

2,3-Disubstituted-1,4-Naphthoquinones Containing an Arylamine with Trifluoromethyl Group: Synthesis, Biological Evaluation, and Computational Study

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MS spectra of the compounds 5a-k and 6	2-13
¹ H and ¹³ C spectra of the compounds 5a-k and 6	14-25
Purity chromatograms of the compounds 5a-k and 6	26-37

* Corresponding authors.

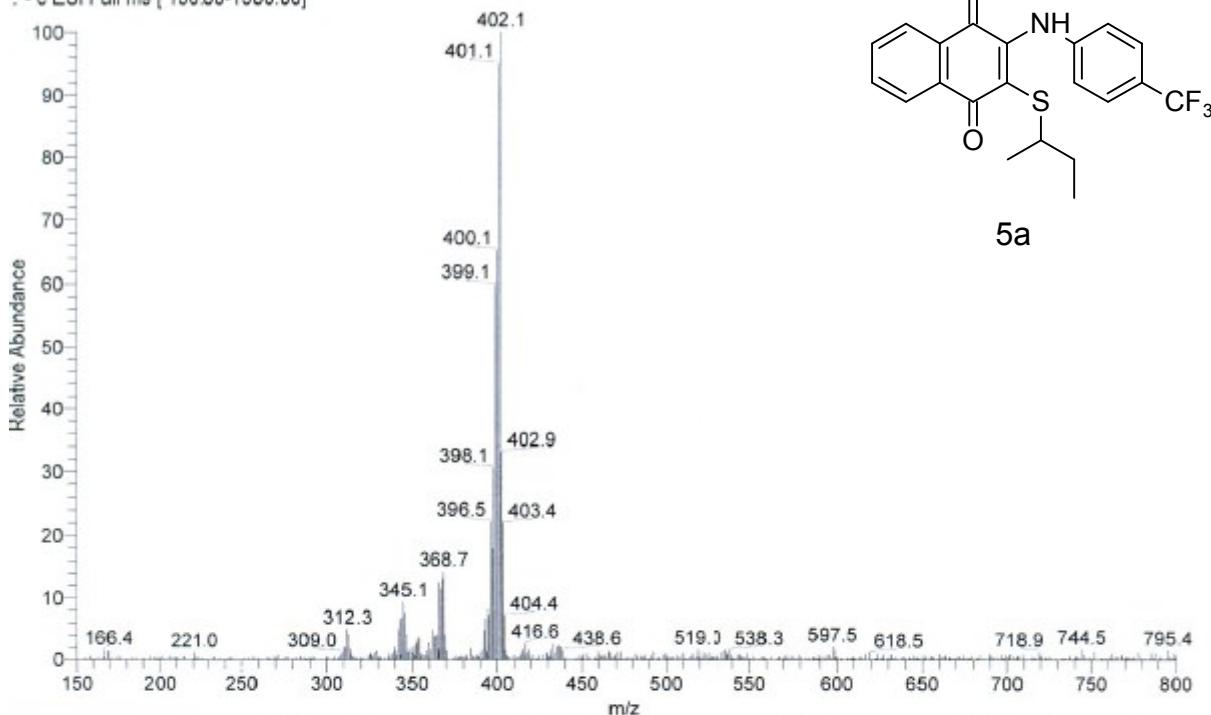
Tel.: +90212 473 7070; fax: +90212 473 7180; e-mail address: aftuyun@gmail.com; aftuyun@istanbul.edu.tr (A. F. Tuyun)

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\Xcalibur\data\2016-kelite\0216\TS5-2
urumcu Adi: TS5-2, CHCl₃ ta cozuldu; MeOH: 0.2 mL/dak
S5-2 #855-866 RT: 9.66-9.87 AV: 12 NL: 6.39E6
- c ESI Full ms [150.00-1500.00]

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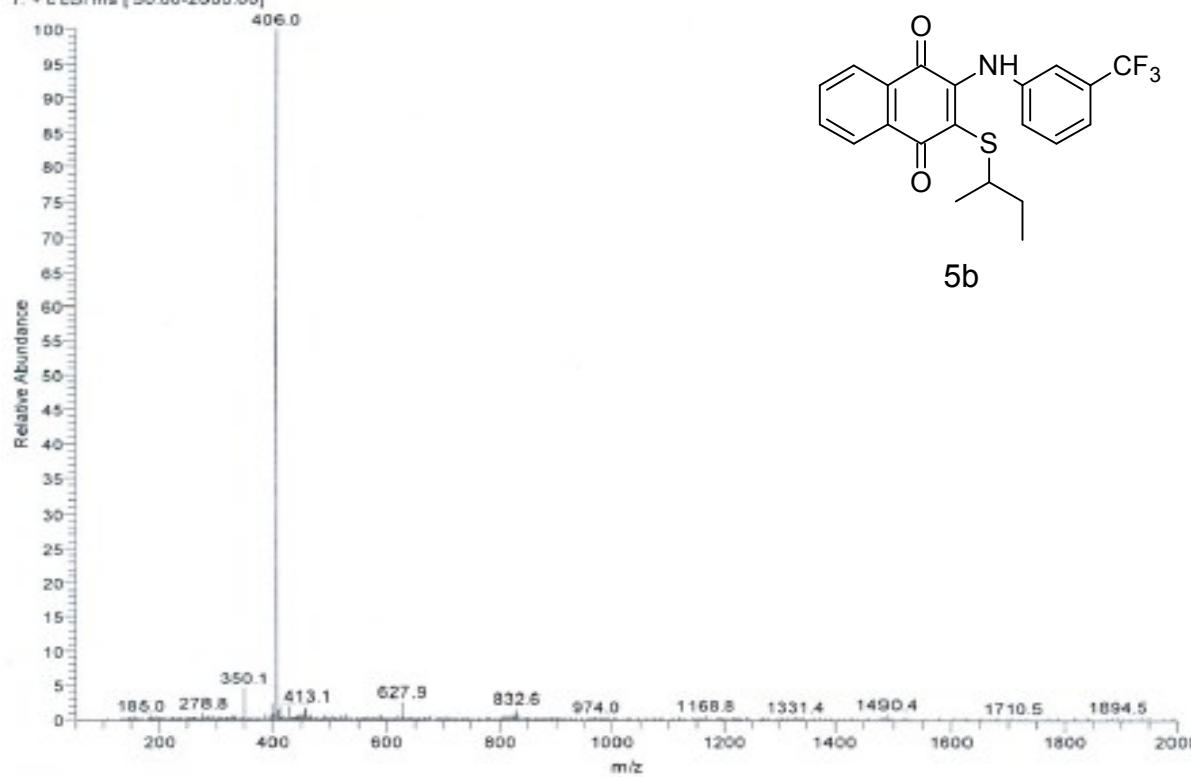


S5-2#855-866 RT: 9.66-9.87 AV: 12
- c ESI Full ms [150.00-1500.00]
m/z= 150.0-800.0

m/z	Intensity	Relative Flags
402.1	6386673.3	100.00
401.1	6070564.5	95.05
400.1	4165766.4	65.23
399.1	3823917.3	59.87
402.9	2110281.3	33.04
398.1	1952833.4	30.58
396.5	1418900.8	22.22
403.4	1405971.5	22.01
397.3	1142003.6	17.88
368.7	908866.3	14.23
367.8	831846.3	13.02
366.1	800751.3	12.54
367.1	741441.0	11.61
345.1	596288.2	9.34
394.5	525036.0	8.22
346.0	489736.4	7.67
395.3	465551.3	7.29
404.4	457711.6	7.17
344.3	436635.0	6.84
393.2	426891.3	6.68

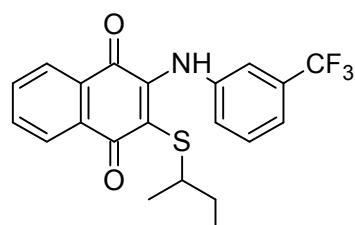
Figure S1: MS spectrum of compound 5a

TSL0-3#32-33 RT: 0.84-0.86 AV: 2 NL: 1.07E8
T + c ESI ms [50.00-2900.00]



m/z Intensity Relative

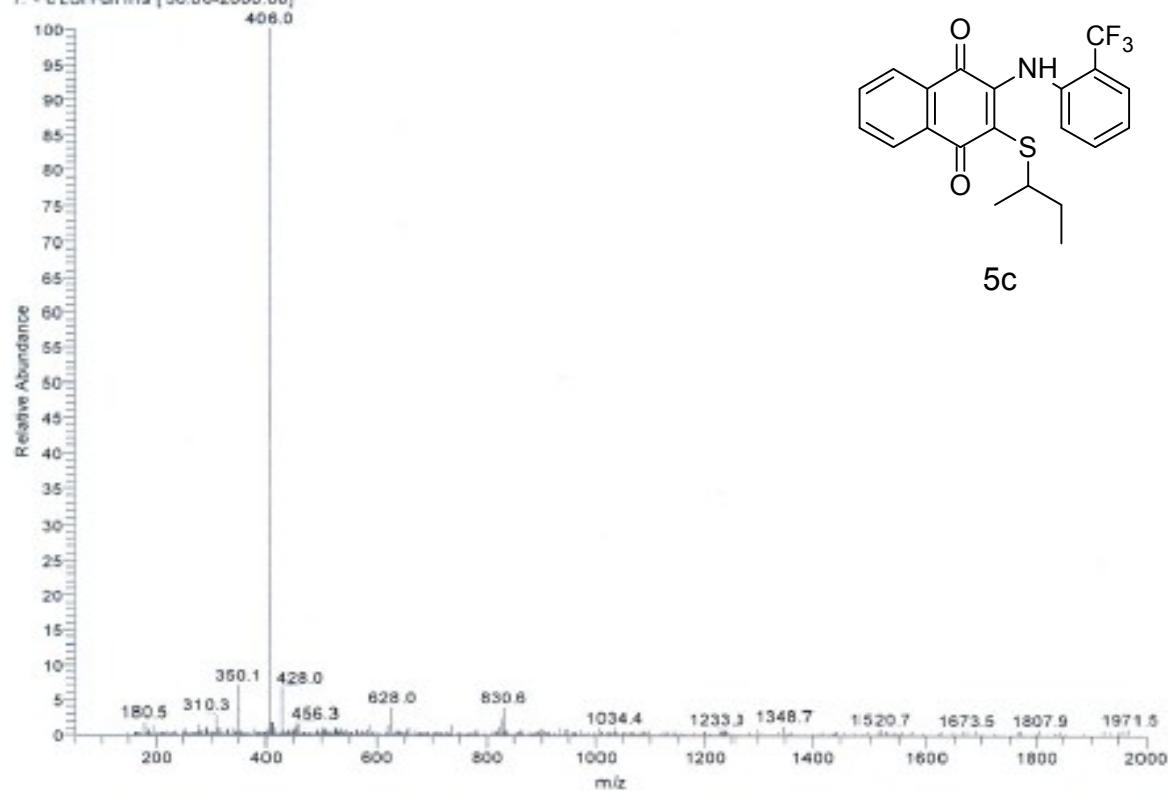
278.8	838801.0	0.78
350.1	4591804.0	4.30
351.1	1020325.5	0.95
391.0	850676.5	0.80
401.1	2371126.0	2.22
403.1	999115.0	0.93
404.2	1027255.5	0.96
406.0	106886184.0	100.00
407.0	23537216.0	22.02
408.0	7704599.5	7.21
409.0	1344772.0	1.26
413.1	2006870.5	1.88
427.9	1896279.0	1.77
450.1	1022021.0	0.96
455.7	834287.0	0.78
456.3	1505905.5	1.41
459.0	1758257.5	1.64
627.9	2605670.5	2.44
830.0	934751.0	0.87
832.6	1638198.5	1.53



5b

Figure S2: MS spectrum of compound 5b

TS-13 #52 RT: 1.40 AV: 1 NL: 5.92E7
T: + c ESI Full ms [50.00-2000.00]



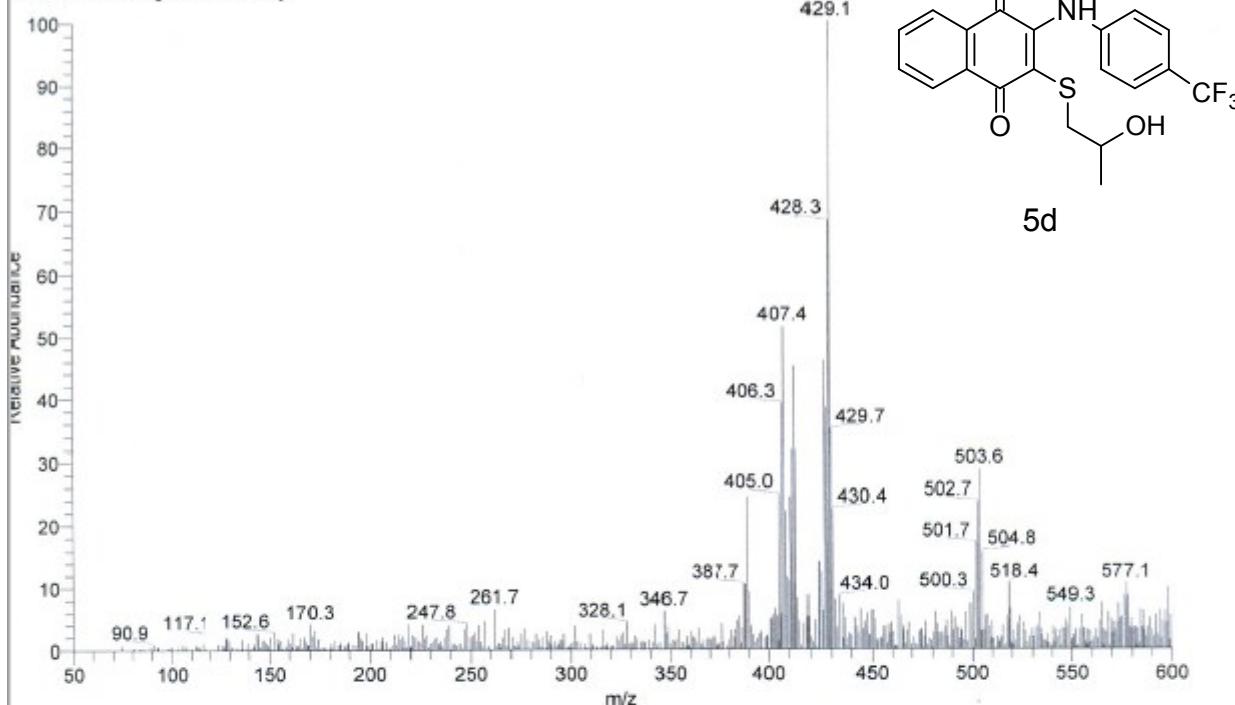
<i>m/z</i>	Intensity	Relative
180.5	936240.0	1.58
194.5	761353.0	1.29
278.7	884169.0	1.49
310.3	1578925.0	2.67
350.1	4108345.0	6.94
406.0	59188200.0	100.00
407.1	12179248.0	20.58
408.0	3615700.0	6.11
409.2	936911.0	1.58
413.3	969008.0	1.64
428.0	3808590.0	6.43
429.0	1419677.0	2.40
456.3	843195.0	1.42
459.1	827561.0	1.40
589.8	747929.0	1.26
628.0	2111647.0	3.57
829.8	1360298.0	2.30
830.6	2182026.0	3.69
831.4	1083566.0	1.83
832.4	1317742.0	2.23

Figure S3: MS spectrum of compound **5c**

%Xcalibur\data\2016-kalite\0216\TS8
Sample Adq: TS6- CHCl3 ta cozuldu; MeOH: 0.2 mL/dak
S6 #353-359 RT: 3.51-3.57 AV: 7 NL: 6.18E6
+ c ESI Full ms [50.00-600.00]

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S6#353-359 RT: 3.51-3.57 AV: 7
+ c ESI Full ms [50.00-600.00]
/z Intensity Relative Flags

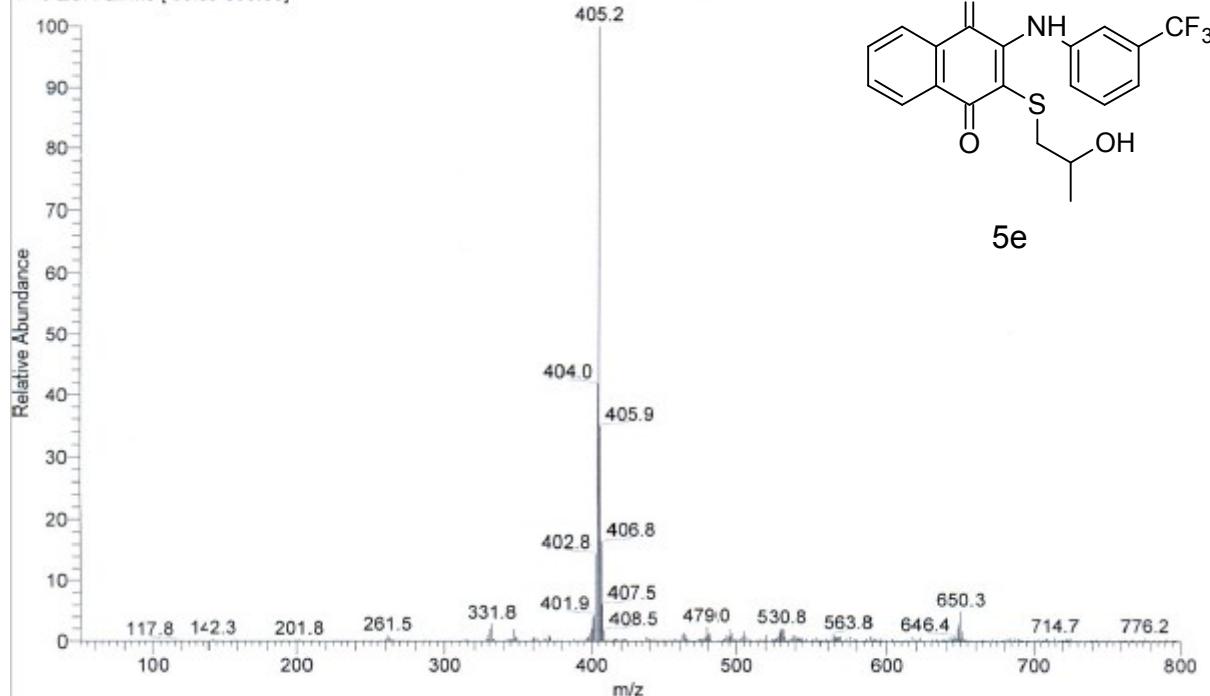
/z	Intensity	Relative Flags
429.1	6177445.0	100.00
428.3	4218797.1	68.29
407.4	3183425.7	51.53
426.4	2844481.4	46.05
412.5	2786190.9	45.10
406.3	2422709.3	39.22
427.4	2381128.1	38.55
429.7	2166510.3	35.07
413.3	1977147.3	32.01
411.6	1974136.1	31.96
503.6	1771548.9	28.68
405.0	1535624.3	24.86
389.4	1509041.1	24.43
410.7	1508968.0	24.43
502.7	1459828.7	23.63
430.4	1392265.1	22.54
408.3	1372240.6	22.21
501.7	1056899.6	17.11
504.8	976501.0	15.81
423.9	874774.3	14.16

Figure S4: MS spectrum of compound 5d

Xcalibur\data\2016-kalite\0216\TS-9
Lumine Adı: TS-9 CHCL3 la cozuldu; MeOH: 0.2 mL\dak
S-9 #66-72 RT: 1.62-1.70 AV: 7 NL: 2.55E7
- c ESI Full ms [50.00-800.00]

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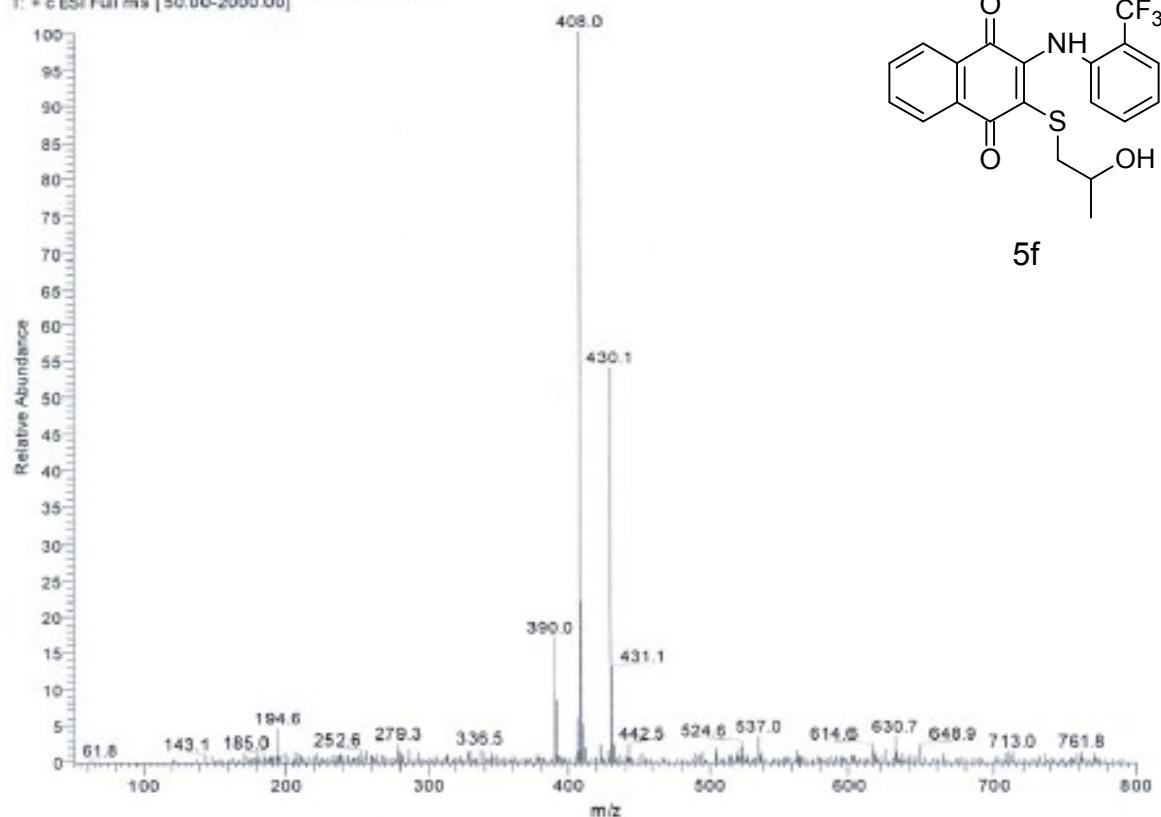


S-9#66-72 RT: 1.62-1.70 AV: 7
- c ESI Full ms [50.00-800.00]

n/z	Intensity	Relative Flags
405.2	25478004.3	100.00
404.0	10666421.4	41.87
405.9	8880818.1	34.86
406.8	4174898.9	16.39
402.8	3682397.7	14.45
407.5	1553838.4	6.10
650.3	1271621.6	4.99
401.9	1113712.9	4.37
400.9	980454.6	3.85
649.0	750360.6	2.95
331.8	731223.9	2.87
479.0	602781.3	2.37
648.1	559838.3	2.20
530.8	540267.9	2.12
399.9	539234.4	2.12
330.9	510307.0	2.00
495.3	498679.6	1.96
346.4	495982.6	1.95
531.7	490869.0	1.93
529.9	479822.3	1.88

Figure S5: MS spectrum of compound 5e

TS-14 #183-1B4 RT: 4.45-4.49 AV: 2 NL: 1.02E7
T: +c ESI Full ms [50.00-2000.00]



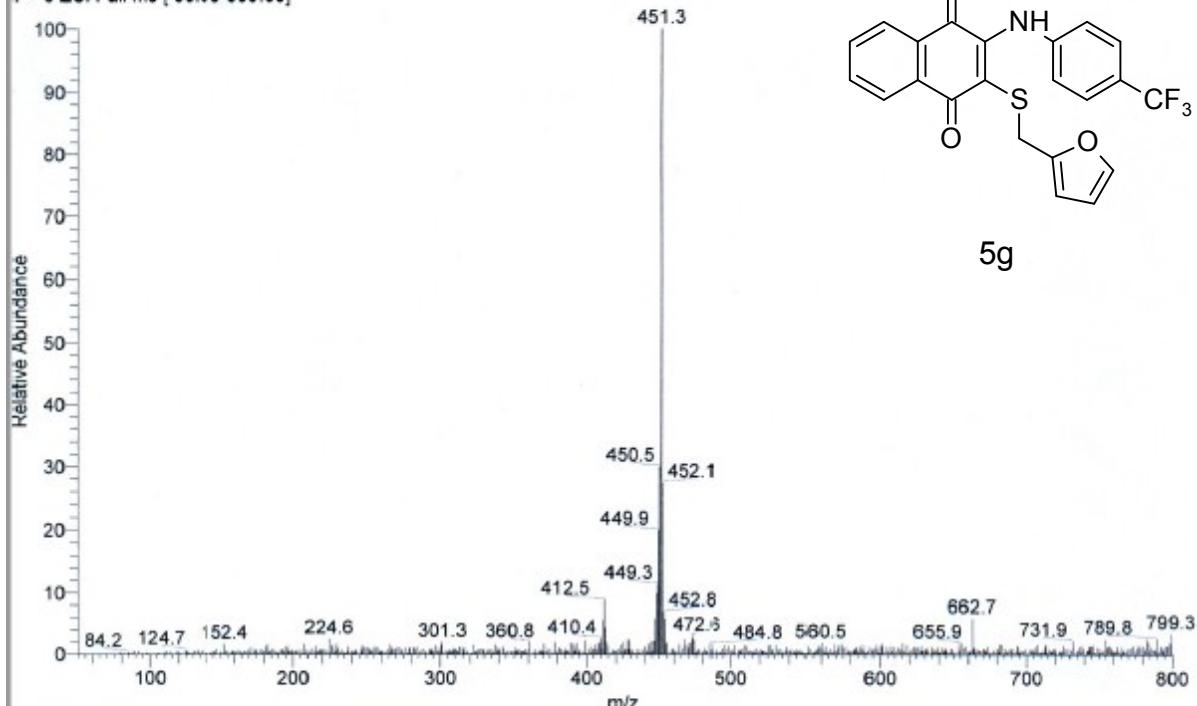
<i>m/z</i>	Intensity	Relative
194.6	435375.5	4.27
279.3	227248.0	2.23
390.0	1723779.5	16.92
391.1	843798.0	8.28
406.2	602849.5	5.92
408.0	10188560.5	100.00
409.1	2244913.5	22.03
410.1	509252.0	5.00
412.2	189885.5	1.86
422.0	236272.5	2.32
430.1	5487280.0	53.86
431.1	1315065.0	12.91
432.2	232898.5	2.29
442.5	233900.5	2.30
524.6	259762.5	2.55
536.2	283281.5	2.78
537.0	319771.0	3.14
614.6	230287.0	2.26
630.7	326280.0	3.20
648.9	223654.0	2.20

Figure S6: MS spectrum of compound **5f**

:Xcalibur\data\2016-kalite\0216\TS-7-3
umine Adı: TS-7-3 CHCL₃ ta cozuldu; MeOH: 0.2 mL/dak
S-7-3 #60-65 RT: 1.46-1.53 AV: 6 NL: 1.82E7
: + c ESI Full ms [50.00-800.00]

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"S-7-3#60-65 RT: 1.46-1.53 AV: 6

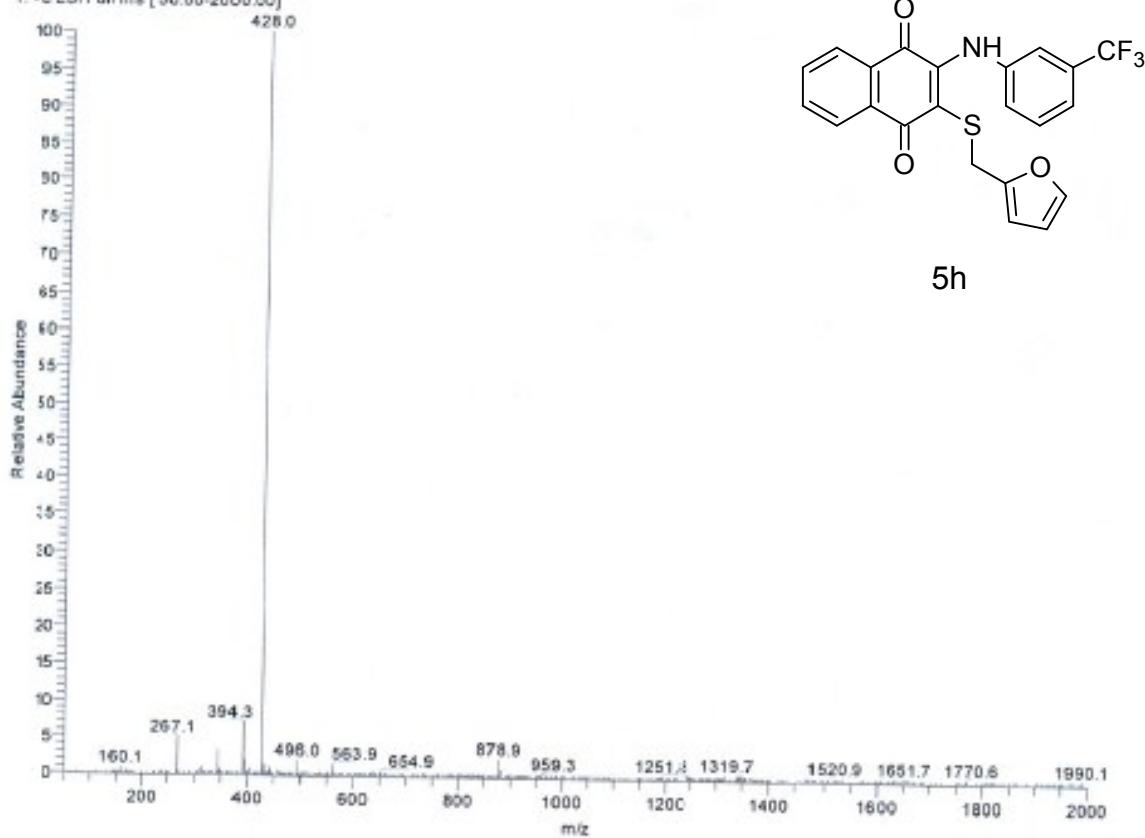
" : + c ESI Full ms [50.00-800.00]

i/z Intensity Relative Flags

451.3	18197904.3	100.00
450.5	5461911.0	30.01
452.1	4986543.0	27.40
449.9	3639079.3	20.00
449.3	2083599.3	11.45
448.4	1806912.8	9.93
412.5	1621231.2	8.91
452.8	1283250.8	7.05
662.7	1084611.3	5.96
447.6	1072284.3	5.89
453.4	1069835.2	5.88
411.7	1041135.8	5.72
413.2	811354.0	4.46
799.3	629680.7	3.46
472.6	554154.5	3.05
789.8	479232.3	2.63
410.4	475586.0	2.61
224.6	467980.2	2.57
473.2	463569.7	2.55
782.8	454691.2	2.50

Figure S7: MS spectrum of compound 5g

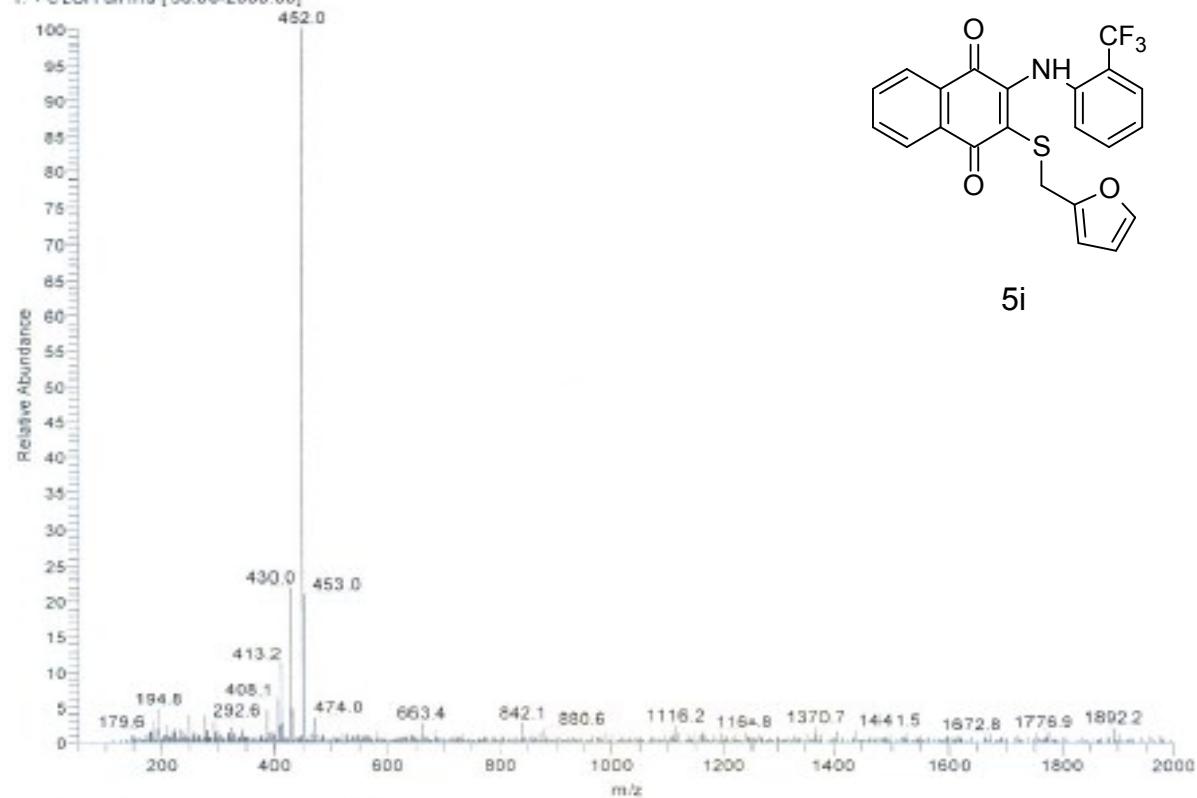
TS-11#85-88 RT: 2.32-2.39 Av: 4 NL: 6.81E6
T: -c ESI Full ms [50.00-2000.00]



<i>m/z</i>	Intensity	Relative
160.1	51159.0	0.75
267.1	322745.0	4.74
268.1	97133.0	1.43
314.5	60254.0	0.89
347.2	215861.8	3.17
348.3	43571.5	0.64
394.3	472350.3	6.94
395.4	127172.3	1.87
396.2	44163.8	0.65
404.1	42733.0	0.63
428.0	6805394.5	100.00
429.0	1436892.0	21.11
430.0	496954.3	7.30
431.0	85115.0	1.25
442.2	53062.8	0.78
496.0	131356.0	1.93
563.9	95022.0	1.40
878.9	155704.5	2.29
880.0	112036.8	1.65
881.0	61836.0	0.91

Figure S8: MS spectrum of compound **5h**

TS-15 #75-76 RT: 2.02-2.05 AV: 2 NL: 1.62E7
T: +c ESI Full ms [50.00-2000.00]



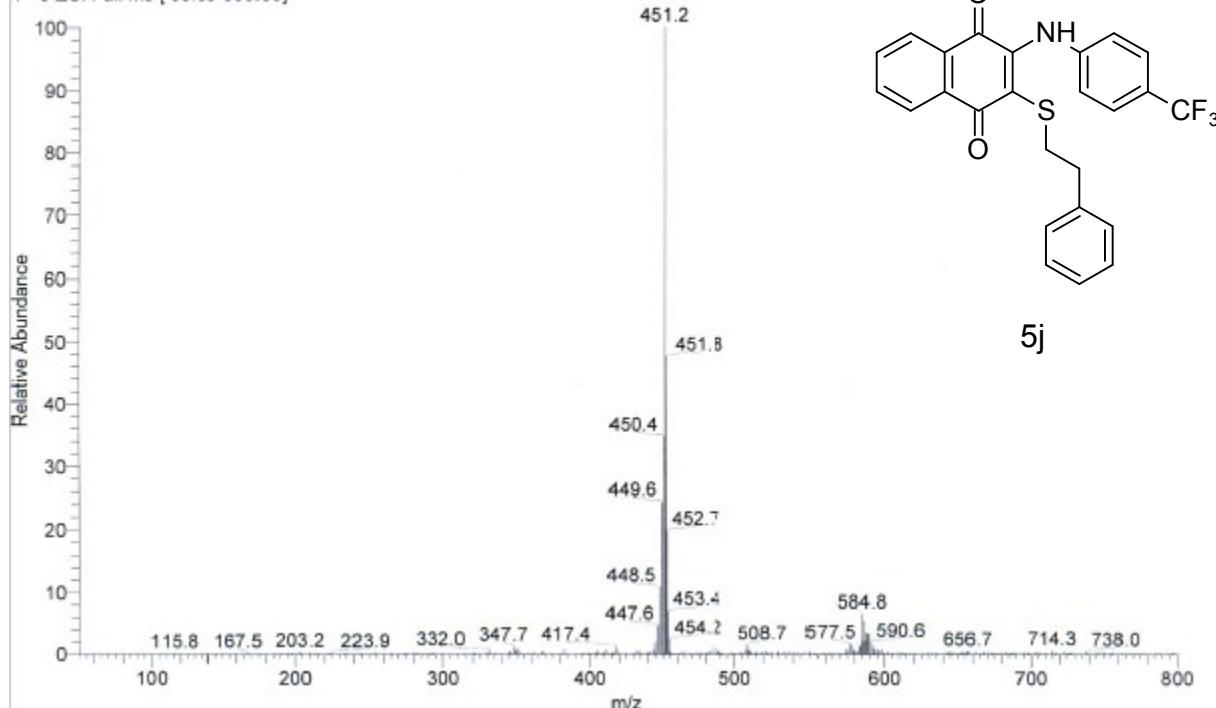
m/z	Intensity	Relative
185.1	481024.0	2.97
194.8	748411.0	4.62
208.7	395401.5	2.44
250.5	621087.0	3.83
278.4	617531.0	3.81
292.6	491831.0	3.04
390.8	712460.5	4.40
408.1	955799.0	5.90
409.1	393674.0	2.43
413.2	1820603.0	11.24
414.2	427934.5	2.64
430.0	3551953.5	21.93
430.9	729070.5	4.50
432.0	573031.5	3.54
452.0	16198191.0	100.00
453.0	3396181.0	20.97
454.1	1229232.5	7.59
474.0	550282.5	3.40
663.4	431288.5	2.66
842.1	425703.5	2.63

Figure S9: MS spectrum of compound 5i

C:\Xcalibur\data\2016-kalite\0216\TS-8-3
Illumine Adı: TS-8-3 CHCL₃ la cozuldu; MeOH: 0.2 mL/dak
TS-8-3 #70-75 RT: 1.96-2.03 AV: 6 NL: 9.75E6
:- c ESI Full ms [50.00-800.00]

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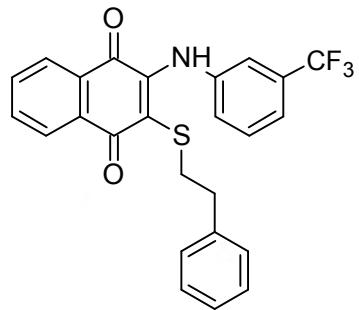
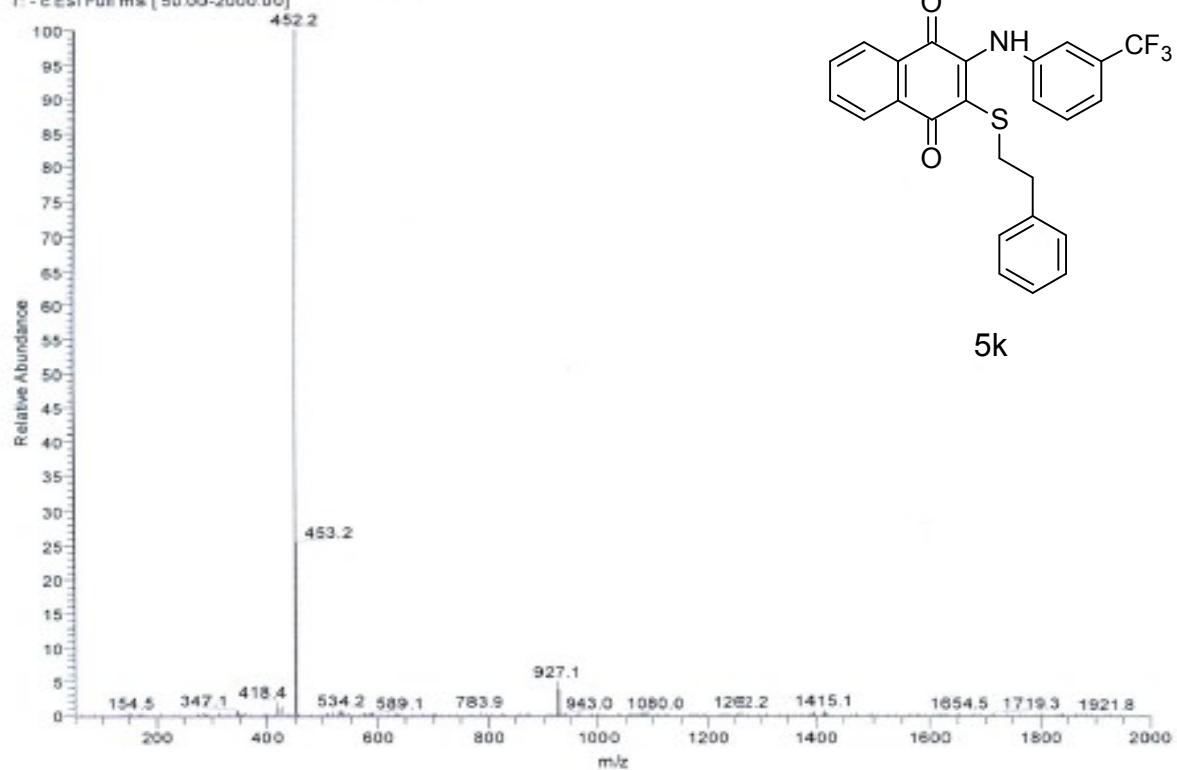
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<i>m/z</i>	Intensity	Relative Flags
451.2	9746288.5	100.00
451.8	4649190.2	47.70
450.4	3380153.0	34.68
449.6	2375933.2	24.38
452.7	1935410.0	19.86
448.5	1063260.5	10.91
453.4	690663.5	7.09
584.8	645725.7	6.63
586.6	535591.2	5.50
447.6	465941.8	4.78
446.4	446187.7	4.58
588.0	348211.7	3.57
588.8	331014.8	3.40
589.5	323108.0	3.32
454.2	240648.3	2.47
585.7	217127.5	2.23
587.2	209290.7	2.15
444.9	193441.0	1.98
590.6	191391.2	1.96
577.5	168702.0	1.73

Figure S10: MS spectrum of compound 5j

TS-12-2 #122-124 RT: 3.15-3.19 AV: 3 NL: 8.80E6
T - c ESI Full ms [50.00-2000.00]



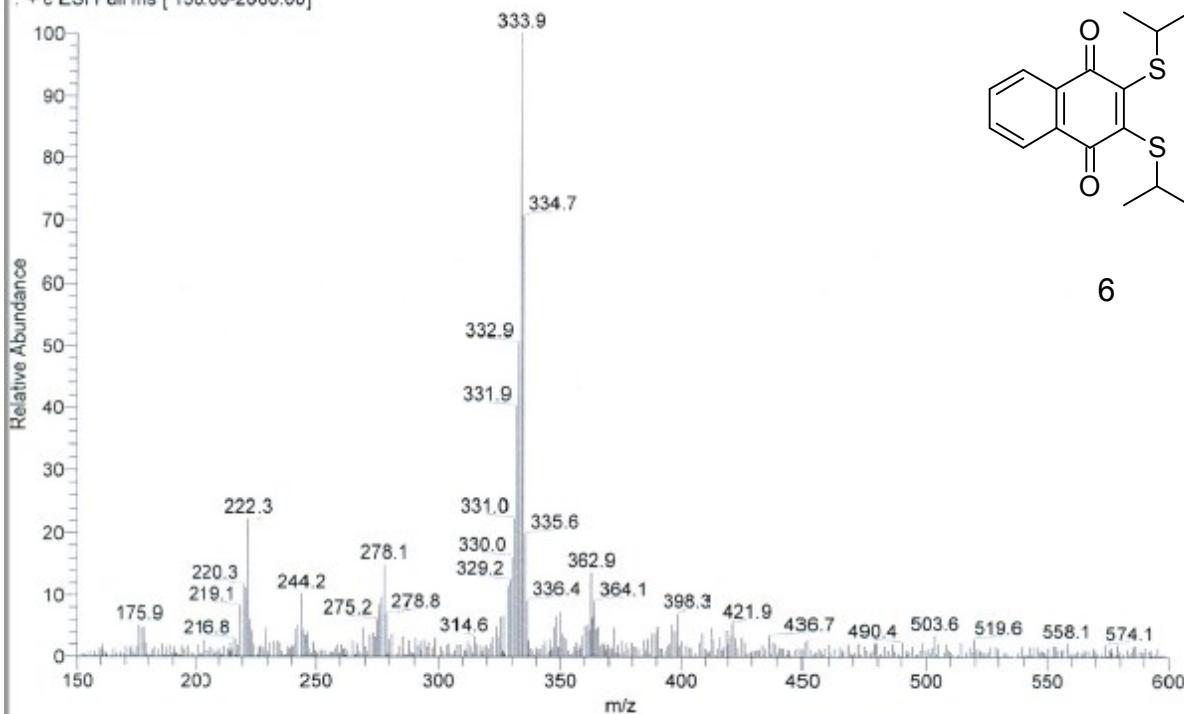
5k

Figure S11: MS spectrum of compound 5k

:\Xcalibur\data\2016-kalite\0216\TS5-1
Lumine Adı: TS5-1, CHCL₃ ta cozuldu; MeOH: 0.2 mL/dak
S5-1 #114-117 RT: 2.98-3.06 AV: 4 NL: 2.20E7
+: c ESI Full ms [150.00-2000.00]

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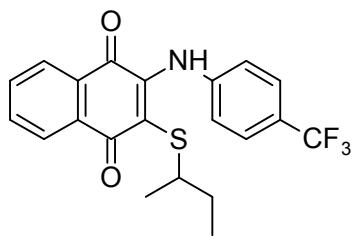


S5-1#114-117 RT: 2.98-3.06 AV: 4
+: c ESI Full ms [150.00-2000.00]
m/z= 150.0-600.0

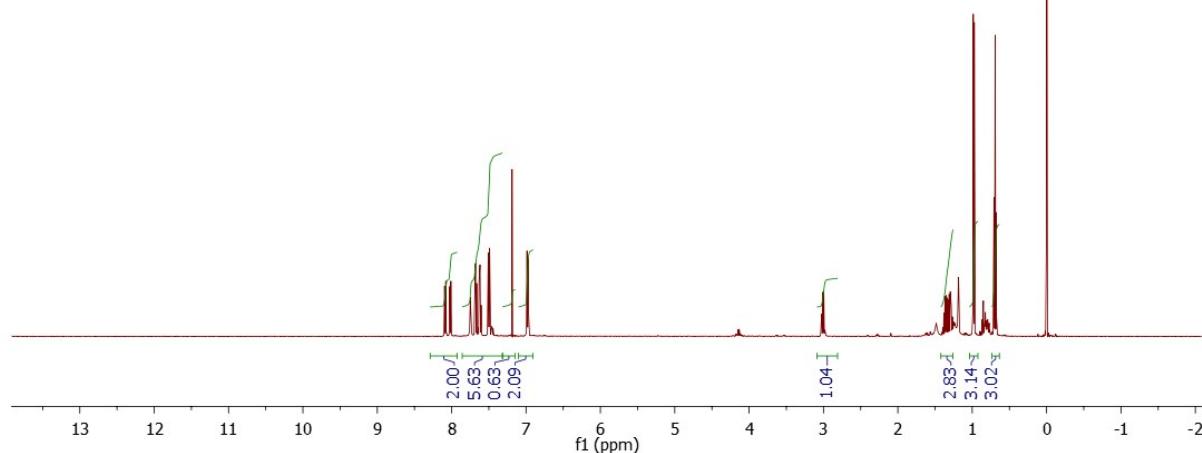
m/z	Intensity	Relative Flags
333.9	22015842.8	100.00
334.7	15554224.0	70.65
332.9	11123043.8	50.52
331.9	8844591.8	40.17
331.0	4925666.8	22.37
222.3	4907199.8	22.29
335.6	4375076.5	19.87
330.0	3568897.5	16.21
278.1	3311255.3	15.04
362.9	3019194.3	13.71
329.2	2749610.3	12.49
220.3	2592786.8	11.78
328.2	2543806.5	11.55
221.3	2478708.8	11.26
244.2	2260789.3	10.27
277.0	2126978.0	9.66
336.4	2006133.5	9.11
364.1	1982823.3	9.01
276.1	1867343.5	8.48
219.1	1821878.8	8.28

Figure S12: MS spectrum of compound 6

PROTON
TS5_2_H1



5a



CARBON
TS5_2_C13

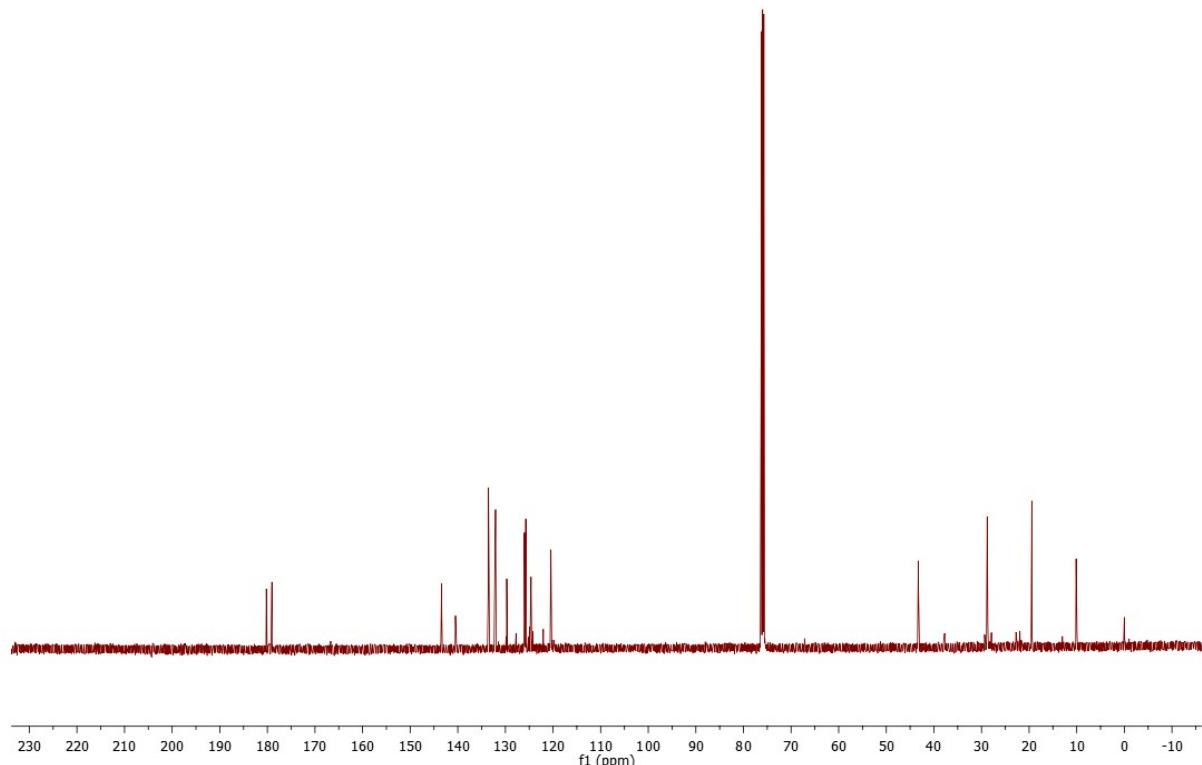


Figure S13: ¹H and ¹³C spectra of compound 5a

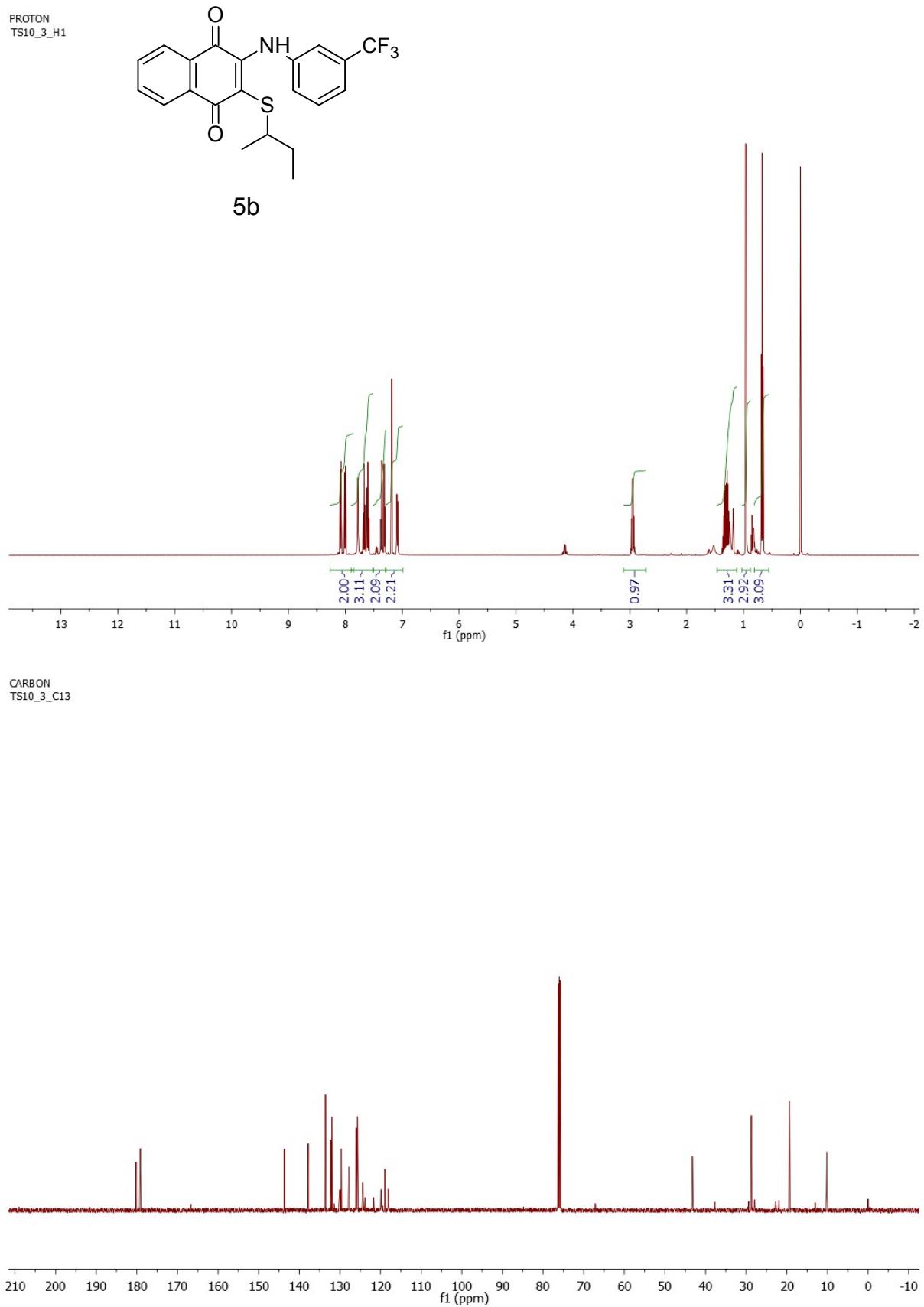
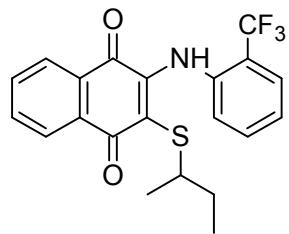
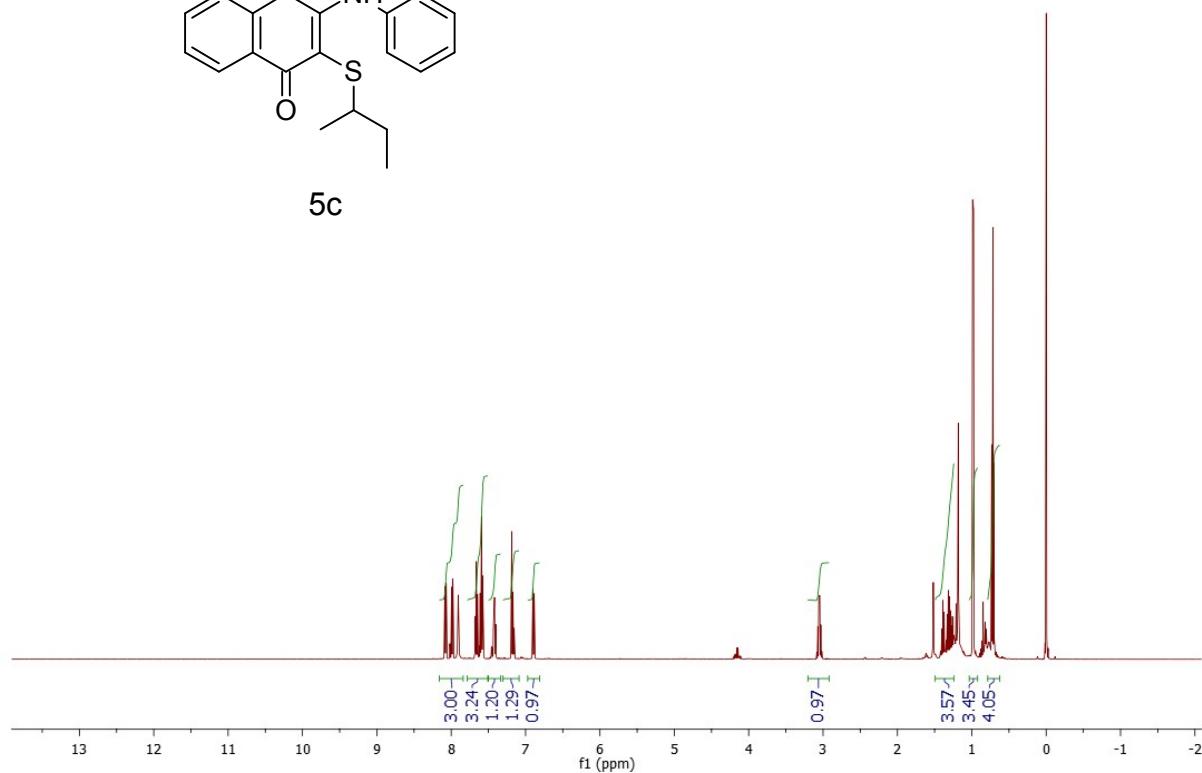


Figure S14: ^1H and ^{13}C spectra of compound **5b**

PROTON
TS13_H1



5c



CARBON
TS13_C13

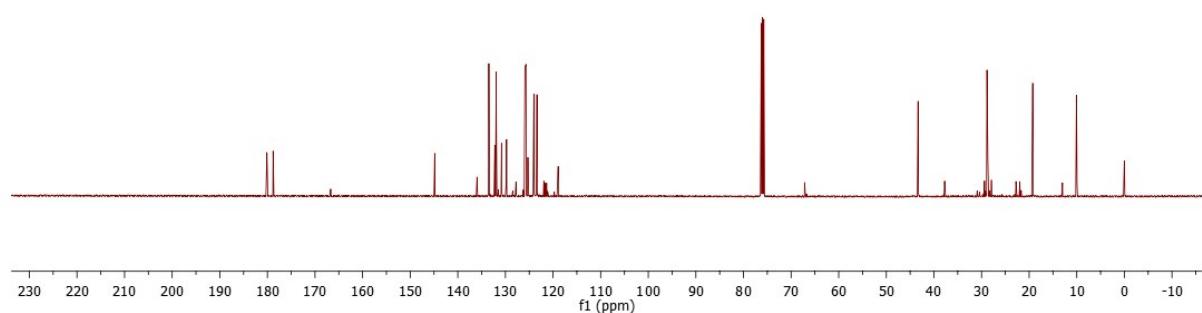
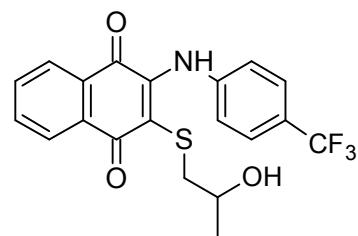
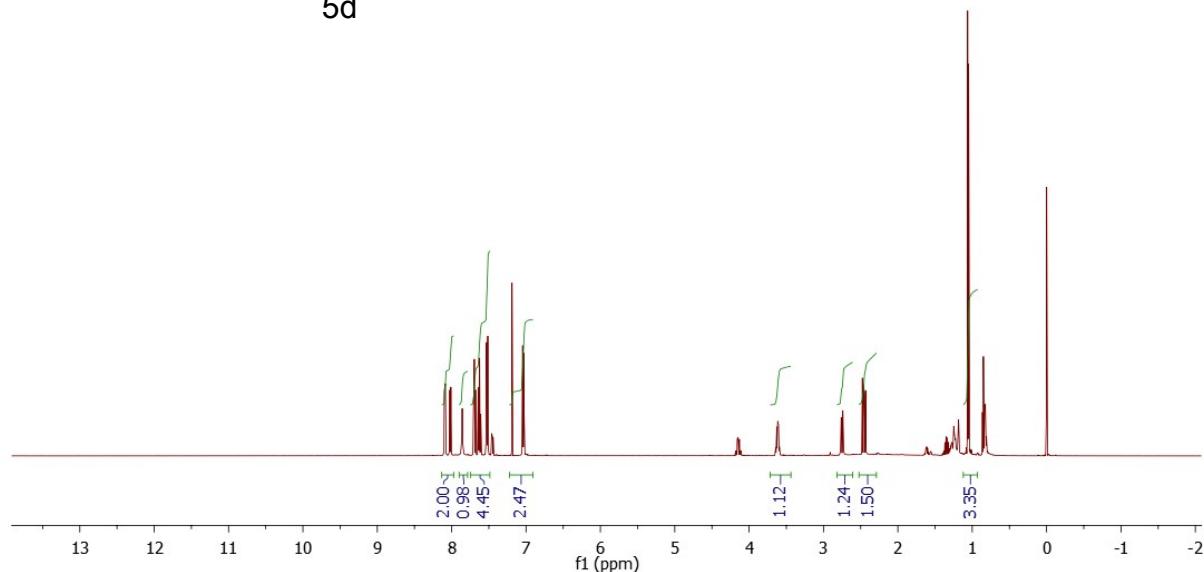


Figure S15: ^1H and ^{13}C spectra of compound 5c

PROTON_01
TS6_H1



5d



CARBON_01
TS6_C13

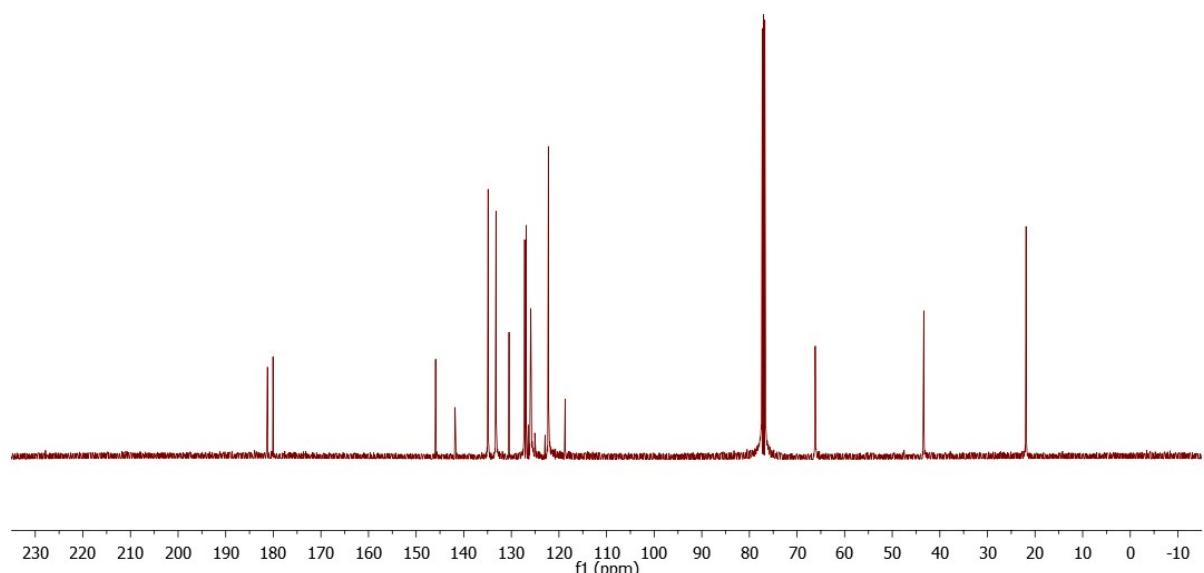
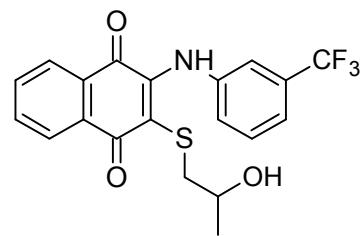
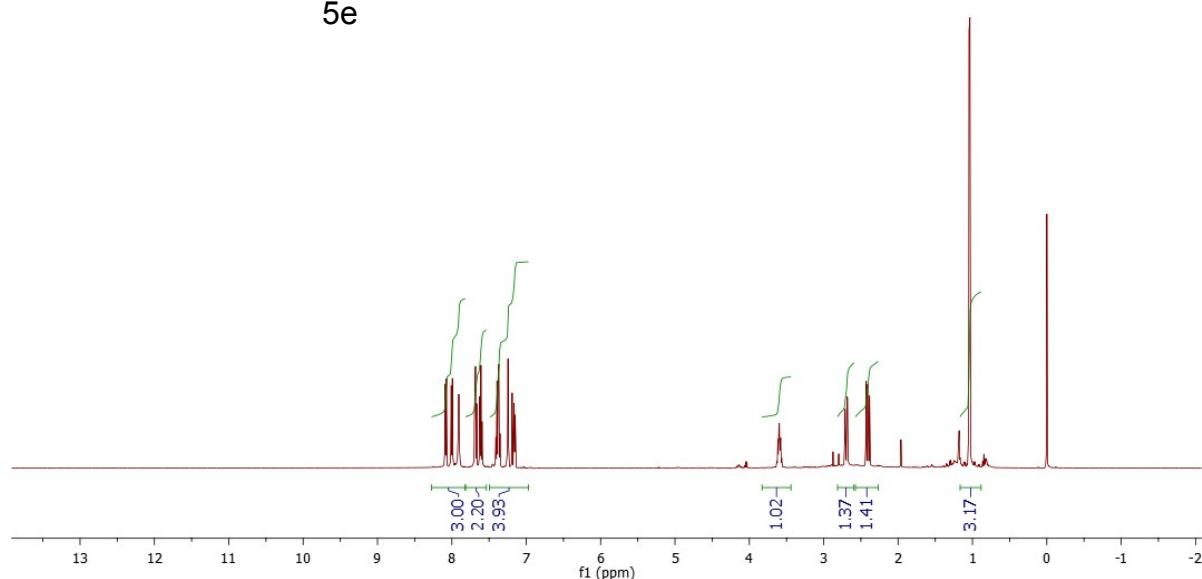


Figure S16: ^1H and ^{13}C spectra of compound 5d

PROTON
TS9_H1



5e



CARBON
TS9_C13

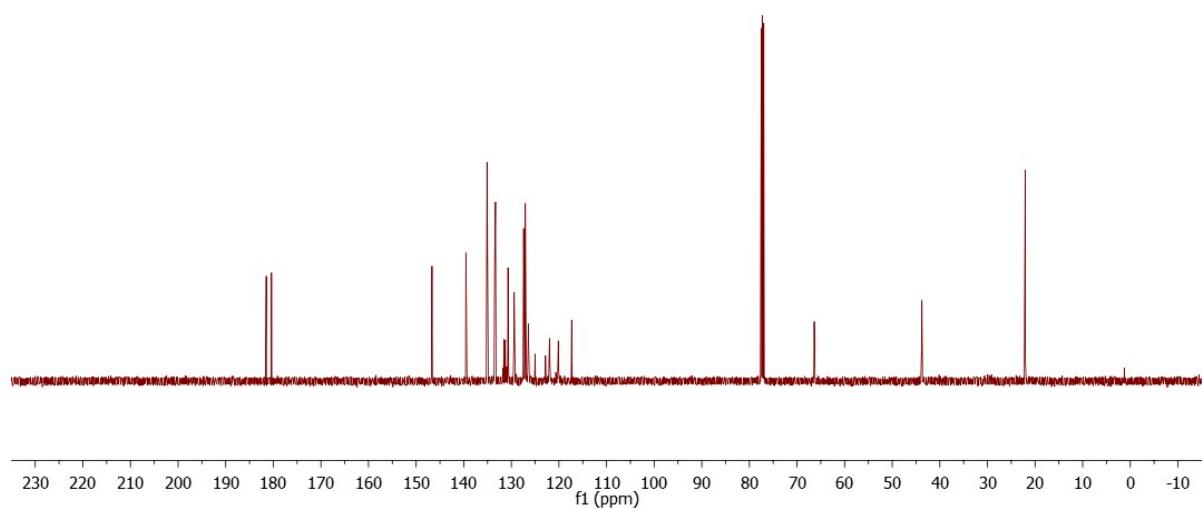
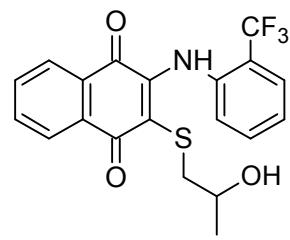
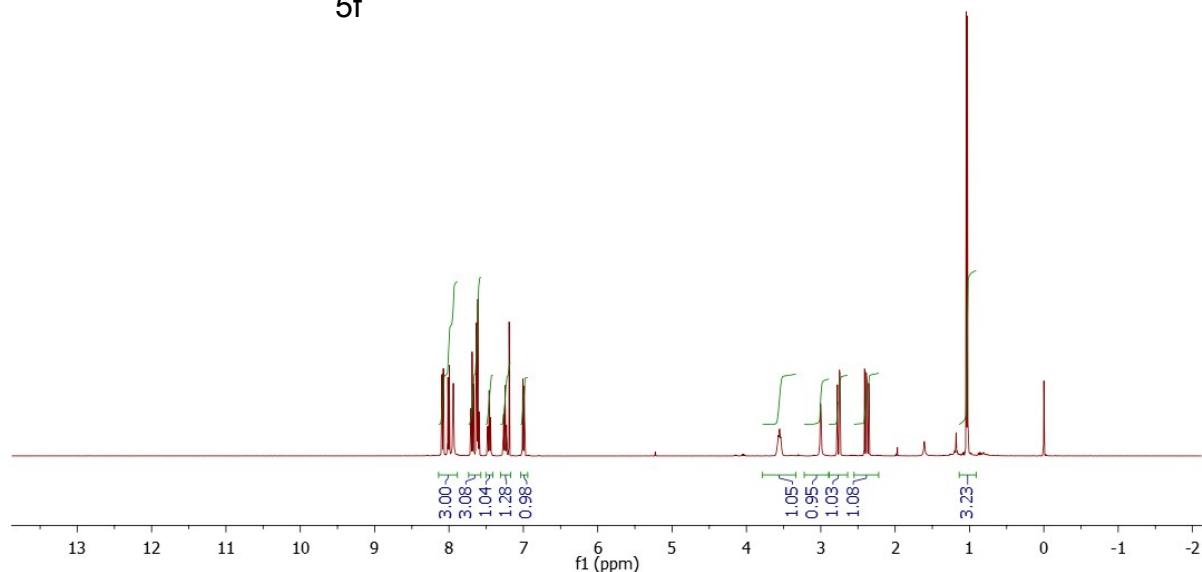


Figure S17: ^1H and ^{13}C spectra of compound 5e

PROTON_01
TS14_H1



5f



CARBON
TS14_C13

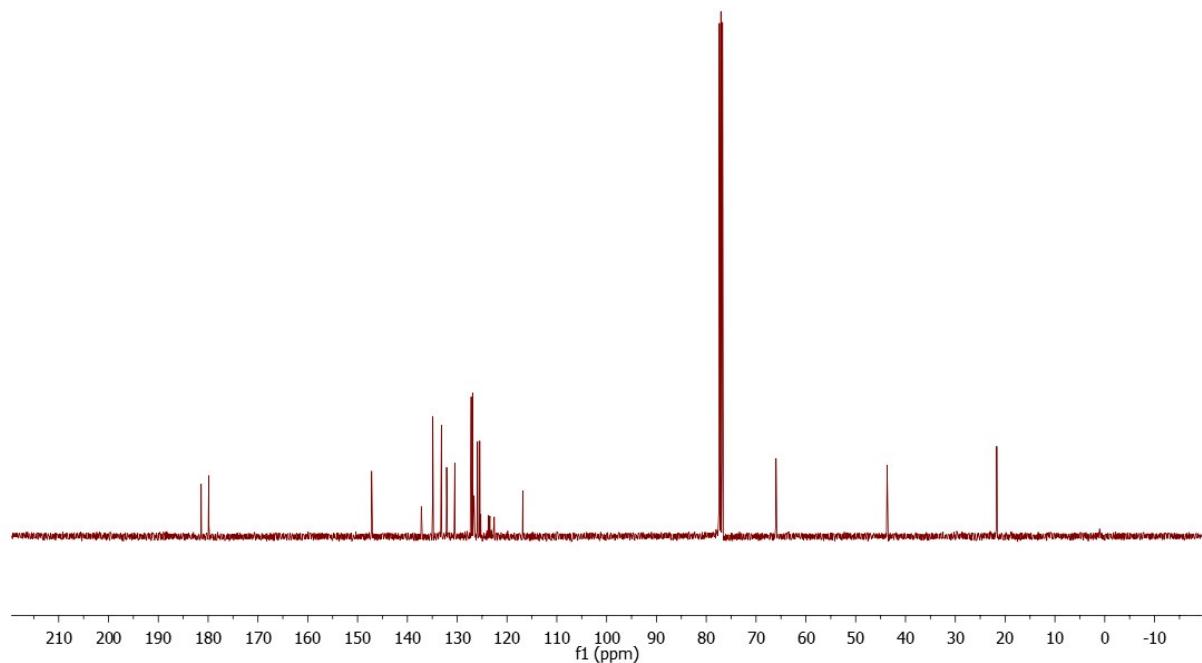
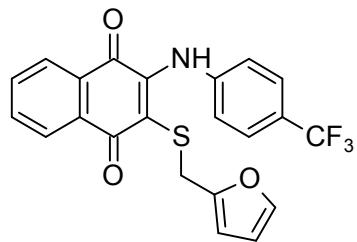
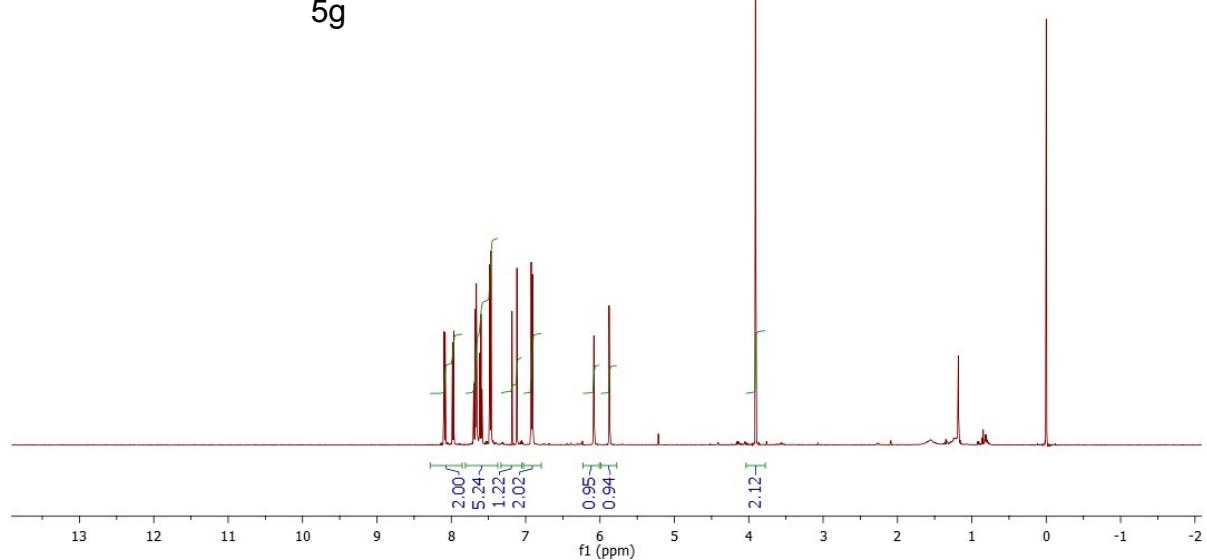


Figure S18: ¹H and ¹³C spectra of compound **5f**

PROTON
TS7_3_H1



5g



CARBON
TS7_3_C13

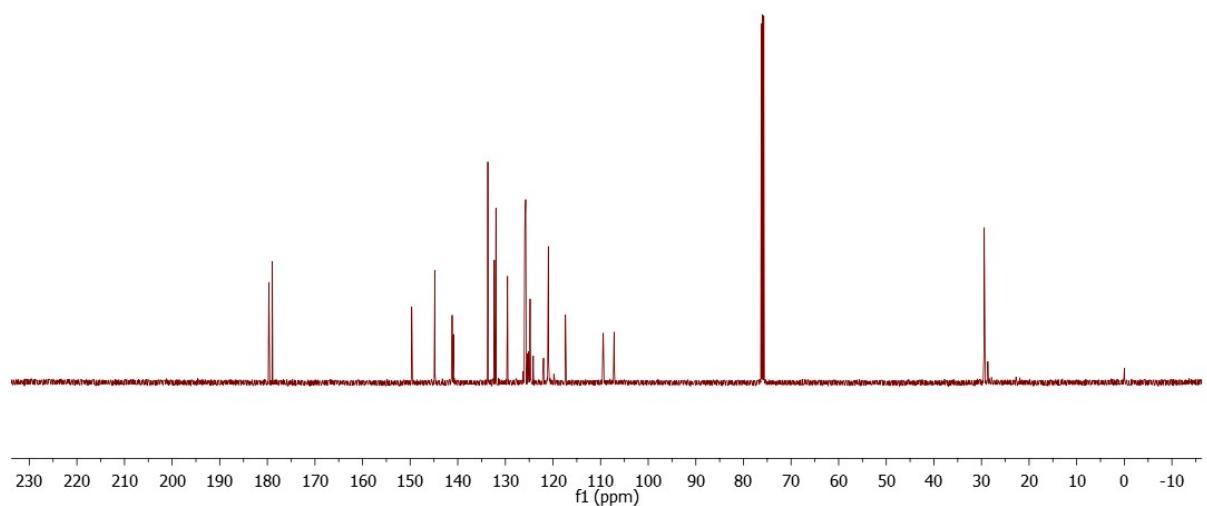
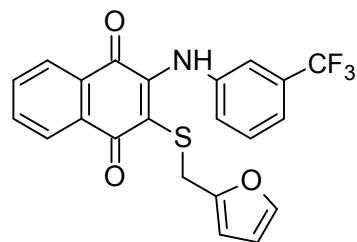
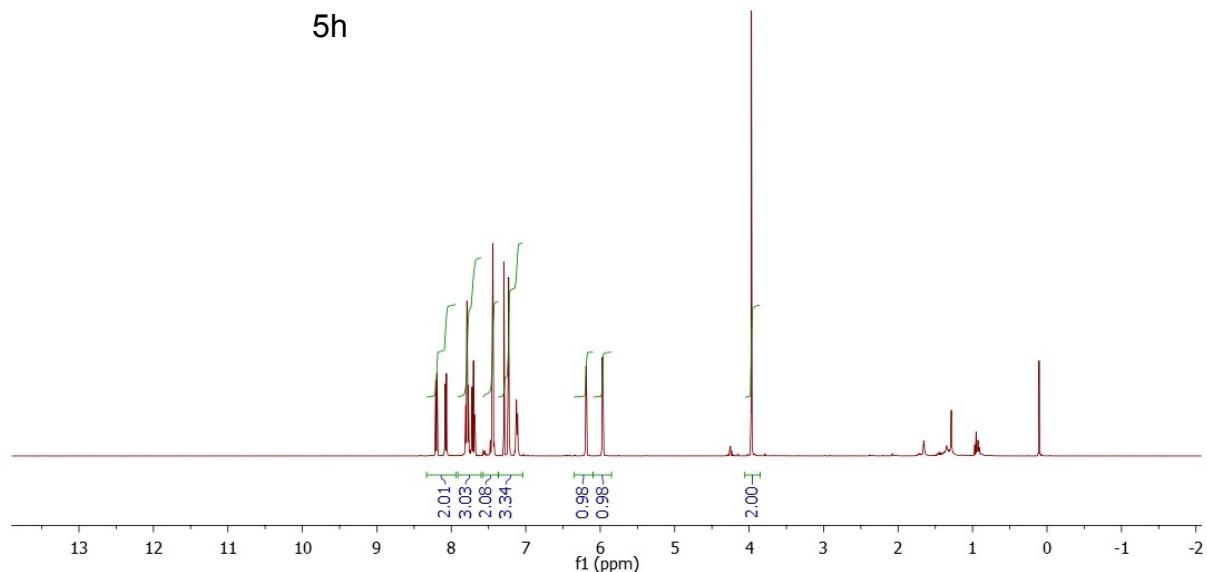


Figure S19: ^1H and ^{13}C spectra of compound 5g

PROTON_01
TS11_H1



5h



CARBON
TS11_C13

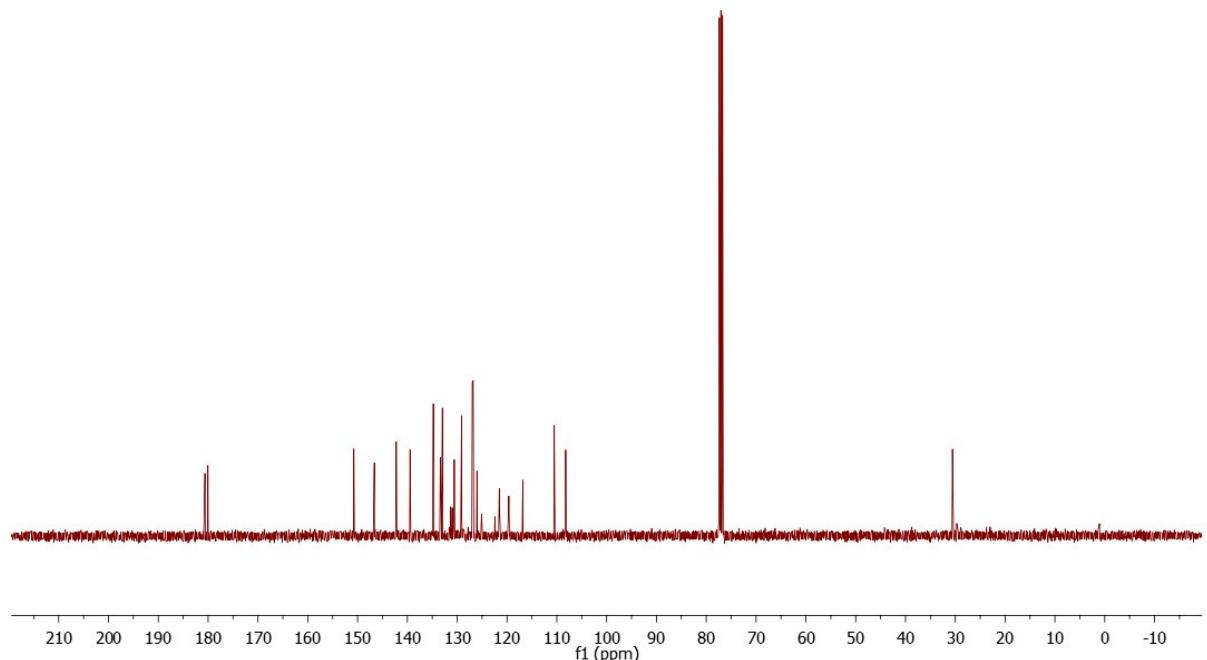
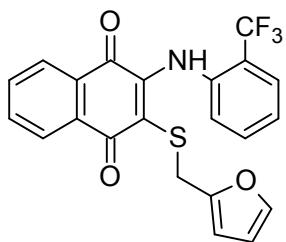
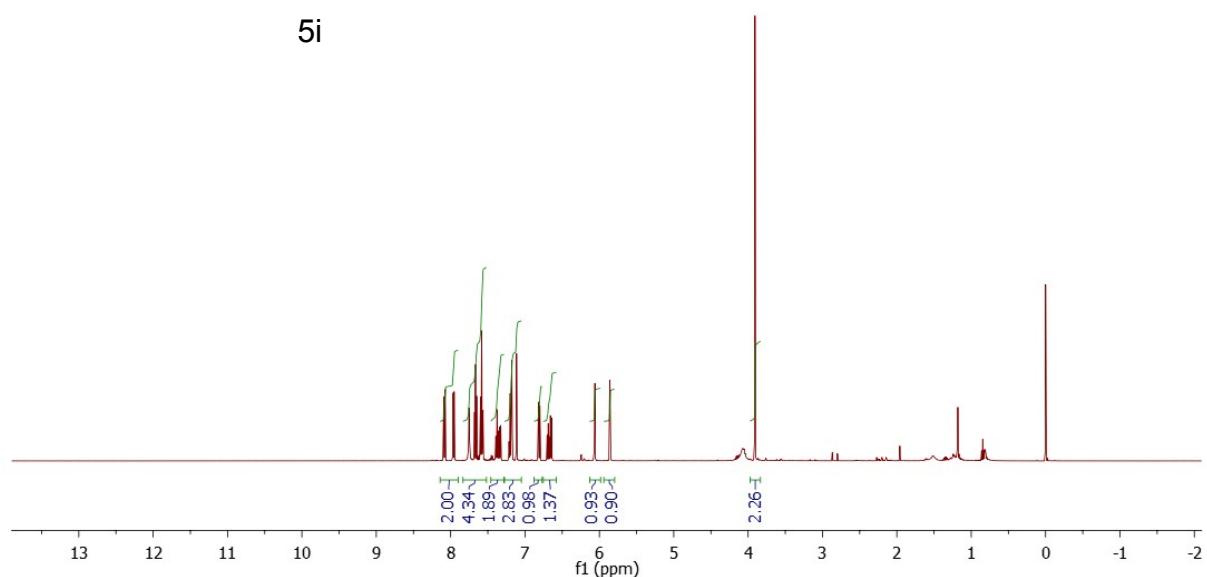


Figure S20: ¹H and ¹³C spectra of compound **5h**

PROTON
TS15_H1



5i



CARBON
TS15_C13

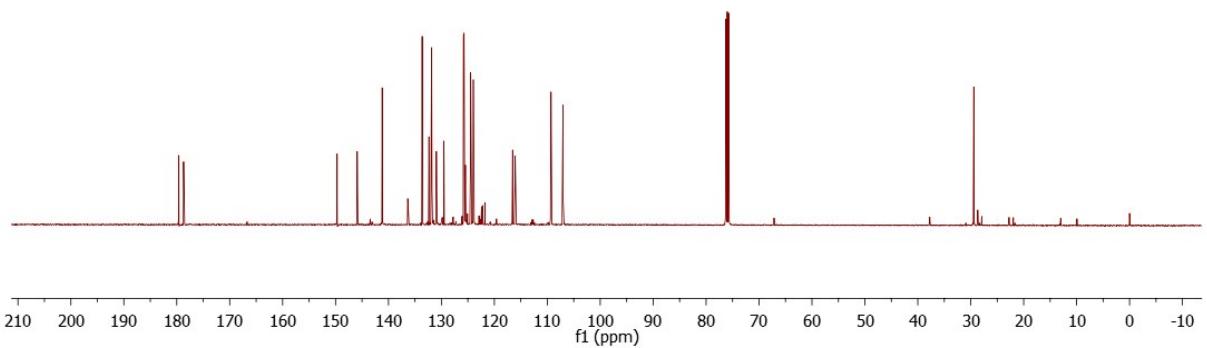


Figure S21: ¹H and ¹³C spectra of compound **5i**

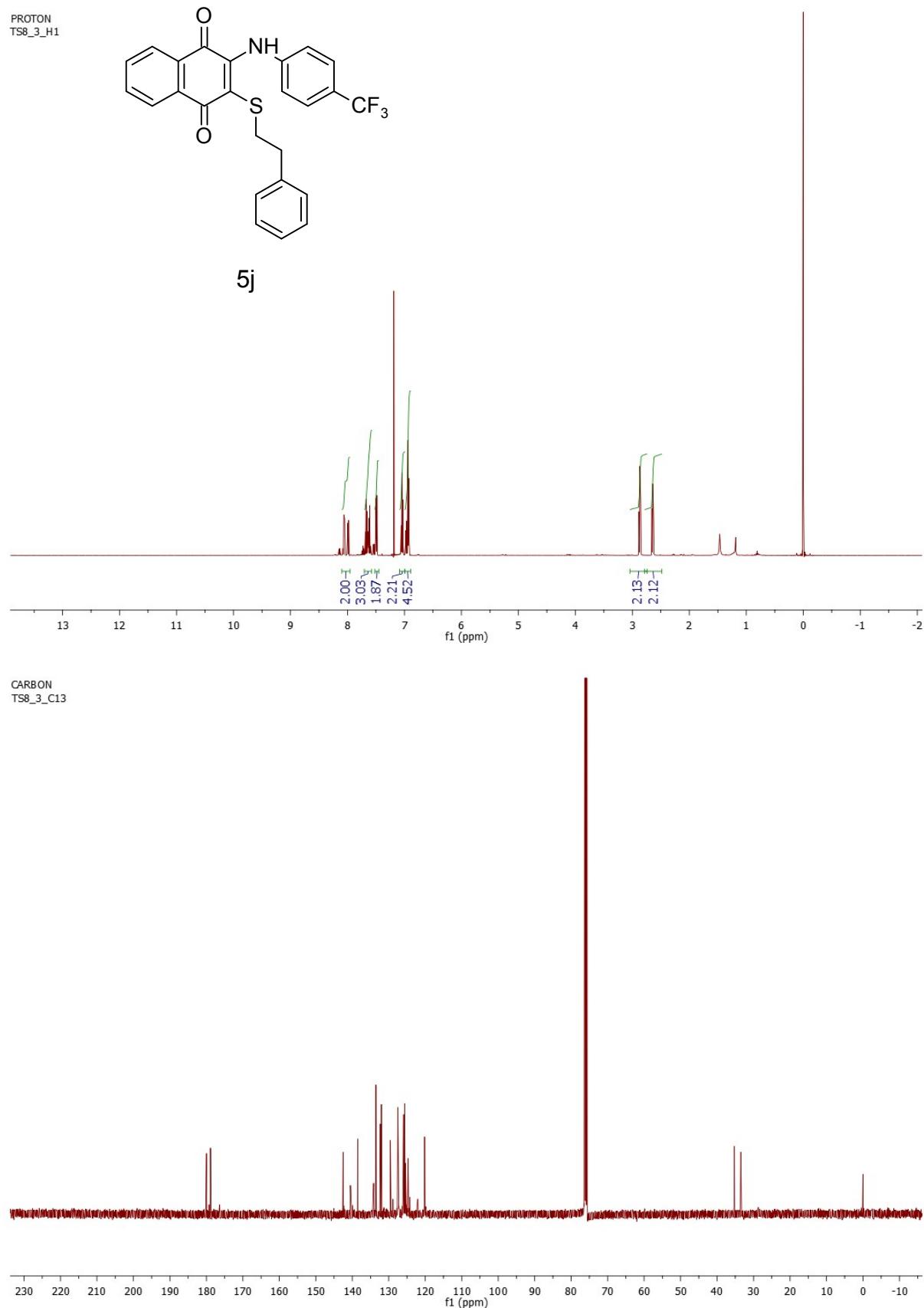
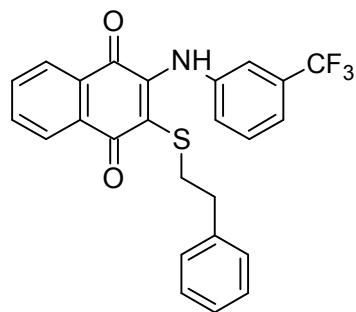
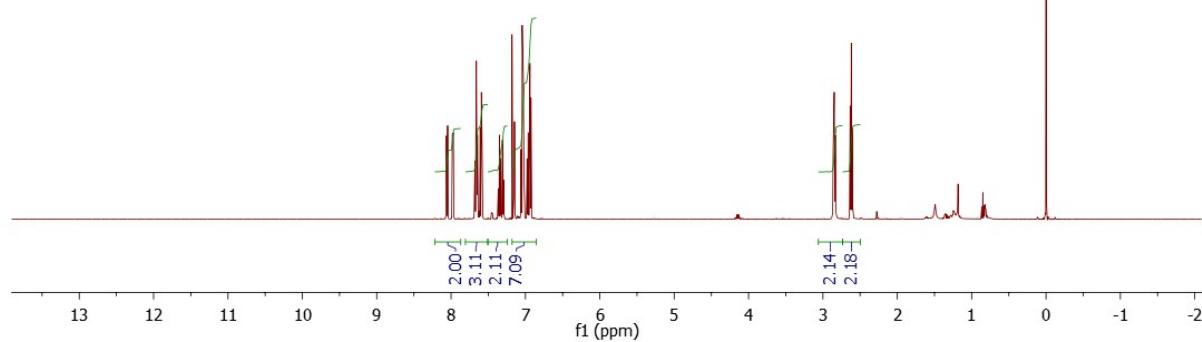


Figure S22: ^1H and ^{13}C spectra of compound **5j**

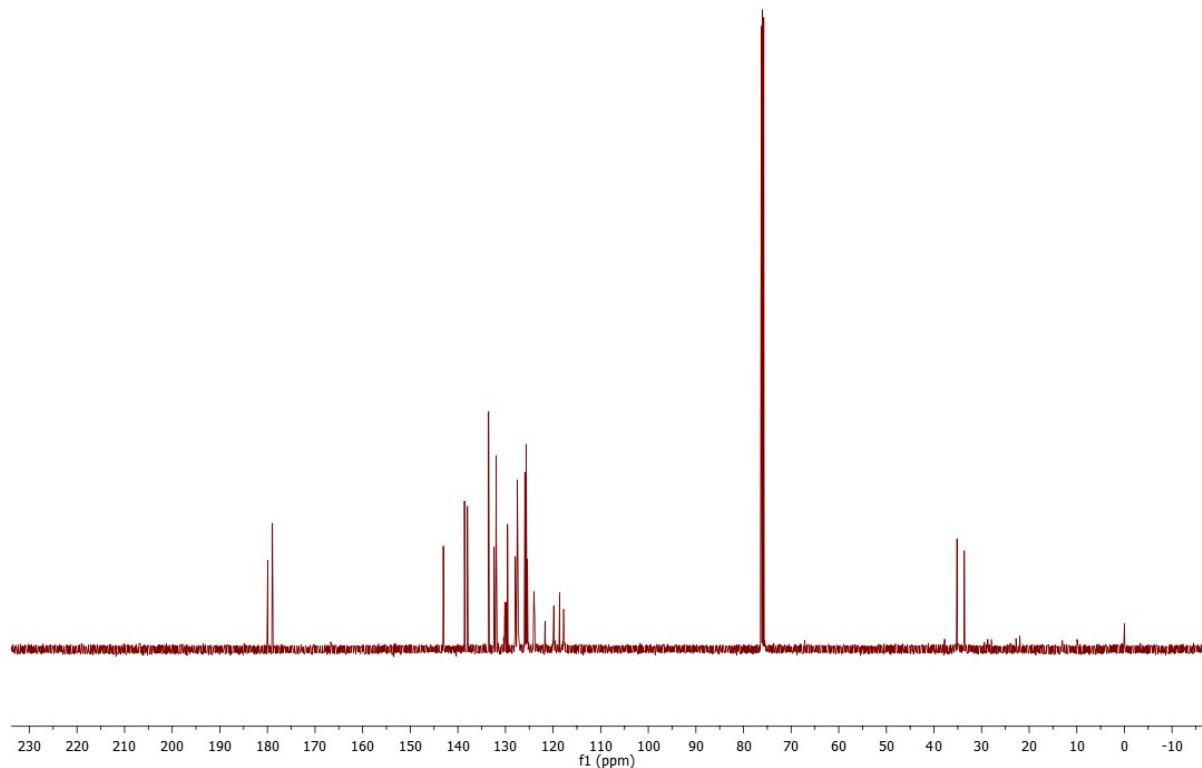
PROTON
TS12_2_H1



5k



CARBON
TS12_2_C13



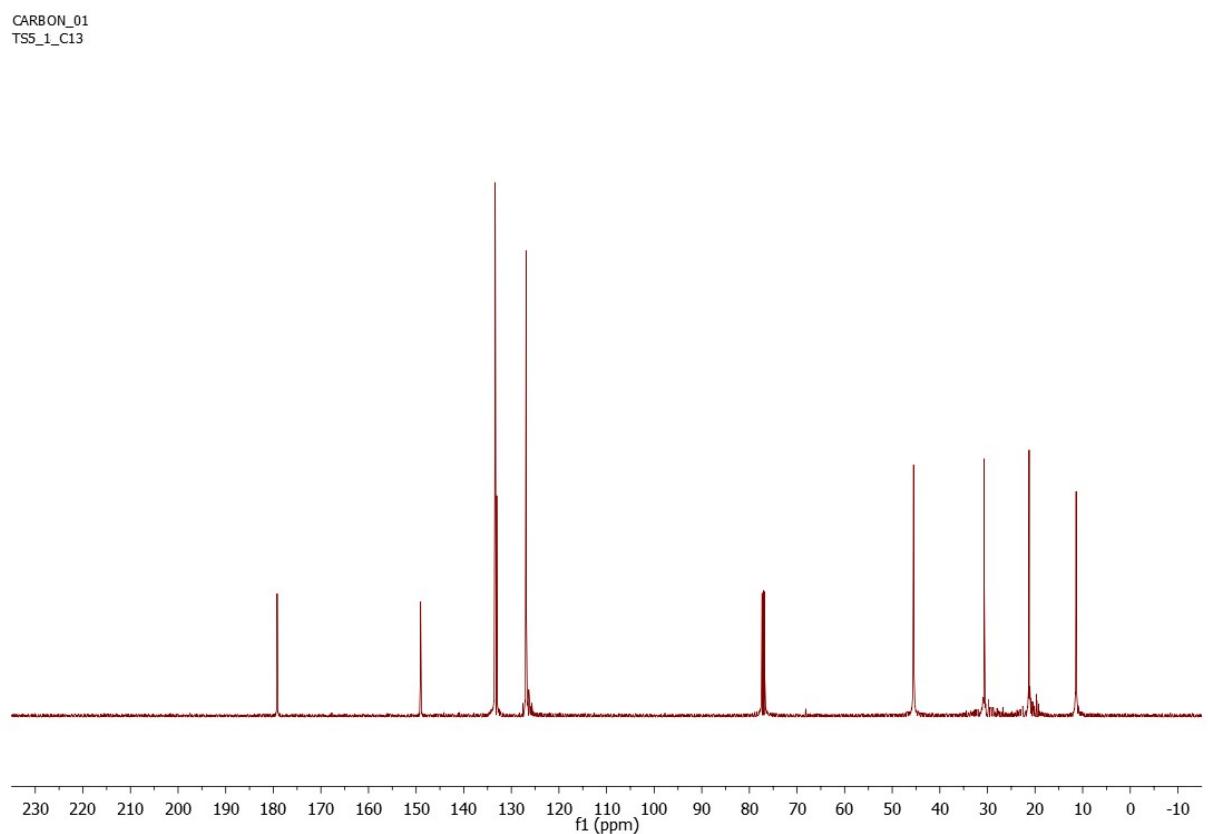
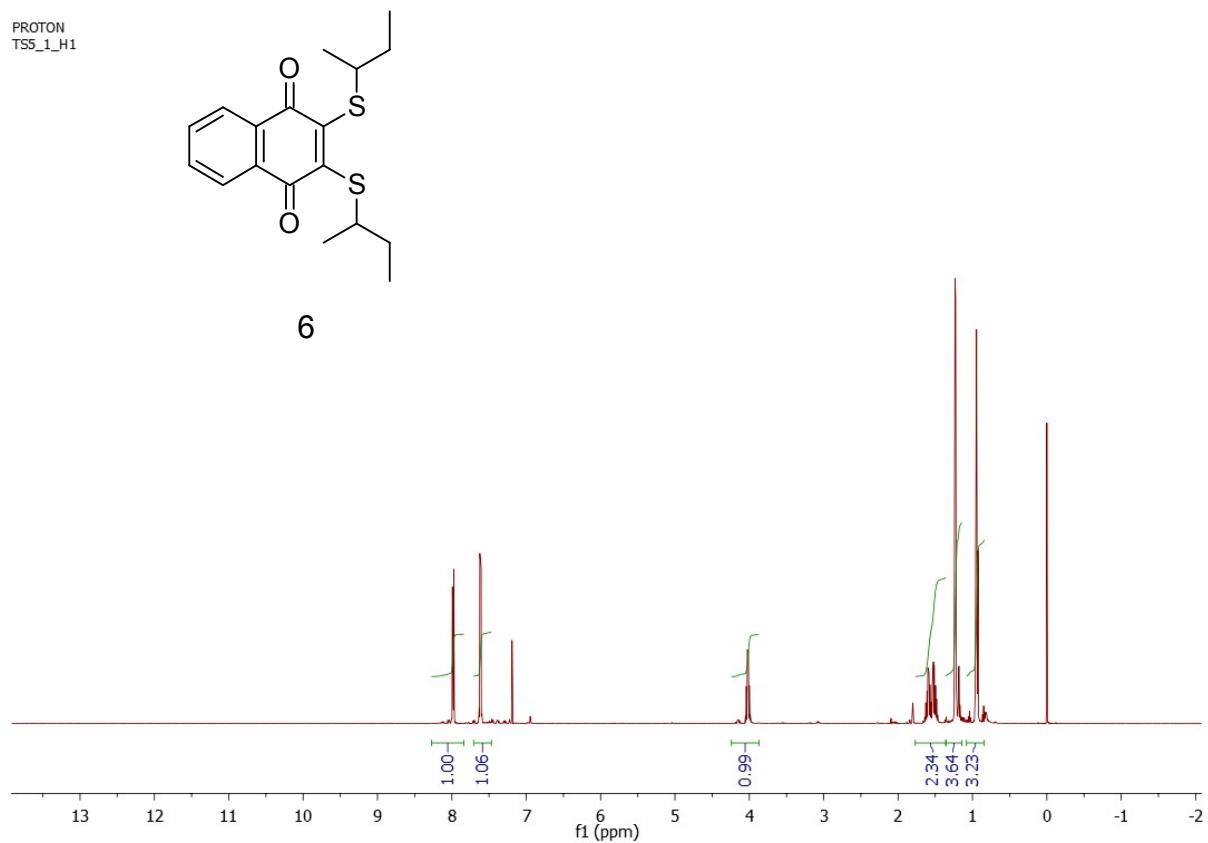
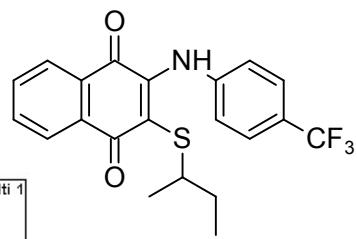
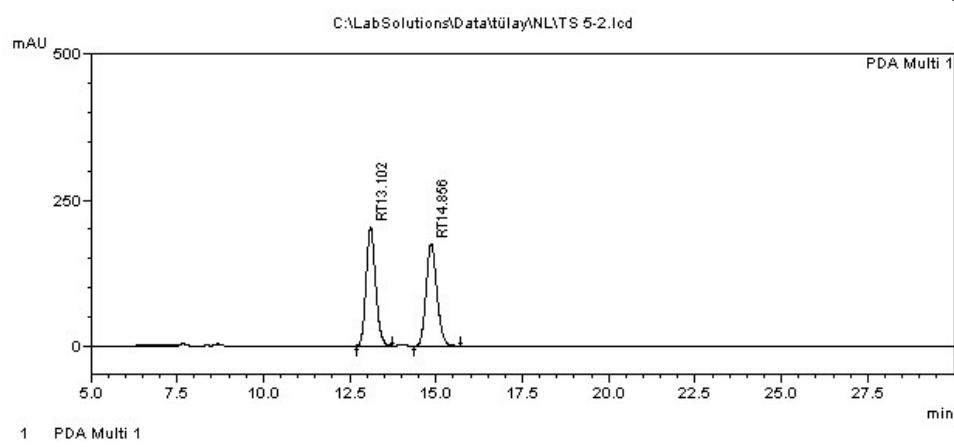


Figure S24: ^1H and ^{13}C spectra of compound **6**

<Chromatogram>



5a

1 PDA Multi 1

<Results>

PDA Ch1 287 nm 4nm

Peak #	Ret. Time	Area	Height	Area %	Height %	Resolution
1	13.102	3872931	202611	50.384	53.606	0.000
2	14.856	3813843	175355	49.616	46.394	3.274
Total		7686774	377967	100.000	100.000	

Figure S25: Purity chromatogram of compound 5a

Column : 25 cm Chiralpac AD-H Chiral

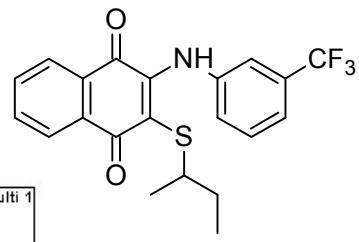
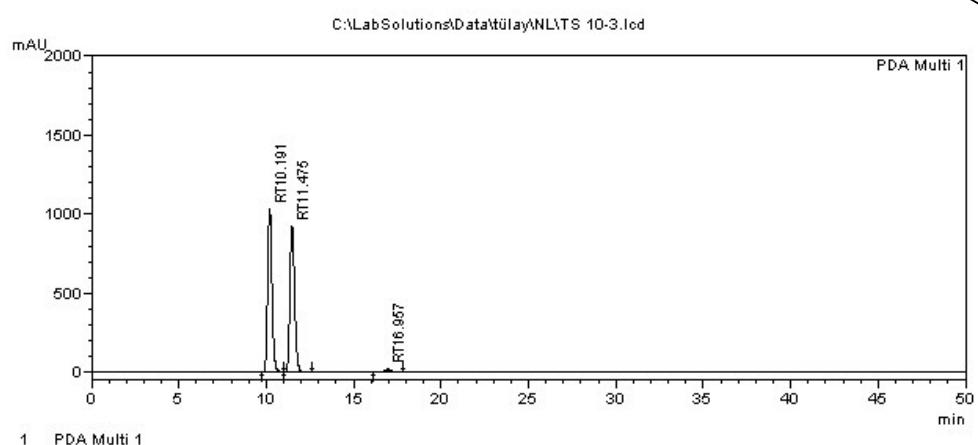
Mobile Phase : Hexane:2-Propanol (85:15)

Wavelength : 254 nm

Flow Rate : 1.0 mL/min

Temperature : 25 °C

<Chromatogram>



1 PDA Multi 1

<Results>

PDA Ch1 285nm 4nm

Peak #	Ret. Time	Area	Height	Area %	Height %	Resolution
1	10.191	17819638	1036145	49.742	52.320	0.000
2	11.475	17463088	923519	48.747	46.633	2.722
3	16.957	541106	20739	1.510	1.047	9.487
Total		35823832	1980403	100.000	100.000	

Figure S26: Purity chromatogram of compound **5b**

Column : 25 cm Chiraldac AD-H Chiral

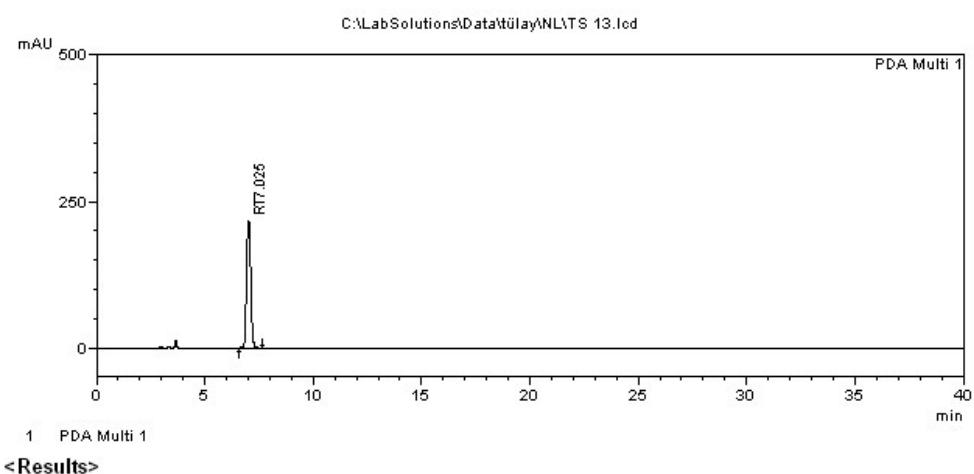
Mobile Phase : Hexane:2-Propanol (95:5)

Wavelength : 254 nm

Flow Rate : 1.0 mL/min

Temperature : 25 °C

<Chromatogram>



<Results>

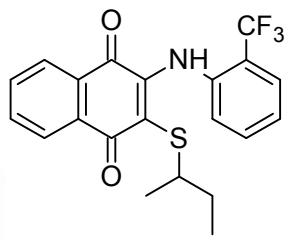


Figure S27: Purity chromatogram of compound **5c**

Column : 25 cm Chiralpac AD-H Chiral

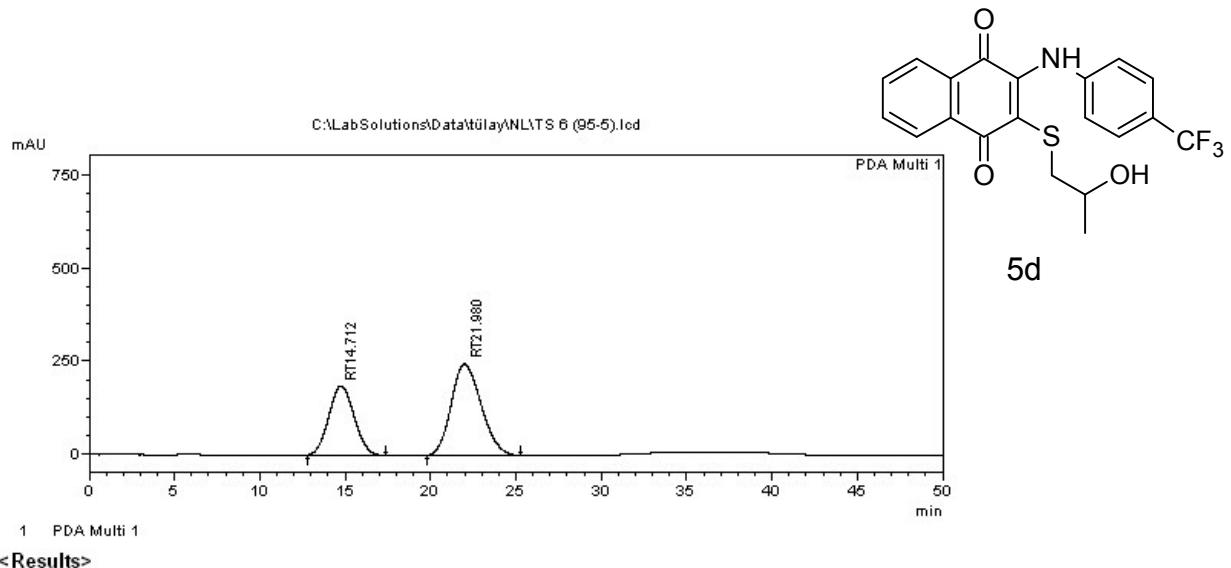
Mobile Phase : Hexane:2-Propanol (85:15)

Wavelength : 254 nm

Flow Rate : 1.0 mL/min

Temperature : 25 °C

PDA Ch1 287nm 4nm						
Peak #	Ret. Time	Area	Height	Area %	Height %	Resolution
1	7.026	2963769	216873	100.000	100.000	0.000
Total		2963769	216873	100.000	100.000	



<Results>

PDA Ch1 285nm 4nm

Peak #	Ret. Time	Area	Height	Area %	Height %	Resolution
1	14.721	19300905	185583	39.218	43.145	0.000
2	22.004	29913201	244568	60.782	56.855	2.465
Total		49214106	430141	100.000	100.000	

Figure S28: Purity chromatogram of compound **5d**

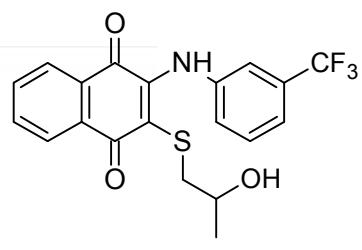
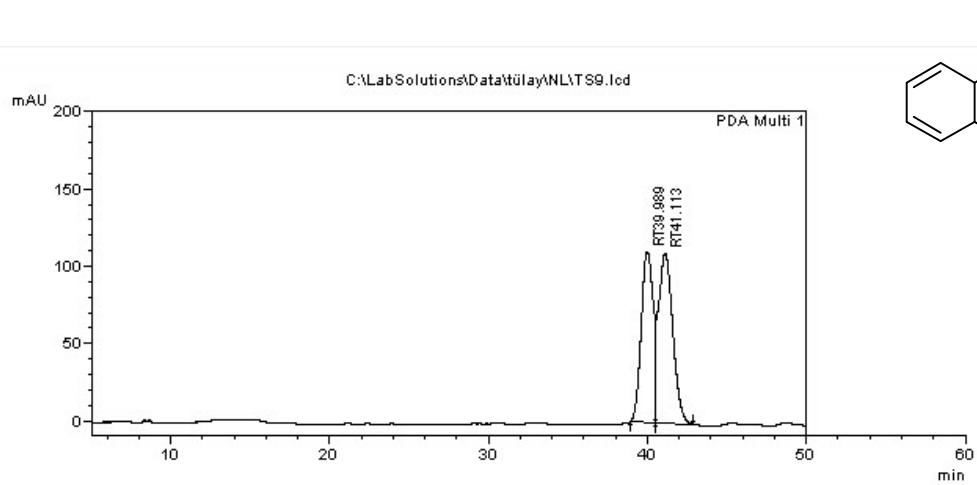
Column : 25 cm Chiraldac AD-H Chiral

Mobile Phase : Hexane:2-Propanol (95:5)

Wavelength : 254 nm

Flow Rate : 1.0 mL/min

Temperature : 25 °C



PDA Ch1 280nm 4nm

Peak #	Ret. Time	Area	Height	Area %	Height %	Resolution
1	39.989	5852746	110629	46.047	50.083	0.000
2	41.113	6857626	110264	53.953	49.917	0.527
Total		12710372	220892	100.000	100.000	

Figure S29: Purity chromatogram of compound **5e**

Column : 25 cm Chiraldpac AD-H Chiral

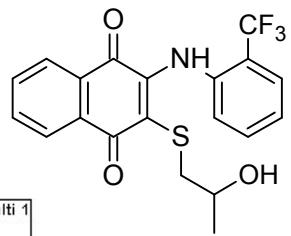
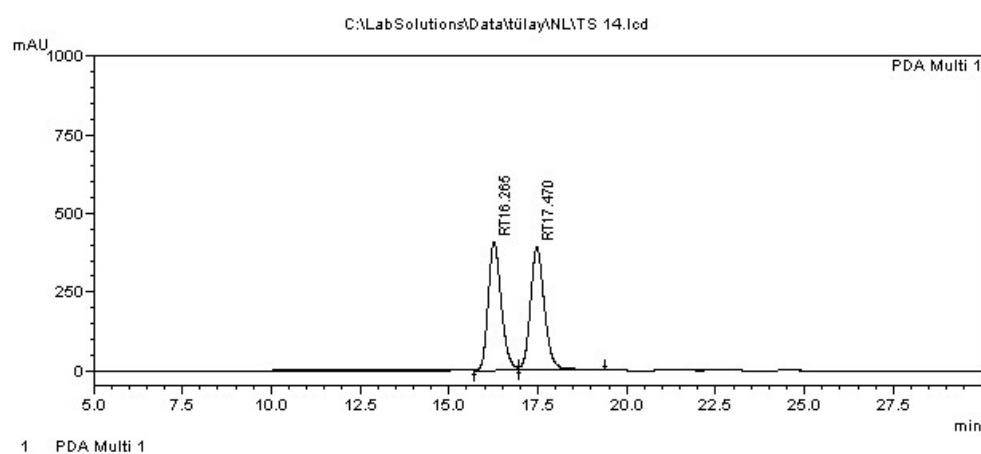
Mobile Phase : Hexane:2-Propanol (85:15)

Wavelength : 254 nm

Flow Rate : 1.0 mL/min

Temperature : 25 °C

<Chromatogram>



<Results>

PDA Ch1 287 nm 4nm

Peak #	Ret. Time	Area	Height	Area %	Height %	Resolution
1	16.265	10440303	407619	48.981	51.041	0.000
2	17.470	10883476	390997	51.039	48.959	1.749
Total		21323779	798616	100.000	100.000	

Figure S30: Purity chromatogram of compound **5f**

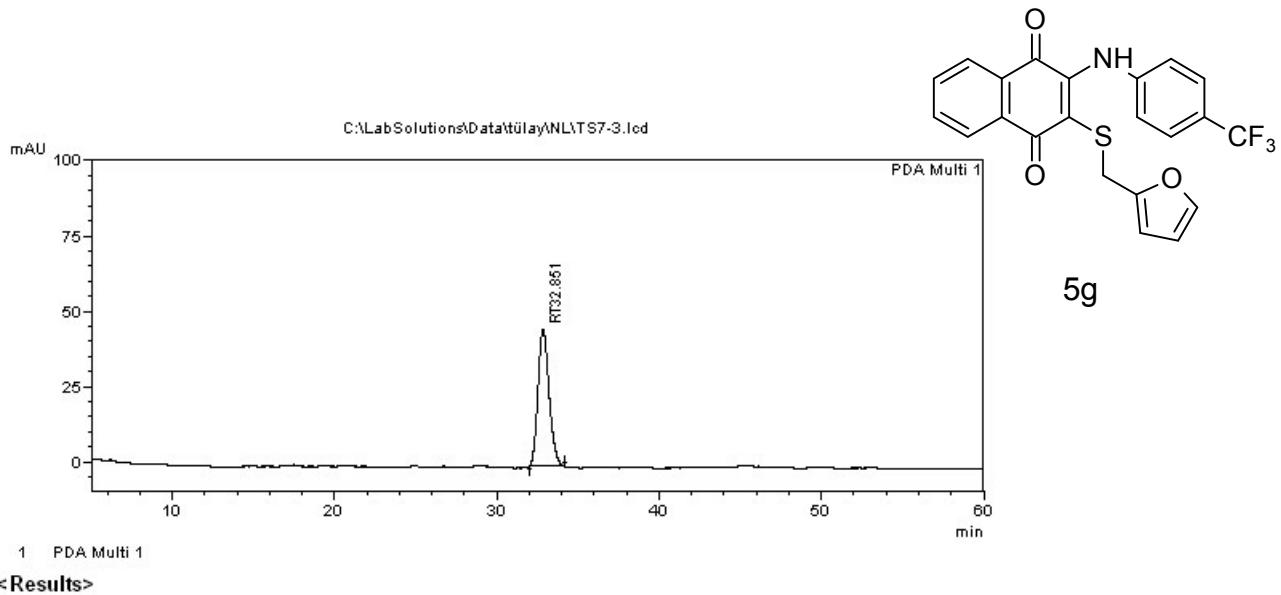
Column : 25 cm Chiraldac AD-H Chiral

Mobile Phase : Hexane:2-Propanol (85:15)

Wavelength : 254 nm

Flow Rate : 1.0 mL/min

Temperature : 25 °C



PDA Ch1 254nm 4nm						
Peak #	Ret. Time	Area	Height	Area %	Height %	Resolution
1	32.861	2160614	45240	100.000	100.000	0.000
Total		2160614	45240	100.000	100.000	

Figure S31: Purity chromatogram of compound **5g**

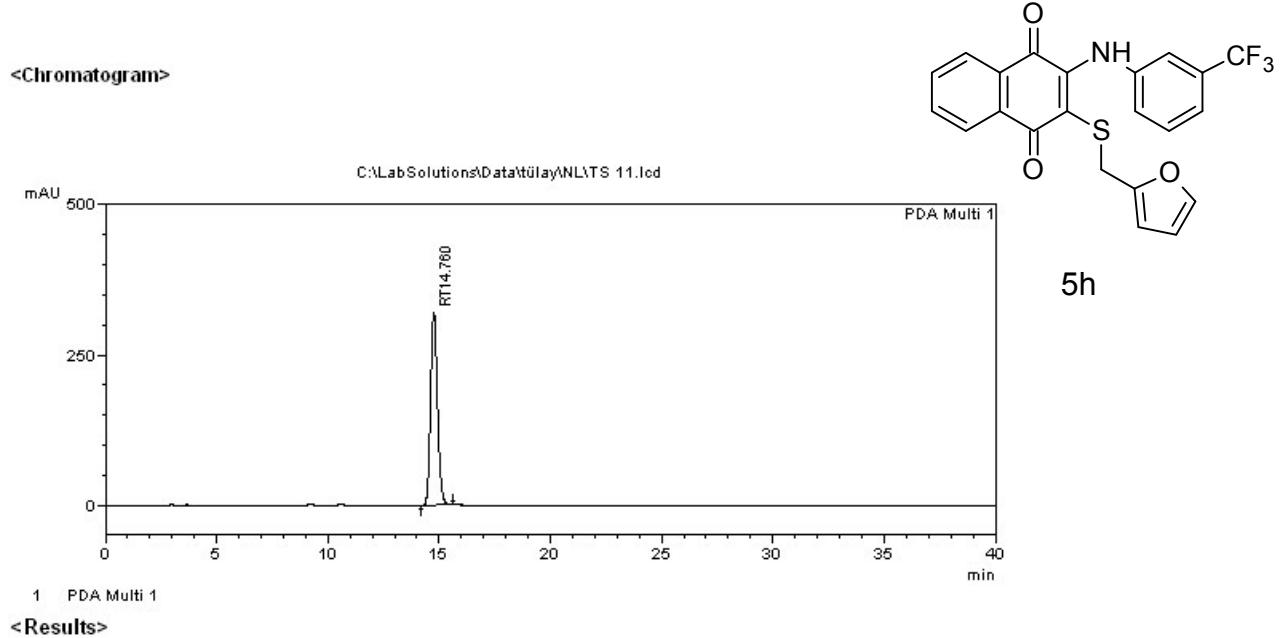
Column : 25 cm Chiraldpac AD-H Chiral

Mobile Phase : Hexane:2-Propanol (85:15)

Wavelength : 254 nm

Flow Rate : 1.0 mL/min

Temperature : 25 °C



<Results>

PDA Ch1 287 nm 4 nm

Peak #	Ret. Time	Area	Height	Area %	Height %	Resolution
1	14.760	6927241	320608	100.000	100.000	0.000
Total		6927241	320608	100.000	100.000	

Figure S32: Purity chromatogram of compound **5h**

Column : 25 cm Chiralpac AD-H Chiral

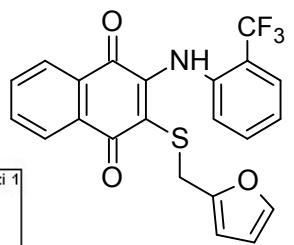
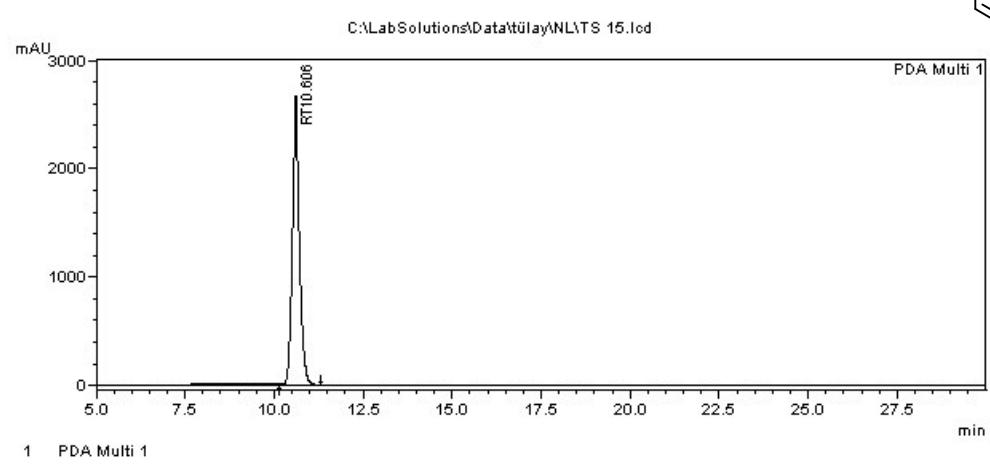
Mobile Phase : Hexane:2-Propanol (85:15)

Wavelength : 254 nm

Flow Rate : 1.0 mL/min

Temperature : 25 °C

<Chromatogram>



<Results>

PDA Ch1 254nm 4nm

Peak #	Ret. Time	Area	Height	Area %	Height %	Resolution
1	10.606	35701235	2665074	100.000	100.000	0.000
Total		35701235	2665074	100.000	100.000	

Figure S33: Purity chromatogram of compound **5i**

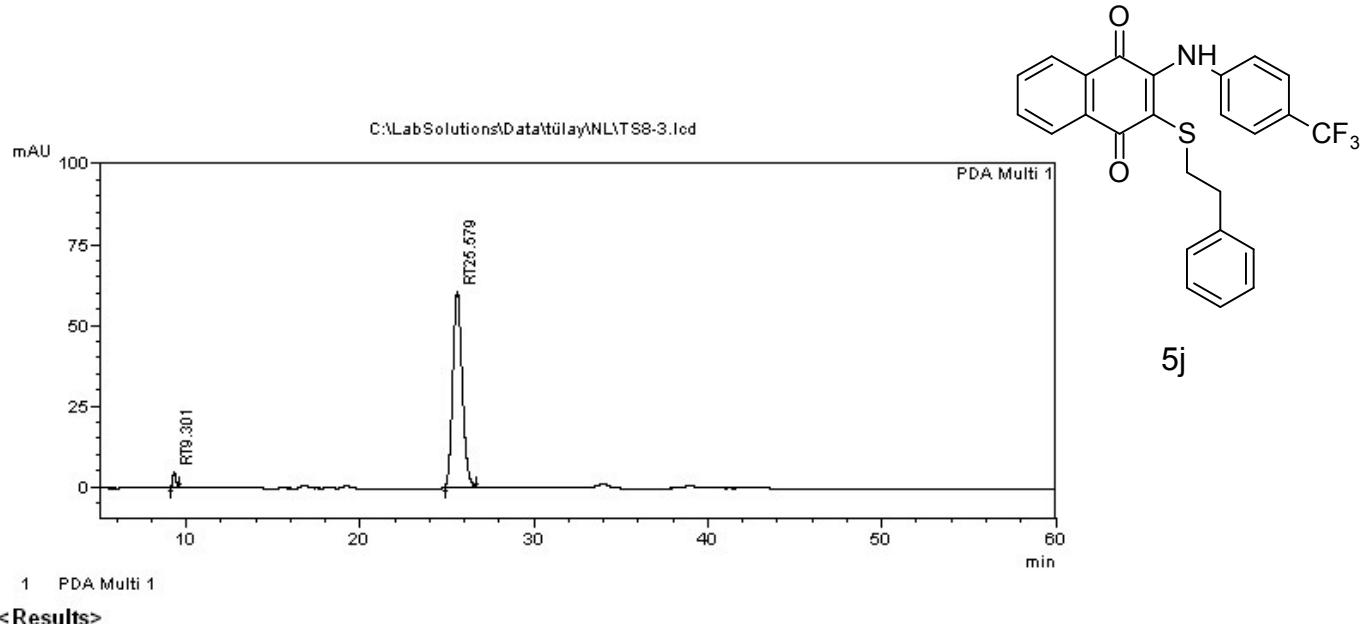
Column : 25 cm Chiralpac AD-H Chiral

Mobile Phase : Hexane:2-Propanol (85:15)

Wavelength : 254 nm

Flow Rate : 1.0 mL/min

Temperature : 25 °C



<Results>

PDA Ch1 290nm 4nm

Peak #	Ret. Time	Area	Height	Area %	Height %	Resolution
1	9.303	57560	4679	2.461	7.216	0.000
2	25.580	2281277	60163	97.539	92.784	24.460
Total		2338836	64842	100.000	100.000	

Figu

re S34: Purity chromatogram of compound **5j**

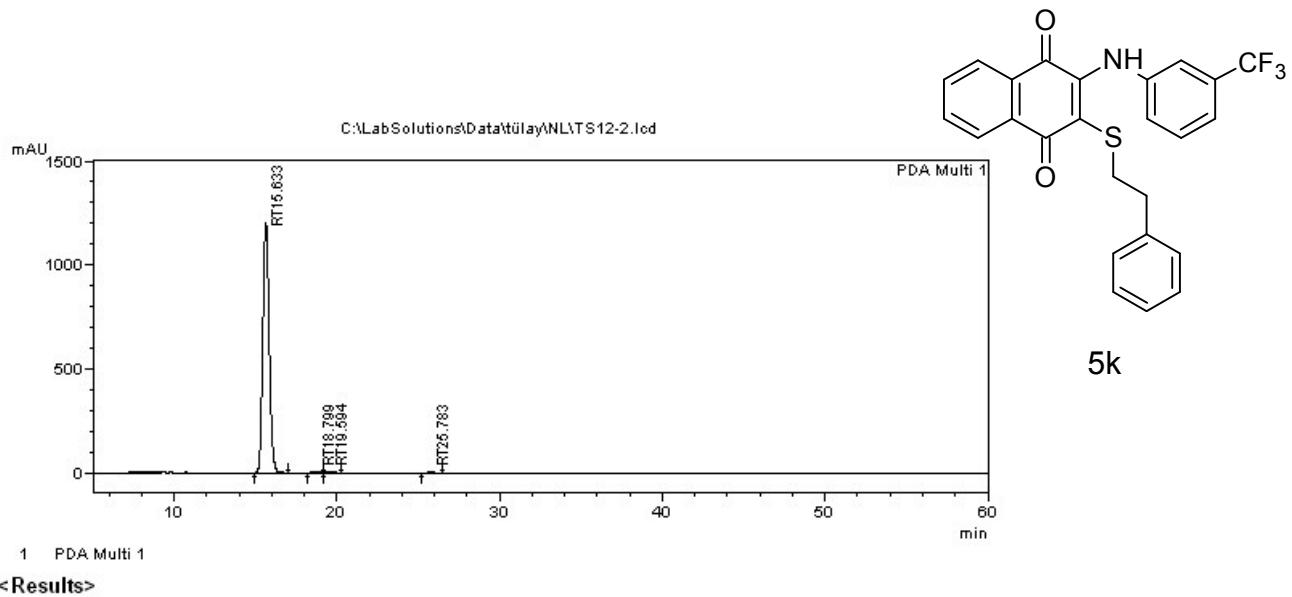
Column : 25 cm Chiraldac AD-H Chiral

Mobile Phase : Hexane:2-Propanol (85:15)

Wavelength : 254 nm

Flow Rate : 1.0 mL/min

Temperature : 25 °C



PDA Ch1 287nm 4nm						
Peak #	Ret. Time	Area	Height	Area %	Height %	Resolution
1	15.633	32664839	1202608	99.563	99.636	0.000
2	18.799	57334	1781	0.175	0.148	4.131
3	19.594	56503	1812	0.172	0.150	0.961
4	25.783	29471	804	0.090	0.067	6.946
Total		32808148	1207004	100.000	100.000	

Figure S35: Purity chromatogram of compound **5k**

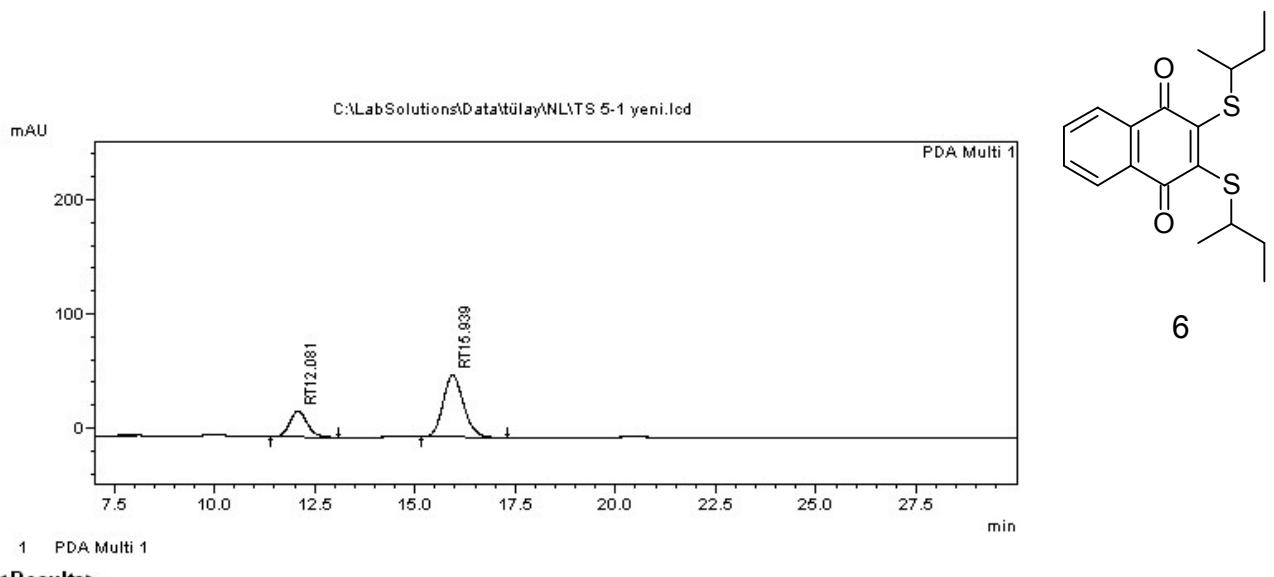
Column : 25 cm Chiralpac AD-H Chiral

Mobile Phase : Hexane:2-Propanol (85:15)

Wavelength : 254 nm

Flow Rate : 1.0 mL/min

Temperature : 25 °C



<Results>

PDA Ch1 285nm 4nm

Peak #	Ret. Time	Area	Height	Area %	Height %	Resolution
1	12.081	686115	22327	26.191	29.182	0.000
2	15.939	1933504	54185	73.809	70.818	4.446
Total		2619619	76512	100.000	100.000	

Figure S36: Purity chromatogram of compound 6

Column : 25 cm Chiraldac AD-H Chiral

Mobile Phase : Hexane:2-Propanol (95:5)

Wavelength : 254 nm

Flow Rate : 1.0 mL/min

Temperature : 25 °C