	196	266.10	4090	0.38
59	108.15	40703	3.74	128	177.00	286	0.03	197	267.10	1380	0.13
60	109.15	4299	0.40	129	178.00	298	0.03	198	268.10	6807	0.63
61	110.10	1364	0.13	130	179.00	385	0.04	199	269.05	1910	0.18
62	111.20	1438	0.13	131	179.95	813	0.07	200	270.10	1612	0.15
63	112.05	1219	0.11	132	181.05	1052	0.10	201	271.10	578	0.05
64	113.05	1459	0.13	133	182.00	1294	0.12	202	272.10	506	0.05
65	114.05	2413	0.22	134	183.00	1018	0.09	203	273.10	322	0.03
66	115.05	4121	0.38	135	184.00	1881	0.17	204	274.10	508	0.05
67	116.05	3428	0.31	136	184.95	1072	0.10	205	275.10	380	0.03
68	117.05	5925	0.54	137	185.95	837	0.08	206	276.10	1478	0.14
69	118.05	4438	0.41	138	187.00	492	0.05	207	277.10	1508	0.14
70	119.10	3518	0.32	139	188.00	319	0.03	208	278.10	3412	0.31
71	120.10	2058	0.19	140	189.00	215	0.02	209	279.10	1281	0.12
72	121.15	1299	0.12	141	193.00	297	0.03	210	280.10	6390	0.59
73	122.15	1090	0.10	142	193.90	562	0.05	211	281.05	1544	0.14
74	123.20	1366	0.13	143	194.90	591	0.05	212	282.10	2294	0.21
75	124.20	670	0.06	144	195.85	654	0.06	213	283.00	895	0.08
76	125.15	505	0.05	145	197.00	806	0.07	214	284.05	525	0.05
77	126.15	589	0.05	146	197.80	682	0.06	215	285.10	468	0.04
78	127.15	900	0.08	147	198.90	470	0.04	216	286.10	326	0.03

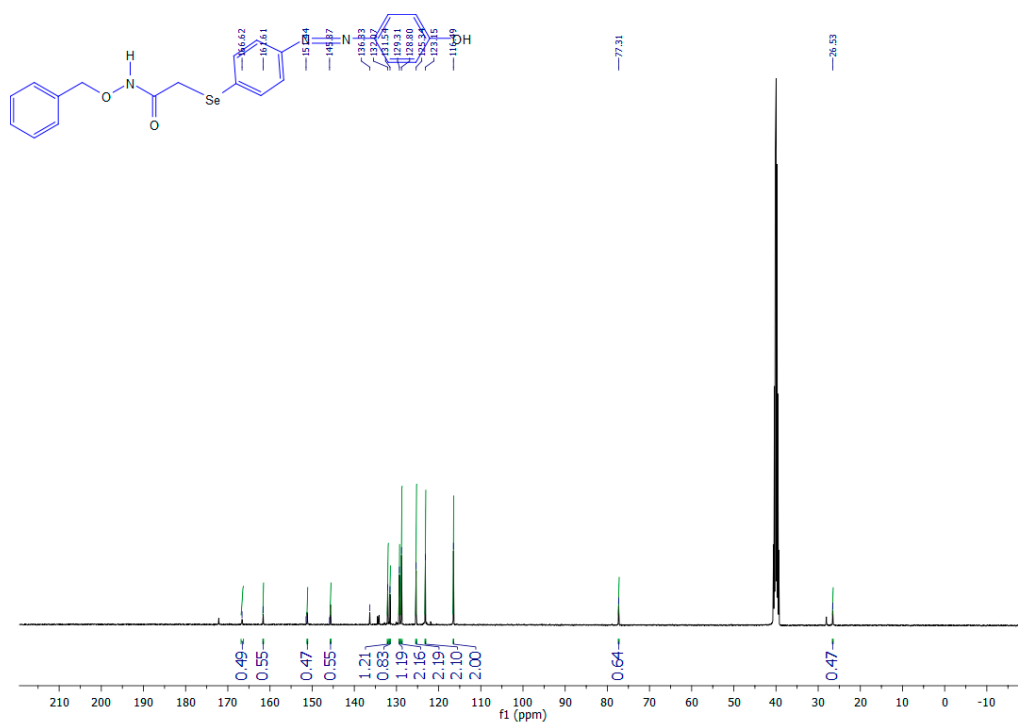
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218	288.10	388	0.04	277	348.15	6118	0.56	336	407.15	636	0.06
219	289.10	449	0.04	278	349.15	4932	0.45	337	408.15	1313	0.12
220	290.10	1342	0.12	279	350.15	33749	3.10	338	409.15	1261	0.12
221	291.15	720	0.07	280	351.15	26545	2.44	339	410.10	1718	0.16
222	292.10	9666	0.89	281	352.15	81401	7.48	340	411.15	1078	0.10
223	293.10	9772	0.90	282	353.25	18543	1.70	341	412.10	1542	0.14
224	294.10	25895	2.38	283	354.15	126433	11.62	342	413.20	1065	0.10
225	295.10	6433	0.59	284	355.10	25895	2.38	343	414.05	713	0.07
226	296.10	51970	4.78	285	356.15	25958	2.39	344	415.10	1226	0.11
227	297.05	10872	1.00	286	357.05	4841	0.44	345	416.10	516	0.05
228	298.10	10124	0.93	287	358.20	778	0.07	346	417.05	555	0.05
229	299.05	2325	0.21	288	359.40	463	0.04	347	418.10	388	0.04
230	300.05	482	0.04	289	360.40	434	0.04	348	419.10	386	0.04
231	301.00	255	0.02	290	361.25	390	0.04	349	420.10	298	0.03
232	302.00	404	0.04	291	362.15	527	0.05	350	421.05	338	0.03
233	302.95	478	0.04	292	363.40	454	0.04	351	422.00	438	0.04
234	304.25	1031	0.09	293	364.40	441	0.04	352	423.05	696	0.06
235	305.35	1173	0.11	294	365.35	958	0.09	353	424.00	836	0.08
236	306.25	8371	0.77	295	366.35	867	0.08	354	425.05	594	0.05
237	307.25	45850	4.21	296	367.40	1481	0.14	355	426.05	1043	0.10
238	308.25	27017	2.48	297	368.40	3076	0.28	356	427.05	578	0.05
239	309.15	7888	0.72	298	369.35	1845	0.17	357	428.00	674	0.06
240	310.10	39802	3.66	299	370.30	999	0.09	358	429.00	345	0.03
241	311.05	8289	0.76	300	371.20	794	0.07	359	430.10	598	0.05
242	312.10	8414	0.77	301	372.25	796	0.07	360	431.05	401	0.04
243	313.20	2913	0.27	302	373.25	649	0.06	361	432.00	599	0.06
244	314.15	773	0.07	303	374.20	500	0.05	362	432.95	390	0.04
245	315.15	373	0.03	304	375.25	533	0.05	363	434.10	383	0.04
246	315.90	276	0.03	305	376.20	764	0.07	364	435.10	258	0.02
247	316.85	386	0.04	306	377.20	614	0.06	365	436.75	321	0.03
248	317.90	399	0.04	307	378.20	868	0.08	366	437.70	484	0.04
249	319.05	578	0.05	308	379.25	1023	0.09	367	438.90	462	0.04
250	320.10	583	0.05	309	380.15	1408	0.13	368	439.80	366	0.03
251	321.10	777	0.07	310	381.20	1009	0.09	369	441.05	496	0.05
252	322.05	1112	0.10	311	382.25	1402	0.13	370	442.05	514	0.05
253	323.10	974	0.09	312	383.25	2090	0.19	371	443.05	902	0.08
254	324.10	1318	0.12	313	384.20	1946	0.18	372	444.05	407	0.04
255	325.15	1202	0.11	314	385.20	3260	0.30	373	445.20	1599	0.15
256	326.10	1844	0.17	315	386.20	2054	0.19	374	446.15	507	0.05
257	327.40	951	0.09	316	387.20	4902	0.45	375	447.70	430	0.04
258	328.35	480	0.04	317	388.20	2028	0.19	376	448.70	351	0.03
259	329.10	278	0.03	318	389.20	1498	0.14	377	449.70	510	0.05
260	330.05	339	0.03	319	390.25	876	0.08	378	450.50	255	0.02
261	331.15	781	0.07	320	391.20	641	0.06	379	451.50	777	0.07
262	332.15	990	0.09	321	392.20	452	0.04	380	452.70	409	0.04
263	333.15	2090	0.19	322	393.25	822	0.08	381	454.20	974	0.09
264	334.10	2071	0.19	323	394.15	865	0.08	382	455.25	365	0.03
265	335.15	3842	0.35	324	395.25	680	0.06	383	456.25	7785	0.72
266	336.15	3157	0.29	325	396.20	770	0.07	384	457.25	8651	0.79
267	337.10	4551	0.42	326	397.15	473	0.04	385	458.20	20503	1.88
268	338.10	1945	0.18	327	398.10	385	0.04	386	459.25	5902	0.54
269	339.25	1566	0.14	328	399.10	409	0.04	387	460.20	38226	3.51
270	340.45	782	0.07	329	400.10	380	0.03	388	461.25	10119	0.93
271	341.40	818	0.08	330	401.10	404	0.04	389	462.20	7446	0.68
272	342.35	561	0.05	331	402.10	418	0.04	390	463.25	1843	0.17
273	343.40	295	0.03	332	403.10	460	0.04	391	464.20	201	0.02
274	345.25	462	0.04	333	404.20	678	0.06				
275	346.20	660	0.06	334	405.20	1041	0.10				

Synthesis of *N*-(benzyloxy)-2-((4-((4-hydroxyphenyl)diazenyl)phenyl)selanyl)acetamide

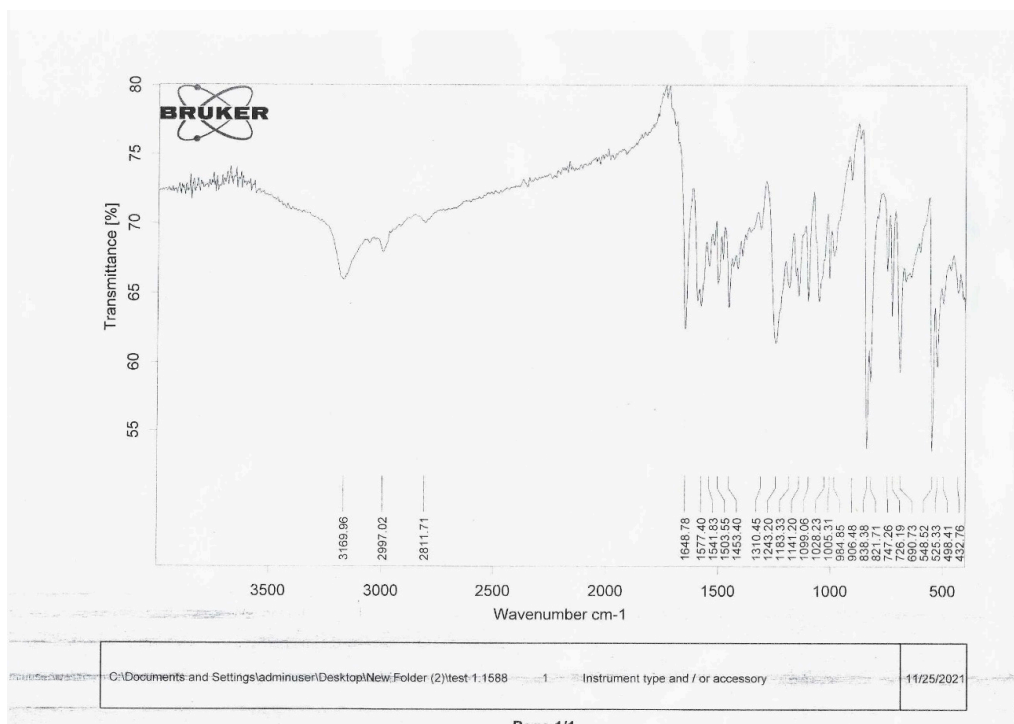
(16)



<sup>1</sup>H NMR chart of compound 16



<sup>13</sup>CNMR chart of compound 16



IR chart of compound 16

# **Cairo University Micro Analytical Center**

## **DI Analysis Shimadzu Qp-2010 Plus**

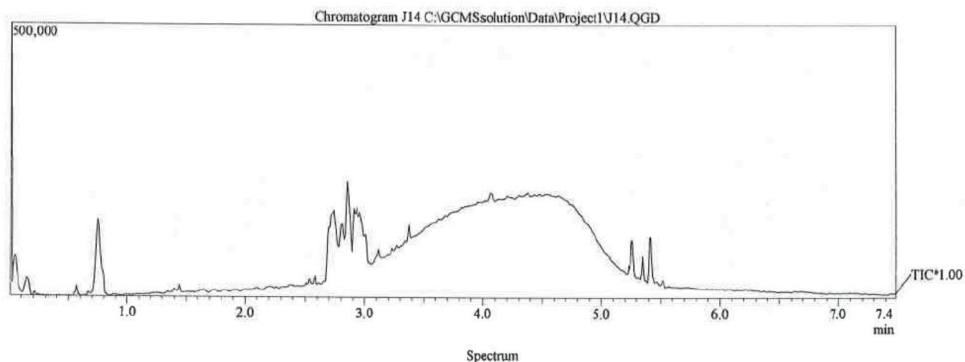
Sample Information  
 Analyzed by : Dr. Mai Younis  
 Analyzed : 03/01/2007 06:29:34  
 Sample Name : J14  
 Sample ID :  
 Customer Name : Dr. Mohamed Soliman - Science - Cairo  
 Data File : C:\GCMSolution\Data\Project\U14.QGD  
 Org Data File : C:\GCMSolution\Data\Project\U14.QGD  
 Method File : C:\GCMSolution\Data\Project\High Temperature Op  
 Org Method File : C:\GCMSolution\Data\Project\High Temperature Op  
 Report File :  
 Tuning File : C:\GCMSolution\System\Tune1\\_default.qgt  
 \$EndIf\$Modified by : Dr. Mai Younis  
 Modified : 03/01/2007 06:37:07

### Method

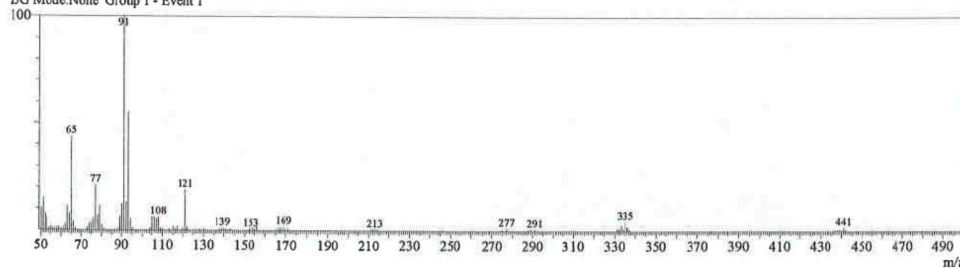
Analytical Line 1  
 IonSourceTemp :250.00 °C  
 [MS Table]  
 --Group 1 - Event 1--  
 Start Time :0.00min  
 End Time :10.00min  
 ACQ Mode :Scan  
 Event Time :0.50sec  
 Scan Speed :1000  
 Start m/z :50.00  
 End m/z :510.00

Electron Voltage :70 eV  
 Ionization Mode :EI

C:\GCMSolution\Data\Project\U14.QGD



Line#:1 R.Time:4.7(Scan#:560)  
 MassPeaks:91  
 RawMode:Single 4.7(560) BasePeak:91(39273)  
 BG Mode:None Group 1 - Event 1



### Mass Table

Line#:1 R.Time:4.7(Scan#:560)

MassPeaks:91

RawMode:Single 4.7(560) BasePeak:91(39273)

BG Mode:None Group 1 - Event 1

#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
1	50.05	4010	10.21	4	53.05	2166	5.52	7	56.00	471	1.20
2	51.05	5861	14.92	5	54.00	393	1.00	8	57.00	305	0.78
3	52.05	2891	7.36	6	55.05	671	1.71	9	58.10	580	1.48

#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.	#	m/z	Abs. In	Rel. Int.
10	59.05	675	1.72	38	106.10	2369	6.03	66	168.05	462	1.18
11	60.10	278	0.71	39	107.10	2078	5.29	67	168.95	749	1.91
12	61.10	543	1.38	40	108.10	2433	6.20	68	170.00	300	0.76
13	62.10	1214	3.09	41	109.10	417	1.06	69	171.00	337	0.86
14	63.05	4420	11.25	42	110.10	362	0.92	70	211.00	234	0.60
15	64.15	2981	7.59	43	113.10	202	0.51	71	212.00	209	0.53
16	65.05	17265	43.96	44	115.05	745	1.90	72	213.00	244	0.62
17	66.05	1585	4.04	45	116.00	204	0.52	73	214.00	233	0.59
18	67.00	335	0.85	46	117.05	776	1.98	74	275.00	210	0.53
19	73.15	441	1.12	47	119.30	326	0.83	75	277.20	522	1.33
20	74.10	1262	3.21	48	120.15	461	1.17	76	288.20	215	0.55
21	75.10	1551	3.95	49	121.15	7432	18.92	77	289.20	278	0.71
22	76.15	2187	5.57	50	122.15	632	1.61	78	291.20	361	0.92
23	77.10	8223	20.94	51	128.10	284	0.72	79	331.15	461	1.17
24	78.15	2585	6.58	52	130.10	399	1.02	80	332.15	458	1.17
25	79.10	4329	11.02	53	138.10	308	0.78	81	333.15	1072	2.73
26	80.10	905	2.30	54	139.25	474	1.21	82	334.10	462	1.18
27	81.10	314	0.80	55	140.20	262	0.67	83	335.20	1775	4.52
28	88.15	284	0.72	56	141.20	305	0.78	84	336.15	756	1.92
29	89.15	2445	6.23	57	143.20	202	0.51	85	337.10	422	1.07
30	90.15	4810	12.25	58	152.20	311	0.79	86	437.10	218	0.56
31	91.10	39273	100.00	59	153.05	326	0.83	87	438.10	258	0.66
32	92.15	5294	13.48	60	154.10	561	1.43	88	439.10	297	0.76
33	93.10	21678	55.20	61	155.00	262	0.67	89	440.10	214	0.54
34	94.10	2052	5.22	62	156.05	994	2.53	90	441.20	713	1.82
35	95.10	414	1.05	63	165.00	249	0.63	91	442.20	238	0.61
36	104.15	434	1.11	64	166.00	322	0.82				
37	105.10	2386	6.08	65	167.05	568	1.45				

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