Synthesis of Notoamide J: A Potentially Pivotal Intermediate in the Biosynthesis of Several Prenylated Indole Alkaloids from Fungi.

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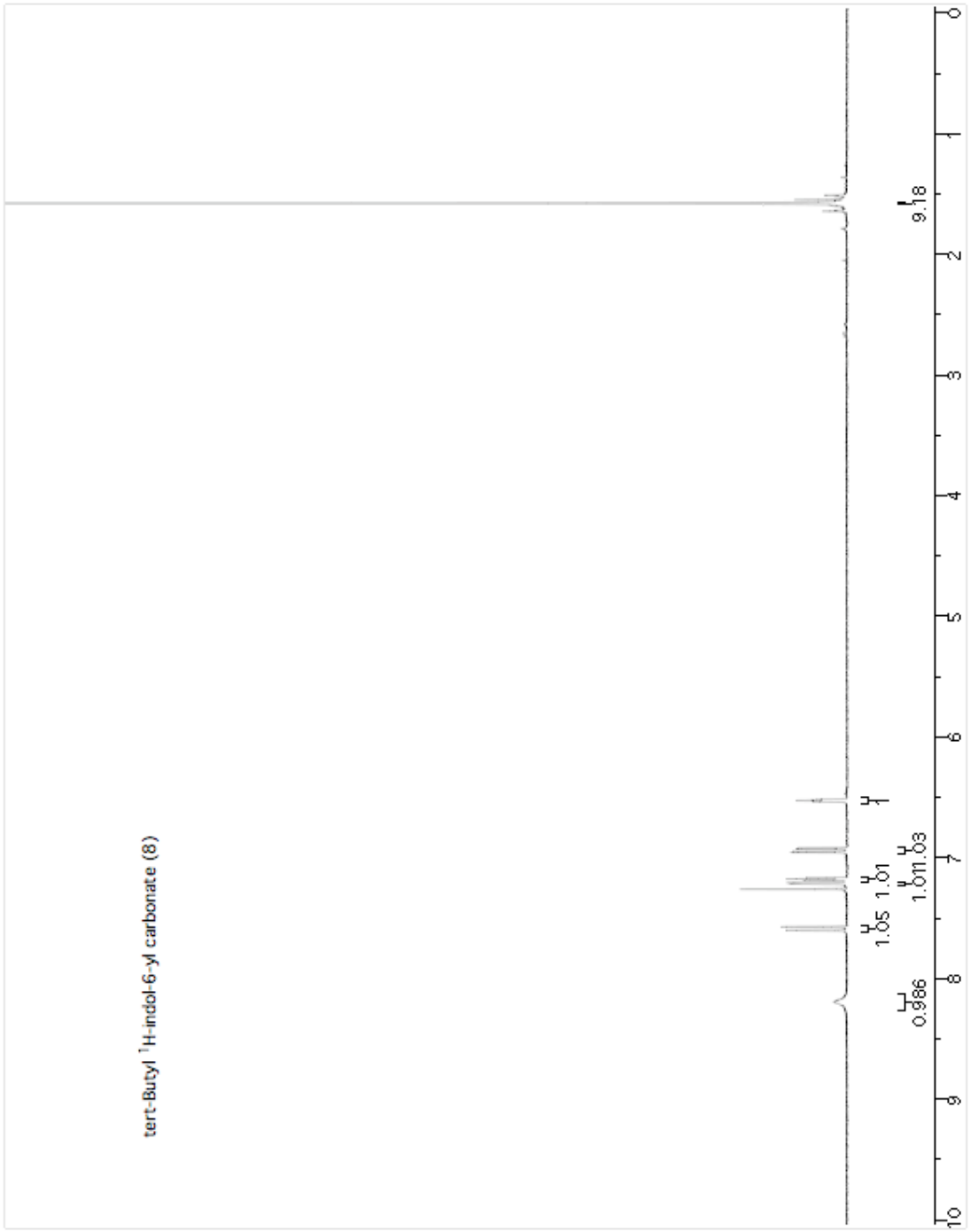
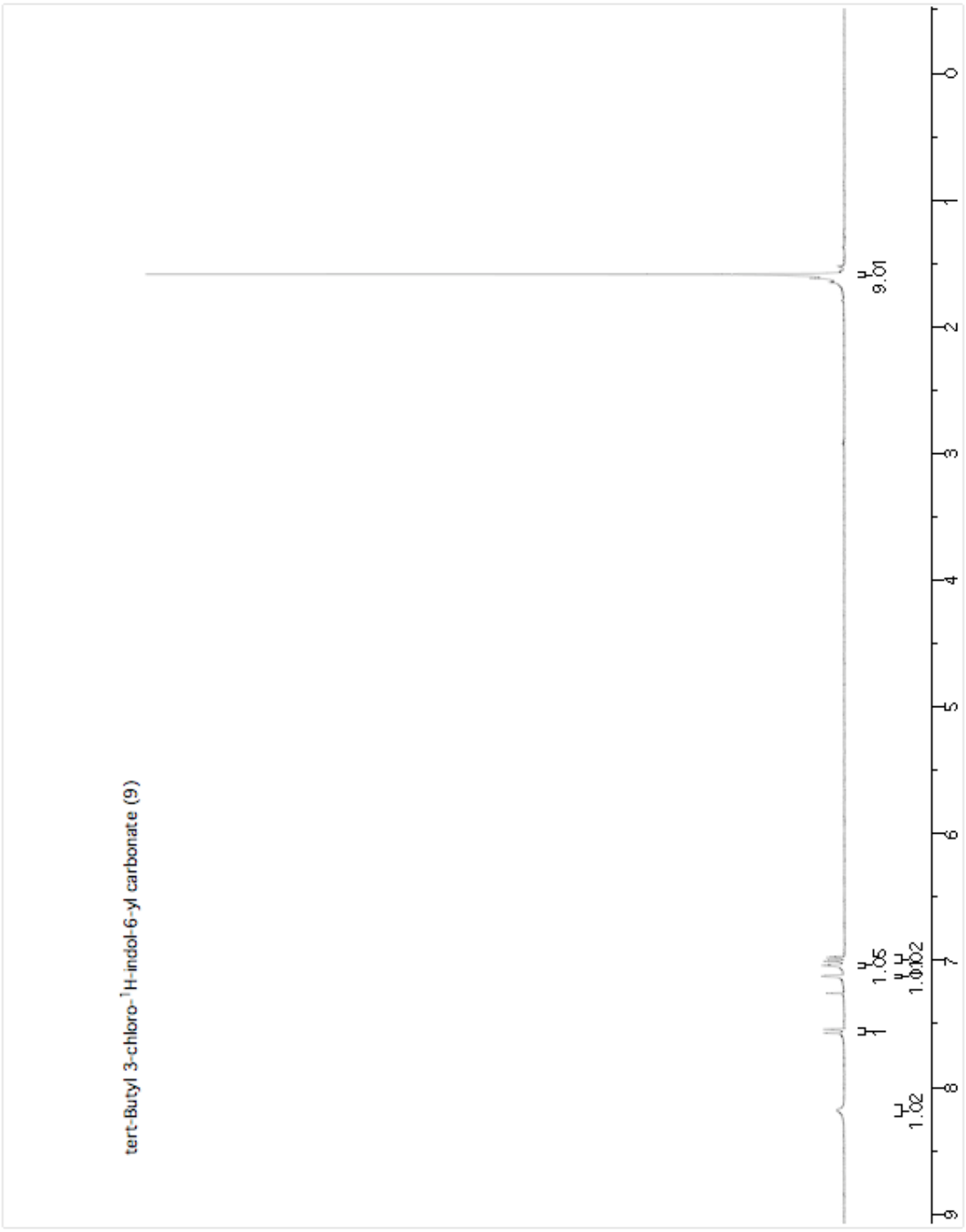
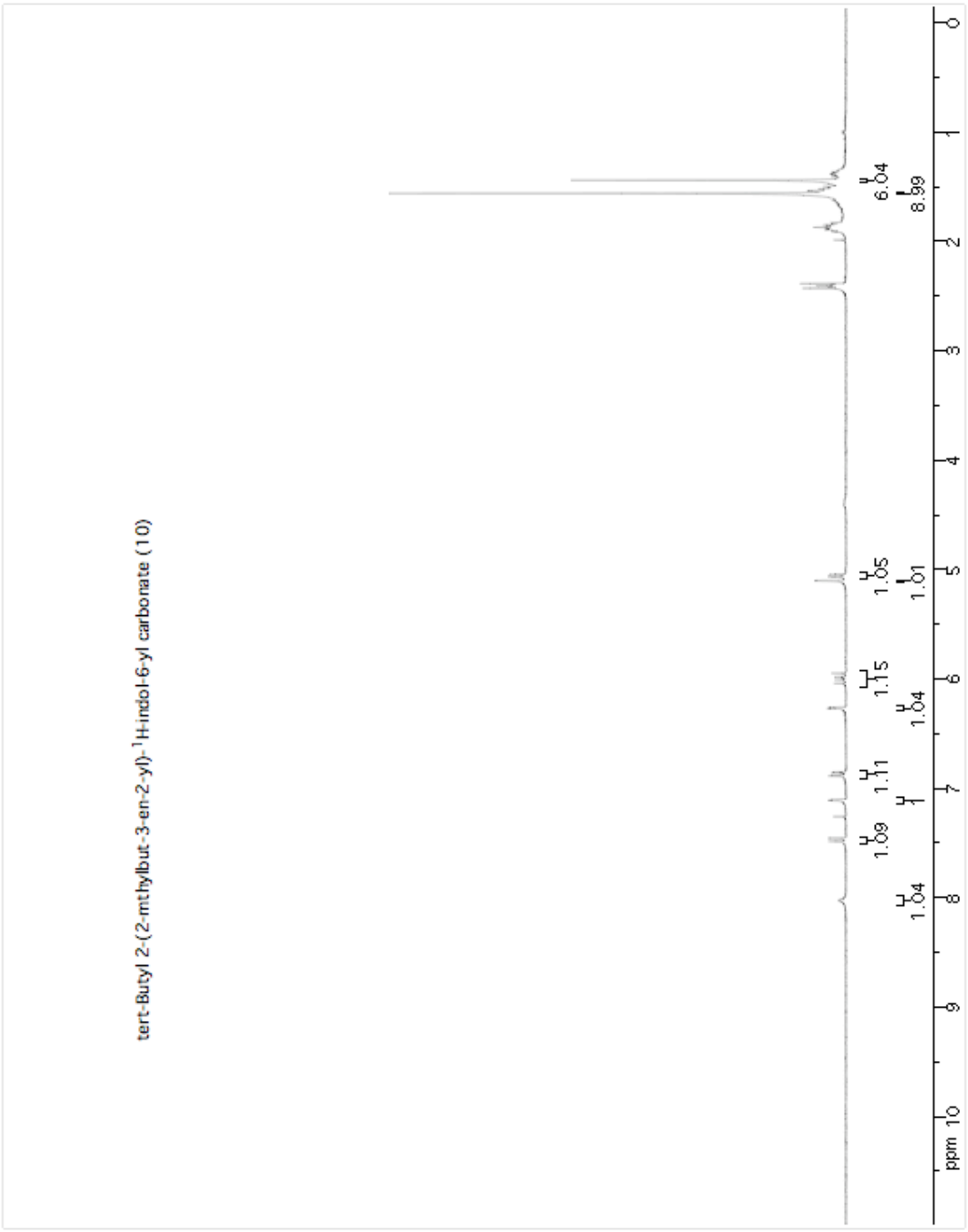
SUPPORTING INFORMATION

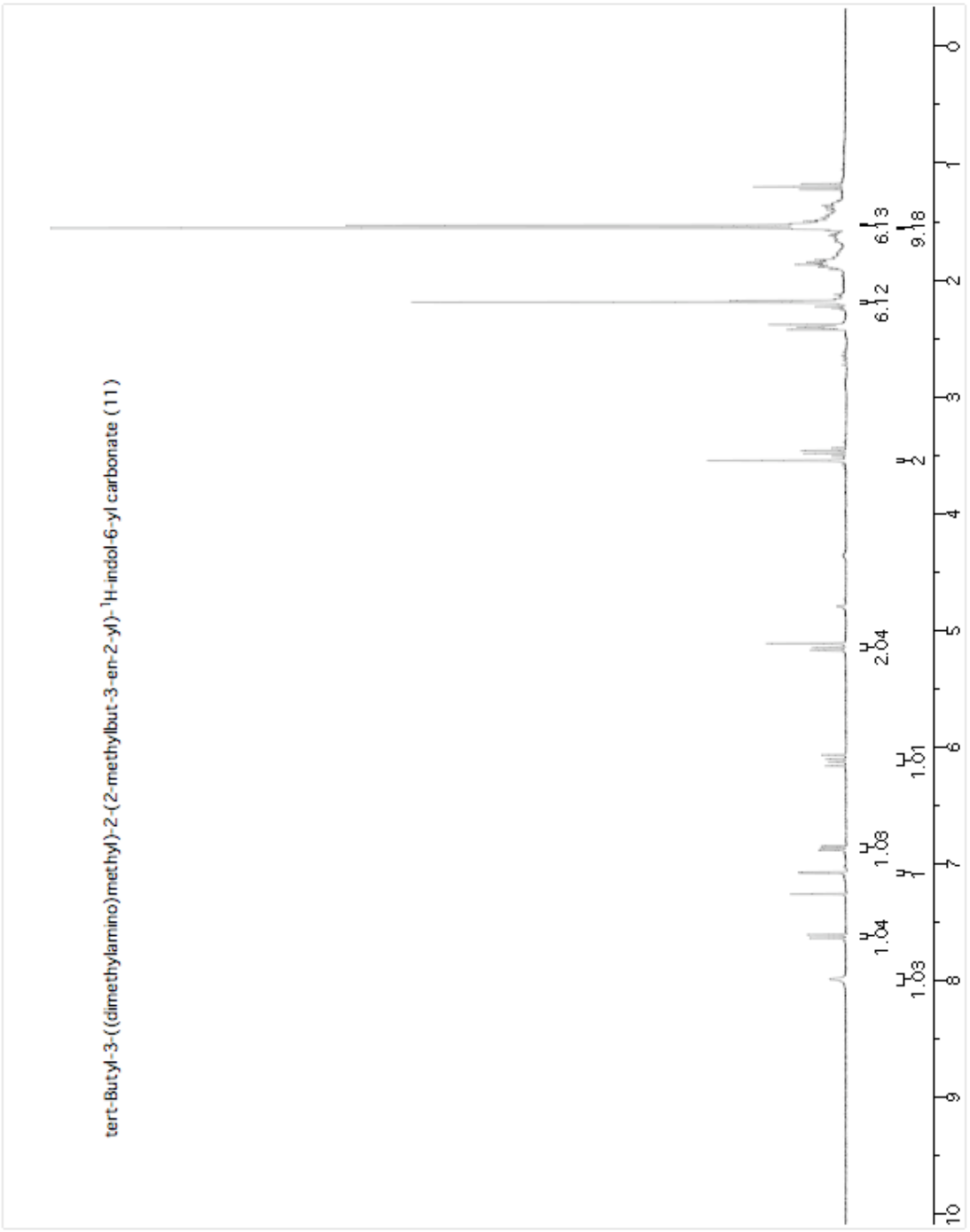
General Methods

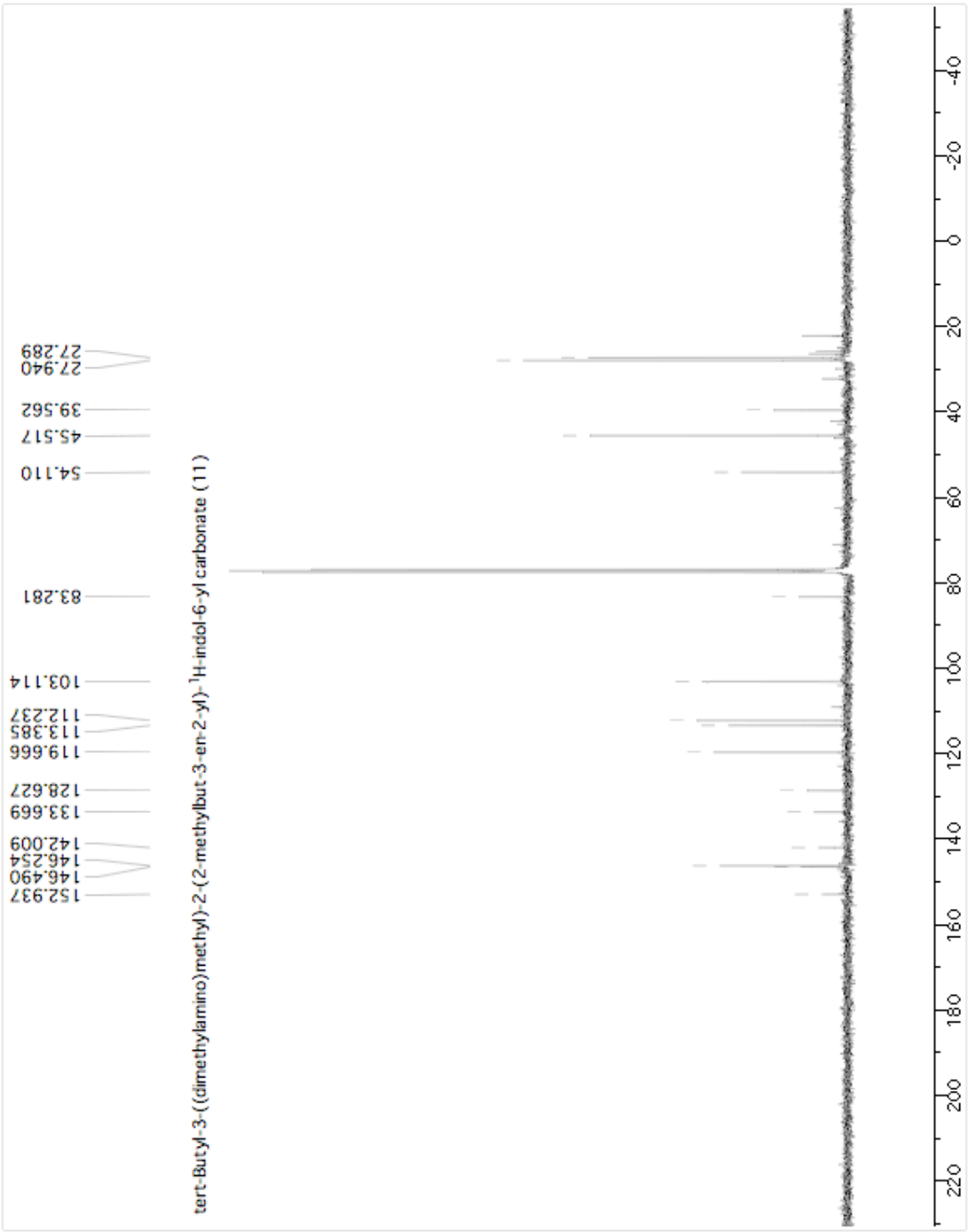
^{1}H and ^{13}C spectra were obtained using 300 MHz or 400 MHz spectrometers. The chemical shifts are given in parts per million (ppm) relative to TMS at δ 0.00 ppm or to residual $CDCl_3$ δ 7.26 ppm for proton spectra and relative to $CDCl_3$ at δ 77.23 ppm for carbon spectra. IR spectra were recorded on an FT-IR spectrometer as thin films. Mass spectra were obtained using a high/low resolution magnetic sector mass spectrometer. Flash column chromatography was performed with silica gel grade 60 (230-400 mesh). Unless otherwise noted materials were obtained from commercially available sources and used without further purification. Dichloromethane (CH_2Cl_2), tetrahydrofuran (THF), toluene (PhMe), *N*, *N*-dimethylformamide (DMF), acetonitrile (CH_3CN), triethylamine (Et_3N), and methanol (MeOH) were all degassed with argon and passed through a solvent purification system containing alumina or molecular sieves.

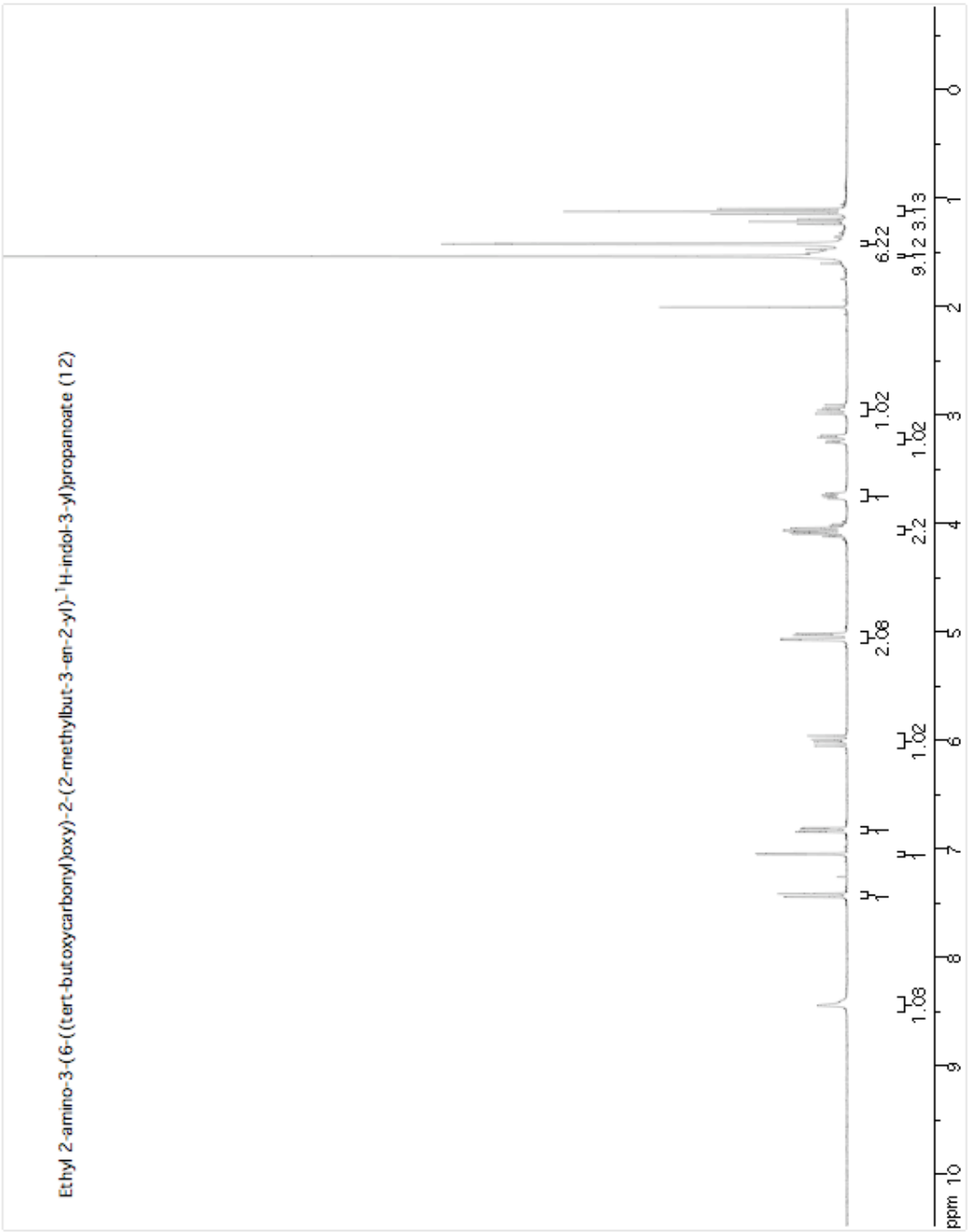

tert-Butyl 1H-indol-6-yl carbonate (8)
0.986
1.05
1.01
1.011.03
9.18
10
9
8
7
6
5
4
3
2
1
0

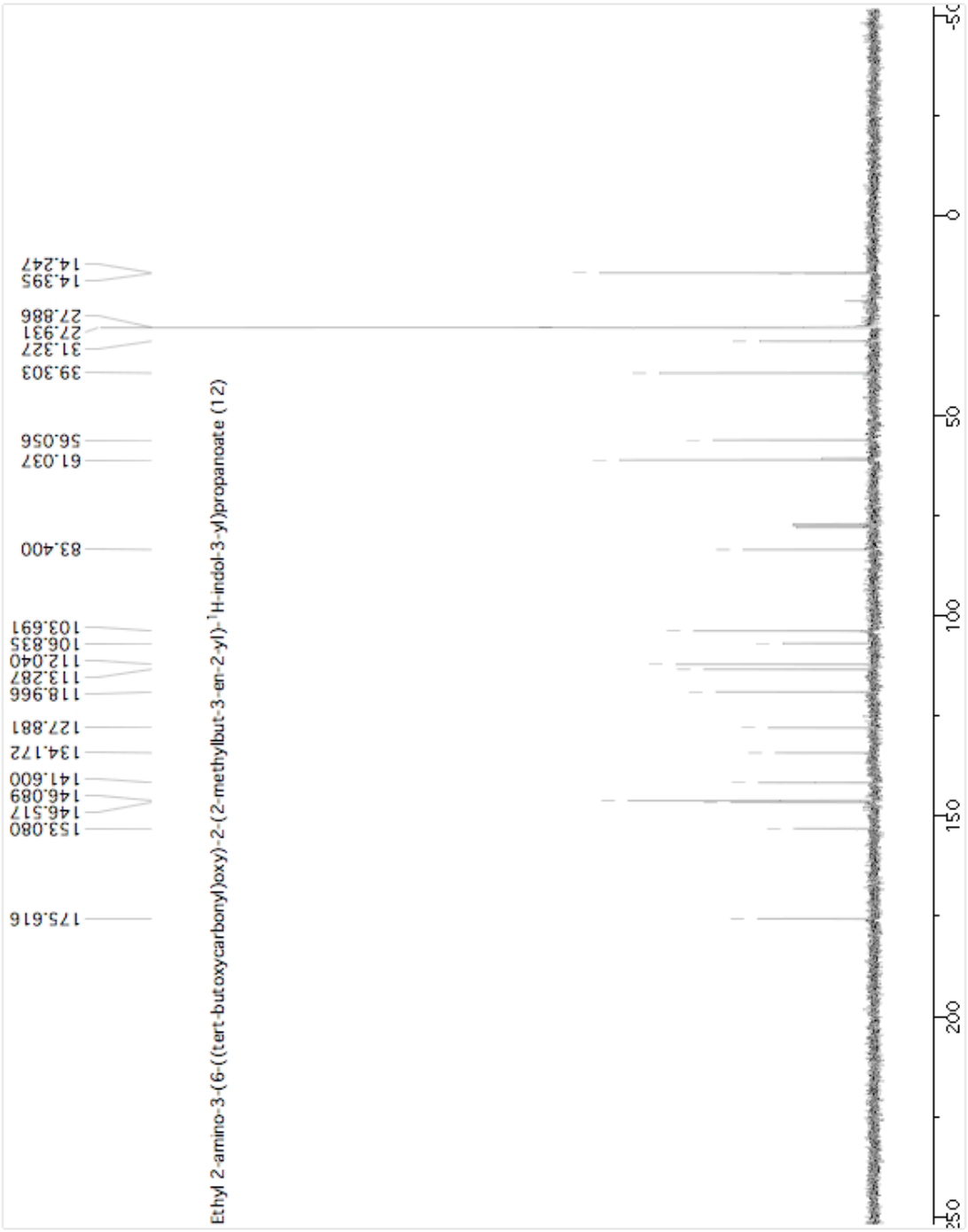

tert-Butyl 3-chloro-1H-indol-6-yl carbonate (9)
9.01
1.05
1.02
9
8
7
6
5
4
3
2
1
0

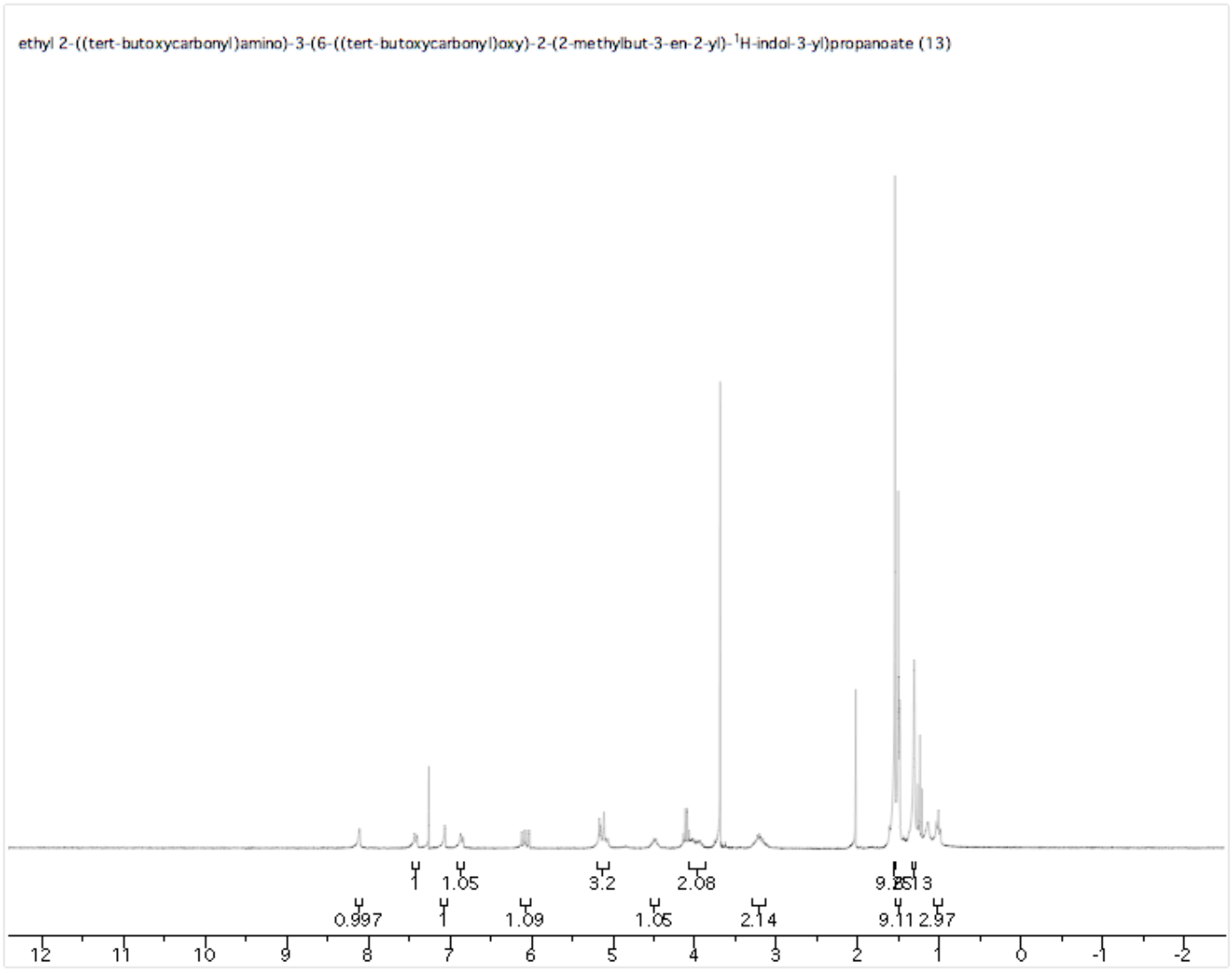

tert-Butyl 2-(2-methylbut-3-en-2-yl)-1H-indol-6-yl carbonate (10)
ppm 10
9
8
7
6
5
4
3
2
1
0
1.04
1.09
1
1.11
1.15
1.04
1.05
1.01
6.04
8.99

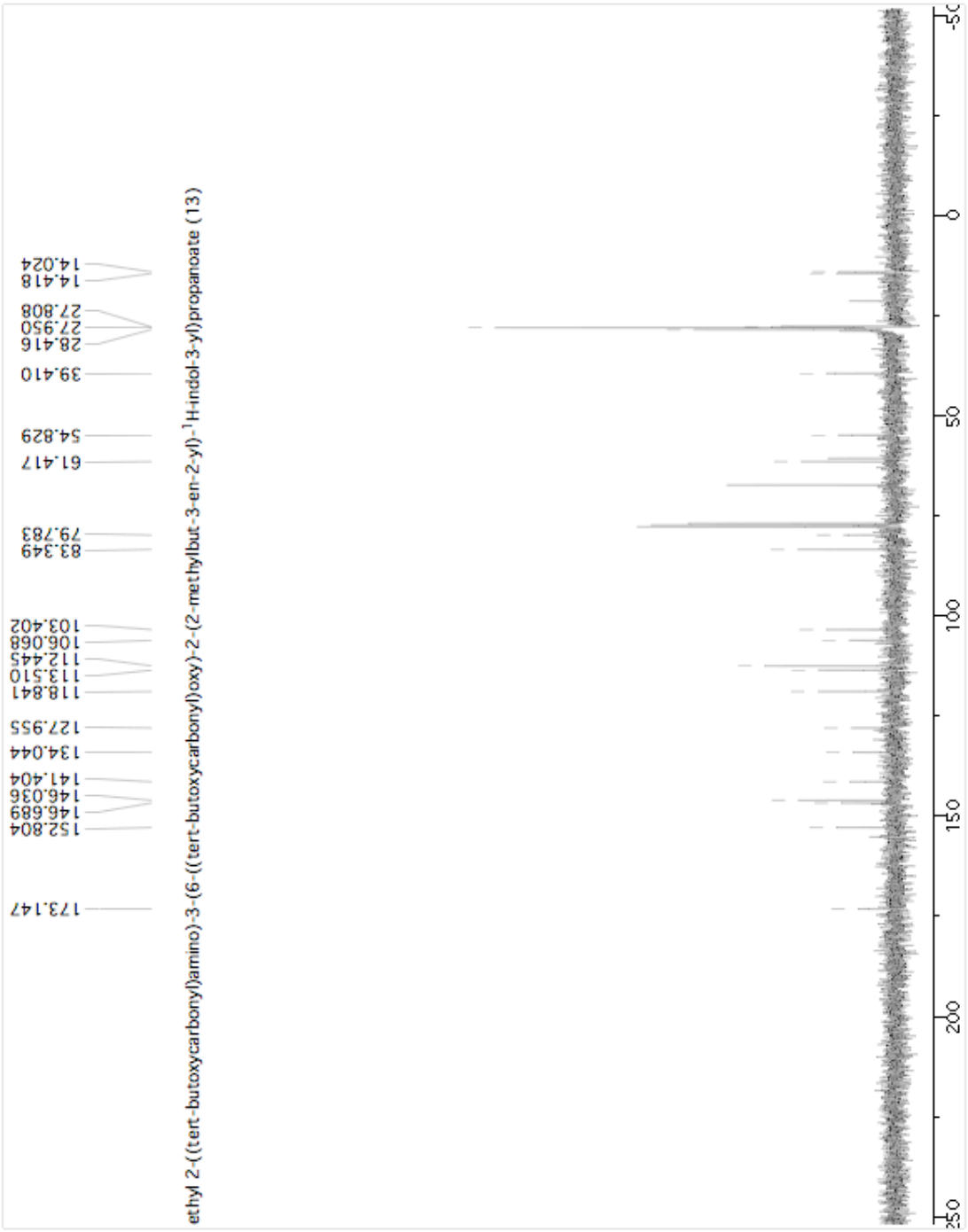

tert-Butyl-3-((dimethylamino)methyl)-2-(2-methylbut-3-en-2-yl)-1H-indol-6-yl carbonate (11)
1.03
1.04
1.03
1.01
2.04
6.12
6.13
9.18

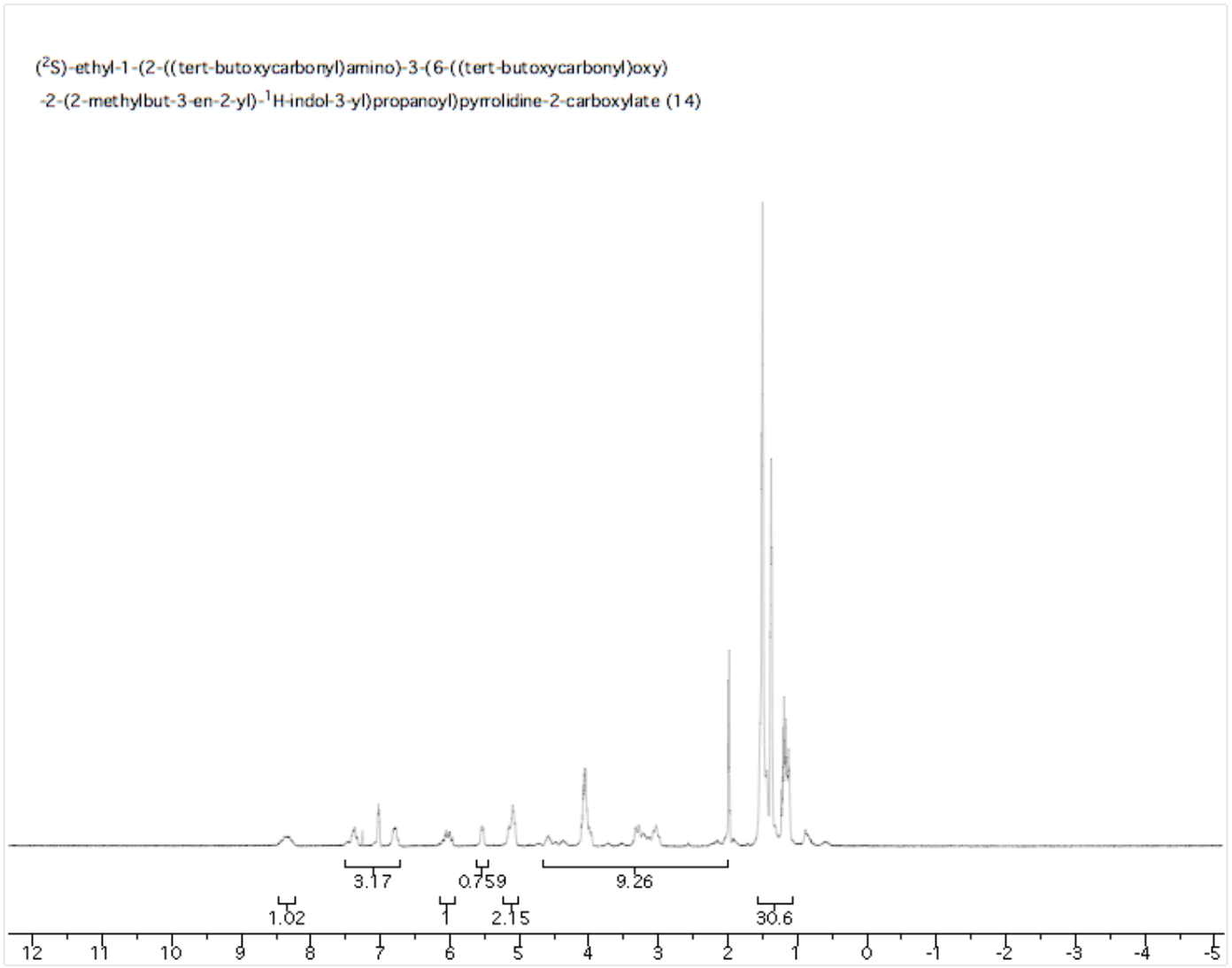

tert-Butyl-3-((dimethylamino)methyl)-2-(2-methylbut-3-en-2-yl)-1H-indol-6-yl carbonate (11)
27.289
27.940
39.562
45.517
54.110
83.281
103.114
112.237
113.385
119.666
128.627
133.669
142.009
146.254
146.490
152.937
220
200
180
160
140
120
100
80
60
40
20
0
-20
-40

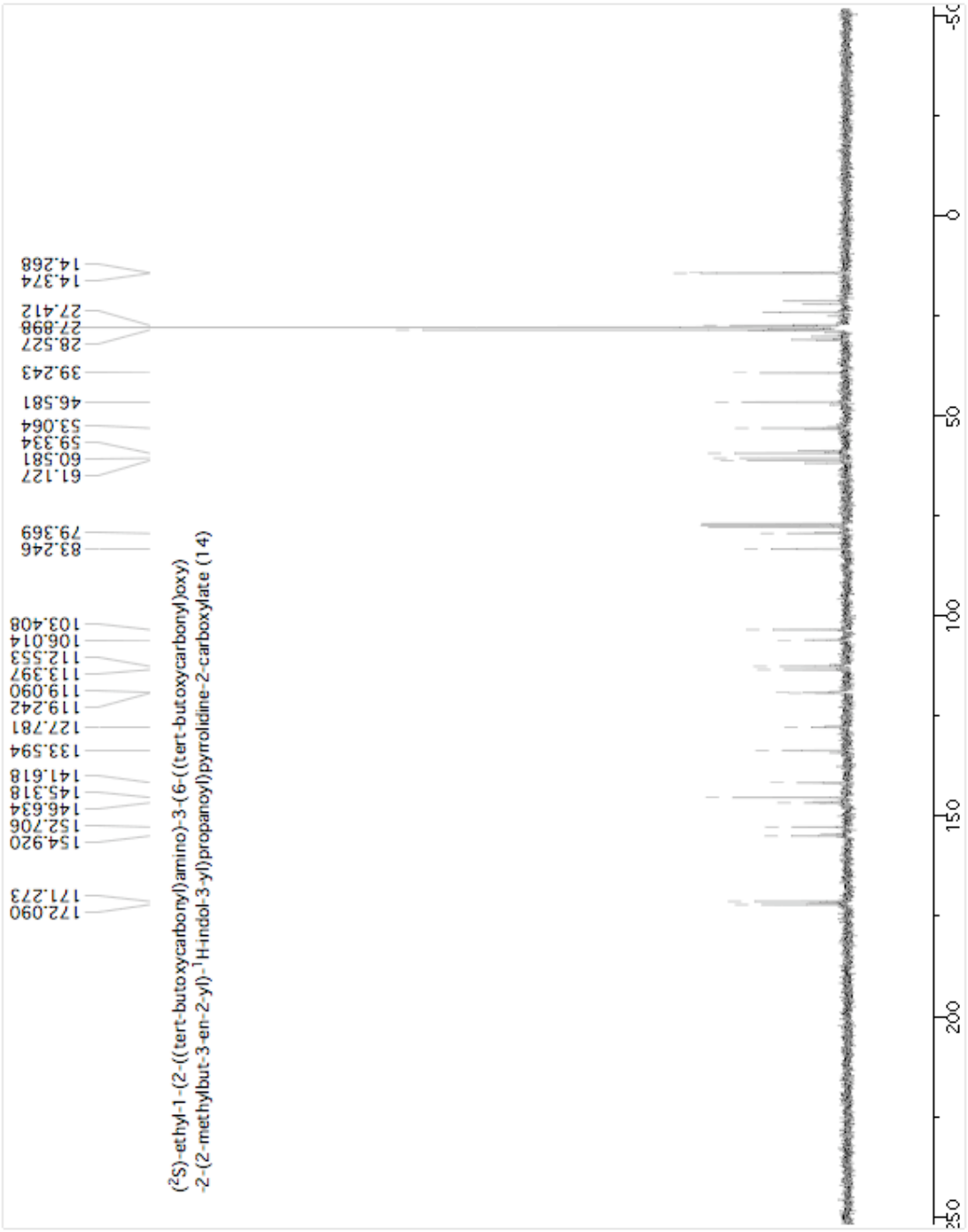

Ethyl 2-amino-3-(6-((tert-butoxycarbonyl)oxy)-2-(2-methylbut-3-en-2-yl)-1H-indol-3-yl)propanoate (12)
1.08
1
1
1.02
2.08
2.2
1
1.02
1.02
6.22
9.12 3.13
ppm

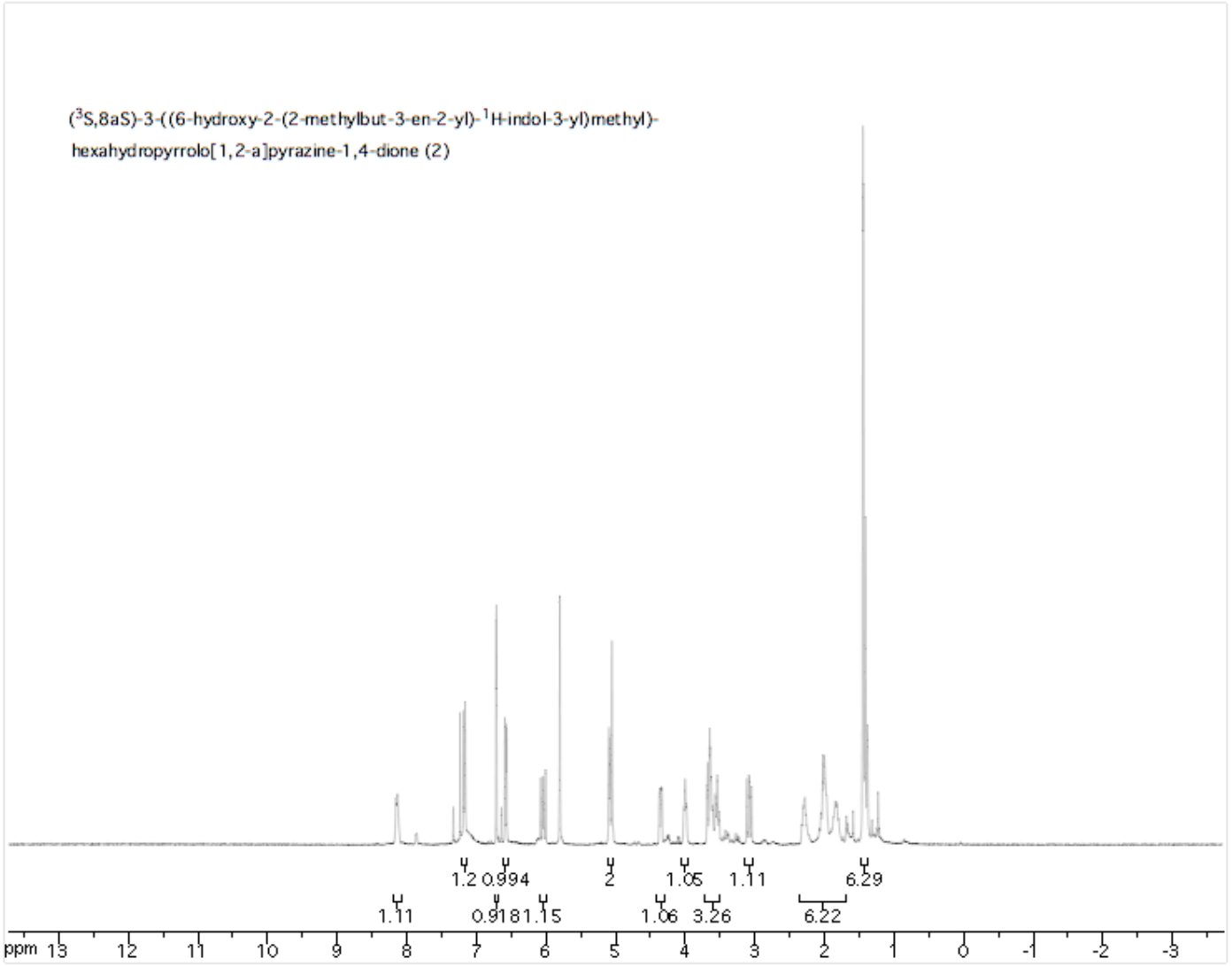

Ethyl 2-amino-3-(6-((tert-butoxycarbonyl)oxy)-2-(2-methylbut-3-en-2-yl)-1H-indol-3-yl)propanoate (12)
175.616
153.080
146.517
146.089
141.600
134.172
127.881
118.966
113.287
112.040
106.835
103.691
83.400
61.037
56.056
39.303
31.327
27.931
27.886
14.395
14.247
250
200
150
100
50
0
-50

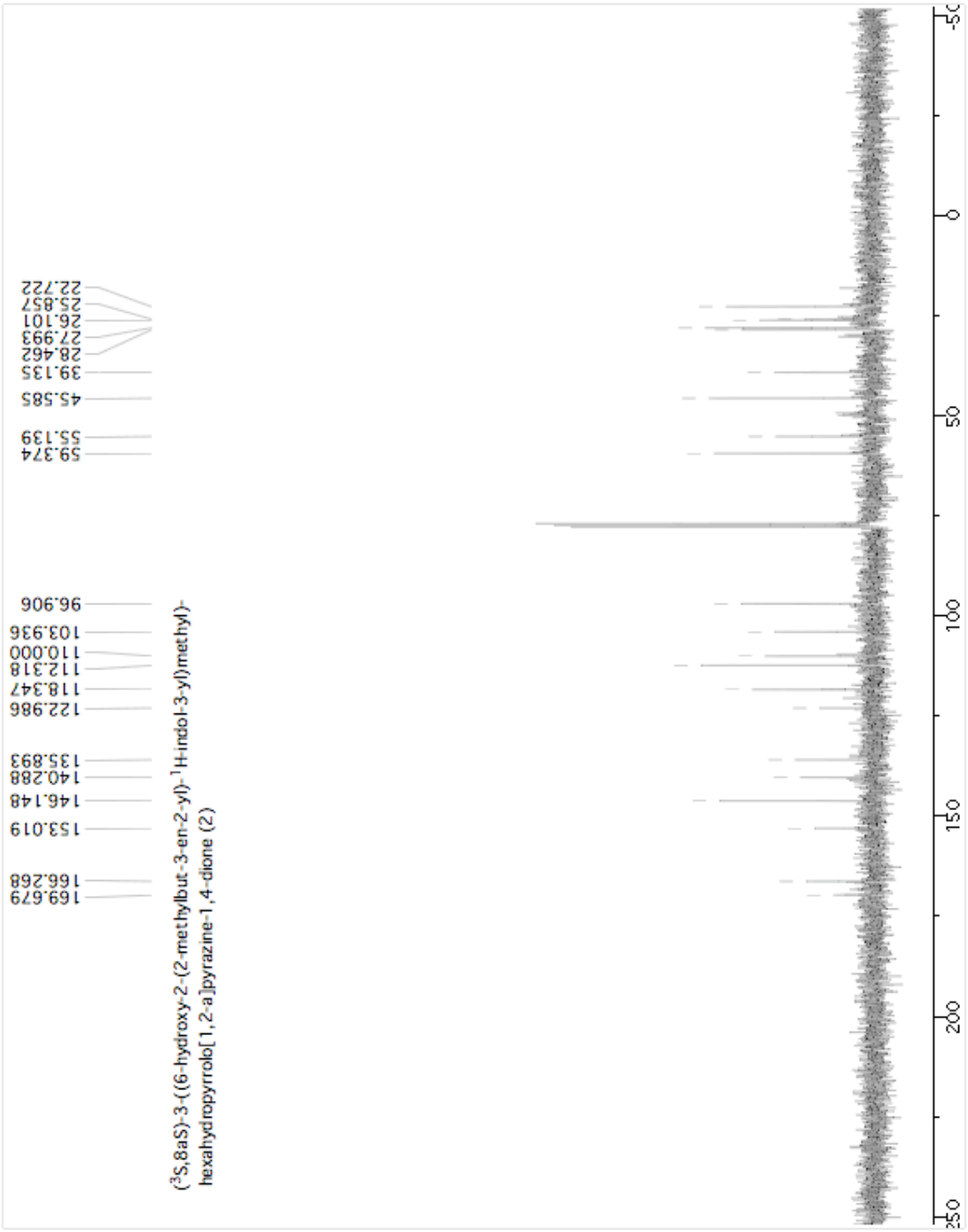

ethyl 2-((tert-butoxycarbonyl)amino)-3-(6-((tert-butoxycarbonyl)oxy)-2-(2-methylbut-3-en-2-yl)-1H-indol-3-yl)propanoate (13)
1
1.05
3.2
2.08
9.25
13
0.997
1
1.09
1.05
2.14
9.11
2.97
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2

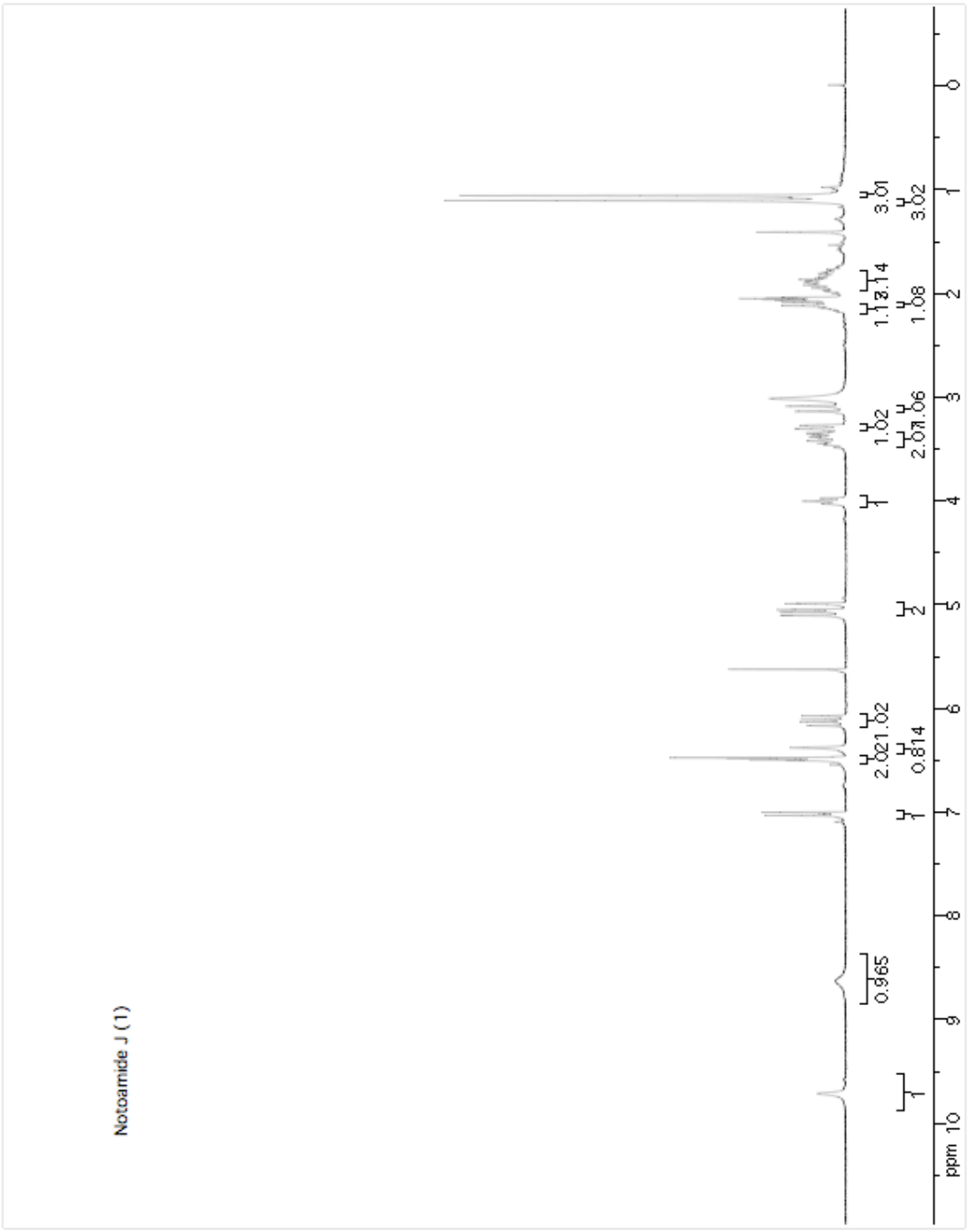

ethyl 2-((tert-butoxycarbonyl)amino)-3-(6-((tert-butoxycarbonyl)oxy)-2-(2-methylbut-3-en-2-yl)-1H-indol-3-yl)propanoate (13)
173.147
152.804
146.689
146.036
141.404
134.044
127.955
118.841
113.510
112.445
106.068
103.402
83.349
79.783
61.417
54.829
39.410
28.416
27.950
27.808
14.418
14.024
250
200
150
100
50
0
-50

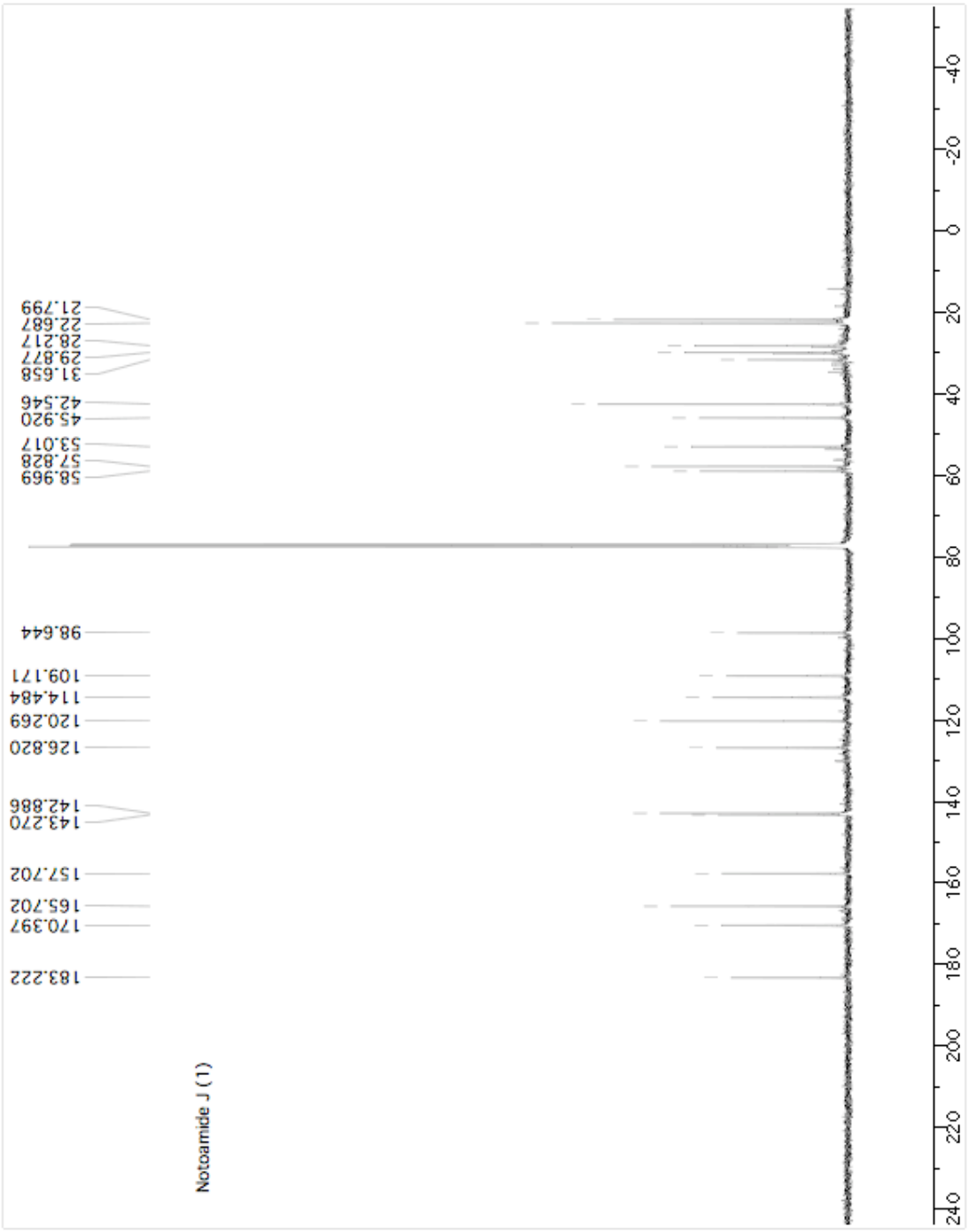

(2S)-ethyl-1-(2-((tert-butoxycarbonyl)amino)-3-(6-((tert-butoxycarbonyl)oxy)
-2-(2-methylbut-3-en-2-yl)-1H-indol-3-yl)propanoyl)pyrrolidine-2-carboxylate (14)
3.17
0.759
9.26
1.02
1
2.15
30.6
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5


172.090
171.273
154.920
152.706
146.634
145.318
141.618
133.594
127.781
119.242
119.090
113.397
112.553
106.014
103.408
83.246
79.369
61.127
60.581
59.334
53.064
46.581
39.243
28.527
27.898
27.412
14.374
14.268
(2S)-ethyl-1-(2-((tert-butoxycarbonyl)amino)-3-(6-((tert-butoxycarbonyl)oxy)
-2-(2-methylbut-3-en-2-yl)-1H-indol-3-yl)propanoyl)pyrrolidine-2-carboxylate (14)
250
200
150
100
50
0
-50

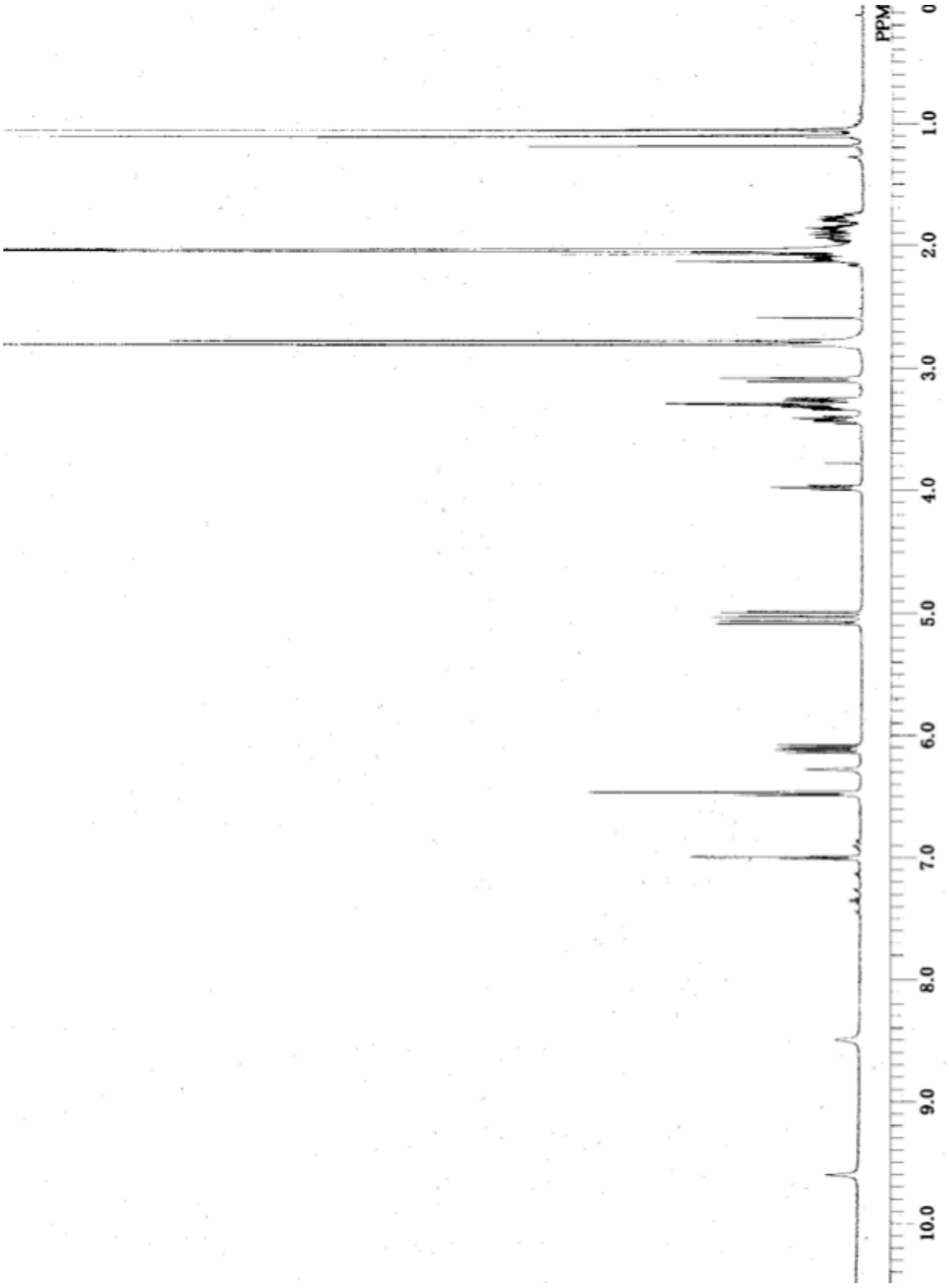

(3S,8aS)-3-((6-hydroxy-2-(2-methylbut-3-en-2-yl)-1H-indol-3-yl)methyl)-
hexahydropyrrolo[1,2-a]pyrazine-1,4-dione (2)
1.2
0.994
2
1.05
1.11
6.29
1.11
0.918
1.15
1.06
3.26
6.22
ppm
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3


169.679
166.268
153.019
146.148
140.288
135.893
122.986
118.347
112.318
110.000
103.936
96.906
59.374
55.139
45.585
39.135
28.462
27.993
26.101
25.857
22.722
(3S,8aS)-3-((6-hydroxy-2-(2-methylbut-3-en-2-yl)-1H-indol-3-yl)methyl)-hexahydropyrrolo[1,2-a]pyrazine-1,4-dione (2)
250
200
150
100
50
0
-50


Notoamide J (1)
ppm 10
9
8
7
6
5
4
3
2
1
0
0.965
2.021.02
0.814
1.02
2.013.06
1.1811.14
1.08
3.01
3.02

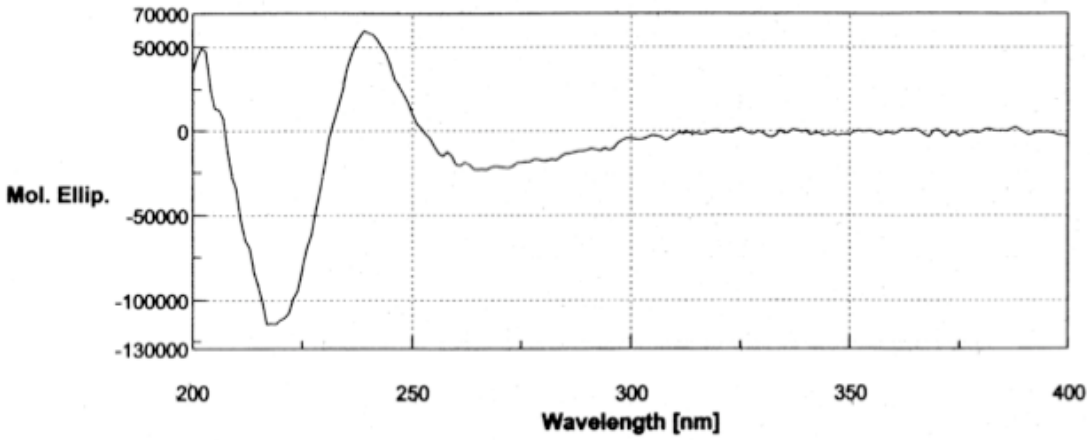

Notoamide J (1)
183.222
170.397
165.702
157.702
143.270
142.886
126.820
120.269
114.484
109.171
98.644
58.969
57.828
53.017
45.920
42.546
31.658
29.877
28.217
22.687
21.799
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
-40

Copy of ^{1}H NMR Spectrum of Natural Notoamide J.[S3]

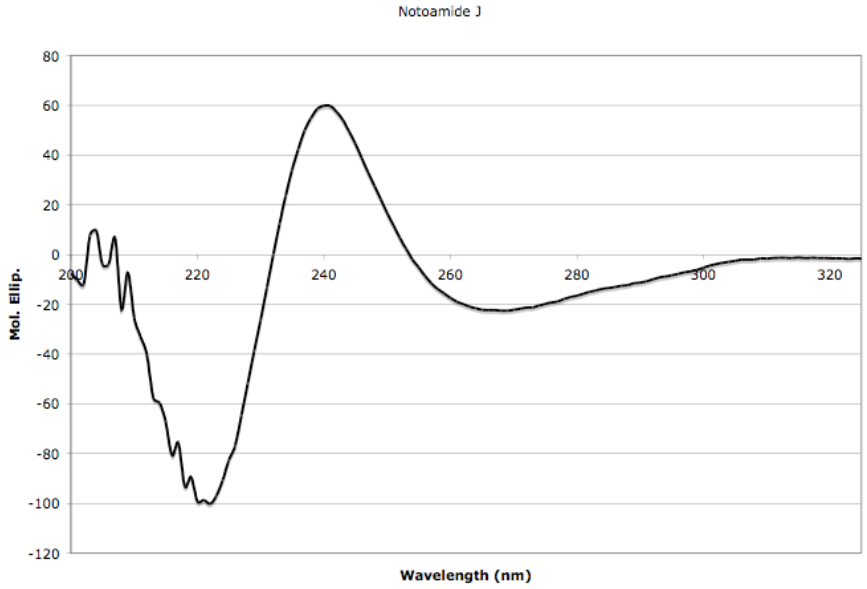


Comparison of CD of Natural Notoamide J[S1] with that of Synthetic **1**

(a)



(b)



(a) CD of Natural Notoamide J[S1] (b) CD of Synthetic Notoamide J

References:

S1. Tsukamoto, S.; Kato, H.; Samizo, M.; Nojiri, Y.; Onuki, H.; Hirota, H.; Ohta, T. *J. Nat. Prod.* **2008**, *71*, 2064-2067.