Electronic Supplementary Material (ESI) for Organic & Biomolecular Chemistry.

Supplementary material

Stereoselective synthesis of natural product inspired carbohydrate fused pyrano[3,2-c]quinolones as antiproliferative agents

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General experimental procedures

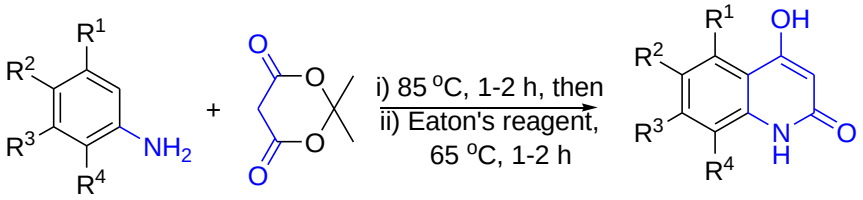
Synthesis of 2-C-formyl galactal 1a and 2-C-formyl glucal 1b: In a 100 ml round bottom flask 30 ml anhydrous DMF was added followed by dropwise addition of $POCl_3$(0.6 mL, 21.6 mmol) at 0 °C and resulting mixture was stirred for 30 min under Argon atmosphere. A solution (dissolved in anhydrous DMF) of 3,4,6-tri-*O*-benzyl-D-galactal (2.99 g, 7.20 mmol) was added to this dropwise within 30 min. The resulting reaction mixture was stirred at 0 °C to room temperature for 5 h which shows disappearance of starting material (TLC). Reaction mixture was quenched by slow addition of (within 30 min) of chilled $NaHCO_3$ (30 mL) solution at 0 °C. Mixture was extracted with ethyl acetate (3 × 30mL).and combined organic layer washed with brine solution (3 × 30mL).then dried over anhydrous Na_2SO_4. The combined organic layer was evaporated under vaccume to get crude residue which was purified though flash column chromatography and pure 2-C-formyl galactal **1a** was isolated in 94 % isolated yield (3.0 g). Similarly using 3,4,6-tri-*O*-benzyl-D-galucal and adopting above protocol 2-C-formyl glucal **1b** was obtained in 54 % (1.7g) isolated yield.[1]

Synthesis of 4-hydroxyquinolones 1-11: In an oven dried 25 ml round bottom flask Aniline (1 mL, 1.024 gm 10.99 mmol) and Meldrum's Acid (1.583 gm,10.99 mmol) were taken and heated at 80 °C for 2 h. After consumption of starting material (TLC), added ethylacetate and aquous solution of sodium bicarbonate. Resulting suspension partitioned in separating funnel and aqueous layer washed with ethyl acetate (3 × 50 mL). The aqueous layer acidified with conc.HCl until pH 1-2 then extracted with dichloromethane (3 × 35 mL). The combined organic layer dried over anhydrous Na_2SO_4 filtered and evaporated on rotary evaporator to get solid residue which was forwarded next step without further purification. The solid residue (1.9 g) and Eaton's reagent (9.5 g, 5 equiv/w) was heated at 80 °C for 1 h or till disappearance of starting material (TLC). The reaction mixture cooled down and added ice cold water and keep stirring for 30 min then solid precipitate appeared which was filtered using Buchner funnel under vaccum till dryness to get almost pure 4-hydroxyquinolone **1** in 80 % yield (1.41gm).[2] Similar reaction protocol was followed for preparation of various other 4-hydroxyquinolone (**2-11** and **34**) using corresponding anilines (Table S1).

References

1. N.G. Ramesh, K.K. Balasubramanian, *Tetrahedron Lett*. 1991, 32 , 3875-3878.
2. (a) S-J. Park, J-C Lee, K-I.Lee. *Bull. Korean Chem. Soc*. 2007, **28**, 1203-1205, (b) K. Arya, M. Agarwal, *Bioorg. Med. Chem. Lett*. 2007, **17**, 86-93.

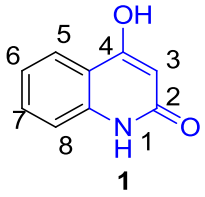
Table S1. Synthesis of 4-hydroxyquinolone **1-11**.



1-11

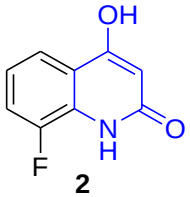
Entry	R^1	R^2	R^3	R^4	Product	Time (h)	Yield (%)
1	H	H	H	H	**1**	1	80
2	H	H	H	F	**2**	2	70
3	H	H	OPh	H	**3**	2	69
4	H	H	H	NO_2	**4**	1	53
5	H	H	H	OCF_3	**5**	2	81
6[a]	H	H-	CF_3	H	**6**	1	55
7	H	H	H	$CHMe_2$	**7**	2	70
8[a]	H	H	Cl	H	**8**	1	60
9[a]	H	H	Br	H	**9**	2	65
10	H	H	H	CF_3	**10**	1	58
11	H	Cl	CF_3	H	**11**	2	51

[a]Two regioisomers were formed in these cases, they were purified and isolated yields of desired isomer is given.



1

4-hydroxyquinolin-2(1H)-one (1). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 11.31 (brs, 1H, OH), 11.20 (s, 1H, NH), 7.76 (dd, *J* = 1.2 Hz, *J* = 8.0 Hz, 1H, H-5),7.47-7.45 (t, *J* = 7.2Hz, 1H, H-6), 7.25 (d, *J* = 8.0 Hz, 1H, H-8), 7.14 (t, *J* = 7.2Hz, 1H, H-7), 5.72 (s,1H, H-3) ^{13}C NMR (100 MHz, DMSO-*d6*), δ: 163.9, 162.8, 139.6, 131.3, 123.1, 121.4, 115.5, 115.4, 98.6 (C-3). HRMS(ESI), calcd, m/z $C_9H_7NO_2$, $[M+H]^+$ 162.0549; Found: 162.0573.



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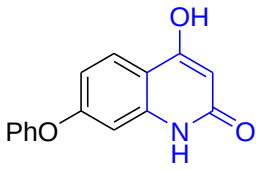
8-Flouro-4-hydroxyquinolin-2(1H)-one (2). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 11.53 (brs, 1H, OH), 11.21 (s, 1H, NH), 7.61 (d, *J* = 8.0 Hz, 1H, H-5), 7.41(ddd, *J* = 11.2 Hz, *J* = 8.0 Hz and *J* = 1.2 Hz, 1H, H-7), 7.13 (td, *J* = 4.8 Hz, *J* = 8.0 Hz,1H, H-6), 5.79 (s, 1H, H-3), ^{13}C NMR (100

MHz, DMSO-*d6*): δ 163.5, 162.4, 121.3, 121.2, 118.9, 117.8, 116.5, 116.3, 99.6 (C-3). HRMS(ESI), calcd, m/z $C_9H_6FNO_2[M+H]^+$ 180.0455;Found: 180.0479.



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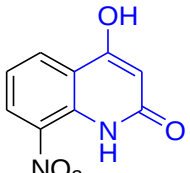
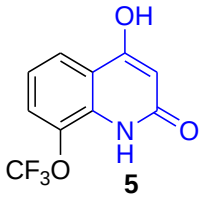
7-phenoxy-4-hydroxyquinolin-2(1H)-one(3) ^{1}H NMR (400 MHz, DMSO-*d6*): 11.44 (s, 1H, OH), 11.16 (s, 1H, NH), 7.78 (d, *J* = 9.2 Hz, 1H, H-5), 7.47-6.80 (m, 7H, ArH), 5.67 (s, 1H, H-3), ^{13}C NMR (100 MHz, DMSO-*d6*): δ 164.1, 163.0, 159.9, 141.2, 130.7, 130.1, 125.2, 117.3, 112.6, 103.1, HRMS(ESI), calcd, m/z $C_{15}H_{11}NO_3$, $[M+H]^+$ 254.0817; Found: 254.0849



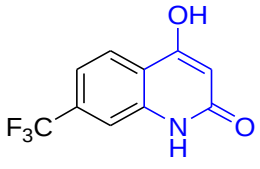
4

8-Nitro-4-hydroxyquinolin-2(1H)-one (4). (400 MHz, DMSO-*d6*): δ 12.07(s, 1H, OH), 10.60(s, 1H, NH), 8.45(dd, *J* =8.4 Hz and *J* =1.2 Hz, 1H, H-5), 8.26 (dd, *J* =8.0 Hz and *J* =1.2 Hz, 1H, H-7), 7.37 (t, *J* = 8.0 Hz, 1H, H-6), 5.88 (s, 1H, H-3), ^{13}C NMR (100 MHz, DMSO-*d6*): δ 162.6, 133.9, 131.2, 128.8, 121.2, 118.4, 98.9 (C-3), HRMS(ESI), calcd, m/z $C_9H_6N_2O_4$, $[M+H]^+$ 207.0400;Found: 207.0432.



5

8-triflouromethoxy-*4-hydroxy-2H-benzopyran-2-one (5).* ^{1}H NMR (400 MHz, DMSO-*d6*): δ 11.62 (brs, 1H, OH), 11.37 (brs, 1H, NH), 7.81 (dd, *J* = 8.0 Hz and *J* =1.6 Hz, 1H, H-5), 7.57 (dd, *J* = 8.0 Hz and *J* =1.6 Hz, 1H, H-7), 7.21 (t, *J* = 8.0 Hz, 1H, H-6), 5.81 (s, 1H, H-3); ^{13}C NMR (100 MHz, DMSO-*d6*): δ 163.7, 162.2, 134.7, 132.6, 123.6, 122.4, 121.3, 117.8, 99.6 (C-3), HRMS(ESI), calcd, m/z $C_{10}H_6F_3NO_3$, $[M+H]^+$ 246.0373; Found: 246.0411.



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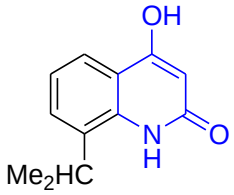
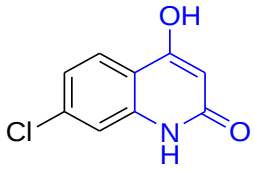
7-triflouromethyl-4-hydroxyquinolin-2(1H)-one (6). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 11.61 (brs, 1H, OH), 11.48 (brs, 1H, NH), 7.98 (d, *J* = 8.4 Hz, 1H, H-5), 7.62 – 7.58(m, 1H), 7.45 (d, *J* = 8.4 Hz, 1H, H-6), 5.86 (s, 1H, H-3), ^{13}C NMR (100 MHz, DMSO-*d6*): δ 163.7, 162.8, 162.0, 141.8, 139.4, 130.4, 124.7, 121.2, 112.4, 100.6 (C-3), HRMS(ESI), calcd, m/z $C_{10}H_6F_3NO_2$, $[M+H]^+$ 230.0423; Found: 230.0458.



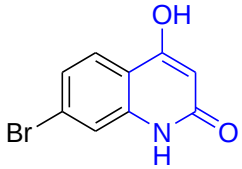
7

8-isopropyl-4-hydroxyquinolin-2(1H)-one (7). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 10.69 (brs,1H NH), 7.72 (dd, *J* = 8.0 Hz and *J* = 1.2 Hz, 1H, H-5), 7.50 (dd, *J* = 7.9 Hz and *J* = 1.4 Hz,1H, H-7), 7.18 (t, *J* = 15.8 Hz,1H, H-6), 5.86 (s, 1H, H-3), 3.60 (septate, *J* = 6.8 Hz, 1H, CH of $CHMe_2$), 1.19 (d, *J* = 6.8 Hz, 6H, $CH\mathit{Me}_2$), ^{13}C NMR (100 MHz, DMSO-*d6*): δ 168.9,168.8, 141.2, 139.2, 132.8, 126.7, 125.7,120.7, 102.3 (C-3), 30.7 (CH), 28.2 (Me_2), HRMS(ESI), calcd, m/z $C_{12}H_{13}NO_2$, $[M+H]^+$ 204.1019; Found: 204.1016.



8

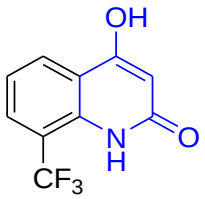
7-chloro-4-hydroxyquinolin-2(1H)-one (8). ^{1}H NMR(400 MHz, DMSO-*d6*): δ 11.51 (brs, 1H, OH), 11.36 (brs, 1H, NH), 7.76 (d, *J*= 8.8 Hz, 1H, H-5), 7.41 (d, *J* = 8.0 Hz, 1H, H-6), 7.18-7.15 (m, 1H), 5.80 (s, 1H, H-3), ^{13}C NMR (100 MHz, DMSO-*d6*): δ 163.9, 162.9, 142.2, 135.7, 131.3, 130.3, 125.1, 121.7, 115.4, 112.5, 100.2 (C-3), HRMS(ESI), calcd, m/z $C_9H_6ClNO_2$, $[M+H]^+$ 196.0159; Found: 196.0170.



9

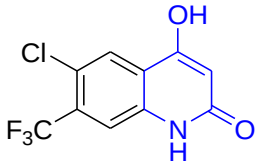
7-bromo-4-hydroxyquinolin-2(1H)-one (9).^{1}H NMR (400 MHz, DMSO-*d6*): δ 11.51 (brs, 1H, OH), 11.28 (brs, 1H, NH), 7.70 (d, *J*= 8.8 Hz, 1H, H-5), 7.43 (d, *J* = 8.0 Hz, 1H, H-6), 7.18-7.15 (m, 1H), 5.80 (s, 1H, H-3), ^{13}C NMR (100 MHz, DMSO-*d6*): δ 163.8, 162.7, 142.3, 131.5,

128.6, 125.1, 117.7, 114.6, 100.3 (C-3), HRMS(ESI), calcd, m/z $C_9H_6BrNO_2$, $[M+K]^+$ 277.9219; Found: 277.0997.



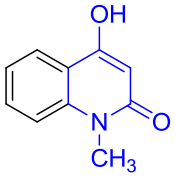
10

8-triflouromethyl-4-hydroxyquinolin-2(1H)-one (10). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 11.81 (brs,1H, OH), 9.94 (brs, 1H, NH), 8.13 (d, *J* = 8.0 Hz, 1H, H-5), 7.90 (d, *J* = 8.0 Hz, 1H, H-7), 7.33 (t, *J* = 7.9 Hz, 1H, H-6), 5.88 (s, 1H, H-3),.^{13}C NMR (400 MHz, DMSO-*d6*): δ 169.9, 168.9, 163.5, 162.5, 141.2, 134.4, 131.5, 129.1, 128.3, 123.0, 121.3, 120.4, 100.1 (C-3), HRMS(ESI), calcd, m/z $C_{10}H_6F_3NO_2$, $[M+H]^+$ 230.0423; Found: 230.0458.



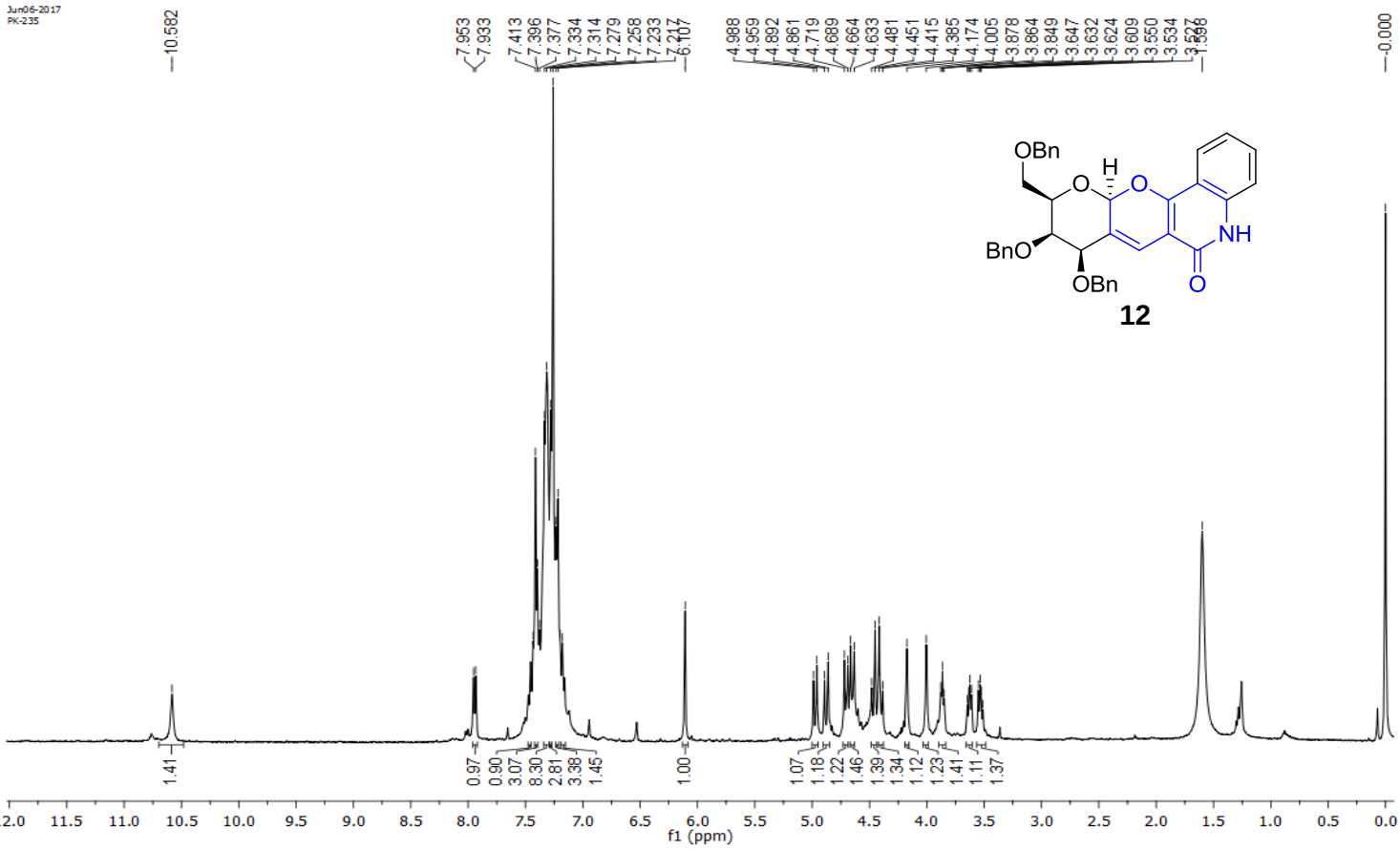
11

6-chloro-7-triflouromethyl-4-hydroxyquinolin-2(1H)-one (11). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 11.55 (s, 1H, OH), 7.93 (s, 1H, H-8), 7.71 (s, 1H, H-5), 5.86 (s, 1H, H-3); ^{13}C NMR (100 MHz, DMSO-*d6*): δ 168.2, 167.3, 165.7, 142.7, 130.5, 129.2, 128.8, 126.6, 123.9, 120.3,106.2 (C-3), HRMS(ESI), calcd, m/z $C_{10}H_5ClF_3NO_2$, $[M+H]^+$ 264.0034; Found: 264.0037.



34

4-hydroxy-1-methylquinolin-2(1H)-one (34). ^{1}H NMR (400 MHz, DMSO-d_6): δ 11.34 (s, 1H, OH), 7.89 (dd, *J* = 1.2 Hz, 1H, H-8), 7.61 (ddd, *J* = 1.2 Hz, *J* = 7.2 Hz, 1H, H-6), 7.46 (d, *J* = 8.4 Hz, 1H, H-5), 7.24 (td, *J* = 0.8 Hz, *J* = 8.0 Hz, 1H, H-7), 5.88 (s, 1H, H-3), 3.53(s, 3H, N-CH_3); ^{13}C NMR (100 MHz, DMSO- d_6): δ 162.9, 161.4, 140.4, 131.7, 123.5, 121.6, 116.5, 114.9, 98.4, 28.8 (CH_3); HRMS(ESI), calcd, m/z $C_{10}H_9NO_2$, [M+H]+ 176.07; Found: 176.0805.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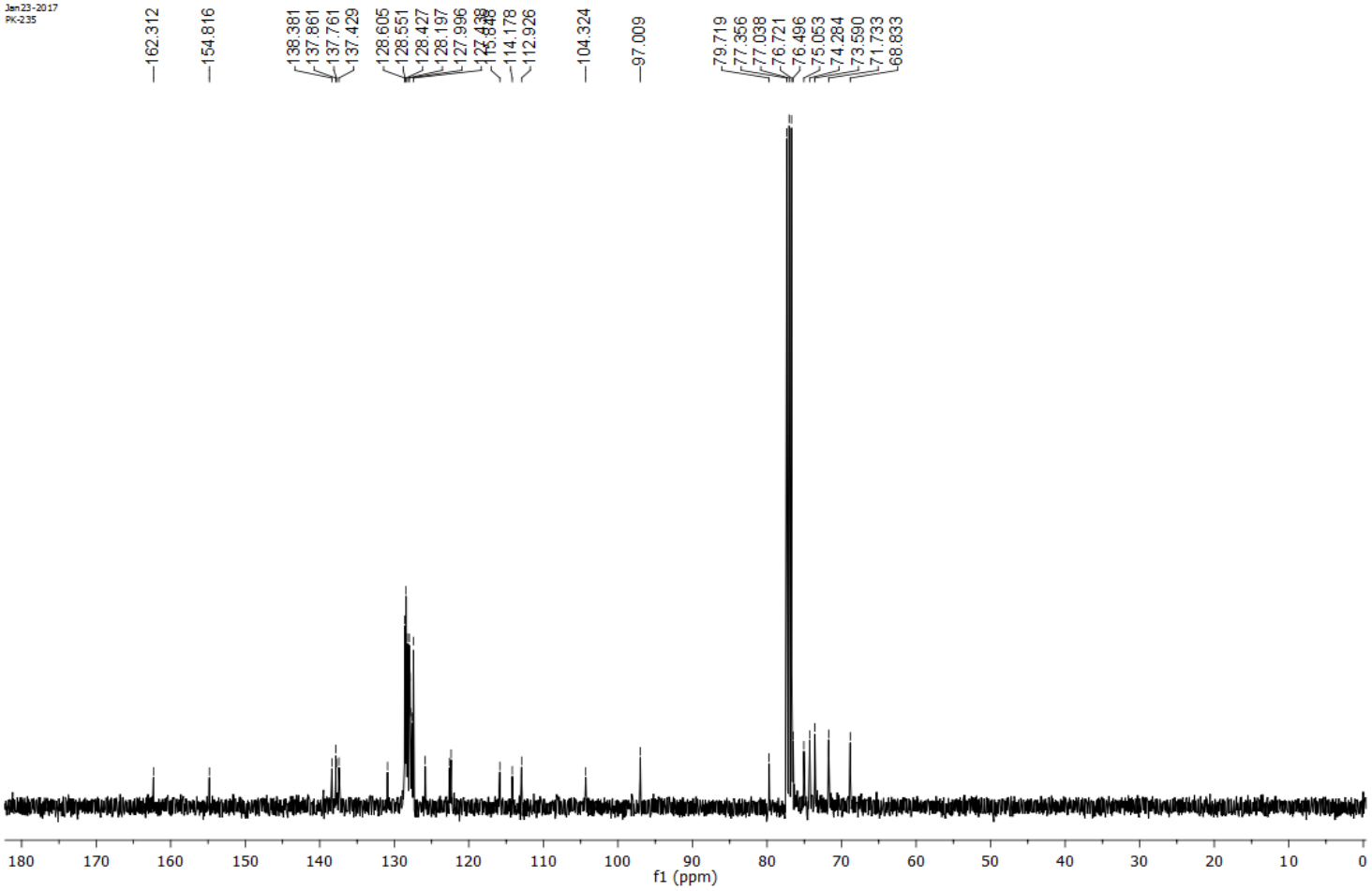
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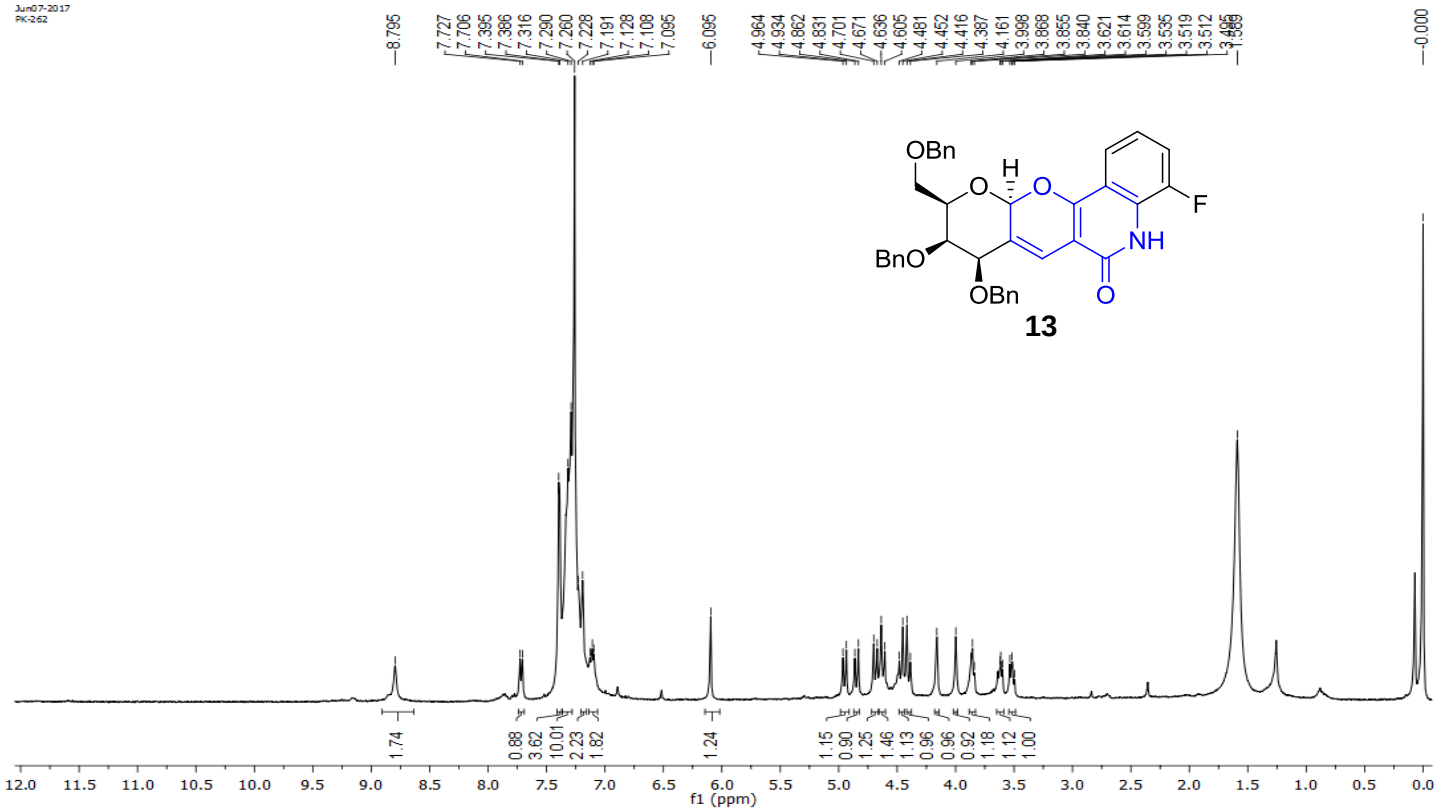
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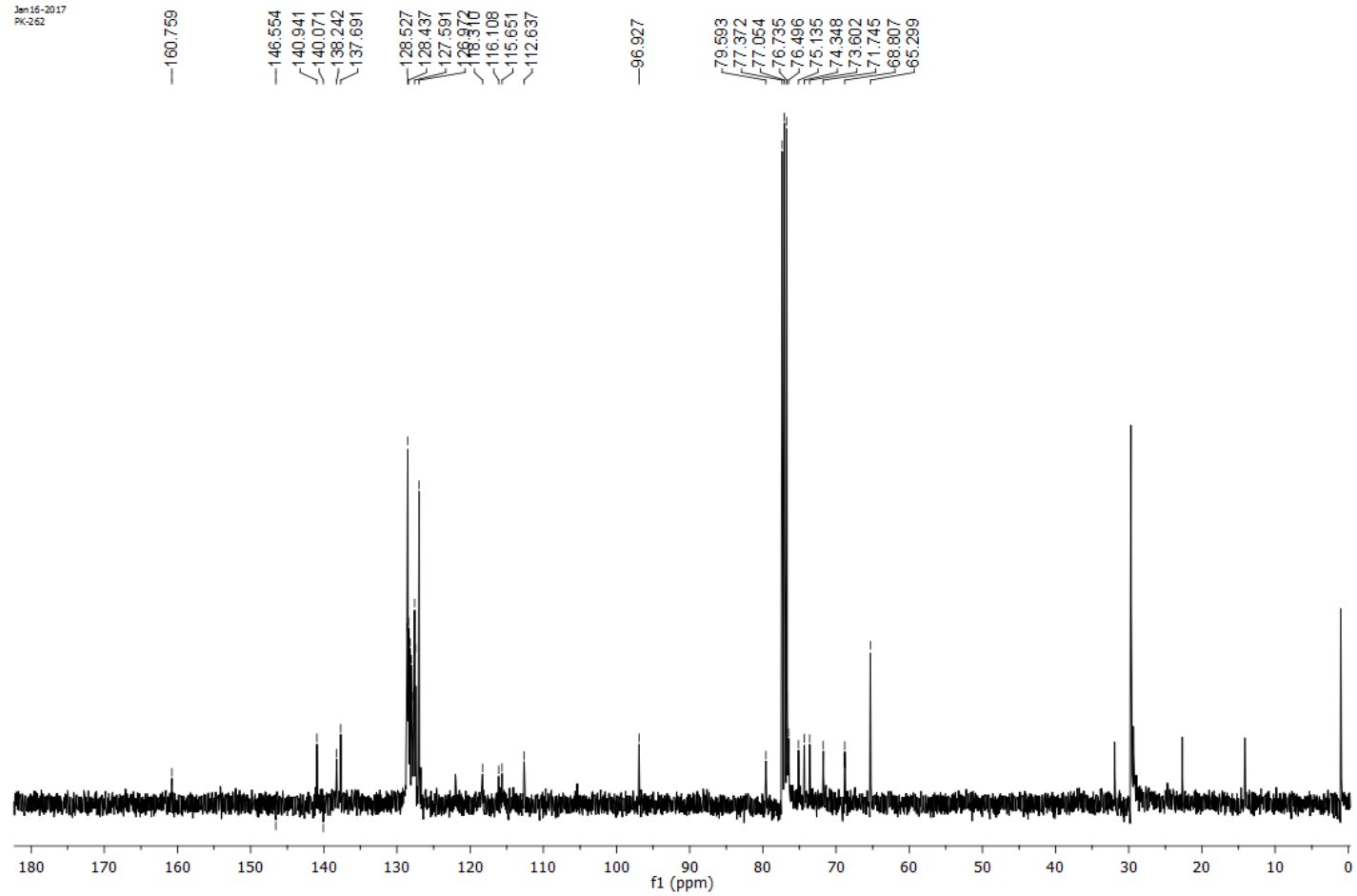
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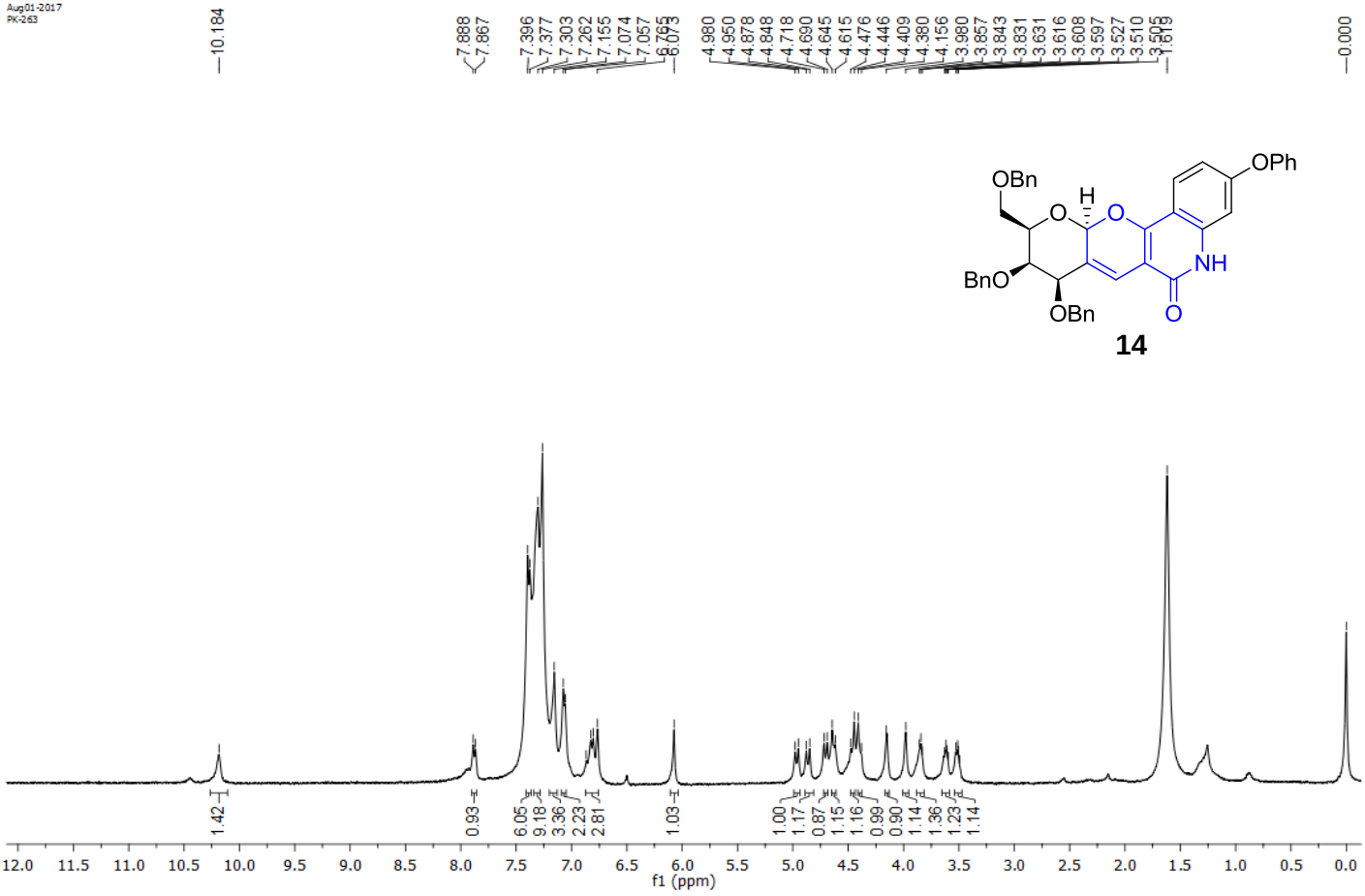
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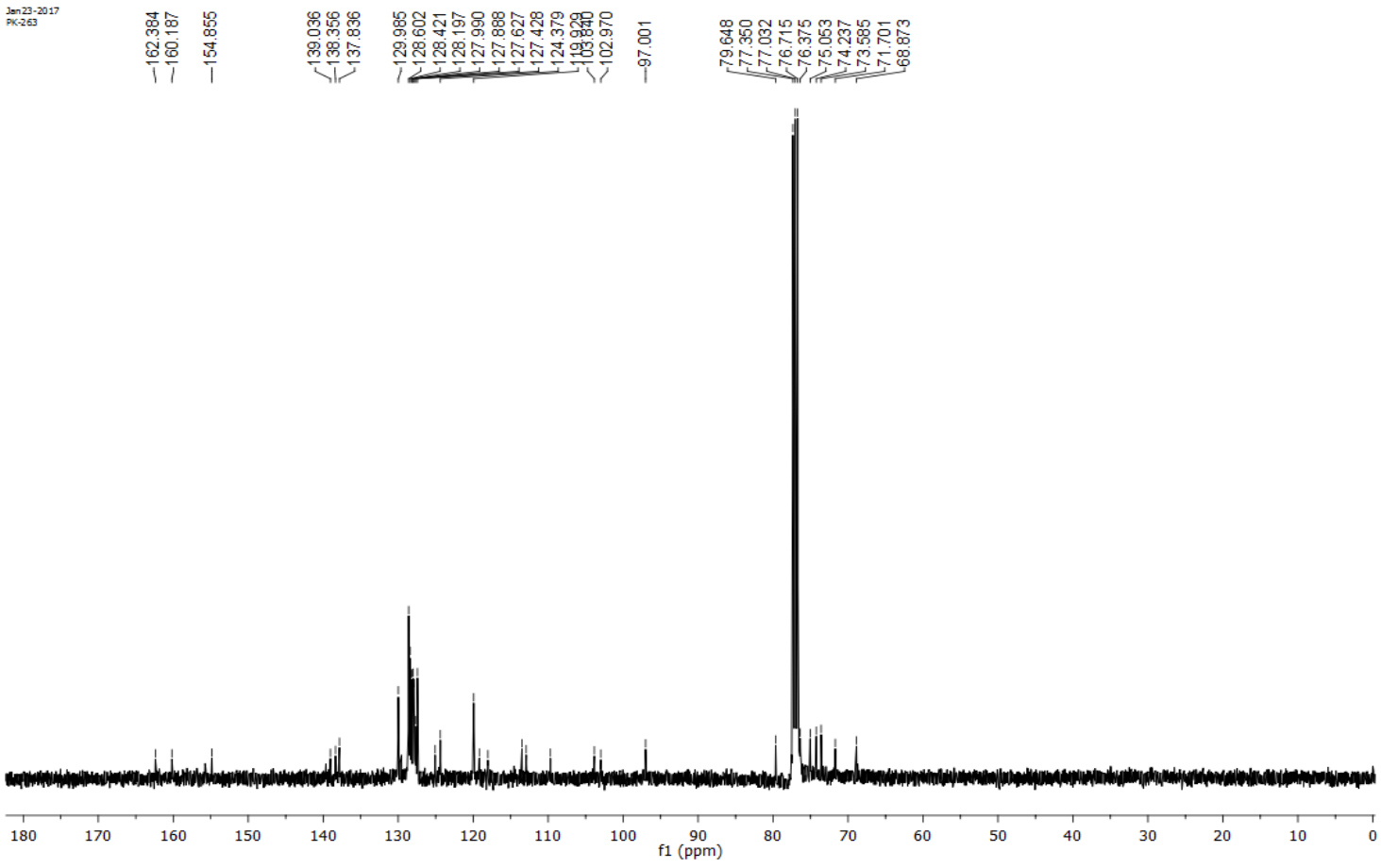
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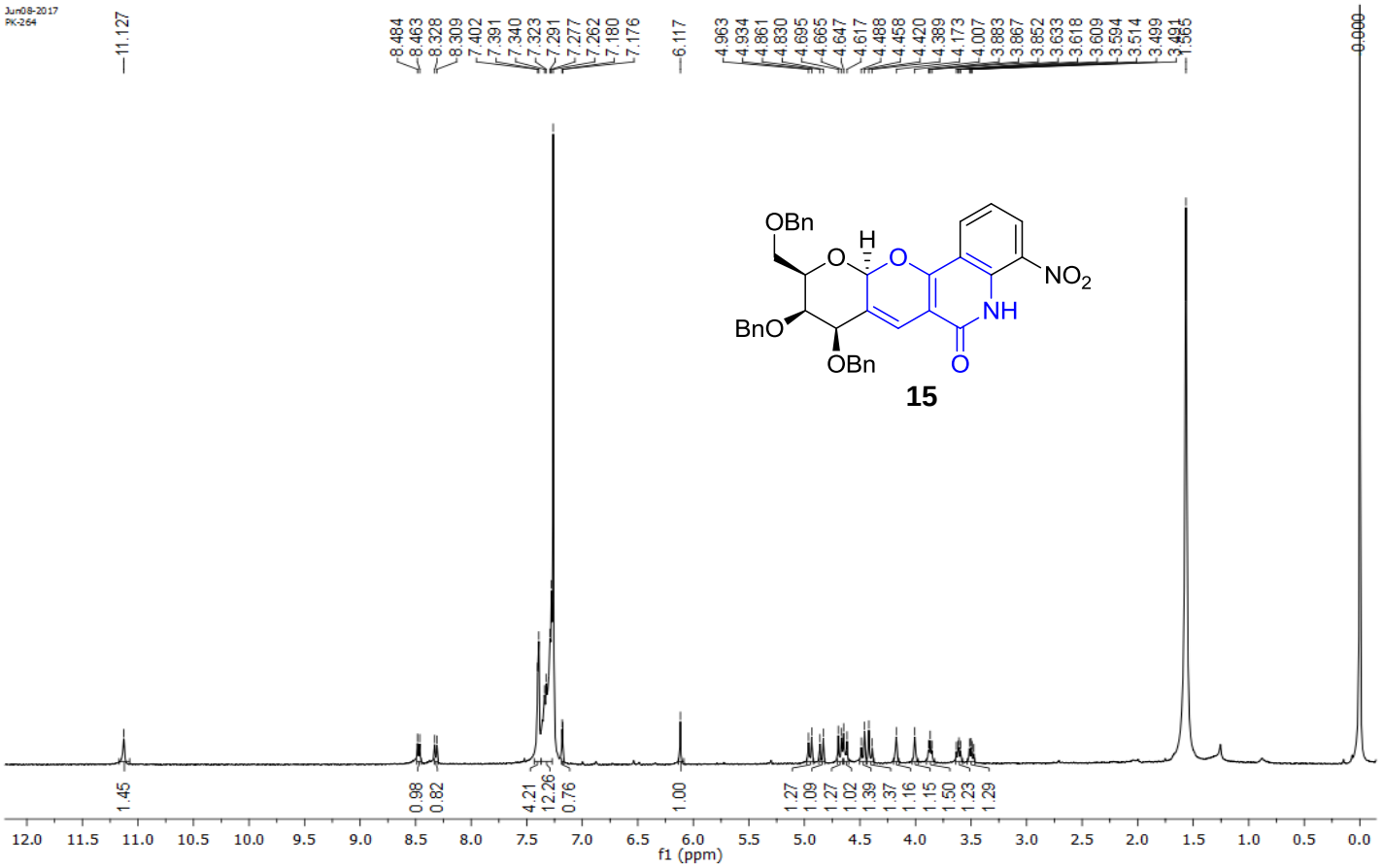
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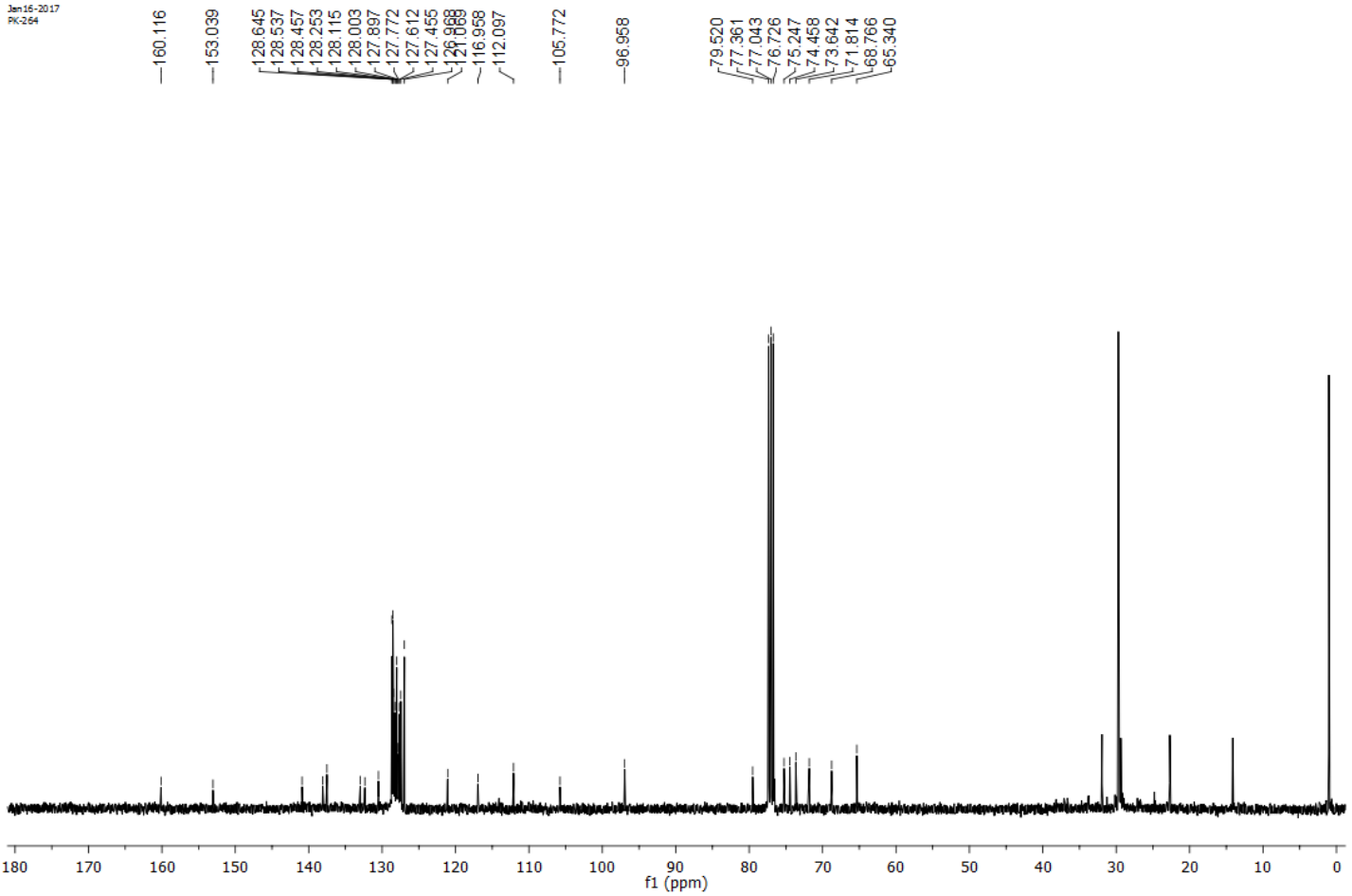
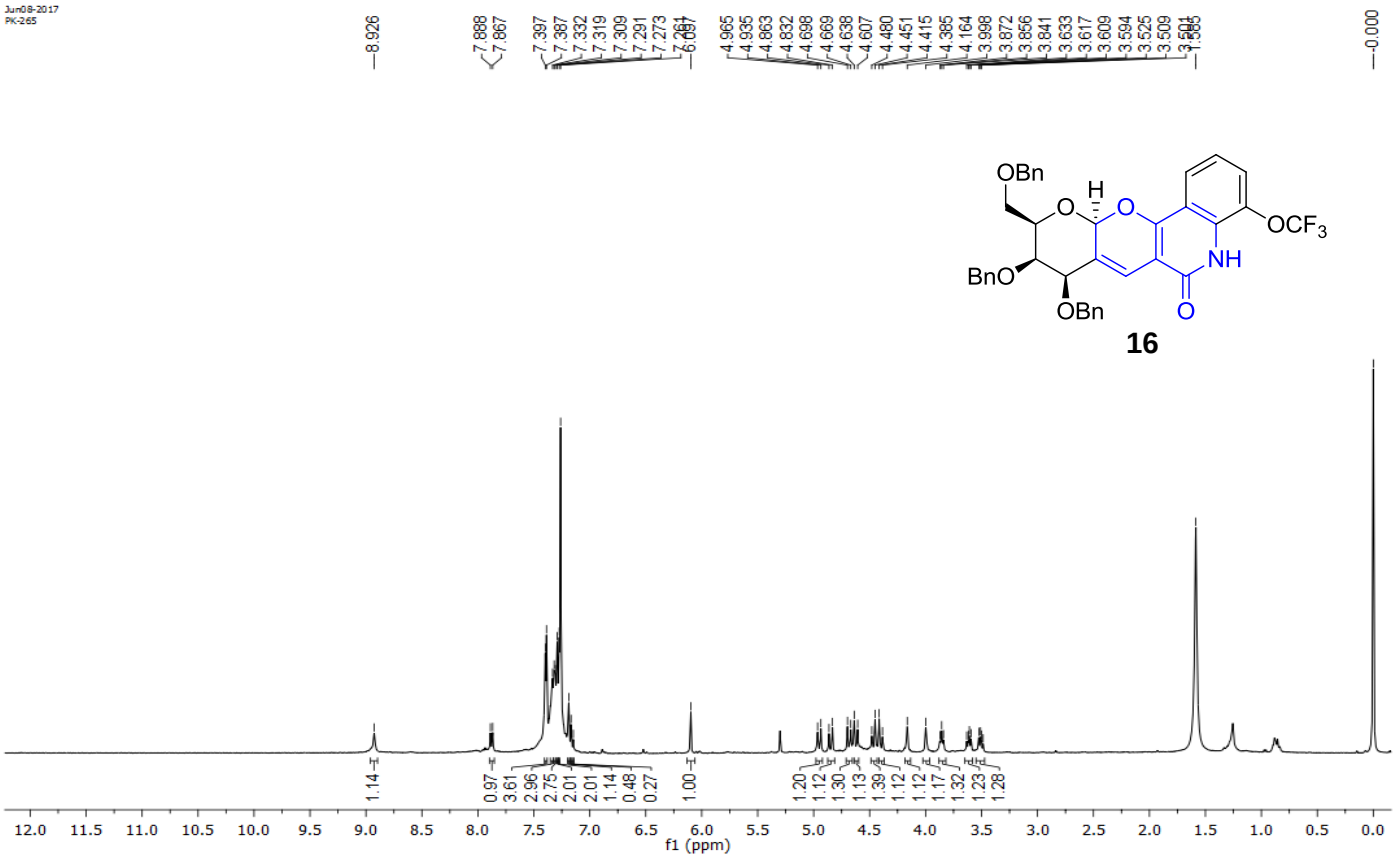
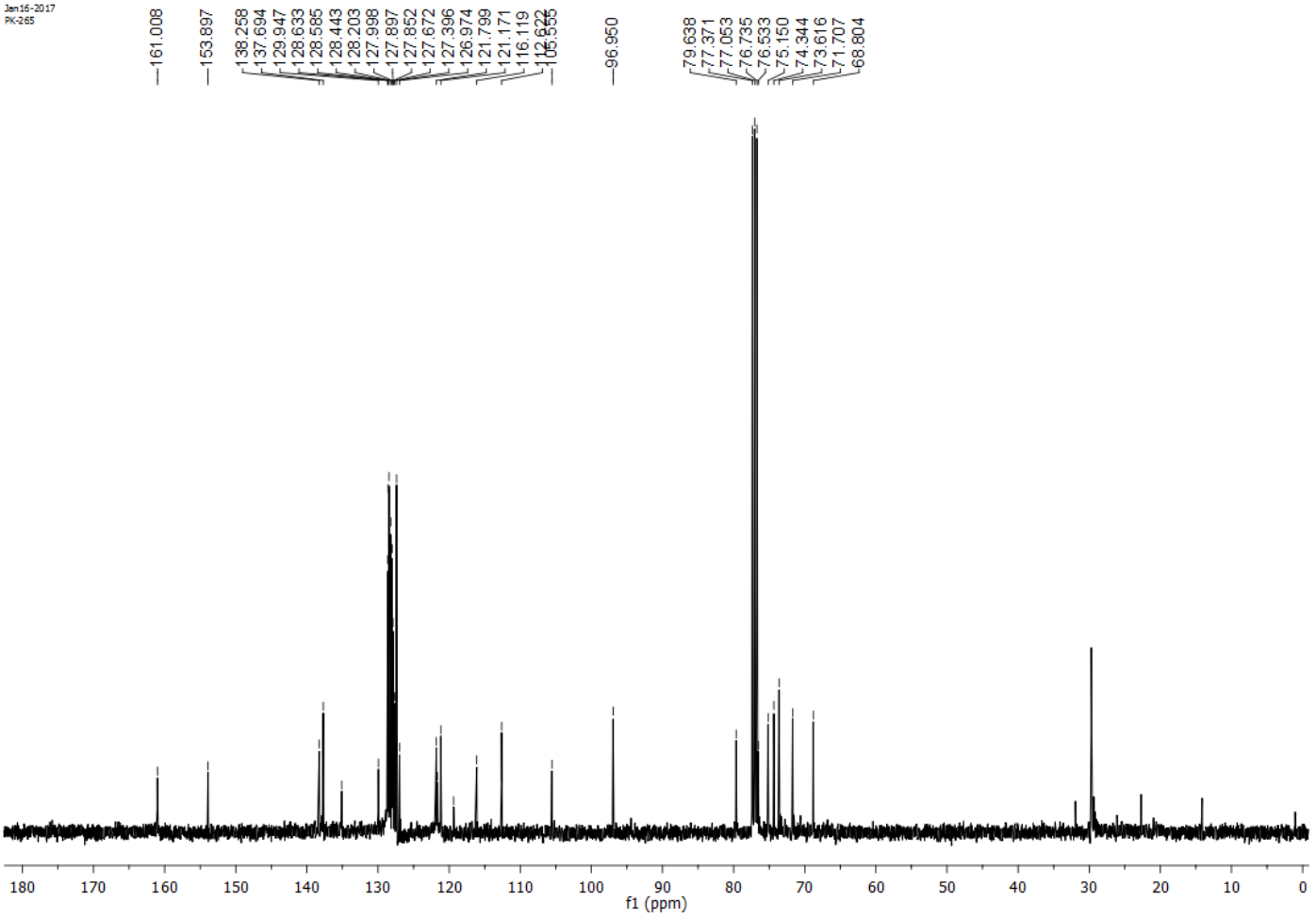
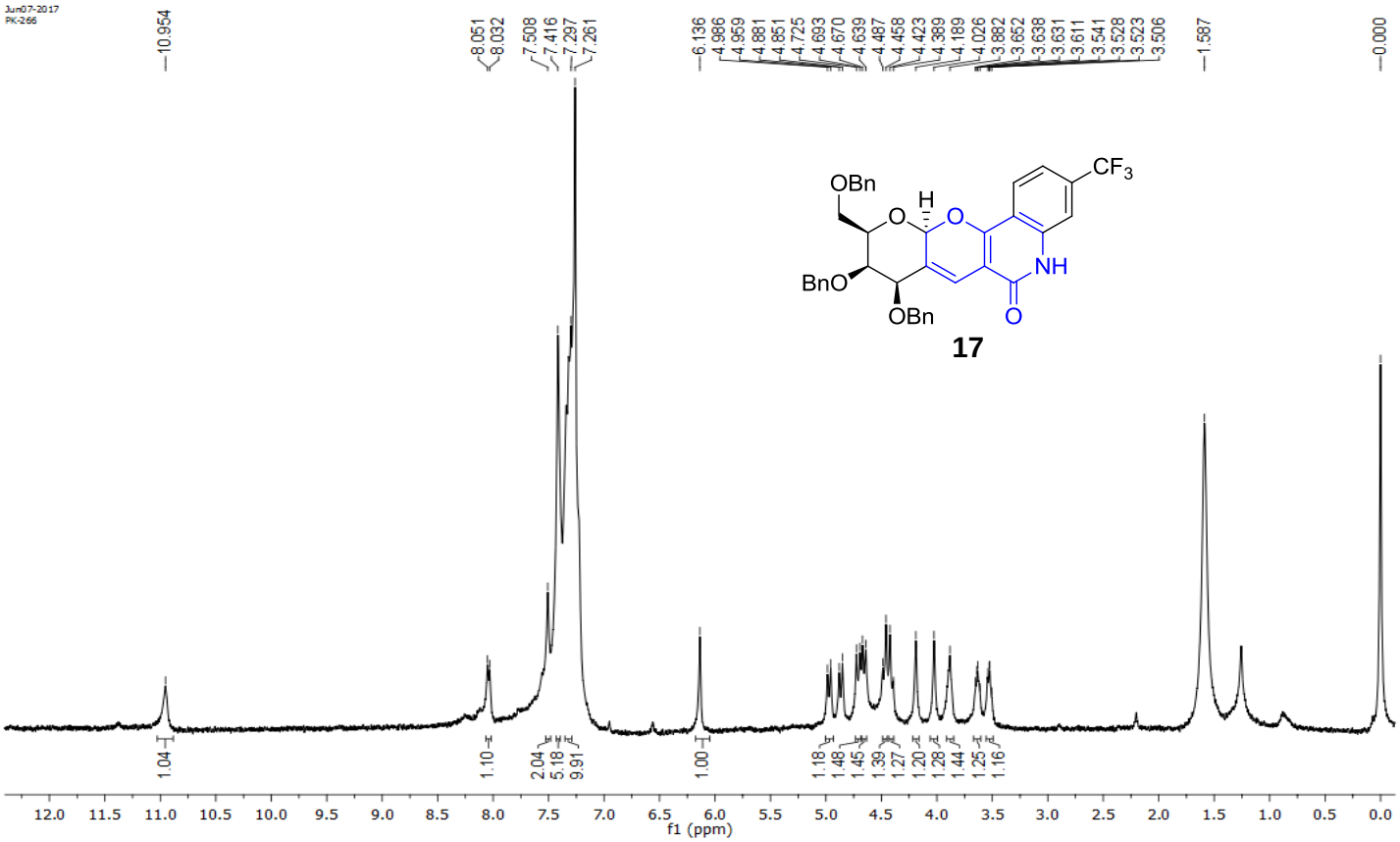
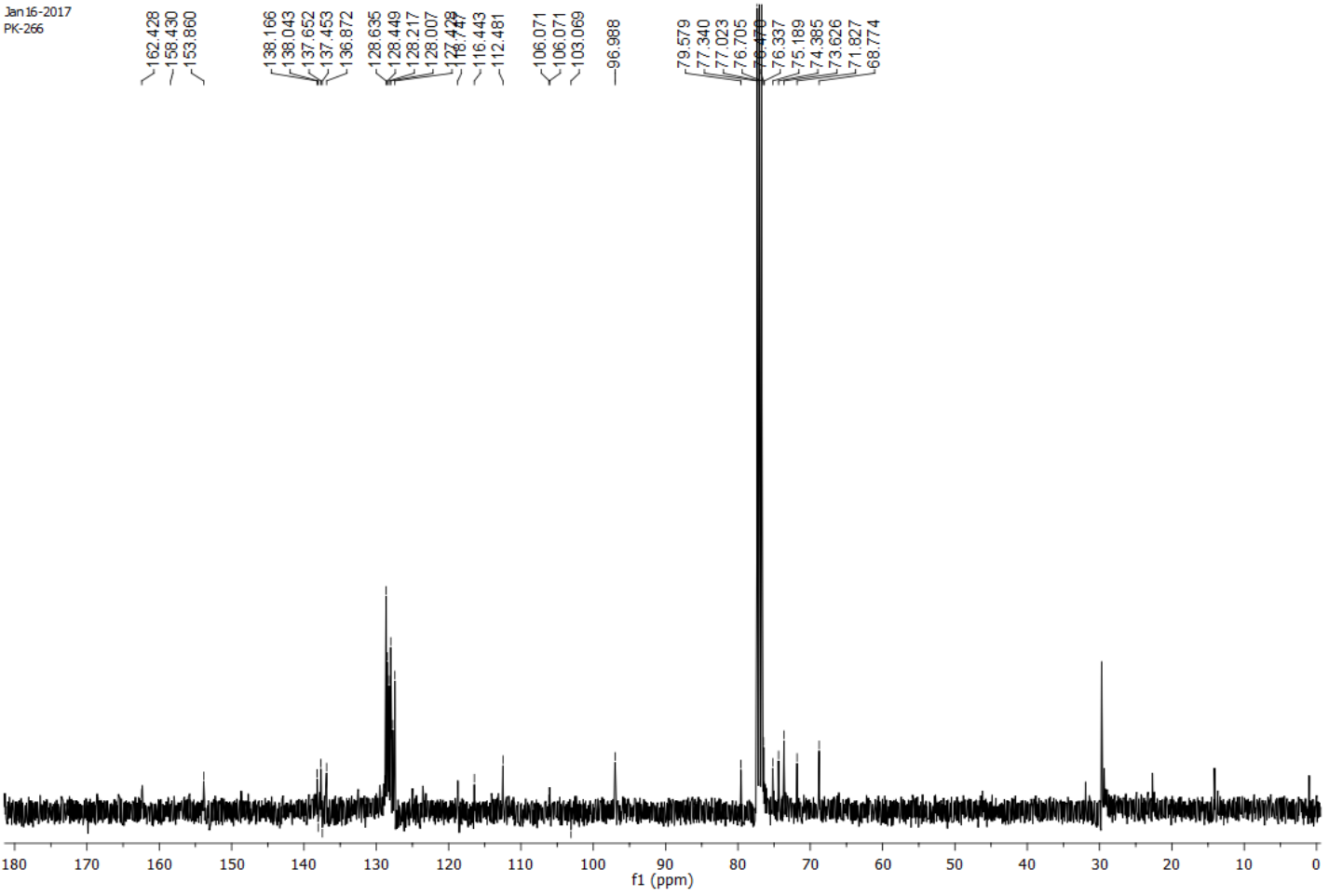
4.647
4.617
4.488
4.458
4.420
4.389
4.173
4.007
3.883
3.867
3.852
3.633
3.618
3.609
3.594
3.514
3.499
3.491
1.565
0.000
OBn
H
O
O
NO2
BnO
NH
OBn
O
15
1.45
0.98
0.82
4.21
12.26
0.76
1.00
1.27
1.09
1.27
1.02
1.39
1.37
1.16
1.15
1.50
1.23
1.29
f1 (ppm)

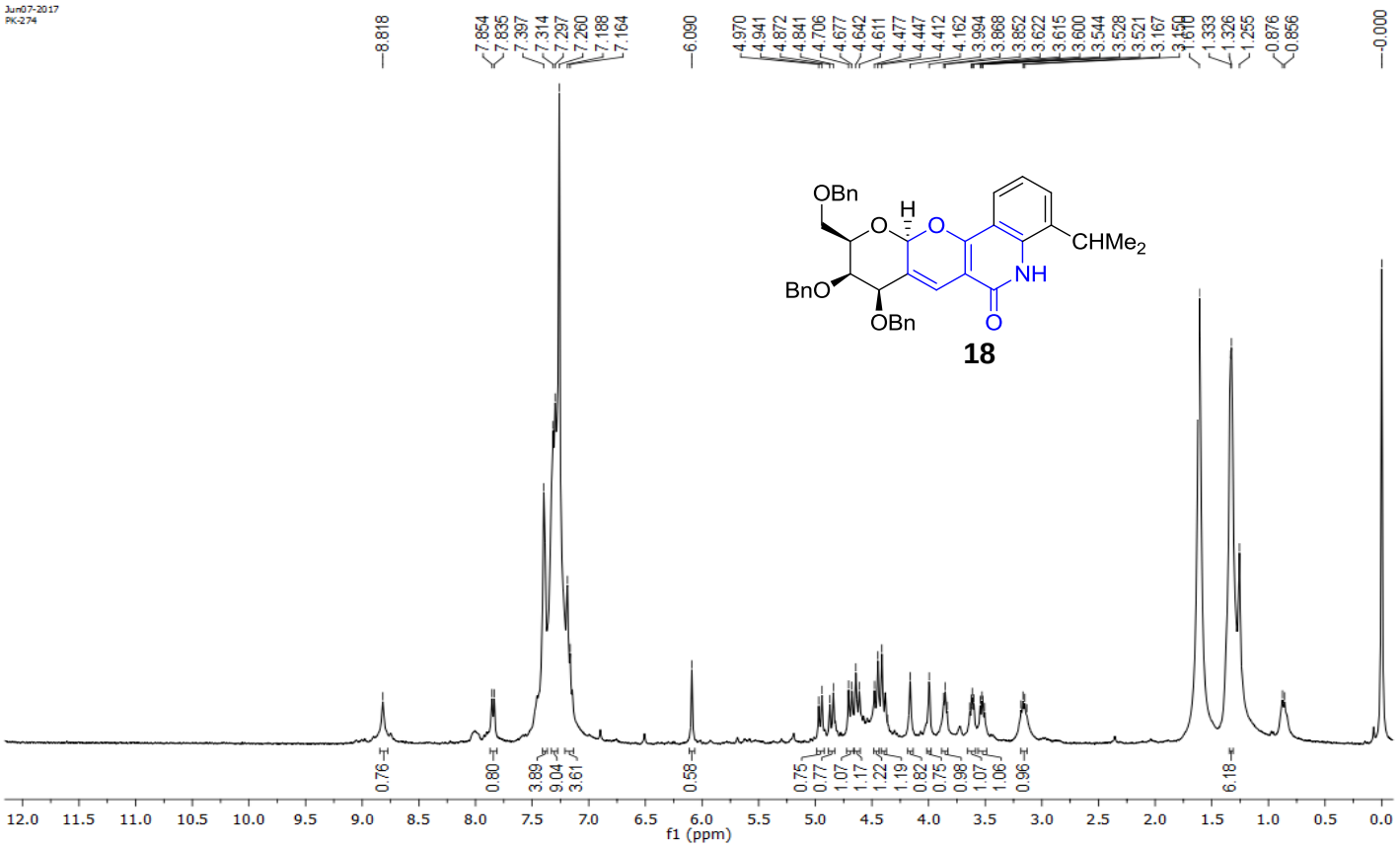

Jan16-2017
PK-264
160.116
153.039
128.645
128.537
128.457
128.253
128.115
128.003
127.897
127.772
127.612
127.455
121.088
116.958
112.097
105.772
96.958
79.520
77.361
77.043
76.726
75.247
74.458
73.642
71.814
68.766
65.340
f1 (ppm)

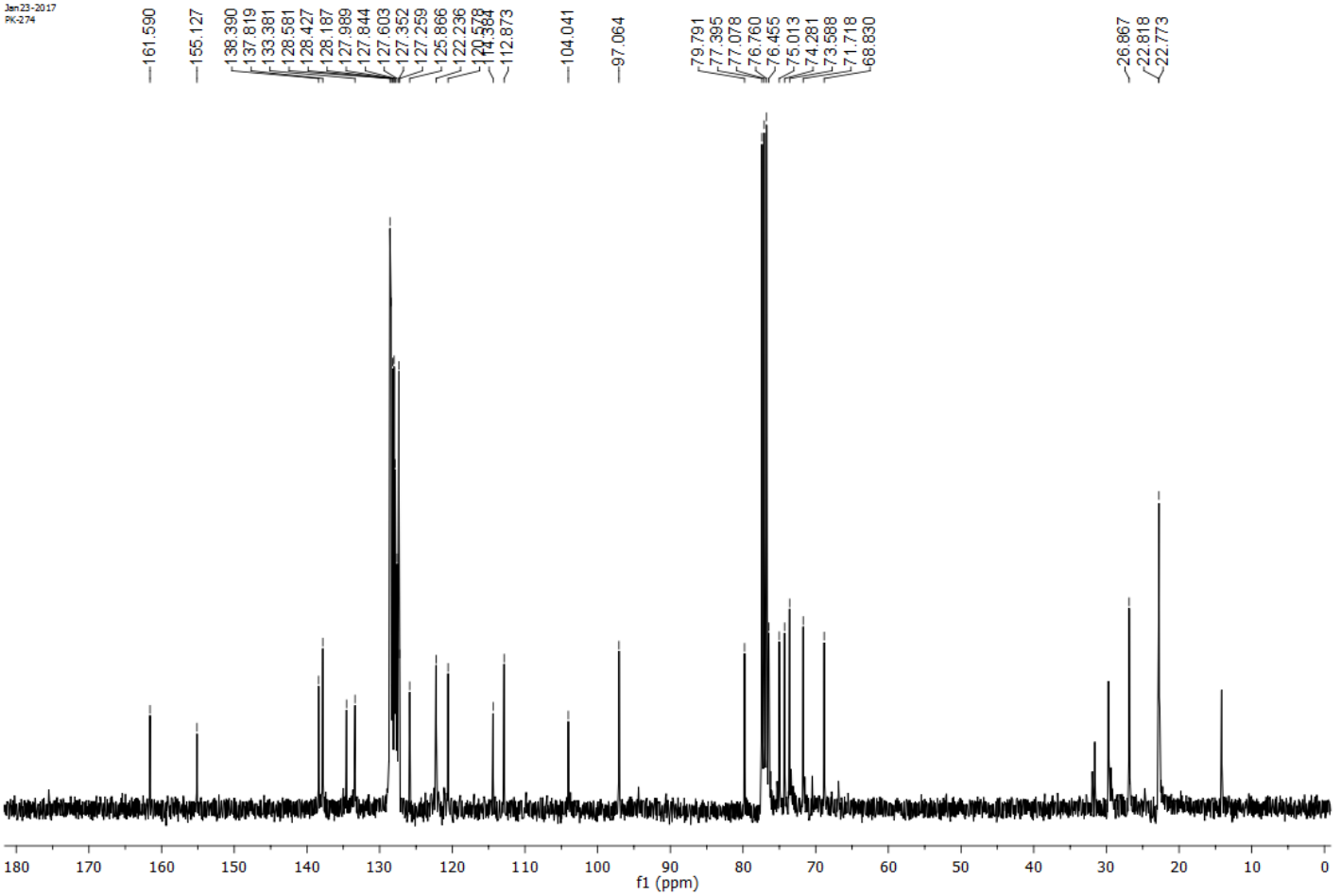

Jun08-2017
PK-265
8.926
7.888
7.867
7.397
7.387
7.332
7.319
7.309
7.291
7.273
7.261
6.097
4.965
4.935
4.863
4.832
4.698
4.669
4.638
4.607
4.480
4.451
4.415
4.385
4.164
3.998
3.872
3.856
3.841
3.633
3.617
3.609
3.594
3.525
3.509
3.501
3.488
0.000
OBn
H
O
O
OCF3
NH
BnO
OBn
O
16
1.14
0.97
3.61
2.96
2.75
2.01
2.01
1.14
0.48
0.27
1.00
1.20
1.12
1.30
1.13
1.39
1.12
1.12
1.17
1.32
1.23
1.28
f1 (ppm)

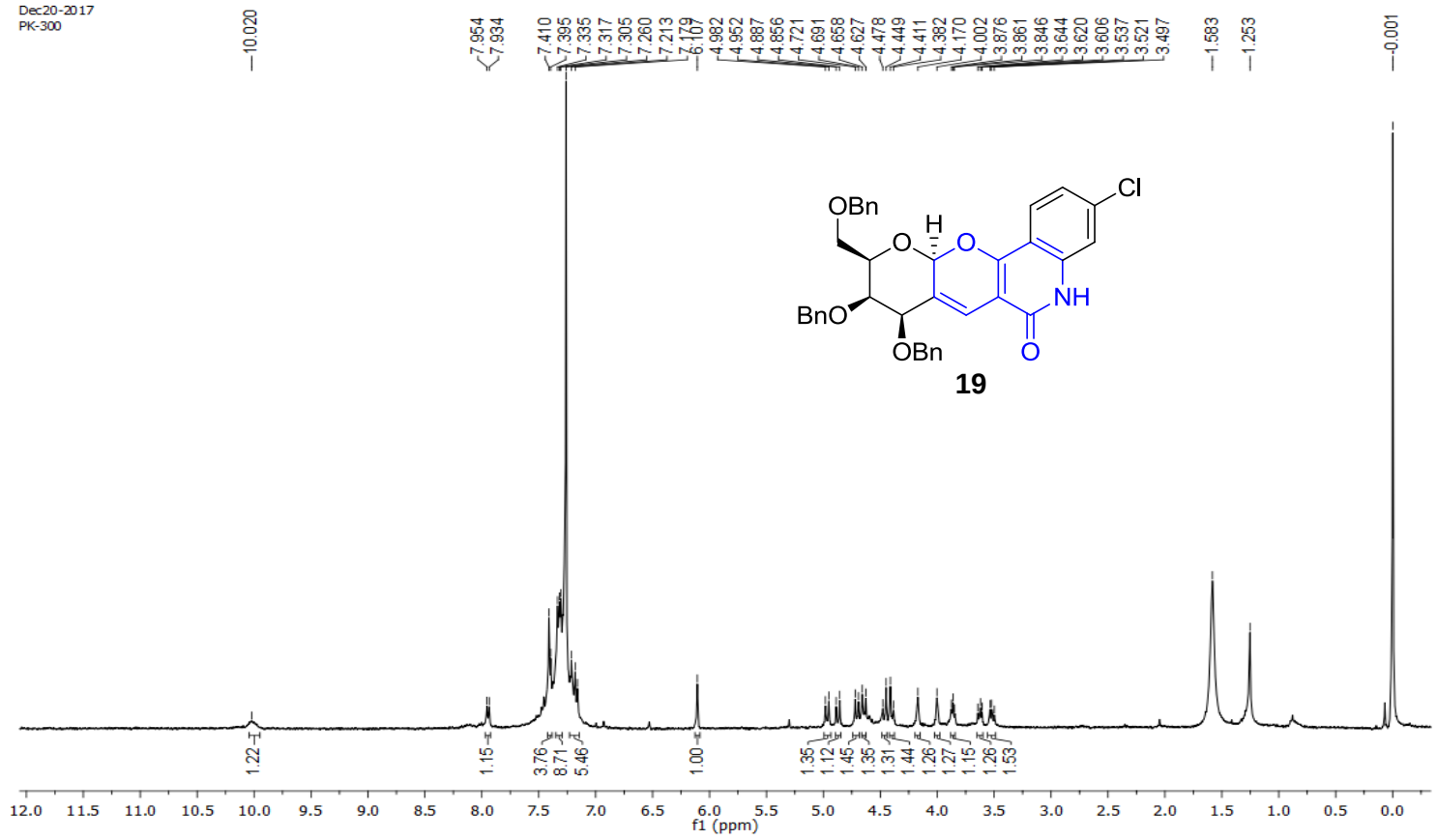

Jan16-2017
PK-265
161.008
153.897
138.258
137.694
129.947
128.633
128.585
128.443
128.203
127.998
127.897
127.852
127.672
127.396
126.974
121.799
121.171
116.119
112.622
105.555
96.950
79.638
77.371
77.053
76.735
76.533
75.150
74.344
73.616
71.707
68.804
f1 (ppm)

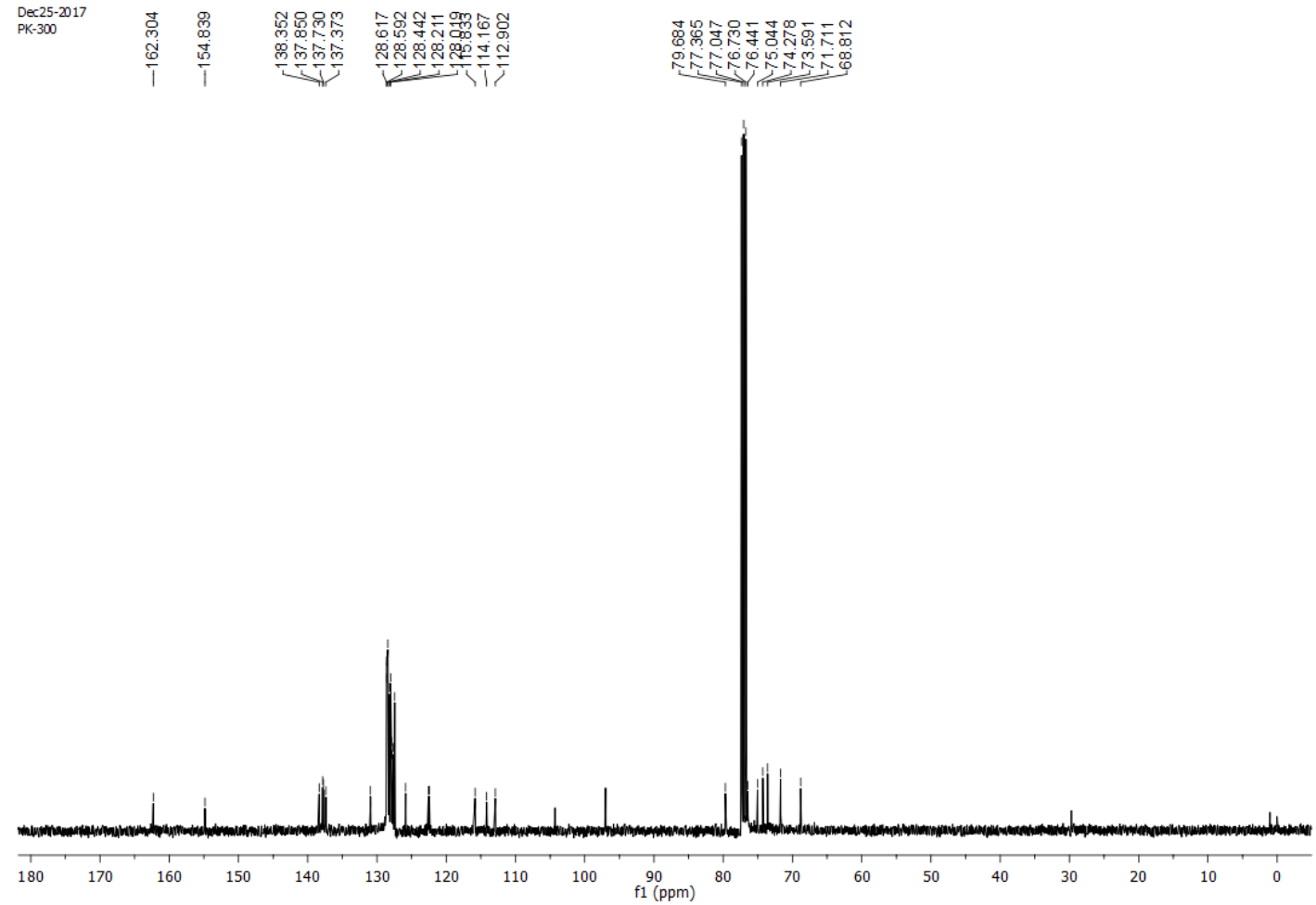

Jun07-2017
PK-266
10.954
8.051
8.032
7.508
7.416
7.297
7.261
6.136
4.986
4.959
4.881
4.861
4.725
4.693
4.670
4.639
4.487
4.458
4.423
4.389
4.189
4.026
3.882
3.652
3.638
3.631
3.611
3.541
3.528
3.523
3.506
1.587
0.000
OBn
H
O
O
CF3
NH
BnO
OBn
O
17
1.04
1.10
2.04
5.18
9.91
1.00
1.18
1.48
1.45
1.39
1.27
1.20
1.28
1.44
1.25
1.16
f1 (ppm)

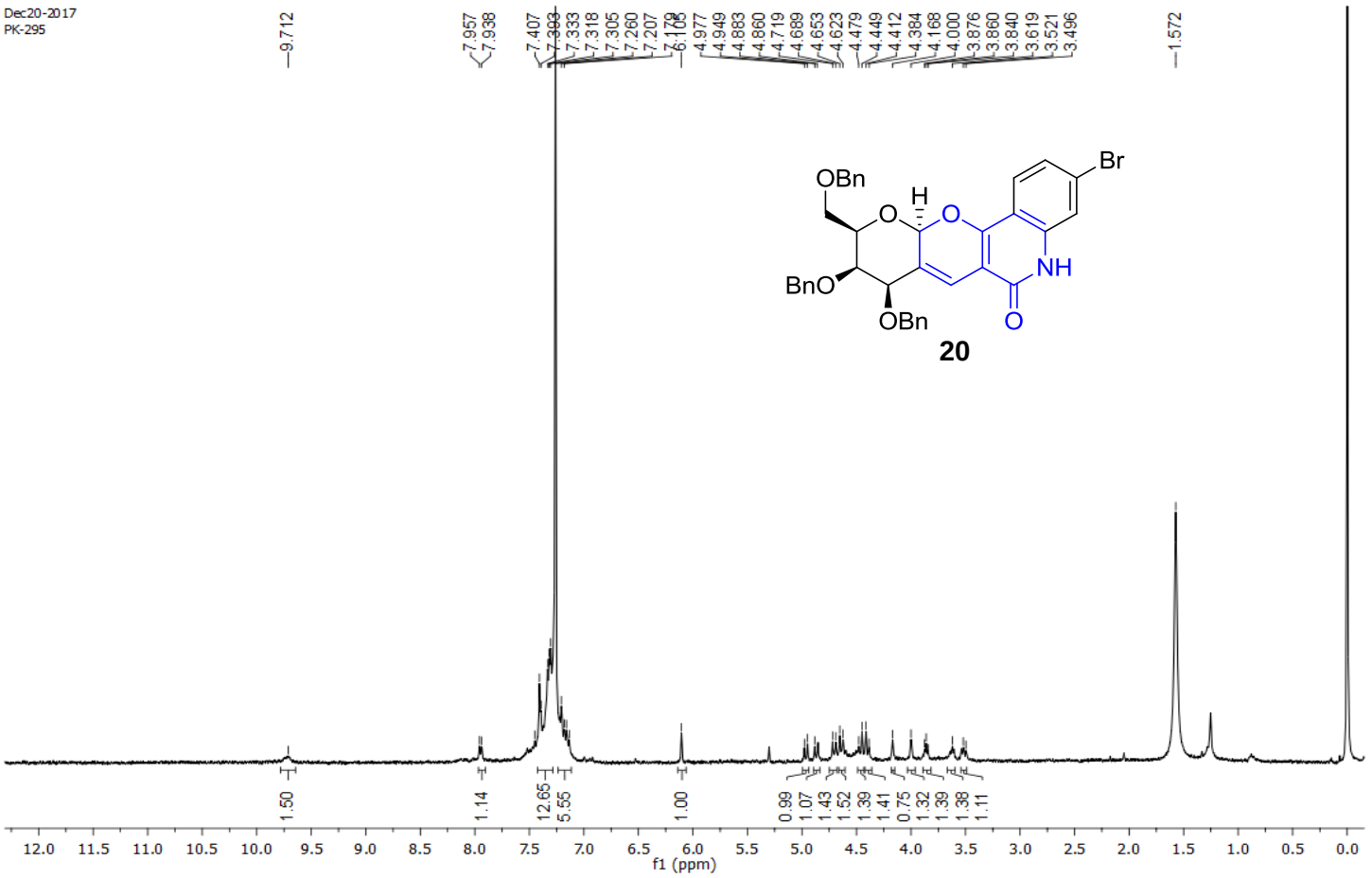

Jan16-2017
PK-266
162.428
158.430
153.860
138.166
138.043
137.652
137.453
136.872
128.635
128.449
128.217
128.007
116.443
112.481
106.071
106.071
103.069
96.988
79.579
77.340
77.023
76.705
76.337
75.189
74.385
73.626
71.827
68.774
f1 (ppm)

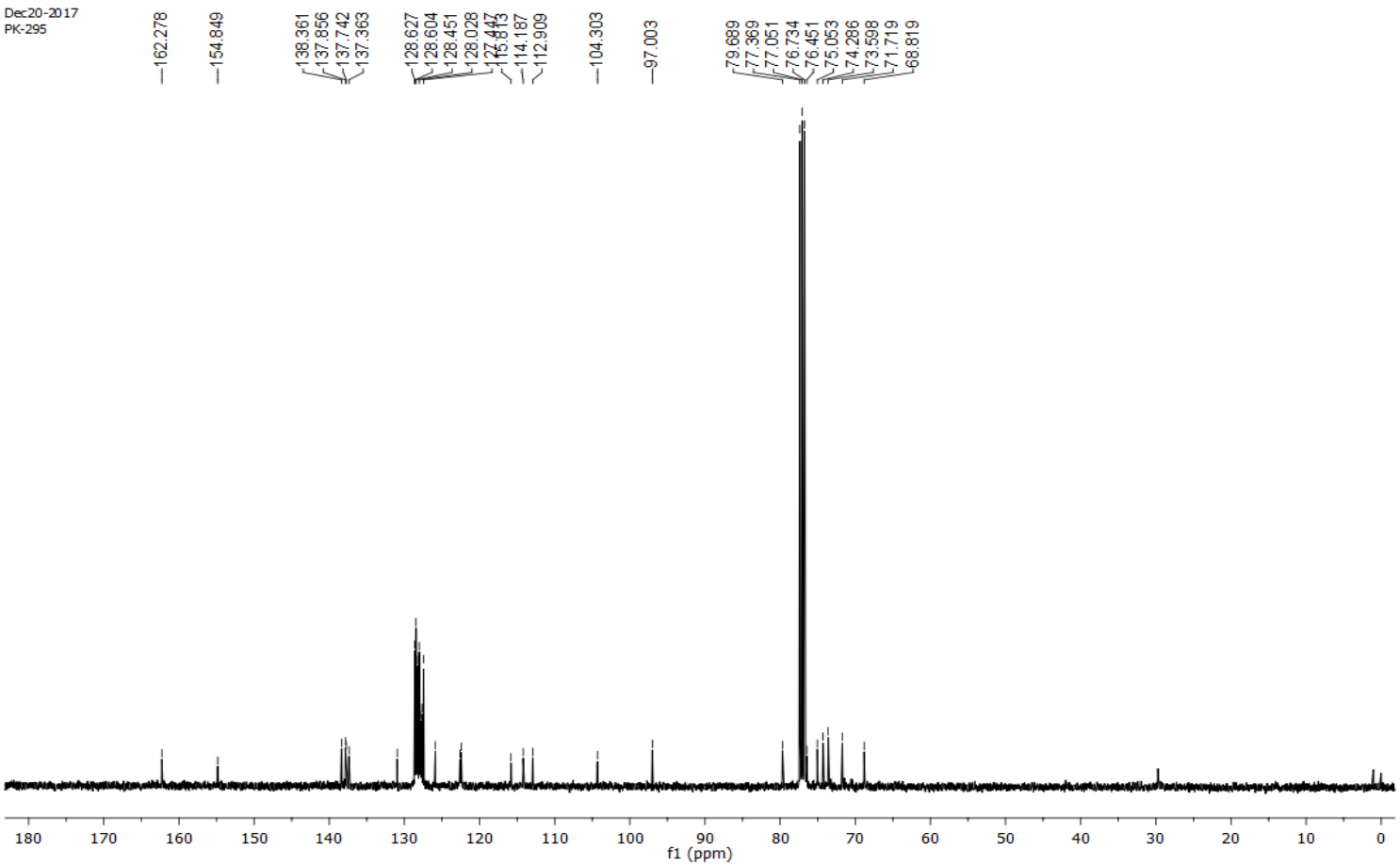

Jun07-2017
PK-274
8.818
7.854
7.835
7.397
7.314
7.297
7.260
7.188
7.164
6.090
4.970
4.941
4.872
4.841
4.706
4.677
4.642
4.611
4.477
4.447
4.412
4.162
3.994
3.868
3.852
3.622
3.615
3.600
3.544
3.528
3.521
3.167
3.150
1.610
1.333
1.326
1.255
0.876
0.856
0.000
OBn
O
H
O
CHMe2
NH
BnO
OBn
O
18
0.76
0.80
3.89
9.04
3.61
0.58
0.75
0.77
1.07
1.17
1.22
1.19
0.82
0.75
0.98
1.07
1.06
0.96
6.18
f1 (ppm)

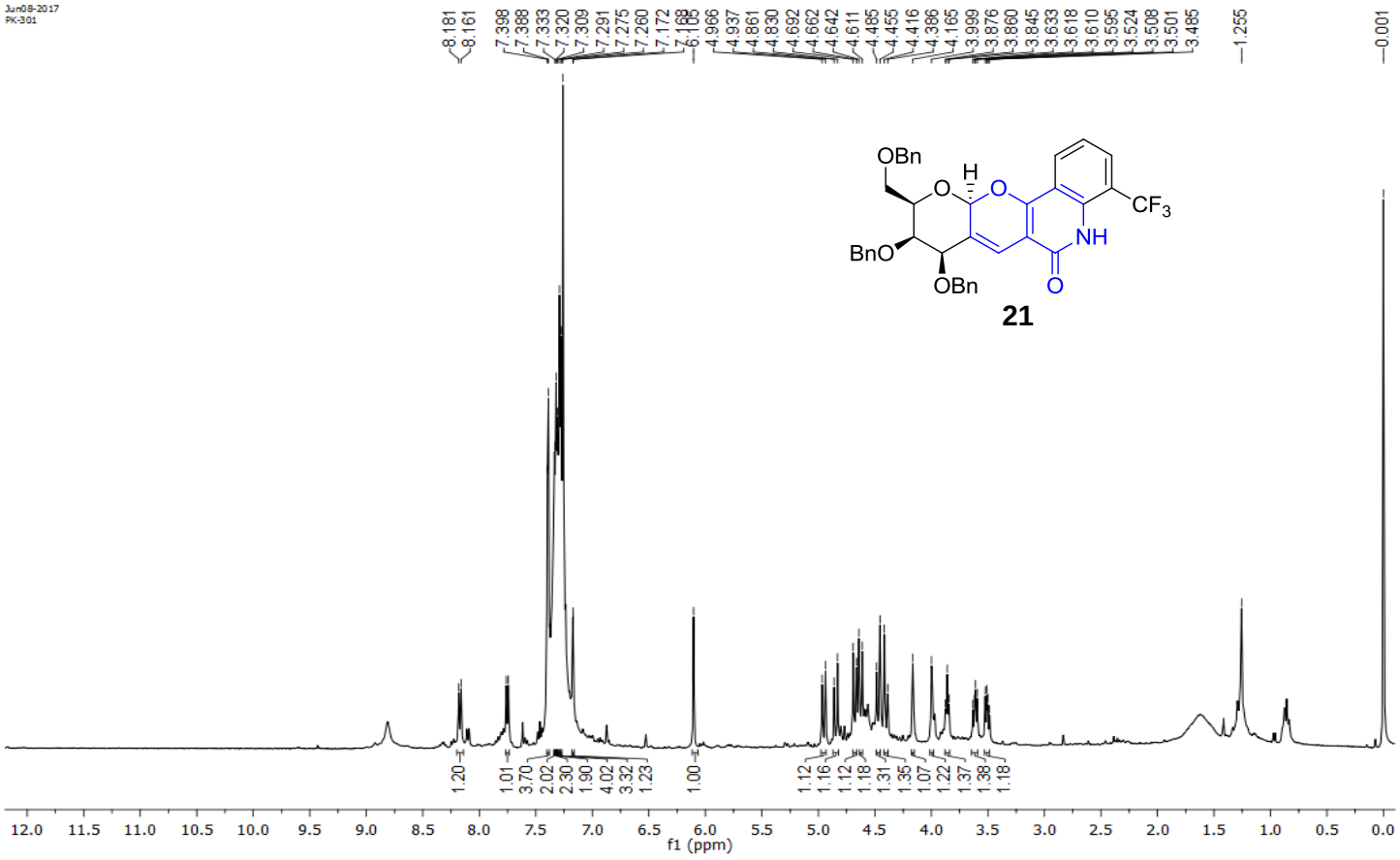

Jan23-2017
PK-274
161.590
155.127
138.390
137.819
133.381
128.581
128.427
128.187
127.989
127.844
127.603
127.352
127.259
125.866
122.236
120.578
114.384
112.873
104.041
97.064
79.791
77.395
77.078
76.760
76.455
75.013
74.281
73.588
71.718
68.830
26.867
22.818
22.773
f1 (ppm)

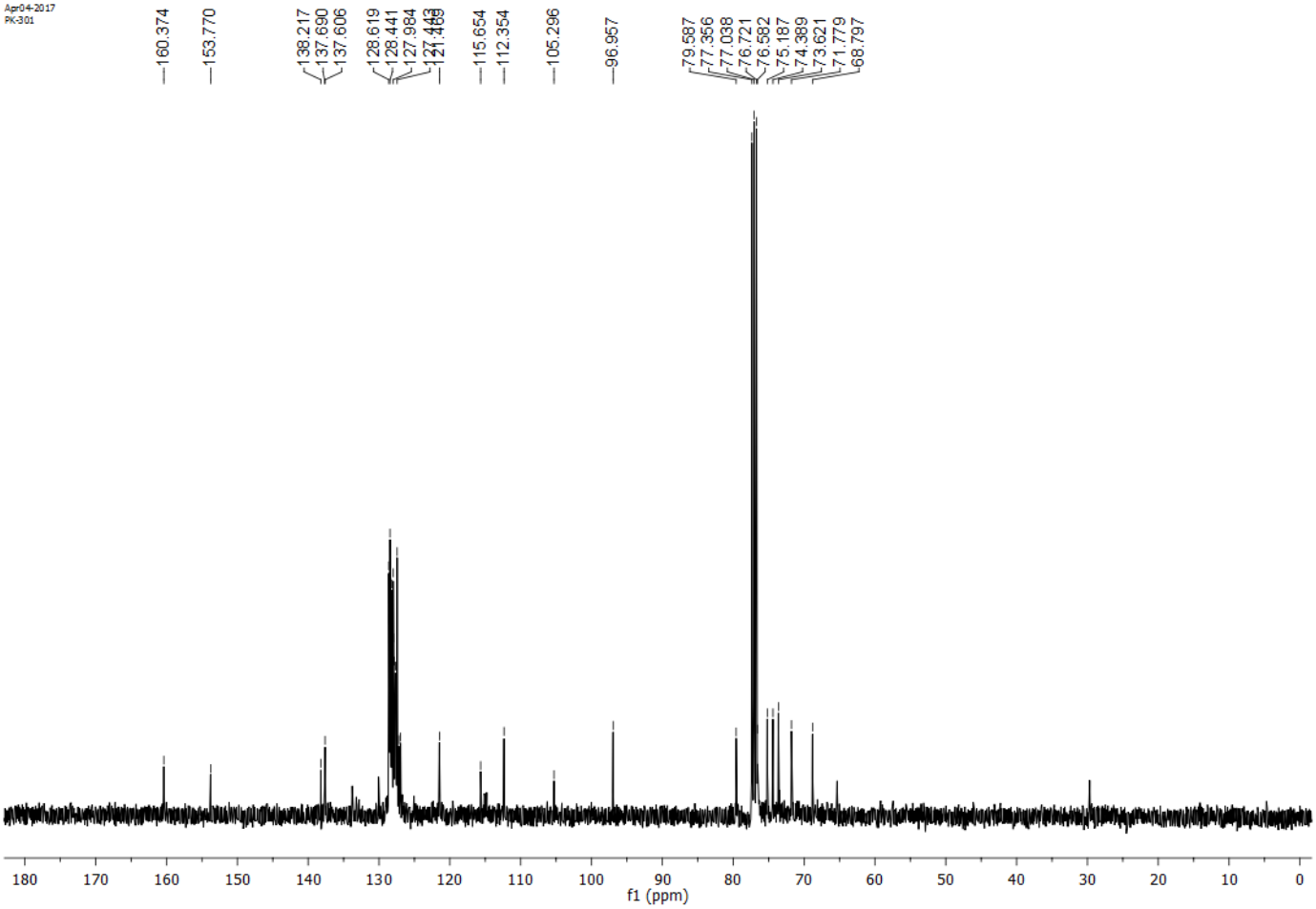

Dec20-2017
PK-300
10.020
7.954
7.934
7.410
7.395
7.335
7.317
7.305
7.260
7.213
7.179
6.107
4.982
4.952
4.887
4.856
4.721
4.691
4.658
4.627
4.478
4.449
4.411
4.382
4.170
4.002
3.876
3.861
3.846
3.644
3.620
3.606
3.537
3.521
3.497
1.583
1.253
0.001
OBn
O
H
O
Cl
NH
BnO
OBn
O
19
1.22
1.15
3.76
8.71
5.46
1.00
1.35
1.12
1.45
1.35
1.31
1.44
1.26
1.27
1.15
1.26
1.53
f1 (ppm)

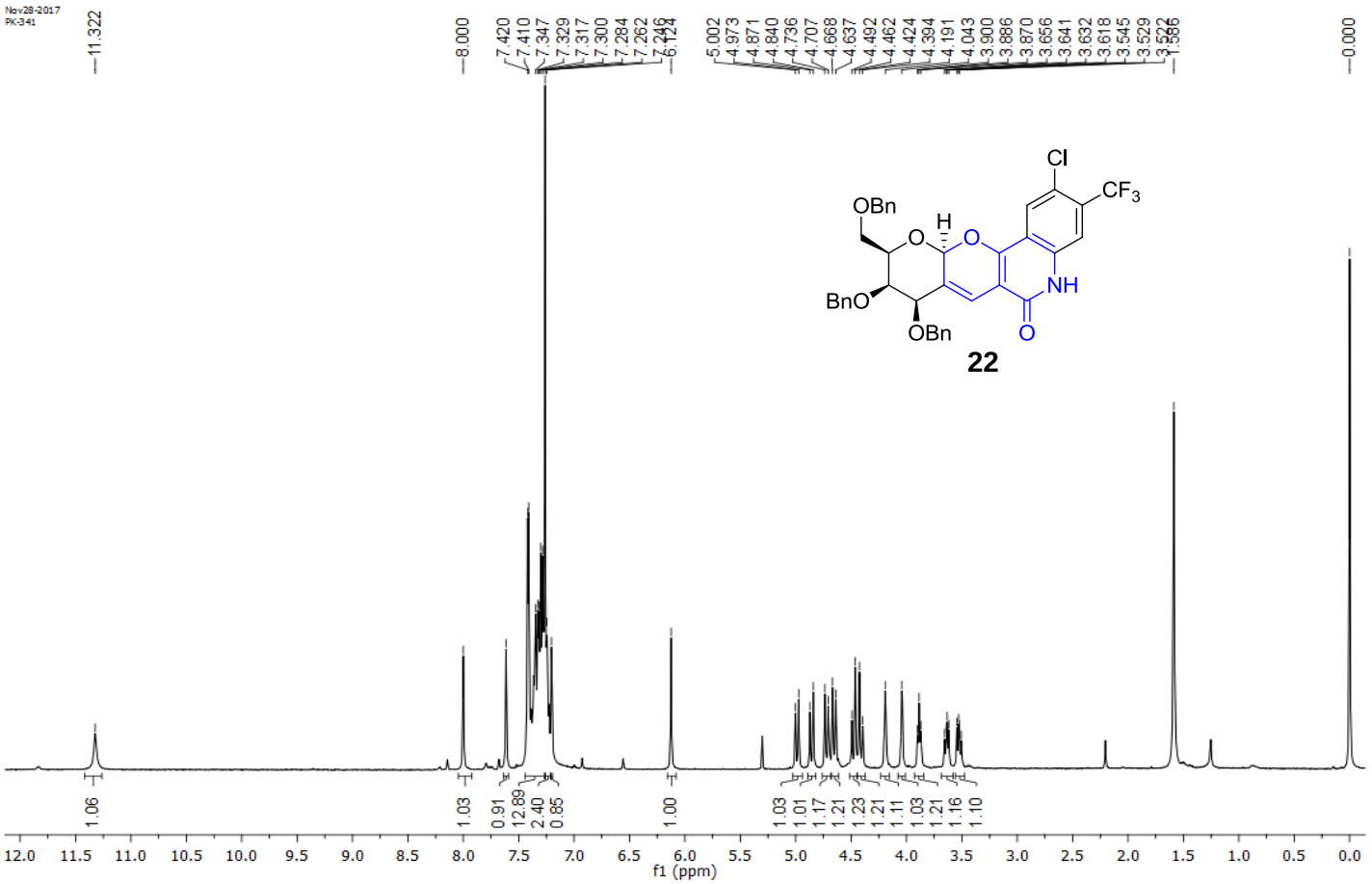

Dec25-2017
PK-300
162.304
154.839
138.352
137.850
137.730
137.373
128.617
128.592
128.442
128.211
128.019
115.833
114.167
112.902
79.684
77.365
77.047
76.730
76.441
75.044
74.278
73.591
71.711
68.812
f1 (ppm)

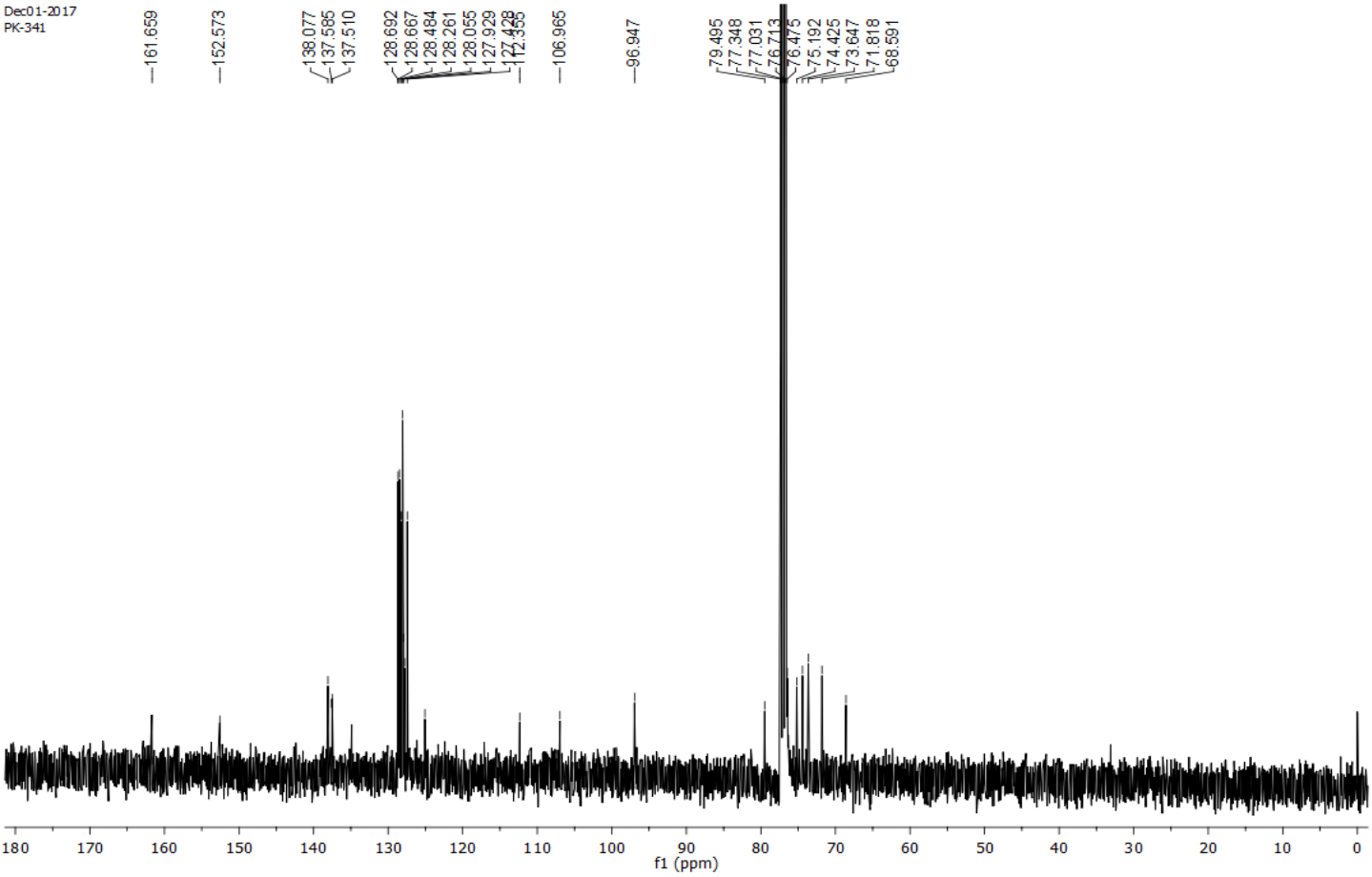

Dec20-2017
PK-295
9.712
7.957
7.938
7.407
7.393
7.333
7.318
7.305
7.260
7.207
7.179
6.105
4.977
4.949
4.883
4.860
4.719
4.689
4.653
4.623
4.479
4.449
4.412
4.384
4.168
4.000
3.876
3.860
3.840
3.619
3.521
3.496
1.572
OBn
O
H
O
Br
NH
BnO
OBn
O
20
1.50
1.14
12.65
5.55
1.00
0.99
1.07
1.43
1.52
1.39
1.41
0.75
1.32
1.39
1.38
1.11
f1 (ppm)

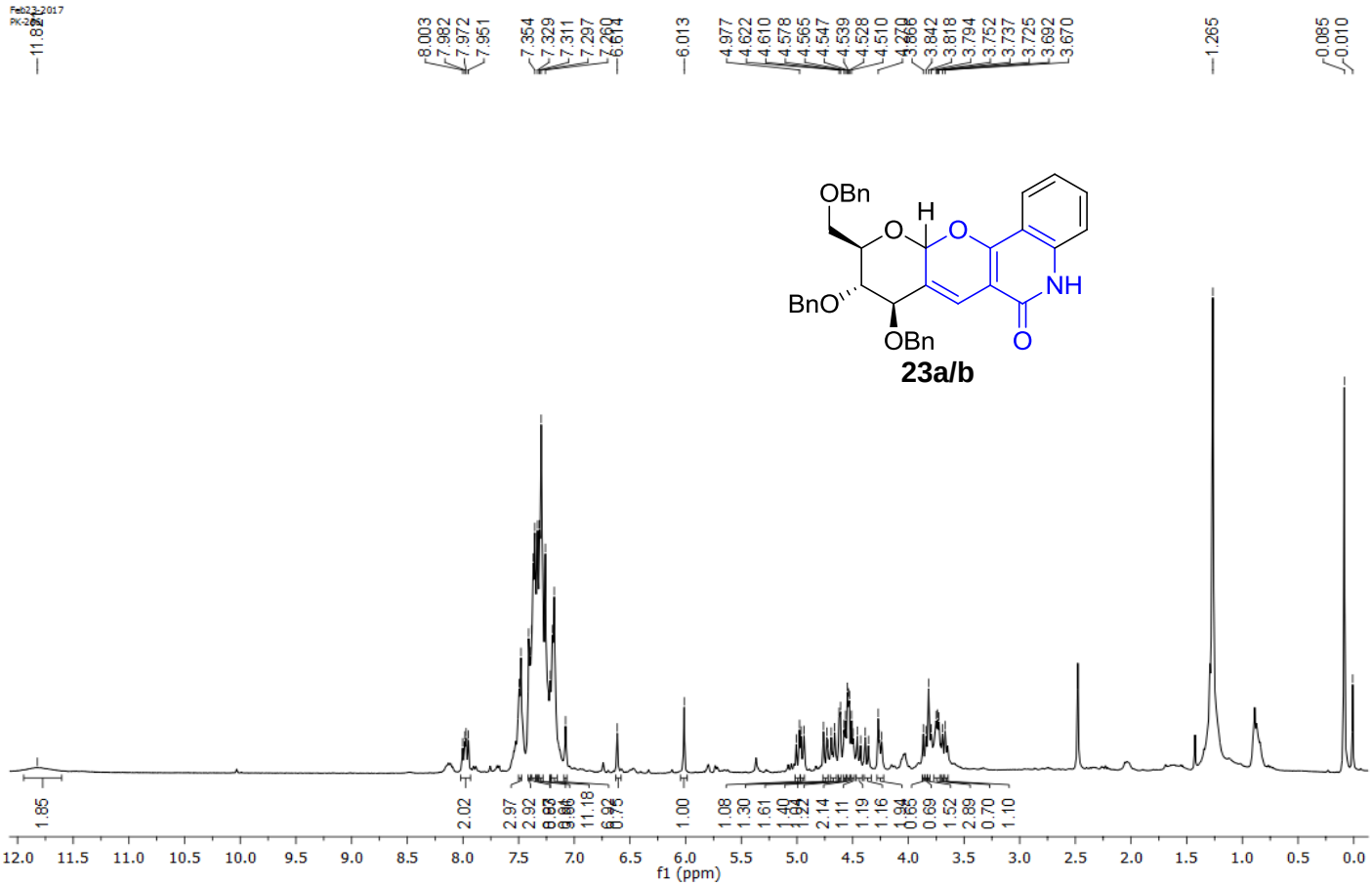

Dec20-2017
PK-295
162.278
154.849
138.361
137.856
137.742
137.363
128.627
128.604
128.451
128.028
127.447
115.813
114.187
112.909
104.303
97.003
79.689
77.369
77.051
76.734
76.451
75.053
74.286
73.598
71.719
68.819
f1 (ppm)

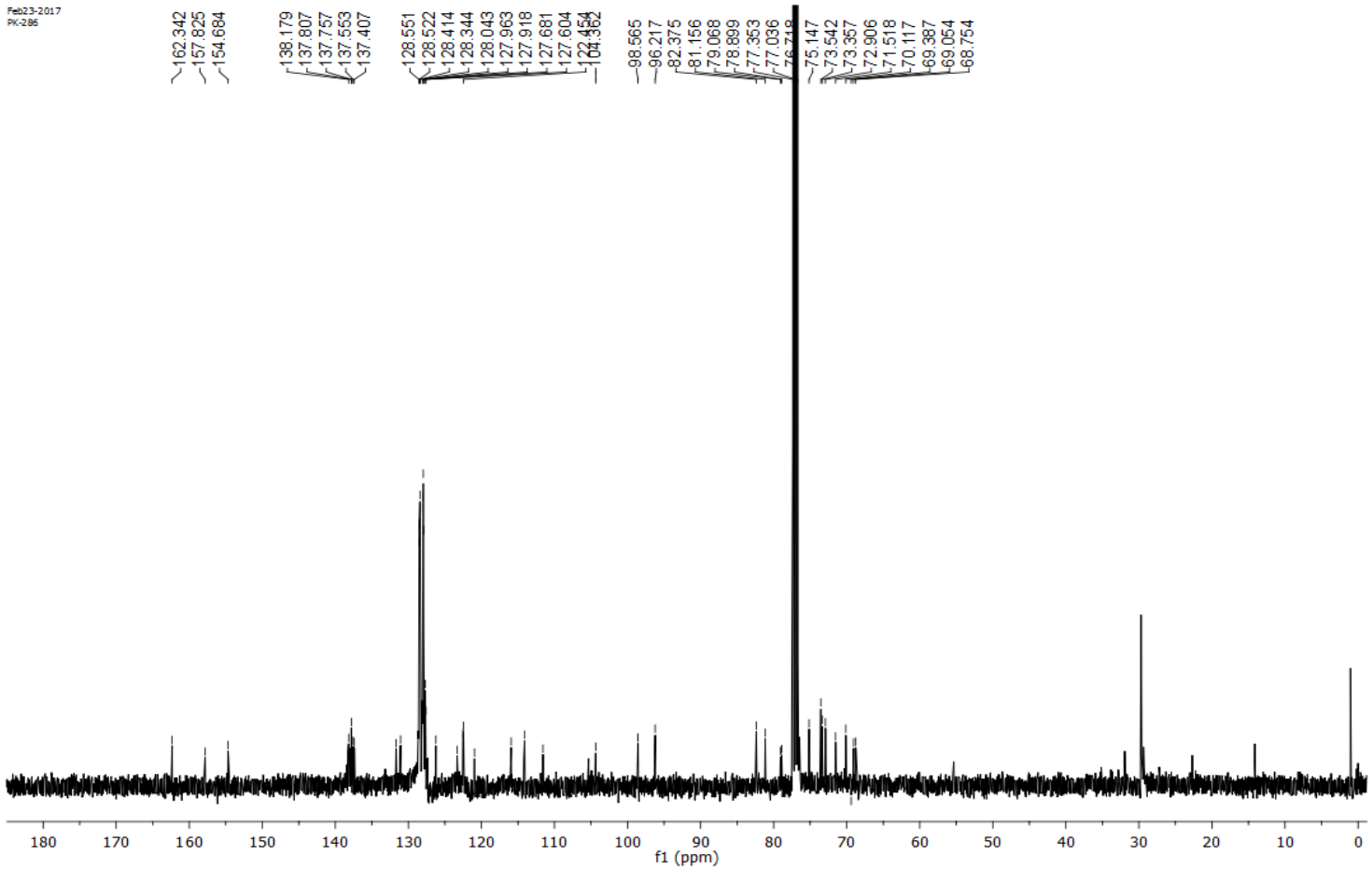

Jun08-2017
PK-301
OBn
O
H
O
CF3
BnO
NH
OBn
O
21
f1 (ppm)

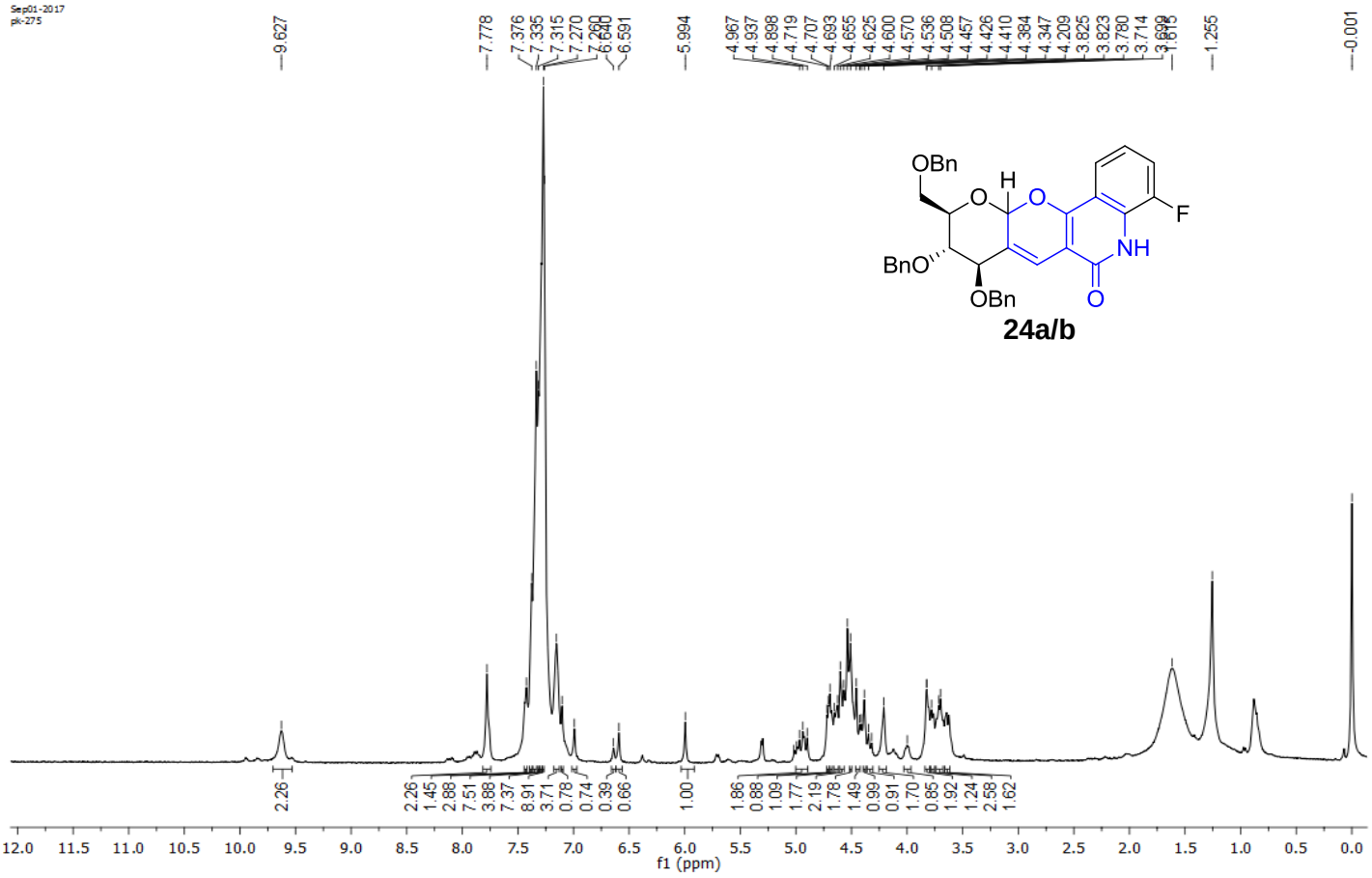

Apr04-2017
PK-301
f1 (ppm)


Nov28-2017
PK-341
11.322
8.000
7.420
7.410
7.347
7.329
7.317
7.300
7.284
7.262
6.124
5.002
4.973
4.871
4.840
4.736
4.707
4.668
4.637
4.492
4.462
4.424
4.394
4.191
4.043
3.900
3.886
3.870
3.656
3.641
3.632
3.618
3.545
3.529
3.522
1.586
0.000
Cl
CF3
OBn
H
O
O
NH
BnO
OBn
O
22
1.06
1.03
0.91
12.89
2.40
0.85
1.00
1.03
1.01
1.17
1.21
1.23
1.21
1.11
1.03
1.21
1.16
1.10
f1 (ppm)

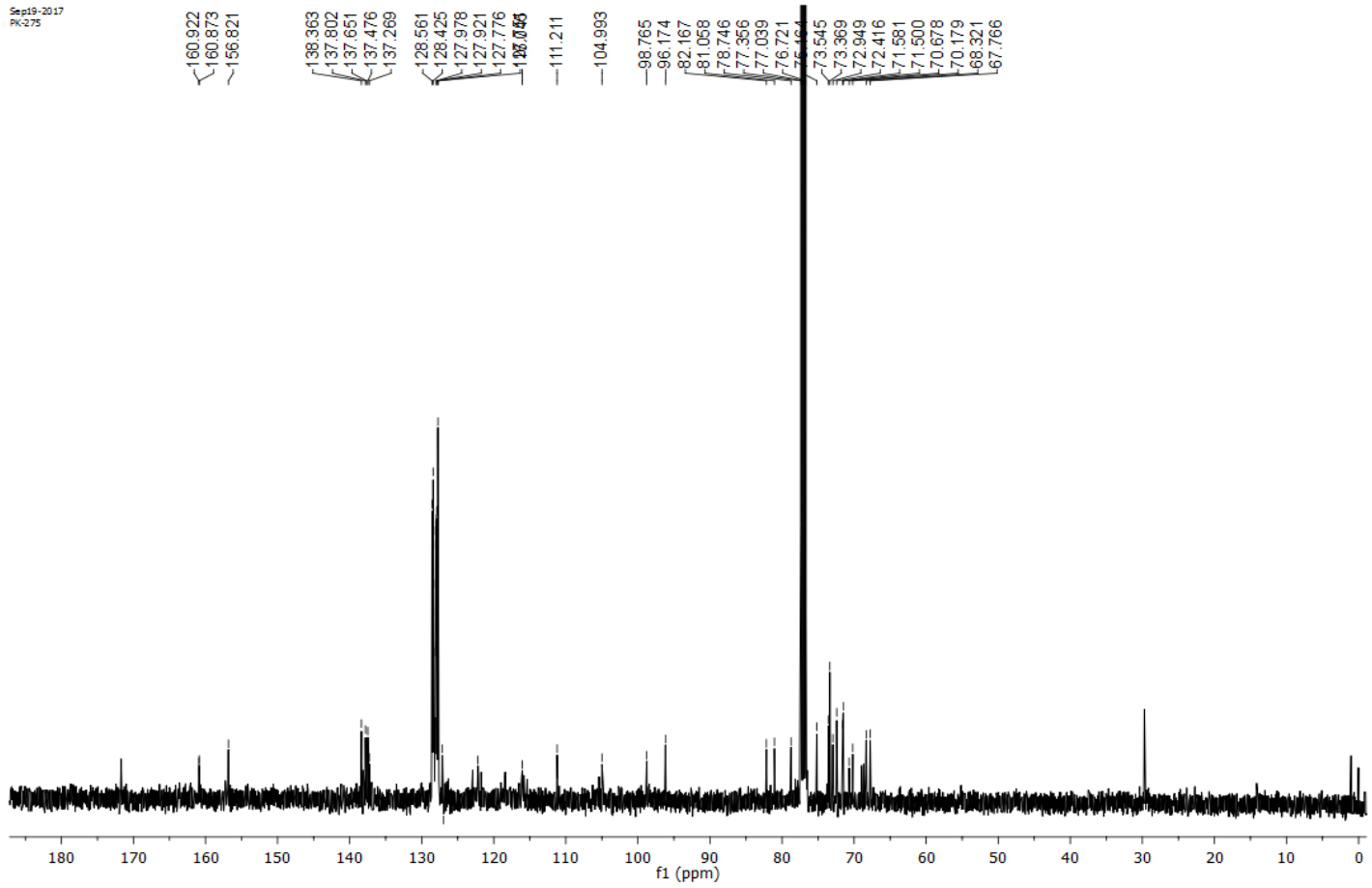

Dec01-2017
PK-341
161.659
152.573
138.077
137.585
137.510
128.692
128.667
128.484
128.261
128.055
127.929
127.428
127.355
106.965
96.947
79.495
77.348
77.031
76.713
76.475
75.192
74.425
73.647
71.818
68.591
f1 (ppm)

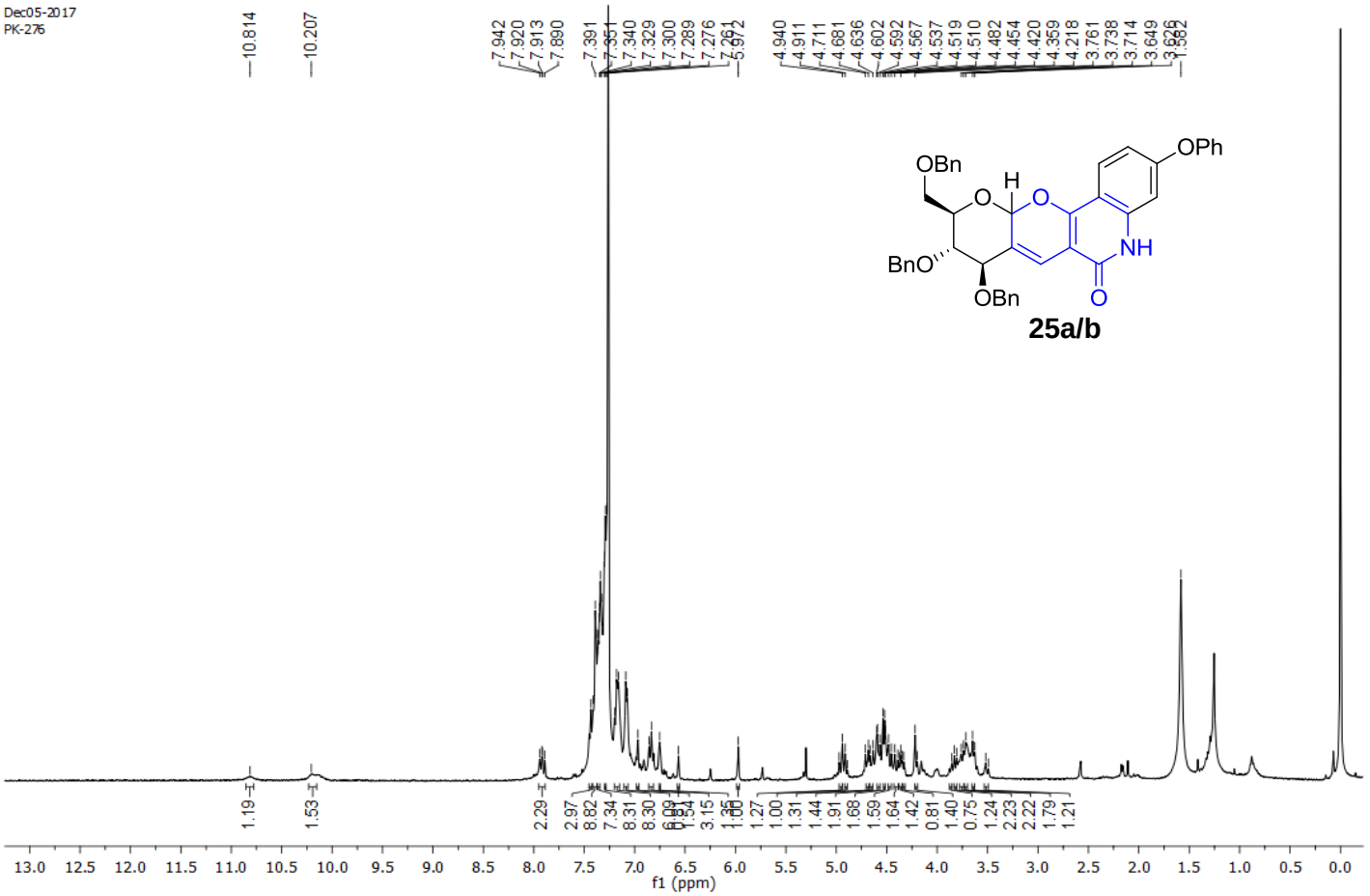

OBn
H
O
O
NH
BnO
OBn
O
23a/b
f1 (ppm)

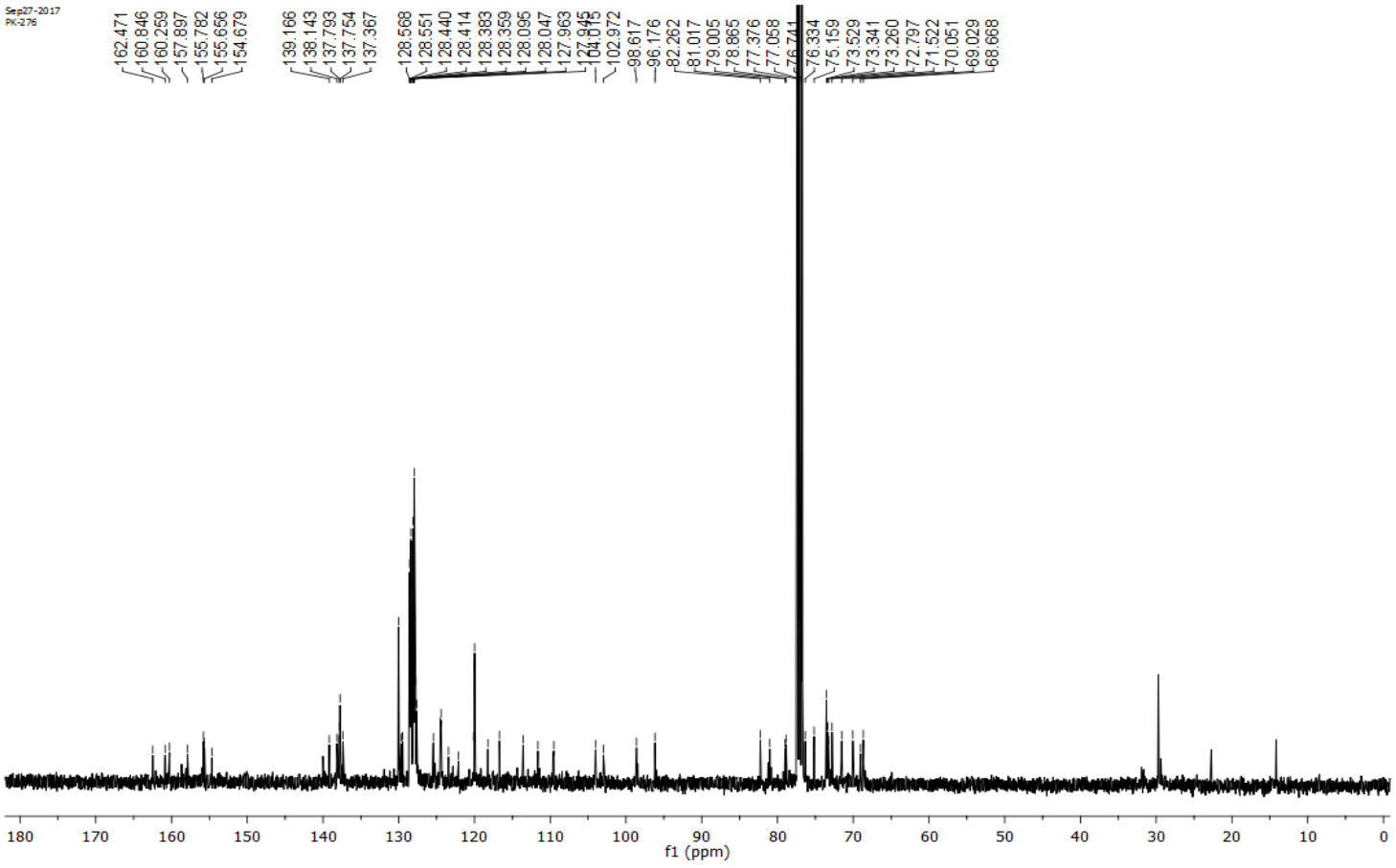

f1 (ppm)

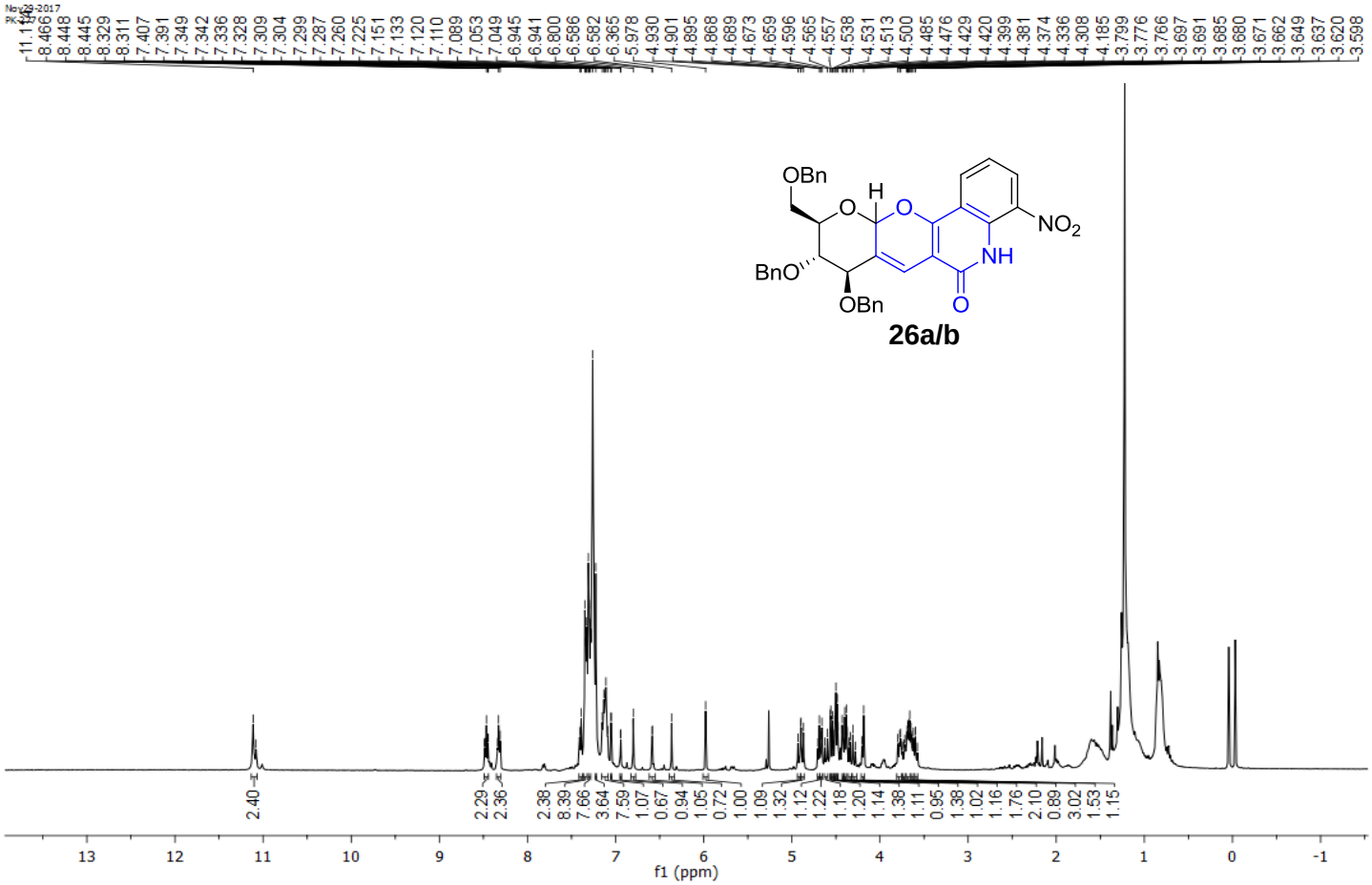

Sep01-2017
pk-275
OBn
H
O
O
F
NH
BnO
OBn
O
f1 (ppm)

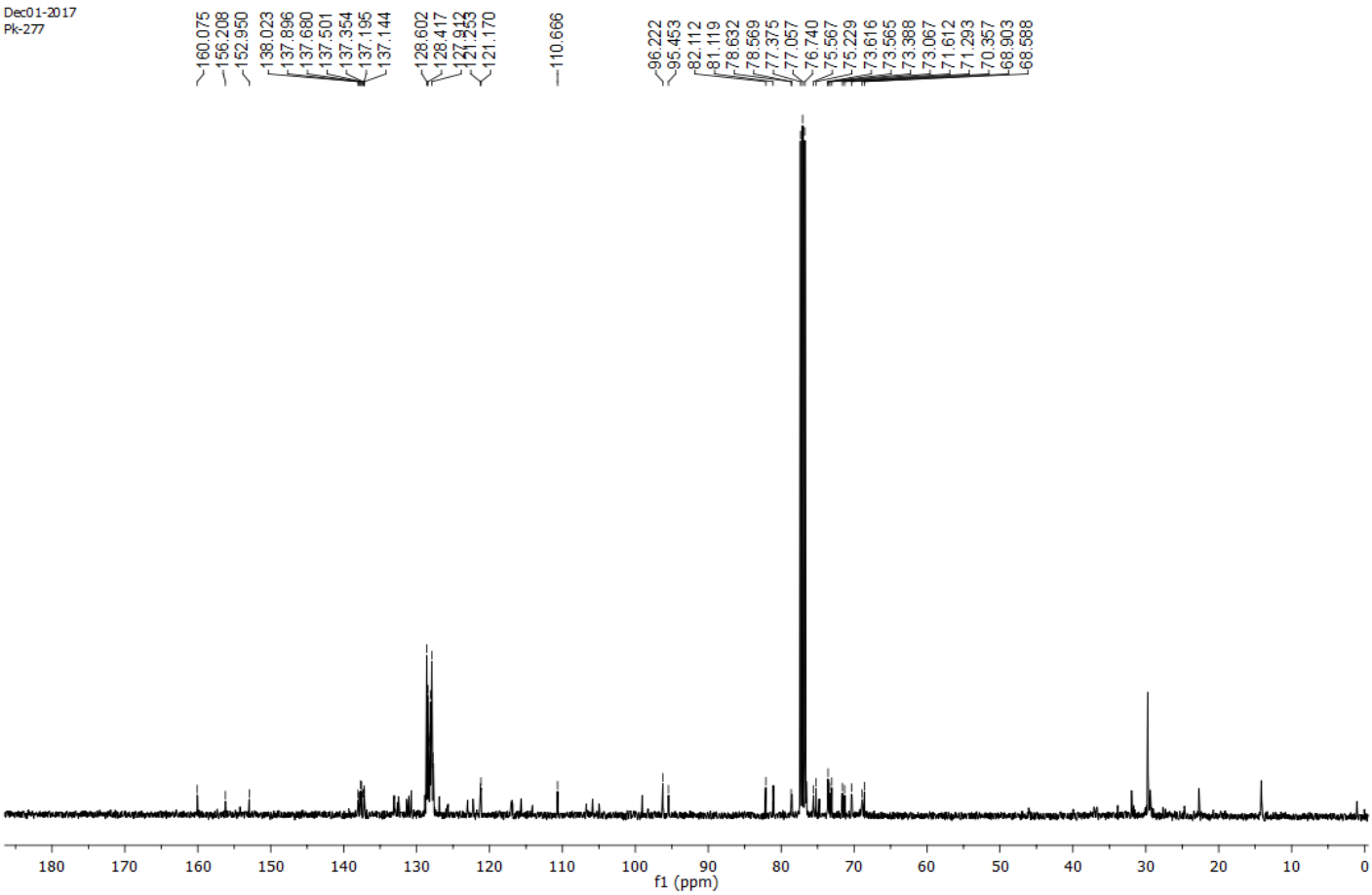
24a/b

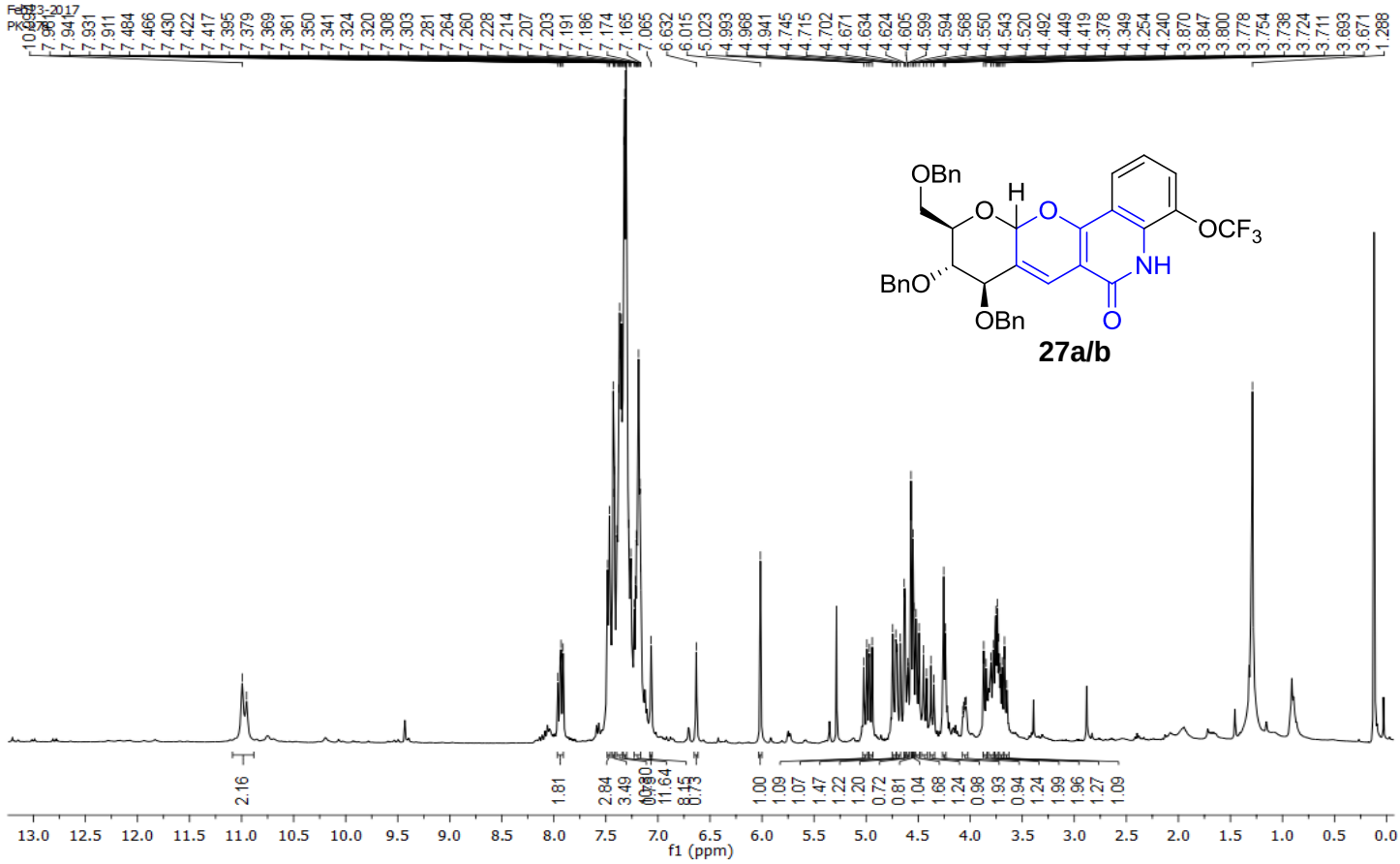

Sep19-2017
PK-275
f1 (ppm)

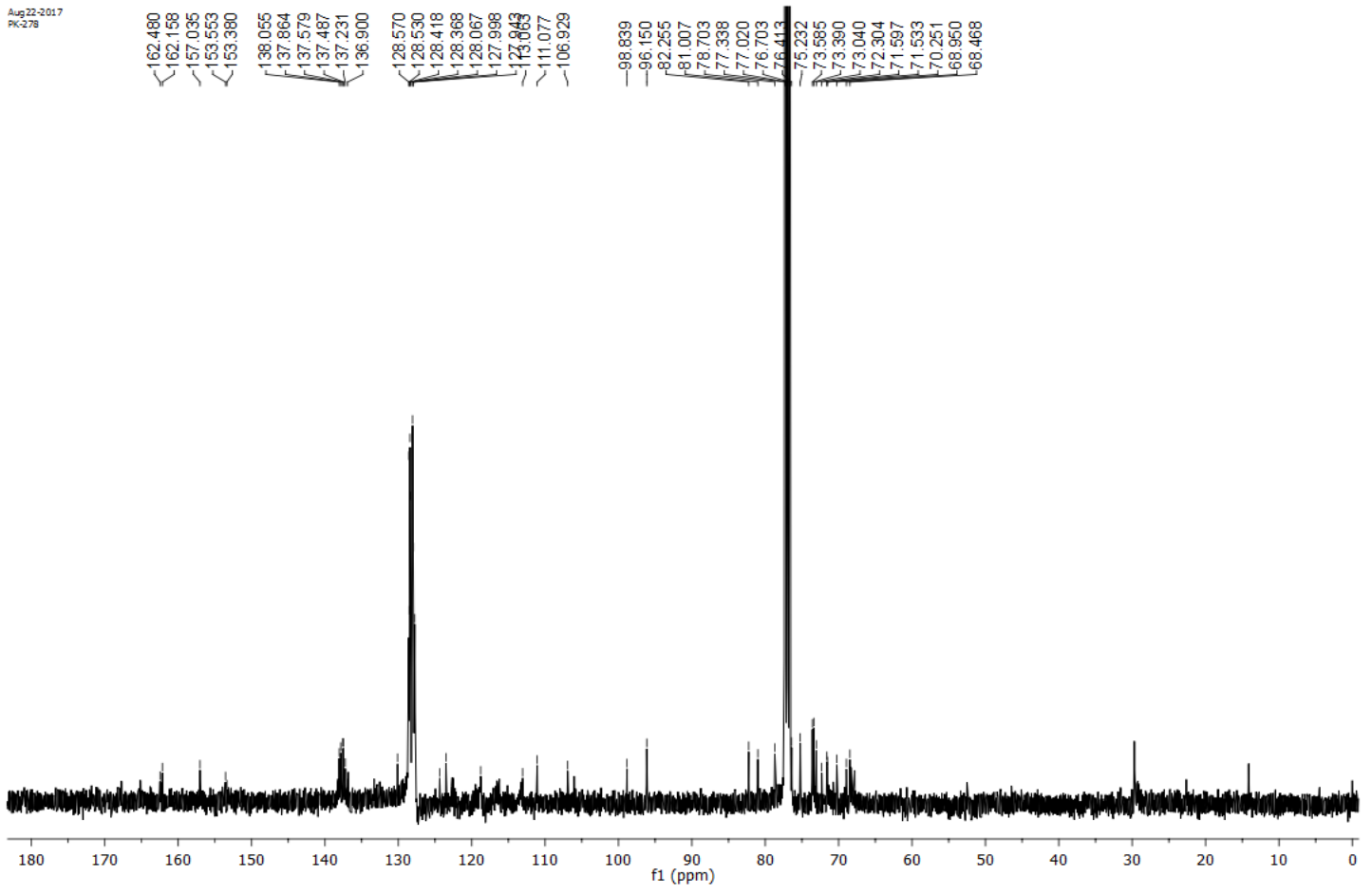

Dec05-2017
PK-276
OBn
OPh
BnO
OBn
NH
O
H
25a/b
f1 (ppm)

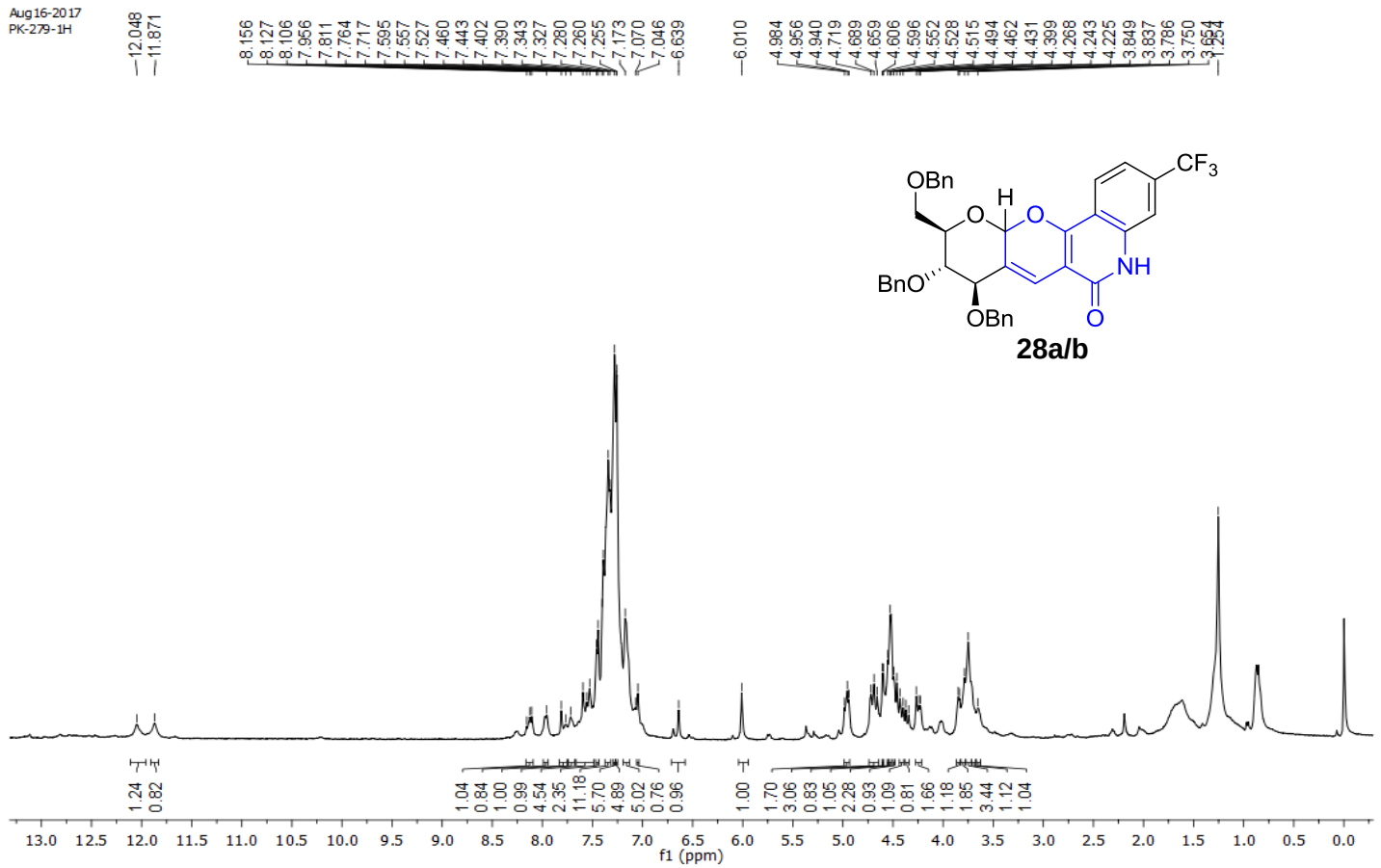

Sep27-2017
PK-276
f1 (ppm)

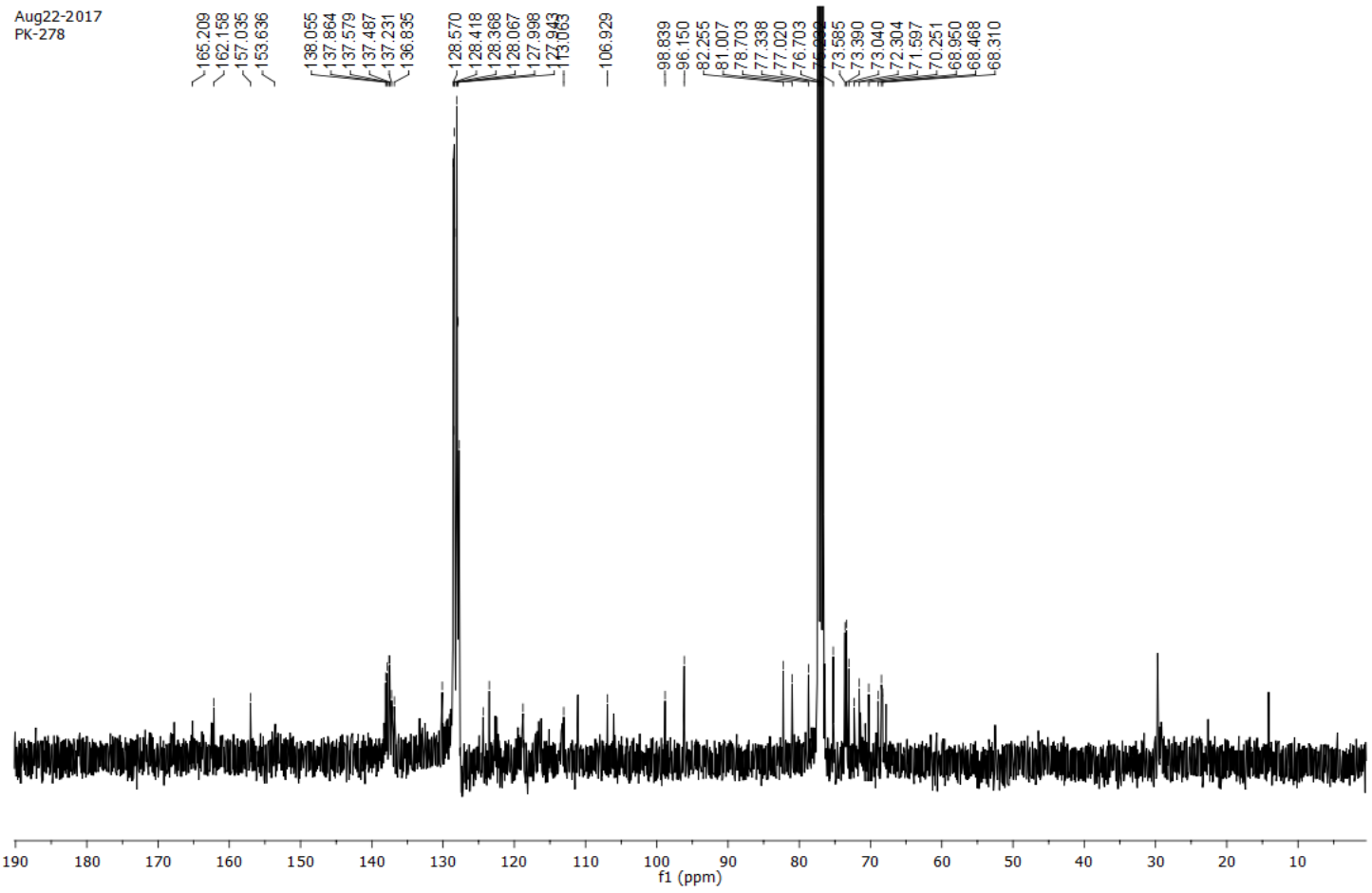

OBn
H
O
O
NO2
BnO
NH
OBn
O
26a/b
f1 (ppm)

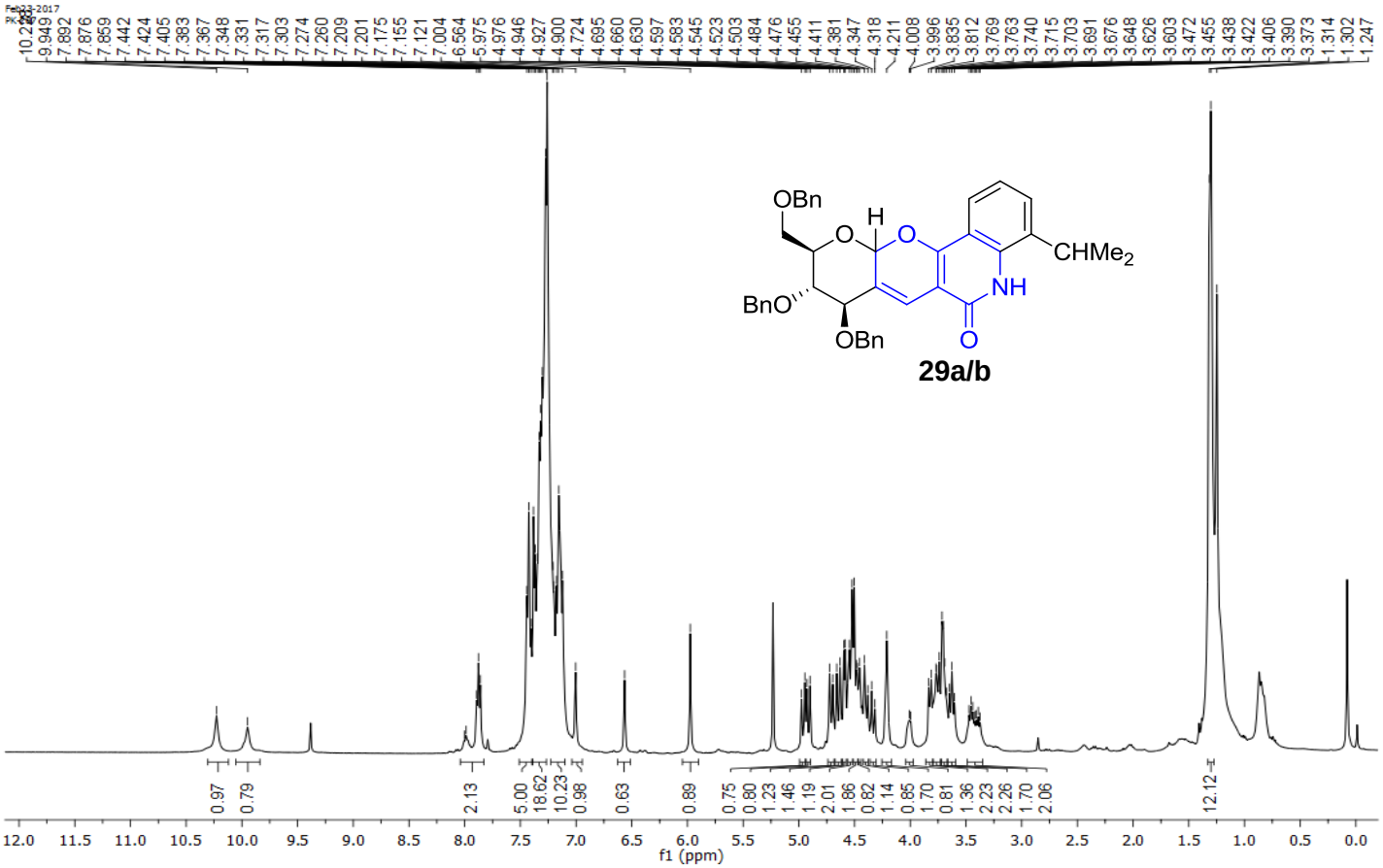

Dec01-2017
Pk-277
f1 (ppm)

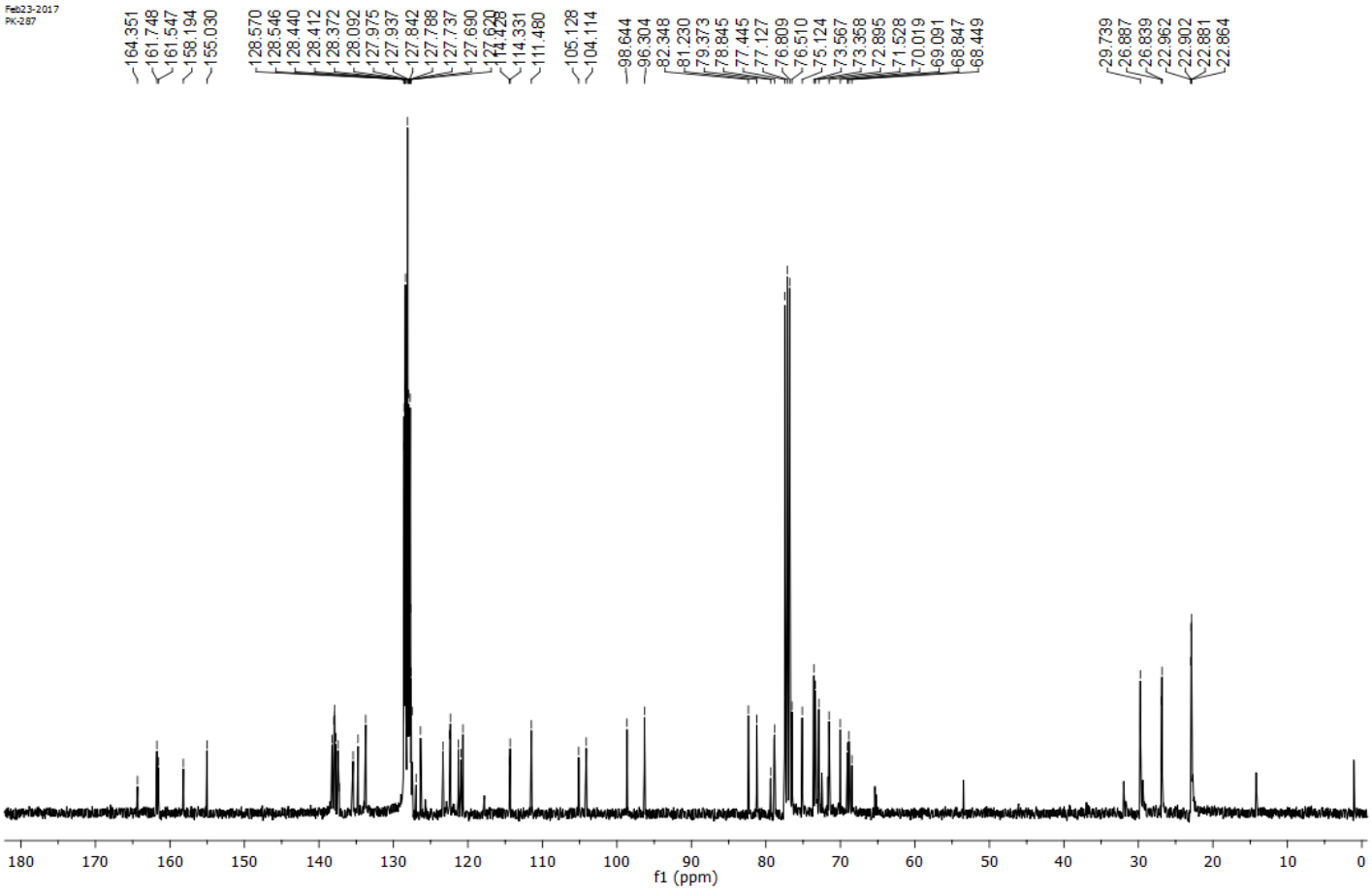

OBn
H
O
O
OCF3
NH
BnO
OBn
O
27a/b
f1 (ppm)


f1 (ppm)

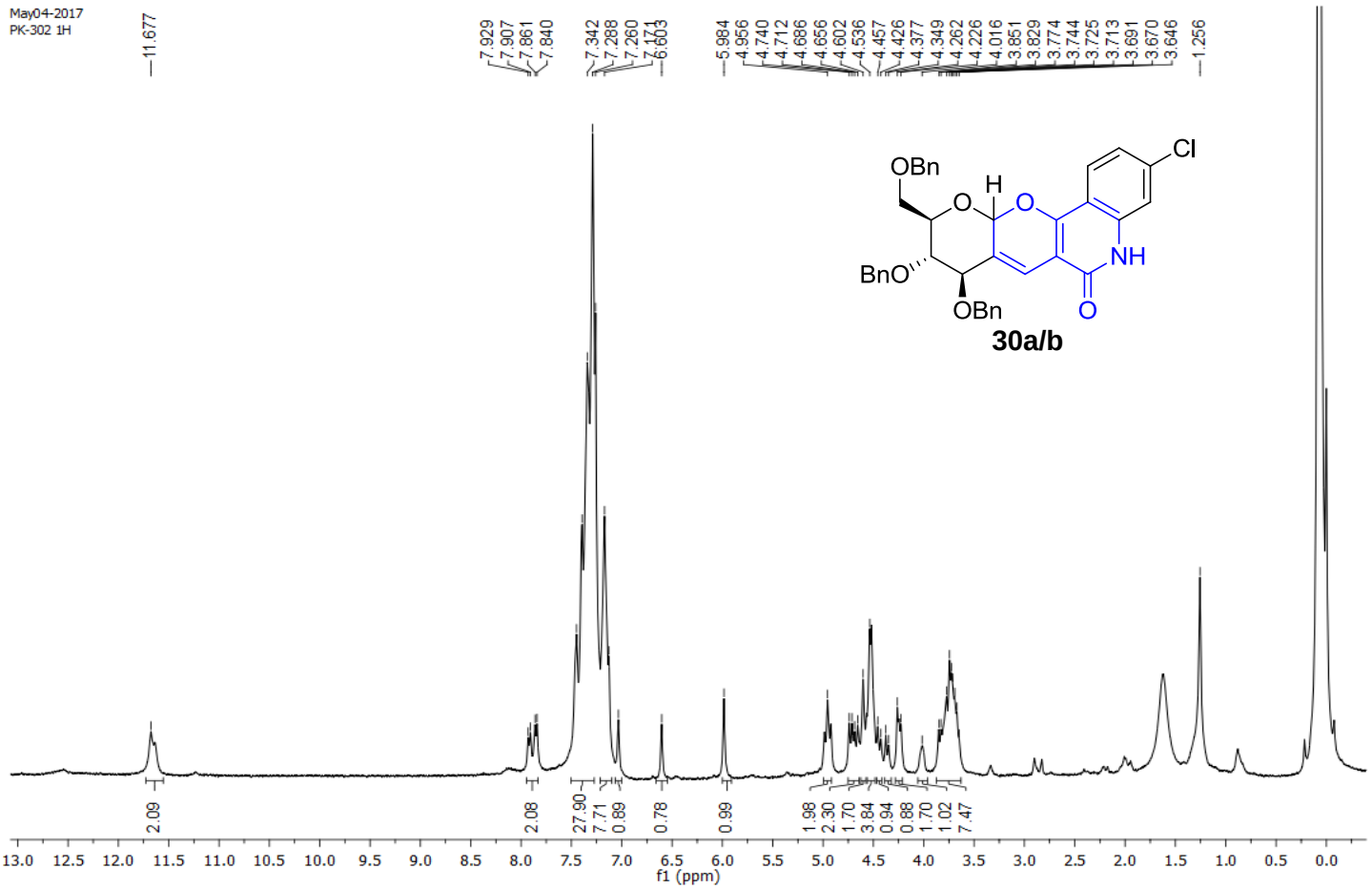

Aug16-2017
PK-279-1H
12.048
11.871
8.156
8.127
8.106
7.956
7.811
7.764
7.717
7.595
7.557
7.527
7.460
7.443
7.402
7.390
7.343
7.327
7.280
7.260
7.255
7.173
7.070
7.046
6.639
6.010
4.984
4.956
4.940
4.719
4.689
4.659
4.606
4.596
4.552
4.528
4.515
4.494
4.462
4.431
4.399
4.268
4.243
4.225
3.849
3.837
3.786
3.750
3.654
1.254
OBn
H
O
O
CF3
NH
BnO
OBn
O
28a/b
1.24
0.82
1.04
0.84
1.00
0.99
4.54
2.35
11.18
5.70
4.89
5.02
0.76
0.96
1.00
1.70
3.06
0.83
1.05
2.28
0.93
1.09
0.81
1.66
1.18
1.85
3.44
1.12
1.04
f1 (ppm)


Aug22-2017
PK-278
165.209
162.158
157.035
153.636
138.055
137.864
137.579
137.487
137.231
136.835
128.570
128.418
128.368
128.067
127.998
113.063
106.929
98.839
96.150
82.255
81.007
78.703
77.338
77.020
76.703
73.585
73.390
73.040
72.304
71.597
70.251
68.950
68.468
68.310
f1 (ppm)


OBn
H
O
O
CHMe2
NH
BnO
OBn
O
29a/b
f1 (ppm)

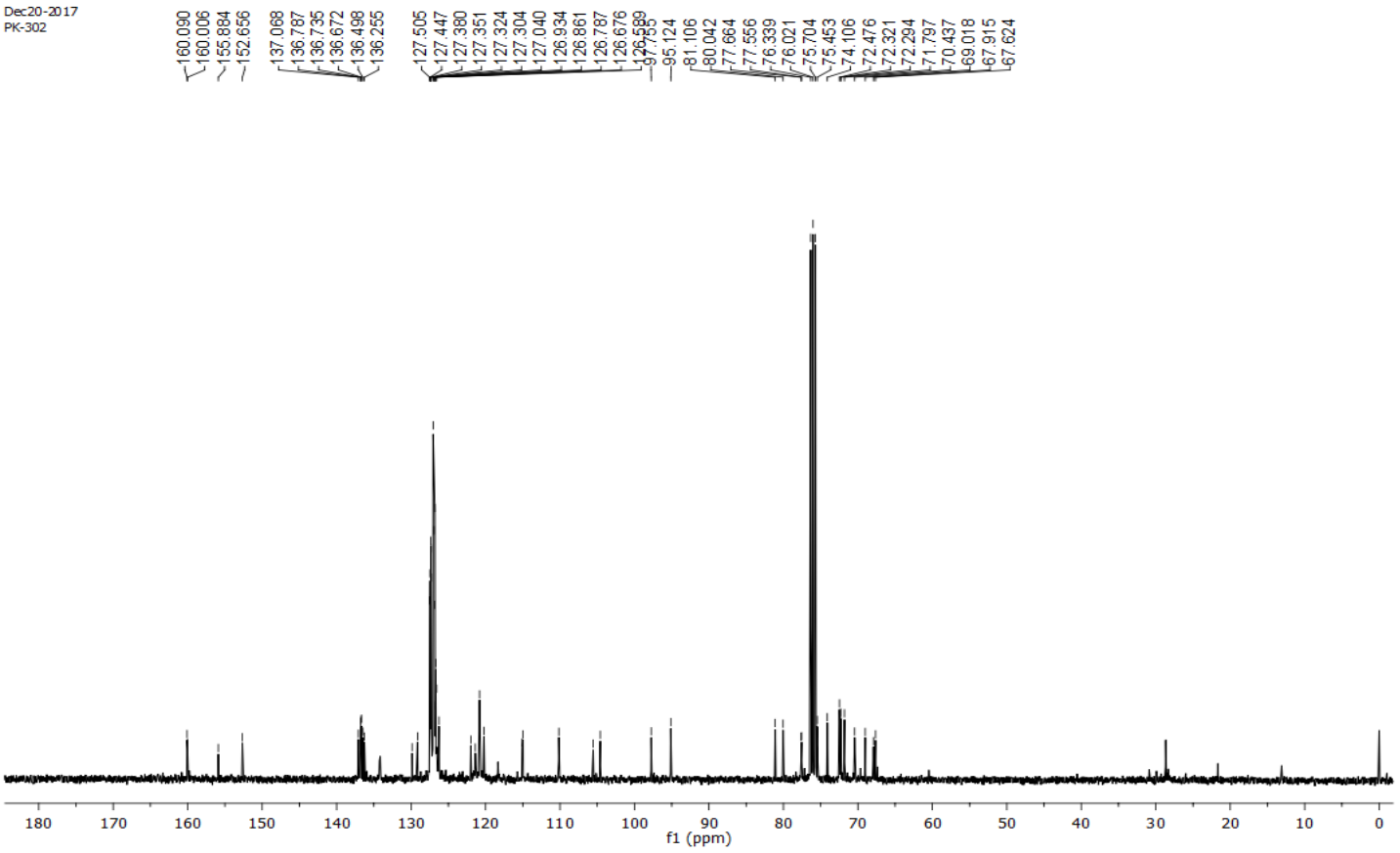

f1 (ppm)

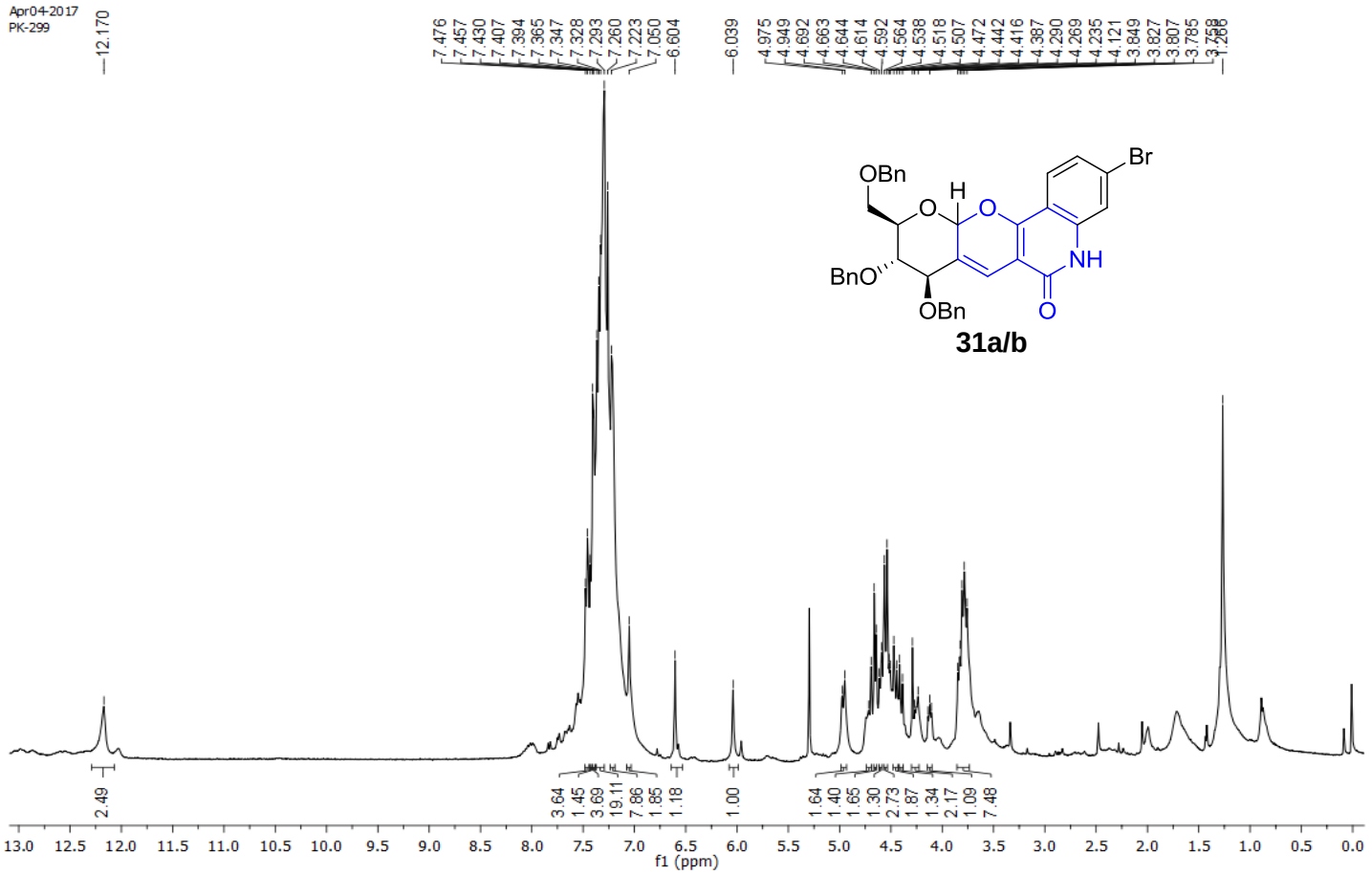
May04-2017
PK-302 1H

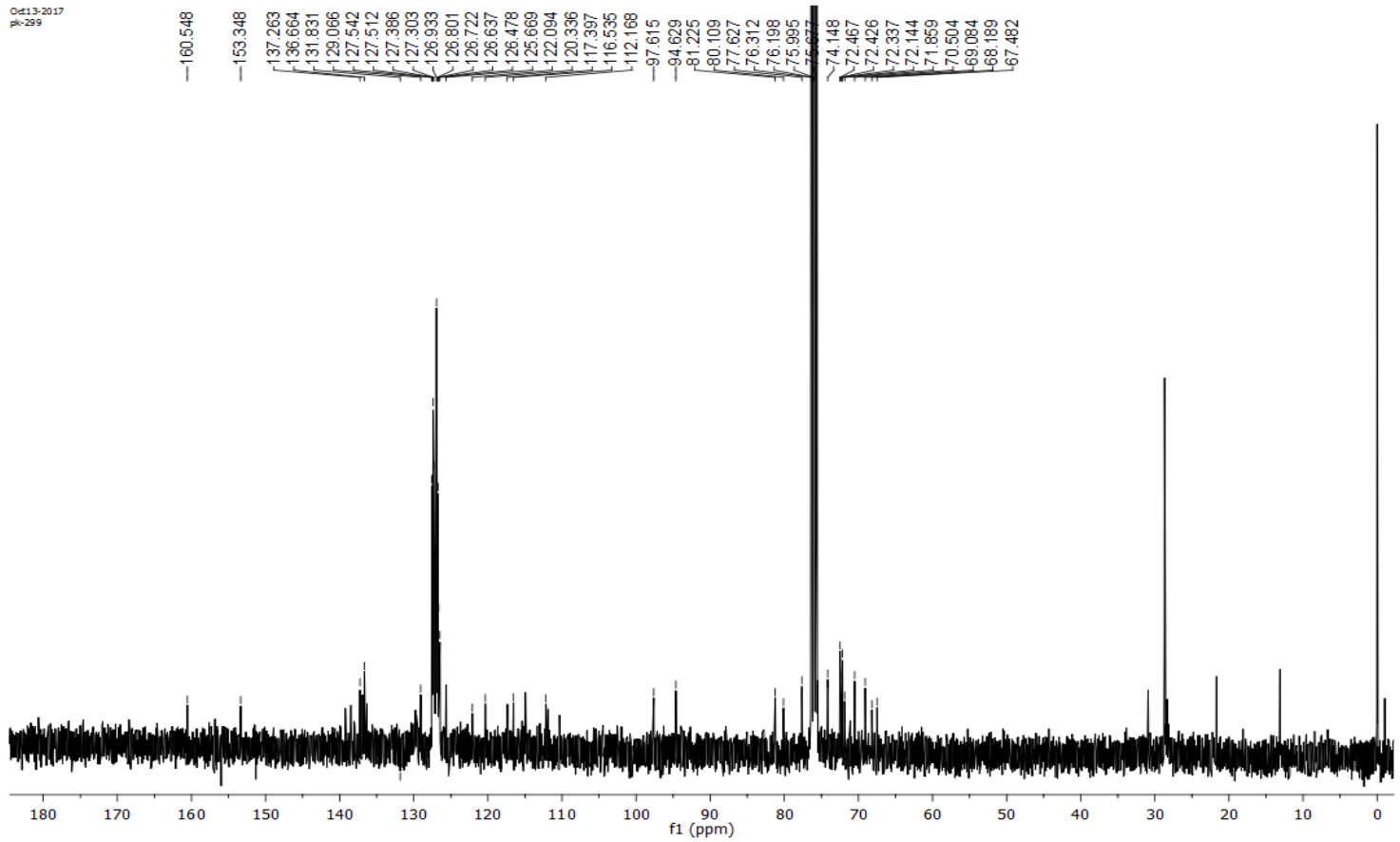


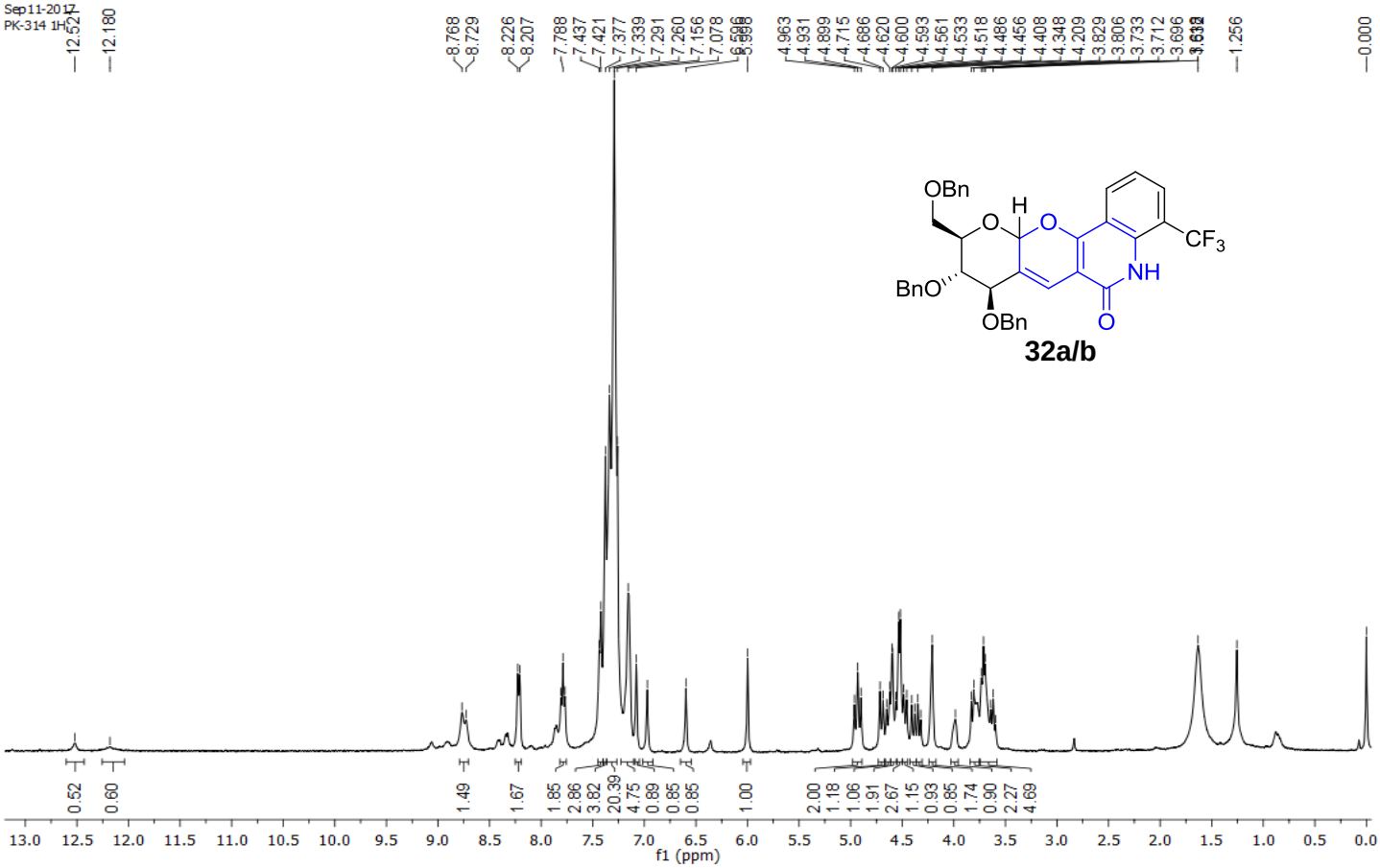
30a/b

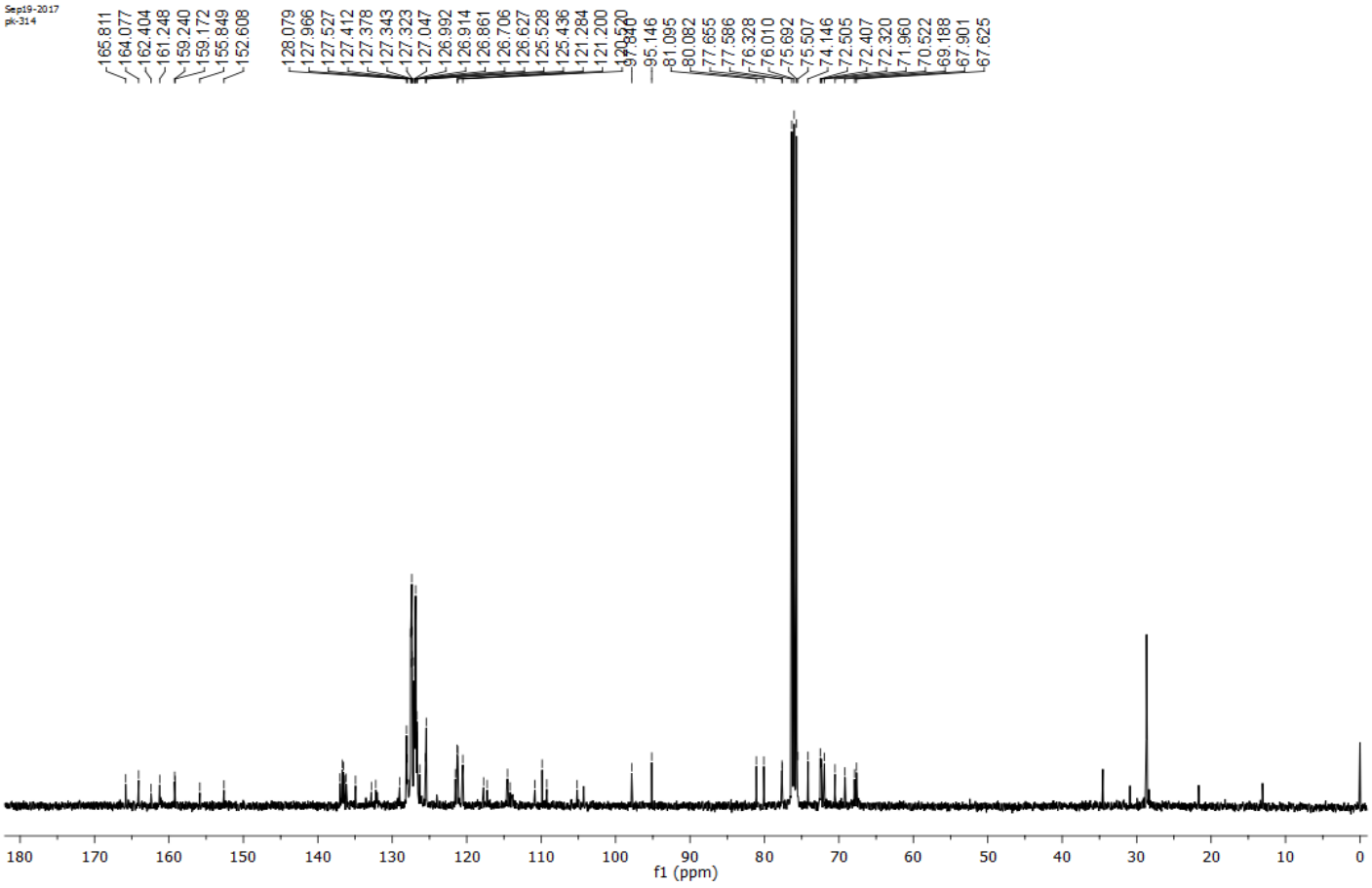
Dec20-2017
PK-302

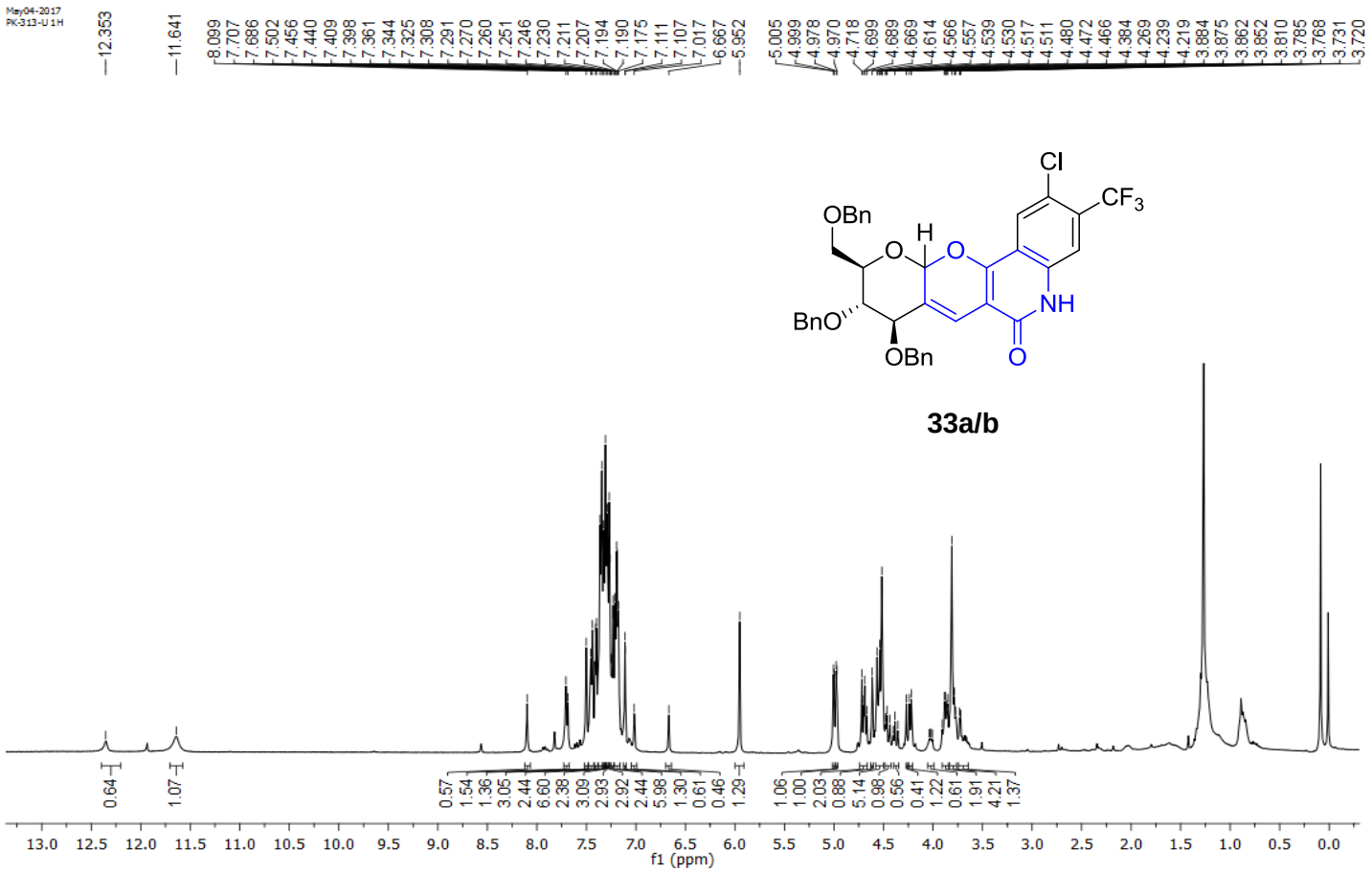


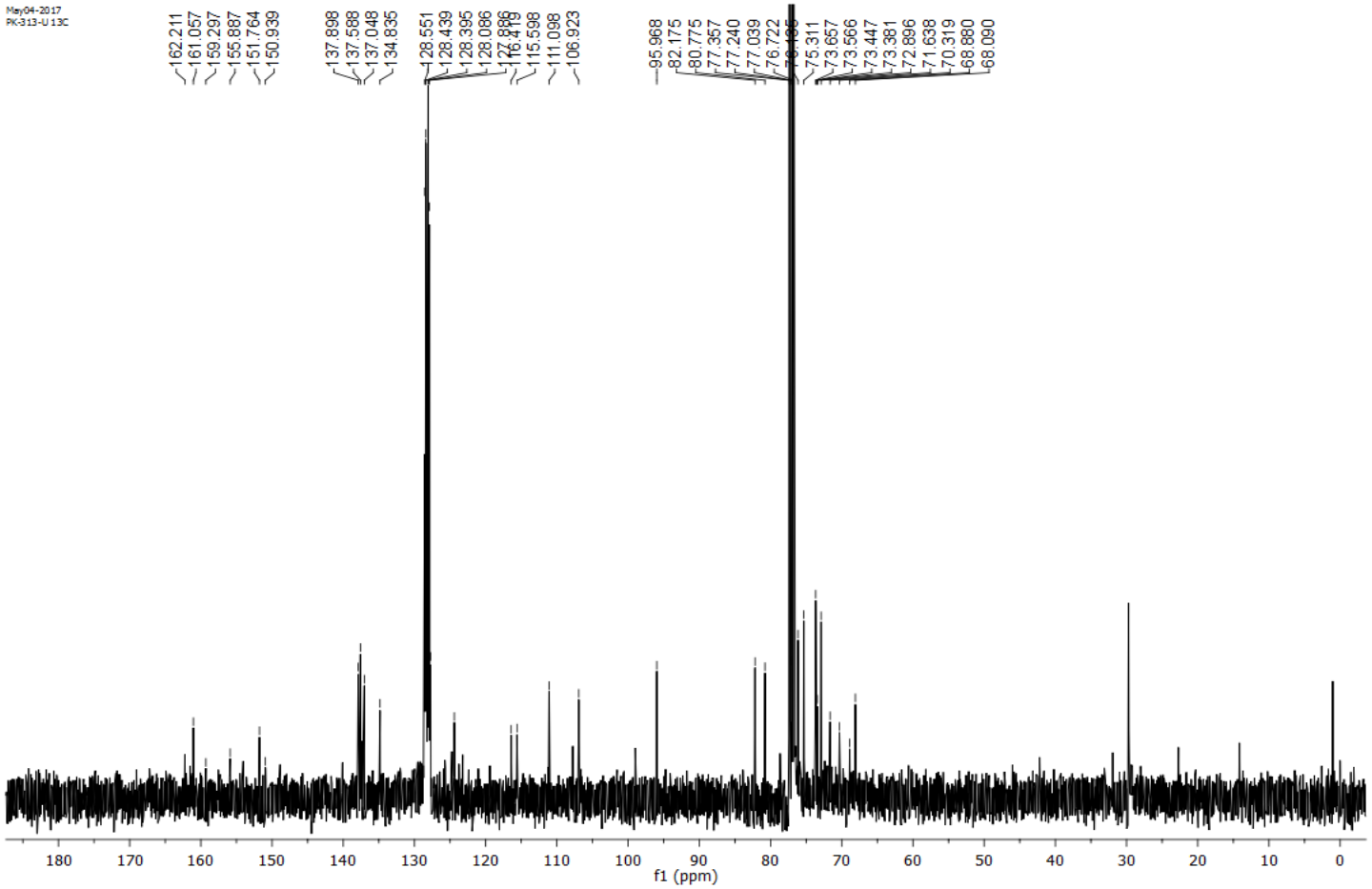

Apr04-2017
PK-299
OBn
H
O
O
Br
NH
BnO
OBn
O
31a/b
f1 (ppm)


Oct13-2017
pk-299
f1 (ppm)

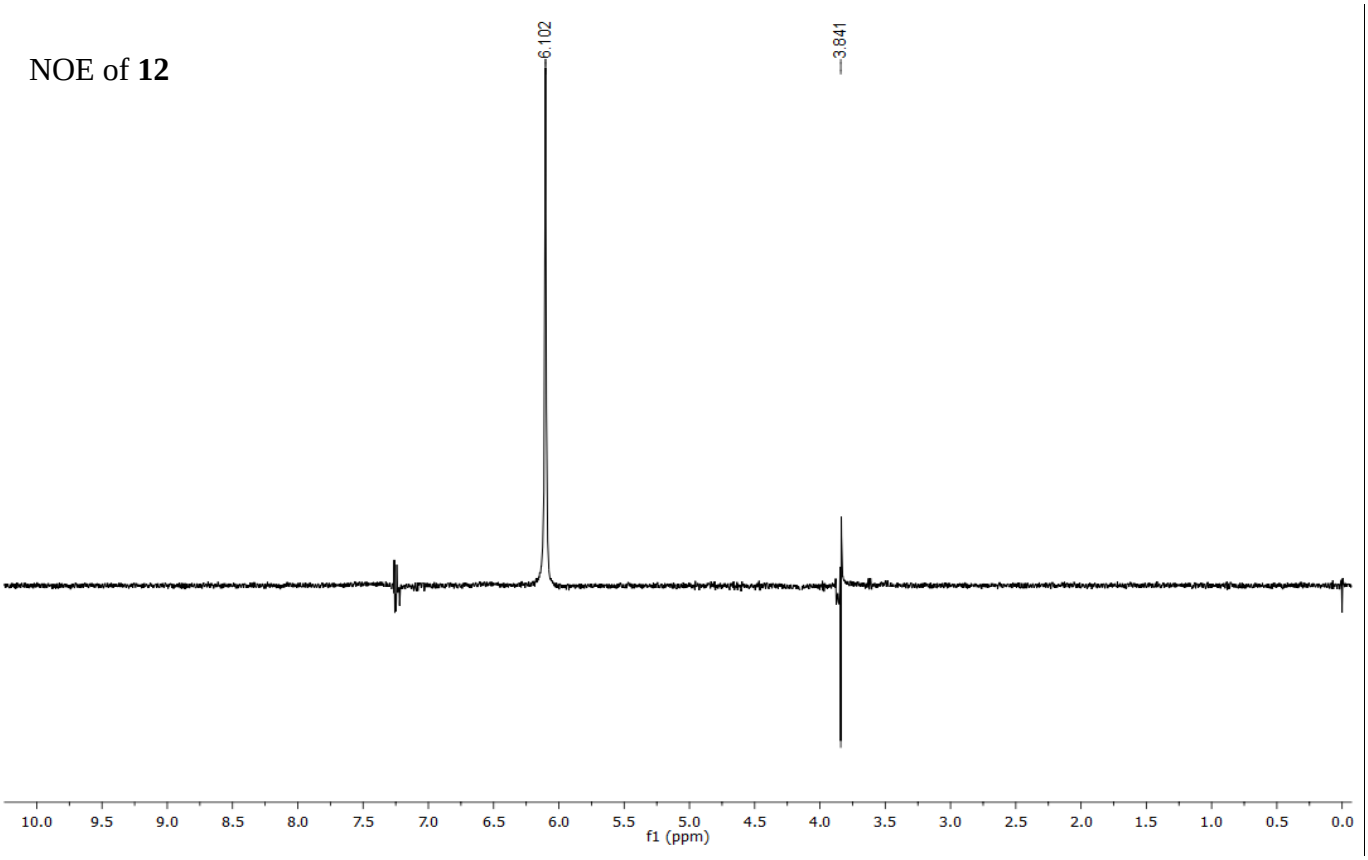

Sep11-2017
PK-314 1H
12.521
12.180
8.768
8.729
8.226
8.207
7.788
7.437
7.421
7.377
7.339
7.291
7.260
7.156
7.078
4.963
4.931
4.899
4.715
4.686
4.620
4.600
4.593
4.561
4.533
4.518
4.486
4.456
4.408
4.348
4.209
3.829
3.806
3.733
3.712
3.696
1.256
0.000
OBn
H
O
O
CF3
NH
BnO
OBn
O
32a/b
0.52
0.60
1.49
1.67
1.85
2.86
3.82
20.39
4.75
0.89
0.85
0.85
1.00
2.00
1.18
1.06
1.91
2.67
1.15
0.93
0.85
1.74
0.90
2.27
4.69
f1 (ppm)


Sep19-2017
pk-314
165.811
164.077
162.404
161.248
159.240
159.172
155.849
152.608
128.079
127.966
127.527
127.412
127.378
127.343
127.323
127.047
126.992
126.914
126.861
126.706
126.627
125.528
125.436
121.284
121.200
120.520
95.146
81.095
80.082
77.655
77.586
76.328
76.010
75.692
75.507
74.146
72.505
72.407
72.320
71.960
70.522
69.188
67.901
67.625
f1 (ppm)

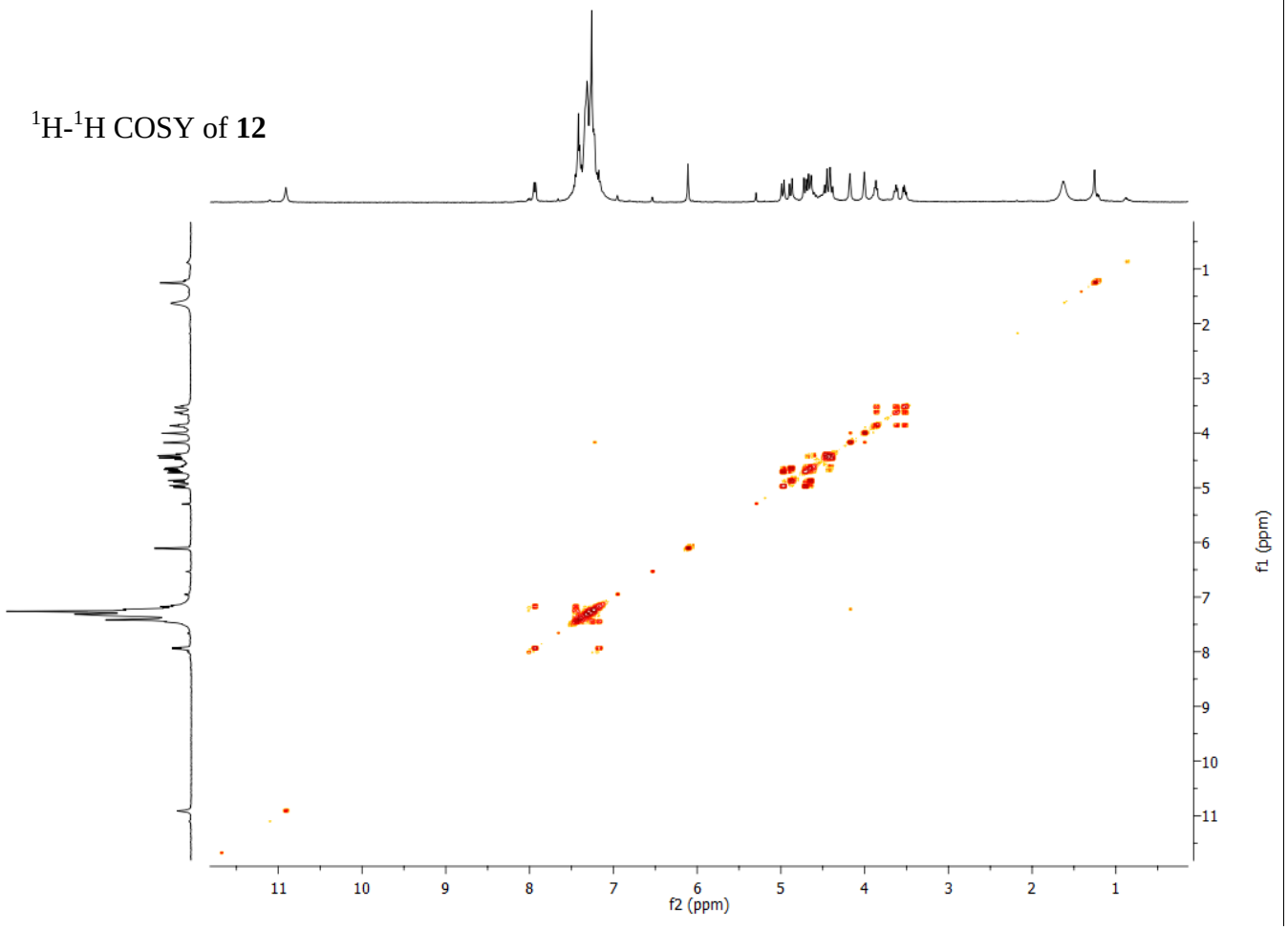

May04-2017
PK-313-U 1H
12.353
11.641
8.099
7.707
7.686
7.502
7.456
7.440
7.409
7.398
7.361
7.344
7.325
7.308
7.291
7.270
7.260
7.251
7.246
7.230
7.211
7.207
7.194
7.190
7.175
7.111
7.107
7.017
6.667
5.952
5.005
4.999
4.978
4.970
4.718
4.699
4.689
4.669
4.614
4.566
4.557
4.539
4.530
4.517
4.511
4.480
4.472
4.466
4.384
4.269
4.239
4.219
3.884
3.875
3.862
3.852
3.810
3.785
3.768
3.731
3.720
Cl
CF3
OBn
H
O
O
NH
BnO
OBn
O
33a/b
0.64
1.07
0.57
1.54
1.36
3.05
2.44
6.60
2.38
3.09
2.93
2.92
2.44
5.98
1.30
0.61
0.46
1.29
1.06
1.00
2.03
0.88
5.14
0.98
0.56
0.41
1.22
0.61
1.91
4.21
1.37
13.0 12.5 12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


May04-2017
PK-313-U 13C
162.211
161.057
159.297
155.887
151.764
150.939
137.898
137.588
137.048
134.835
128.551
128.439
128.395
128.086
127.886
116.419
115.598
111.098
106.923
95.968
82.175
80.775
77.357
77.240
77.039
76.722
75.311
73.657
73.566
73.447
73.381
72.896
71.638
70.319
68.880
68.090
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

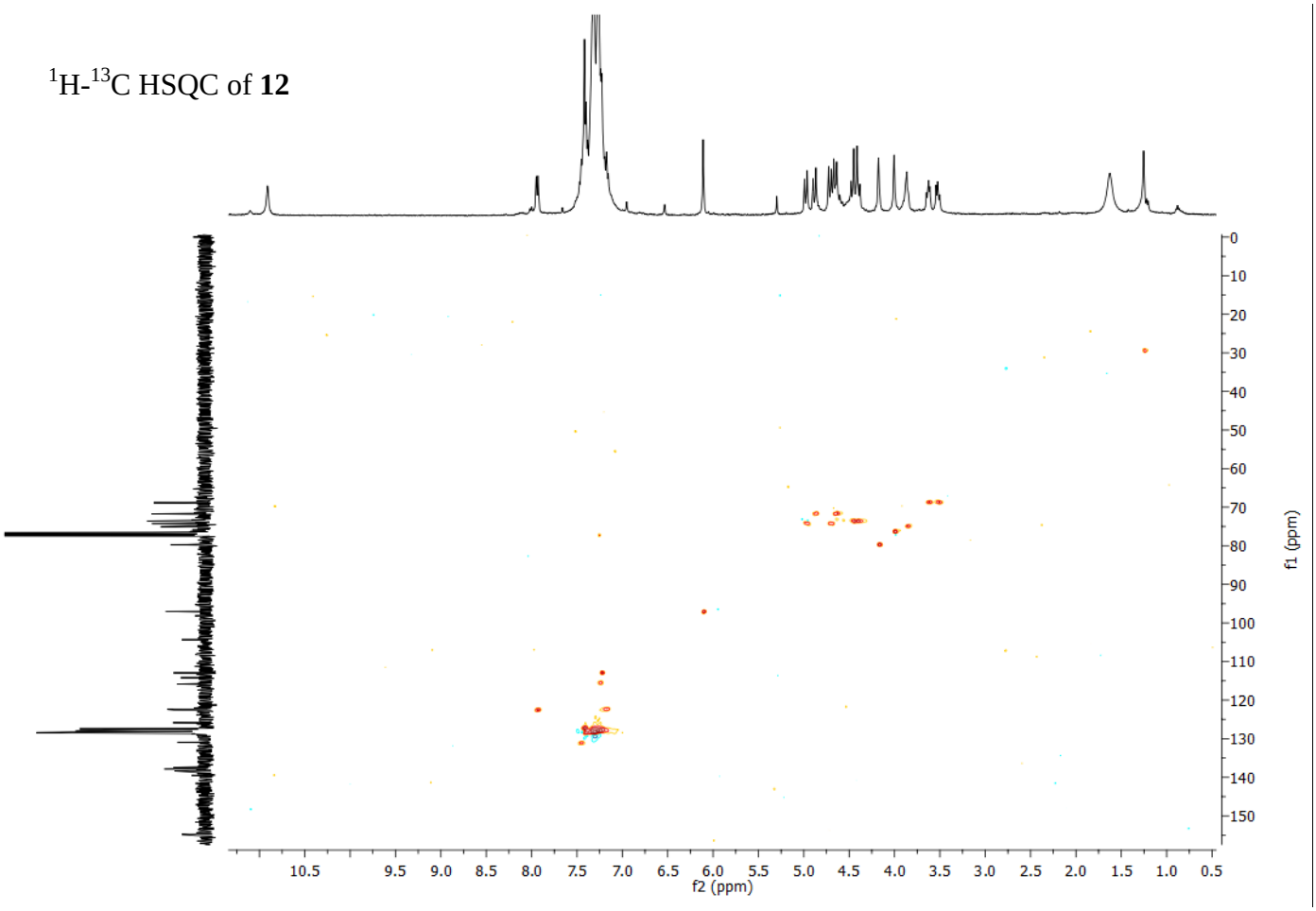
NOE of **12**

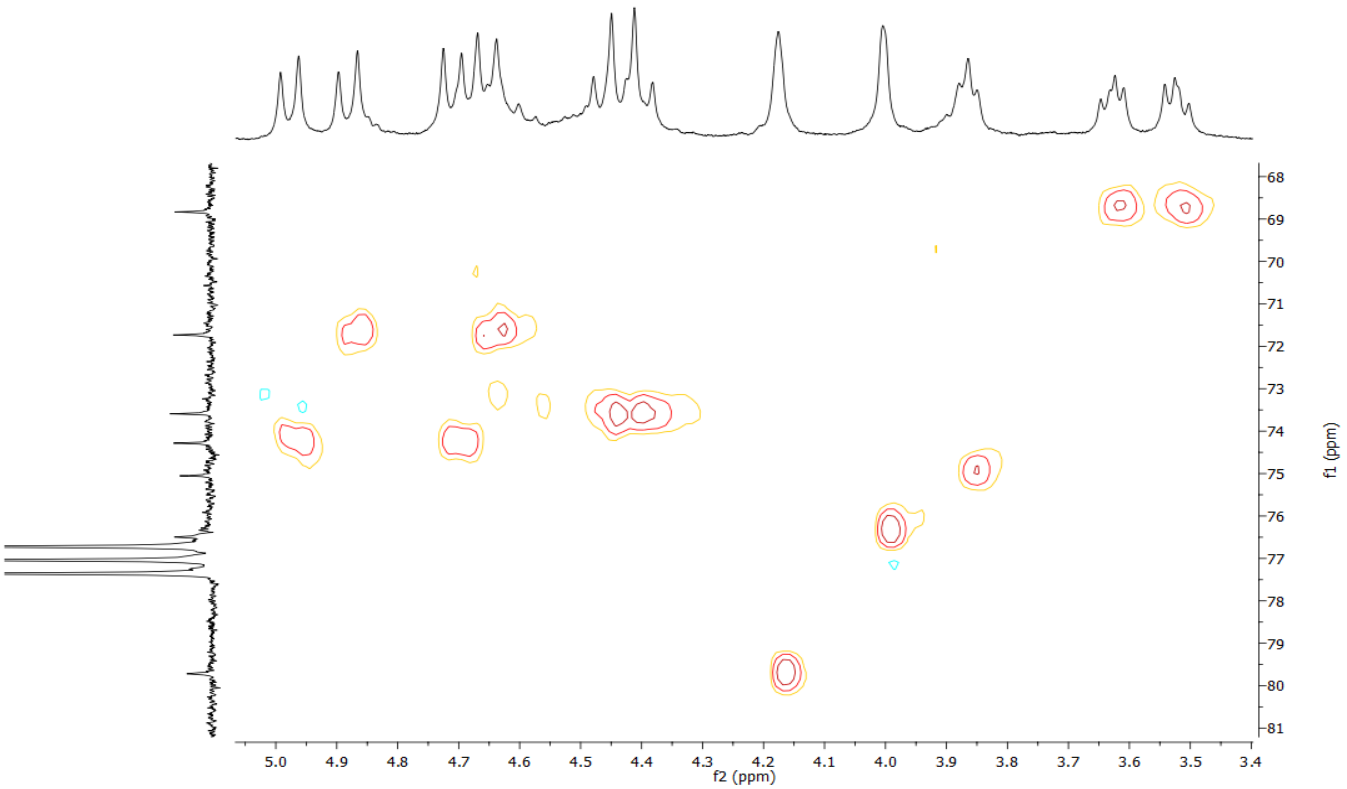


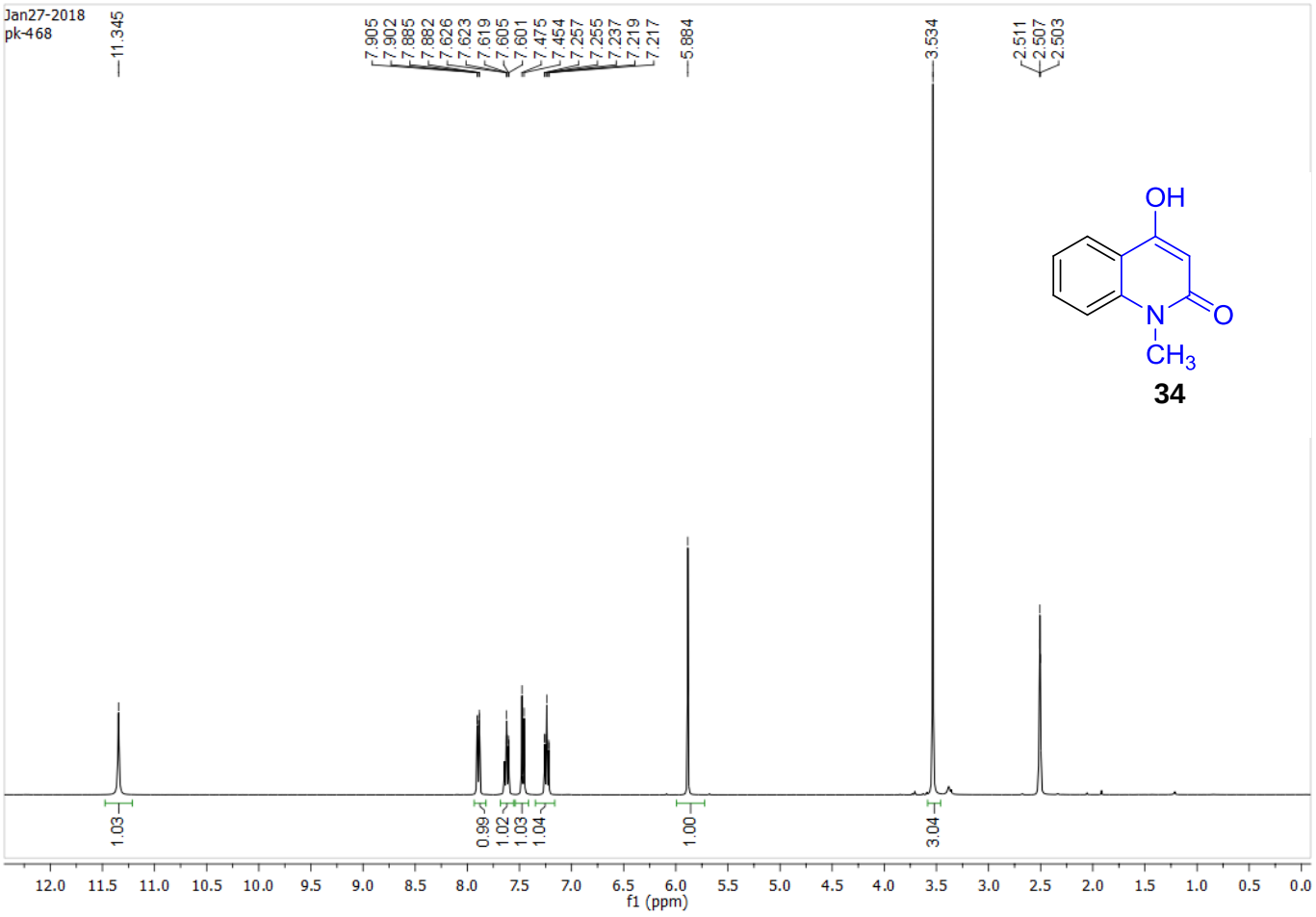
^{1}H-^{1}H COSY of **12**

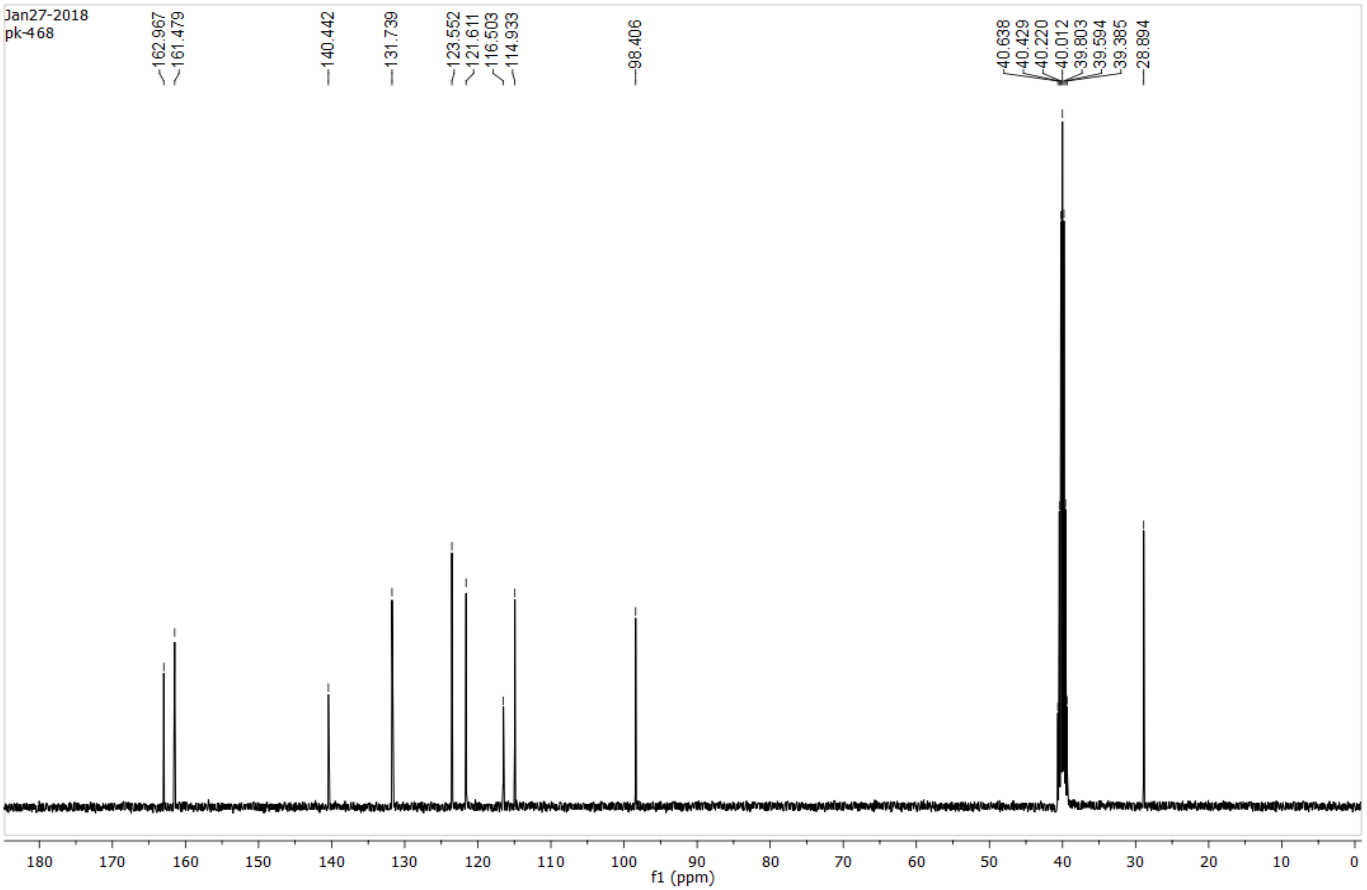


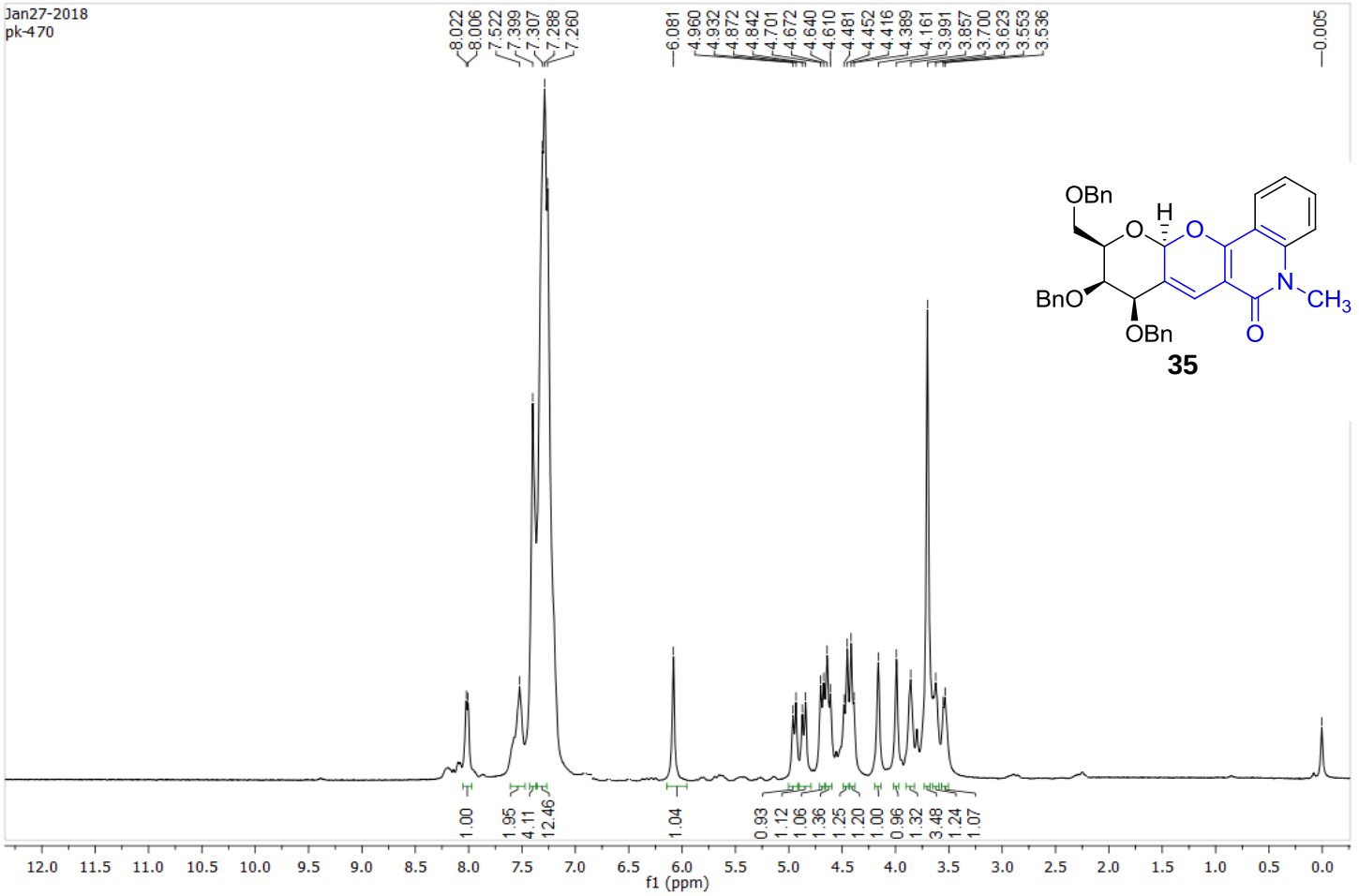
^{1}H-^{13}C HSQC of **12**

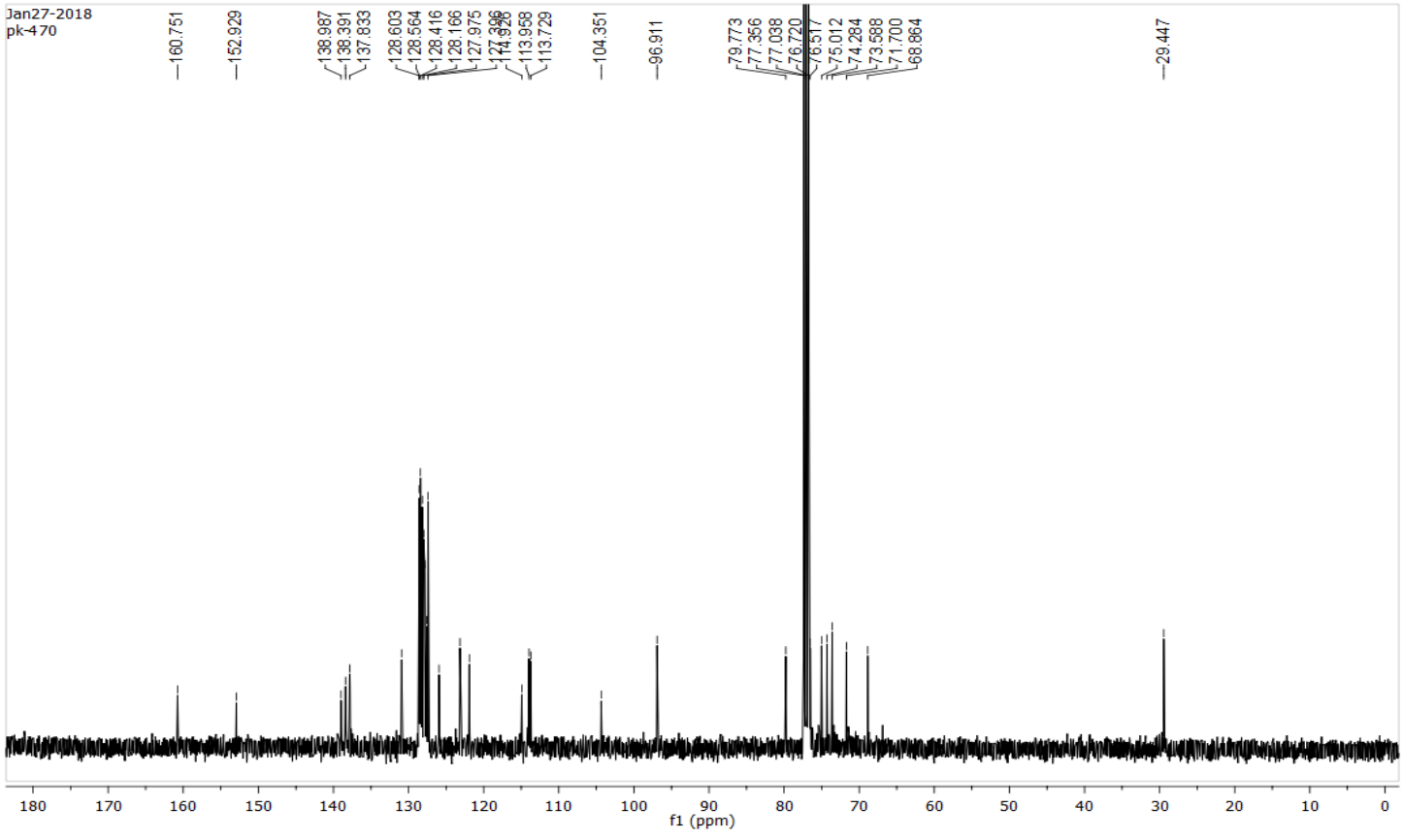




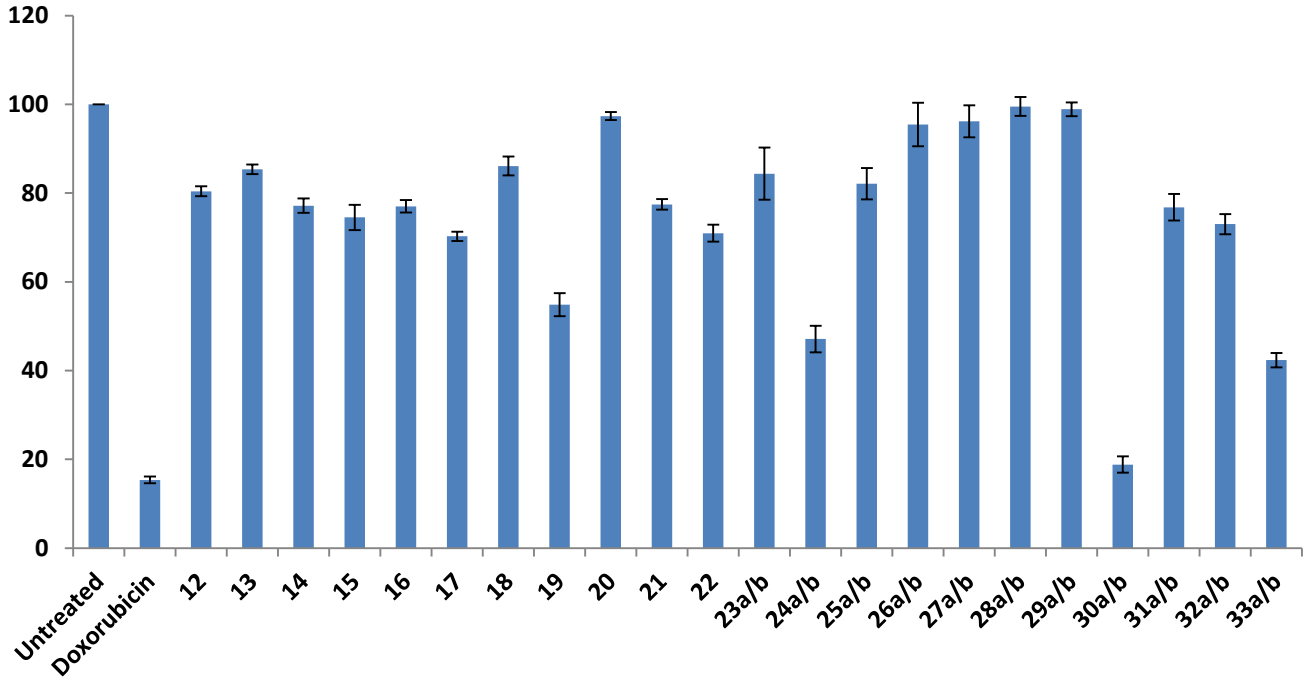

Jan27-2018
pk-468
11.345
7.905
7.902
7.885
7.882
7.626
7.623
7.619
7.605
7.601
7.475
7.454
7.257
7.255
7.237
7.219
7.217
5.884
3.534
2.511
2.507
2.503
OH
N
O
CH3
34
1.03
0.99
1.02
1.03
1.04
1.00
3.04
f1 (ppm)

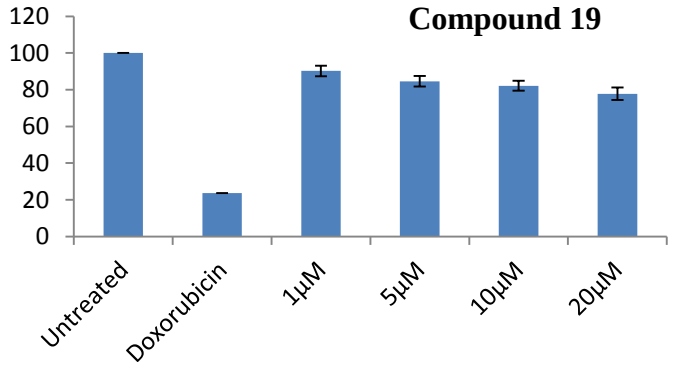

Jan27-2018
pk-468
162.967
161.479
140.442
131.739
123.552
121.611
116.503
114.933
98.406
40.638
40.429
40.220
40.012
39.803
39.594
39.385
28.894
f1 (ppm)

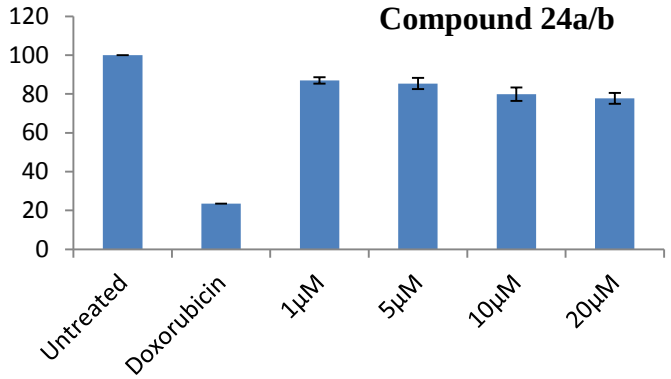

Jan27-2018
pk-470
8.022
8.006
7.522
7.399
7.307
7.288
7.260
6.081
4.960
4.932
4.872
4.842
4.701
4.672
4.640
4.610
4.481
4.452
4.416
4.389
4.161
3.991
3.857
3.700
3.623
3.553
3.536
0.005
1.00
1.95
4.11
12.46
1.04
0.93
1.12
1.06
1.36
1.25
1.20
1.00
0.96
1.32
3.48
1.24
1.07
f1 (ppm)
OBn
BnO
OBn
H
O
O
N
CH3
O
35

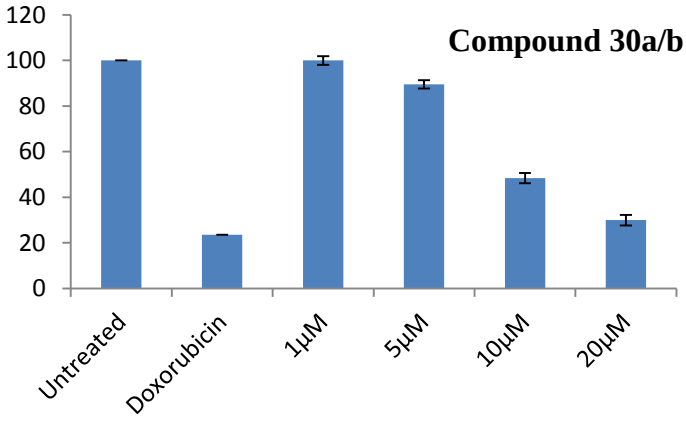

Jan27-2018
pk-470
160.751
152.929
138.987
138.391
137.833
128.603
128.564
128.416
128.166
127.975
114.928
113.958
113.729
104.351
96.911
79.773
77.356
77.038
76.720
76.517
75.012
74.284
73.588
71.700
68.864
29.447
f1 (ppm)

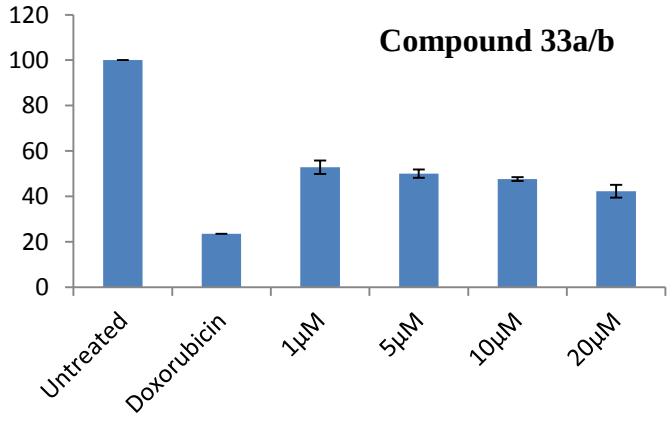
Results for Cell Viability testing of Compounds 12-22 and 23a/b-33a/b at 25 µM concentration in MCF-7 Cell line











Results for Cell Viability testing of Compounds 12-22 and 23a/b-33a/b at 25 µM concentration in HepG2 Cell line