Electronic Supplementary Material (ESI) for RSC Advances.

A novel substrate directed multicomponent reaction for the synthesis of tetrahydro-spiro[pyrazolo[4,3-*f*]quinoline-8,5'-pyrimidines and tetrahydro-pyrazolo[4,3-*f*]pyrimido[4,5-*b*]quinolines via selective multiple C-C bonds formation under metal-free reaction condition

Divyang M. Patel[a], Hetal J. Patel[a], José M. Padrón[b], and Hitendra M. Patel[a]*

[a] *Department of Chemistry, Sardar Patel University, Vallabh Vidyanagar, 388120, Gujarat, India.*

[b] *BioLab, Instituto Universitario de Bio-Orgánica Antonio González, CIBICAN, Universidad de La Laguna, Avda. Astrofísico Francisco Sánchez 2, 38206 La Laguna, Spain.*

*E-mail: hm_patel@spuvvn.edu

Table of Contents……..…….... S1

Crystal X-ray report of compound **5g [CCDC:1990292]**.

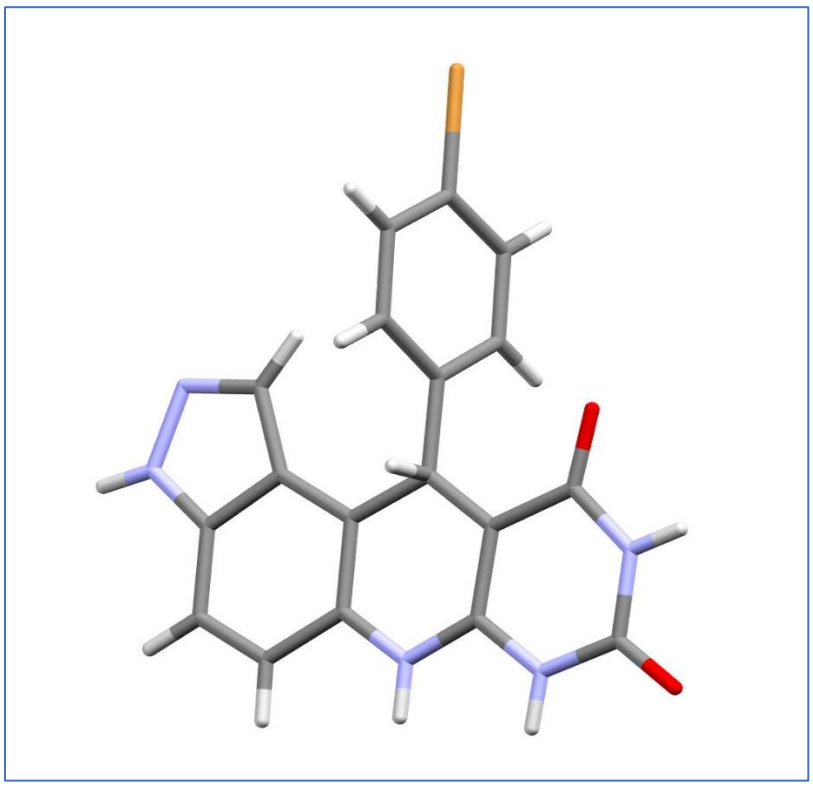


Figure **S1**. Crystal X-ray structure of compound **5g**.

Table S1. Crystal data and structure refinement for **5g**.

Identification code	5g	
Empirical formula	C18 H12 Br N5 O2	
Formula weight	410.23	
Temperature	298 K	
Wavelength	0.71073 Å	
Crystal system	Triclinic	
Space group	P -1	
Unit cell dimensions	a = 10.1063(13) Å	α= 94.851° (4).
	b = 10.6214(12) Å	β= 97.256° (4).
	c = 12.8286(16) Å	γ = 111.253° (3).
Volume	1260.4(3) $Å^3$	
Density (calculated)	1.081 g/Cm^3	

F(000)	412.0
Data completeness	0.991

Crystal X-ray report of compound **7b [CCDC:1978229]**.

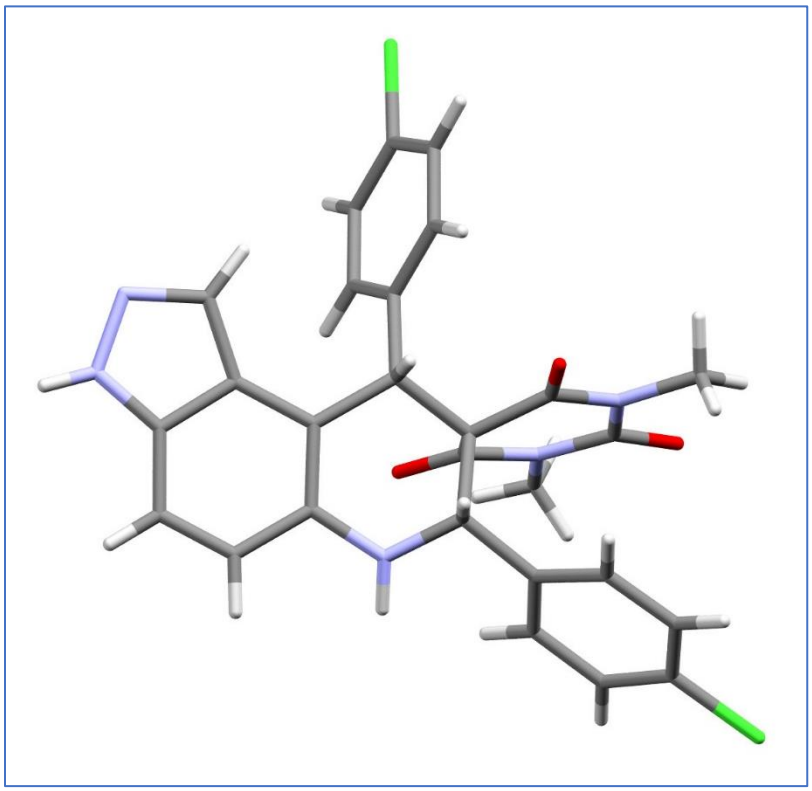


Figure **S2**. Crystal X-ray structure of compound **7b**.

Table S2. Crystal data and structure refinement for **7b**.

Identification code	7b
Empirical formula	C27 H21 Cl2 N5 O3
Formula weight	534.39
Temperature	293 K
Wavelength	0.71073 Å
Crystal system	Monoclinic
Space group	P 21/c

Unit cell dimensions	a = 9.6991 (4) Å	α= 90°.
	b = 15.1736 (7) Å	β= 101.750° (2).
	c = 18.5825 (9) Å	γ = 90°.
Volume	2677.5(2)Å^3	
Density (calculated)	1.326 g/Cm^3	
F(000)	1104.0	
Data completeness	0.993	

Crystal X-ray report of compound **7h [CCDC: 1968978]**.

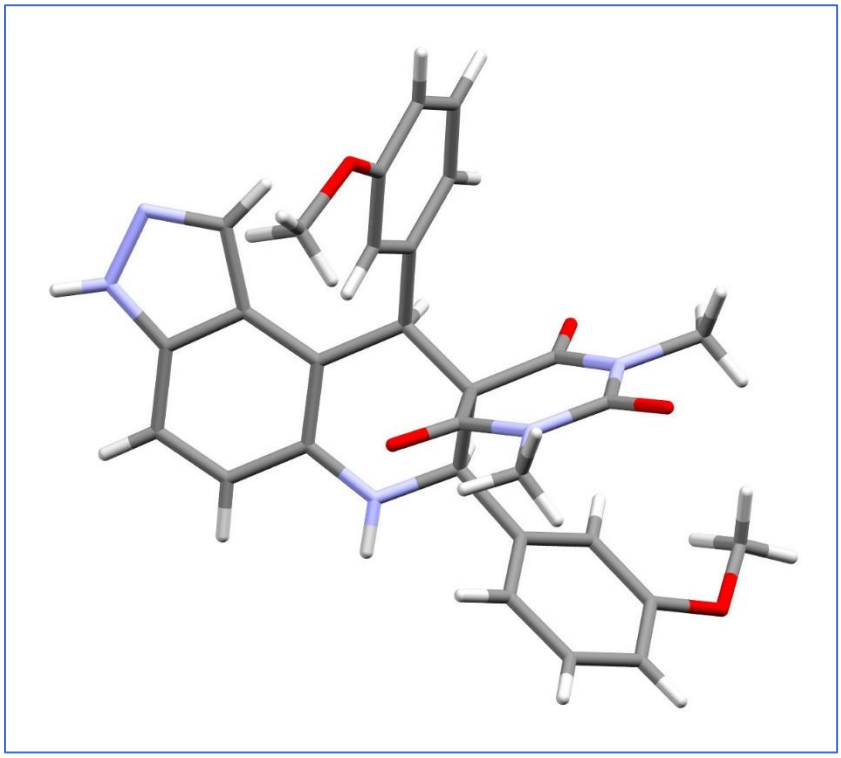


Figure **S3**. Crystal X-ray structure of compound **7h**.

Table S3. Crystal data and structure refinement for **7h**.

Identification code	7h
Empirical formula	C27 H27 N5 O5
Formula weight	525.55

Temperature	293 K	
Wavelength	0.71073 Å	
Crystal system	Orthorhombic	
Space group	P 21 21 21	
Unit cell dimensions	12.2814(14)Å	α= 90°.
	b = 12.4871(16) Å	β= 90°.
	c = 16.249(2)Å	γ = 90°.
Volume	2492.0(5) $Å^3$	
Density (calculated)	1.401g/Cm^3	
F(000)	1104.0	
Data completeness	1.76/0.99	

Characterizations details of 11-aryl-3,6,7,11-tetrahydro-8*H*-pyrazolo[4,3-*f*]pyrimido[4,5-*b*]quinoline-8,10(9*H*)-diones 5(a-k) and 7,9-diaryl-3,6,7,9-tetrahydro-2'*H*-spiro[pyrazolo[4,3-*f*] quinoline-8,5'-pyrimidine]-2',4',6'(3'*H*)-triones (7a-i).

Spectroscopic and analytical characterization of 11-aryl-3,6,7,11-tetrahydro-8*H*-pyrazolo[4,3-f]pyrimido[4,5-*b*]quinoline-8,10(9*H*)-diones 5(a-k).

11-phenyl-3,6,7,11-tetrahydro-8*H*-pyrazolo[4,3-*f*]pyrimido[4,5-*b*]quinoline-8,10(9*H*)-dione. (5a)

Light pink solid, %purity (HPLC) =88.1%, mp. 282-284°C; ^{1}H-NMR (400 MHz, DMSO-d_6) (δ, ppm): 12.98 (s, 1H, NH), 10.54 (s, 1H, NH), 10.34 (s, 1H, NH), 8.88(s, 1H, ArH), 8.02(s, 1H, ArH) ,7.30-7.39 (m, 3H, ArH), 7.13-7.19 (m, 3H, ArH), 7.05 (t, *J*= 7.2 Hz, 1H, ArH), 5.41 (s, 1H, CH); ^{13}C-NMR (100 MHz, DMSO-d_6) (δ, ppm): 162.77, 150.25, 147.13, 145.66, 137.23, 131.76, 128.45, 128.23, 127.92, 127.49, 125.92, 121.48, 117.07, 113.94, 109.43, 85.26, 64.88, 38.08, 15.13; MS(MM-ES+APCI) 329.9 $[M+H]^+$.

11-(4-chlorophenyl)-3,6,7,11-tetrahydro-8*H*-pyrazolo[4,3-*f*]pyrimido[4,5-*b*]quinoline-8,10(9*H*)-dione. (5b)

Off white solid, mp. 280-282°C; ^{1}H-NMR (400 MHz, DMSO-d_6) (δ, ppm): 13.05 (s, 1H, NH), 10.67 (s, 1H, NH), 10.45 (*s*, 1H, NH), 7.52(*s*, 1H, ArH),7.45 (d, *J*= 9.2 Hz, 2H, ArH), 7.30-7.39 (m, 2H, ArH), 7.22 (d, *J*= 7.6 Hz, 2H, ArH), 7.07 (d, *J*= 9.2 Hz, 1H, ArH), 6.91 (s, 1H, CH), 4.91 (s, 1H, CH);^{13}C-NMR (100 MHz, DMSO-d_6) (δ, ppm):169.98, 165.22, 162.76, 153.25, 146.01, 139.90, 137.25, 137.23, 132.07, 131.24, 130.48, 130.27, 130.20, 129.35, 128.70, 128.66, 128.59, 128.22,

127.87, 127.79, 121.36, 117.13, 116.54, 113.68, 113.29, 109.70, 109.57, 84.89; MS(MM-ES+APCI) 365.8 $[M+H]^+$.

11-(4-nitrophenyl)-3,6,7,11-tetrahydro-8*H*-pyrazolo[4,3-*f*]pyrimido[4,5-*b*]quinoline-8,10(9*H*)-dione. (5c)

Pale yellow solid, mp. 268-270°C; ^{13}C-NMR (100 MHz, DMSO-d_6) (δ, ppm):169.69, 167.73, 162.74, 154.26, 153.20, 150.12, 145.78, 145.72, 137.24, 131.63, 129.57, 128.80, 128.33, 123.92, 123.30, 121.36, 117.27, 112.31, 110.19, 110.12, 84.35; MS(MM-ES+APCI) 376.8 $[M+H]^+$.

11-(4-methoxyphenyl)-3,6,7,11-tetrahydro-8*H*-pyrazolo[4,3-*f*]pyrimido[4,5-*b*]quinoline-8,10(9*H*)-dione. (5d)

Off white solid, %purity (HPLC) =98.7%, mp. 278-280°C; ^{1}H-NMR (400 MHz, DMSO-d_6) (δ, ppm): 12.97 (s, 1H, NH), 10.54 (s, 1H, NH), 10.29 (s, 1H, NH), 8.82 (*s*, 1H, ArH), 7.34(*d*, *J*= 8.8 Hz, 1H, ArH),7.22 (*d*, *J*= 8.8 Hz, 2H, ArH), 7.13 (*d*, *J*= 8.8 Hz, 1H, ArH), 6.72 (*d*, *J*= 8.8 Hz, 2H, ArH), 5.36 (s, 1H, CH), 3.63 (s, 1H, OCH_3); ^{13}C-NMR (100 MHz, DMSO-d_6) (δ, ppm):162.78, 157.41, 150.19, 145.41, 139.47, 137.24, 131.78, 128.41, 128.10, 121.46, 117.05, 114.26, 113.28, 109.30, 85.46, 54.86, 37.17; MS(MM-ES+APCI) 359.8 $[M+H]^+$.

11-(p-tolyl)-3,6,7,11-tetrahydro-8*H*-pyrazolo[4,3-*f*]pyrimido[4,5-*b*]quinoline-8,10(9*H*)-dione. (5e)

Off white solid, %purity (HPLC) =98.5%, mp. >300°C; ^{1}H-NMR (400 MHz, DMSO-d_6) (δ, ppm): 12.97 (s, 1H, NH), 10.54 (s, 1H, NH), 10.29 (s, 1H, NH), 8.82 (*s*, 1H, ArH), 8.01 (*s*, 1H, ArH), 7.34(*d*, *J*= 8.8 Hz, 1H, ArH),7.19 (*d*, *J*= 8.4 Hz, 2H, ArH), 7.13 (*d*, *J*= 8.8 Hz, 1H, ArH), 6.96 (*d*, *J*= 8.0 Hz, 2H, ArH), 5.36 (s, 1H, CH), 2.15 (s, 1H, CH_3); ^{13}C-NMR (100 MHz, DMSO-d_6) (δ, ppm):162.75, 150.15, 145.45, 144.25, 134.87, 131.79, 128.46, 128.12, 127.37, 117.07, 114.11, 110.66, 109.37, 109.32, 108.0, 90.66, 85.34, 84.77, 20.49; MS(MM-ES+APCI) 345.0 $[M+H]^+$.

11-(4-fluorophenyl)-3,6,7,11-tetrahydro-8*H*-pyrazolo[4,3-*f*]pyrimido[4,5-*b*]quinoline-8,10(9*H*)-dione. (5f)

Off white solid, %purity (HPLC) =99.5%, mp. >300°C; ^{1}H-NMR (400 MHz, DMSO-d_6) (δ, ppm): 13.0 (s, 1H, NH), 10.57 (s, 1H, NH), 10.33 (s, 1H, NH), 8.88 (*s*, 1H, ArH), 8.01 (*s*, 1H, ArH), 7.33-7.38(*m*, 3H, ArH),7.15 (*d*, *J*= 8.8 Hz, 1H, ArH), 6.99 (*t*, *J*= 8.8 Hz, 2H, ArH), 5.45 (s, 1H, CH);^{13}C-NMR (100 MHz, DMSO-d_6) (δ, ppm):162.77, 161.69, 159.29, 150.16, 145.53, 143.33, 143.29, 137.25,

131.73, 131.71, 129.27,129.19, 128.19, 121.39, 117.12, 114.66, 114.45, 113.66, 109.59, 85.16, 37.35; MS(MM-ES+APCI) 349.8 $[M+H]^+$.

11-(4-bromophenyl)-3,6,7,11-tetrahydro-8*H*-pyrazolo[4,3-*f*]pyrimido[4,5-*b*]quinoline-8,10(9*H*)-dione. (5g)

Off white solid, mp. 290-292°C; ^{1}H-NMR (400 MHz, DMSO-d_6) (δ, ppm): 13.05 (s, 1H, NH), 10.66 (s, 1H, NH), 10.45 (s, 1H, NH), 7.57 (*d*, *J*= 8.4 Hz, 2H, ArH), 7.44 (*d*, *J*= 8.8 Hz, 1H, ArH) 7.24-7.34(*m*, 2H, ArH),7.08 (*d*, *J*= 8.8 Hz, 1H, ArH), 6.92 (*s*, 1H, ArH), 4.90 (s, 1H, CH); ^{13}C-NMR (100 MHz, DMSO-d_6) (δ, ppm):169.98, 165.21, 162.79, 153.27, 146.42, 140.32, 137.25, 131.64, 131.28, 131.24, 130.80, 130.55, 130.41, 130.29, 129.86, 129.77, 121.36, 120.61, 119.02, 116.59, 113.61, 110.06, 84.85, 54.91, 42.62; MS(MM-ES+APCI) 408.8 $[M+H]^+$.

11-(3-methoxyphenyl)-3,6,7,11-tetrahydro-8*H*-pyrazolo[4,3-*f*]pyrimido[4,5-*b*]quinoline-8,10(9*H*)-dione. (5h)

White solid, %purity (HPLC) =99.6%, mp. >300°C; ^{1}H-NMR (400 MHz, DMSO-d_6) (δ, ppm): 12.98 (s, 1H, NH), 10.56 (s, 1H, NH), 10.32 (s, 1H, NH), 8.85 (*s*, 1H, ArH), 7.36 (*d*, *J*= 8.8 Hz, 1H, ArH), 7.06-7.15(*m*, 2H, ArH), 6.91 (s, 1H, ArH), 6.85 (*d*, *J*= 7.6 Hz, 1H, ArH), 6.64 (*dd*, *J*= 6.4 Hz, *J*=1.6 Hz, 1H, ArH), 5.39 (s, 1H, CH), 3.66 (s, 3H, OCH_3); ^{13}C-NMR (100 MHz, DMSO-d_6) (δ, ppm):162.77, 158.90, 148.59, 138.51, 128.95, 121.49, 119.81, 119.67, 119.53, 117.12, 117.05, 113.90, 113.86, 113.65, 110.66, 109.46, 109.44, 109.41, 109.35, 107.37, 73.14, 54.82; MS(MM-ES+APCI) 360.0 $[M+H]^+$.

11-([1,1'-biphenyl]-4-yl)-3,6,7,11-tetrahydro-8*H*-pyrazolo[4,3-*f*]pyrimido[4,5-*b*]quinoline-8,10(9*H*)-dione. (5i)

Off white solid, mp. >300°C; ^{1}H-NMR (400 MHz, DMSO-d_6) (δ, ppm): 12.97 (s, 1H, NH), 10.54 (s, 1H, NH), 10.34 (s, 1H, NH), 8.88 (*s*, 1H, ArH), 8.06 (*d*, *J*= 16.8 Hz, 1H, ArH), 7.26-7.79(*m*, 10H, ArH), 5.44 (s, 1H, CH); ^{13}C-NMR (100 MHz, DMSO-d_6) (δ, ppm):162.81, 162.78, 150.22, 150.20, 146.34, 145.63, 140.06, 138.01, 137.26, 131.81, 129.29, 128.99, 128.92, 128.76, 128.24, 128.04, 127.96, 127.09, 126.69, 126.51, 126.40, 126.08, 121.52, 121.50, 117.13, 117.10, 113.81, 113.78, 109.50, 85.17; MS(MM-ES+APCI) 407.0 $[M+H]^+$.

11-(3-chlorophenyl)-3,6,7,11-tetrahydro-8*H*-pyrazolo[4,3-*f*]pyrimido[4,5-*b*]quinoline-8,10(9*H*)-dione. (5j)

Off white solid, %purity (HPLC) =99.5%, mp. >300°C; ^{1}H-NMR (400 MHz, DMSO-d_6) (δ, ppm): 13.02 (s, 1H, NH), 10.59 (s, 1H, NH), 10.36 (s, 1H, NH), 8.91 (*s*, 1H, ArH), 8.05 (s, 1H, ArH), 7.38 (*d*, *J*= 8.4 Hz, 2H, ArH), 7.12-7.28(*m*, 4H, ArH), 5.46 (s, 1H, CH); ^{13}C-NMR (100 MHz, DMSO-d_6) (δ, ppm):162.75, 157.90, 150.14, 150.13, 149.39, 145.67, 143.05, 137.25, 136.75, 132.60, 131.76, 129.85, 128.30, 128.24, 127.42, 127.23, 126.53, 126.26, 125.98, 117.17, 113.05, 110.22, 109.82, 109.81, 109.81, 109.61, 107.35, 84.77, 79.21; MS(MM-ES+APCI) 365.8 $[M+H]^+$.

11-(2-chlorophenyl)-3,6,7,11-tetrahydro-8*H*-pyrazolo[4,3-*f*]pyrimido[4,5-*b*]quinoline-8,10(9*H*)-dione. (5k)

Off white solid, %purity (HPLC) =99.0%, mp. >300°C; ^{1}H-NMR (400 MHz, DMSO-d_6) (δ, ppm): 13.04 (s, 1H, NH), 10.49 (s, 1H, NH), 10.30 (s, 1H, NH), 8.93 (*s*, 1H, ArH), 7.88 (s, 1H, ArH), 7.37 (*d*, *J*= 8.4 Hz, 1H, ArH), 7.30 (*d*, *J*= 6.8 Hz, 1H, ArH), 7.09-7.19(*m*, 3H, ArH), 5.82 (s, 1H, CH);^{13}C-NMR (100 MHz, DMSO-d_6) (δ, ppm):162.57, 150.16, 145.61, 144.39, 137.15, 131.39, 131.29, 131.24, 128.98, 128.52, 127.68, 127.28, 121.59, 117.30, 112.70, 109.91, 84.77; MS(MM-ES+APCI) 365.8 $[M+H]^+$.

Spectroscopic and analytical characterization of 7,9-diaryl-3,6,7,9-tetrahydro-1'*H*-spiro[pyrazolo[4,3-*f*]quinoline-8,5'-pyrimidine]-2',4',6'(3'*H*)-triones (7a-i).

1',3'-dimethyl-7,9-diphenyl-3,6,7,9-tetrahydro-2'*H*-spiro[pyrazolo[4,3-*f*]quinoline-8,5'-pyrimidine]-2',4',6'(*1'H*,*3'H*)-trione. (7a)

White solid, %purity (HPLC) =98.7%, mp. 252-254°C; ^{1}H-NMR (400 MHz, $CDCl_3$) (δ, ppm): 7.46-7.52 (m, 1H, ArH), 7.29-7.40 (m, 7H, ArH), 7.23-7.27 (m, 2H, ArH), 7.05-7.14 (m, 2H, ArH), 6.81 (*d*, *J*= 7.6 Hz, 1H, ArH), 5.42 (s, 1H, CH), 4.95 (s, 1H, CH), 2.99 (s, 3H, CH_3), 2.90 (s, 3H, CH_3); ^{13}C-NMR (100 MHz, $CDCl_3$) (δ, ppm):170.20, 165.18, 149.91, 137.72, 136.24, 130.0, 129.83, 129.64, 128.96, 128.82, 128.67, 128.55, 128.36, 128.20, 126.77, 125.80, 120.63, 120.62, 120.58, 64.71, 59.86, 59.85, 50.37; MS(MM-ES+APCI) 465.8 $[M+H]^+$.

7,9-bis(4-chlorophenyl)-1',3'-dimethyl-3,6,7,9-tetrahydro-2'*H*-spiro[pyrazolo[4,3-*f*]quinoline-8,5'-pyrimidine]-2',4',6'(1'*H*,3'*H*)-trione. (7b)

White solid, %purity (HPLC) =99.3%, mp. 246-248°C; ^{1}H-NMR (400 MHz, $CDCl_3$) (δ, ppm): 7.48 (*d*, *J*= 9.2 Hz, 1H, ArH), 7.27-7.36 (m, 4H, ArH), 7.09-7.20 (m, 4H, ArH), 5.39 (s, 1H, CH), 4.92 (s, 1H, CH), 3.04 (s, 3H, CH_3), 2.93 (s, 3H, CH_3); ^{13}C-NMR (100 MHz, $CDCl_3$) (δ, ppm):169.74, 164.70,

149.53, 135.84, 135.76, 134.63, 134.41, 131.24, 131.20, 129.29, 129.05, 128.17, 121.83, 63.83, 59.59, 49.37; MS(MM-ES+APCI) 535.8 $[M+H]^+$.

1',3'-dimethyl-7,9-bis(4-nitrophenyl)-3,6,7,9-tetrahydro-2'*H*-spiro[pyrazolo[4,3-*f*]quinoline-8,5'-pyrimidine]-2',4',6'(1'*H*,3'*H*)-trione. (7c)

Pale yellow solid, %purity (HPLC) =99.6%, mp. 264-266°C; ^{1}H-NMR (400 MHz, $CDCl_3$) (δ, ppm): 8.24 (*d*, *J*= 8.8 Hz, 3H, ArH), 8.0 (*d*, *J*= 8.8 Hz, 1H, ArH), 7.41-7.56 (m, 4H, ArH), 6.48 (s, 1H, ArH), 5.64 (s, 1H, CH), 5.08 (s, 1H, CH), 3.05 (s, 3H, CH_3), 2.92 (s, 3H, CH_3); ^{13}C-NMR (100 MHz, $CDCl_3$) (δ, ppm):169.27, 164.13, 149.11, 148.65, 147.81, 145.20, 142.94, 131.34, 130.70, 128.13, 128.04, 124.25, 124.17, 123.90, 123.83, 123.62, 123.46, 119.57, 64.14, 59.75, 49.62, 49.55, 28.77, 27.99; MS(MM-ES+APCI) 555.8 $[M+H]^+$.

7,9-bis(4-methoxyphenyl)-1',3'-dimethyl-3,6,7,9-tetrahydro-2'*H*-spiro[pyrazolo[4,3-*f*]quinoline-8,5'-pyrimidine]-2',4',6'(1'*H*,3'*H*)-trione. (7d)

Off white solid, %purity (HPLC) =96.2%, mp. 244-246°C; ^{1}H-NMR (400 MHz, $CDCl_3$) (δ, ppm): 7.58 (*d*, *J*= 4.0 Hz, 1H, ArH), 7.16-7.25 (m, 4H, ArH), 6.73-6.83 (m, 4H, ArH), 5.34 (s, 1H, CH), 4.95 (s, 1H, CH), 3.81 (s, 6H, 2-OCH_3), 3.02 (s, 3H, CH_3), 2.95 (s, 3H, CH_3); ^{13}C-NMR (100 MHz, $CDCl_3$) (δ, ppm):170.15, 170.12, 160.43, 149.91, 131.16, 130.66, 128.03, 127.93, 127.84, 127.75, 114.50, 114.31, 114.17, 113.91, 63.85, 63.78, 63.72, 59.75, 55.31, 55.26, 49.47, 28.49, 27.81; MS(MM-ES+APCI) 525.8 $[M+H]^+$.

1',3'-dimethyl-7,9-di-p-tolyl-3,6,7,9-tetrahydro-2'*H*-spiro[pyrazolo[4,3-*f*]quinoline-8,5'-pyrimidine]-2',4',6'(1'H,3'*H*)-trione. (7e)

Off white solid, %purity (HPLC) =98.7%, mp. 178-180°C; ^{1}H-NMR (400 MHz, $CDCl_3$) (δ, ppm): 7.38 (*d*, *J*= 8.8 Hz, 1H, ArH), 7.06-7.25 (m, 8H, ArH), 6.92 (*d*, *J*= 8.0 Hz, 1H, ArH), 6.67 (*d*, *J*= 8.4 Hz, 1H, ArH), 5.35 (s, 1H, CH), 4.91 (s, 1H, CH), 3.0 (s, 3H, CH_3), 2.92 (s, 3H, CH_3), 2.33 (s, 6H, $2CH_3$); ^{13}C-NMR (100 MHz, $CDCl_3$) (δ, ppm): 170.31, 165.30, 150.09, 150.07, 139.52, 138.40, 138.12, 136.01, 134.45, 133.18, 132.67, 129.92, 129.62, 129.51, 129.44, 129.32, 126.63, 121.18, 64.36, 59.72, 59.69, 50.10, 38.27, 28.40, 27.70, 21.17, 21.15; MS(MM-ES+APCI) 493.8 $[M+H]^+$.

7,9-bis(4-fluorophenyl)-1',3'-dimethyl-3,6,7,9-tetrahydro-2'*H*-spiro[pyrazolo[4,3-*f*]quinoline-8,5'-pyrimidine]-2',4',6'(1'*H*,3'*H*)-trione. (7f)

White solid, %purity (HPLC) =99.4%, mp. 262-264°C; ^{1}H-NMR (400 MHz, $CDCl_3$) (δ, ppm): 7.22-7.37 (m, 4H, ArH), 7.01-7.13 (m, 4H, ArH), 6.81-6.86 (m, 2H, ArH), 6.53 (s, 1H, ArH), 5.42 (s, 1H,

CH), 4.93 (s, 1H, CH), 3.03 (s, 3H, CH_3), 2.93 (s, 3H, CH_3); ^{13}C-NMR (100 MHz, $CDCl_3$) (δ, ppm):170.04, 164.97, 164.41, 163.75, 161.92, 161.28, 149.68, 133.46, 133.42, 132.08, 132.04, 131.72, 131.64, 131.54, 131.46, 128.67, 128.58, 120.35, 116.17, 115.96, 115.92, 115.71, 115.62, 115.41, 63.93, 60.04, 49.44, 28.50, 27.78; MS(MM-ES+APCI) 501.8 $[M+H]^+$.

7,9-bis(4-bromophenyl)-1',3'-dimethyl-3,6,7,9-tetrahydro-2'H-spiro[pyrazolo[4,3-*f*]quinoline-8,5'-pyrimidine]-2',4',6'(1′*H*,3′*H*)-trione. (7g)

White solid, %purity (HPLC) =98.8%, mp. 208-210°C; ^{1}H-NMR (400 MHz, $CDCl_3$) (δ, ppm): 7.47-7.50 (m, 3H, ArH), 7.40 (*d*, *J*= 8.8 Hz, 1H, ArH), 7.20-7.26 (m, 2H, ArH), 7.05-7.13 (m, 3H, ArH), 6.69 (*d*, *J*= 8.4 Hz, 1H, ArH), 6.56 (s, 1H, ArH), 5.39 (s, 1H, CH), 4.90 (s, 1H, CH), 3.04 (s, 3H, CH_3), 2.93 (s, 3H, CH_3); ^{13}C-NMR (100 MHz, $CDCl_3$) (δ, ppm):169.80, 160.73, 149.56, 138.28, 136.54, 135.04, 132.23, 131.94, 131.92, 131.60, 131.53, 128.44, 123.84, 122.71, 120.96, 111.84, 110.32, 63.99, 59.54, 49.51, 28.60, 27.86; MS(MM-ES+APCI) 623.6 $[M+H]^+$.

7,9-bis(3-methoxyphenyl)-1',3'-dimethyl-3,6,7,9-tetrahydro-2′*H*-spiro[pyrazolo[4,3-*f*]quinoline-8,5'-pyrimidine]-2',4',6'(1′*H*,3′*H*)-trione. (7h)

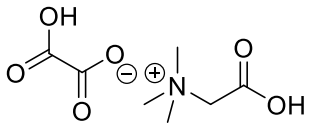
White solid, %purity (HPLC) =99.1%, mp. 234-236°C; ^{13}C-NMR (100 MHz, $CDCl_3$) (δ, ppm):170.25, 170.12, 165.35, 165.14, 160.07, 159.75, 159.58, 150.04, 150.01, 139.19, 139.14, 138.07, 137.76, 130.01, 129.57, 122.38, 122.19, 120.72, 120.60, 118.98, 118.96, 116.0, 115.02, 114.78, 113.17, 112.68, 112.35, 112.33, 109.87, 64.53, 59.58, 59.47, 55.35, 55.28, 55.12, 50.59, 50.29, 28.47, 28.44, 27.78, 27.73; MS(MM-ES+APCI) 525.8 $[M+H]^+$.

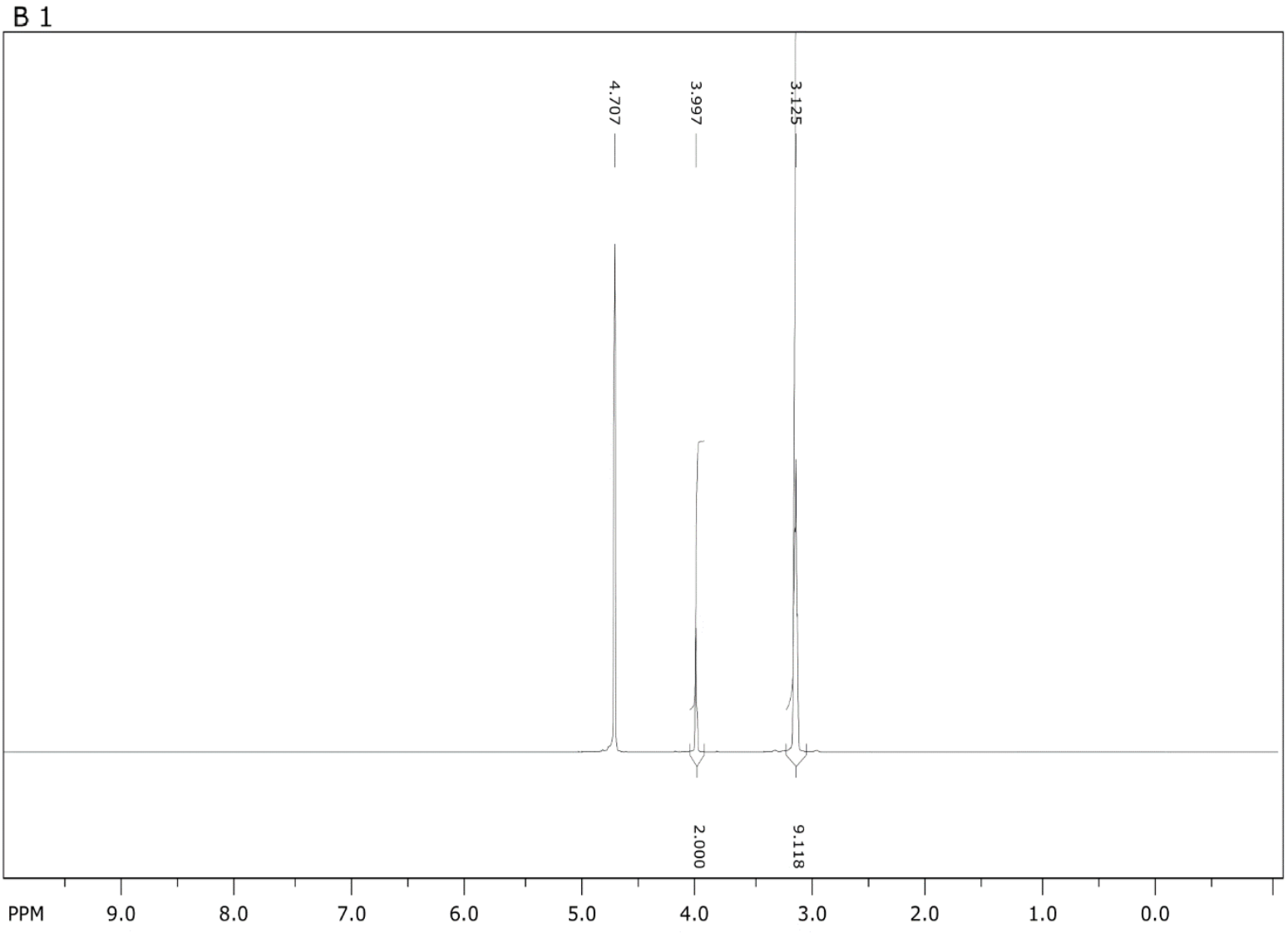
7,9-di([1,1'-biphenyl]-4-yl)-1',3'-dimethyl-3,6,7,9-tetrahydro-2′*H*-spiro[pyrazolo[4,3-*f*]quinoline-8,5'-pyrimidine]-2',4',6'(1′*H*,3′*H*)-trione. (7i)

Off white solid, %purity (HPLC) =98.3%, mp. 258-260°C; ^{1}H-NMR (400 MHz, $CDCl_3$) (δ, ppm): 7.53-7.65 (m, 7H, ArH), 7.28-7.51 (m, 11H, ArH), 7.08 (*d*, *J*= 6.0 Hz, 1H, ArH), 6.88 (*d*, *J*= 8.4 Hz, 1H, ArH), 5.47 (s, 1H, CH), 5.02 (s, 1H, CH), 3.04 (s, 3H, CH_3), 2.95 (s, 3H, CH_3); ^{13}C-NMR (100 MHz, $CDCl_3$) (δ, ppm):170.18, 165.19, 149.86, 142.55, 141.10, 140.10, 139.87, 136.59, 135.06, 134.95, 130.46, 130.22, 128.90, 128.81, 127.86, 127.56, 127.28, 127.22, 127.10, 127.06, 126.96, 121.23, 64.40, 64.33, 59.77, 50.10, 50.01, 49.94, 28.53, 27.82; MS(MM-ES+APCI) 617.8 $[M+H]^+$.

 # Spectroscopic characterization of betaine based Deep Eutectic Mixtures (DEMs) (B_1-B_4).

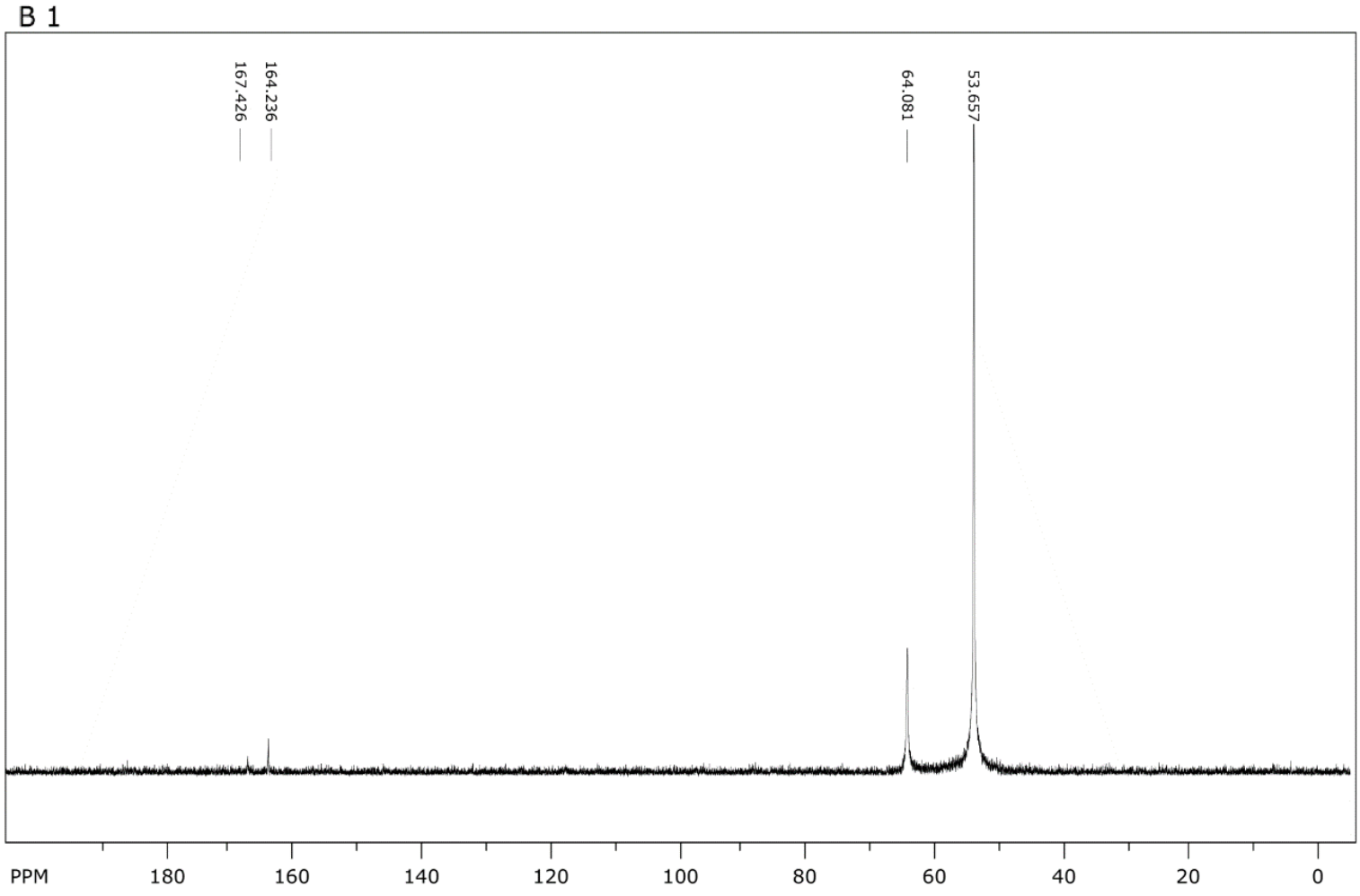
Figure: S4: ^{1}H-NMR Spectra of Fresh catalyst B_1 (Betaine: Oxalic acid).





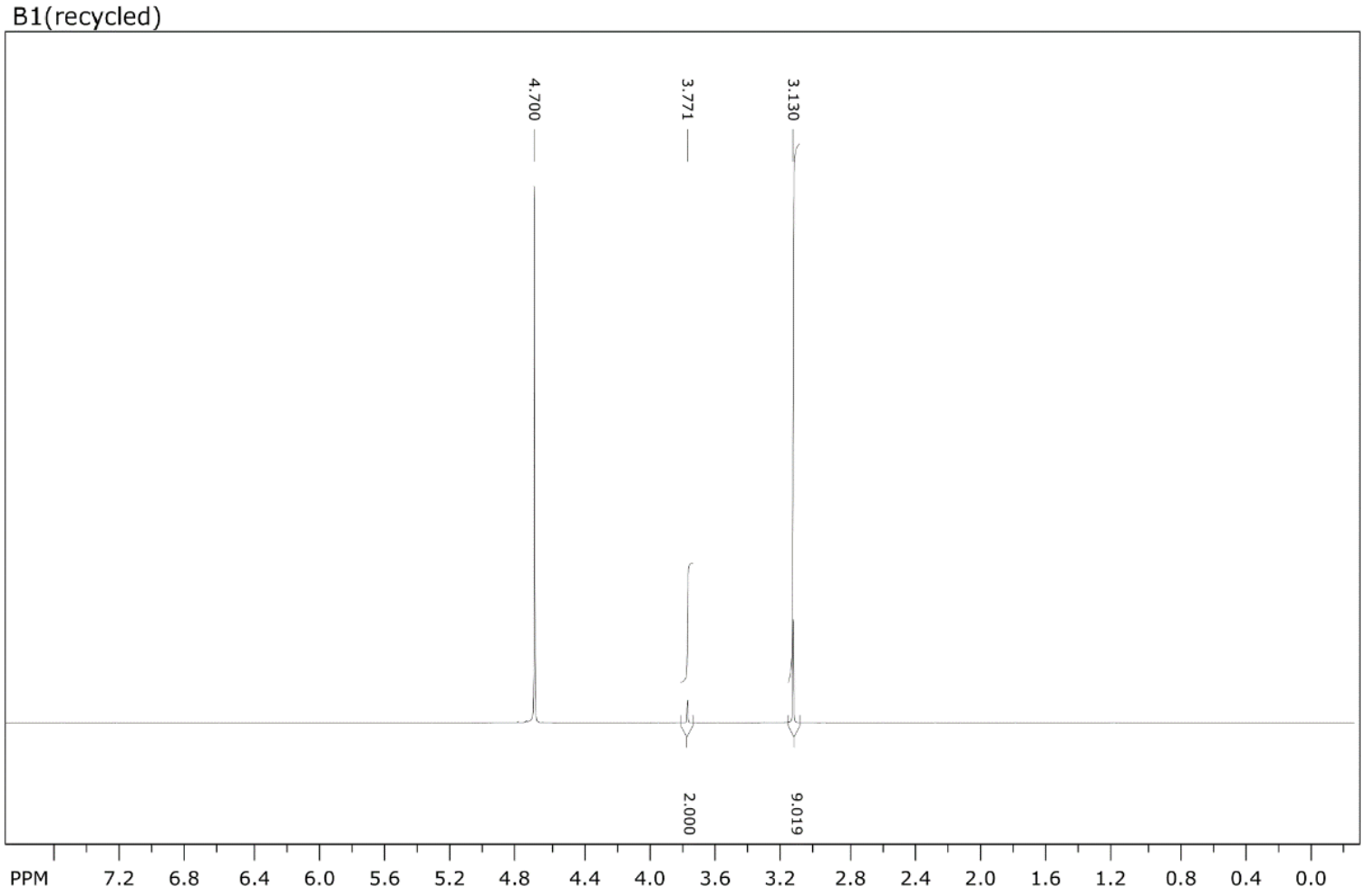
^{1}H-NMR (400 MHz, D_2O): δ (ppm): 3.99(s, 2H, N-CH_2), 3.12 (s, 9H, N^+ (-CH_3)$_3$).

Figure: S5: ^{13}C-NMR Spectra of Fresh catalyst B_1 (Betaine: Oxalic acid).



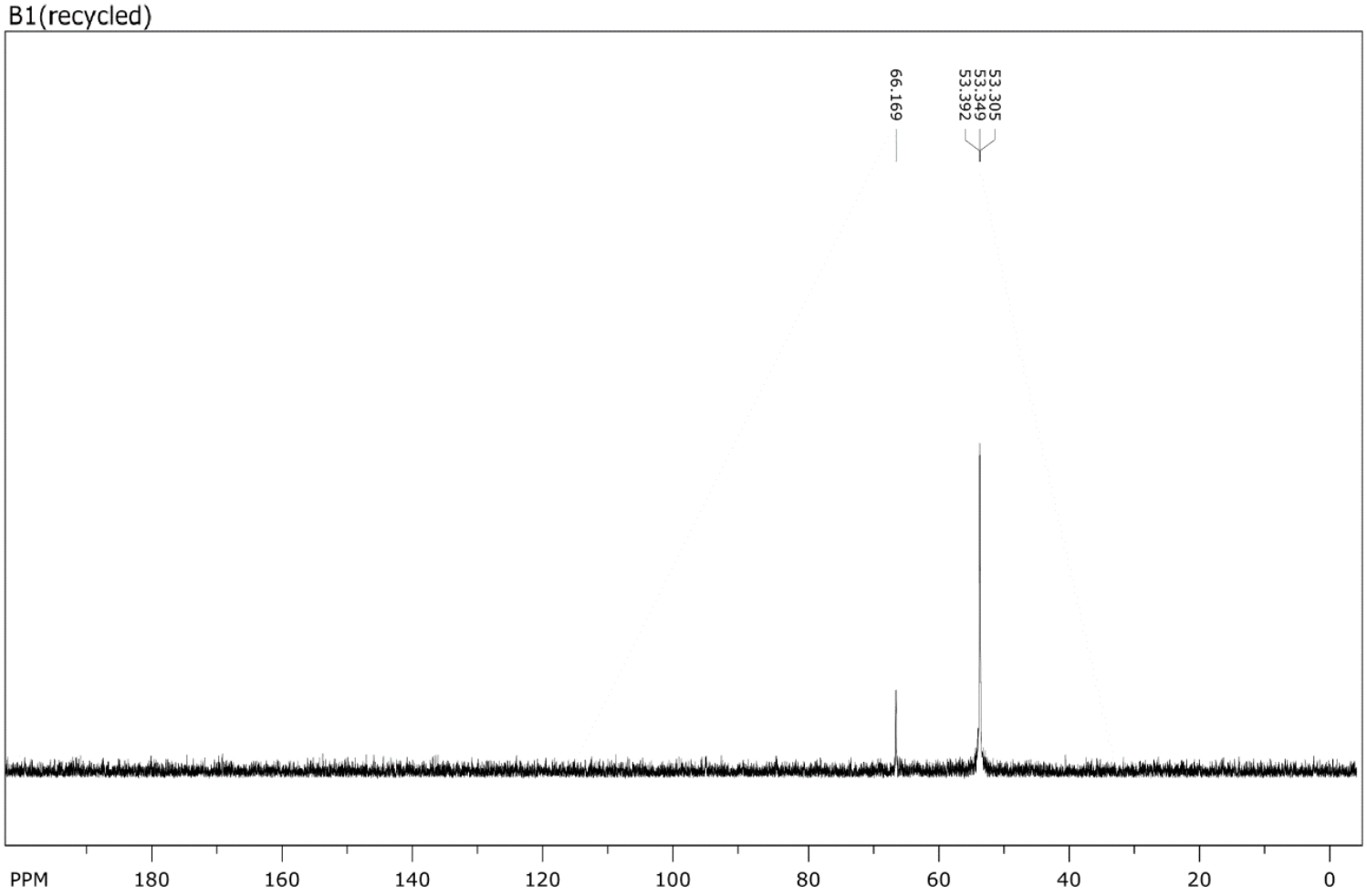
^{13}C-NMR (100 MHz, D_2O): δ (ppm): 167.42(CO), 164.23(CO), 64.08(N-CH_2), 53.65(N^+ (-CH_3)$_3$).

Figure: S6: ^{1}H-NMR Spectra of recycled catalyst B_1 (Betaine: Oxalic acid).



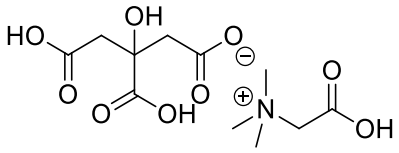
^{1}H-NMR (400 MHz, D_2O): δ (ppm): 3.77(s, 2H, N-CH_2), 3.13 (s, 9H, N^+ (-CH_3)$_3$).

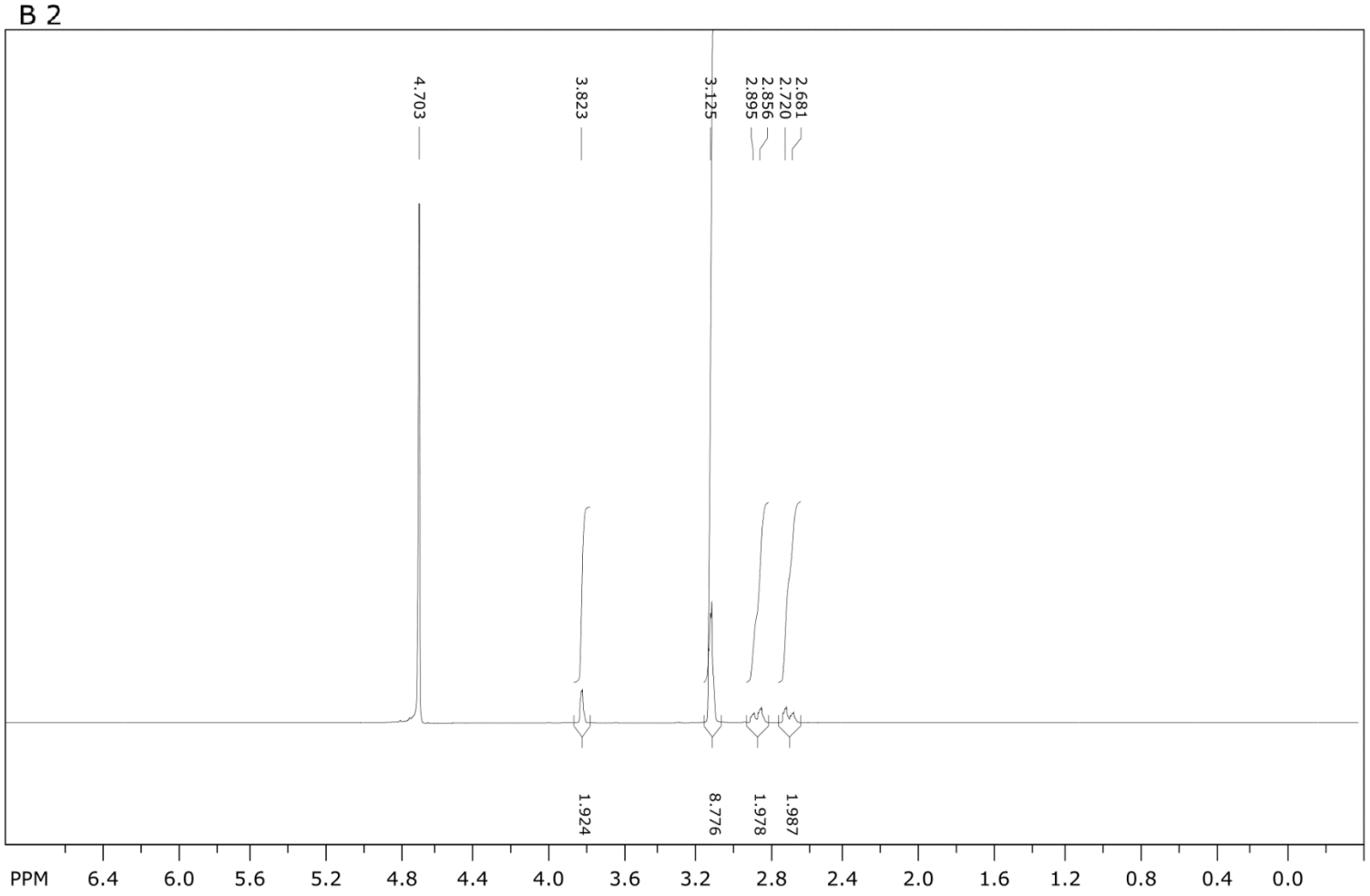
Figure: S7: ^{13}C-NMR Spectra of recycled catalyst B_1 (Betaine: Oxalic acid).



^{13}C-NMR (100 MHz, D_2O): δ (ppm): 64.08(N-CH_2), 53.65(N^+ (-CH_3)$_3$).

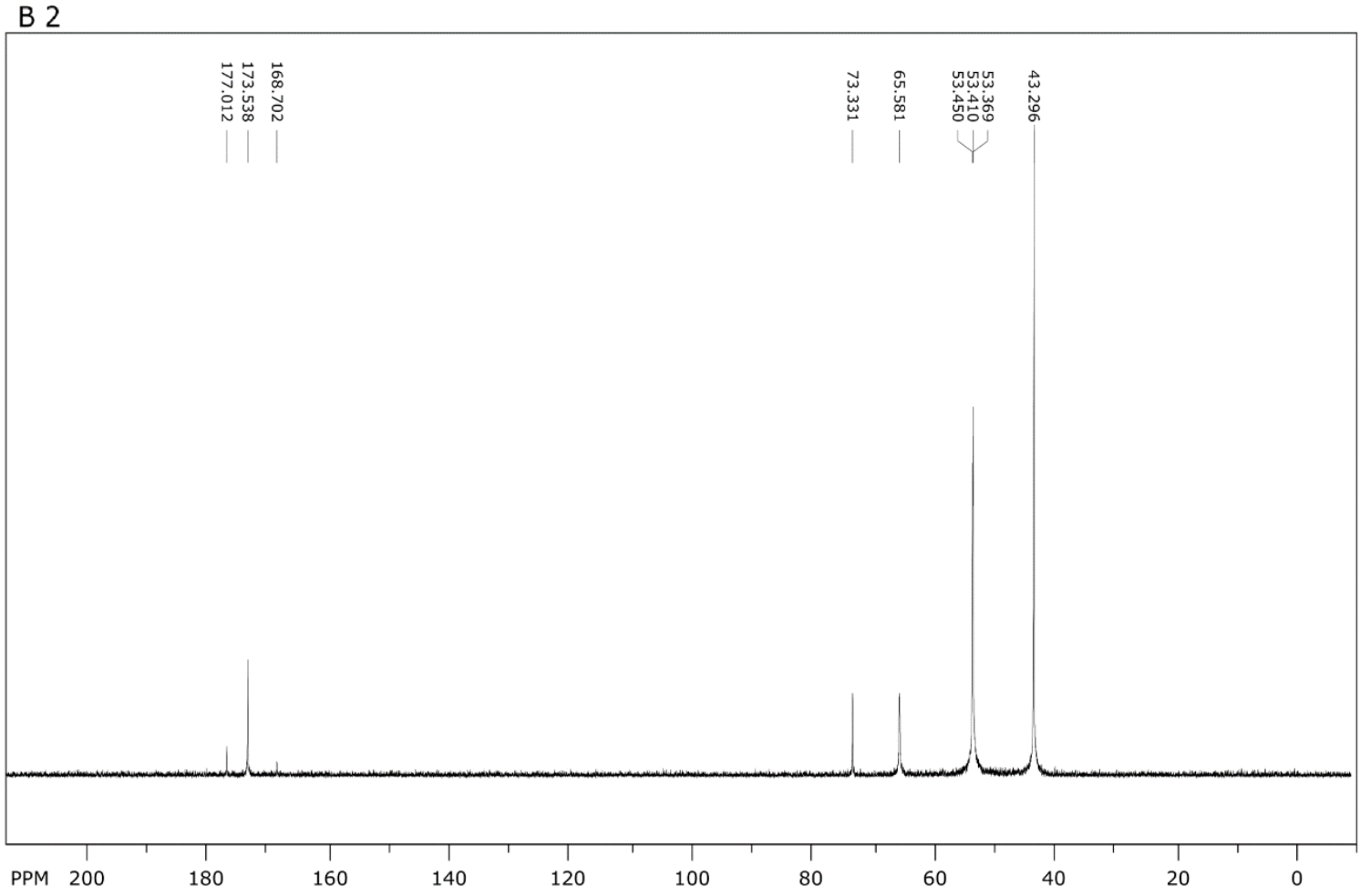
Figure: S8: ^{1}H-NMR Spectra of catalyst B_2 (Betaine: Citric acid).





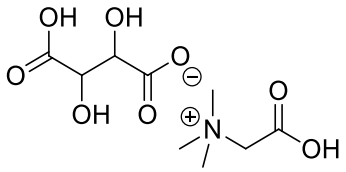
^{1}H-NMR (400 MHz, D_2O): δ (ppm): 3.82 (s, 2H, N-CH_2), 3.12 (s, 9H, N^+ (-CH_3)$_3$), 2.87 (d, *J* = 15.6 Hz, 2H, COO-CH_2), 2.70 (d, *J* = 15.6 Hz, 2H, COO-CH_2).

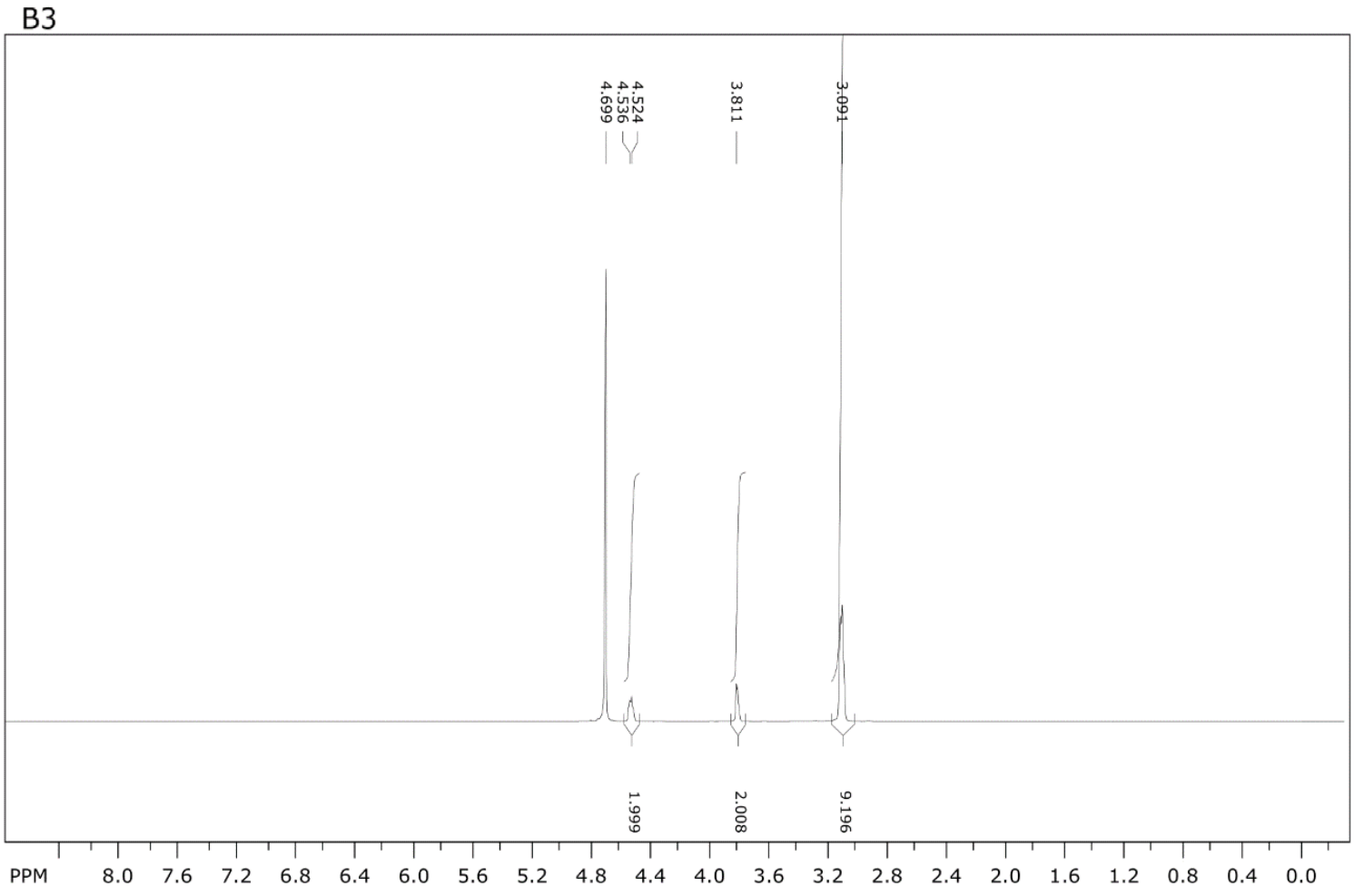
Figure: S9: ^{13}C-NMR Spectra of catalyst B_2 (Betaine: Citric acid).



^{13}C-NMR (100 MHz, D_2O): δ (ppm): 177.01(CO), 173.53(CO), 168.70(CO), 73.33(C-OH), 65.58(N-CH_2), 53.45(N^+ (-CH_3)), 53.41(N^+ (-CH_3)), 53.36(N^+ (-CH_3)), 43.29(-CH_2).

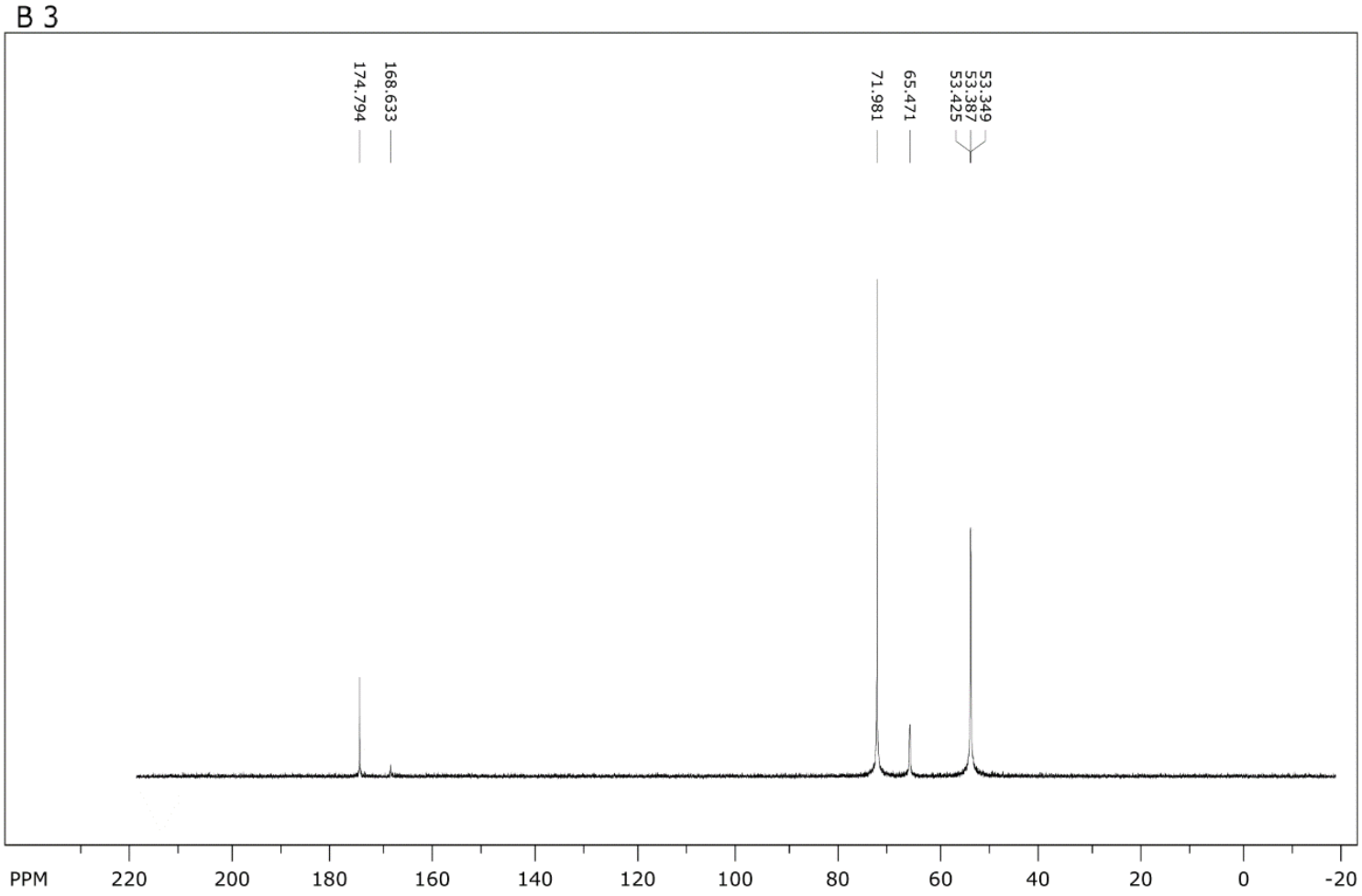
Figure: S10: ^{1}H-NMR Spectra of catalyst B_3 (Betaine: Tartaric acid).





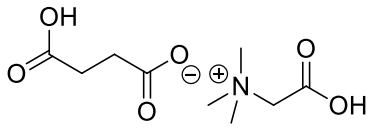
^{1}H-NMR (400 MHz, D_2O): δ (ppm): 4.53 (d, *J*= 4.8 Hz, 2H, -CH), 3.81 (s, 2H, N-CH_2), 3.09 (s, 9H, N^+ (-$CH_3)_3$).

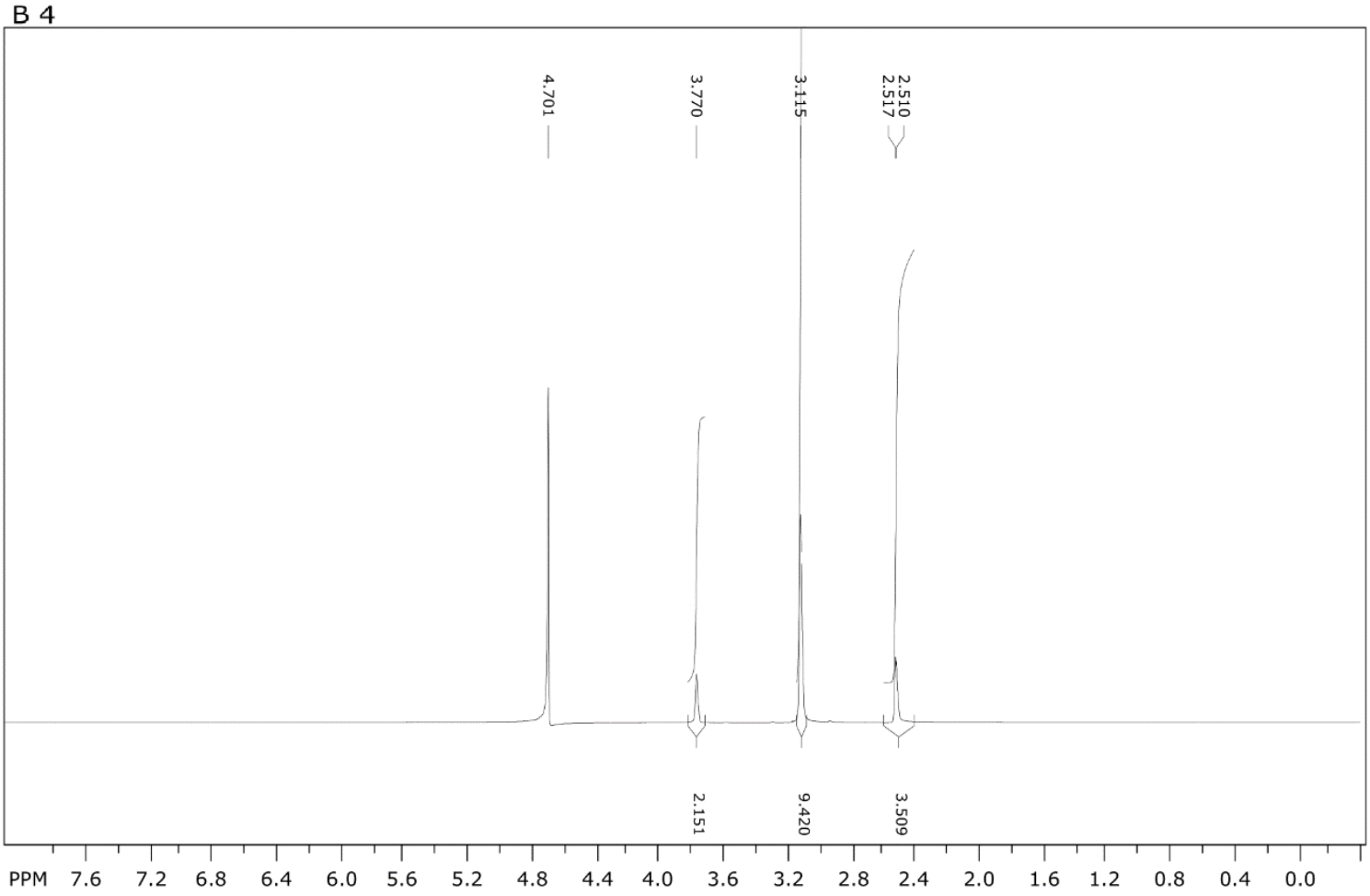
Figure: S11: ^{13}C-NMR Spectra of catalyst B_3 (Betaine: Tartaric acid).



^{13}C-NMR (100 MHz, D_2O): δ (ppm): 174.79(CO), 168.63(CO), 71.98(C-OH), 65.47(N-CH_2), 53.42(N^+ (-CH_3)), 53.38(N^+ (-CH_3)), 53.34(N^+ (-CH_3)).

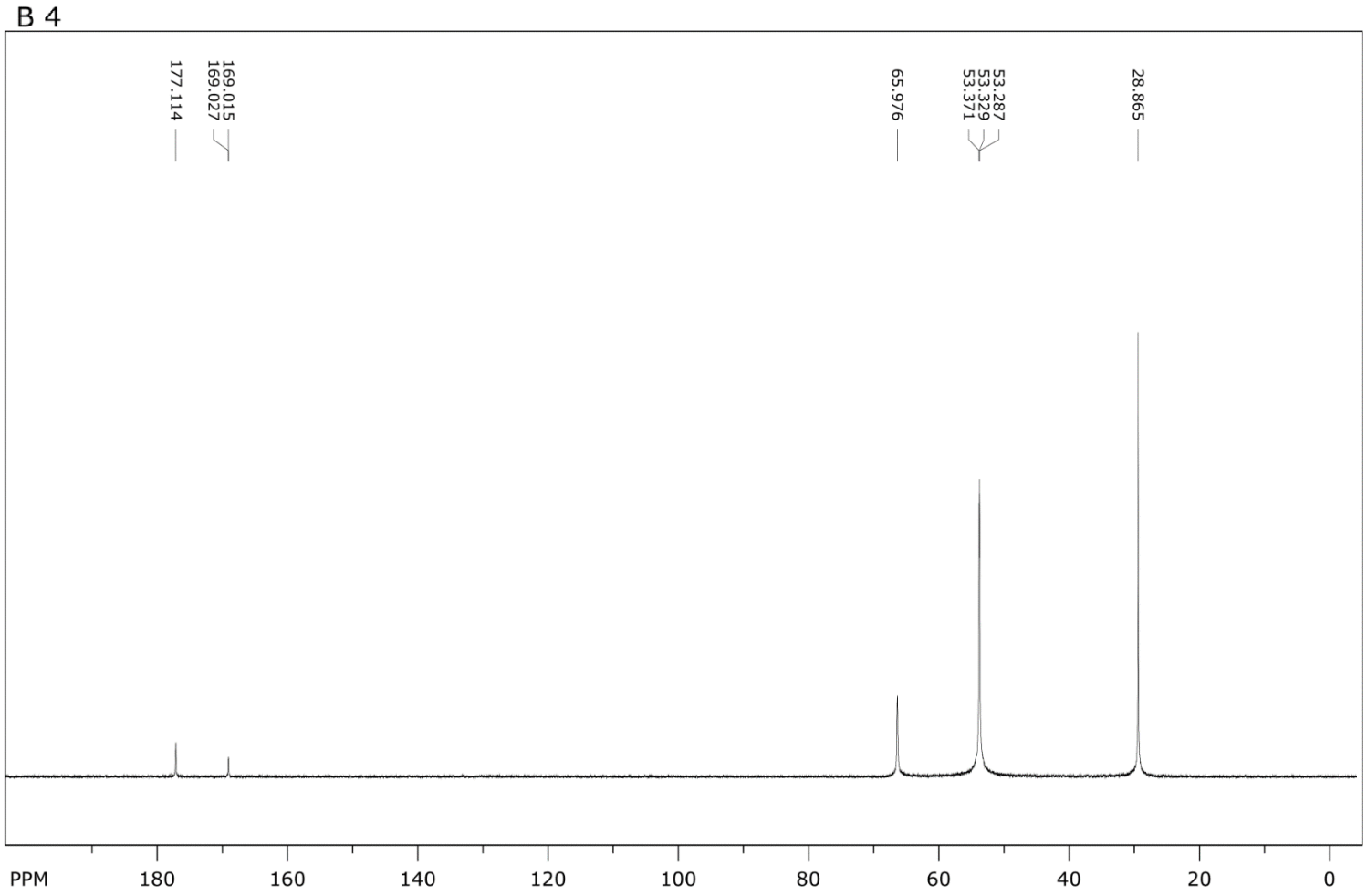
Figure: S12: ^{1}H-NMR Spectra of catalyst B_3 (Betaine: Succinic acid)





^{1}H-NMR (400 MHz, D_2O): δ (ppm): 3.77 (s, 2H, N-CH_2), 3.11 (s, 9H, N^+ (-CH_3)$_3$), 2.51 (d, *J* = 2.8 Hz, 4H, CH_2).

Figure: S13: ^{13}C-NMR Spectra of catalyst B_4 (Betaine: Succinic acid)



^{13}C-NMR (100 MHz, D_2O): δ (ppm): 177.11(CO), 169.02(CO), 169.01(CO), 65.97(N-CH_2), 53.37(N^+ (-CH_3)), 53.32(N^+ (-CH_3)), 53.28(N^+ (-CH_3)), 28.86 (-CH_2).

Figure: S14: LC report of compound 5a.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L1.D
Sample Name: L1
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   1
    Acq. Instrument : LCMS                          Location :   42
    Injection Date  : 3/4/2020 3:39:33 PM               Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 3:38:11 PM by SYSTEM
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L1


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

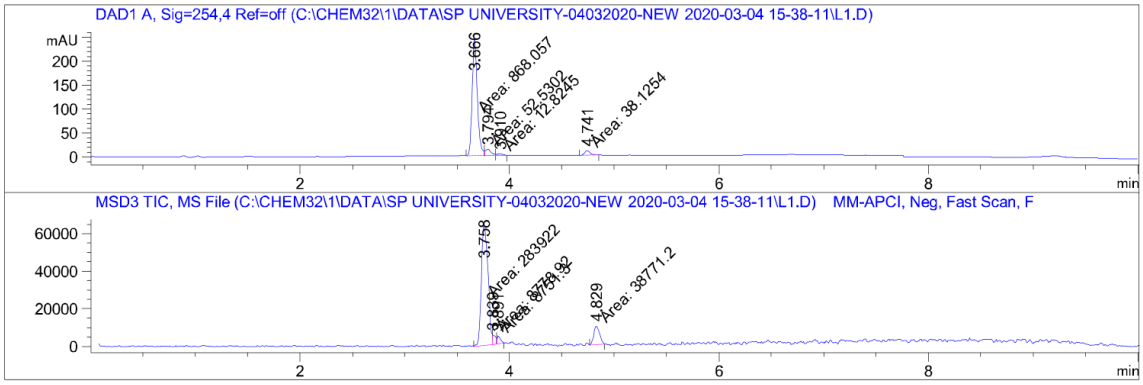
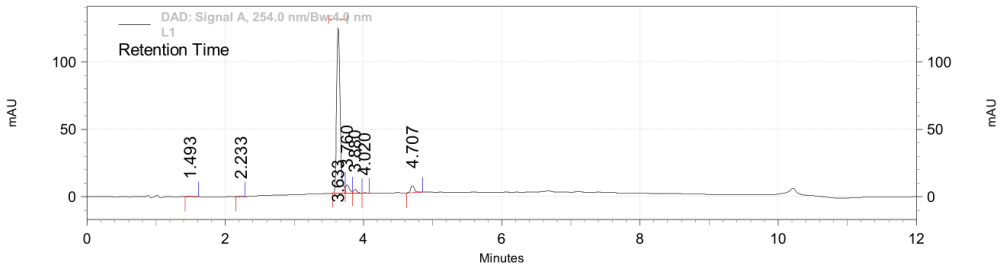


Figure: S15: HPLC report of compound 5a.

aether
elementally innovative

Aether Industries Ltd

Sample ID : L1 Instruent ID : QCI04 (Offline)
Inj Vol : 1µl
Vial No : 42
Method : D:\HPLC DATA\2020\March\Method\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2020\March\Result\QCI04\04032020\L1.dat
Acquired : 04/03/2020 18:51:21 (GMT +05:30)



DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	1.49	323316	0.51	
2	2.23	139971	0.22	
3	3.63	56312824	88.19	L1
4	3.76	3190555	5.00	
5	3.88	1269614	1.99	
6	4.02	83331	0.13	
7	4.71	2536643	3.97	

Totals		63856254	100.00	

Figure: S16: LC-MS report of compound 5a.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L1.D
Sample Name: L1
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   1
    Acq. Instrument : LCMS                          Location :   42
    Injection Date  : 3/4/2020 3:39:33 PM               Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 3:38:11 PM by SYSTEM
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L1


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD3 TIC, MS File,  MM-APCI, Neg, Fast Scan, Frag: 100
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                  Mol. Weight
    Time (MS)      MS Area     or Ion

       3.758        283922       331.00 I
                                 329.90 I

       3.839          8779       347.75 I
                                 329.80 I
                                 327.80 I

       3.891          8751       347.80 I
                                 327.80 I

       4.829         38771       436.80 I
                                 435.80 I
```

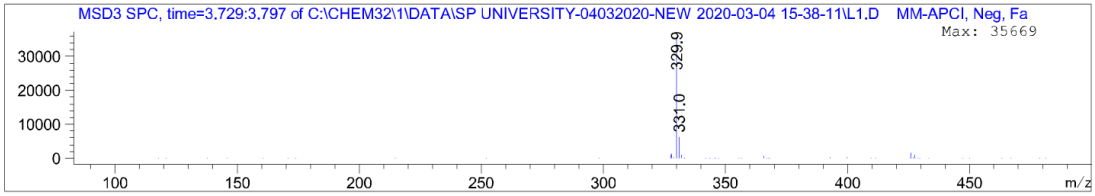


Figure: S17: LC-MS report of compound 5b.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L2.D
Sample Name: L2
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   2
    Acq. Instrument : LCMS                          Location :   43
    Injection Date  : 3/4/2020 3:50:41 PM               Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 3:49:45 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L2


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD3 TIC, MS File,  MM-APCI, Neg, Fast Scan, Frag: 100
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                   Mol. Weight
    Time (MS)      MS Area      or Ion

       4.205        296116       365.80 I
                                 364.85 I
                                 363.80 I

       4.347       1293902       383.95 I
                                 383.00 I
                                 381.80 I
                                 364.80 I
```

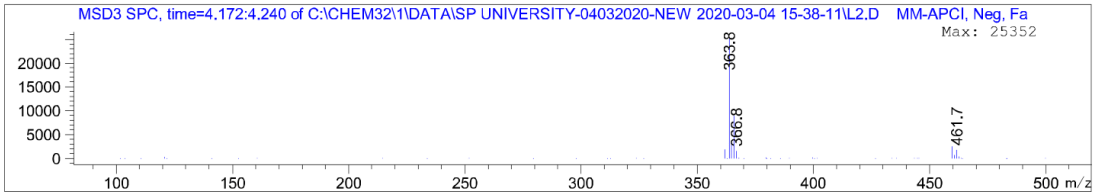


Figure: S18: LCMS report of compound 5c.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L3.D
Sample Name: L3
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   3
    Acq. Instrument : LCMS                          Location :   44
    Injection Date  : 3/4/2020 4:01:50 PM                Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 4:00:57 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L3


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD1 TIC, MS File,  MM-APCI, Pos, Fast Scan, Frag: 100
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                  Mol. Weight
    Time (MS)      MS Area     or Ion

       3.883        150577       465.80 I
                                 464.80 I
                                 376.80 I

       3.919        112787       464.80 I
                                 377.80 I
                                 376.80 I

       4.051        418266       395.80 I
                                 394.80 I
                                 377.60 I
                                 352.80 I
                                 351.80 I
                                 308.80 I
                                 306.75 I
```

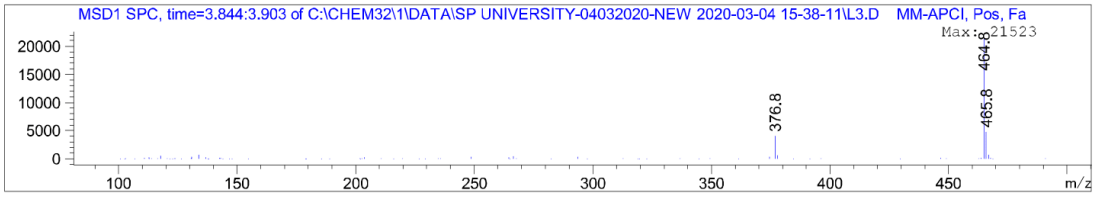


Figure: S19: LC report of compound 5d.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L4.D
Sample Name: L4
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   4
    Acq. Instrument : LCMS                          Location :   45
    Injection Date  : 3/4/2020 4:12:59 PM               Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 4:12:06 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L4


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

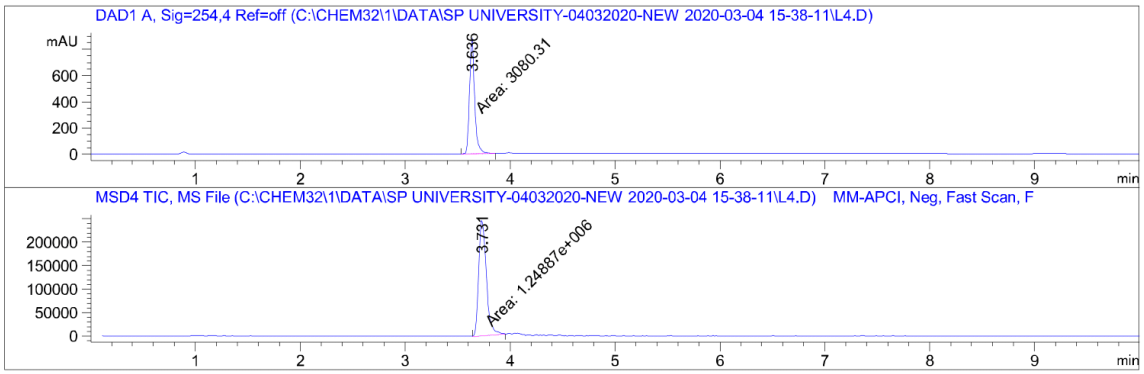
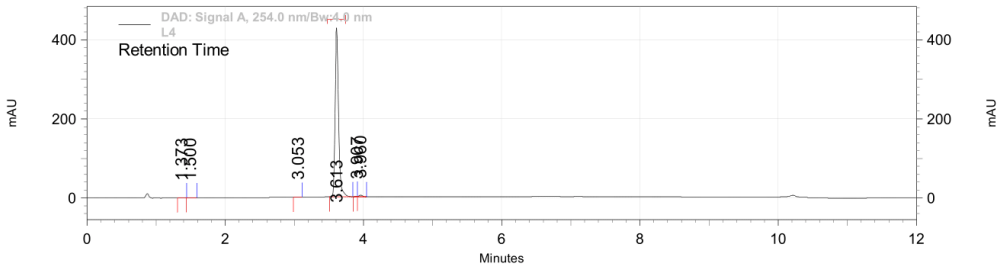


Figure: S20: HPLC report of compound 5d.

aether
elementally innovative

Aether Industries Ltd

Sample ID : L4 Instruent ID : QCI04 (Offline)
Inj Vol : 1µl
Vial No : 45
Method : D:\HPLC DATA\2020\March\Method\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2020\March\Result\QCI04\04032020\L4.dat
Acquired : 04/03/2020 19:31:23 (GMT +05:30)

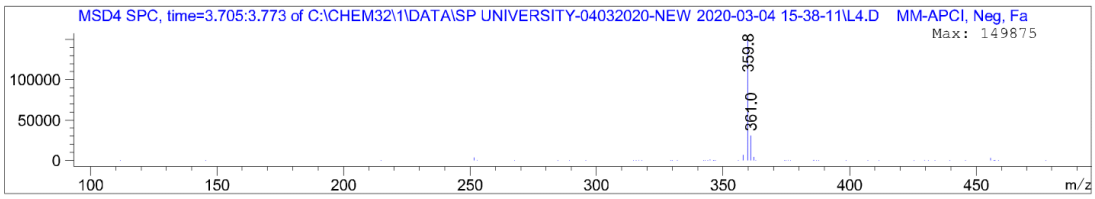


DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	1.37	53282	0.03	
2	1.50	92229	0.05	
3	3.05	162604	0.08	
4	3.61	199815557	98.77	L4
5	3.91	282440	0.14	
6	3.96	1893121	0.94	
Totals		202299233	100.00	

Figure: S21: LCMS report of compound 5d.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L4.D
Sample Name: L4
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   4
    Acq. Instrument : LCMS                          Location :   45
    Injection Date  : 3/4/2020 4:12:59 PM               Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 4:12:06 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L4


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD4 TIC, MS File,  MM-APCI, Neg, Fast Scan, Frag: 150
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                   Mol. Weight
    Time (MS)      MS Area      or Ion

       3.731       1248873       361.00 I
                                 359.80 I
```




```
                        *** End of Report ***
```

Figure: S22: LC report of compound 5e.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L5.D
Sample Name: L5
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   5
    Acq. Instrument : LCMS                          Location :   46
    Injection Date  : 3/4/2020 4:24:09 PM                Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 4:23:14 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L5


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

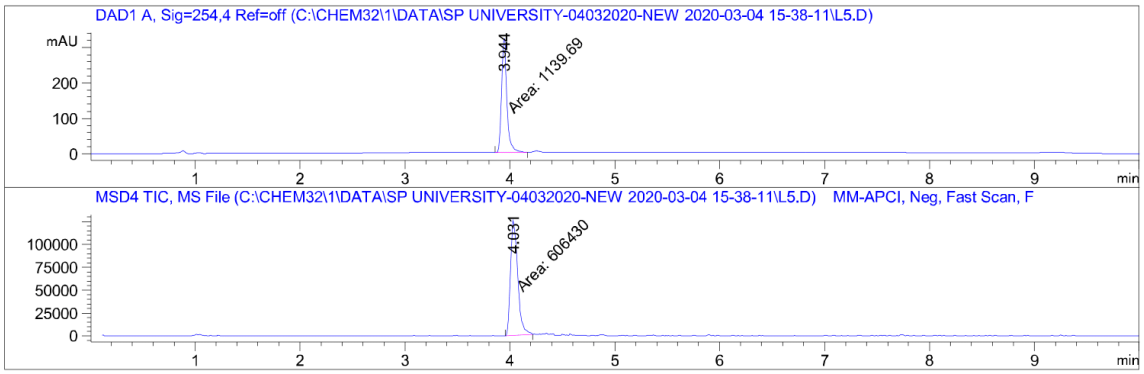
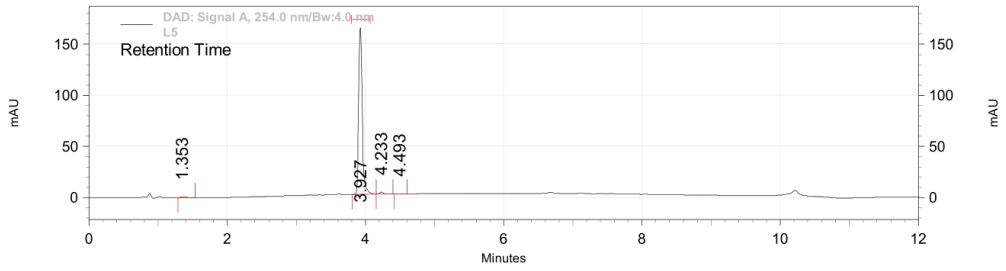


Figure: S23: HPLC report of compound 5e.

aether
elementally innovative

Aether Industries Ltd

Sample ID : L5 Instruent ID : QCI04 (Offline)
Inj Vol : 1µl
Vial No : 46
Method : D:\HPLC DATA\2020\March\Method\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2020\March\Result\QCI04\04032020\L5.dat
Acquired : 04/03/2020 19:44:46 (GMT +05:30)

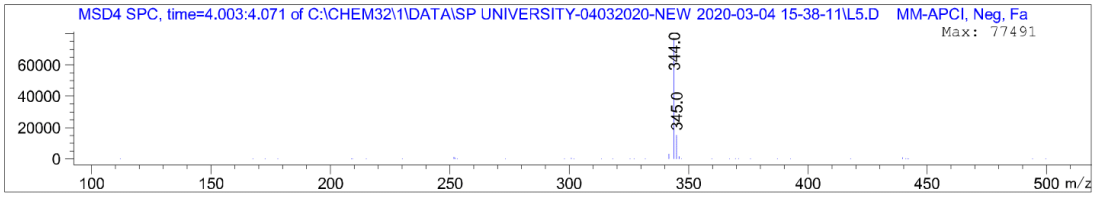


DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	1.35	76935	0.10	
2	3.93	77227417	98.57	L5
3	4.23	920248	1.17	
4	4.49	121160	0.15	
Totals		78345760	100.00	

Figure: S24: LCMS report of compound 5e.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L5.D
Sample Name: L5
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   5
    Acq. Instrument : LCMS                          Location :   46
    Injection Date  : 3/4/2020 4:24:09 PM                Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 4:23:14 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L5


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD4 TIC, MS File,  MM-APCI, Neg, Fast Scan, Frag: 150
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                   Mol. Weight
    Time (MS)      MS Area      or Ion

       4.031        606430       345.00 I
                                 343.95 I
```




```
                        *** End of Report ***
```

Figure: S25: LC report of compound 5f.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L6.D
Sample Name: L6
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   6
    Acq. Instrument : LCMS                          Location :   47
    Injection Date  : 3/4/2020 4:35:19 PM               Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 4:34:24 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L6


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

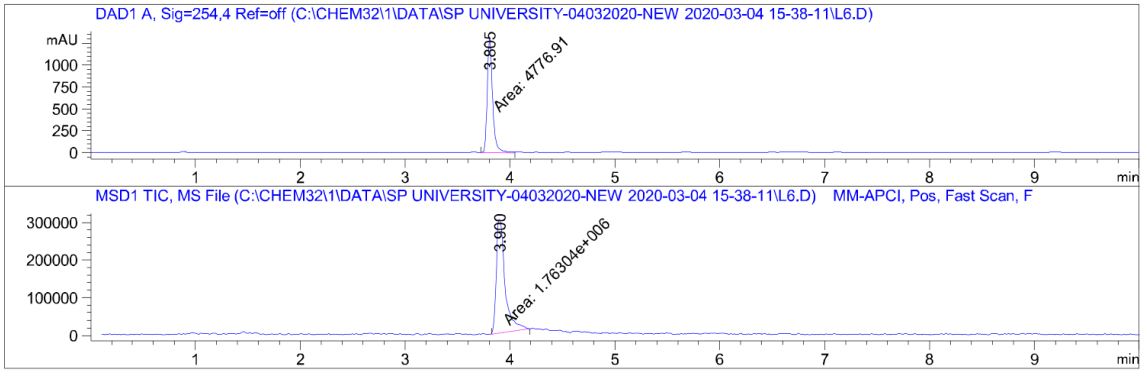
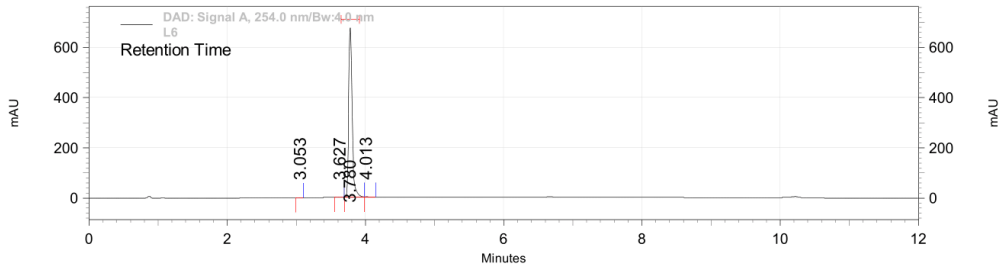


Figure: S26: HPLC report of compound 5f.

aether
elementally innovative

Aether Industries Ltd

Sample ID : L6 Instruent ID : QCI04 (Offline)
Inj Vol : 1µl
Vial No : 47
Method : D:\HPLC DATA\2020\March\Method\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2020\March\Result\QCI04\04032020\L6.dat
Acquired : 04/03/2020 19:58:06 (GMT +05:30)

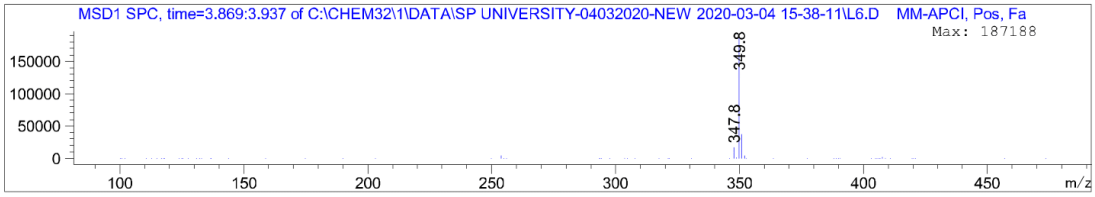


DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	3.05	118786	0.04	
2	3.63	354838	0.11	
3	3.78	318974440	99.58	L6
4	4.01	859275	0.27	
Totals		320307339	100.00	

Figure: S27: LCMS report of compound 5f.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L6.D
Sample Name: L6
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   6
    Acq. Instrument : LCMS                          Location :   47
    Injection Date  : 3/4/2020 4:35:19 PM                Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 4:34:24 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L6


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD1 TIC, MS File,  MM-APCI, Pos, Fast Scan, Frag: 100
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                   Mol. Weight
    Time (MS)      MS Area      or Ion

       3.900       1763041       350.80 I
                                 349.80 I
```




```
                        *** End of Report ***
```

Figure: S28: LCMS report of compound 5g.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L7.D
Sample Name: L7
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   7
    Acq. Instrument : LCMS                          Location :   48
    Injection Date  : 3/4/2020 4:46:30 PM                Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 4:45:35 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L7


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD4 TIC, MS File,  MM-APCI, Neg, Fast Scan, Frag: 150
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                  Mol. Weight
    Time (MS)      MS Area     or Ion

       4.290        863708      410.95 I
                                409.80 I
                                408.80 I
                                407.80 I

       4.430        694703      428.90 I
                                427.80 I
                                425.80 I
                                410.60 I
                                408.80 I
                                407.65 I
                                385.80 I
                                384.80 I
                                382.80 I
                                367.70 I
                                341.75 I
                                339.80 I
```

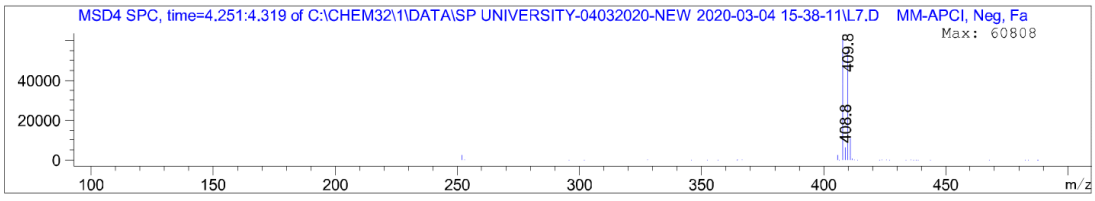


Figure: S29: LC report of compound 5h.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L8.D
Sample Name: L8
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   8
    Acq. Instrument : LCMS                          Location :   49
    Injection Date  : 3/4/2020 4:57:41 PM               Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 4:56:45 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L8


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

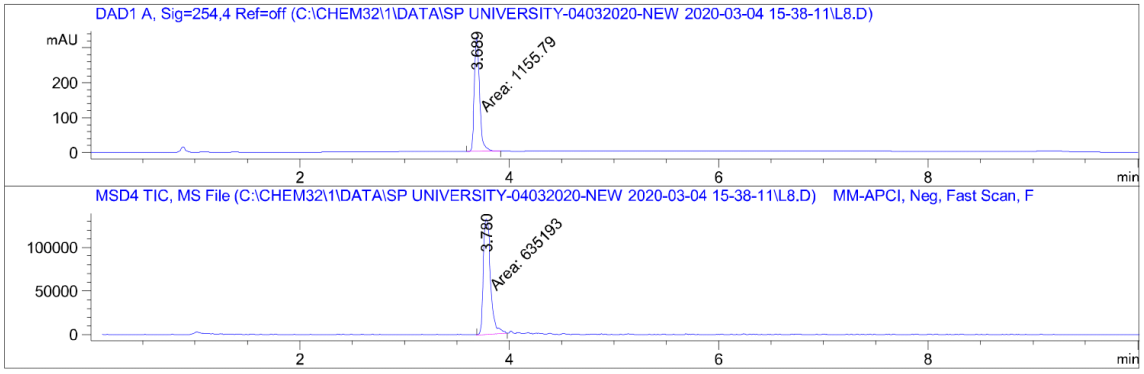
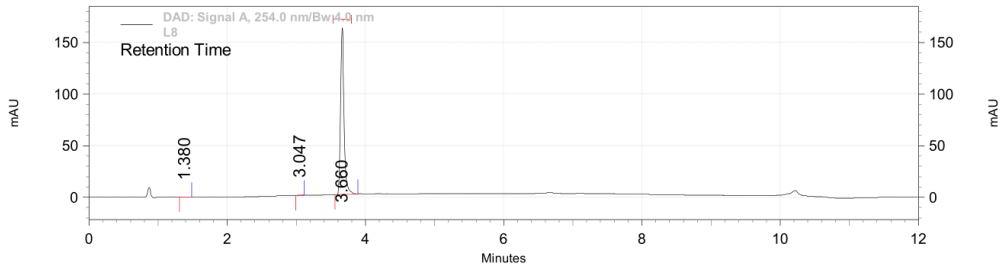


Figure: S30: HPLC report of compound 5h.

aether
elementally innovative

Aether Industries Ltd

Sample ID : L8 Instruent ID : QCI04 (Offline)
Inj Vol : 1µl
Vial No : 49
Method : D:\HPLC DATA\2020\March\Method\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2020\March\Result\QCI04\04032020\L8.dat
Acquired : 04/03/2020 20:24:55 (GMT +05:30)

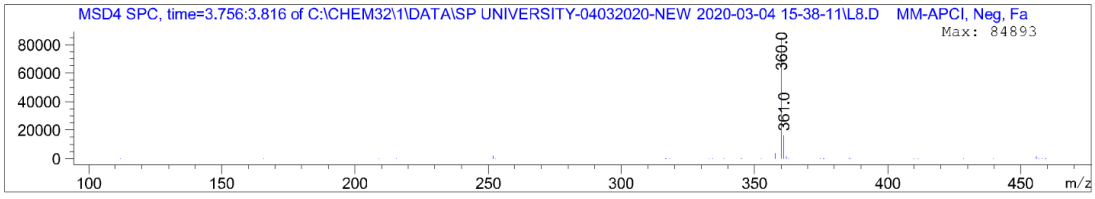


DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	1.38	88239	0.12	
2	3.05	187621	0.25	
3	3.66	76108132	99.64	L8
Totals		76383992	100.00	

Figure: S31: LCMS report of compound 5h.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L8.D
Sample Name: L8
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   8
    Acq. Instrument : LCMS                          Location :   49
    Injection Date  : 3/4/2020 4:57:41 PM                Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 4:56:45 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L8


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD4 TIC, MS File,  MM-APCI, Neg, Fast Scan, Frag: 150
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                   Mol. Weight
    Time (MS)      MS Area      or Ion

       3.780        635193       361.00 I
                                 360.00 I
```




```
                        *** End of Report ***
```

Figure: S32: LCMS report of compound 5i.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L9.D
Sample Name: L9
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   9
    Acq. Instrument : LCMS                          Location :   50
    Injection Date  : 3/4/2020 5:08:55 PM                Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 5:07:59 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L9


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD3 TIC, MS File,  MM-APCI, Neg, Fast Scan, Frag: 100
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                   Mol. Weight
    Time (MS)      MS Area      or Ion

       4.757        310489       407.00 I
                                 406.00 I

       4.961         16897       425.00 I
                                 423.80 I
```

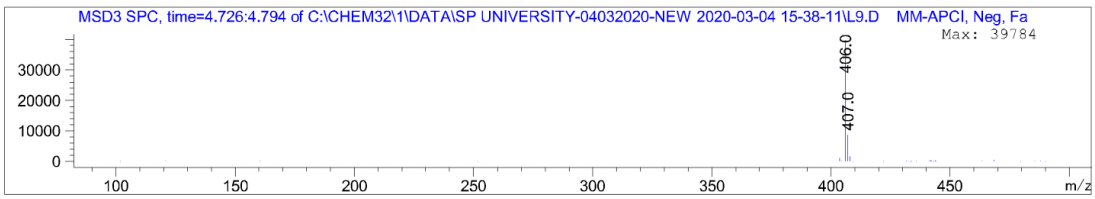


Figure: S33: LC report of compound 5j.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L10.D
Sample Name: L10
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  10
    Acq. Instrument : LCMS                          Location :   51
    Injection Date  : 3/4/2020 5:20:09 PM                Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 5:19:12 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L10


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

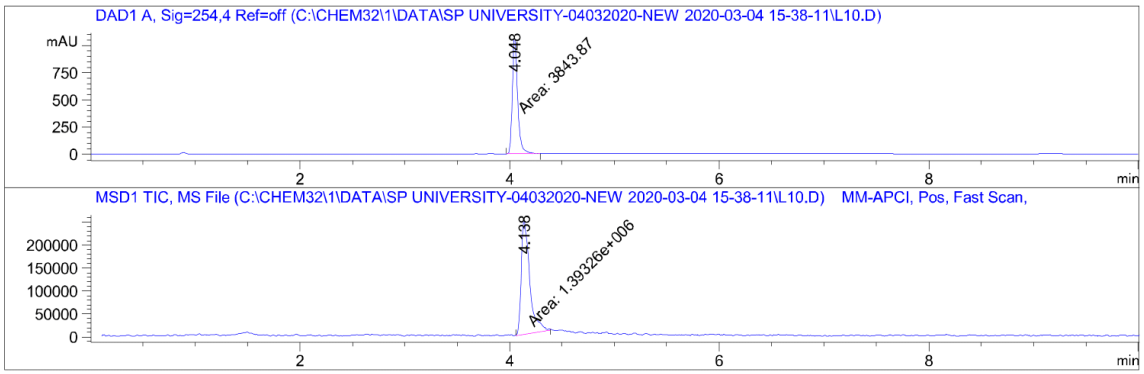
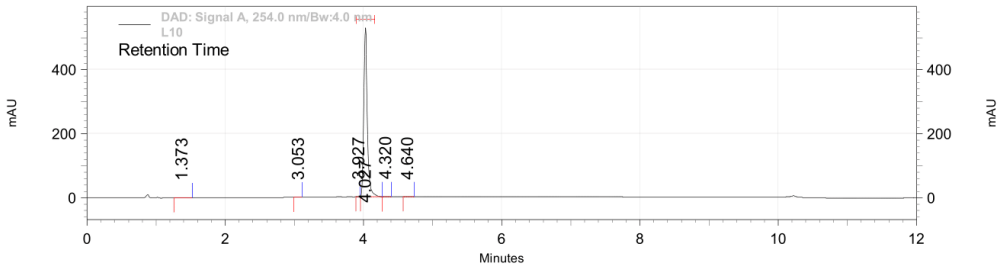


Figure: S34: HPLC report of compound 5j.

aether
elementally innovative

Aether Industries Ltd

Sample ID : L10 Instruent ID : QCI04 (Offline)
Inj Vol : 1µl
Vial No : 51
Method : D:\HPLC DATA\2020\March\Method\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2020\March\Result\QCI04\04032020\L10.dat
Acquired : 04/03/2020 20:51:42 (GMT +05:30)

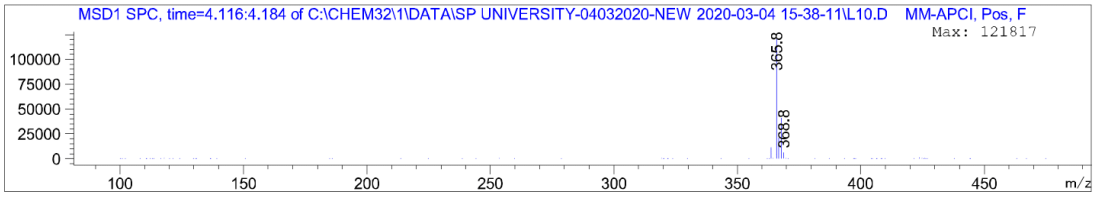


DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	1.37	113771	0.04	
2	3.05	120485	0.05	
3	3.93	57132	0.02	
4	4.03	252511776	99.58	110
5	4.32	365361	0.14	
6	4.64	398230	0.16	
Totals		253566755	100.00	

Figure: S35: LCMS report of compound 5j.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L10.D
Sample Name: L10
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  10
    Acq. Instrument : LCMS                          Location :   51
    Injection Date  : 3/4/2020 5:20:09 PM                Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 5:19:12 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L10


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD1 TIC, MS File,  MM-APCI, Pos, Fast Scan, Frag: 100
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                   Mol. Weight
    Time (MS)      MS Area      or Ion

       4.138       1393262       367.80 I
                                 366.80 I
                                 365.80 I
```




```
                        *** End of Report ***
```

Figure: S36: LC report of compound 5k.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L12.D
Sample Name: L12
    ======================================================================
    Acq. Operator   : SYSTEM                          Seq. Line :  12
    Acq. Instrument : LCMS                             Location :  53
    Injection Date  : 3/4/2020 5:42:33 PM                  Inj :  1
                                                    Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 5:41:39 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L12


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

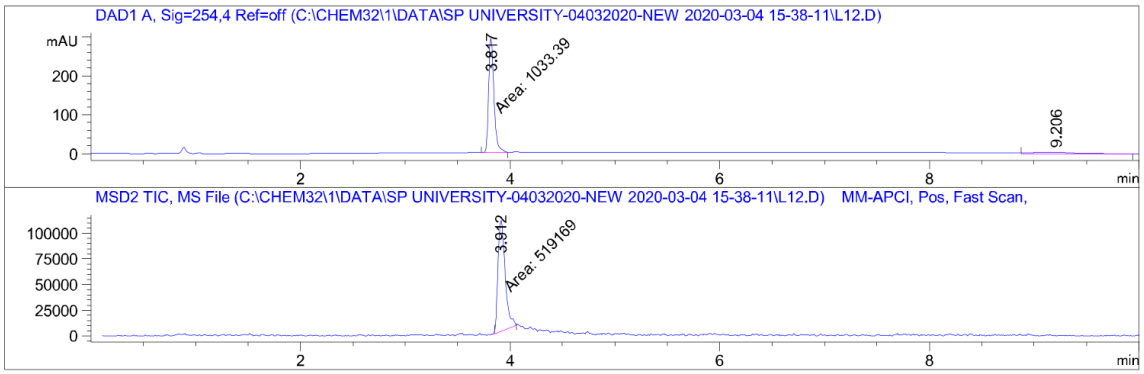
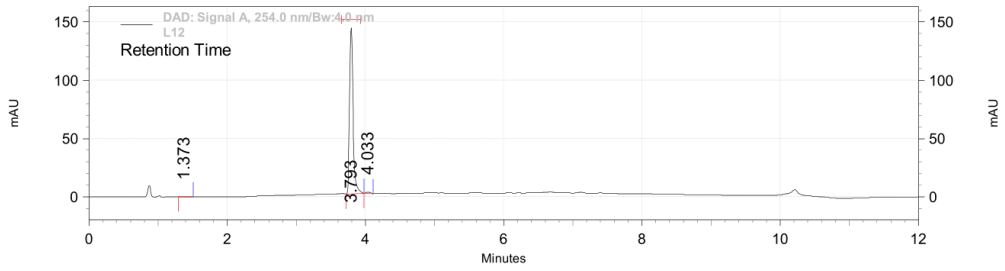


Figure: S37: HPLC report of compound 5k.

aether
elementally innovative

Aether Industries Ltd

Sample ID : L12 Instruent ID : QCI04 (Offline)
Inj Vol : 1µl
Vial No : 53
Method : D:\HPLC DATA\2020\March\Method\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2020\March\Result\QCI04\04032020\L12.dat
Acquired : 04/03/2020 21:18:27 (GMT +05:30)

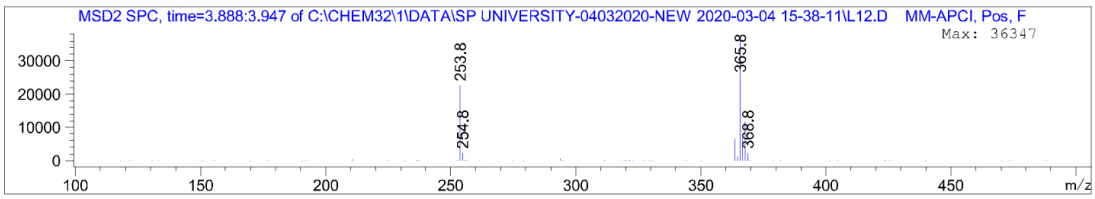


DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	1.37	79825	0.12	
2	3.79	67538275	99.03	L12
3	4.03	579816	0.85	
Totals		68197916	100.00	

Figure: S38: LCMS report of compound 5k.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-04032020-NEW 2020-03-04 15-38-11\L12.D
Sample Name: L12
    ======================================================================
    Acq. Operator   : SYSTEM                          Seq. Line :  12
    Acq. Instrument : LCMS                             Location :   53
    Injection Date  : 3/4/2020 5:42:33 PM                   Inj :   1
                                                    Inj Volume : 5.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-04032020-New 2020-03-04 15-38-11\M206-FA.M
    Last changed    : 3/4/2020 5:41:39 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 3/2/2020 5:44:32 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : L12


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD2 TIC, MS File,  MM-APCI, Pos, Fast Scan, Frag: 150
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                   Mol. Weight
    Time (MS)      MS Area      or Ion

       3.912        519169       367.75 I
                                 366.80 I
                                 365.80 I
                                 363.65 I
                                 253.80 I
```




```
                        *** End of Report ***
```

Figure: S39: LC report of compound 7a.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-14112019 2019-11-14 18-16-00\CB1.D
Sample Name: CB1
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   2
    Acq. Instrument : LCMS                          Location :   62
    Injection Date  : 11/14/2019 6:30:12 PM              Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-14112019 2019-11-14 18-16-00\M206-FA.M
    Last changed    : 11/14/2019 6:29:18 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 11/14/2019 6:11:49 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB1


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

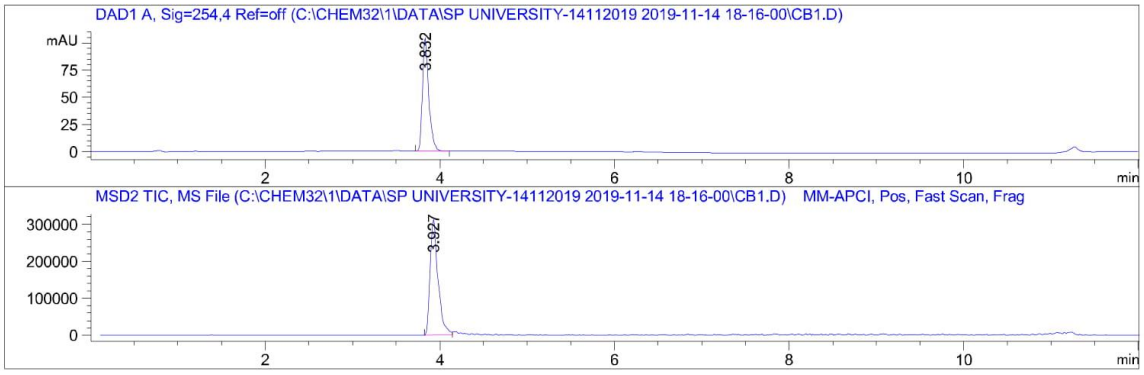
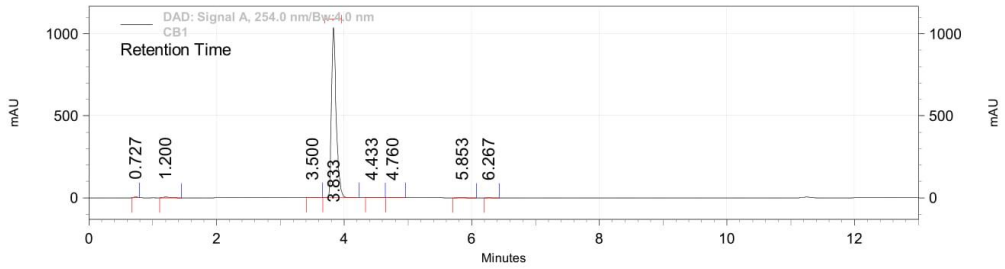


Figure: S40: HPLC report of compound 7a.

aether
elementally innovative

Aether Industries Ltd

Sample ID : CB1 Instruent ID : QCI04 (Offline)
Inj Vol : 2µl
Vial No : 62
Method : D:\HPLC DATA\2019\November\Method\50 X 4.6 2.7u\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2019\November\Result\QCI04\14112019\--CB1.dat
Acquired : 14/11/2019 23:55:21 (GMT +05:30)

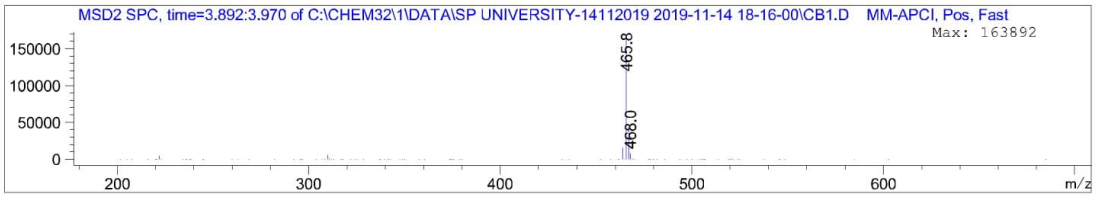


DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	0.73	2056896	0.28	
2	1.20	3736336	0.51	
3	3.50	1109607	0.15	
4	3.83	718446573	98.74	CB1
5	4.43	762509	0.10	
6	4.76	457205	0.06	
7	5.85	668336	0.09	
8	6.27	396042	0.05	
Totals		727633504	100.00	

Figure: S41: LCMS report of compound 7a.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-14112019 2019-11-14 18-16-00\CB1.D
Sample Name: CB1
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :   2
    Acq. Instrument : LCMS                          Location :   62
    Injection Date  : 11/14/2019 6:30:12 PM              Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-14112019 2019-11-14 18-16-00\M206-FA.M
    Last changed    : 11/14/2019 6:29:18 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 11/14/2019 6:11:49 PM by SYSTEM
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB1


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD2 TIC, MS File,  MM-APCI, Pos, Fast Scan, Frag: 150
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                   Mol. Weight
    Time (MS)      MS Area      or Ion

       3.927       1992628       467.00 I
                                 465.80 I
```




```
                        *** End of Report ***
```

Figure: S42: LC report of compound 7b.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB2.D
Sample Name: CB2
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  16
    Acq. Instrument : LCMS                          Location :   56
    Injection Date  : 1/22/2020 3:33:16 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 3:32:21 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB2


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

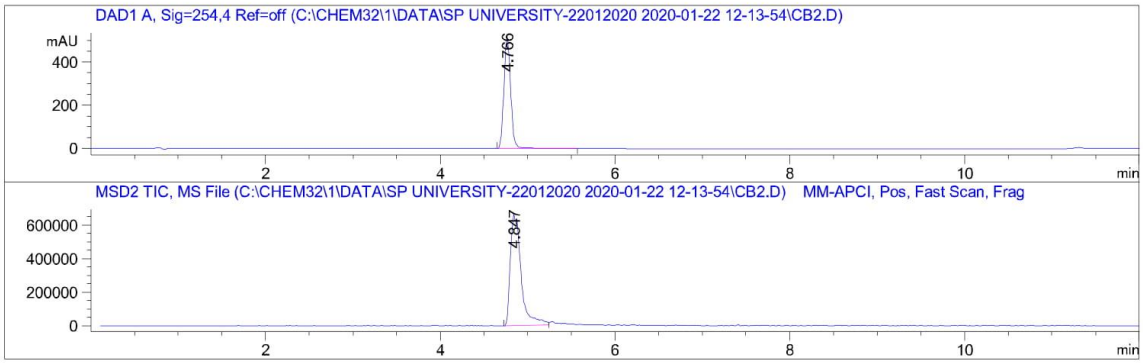
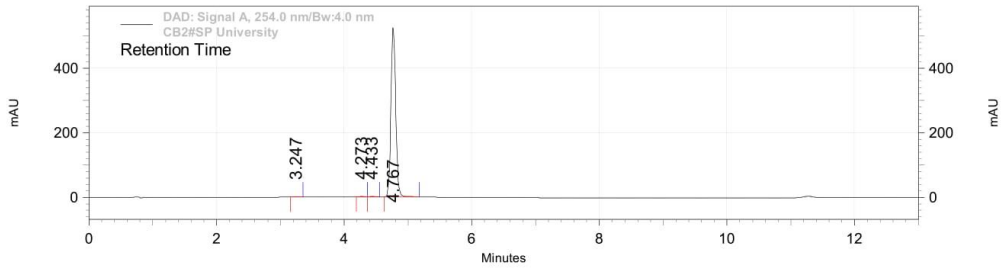


Figure: S43: HPLC report of compound 7b.

aether
elementally innovative

Aether Industries Ltd

Sample ID : CB2#SP University Instruent ID : QCI04 (Offline)
Inj Vol : 2µl
Vial No : 56
Method : D:\HPLC DATA\2020\January\Method\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2020\January\Result\QCI04\22012020\CB2#SP University.dat
Acquired : 22/01/2020 22:48:22 (GMT +05:30)

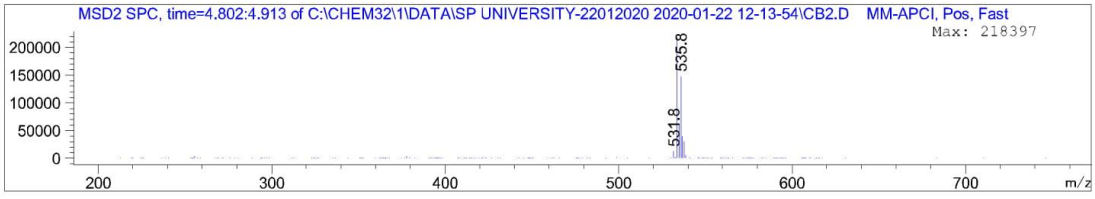


DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	3.25	203650	0.05	
2	4.27	1035499	0.28	
3	4.43	1205681	0.32	
4	4.77	368629438	99.34	
Totals		371074268	100.00	

Figure: S44: LCMS report of compound 7b.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB2.D
Sample Name: CB2
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  16
    Acq. Instrument : LCMS                          Location :   56
    Injection Date  : 1/22/2020 3:33:16 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 3:32:21 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB2


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD2 TIC, MS File,  MM-APCI, Pos, Fast Scan, Frag: 150
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                  Mol. Weight
    Time (MS)      MS Area     or Ion

       4.847       5722229      537.80 I
                                536.80 I
                                535.80 I
                                534.80 I
                                533.80 I
```




```
                    *** End of Report ***
```

Figure: S45: LC report of compound 7c.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB3.D
Sample Name: CB3
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  17
    Acq. Instrument : LCMS                          Location :   57
    Injection Date  : 1/22/2020 3:46:27 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 3:45:33 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB3


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

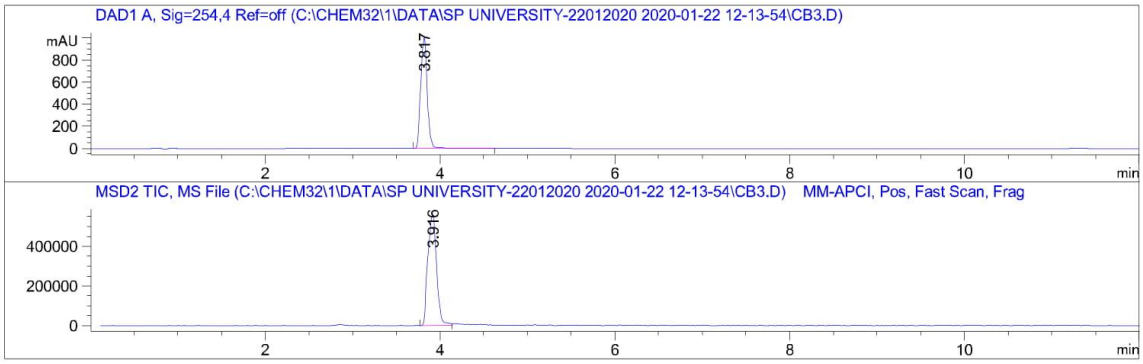
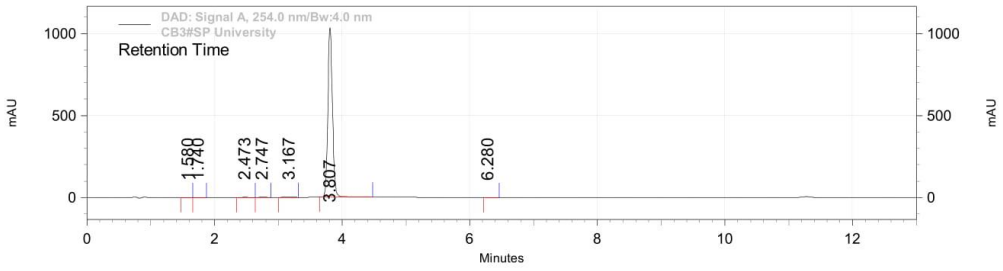


Figure: S46: HPLC report of compound 7c.

aether
elementally innovative

Aether Industries Ltd

Sample ID : CB3#SP University Instruent ID : QCI04 (Offline)
Inj Vol : 2µl
Vial No : 57
Method : D:\HPLC DATA\2020\January\Method\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2020\January\Result\QCI04\22012020\CB3#SP University.dat
Acquired : 22/01/2020 23:02:44 (GMT +05:30)

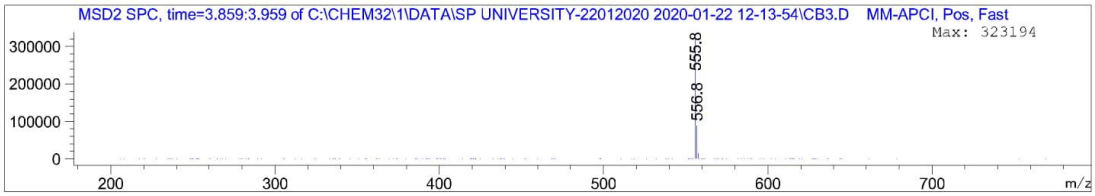


DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	1.58	106788	0.02	
2	1.74	116449	0.02	
3	2.47	511248	0.07	
4	2.75	713974	0.10	
5	3.17	811969	0.12	
6	3.81	696826850	99.66	
7	6.28	115377	0.02	
Totals		699202655	100.00	

Figure: S47: LCMS report of compound 7c.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB3.D
Sample Name: CB3
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  17
    Acq. Instrument : LCMS                          Location :   57
    Injection Date  : 1/22/2020 3:46:27 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 3:45:33 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB3


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD2 TIC, MS File,  MM-APCI, Pos, Fast Scan, Frag: 150
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                  Mol. Weight
    Time (MS)      MS Area     or Ion

       3.916       3807850      556.80 I
                                555.80 I
```




```
                        *** End of Report ***
```

Figure: S48: LC report of compound 7d.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB4.D
Sample Name: CB4
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  18
    Acq. Instrument : LCMS                          Location :   58
    Injection Date  : 1/22/2020 3:59:38 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 3:58:44 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB4


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

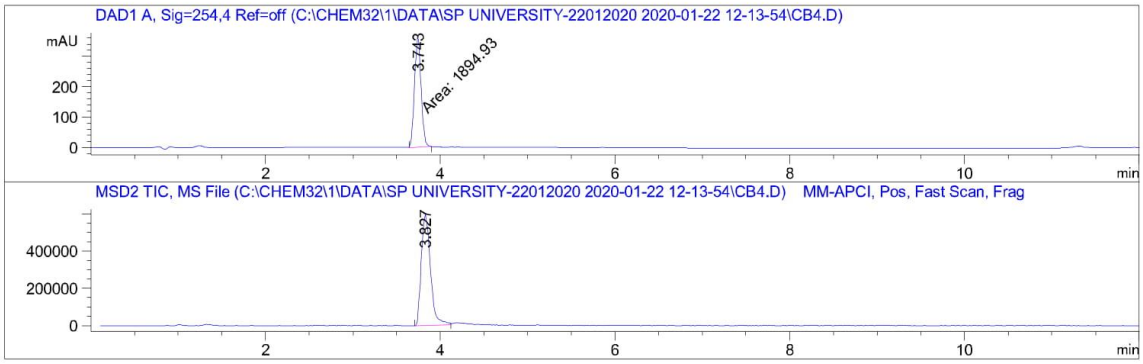
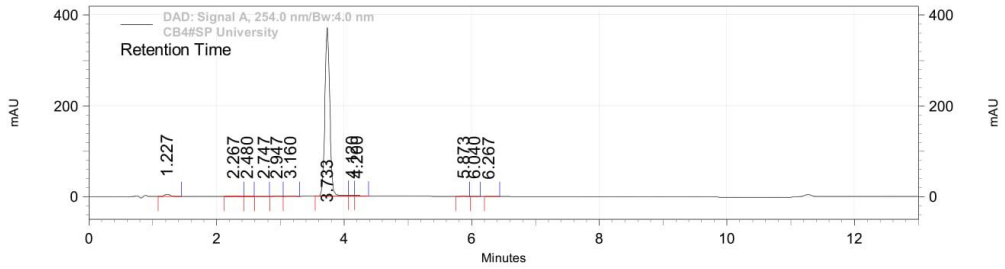


Figure: S49: HPLC report of compound 7d.

aether
elementally innovative

Aether Industries Ltd

Sample ID : CB4#SP University Instruent ID : QCI04 (Offline)
Inj Vol : 2µl
Vial No : 58
Method : D:\HPLC DATA\2020\January\Method\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2020\January\Result\QCI04\22012020\CB4#SP University.dat
Acquired : 22/01/2020 23:17:07 (GMT +05:30)

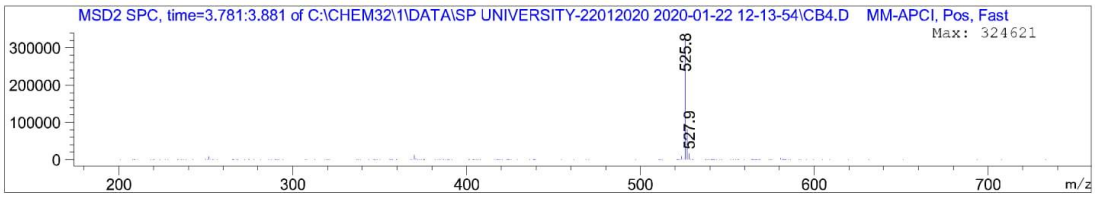


DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	1.23	4839605	1.77	
2	2.27	1407902	0.52	
3	2.48	240476	0.09	
4	2.75	127174	0.05	
5	2.95	489782	0.18	
6	3.16	422872	0.15	
7	3.73	262931045	96.24	
8	4.12	891607	0.33	
9	4.20	1072338	0.39	
10	5.87	397586	0.15	
11	6.04	227911	0.08	
12	6.27	151132	0.06	
Totals		273199430	100.00	

Figure: S50: LCMS report of compound 7d.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB4.D
Sample Name: CB4
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  18
    Acq. Instrument : LCMS                          Location :   58
    Injection Date  : 1/22/2020 3:59:38 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 3:58:44 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB4


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD2 TIC, MS File,  MM-APCI, Pos, Fast Scan, Frag: 150
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                   Mol. Weight
    Time (MS)      MS Area      or Ion

       3.827       4320049       526.90 I
                                 525.80 I
```




```
                        *** End of Report ***
```

Figure: S51: LC report of compound 7e.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB5.D
Sample Name: CB5
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  19
    Acq. Instrument : LCMS                          Location :   59
    Injection Date  : 1/22/2020 4:12:54 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 4:11:56 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB5


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

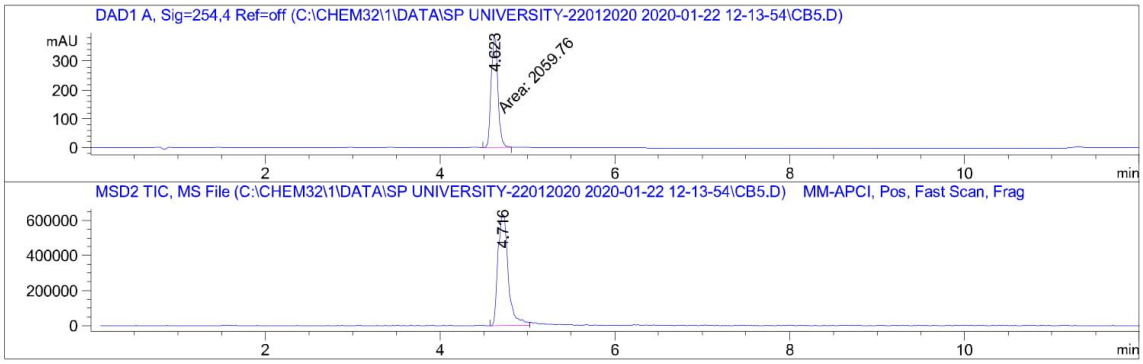
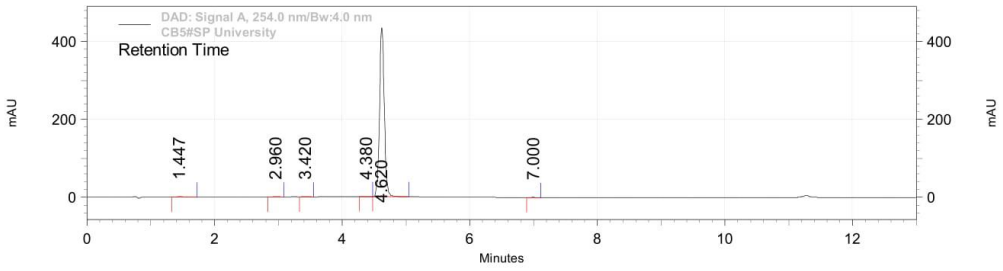


Figure: S52: HPLC report of compound 7e.

aether
elementally innovative

Aether Industries Ltd

Sample ID : CB5#SP University Instruent ID : QCI04 (Offline)
Inj Vol : 2µl
Vial No : 59
Method : D:\HPLC DATA\2020\January\Method\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2020\January\Result\QCI04\22012020\CB5#SP University.dat
Acquired : 22/01/2020 23:31:29 (GMT +05:30)

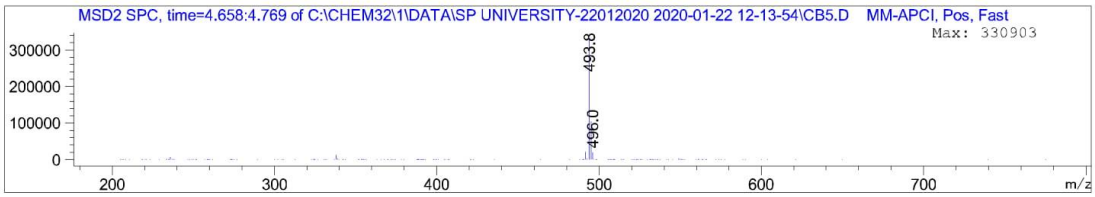


DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	1.45	1603852	0.52	
2	2.96	499660	0.16	
3	3.42	520939	0.17	
4	4.38	439523	0.14	
5	4.62	302189660	98.79	
6	7.00	651332	0.21	
Totals		305904966	100.00	

Figure: S53: LCMS report of compound 7e.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB5.D
Sample Name: CB5
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  19
    Acq. Instrument : LCMS                          Location :   59
    Injection Date  : 1/22/2020 4:12:54 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 4:11:56 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB5


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD2 TIC, MS File,  MM-APCI, Pos, Fast Scan, Frag: 150
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                   Mol. Weight
    Time (MS)      MS Area      or Ion

       4.716       5116771       494.95 I
                                 493.80 I
```




```
                    *** End of Report ***
```

Figure: S54: LC report of compound 7f.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB6.D
Sample Name: CB6
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  20
    Acq. Instrument : LCMS                          Location :   60
    Injection Date  : 1/22/2020 4:26:05 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 4:25:11 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB6


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

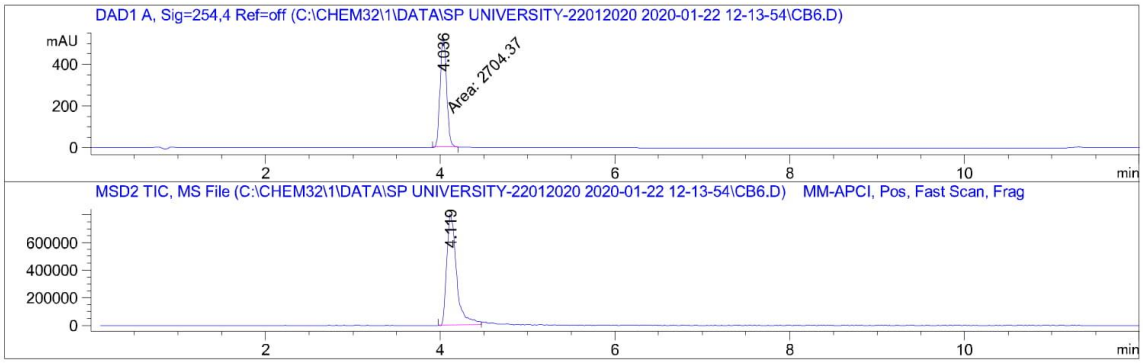
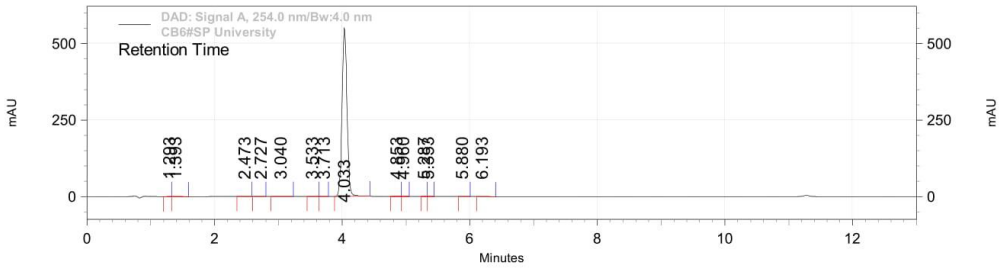


Figure: S55: HPLC report of compound 7f.

aether
elementally innovative

Aether Industries Ltd

Sample ID : CB6#SP University Instruent ID : QCI04 (Offline)
Inj Vol : 2µl
Vial No : 60
Method : D:\HPLC DATA\2020\January\Method\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2020\January\Result\QCI04\22012020\CB6#SP University.dat
Acquired : 22/01/2020 23:45:52 (GMT +05:30)

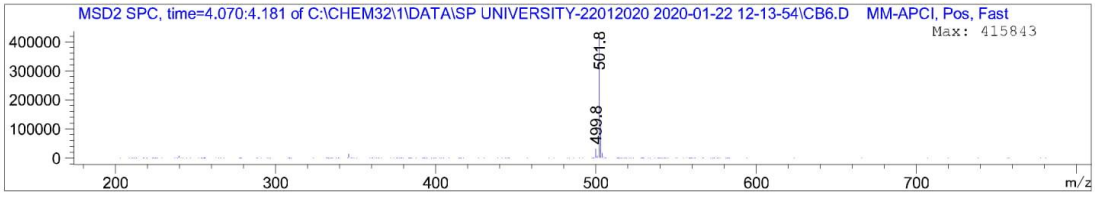


DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	1.29	151966	0.04	
2	1.39	354255	0.09	
3	2.47	181695	0.05	
4	2.73	131381	0.03	
5	3.04	357397	0.09	
6	3.53	118106	0.03	
7	3.71	83416	0.02	
8	4.03	395687459	99.48	
9	4.85	62560	0.02	
10	4.96	59232	0.01	
11	5.29	79810	0.02	
12	5.35	104893	0.03	
13	5.88	88964	0.02	
14	6.19	289507	0.07	
Totals		397750641	100.00	

Figure: S56: LCMS report of compound 7f.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB6.D
Sample Name: CB6
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  20
    Acq. Instrument : LCMS                          Location :   60
    Injection Date  : 1/22/2020 4:26:05 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 4:25:11 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB6


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD2 TIC, MS File,  MM-APCI, Pos, Fast Scan, Frag: 150
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                  Mol. Weight
    Time (MS)      MS Area     or Ion

       4.119       6321377      502.80 I
                                501.80 I
```




```
                    *** End of Report ***
```

Figure: S57: LC report of compound 7g.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB7.D
Sample Name: CB7
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  21
    Acq. Instrument : LCMS                          Location :   61
    Injection Date  : 1/22/2020 4:39:15 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 4:38:21 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB7


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

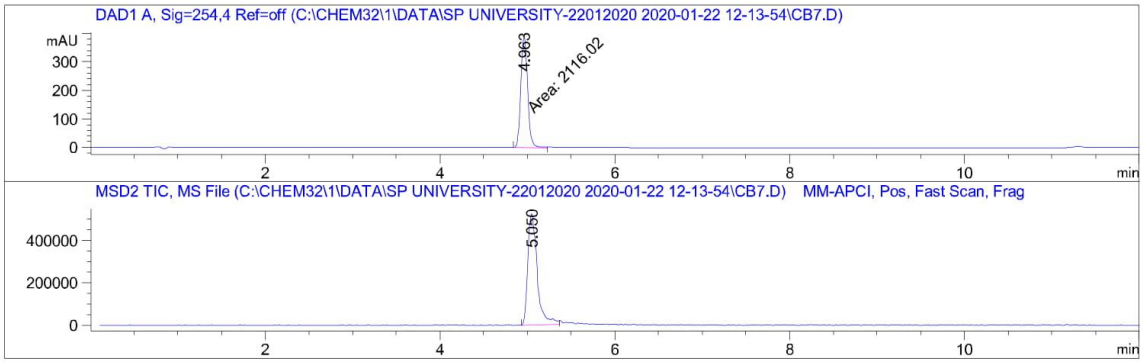
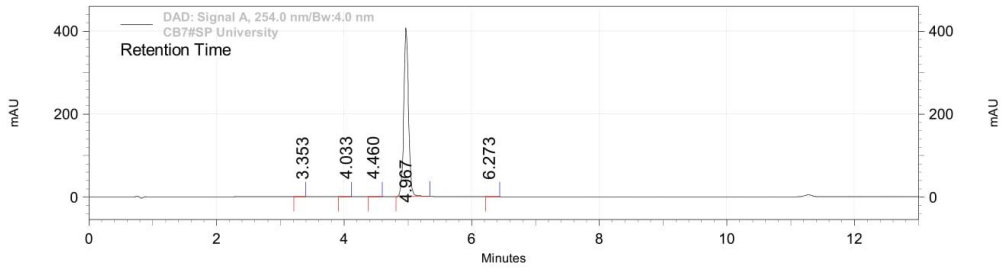


Figure: S58: HPLC report of compound 7g.

aether
elementally innovative

Aether Industries Ltd

Sample ID : CB7#SP University Instruent ID : QCI04 (Offline)
Inj Vol : 2µl
Vial No : 61
Method : D:\HPLC DATA\2020\January\Method\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2020\January\Result\QCI04\22012020\CB7#SP University.dat
Acquired : 23/01/2020 00:00:12 (GMT +05:30)

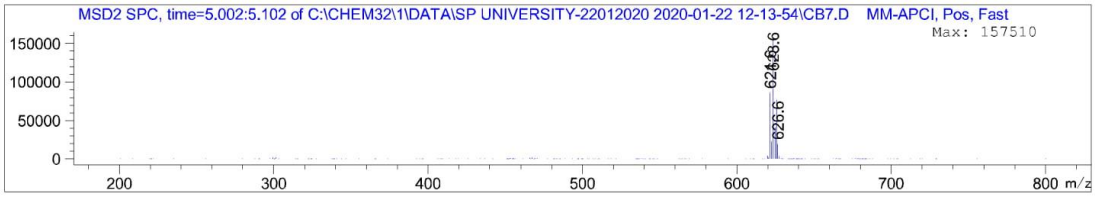


DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	3.35	50049	0.02	
2	4.03	81288	0.03	
3	4.46	98871	0.04	
4	4.97	280783304	99.88	
5	6.27	97903	0.03	
Totals		281111415	100.00	

Figure: S59: LCMS report of compound 7g.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB7.D
Sample Name: CB7
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  21
    Acq. Instrument : LCMS                          Location :   61
    Injection Date  : 1/22/2020 4:39:15 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 4:38:21 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB7


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD2 TIC, MS File,  MM-APCI, Pos, Fast Scan, Frag: 150
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                  Mol. Weight
    Time (MS)      MS Area     or Ion

       5.050       3944078      626.60 I
                                625.60 I
                                624.70 I
                                623.60 I
                                622.60 I
                                621.60 I
```




```
                    *** End of Report ***
```

Figure: S60: LC report of compound 7h.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB8.D
Sample Name: CB8
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  22
    Acq. Instrument : LCMS                          Location :   62
    Injection Date  : 1/22/2020 4:52:24 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 4:51:32 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB8


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

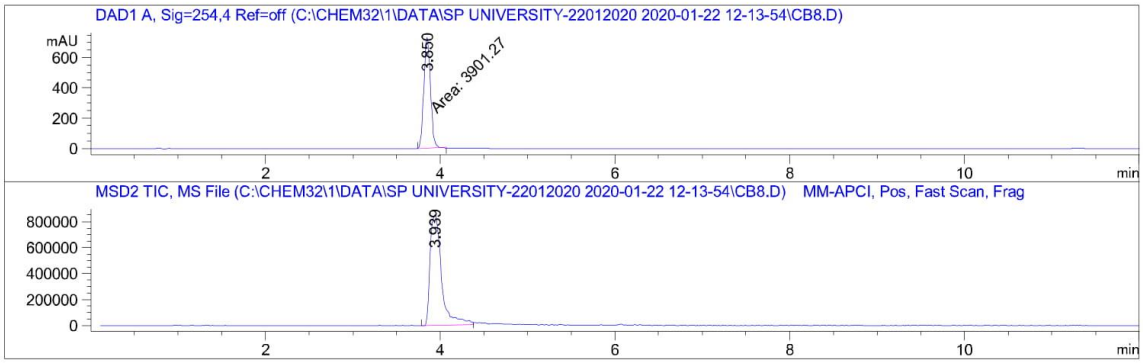
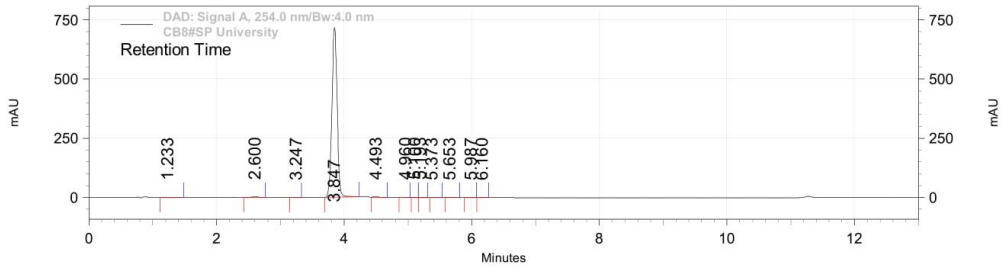


Figure: S61: HPLC report of compound 7h.

aether
elementally innovative

Aether Industries Ltd

Sample ID : CB8#SP University Instruent ID : QCI04 (Offline)
Inj Vol : 2µl
Vial No : 62
Method : D:\HPLC DATA\2020\January\Method\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2020\January\Result\QCI04\22012020\CB8#SP University.dat
Acquired : 23/01/2020 00:14:33 (GMT +05:30)



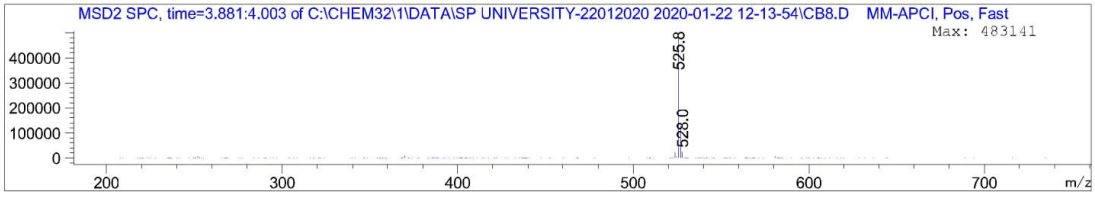
DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	1.23	916300	0.17	
2	2.60	1756597	0.32	
3	3.25	72602	0.01	
4	3.85	548706811	99.13	
5	4.49	383380	0.07	
6	4.96	132298	0.02	
7	5.10	194416	0.04	
8	5.19	190523	0.03	
9	5.37	53876	0.01	
10	5.65	151640	0.03	
11	5.99	547986	0.10	
12	6.16	436298	0.08	

Totals		553542727	100.00	

Figure: S62: LCMS report of compound 7h.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB8.D
Sample Name: CB8
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  22
    Acq. Instrument : LCMS                          Location :   62
    Injection Date  : 1/22/2020 4:52:24 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 4:51:32 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB8


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD2 TIC, MS File,  MM-APCI, Pos, Fast Scan, Frag: 150
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                  Mol. Weight
    Time (MS)      MS Area     or Ion

       3.939       7845816      526.90 I
                                525.80 I
```




```
                    *** End of Report ***
```

Figure: S63: LC report of compound 7i.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB9.D
Sample Name: CB9
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  23
    Acq. Instrument : LCMS                          Location :   63
    Injection Date  : 1/22/2020 5:05:37 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 5:04:42 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB9


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================
```

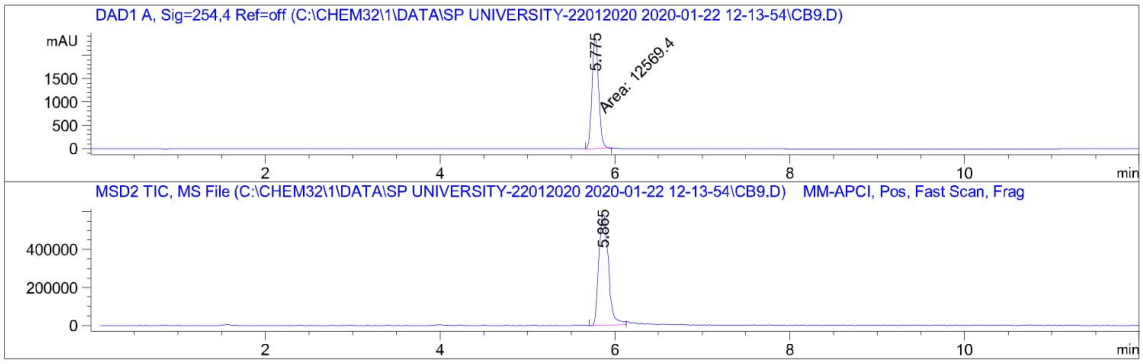
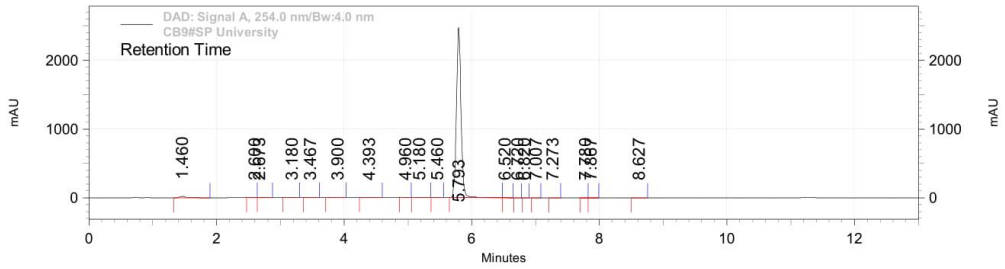


Figure: S64: HPLC report of compound 7i.

aether
elementally innovative

Aether Industries Ltd

Sample ID : CB9#SP University Instruent ID : QCI04 (Offline)
Inj Vol : 2µl
Vial No : 63
Method : D:\HPLC DATA\2020\January\Method\MD\SP Uni-FA.met
Data File : D:\HPLC DATA\2020\January\Result\QCI04\22012020\CB9#SP University.dat
Acquired : 23/01/2020 00:28:56 (GMT +05:30)

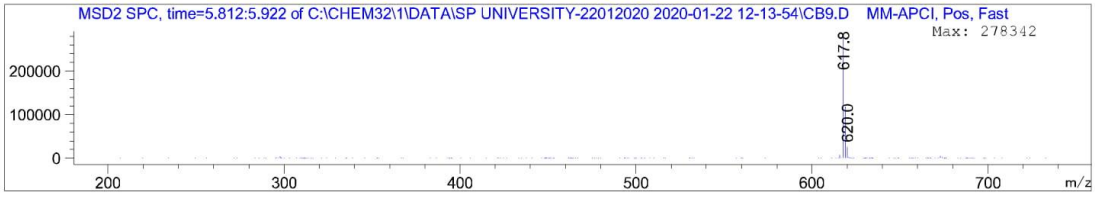


DAD: Signal A, 254.0 nm/Bw:4.0 nm Results

Peak Number	RT	Area	Area %	Name
1	1.46	15973285	0.95	
2	2.60	942949	0.06	
3	2.67	861794	0.05	
4	3.18	351213	0.02	
5	3.47	370160	0.02	
6	3.90	1468987	0.09	
7	4.39	2653316	0.16	
8	4.96	245439	0.01	
9	5.18	2160883	0.13	
10	5.46	615815	0.04	
11	5.79	1659459204	98.38	
12	6.52	487405	0.03	
13	6.72	139304	0.01	
14	6.82	65032	0.00	
15	7.01	221573	0.01	
16	7.27	113591	0.01	
17	7.78	305065	0.02	
18	7.87	323334	0.02	
19	8.63	57243	0.00	
Totals		1686815592	100.00	

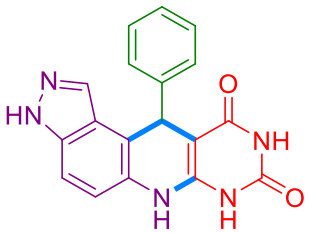
Figure: S65: LCMS report of compound 7i.

```
Data File C:\CHEM32\1\DATA\SP UNIVERSITY-22012020 2020-01-22 12-13-54\CB9.D
Sample Name: CB9
    ======================================================================
    Acq. Operator   : SYSTEM                        Seq. Line :  23
    Acq. Instrument : LCMS                          Location :   63
    Injection Date  : 1/22/2020 5:05:37 PM               Inj :   1
                                                  Inj Volume : 1.000 µl
    Different Inj Volume from Sample Entry!  Actual Inj Volume : 2.000 µl
    Acq. Method     : C:\Chem32\1\Data\SP University-22012020 2020-01-22 12-13-54\M206-FA.M
    Last changed    : 1/22/2020 5:04:42 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Chem32\1\Methods\MS-Washing-30min.M
    Last changed    : 1/22/2020 4:03:07 PM by SYSTEM
                      (modified after loading)
    Method Info     : Sulfa drug OQ/PV  Method for the G6120B Quadrupole LC/MS System
                      MM-ES Positive Ion Sensitivity Test

    Sample Info     : CB9


    Sample-related custom fields:

    Name                          |Value
    ------------------------------|-------------------------------------
    Additional Info : Peak(s) manually integrated
    ======================================================================

    MS Signal: MSD2 TIC, MS File,  MM-APCI, Pos, Fast Scan, Frag: 150
        Spectra averaged over upper half of peaks.
        Noise Cutoff: 500 counts.
        Reportable Ion Abundance: > 10%.


    Retention                   Mol. Weight
    Time (MS)      MS Area      or Ion

       5.865       4365161       618.90 I
                                 617.80 I
```




```
*** End of Report ***
```

Figure S66: ^{1}H-NMR Spectra of Compound 5a.



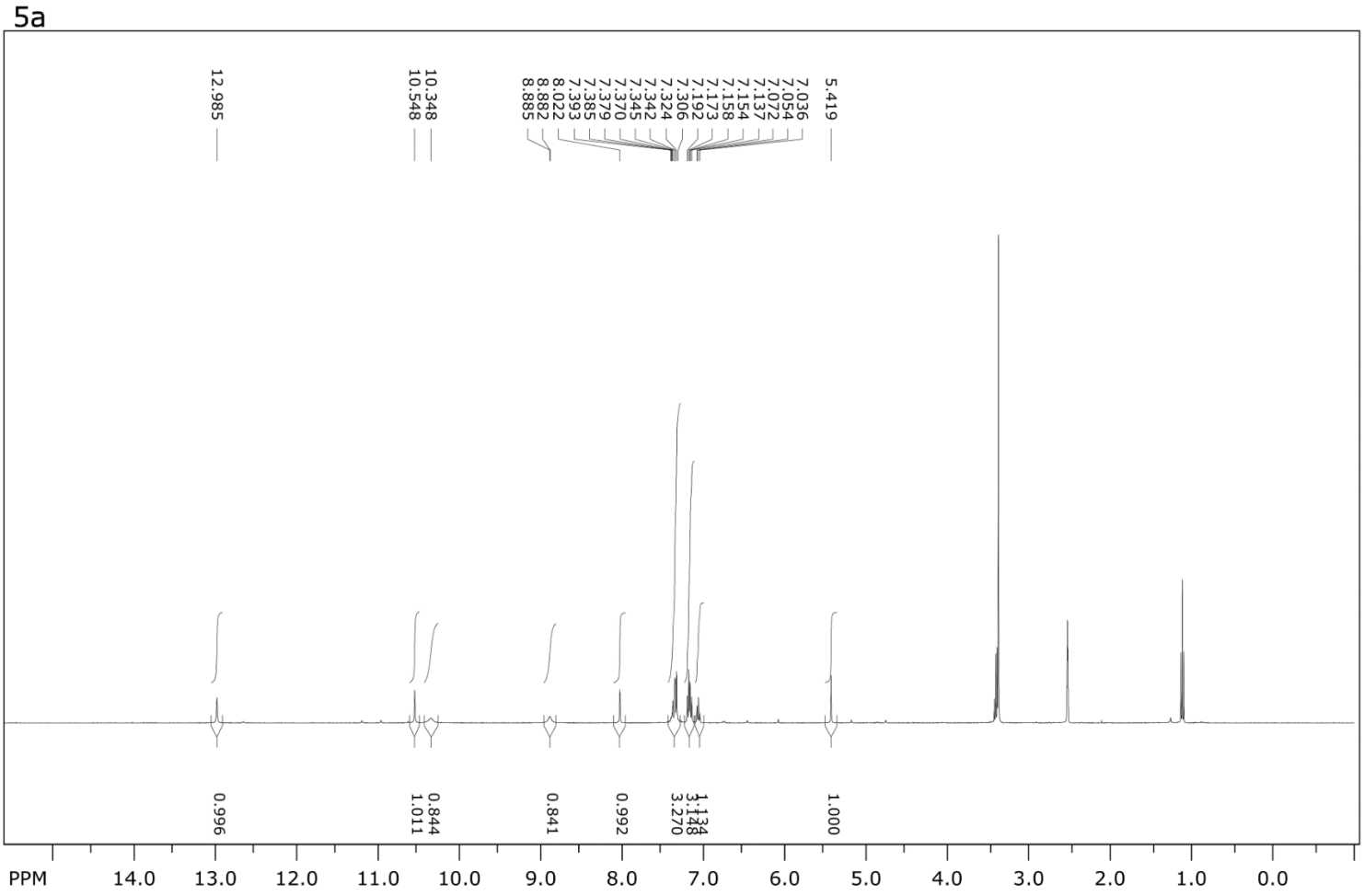


Figure S67: ^{13}C-NMR Spectra of Compound 5a.

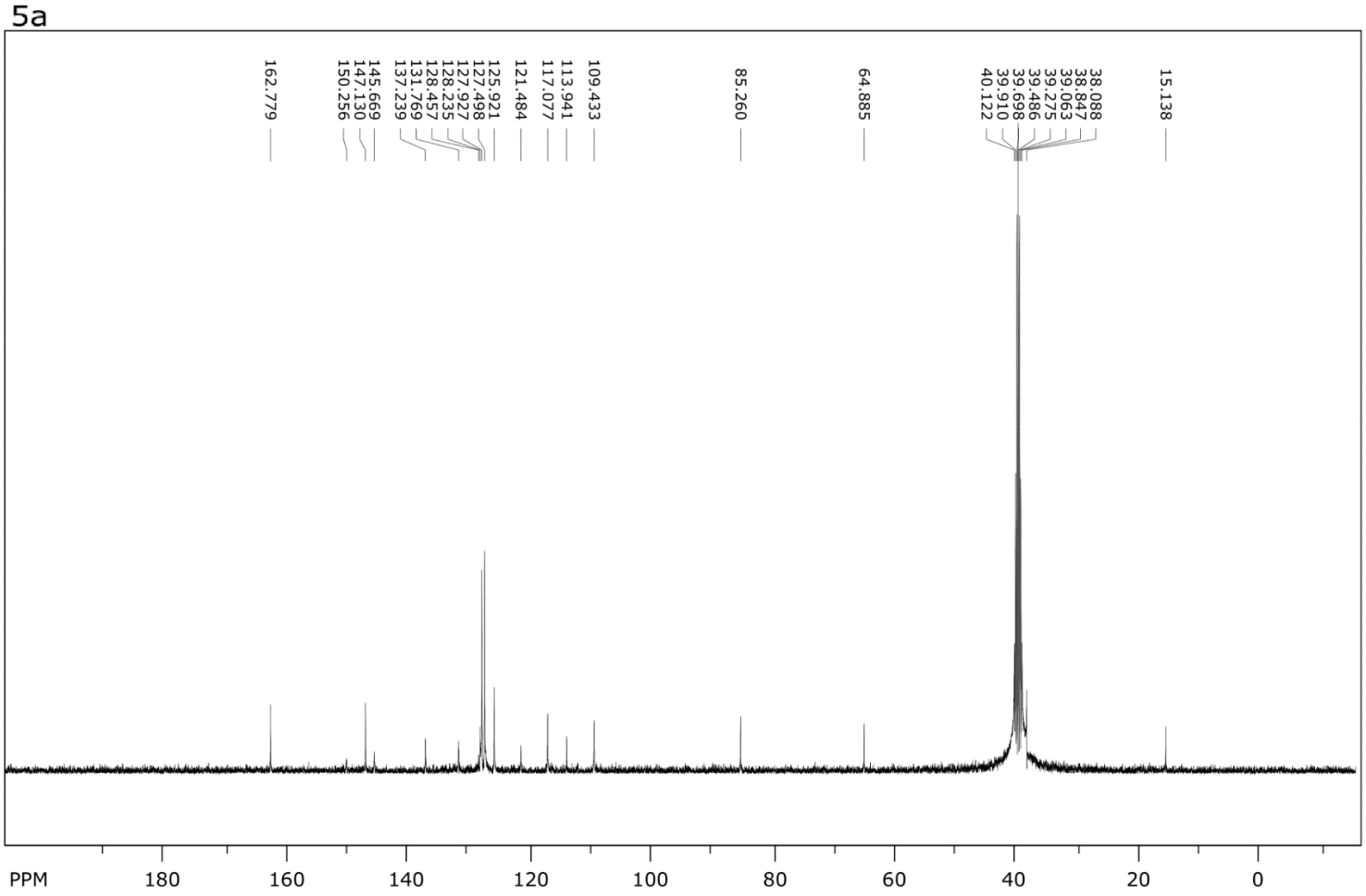
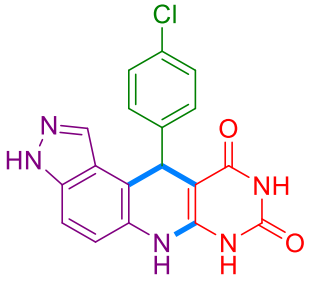


Figure S68: ^{1}H-NMR Spectra of Compound 5b.



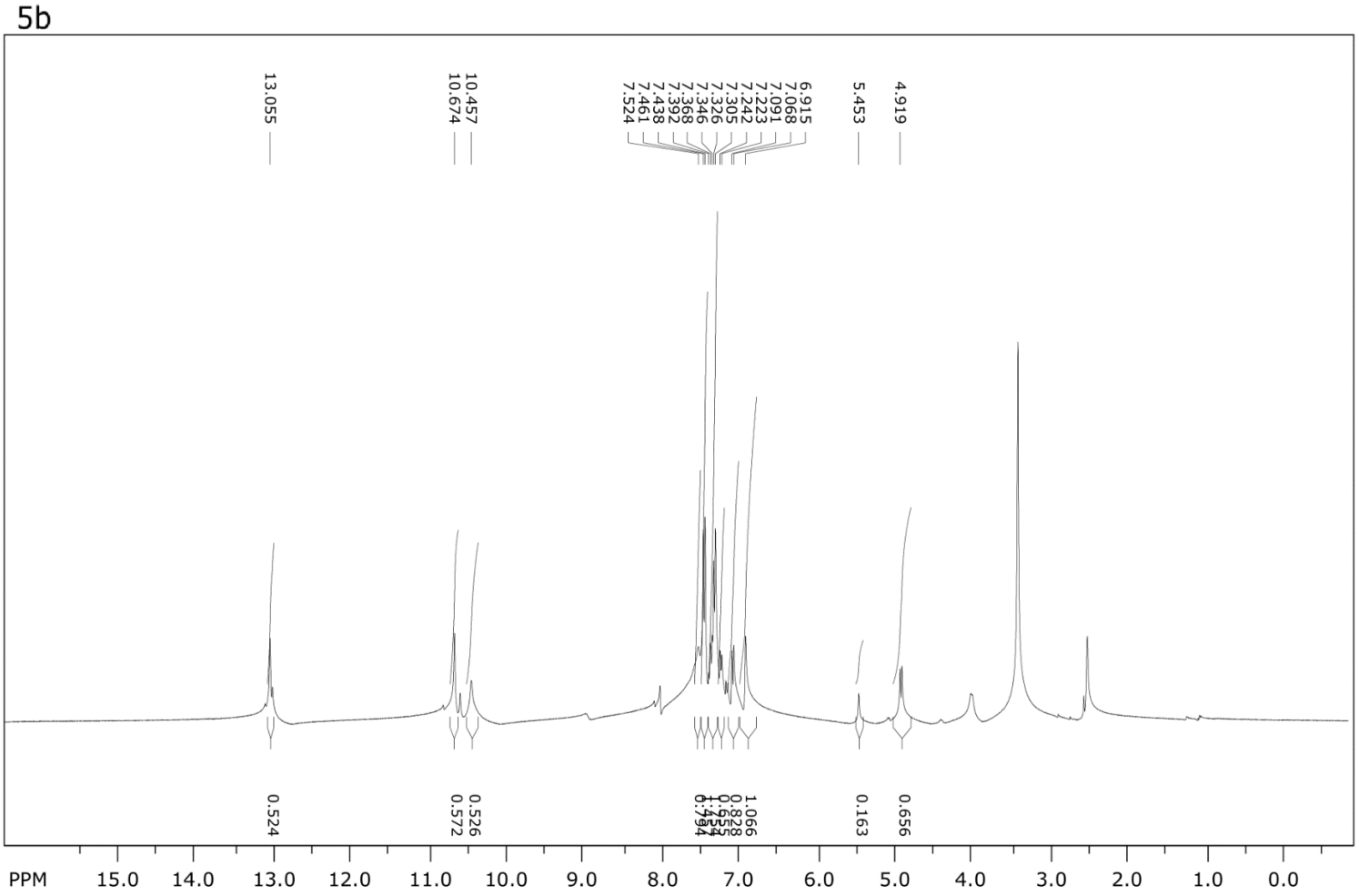


Figure S69: Extended ^{1}H-NMR Spectra of Compound 5b.

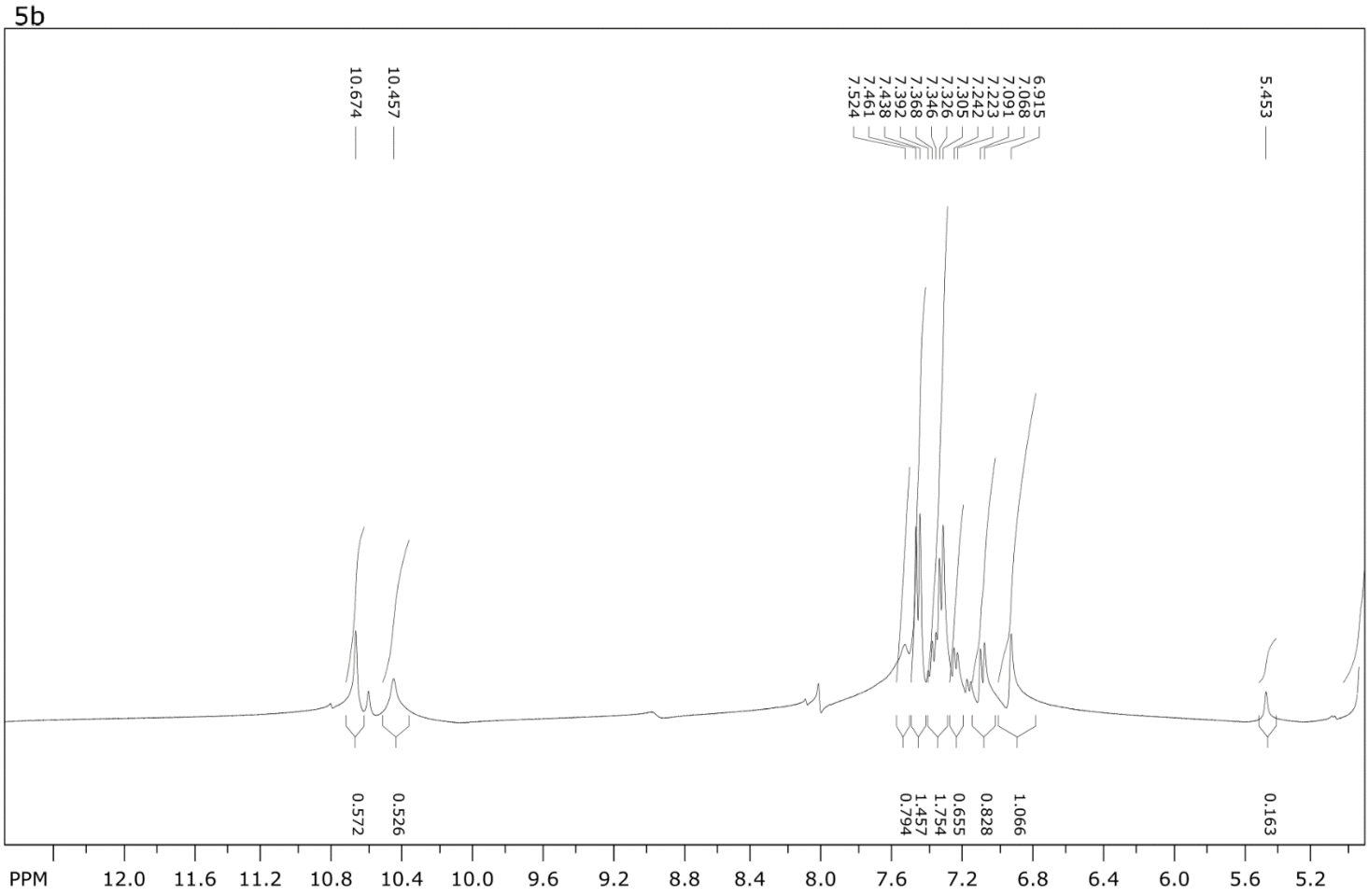


Figure S70: ^{13}C-NMR Spectra of Compound 5b.

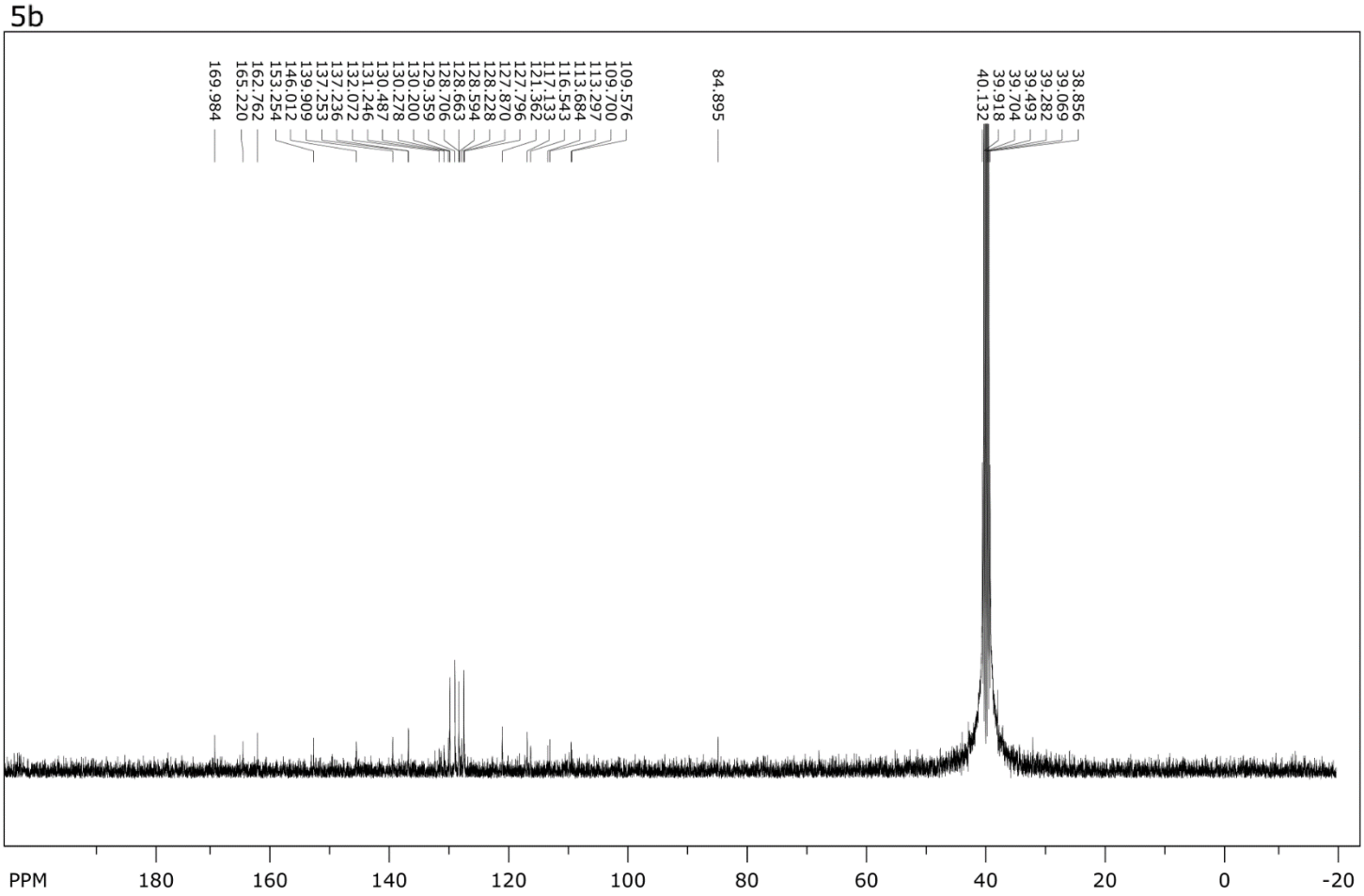
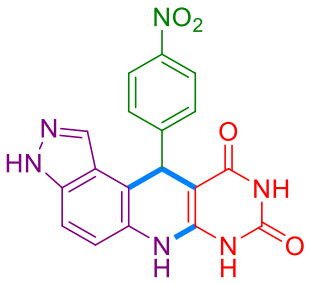


Figure S71: ^{13}C-NMR Spectra of Compound 5c.



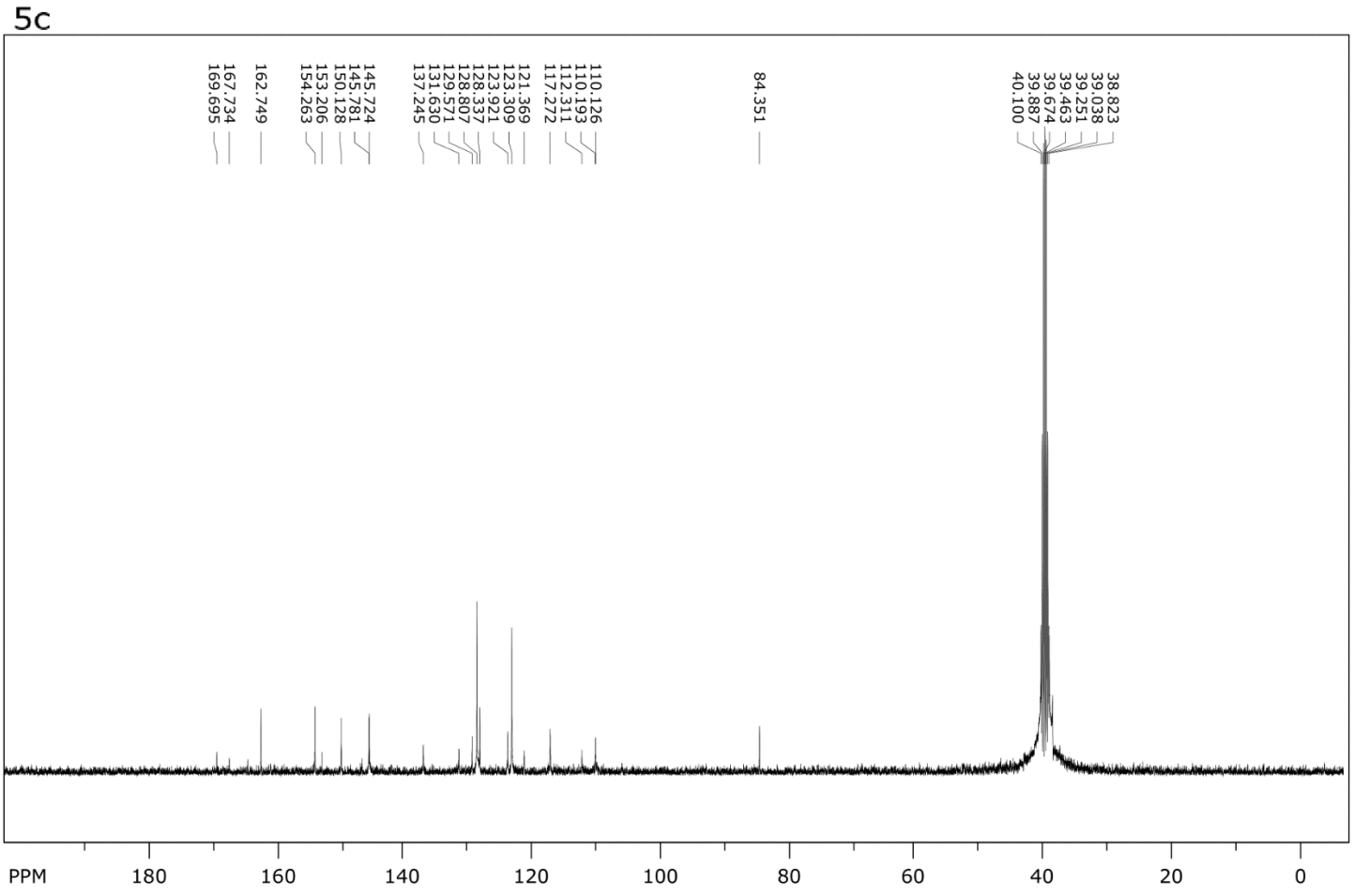
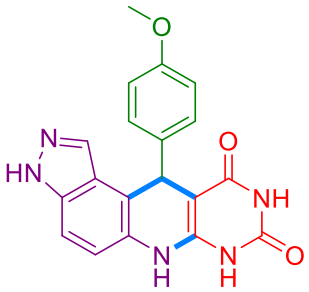


Figure S72: ^{1}H-NMR Spectra of Compound 5d.



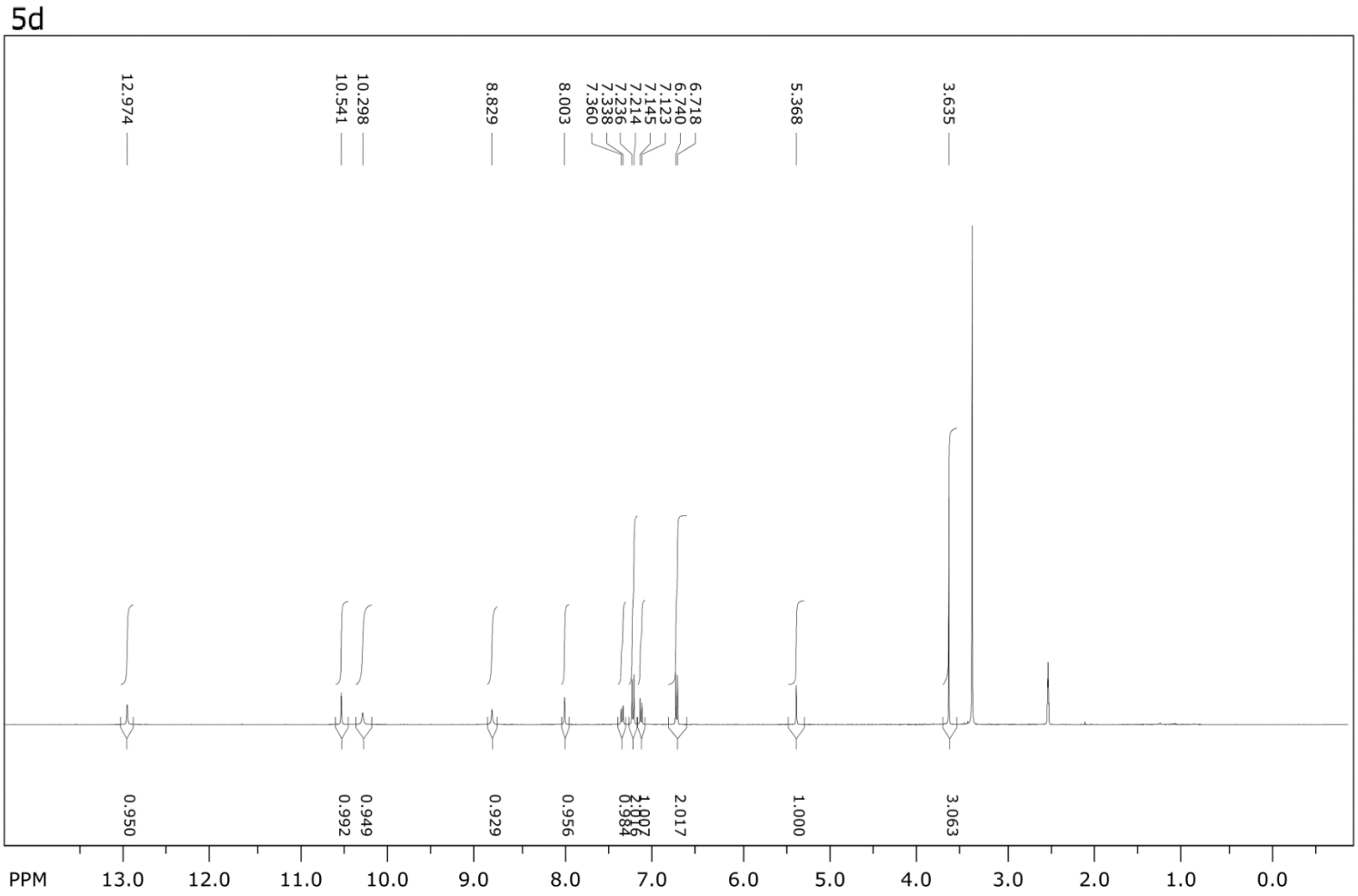


Figure S73: ^{13}C-NMR Spectra of Compound 5d.

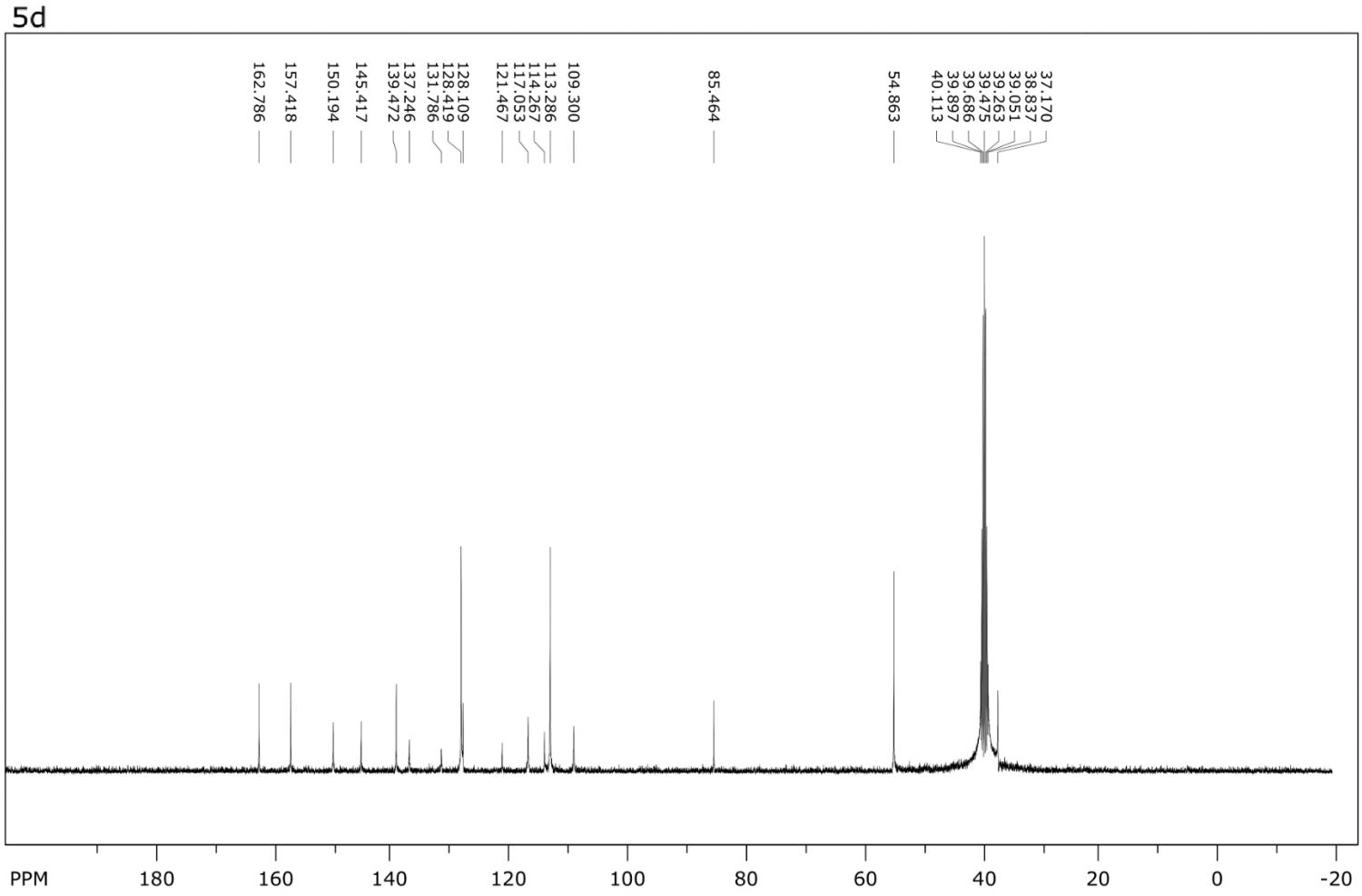
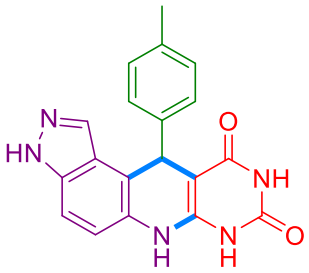


Figure S74: ^{1}H-NMR Spectra of Compound 5e.



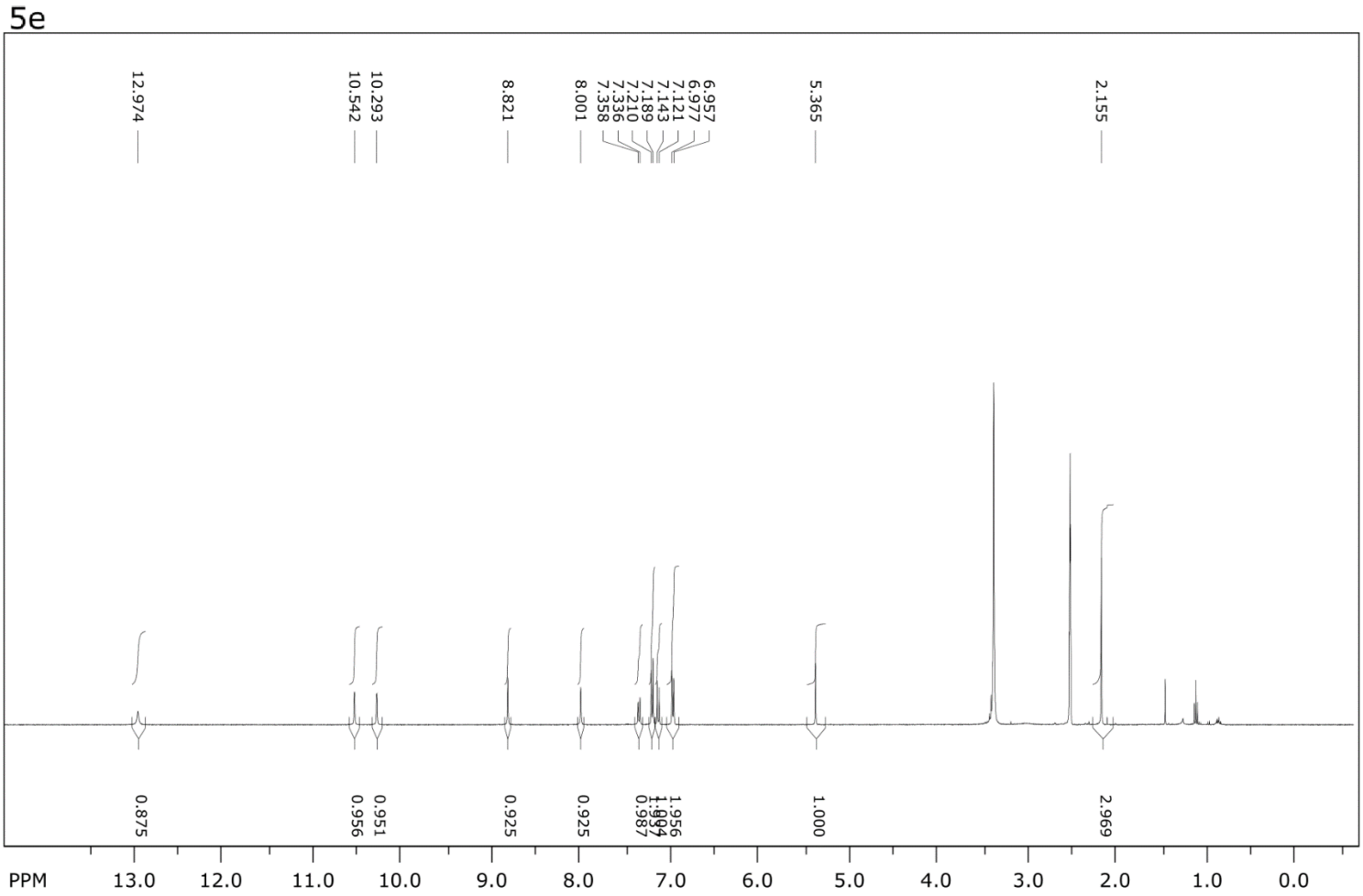


Figure S75: Extended ^{1}H-NMR Spectra of Compound 5e.

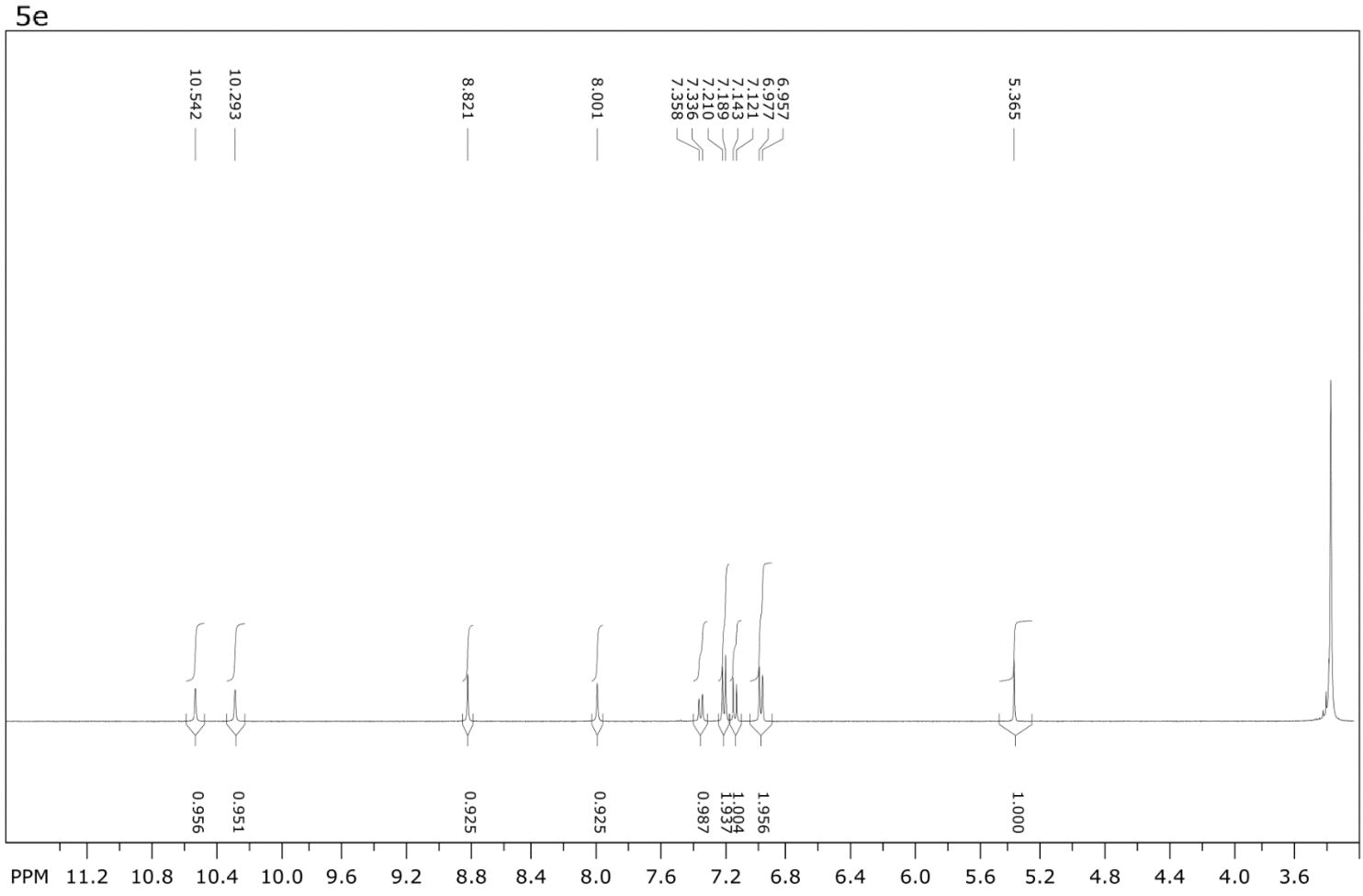


Figure S76: ^{13}C-NMR Spectra of Compound 5e.

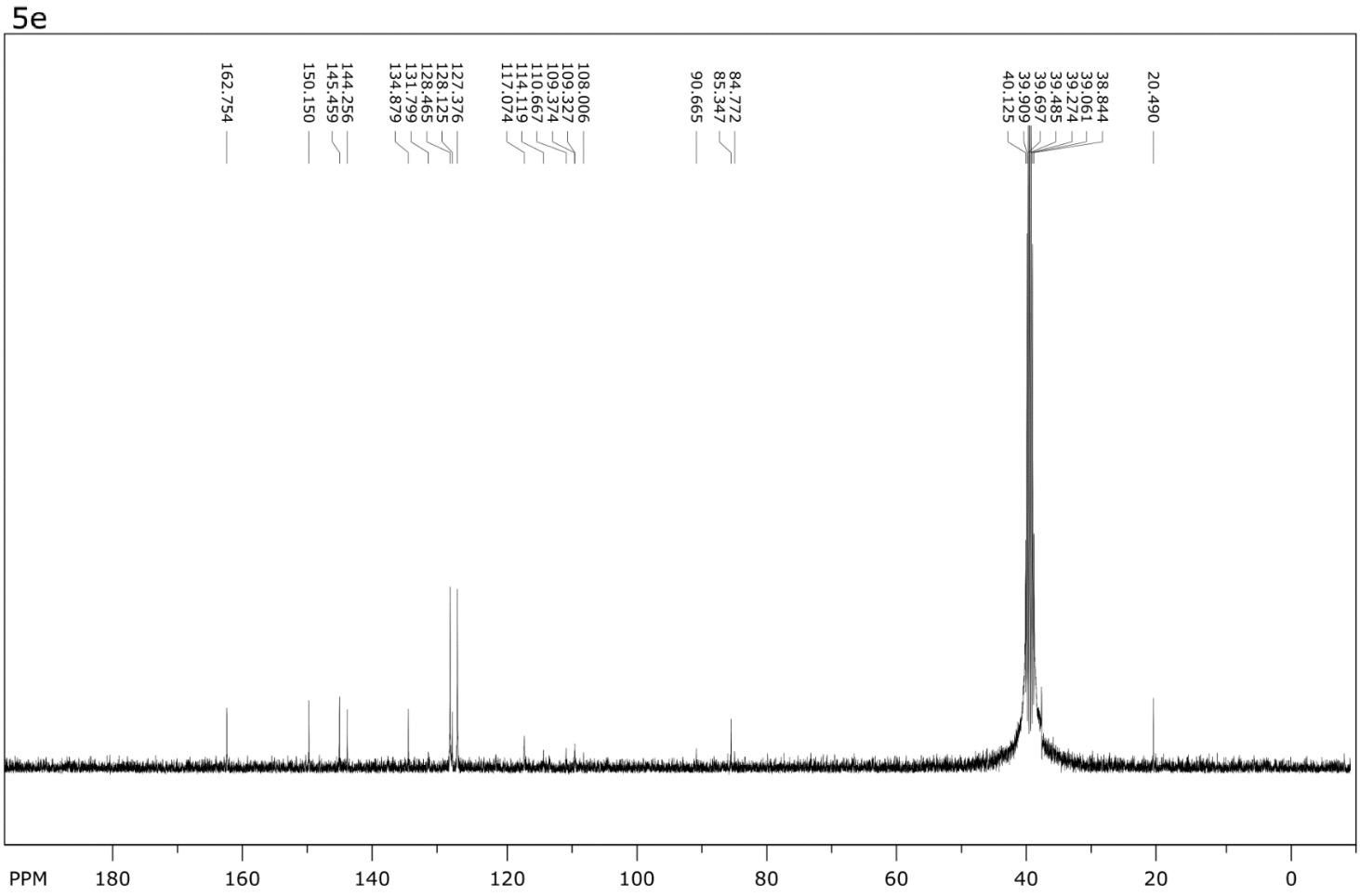
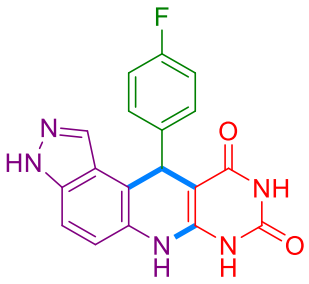


Figure S77: ^{1}H-NMR Spectra of Compound 5f.



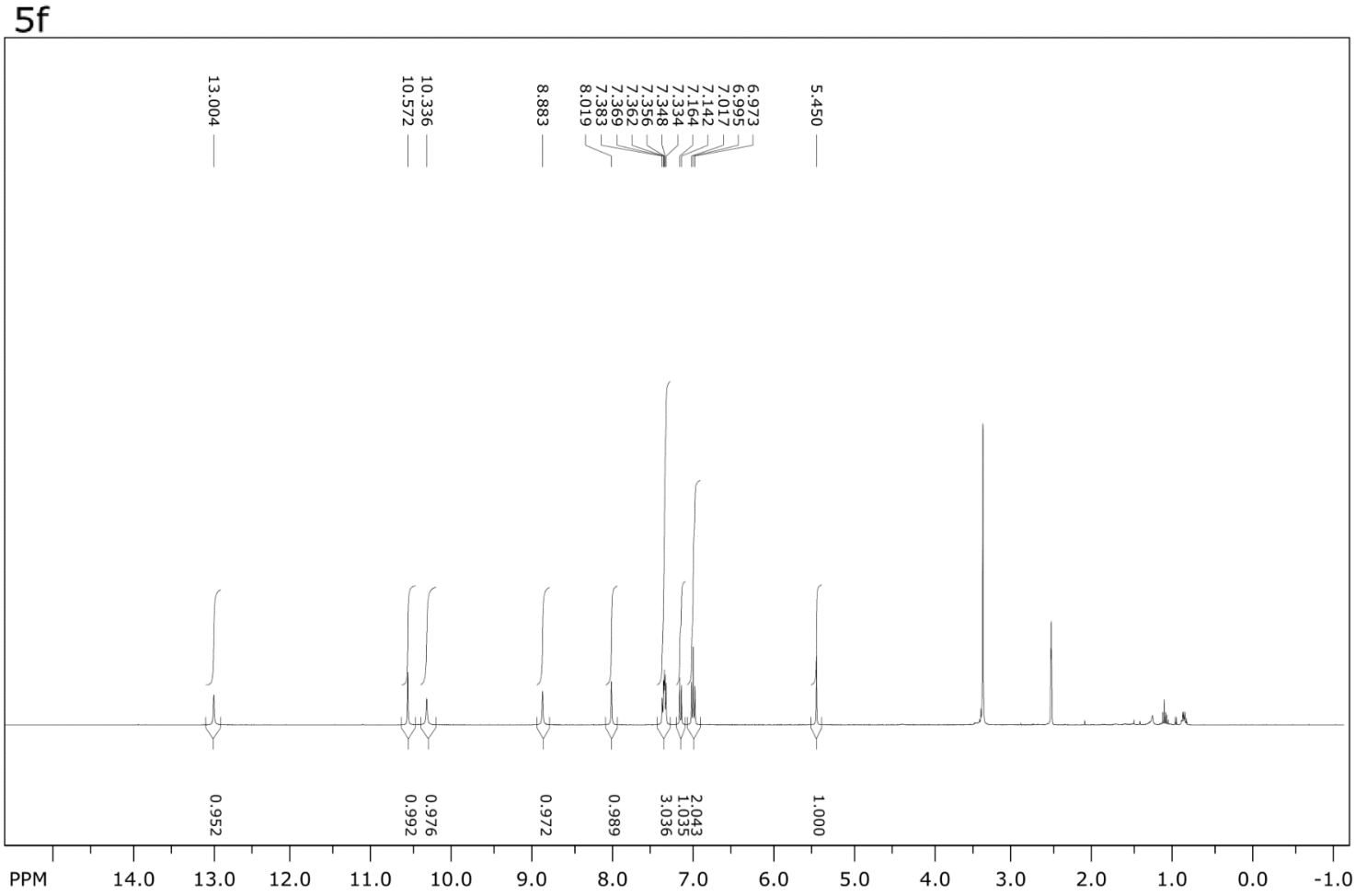


Figure S78: ^{13}C-NMR Spectra of Compound 5f.

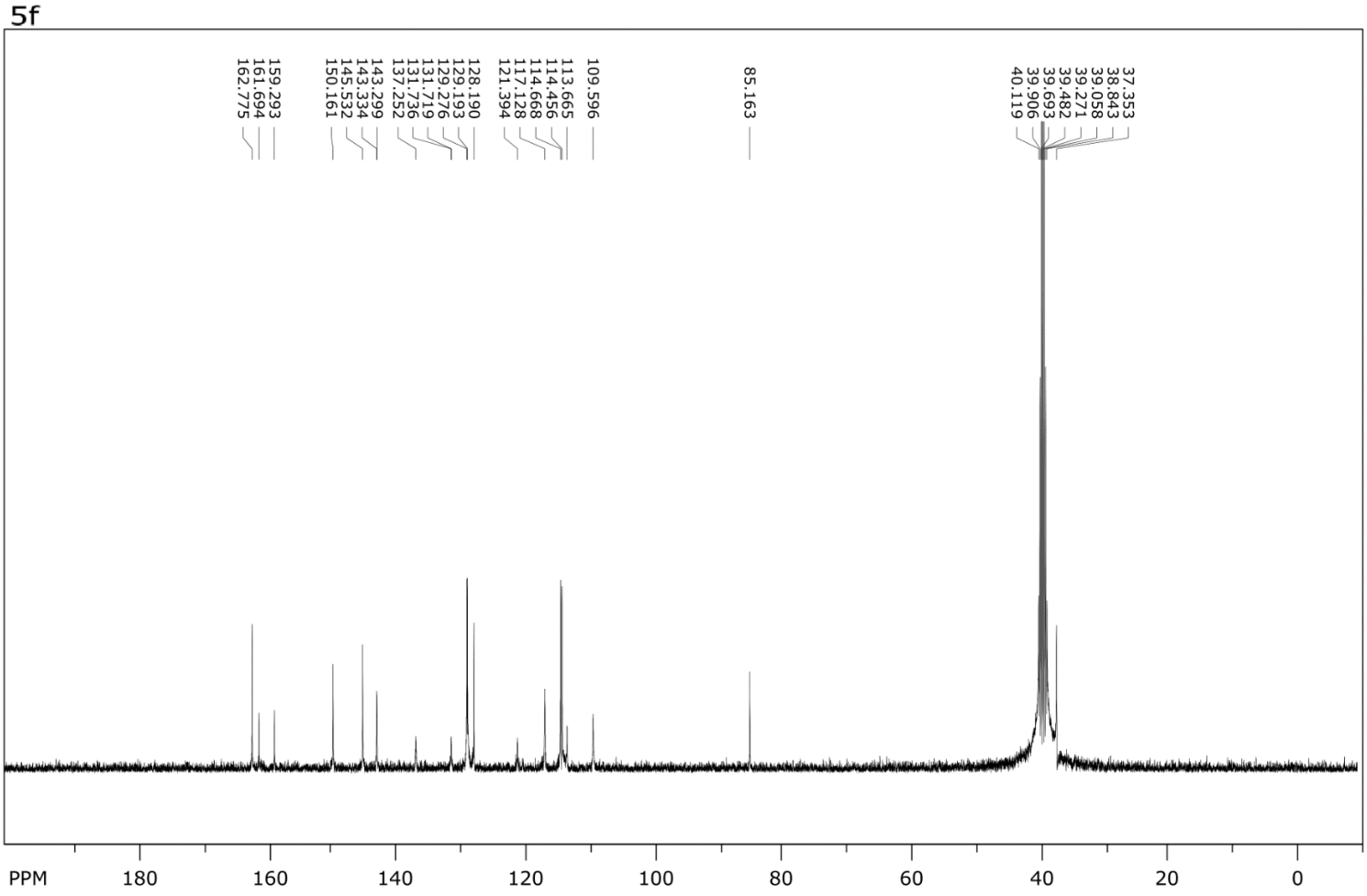
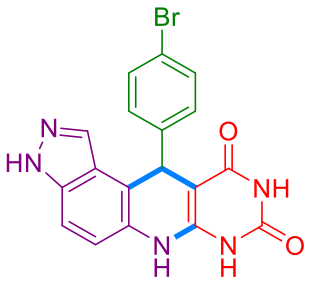


Figure S79: ^{1}H-NMR Spectra of Compound 5g.



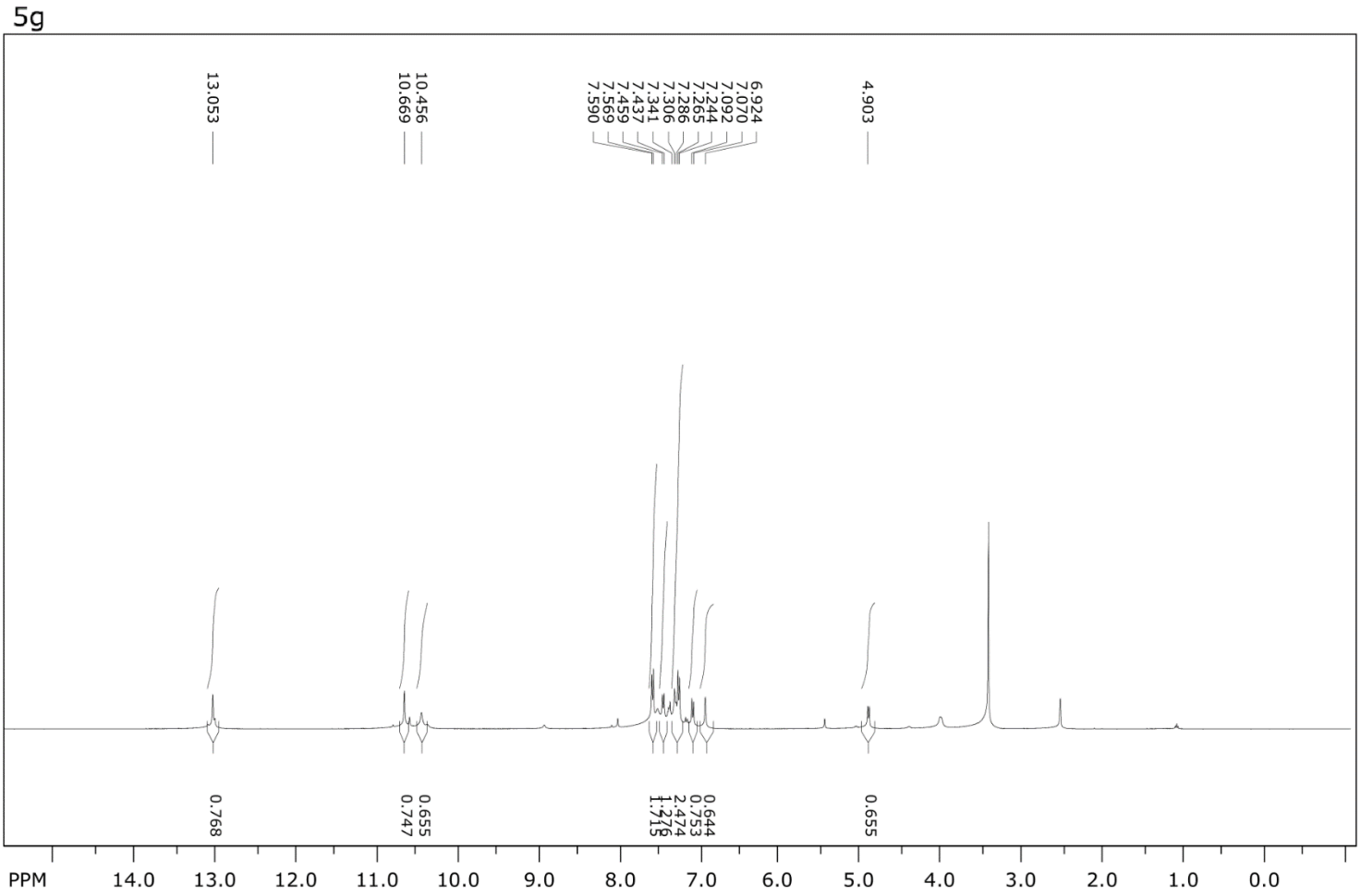


Figure S80: ^{13}C-NMR Spectra of Compound 5g.

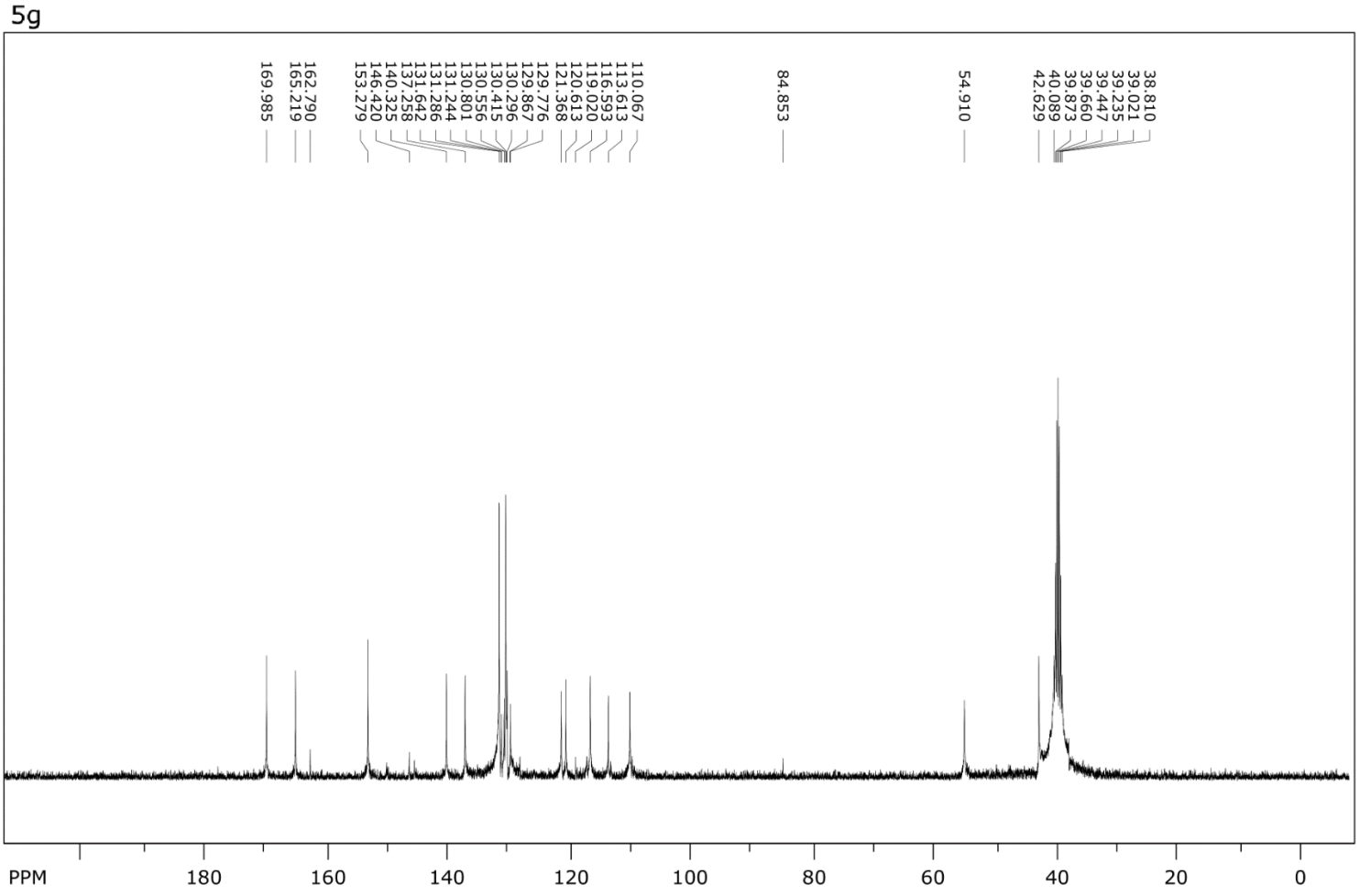
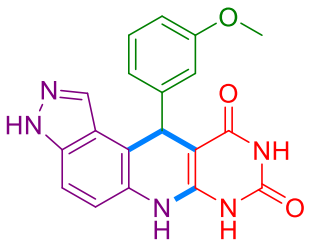


Figure S81: ^{1}H-NMR Spectra of Compound 5h.



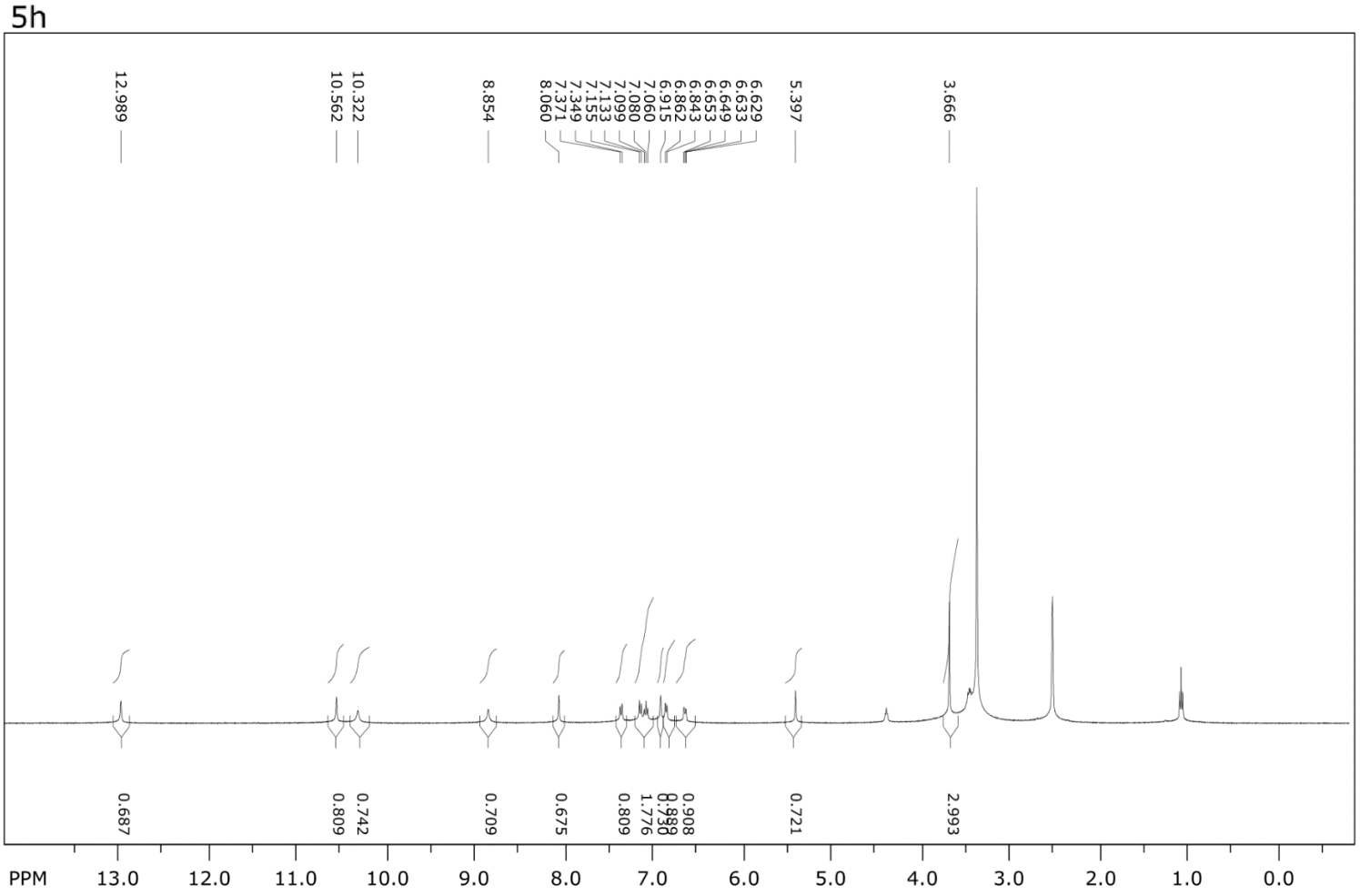


Figure S82: ^{13}C-NMR Spectra of Compound 5h.

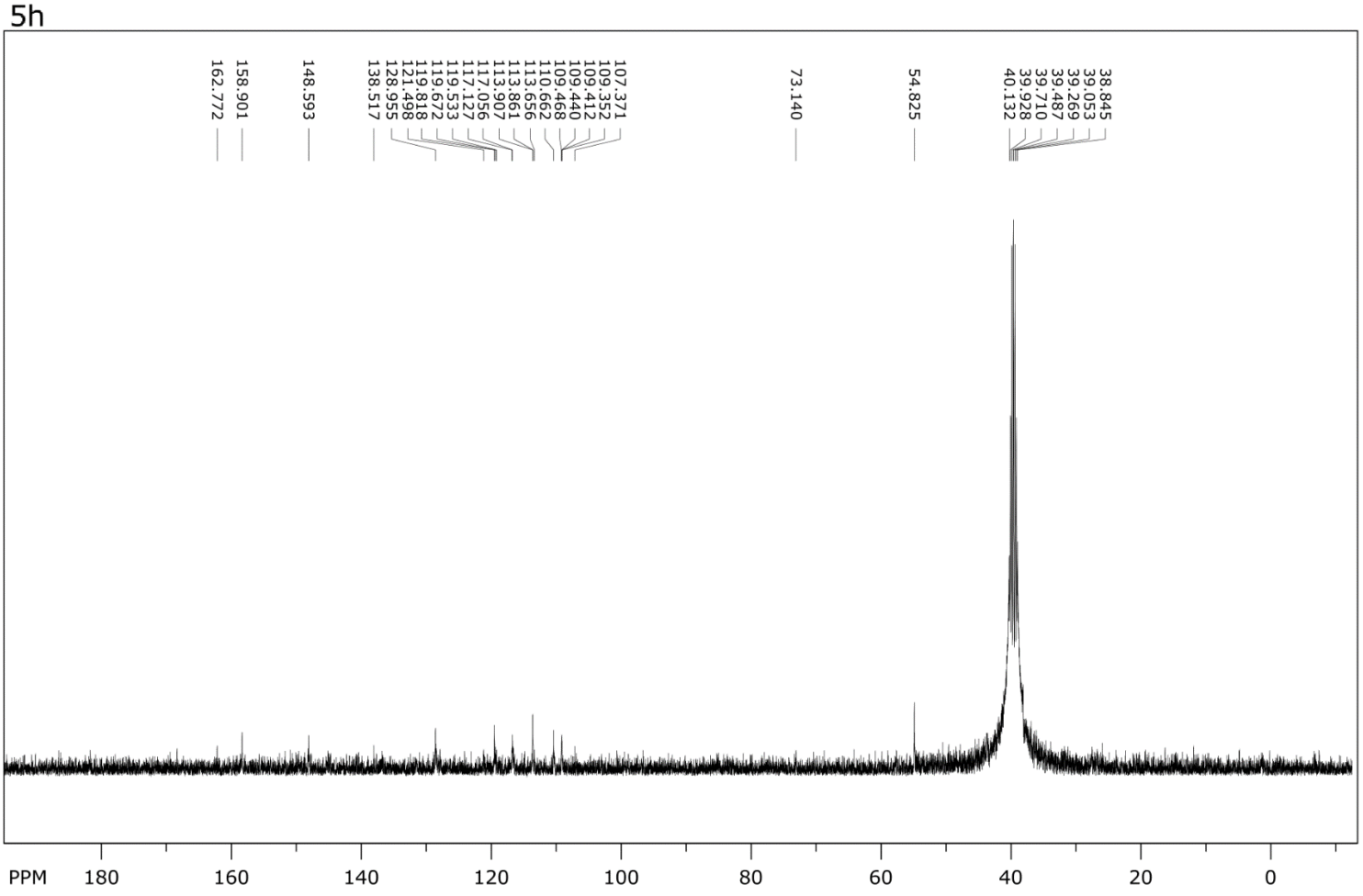
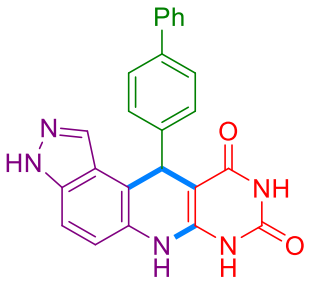


Figure S83: ^{1}H-NMR Spectra of Compound 5i.



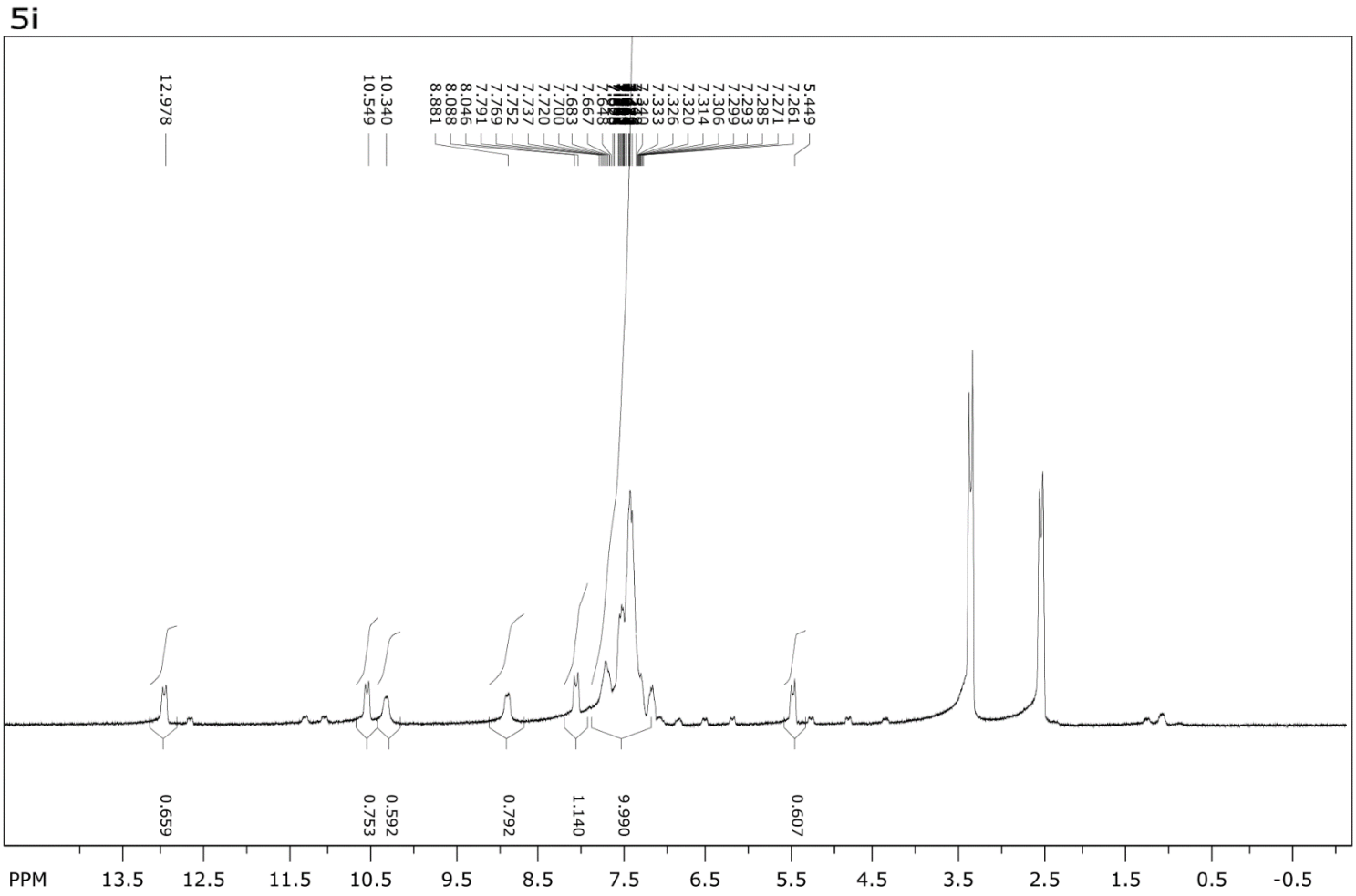


Figure S84: Extended ^{1}H-NMR Spectra of Compound 5i.

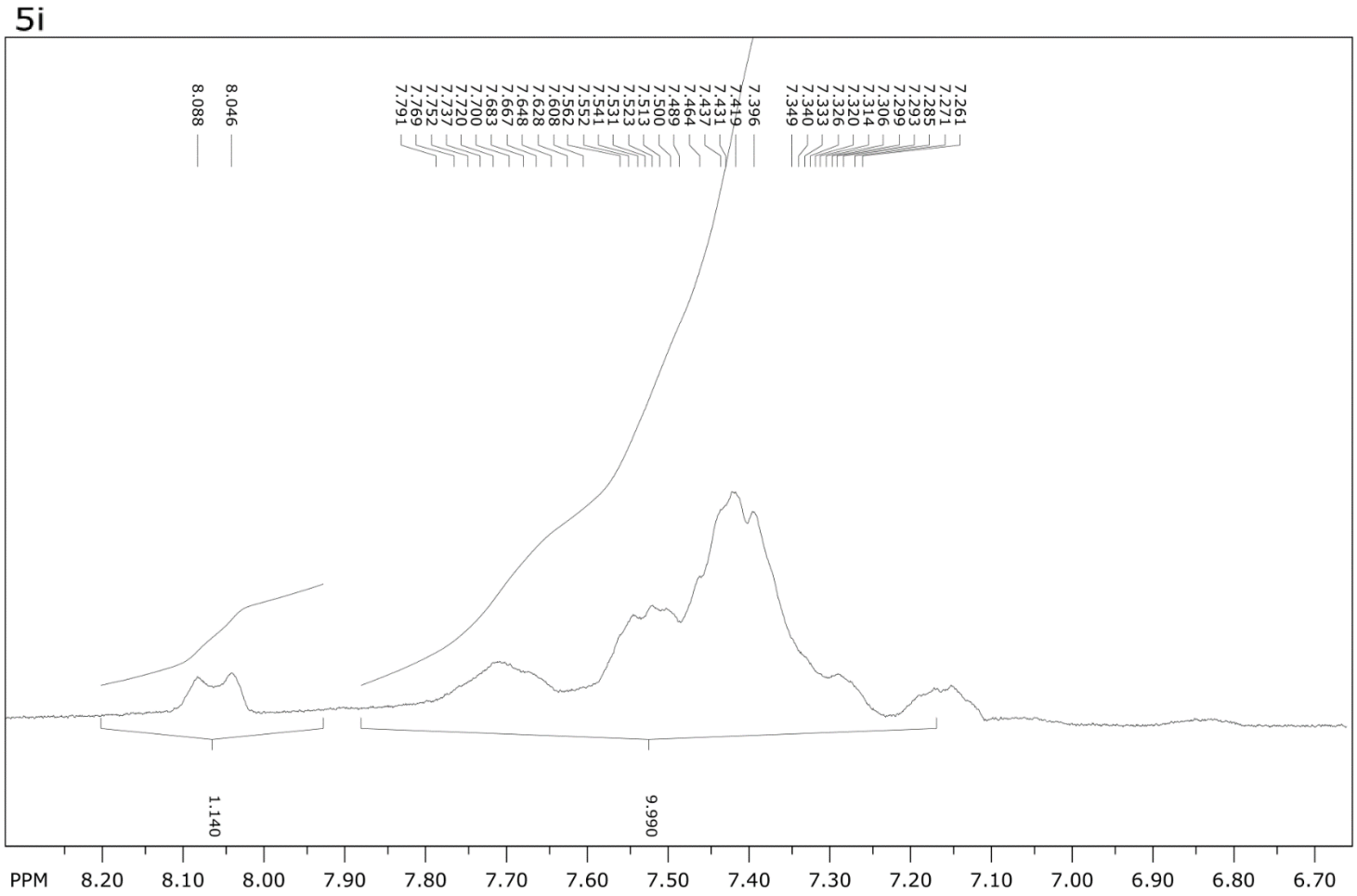


Figure S85: ^{13}C-NMR Spectra of Compound 5i.

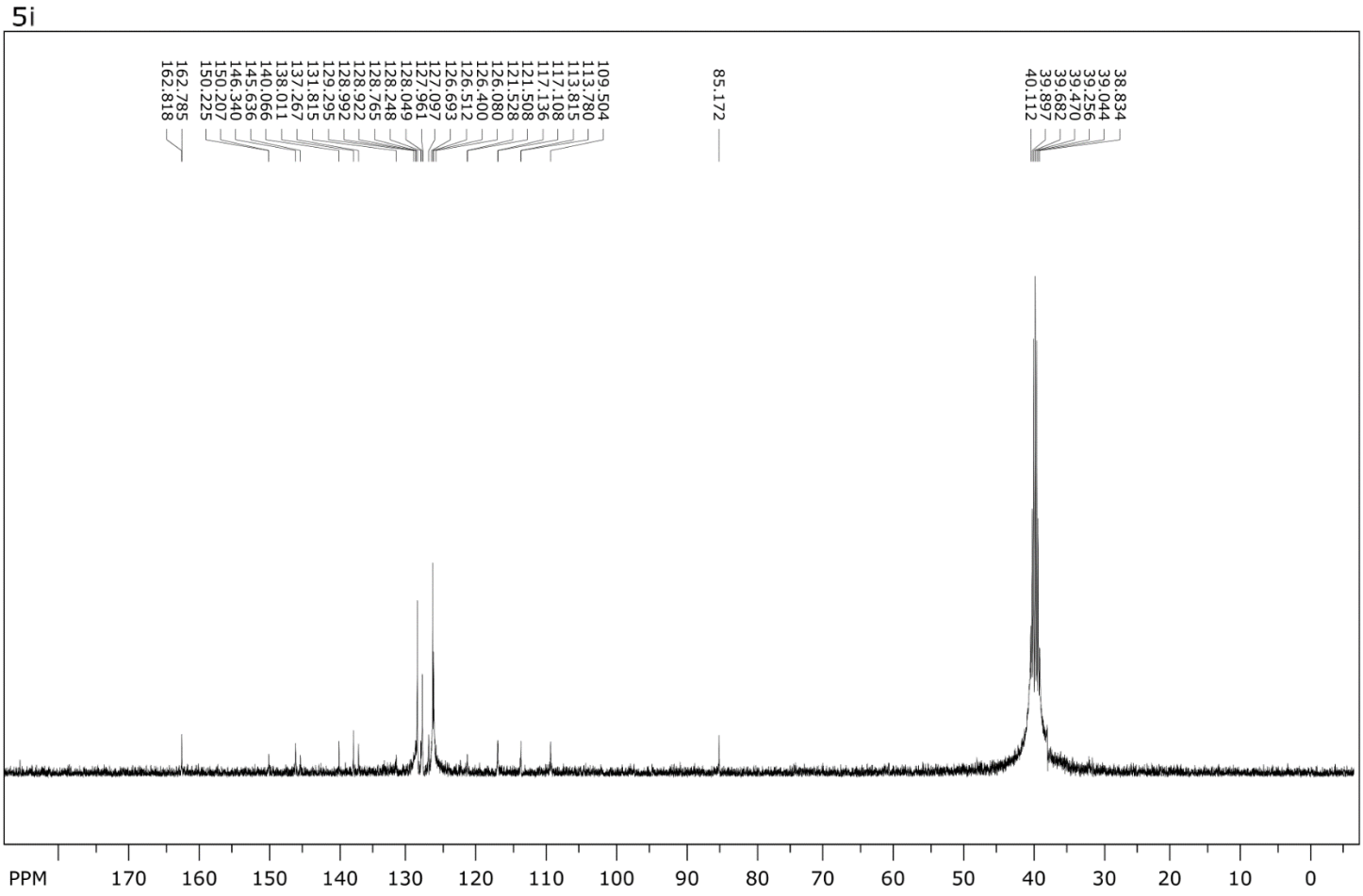
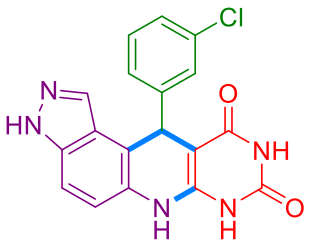


Figure S86: ^{1}H-NMR Spectra of Compound 5j.



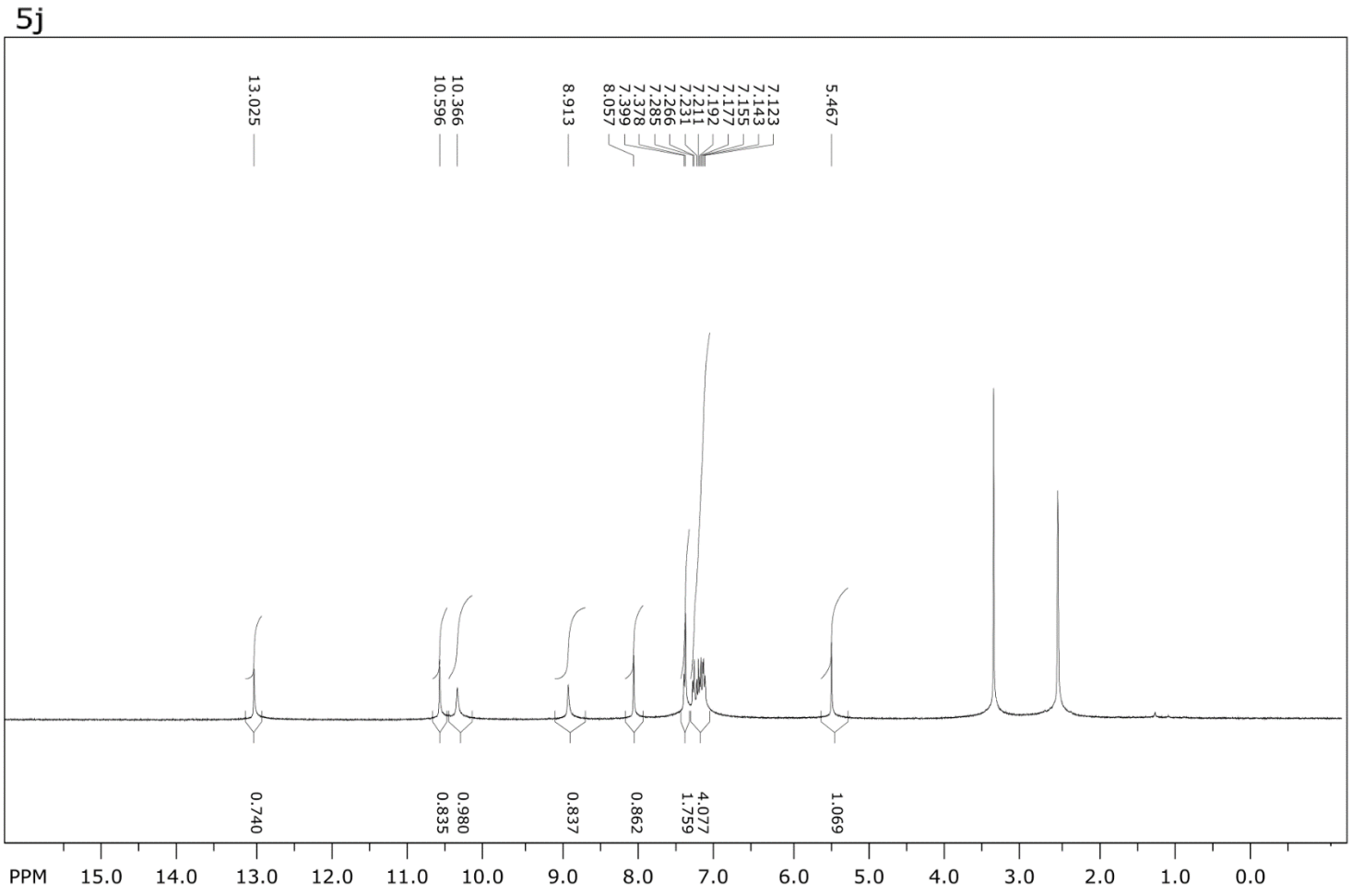


Figure S87: ^{13}C-NMR Spectra of Compound 5j.

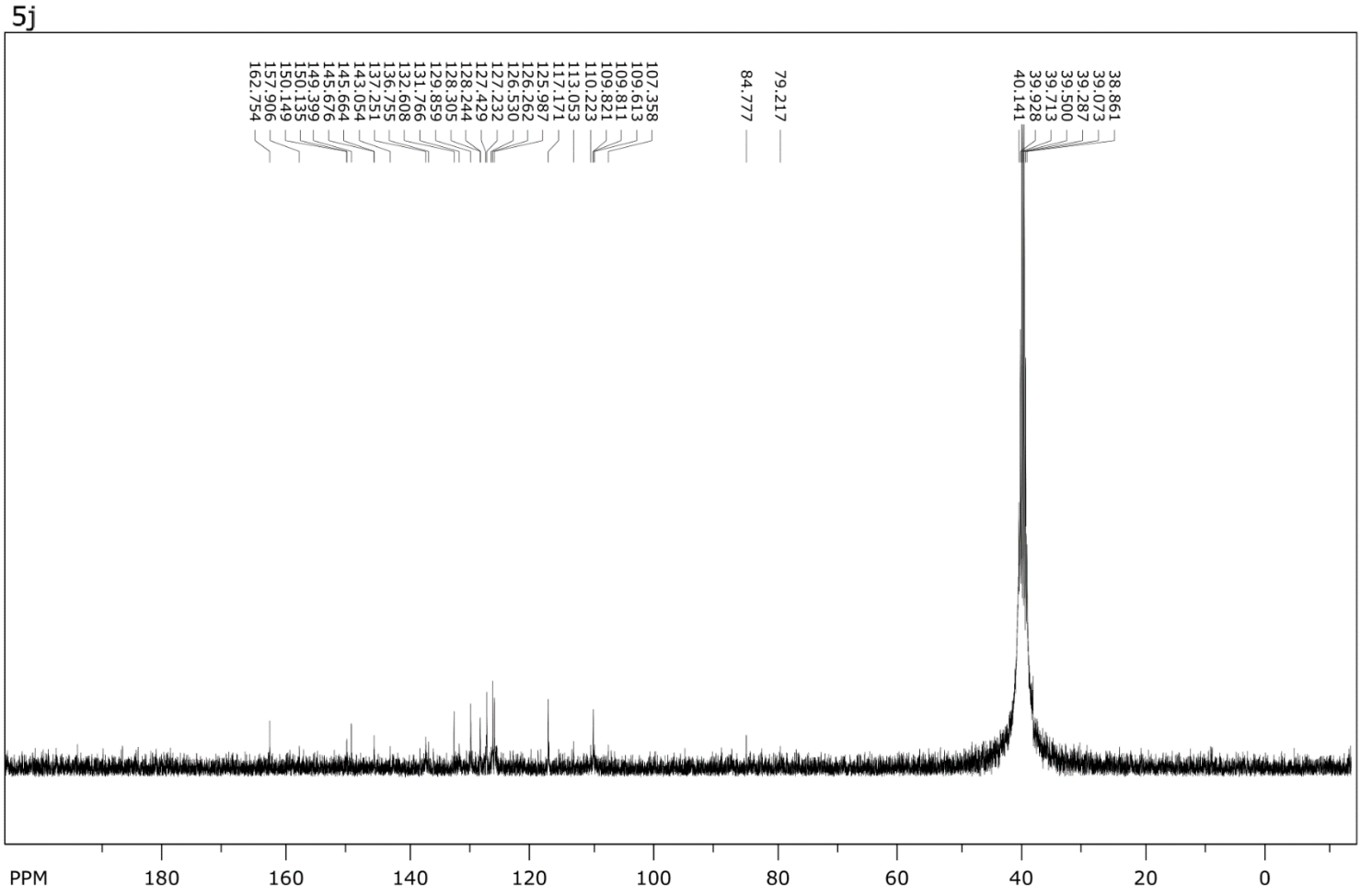
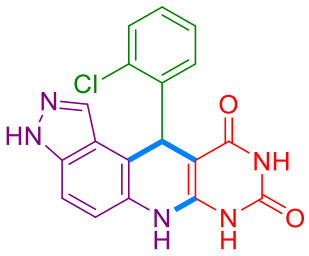


Figure S88: ^{1}H-NMR Spectra of Compound 5k.



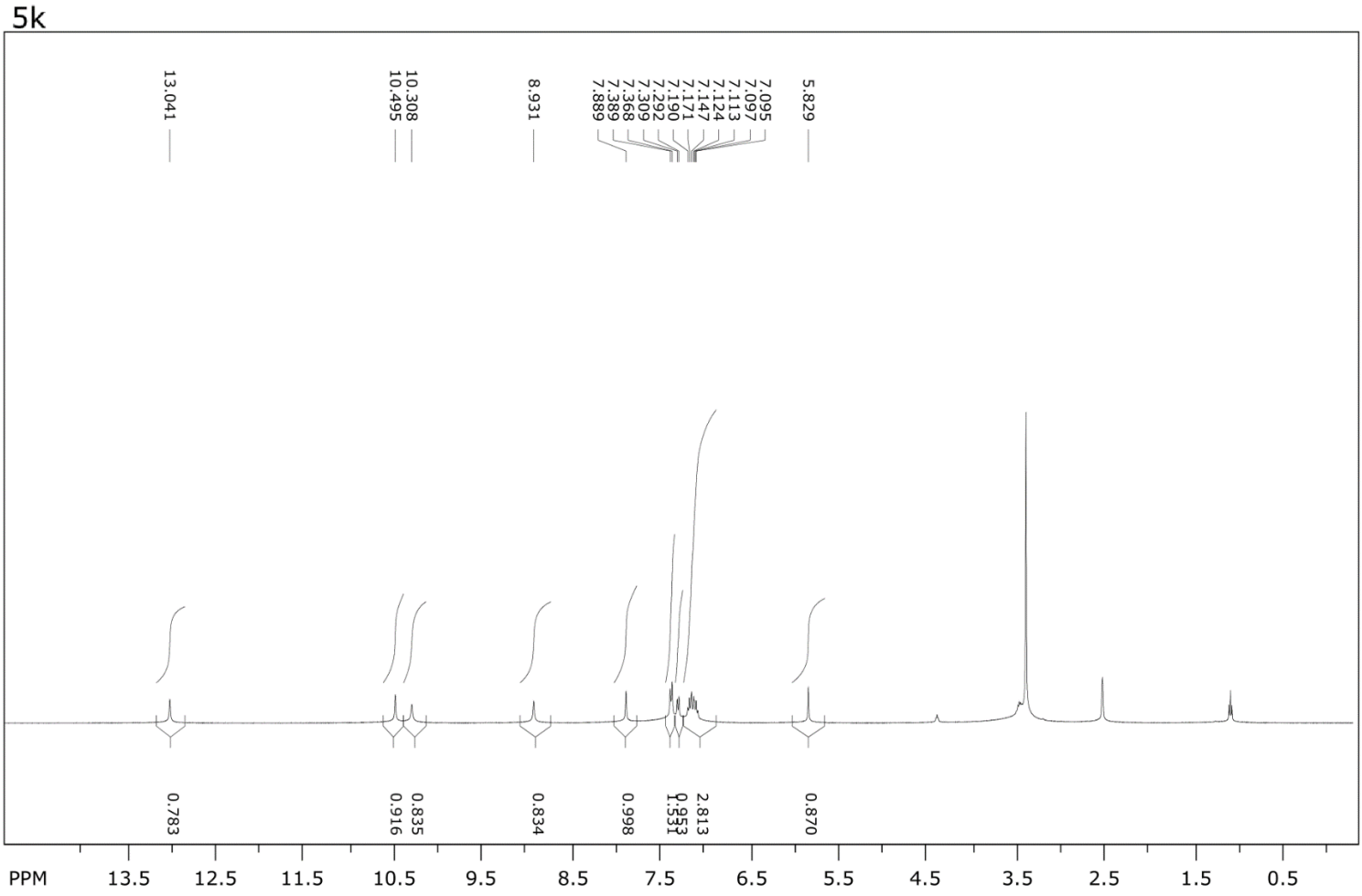


Figure S89: ^{13}C-NMR Spectra of Compound 5k.

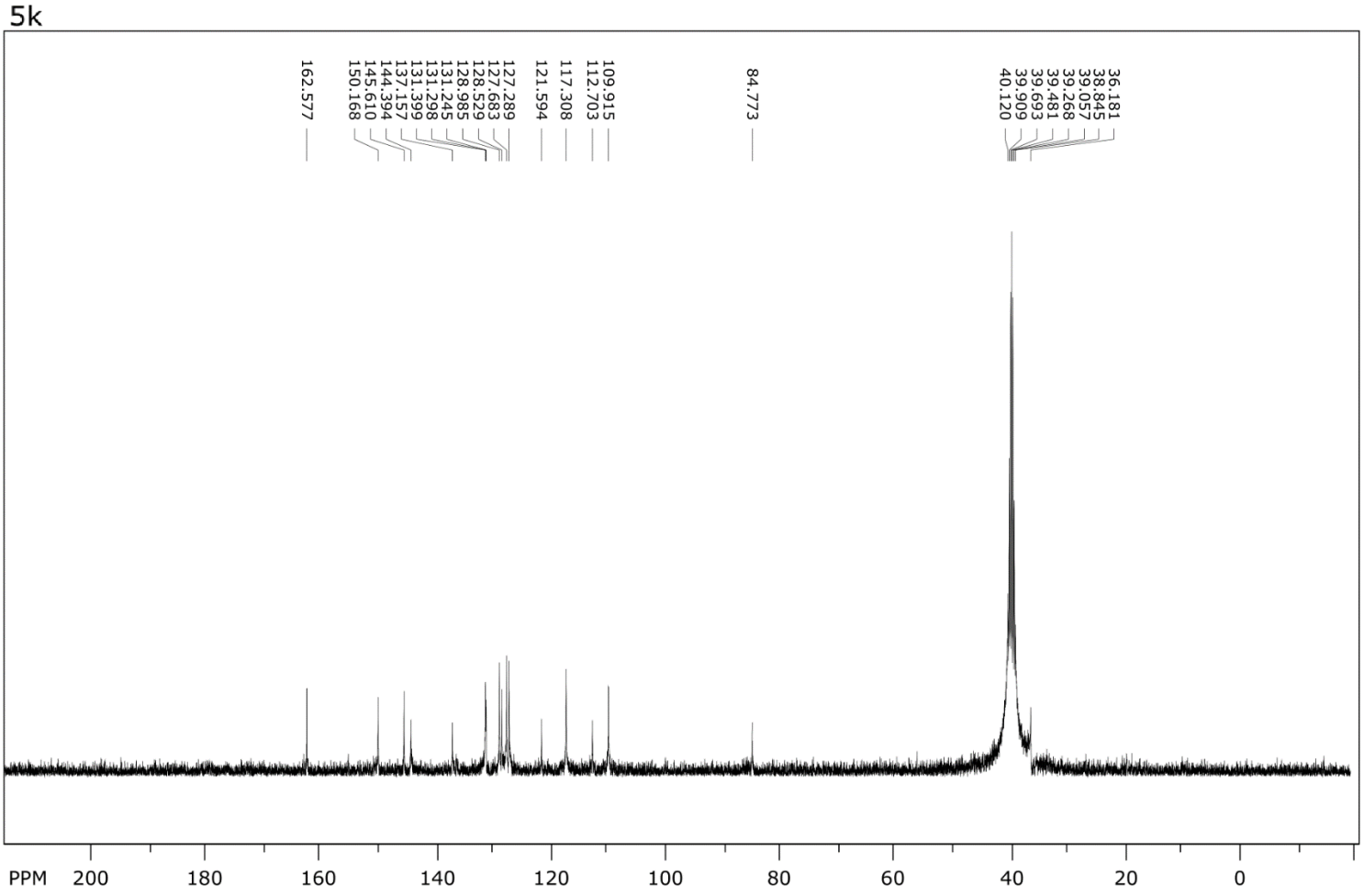
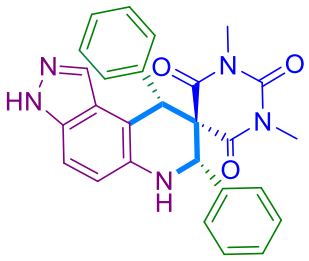


Figure S90: ^{1}H-NMR Spectra of Compound 7a.



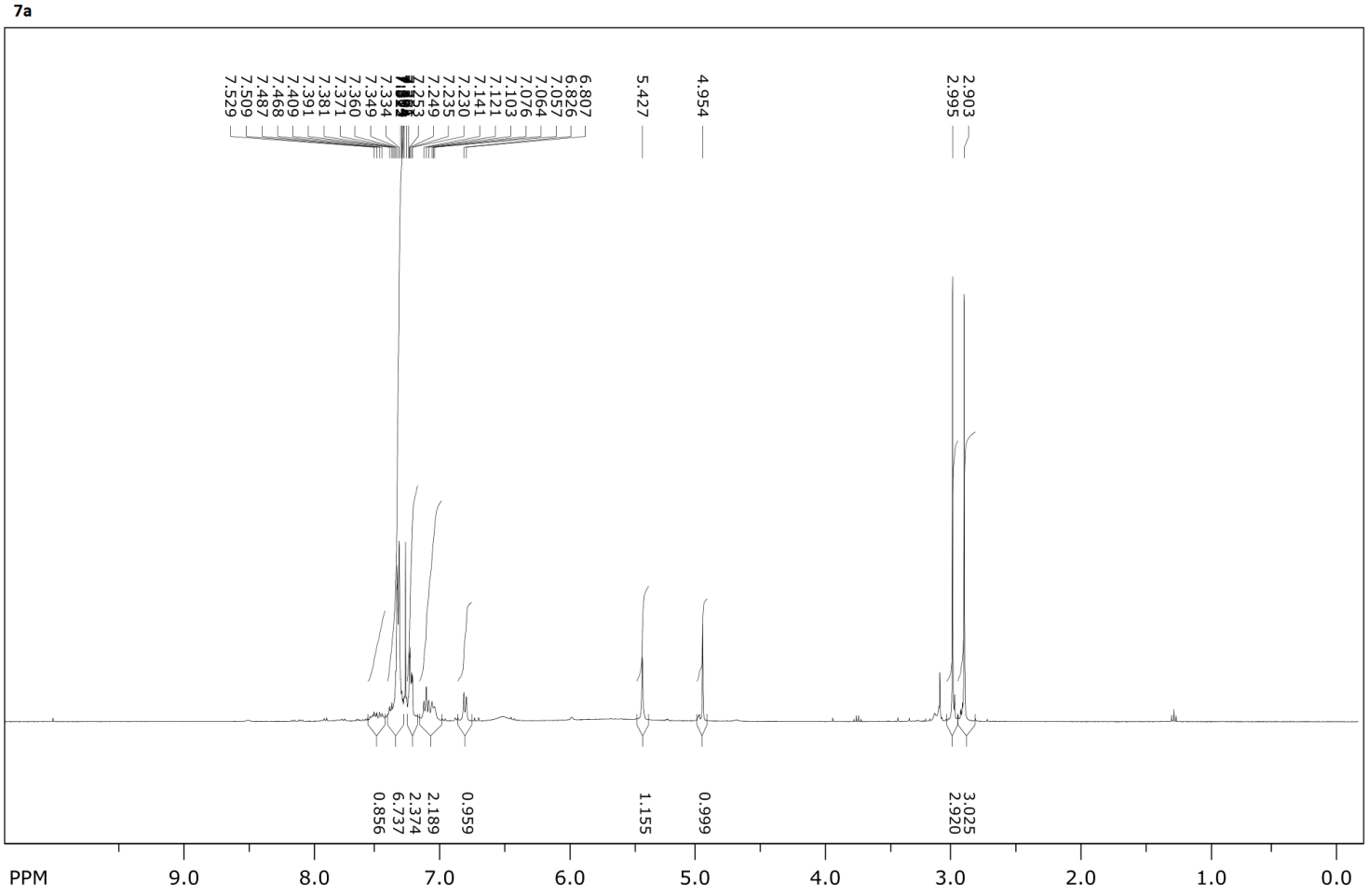


Figure S91: Extended ^{1}H-NMR Spectra of Compound 7a.

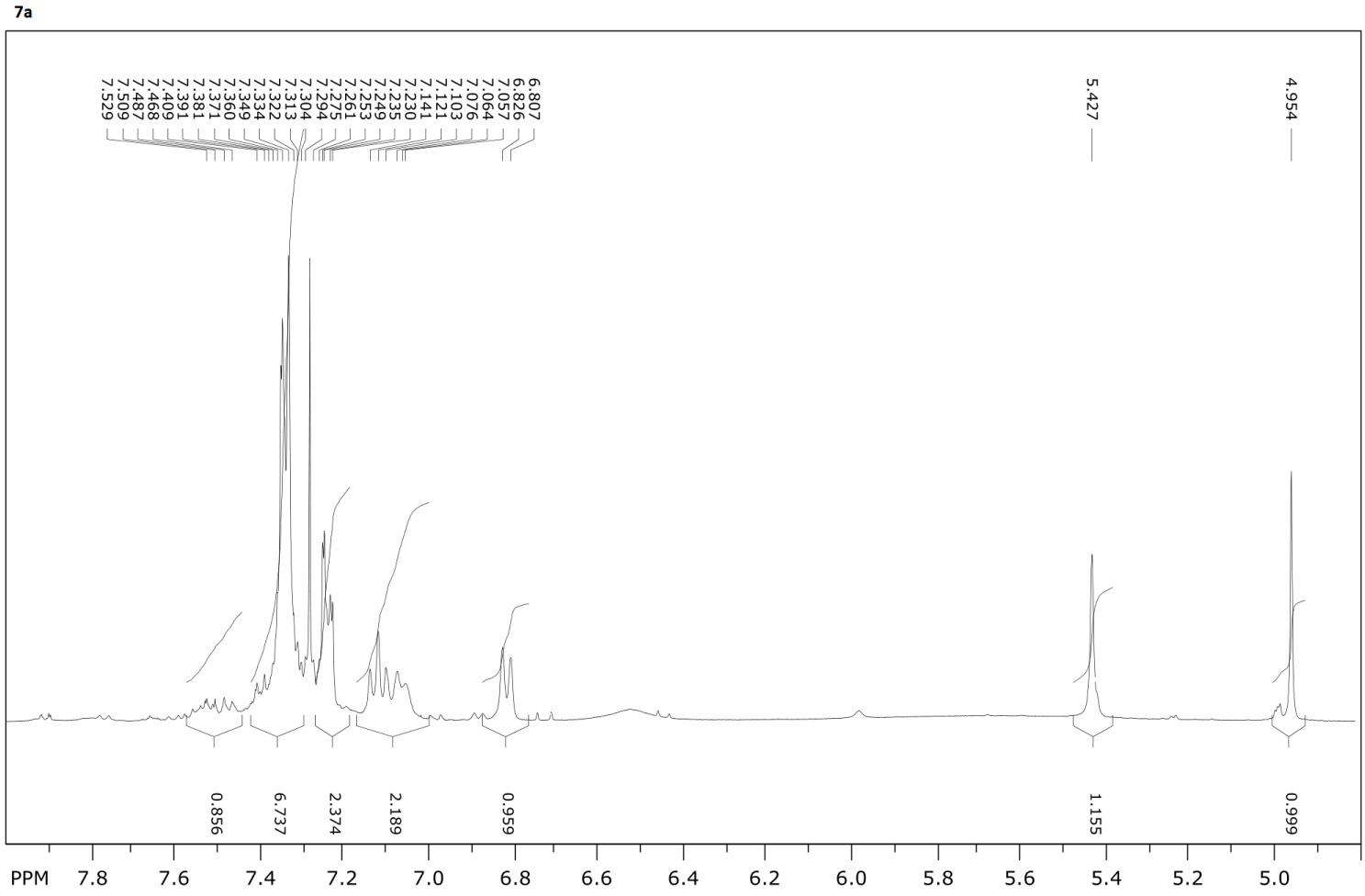


Figure S92: ^{13}C-NMR Spectra of Compound 7a.

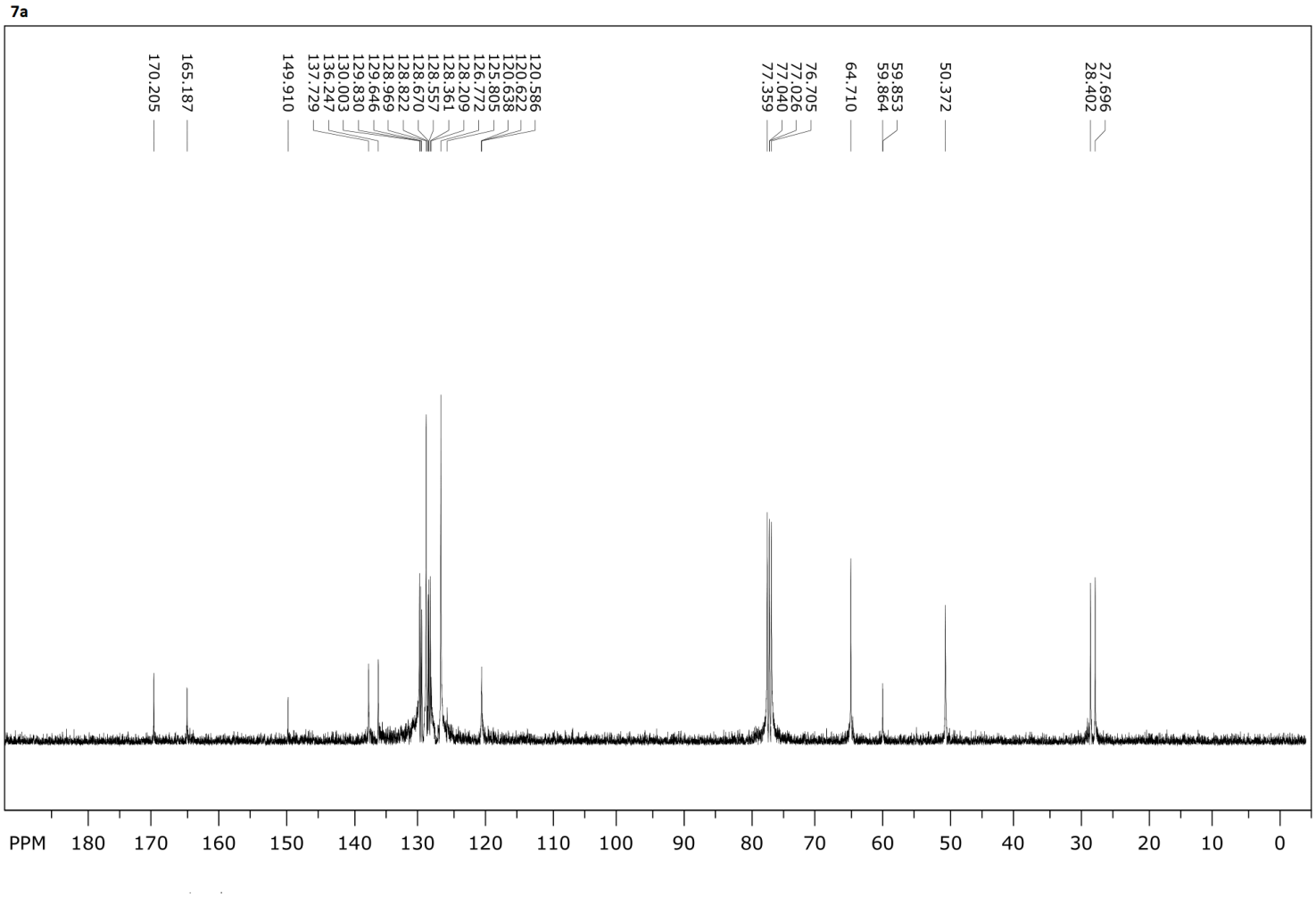
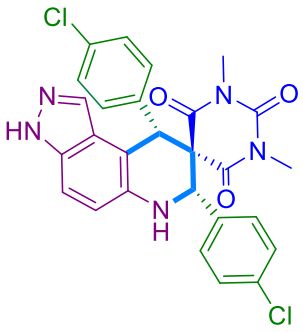


Figure S93: ^{1}H-NMR Spectra of Compound 7b.



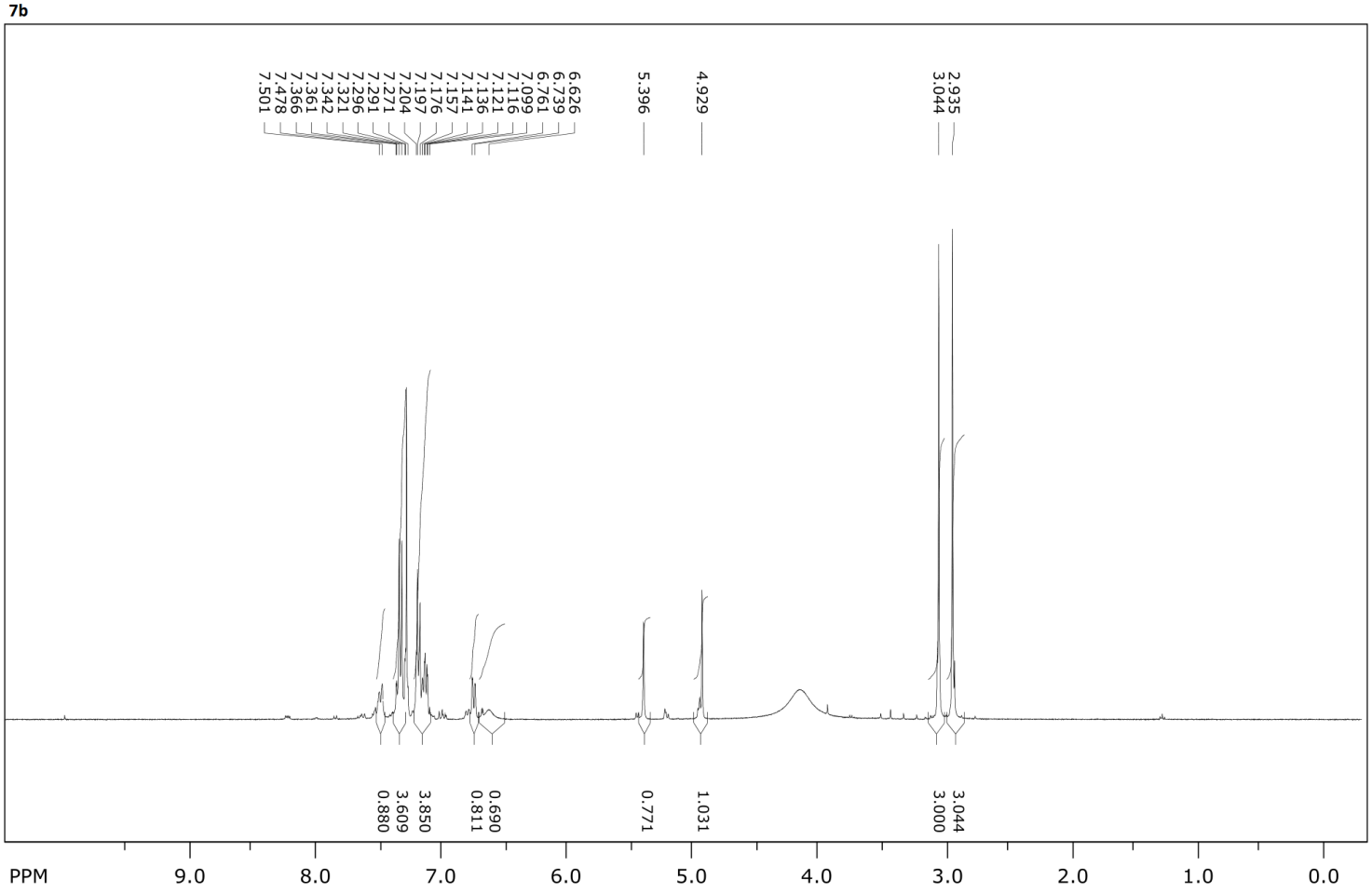


Figure S94: ^{13}C-NMR Spectra of Compound 7b.

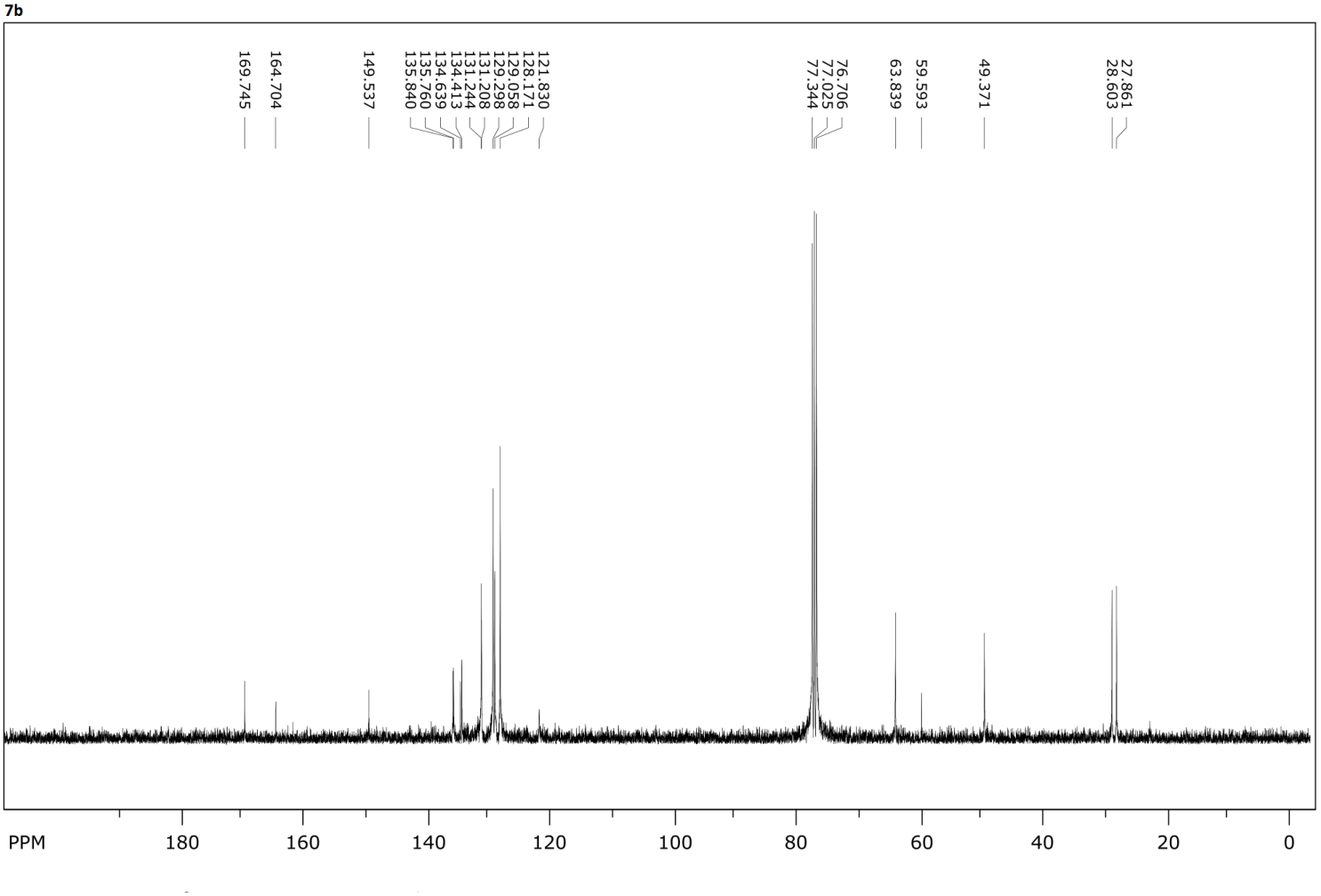
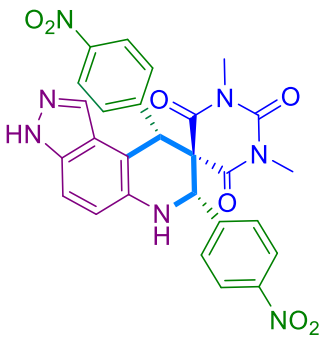


Figure S95: ^{1}H-NMR Spectra of Compound 7c.



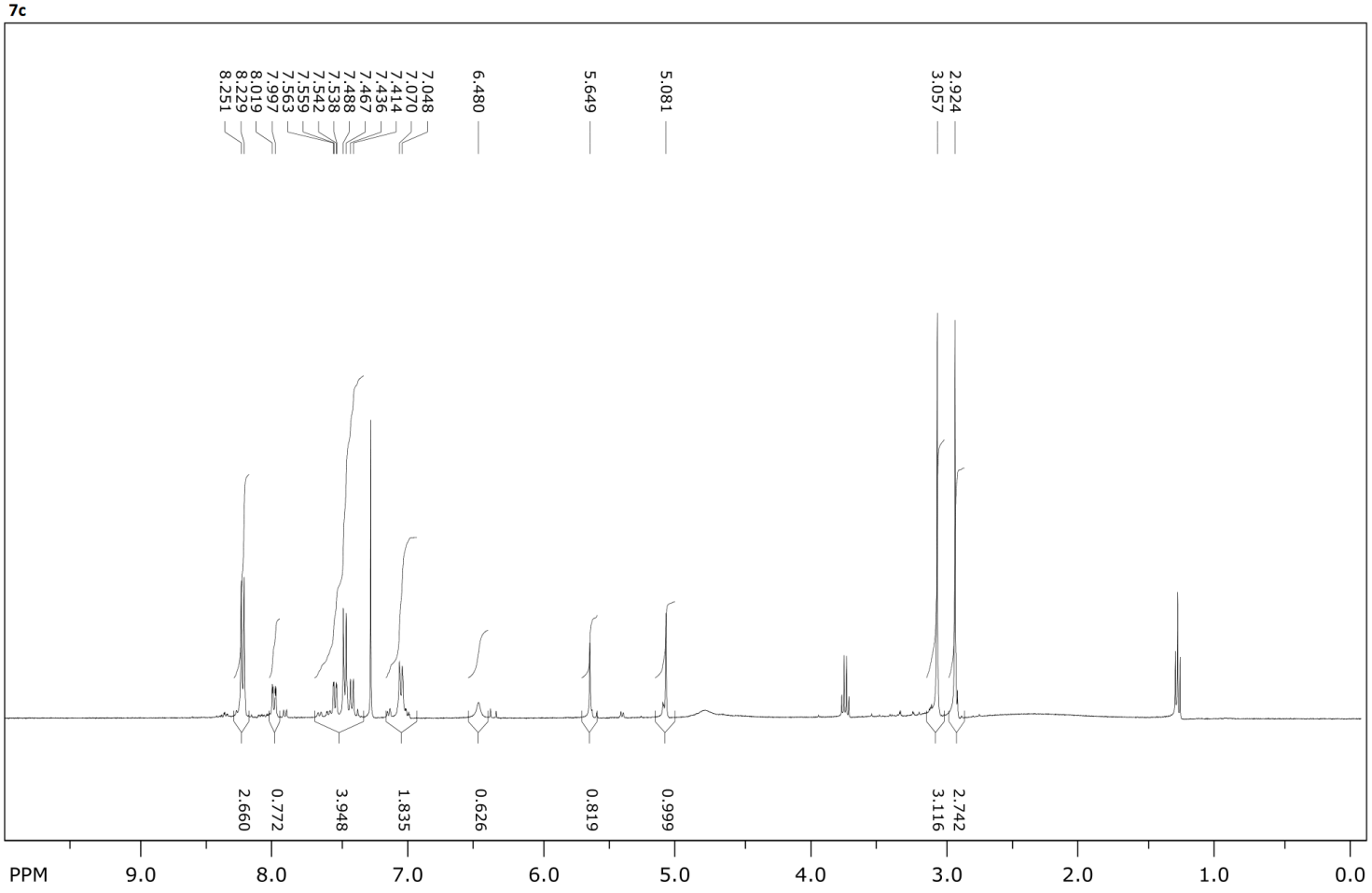


Figure S96: ^{13}C-NMR Spectra of Compound 7c.

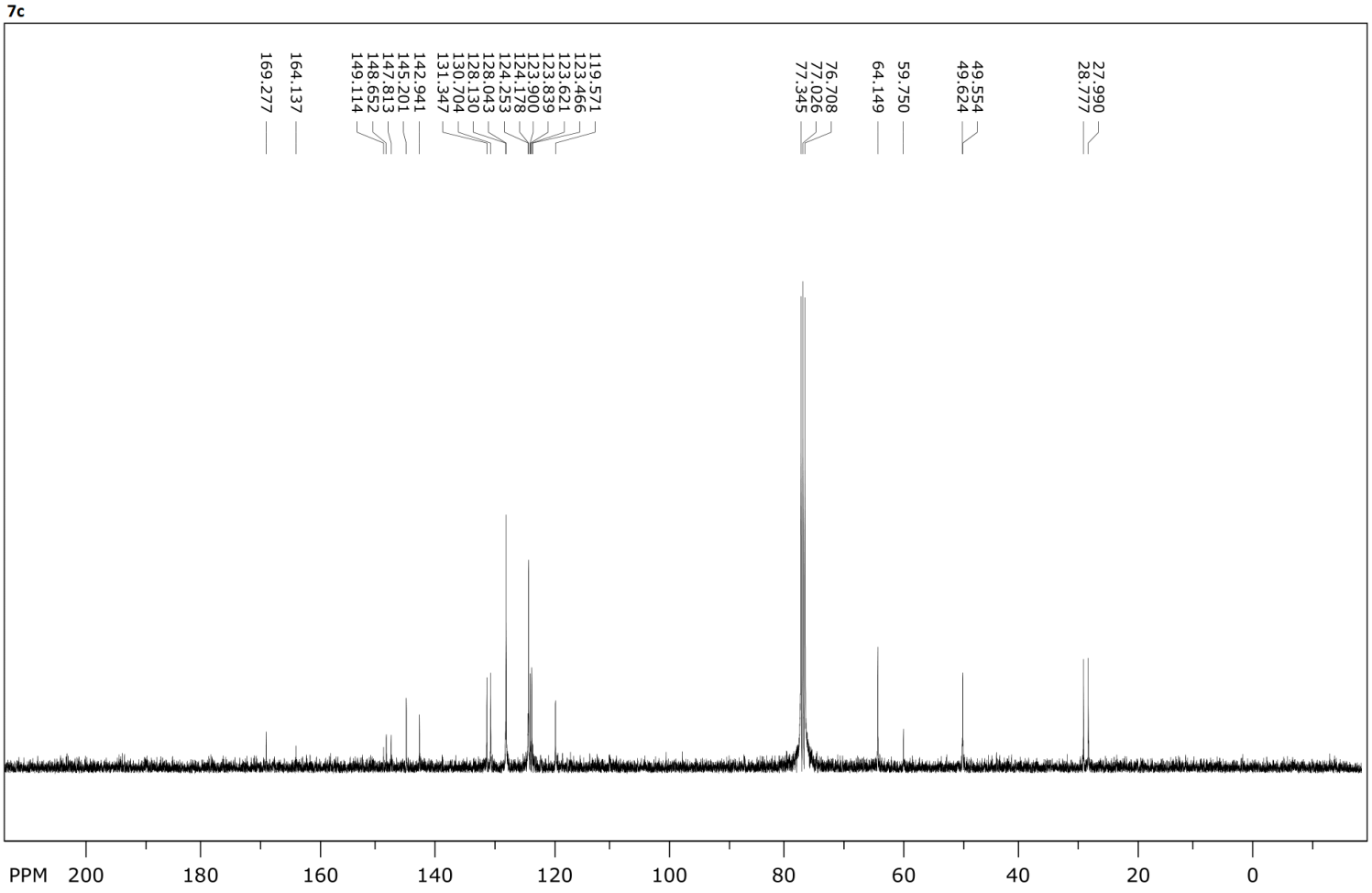
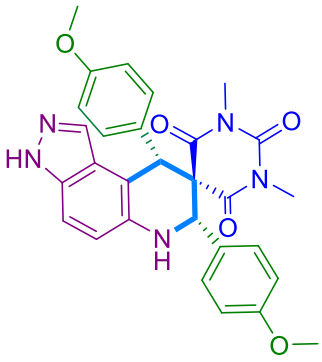


Figure S97: ^{1}H-NMR Spectra of Compound 7d.



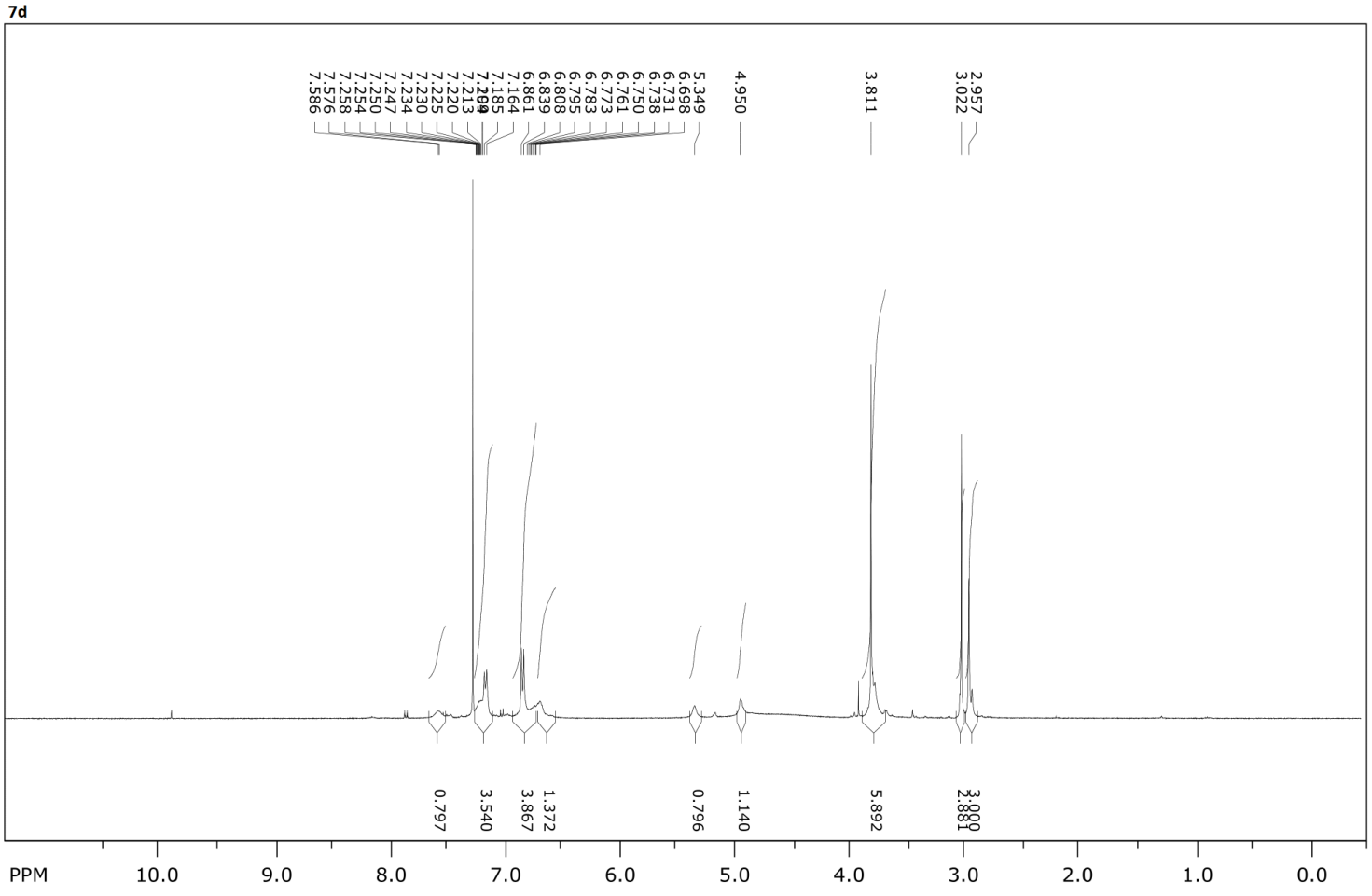


Figure S98: Extended ^{1}H-NMR Spectra of Compound 7d.

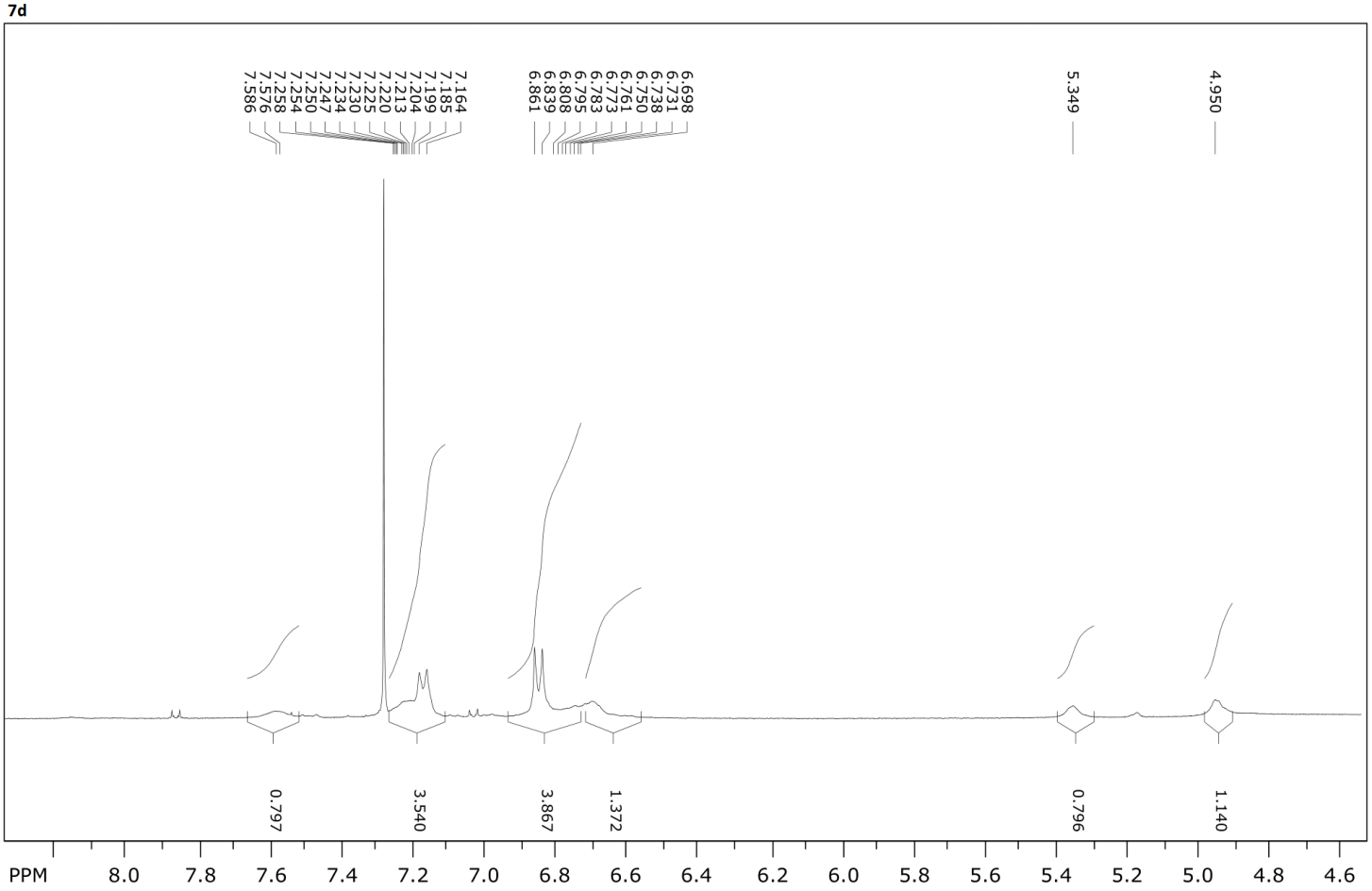


Figure S99: ^{13}C-NMR Spectra of Compound 7d.

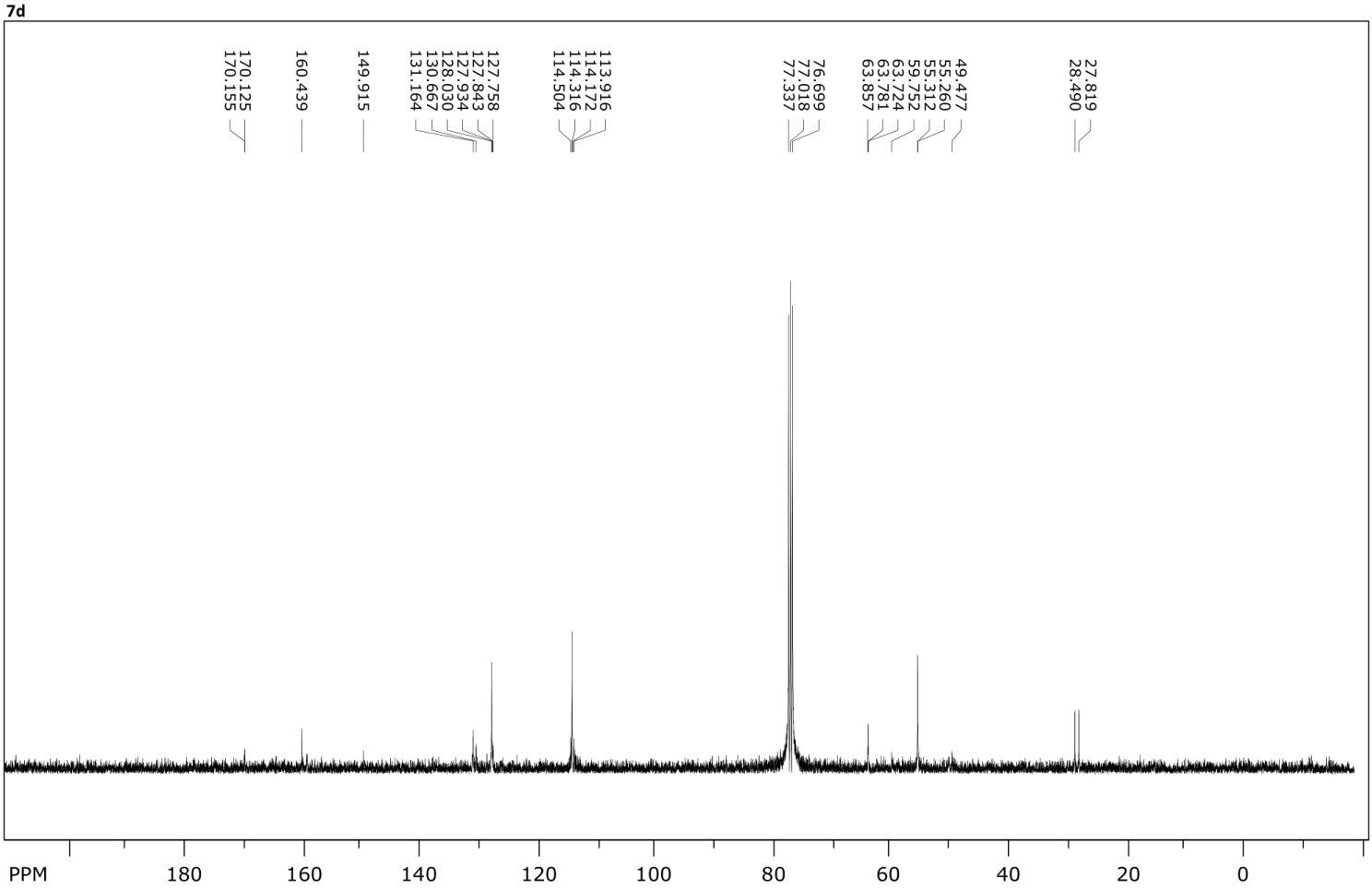
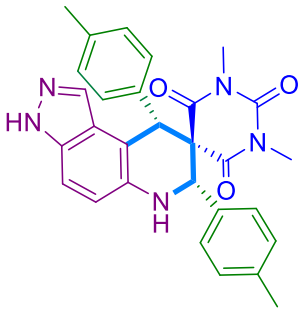


Figure S100: ^{1}H-NMR Spectra of Compound 7e.



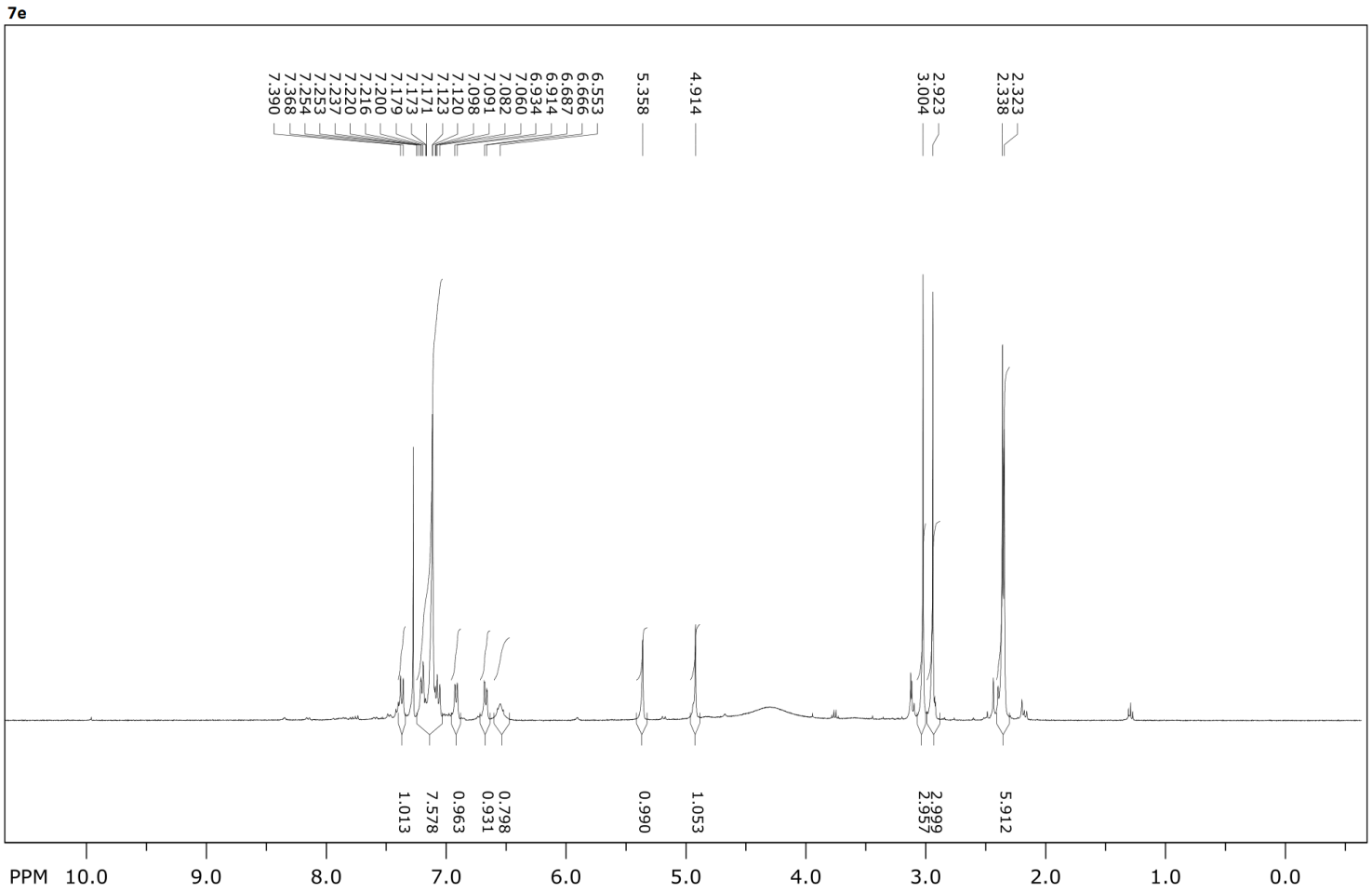


Figure S101: ^{13}C-NMR Spectra of Compound 7e.

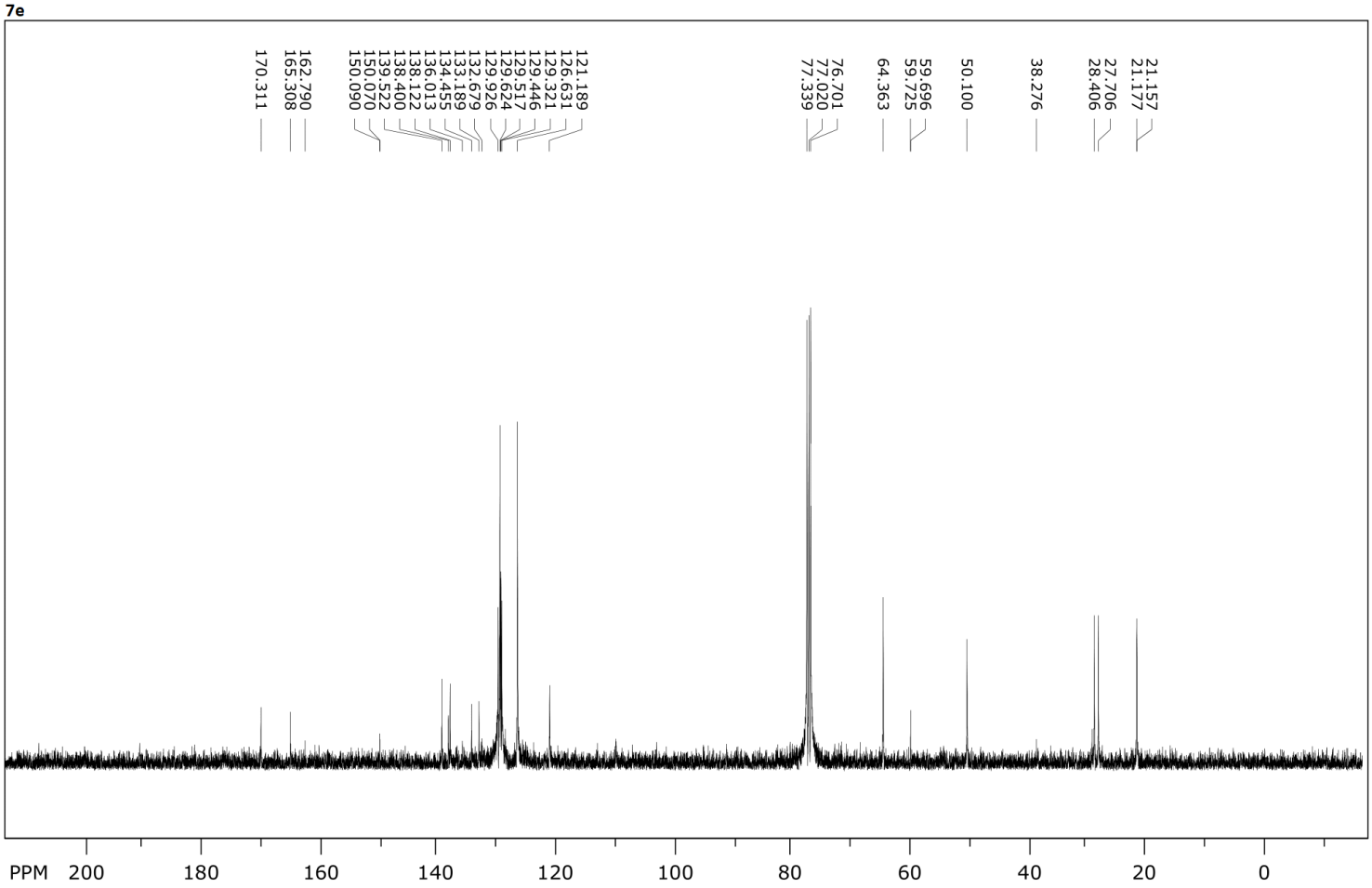
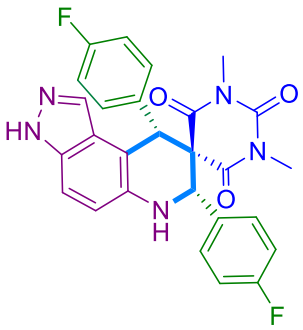


Figure S102: ^{1}H-NMR Spectra of Compound 7f.



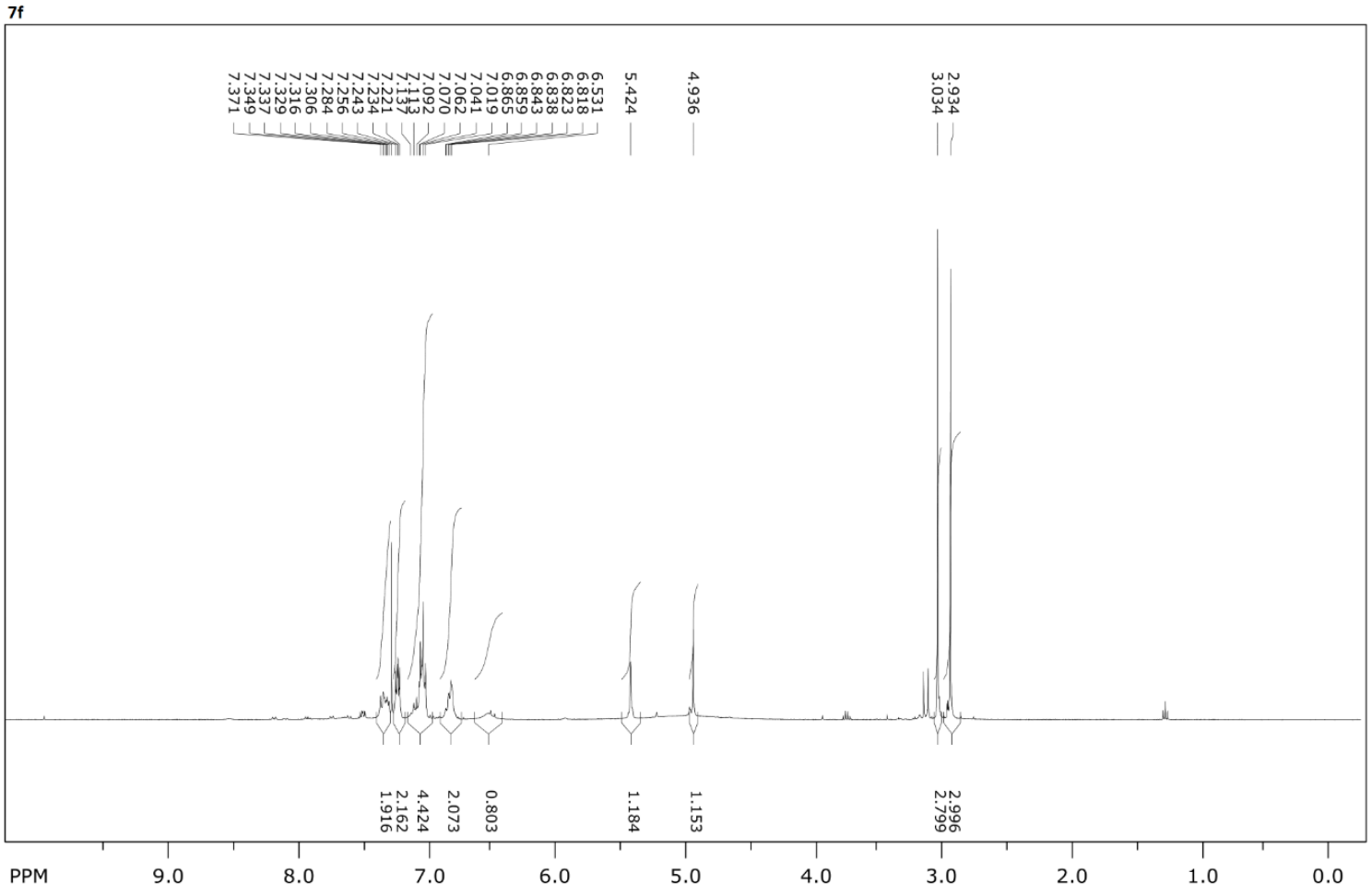


Figure S103: ^{13}C-NMR Spectra of Compound 7f.

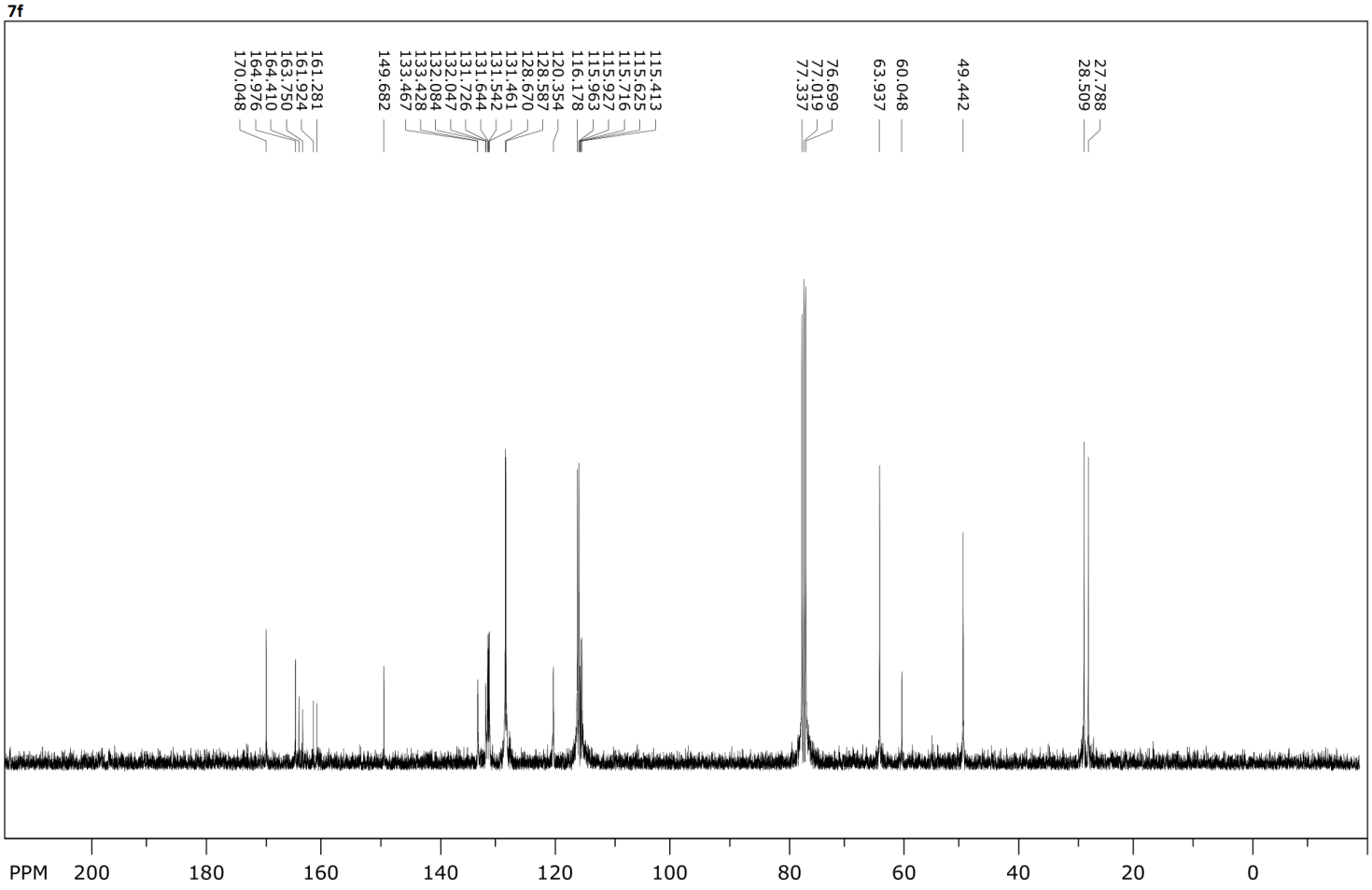
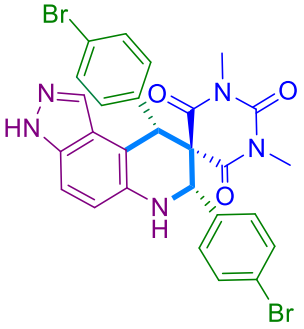


Figure S104: ^{1}H-NMR Spectra of Compound 7g.



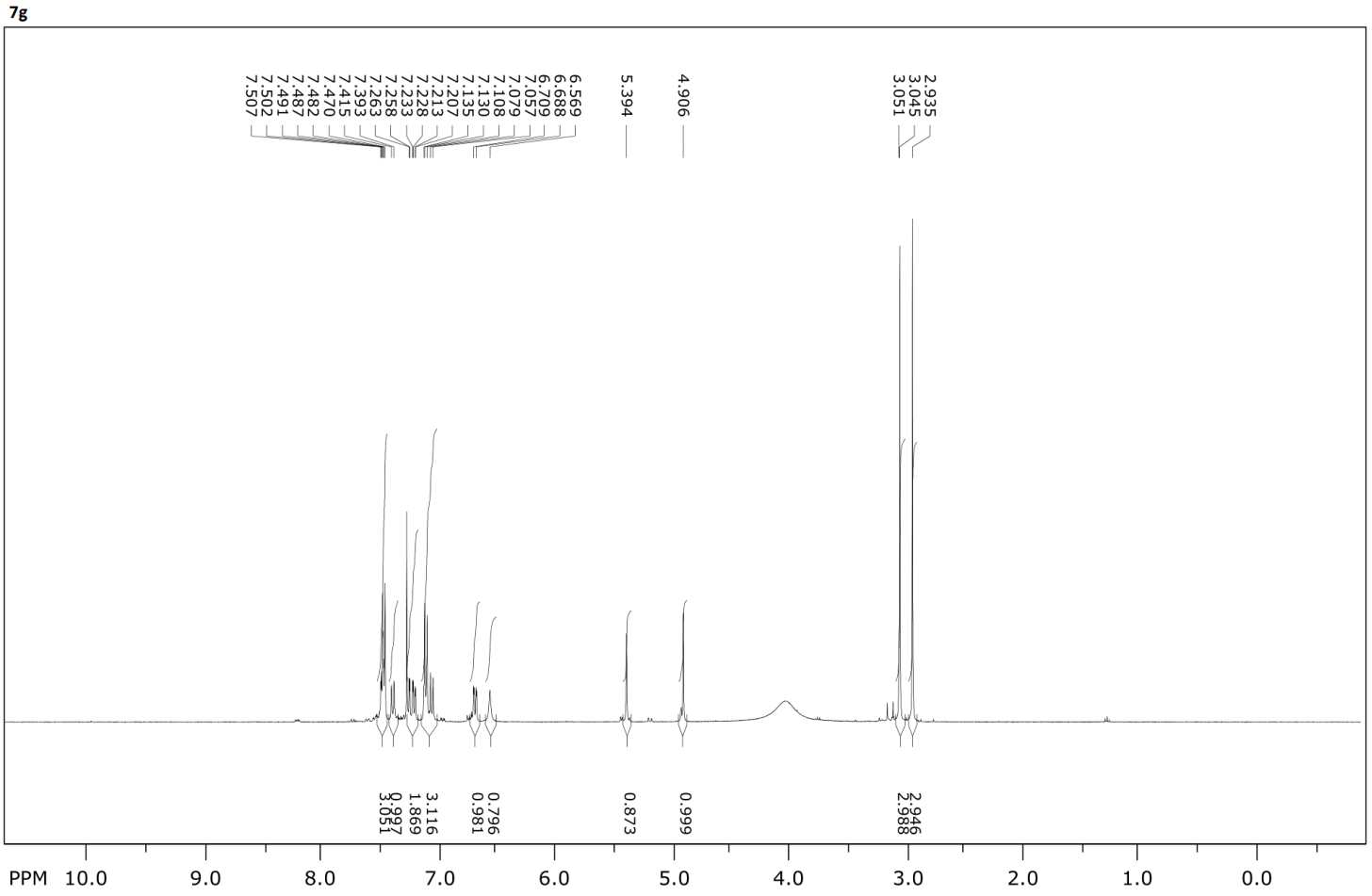


Figure S105: ^{13}C-NMR Spectra of Compound 7g.

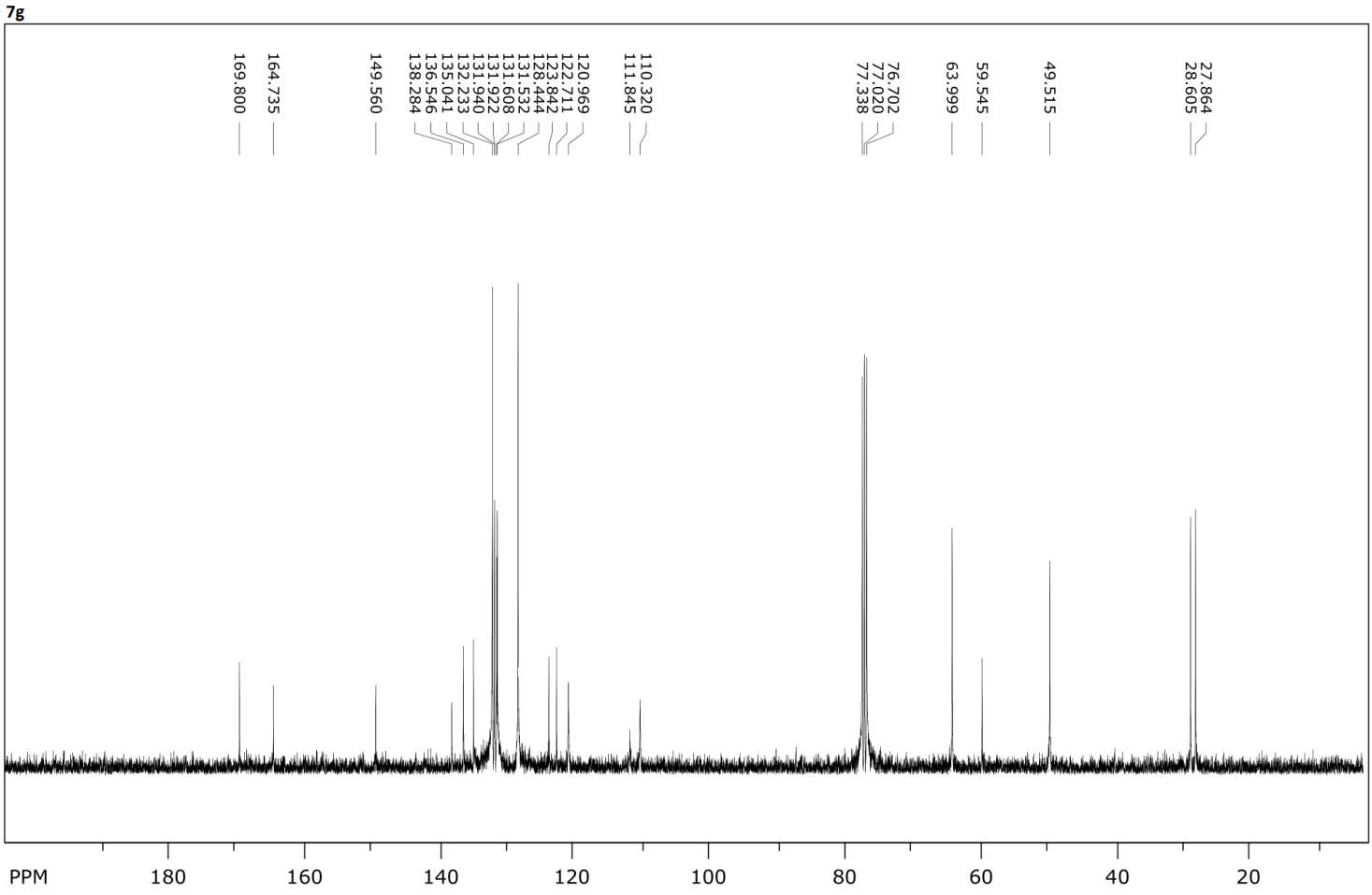
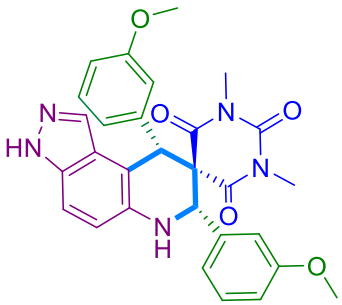


Figure S106: ^{13}C-NMR Spectra of Compound 7h.



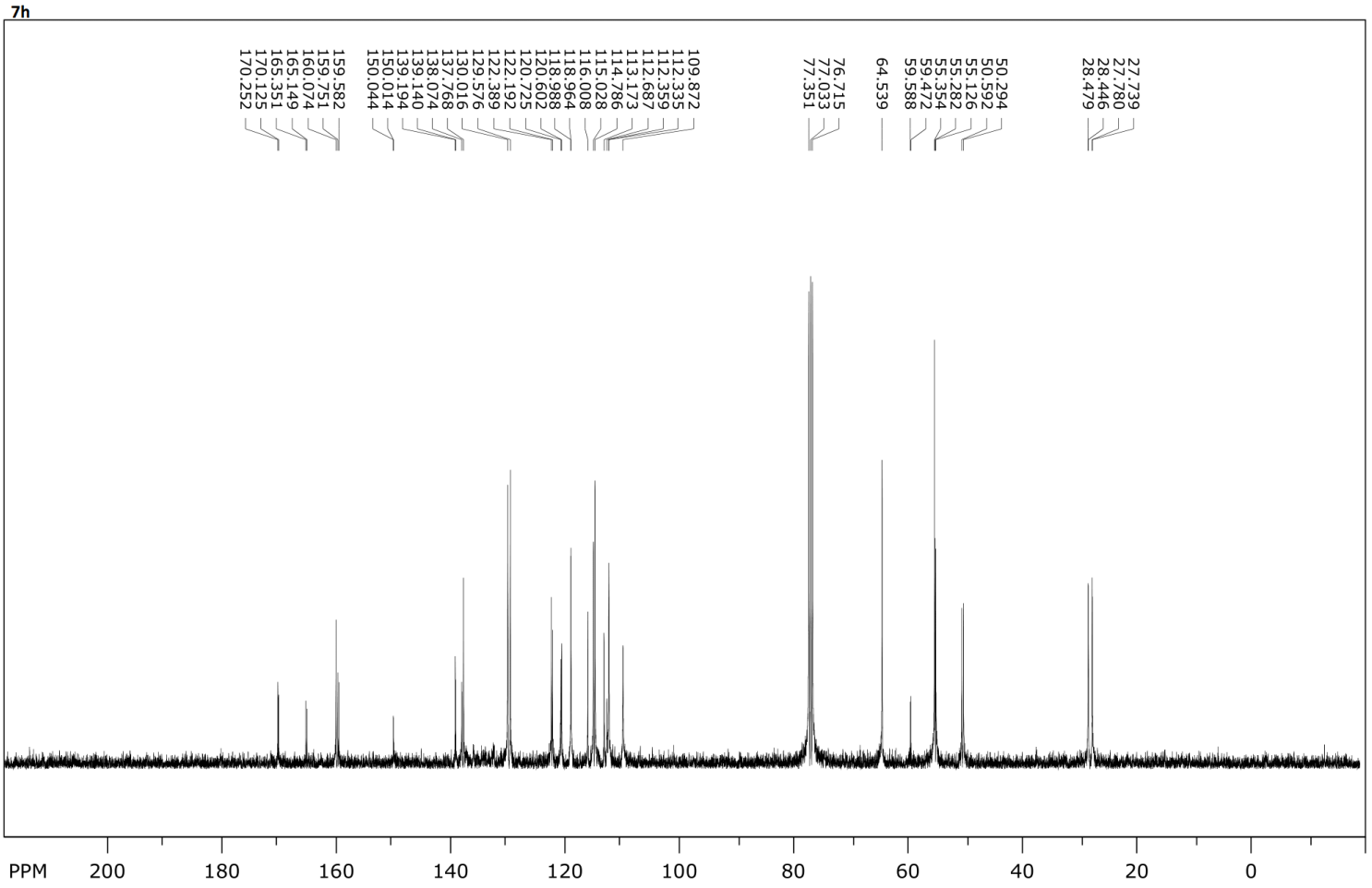
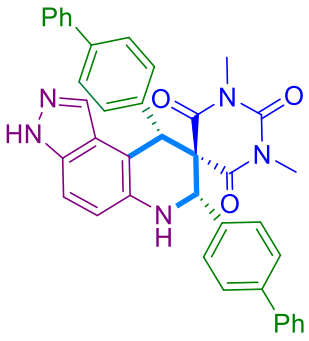


Figure S107: ^{1}H-NMR Spectra of Compound 7i.



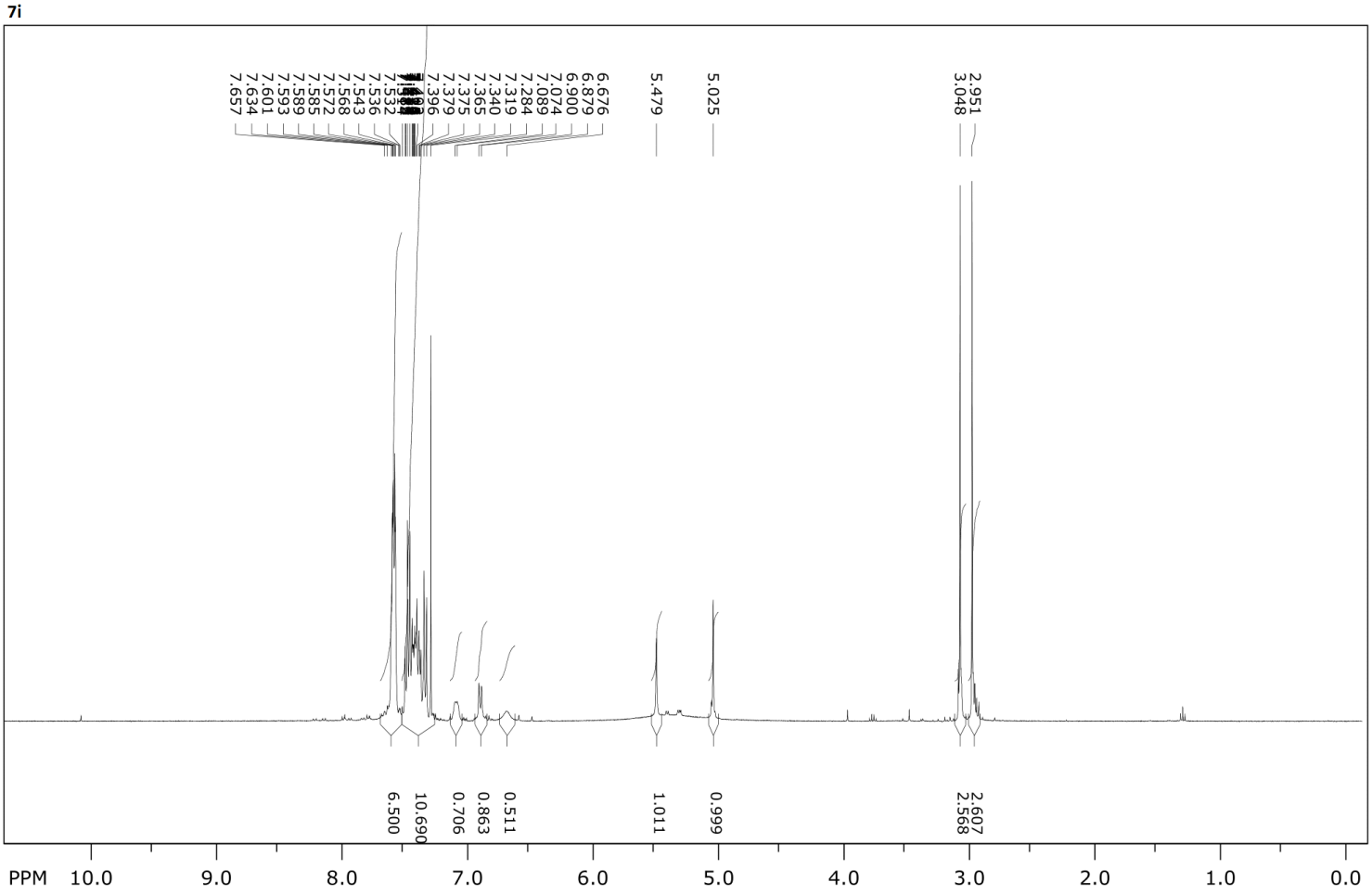


Figure S108: Extended ^{1}H-NMR Spectra of Compound 7i.

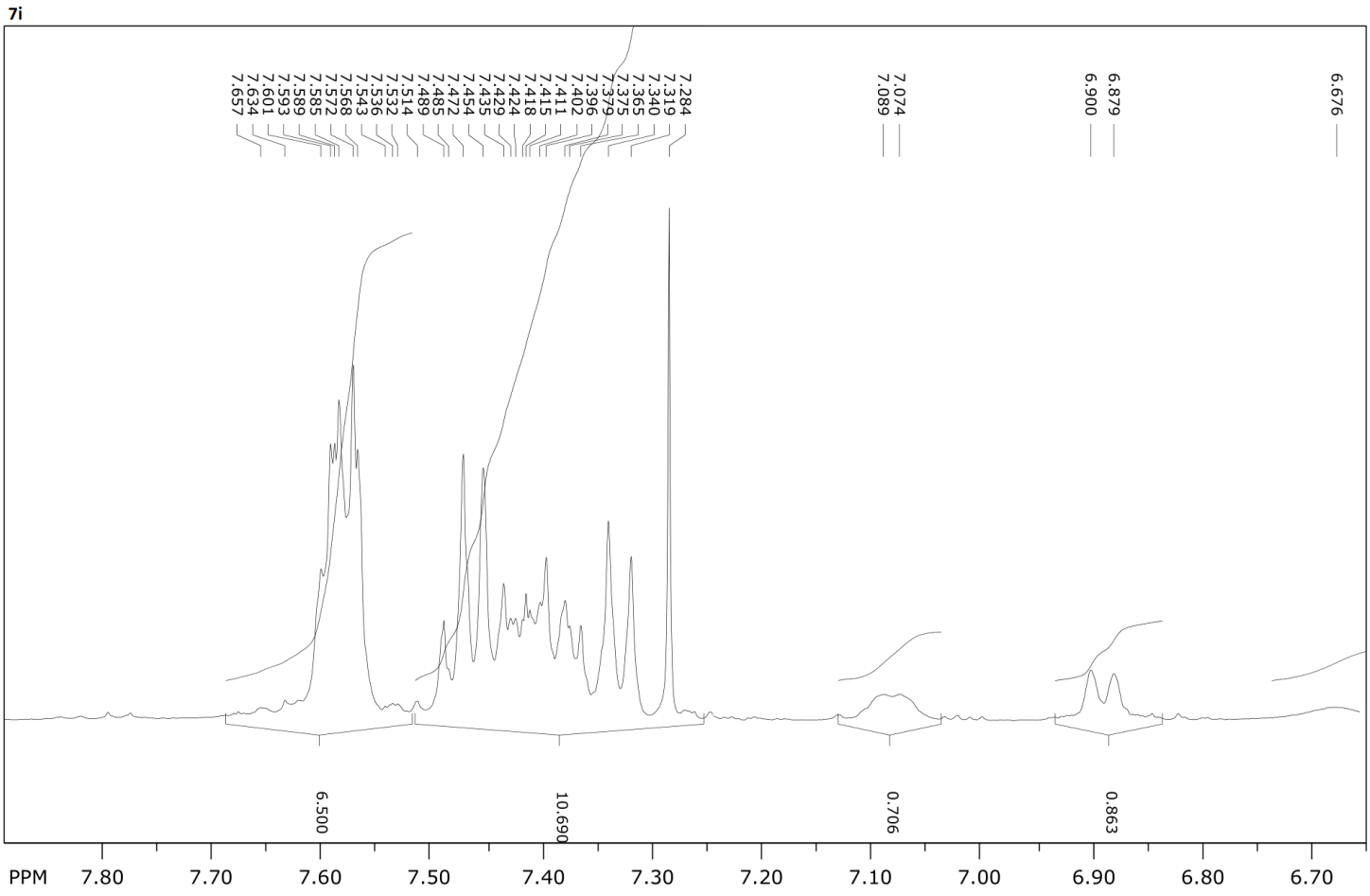
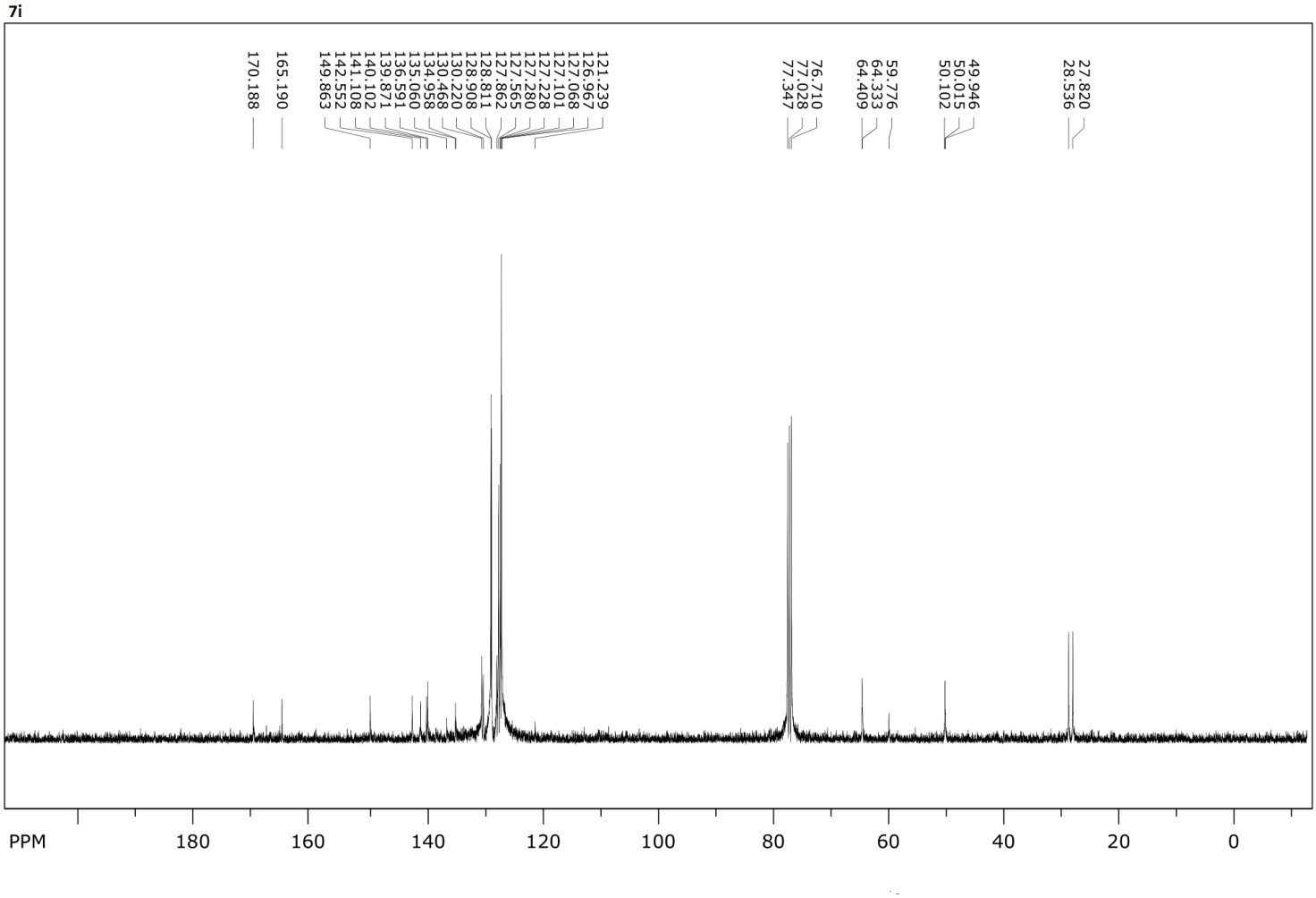


Figure S109: ^{13}C-NMR Spectra of Compound 7i.



Validation of Green chemistry metrics for all newly synthesized compounds.

Materials used for green chemistry metrics calculations

5-aminoindazole (**1, 1.0 mmol**), barbituric acid (**2a, 1.0 mmol**), *N*, *N*-dimethyl barbituric acid (**2b, 1.0 mmol**) and aldehyde (**3(a-k), 1.0 mmol** and **3(a-i), 2.0mmol**).

Respective amount of reagents:

5-aminoindazole (**1**): 0.133gm (Mol.wt.=133.15), barbituric acid (**2a**): 0.128gm (Mol.wt.=128.14), *N*, *N*-dimethyl barbituric acid (**2b**): 0.156gm (Mol.wt.=156.14), benzaldehyde (**3a**): 0.106gm (Mol.wt.= 106.12), 4-chlorobenzaldehyde (**3b**): 0.140gm (Mol.wt.= 140.56), 4-nitrobenzaldehyde (**3c**): 0.151gm (Mol.wt.= 151.12), 4-methoxybenzaldehyde (**3d**): 0.136gm (Mol.wt.= 136.15),4-methylbenzaldehyde (**3e**): 0.120gm (Mol.wt.= 120.15), 4-fluorobenzaldehyde (**3f**): 0.124gm (Mol.wt.= 124.11), 4-bromobenzaldehyde (**3g**): 0.185gm, (Mol.wt.=185.02), 3-methoxybenzaldehyde (**3h**): 0.136gm (Mol. wt.=136.15), 4-phenylbenzaldehyde (**3i**): 0.182gm (Mol.wt.=182.22), 3-chlorobenzaldehyde (**3j**): 0.140gm (Mol.wt.=140.56), 2-chlorobenzaldehyde (**3k**): 0.140gm (Mol. wt.=140.56).

Note: For the synthesis of **7(a-i)** series of compounds the respective amount of aldehydes **3(a-i)** is doubled.

Solvents used:

Ethanol as a reaction media (5mL): 3.77gm
Water in reaction work-up process (15 mL): 14.6gm
Ethanol for washing purpose (5mL): 3.77gm

Products:

For 5(a-k) series of compounds:
5a: 0.26gm (Mol.wt.=331.34), **5b:** 0.32gm (Mol.wt.=365.78), **5c:** 0.28gm (Mol.wt.=376.33), **5d:** 0.32gm (Mol.wt.=361.36), **5e:** 0.28gm (Mol.wt.=346.36), **5f:** 0.24gm (Mol.wt.=349.33), **5g:** 0.3gm (Mol.wt.=410.23), **5h:** 0.28gm (Mol.wt.= 361.36), **5i:** 0.32gm (Mol.wt.=407.43), **5j:** 0.23gm (Mol.wt.=365.78), **5k:** 0.3gm (Mol.wt=365.78).

For 7(a-i) series of compounds:
7a: 0.4gm (Mol.wt.=465.51), **7b:** 0.44gm (Mol.wt.=534.40), **7c:** 0.49gm (Mol.wt.=555.51), **7d:** 0.48gm (Mol.wt.=525.57), **7e:** 0.42gm (Mol.wt.=493.57), **7f:** 0.39gm (Mol.wt.=501.49), **7g:** 0.42gm (Mol.wt.=623.31), **7h:** 0.47gm (Mol.wt.=525.57), **7i:** 0.51gm (Mol.wt.=617.71).

#Calculation of green chemistry metrics for one representative entry, viz. 5a.

✓ E- factor = (Total mass of wastes)/ (Mass of product)

E- factor = ((0.133gm+0.128gm+0.106gm)-0.26)/0.26 = 0.41

✓ AE (%) = (Molecular wt. of product)/ (Total molecular wt. of reactants) x 100

AE (%) = [(331.34)/ (133.15+128.09+106.12)] x 100 = 90.19%

✓ RME (%) = (Mass of isolated product)/ (Total mass of reactant) x 100

RME (%) = [(0.26gm)/ (0.133gm+0.128gm+0.106gm)] x 100 = 70.84%

✓ OE (%) = RME/ AE x 100

OE (%) = (70.84/ 90.19) x 100 =78.54%

✓ AEF (%) = AE x % yield

AEF (%) = (90.19 x 80)/100 =72.15

Fig S110: Radar chart for green metrics evaluation of compounds **5(a-i)**

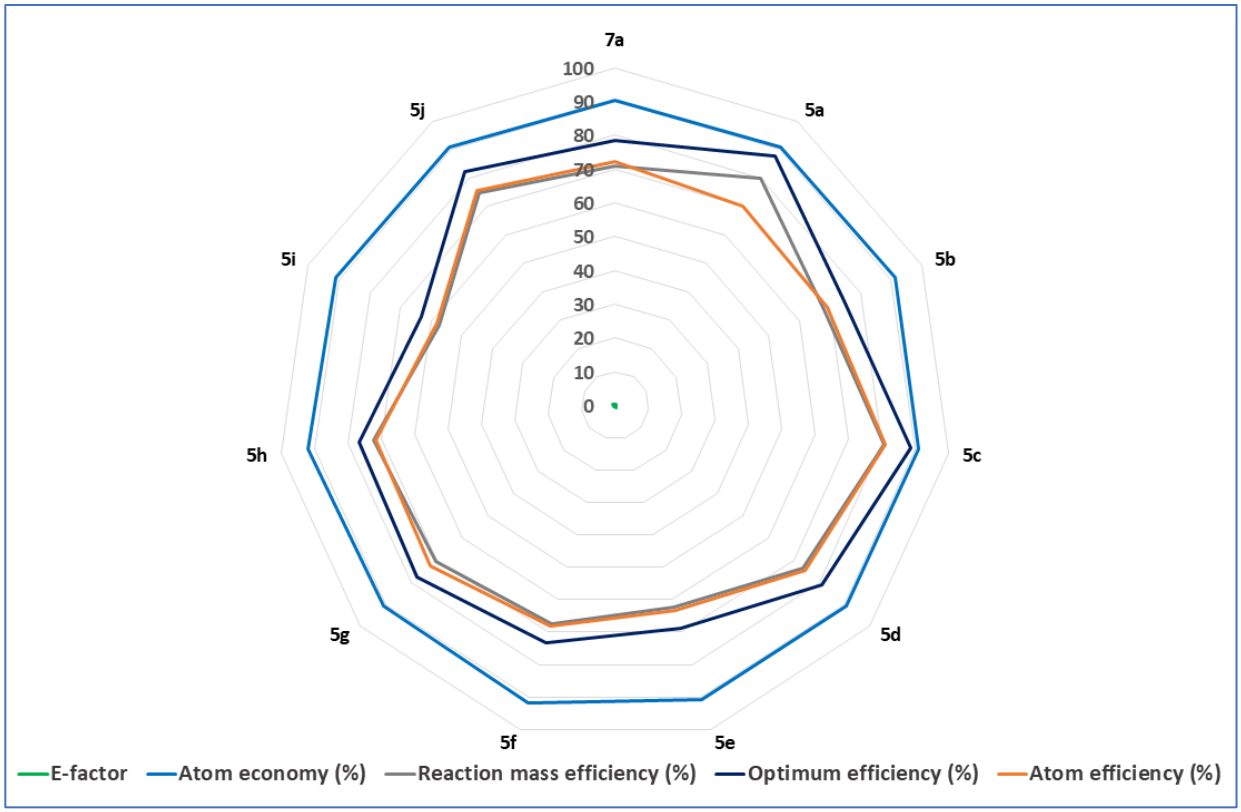


Table S4:

Sr. No.	Product (5(a-k))	E-factor	AE (%)	RME (%)	OE (%)	AEF (%)
1	**5a**	0.41	90.19	70.84	78.54	72.15
2	**5b**	0.25	91.03	79.80	87.66	70.22
3	**5c**	0.47	91.26	68.0	74.51	69.35
4	**5d**	0.24	90.93	80.60	88.63	80.92
5	**5e**	0.36	90.81	73.49	80.92	74.46
6	**5f**	0.60	90.65	62.33	68.76	63.45
7	**5g**	0.49	91.92	67.26	73.17	68.02
8	**5h**	0.41	90.93	70.53	77.56	72.74
9	**5i**	0.38	91.87	72.23	76.62	71.65
10	**5j**	0.74	91.03	57.36	63.01	58.25
11	**5k**	0.33	91.03	74.81	82.18	75.55

Table S5:

Sr. No.	Product (7(a-i))	E-factor	AE (%)	RME (%)	OE (%)	AEF (%)
1	**7a**	0.25	96.67	79.84	82.59	82.16
2	**7b**	0.29	93.70	77.19	82.38	77.77
3	**7c**	0.20	93.91	82.91	88.29	82.64
4	**7d**	0.17	93.58	85.56	91.43	85.15
5	**7e**	0.26	93.19	79.39	85.19	79.21
6	**7f**	0.38	93.29	72.63	77.85	71.83
7	**7g**	0.56	94.54	63.73	67.41	64.28
8	**7h**	0.19	93.58	83.78	89.53	84.22
9	**7i**	0.28	94.49	78.10	82.65	77.48