Supporting Information

Recyclable ionic iron substituted ceria: A precious-metal-free, ligand-free, and versatile catalyst for C-C coupling and *ipso*-hydroxylation of arylboronic acid

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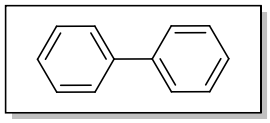
1 General information

The X-ray diffraction pattern of the catalyst was recorded on a Philips X'Pert Diffractometer. IR spectra are recorded in a Perkin Elmer spectrometer with a KBr pellet. NMR spectra were recorded on Bruker-AV400 spectrometer in $CDCl_3$ and D_2O, tetramethylsilane (TMS; δ = 0.00 ppm) served as an internal standard for ^1H NMR. The corresponding residual non-deuterated solvent signal ($CDCl_3$; δ = 77.00 ppm) was used as an internal standard for ^{13}C NMR. Column chromatography was carried out by packing glass columns with silica gel 100 – 200 mesh and thin-layer chromatography was carried out using SILICA GEL GF-254. All reagents and reactants were procured from Sigma-Aldrich and SD-Fine chemicals. Solvents used for workup and chromatographic procedures were purchased from commercial suppliers and used without further purification.

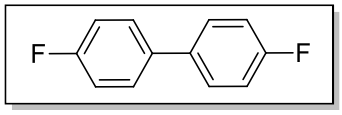
2 a) Characterization data for homo-coupling reaction products

2a Biphenyl[1]



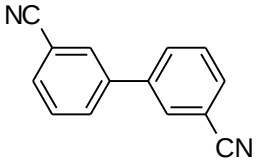
Obtained as a White solid; **Yield**: 86% (66 mg); $\mathbf{R_f}$ = 0.6 (petroleum ether); **M.p**: 69 ^{0}C; **^{1}H NMR** ($CDCl_3$, 400 MHz) δ (ppm): 7.64 – 7.66 (d, *J* = 7.38 Hz, 4H), 7.48 – 7.51 (t, *J* = 7.25 Hz, 4H), 7.38 – 7.42 (t, *J* = 7.34 Hz, 2H); **^{13}C NMR** ($CDCl_3$, 100 MHz) δ (ppm): 127.21, 127.29, 128.80, 141.27.

2b 4,4'-Difluoro-1,1'-biphenyl[1]



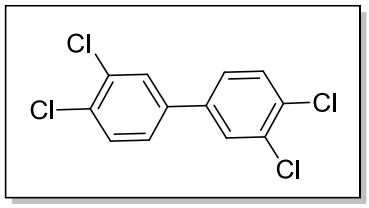
Obtained as a white solid; **Yield**: 84% (80 mg); $\mathbf{R_f}$ = 0.6 (petroleum ether); **M. p** = 89 ^{0}C; **^{1}H NMR** ($CDCl_3$, 400 MHz) δ (ppm): 7.53 - 7.50 (dd, *J* = 8.07 Hz, 4H), 7.17 – 7.13 (t, *J* = 8.5 Hz, 4H); **^{13}CNMR** ($CDCl_3$, 100 MHz) δ (ppm): 163.66, 161.21, 136.42, 136.39, 128.62, 128.54, 115.81, 115.60.

2c 1,1'-biphenyl-3,3'-dicarbonitrile[2]



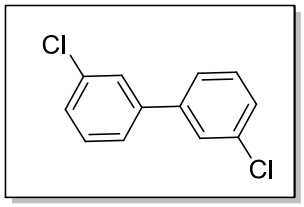
Obtained as light-yellow solid; **Yield**: 82% (83.5 mg); $\mathbf{R_f}$ = 0.6 (petroleum ether); **M. p** = 170 ^{0}C; **^{1}H NMR** ($CDCl_3$, 400 MHz) δ (ppm): 7.86 (s, 2H), 7.83 – 7.81 (d, J = 8.0 Hz, 2H), 7.75 – 7.73 (d, J = 8.0 Hz, 2H), 7.66 – 7.62 (t, J = 8.0 Hz, 2H); **^{13}CNMR** ($CDCl_3$, 100 MHz) δ (ppm): 140.19, 131.84, 131.52, 130.68, 130.08, 118.70, 113.49.

2d 3,3',4,4'-Tetrachloro-1,1'-biphenyl[3]



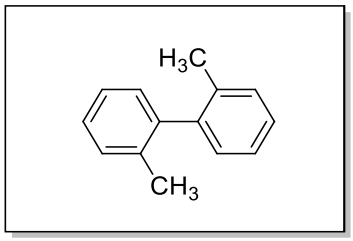
Obtained as a white solid; **Yield**: 80% (116.5 mg); $\mathbf{R_f}$ = 0.6 (petroleum ether); **M. p** = 170 ^{0}C; **^{1}H NMR** ($CDCl_3$, 400 MHz) δ (ppm): 7.55 – 7.53 (d, J = 7.88 Hz, 2H), 7.58 (s, 1H), 7.56 (s, 1H), 7.43 – 7.40 (d, J = 8.4, 2.2 Hz, 2H); **^{13}CNMR** ($CDCl_3$, 100 MHz) δ (ppm): 138.72, 133.24, 132.48, 130.96, 128.80, 126.15.

2e 3,3'-Dichloro-1,1'-biphenyl[1]



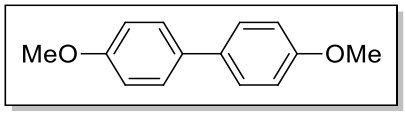
Obtained as a colorless liquid; **Yield**: 81% (90.5 mg); $\mathbf{R_f}$ = 0.6 (petroleum ether); **^{1}H NMR** ($CDCl_3$, 400 MHz) δ (ppm): 7.57 (s, 2H), 7.47 – 7.45 (m, 2H), 7.42 – 7.36 (m, 4H); **^{13}CNMR** ($CDCl_3$, 100 MHz) δ (ppm): 141.64, 130.13, 127.89, 127.28, 125.27.

2f 2,2'-Dimethyl-1,1'-biphenyl[1]



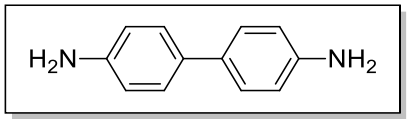
Obtained colorless liquid; **Yield**: 79% (72 mg); $\mathbf{R_f}$ = 0.6 (petroleum ether); **^{1}H NMR** ($CDCl_3$, 400 MHz) δ (ppm): 7.42 – 7.32 (m, 6H), 7.19 – 7.17 (d, *J* = 7.38 Hz, 2H), 2.44 (s, 6H); **^{13}CNMR** ($CDCl_3$, 100 MHz) δ (ppm): 141.56, 136.07, 128.60, 127.99, 127.91, 124.28, 21.56.

2g 4,4'-Dimethoxy-1,1'-biphenyl[1]



Obtained as a colorless solid; **Yield**: 85% (91 mg); $\mathbf{R_f}$ = 0.40 (5% ethyl acetate in petroleum ether); **M. p** = 170 ^{0}C; **^{1}H NMR** ($CDCl_3$, 400 MHz) δ (ppm): 7.52 - 7.50 (d, *J* = 8.28 Hz, 4H), 7.00 -6.98 (d, *J* = 8.53 Hz, 4H), 3.87 (s, 6H); **^{13}CNMR** ($CDCl_3$, 100 MHz) δ (ppm): 158.69, 133.49, 127.75, 114.17, 55.37.

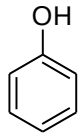
2h Benzidine[4]



Obtained as white solid; **Yield**: 86% (79 mg); $\mathbf{R_f}$ = 0.36 (20% ethyl acetate in petroleum ether); **M. p** = 128 ^{0}C; **^{1}H NMR** ($CDCl_3$, 400 MHz) δ (ppm): 7.39 – 7.37 (d, J = 8.03 Hz, 4H), 6.77 – 6.75 (d, J = 7.78 Hz, 4H), 3.69 (br, s, 4H); **^{13}CNMR** ($CDCl_3$, 100 MHz) δ (ppm): 144.97, 131.84, 127.32, 115.49.

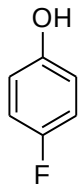
4 b) Characterization data for *ipso*-hydroxylation reaction products

3a Phenol[5]



Obtained as a white solid; **Yield**: 97% (91.2 mg); $\mathbf{R_f}$ = 0.35 (10% ethyl acetate in petroleum ether); **M. p** = 41 ^{o}C; **^{1}H NMR** ($CDCl_3$, 400 MHz) δ (ppm): 7.31 - 7.27 (t, *J* = 7.91 Hz, 2H), 7.01 - 6.97 (t, *J* = 7.4 Hz, 1H), 6.92 – 6.90 (m, 2H), 6.58 (s, br, 1H); **^{13}C NMR** ($CDCl_3$, 100 MHz) δ (ppm): 155.42, 129.80, 120.88, 115.48.

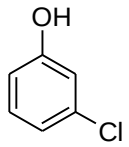
3b 4-fluorophenol[5]



Obtained as a white solid; **Yield**: 91% (102.0 mg); $\mathbf{R_f}$ = 0.29 (10% ethyl acetate in petroleum ether); **M. p** = 45 ^{o}C; **^{1}H NMR** ($CDCl_3$, 400 MHz) δ (ppm): 7.01 – 6.92 (m, 2H), 6.87 – 6.78

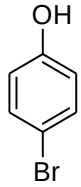
(m, 2H), 5.19 (s, br, 1H); **^{13}CNMR** ($CDCl_3$, 100 MHz) δ (ppm): 158.42, 156.06, 151.52, 116.28, 115.88.

3c 3-chlorophenol[6]



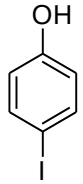
Obtained as a white solid; **Yield**: 90% (115.7 mg); $\mathbf{R_f}$ = 0.3 (10% ethyl acetate in petroleum ether); **M. p** = 33 °C; **^{1}H NMR** ($CDCl_3$, 400 MHz) δ (ppm): 7.20 – 7.16 (t, *J* = 8.02 Hz, 1H), 6.95 – 6.88 (m, 2H), 6.76 – 6.69 (m, 1H), 5.62 (s, br, 1H); **^{13}CNMR** ($CDCl_3$, 100 MHz) δ (ppm): 156.38, 134.90, 130.47, 121.00, 115.91, 113.77.

3d 4-bromophenol[5]



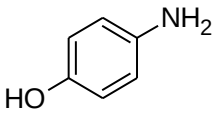
Obtained as a white solid; **Yield**: 89% (153.9 mg); $\mathbf{R_f}$ = 0.42 (10% ethyl acetate in petroleum ether); **M. p** = 65 °C; **^{1}H NMR** ($CDCl_3$, 400 MHz) δ (ppm): 7.37 – 7.34 (m, 2H), 6.77 – 6.73 (m, 2H), 5.14 (s, br, 1H); **^{13}CNMR** ($CDCl_3$, 100 MHz) δ (ppm): 154.48, 132.55, 117.25, 113.02.

3e 4-iodophenol[7]



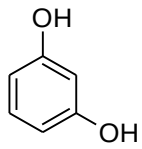
Obtained as light-yellow solid; **Yield**: 93% (204.6 mg); $\mathbf{R_f}$ = 0.3 (10% ethyl acetate in petroleum ether); **M. p** = 91 ^{o}C; **^{1}H NMR** ($CDCl_3$, 400 MHz) δ (ppm): 7.54 – 7.52 (d, *J* = 8 Hz, 2H), 6.66 – 6.64 (d, *J* = 8Hz, 2H), 5.62 (s, br, 1H); **^{13}CNMR** ($CDCl_3$, 100 MHz) δ (ppm): 155.14, 138.54, 117.90, 83.01.

3f 4-aminophenol[8]



Obtained as a colorless solid; **Yield**: 94% (105.2 mg); $\mathbf{R_f}$ = 0.50 (60% ethyl acetate in petroleum ether); **^{1}H NMR** (DMSO-d6, 400 MHz) δ (ppm): 8.51 (s, 1H), 6.51 – 6.43 (m, 4H), 3.68 (br, s, 2H); **^{13}CNMR** (DMSO-d6, 100 MHz) δ (ppm): 148.70, 140.87, 115.96, 115.86.

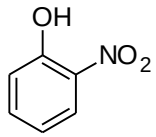
3g Resorcinol[5]



Obtained as light brown solid; **Yield:** 87% (95.8 mg); $\mathbf{R_f}$ = 0.53 (30% ethyl acetate - petroleum ether); **Melting Point**: 110 ^{o}C; **^{1}H NMR** (DMSO-d6, 400 MHz): δ 9.26 (s, 1H),

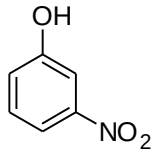
6.95-6.91 (t, *J* = 7.78 Hz, 1H), 6.23 – 6.21 (m, 2H), 3.78 (s, br, 2H); **^{13}C NMR** (DMSO-d6, 100 MHz): δ 158.83, 130.29, 106.78, 102.96.

3h 2-nitrophenol[5]



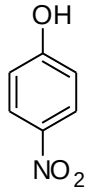
Obtained as a yellow solid; **Yield**: 86% (119.6 mg); **R_f** = 0.6 (30% ethyl acetate in petroleum ether); **M. p** = 45 ^{o}C; **^{1}H NMR** ($CDCl_3$, 400 MHz) δ (ppm): 10.60 (s, 1H), 8.13 – 8.11 (d, *J* = 8.51 Hz, 1H), 7.62 – 7.58 (t, *J* = 7.69, 1H), 7.18 – 7.16 (d, *J* = 8.5 Hz, 1H), 7.03 – 6.99 (t, *J*=7.82, 1H); **^{13}CNMR** ($CDCl_3$, 100 MHz) δ (ppm): 155.12, 137.58, 125.07, 120.25, 119.98.

3i 3-nitrophenol[6]



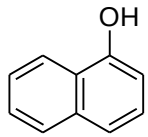
Obtained as a yellow solid; **Yield**: 89% (123.7 mg); **R_f** = 0.58 (30% ethyl acetate in petroleum ether); **M. p** = 94 - 96 ^{o}C; **^{1}H NMR** ($CDCl_3$, 400 MHz) δ (ppm): 7.84 - 7.82 (d, *J* = 8 Hz, 1H), 7.72 (s, 1H), 7.45 – 7.40 (t, *J* = 8.19 Hz, 1H), 7.21 – 7.19 (m, 1H), 5.91 (s, br, 1H); **^{13}CNMR** ($CDCl_3$, 100 MHz) δ (ppm): 156.38, 130.29, 121.93, 115.82, 110.51.

3j 4-nitrophenol[5]



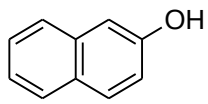
Obtained as a yellow solid; **Yield**: 91% (126.5 mg); $\mathbf{R_f}$ = 0.6 (30% ethyl acetate in petroleum ether); **M. p** = 112 °C; **^{1}H NMR** (DMSO-d6, 400 MHz) δ (ppm): 8.09 – 8.07 (d, *J* = 9.01 Hz, 2H), 6.92 – 6.89 (d, *J* = 9.01 Hz, 2H); **^{13}C NMR** (DMSO-d6, 100 MHz) δ (ppm): 164.23, 140.01, 126.56, 116.14.

3k 1-naphthol[5]



Obtained as colourless liquid; **Yield**: 83% (119.5 mg); $\mathbf{R_f}$ = 0.42 (10% ethyl acetate in petroleum ether); **M. p**: 96 °C; **^{1}H NMR** ($CDCl_3$, 400 MHz): δ 8.24 – 8.22 (m, 1H), 7.87 – 7.85 (m, 1H), 7.55 – 7.48 (m, 3H), 7.36 – 7.33 (t, *J* = 7.88 Hz, 1H), 6.86 – 6.84 (d, *J* = 7.38 Hz, 1H) 5.50 - 5.49 (d, br, *J*=4.88 Hz, 1H); **^{13}C NMR** ($CDCl_3$, 100 MHz): δ 151.39, 134.78, 127.72, 126.49, 125.88, 125.32, 121.58, 120.71, 108.65.

3l 2-naphthol[5]



Obtained as a white solid; **Yield**: 82% (118.1 mg); $\mathbf{R_f}$ = 0.37 (10% ethyl acetate in petroleum ether); **M. p**: 122 °C; **^{1}H NMR** ($CDCl_3$, 400 MHz): δ 7.81-7.77 (t, *J* = 7.75 Hz, 2H), 7.72 –

7.70 (d, *J* = 8.25 Hz, 1H), 7.48 – 7.44 (t, *J* = 7.44 Hz, 1H), 7.38 – 7.34 (t, *J* = 8 Hz, 1H), 7.18 – 7.13 (m, 2H), 5.29 (s, br, 1H); **^{13}C NMR** ($CDCl_3$, 100 MHz): δ 153.36, 134.59, 129.88, 127.79, 126.56, 126.39, 123.64, 117.77, 109.49.

3 References

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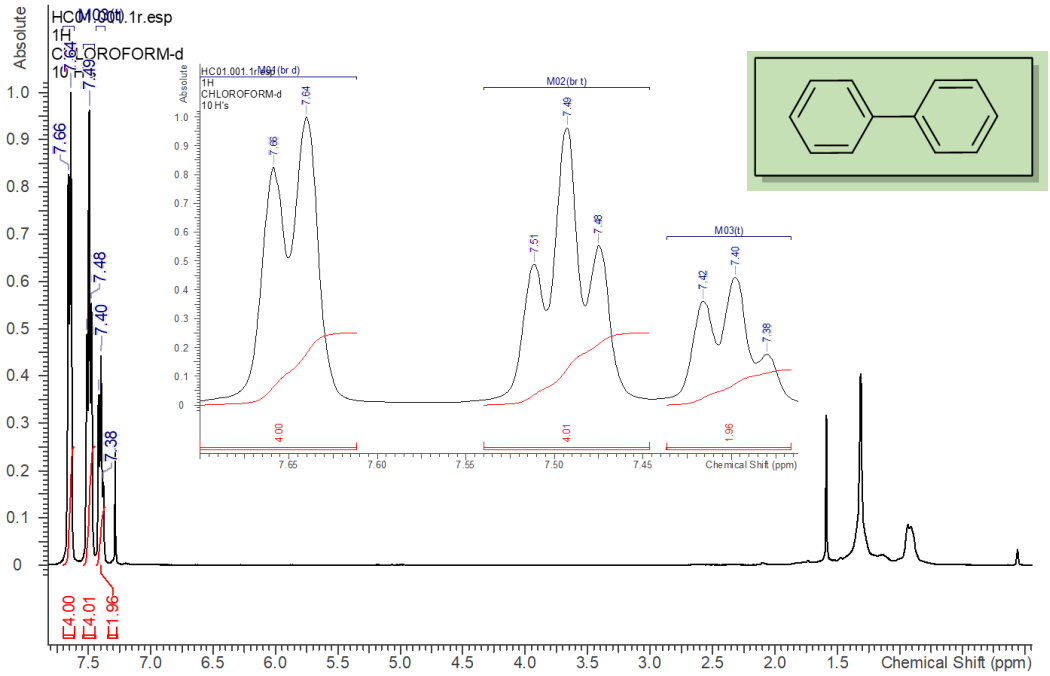
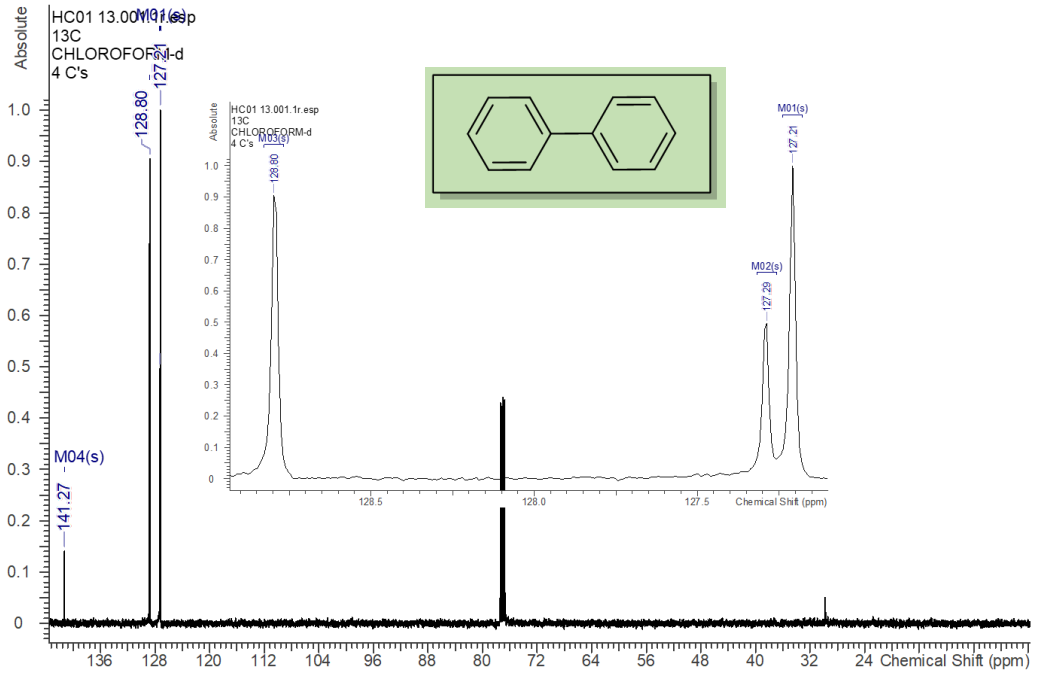
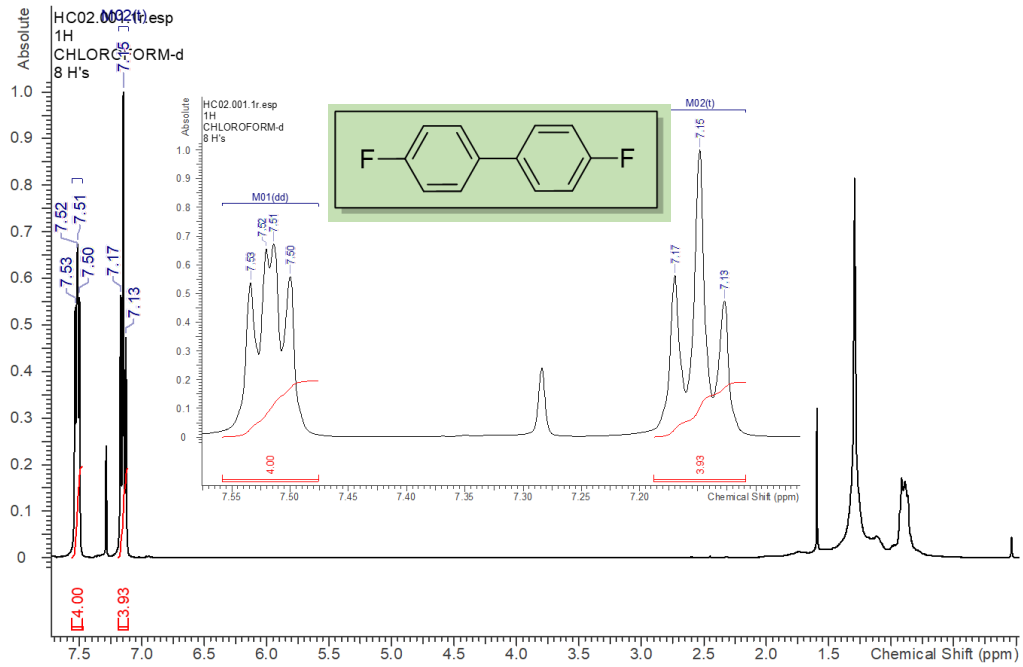
4 Copies of ^{1}H and ^{13}CNMR spectra



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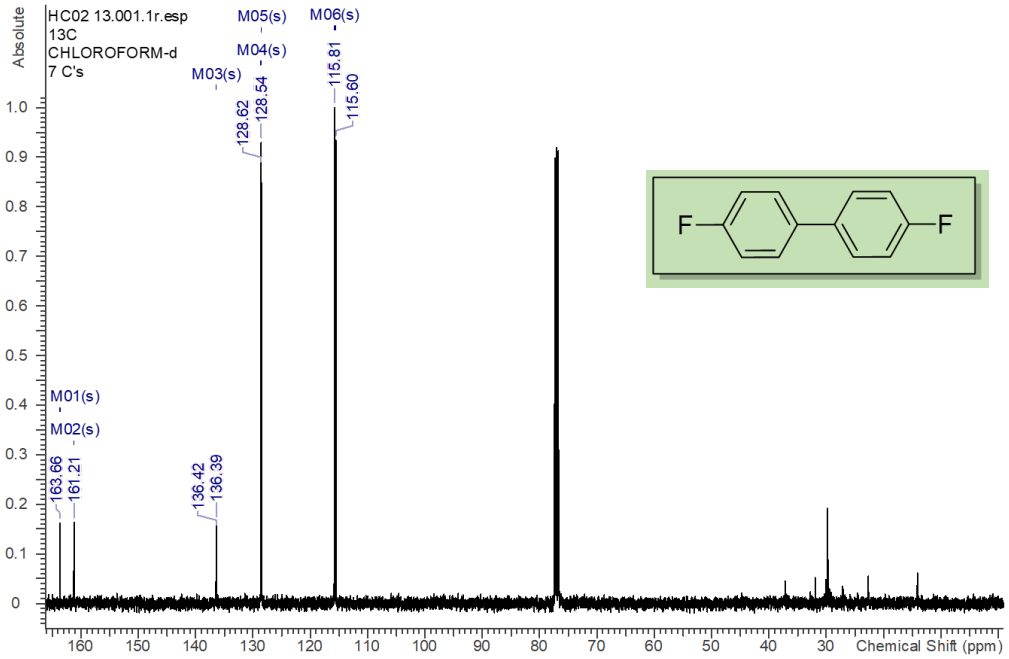
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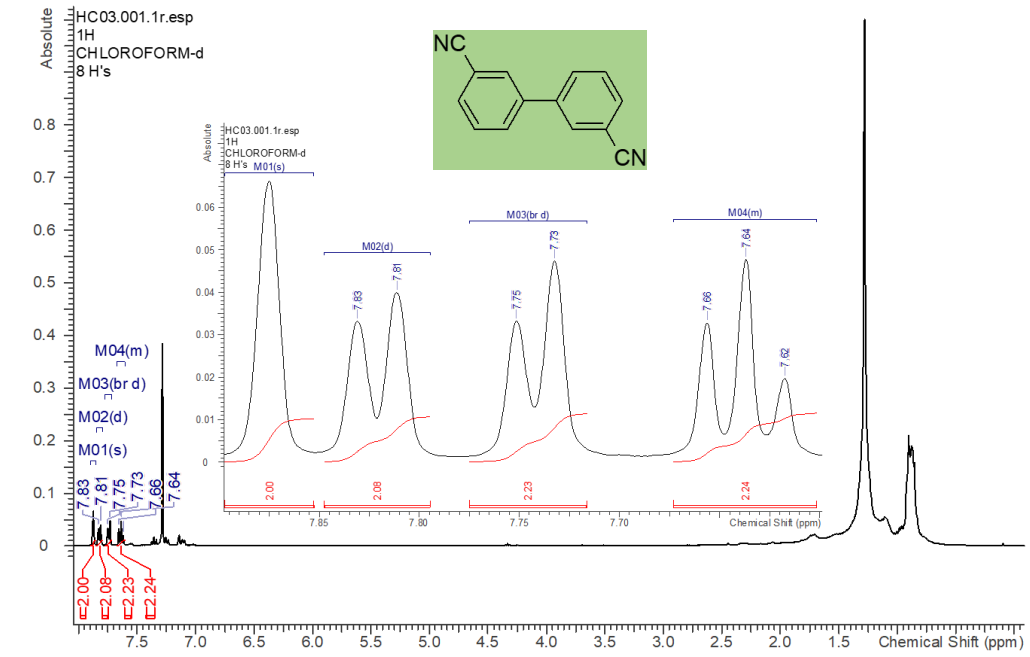
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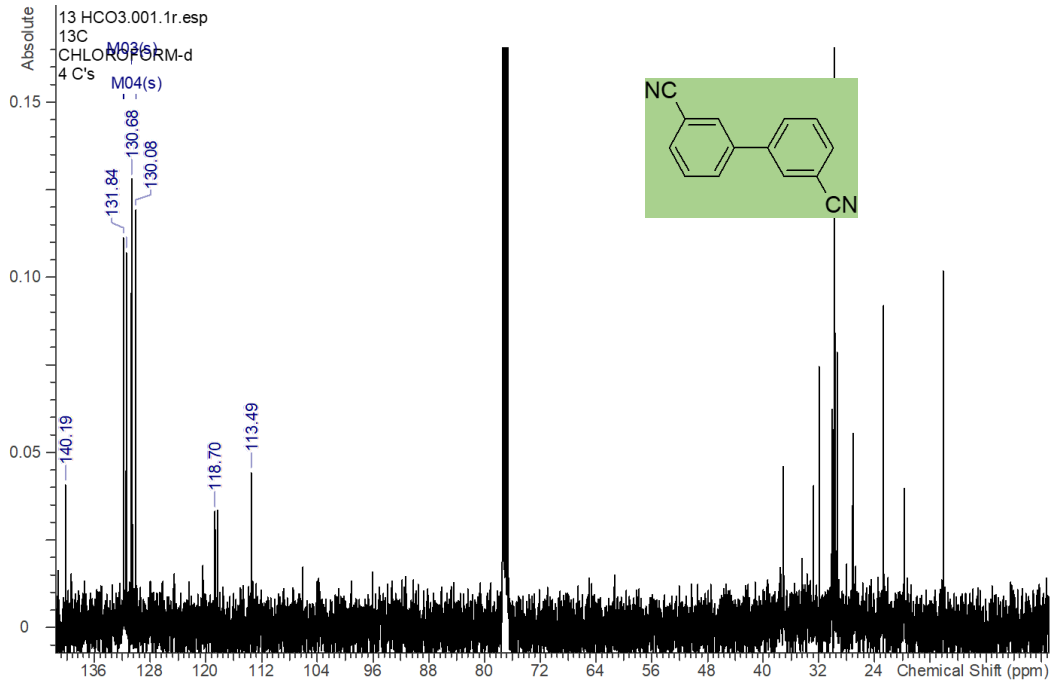
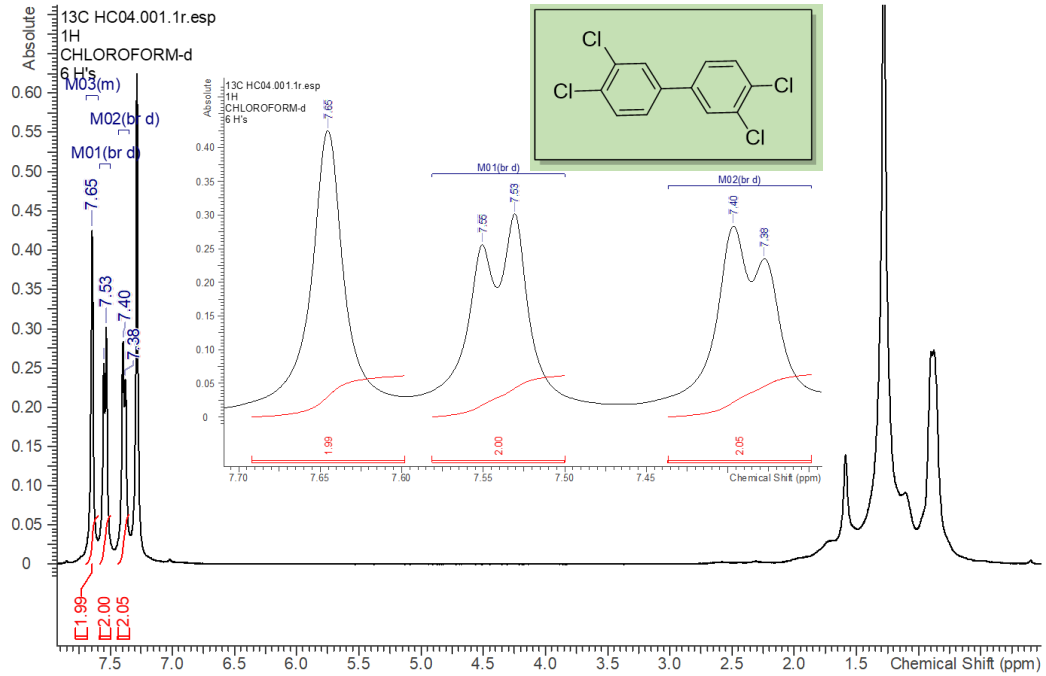
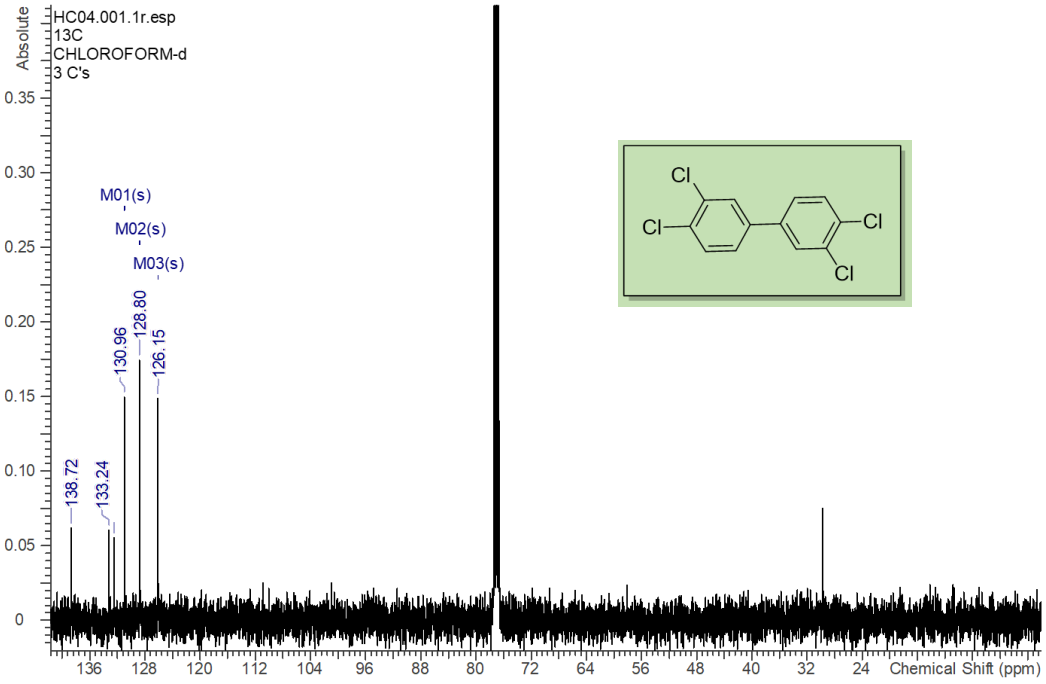
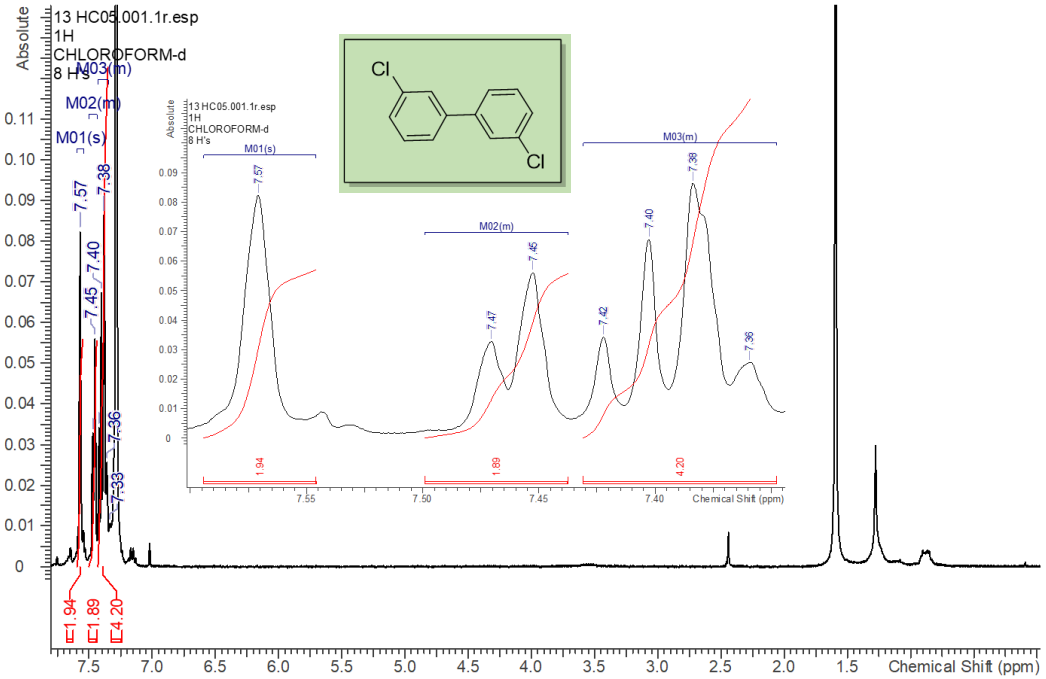
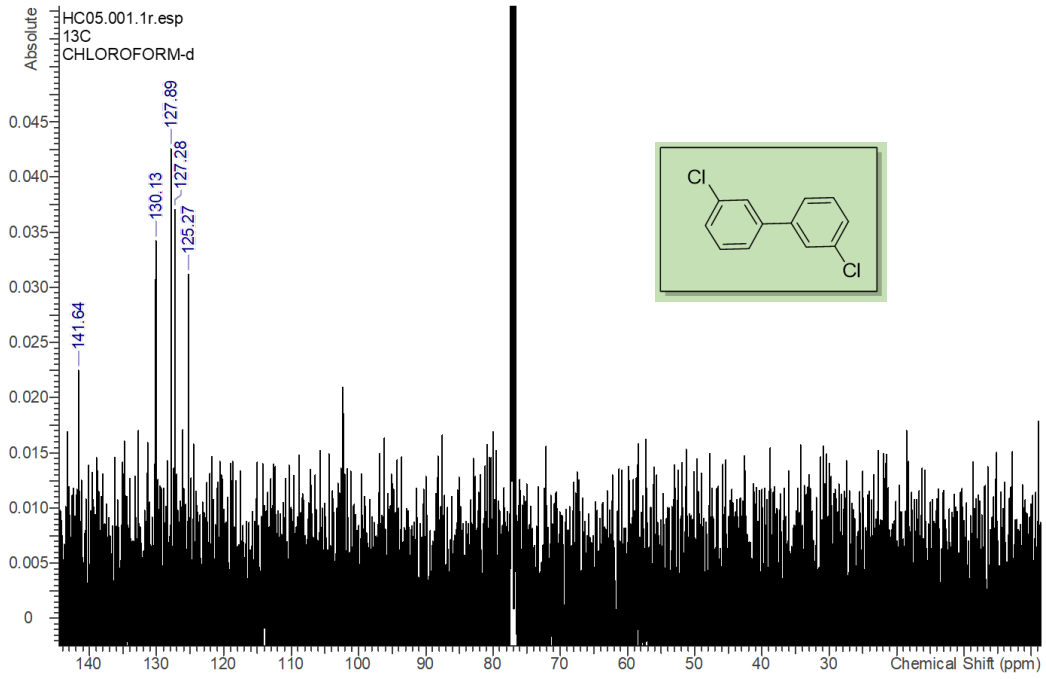
M01(s)
7.83
7.81
7.75
7.73
7.66
7.64
2.00
2.08
2.23
2.24
Absolute
Chemical Shift (ppm)

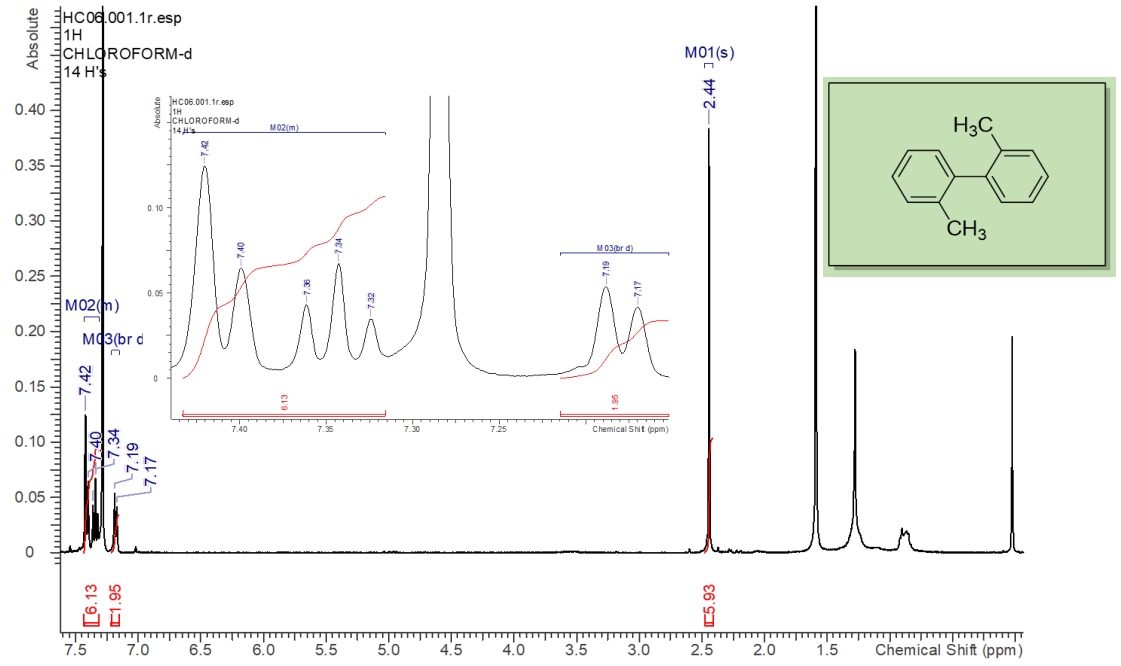

13 HCO3.001.1r.esp
13C
CHLOROFORM-d
4 C's
M04(s)
NC
CN
140.19
131.84
130.68
130.08
118.70
113.49
Absolute
Chemical Shift (ppm)

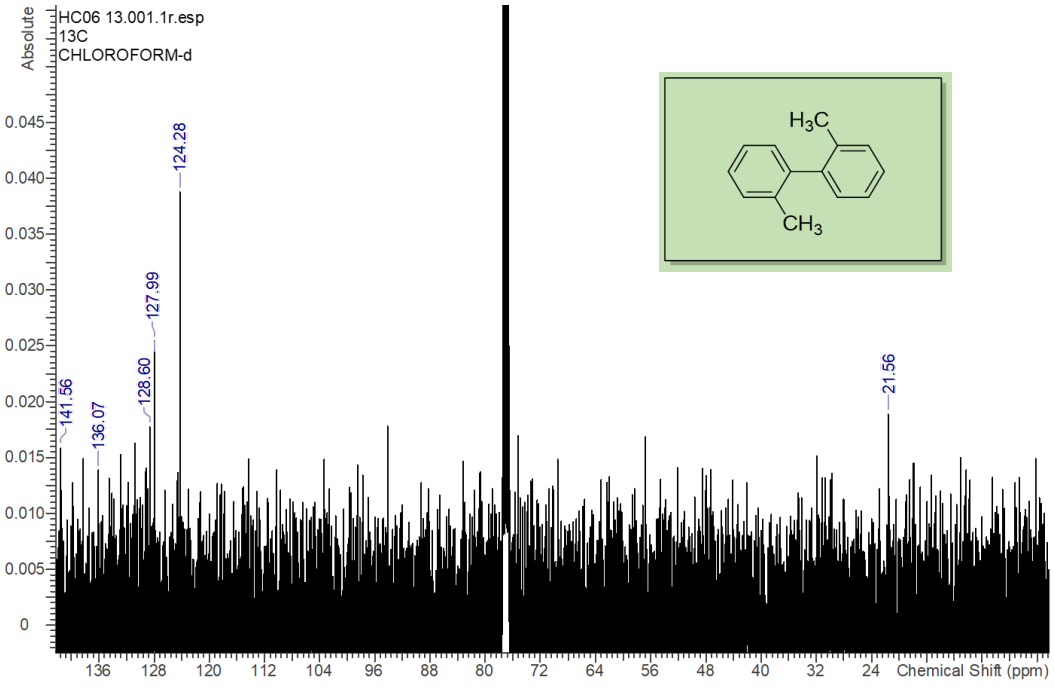

13C HC04.001.1r.esp
1H
CHLOROFORM-d
6 H's
M03(m)
M02(br d)
M01(br d)
7.65
7.53
7.40
7.38
1.99
2.00
2.05
Cl
Cl
Cl
Cl
Absolute
Chemical Shift (ppm)

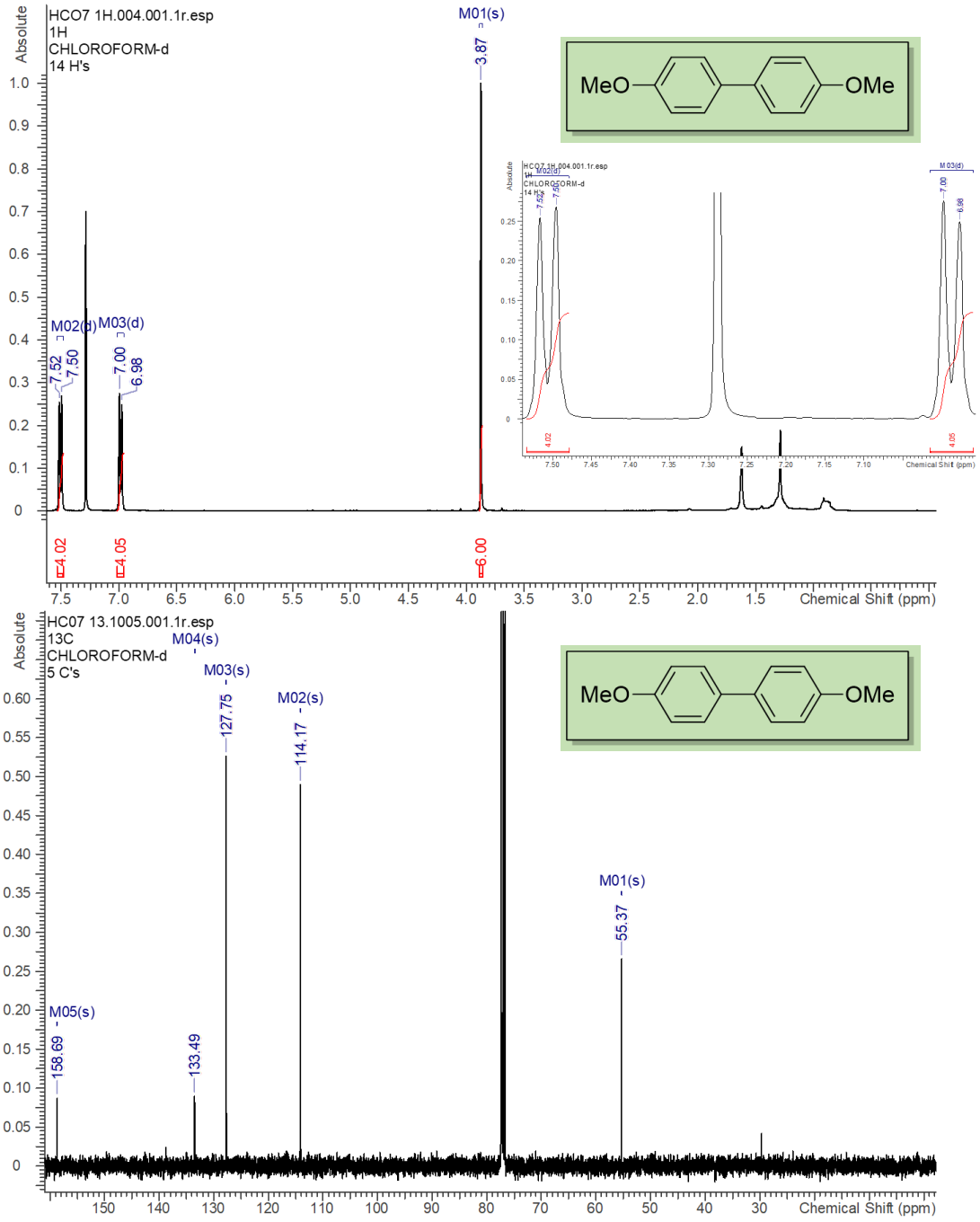

HC04.001.1r.esp
13C
CHLOROFORM-d
3 C's
M01(s)
M02(s)
M03(s)
138.72
133.24
130.96
128.80
126.15
Cl
Cl
Cl
Cl
Absolute
Chemical Shift (ppm)

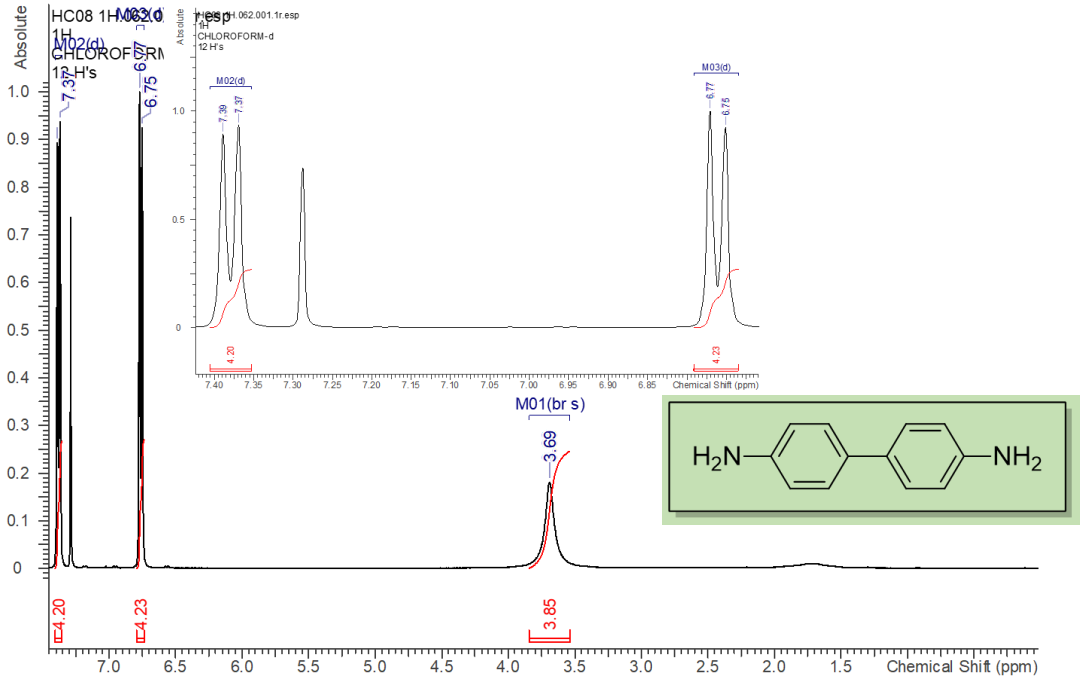

13 HC05.001.1r.esp
1H
CHLOROFORM-d
8 H's
M03(m)
M02(m)
M01(s)
7.57
7.38
7.40
7.45
7.36
7.93
1.94
1.89
4.20
Cl
Cl
Absolute
Chemical Shift (ppm)

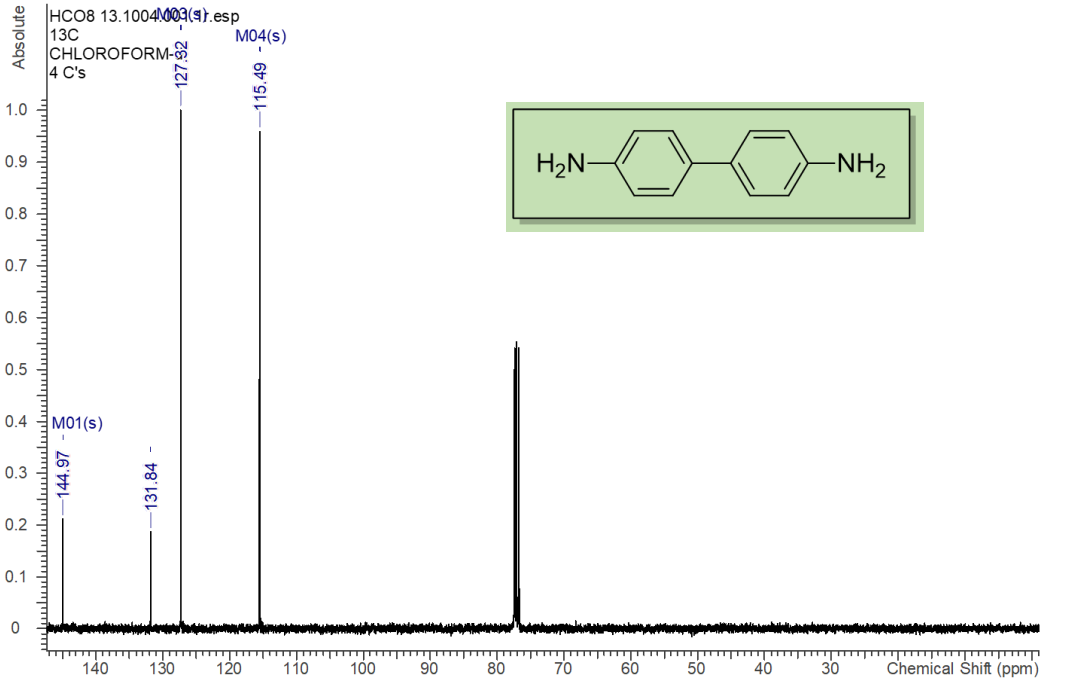

HC05.001.1r.esp
13C
CHLOROFORM-d
127.89
130.13
127.28
125.27
141.64
Cl
Cl
Absolute
Chemical Shift (ppm)

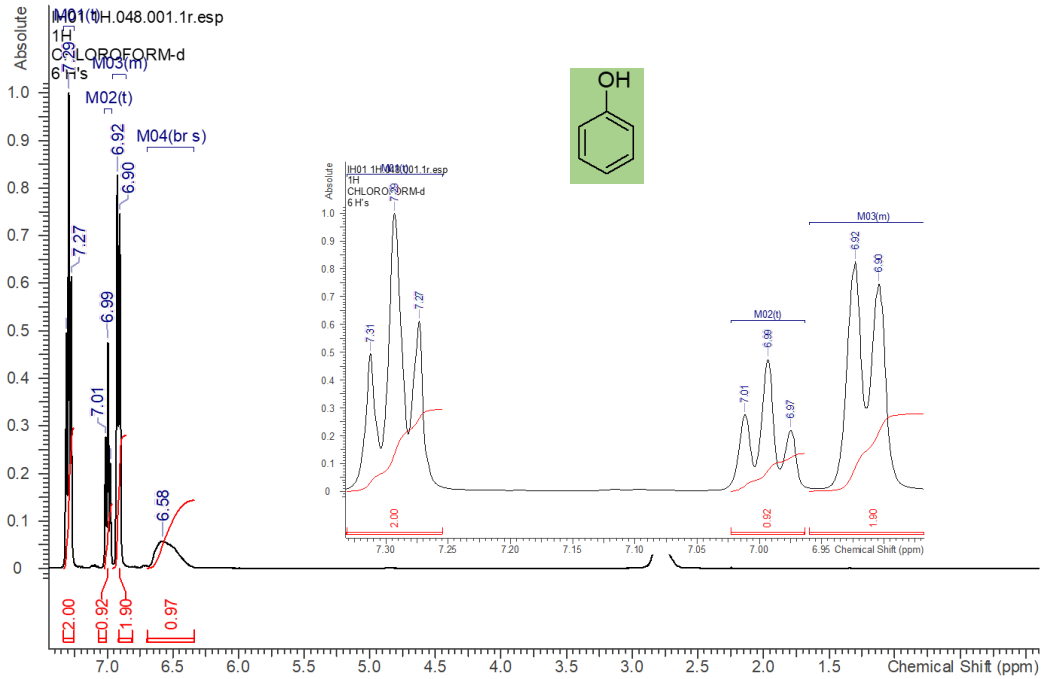

HC06.001.1r.esp
1H
CHLOROFORM-d
14 H's
Absolute
M01(s)
2.44
M02(m)
M03(br d
7.42
7.40
7.34
7.19
7.17
6.13
1.95
5.93
Chemical Shift (ppm)
H3C
CH3

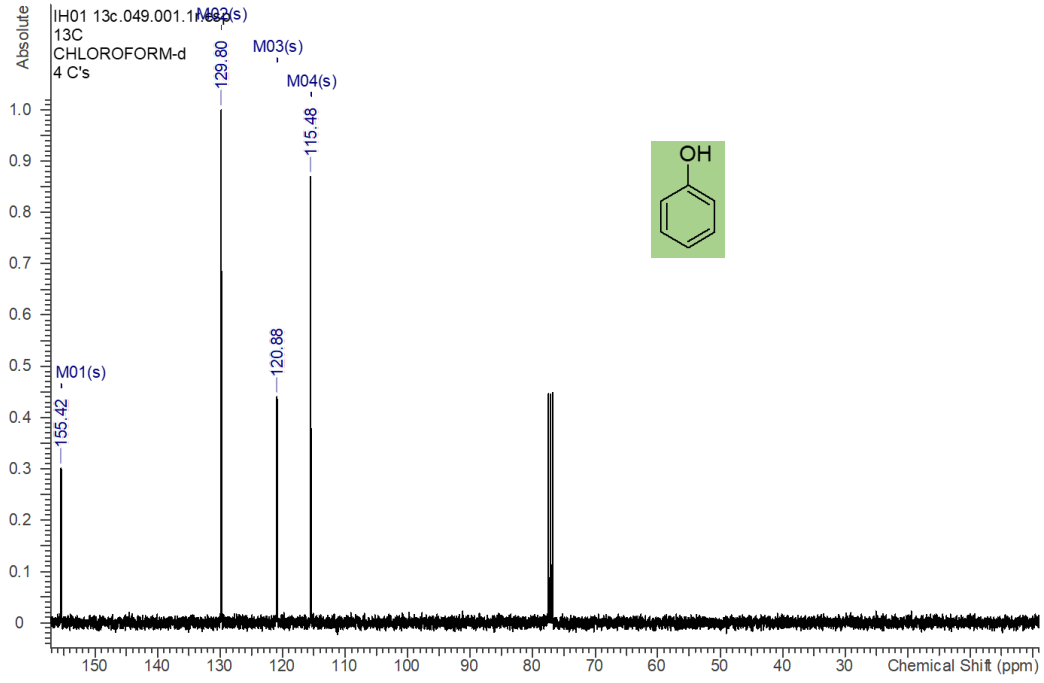

HC06 13.001.1r.esp
13C
CHLOROFORM-d
Absolute
124.28
127.99
128.60
141.56
136.07
21.56
Chemical Shift (ppm)
H3C
CH3

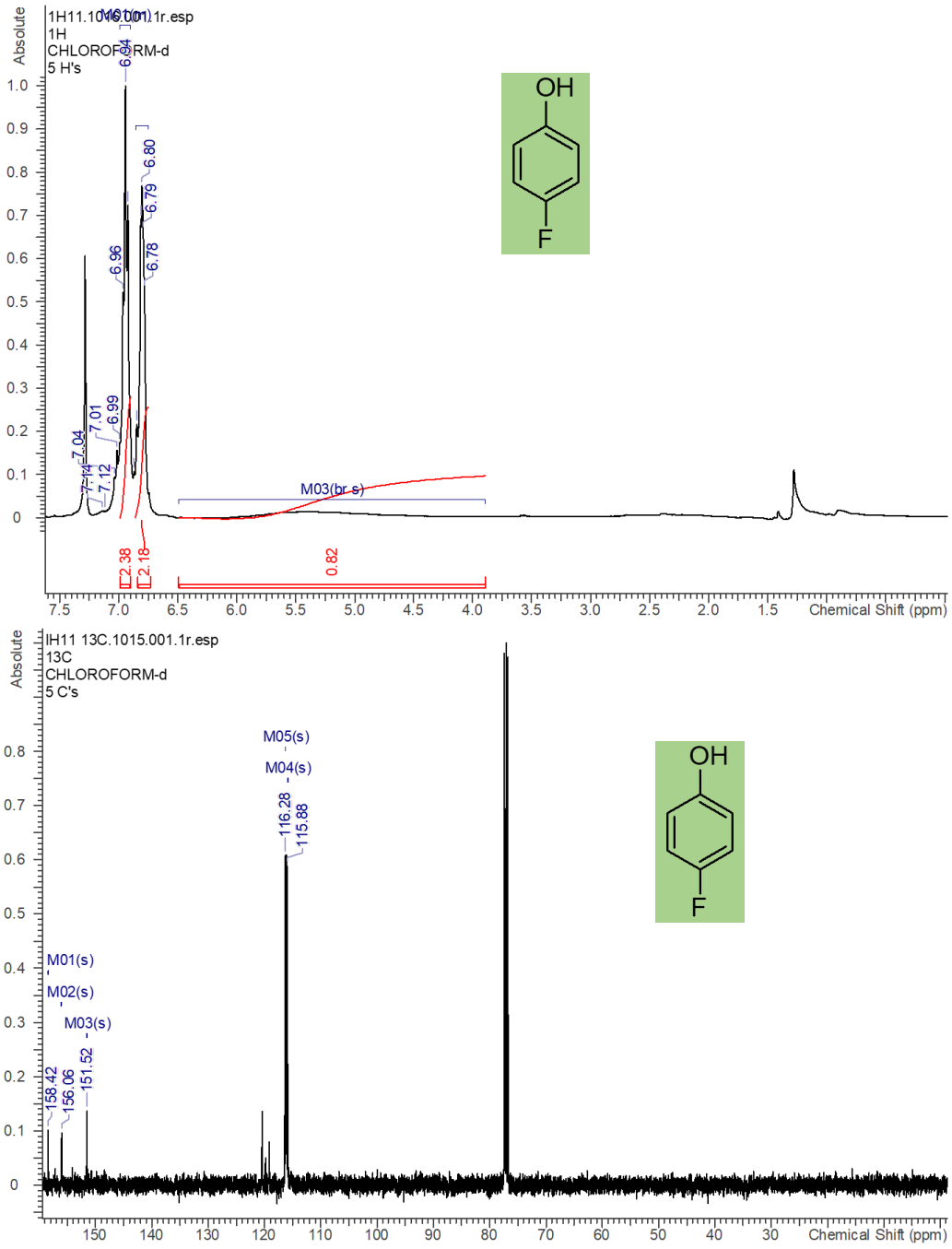

HCO7 1H.004.001.1r.esp
1H
CHLOROFORM-d
14 H's
Absolute
M01(s)
3.87
MeO
OMe
M02(d)
M03(d)
7.52
7.50
7.00
6.98
4.02
4.05
6.00
Chemical Shift (ppm)
HC07 13.1005.001.1r.esp
13C
CHLOROFORM-d
5 C's
M04(s)
M03(s)
M02(s)
127.75
114.17
M01(s)
55.37
M05(s)
158.69
133.49
Chemical Shift (ppm)

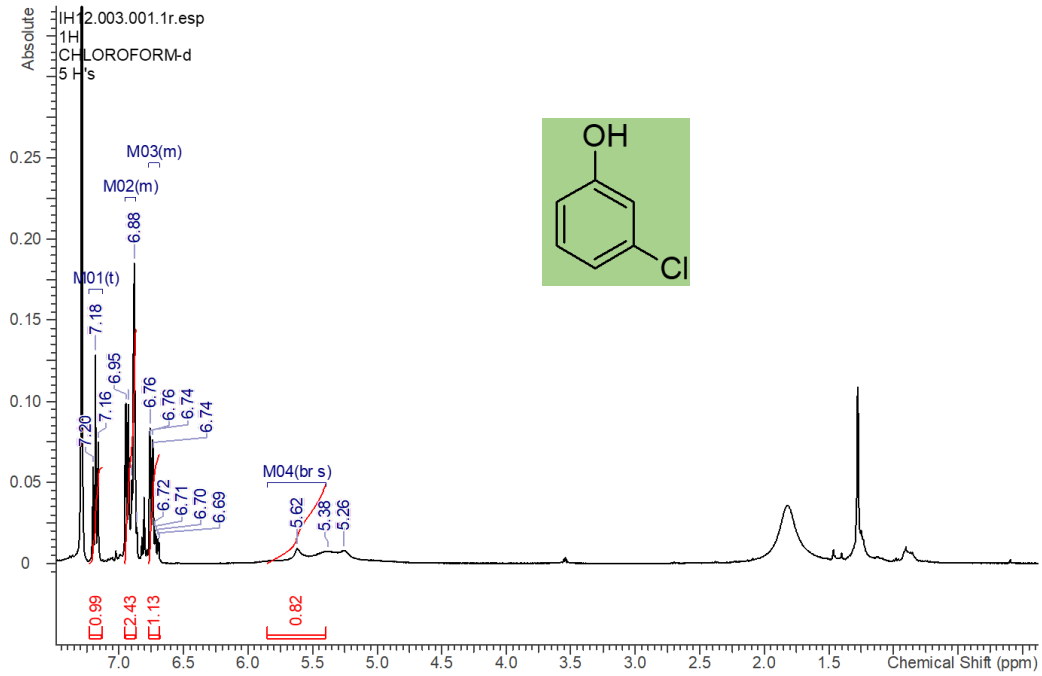

Absolute
M02(d)
7.37
6.75
M03(d)
M01(br s)
3.69
4.20
4.23
3.85
Chemical Shift (ppm)
H_2N
NH_2

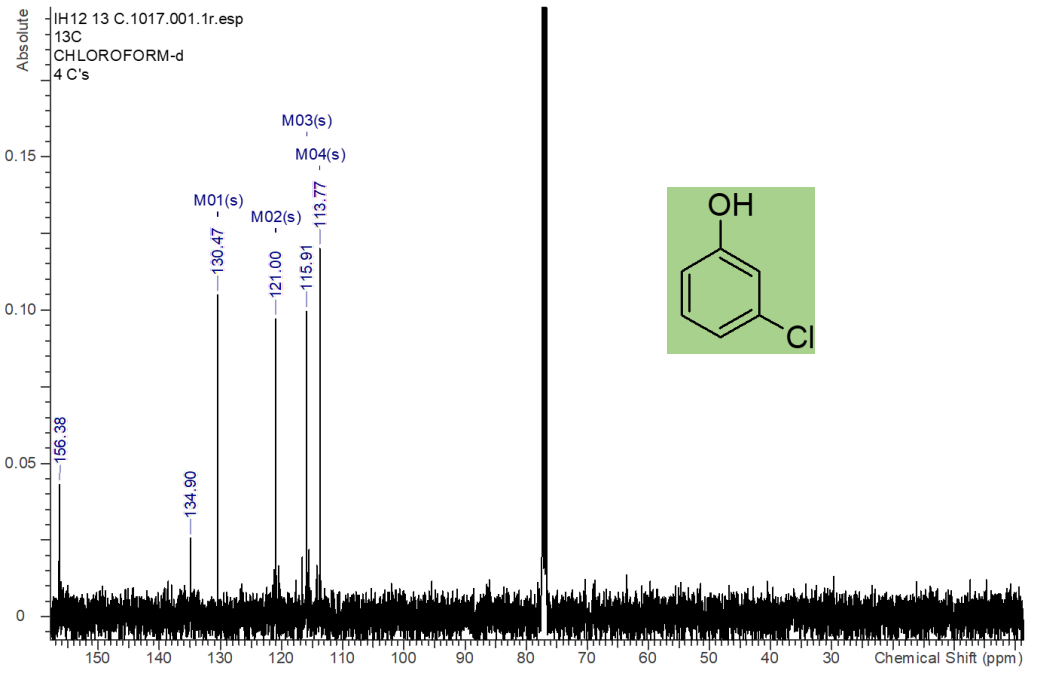

Absolute
13C
CHLOROFORM-d
4 C's
M01(s)
M04(s)
144.97
131.84
127.92
115.49
Chemical Shift (ppm)
H_2N
NH_2

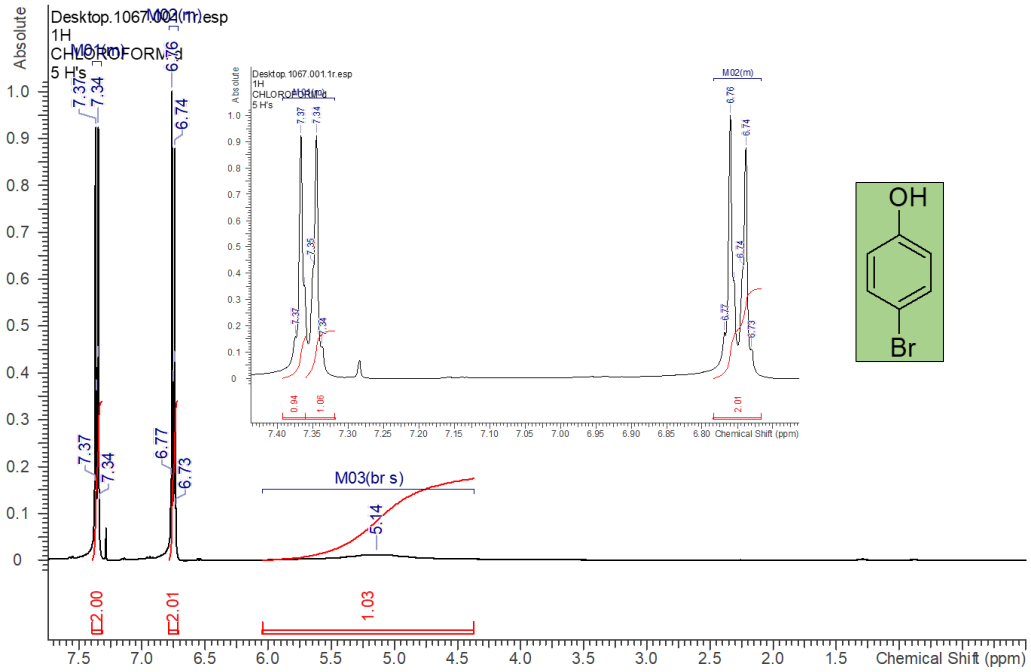

IH01 1H.048.001.1r.esp
1H
CHLOROFORM-d
6 H's
M01(t)
M02(t)
M03(m)
M04(br s)
7.31
7.27
7.01
6.99
6.92
6.90
6.58
2.00
0.92
1.90
0.97
Absolute
Chemical Shift (ppm)
OH

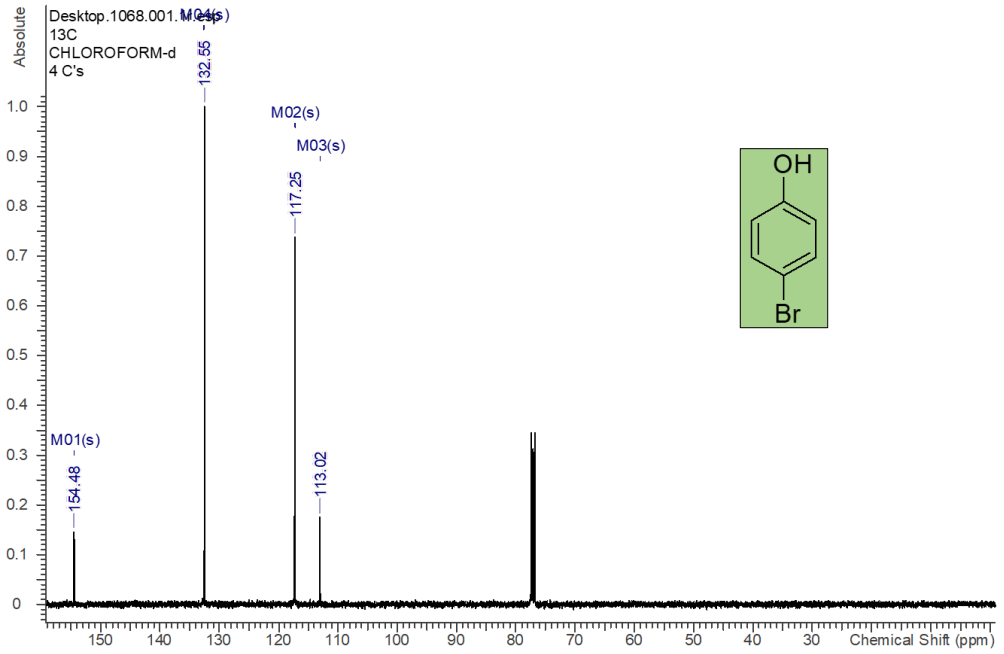

IH01 13c.049.001.1r.esp
13C
CHLOROFORM-d
4 C's
M01(s)
M02(s)
M03(s)
M04(s)
155.42
129.80
120.88
115.48
Absolute
Chemical Shift (ppm)
OH

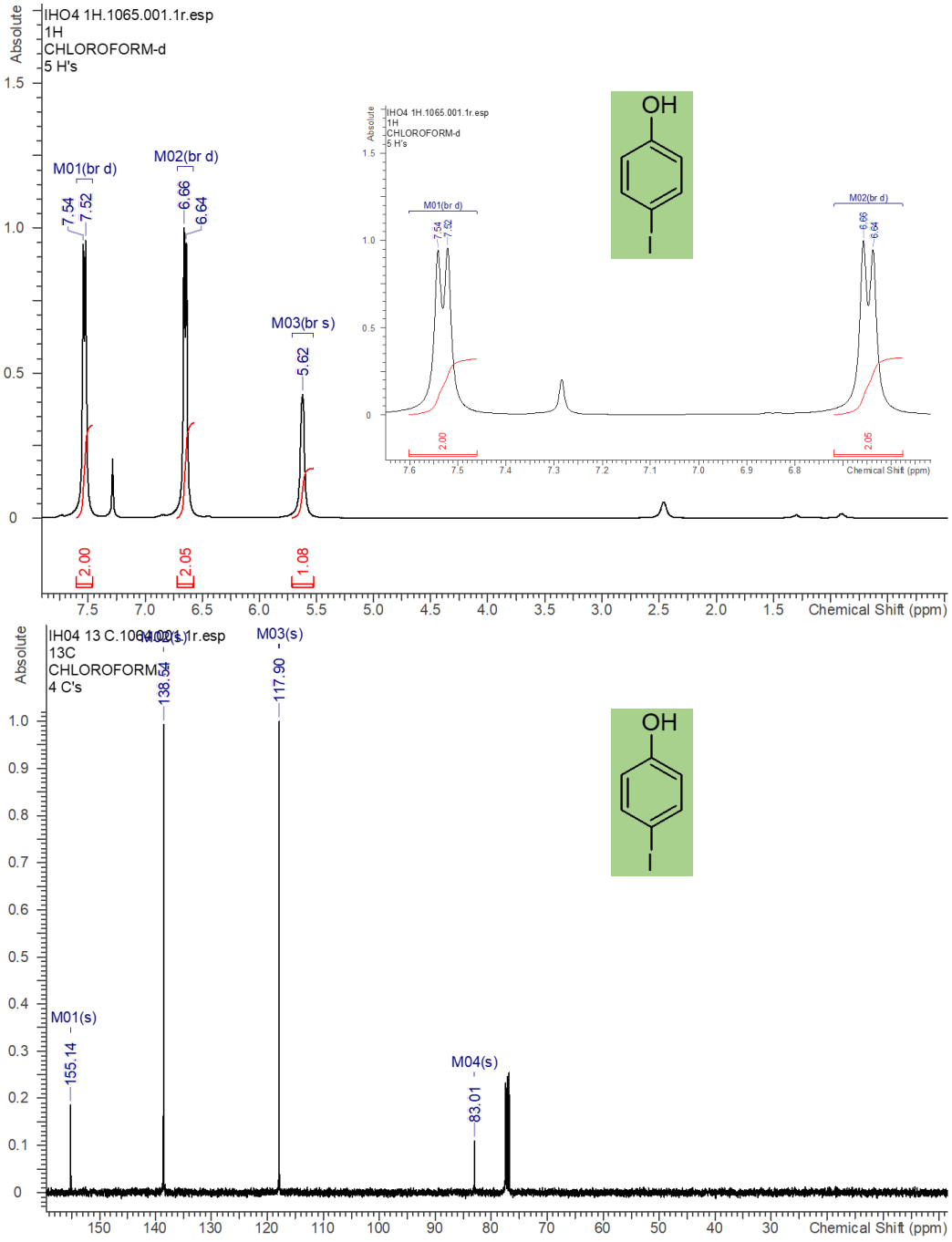

1H11.1015.001.1r.esp
1H
CHLOROFORM-d
5 H's
Absolute
OH
F
6.94
6.80
6.79
6.78
6.96
7.04
7.01
6.99
7.14
7.12
M03(br.s)
2.38
2.18
0.82
Chemical Shift (ppm)
IH11 13C.1015.001.1r.esp
13C
CHLOROFORM-d
5 C's
M05(s)
M04(s)
116.28
115.88
M01(s)
M02(s)
M03(s)
158.42
156.06
151.52
Chemical Shift (ppm)

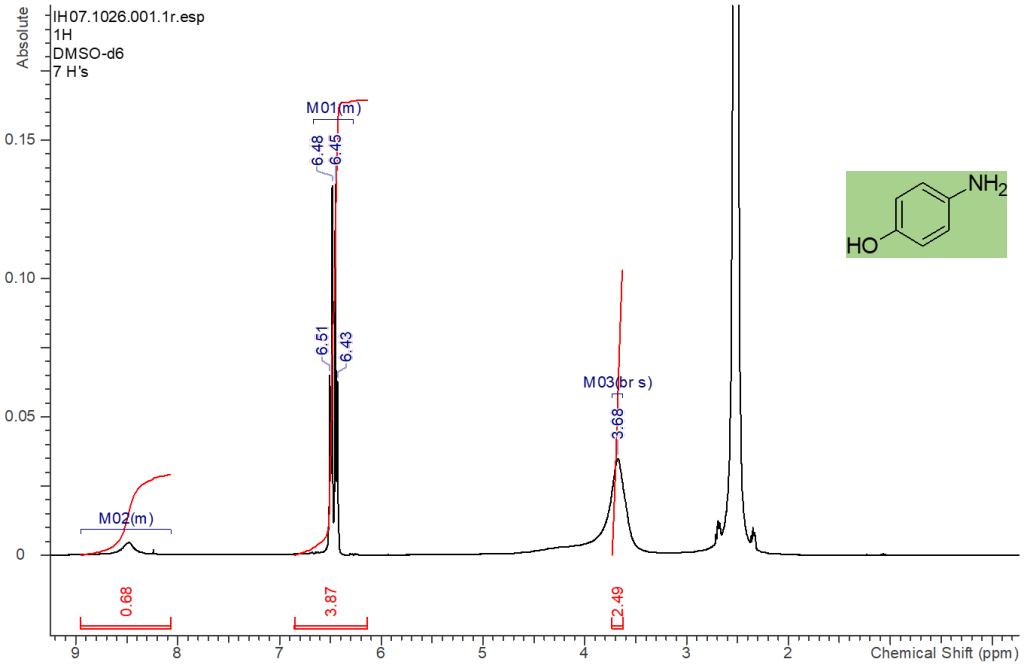

IH12.003.001.1r.esp
1H
CHLOROFORM-d
5 H's
Absolute
M03(m)
M02(m)
M01(t)
6.88
7.18
6.95
7.16
6.76
6.76
6.74
6.74
7.20
M04(br s)
6.72
6.71
6.70
6.69
5.62
5.38
5.26
0.99
2.43
1.13
0.82
Chemical Shift (ppm)
OH
Cl

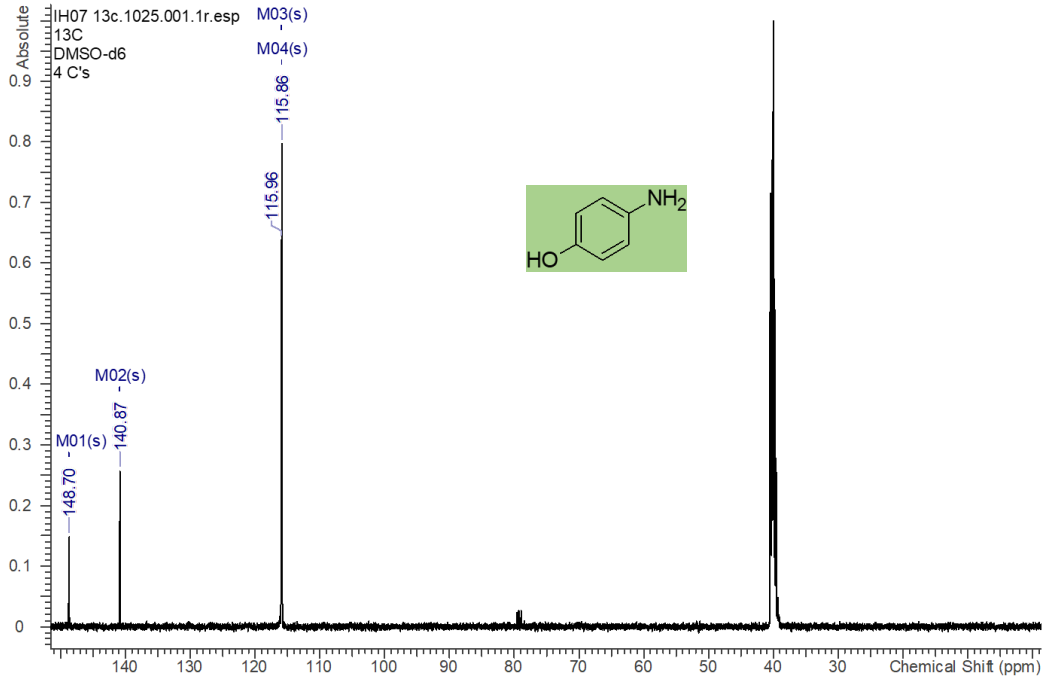

IH12 13 C.1017.001.1r.esp
13C
CHLOROFORM-d
4 C's
Absolute
M03(s)
M04(s)
M01(s)
M02(s)
113.77
130.47
121.00
115.91
156.38
134.90
Chemical Shift (ppm)
OH
Cl

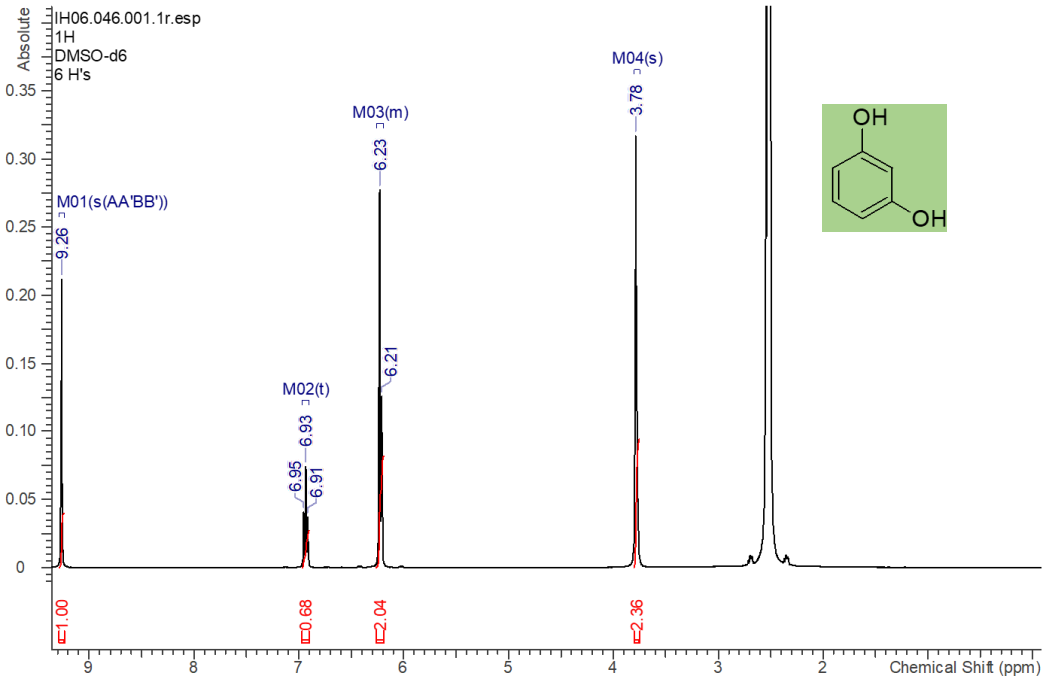

Absolute
1H
CHLOROFORM-d
5 H's
M01(m)
M02(m)
7.37
7.34
6.76
6.74
6.77
6.73
M03(br s)
5.14
2.00
2.01
1.03
OH
Br
Chemical Shift (ppm)

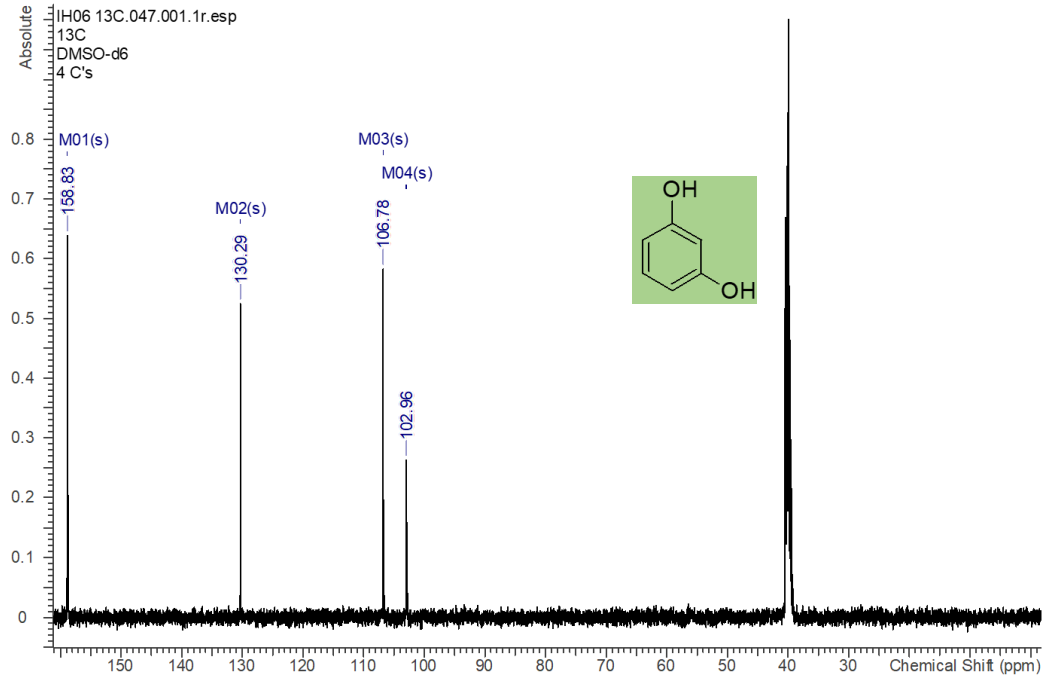

Absolute
13C
CHLOROFORM-d
4 C's
M01(s)
M02(s)
M03(s)
154.48
132.55
117.25
113.02
OH
Br
Chemical Shift (ppm)

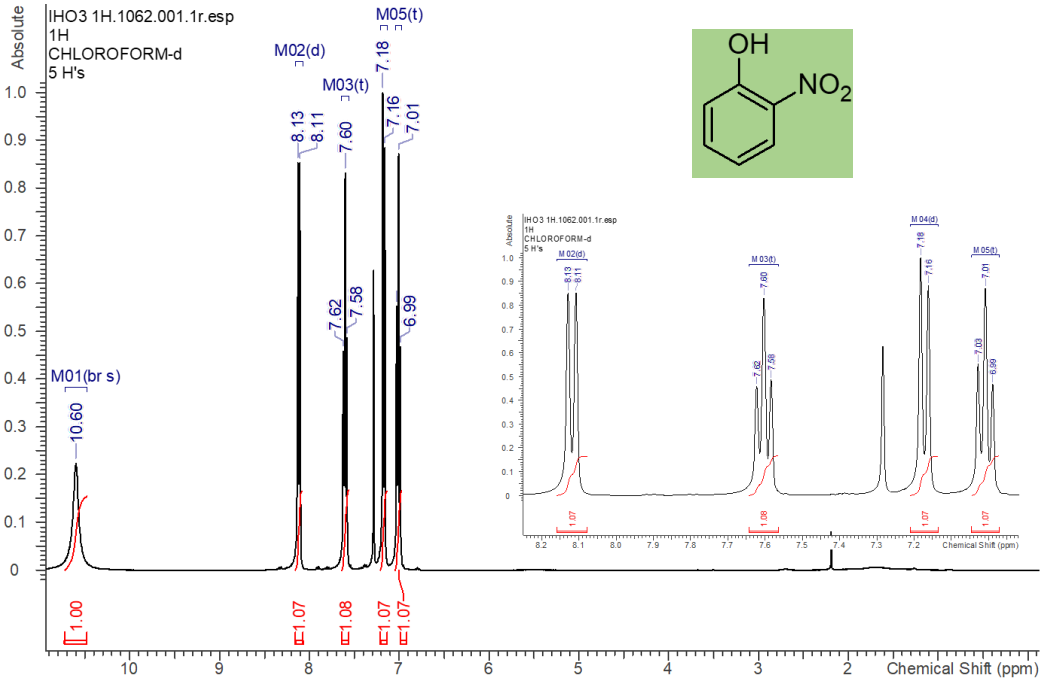

IHO4 1H.1065.001.1r.esp
1H
CHLOROFORM-d
5 H's
Absolute
M01(br d)
7.54
7.52
M02(br d)
6.66
6.64
M03(br s)
5.62
2.00
2.05
1.08
Chemical Shift (ppm)
OH
IHO4 13 C.1065.002.1r.esp
13C
CHLOROFORM-d
4 C's
M01(s)
155.14
M02(s)
138.54
M03(s)
117.90
M04(s)
83.01
Chemical Shift (ppm)

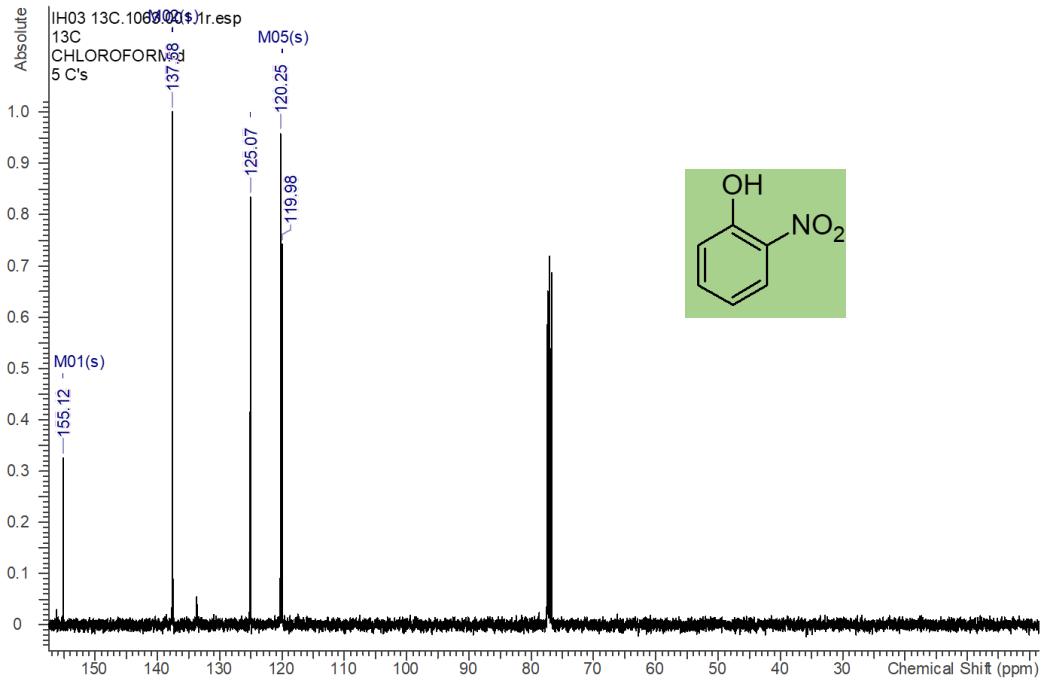

IH07.1026.001.1r.esp
1H
DMSO-d6
7 H's
Absolute
M01(m)
6.48
6.45
6.51
6.43
M03(br s)
3.68
M02(m)
0.68
3.87
2.49
NH2
HO
Chemical Shift (ppm)

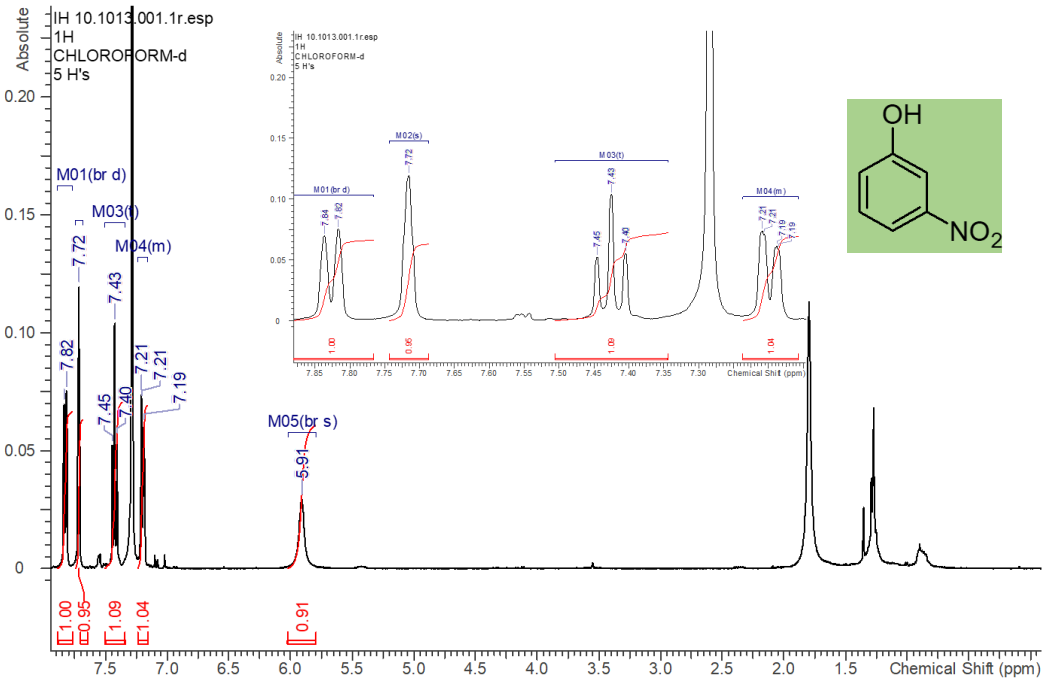

IH07 13c.1025.001.1r.esp
13C
DMSO-d6
4 C's
Absolute
M03(s)
M04(s)
115.86
115.96
M02(s)
140.87
M01(s)
148.70
NH2
HO
Chemical Shift (ppm)

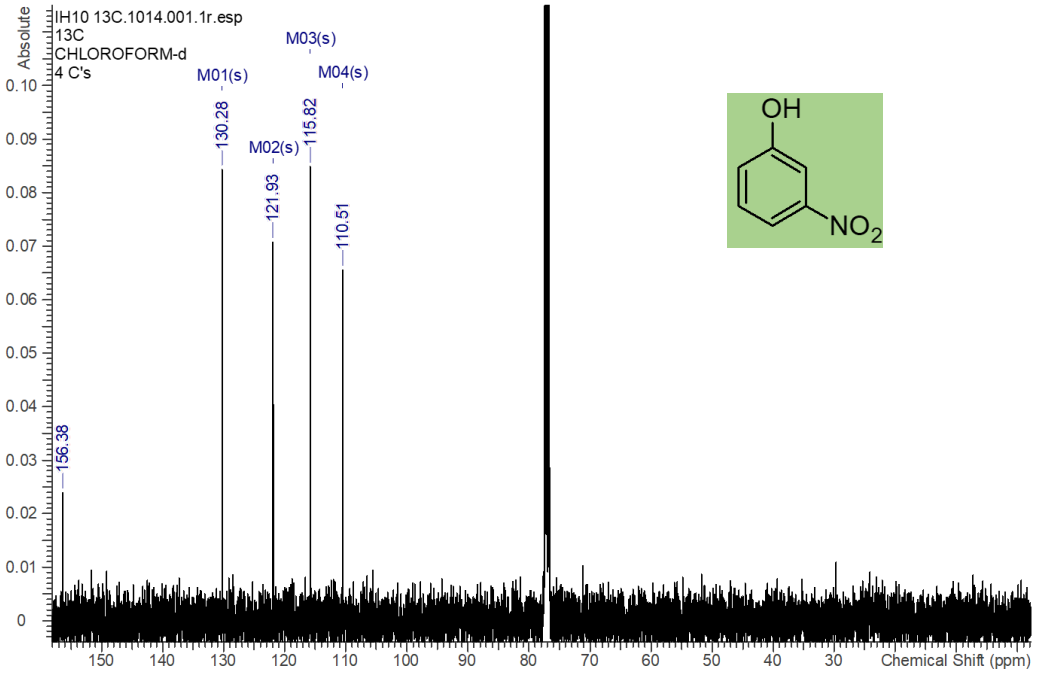

IH06.046.001.1r.esp
1H
DMSO-d6
6 H's
Absolute
M01(s(AA'BB'))
9.26
M02(t)
6.93
6.95
6.91
M03(m)
6.23
6.21
M04(s)
3.78
OH
OH
1.00
0.68
2.04
2.36
Chemical Shift (ppm)

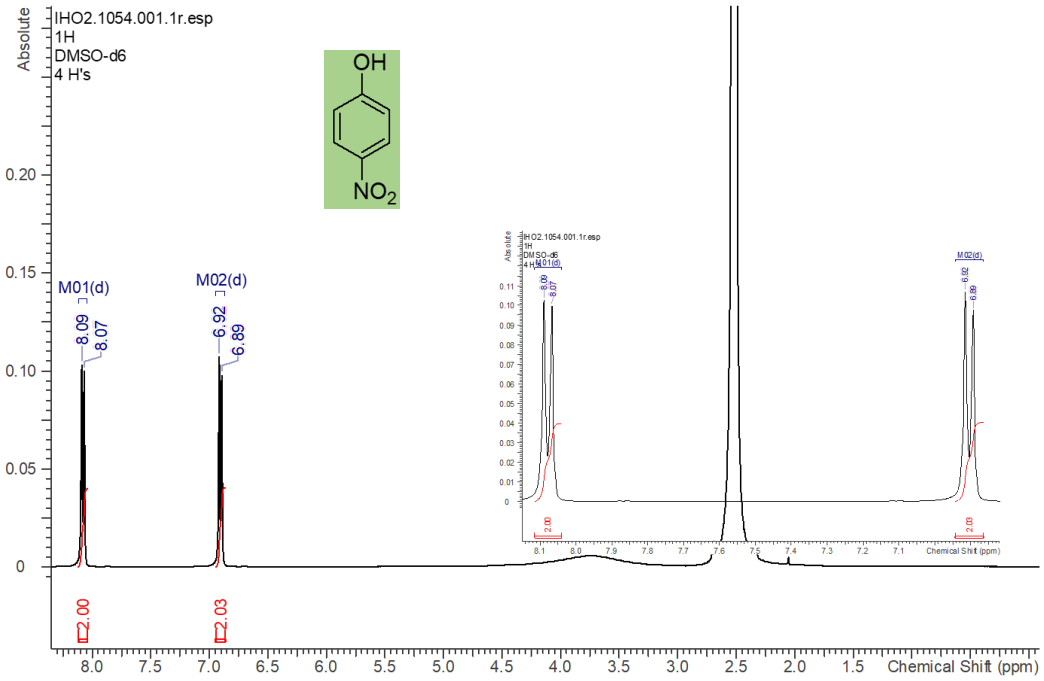

IH06 13C.047.001.1r.esp
13C
DMSO-d6
4 C's
Absolute
M01(s)
158.83
M02(s)
130.29
M03(s)
106.78
M04(s)
102.96
OH
OH
Chemical Shift (ppm)

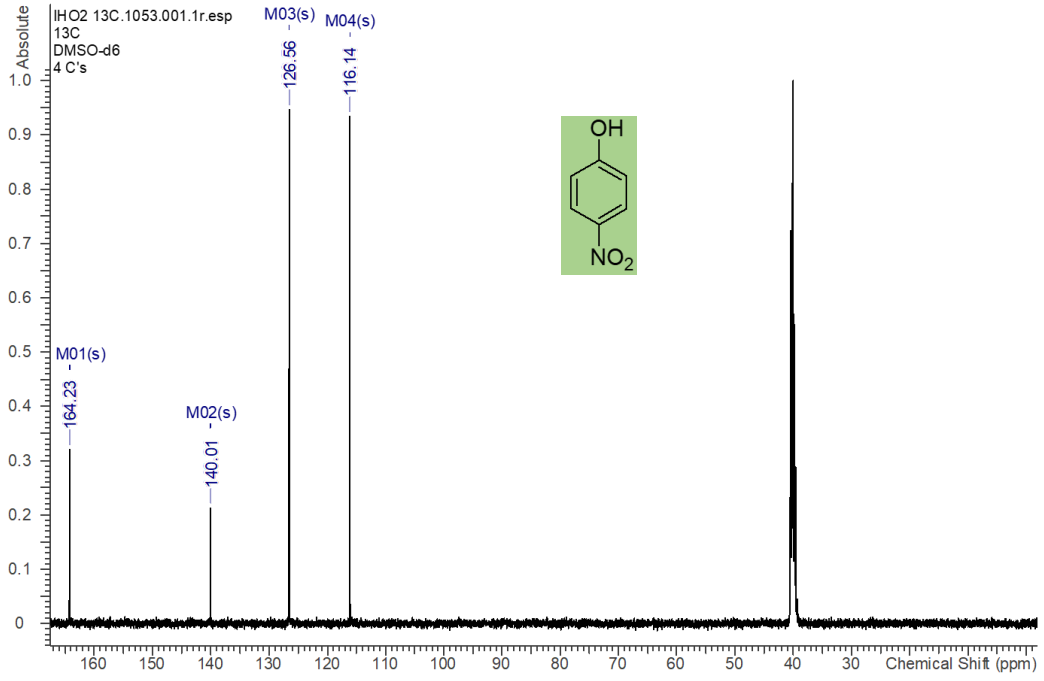

IHO3 1H.1062.001.1r.esp
1H
CHLOROFORM-d
5 H's
Absolute
M01(br s)
10.60
M02(d)
8.13
8.11
M03(t)
7.60
7.62
7.58
M05(t)
7.18
7.16
7.01
6.99
1.00
1.07
1.08
1.07
1.07
OH
NO2
Chemical Shift (ppm)

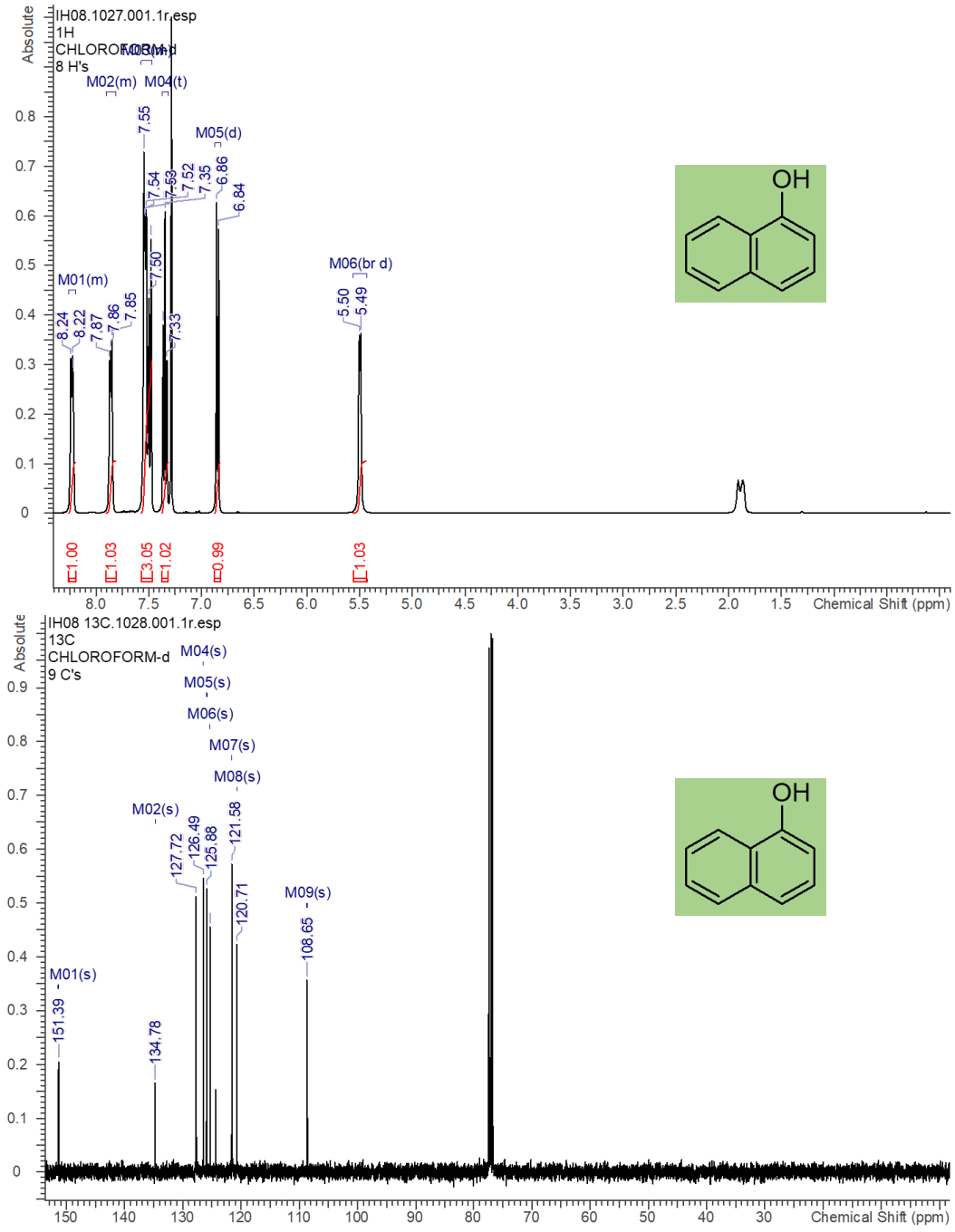

IH03 13C.1062.001.1r.esp
13C
CHLOROFORM-d
5 C's
Absolute
M01(s)
155.12
M02(s)
137.88
125.07
M05(s)
120.25
119.98
OH
NO2
Chemical Shift (ppm)

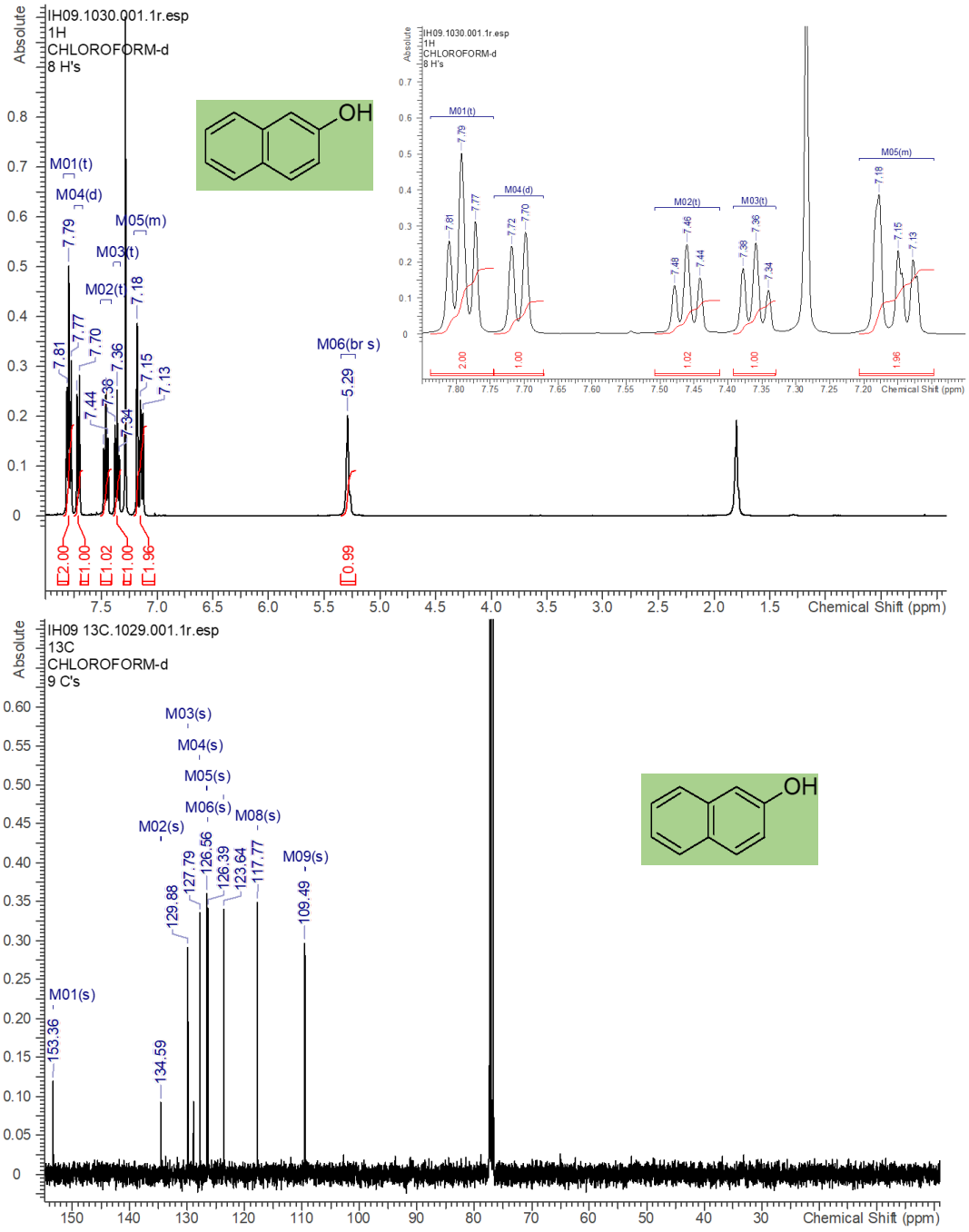

IH 10.1013.001.1r.esp
1H
CHLOROFORM-d
5 H's
Absolute
M01(br d)
M03(t)
M04(m)
M02(s)
M05(br s)
7.82
7.72
7.45
7.43
7.40
7.21
7.21
7.19
5.91
1.00
0.95
1.09
1.04
0.91
OH
NO2
Chemical Shift (ppm)


IH10 13C.1014.001.1r.esp
13C
CHLOROFORM-d
4 C's
Absolute
M01(s)
M02(s)
M03(s)
M04(s)
156.38
130.28
121.93
115.82
110.51
OH
NO2
Chemical Shift (ppm)


IHO2.1054.001.1r.esp
1H
DMSO-d6
4 H's
OH
NO2
M01(d)
8.09
8.07
M02(d)
6.92
6.89
2.00
2.03
Absolute
Chemical Shift (ppm)


IHO2 13C.1053.001.1r.esp
13C
DMSO-d6
4 C's
M01(s)
164.23
M02(s)
140.01
M03(s)
126.56
M04(s)
116.14
OH
NO2
Absolute
Chemical Shift (ppm)


IH08.1027.001.1r.esp
1H
CHLOROFORM-d
8 H's
Absolute
M01(m)
M02(m)
M04(t)
M05(d)
M06(br d)
8.24
8.22
7.87
7.86
7.85
7.55
7.54
7.53
7.52
7.50
7.35
7.33
6.86
6.84
5.50
5.49
1.00
1.03
3.05
1.02
0.99
1.03
Chemical Shift (ppm)
OH
IH08 13C.1028.001.1r.esp
13C
CHLOROFORM-d
9 C's
M01(s)
M02(s)
M04(s)
M05(s)
M06(s)
M07(s)
M08(s)
M09(s)
151.39
134.78
127.72
126.49
125.88
121.58
120.71
108.65
Chemical Shift (ppm)
OH


IH09.1030.001.1r.esp
1H
CHLOROFORM-d
8 H's
Absolute
M01(t)
M04(d)
M05(m)
M03(t)
M02(t)
M06(br s)
7.79
7.81
7.77
7.70
7.44
7.36
7.34
7.18
7.15
7.13
5.29
2.00
1.00
1.02
1.00
1.96
0.99
OH
Chemical Shift (ppm)
IH09 13C.1029.001.1r.esp
13C
CHLOROFORM-d
9 C's
M01(s)
M02(s)
M03(s)
M04(s)
M05(s)
M06(s)
M08(s)
M09(s)
153.36
134.59
129.88
127.79
126.56
126.39
123.64
117.77
109.49
OH
Chemical Shift (ppm)