

Supporting Information

Construction of 1,3,4-Oxadiazole and 1,3,4-Thiadiazole Library with a High Level of Skeletal Diversity based on Branching Diversity-oriented Synthesis on Solid-phase

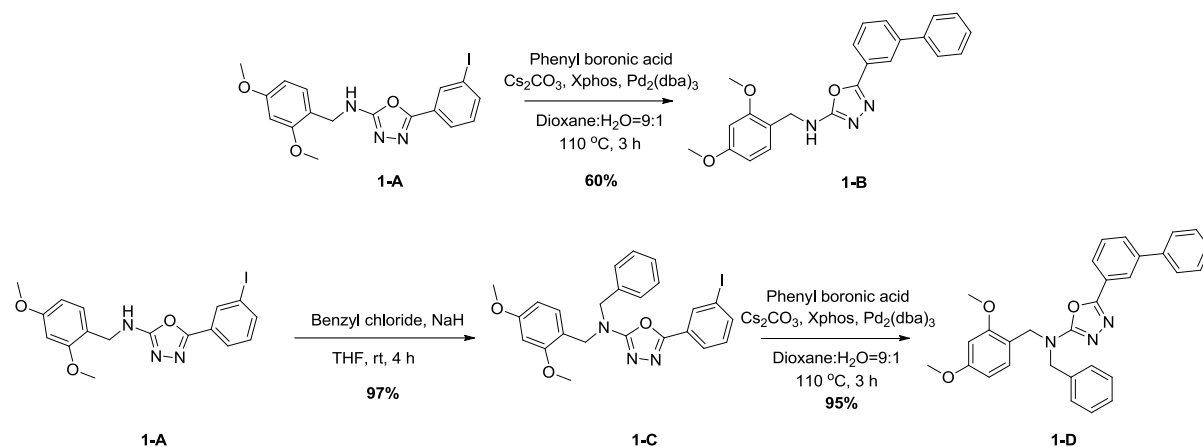
Ji-Eun Ha, Seung-Ju Yang, Young-Dae Gong*

*Innovative Drug Library Research Center, Department of Chemistry, College of Science,
Dongguk University, 26, 3-ga, Pil-dong, Jung-gu, Seoul 04620, Korea*

* Corresponding author. Tel. : +82-2-2260-3206, Fax : +82-2-2290-1349 ; e-mail: ydgong@dongguk.edu

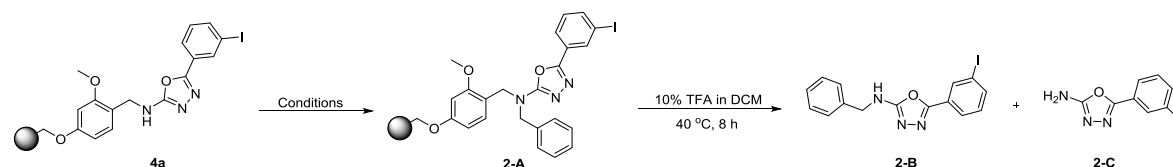
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Scheme S1



: First, we set Suzuki-coupling reaction at early stage rather than *N*-alkylation. However, we obtained desired Suzuki-coupled 1,3,4-oxadiazole **1-B** in low yield (60%). Thus, we introduced alkyl group at 2-amine position, and then conducted Suzuki-coupling. As a result, we obtained desired 1,3,4-oxadiazole **1-D** in high yield (92.2% for two steps).

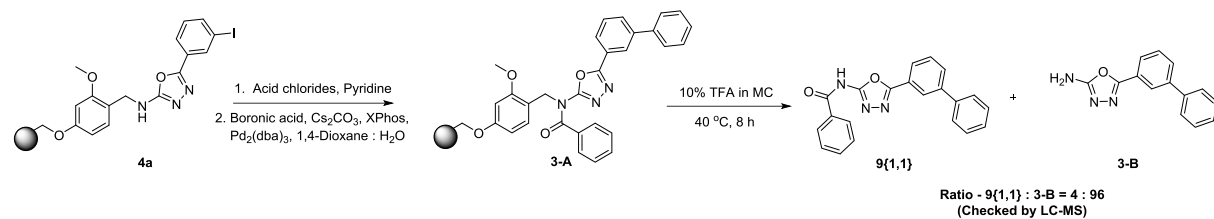
Scheme S2



Entry.	Conditions					Ratio ^a 2-B : 2-C
	4a	Benzyl chloride	base	Solvent	Temp / Time	
1			19 mg NaH 0.795 mmol 5 eq.	DMF		1:4
2			19 mg NaH 0.795 mmol 5 eq.	THF		1:1
3	150 mg 0.159 mmol 1 eq.	91.5 μL 0.795 mmol 5 eq.	64 mg tBuOLi 0.795 mmol 5 eq.	DMF	60 °C / 16 h	1:1
4			64 mg tBuOLi 0.795 mmol 5 eq.	DMF:HMPA 9:1		1:1
5			89.2 mg tBuOK 0.795 mmol 5 eq.	DMF		7:3

^a is checked by LC-MS at 254 nm.

Scheme S3

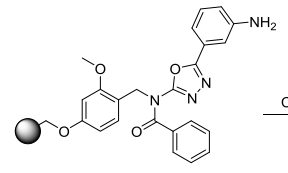


Scheme S4

Entry.	Conditions					Conversion ^a (%)
	10a	isocyanate	base	solvent	Temp / Time	
1			-	DCM 2 mL		78
2			pyridine	64.4 μL 0.795 mmol 5 eq.	THF 2 mL	86
3	150 mg 0.159 mmol 1 eq.	 86.7 μL 0.795 mmol 5 eq.	Et ₃ N	88.7 μL 0.636 mmol 4 eq.	THF 2 mL	50
4			Et ₃ N	110 μL 0.795 mmol 5 eq.	MC 2 mL	73
5			pyridine	64.3 μL 0.795 mmol 5 eq.	THF 2 mL	60 °C / 12 hr >99
6			pyridine	64.4 μL 0.795 mmol 5 eq.	THF 2 mL	60 °C / 12 h 75
7	150 mg 0.159 mmol 1 eq.	 98.2 μL 0.795 mmol 5 eq.	Et ₃ N	111 μL 0.795 mmol 5 eq.	MC 2 mL	rt / 12 h 80
8			DMAP	11 mg 0.087 mmol 0.55 eq	MC 2 mL	60 °C / 12 h >99
9			pyridine	64.3 μL 0.795 mmol 5 eq.	THF 2 mL	60 °C / 12 hr 70
10	150 mg 0.159 mmol 1 eq	 63 μL 0.795 mmol 5 eq	DMAP	11 mg 0.087 mmol 0.55 eq.	MC 2 mL	60 °C / 12 h 75
11			DMAP	11 mg 0.087 mmol 0.55 eq.	MC 2 mL	rt / 12 h >99

^a is checked by LC-MS at 254 nm,

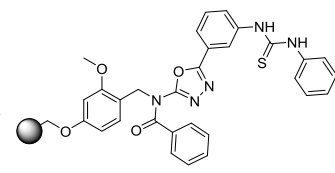
Scheme S5



10a

Conditions

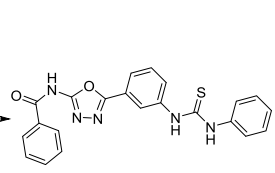
→



5-A

10% TFA in MC
40 °C, 8 h

→

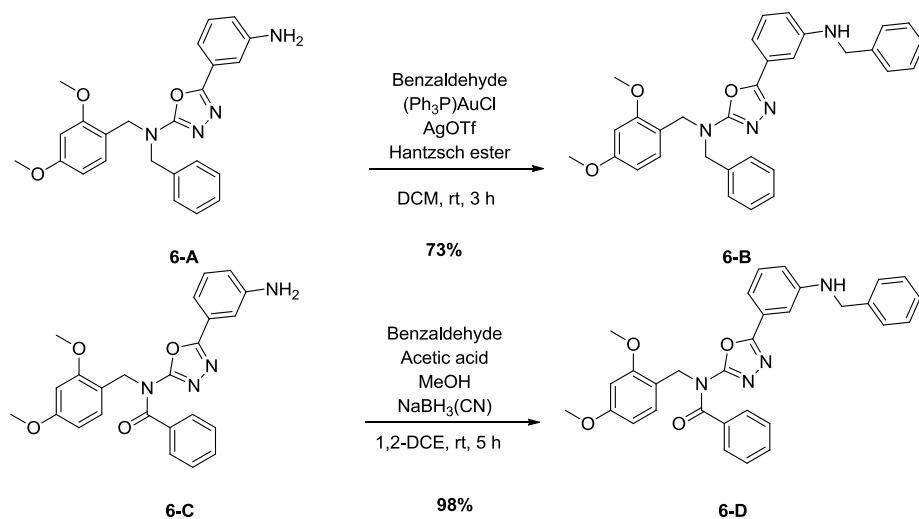


14{1,1}

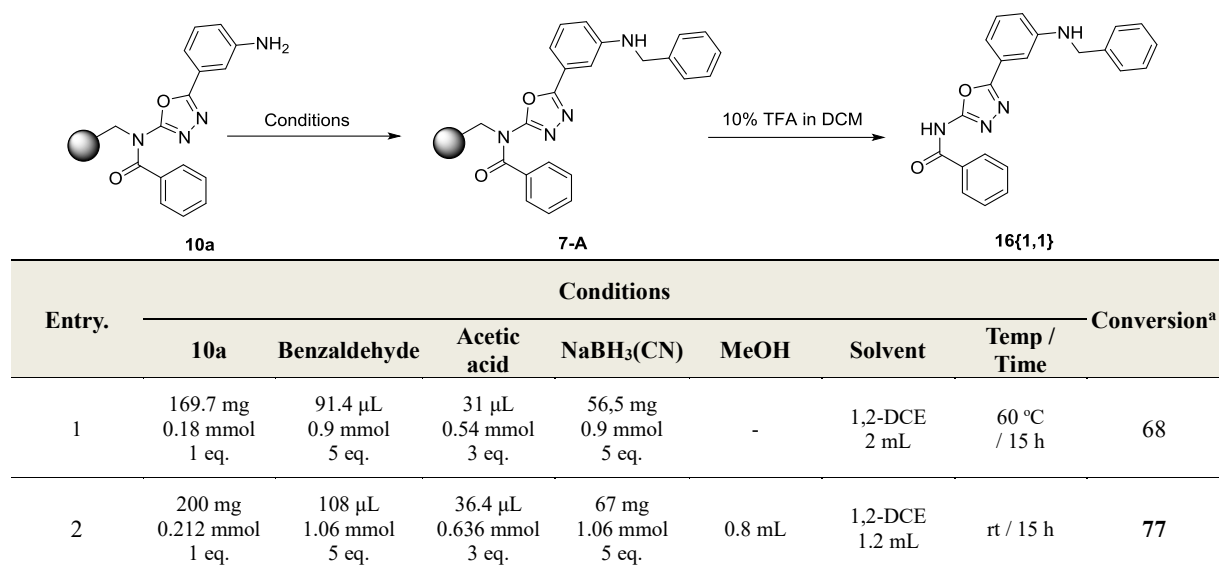
Conditions								Conversion ^a
Entry.	10a	Isothiocyanate	Base	solvent	Temp / Time			
1	150 mg 0.159 mmol 1 eq.	 95 μL 0.795 mmol 5eq.	pyridine 64.4 μL 0.795 mmol 5 eq.	THF 2 mL	60 °C / 12 h		80	
3	146.6 mg 0.152 mmol 1 eq.	 92.8 μL 0.76 mmol 5 eq.	DMAP 5 mg 0.038 mmol 0.25 eq.	DMF 2 mL	60 °C / 12 h		70	
4			X	THF 2 mL			20	
5	50 mg 0.053 mmol 1 eq.	 32 μL 0.265 mmol 5 eq.	X	DMSO 2 mL	60 °C / 12 h		85	
6			X	ACN 2 mL			25	
7			Et ₃ N 37.2 μL 0.265 mmol 5 eq.	CHCl ₃ 2 mL			40	
8	200 mg 0.212 mmol 1 eq.	 126.6 μL 1.06 mmol 5 eq.	DMAP 14 mg 0.117 mmol 0.55 eq.	CHCl ₃ 2 mL	60 °C / 12 h		90	

^a is checked by LC-MS at 254 nm,

Scheme S6

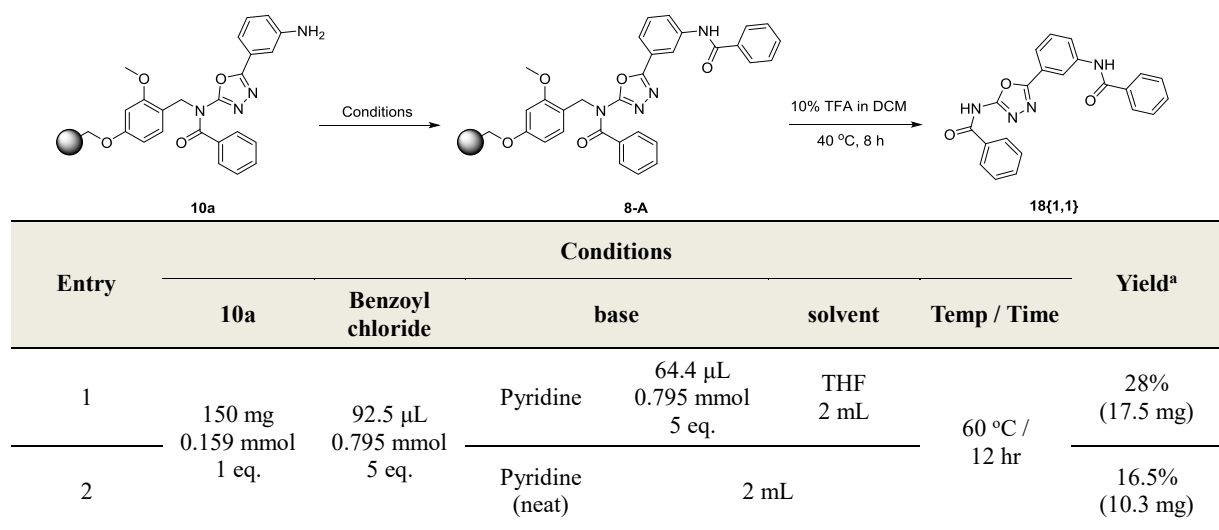


Scheme S7



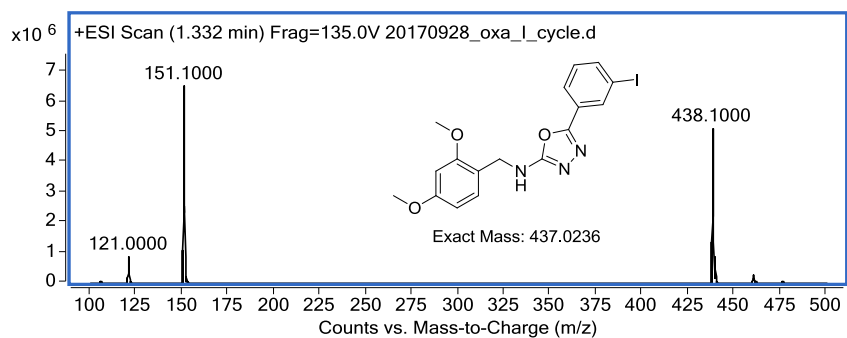
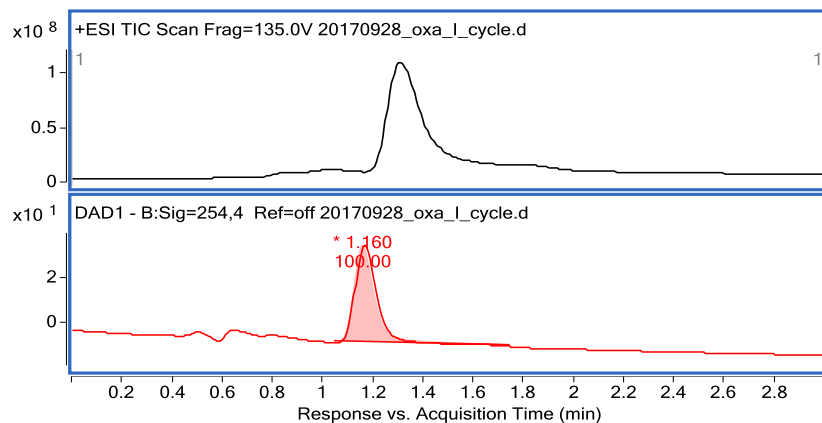
^a is checked by LC-MS at 254 nm,

Scheme S8

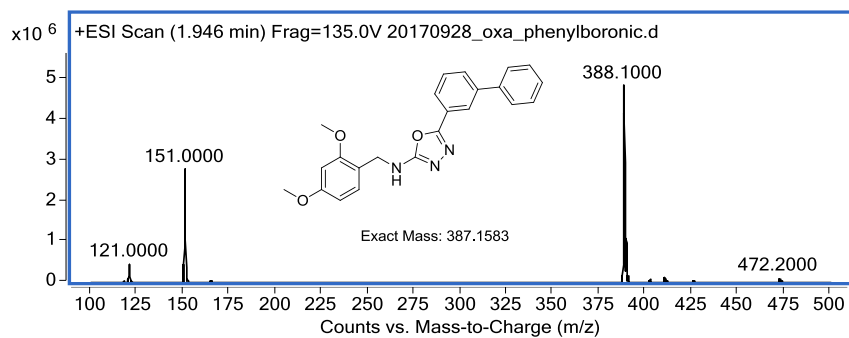
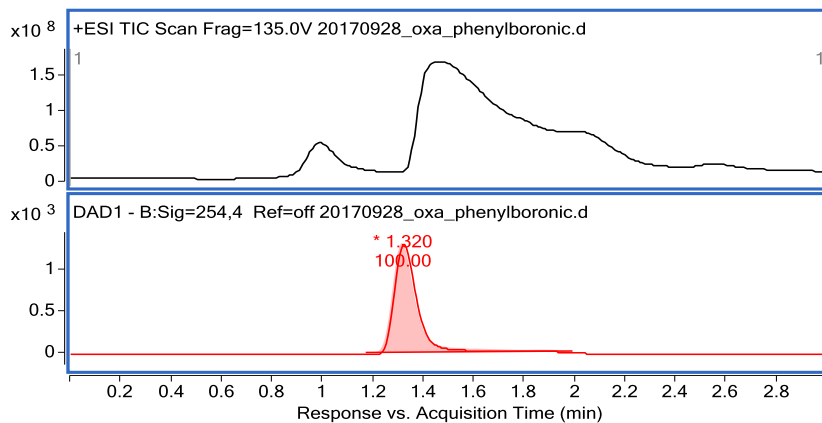


^a is seven steps overall yield.

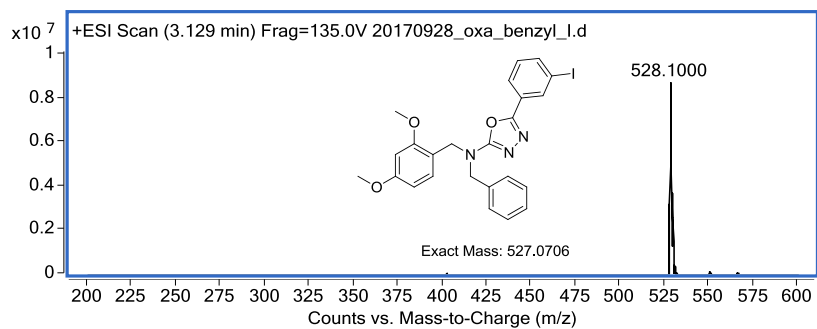
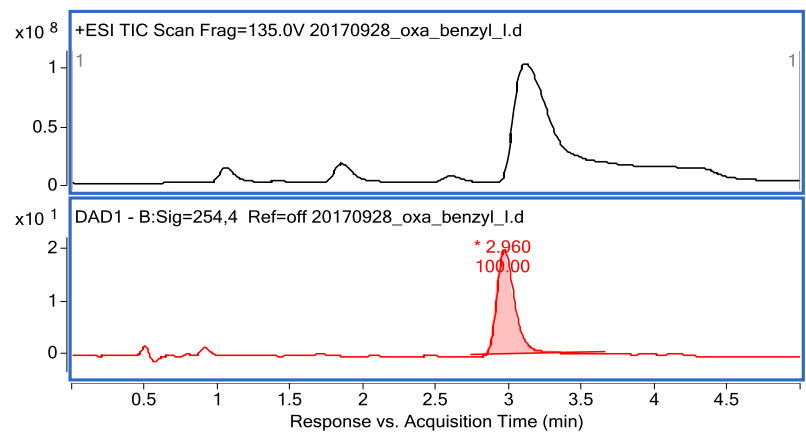
<LC-MS Spectra for checking authenticity of 1-A, 1-B, 1-C, 1-D, 6-A, 6-B, 6-C, and 6-D>



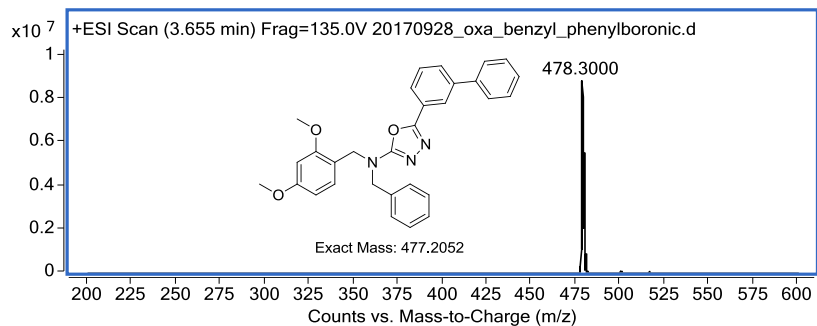
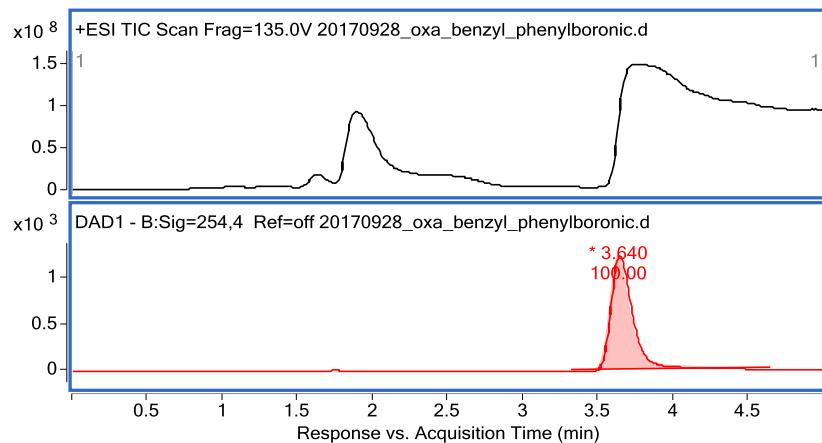
LC/MS – 1-A



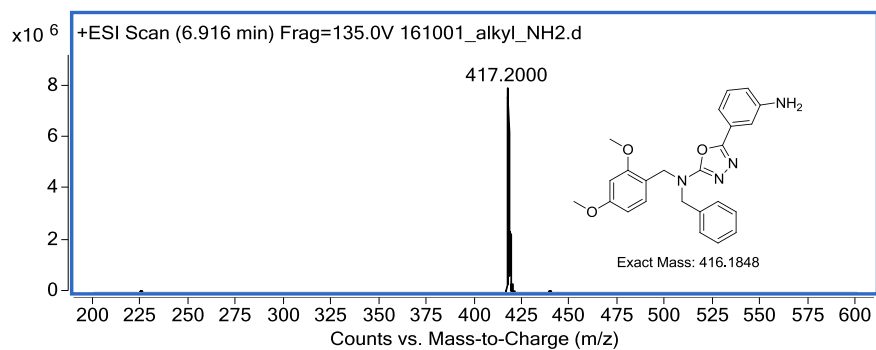
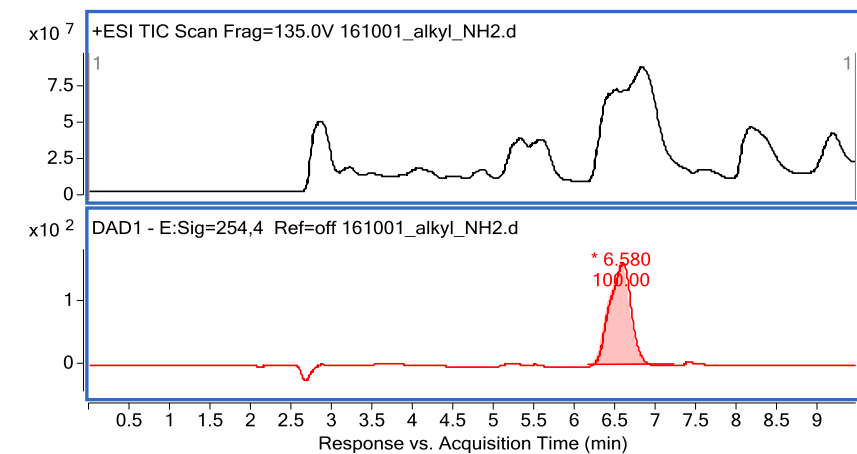
LC/MS – 1-B



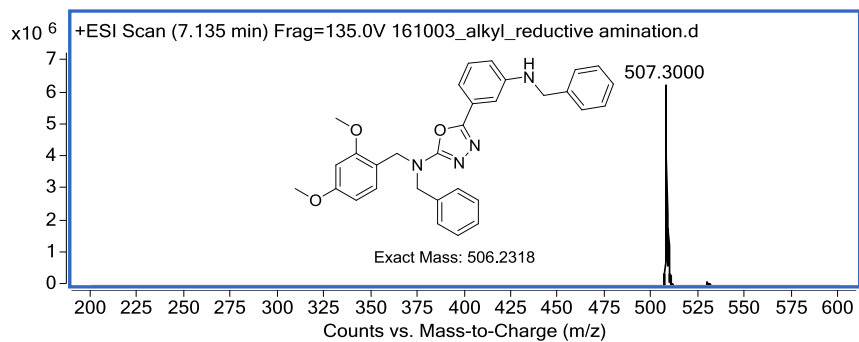
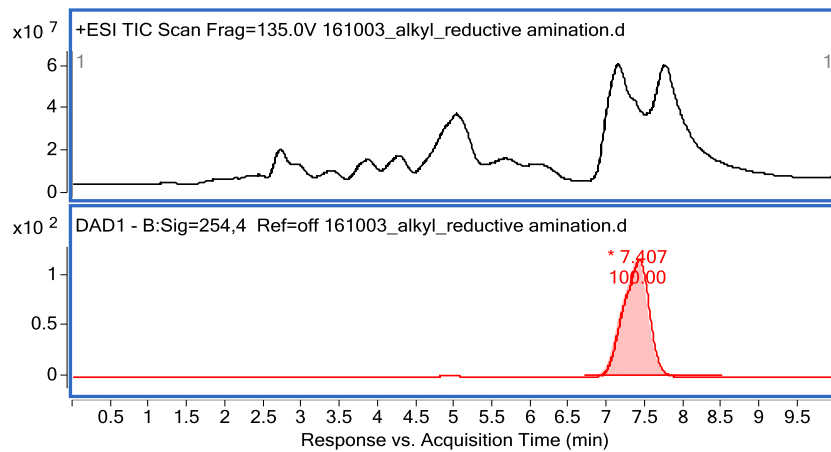
LC/MS – 1-C



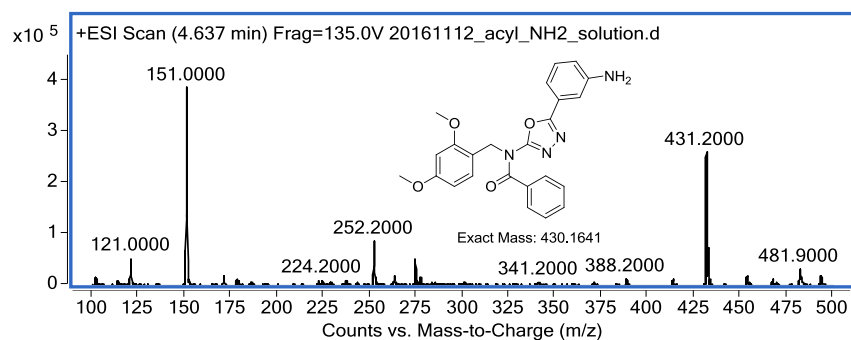
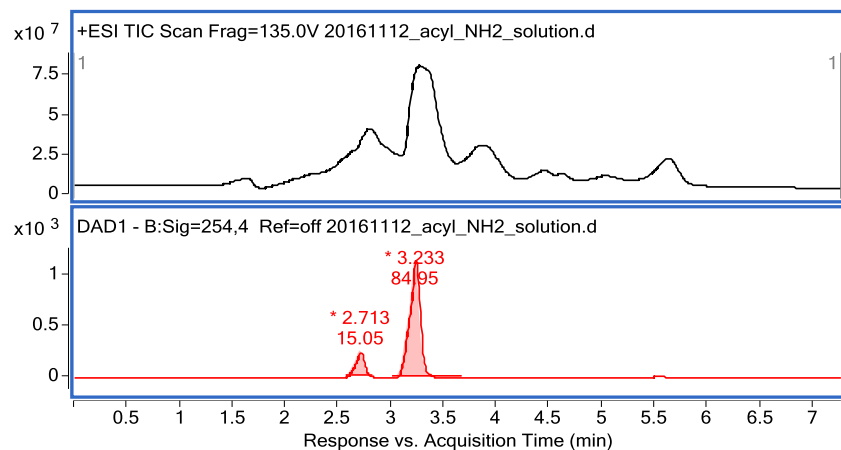
LC/MS – 1-D



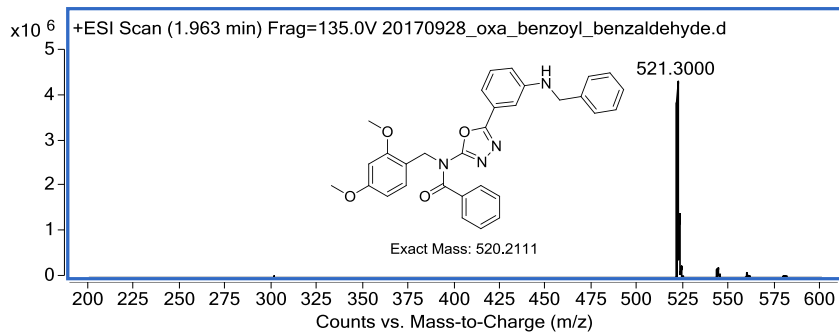
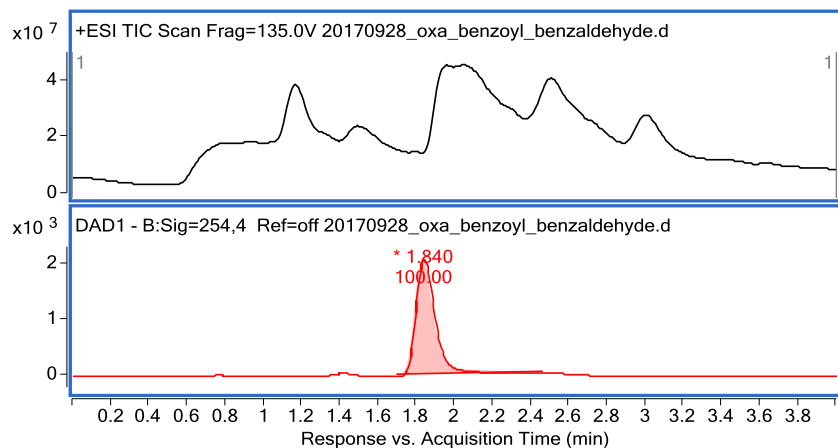
LC/MS – 6-A



LC/MS – 6-B

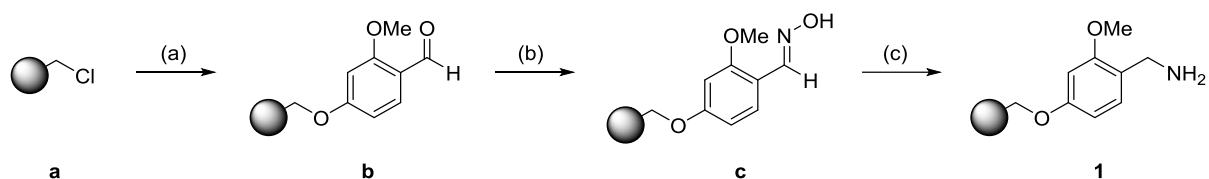


LC/MS – 6-C



LC/MS - 6-D

<Experimental procedure for synthesis of BOMBA resin 1>



Reagents and conditions: (a) 3-methoxy-4-formylphenol, K_2CO_3 , KI, DMF, 60 °C, 16 h; (b) $\text{NH}_2\text{OH}\cdot\text{HCl}$, pyridine, rt, 6 h; (c) LiAlH_4 , THF, rt, 1 d.

Preparation of AMEBA resin b

To a suspension of Merrifield resin **a** (2.20 mmol/g, 6.00 g, 13.1 mmol) in DMF (35 mL) was added potassium carbonate (5.43 g, 39.3 mmol) and potassium iodide (0.02 g, 0.13 mmol), followed by 3-methoxy-4-formylphenol (5.97 g, 39.3 mmol). The mixture was stirred at 60 °C for 16 h, after which time the resin was filtered and washed successively with DMF, MeOH, H_2O , MeOH, DCM and MeOH. The resin was dried in vacuo. Resin **b** was white in color (7.73 g).

Preparation of 4-oxime-2-methoxyphenyl resin c

AMEBA resin **b** (7.7 g) and hydroxylamine hydrochloride (3.54 g, 51 mmol) were suspended in pyridine (40 mL). After agitating for 6 h at room temperature, the resin was filtered and washed with 1:1 pyridine/ H_2O , H_2O and several times with MeOH and DCM. FT-IR indicate analysis indicated complete disappearance of the carbonyl peak at 1678 cm^{-1} . Resin **c** was white in color (7.63 g).

Preparation of BOMBA resin 1

To a suspension of oxime resin **c** (7.6 g) in THF (35 mL) was added lithium aluminum hydride (1 g, 26.2 mmol). The mixture was stirred at room temperature for 1 day, after which time the reaction mixture was cooled to 0 °C, the excess lithium aluminum hydride slowly quenched with EtOH, and the aluminum salt byproducts were dissolved with a 10% HCl. Once dissolved, the resin was filtered and washed H₂O then several times with MeOH and DCM, followed by washing with 10% triethylamine in DCM to neutralize the amine. Following the final wash with MeOH, the resin was dried in vacuum oven. Resin **d** was dark yellow in color (9.65 g)

<Loading Level determination>

Loading : To an ice cold slurry of BOMBA resin **d** (0.10 g) and *N, N*-Diisopropylethylamine (0.22 mL, 1.32 mmol) was added a solution of 9-Fluorenylmethoxycarbonyl chloride (0.23 g, 0.88 mmol) in DCM (1.5 mL). The slurry was incubated for 3 h at room temperature. Then the resin was removed by filtration and sequentially washed with H₂O, MeOH and DCM, following final wash with MeOH, the resin was dried in vacuum oven. Fmoc-amino resin was obtained as a light yellow solid (0.28 g).

Deloading : A suspension of the Fmoc amino resin and piperidine (0.5 mL) in DCM (2.0 mL) was stirred at room temperature for 2 h. Then the resin was filtered and washed with DCM (2 x 50.0 mL). The filtrate was concentrated in vacuo giving a residue which was subjected to silica gel column chromatography (*n*-hexane-EtOAc, 10:1, v/v) to afford 9-Methylene-9*H*-fluorene (28 mg, BOMBA resin loading capacity : 1.06 mmol/g).

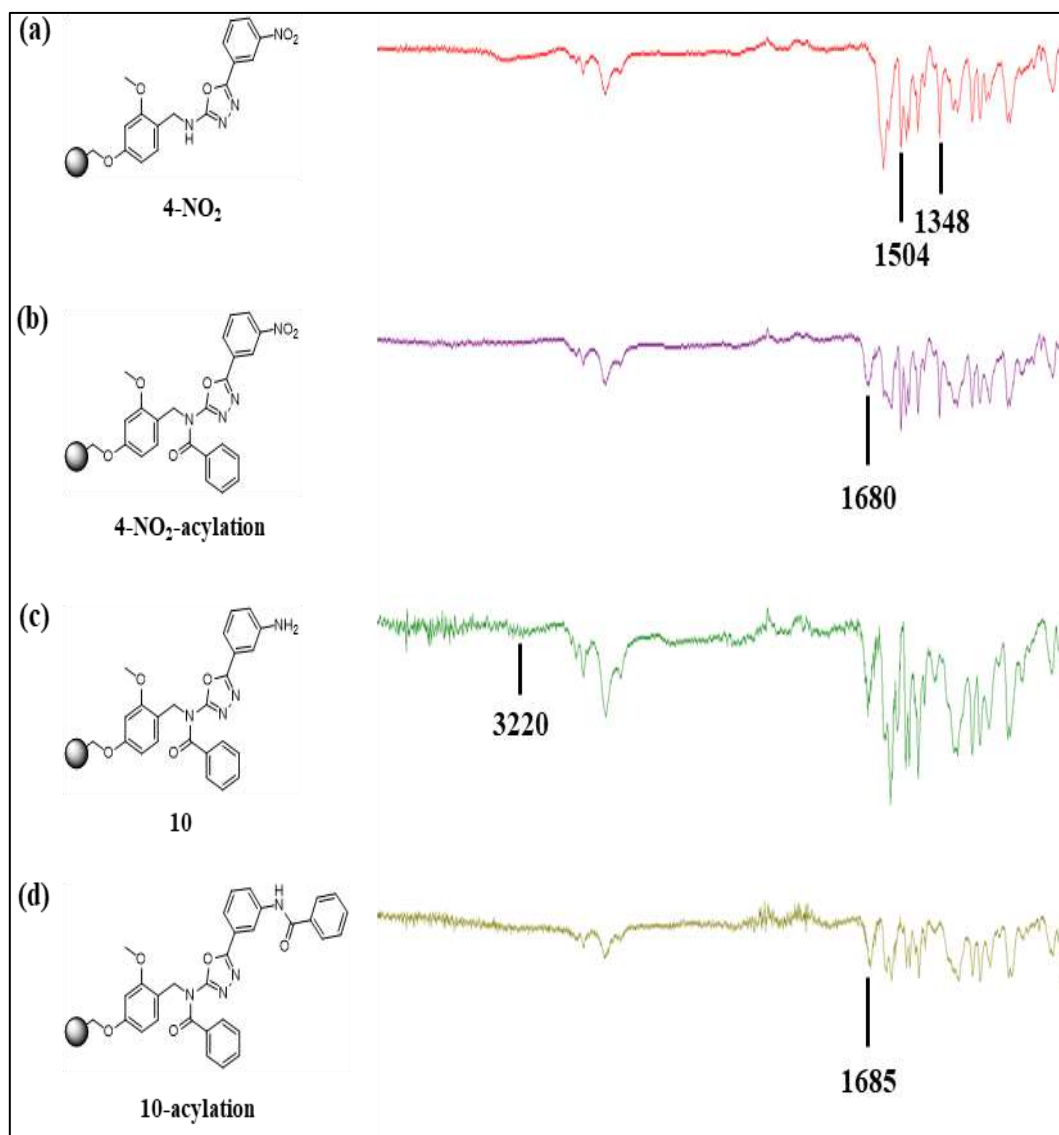


Figure S1. Representative ATR-FTIR spectrum of corresponding oxadiazole resins

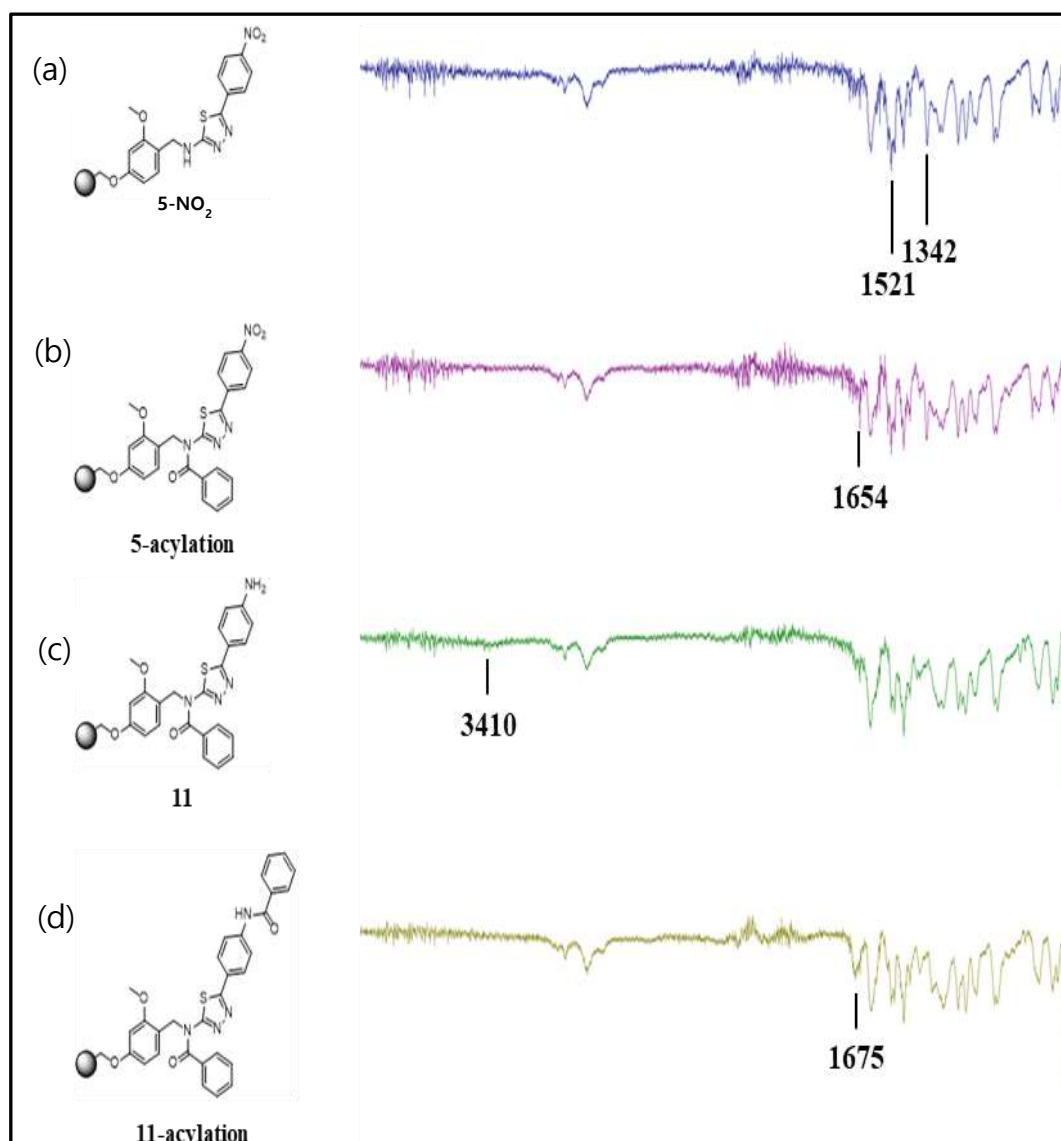


Figure S2. Representative ATR-FTIR spectrum of corresponding thiadiazole resins

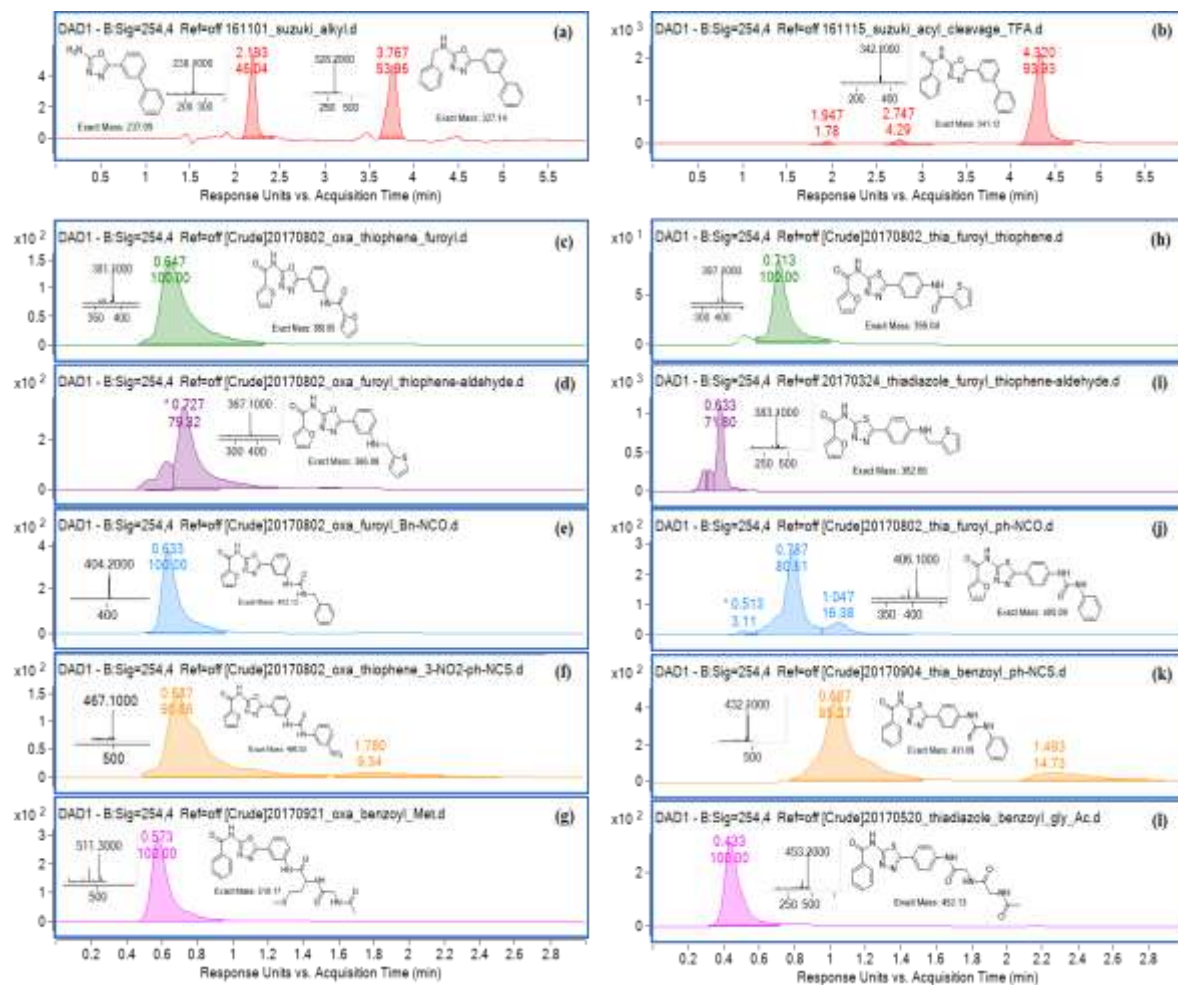


Figure S3. The LC/MS Spectra of the crude product mixtures

- Full analytical data of all synthesized compounds

N-benzyl-5-(4'-methoxy-[1,1'-biphenyl]-3-yl)-1,3,4-oxadiazol-2-amine 8{1,2} ¹H NMR (500 MHz, DMSO-d₆) δ 8.41 (t, *J* = 6.0 Hz, 1H), 7.97 (s, 1H), 7.75 (t, *J* = 7.4 Hz, 2H), 7.65 (d, *J* = 8.4 Hz, 2H), 7.59 (t, *J* = 7.7 Hz, 1H), 7.40 (d, *J* = 7.5 Hz, 2H), 7.36 (t, *J* = 7.4 Hz, 2H), 7.28 (d, *J* = 7.3 Hz, 1H), 7.07 (d, *J* = 8.5 Hz, 2H), 4.47 (d, *J* = 6.0 Hz, 2H), 3.81 (s, 3H); ¹³C NMR (126 MHz, Chloroform-d) δ 163.29, 159.52, 159.30, 141.50, 137.38, 132.52, 129.29, 128.86, 128.84, 128.19, 128.03, 127.80, 124.83, 124.00, 123.98, 114.31, 55.37, 47.74; m.p. 185-188 °C; LC-MS (ESI): *m/z* = 358.2 [M + H]⁺; HRMS (ESI) calcd for C₂₂H₁₉N₃O₂ [M + H]⁺ : 358.1550, found : 358.1540.

N-benzyl-5-(3'-nitro-[1,1'-biphenyl]-3-yl)-1,3,4-oxadiazol-2-amine 8{1,3} ¹H NMR (500 MHz, Chloroform-d) δ 8.49 (s, 1H), 8.25 (d, *J* = 8.1 Hz, 1H), 8.16 (s, 1H), 7.96 (d, *J* = 7.2 Hz, 2H), 7.71 (d, *J* = 7.7 Hz, 1H), 7.65 (t, *J* = 8.0 Hz, 1H), 7.59 (t, *J* = 7.8 Hz, 1H), 7.43 (d, *J* = 7.1 Hz, 2H), 7.39 (t, *J* = 7.4 Hz, 2H), 7.34 (d, *J* = 7.1 Hz, 1H), 5.25 (s, 1H), 4.65 (d, *J* = 5.6 Hz, 2H); ¹³C NMR (126 MHz, Chloroform-d) δ 163.39, 158.76, 148.75, 141.71, 139.42, 137.26, 133.07, 129.93, 129.82, 129.17, 128.89, 128.08, 127.79, 125.72, 125.38, 124.41, 122.61, 121.99, 47.74; m.p. 154-156 °C; LC-MS (ESI): *m/z* = 373.2 [M + H]⁺; HRMS (ESI) calcd for C₂₁H₁₆N₄O₃ [M + H]⁺ : 373.1295, found : 373.1284.

N-benzyl-5-(3-(thiophen-3-yl)phenyl)-1,3,4-oxadiazol-2-amine 8{1,4} ¹H NMR (500 MHz, DMSO-d₆) δ 8.41 (t, *J* = 6.1 Hz, 1H), 8.08 (s, 1H), 8.00 (s, 1H), 7.86 (d, *J* = 7.9 Hz, 1H), 7.74 – 7.69 (m, 2H), 7.59 (dd, *J* = 17.7, 6.4 Hz, 2H), 7.41 (d, *J* = 7.4 Hz, 2H), 7.36 (t, *J* = 7.5 Hz, 2H), 7.28 (d, *J* = 7.2 Hz, 1H), 4.48 (d, *J* = 6.1 Hz, 2H); ¹³C NMR (126 MHz, Chloroform-d) δ

163.29, 159.16, 141.18, 137.34, 136.52, 129.38, 128.88, 128.52, 128.05, 127.80, 126.59, 126.16, 124.92, 124.38, 123.71, 121.13, 47.73; m.p. 148-154 °C; LC-MS (ESI): $m/z = 334.2$ $[M + H]^+$; HRMS (ESI) calcd for $C_{19}H_{15}N_3OS$ $[M + H]^+$: 334.1009, found : 334.0999.

5-([1,1'-biphenyl]-3-yl)-N-methyl-1,3,4-oxadiazol-2-amine 8{2,1} 1H NMR (500 MHz, Chloroform- d) δ 8.14 (s, 1H), 7.88 (d, $J = 7.8$ Hz, 1H), 7.68 (d, $J = 10.3$ Hz, 1H), 7.64 (d, $J = 8.5$ Hz, 2H), 7.53 (t, $J = 7.8$ Hz, 1H), 7.47 (t, $J = 6.8$ Hz, 2H), 7.39 (t, $J = 6.8$ Hz, 1H), 3.13 (d, $J = 5.0$ Hz, 3H); ^{13}C NMR (126 MHz, Chloroform- d) δ 164.07, 159.14, 141.94, 140.08, 129.33, 129.24, 128.89, 127.81, 127.16, 124.96, 124.57, 124.45, 30.06; m.p. 190-193 °C; LC-MS (ESI): $m/z = 252.1$ $[M + H]^+$; HRMS (ESI) calcd for $C_{15}H_{13}N_3O$ $[M + H]^+$: 252.1131, found : 252.1124.

5-(4'-methoxy-[1,1'-biphenyl]-3-yl)-N-methyl-1,3,4-oxadiazol-2-amine 8{2,2} 1H NMR (500 MHz, Chloroform- d) δ 8.10 (s, 1H), 7.83 (d, $J = 7.7$ Hz, 1H), 7.64 (d, $J = 7.6$ Hz, 1H), 7.57 (d, $J = 8.6$ Hz, 2H), 7.49 (t, $J = 7.7$ Hz, 1H), 7.00 (d, $J = 8.7$ Hz, 2H), 3.86 (s, 4H), 3.13 (s, 4H); ^{13}C NMR (126 MHz, Chloroform- d) δ 164.09, 159.52, 159.20, 141.51, 132.55, 129.28, 128.78, 128.20, 124.91, 123.96, 114.30, 55.37, 30.04; m.p. 172-175 °C; LC-MS (ESI): $m/z = 282.2$ $[M + H]^+$; HRMS (ESI) calcd for $C_{16}H_{15}N_3O_2$ $[M + H]^+$: 282.1237, found : 282.1127.

N-methyl-5-(3'-nitro-[1,1'-biphenyl]-3-yl)-1,3,4-oxadiazol-2-amine 8{2,3} 1H NMR (500 MHz, Chloroform- d) δ 8.49 (s, 1H), 8.25 (d, $J = 8.1$ Hz, 1H), 8.17 (s, 1H), 7.96 (d, $J = 7.6$ Hz, 2H), 7.72 (d, $J = 7.7$ Hz, 1H), 7.65 (t, $J = 7.9$ Hz, 1H), 7.59 (t, $J = 7.8$ Hz, 1H), 3.15 (s, 3H); ^{13}C NMR (126 MHz, Chloroform- d) δ 158.72, 156.94, 148.79, 140.88, 140.47, 133.32, 132.23, 130.55, 130.35, 126.53, 125.16, 123.27, 122.18, 121.74, 30.44; m.p. 199-202 °C; LC-MS (ESI):

$m/z = 297.1$ $[M + H]^+$; HRMS (ESI) calcd for $C_{15}H_{12}N_4O_3$ $[M + H]^+$: 297.0982, found : 297.0970.

N-methyl-5-(3-(thiophen-3-yl)phenyl)-1,3,4-oxadiazol-2-amine 8{2,4} 1H NMR (500 MHz, Chloroform- d) δ 8.15 (s, 1H), 7.81 (d, $J = 7.7$ Hz, 1H), 7.68 (d, $J = 7.7$ Hz, 1H), 7.55 (s, 1H), 7.48 (t, $J = 7.8$ Hz, 1H), 7.43 (dt, $J = 7.8, 4.4$ Hz, 2H), 3.14 (s, 3H); ^{13}C NMR (126 MHz, Chloroform- d) δ 158.60, 157.38, 140.19, 137.53, 131.47, 130.11, 127.24, 126.00, 125.07, 124.35, 122.03, 121.18, 30.38; m.p. $^{\circ}C$; LC-MS (ESI): $m/z = 258.1$ $[M + H]^+$; HRMS (ESI) calcd for $C_{13}H_{11}N_3OS$ $[M + H]^+$: 258.0696, found : 258.0699.

5-([1,1'-biphenyl]-3-yl)-N-(cyclohexylmethyl)-1,3,4-oxadiazol-2-amine 8{3,1} 1H NMR (500 MHz, Chloroform- d) δ 8.14 (s, 1H), 7.88 (d, $J = 7.8$ Hz, 1H), 7.67 (d, $J = 7.8$ Hz, 1H), 7.63 (d, $J = 7.3$ Hz, 2H), 7.52 (t, $J = 7.8$ Hz, 1H), 7.47 (t, $J = 7.6$ Hz, 2H), 7.39 (t, $J = 7.4$ Hz, 1H), 4.90 (t, $J = 5.9$ Hz, 1H), 3.30 (t, $J = 6.5$ Hz, 2H), 1.82 (d, $J = 13.0$ Hz, 2H), 1.76 (d, $J = 13.0$ Hz, 2H), 1.71 – 1.65 (m, 2H), 1.26 (t, $J = 12.6$ Hz, 2H), 1.18 (d, $J = 12.6$ Hz, 1H), 1.01 (dd, $J = 12.0, 2.8$ Hz, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 163.68, 158.84, 141.90, 140.11, 129.31, 129.15, 128.88, 127.79, 127.16, 125.04, 124.52, 124.40, 49.99, 37.88, 30.63, 26.34, 25.73; m.p. 140-145 $^{\circ}C$; LC-MS (ESI): $m/z = 334.2$ $[M + H]^+$; HRMS (ESI) calcd for $C_{21}H_{23}N_3O$ $[M + H]^+$: 334.1914, found : 334.1906.

N-(cyclohexylmethyl)-5-(4'-methoxy-[1,1'-biphenyl]-3-yl)-1,3,4-oxadiazol-2-amine 8{3,2} 1H NMR (500 MHz, Chloroform- d) δ 8.10 (s, 1H), 7.82 (d, $J = 7.8$ Hz, 1H), 7.63 (d, $J = 7.8$ Hz, 1H), 7.57 (d, $J = 8.7$ Hz, 2H), 7.49 (t, $J = 7.8$ Hz, 1H), 7.00 (d, $J = 8.7$ Hz, 2H), 4.87 (s, 1H), 3.87 (s, 3H), 3.30 (t, $J = 6.5$ Hz, 2H), 1.82 (d, $J = 13.0$ Hz, 2H), 1.76 (d, $J = 13.0$ Hz, 2H),

1.71 – 1.63 (m, 3H), 1.28 (d, $J = 12.6$ Hz, 3H), 1.01 (d, $J = 12.0$ Hz, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 163.65, 159.51, 158.93, 141.48, 132.59, 129.26, 128.71, 128.20, 124.98, 123.92, 114.30, 99.96, 55.38, 49.99, 37.88, 30.63, 26.34, 25.73; m.p. 180-185 °C; LC-MS (ESI): $m/z = 364.3$ $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{22}\text{H}_{25}\text{N}_3\text{O}_2$ $[\text{M} + \text{H}]^+$: 364.2020, found : 364.2007.

N-(cyclohexylmethyl)-5-(3'-nitro-[1,1'-biphenyl]-3-yl)-1,3,4-oxadiazol-2-amine 8_{3,3} ^1H NMR (500 MHz, Chloroform- d) δ 8.50 (s, 1H), 8.25 (d, $J = 6.6$ Hz, 1H), 8.17 (s, 1H), 7.96 (t, $J = 6.8$ Hz, 2H), 7.71 (d, $J = 7.8$ Hz, 1H), 7.66 (t, $J = 8.0$ Hz, 1H), 7.59 (t, $J = 7.8$ Hz, 1H), 4.97 (s, 1H), 3.32 (t, $J = 6.5$ Hz, 2H), 1.83 (d, $J = 13.0$ Hz, 2H), 1.77 (d, $J = 13.0$ Hz, 2H), 1.71 – 1.65 (m, 2H), 1.27 (t, $J = 12.6$ Hz, 2H), 1.23 – 1.16 (m, 1H), 1.09 – 0.97 (m, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 163.77, 158.39, 148.75, 141.77, 139.38, 133.09, 129.93, 129.78, 129.02, 125.66, 125.54, 124.33, 122.59, 122.00, 49.99, 37.86, 30.63, 26.33, 25.72; m.p. 130-135 °C; LC-MS (ESI): $m/z = 379.2$ $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{21}\text{H}_{22}\text{N}_4\text{O}_3$ $[\text{M} + \text{H}]^+$: 379.1765, found : 379.1745.

N-(cyclohexylmethyl)-5-(3-(thiophen-3-yl)phenyl)-1,3,4-oxadiazol-2-amine 8_{3,4} ^1H NMR (500 MHz, Chloroform- d) δ 8.15 (s, 1H), 7.80 (d, $J = 7.8$ Hz, 1H), 7.68 (d, $J = 7.8$ Hz, 1H), 7.54 (s, 1H), 7.48 (t, $J = 7.8$ Hz, 1H), 7.46 – 7.41 (m, 2H), 4.90 (t, $J = 5.7$ Hz, 1H), 3.30 (t, $J = 6.5$ Hz, 2H), 1.82 (d, $J = 12.8$ Hz, 2H), 1.76 (d, $J = 13.0$ Hz, 2H), 1.70 (d, $J = 13.1$ Hz, 2H), 1.27 (d, $J = 12.6$ Hz, 2H), 1.20 (t, $J = 12.2$ Hz, 1H), 1.05 – 0.98 (m, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 163.67, 158.77, 141.23, 136.48, 129.35, 128.38, 126.56, 126.19, 125.07, 124.32, 123.63, 121.11, 49.99, 37.87, 30.63, 26.33, 25.73; m.p. °C; LC-MS (ESI): $m/z = 340.2$ $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{19}\text{H}_{21}\text{N}_3\text{OS}$ $[\text{M} + \text{H}]^+$: 340.1478, found : 340.1470.

N-(5-(4'-methoxy-[1,1'-biphenyl]-3-yl)-1,3,4-oxadiazol-2-yl)benzamide 9{1,2} ¹H NMR (500 MHz, DMSO-d₆) δ 12.16 (s, 1H), 8.14 (s, 1H), 8.06 (d, *J* = 7.3 Hz, 2H), 7.92 (d, *J* = 7.7 Hz, 1H), 7.88 (d, *J* = 7.8 Hz, 1H), 7.75 – 7.64 (m, 4H), 7.58 (t, *J* = 7.4 Hz, 2H), 7.09 (d, *J* = 8.2 Hz, 2H), 3.82 (s, 3H); ¹³C NMR (126 MHz, Chloroform-d) δ 165.73, 161.57, 159.57, 157.71, 142.31, 134.97, 131.93, 131.75, 130.10, 129.48, 128.60, 128.32, 125.26, 125.07, 121.44, 114.71, 94.62, 55.63; m.p. 215-225 °C; LC-MS (ESI): *m/z* = 372.2 [M + H]⁺; HRMS (ESI) calcd for C₂₂H₁₇N₃O₃ [M + H]⁺ : 372.1343, found : 372.1329.

N-(5-(3'-nitro-[1,1'-biphenyl]-3-yl)-1,3,4-oxadiazol-2-yl)benzamide 9{1,3} ¹H NMR (500 MHz, Chloroform-d) δ 8.52 (s, 1H), 8.34 – 8.28 (m, 2H), 8.11 (t, *J* = 6.8 Hz, 3H), 8.01 (d, *J* = 7.8 Hz, 1H), 7.97 (d, *J* = 7.8 Hz, 1H), 7.78 (q, *J* = 7.7, 7.2 Hz, 2H), 7.72 (t, *J* = 8.0 Hz, 1H), 7.64 (t, *J* = 7.7 Hz, 2H); ¹³C NMR (126 MHz, Chloroform-d) δ 165.94, 157.87, 148.76, 140.91, 140.42, 135.21, 133.40, 132.25, 130.65, 130.31, 129.81, 129.59, 128.64, 127.07, 125.71, 123.22, 122.17, 122.05, 86.06; m.p. 274-278 °C; LC-MS (ESI): *m/z* = 387.1 [M + H]⁺; HRMS (ESI) calcd for C₂₁H₁₄N₄O₄ [M + H]⁺ : 387.1088, found : 387.1072.

N-(5-(3-(thiophen-3-yl)phenyl)-1,3,4-oxadiazol-2-yl)benzamide 9{1,4} ¹H NMR (500 MHz, Chloroform-d) δ 8.27 (s, 1H), 8.10 (d, *J* = 6.2 Hz, 2H), 7.96 (d, *J* = 7.4 Hz, 1H), 7.89 (d, *J* = 7.7 Hz, 1H), 7.75 (t, *J* = 7.3 Hz, 1H), 7.63 (d, *J* = 8.0 Hz, 4H), 7.46 (s, 2H); ¹³C NMR (126 MHz, Chloroform-d) δ 165.48, 140.27, 137.36, 134.81, 132.54, 131.16, 130.12, 129.48, 128.56, 127.02, 125.98, 125.55, 124.74, 122.79, 121.86, 77.61; m.p. decomposed above ~ 200 °C; LC-MS (ESI): *m/z* = 348.1 [M + H]⁺; HRMS (ESI) calcd for C₁₉H₁₃N₃O₂S [M + H]⁺ : 348.0801, found : 348.0789.

N-(5-([1,1'-biphenyl]-3-yl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide 9{2,1} ¹H NMR (500 MHz, Chloroform-d) δ 8.27 (s, 1H), 8.02 (d, *J* = 7.5 Hz, 1H), 7.85 (d, *J* = 7.5 Hz, 1H), 7.73 (s, 1H), 7.65 (d, *J* = 7.5 Hz, 3H), 7.54 (s, 1H), 7.49 (t, *J* = 7.2 Hz, 3H), 7.43 (d, *J* = 6.9 Hz, 1H), 6.68 (s, 1H); ¹³C NMR (126 MHz, Chloroform-d) δ 157.69, 155.24, 147.62, 144.98, 142.62, 139.26, 131.61, 129.93, 129.07, 128.25, 127.14, 125.63, 125.45, 122.24, 119.78, 115.67, 113.43; m.p. 155-160 °C; LC-MS (ESI): *m/z* = 332.1 [M + H]⁺; HRMS (ESI) calcd for C₁₉H₁₃N₃O₃ [M + H]⁺ : 332.1030, found : 332.1018.

N-(5-(4'-methoxy-[1,1'-biphenyl]-3-yl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide 9{2,2} ¹H NMR (500 MHz, Chloroform-d) δ 8.18 (s, 1H), 7.93 (d, *J* = 7.2 Hz, 1H), 7.85 (d, *J* = 7.5 Hz, 1H), 7.76 (s, 1H), 7.63 (t, *J* = 7.8 Hz, 2H), 7.58 (d, *J* = 8.5 Hz, 2H), 7.05 (d, *J* = 8.6 Hz, 2H), 6.72 (s, 1H), 3.92 (s, 3H); ¹³C NMR (126 MHz, Chloroform-d) δ 159.37, 148.94, 142.46, 135.79, 132.25, 132.20, 131.18, 130.28, 128.42, 125.43, 125.28, 121.83, 121.54, 120.97, 114.89, 114.09, 114.03, 55.84; m.p. 220-230 °C; LC-MS (ESI): *m/z* = 362.1 [M + H]⁺; HRMS (ESI) calcd for C₂₀H₁₅N₃O₄ [M + H]⁺ : 362.1135, found : 362.1125.

N-(5-(3'-nitro-[1,1'-biphenyl]-3-yl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide 9{2,3} ¹H NMR (500 MHz, Chloroform-d) δ 8.51 (s, 1H), 8.29 (s, 2H), 8.11 (d, *J* = 6.8 Hz, 1H), 8.00 (d, *J* = 6.7 Hz, 1H), 7.90 (d, *J* = 6.8 Hz, 1H), 7.71 (dt, *J* = 14.5, 8.9 Hz, 3H), 7.56 (s, 1H), 6.70 (s, 1H); ¹³C NMR (126 MHz, Chloroform-d) δ 157.08, 155.90, 149.07, 148.81, 144.00, 140.95, 140.57, 133.59, 132.66, 130.84, 130.48, 127.76, 127.21, 125.88, 123.39, 122.25, 122.02, 121.68, 114.21; m.p. 255-260 °C; LC-MS (ESI): *m/z* = 377.1 [M + H]⁺; HRMS (ESI) calcd for C₁₉H₁₂N₄O₅ [M + H]⁺ : 377.0880, found : 377.0868.

N-(5-(3-(thiophen-3-yl)phenyl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide **9**_{2,4} ¹H NMR (500 MHz, Chloroform-d) δ 8.24 (s, 1H), 7.90 (dd, J = 13.6, 7.8 Hz, 3H), 7.76 (s, 1H), 7.62 (s, 3H), 7.45 (s, 2H), 6.72 (s, 1H); ¹³C NMR (126 MHz, Chloroform-d) δ 156.87, 155.80, 148.88, 144.05, 140.13, 137.61, 131.78, 130.34, 127.69, 127.21, 125.94, 125.63, 124.86, 122.04, 121.76, 121.09, 114.07; m.p. 205-215 °C; LC-MS (ESI): m/z = 338.1 [M + H]⁺; HRMS (ESI) calcd for C₁₇H₁₁N₃O₃S [M + H]⁺ : 338.0594, found : 338.0583.

N-(5-([1,1'-biphenyl]-3-yl)-1,3,4-oxadiazol-2-yl)cyclopropanecarboxamide **9**_{3,1} ¹H NMR (500 MHz, Chloroform-d) δ 8.21 (s, 1H), 7.97 (d, J = 7.6 Hz, 1H), 7.82 (d, J = 7.7 Hz, 1H), 7.65 – 7.58 (m, 3H), 7.48 (t, J = 7.5 Hz, 2H), 7.41 (t, J = 7.2 Hz, 1H), 1.89 (s, 1H), 1.28 (s, 2H), 1.16 (s, 2H); ¹³C NMR (126 MHz, Chloroform-d) δ 172.49, 161.17, 157.10, 142.64, 139.26, 131.62, 129.89, 129.05, 128.25, 127.14, 125.59, 125.38, 122.15, 15.79, 10.93; m.p. 177-182 °C; LC-MS (ESI): m/z = 306.1 [M + H]⁺; HRMS (ESI) calcd for C₁₈H₁₅N₃O₂ [M + H]⁺ : 306.1237, found : 306.1235.

N-(5-(4'-methoxy-[1,1'-biphenyl]-3-yl)-1,3,4-oxadiazol-2-yl)cyclopropanecarboxamide **9**_{3,2} ¹H NMR (500 MHz, Chloroform-d) δ 8.17 (s, 1H), 7.92 (d, J = 7.1 Hz, 1H), 7.68 (d, J = 7.2 Hz, 1H), 7.55 (d, J = 8.3 Hz, 2H), 7.50 (t, J = 7.9 Hz, 2H), 6.98 (d, J = 8.3 Hz, 2H), 3.86 (s, 3H), 1.20 (s, 2H), 1.04 (s, 2H), 0.89 – 0.83 (m, 1H); ¹³C NMR (126 MHz, Chloroform-d) δ 159.62, 141.74, 132.23, 129.86, 129.42, 129.09, 128.25, 128.17, 124.76, 124.59, 123.85, 114.35, 114.29, 55.38, 9.81, 8.02; m.p. 170-180 °C; LC-MS (ESI): m/z = 336.2 [M + H]⁺; HRMS (ESI) calcd for C₁₉H₁₇N₃O₃ [M + H]⁺ : 336.1343, found : 336.1340.

N-(5-(3'-nitro-[1,1'-biphenyl]-3-yl)-1,3,4-oxadiazol-2-yl)cyclopropanecarboxamide 9{3,3}

^1H NMR (500 MHz, Chloroform- d) δ 8.48 (s, 1H), 8.28 (d, J = 8.9 Hz, 1H), 8.06 (d, J = 7.3 Hz, 1H), 7.97 (d, J = 6.0 Hz, 1H), 7.86 (d, J = 7.0 Hz, 2H), 7.70 – 7.64 (m, 2H), 1.27 (s, 2H), 1.15 (s, 2H), 0.86 (d, J = 13.8 Hz, 1H); ^{13}C NMR (126 MHz, Chloroform- d) δ 160.21, 159.88, 148.77, 141.04, 133.20, 130.34, 130.16, 129.88, 127.57, 126.76, 126.44, 125.36, 122.99, 122.83, 122.02, 10.91, 8.91; m.p. 140-150 °C; LC-MS (ESI): m/z = 351.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{18}\text{H}_{14}\text{N}_4\text{O}_4$ $[\text{M} + \text{H}]^+$: 351.1088, found : 351.1079.

N-(5-(3-(thiophen-3-yl)phenyl)-1,3,4-oxadiazol-2-yl)cyclopropanecarboxamide 9{3,4}

^1H NMR (500 MHz, Chloroform- d) δ 8.20 (s, 1H), 7.90 (d, J = 7.6 Hz, 1H), 7.81 (d, J = 7.7 Hz, 1H), 7.56 (d, J = 8.0 Hz, 2H), 7.43 (d, J = 7.0 Hz, 3H), 1.26 (s, 2H), 1.15 – 1.12 (m, 2H), 0.89 – 0.86 (m, 1H); ^{13}C NMR (126 MHz, Chloroform- d) δ 160.29, 140.44, 137.09, 130.56, 129.86, 126.90, 126.02, 125.28, 124.48, 121.68, 115.94, 113.68, 99.98, 10.68, 8.72; m.p. 165-180 °C; LC-MS (ESI): m/z = 312.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{16}\text{H}_{13}\text{N}_3\text{O}_2\text{S}$ $[\text{M} + \text{H}]^+$: 312.0801, found : 312.0797.

N-(5-(3-(3-benzylureido)phenyl)-1,3,4-oxadiazol-2-yl)benzamide 12{1,2}

^1H NMR (500 MHz, DMSO- d_6) δ 9.01 (s, 1H), 8.27 (s, 1H), 8.06 (d, J = 7.7 Hz, 2H), 7.68 (t, J = 7.2 Hz, 1H), 7.58 (t, J = 7.4 Hz, 2H), 7.54 (d, J = 7.7 Hz, 2H), 7.49 – 7.44 (m, 1H), 7.34 (d, J = 6.2 Hz, 4H), 7.25 (s, 1H), 6.81 (s, 1H), 4.33 (s, 2H); ^{13}C NMR (126 MHz, DMSO) δ 158.43, 155.59, 141.93, 140.71, 139.56, 133.38, 132.83, 130.31, 129.11, 128.80, 128.78, 127.59, 127.20, 124.17, 121.11, 119.14, 115.25, 107.40, 43.24; m.p. 215-230 °C; LC-MS (ESI): m/z = 414.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{19}\text{N}_5\text{O}_3$ $[\text{M} + \text{H}]^+$: 414.1561, found : 414.1540.

N-(5-(3-(3-ethylureido)phenyl)-1,3,4-oxadiazol-2-yl)benzamide 12{1,3} ^1H NMR (500 MHz, DMSO- d_6) δ 12.18 (s, 1H), 8.84 (s, 1H), 8.23 (s, 1H), 8.12 – 7.96 (m, 2H), 7.71 – 7.64 (m, 1H), 7.58 (d, J = 7.0 Hz, 2H), 7.51 (d, J = 7.4 Hz, 2H), 7.48 – 7.41 (m, 1H), 6.25 (s, 1H), 3.17 – 3.08 (m, 2H), 1.07 (t, J = 7.0 Hz, 3H); ^{13}C NMR (126 MHz, DMSO) δ 157.40, 155.49, 142.09, 139.56, 133.38, 130.49, 130.25, 129.12, 128.79, 124.12, 121.02, 118.94, 115.16, 107.40, 34.47, 15.86; m.p. 196-208 °C; LC-MS (ESI): m/z = 352.2 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{18}\text{H}_{17}\text{N}_5\text{O}_3$ $[\text{M} + \text{H}]^+$: 352.1404, found : 352.1396.

N-(5-(3-(3-phenylureido)phenyl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide 12{2,1} ^1H NMR (500 MHz, Chloroform- d) δ 8.11 (s, 1H), 7.97 (s, 1H), 7.80 (d, J = 7.7 Hz, 1H), 7.76 (s, 1H), 7.70 (d, J = 7.6 Hz, 1H), 7.61 (d, J = 3.5 Hz, 1H), 7.55 (t, J = 8.0 Hz, 1H), 7.46 (t, J = 7.7 Hz, 2H), 7.34 (t, J = 9.9 Hz, 4H), 6.72 (d, J = 3.5 Hz, 1H); ^{13}C NMR (126 MHz, DMSO) δ 152.97, 147.95, 141.20, 139.93, 130.46, 129.85, 129.27, 129.08, 124.26, 122.54, 121.62, 121.45, 121.21, 119.81, 118.88, 117.71, 115.65, 112.93; m.p. 235-240 °C; LC-MS (ESI): m/z = 390.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{15}\text{N}_5\text{O}_4$ $[\text{M} + \text{H}]^+$: 390.1197, found : 390.1190.

N-(5-(3-(3-benzylureido)phenyl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide 12{2,2} ^1H NMR (500 MHz, DMSO- d_6) δ 12.19 (s, 1H), 8.98 (s, 1H), 8.24 (s, 1H), 8.05 (s, 1H), 7.60 (s, 1H), 7.51 (d, J = 7.5 Hz, 1H), 7.46 (d, J = 7.8 Hz, 1H), 7.36 – 7.31 (m, 4H), 7.25 (t, J = 7.6 Hz, 1H), 6.77 (s, 2H), 4.32 (s, 2H); ^{13}C NMR (126 MHz, DMSO) δ 155.58, 147.94, 141.91, 140.71, 139.57, 130.30, 128.78, 127.60, 127.48, 127.44, 127.21, 124.12, 121.11, 119.13, 117.67, 115.23, 112.92, 107.41, 43.24; m.p. 190-200 °C; LC-MS (ESI): m/z = 404.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{21}\text{H}_{17}\text{N}_5\text{O}_4$ $[\text{M} + \text{H}]^+$: 404.1353, found : 404.1342.

N-(5-(3-(3-ethylureido)phenyl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide 12{2,3} ¹H NMR (500 MHz, DMSO-d₆) δ 12.17 (s, 1H), 8.83 (s, 1H), 8.23 (s, 1H), 8.04 (s, 1H), 7.58 (s, 1H), 7.48 (s, 2H), 7.43 (s, 1H), 6.76 (s, 1H), 6.25 (s, 1H), 3.16 – 3.08 (m, 2H), 1.07 (t, *J* = 7.1 Hz, 3H); ¹³C NMR (126 MHz, DMSO) δ 155.47, 147.93, 142.06, 139.56, 130.42, 130.24, 124.07, 121.01, 118.93, 117.92, 117.68, 115.13, 112.92, 107.40, 34.47, 15.87; m.p. 225-230 °C; LC-MS (ESI): *m/z* = 342.1 [M + H]⁺; HRMS (ESI) calcd for C₁₆H₁₅N₅O₄ [M + H]⁺ : 342.1197, found : 342.1193.

N-(5-(3-(3-phenylureido)phenyl)-1,3,4-oxadiazol-2-yl)thiophene-2-carboxamide 12{3,1} ¹H NMR (500 MHz, DMSO-d₆) δ 12.32 (s, 1H), 9.12 (s, 1H), 8.84 (s, 1H), 8.30 (s, 1H), 8.02 (s, 1H), 7.59 – 7.55 (m, 1H), 7.54 – 7.50 (m, 2H), 7.48 (s, 3H), 7.32 – 7.28 (m, 3H), 6.99 (d, *J* = 7.3 Hz, 1H); ¹³C NMR (126 MHz, DMSO) δ 167.87, 152.97, 141.21, 140.71, 139.94, 137.20, 131.97, 130.46, 129.39, 129.27, 129.05, 122.54, 121.63, 119.79, 118.87, 118.77, 118.17, 115.63; m.p. 190-195 °C; LC-MS (ESI): *m/z* = 406.1 [M + H]⁺; HRMS (ESI) calcd for C₂₀H₁₅N₅O₃S [M + H]⁺ : 406.0968, found : 406.0968.

N-(5-(3-(3-benzylureido)phenyl)-1,3,4-oxadiazol-2-yl)thiophene-2-carboxamide 12{3,2} ¹H NMR (500 MHz, DMSO-d₆) δ 12.32 (s, 1H), 9.01 (s, 1H), 8.26 (s, 1H), 8.14 (s, 1H), 8.01 (s, 1H), 7.91 (d, *J* = 11.9 Hz, 1H), 7.51 (s, 1H), 7.45 (s, 1H), 7.33 (s, 4H), 7.26 (s, 2H), 6.81 (s, 1H), 4.33 (s, 2H); ¹³C NMR (126 MHz, DMSO) δ 155.58, 141.92, 140.71, 139.57, 131.95, 130.30, 129.04, 128.86, 128.78, 127.68, 127.60, 127.42, 127.21, 124.15, 121.11, 119.11, 115.22, 107.41, 43.23; m.p. 194-214 °C; LC-MS (ESI): *m/z* = 420.1 [M + H]⁺; HRMS (ESI) calcd for C₂₁H₁₇N₅O₃S [M + H]⁺ : 420.1125, found : 420.1106.

N-(5-(3-(3-ethylureido)phenyl)-1,3,4-oxadiazol-2-yl)thiophene-2-carboxamide 12{3,3} ^1H NMR (500 MHz, DMSO- d_6) δ 12.28 (s, 1H), 8.89 (s, 1H), 8.23 (s, 1H), 8.16 (s, 1H), 8.01 (s, 1H), 7.50 (d, $J = 7.8$ Hz, 2H), 7.46 – 7.40 (m, 1H), 7.28 (s, 1H), 6.30 (s, 1H), 3.12 (d, $J = 6.8$ Hz, 2H), 1.07 (t, $J = 7.1$ Hz, 3H); ^{13}C NMR (126 MHz, DMSO) δ 162.77, 155.47, 142.08, 139.58, 137.70, 134.73, 131.95, 130.25, 129.06, 124.08, 121.00, 118.91, 115.12, 107.41, 34.47, 15.88; m.p. 298-307 °C; LC-MS (ESI): $m/z = 358.2$ $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{16}\text{H}_{15}\text{N}_5\text{O}_3\text{S}$ $[\text{M} + \text{H}]^+$: 358.0968, found : 358.0964.

N-(5-(3-(3-(3-methoxyphenyl)thioureido)phenyl)-1,3,4-oxadiazol-2-yl)benzamide 14{1,2} ^1H NMR (500 MHz, DMSO- d_6) δ 12.19 (s, 1H), 10.18 (s, 1H), 10.14 (s, 1H), 8.22 (d, $J = 6.5$ Hz, 2H), 8.05 (d, $J = 7.5$ Hz, 3H), 7.73 (d, $J = 6.0$ Hz, 2H), 7.67 (d, $J = 7.4$ Hz, 1H), 7.60 – 7.56 (m, 3H), 7.26 (t, $J = 8.1$ Hz, 1H), 7.20 (s, 1H), 3.18 (s, 3H); ^{13}C NMR (126 MHz, DMSO) δ 180.04, 159.79, 157.41, 141.08, 140.79, 139.57, 133.41, 130.05, 129.80, 129.13, 128.80, 127.14, 123.81, 122.23, 121.40, 116.18, 110.53, 109.81, 107.41, 55.57; m.p. 110-115 °C; LC-MS (ESI): $m/z = 446.2$ $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{19}\text{N}_5\text{O}_3\text{S}$ $[\text{M} + \text{H}]^+$: 446.1281, found : 446.1260.

N-(5-(3-(3-(3-nitrophenyl)thioureido)phenyl)-1,3,4-oxadiazol-2-yl)benzamide 14{1,3} ^1H NMR (500 MHz, DMSO- d_6) δ 12.22 (s, 1H), 10.44 (s, 2H), 8.56 (s, 1H), 8.05 (d, $J = 7.5$ Hz, 2H), 7.99 (d, $J = 10.2$ Hz, 1H), 7.94 (d, $J = 7.6$ Hz, 1H), 7.75 (t, $J = 8.7$ Hz, 2H), 7.67 (dd, $J = 12.9, 5.5$ Hz, 2H), 7.63 (d, $J = 8.4$ Hz, 2H), 7.58 (t, $J = 7.6$ Hz, 3H); ^{13}C NMR (126 MHz, DMSO) δ 180.49, 158.58, 157.39, 148.01, 141.21, 140.63, 139.56, 133.41, 132.80, 130.29, 130.12, 129.12, 128.80, 127.35, 124.04, 122.69, 121.54, 119.31, 118.14, 107.40; m.p. 165-180 °C; LC-MS (ESI): $m/z = 461.2$ $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{22}\text{H}_{16}\text{N}_6\text{O}_4\text{S}$ $[\text{M} + \text{H}]^+$:

461.1027, found : 461.1004.

N-(5-(3-(3-(4-fluorophenyl)thioureido)phenyl)-1,3,4-oxadiazol-2-yl)benzamide 14{1,4}

¹H NMR (500 MHz, DMSO-d₆) δ 12.18 (s, 1H), 10.24 (s, 1H), 10.17 (s, 1H), 8.22 (s, 2H), 8.05 (d, *J* = 6.9 Hz, 3H), 7.73 (t, *J* = 7.1 Hz, 2H), 7.67 (d, *J* = 7.1 Hz, 2H), 7.58 (s, 4H), 7.51 (s, 3H), 7.20 (t, *J* = 8.3 Hz, 3H), 6.98 (d, *J* = 6.7 Hz, 1H); ¹³C NMR (126 MHz, DMSO-d₆) δ 180.63, 160.71, 158.79, 141.08, 139.59, 136.02, 136.00, 133.42, 130.08, 129.14, 128.82, 127.14, 126.82, 126.75, 121.37, 115.73, 115.55, 107.42; m.p. 85-90 °C; LC-MS (ESI): *m/z* = 434.2 [M + H]⁺; HRMS (ESI) calcd for C₂₂H₁₆FN₅O₂S [M + H]⁺ : 434.1082, found : 434.1080.

N-(5-(3-(3-phenylthioureido)phenyl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide 14{2,1}

¹H NMR (500 MHz, DMSO-d₆) δ 12.19 (s, 1H), 10.05 (d, *J* = 17.7 Hz, 2H), 8.19 (s, 1H), 8.04 (s, 2H), 7.73 (d, *J* = 8.6 Hz, 1H), 7.70 (d, *J* = 7.8 Hz, 1H), 7.57 (d, *J* = 7.9 Hz, 2H), 7.49 (d, *J* = 7.8 Hz, 2H), 7.36 (t, *J* = 7.8 Hz, 2H); ¹³C NMR (126 MHz, DMSO) δ 180.23, 170.80, 149.70, 147.96, 141.09, 139.66, 130.36, 130.06, 129.03, 127.03, 125.17, 124.24, 123.82, 122.16, 121.27, 117.71, 112.93, 111.07; m.p. 200-210 °C; LC-MS (ESI): *m/z* = 406.1 [M + H]⁺; HRMS (ESI) calcd for C₂₀H₁₅N₅O₃S [M + H]⁺ : 406.0968, found : 406.0943.

N-(5-(3-(3-(3-methoxyphenyl)thioureido)phenyl)-1,3,4-oxadiazol-2-yl)furan-2-

carboxamide 14{2,2} ¹H NMR (500 MHz, DMSO-d₆) δ 12.19 (s, 1H), 10.17 (s, 1H), 10.14 (s, 1H), 8.21 (s, 1H), 8.04 (s, 1H), 7.71 (t, *J* = 8.7 Hz, 2H), 7.57 (d, *J* = 8.0 Hz, 1H), 7.26 (t, *J* = 8.1 Hz, 1H), 7.20 (s, 1H), 7.05 (d, *J* = 7.9 Hz, 1H), 6.98 (d, *J* = 7.5 Hz, 1H), 6.79 – 6.71 (m, 2H), 3.75 (s, 3H); ¹³C NMR (126 MHz, DMSO) δ 178.96, 169.73, 158.72, 156.34, 146.89, 140.01, 139.73, 138.51, 128.97, 128.72, 126.04, 122.71, 121.13, 120.28, 116.66, 115.11,

111.86, 109.46, 108.73, 106.34, 54.50; m.p. 160-165 °C; LC-MS (ESI): $m/z = 436.1$ $[M + H]^+$; HRMS (ESI) calcd for $C_{21}H_{17}N_5O_4S$ $[M + H]^+$: 436.1074, found : 436.1054.

N-(5-(3-(3-(3-nitrophenyl)thioureido)phenyl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide

14{2,3} 1H NMR (500 MHz, DMSO- d_6) δ 12.22 (s, 1H), 10.41 (s, 2H), 8.55 (t, $J = 2.1$ Hz, 1H), 8.16 (s, 1H), 8.05 (s, 1H), 7.99 (dd, $J = 8.2, 2.2$ Hz, 1H), 7.96 – 7.91 (m, 1H), 7.77 – 7.71 (m, 2H), 7.64 (t, $J = 8.2$ Hz, 1H), 7.62 – 7.56 (m, 2H), 6.76 (dd, $J = 3.4, 1.6$ Hz, 1H); ^{13}C NMR (126 MHz, DMSO) δ 180.50, 158.08, 148.02, 146.33, 141.19, 140.59, 139.55, 130.29, 130.19, 130.14, 127.34, 124.01, 122.68, 121.51, 119.33, 118.16, 117.75, 112.94, 107.39, 99.99; m.p. 150-171 °C; LC-MS (ESI): $m/z = 451.2$ $[M + H]^+$; HRMS (ESI) calcd for $C_{20}H_{14}N_6O_5S$ $[M + H]^+$: 451.0819, found : 451.0806.

N-(5-(3-(3-(4-fluorophenyl)thioureido)phenyl)-1,3,4-oxadiazol-2-yl)furan-2-

carboxamide 14{2,4} 1H NMR (500 MHz, DMSO- d_6) δ 12.21 (s, 1H), 10.22 (s, 1H), 10.15 (s, 1H), 8.23 (d, $J = 6.8$ Hz, 2H), 8.05 (s, 1H), 7.71 (d, $J = 9.9$ Hz, 1H), 7.57 (d, $J = 8.3$ Hz, 1H), 7.53 – 7.45 (m, 2H), 7.25 – 7.16 (m, 2H), 6.98 (d, $J = 6.8$ Hz, 1H), 6.77 (s, 1H); ^{13}C NMR (126 MHz, DMSO- d_6) δ 180.62, 160.71, 158.79, 157.42, 147.99, 139.60, 136.02, 135.99, 130.08, 126.82, 126.75, 123.82, 121.33, 117.75, 115.73, 115.55, 112.95, 107.42; m.p. 75-80 °C; LC-MS (ESI): $m/z = 424.2$ $[M + H]^+$; HRMS (ESI) calcd for $C_{20}H_{14}FN_5O_3S$ $[M + H]^+$: 424.0874, found : 424.0875.

N-(5-(3-(3-phenylthioureido)phenyl)-1,3,4-oxadiazol-2-yl)thiophene-2-carboxamide

14{3,1} 1H NMR (500 MHz, DMSO- d_6) δ 13.37 (s, 1H), 12.33 (s, 1H), 10.07 (dd, $J = 28.6, 15.6$ Hz, 1H), 8.22 (d, $J = 7.6$ Hz, 2H), 8.01 (d, $J = 4.9$ Hz, 1H), 7.87 (d, $J = 6.2$ Hz, 1H), 7.72 (dd, $J = 14.1, 7.9$ Hz, 1H), 7.61 – 7.53 (m, 1H), 7.49 (d, $J = 7.9$ Hz, 1H), 7.41 – 7.31 (m, 2H),

7.27 (s, 1H), 7.19 – 7.12 (m, 1H), 6.98 (d, $J = 7.6$ Hz, 1H); ^{13}C NMR (126 MHz, DMSO) δ 180.22, 170.80, 167.56, 165.02, 157.41, 152.77, 141.12, 139.70, 139.59, 137.15, 136.09, 132.00, 130.05, 129.01, 128.96, 125.14, 124.24, 107.42; m.p. 240-246 °C; LC-MS (ESI): $m/z = 422.1$ $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{15}\text{N}_5\text{O}_2\text{S}_2$ $[\text{M} + \text{H}]^+$: 422.0740, found : 422.0719.

N-(5-(3-(3-(3-methoxyphenyl)thioureido)phenyl)-1,3,4-oxadiazol-2-yl)thiophene-2-

carboxamide 14 {3,2} ^1H NMR (500 MHz, DMSO- d_6) δ 12.24 (s, 1H), 10.13 (dd, $J = 31.5$, 12.7 Hz, 2H), 8.21 (s, 1H), 8.00 (s, 1H), 7.89 (d, $J = 12.1$ Hz, 1H), 7.72 (t, $J = 7.5$ Hz, 1H), 7.56 (t, $J = 7.9$ Hz, 1H), 7.26 (s, 2H), 7.20 (s, 1H), 7.05 (d, $J = 7.4$ Hz, 1H), 6.98 (d, $J = 7.6$ Hz, 1H), 6.79 – 6.67 (m, 1H), 3.75 (s, 3H); ^{13}C NMR (126 MHz, DMSO) δ 180.03, 159.79, 157.41, 152.77, 141.07, 140.79, 139.57, 132.00, 132.00, 130.05, 129.80, 129.05, 127.91, 127.13, 122.20, 121.37, 116.19, 110.54, 109.81, 107.41, 55.57; m.p. 190-195 °C; LC-MS (ESI): $m/z = 452.1$ $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{21}\text{H}_{17}\text{N}_5\text{O}_3\text{S}_2$ $[\text{M} + \text{H}]^+$: 452.0846, found : 452.0832.

N-(5-(3-(3-(3-nitrophenyl)thioureido)phenyl)-1,3,4-oxadiazol-2-yl)thiophene-2-

carboxamide 14 {3,3} ^1H NMR (500 MHz, DMSO- d_6) δ 13.35 (s, 1H), 12.30 (s, 1H), 10.56 (t, $J = 15.0$ Hz, 1H), 8.59 (d, $J = 9.3$ Hz, 1H), 8.28 – 8.11 (m, 2H), 7.99 (dd, $J = 21.4$, 13.8 Hz, 4H), 7.75 (d, $J = 7.6$ Hz, 1H), 7.68 – 7.56 (m, 2H), 7.28 (s, 1H), 6.98 (d, $J = 7.1$ Hz, 1H); ^{13}C NMR (126 MHz, DMSO) δ 179.37, 156.33, 146.97, 140.13, 139.91, 139.54, 138.50, 130.93, 129.21, 129.13, 128.98, 126.84, 126.20, 121.56, 120.36, 118.46, 118.22, 117.14, 116.98, 106.34; m.p. 55-65 °C; LC-MS (ESI): $m/z = 467.1$ $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{14}\text{N}_6\text{O}_4\text{S}_2$ $[\text{M} + \text{H}]^+$: 467.0591, found : 467.0577.

N-(5-(3-(3-(4-fluorophenyl)thioureido)phenyl)-1,3,4-oxadiazol-2-yl)thiophene-2-

carboxamide 14{3,4} ^1H NMR (500 MHz, DMSO- d_6) δ 12.31 (s, 1H), 11.28 (s, 1H), 10.07 (d, J = 31.0 Hz, 1H), 8.25 (d, J = 49.2 Hz, 1H), 8.08 – 7.94 (m, 2H), 7.89 (d, J = 15.5 Hz, 1H), 7.76 (d, J = 28.4 Hz, 2H), 7.58 – 7.43 (m, 2H), 7.20 (t, J = 35.3 Hz, 3H); ^{13}C NMR (126 MHz, DMSO- d_6) δ 166.16, 165.07, 164.63, 164.23, 162.78, 152.81, 151.97, 139.71, 131.75, 131.72, 131.70, 126.76, 126.69, 125.45, 115.75, 115.69, 115.57, 115.52; m.p. 135-140 °C; LC-MS (ESI): m/z = 440.2 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{14}\text{FN}_5\text{O}_2\text{S}_2$ $[\text{M} + \text{H}]^+$: 440.0646, found : 440.0631.

N-(5-(3-((pyridin-3-ylmethyl)amino)phenyl)-1,3,4-oxadiazol-2-yl)benzamide 16{1,2} ^1H NMR (500 MHz, Chloroform- d) δ 8.26 (s, 1H), 8.21 (d, J = 7.6 Hz, 1H), 8.04 (d, J = 7.7 Hz, 2H), 7.74 (dt, J = 23.6, 6.7 Hz, 3H), 7.62 (t, J = 7.6 Hz, 2H), 7.57 (d, J = 7.9 Hz, 1H), 7.47 (t, J = 7.2 Hz, 1H), 7.40 (t, J = 7.4 Hz, 2H), 7.29 (d, J = 7.4 Hz, 2H), 4.73 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 166.20, 159.46, 158.07, 135.35, 135.07, 132.01, 131.00, 130.31, 129.63, 128.92, 128.49, 127.98, 127.67, 123.77, 121.74, 66.43, 58.38, 14.23; m.p. 115-120 °C; LC-MS (ESI): m/z = 372.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{21}\text{H}_{17}\text{N}_5\text{O}_2$ $[\text{M} + \text{H}]^+$: 372.1455, found : 372.1451.

N-(5-(3-((thiophen-2-ylmethyl)amino)phenyl)-1,3,4-oxadiazol-2-yl)benzamide 16{1,3} ^1H NMR (500 MHz, Chloroform- d) δ 8.27 (s, 1H), 8.21 (d, J = 7.8 Hz, 1H), 8.04 (d, J = 7.7 Hz, 2H), 7.78 – 7.68 (m, 3H), 7.61 (t, J = 7.5 Hz, 4H), 7.42 (d, J = 4.9 Hz, 1H), 7.11 (d, J = 2.8 Hz, 1H), 7.04 – 7.01 (m, 1H), 4.96 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 165.98, 159.45, 158.18, 135.11, 134.72, 132.21, 131.94, 129.88, 129.82, 129.55, 128.82, 128.63, 128.39, 128.09, 127.54, 123.97, 121.81, 51.82; m.p. 110-115 °C; LC-MS (ESI): m/z = 377.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{16}\text{N}_4\text{O}_2\text{S}$ $[\text{M} + \text{H}]^+$: 377.1067, found : 377.1061.

N-(5-(3-((4-methoxybenzyl)amino)phenyl)-1,3,4-oxadiazol-2-yl)benzamide 16{1,4} ^1H NMR (500 MHz, DMSO- d_6) δ 8.05 (d, J = 6.6 Hz, 3H), 7.68 (s, 1H), 7.58 (d, J = 6.6 Hz, 3H), 7.31 (d, J = 7.3 Hz, 3H), 7.21 (s, 1H), 7.12 (d, J = 7.3 Hz, 1H), 6.90 (d, J = 7.4 Hz, 2H), 6.80 (d, J = 7.9 Hz, 1H), 4.26 (s, 2H), 3.72 (s, 3H); ^{13}C NMR (126 MHz, DMSO- d_6) δ 158.83, 158.66, 158.55, 158.27, 149.64, 133.39, 131.79, 130.35, 129.13, 128.91, 128.79, 124.29, 115.84, 115.41, 114.22, 113.85, 109.81, 55.42, 46.18; m.p. 155-160 °C; LC-MS (ESI): m/z = 401.3 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{20}\text{N}_4\text{O}_3$ $[\text{M} + \text{H}]^+$: 401.1608, found : 401.1611.

N-(5-(3-((4-nitrobenzyl)amino)phenyl)-1,3,4-oxadiazol-2-yl)benzamide 16{1,5} ^1H NMR (500 MHz, DMSO- d_6) δ 12.14 (s, 1H), 8.22 (d, J = 8.6 Hz, 2H), 8.04 (d, J = 7.4 Hz, 2H), 7.66 (t, J = 7.9 Hz, 2H), 7.57 (t, J = 7.6 Hz, 3H), 7.54 – 7.47 (m, 1H), 7.26 (d, J = 8.0 Hz, 1H), 7.20 (s, 1H), 7.14 (d, J = 7.7 Hz, 1H), 6.78 (d, J = 9.6 Hz, 1H), 4.52 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 162.41, 160.74, 160.41, 157.28, 155.89, 154.60, 153.30, 153.07, 139.40, 139.14, 130.06, 129.56, 129.14, 124.93, 124.45, 116.03, 114.52, 66.31; m.p. 65-70 °C; LC-MS (ESI): m/z = 416.2 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{22}\text{H}_{17}\text{N}_5\text{O}_4$ $[\text{M} + \text{H}]^+$: 416.1353, found : 416.1356.

N-(5-(3-(benzylamino)phenyl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide 16{2,1} ^1H NMR (500 MHz, Chloroform- d) δ 8.26 – 8.17 (m, 3H), 7.78 (d, J = 6.7 Hz, 2H), 7.74 (t, J = 8.0 Hz, 1H), 7.65 (dd, J = 11.4, 3.6 Hz, 2H), 7.59 (d, J = 9.1 Hz, 1H), 7.47 (t, J = 7.3 Hz, 1H), 7.40 (t, J = 7.6 Hz, 2H), 7.29 (s, 1H), 6.77 (s, 1H), 4.73 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 158.81, 156.30, 155.65, 149.76, 142.82, 134.96, 132.05, 130.97, 130.03, 129.44, 129.21, 128.43, 127.43, 123.38, 121.73, 114.29, 112.60, 58.65; m.p. 146-160 °C; LC-

MS (ESI): $m/z = 361.2$ $[M + H]^+$; HRMS (ESI) calcd for $C_{20}H_{16}N_4O_3$ $[M + H]^+ : 361.1295$, found : 361.1286.

N-(5-(3-((pyridin-3-ylmethyl)amino)phenyl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide

16{2,2} 1H NMR (500 MHz, Chloroform- d) δ 9.36 (s, 1H), 8.99 – 8.91 (m, 1H), 8.83 (d, $J = 8.0$ Hz, 1H), 8.29 (s, 1H), 8.20 (d, $J = 7.4$ Hz, 1H), 8.18 – 8.09 (m, 2H), 7.81 – 7.75 (m, 4H), 7.69 (d, $J = 3.6$ Hz, 1H), 6.79 (s, 1H), 5.10 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 160.04, 159.74, 157.25, 156.36, 150.42, 150.15, 144.35, 143.41, 136.81, 133.23, 132.23, 129.49, 128.83, 127.89, 123.89, 123.60, 121.32, 115.09, 52.84; m.p. 160-172 °C; LC-MS (ESI): $m/z = 362.2$ $[M + H]^+$; HRMS (ESI) calcd for $C_{19}H_{15}N_5O_3$ $[M + H]^+ : 362.1248$, found : 362.1242.

N-(5-(3-((thiophen-2-ylmethyl)amino)phenyl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide

16{2,3} 1H NMR (500 MHz, Chloroform- d) δ 8.29 (s, 1H), 8.20 (d, $J = 7.9$ Hz, 1H), 7.81 – 7.69 (m, 3H), 7.65 – 7.62 (m, 2H), 7.43 (d, $J = 5.1$ Hz, 1H), 7.11 (d, $J = 3.1$ Hz, 1H), 7.04 – 7.01 (m, 1H), 6.75 (d, $J = 3.6$ Hz, 1H), 4.97 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 159.56, 157.31, 156.01, 149.31, 143.80, 134.88, 132.55, 132.31, 130.20, 129.33, 128.56, 128.30, 128.19, 123.53, 122.34, 122.18, 114.39, 52.30; m.p. 90-95 °C; LC-MS (ESI): $m/z = 367.1$ $[M + H]^+$; HRMS (ESI) calcd for $C_{18}H_{14}N_4O_3S$ $[M + H]^+ : 367.0859$, found : 367.0853.

N-(5-(3-((4-methoxybenzyl)amino)phenyl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide

16{2,4} 1H NMR (500 MHz, DMSO- d_6) δ 12.16 (s, 1H), 8.04 (s, 1H), 7.57 (s, 1H), 7.43 (s, 1H), 7.30 (d, $J = 8.4$ Hz, 2H), 7.27 – 7.22 (m, 1H), 7.19 (s, 1H), 7.09 (d, $J = 7.4$ Hz, 1H), 6.90 (d, $J = 8.2$ Hz, 2H), 6.81 – 6.73 (m, 2H), 4.26 (s, 2H), 3.72 (s, 3H); ^{13}C NMR (126 MHz,

DMSO-d₆) δ 158.60, 149.60, 148.01, 131.68, 130.74, 128.87, 118.02, 117.65, 115.89, 115.68, 114.28, 113.89, 113.80, 112.80, 109.60, 65.30, 55.40; m.p. 65-70 °C; LC-MS (ESI): m/z = 391.2 $[M + H]^+$; HRMS (ESI) calcd for C₂₁H₁₈N₄O₄ $[M + H]^+$: 391.1401, found : 391.1407.

N-(5-(3-((4-nitrobenzyl)amino)phenyl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide 16{2,5}
¹H NMR (500 MHz, DMSO-d₆) δ 12.16 (s, 1H), 8.22 (d, J = 7.7 Hz, 2H), 8.04 (s, 1H), 7.65 (d, J = 7.8 Hz, 2H), 7.58 (s, 1H), 7.27 (t, J = 7.5 Hz, 1H), 7.19 (s, 1H), 7.12 (d, J = 7.4 Hz, 1H), 6.76 (s, 3H), 4.52 (s, 2H); ¹³C NMR (126 MHz, DMSO-d₆) δ 149.24, 148.83, 148.03, 146.96, 130.56, 130.31, 128.55, 128.39, 124.08, 123.69, 118.87, 117.69, 116.52, 115.77, 114.29, 112.94, 109.85, 65.39; m.p. 135-140 °C; LC-MS (ESI): m/z = 406.2 $[M + H]^+$; HRMS (ESI) calcd for C₂₀H₁₅N₅O₅ $[M + H]^+$: 406.1146, found : 406.1147.

N-(5-(3-(benzylamino)phenyl)-1,3,4-oxadiazol-2-yl)thiophene-2-carboxamide 16{3,1} ¹H NMR (500 MHz, Chloroform-d) δ 8.24 – 8.19 (m, 2H), 8.13 (d, J = 3.6 Hz, 2H), 7.97 (d, J = 4.9 Hz, 1H), 7.75 (t, J = 7.9 Hz, 1H), 7.62 (d, J = 7.7 Hz, 1H), 7.49 (d, J = 7.4 Hz, 1H), 7.41 (t, J = 7.6 Hz, 3H), 7.35 – 7.31 (m, 1H), 7.28 (d, J = 7.4 Hz, 2H), 4.74 (s, 2H); ¹³C NMR (126 MHz, Chloroform-d) δ 161.34, 159.51, 157.50, 139.53, 135.92, 135.82, 133.11, 133.00, 131.92, 130.97, 130.39, 130.11, 129.51, 129.35, 128.28, 123.18, 122.59, 59.55; m.p. 144-153 °C; LC-MS (ESI): m/z = 377.1 $[M + H]^+$; HRMS (ESI) calcd for C₂₀H₁₆N₄O₂S $[M + H]^+$: 377.1067, found : 377.1057.

N-(5-(3-((pyridin-3-ylmethyl)amino)phenyl)-1,3,4-oxadiazol-2-yl)thiophene-2-carboxamide 16{3,2} ¹H NMR (500 MHz, Chloroform-d) δ 9.31 (s, 1H), 8.93 (d, J = 5.7 Hz, 1H), 8.82 (d, J = 8.0 Hz, 1H), 8.27 (s, 1H), 8.19 (d, J = 7.3 Hz, 1H), 8.14 (s, 3H), 7.98 (d, J =

4.7 Hz, 1H), 7.84 – 7.73 (m, 3H), 7.34 – 7.31 (m, 1H), 5.10 (s, 2H); ^{13}C NMR (126 MHz, Chloroform-d) δ 161.01, 159.58, 157.49, 149.71, 144.12, 143.19, 139.01, 137.06, 135.39, 133.18, 133.00, 132.39, 130.16, 128.90, 128.59, 127.34, 123.41, 120.74, 52.33; m.p. 110-115 °C; LC-MS (ESI): m/z = 378.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{19}\text{H}_{15}\text{N}_5\text{O}_2\text{S}$ $[\text{M} + \text{H}]^+$: 378.1019, found : 378.1016.

N-(5-(3-((thiophen-2-ylmethyl)amino)phenyl)-1,3,4-oxadiazol-2-yl)thiophene-2-

carboxamide 16{3,3} ^1H NMR (500 MHz, Chloroform-d) δ 8.22 (d, J = 8.6 Hz, 2H), 8.14 (dd, J = 16.0, 5.3 Hz, 1H), 8.10 (d, J = 3.6 Hz, 1H), 7.92 (d, J = 4.7 Hz, 1H), 7.75 (t, J = 7.9 Hz, 1H), 7.64 (d, J = 8.2 Hz, 1H), 7.43 (d, J = 4.6 Hz, 1H), 7.33 – 7.29 (m, 1H), 7.11 (d, J = 3.1 Hz, 1H), 7.05 – 7.02 (m, 1H), 4.97 (s, 2H); ^{13}C NMR (126 MHz, Chloroform-d) δ 160.53, 159.38, 157.73, 137.67, 134.82, 134.25, 133.88, 132.49, 132.27, 130.17, 129.70, 129.30, 128.51, 128.28, 128.18, 123.47, 122.03, 52.20; m.p. 180-190 °C; LC-MS (ESI): m/z = 383.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{18}\text{H}_{14}\text{N}_4\text{O}_2\text{S}_2$ $[\text{M} + \text{H}]^+$: 383.0631, found : 383.0622.

N-(5-(3-((4-methoxybenzyl)amino)phenyl)-1,3,4-oxadiazol-2-yl)thiophene-2-

carboxamide 16{3,4} ^1H NMR (500 MHz, DMSO-d₆) δ 8.29 (s, 1H), 8.14 (s, 1H), 7.99 (s, 1H), 7.87 (s, 1H), 7.29 (d, J = 7.2 Hz, 3H), 7.18 (d, J = 8.9 Hz, 3H), 6.89 (d, J = 7.4 Hz, 2H), 6.81 (dd, J = 17.2, 8.1 Hz, 1H), 4.26 (s, 2H), 3.72 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d₆) δ 165.21, 158.71, 152.92, 137.17, 133.40, 132.40, 131.99, 131.96, 131.69, 129.49, 128.90, 128.87, 128.22, 127.94, 115.38, 114.22, 111.90, 65.39, 55.48; m.p. 65-70 °C; LC-MS (ESI): m/z = 407.2 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{21}\text{H}_{18}\text{N}_4\text{O}_3\text{S}$ $[\text{M} + \text{H}]^+$: 407.1172, found : 407.1171.

N-(5-(3-((4-nitrobenzyl)amino)phenyl)-1,3,4-oxadiazol-2-yl)thiophene-2-carboxamide

16{3,5} ^1H NMR (500 MHz, DMSO- d_6) δ 12.16 (s, 1H), 8.04 (s, 1H), 7.57 (s, 1H), 7.43 (s, 1H), 7.30 (d, J = 8.4 Hz, 2H), 7.27 – 7.23 (m, 1H), 7.19 (s, 1H), 7.10 (d, J = 7.2 Hz, 1H), 6.90 (d, J = 7.5 Hz, 2H), 6.79 (d, J = 8.3 Hz, 1H), 6.76 (s, 1H), 4.26 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 163.20, 162.30, 161.81, 160.91, 154.22, 154.03, 153.39, 151.73, 145.32, 140.17, 139.12, 131.50, 128.00, 124.50, 122.12, 118.37, 108.90, 66.36; m.p. 130-140 °C; LC-MS (ESI): m/z = 422.2 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{15}\text{N}_5\text{O}_4\text{S}$ $[\text{M} + \text{H}]^+$: 422.0918, found : 422.0912.

N-(3-(5-benzamido-1,3,4-oxadiazol-2-yl)phenyl)furan-2-carboxamide 18{1,2} ^1H NMR (500 MHz, Chloroform- d) δ 8.69 (s, 1H), 8.30 (s, 1H), 8.07 (d, J = 7.6 Hz, 3H), 7.89 (d, J = 7.6 Hz, 1H), 7.74 (t, J = 7.4 Hz, 1H), 7.61 (t, J = 6.7 Hz, 4H), 7.38 (d, J = 3.4 Hz, 1H), 6.67 – 6.61 (m, 1H); ^{13}C NMR (126 MHz, Chloroform- d) δ 166.40, 160.52, 158.86, 156.99, 146.72, 145.38, 137.59, 135.97, 131.10, 129.81, 128.86, 126.54, 124.40, 121.14, 119.88, 118.67, 113.56, 77.72; m.p. 230-235 °C; LC-MS (ESI): m/z = 375.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{14}\text{N}_4\text{O}_4$ $[\text{M} + \text{H}]^+$: 375.1088, found : 375.1074.

N-(3-(5-benzamido-1,3,4-oxadiazol-2-yl)phenyl)thiophene-2-carboxamide 18{1,3} ^1H NMR (500 MHz, Chloroform- d) δ 8.55 (s, 1H), 8.24 (s, 1H), 8.06 (d, J = 7.6 Hz, 3H), 7.86 (d, J = 7.7 Hz, 1H), 7.81 (d, J = 3.1 Hz, 1H), 7.74 (t, J = 7.4 Hz, 1H), 7.67 (d, J = 4.9 Hz, 1H), 7.60 (dd, J = 14.2, 6.7 Hz, 3H), 7.20 – 7.16 (m, 1H); ^{13}C NMR (126 MHz, Chloroform- d) δ 166.46, 163.40, 160.48, 156.90, 138.03, 136.06, 135.93, 133.51, 131.41, 131.10, 129.85, 128.85, 126.96, 124.35, 120.99, 120.18, 100.21, 77.75; m.p. 255-260 °C; LC-MS (ESI): m/z = 391.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{14}\text{N}_4\text{O}_3\text{S}$ $[\text{M} + \text{H}]^+$: 391.0859, found : 391.0851.

N-(5-(3-benzamidophenyl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide 18{2,1} ¹H NMR (500 MHz, Chloroform-d) δ 8.66 (s, 1H), 8.36 (s, 1H), 8.07 (d, *J* = 7.9 Hz, 1H), 7.90 (dd, *J* = 15.9, 7.7 Hz, 3H), 7.77 (s, 1H), 7.69 – 7.59 (m, 3H), 7.56 (t, *J* = 7.5 Hz, 2H), 6.76 – 6.72 (m, 1H); ¹³C NMR (126 MHz, Chloroform-d) δ 170.40, 160.62, 156.34, 155.68, 149.66, 143.47, 138.26, 133.98, 132.49, 131.19, 129.61, 127.57, 127.11, 124.65, 123.02, 121.06, 120.44, 114.60; m.p. 265-270 °C; LC-MS (ESI): *m/z* = 375.1 [M + H]⁺; HRMS (ESI) calcd for C₂₀H₁₄N₄O₄ [M + H]⁺ : 375.1088, found : 375.1079.

N-(3-(5-(furan-2-carboxamido)-1,3,4-oxadiazol-2-yl)phenyl)furan-2-carboxamide 18{2,2} ¹H NMR (500 MHz, Chloroform-d) δ 8.64 (s, 1H), 8.31 (s, 1H), 8.04 (d, *J* = 8.0 Hz, 1H), 7.88 (d, *J* = 7.7 Hz, 1H), 7.74 (s, 1H), 7.63 – 7.54 (m, 3H), 7.38 (d, *J* = 3.4 Hz, 1H), 6.72 – 6.69 (m, 1H), 6.66 – 6.62 (m, 1H); ¹³C NMR (126 MHz, Chloroform-d) δ 160.60, 158.75, 156.49, 155.52, 149.15, 146.66, 145.40, 143.67, 137.57, 131.00, 126.17, 124.25, 122.28, 121.34, 119.71, 118.57, 114.30, 113.52; m.p. 255-260 °C; LC-MS (ESI): *m/z* = 365.1 [M + H]⁺; HRMS (ESI) calcd for C₁₈H₁₂N₄O₅ [M + H]⁺ : 365.0880, found : 365.0871.

N-(5-(3-(thiophene-2-carboxamido)phenyl)-1,3,4-oxadiazol-2-yl)furan-2-carboxamide 18{2,3} ¹H NMR (500 MHz, Chloroform-d) δ 8.54 (s, 1H), 8.30 (s, 1H), 8.01 (d, *J* = 7.9 Hz, 1H), 7.86 (d, *J* = 7.7 Hz, 1H), 7.84 – 7.79 (m, 1H), 7.75 (s, 1H), 7.68 (d, *J* = 4.8 Hz, 1H), 7.62 – 7.56 (m, 2H), 7.22 – 7.17 (m, 1H), 6.73 (d, *J* = 2.9 Hz, 1H); ¹³C NMR (126 MHz, Chloroform-d) δ 163.32, 160.56, 156.37, 155.56, 149.31, 143.55, 138.04, 135.98, 133.50, 131.38, 131.04, 128.84, 126.61, 124.22, 122.54, 121.12, 120.05, 114.42; m.p. 195-200 °C; LC-MS (ESI): *m/z* = 381.1 [M + H]⁺; HRMS (ESI) calcd for C₁₈H₁₂N₄O₄S [M + H]⁺ : 381.0652, found : 381.0643.

N-(5-(3-benzamidophenyl)-1,3,4-oxadiazol-2-yl)thiophene-2-carboxamide 18{3,1} ^1H NMR (500 MHz, Chloroform- d) δ 8.67 (s, 1H), 8.25 (s, 1H), 8.19 – 8.07 (m, 2H), 7.91 (dt, J = 12.7, 7.2 Hz, 4H), 7.67 (t, J = 6.0 Hz, 2H), 7.56 (t, J = 7.4 Hz, 2H), 7.33 – 7.28 (m, 1H); ^{13}C NMR (126 MHz, Chloroform- d) δ 170.10, 166.29, 164.01, 162.39, 141.43, 135.69, 133.96, 132.73, 129.82, 129.64, 129.15, 128.80, 127.52, 123.47, 122.30, 77.76; m.p. decomposed above ~ 260 $^{\circ}\text{C}$; LC-MS (ESI): m/z = 391.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{14}\text{N}_4\text{O}_3\text{S}$ $[\text{M} + \text{H}]^+$: 391.0859, found : 391.0856.

N-(3-(5-(thiophene-2-carboxamido)-1,3,4-oxadiazol-2-yl)phenyl)furan-2-carboxamide 18{3,2} ^1H NMR (500 MHz, Chloroform- d) δ 8.72 (s, 1H), 8.25 (s, 1H), 8.16 – 8.07 (m, 2H), 7.93 – 7.86 (m, 2H), 7.64 (d, J = 8.6 Hz, 2H), 7.40 (d, J = 3.2 Hz, 1H), 7.30 (s, 1H), 6.69 – 6.63 (m, 1H); ^{13}C NMR (126 MHz, Chloroform- d) δ 165.92, 163.34, 162.45, 158.31, 146.39, 145.52, 140.51, 135.39, 129.65, 128.92, 128.86, 128.72, 123.76, 121.63, 118.70, 113.71, 77.67; m.p. 100-110 $^{\circ}\text{C}$; LC-MS (ESI): m/z = 381.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{18}\text{H}_{12}\text{N}_4\text{O}_4\text{S}$ $[\text{M} + \text{H}]^+$: 381.0652, found : 381.0651.

N-(3-(5-(thiophene-2-carboxamido)-1,3,4-oxadiazol-2-yl)phenyl)thiophene-2-carboxamide 18{3,3} ^1H NMR (500 MHz, DMSO- d_6) δ 12.31 (s, 1H), 11.29 (s, 1H), 10.51 (d, J = 25.7 Hz, 1H), 8.47 (s, 1H), 8.30 (s, 1H), 8.08 (s, 1H), 8.02 (d, J = 5.9 Hz, 1H), 7.90 (s, 1H), 7.72 (d, J = 7.7 Hz, 1H), 7.59 (d, J = 5.9 Hz, 1H), 7.25 (s, 1H), 7.22 – 7.16 (m, 1H); ^{13}C NMR (126 MHz, DMSO) δ 166.66, 163.94, 159.56, 151.68, 139.12, 136.11, 135.15, 130.92, 128.92, 128.82, 127.56, 126.82, 123.72, 122.44, 122.08, 120.52, 119.46, 116.76; m.p. 185-200 $^{\circ}\text{C}$; LC-MS (ESI): m/z = 397.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{18}\text{H}_{12}\text{N}_4\text{O}_3\text{S}_2$ $[\text{M} + \text{H}]^+$:

397.0424, found : 397.0412.

N-(5-(3-(2-(2-acetamidoacetamido)propanamido)phenyl)-1,3,4-oxadiazol-2-

yl)benzamide 20{1,2} ¹H NMR (500 MHz, DMSO-d₆) δ 12.19 (s, 1H), 10.30 (s, 1H), 8.37 (s, 1H), 8.27 (t, *J* = 5.3 Hz, 1H), 8.24 – 8.16 (m, 1H), 8.05 (d, *J* = 7.3 Hz, 2H), 7.77 (d, *J* = 8.2 Hz, 1H), 7.67 (d, *J* = 7.6 Hz, 2H), 7.57 (d, *J* = 7.0 Hz, 3H), 3.90 (d, *J* = 5.6 Hz, 3H), 3.60 (s, 1H), 2.07 (s, 2H), 1.90 (s, 3H); ¹³C NMR (126 MHz, DMSO) δ 170.01, 169.34, 169.22, 168.81, 167.80, 139.18, 139.04, 132.34, 129.45, 128.06, 127.72, 123.17, 121.41, 120.15, 116.05, 115.73, 42.19, 24.52, 21.86, 14.02; m.p. 210-220 °C; LC-MS (ESI): *m/z* = 451.3 [M + H]⁺; HRMS (ESI) calcd for C₂₂H₂₂N₆O₅ [M + K]⁺ : 489.1284, found : 489.1272.

N-(5-(3-(2-(2-acetamidoacetamido)-3-hydroxypropanamido)phenyl)-1,3,4-oxadiazol-2-

yl)benzamide 20{1,3} ¹H NMR (500 MHz, DMSO-d₆) δ 12.21 (s, 1H), 10.30 (s, 1H), 8.37 (s, 1H), 8.27 (t, *J* = 5.7 Hz, 1H), 8.05 (d, *J* = 7.5 Hz, 2H), 7.77 (d, *J* = 8.3 Hz, 1H), 7.67 (d, *J* = 7.6 Hz, 2H), 7.58 (t, *J* = 7.6 Hz, 4H), 3.90 (d, *J* = 5.9 Hz, 2H), 3.77 (d, *J* = 5.6 Hz, 2H), 3.60 (s, 1H), 1.90 (s, 3H), 1.76 (d, *J* = 3.3 Hz, 1H); ¹³C NMR (126 MHz, DMSO) δ 170.39, 170.29, 169.92, 169.75, 168.88, 140.26, 133.42, 130.53, 130.44, 129.17, 128.80, 124.25, 122.75, 122.49, 121.22, 116.80, 67.49, 43.27, 25.60, 22.89; m.p. 200-205 °C; LC-MS (ESI): *m/z* = 467.2 [M + H]⁺; HRMS (ESI) calcd for C₂₂H₂₂N₆O₆ [M + H]⁺ : 467.1674, found : 467.1663.

N-(5-(3-(2-(2-acetamidoacetamido)-4-(methylthio)butanamido)phenyl)-1,3,4-oxadiazol-

2-yl)benzamide 20{1,4} ¹H NMR (500 MHz, DMSO-d₆) δ 12.20 (s, 1H), 10.30 (s, 1H), 8.36 (s, 1H), 8.27 (d, *J* = 6.2 Hz, 1H), 8.05 (d, *J* = 6.4 Hz, 3H), 7.77 (d, *J* = 7.9 Hz, 1H), 7.67 (d, *J* = 6.8 Hz, 2H), 7.57 (d, *J* = 12.7 Hz, 3H), 3.90 (d, *J* = 5.4 Hz, 3H), 3.76 – 3.72 (m, 1H), 3.60 (s,

2H), 1.90 (s, 3H), 1.87 (s, 2H), 1.76 (s, 2H); ^{13}C NMR (126 MHz, DMSO) δ 171.09, 170.45, 170.33, 169.89, 140.25, 133.41, 130.51, 130.47, 129.13, 128.80, 124.25, 122.84, 121.49, 121.23, 117.14, 116.82, 42.63, 31.86, 30.11, 25.59, 22.93, 15.09; m.p. 215-220 °C; LC-MS (ESI): m/z = 511.3 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{26}\text{N}_6\text{O}_5\text{S}$ $[\text{M} + \text{H}]^+$: 511.1758, found : 511.1752.

N-(5-(3-(2-(2-acetamidoacetamido)-3-phenylpropanamido)phenyl)-1,3,4-oxadiazol-2-yl)benzamide 20 {1,5} ^1H NMR (500 MHz, DMSO- d_6) δ 12.21 (s, 1H), 10.30 (s, 1H), 8.36 (s, 1H), 8.27 (t, J = 5.7 Hz, 1H), 8.11 (t, J = 5.6 Hz, 1H), 8.05 (d, J = 7.5 Hz, 3H), 7.81 – 7.73 (m, 2H), 7.68 (t, J = 7.2 Hz, 3H), 7.60 – 7.56 (m, 3H), 7.29 (d, J = 3.6 Hz, 2H), 3.90 (d, J = 5.8 Hz, 2H), 1.90 (s, 3H), 1.84 (s, 2H), 1.76 (t, J = 6.3 Hz, 1H); ^{13}C NMR (126 MHz, DMSO) δ 170.88, 170.31, 170.23, 169.60, 168.88, 140.25, 140.06, 137.92, 133.42, 130.52, 129.62, 129.14, 128.80, 128.64, 126.94, 124.25, 122.50, 121.23, 117.06, 116.82, 55.45, 43.28, 42.39, 22.90; m.p. 207-215 °C; LC-MS (ESI): m/z = 527.3 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{28}\text{H}_{26}\text{N}_6\text{O}_5$ $[\text{M} + \text{H}]^+$: 527.2037, found : 527.2015.

3-(2-acetamidoacetamido)-4-((3-(5-benzamido-1,3,4-oxadiazol-2-yl)phenyl)amino)-4-oxobutanoic acid 20 {1,6} ^1H NMR (500 MHz, DMSO- d_6) δ 12.27 (s, 1H), 8.37 (s, 1H), 8.27 (s, 2H), 8.16 – 7.97 (m, 2H), 7.93 – 7.81 (m, 1H), 7.81 – 7.74 (m, 1H), 7.74 – 7.62 (m, 2H), 7.61 – 7.44 (m, 3H), 3.90 (s, 2H), 3.72 (s, 1H), 3.60 (s, 2H), 1.90 (s, 3H), 1.76 (s, 1H); ^{13}C NMR (126 MHz, DMSO) δ 172.10, 170.31, 169.72, 168.88, 140.26, 133.41, 130.52, 129.13, 129.06, 128.87, 128.80, 127.90, 124.25, 122.54, 122.50, 121.23, 116.82, 43.27, 25.60, 22.89, 15.64; m.p. 206-214 °C; LC-MS (ESI): m/z = 495.3 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{22}\text{N}_6\text{O}_7$ $[\text{M} + \text{H}]^+$: 495.1623, found : 495.1615.

N-(5-(4-(3-benzylureido)phenyl)-1,3,4-thiadiazol-2-yl)benzamide 13{1,2} ^1H NMR (500 MHz, DMSO- d_6) δ 13.09 (s, 1H), 8.97 (s, 1H), 8.15 (d, $J = 7.7$ Hz, 2H), 7.87 (d, $J = 8.3$ Hz, 2H), 7.68 (t, $J = 7.1$ Hz, 1H), 7.63 – 7.55 (m, 4H), 7.35 (d, $J = 6.9$ Hz, 4H), 7.26 (s, 1H), 6.79 (s, 1H), 4.35 (s, 2H); ^{13}C NMR (126 MHz, DMSO) δ 205.88, 154.34, 154.25, 142.24, 139.55, 132.38, 128.06, 127.81, 127.73, 127.09, 126.57, 126.47, 126.18, 122.19, 117.22, 117.13, 42.19; m.p. 284-316 °C; LC-MS (ESI): $m/z = 430.1$ $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{19}\text{N}_5\text{O}_2\text{S}$ $[\text{M} + \text{H}]^+$: 430.1332, found : 430.1304.

N-(5-(4-(3-ethylureido)phenyl)-1,3,4-thiadiazol-2-yl)benzamide 13{1,3} ^1H NMR (500 MHz, DMSO- d_6) δ 13.14 (s, 1H), 8.85 (s, 1H), 8.15 (d, $J = 7.4$ Hz, 2H), 7.85 (d, $J = 8.6$ Hz, 2H), 7.68 (t, $J = 7.6$ Hz, 2H), 7.59 (dd, $J = 8.0, 4.5$ Hz, 4H), 3.14 (d, $J = 6.8$ Hz, 2H), 1.08 (t, $J = 7.2$ Hz, 3H); ^{13}C NMR (126 MHz, DMSO) δ 155.29, 143.48, 133.44, 129.12, 129.10, 128.86, 128.83, 128.73, 128.13, 123.04, 118.15, 107.39, 34.47, 15.85; m.p. 232-237 °C; LC-MS (ESI): $m/z = 368.1$ $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{18}\text{H}_{17}\text{N}_5\text{O}_2\text{S}$ $[\text{M} + \text{H}]^+$: 368.1176, found : 368.1165.

N-(5-(4-(3-phenylureido)phenyl)-1,3,4-thiadiazol-2-yl)furan-2-carboxamide 13{2,1} ^1H NMR (500 MHz, Chloroform- d) δ 7.90 (d, $J = 8.2$ Hz, 2H), 7.79 (s, 1H), 7.69 (d, $J = 3.5$ Hz, 1H), 7.57 (d, $J = 8.3$ Hz, 2H), 7.51 (t, $J = 7.5$ Hz, 2H), 7.41 (t, $J = 7.2$ Hz, 1H), 7.35 (d, $J = 7.8$ Hz, 2H), 6.78 – 6.72 (m, 1H); ^{13}C NMR (126 MHz, DMSO) δ 152.76, 148.20, 145.68, 142.57, 139.92, 129.28, 128.23, 123.82, 122.54, 121.37, 121.20, 118.83, 118.76, 118.63, 117.83, 112.94; m.p. decomposed above ~ 330 °C; LC-MS (ESI): $m/z = 406.1$ $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{15}\text{N}_5\text{O}_3\text{S}$ $[\text{M} + \text{H}]^+$: 406.0968, found : 406.0948.

N-(5-(4-(3-benzylureido)phenyl)-1,3,4-thiadiazol-2-yl)furan-2-carboxamide 13{2,2} ^1H NMR (500 MHz, DMSO- d_6) δ 13.05 (s, 1H), 8.95 (s, 1H), 8.06 (s, 1H), 7.85 (d, J = 8.6 Hz, 2H), 7.75 (s, 1H), 7.58 (d, J = 8.7 Hz, 2H), 7.39 – 7.30 (m, 4H), 7.25 (t, J = 6.8 Hz, 1H), 6.77 (s, 2H), 4.33 (d, J = 5.8 Hz, 2H); ^{13}C NMR (126 MHz, DMSO) δ 155.39, 148.19, 145.83, 143.31, 140.60, 128.79, 128.16, 127.63, 127.51, 127.24, 123.16, 118.27, 118.19, 117.80, 112.93, 107.40, 43.25; m.p. 295-300 °C; LC-MS (ESI): m/z = 420.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{21}\text{H}_{17}\text{N}_5\text{O}_3\text{S}$ $[\text{M} + \text{H}]^+$: 420.1125, found : 420.1103.

N-(5-(4-(3-ethylureido)phenyl)-1,3,4-thiadiazol-2-yl)furan-2-carboxamide 13{2,3} ^1H NMR (500 MHz, DMSO- d_6) δ 13.16 (s, 1H), 8.82 (s, 1H), 8.06 (s, 1H), 7.84 (d, J = 8.6 Hz, 2H), 7.74 (s, 1H), 7.66 (d, J = 8.4 Hz, 1H), 7.57 (d, J = 8.6 Hz, 2H), 3.17 – 3.09 (m, 2H), 1.07 (t, J = 7.2 Hz, 3H); ^{13}C NMR (126 MHz, DMSO) δ 155.27, 148.18, 143.49, 128.73, 128.13, 122.94, 118.14, 117.79, 117.60, 114.82, 112.89, 107.40, 34.47, 15.85; m.p. 320-325 °C; LC-MS (ESI): m/z = 358.2 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{16}\text{H}_{15}\text{N}_5\text{O}_3\text{S}$ $[\text{M} + \text{H}]^+$: 358.0968, found : 358.0959.

N-(5-(4-(3-phenylureido)phenyl)-1,3,4-thiadiazol-2-yl)thiophene-2-carboxamide 13{3,1} ^1H NMR (500 MHz, Chloroform- d) δ 8.18 (d, J = 3.7 Hz, 1H), 7.91 – 7.82 (m, 3H), 7.54 (d, J = 8.4 Hz, 2H), 7.50 (t, J = 7.7 Hz, 2H), 7.39 (t, J = 7.4 Hz, 1H), 7.34 (d, J = 7.8 Hz, 2H), 7.30 (t, J = 4.4 Hz, 1H), 7.23 (s, 1H); ^{13}C NMR (126 MHz, DMSO) δ 152.78, 142.61, 139.94, 134.71, 132.09, 129.28, 129.23, 129.17, 128.69, 128.21, 123.81, 122.53, 118.81, 118.75, 118.62, 114.46; m.p. 305-315 °C; LC-MS (ESI): m/z = 422.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{15}\text{N}_5\text{O}_2\text{S}_2$ $[\text{M} + \text{H}]^+$: 422.0740, found : 422.0731.

N-(5-(4-(3-benzylureido)phenyl)-1,3,4-thiadiazol-2-yl)thiophene-2-carboxamide 13{3,2}

¹H NMR (500 MHz, DMSO-d₆) δ 13.19 (s, 1H), 8.99 (s, 1H), 8.32 (s, 1H), 8.02 (d, *J* = 4.7 Hz, 1H), 7.85 (d, *J* = 8.7 Hz, 2H), 7.60 (d, *J* = 8.8 Hz, 2H), 7.34 (t, *J* = 7.2 Hz, 4H), 7.31 – 7.27 (m, 1H), 7.26 (t, *J* = 6.6 Hz, 1H), 6.82 (t, *J* = 5.9 Hz, 1H), 4.33 (s, 2H); ¹³C NMR (126 MHz, DMSO) δ 206.95, 155.40, 143.35, 140.61, 134.73, 132.06, 131.88, 129.16, 128.79, 128.13, 127.62, 127.52, 127.23, 123.15, 118.27, 118.16, 43.24; m.p. 295-314 °C; LC-MS (ESI): *m/z* = 436.2 [M + H]⁺; HRMS (ESI) calcd for C₂₁H₁₇N₅O₂S₂ [M + H]⁺ : 436.0896, found : 436.0863.

N-(5-(4-(3-ethylureido)phenyl)-1,3,4-thiadiazol-2-yl)thiophene-2-carboxamide 13{3,3}

¹H NMR (500 MHz, DMSO-d₆) δ 13.19 (s, 1H), 8.81 (s, 1H), 8.32 (s, 1H), 8.02 (s, 2H), 7.82 (d, *J* = 8.6 Hz, 2H), 7.61 (d, *J* = 8.3 Hz, 1H), 7.56 (d, *J* = 8.7 Hz, 2H), 3.16 – 3.09 (m, 2H), 1.07 (t, *J* = 7.2 Hz, 3H); ¹³C NMR (126 MHz, DMSO) δ 155.28, 143.51, 139.56, 134.70, 132.06, 129.17, 128.69, 128.11, 122.94, 118.14, 114.23, 107.40, 34.47, 15.85; m.p. 295-302 °C; LC-MS (ESI): *m/z* = 374.1 [M + H]⁺; HRMS (ESI) calcd for C₁₆H₁₅N₅O₂S₂ [M + H]⁺ : 374.0740, found : 374.0734.

N-(5-(4-(3-(3-methoxyphenyl)thioureido)phenyl)-1,3,4-thiadiazol-2-yl)benzamide 15{1,2}

¹H NMR (500 MHz, DMSO-d₆) δ 13.16 (s, 1H), 10.24 (s, 1H), 10.16 (s, 1H), 8.16 (d, *J* = 7.7 Hz, 2H), 7.95 (d, *J* = 8.4 Hz, 2H), 7.74 (d, *J* = 8.5 Hz, 2H), 7.68 (q, *J* = 12.2, 9.7 Hz, 2H), 7.59 (t, *J* = 7.5 Hz, 3H), 7.33 – 7.19 (m, 2H), 3.76 (s, 3H); ¹³C NMR (126 MHz, DMSO) δ 179.58, 159.75, 142.26, 140.91, 139.55, 133.51, 129.74, 129.15, 128.89, 128.72, 127.64, 126.07, 123.74, 116.06, 114.43, 110.41, 109.68, 107.40, 55.57; m.p. decomposed above ~ 270 °C; LC-MS (ESI): *m/z* = 462.2 [M + H]⁺; HRMS (ESI) calcd for C₂₃H₁₉N₅O₂S₂ [M + H]⁺ : 462.1053,

found : 462.1034.

N-(5-(4-(3-(3-nitrophenyl)thioureido)phenyl)-1,3,4-thiadiazol-2-yl)benzamide 15{1,3} ^1H NMR (500 MHz, DMSO- d_6) δ 13.17 (s, 1H), 10.47 (s, 1H), 10.44 (s, 1H), 8.60 (s, 1H), 8.16 (d, $J = 7.3$ Hz, 2H), 7.99 (d, $J = 8.6$ Hz, 3H), 7.96 (d, $J = 7.7$ Hz, 1H), 7.73 (s, 1H), 7.65 (t, $J = 8.2$ Hz, 2H), 7.59 (t, $J = 7.8$ Hz, 3H); ^{13}C NMR (126 MHz, DMSO) δ 180.07, 148.00, 141.68, 141.28, 139.57, 133.54, 130.17, 130.11, 129.16, 128.89, 128.80, 127.86, 126.60, 124.09, 123.84, 119.30, 118.11, 107.41; m.p. decomposed above ~ 285 $^\circ\text{C}$; LC-MS (ESI): $m/z = 477.1$ $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{22}\text{H}_{16}\text{N}_6\text{O}_3\text{S}_2$ $[\text{M} + \text{H}]^+$: 477.0798, found : 477.0776.

N-(5-(4-(3-(4-fluorophenyl)thioureido)phenyl)-1,3,4-thiadiazol-2-yl)benzamide 15{1,4} ^1H NMR (500 MHz, DMSO- d_6) δ 13.17 (s, 1H), 10.13 (s, 1H), 10.02 (s, 1H), 8.15 (d, $J = 7.3$ Hz, 2H), 7.96 (d, $J = 7.7$ Hz, 2H), 7.71 (d, $J = 8.4$ Hz, 2H), 7.68 (d, $J = 6.8$ Hz, 1H), 7.59 (d, $J = 6.8$ Hz, 3H), 7.51 (d, $J = 5.4$ Hz, 2H), 7.20 (t, $J = 8.1$ Hz, 1H); ^{13}C NMR (126 MHz, DMSO- d_6) δ 180.23, 160.68, 158.76, 142.18, 136.09, 136.07, 133.52, 129.16, 128.91, 127.71, 126.74, 126.67, 123.79, 115.70, 115.52, 107.45; m.p. 210-215 $^\circ\text{C}$; LC-MS (ESI): $m/z = 450.2$ $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{22}\text{H}_{16}\text{FN}_5\text{OS}_2$ $[\text{M} + \text{H}]^+$: 450.0853, found : 450.0855.

N-(5-(4-(3-phenylthioureido)phenyl)-1,3,4-thiadiazol-2-yl)furan-2-carboxamide 15{2,1} ^1H NMR (500 MHz, DMSO- d_6) δ 13.12 (s, 1H), 10.16 (s, 1H), 10.09 (s, 1H), 8.07 (s, 1H), 7.94 (d, $J = 8.6$ Hz, 2H), 7.77 – 7.72 (m, 3H), 7.52 (d, $J = 7.8$ Hz, 2H), 7.36 (t, $J = 7.8$ Hz, 2H), 7.16 (t, $J = 7.4$ Hz, 1H), 6.79 (s, 1H); ^{13}C NMR (126 MHz, DMSO) δ 206.96, 179.81, 148.24, 142.30, 139.77, 139.55, 128.96, 127.65, 125.95, 125.08, 124.15, 123.79, 123.67, 117.91, 112.95, 107.39; m.p. 305-310 $^\circ\text{C}$; LC-MS (ESI): $m/z = 422.1$ $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for

$C_{20}H_{15}N_5O_2S_2$ $[M + H]^+$: 422.0740, found : 422.0721.

N-(5-(4-(3-(3-methoxyphenyl)thioureido)phenyl)-1,3,4-thiadiazol-2-yl)furan-2-

carboxamide 15 {2,2} 1H NMR (500 MHz, DMSO- d_6) δ 13.14 (s, 1H), 10.12 (s, 1H), 10.06 (s, 1H), 8.07 (s, 1H), 7.94 (d, J = 8.6 Hz, 2H), 7.76 (s, 1H), 7.71 (d, J = 8.6 Hz, 2H), 7.26 (t, J = 8.1 Hz, 1H), 7.21 (s, 1H), 7.07 (d, J = 7.9 Hz, 1H), 6.79 (s, 1H), 6.74 (d, J = 8.4 Hz, 1H), 3.76 (s, 3H); ^{13}C NMR (126 MHz, DMSO) δ 179.60, 159.77, 148.25, 142.25, 140.87, 139.55, 129.76, 128.73, 127.65, 126.01, 123.76, 117.91, 116.08, 114.79, 112.96, 110.44, 109.70, 107.40, 55.57; m.p. 273-302 °C; LC-MS (ESI): m/z = 452.1 $[M + H]^+$; HRMS (ESI) calcd for $C_{21}H_{17}N_5O_3S_2$ $[M + H]^+$: 452.0846, found : 452.0826.

N-(5-(4-(3-(3-nitrophenyl)thioureido)phenyl)-1,3,4-thiadiazol-2-yl)furan-2-carboxamide

15 {2,3} 1H NMR (500 MHz, DMSO- d_6) δ 13.14 (s, 1H), 10.44 (s, 1H), 10.41 (s, 1H), 8.58 (s, 1H), 8.07 (s, 1H), 7.96 (dd, J = 13.3, 8.0 Hz, 4H), 7.76 (s, 1H), 7.70 (d, J = 8.6 Hz, 2H), 7.65 (d, J = 8.2 Hz, 1H), 6.78 (dd, J = 3.5, 1.6 Hz, 1H); ^{13}C NMR (126 MHz, DMSO) δ 180.04, 148.28, 148.00, 141.70, 141.27, 139.56, 130.16, 130.07, 128.79, 127.85, 127.42, 126.50, 124.03, 119.28, 118.08, 117.94, 112.97, 107.40; m.p. decomposed above ~ 244 °C; LC-MS (ESI): m/z = 467.1 $[M + H]^+$; HRMS (ESI) calcd for $C_{20}H_{14}N_6O_4S_2$ $[M + H]^+$: 467.0591, found : 467.0570.

N-(5-(4-(3-(4-fluorophenyl)thioureido)phenyl)-1,3,4-thiadiazol-2-yl)furan-2-

carboxamide 15 {2,4} 1H NMR (500 MHz, DMSO- d_6) δ 13.14 (s, 1H), 10.11 (s, 1H), 10.00 (s, 1H), 8.07 (s, 1H), 7.94 (d, J = 8.1 Hz, 2H), 7.76 (s, 1H), 7.70 (d, J = 8.1 Hz, 2H), 7.54 – 7.47 (m, 2H), 7.20 (t, J = 8.4 Hz, 2H), 6.78 (s, 1H); ^{13}C NMR (126 MHz, DMSO- d_6) δ 180.21,

160.68, 158.76, 148.28, 142.19, 136.08, 136.06, 127.71, 126.74, 126.67, 126.04, 123.76, 117.93, 115.70, 115.52, 112.97; m.p. 235-240 °C; LC-MS (ESI): $m/z = 440.1$ $[M + H]^+$; HRMS (ESI) calcd for $C_{20}H_{14}FN_5O_2S_2$ $[M + H]^+$: 440.0646, found : 440.0626.

N-(5-(4-(3-phenylthioureido)phenyl)-1,3,4-thiadiazol-2-yl)thiophene-2-carboxamide

15{3,1} 1H NMR (500 MHz, DMSO- d_6) δ 13.28 (s, 1H), 10.19 (s, 1H), 10.11 (s, 1H), 8.32 (s, 1H), 8.03 (d, $J = 4.8$ Hz, 1H), 7.94 (d, $J = 8.6$ Hz, 2H), 7.74 (d, $J = 8.7$ Hz, 2H), 7.53 (d, $J = 7.7$ Hz, 2H), 7.36 (t, $J = 7.9$ Hz, 2H), 7.31 – 7.28 (m, 1H), 7.16 (t, $J = 7.4$ Hz, 1H); ^{13}C NMR (126 MHz, DMSO) δ 206.96, 179.79, 142.32, 139.78, 139.55, 134.78, 132.15, 129.19, 128.96, 127.63, 125.94, 125.08, 124.13, 123.64, 114.39, 107.40; m.p. decomposed above ~ 305 °C; LC-MS (ESI): $m/z = 438.1$ $[M + H]^+$; HRMS (ESI) calcd for $C_{20}H_{15}N_5OS_3$ $[M + H]^+$: 438.0511, found : 438.0494.

N-(5-(4-(3-(3-methoxyphenyl)thioureido)phenyl)-1,3,4-thiadiazol-2-yl)thiophene-

carboxamide 15{3,2} 1H NMR (500 MHz, DMSO- d_6) δ 13.26 (s, 1H), 10.18 (s, 1H), 10.11 (s, 1H), 8.33 (s, 1H), 8.03 (d, $J = 4.8$ Hz, 1H), 7.94 (d, $J = 8.7$ Hz, 2H), 7.73 (d, $J = 8.7$ Hz, 2H), 7.31 – 7.29 (m, 1H), 7.26 (t, $J = 8.1$ Hz, 1H), 7.23 (t, $J = 2.1$ Hz, 1H), 7.07 (d, $J = 9.2$ Hz, 1H), 6.74 (dd, $J = 9.2, 1.5$ Hz, 1H), 3.76 (s, 3H); ^{13}C NMR (126 MHz, DMSO) δ 206.95, 179.58, 159.76, 142.28, 140.89, 139.55, 132.14, 129.74, 129.19, 128.68, 127.62, 125.99, 123.72, 116.05, 114.29, 110.42, 109.68, 107.40, 55.56; m.p. decomposed above ~ 284 °C; LC-MS (ESI): $m/z = 468.1$ $[M + H]^+$; HRMS (ESI) calcd for $C_{21}H_{17}N_5O_2S_3$ $[M + H]^+$: 468.0617, found : 468.0596.

N-(5-(4-(3-(3-nitrophenyl)thioureido)phenyl)-1,3,4-thiadiazol-2-yl)thiophene-2-

carboxamide 15{3,3} ^1H NMR (500 MHz, DMSO- d_6) δ 13.26 (s, 1H), 10.49 (s, 1H), 10.46 (s, 1H), 8.60 (t, J = 2.2 Hz, 1H), 8.33 (s, 1H), 8.04 – 8.02 (m, 1H), 7.97 (t, J = 8.0 Hz, 4H), 7.72 (d, J = 8.7 Hz, 2H), 7.64 (t, J = 8.2 Hz, 1H), 7.31 – 7.29 (m, 1H); ^{13}C NMR (126 MHz, DMSO) δ 206.95, 180.02, 147.99, 141.73, 141.28, 139.56, 132.16, 130.14, 130.04, 129.19, 128.75, 127.81, 127.42, 126.50, 124.02, 119.26, 118.06, 107.40; m.p. decomposed above $\sim$ 250 $^\circ\text{C}$; LC-MS (ESI): m/z = 483.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{14}\text{N}_6\text{O}_3\text{S}_3$ $[\text{M} + \text{H}]^+$: 483.0362, found : 483.0337.

N-(5-(4-(3-(4-fluorophenyl)thioureido)phenyl)-1,3,4-thiadiazol-2-yl)thiophene-2-

carboxamide 15{3,4} ^1H NMR (500 MHz, DMSO- d_6) δ 13.27 (s, 2H), 10.16 (s, 1H), 10.04 (s, 1H), 8.33 (s, 2H), 8.03 (s, 2H), 7.94 (d, J = 8.3 Hz, 2H), 7.71 (d, J = 8.4 Hz, 2H), 7.54 – 7.46 (m, 2H), 7.30 (s, 2H), 7.20 (t, J = 8.7 Hz, 2H); ^{13}C NMR (126 MHz, DMSO- d_6) δ 180.21, 160.67, 158.75, 142.22, 139.59, 136.09, 136.07, 131.90, 129.22, 127.68, 126.73, 126.67, 123.76, 115.69, 115.51, 107.42; m.p. decomposed above $\sim$ 280 $^\circ\text{C}$; LC-MS (ESI): m/z = 456.2 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{14}\text{FN}_5\text{OS}_3$ $[\text{M} + \text{H}]^+$: 456.0417, found : 456.0417.

N-(5-(4-((pyridin-3-ylmethyl)amino)phenyl)-1,3,4-thiadiazol-2-yl)benzamide 17{1,2} ^1H NMR (500 MHz, Chloroform- d) δ 8.97 (s, 1H), 8.78 (d, J = 5.6 Hz, 1H), 8.63 (d, J = 8.1 Hz, 1H), 8.06 (d, J = 7.8 Hz, 3H), 7.86 (d, J = 8.6 Hz, 2H), 7.78 (t, J = 7.2 Hz, 2H), 7.63 (t, J = 7.6 Hz, 3H), 6.99 (d, J = 8.7 Hz, 2H), 4.88 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 167.54, 167.07, 159.78, 150.13, 146.91, 141.37, 138.89, 136.05, 131.11, 130.11, 130.04, 129.05, 128.81, 128.74, 128.20, 116.20, 45.92; m.p. 205-210 $^\circ\text{C}$; LC-MS (ESI): m/z = 388.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{21}\text{H}_{17}\text{N}_5\text{OS}$ $[\text{M} + \text{H}]^+$: 388.1227, found : 388.1212.

N-(5-(4-((thiophen-2-ylmethyl)amino)phenyl)-1,3,4-thiadiazol-2-yl)benzamide 17{1,3}

^1H NMR (500 MHz, Chloroform- d) δ 8.13 (d, J = 7.5 Hz, 2H), 8.08 (d, J = 8.6 Hz, 2H), 7.77 (t, J = 7.5 Hz, 1H), 7.64 (t, J = 7.9 Hz, 3H), 7.57 (d, J = 8.6 Hz, 2H), 7.45 (d, J = 5.9 Hz, 1H), 7.11 (d, J = 3.0 Hz, 1H), 7.07 – 7.03 (m, 1H), 4.92 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 166.17, 163.27, 136.79, 135.61, 132.37, 130.12, 129.92, 129.78, 129.73, 129.67, 128.77, 128.55, 128.27, 124.71, 124.65, 52.04; m.p. decomposed above $\sim 256^\circ\text{C}$; LC-MS (ESI): m/z = 393.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{16}\text{N}_4\text{OS}_2$ $[\text{M} + \text{H}]^+$: 393.0838, found : 393.0832.

N-(5-(4-((4-methoxybenzyl)amino)phenyl)-1,3,4-thiadiazol-2-yl)benzamide 17{1,4}

^1H NMR (500 MHz, Chloroform- d) δ 8.15 (s, 2H), 8.02 (d, J = 8.6 Hz, 2H), 7.73 (t, J = 7.4 Hz, 1H), 7.61 (t, J = 7.7 Hz, 2H), 7.59 – 7.53 (m, 1H), 7.45 (d, J = 8.6 Hz, 2H), 7.17 (d, J = 8.6 Hz, 2H), 6.88 (d, J = 8.6 Hz, 2H), 4.58 (s, 2H), 3.82 (s, 3H); ^{13}C NMR (126 MHz, Chloroform- d) δ 165.43, 162.68, 161.27, 161.12, 137.14, 134.84, 131.82, 129.82, 129.48, 129.20, 128.54, 124.17, 123.89, 120.41, 114.81, 57.18, 55.41; m.p. $178\text{--}180^\circ\text{C}$; LC-MS (ESI): m/z = 417.2 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{20}\text{N}_4\text{O}_2\text{S}$ $[\text{M} + \text{H}]^+$: 417.1380, found : 417.1382.

N-(5-(4-((4-nitrobenzyl)amino)phenyl)-1,3,4-thiadiazol-2-yl)benzamide 17{1,5}

^1H NMR (500 MHz, Chloroform- d) δ 8.24 (d, J = 8.7 Hz, 2H), 8.11 (d, J = 7.5 Hz, 2H), 7.92 (d, J = 8.7 Hz, 2H), 7.74 (t, J = 7.4 Hz, 1H), 7.61 (t, J = 7.8 Hz, 2H), 7.53 (d, J = 8.6 Hz, 2H), 7.20 (d, J = 8.7 Hz, 2H), 4.72 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 165.84, 161.63, 160.66, 148.40, 135.09, 129.87, 129.85, 129.56, 129.42, 129.03, 128.53, 128.09, 124.47, 119.32, 119.24, 51.86; m.p. $255\text{--}260^\circ\text{C}$; LC-MS (ESI): m/z = 432.2 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{22}\text{H}_{17}\text{N}_5\text{O}_3\text{S}$ $[\text{M} + \text{H}]^+$: 432.1125, found : 432.1124.

N-(5-(4-(benzylamino)phenyl)-1,3,4-thiadiazol-2-yl)furan-2-carboxamide 17{2,1} ^1H NMR (500 MHz, Chloroform- d) δ 8.06 (d, J = 8.7 Hz, 2H), 7.81 (s, 1H), 7.72 (d, J = 3.7 Hz, 1H), 7.54 (d, J = 8.7 Hz, 2H), 7.49 (t, J = 7.5 Hz, 1H), 7.40 (t, J = 7.6 Hz, 2H), 7.25 (d, J = 7.4 Hz, 2H), 6.77 (dd, J = 3.7, 1.6 Hz, 1H), 4.70 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 156.10, 149.61, 143.48, 137.28, 131.37, 130.57, 130.52, 129.90, 129.82, 129.75, 127.94, 124.96, 122.70, 114.46, 58.68; m.p. 262-272 °C; LC-MS (ESI): m/z = 377.2 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{16}\text{N}_4\text{O}_2\text{S}$ $[\text{M} + \text{H}]^+$: 377.1067, found : 377.1057.

N-(5-(4-((pyridin-3-ylmethyl)amino)phenyl)-1,3,4-thiadiazol-2-yl)furan-2-carboxamide 17{2,2} ^1H NMR (500 MHz, Chloroform- d) δ 8.98 (s, 1H), 8.79 (s, 1H), 8.65 (d, J = 8.2 Hz, 1H), 8.09 (s, 1H), 7.88 (d, J = 7.9 Hz, 2H), 7.79 (s, 2H), 7.68 (s, 1H), 7.07 – 7.01 (m, 2H), 6.77 (s, 1H), 4.90 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 167.47, 157.42, 149.83, 149.78, 147.35, 143.54, 141.68, 138.60, 131.34, 131.11, 128.39, 127.67, 125.28, 122.87, 116.88, 114.78, 46.49; m.p. 196-208 °C; LC-MS (ESI): m/z = 378.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{19}\text{H}_{15}\text{N}_5\text{O}_2\text{S}$ $[\text{M} + \text{H}]^+$: 378.1019, found : 378.1033.

N-(5-(4-((thiophen-2-ylmethyl)amino)phenyl)-1,3,4-thiadiazol-2-yl)furan-2-carboxamide 17{2,3} ^1H NMR (500 MHz, Chloroform- d) δ 8.08 (d, J = 8.6 Hz, 2H), 7.81 (s, 1H), 7.72 (d, J = 3.7 Hz, 1H), 7.59 (d, J = 8.6 Hz, 2H), 7.46 (d, J = 5.1 Hz, 1H), 7.10 (d, J = 3.2 Hz, 1H), 7.07 – 7.03 (m, 1H), 6.78 – 6.75 (m, 1H), 4.95 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 162.77, 156.14, 149.65, 143.48, 137.04, 132.64, 130.35, 129.92, 129.92, 129.82, 128.50, 128.43, 125.01, 124.93, 122.76, 114.50, 52.37; m.p. 250-260 °C; LC-MS (ESI): m/z = 383.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{18}\text{H}_{14}\text{N}_4\text{O}_2\text{S}_2$ $[\text{M} + \text{H}]^+$: 383.0631, found : 383.0622.

N-(5-(4-((4-methoxybenzyl)amino)phenyl)-1,3,4-thiadiazol-2-yl)furan-2-carboxamide

17{2,4} ^1H NMR (500 MHz, Chloroform- d) δ 7.88 (d, J = 8.6 Hz, 3H), 7.74 (d, J = 0.9 Hz, 2H), 7.58 (d, J = 3.6 Hz, 2H), 7.28 (d, J = 8.6 Hz, 3H), 7.16 (d, J = 8.6 Hz, 3H), 6.84 (d, J = 8.7 Hz, 3H), 6.68 (dd, J = 3.6, 1.6 Hz, 2H), 4.48 (s, 3H), 3.78 (s, 5H); ^{13}C NMR (126 MHz, Chloroform- d) δ 161.77, 161.17, 160.70, 155.35, 147.95, 144.27, 139.44, 131.37, 128.97, 127.72, 122.56, 122.00, 119.98, 114.57, 113.34, 55.40, 18.88; m.p. 250-255 °C; LC-MS (ESI): m/z = 407.2 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{21}\text{H}_{18}\text{N}_4\text{O}_3\text{S}$ $[\text{M} + \text{H}]^+$: 407.1172, found : 407.1173.

N-(5-(4-((4-nitrobenzyl)amino)phenyl)-1,3,4-thiadiazol-2-yl)furan-2-carboxamide 17{2,5}

^1H NMR (500 MHz, Chloroform- d) δ 8.26 (d, J = 8.6 Hz, 2H), 8.03 (d, J = 8.6 Hz, 2H), 7.80 (s, 1H), 7.69 (d, J = 3.6 Hz, 1H), 7.54 (d, J = 8.6 Hz, 2H), 7.46 (d, J = 8.6 Hz, 2H), 6.76 (dd, J = 3.6, 1.5 Hz, 1H), 4.81 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 162.81, 161.71, 156.20, 149.37, 149.05, 143.48, 139.51, 136.72, 131.32, 130.14, 127.27, 124.77, 122.97, 122.27, 114.30, 55.27; m.p. 270-275 °C; LC-MS (ESI): m/z = 422.2 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{15}\text{N}_5\text{O}_4\text{S}$ $[\text{M} + \text{H}]^+$: 422.0918, found : 422.0919.

N-(5-(4-(benzylamino)phenyl)-1,3,4-thiadiazol-2-yl)thiophene-2-carboxamide 17{3,1}

^1H NMR (500 MHz, Chloroform- d) δ 8.20 (d, J = 3.9 Hz, 1H), 8.04 (d, J = 8.6 Hz, 2H), 7.90 (d, J = 4.9 Hz, 1H), 7.52 (d, J = 8.6 Hz, 2H), 7.48 (t, J = 7.5 Hz, 1H), 7.40 (t, J = 7.6 Hz, 2H), 7.33 – 7.30 (m, 1H), 7.25 (s, 1H), 4.69 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 163.01, 161.54, 160.17, 137.06, 136.91, 133.83, 133.43, 131.12, 130.40, 129.98, 129.72, 129.61, 129.55, 127.94, 124.63, 58.33; m.p. 265-270 °C; LC-MS (ESI): m/z = 393.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{20}\text{H}_{16}\text{N}_4\text{OS}_2$ $[\text{M} + \text{H}]^+$: 393.0838, found : 393.0831.

N-(5-(4-((pyridin-3-ylmethyl)amino)phenyl)-1,3,4-thiadiazol-2-yl)thiophene-2-

carboxamide 17{3,2} ^1H NMR (500 MHz, Chloroform-d) δ 9.01 (s, 1H), 8.80 (d, J = 5.7 Hz, 1H), 8.64 (d, J = 8.2 Hz, 1H), 8.12 (d, J = 3.9 Hz, 1H), 8.08 (d, J = 8.1 Hz, 1H), 7.93 (d, J = 4.3 Hz, 1H), 7.87 (d, J = 8.8 Hz, 2H), 7.35 – 7.28 (m, 2H), 7.04 (d, J = 8.8 Hz, 2H), 4.90 (s, 2H); ^{13}C NMR (126 MHz, Chloroform-d) δ 166.78, 161.46, 159.86, 149.35, 147.15, 141.62, 141.53, 138.37, 137.64, 134.23, 132.94, 131.10, 129.91, 128.24, 116.76, 66.89; m.p. 260-270 °C; LC-MS (ESI): m/z = 394.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{19}\text{H}_{15}\text{N}_5\text{OS}_2$ $[\text{M} + \text{H}]^+$: 394.0791, found : 394.0787.

N-(5-(4-((thiophen-2-ylmethyl)amino)phenyl)-1,3,4-thiadiazol-2-yl)thiophene-2-

carboxamide 17{3,3} ^1H NMR (500 MHz, Chloroform-d) δ 8.20 (d, J = 3.6 Hz, 1H), 8.06 (d, J = 8.6 Hz, 2H), 7.88 (d, J = 4.7 Hz, 1H), 7.55 (d, J = 8.6 Hz, 2H), 7.45 (d, J = 5.0 Hz, 1H), 7.33 – 7.29 (m, 1H), 7.10 (d, J = 3.1 Hz, 1H), 7.06 – 7.03 (m, 1H), 4.91 (s, 2H); ^{13}C NMR (126 MHz, Chloroform-d) δ 162.78, 161.38, 160.00, 136.72, 136.67, 133.67, 133.55, 133.50, 132.13, 129.97, 129.89, 129.48, 128.79, 128.15, 124.48, 124.43, 51.66; m.p. 265-270 °C; LC-MS (ESI): m/z = 399.1 $[\text{M} + \text{H}]^+$; HRMS (ESI) calcd for $\text{C}_{18}\text{H}_{14}\text{N}_4\text{OS}_3$ $[\text{M} + \text{H}]^+$: 399.0402, found : 399.0393.

N-(5-(4-((4-methoxybenzyl)amino)phenyl)-1,3,4-thiadiazol-2-yl)thiophene-2-

carboxamide 17{3,4} ^1H NMR (500 MHz, Chloroform-d) δ 8.19 (d, J = 3.8 Hz, 2H), 8.05 (dd, J = 12.5, 8.6 Hz, 4H), 7.88 (d, J = 4.9 Hz, 2H), 7.65 (d, J = 8.5 Hz, 1H), 7.50 (d, J = 8.6 Hz, 3H), 7.31 (d, J = 4.1 Hz, 2H), 7.17 (d, J = 8.6 Hz, 3H), 6.91 (d, J = 8.6 Hz, 3H), 4.63 (s, 3H), 3.84 (s, 5H); ^{13}C NMR (126 MHz, Chloroform-d) δ 162.91, 161.22, 160.02, 136.76, 133.64,

133.58, 132.03, 130.07, 129.53, 129.45, 129.43, 124.67, 124.56, 120.07, 115.00, 57.93, 55.53; m.p. 255-260 °C; LC-MS (ESI): $m/z = 423.2$ $[M + H]^+$; HRMS (ESI) calcd for $C_{21}H_{18}N_4O_2S_2$ $[M + H]^+$: 423.0944, found : 423.0947.

N-(5-(4-((4-nitrobenzyl)amino)phenyl)-1,3,4-thiadiazol-2-yl)thiophene-2-carboxamide

17{3,5} 1H NMR (500 MHz, Chloroform- d) δ 8.26 (d, $J = 8.6$ Hz, 2H), 8.17 (d, $J = 3.5$ Hz, 1H), 8.00 (d, $J = 8.6$ Hz, 2H), 7.88 (d, $J = 4.8$ Hz, 1H), 7.53 (d, $J = 8.6$ Hz, 2H), 7.38 (d, $J = 8.6$ Hz, 2H), 7.32 – 7.29 (m, 1H), 4.78 (s, 2H); ^{13}C NMR (126 MHz, Chloroform- d) δ 162.44, 161.92, 160.16, 148.80, 140.54, 137.54, 136.72, 133.55, 133.52, 130.78, 129.88, 129.51, 126.20, 124.59, 121.74, 54.00; m.p. 320-325 °C; LC-MS (ESI): $m/z = 438.1$ $[M + H]^+$; HRMS (ESI) calcd for $C_{20}H_{15}N_5O_3S_2$ $[M + H]^+$: 438.0689, found : 438.0690.

N-(4-(5-benzamido-1,3,4-thiadiazol-2-yl)phenyl)furan-2-carboxamide **19**{1,2} 1H NMR (500 MHz, Chloroform- d) δ 8.55 (s, 1H), 8.12 (d, $J = 7.7$ Hz, 2H), 7.97 (d, $J = 8.4$ Hz, 2H), 7.87 (d, $J = 8.4$ Hz, 2H), 7.75 (t, $J = 7.3$ Hz, 1H), 7.66 – 7.60 (m, 3H), 7.43 (d, $J = 3.2$ Hz, 1H), 6.70 – 6.65 (m, 1H); ^{13}C NMR (126 MHz, Chloroform- d) δ 166.23, 163.91, 158.68, 146.73, 145.50, 140.93, 135.67, 129.81, 129.15, 128.83, 128.79, 123.36, 121.91, 119.00, 118.96, 113.81; m.p. decomposed above ~ 253 °C; LC-MS (ESI): $m/z = 391.1$ $[M + H]^+$; HRMS (ESI) calcd for $C_{20}H_{14}N_4O_3S$ $[M + H]^+$: 391.0859, found : 391.0832.

N-(4-(5-benzamido-1,3,4-thiadiazol-2-yl)phenyl)thiophene-2-carboxamide **19**{1,3} 1H NMR (500 MHz, Chloroform- d) δ 8.29 (s, 1H), 8.11 (d, $J = 7.6$ Hz, 2H), 7.95 (d, $J = 8.4$ Hz, 2H), 7.81 (dd, $J = 12.1, 5.9$ Hz, 3H), 7.75 (t, $J = 7.4$ Hz, 1H), 7.69 (d, $J = 4.8$ Hz, 1H), 7.62 (t, $J = 7.7$ Hz, 2H), 7.23 – 7.19 (m, 1H); ^{13}C NMR (126 MHz, Chloroform- d) δ 166.01, 163.66,

162.88, 162.34, 141.15, 136.08, 135.51, 133.42, 131.43, 129.71, 128.96, 128.83, 128.79, 128.74, 123.38, 122.02; m.p. 295-300 °C; LC-MS (ESI): $m/z = 407.1$ $[M + H]^+$; HRMS (ESI) calcd for $C_{20}H_{14}N_4O_2S_2$ $[M + H]^+$: 407.0631, found : 407.0615.

N-(5-(4-benzamidophenyl)-1,3,4-thiadiazol-2-yl)furan-2-carboxamide 19{2,1} 1H NMR (500 MHz, Chloroform-d) δ 8.33 (s, 1H), 7.96 (d, $J = 8.6$ Hz, 2H), 7.85 (t, $J = 6.9$ Hz, 4H), 7.79 (s, 1H), 7.69 – 7.64 (m, 2H), 7.56 (t, $J = 7.7$ Hz, 2H), 6.76 – 6.71 (m, 1H); ^{13}C NMR (126 MHz, Chloroform-d) δ 169.68, 163.75, 161.53, 155.76, 149.06, 143.52, 141.20, 133.76, 132.72, 129.51, 128.97, 127.41, 123.61, 122.04, 121.98, 114.10; m.p. decomposed above ~ 330 °C; LC-MS (ESI): $m/z = 391.1$ $[M + H]^+$; HRMS (ESI) calcd for $C_{20}H_{14}N_4O_3S$ $[M + H]^+$: 391.0859, found : 391.0837.

N-(4-(5-(furan-2-carboxamido)-1,3,4-thiadiazol-2-yl)phenyl)furan-2-carboxamide 19{2,2} 1H NMR (500 MHz, Chloroform-d) δ 8.56 (s, 1H), 7.96 (d, $J = 8.4$ Hz, 2H), 7.87 (d, $J = 8.5$ Hz, 2H), 7.79 (s, 1H), 7.69 (d, $J = 3.6$ Hz, 1H), 7.65 (s, 1H), 7.42 (d, $J = 3.5$ Hz, 1H), 6.74 (d, $J = 3.3$ Hz, 1H), 6.69 – 6.65 (m, 1H); ^{13}C NMR (126 MHz, Chloroform-d) δ 163.70, 161.61, 158.43, 155.75, 149.08, 146.50, 145.51, 143.54, 140.68, 128.99, 123.54, 121.98, 121.67, 118.74, 114.09, 113.70; m.p. decomposed above ~ 300 °C; LC-MS (ESI): $m/z = 381.1$ $[M + H]^+$; HRMS (ESI) calcd for $C_{18}H_{12}N_4O_4S$ $[M + H]^+$: 381.0652, found : 381.0636.

N-(5-(4-(thiophene-2-carboxamido)phenyl)-1,3,4-thiadiazol-2-yl)furan-2-carboxamide 19{2,3} 1H NMR (500 MHz, Chloroform-d) δ 8.36 (s, 1H), 7.95 (d, $J = 8.5$ Hz, 2H), 7.86 – 7.77 (m, 4H), 7.70 (dd, $J = 9.8, 4.3$ Hz, 2H), 7.24 – 7.20 (m, 1H), 6.77 – 6.73 (m, 1H); ^{13}C NMR (126 MHz, Chloroform-d) δ 164.32, 163.21, 156.00, 149.31, 143.48, 141.46, 136.01,

133.63, 131.66, 129.17, 128.95, 123.09, 122.38, 122.21, 121.90, 114.31; m.p. decomposed above ~ 310 °C; LC-MS (ESI): $m/z = 397.0$ $[M + H]^+$; HRMS (ESI) calcd for $C_{18}H_{12}N_4O_3S_2$ $[M + H]^+$: 397.0424, found : 397.0417.

N-(5-(4-benzamidophenyl)-1,3,4-thiadiazol-2-yl)thiophene-2-carboxamide 19{3,1} 1H NMR (500 MHz, Chloroform- d) δ 8.33 (s, 1H), 8.19 (s, 1H), 7.95 (d, $J = 7.3$ Hz, 2H), 7.85 (d, $J = 8.7$ Hz, 5H), 7.66 (t, $J = 7.0$ Hz, 1H), 7.56 (t, $J = 7.0$ Hz, 2H), 7.30 (s, 1H); ^{13}C NMR (126 MHz, Chloroform- d) δ 169.98, 163.69, 160.24, 141.16, 137.18, 133.96, 133.88, 133.31, 132.75, 129.60, 129.04, 127.47, 123.78, 122.21; m.p. decomposed above ~ 315 °C; LC-MS (ESI): $m/z = 407.1$ $[M + H]^+$; HRMS (ESI) calcd for $C_{20}H_{14}N_4O_2S_2$ $[M + H]^+$: 407.0631, found : 407.0631.

N-(4-(5-(thiophene-2-carboxamido)-1,3,4-thiadiazol-2-yl)phenyl)furan-2-carboxamide 19{3,2} 1H NMR (500 MHz, Chloroform- d) δ 8.53 (s, 1H), 8.19 (d, $J = 3.7$ Hz, 1H), 7.95 (d, $J = 8.6$ Hz, 2H), 7.87 (t, $J = 7.8$ Hz, 3H), 7.64 (s, 1H), 7.42 (d, $J = 3.5$ Hz, 1H), 7.32 – 7.29 (m, 1H), 6.69 – 6.65 (m, 1H); ^{13}C NMR (126 MHz, Chloroform- d) δ 163.81, 160.32, 158.67, 146.70, 145.51, 140.78, 137.30, 134.08, 133.26, 129.65, 129.11, 123.56, 121.89, 118.97, 113.84; m.p. 315-320 °C; LC-MS (ESI): $m/z = 397.1$ $[M + H]^+$; HRMS (ESI) calcd for $C_{18}H_{12}N_4O_3S_2$ $[M + H]^+$: 397.0424, found : 397.0413.

N-(4-(5-(thiophene-2-carboxamido)-1,3,4-thiadiazol-2-yl)phenyl)thiophene-2-carboxamide 19{3,3} 1H NMR (500 MHz, Chloroform- d) δ 8.27 (s, 1H), 8.18 (d, $J = 3.5$ Hz, 1H), 7.94 (d, $J = 8.6$ Hz, 2H), 7.89 (d, $J = 4.8$ Hz, 1H), 7.84 – 7.77 (m, 3H), 7.70 (d, $J = 4.9$ Hz, 1H), 7.32 – 7.29 (m, 1H), 7.23 – 7.19 (m, 1H); ^{13}C NMR (126 MHz, Chloroform- d) δ 163.66, 160.20, 141.05, 137.16, 136.00, 133.95, 133.46, 133.30, 131.55, 129.59, 129.00,

128.88, 123.57, 122.11, 100.19; m.p. decomposed above ~ 310 °C; LC-MS (ESI): $m/z = 413.0$ $[M + H]^+$; HRMS (ESI) calcd for $C_{18}H_{12}N_4O_2S_3$ $[M + H]^+$: 413.0195, found : 413.0197.

N-(5-(4-(2-(2-acetamidoacetamido)propanamido)phenyl)-1,3,4-thiadiazol-2-

yl)benzamide 21 {1,2} 1H NMR (500 MHz, DMSO- d_6) δ 13.12 (s, 1H), 10.28 (s, 1H), 8.28 (t, $J = 6.5$ Hz, 1H), 8.15 (d, $J = 7.7$ Hz, 3H), 7.77 (d, $J = 8.4$ Hz, 1H), 7.67 (s, 1H), 7.59 (d, $J = 7.2$ Hz, 3H), 6.74 (d, $J = 8.2$ Hz, 1H), 3.92 (d, $J = 5.6$ Hz, 3H), 3.78 – 3.68 (m, 2H), 1.91 (s, 3H), 1.34 (d, $J = 7.1$ Hz, 1H); ^{13}C NMR (126 MHz, DMSO) δ 170.27, 168.82, 141.49, 133.51, 129.15, 129.11, 128.88, 128.83, 128.73, 128.17, 128.11, 125.34, 119.88, 115.10, 49.60, 43.30, 22.89, 18.43; m.p. 185-195 °C; LC-MS (ESI): $m/z = 467.2$ $[M + H]^+$; HRMS (ESI) calcd for $C_{22}H_{22}N_6O_4S$ $[M + Na]^+$: 489.1315, found : 489.1332.

N-(5-(4-(2-(2-acetamidoacetamido)-3-hydroxypropanamido)phenyl)-1,3,4-thiadiazol-2-

yl)benzamide 21 {1,3} 1H NMR (500 MHz, DMSO- d_6) δ 13.17 (s, 1H), 10.28 (s, 1H), 8.28 (t, $J = 5.4$ Hz, 1H), 8.15 (d, $J = 7.7$ Hz, 3H), 7.96 (s, 1H), 7.79 (s, 1H), 7.67 (s, 1H), 7.59 (t, $J = 6.9$ Hz, 3H), 6.74 (d, $J = 8.2$ Hz, 1H), 4.56 – 4.41 (m, 1H), 3.92 (d, $J = 5.6$ Hz, 2H), 3.72 (d, $J = 4.2$ Hz, 2H), 1.91 (s, 3H), 1.85 (s, 1H); ^{13}C NMR (126 MHz, DMSO) δ 171.79, 170.27, 169.82, 168.82, 165.54, 158.56, 129.15, 129.11, 128.88, 128.83, 128.73, 128.16, 127.83, 119.87, 43.31, 40.56, 22.89, 8.78; m.p. 230-240 °C; LC-MS (ESI): $m/z = 483.3$ $[M + H]^+$; HRMS (ESI) calcd for $C_{22}H_{22}N_6O_5S$ $[M + H]^+$: 483.1445, found : 483.1441.

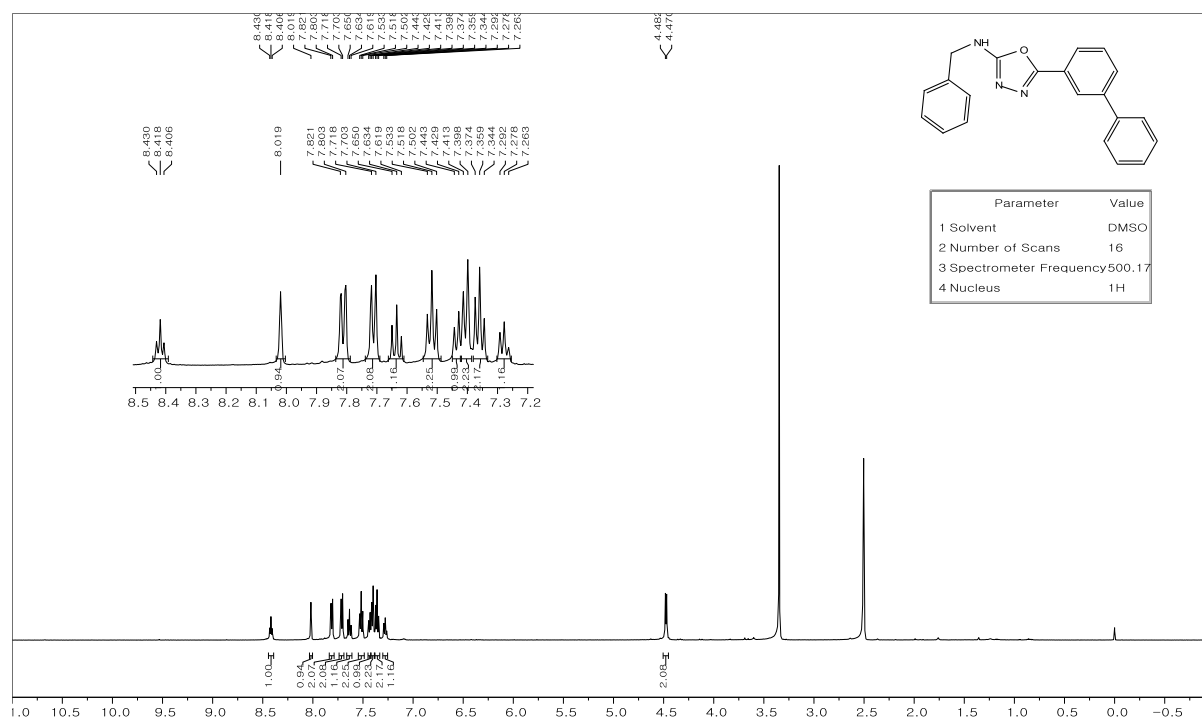
N-(5-(4-(2-(2-acetamidoacetamido)-4-(methylthio)butanamido)phenyl)-1,3,4-thiadiazol-

2-yl)benzamide 21 {1,4} 1H NMR (500 MHz, DMSO- d_6) δ 13.14 (s, 1H), 10.25 (s, 1H), 8.36 – 8.32 (m, 1H), 8.21 (s, 1H), 8.16 (s, 2H), 7.95 (s, 2H), 7.84 (s, 1H), 7.80 – 7.77 (m, 1H), 7.68

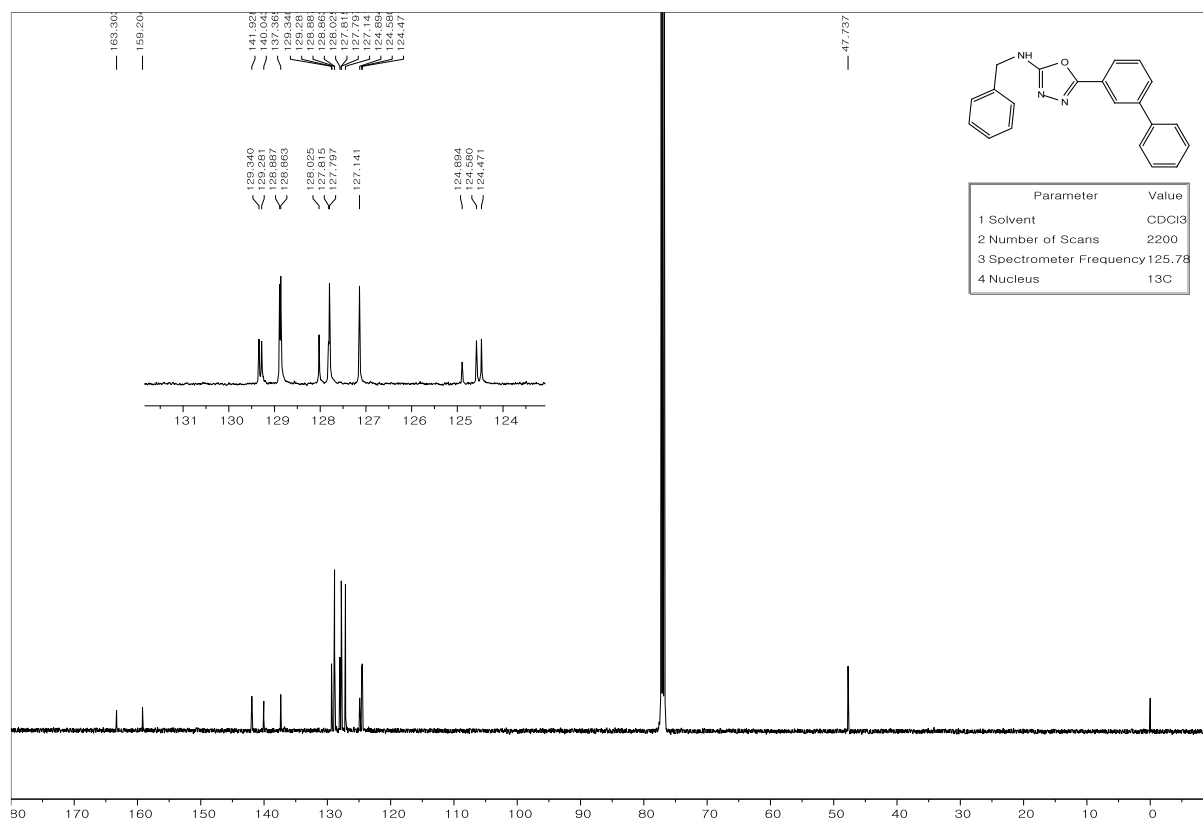
(s, 1H), 7.59 (s, 2H), 4.64 – 4.41 (m, 2H), 4.01 – 3.84 (m, 2H), 3.78 – 3.76 (m, 2H), 2.08 (s, 3H), 1.91 (s, 1H), 1.89 (s, 3H); ^{13}C NMR (126 MHz, DMSO) δ 171.03, 170.43, 170.28, 169.87, 168.82, 141.33, 133.50, 129.15, 128.88, 128.16, 128.09, 125.60, 120.23, 119.88, 53.26, 42.63, 31.98, 30.12, 22.96, 15.12; m.p. decomposed above $\sim 250\text{ }^{\circ}\text{C}$; LC-MS (ESI): $m/z = 527.3$ [$\text{M} + \text{H}$] $^{+}$; HRMS (ESI) calcd for $\text{C}_{24}\text{H}_{26}\text{N}_6\text{O}_4\text{S}_2$ [$\text{M} + \text{H}$] $^{+}$: 527.1530, found : 527.1521.

N-(5-(4-(2-(2-acetamidoacetamido)-3-phenylpropanamido)phenyl)-1,3,4-thiadiazol-2-yl)benzamide 21 {1,5} ^1H NMR (500 MHz, DMSO- d_6) δ 13.15 (s, 1H), 10.28 (s, 1H), 8.28 (t, $J = 5.5$ Hz, 1H), 8.15 (d, $J = 7.7$ Hz, 4H), 7.95 (d, $J = 8.4$ Hz, 2H), 7.78 (d, $J = 8.4$ Hz, 2H), 7.69 (d, $J = 4.4$ Hz, 2H), 7.58 (d, $J = 6.3$ Hz, 3H), 7.29 (d, $J = 4.1$ Hz, 1H), 6.75 (d, $J = 8.3$ Hz, 1H), 4.69 (dd, $J = 15.1, 6.9$ Hz, 2H), 3.92 (d, $J = 5.7$ Hz, 2H), 1.91 (s, 3H), 1.85 (s, 1H); ^{13}C NMR (126 MHz, DMSO) δ 170.27, 168.82, 141.49, 133.50, 129.65, 129.15, 129.11, 128.89, 128.83, 128.73, 128.63, 128.17, 128.12, 127.84, 125.34, 120.16, 119.87, 115.20, 114.33, 43.31, 25.60, 22.91, 22.77; m.p. 220-230 $^{\circ}\text{C}$; LC-MS (ESI): $m/z = 543.3$ [$\text{M} + \text{H}$] $^{+}$; HRMS (ESI) calcd for $\text{C}_{28}\text{H}_{26}\text{N}_6\text{O}_4\text{S}$ [$\text{M} + \text{H}$] $^{+}$: 543.1809, found : 543.1804.

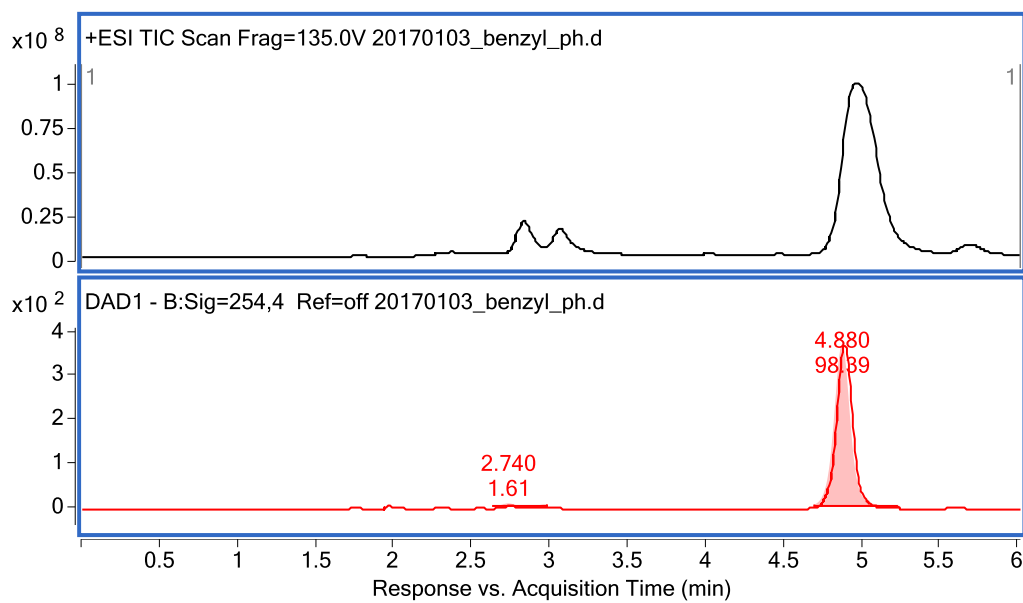
3-(2-acetamidoacetamido)-4-((4-(5-benzamido-1,3,4-thiadiazol-2-yl)phenyl)amino)-4-oxobutanoic acid 21 {1,6} ^1H NMR (500 MHz, DMSO- d_6) δ 13.17 (s, 1H), 10.28 (s, 1H), 8.29 – 8.27 (m, 1H), 8.15 (d, $J = 7.7$ Hz, 3H), 7.79 (s, 1H), 7.68 (s, 1H), 7.59 (s, 3H), 6.70 (d, $J = 8.3$ Hz, 1H), 3.92 (d, $J = 5.7$ Hz, 2H), 3.74 (d, $J = 6.2$ Hz, 1H), 3.72 (d, $J = 5.5$ Hz, 1H), 1.91 (s, 3H), 1.89 (s, 2H); ^{13}C NMR (126 MHz, DMSO) δ 170.28, 168.83, 145.05, 141.50, 133.51, 129.15, 129.11, 128.88, 128.83, 128.73, 128.37, 128.16, 125.34, 119.88, 114.69, 43.31, 36.54, 22.95, 22.89; m.p. 225-230 $^{\circ}\text{C}$; LC-MS (ESI): $m/z = 511.3$ [$\text{M} + \text{H}$] $^{+}$; HRMS (ESI) calcd for $\text{C}_{23}\text{H}_{22}\text{N}_6\text{O}_6\text{S}$ [$\text{M} + \text{H}$] $^{+}$: 511.1394, found : 511.1379.

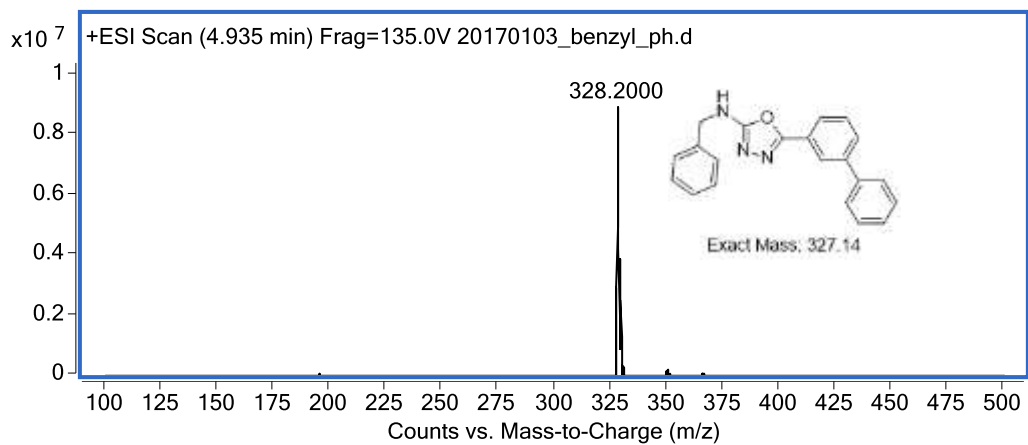


¹H NMR – 8{1,1}

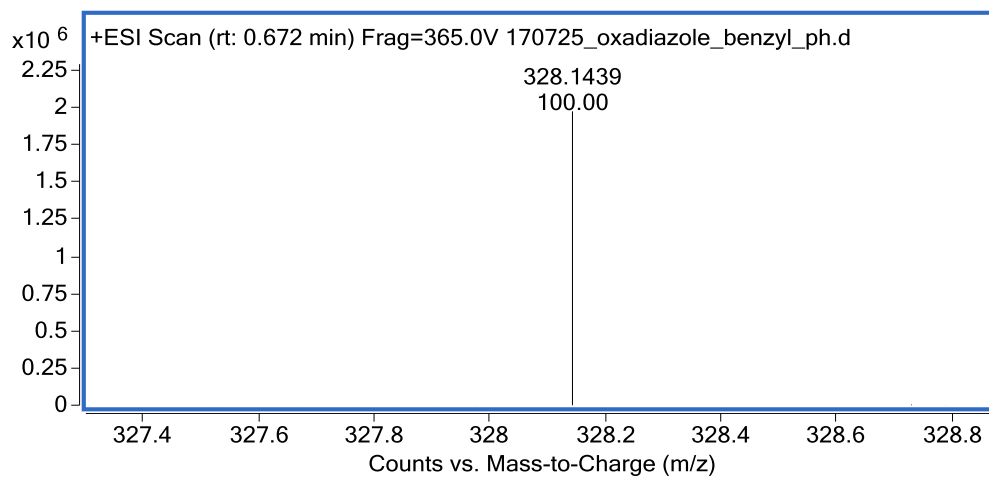


^{13}C NMR – 8{1,1}

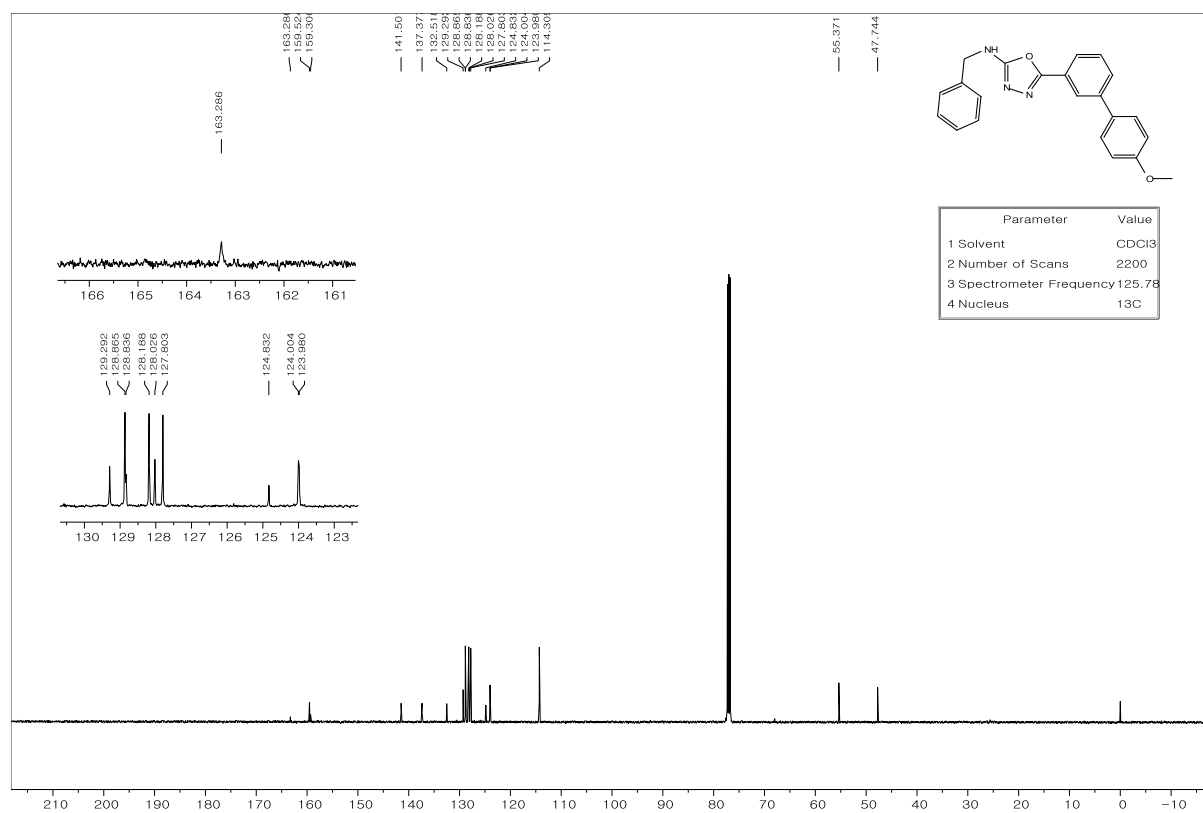
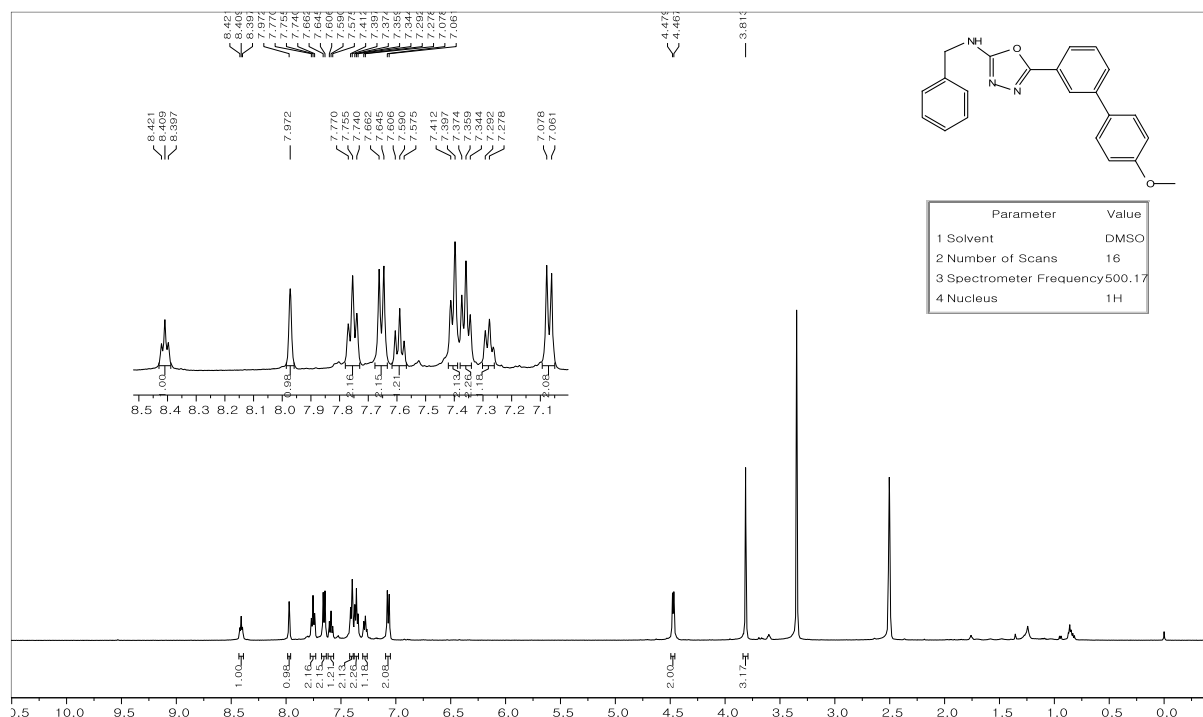


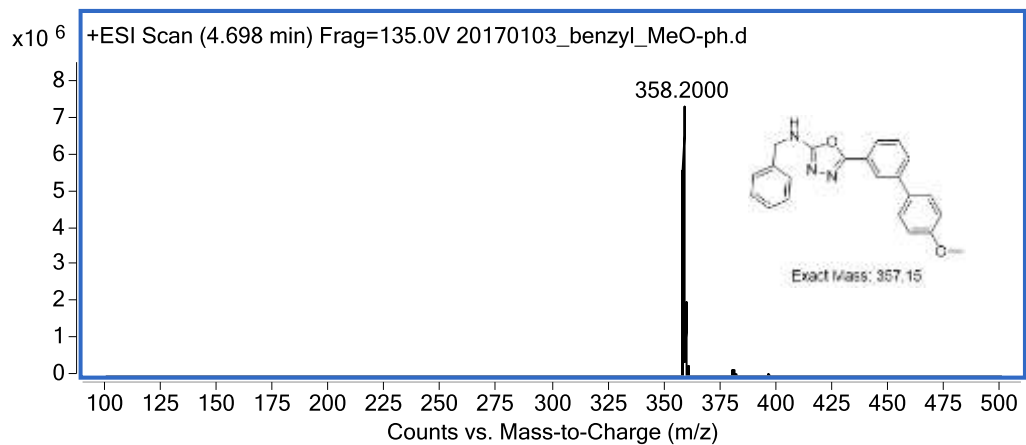
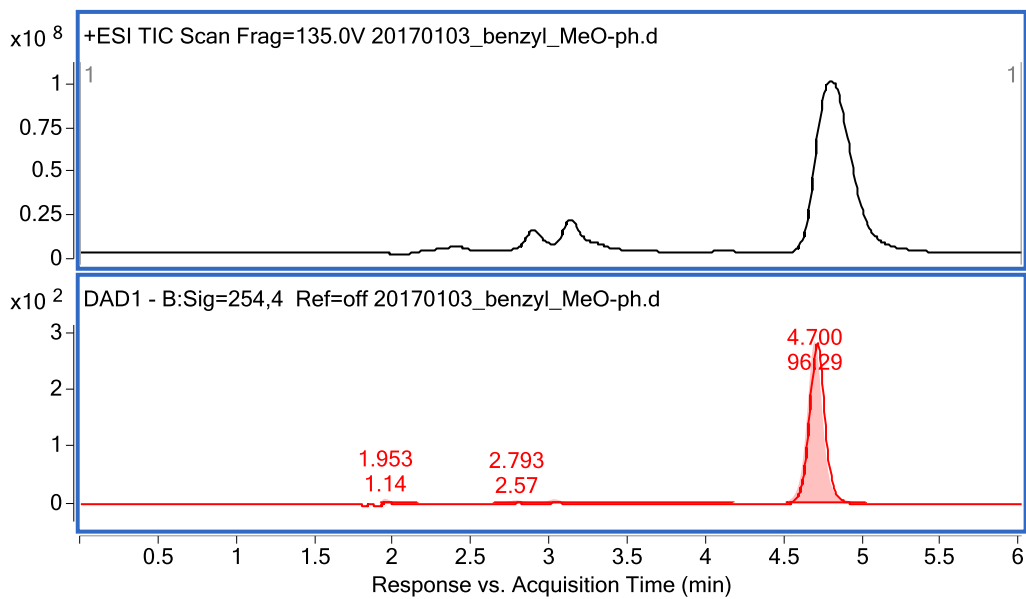


LC/MS – 8{1,1}

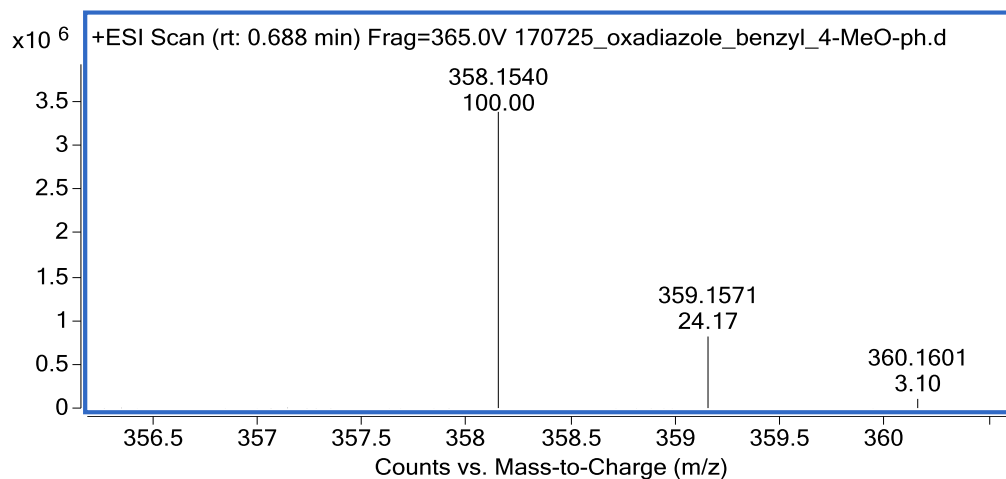


HR/MS – 8{1,1}

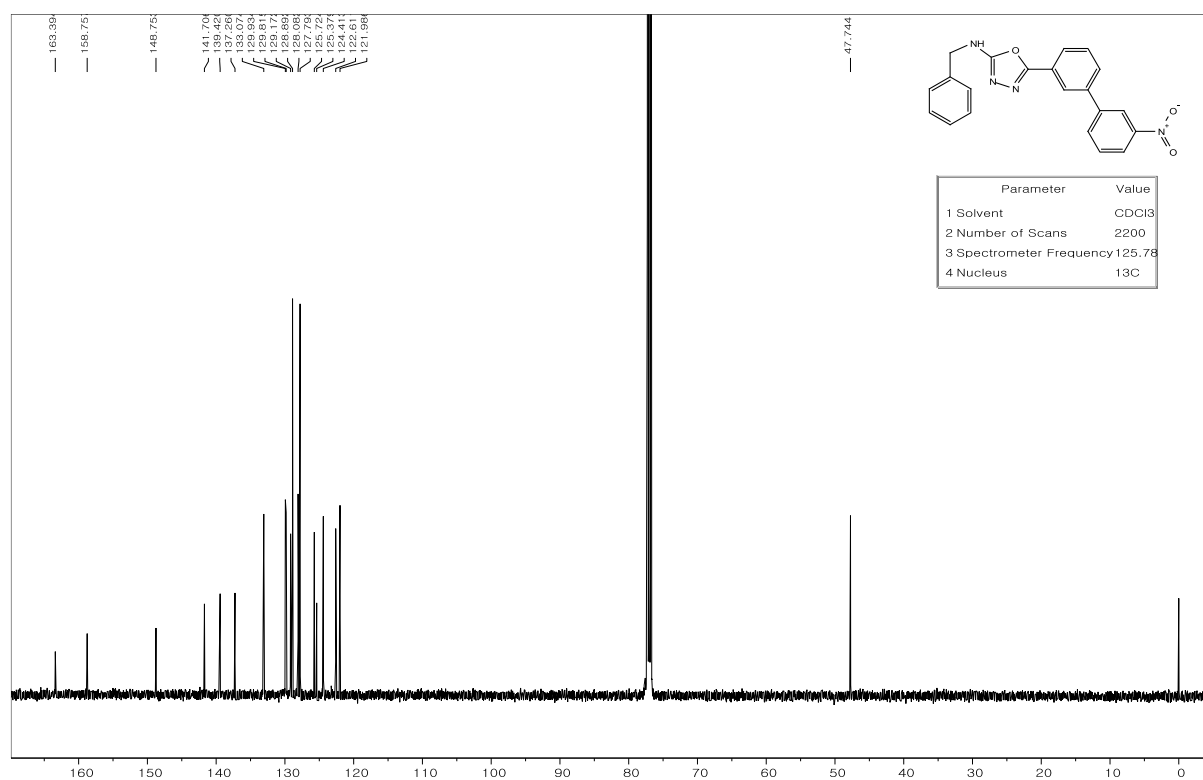
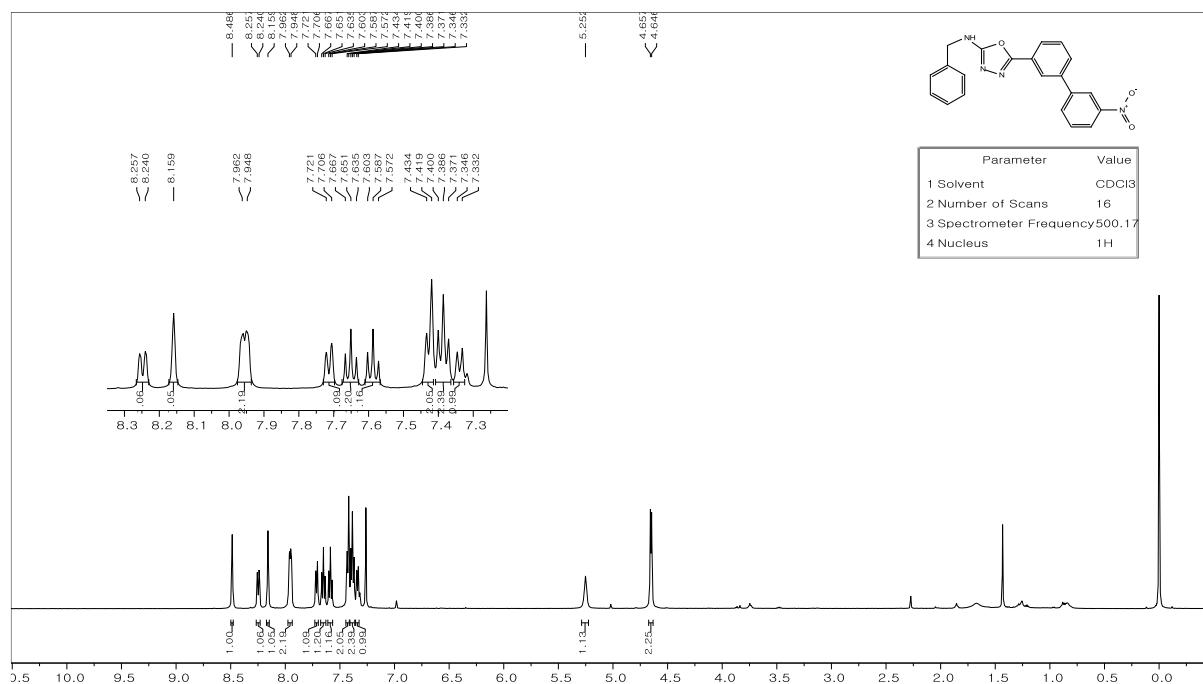


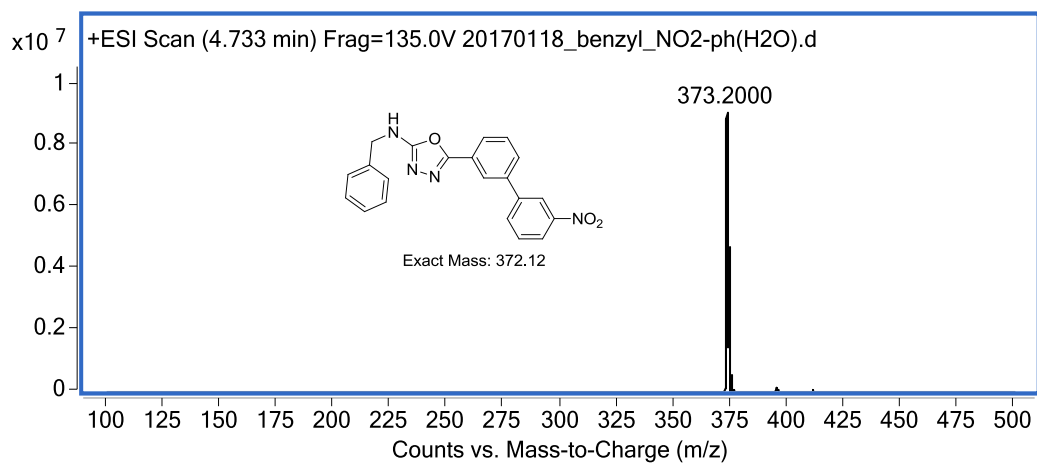
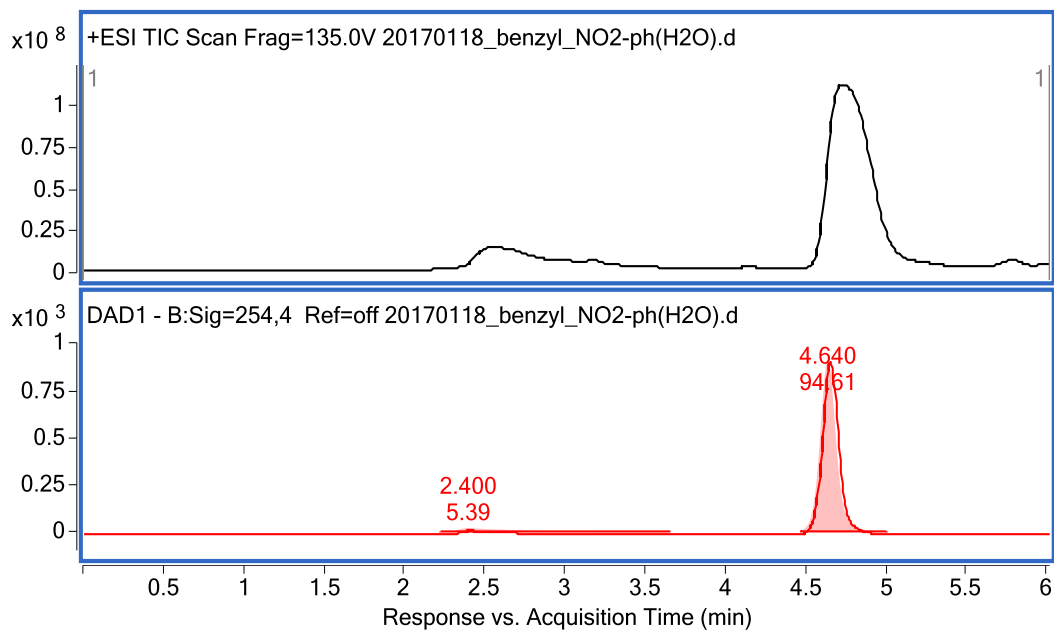


LC/MS – 8{1,2}

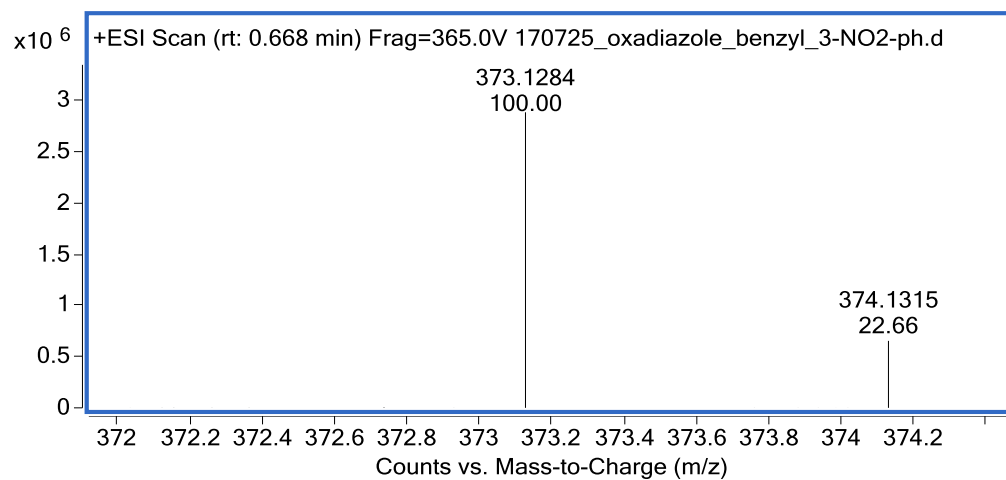


HR/MS – 8{1,2}

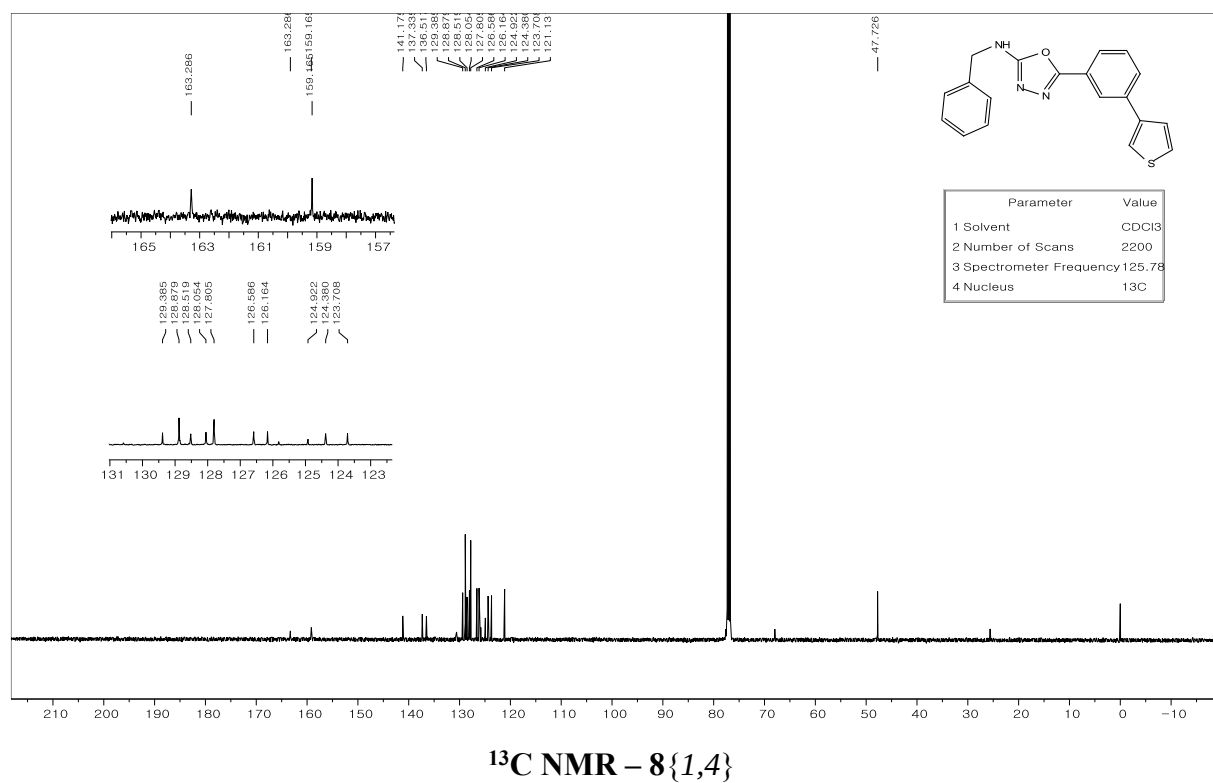
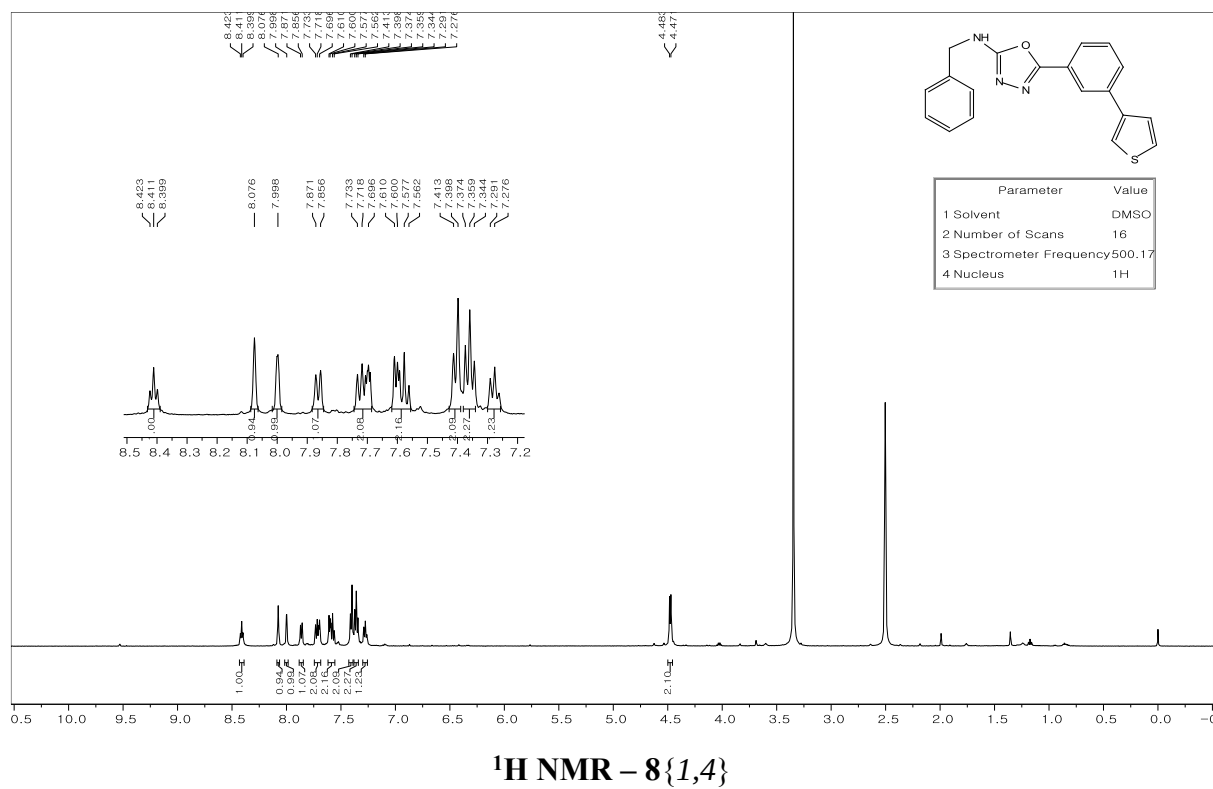


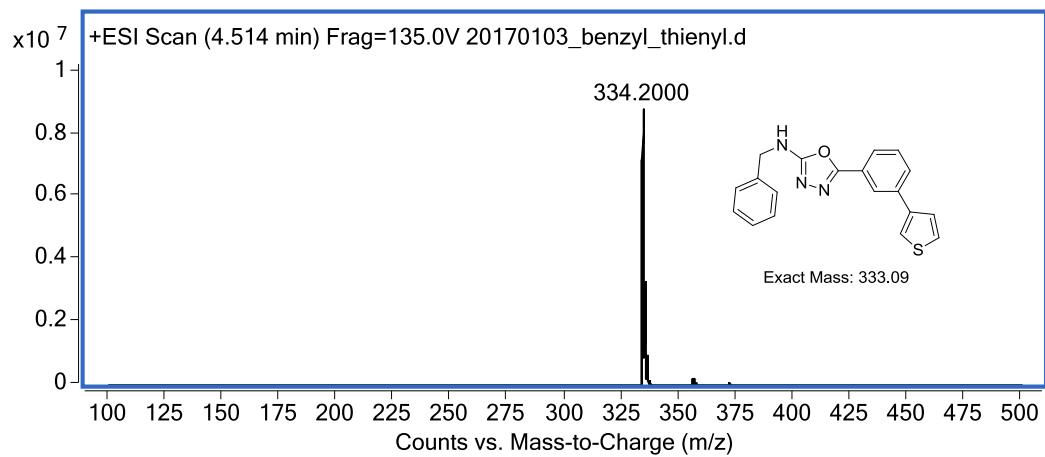
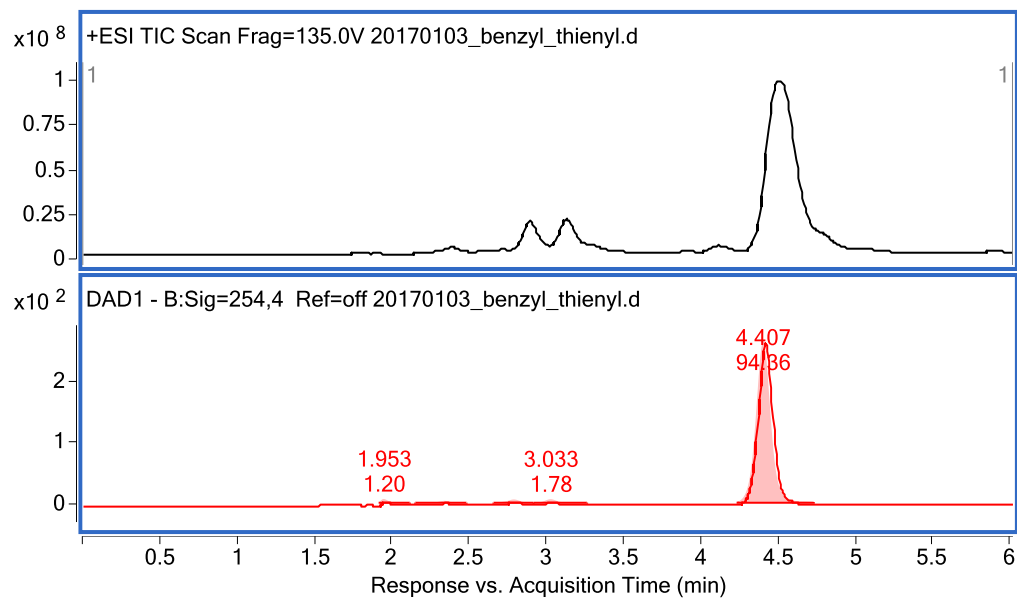


LC/MS – 8{1,3}

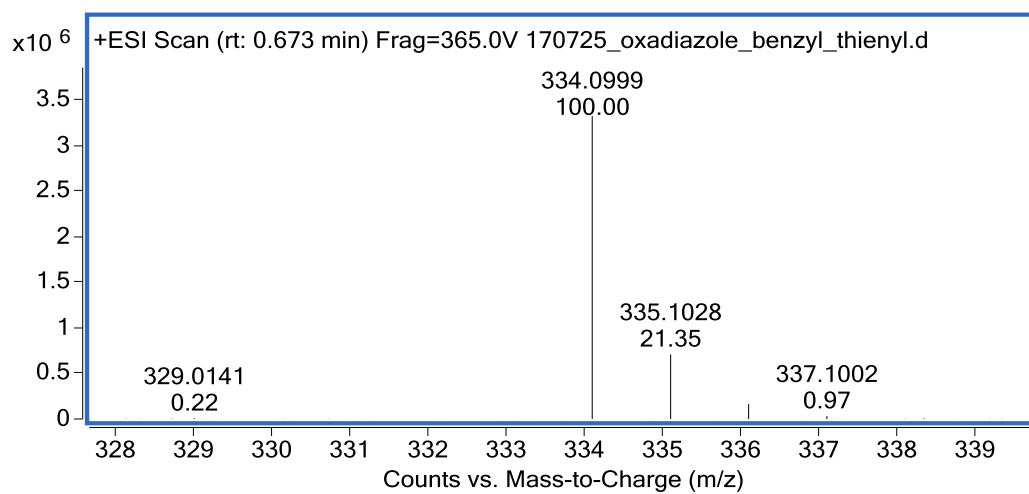


HR/MS – 8{1,3}

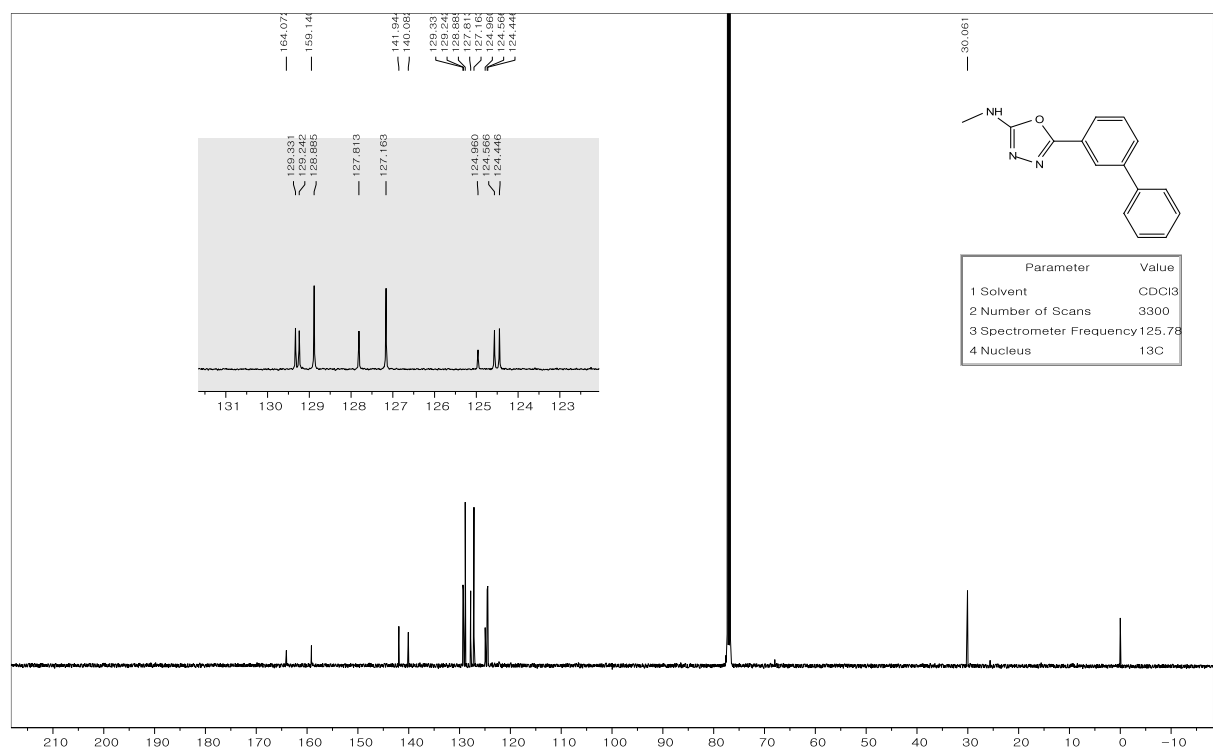
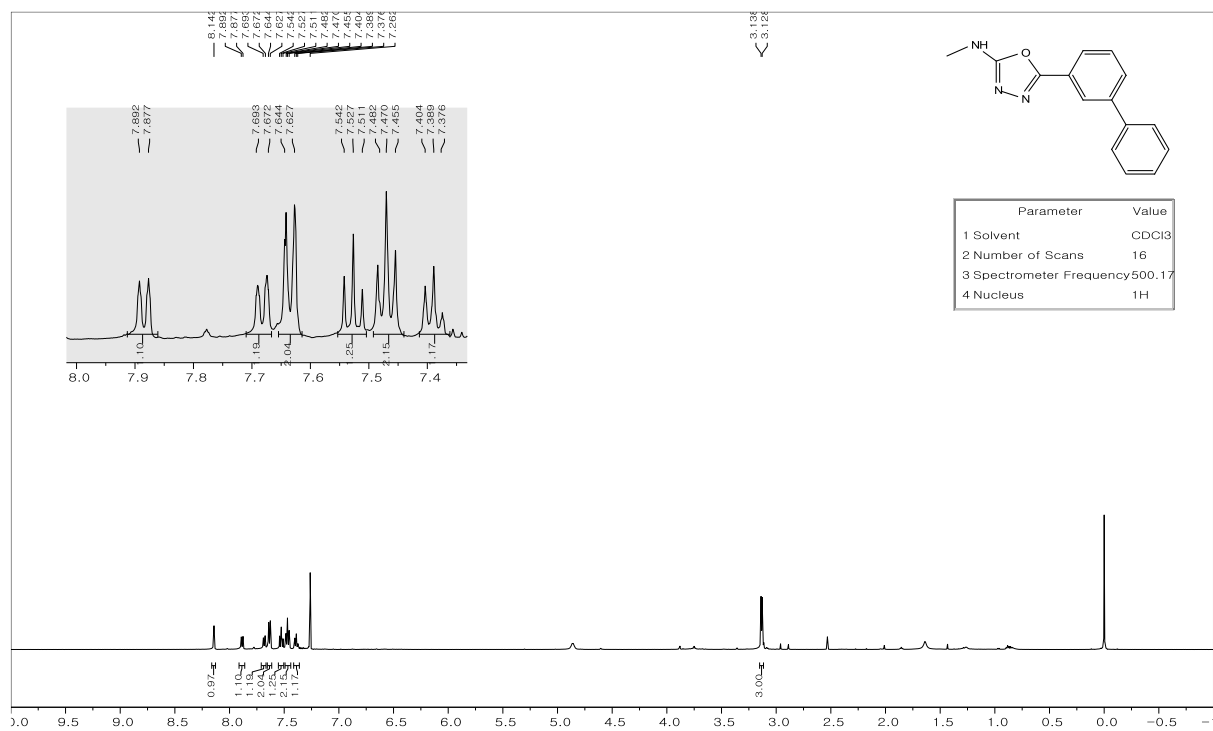


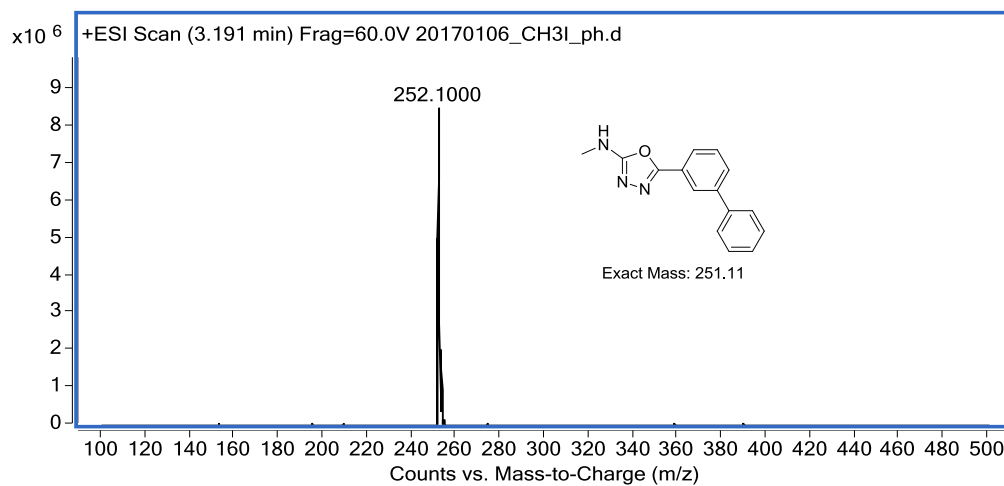
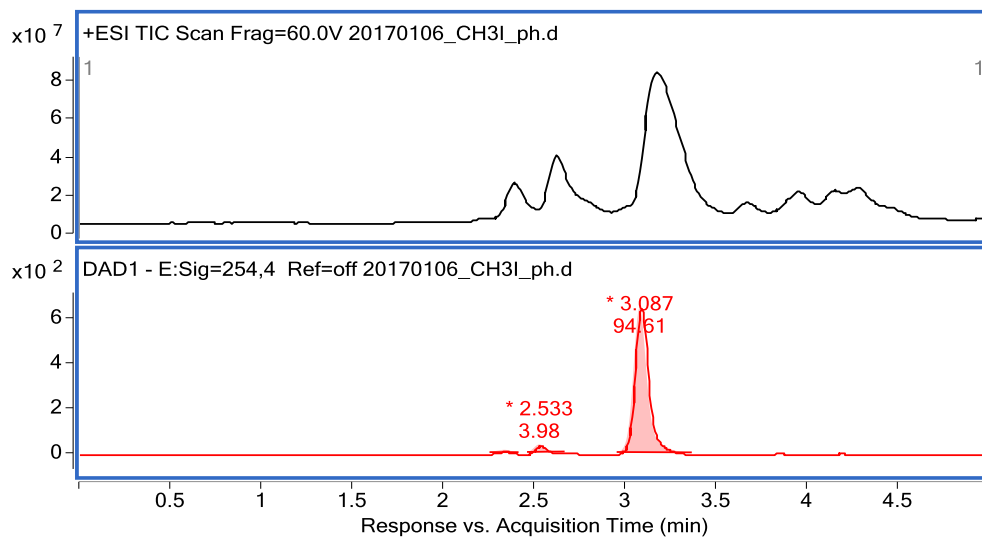


LC/MS – 8{1,4}

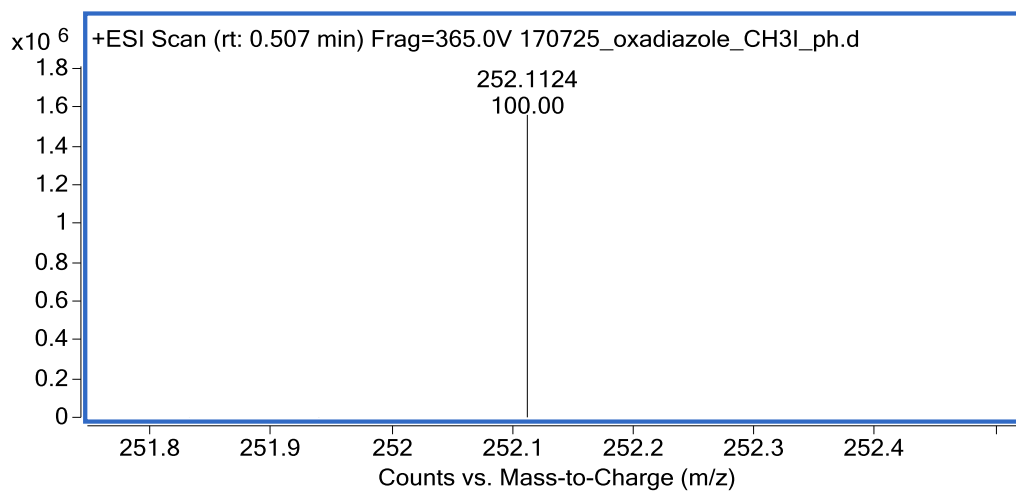


HR/MS – 8{1,4}

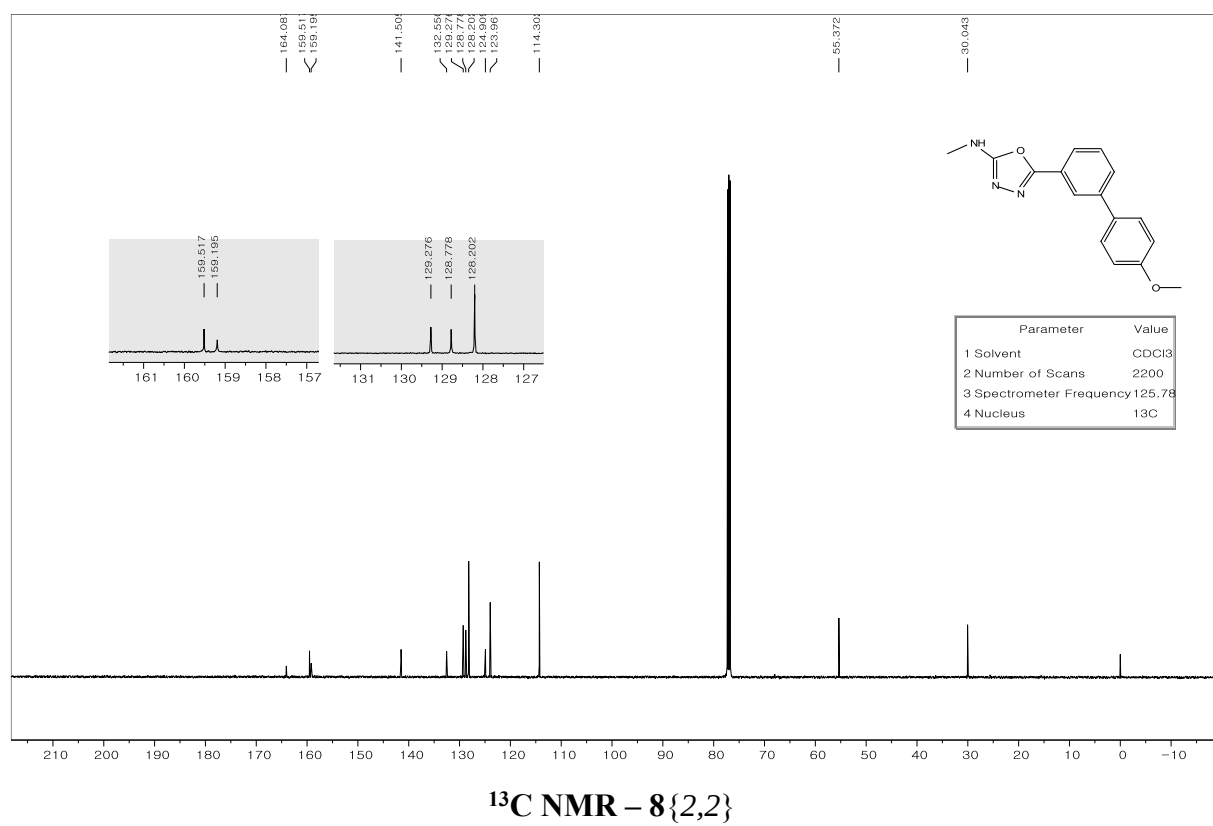
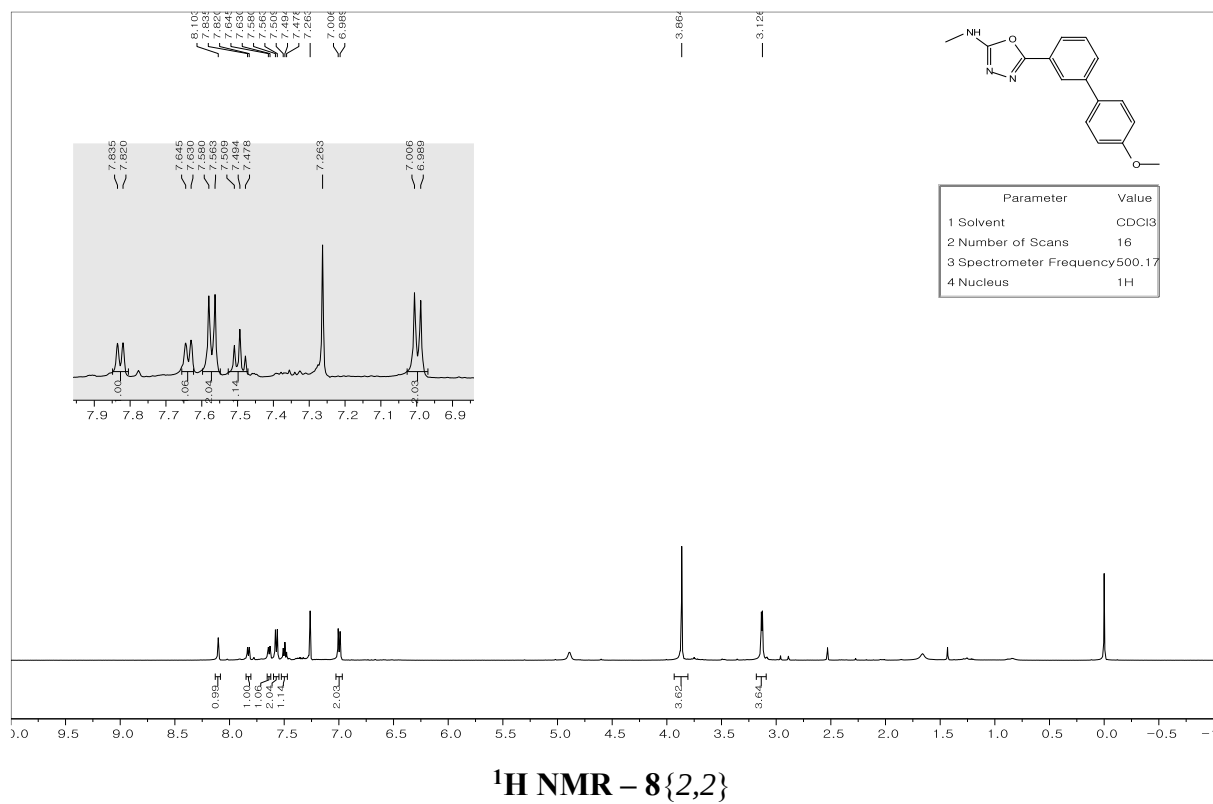


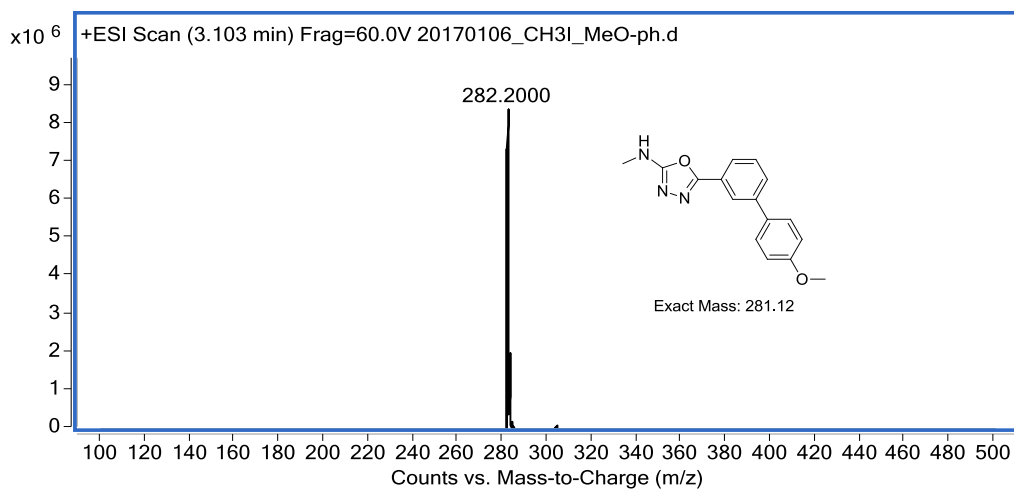
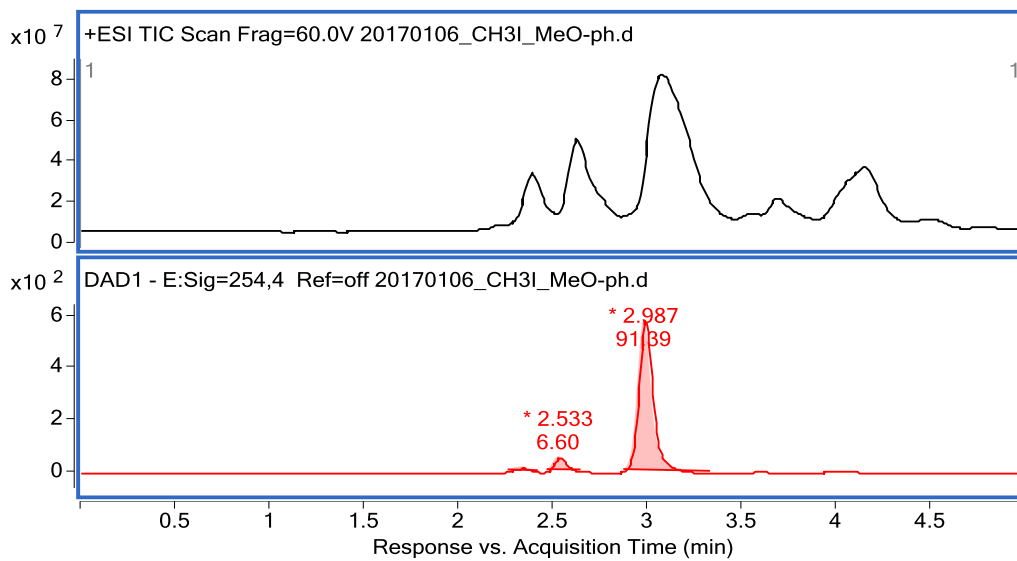


LC/MS – 8{2,1}

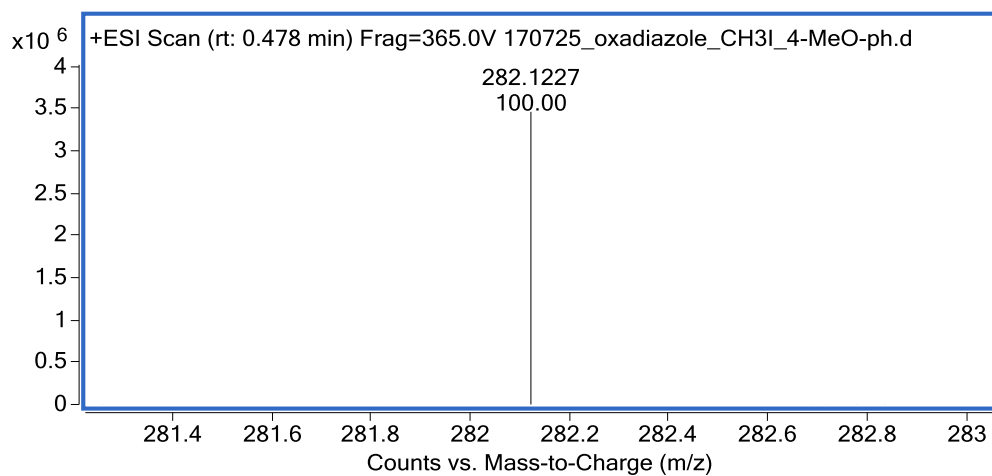


HR/MS – 8{2,1}



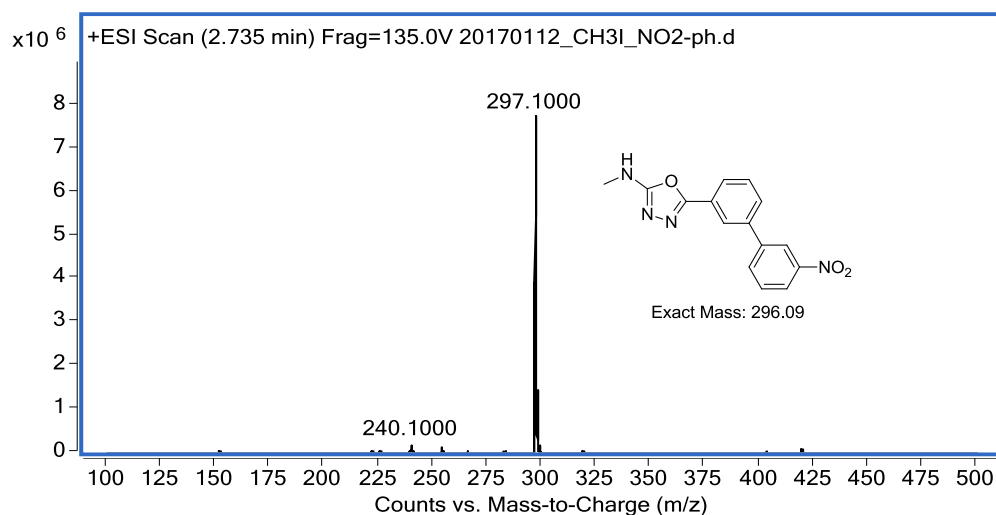
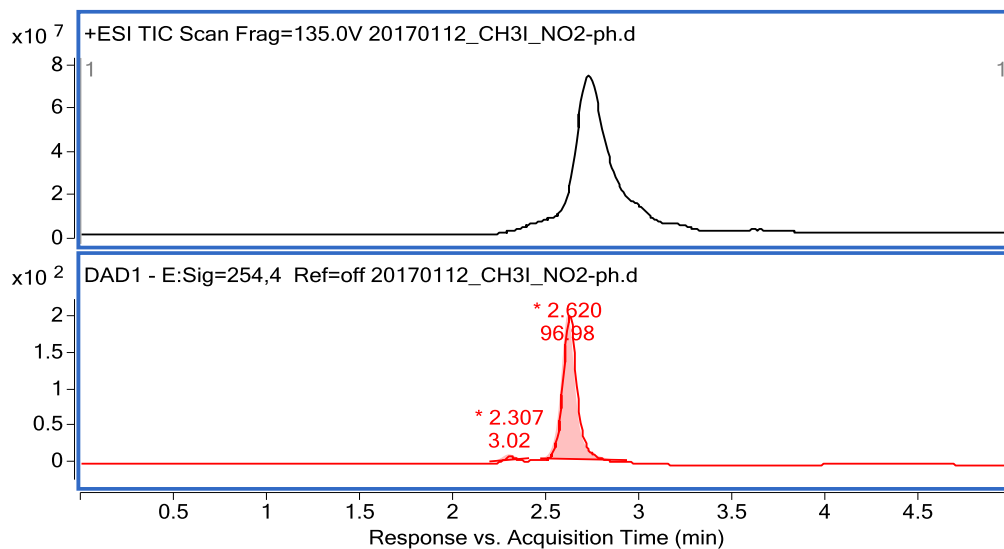


LC/MS – 8{2,2}

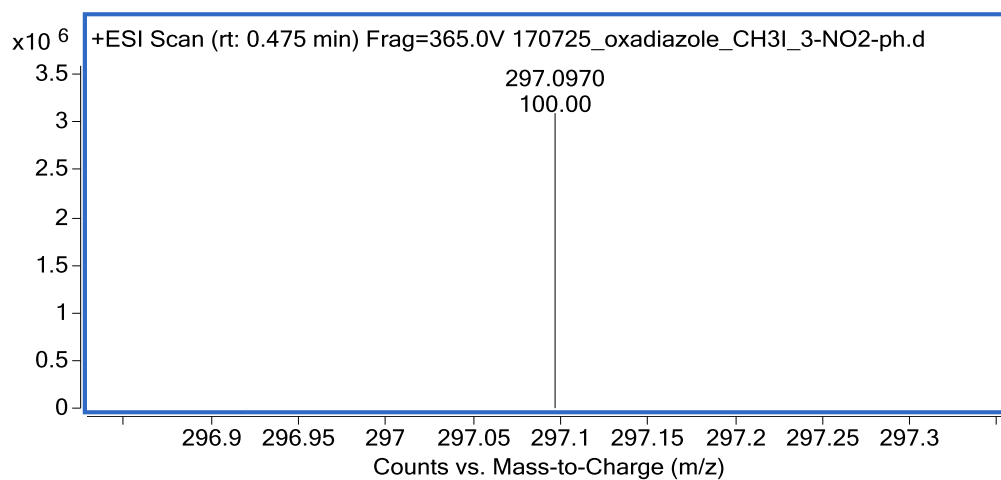


HR/MS – 8{2,2}

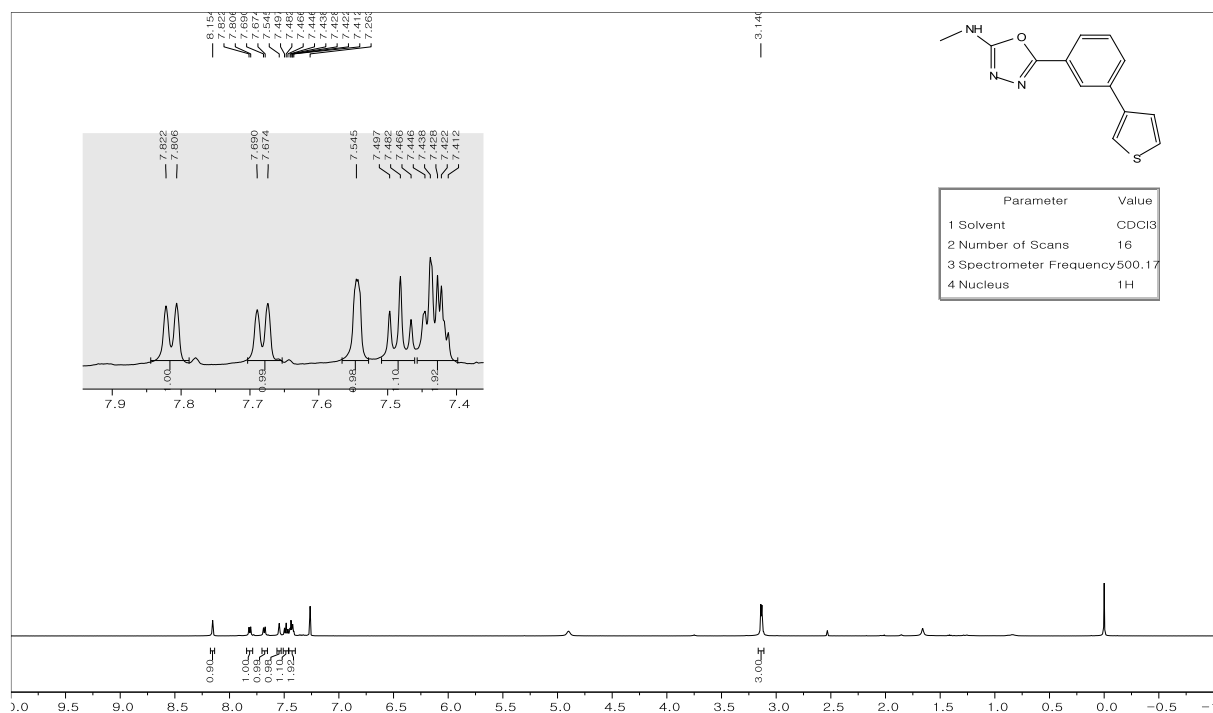




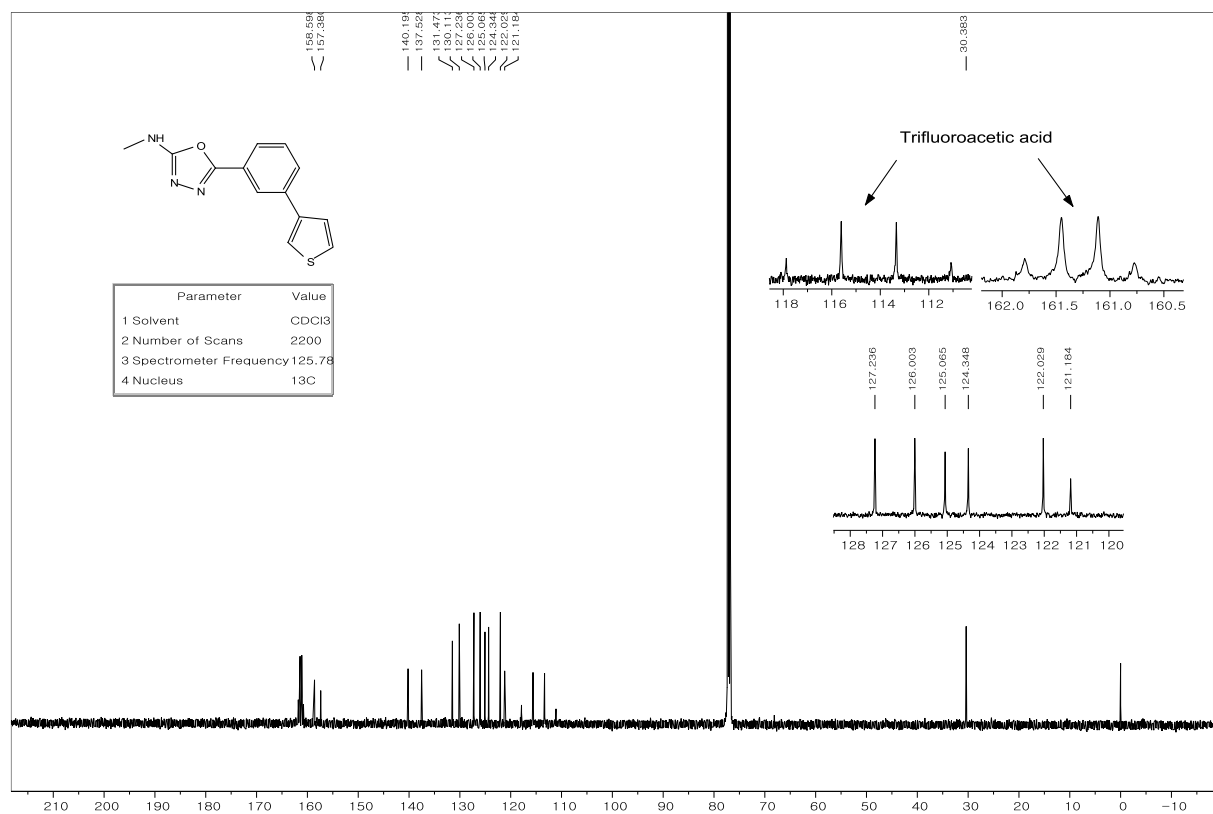
LC/MS – 8{2,3}



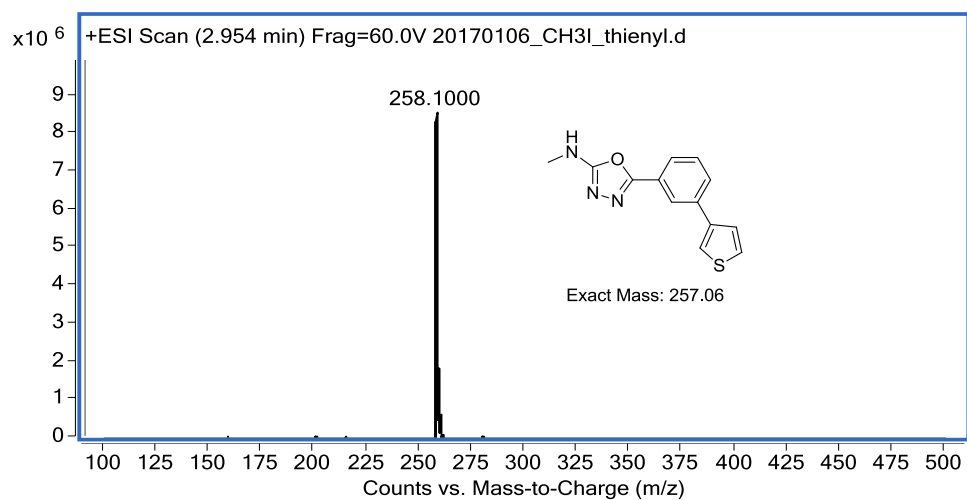
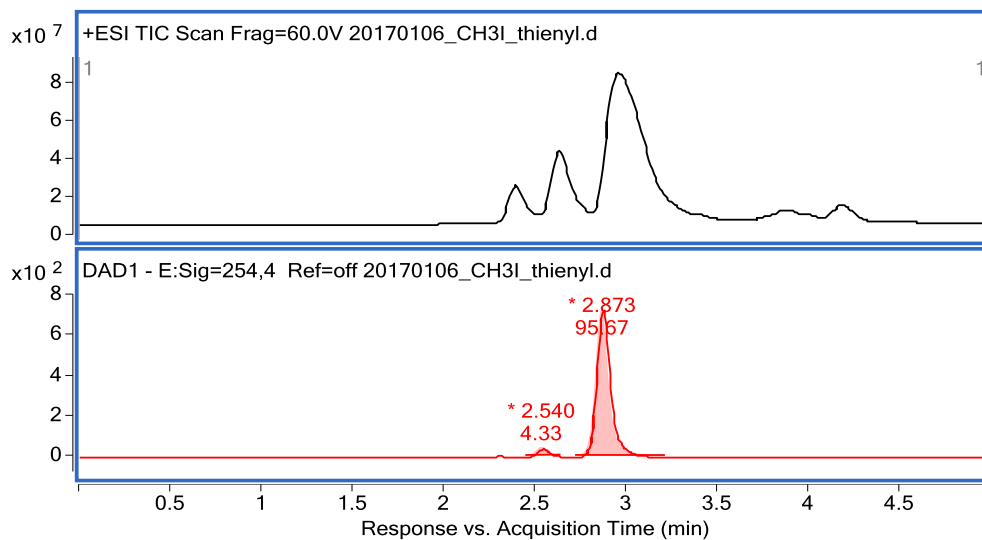
HR/MS – 8{2,3}



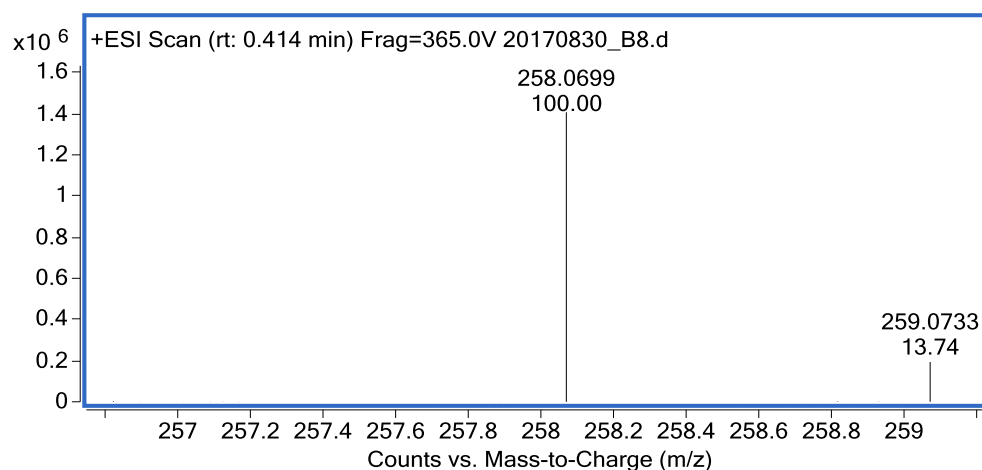
¹H NMR – 8{2,4}



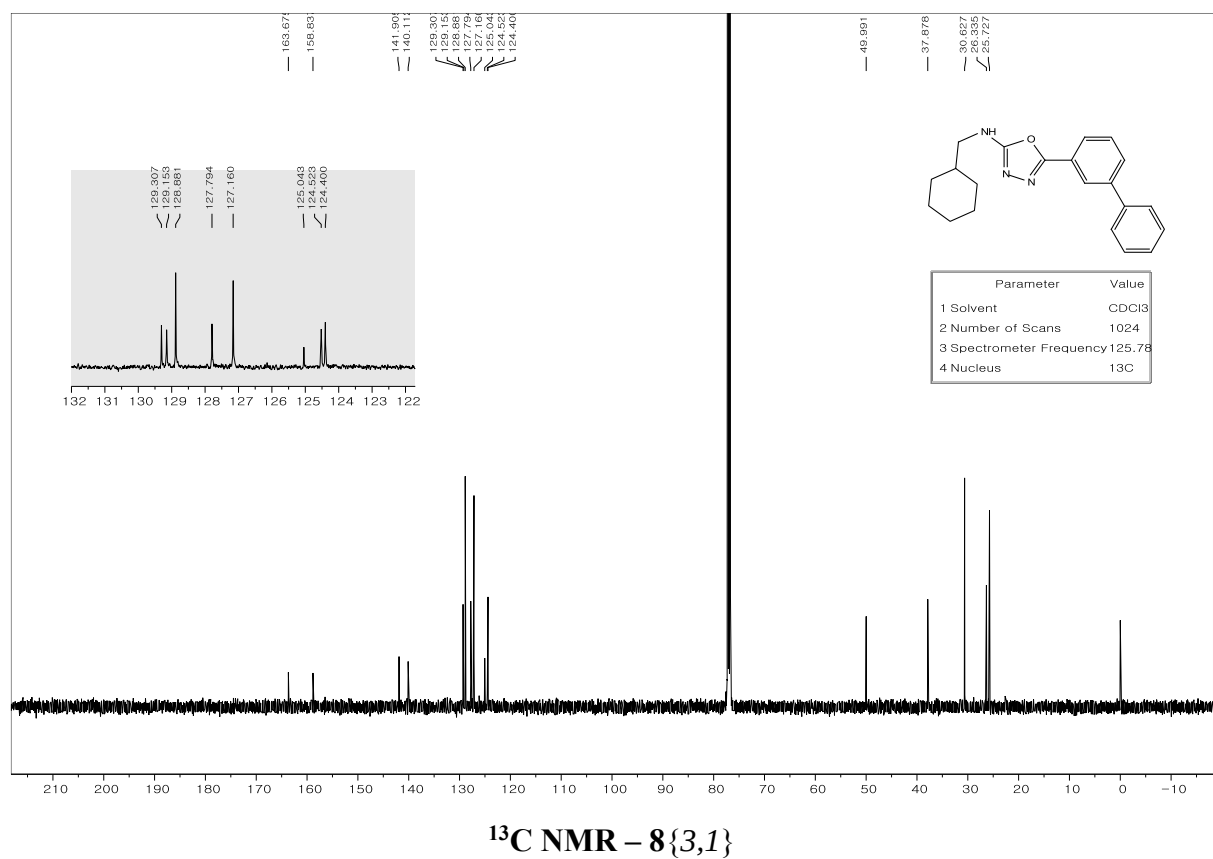
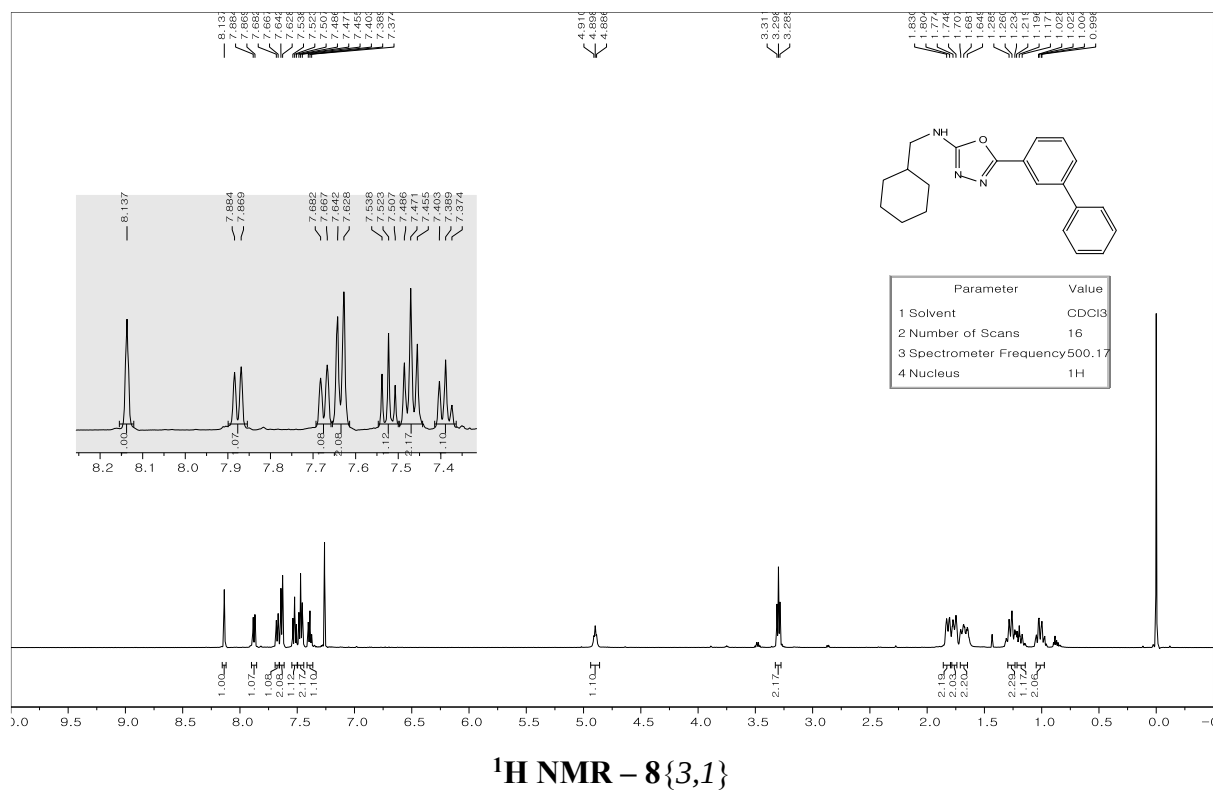
¹³C NMR – 8{2,4}

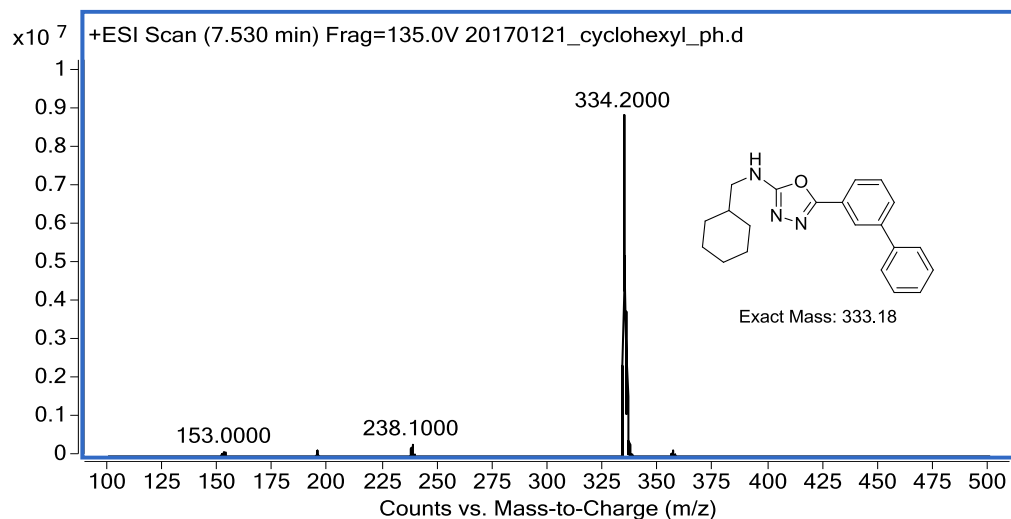
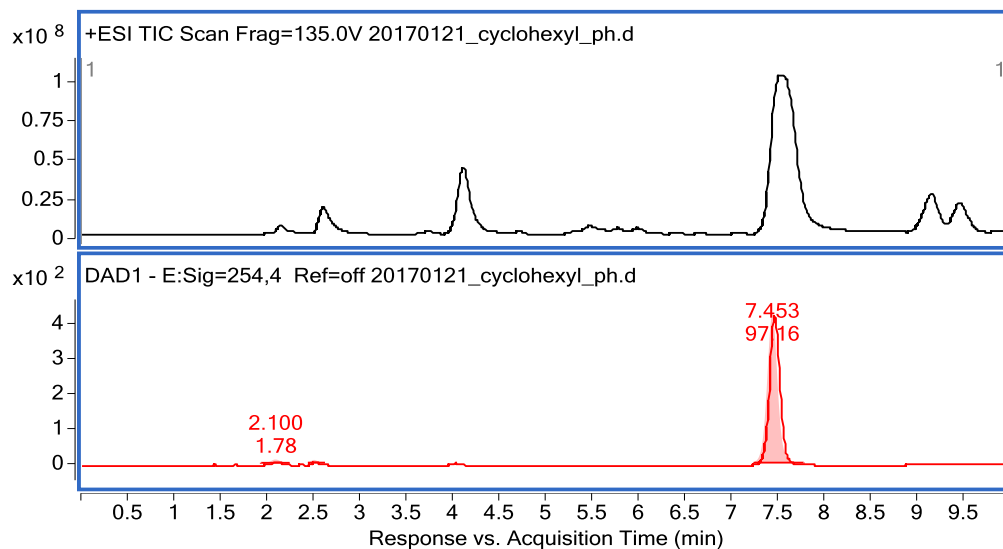


LC/MS – 8{2,4}

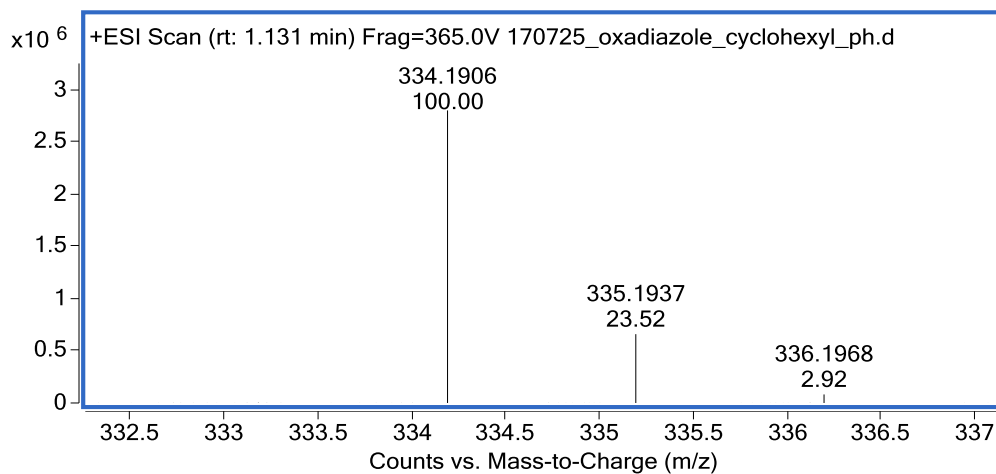


HR/MS – 8{2,4}

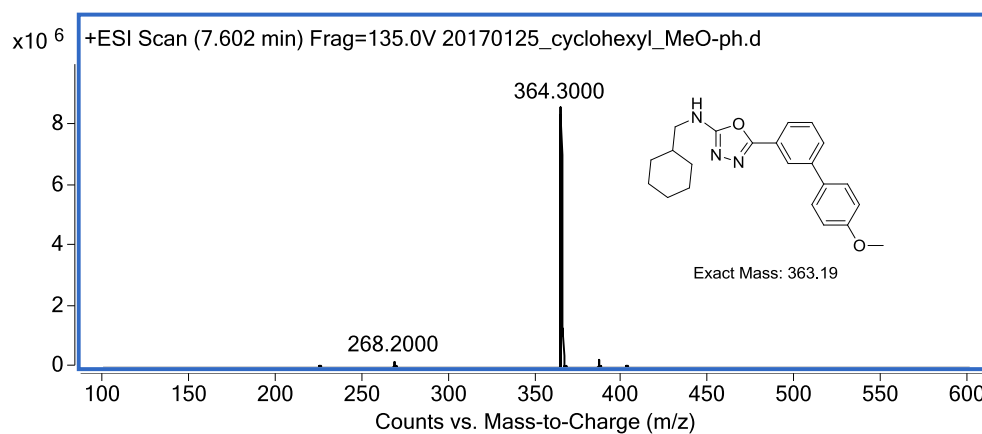
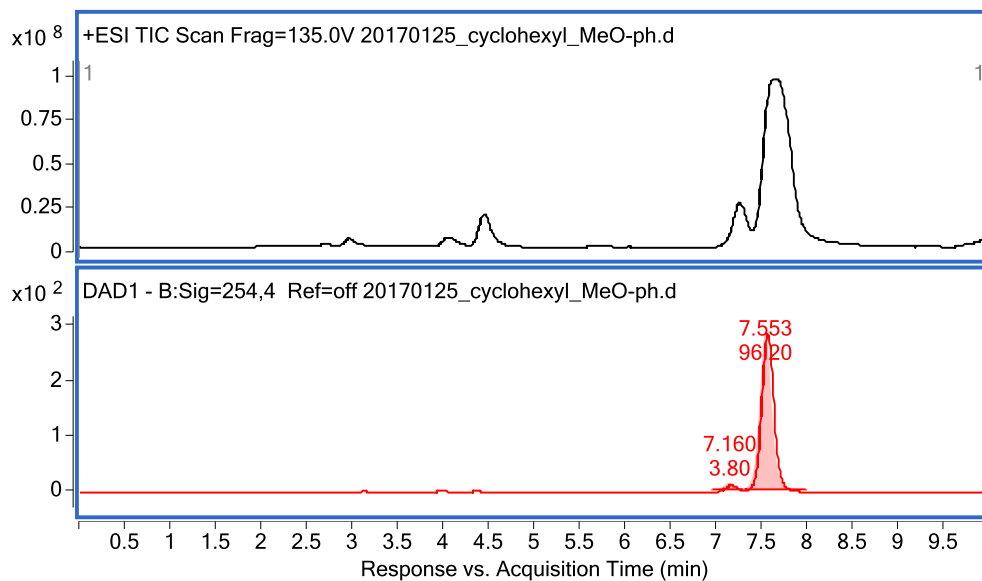




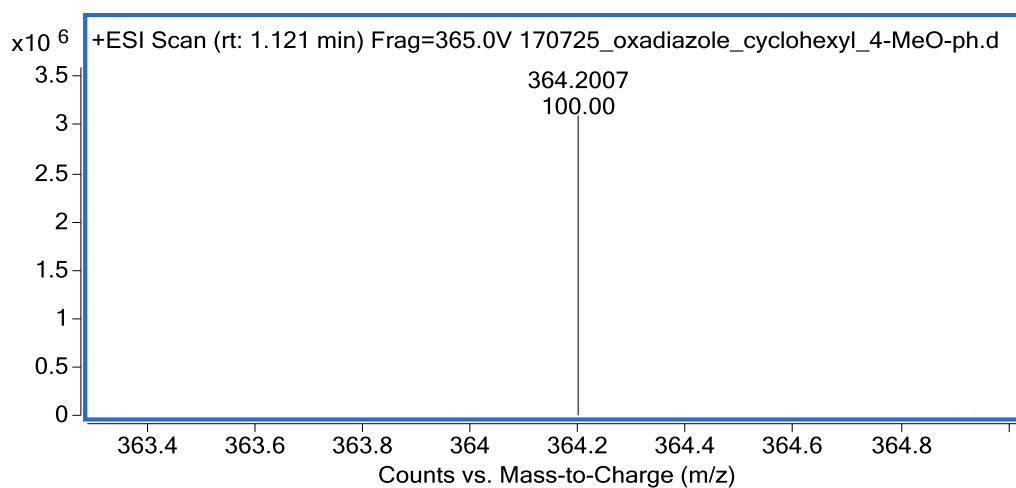
LC/MS – 8{3,1}



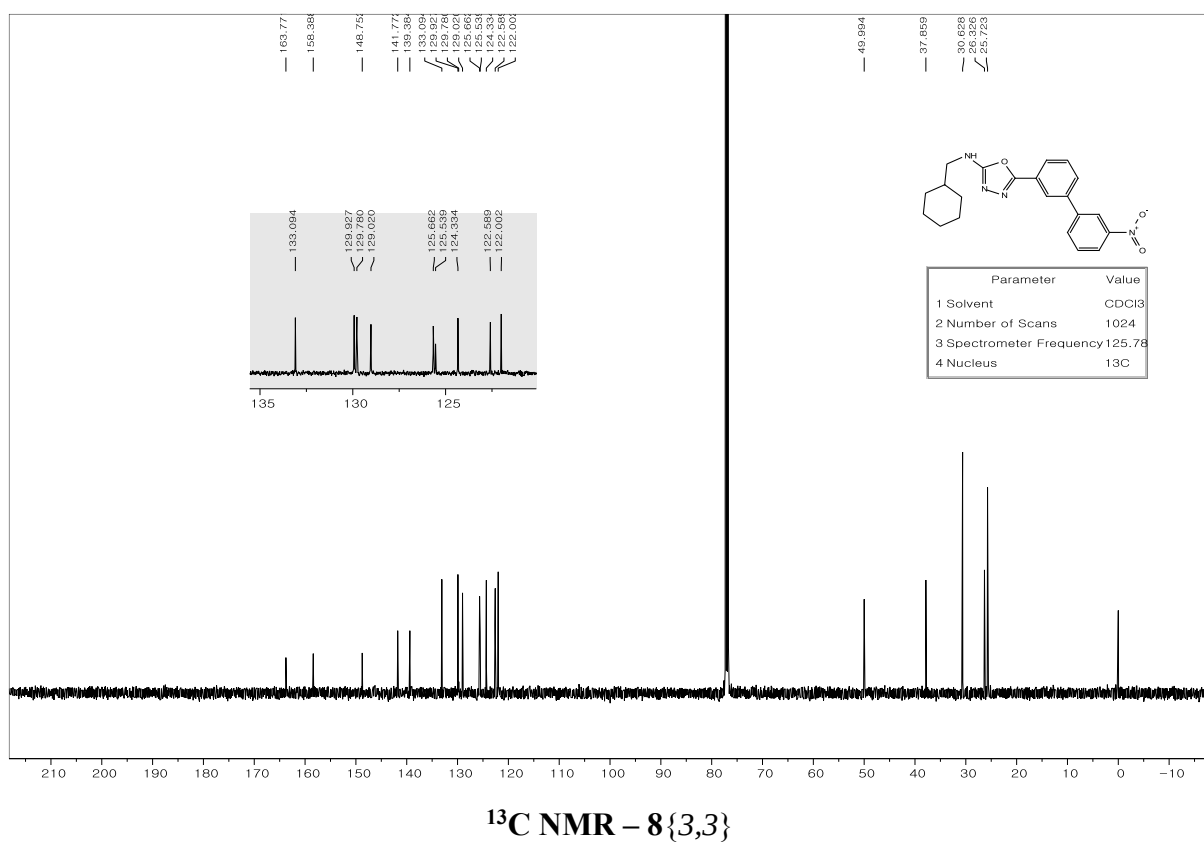
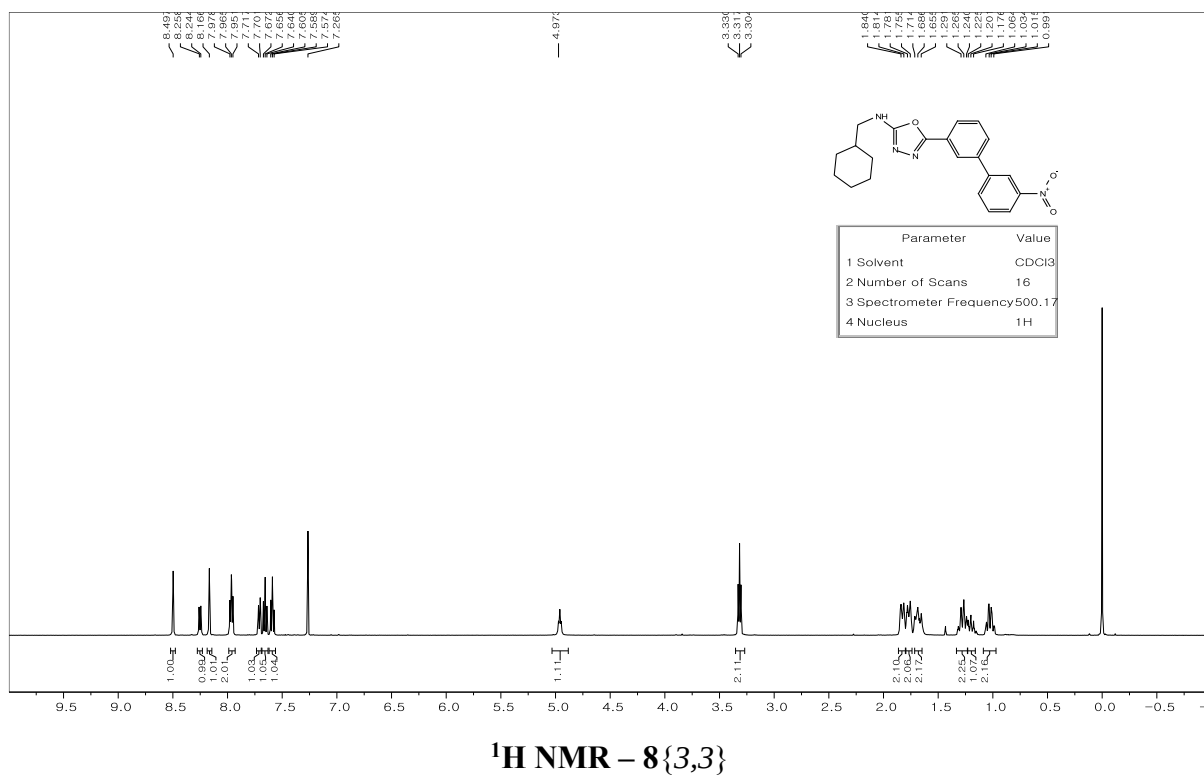
HR/MS – 8{3,1}

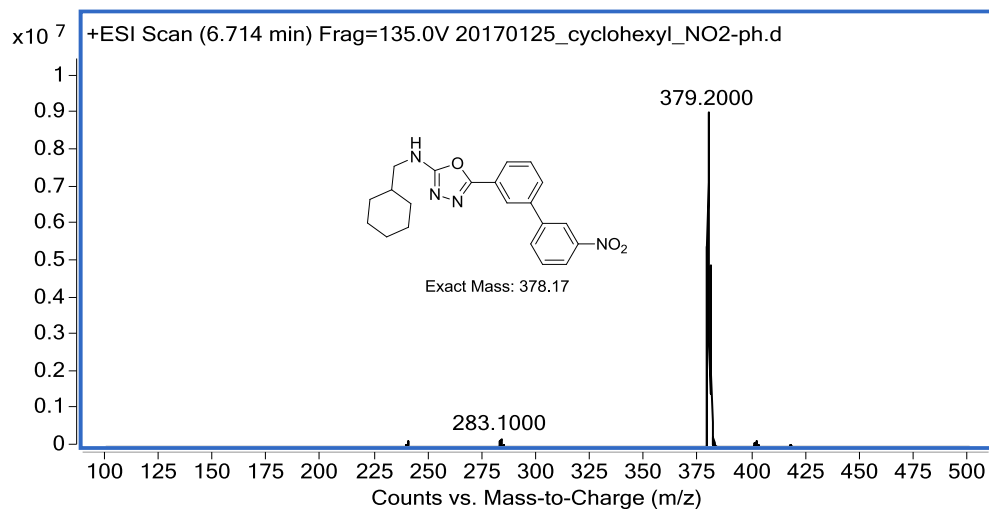
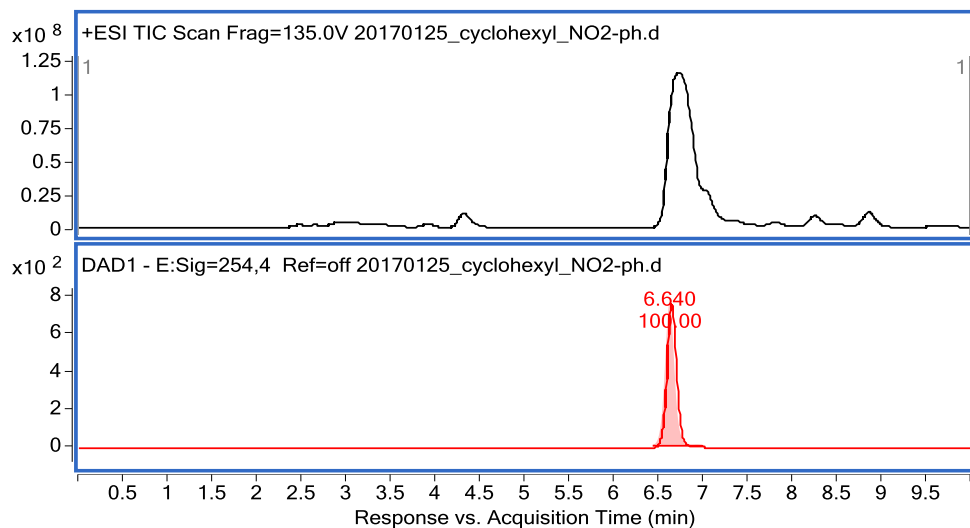


LC/MS – 8{3,2}

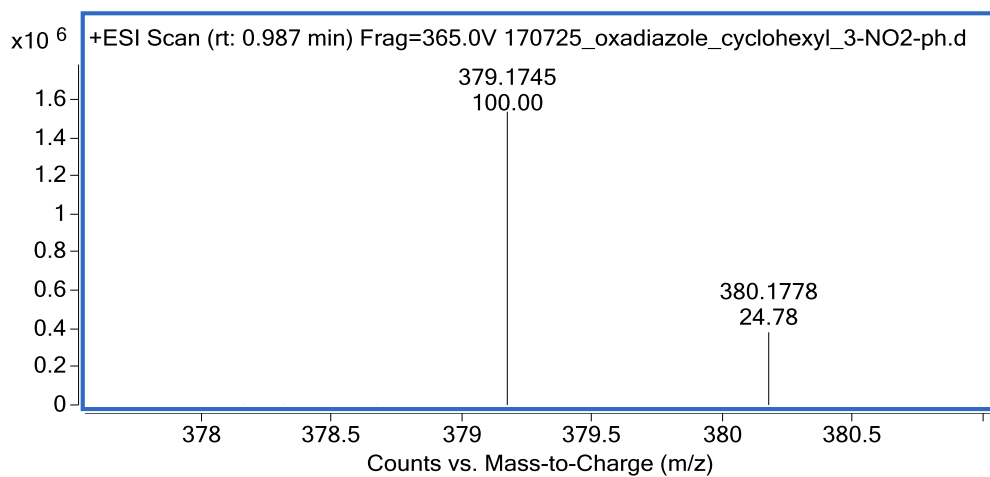


HR/MS – 8{3,2}

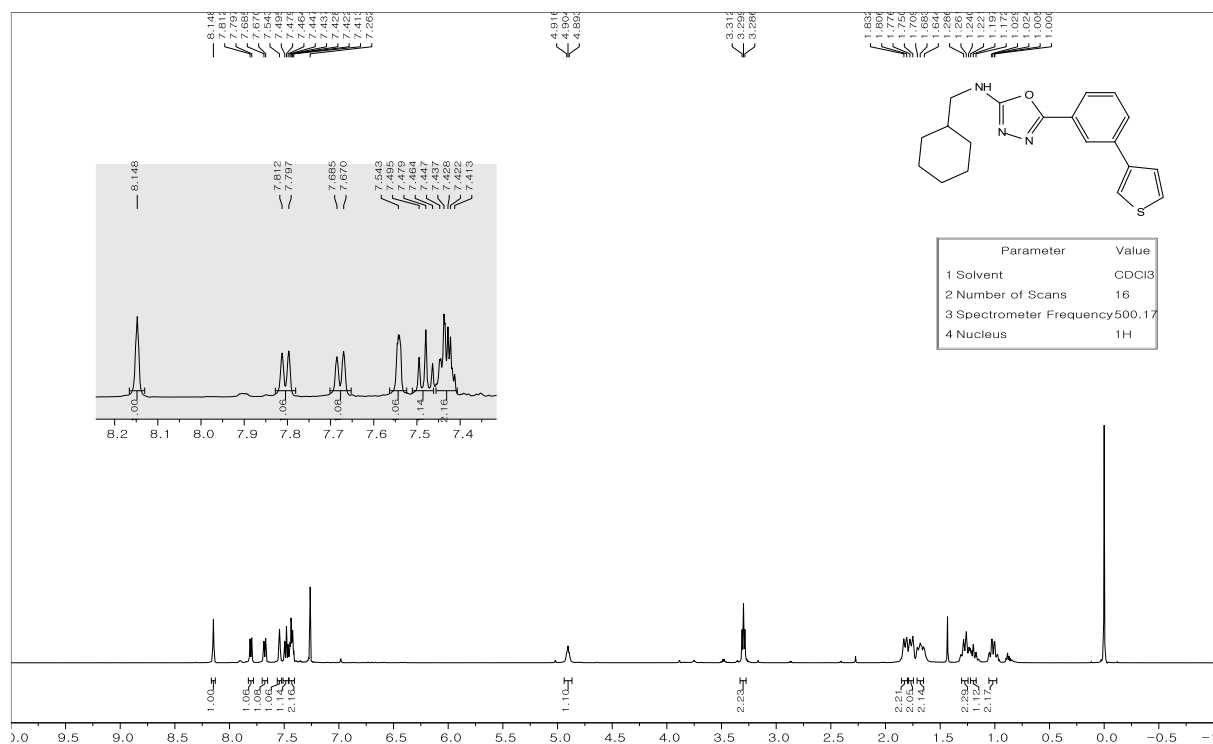




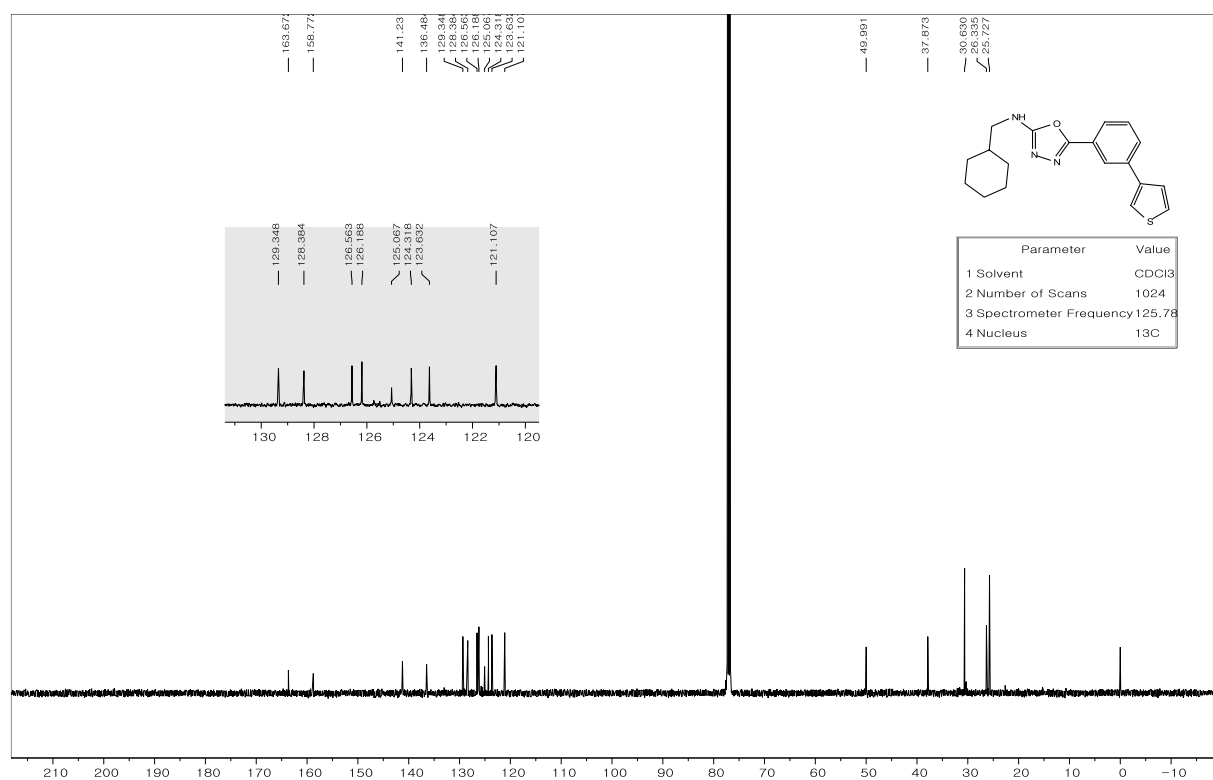
LC/MS – 8{3,3}



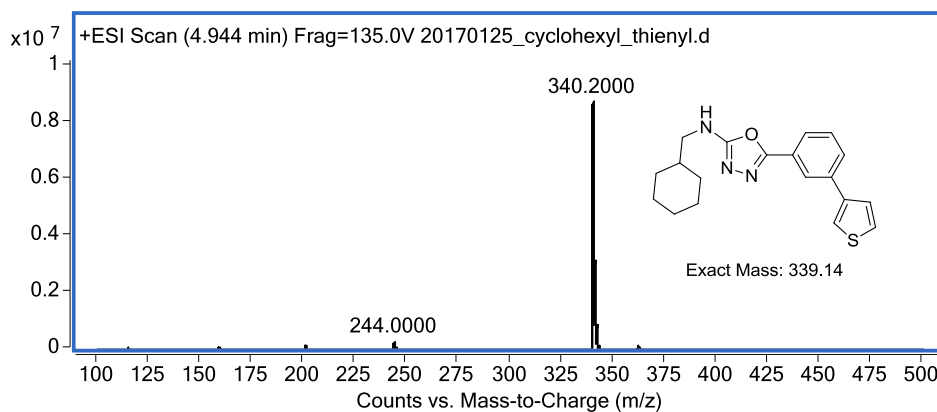
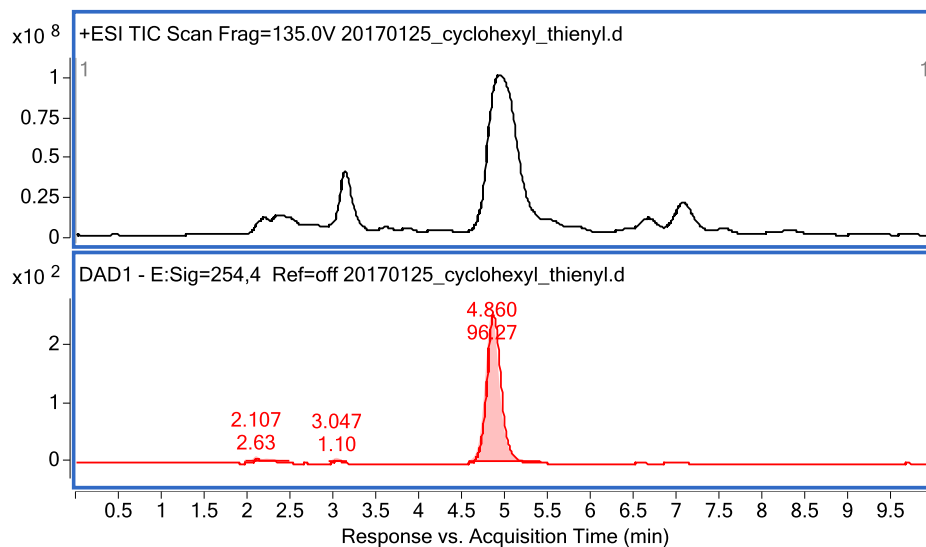
HR/MS – 8{3,3}



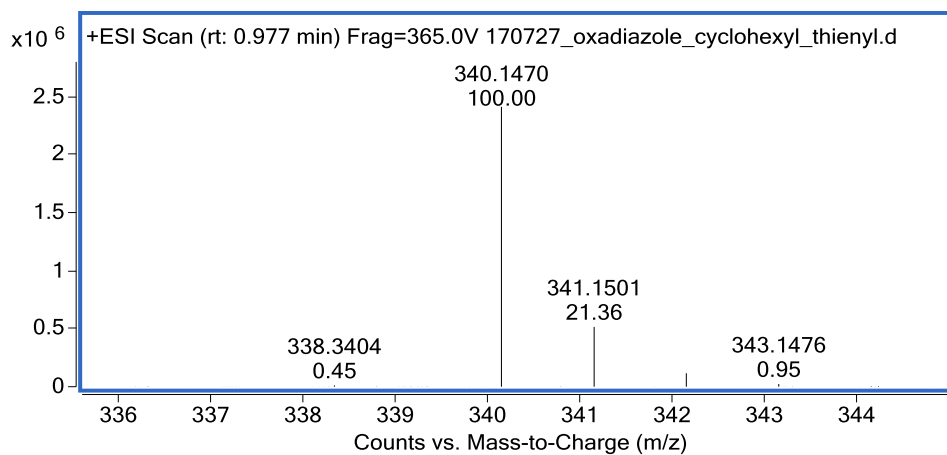
¹H NMR – 8{3,4}



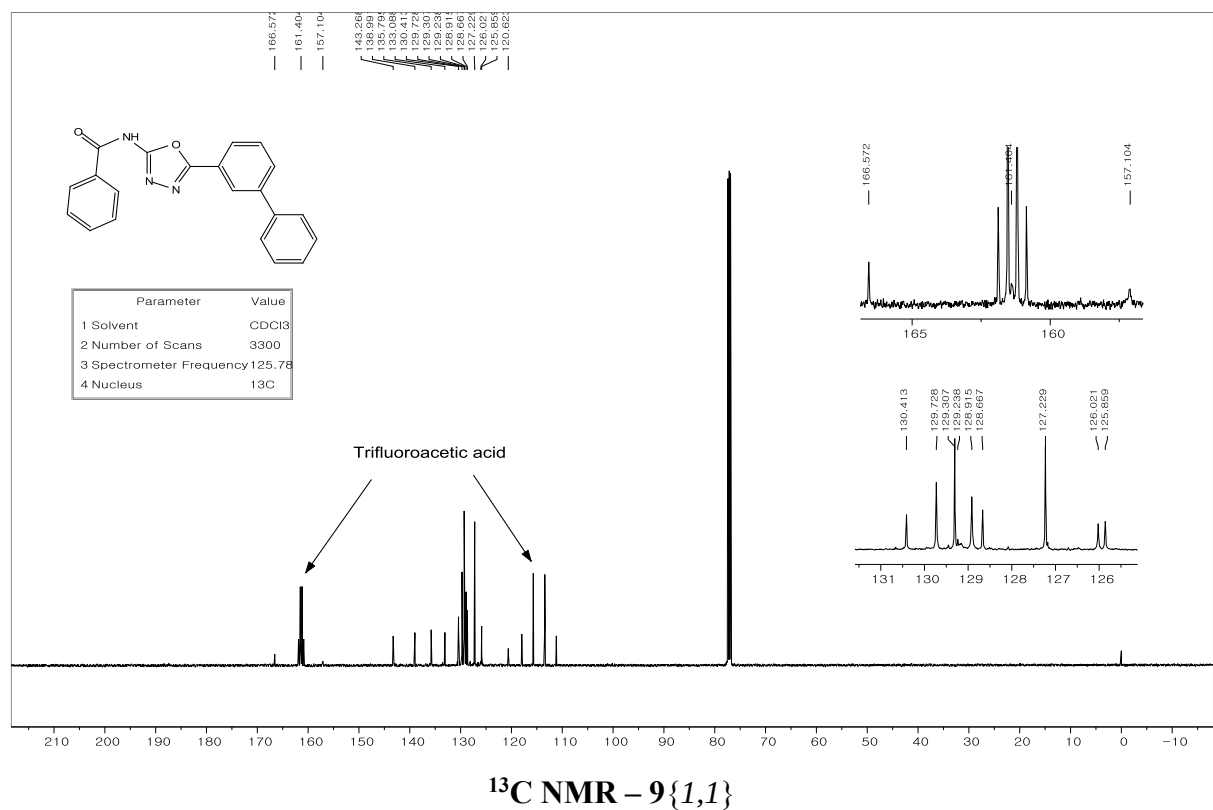
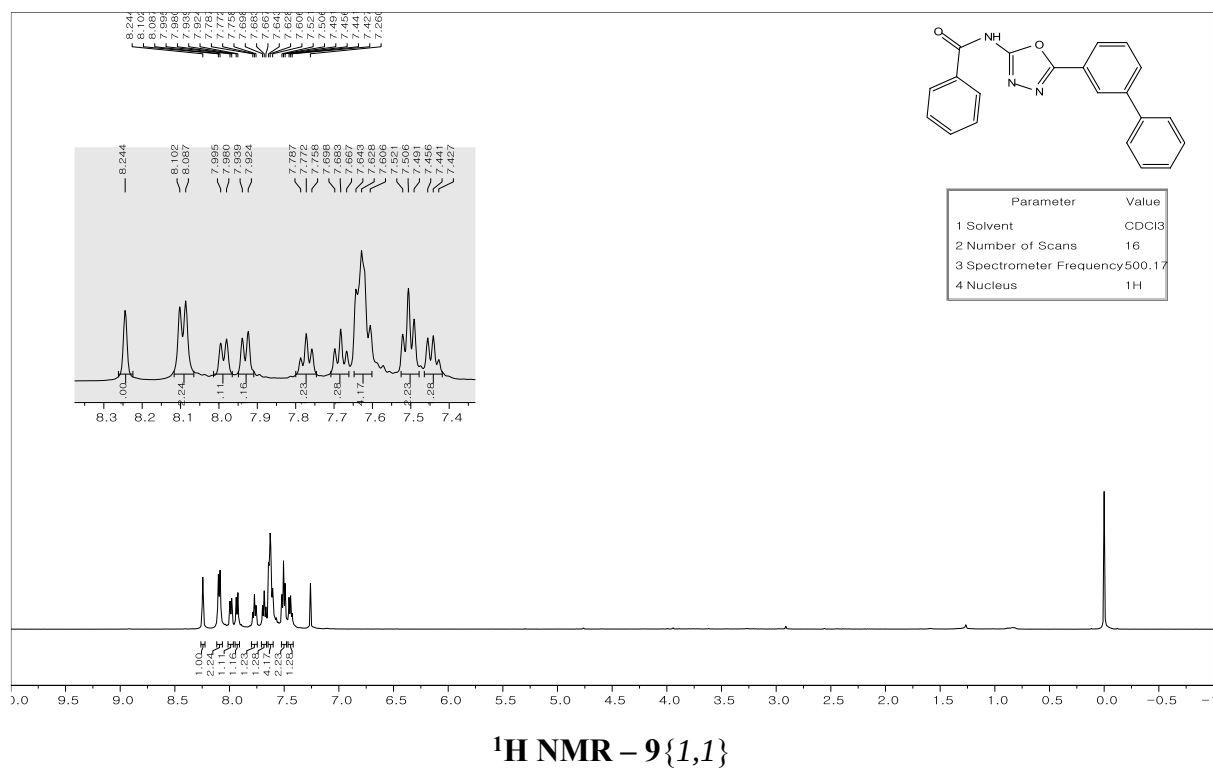
¹³C NMR – 8{3,4}

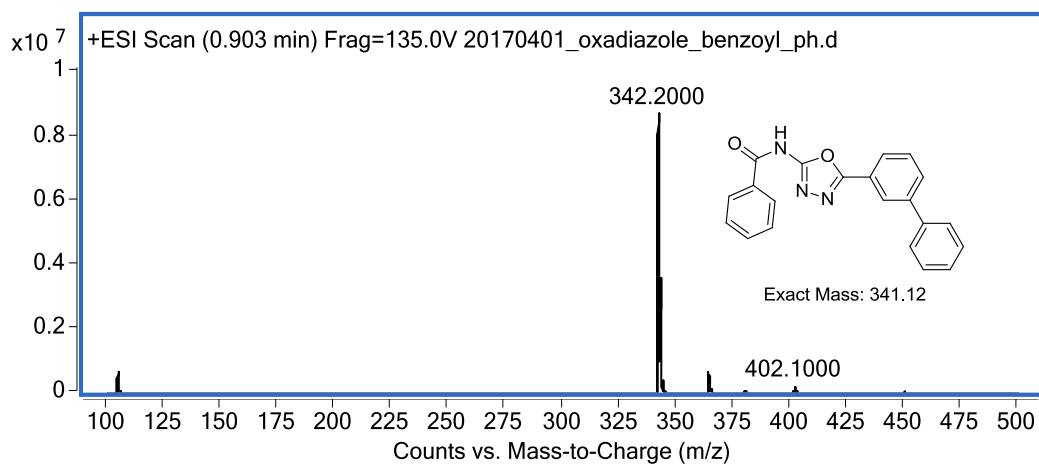
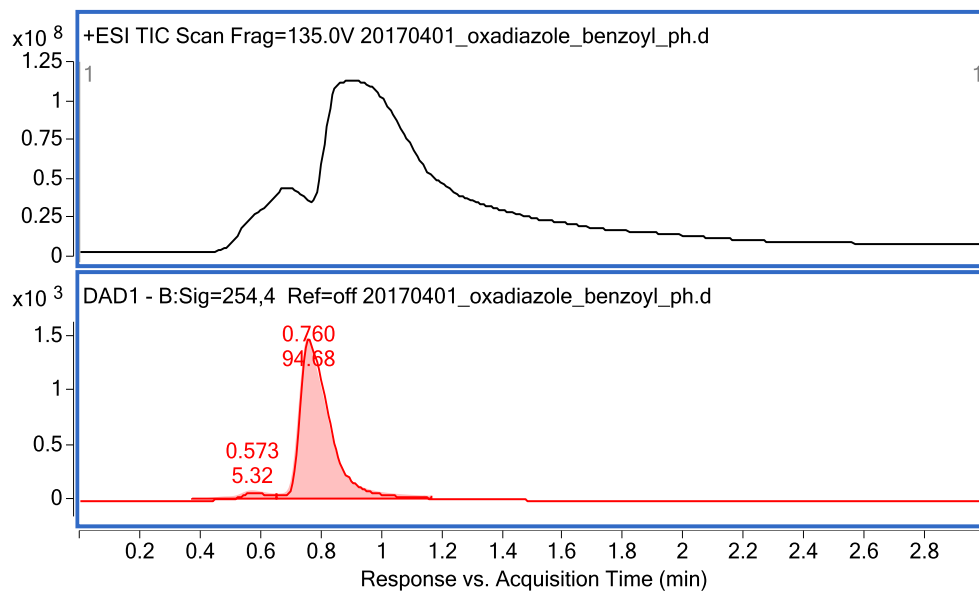


LC/MS – 8{3,4}

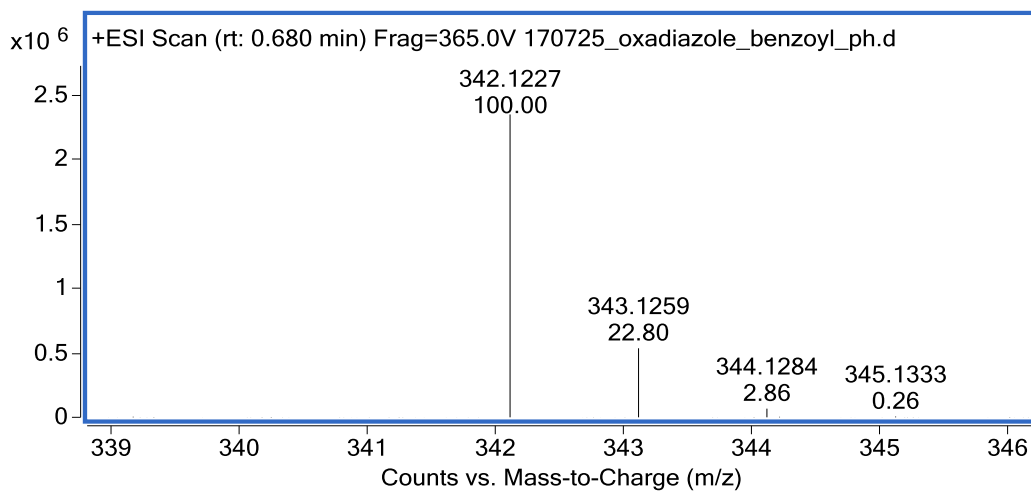


HR/MS – 8{3,4}

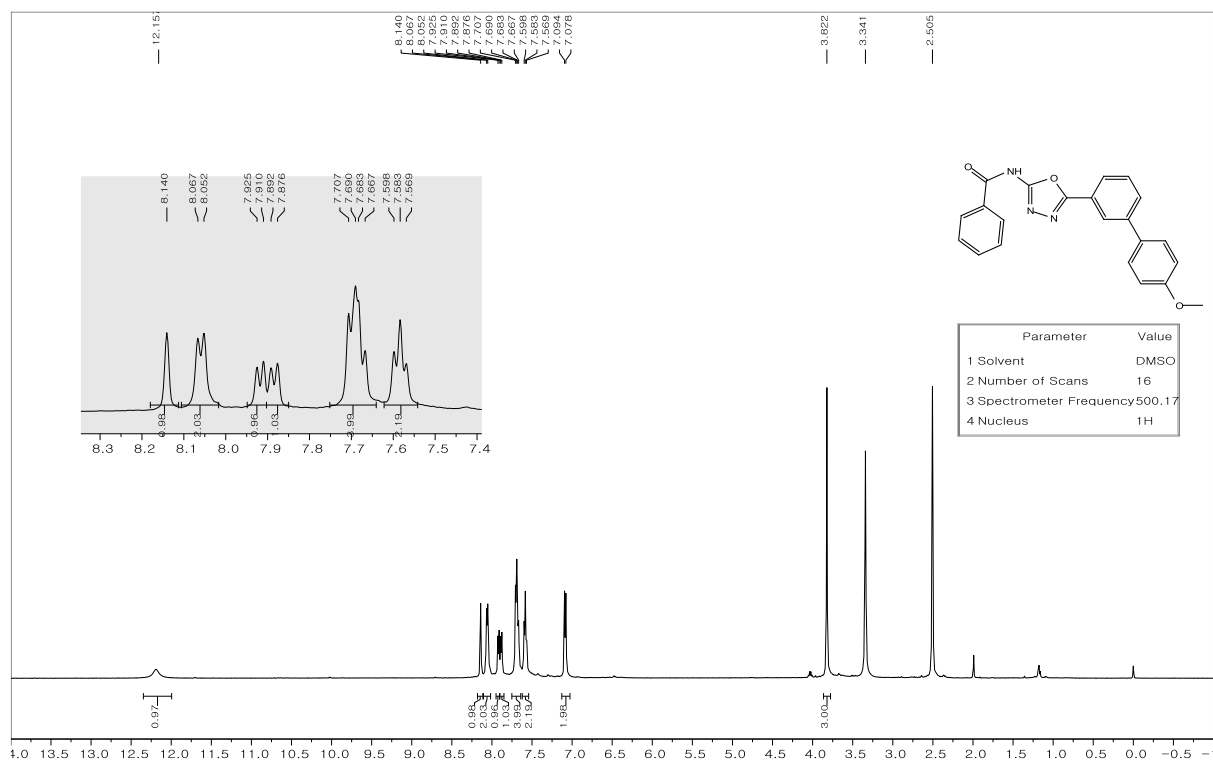




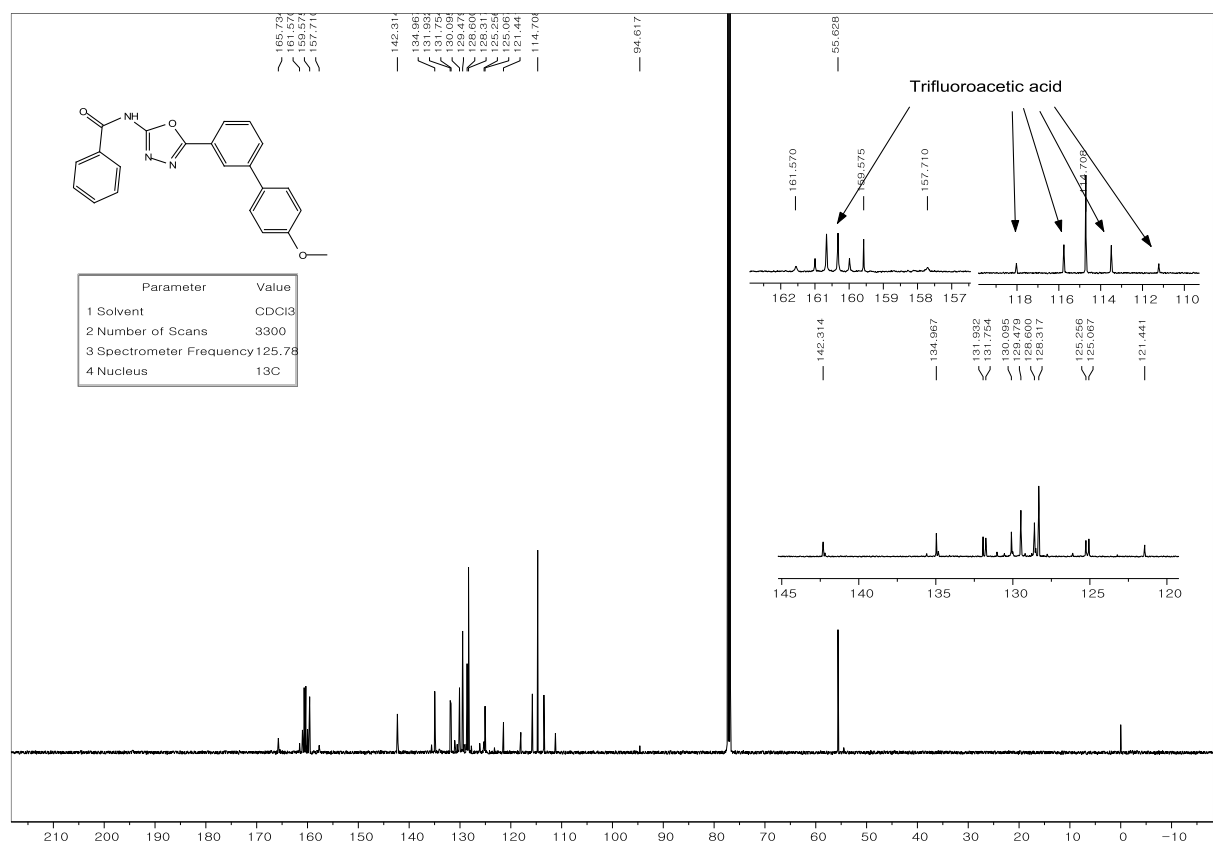
LC/MS – 9{1,1}



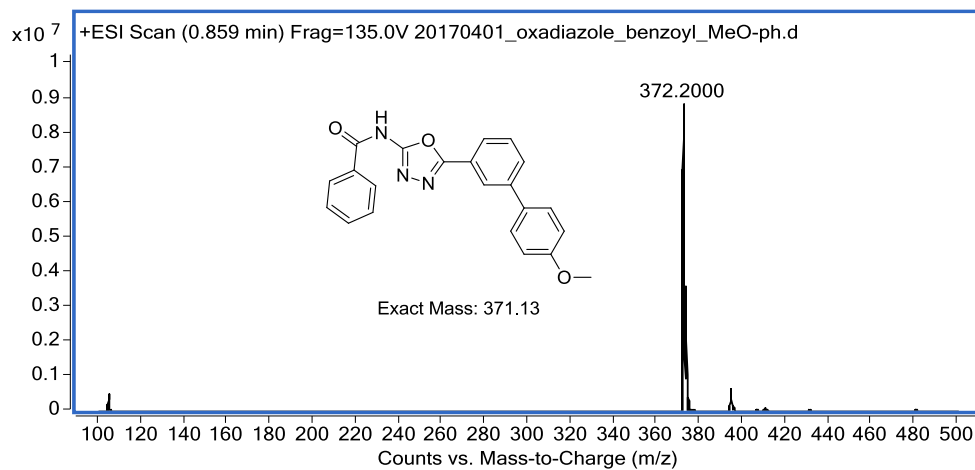
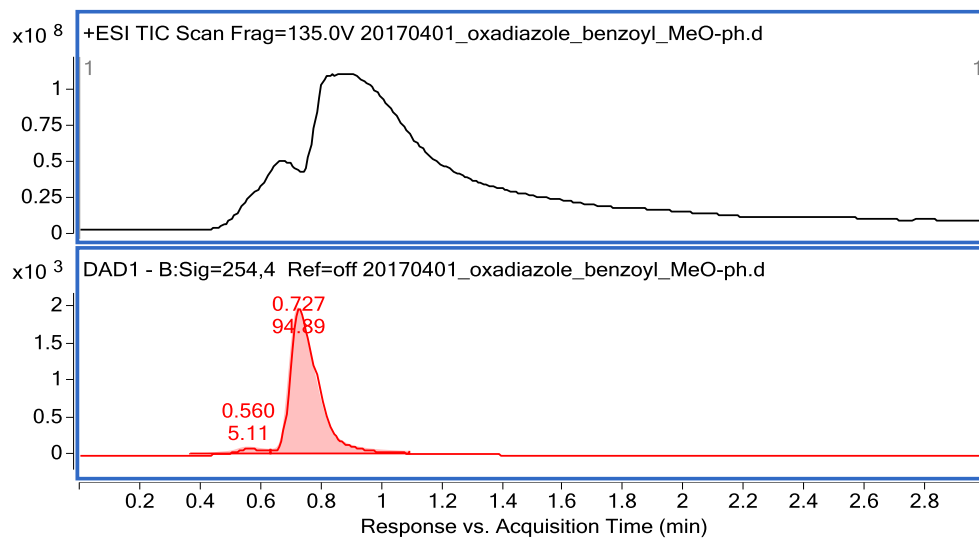
HR/MS – 9{1,1}



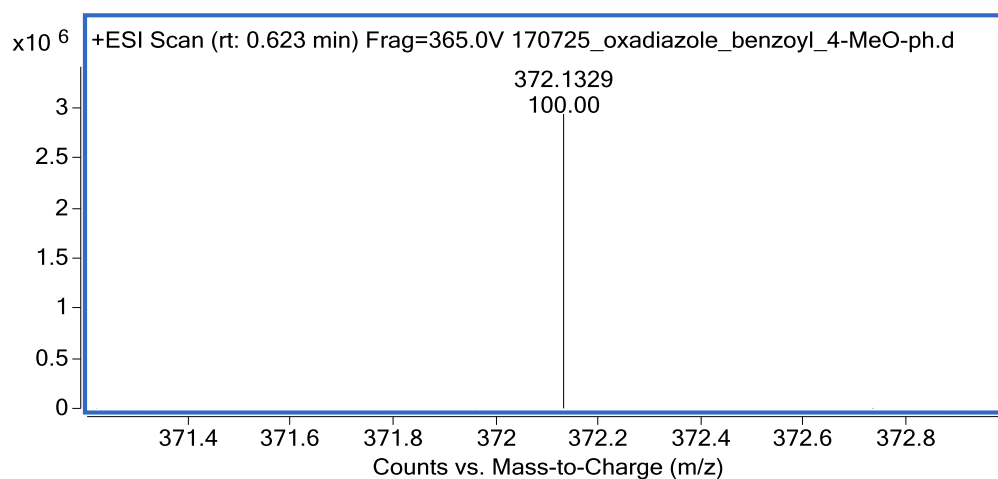
¹H NMR – 9{1,2}



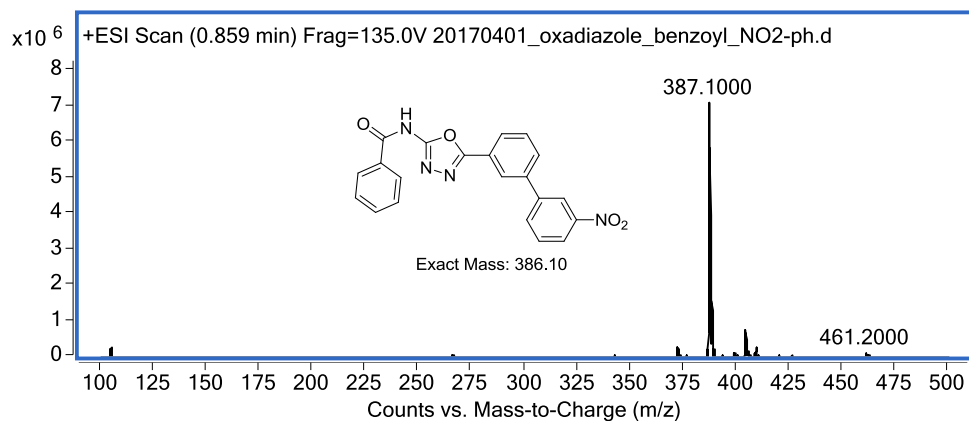
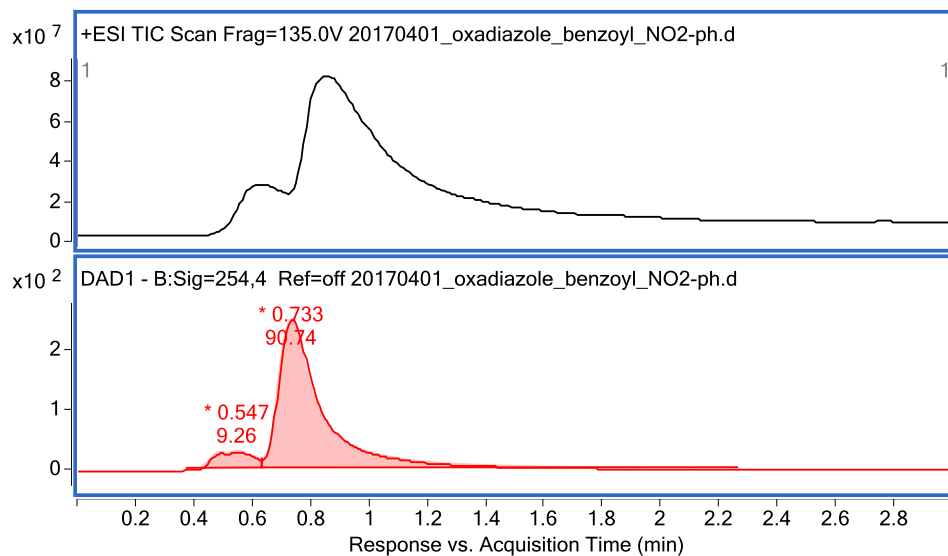
¹³C NMR – 9{1,2}



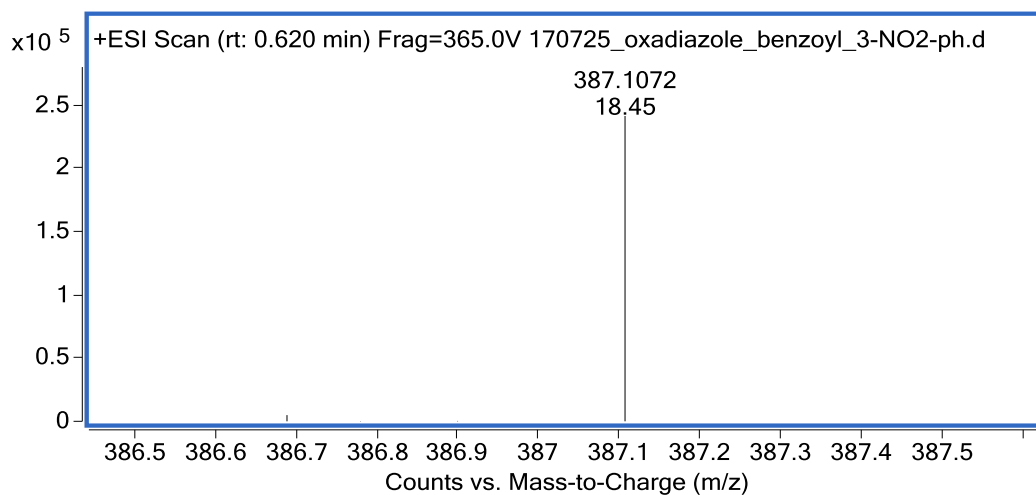
LC/MS – 9{1,2}



HR/MS – 9{1,2}

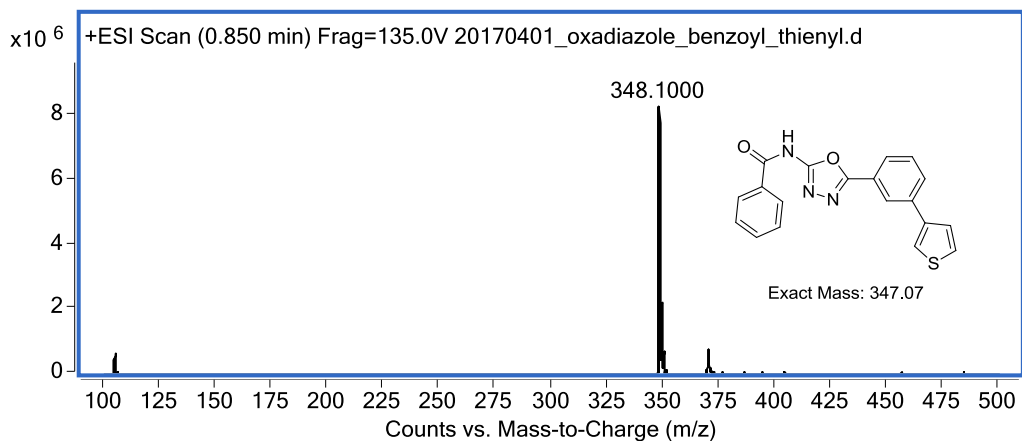
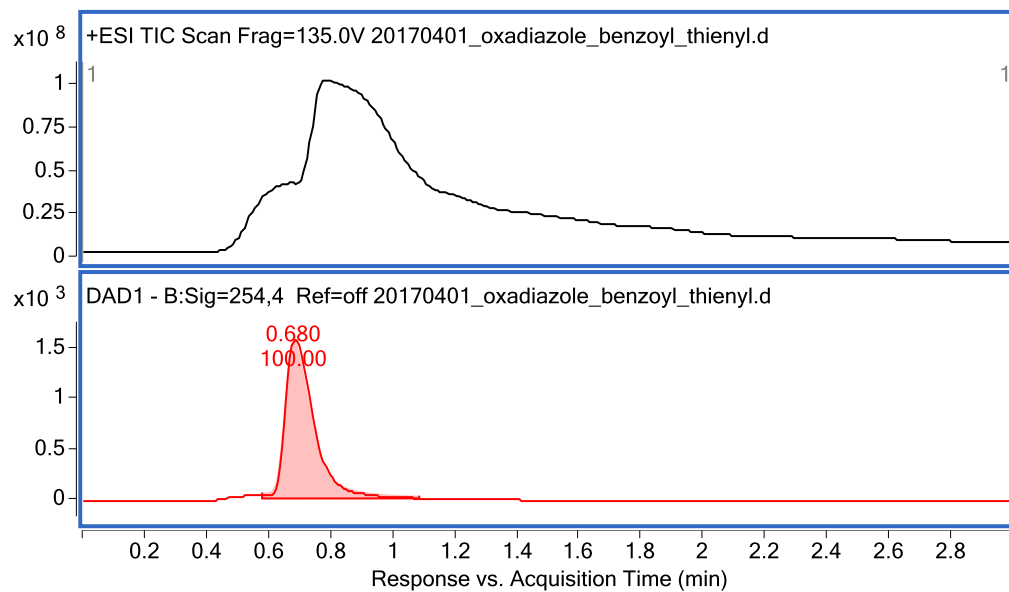


LC/MS – 9{1,3}

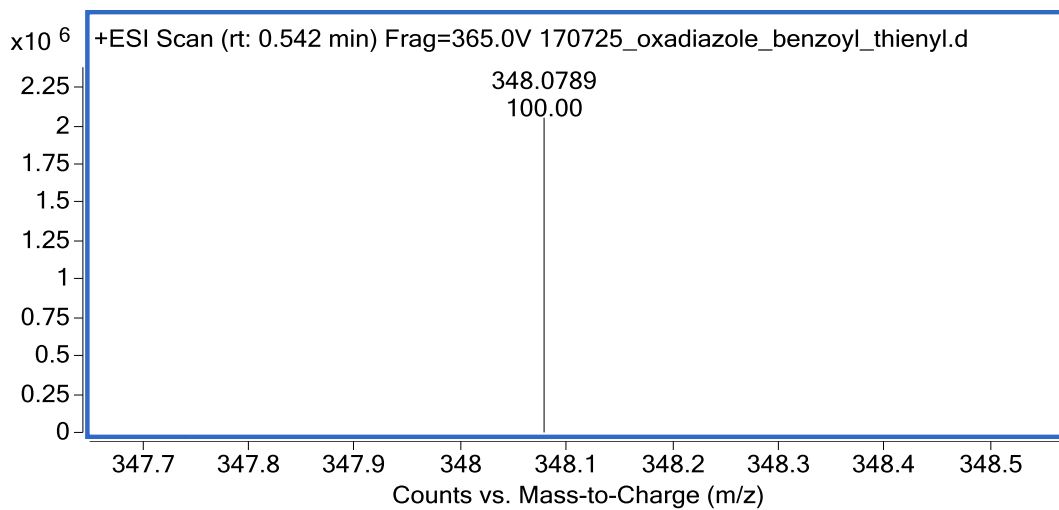


HR/MS – 9{1,3}

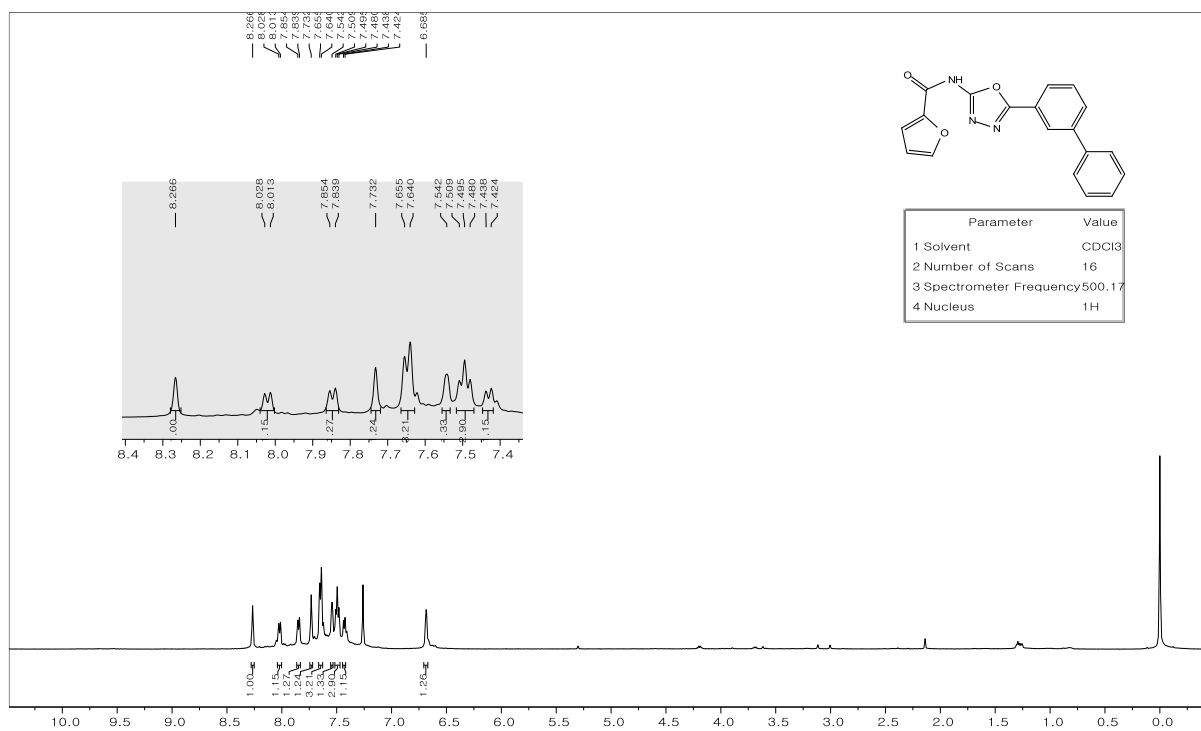




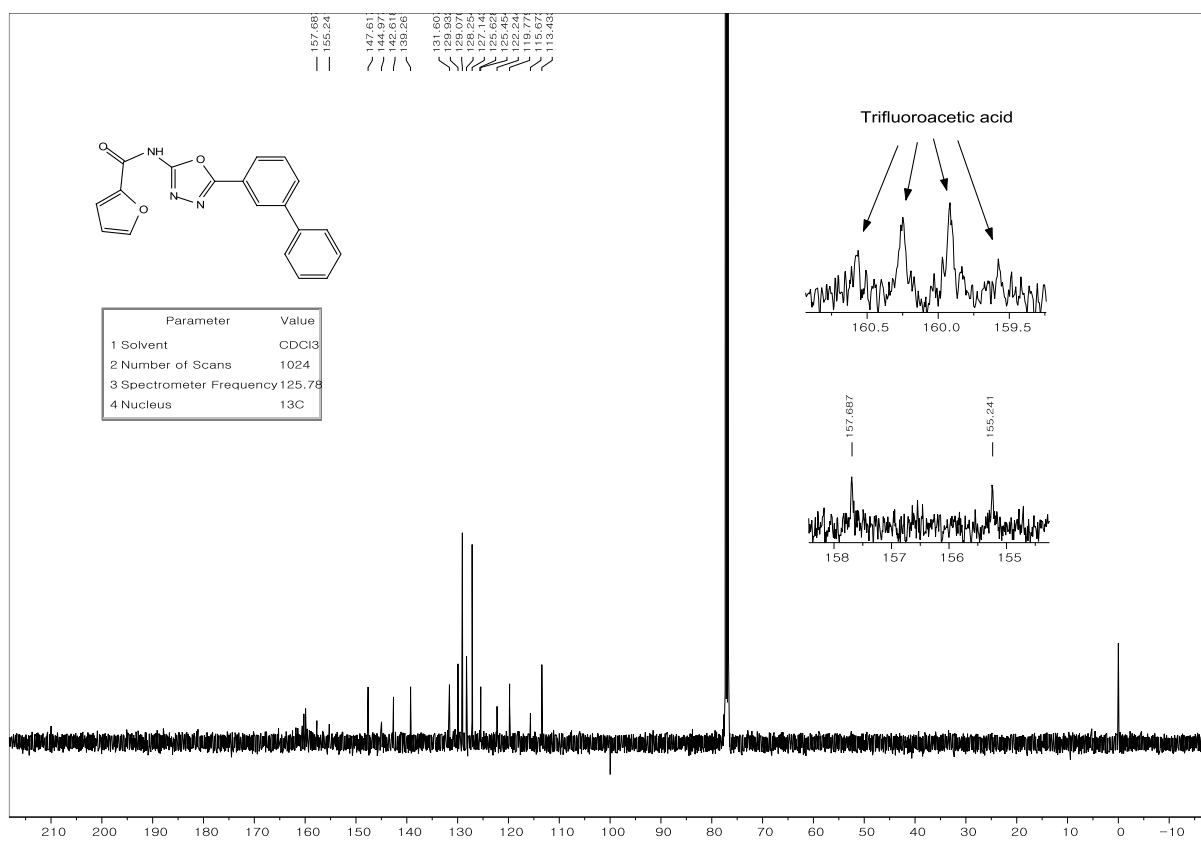
LC/MS – 9{1,4}



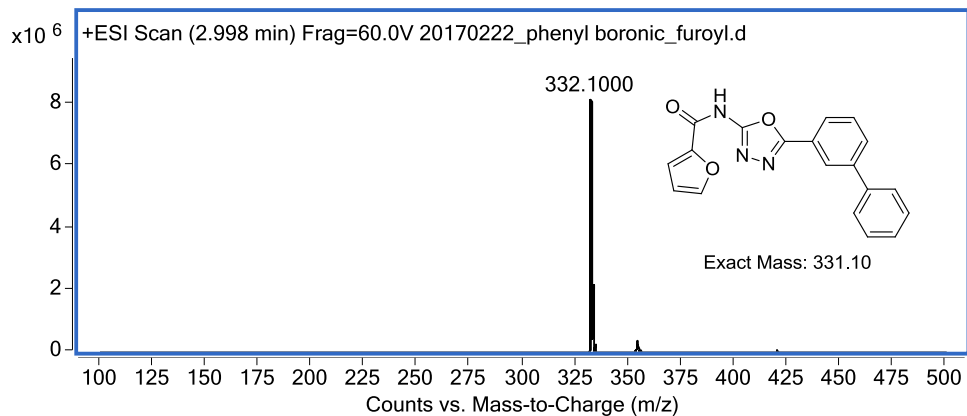
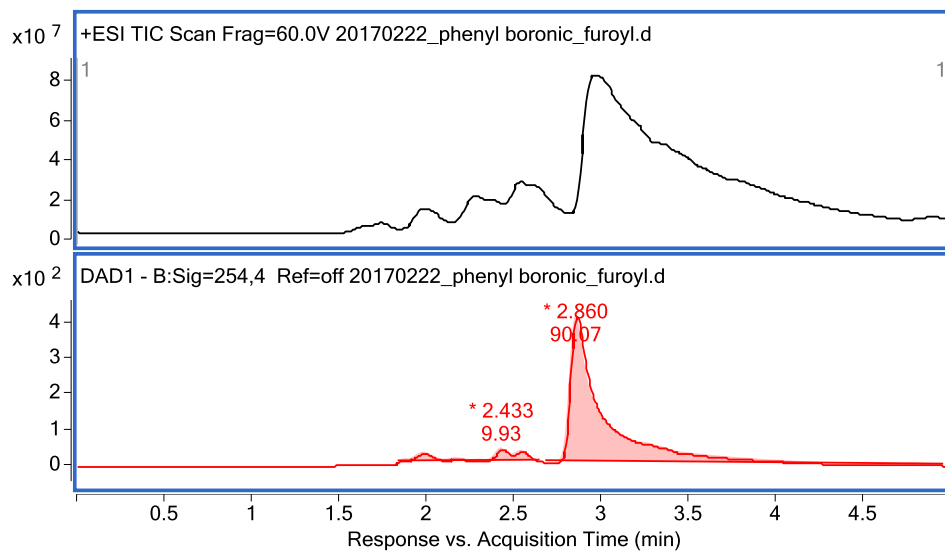
HR/MS – 9{1,4}



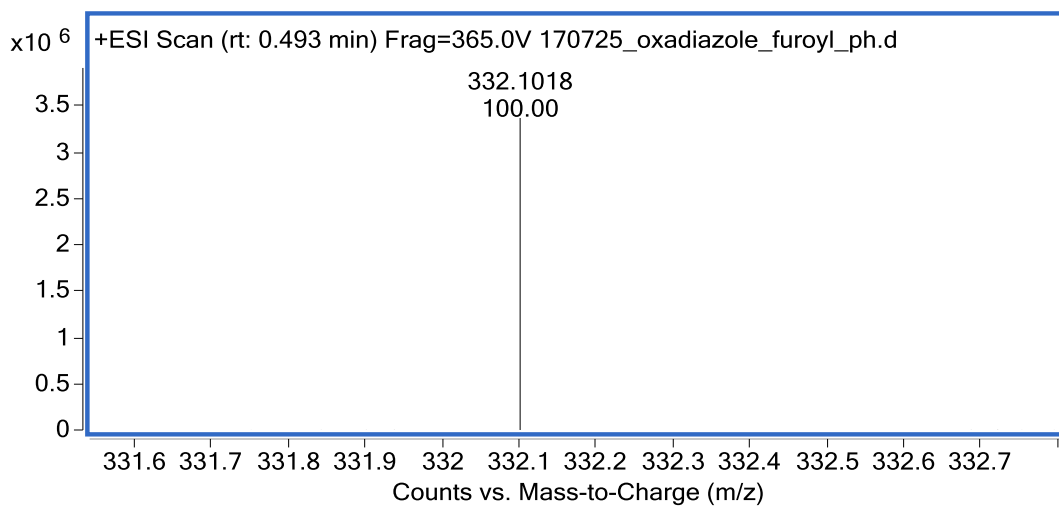
¹H NMR – 9{2,1}



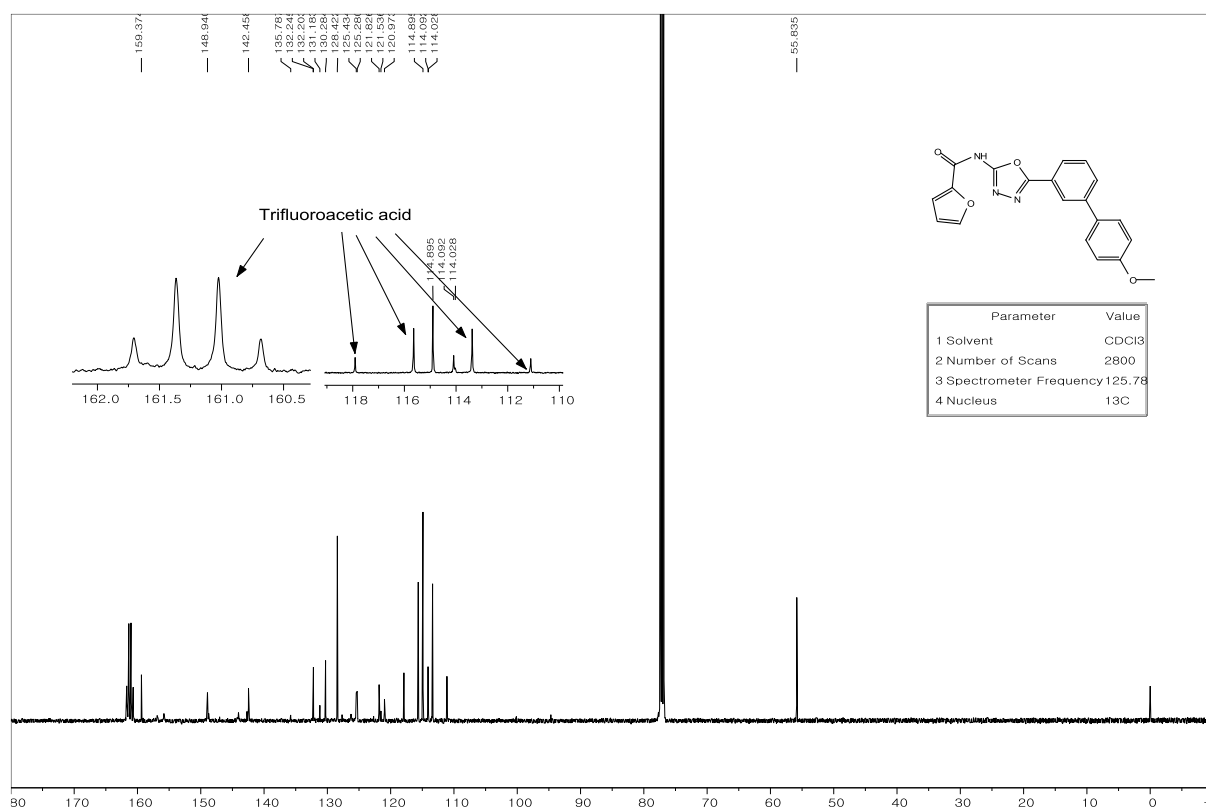
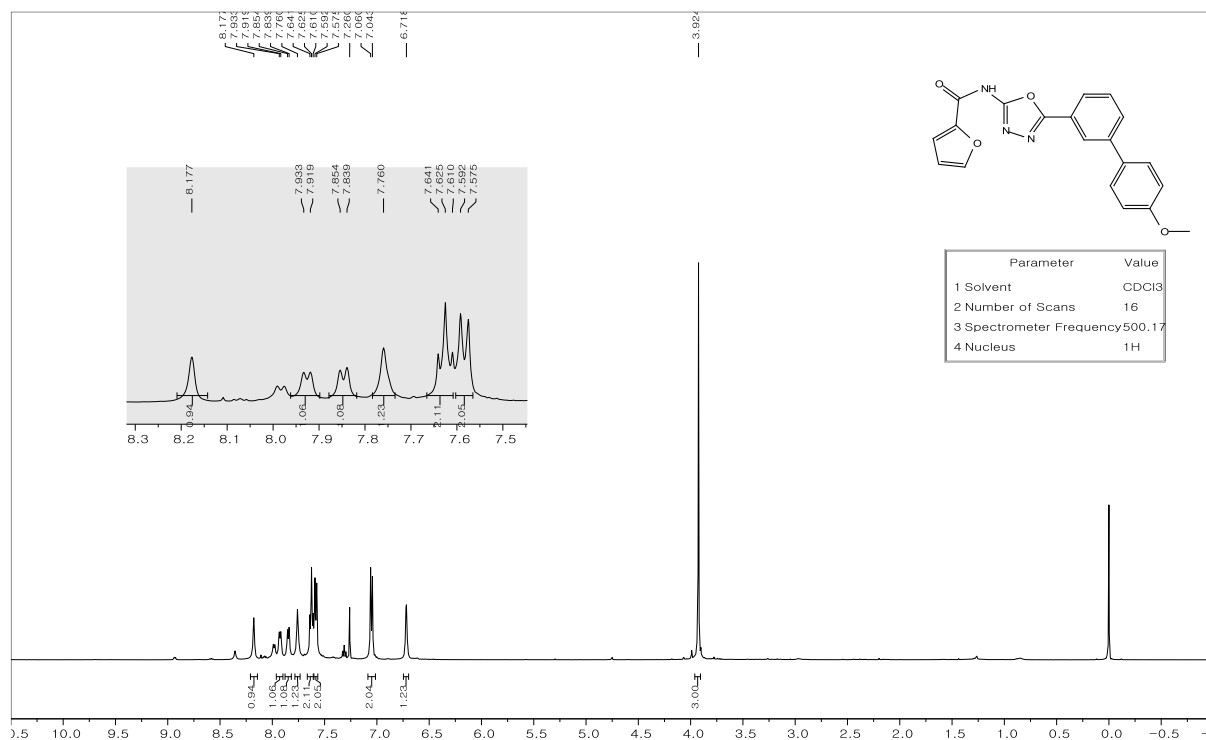
¹³C NMR – 9{2,1}

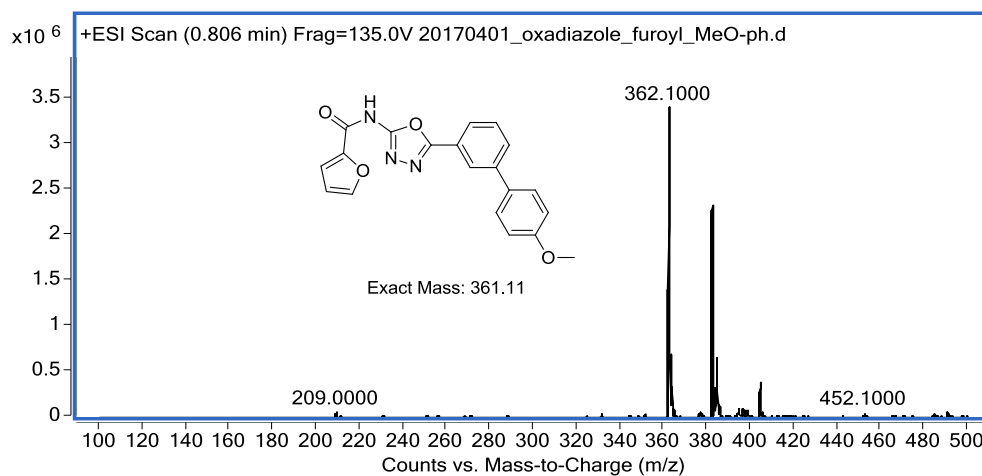
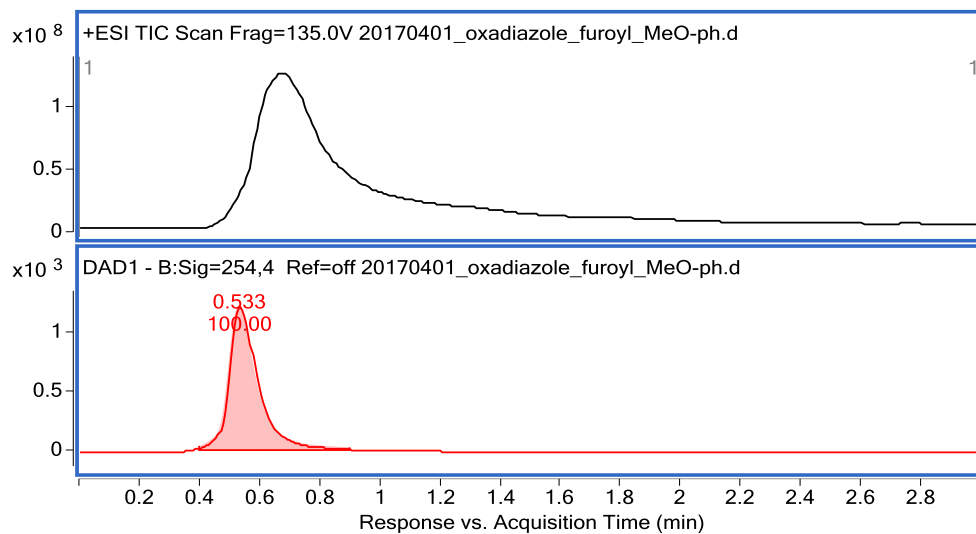


LC/MS – 9{2,1}

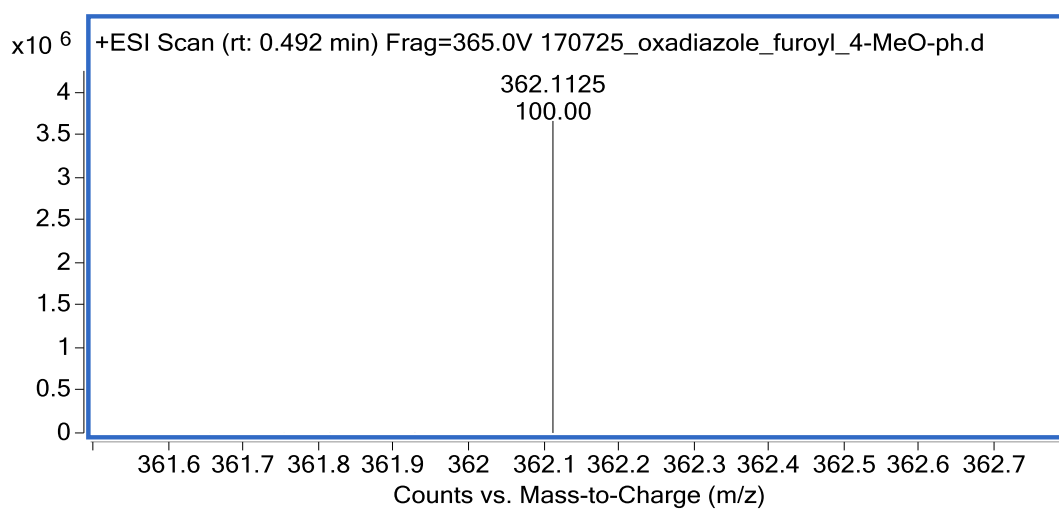


HR/MS – 9{2,1}

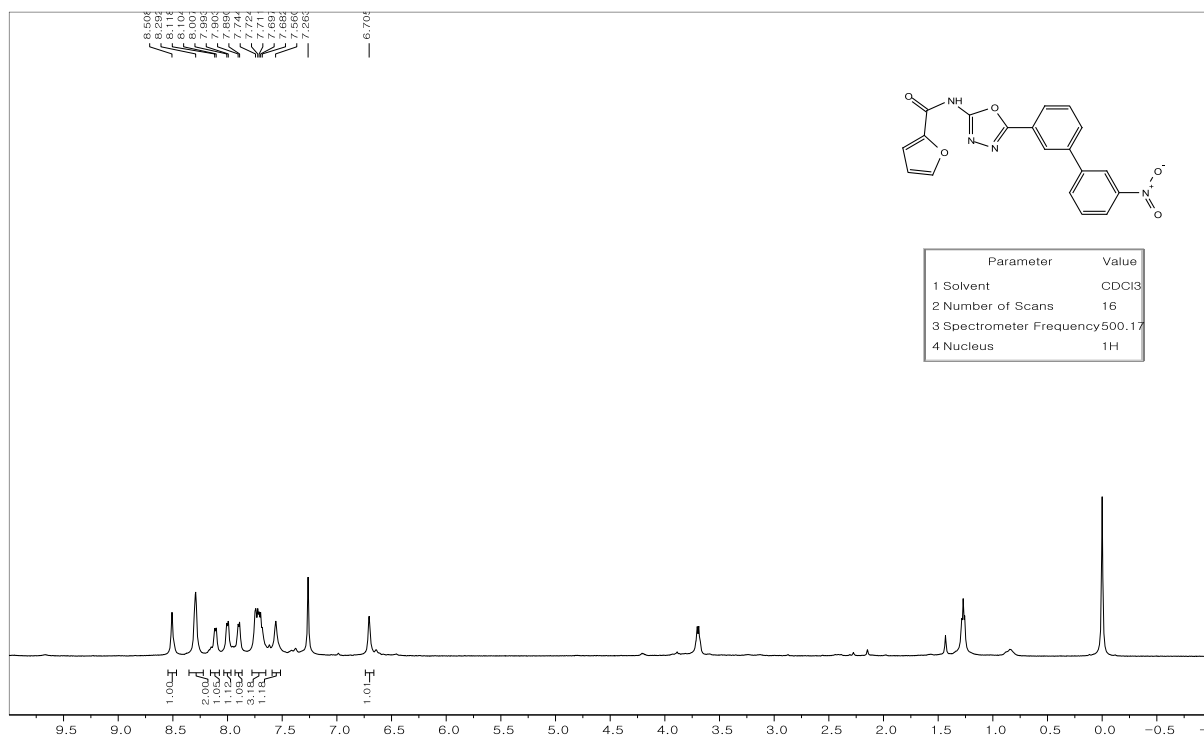




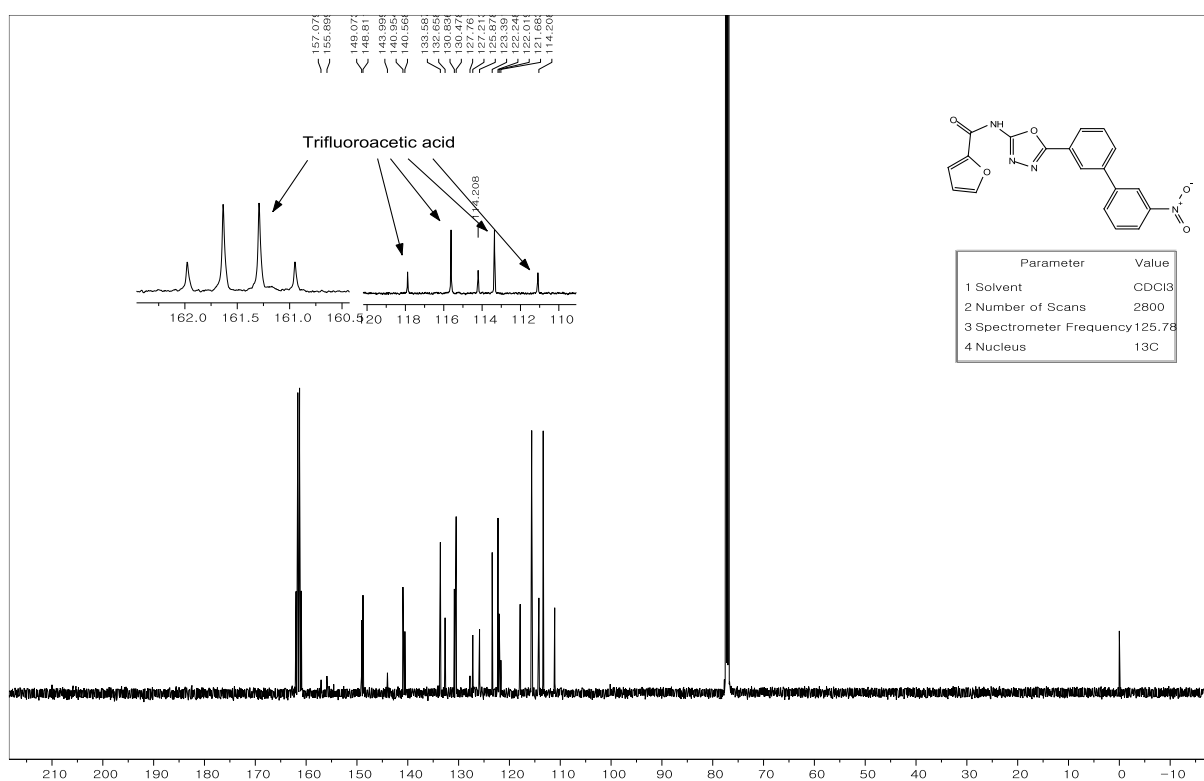
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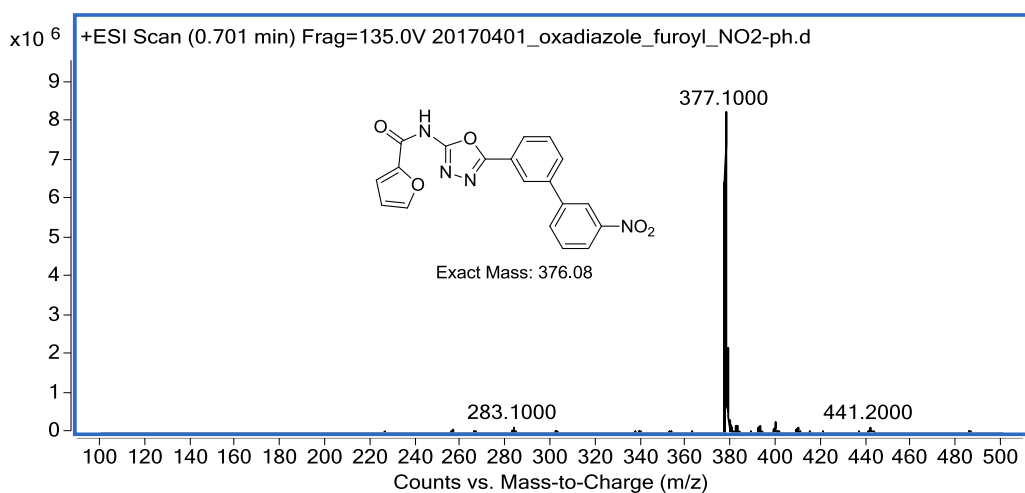
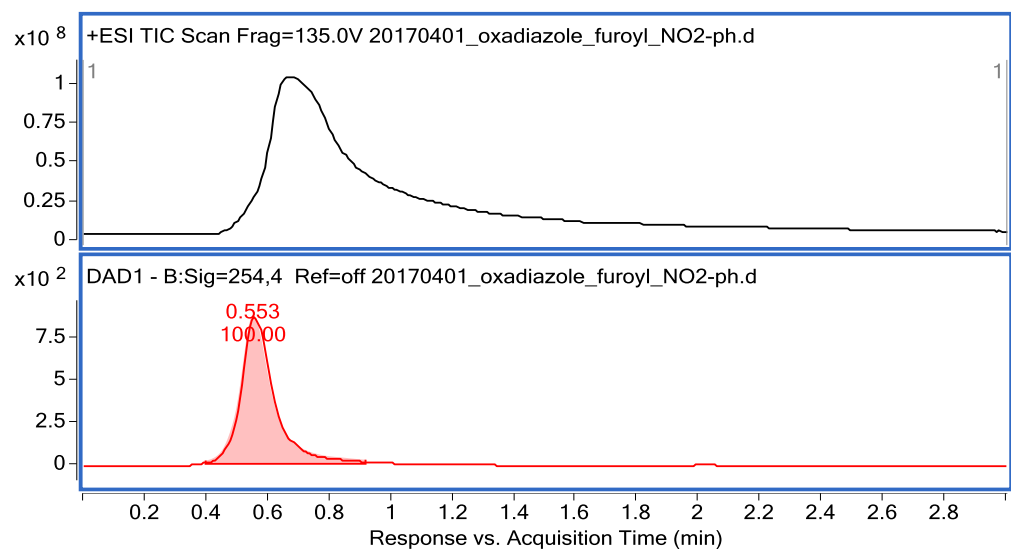
HR/MS – 9{2,2}



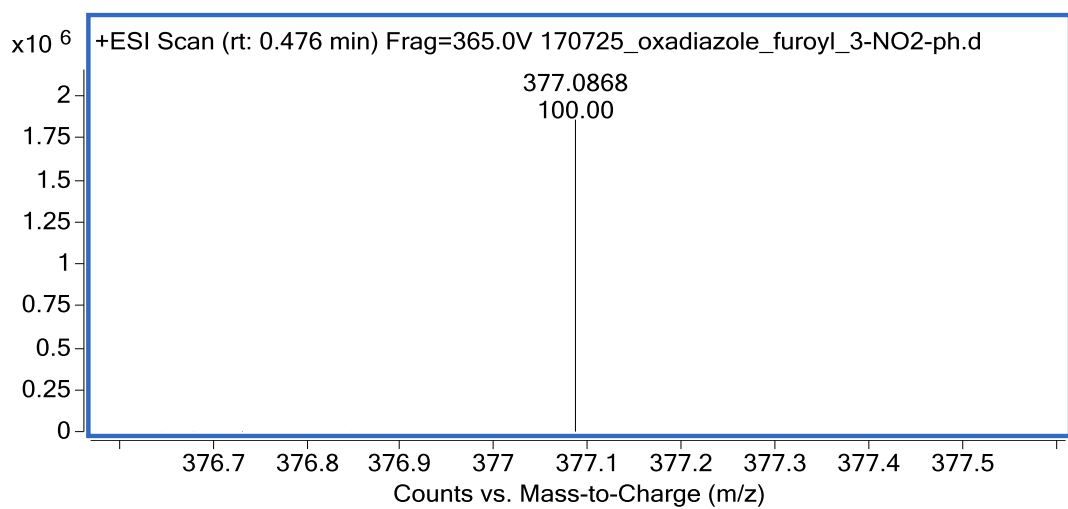
¹H NMR – 9{2,3}



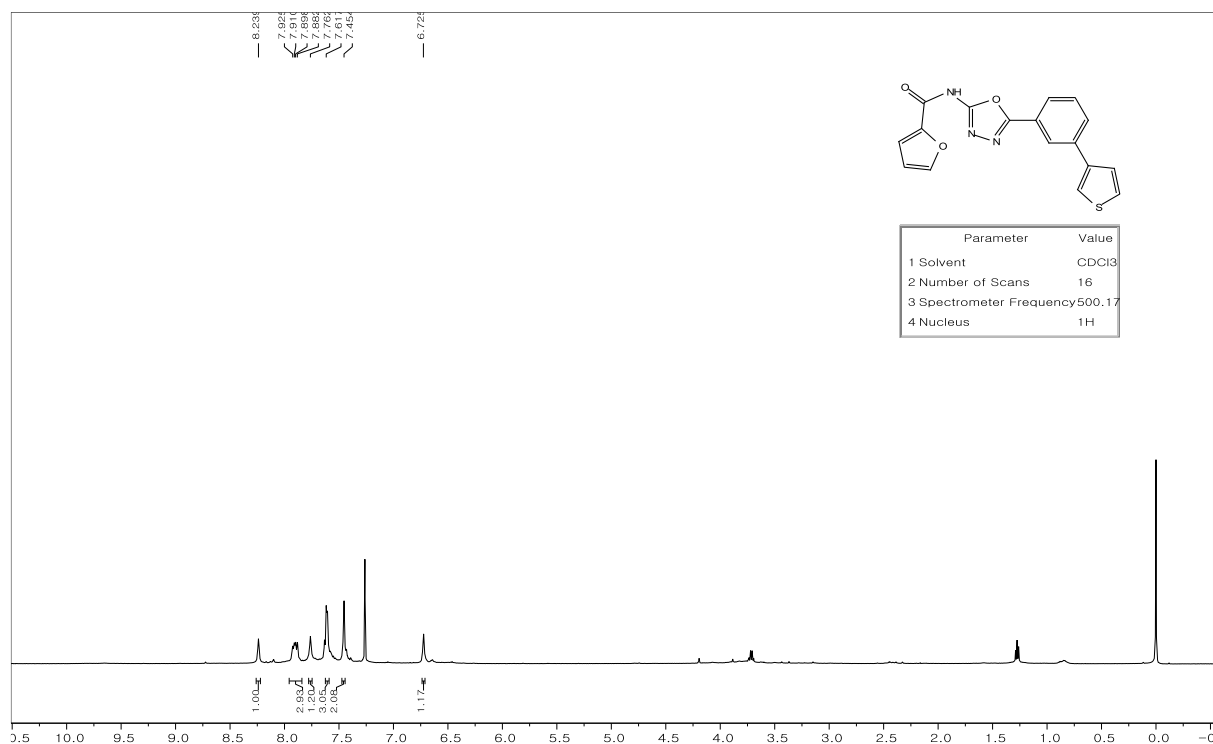
¹³C NMR – 9{2,3}

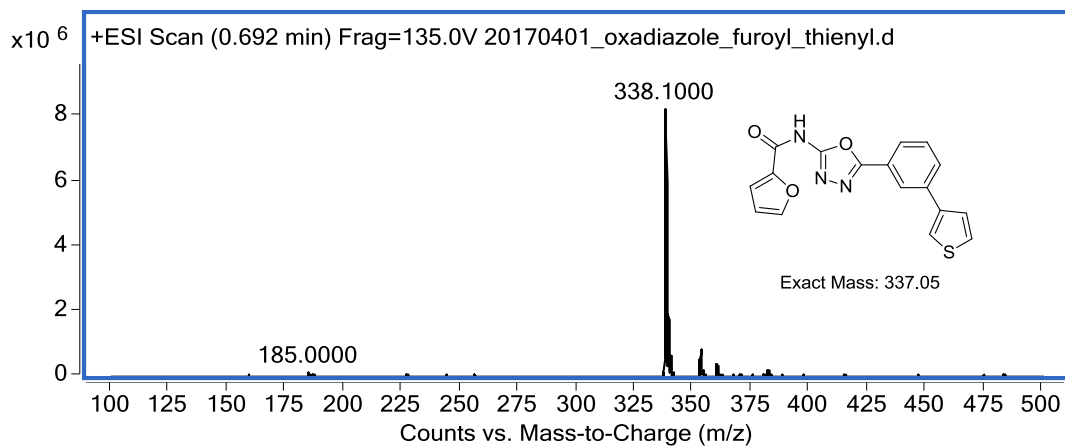
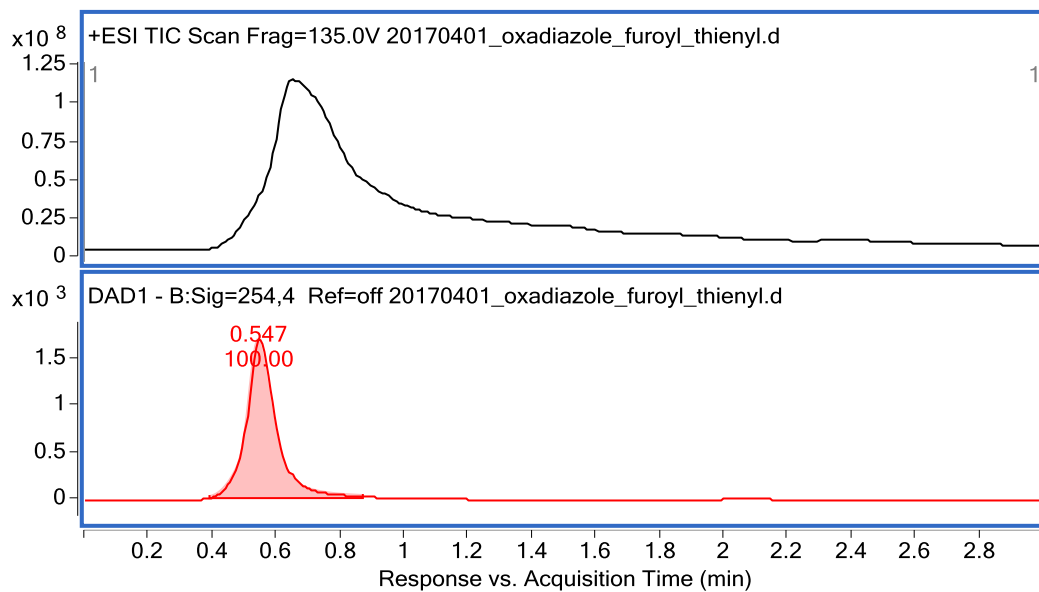


LC/MS – 9{2,3}

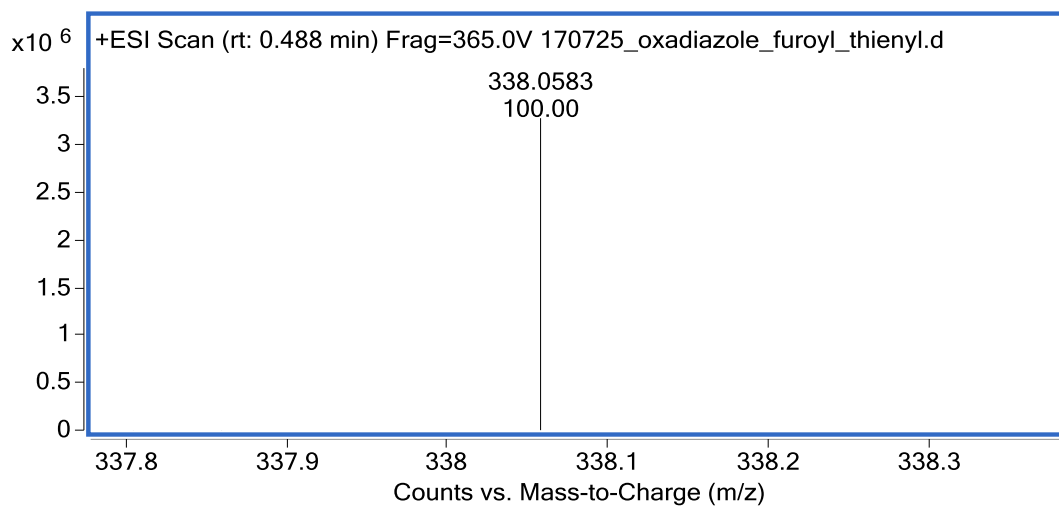


HR/MS – 9{2,3}

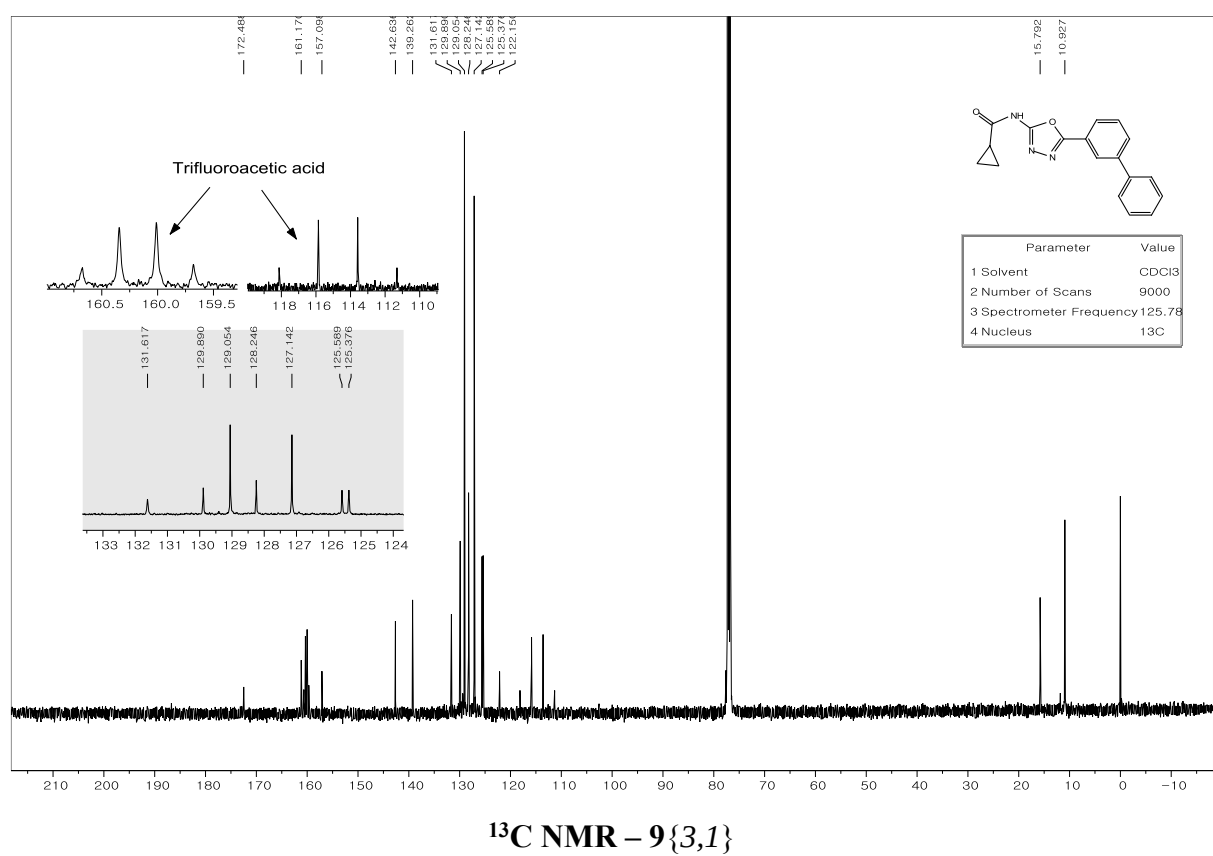
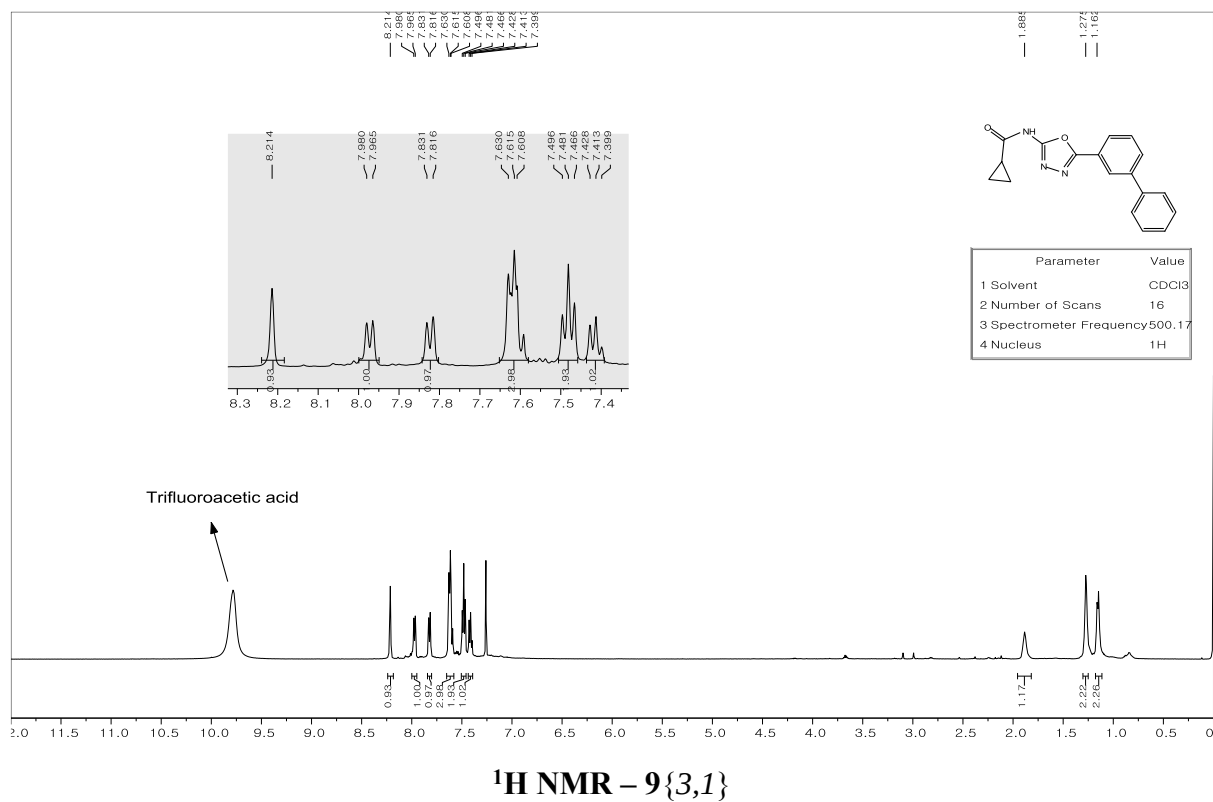


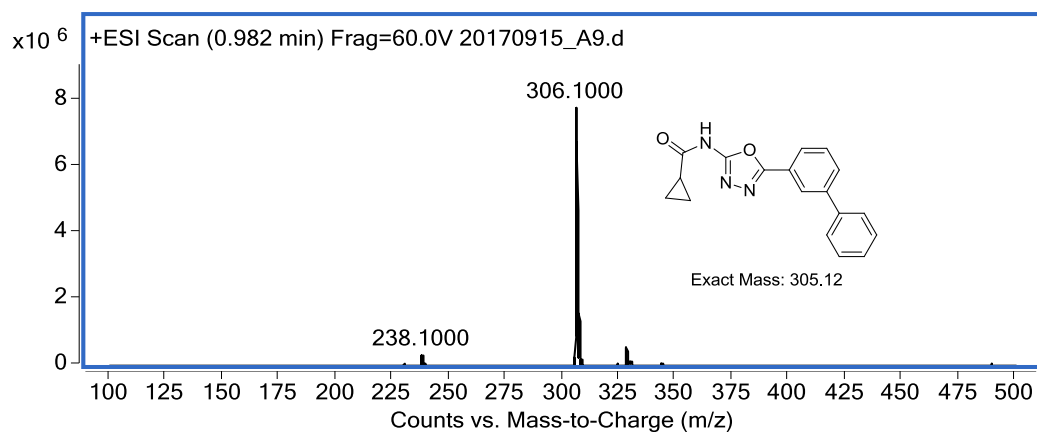
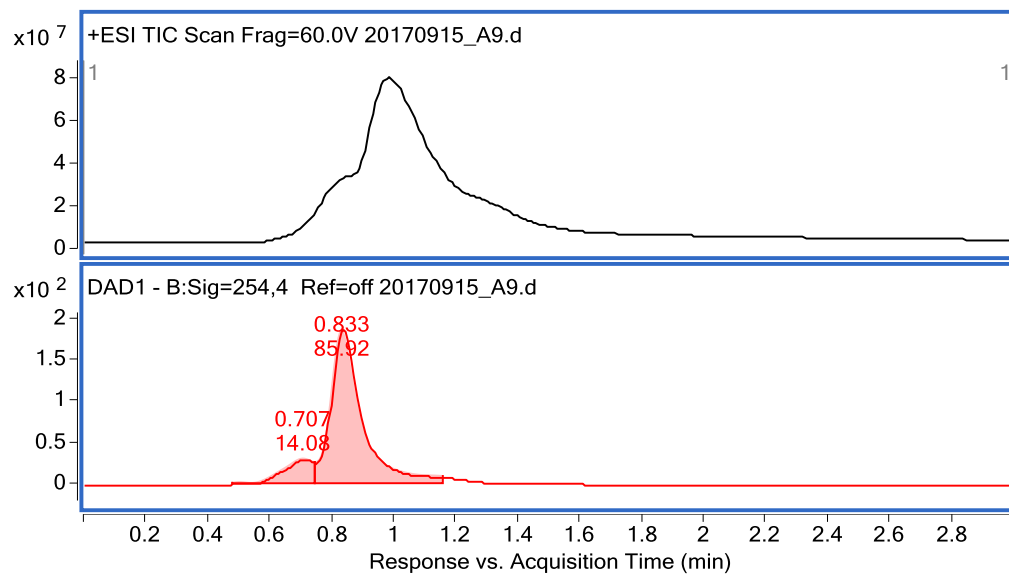


LC/MS – 9{2,4}

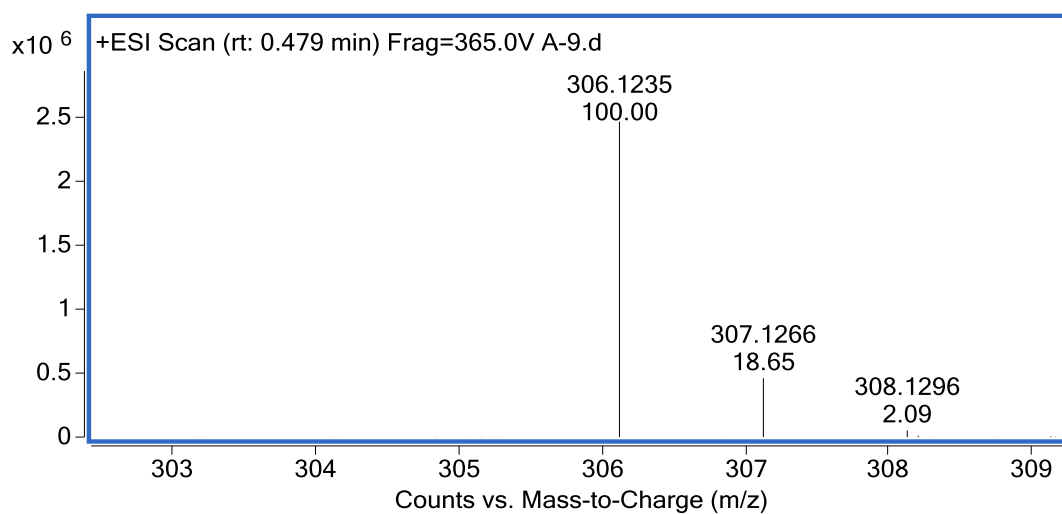


HR/MS – 9{2,4}

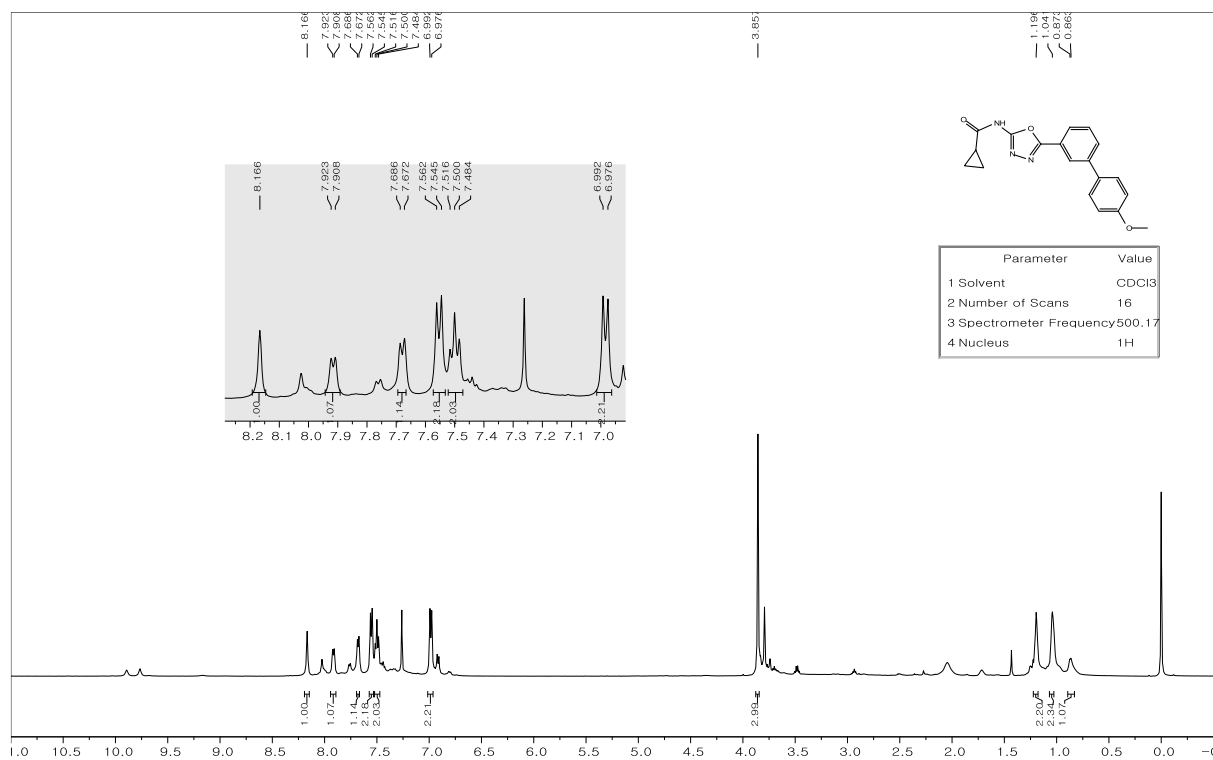




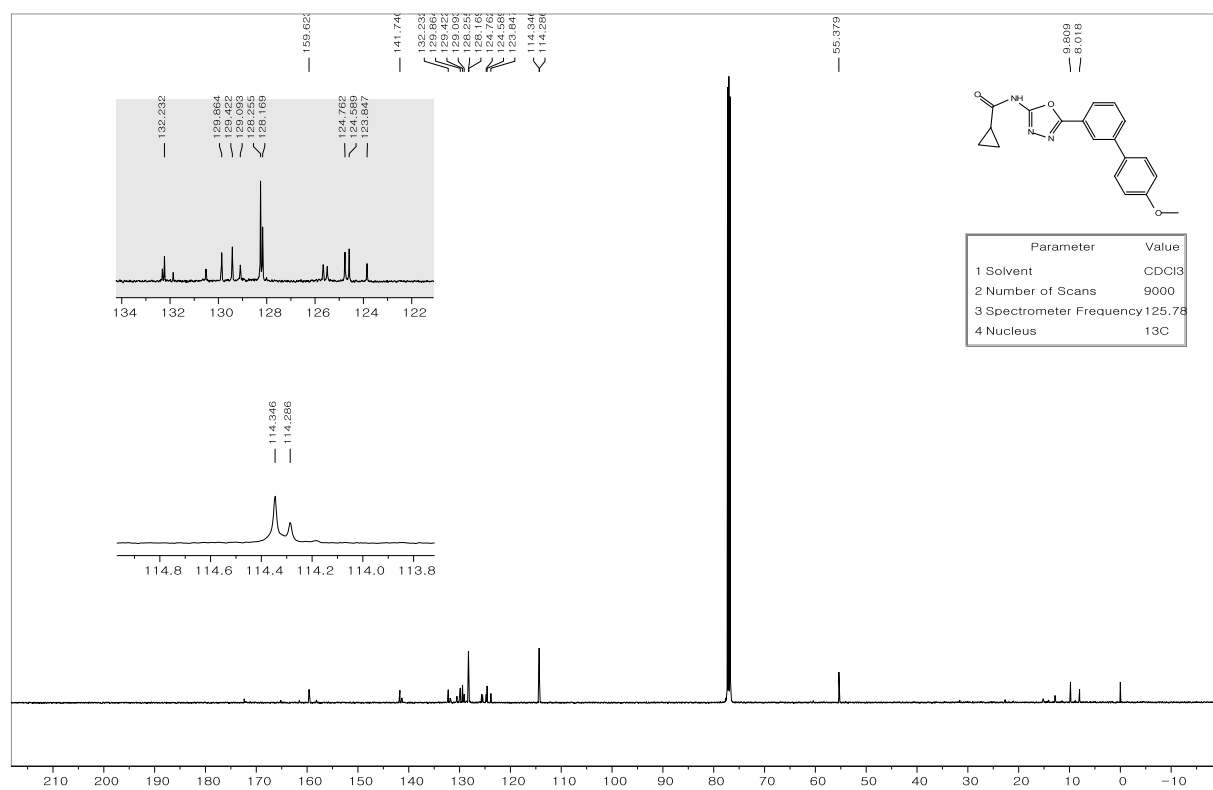
LC/MS – 9{3,1}



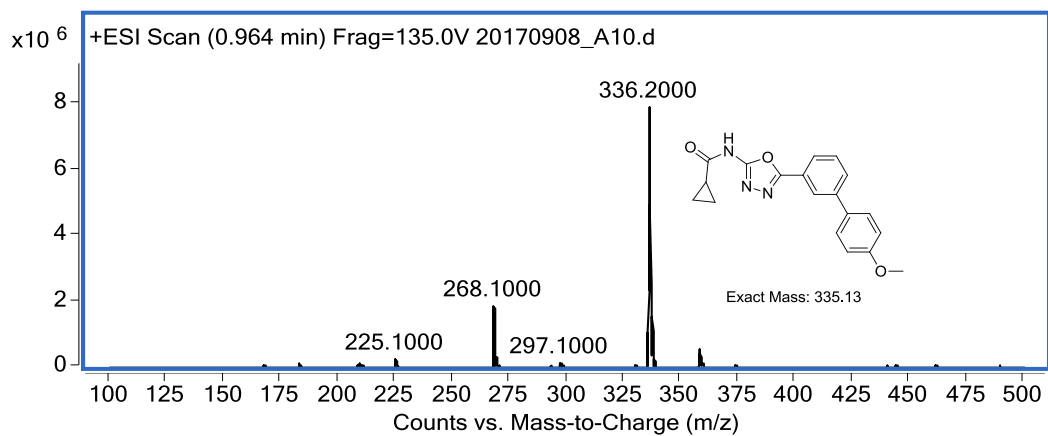
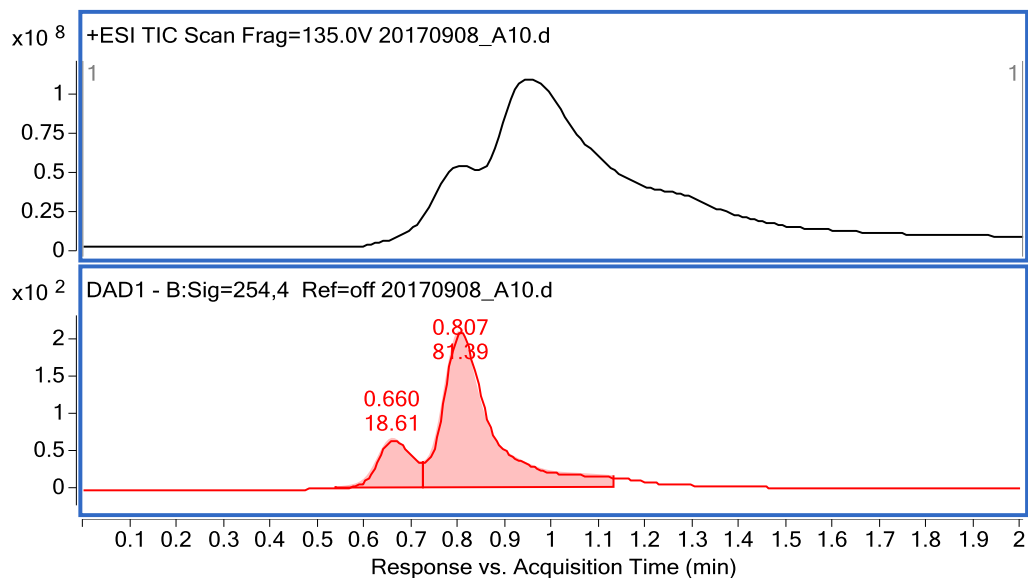
HR/MS – 9{3,1}



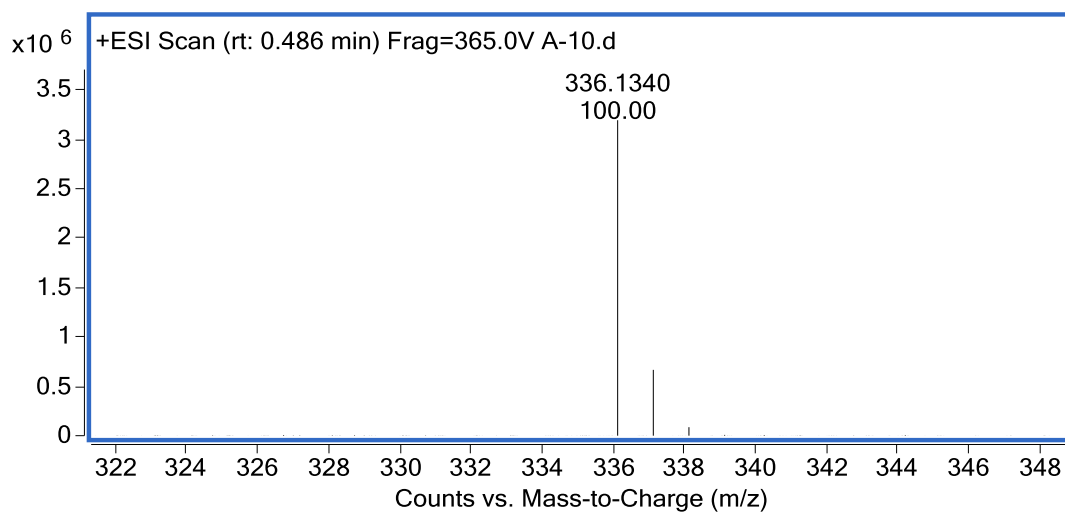
¹H NMR – 9{3,2}



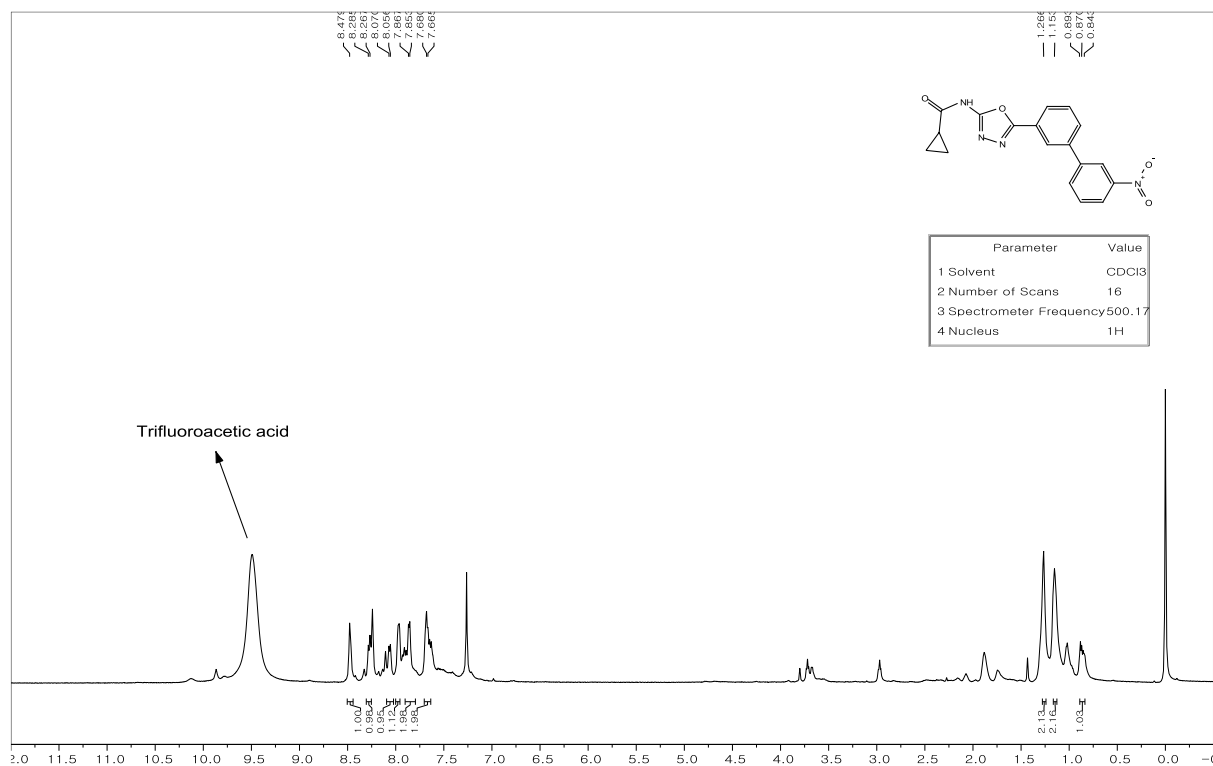
¹³C NMR – 9{3,2}



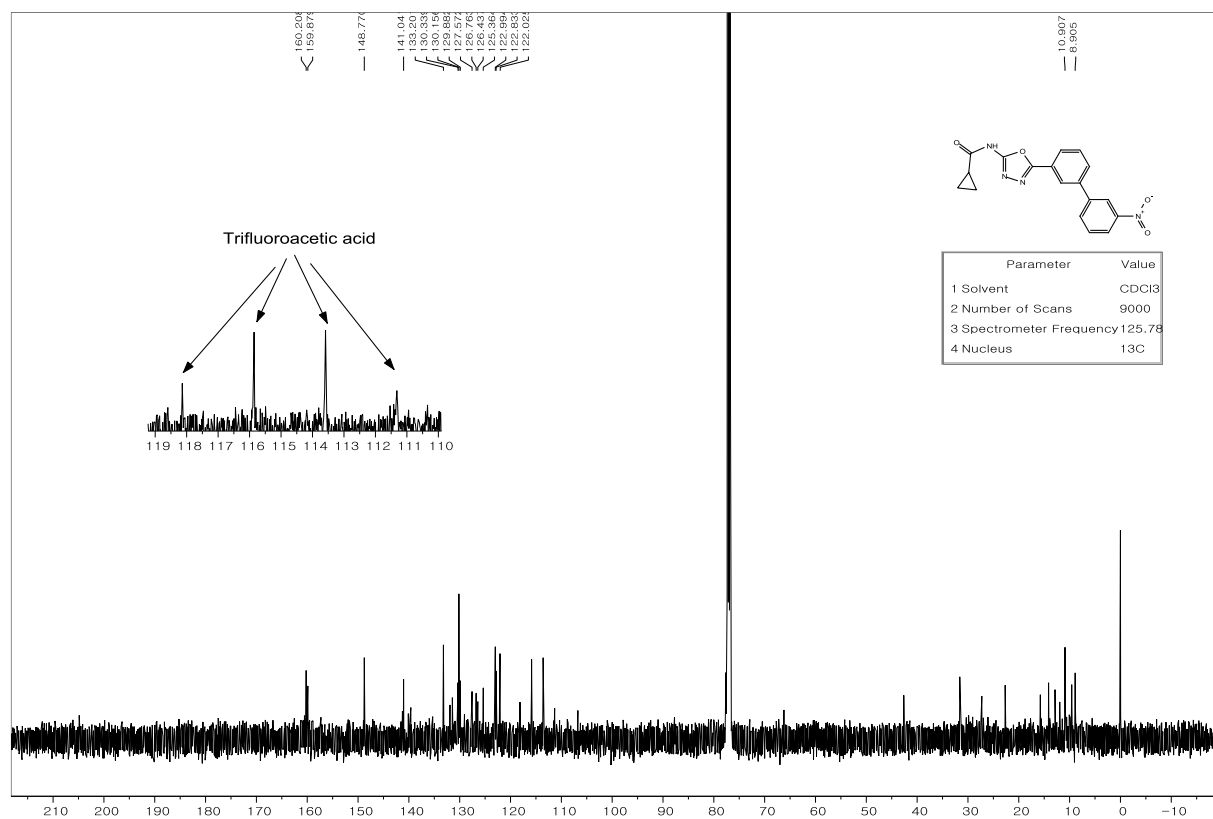
LC/MS – 9{3,2}



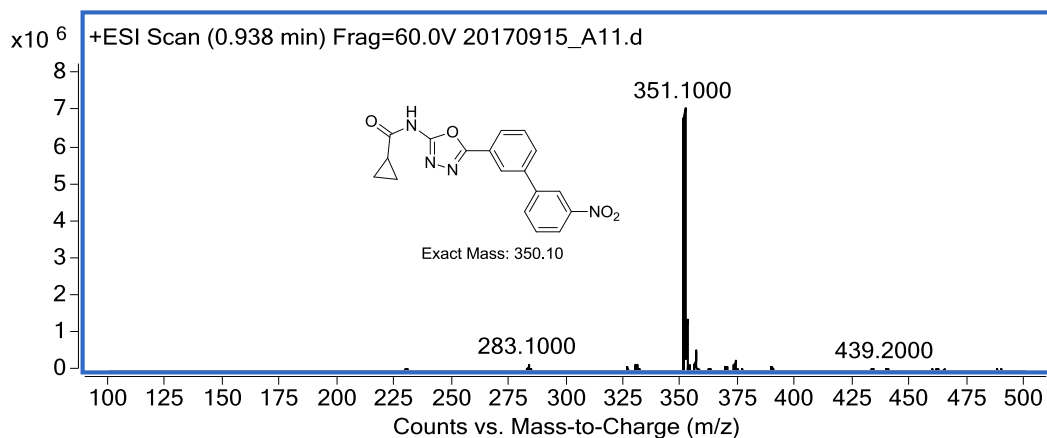
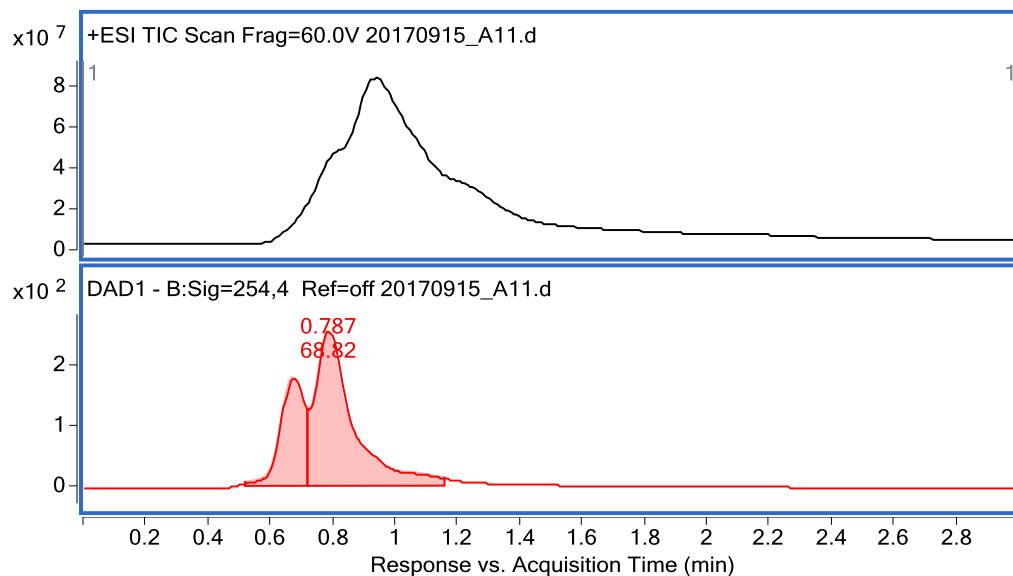
HR/MS – 9{3,2}



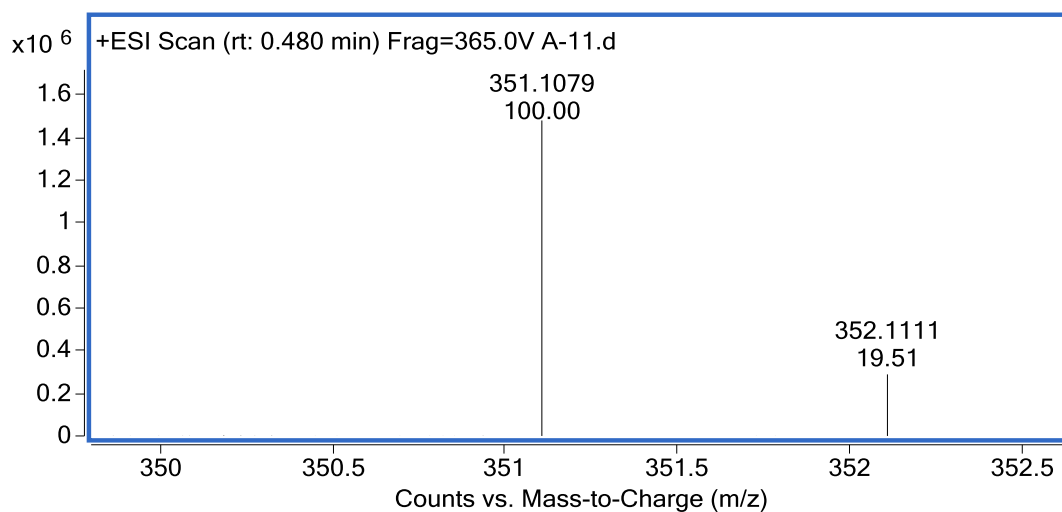
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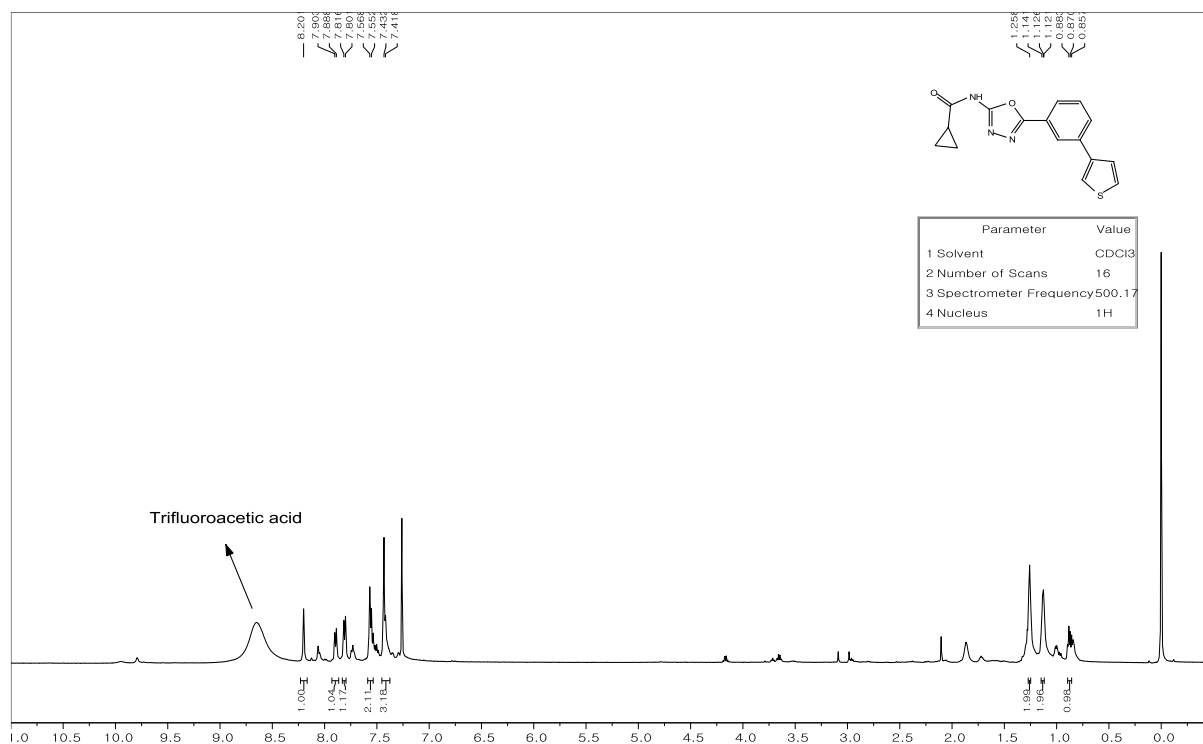
¹³C NMR – 9{3,3}



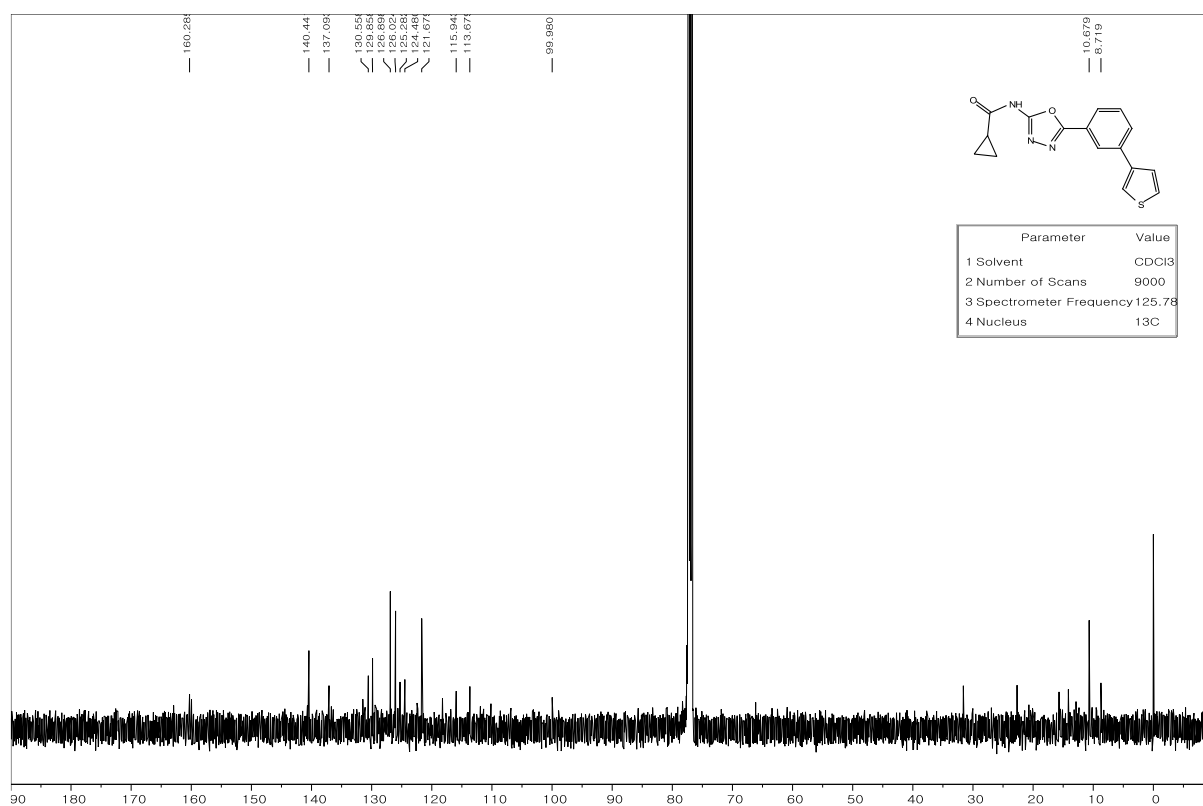
LC/MS – 9{3,3}



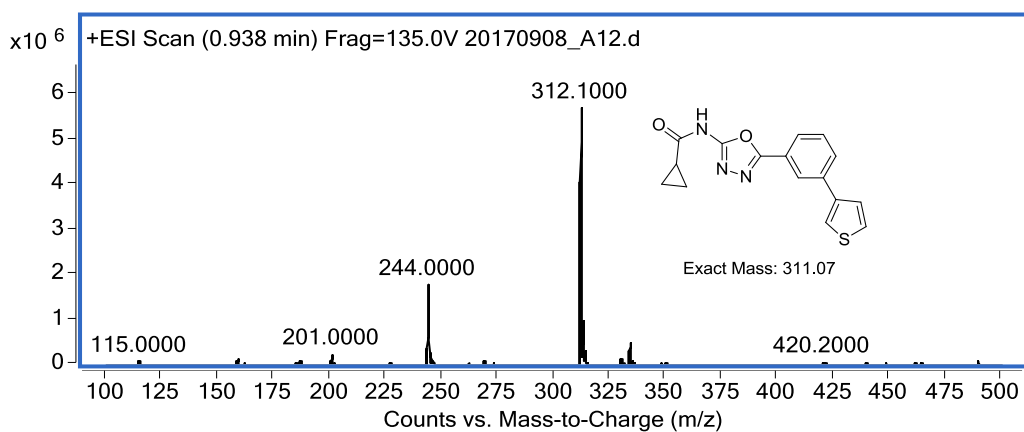
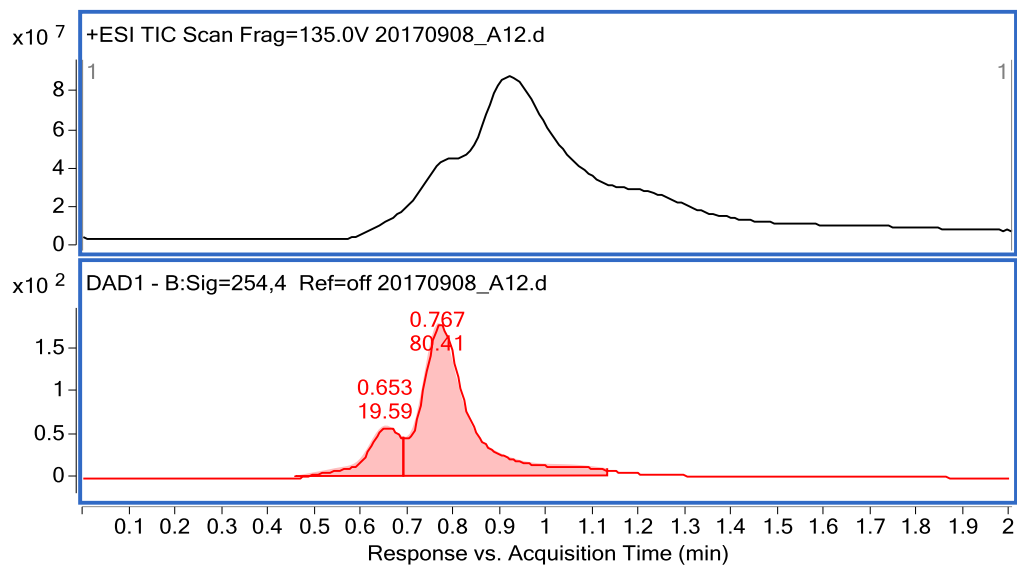
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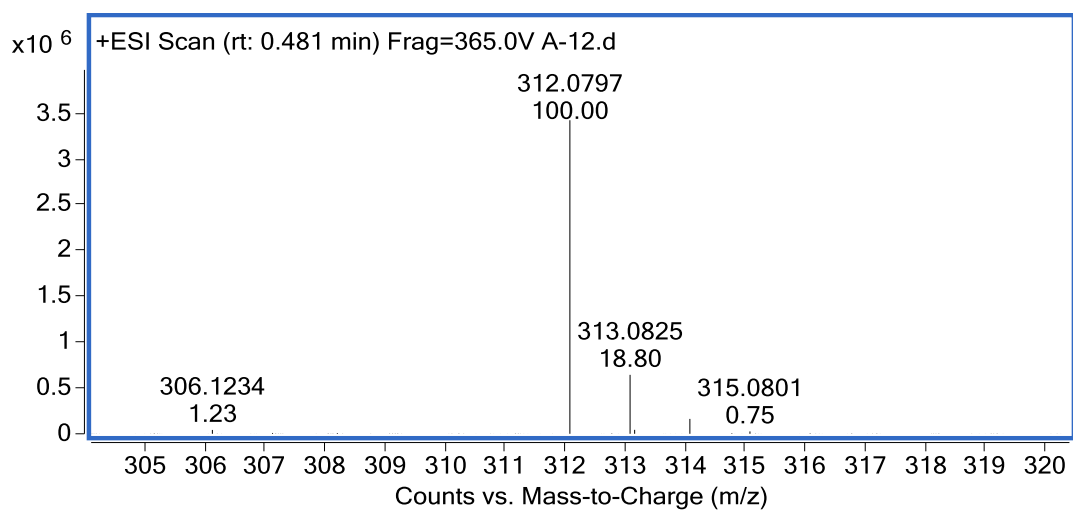
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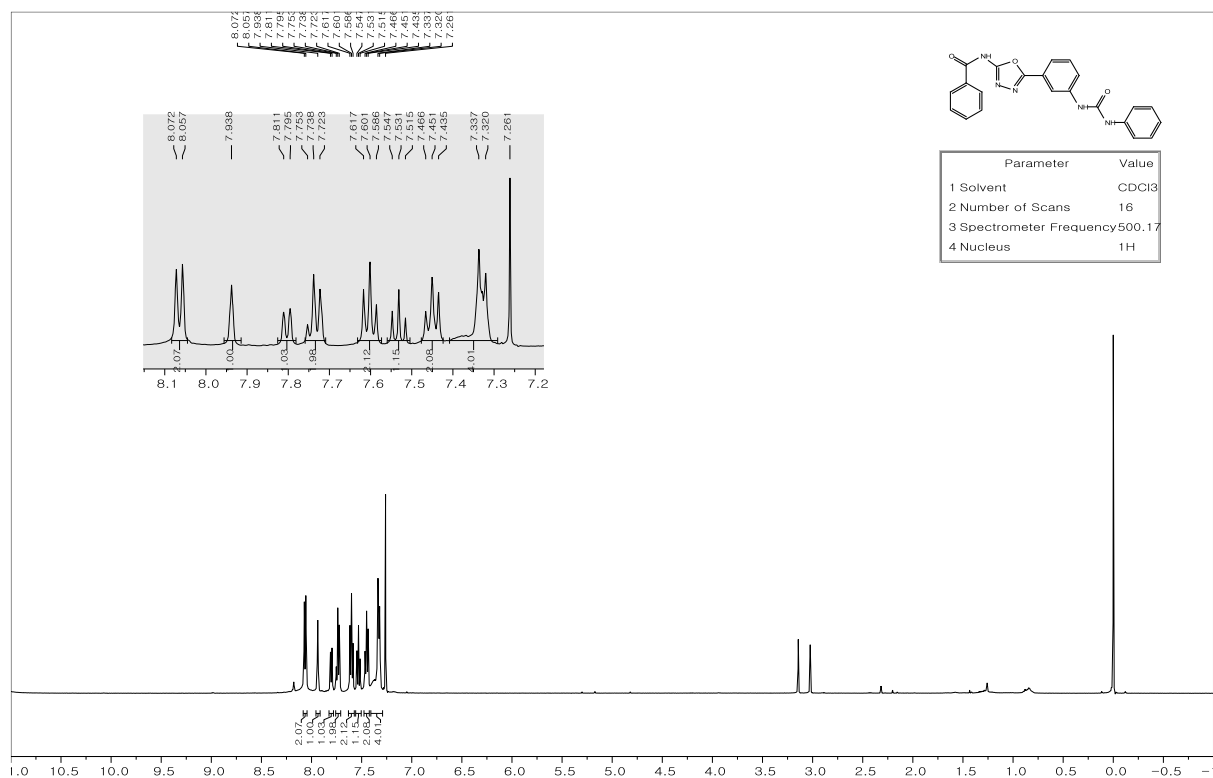
¹³C NMR – 9{3,4}



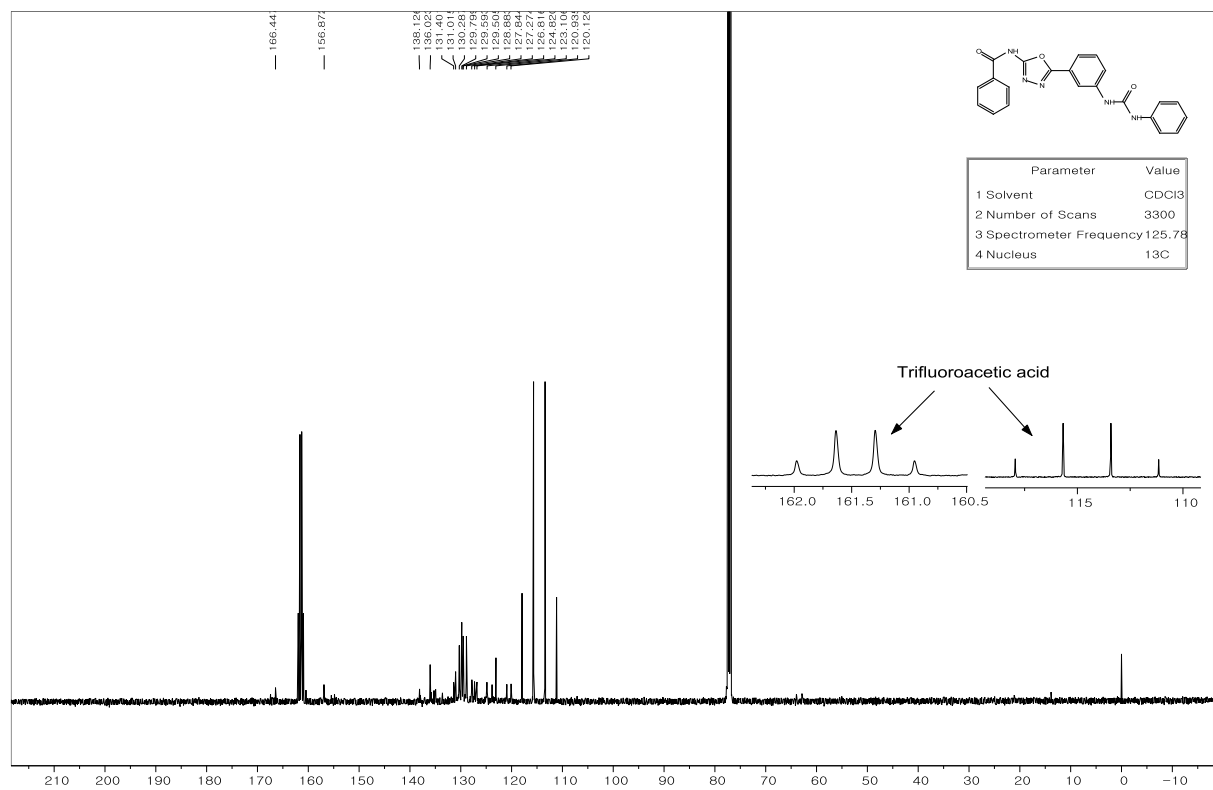
LC/MS – 9{3,4}



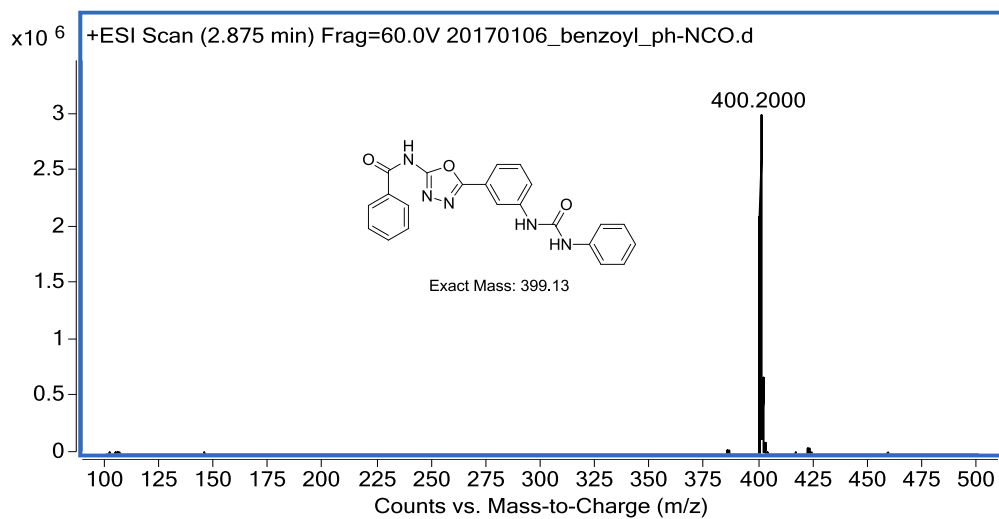
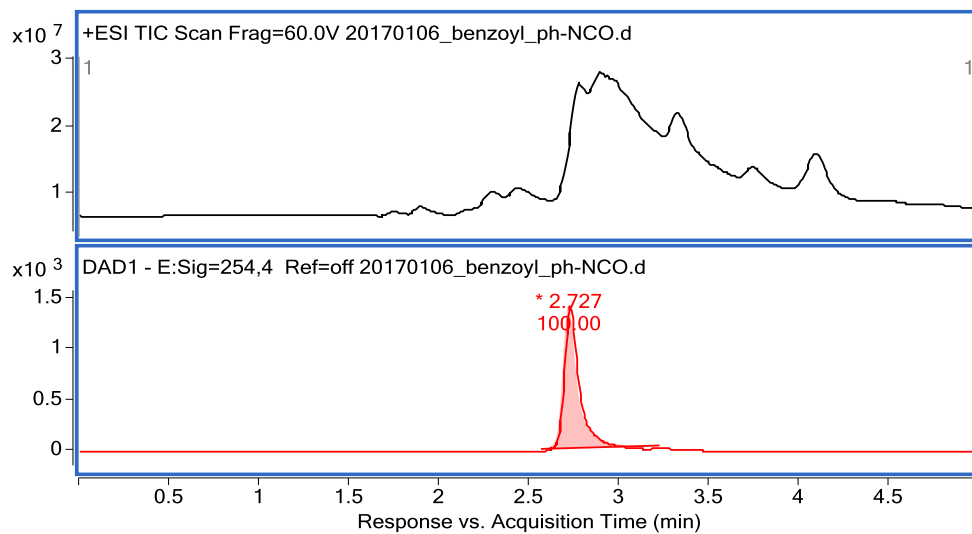
HR/MS – 9{3,4}



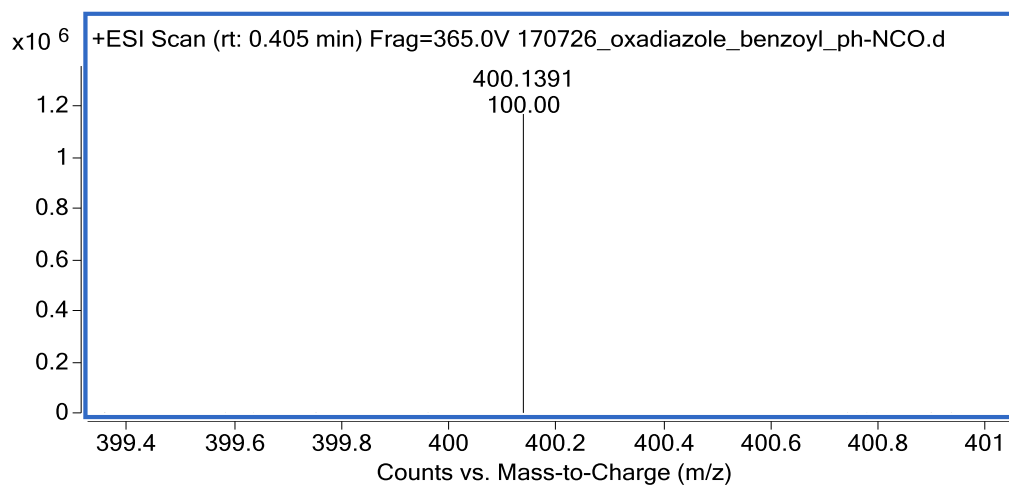
¹H NMR – 12{1,1}



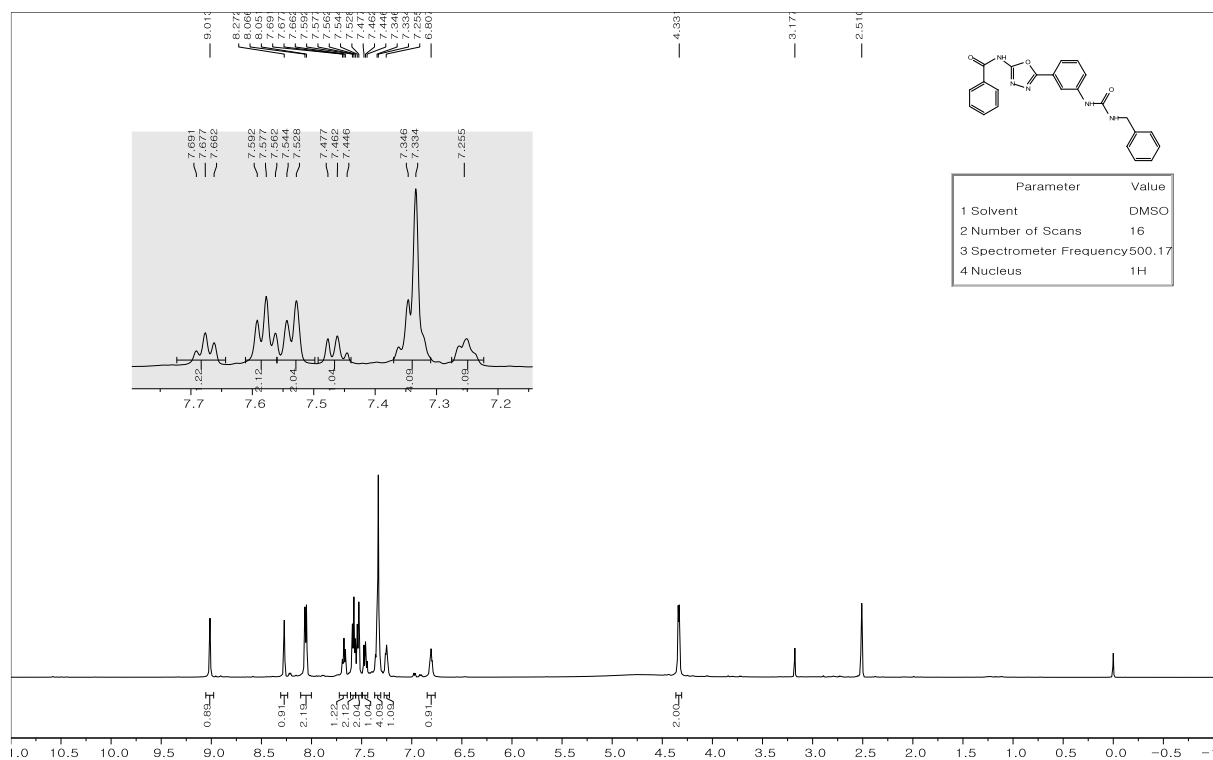
¹³C NMR – 12{1,1}



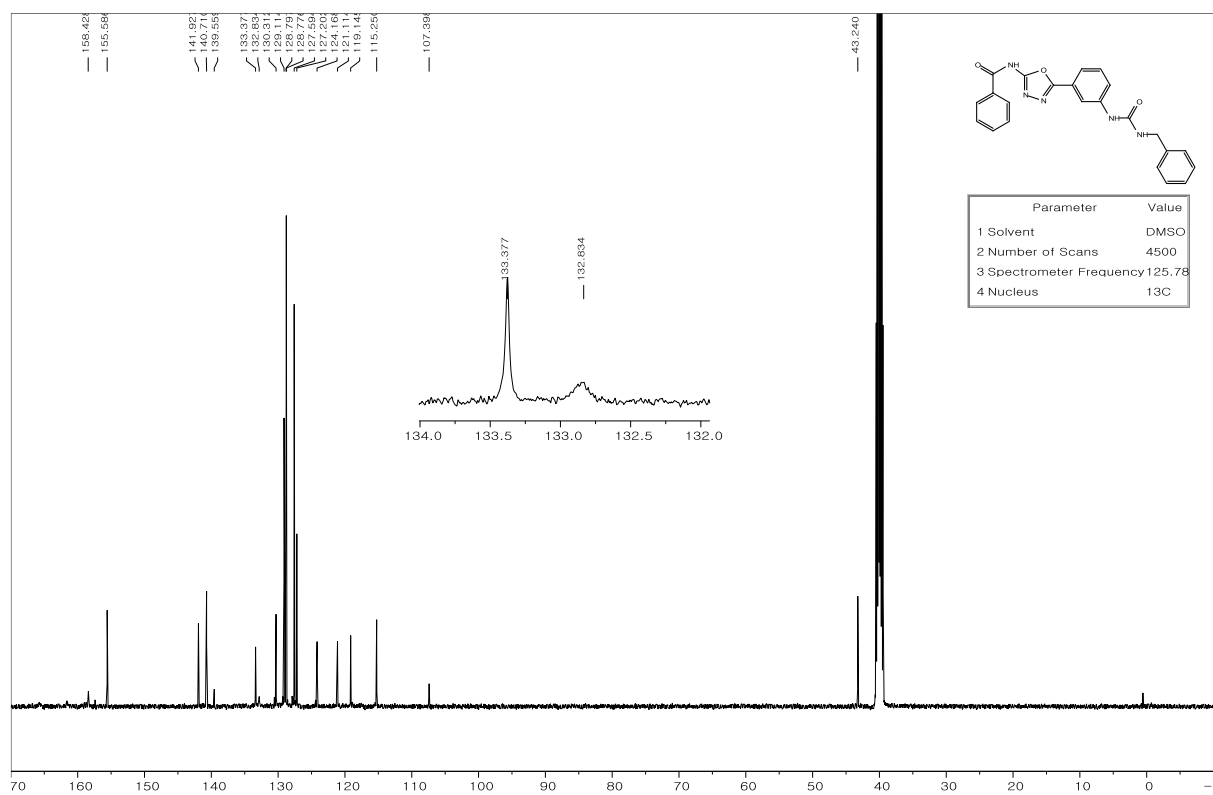
LC/MS – 12{1,1}



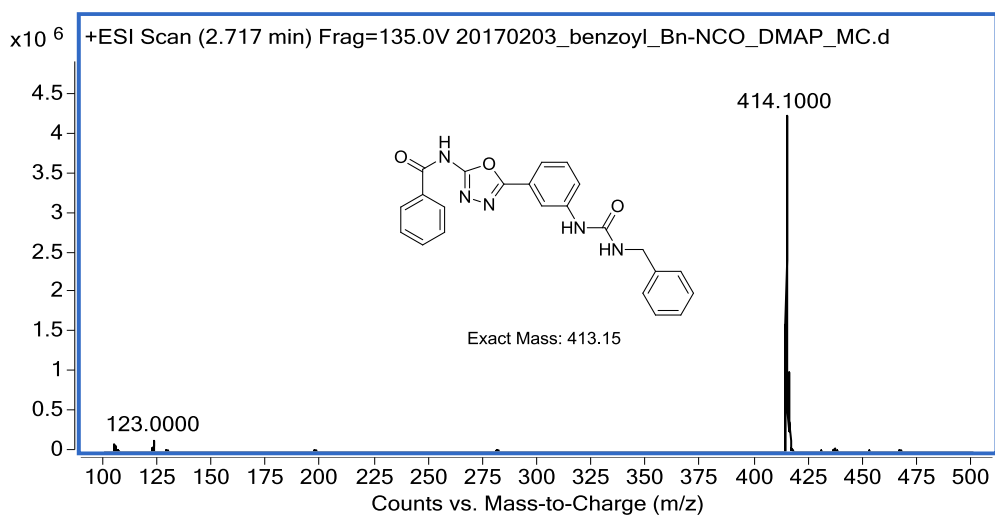
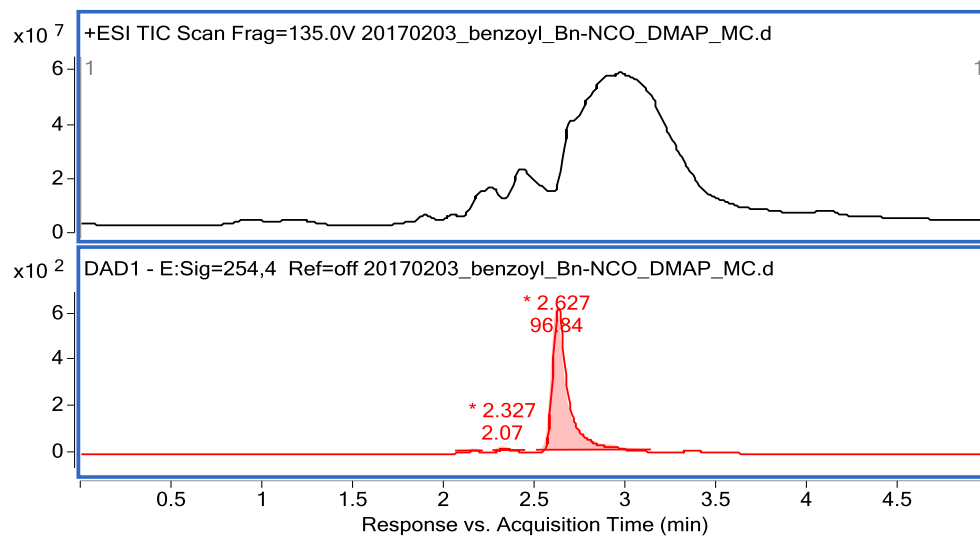
HR/MS – 12{1,1}



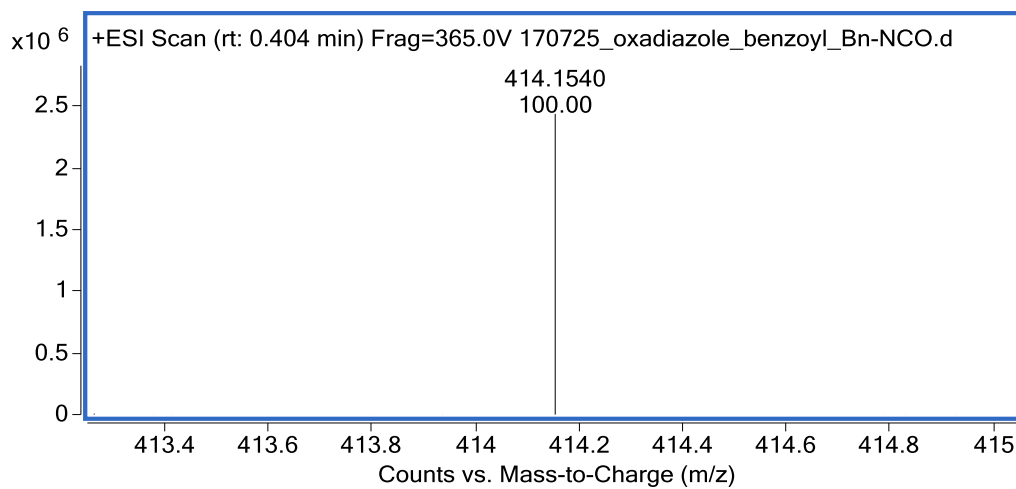
¹H NMR – 12{1,2}



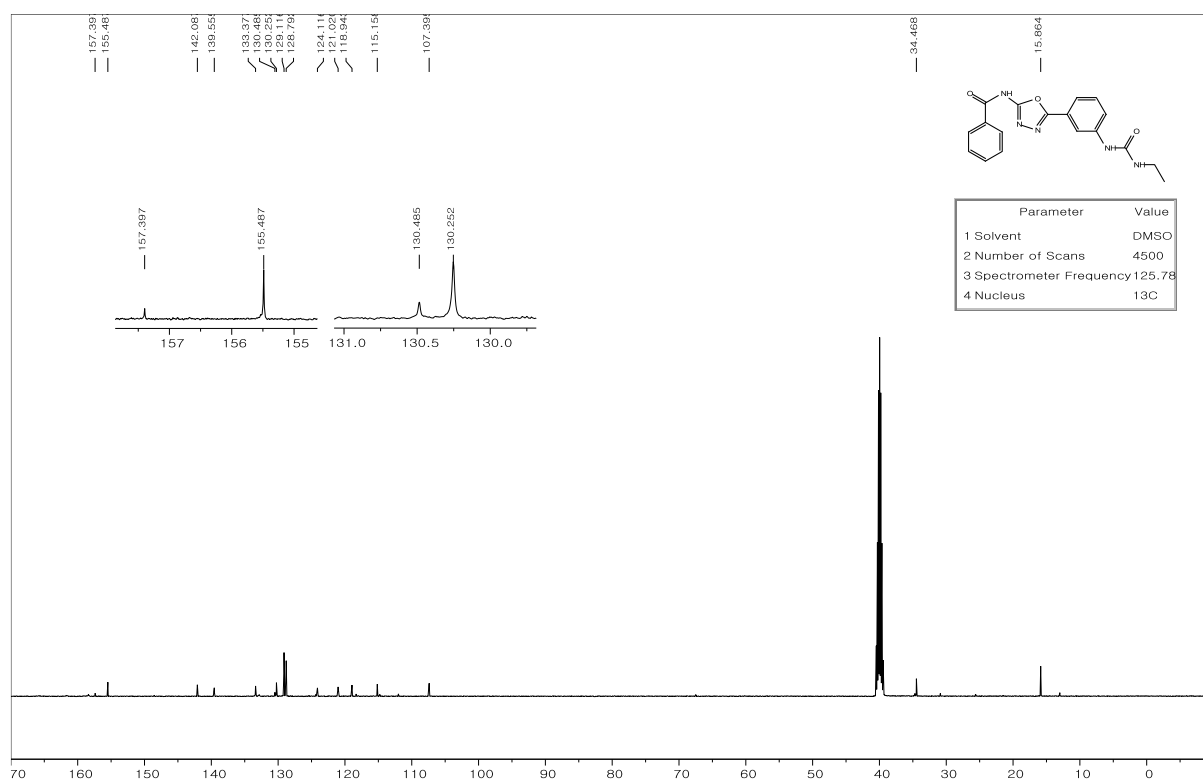
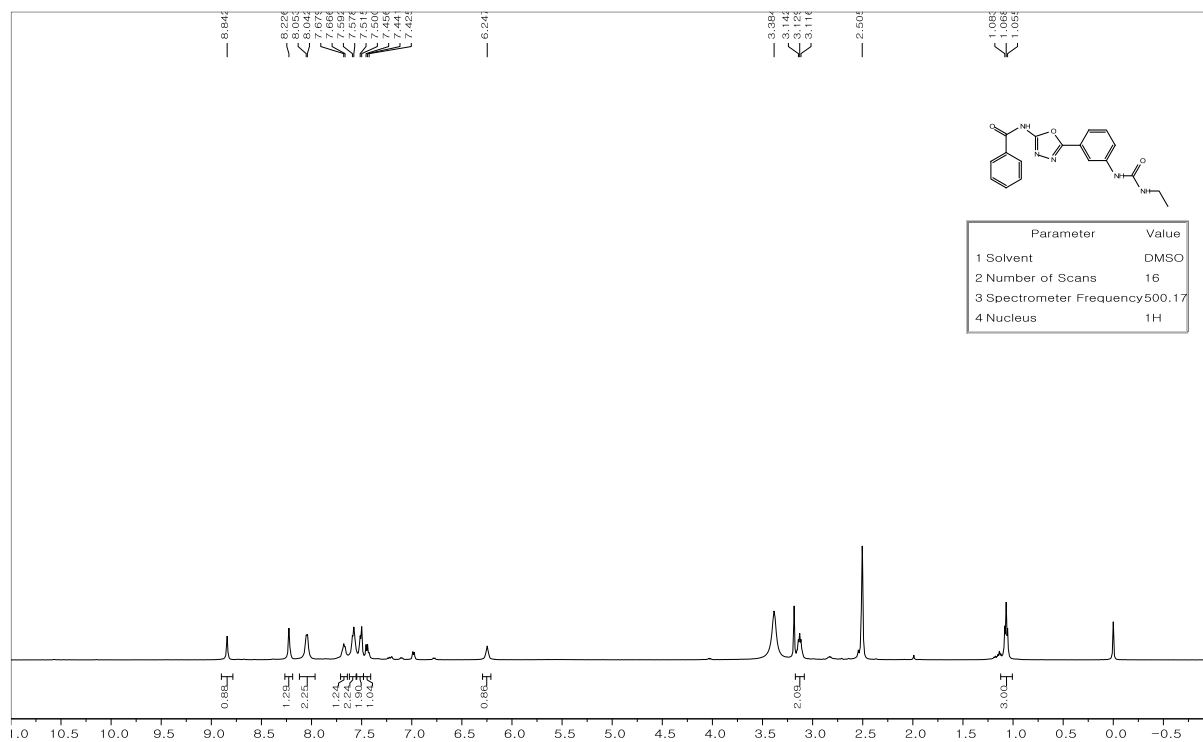
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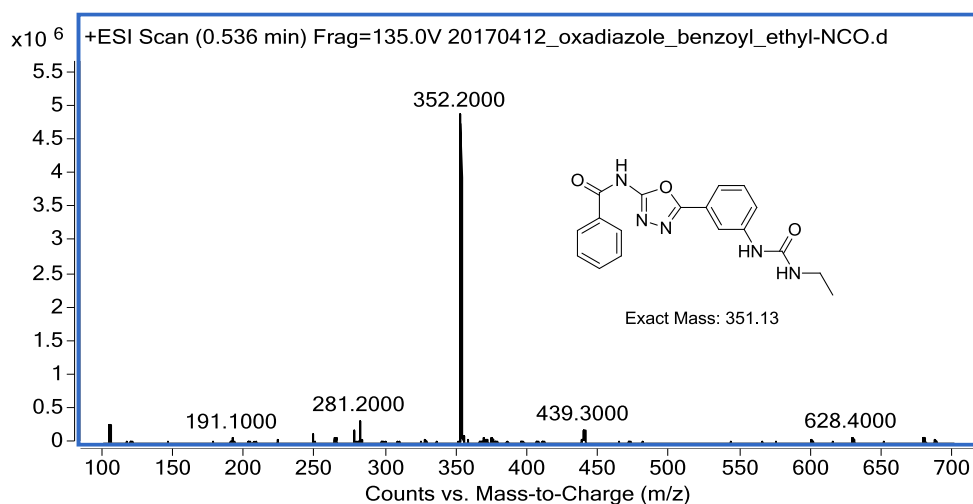
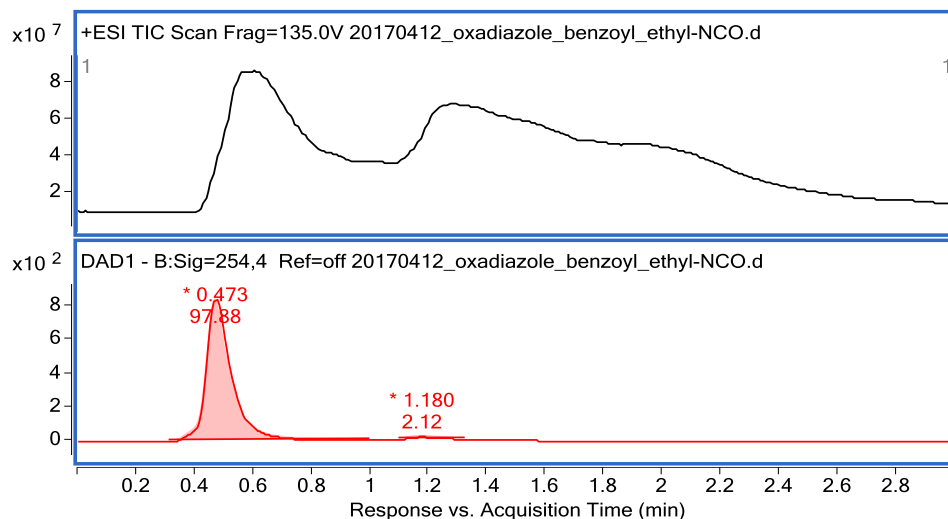


LC/MS – 12{1,2}

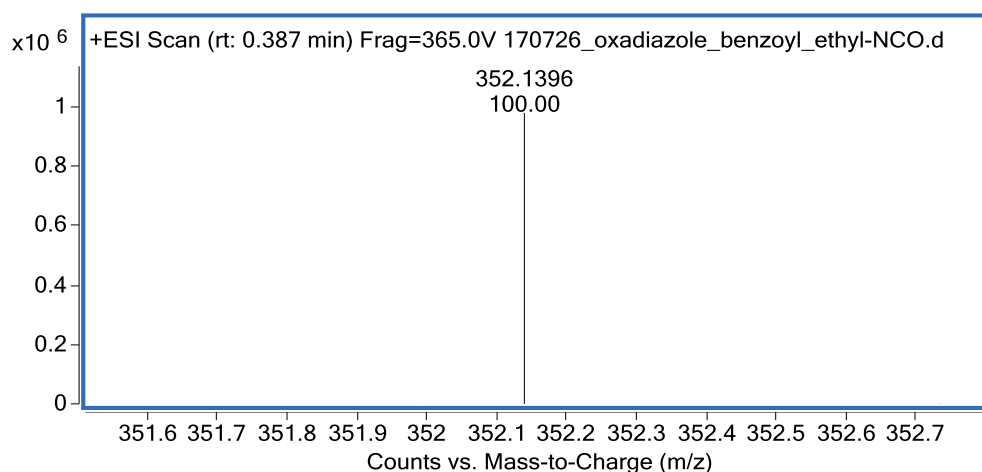


HR/MS – 12{1,2}

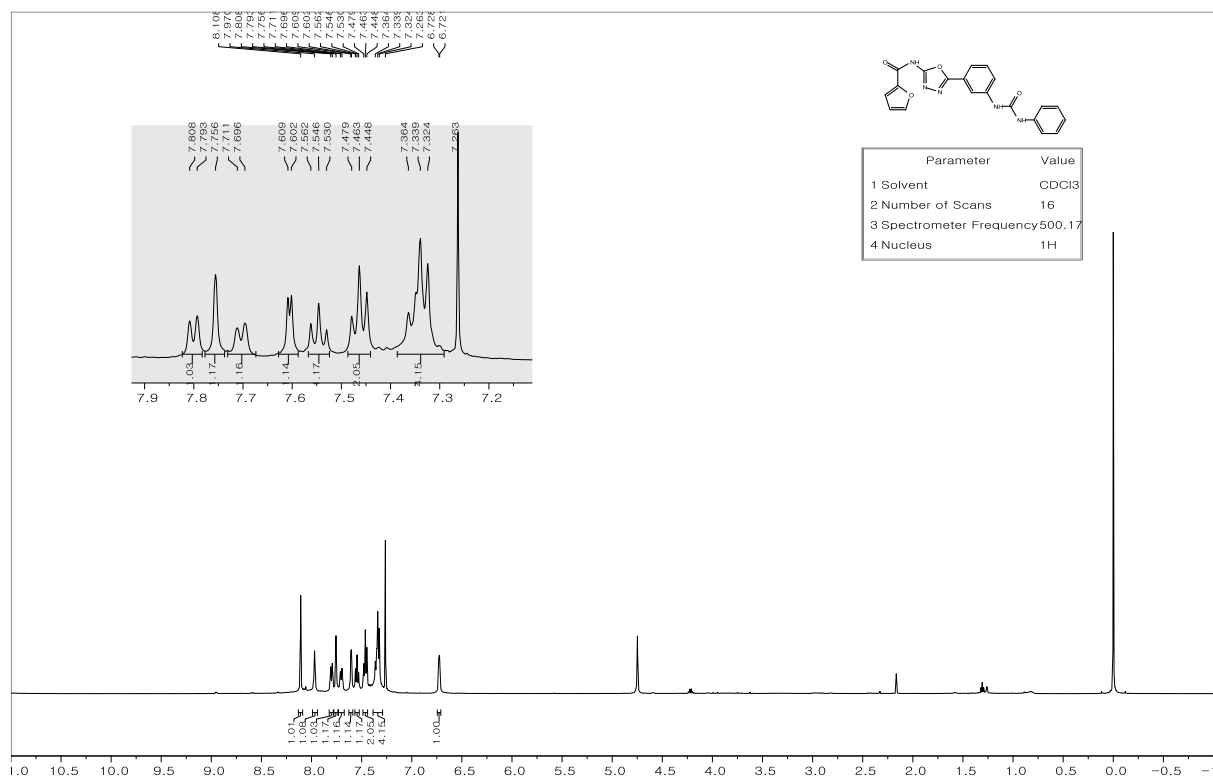




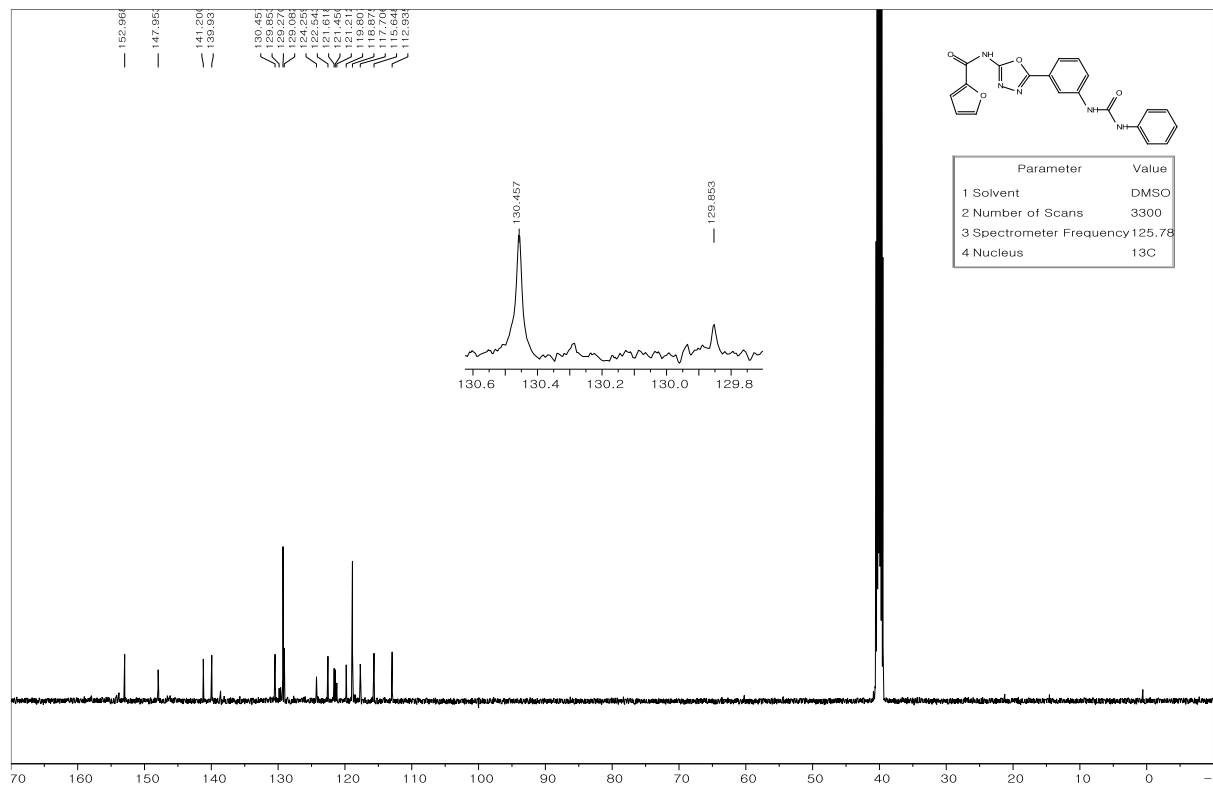
LC/MS – 12{1,3}



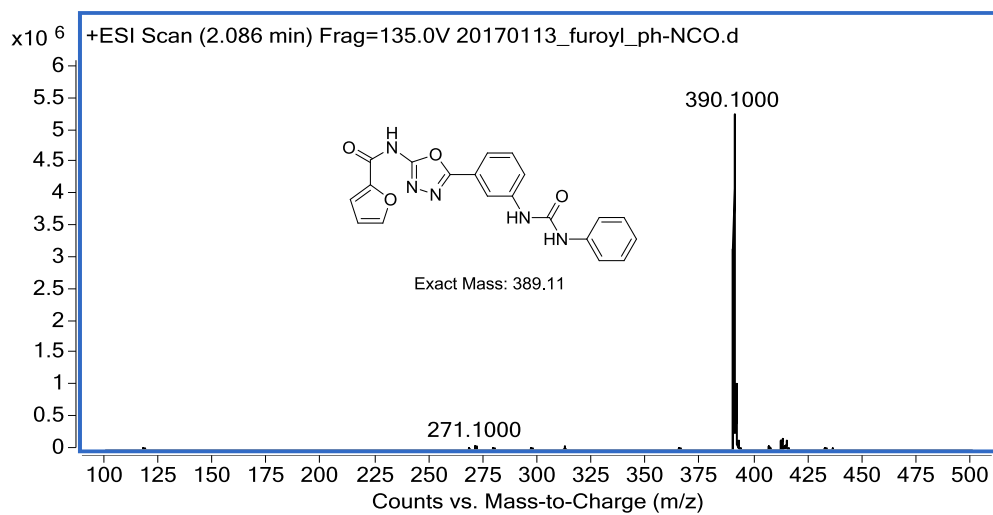
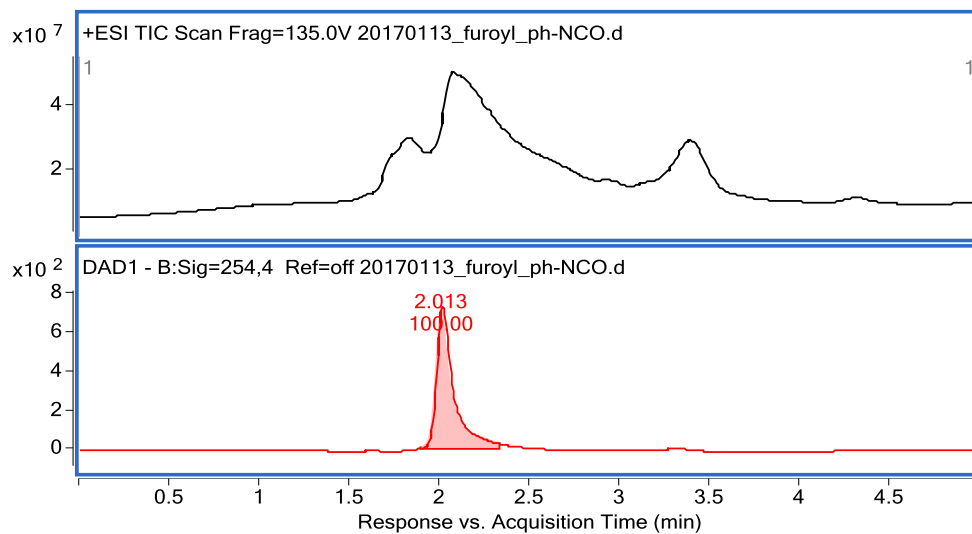
HR/MS – 12{1,3}



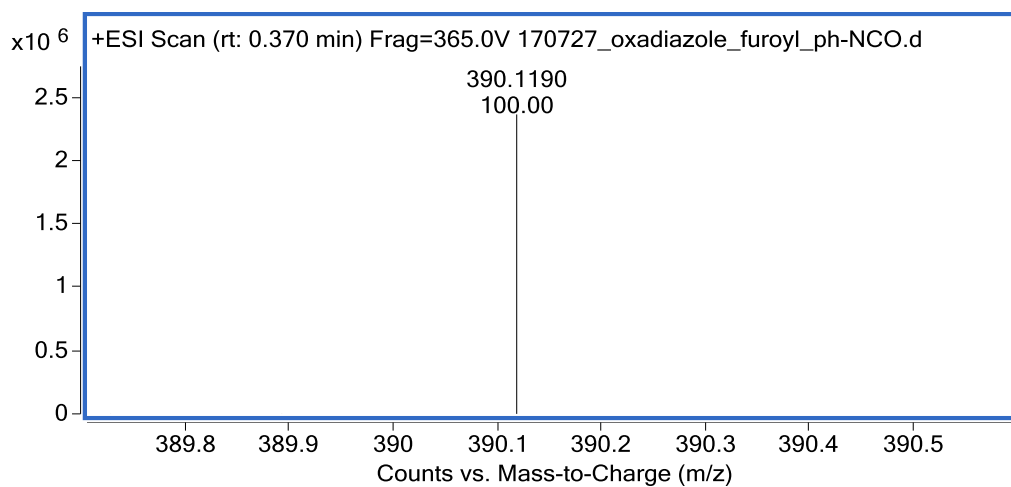
¹H NMR – 12{2,1}



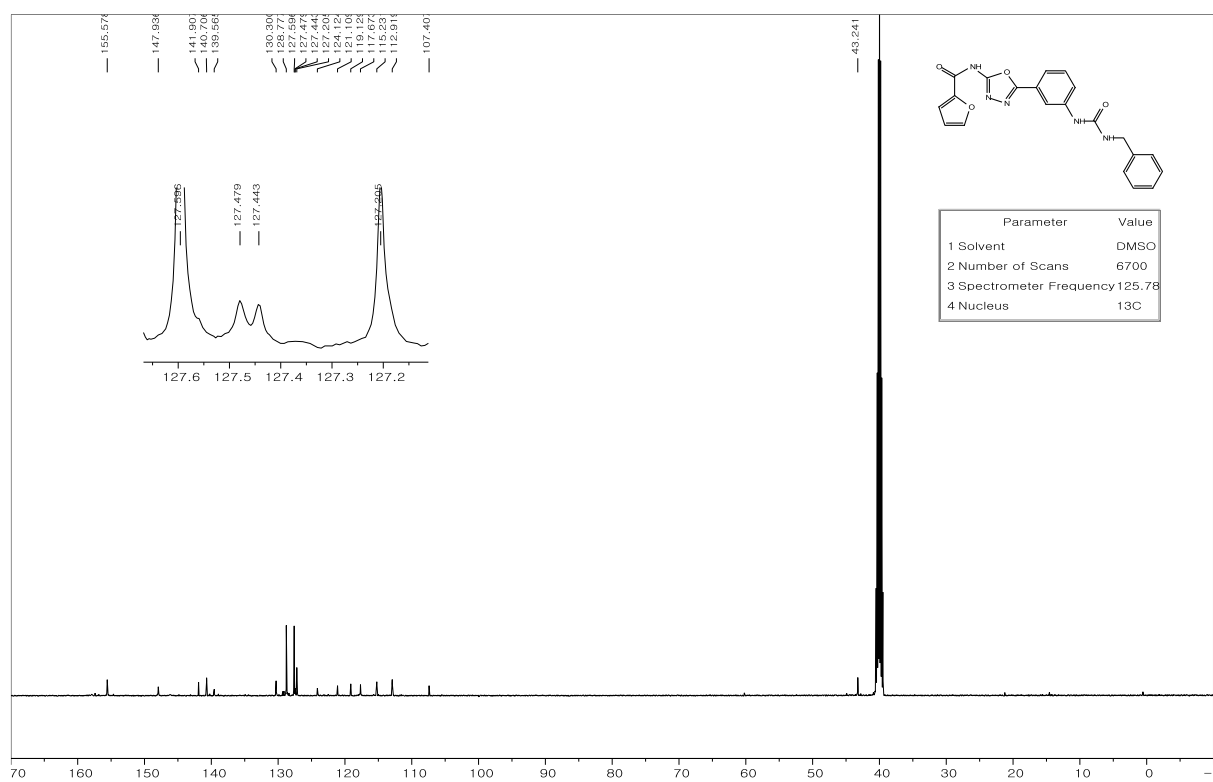
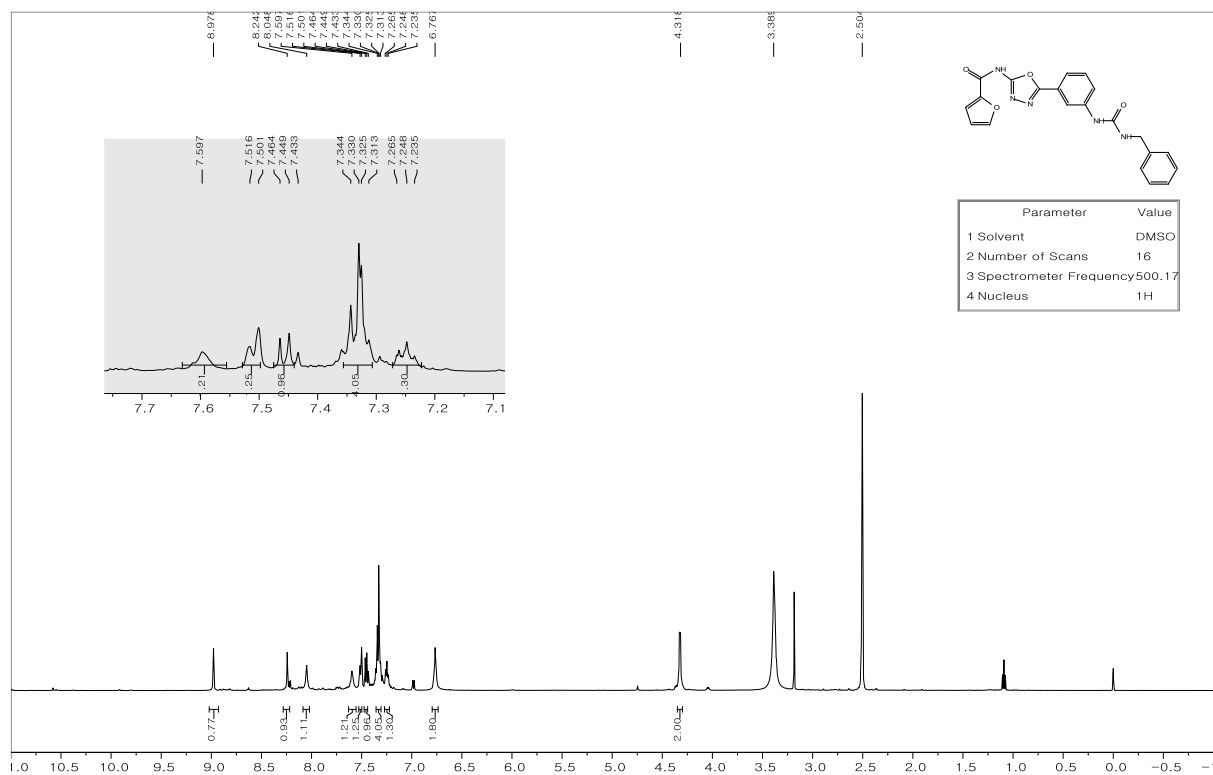
¹³C NMR – 12{2,1}

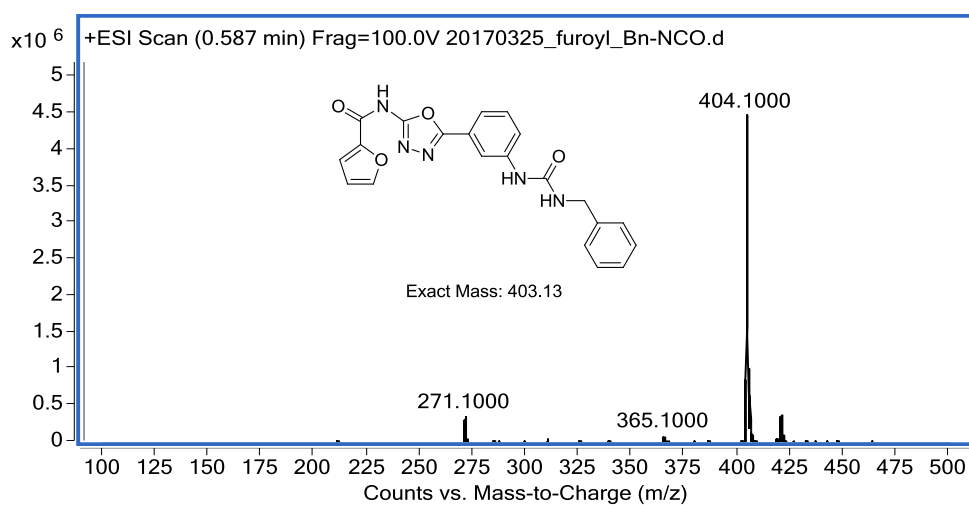
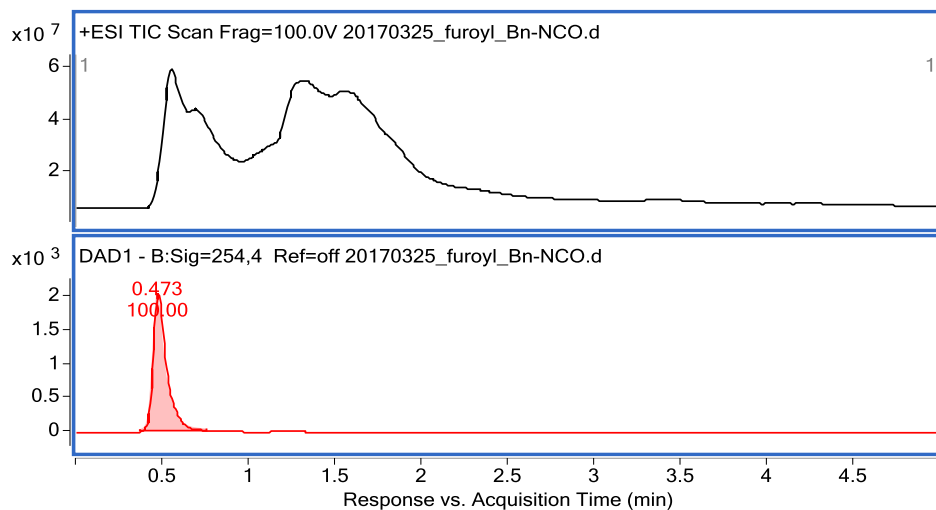


LC/MS – 12{2,1}

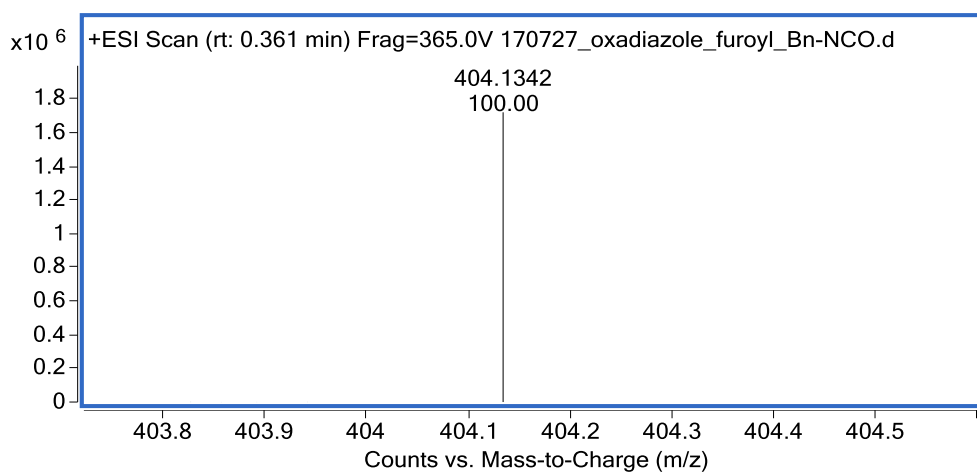


HR/MS – 12{2,1}

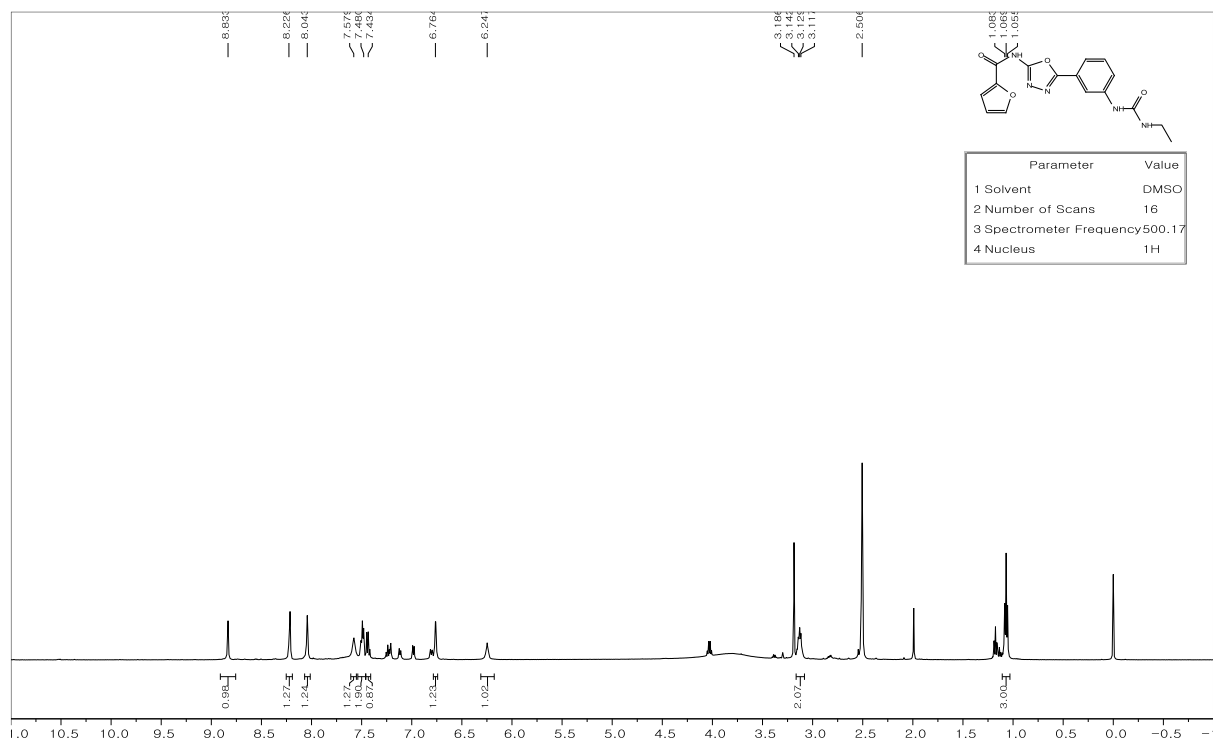




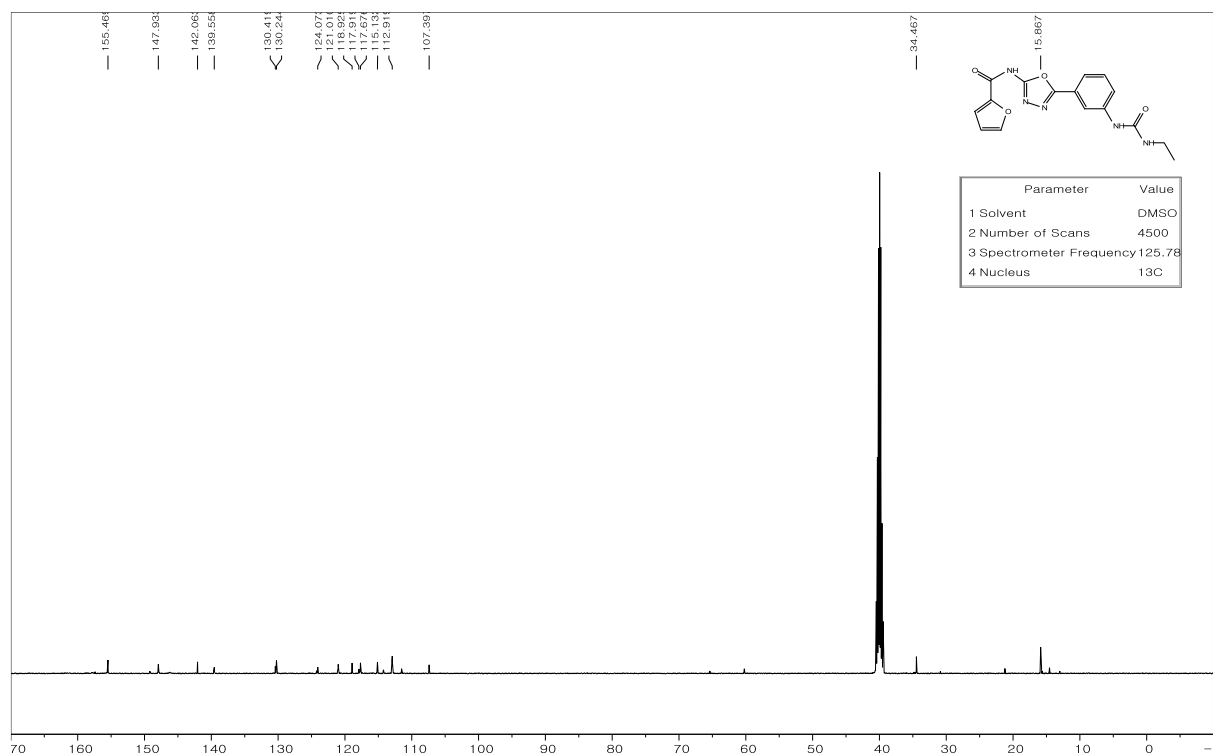
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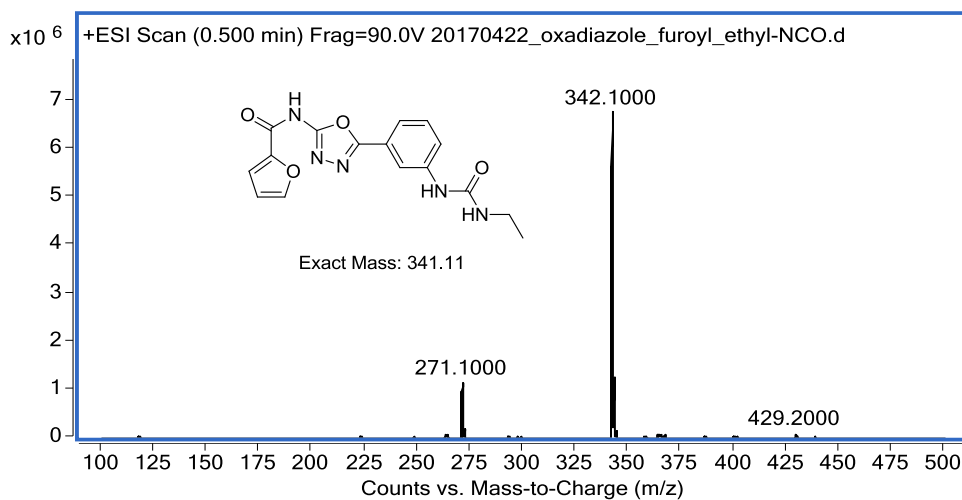
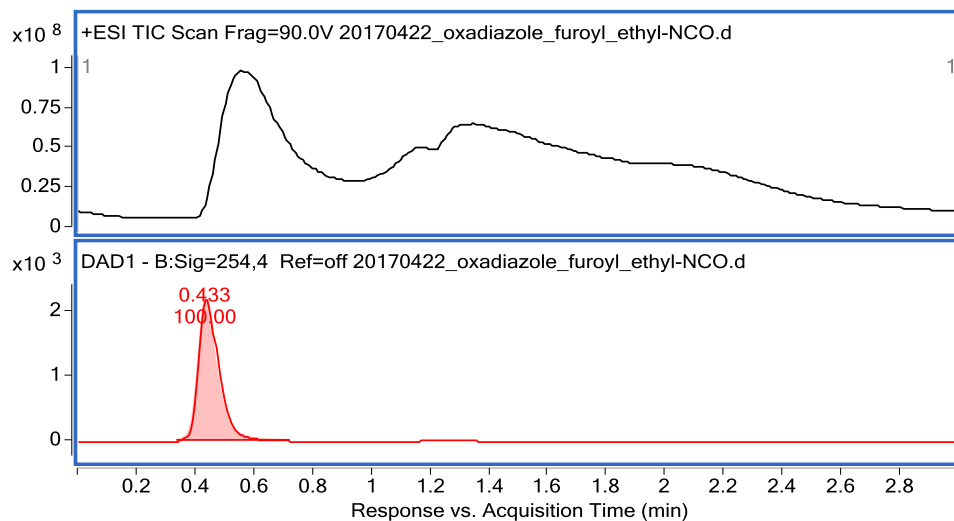
HR/MS – 12{2,2}



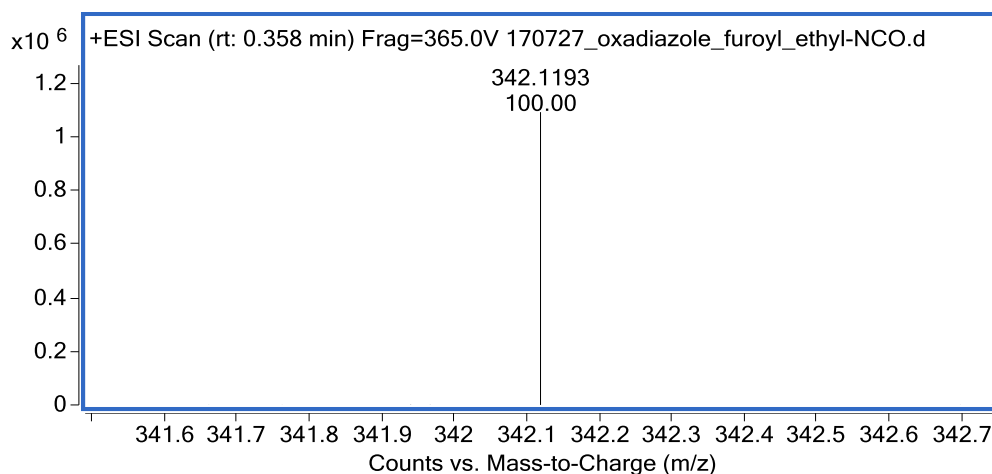
¹H NMR – 12{2,3}



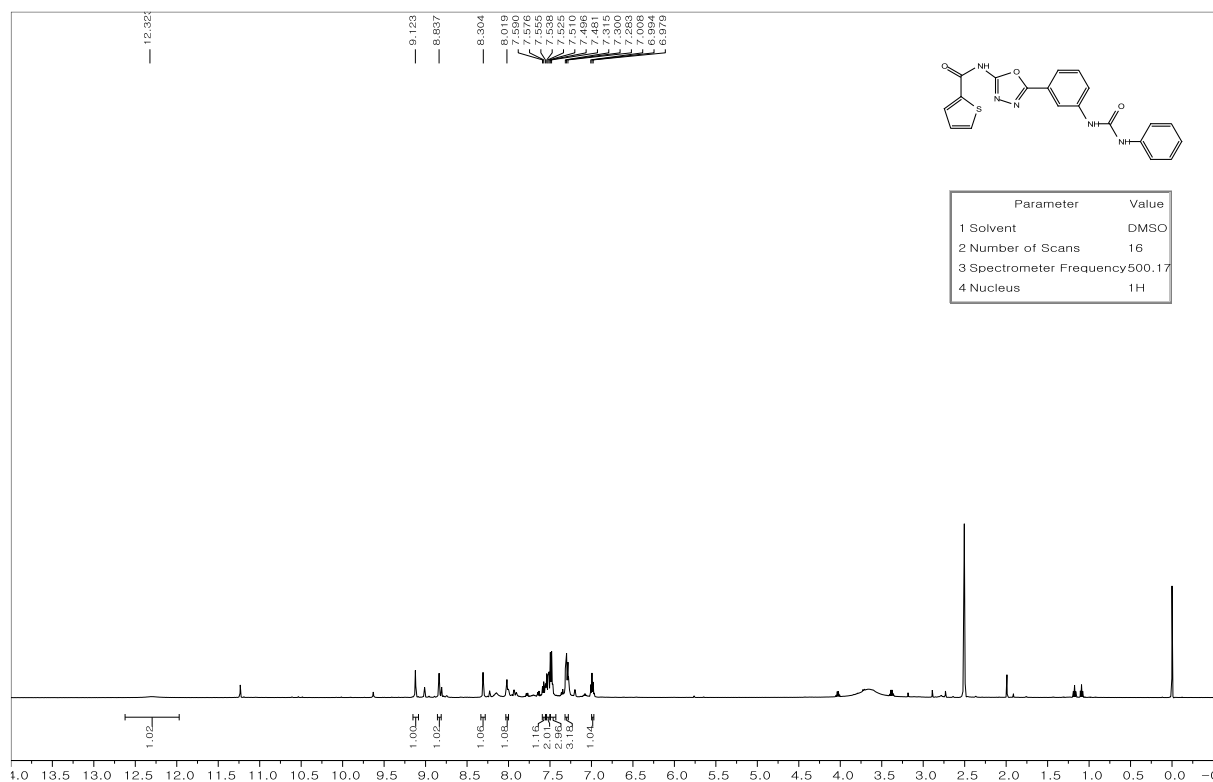
¹³C NMR – 12{2,3}



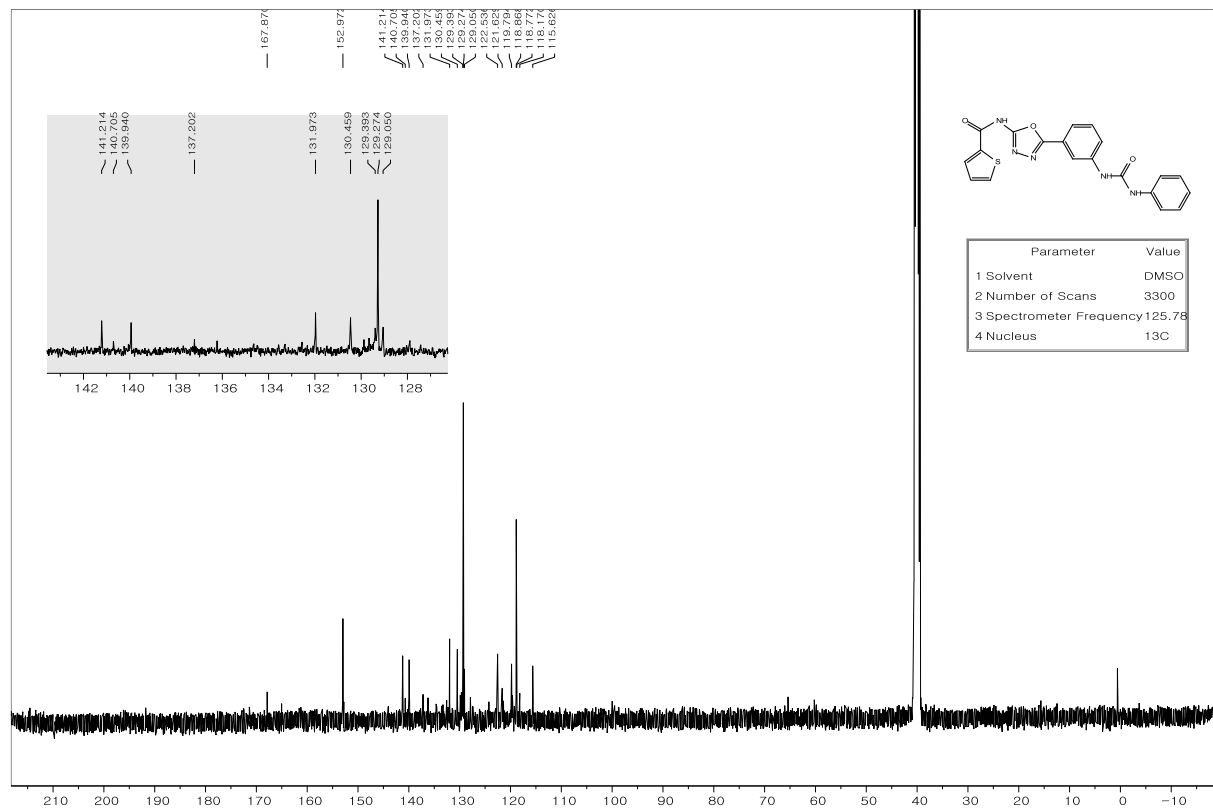
LC/MS – 12{2,3}



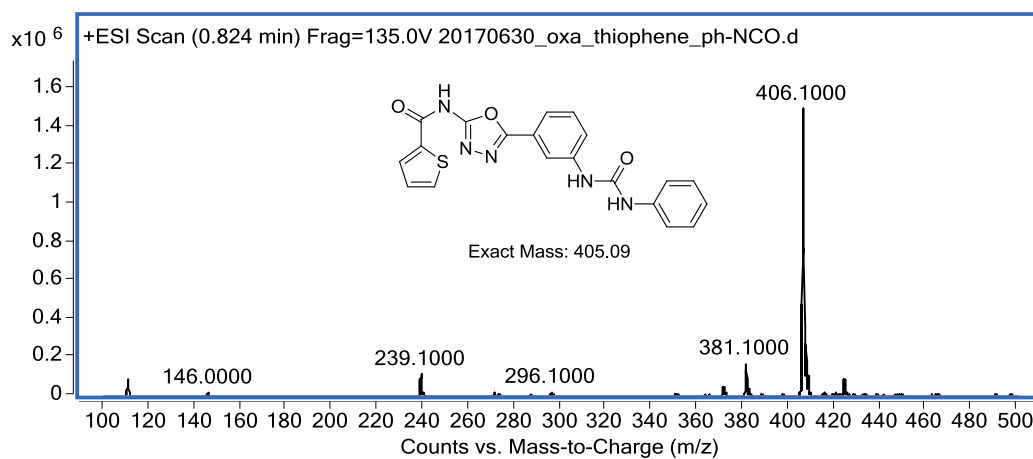
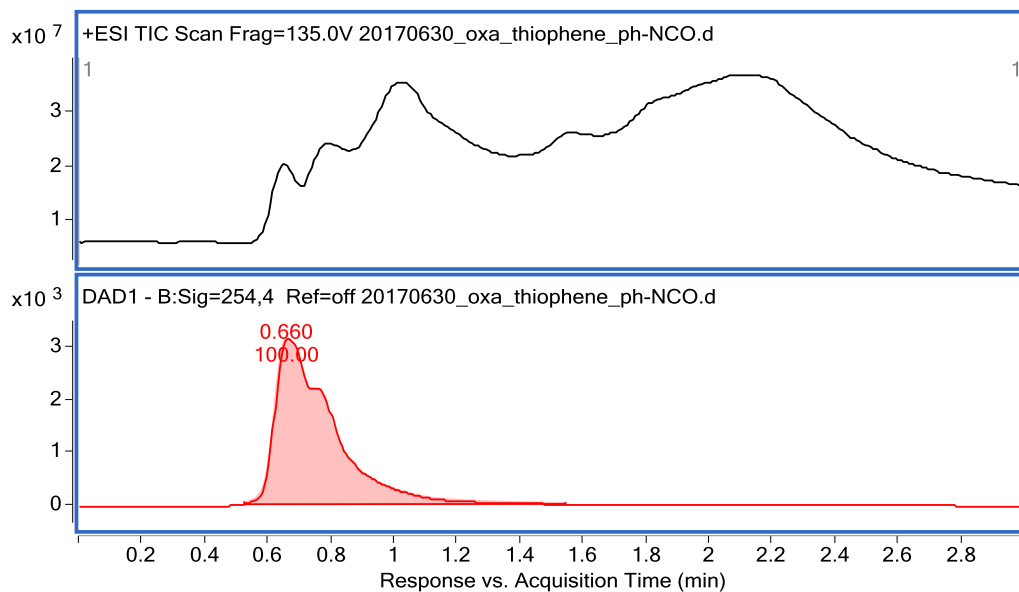
HR/MS – 12{2,3}



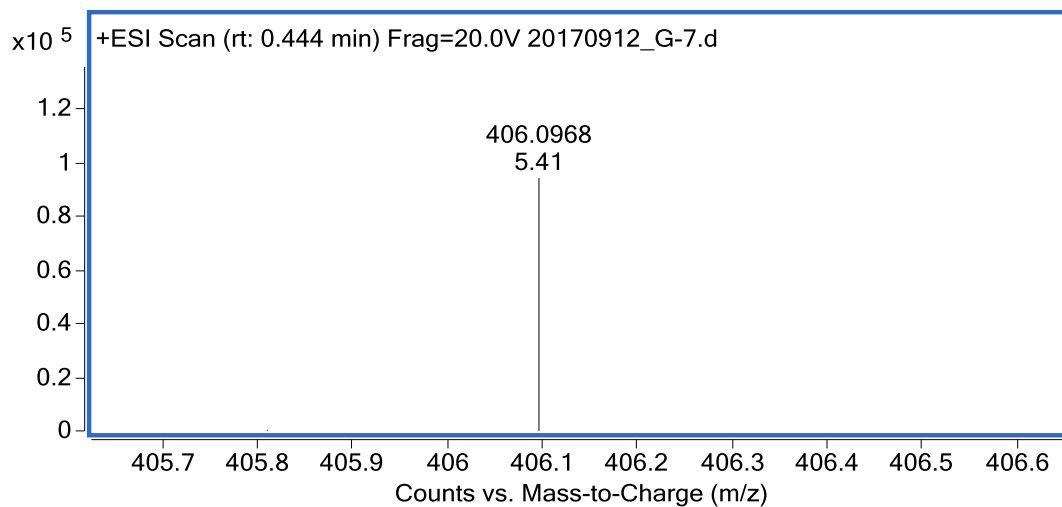
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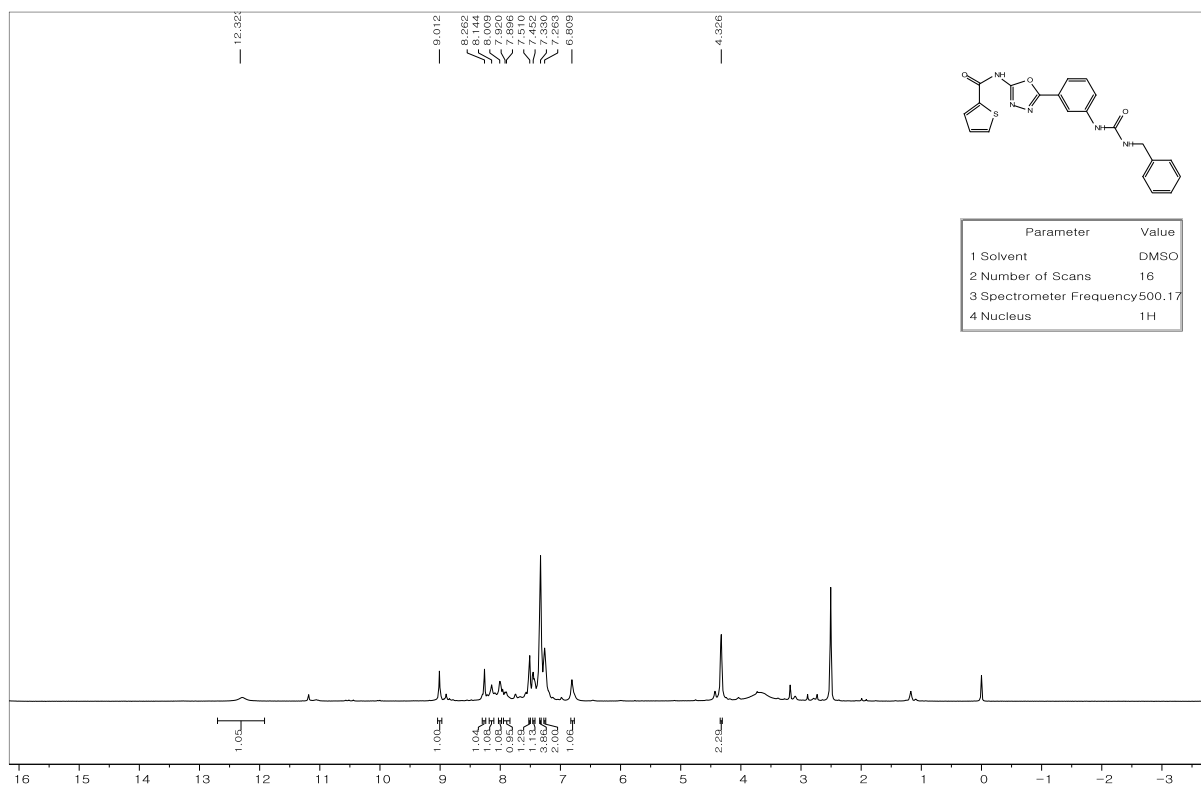
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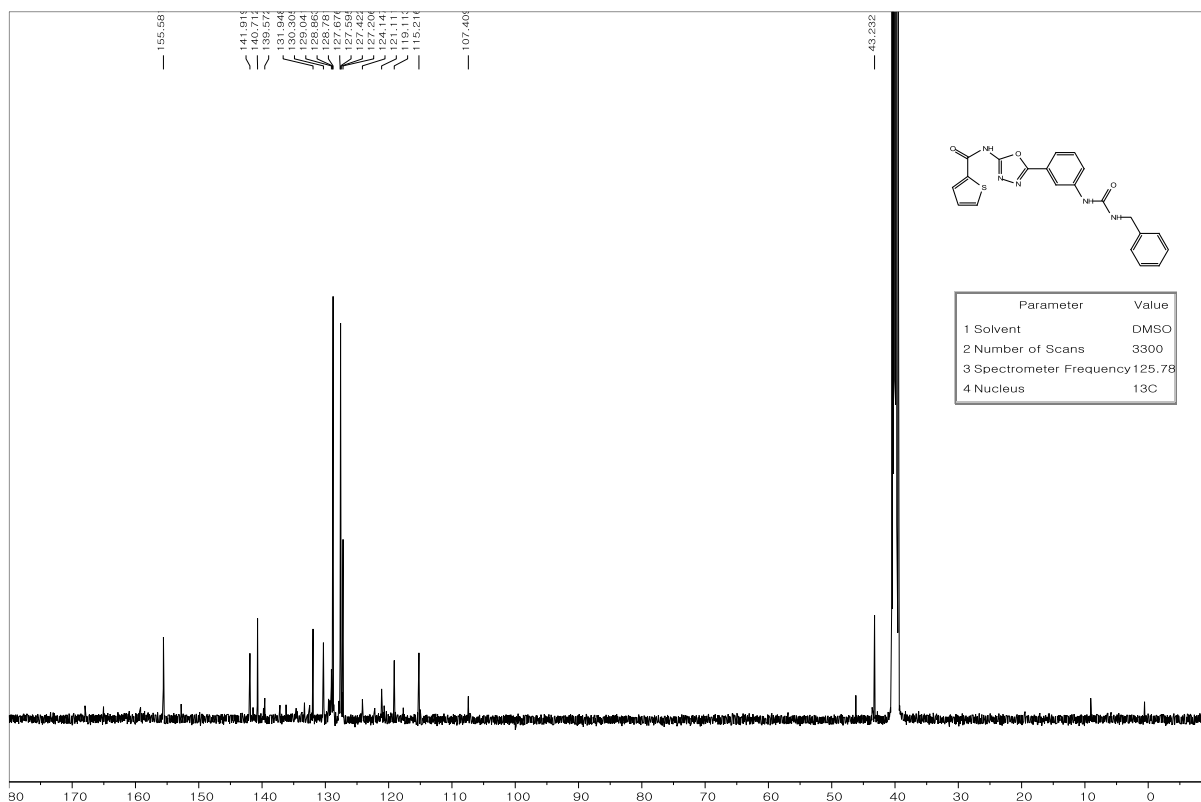
LC/MS – 12{3,1}



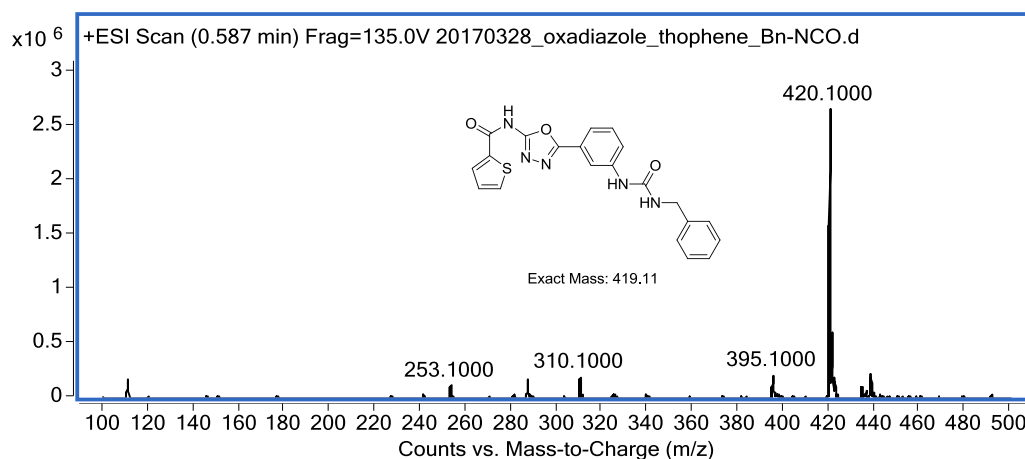
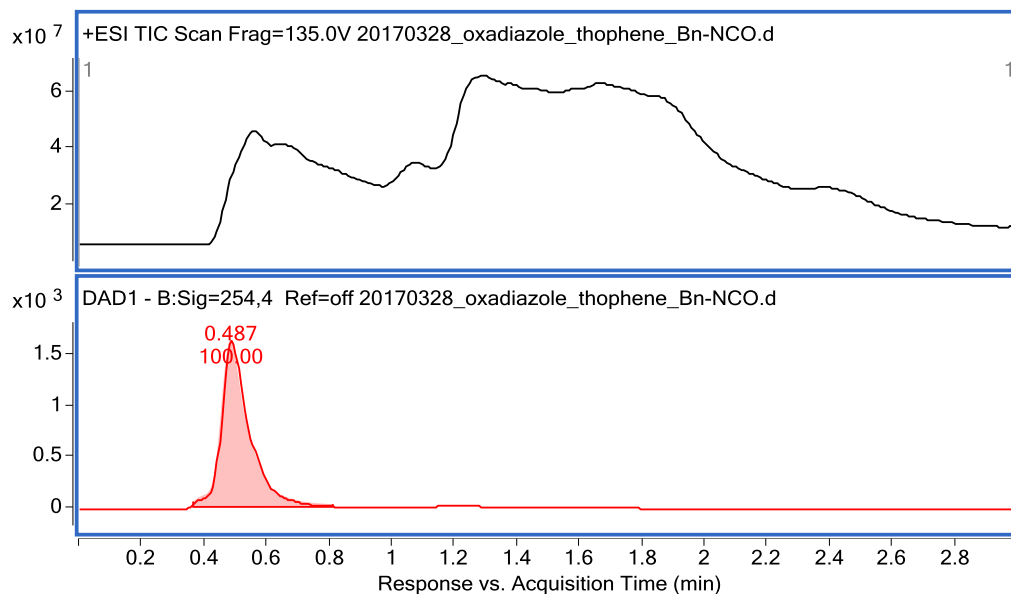
HR/MS – 12{3,1}



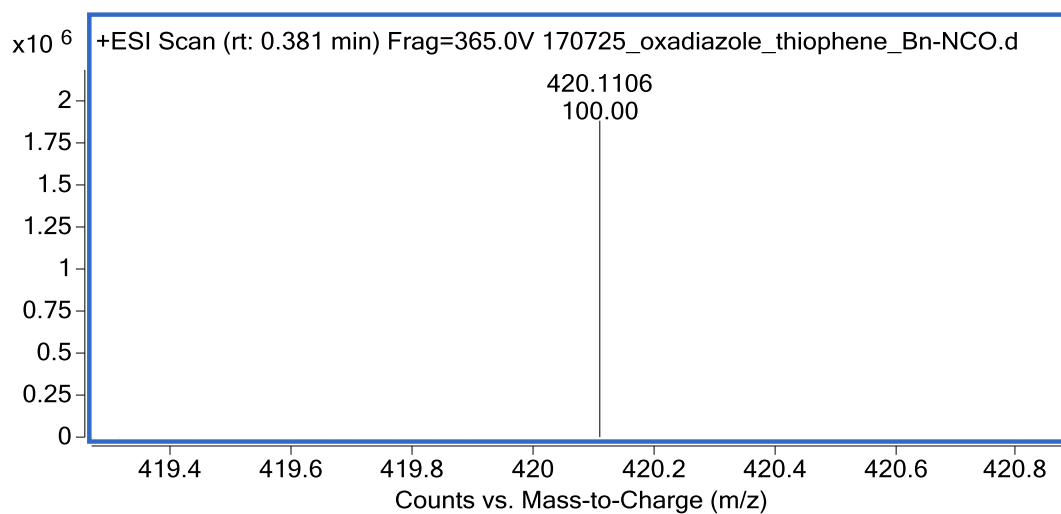
¹H NMR – 12 {3,2}



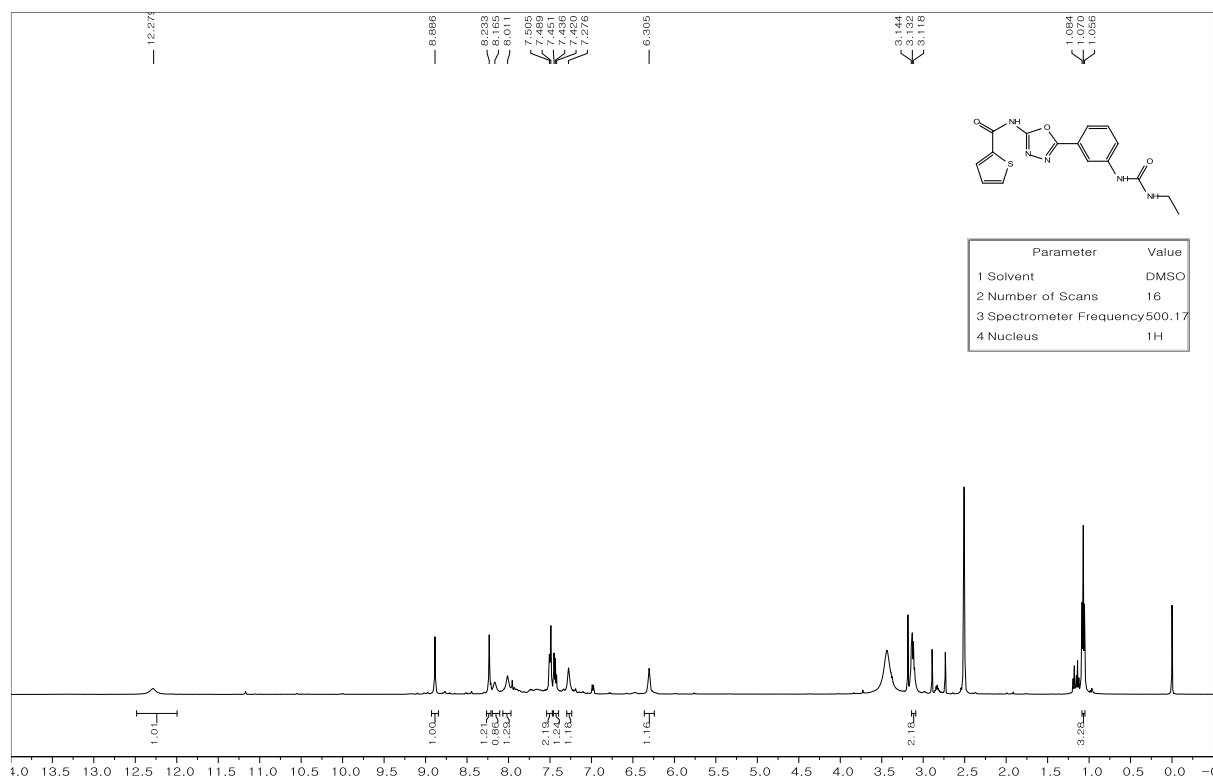
¹³C NMR – 12 {3,2}



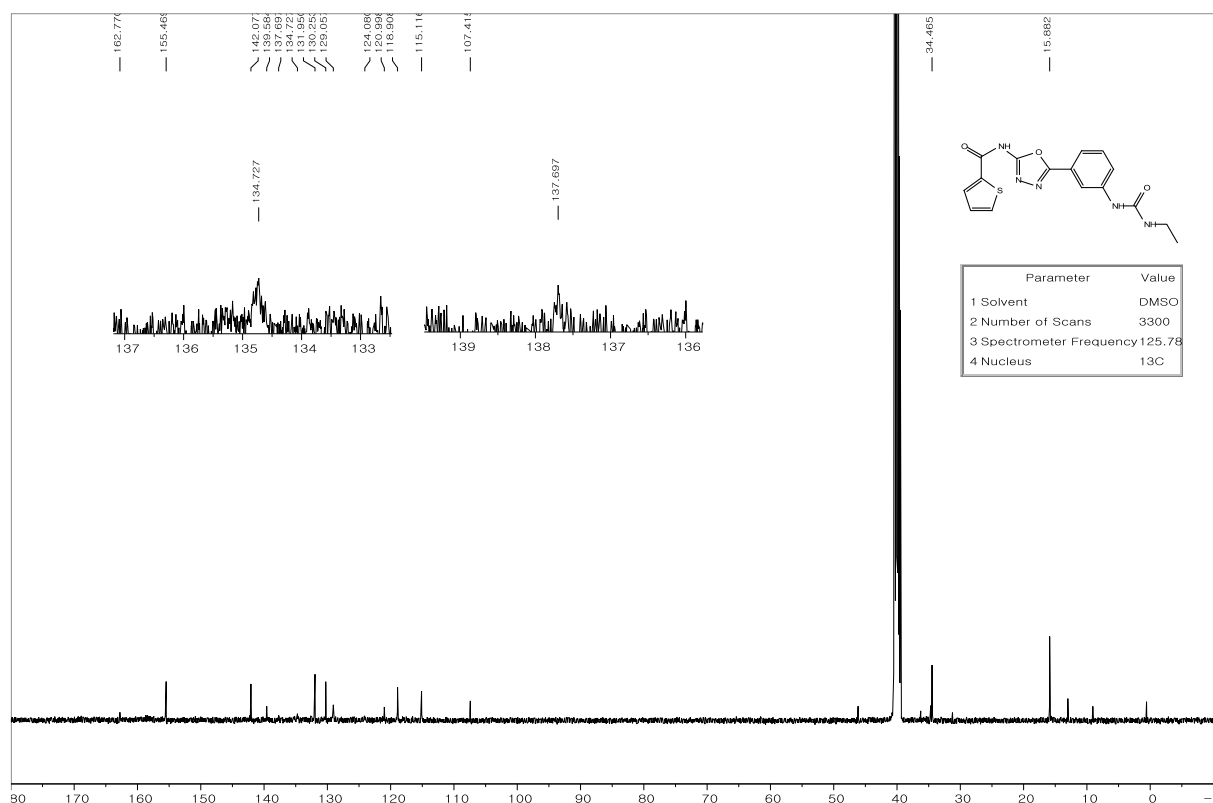
LC/MS – 12{3,2}



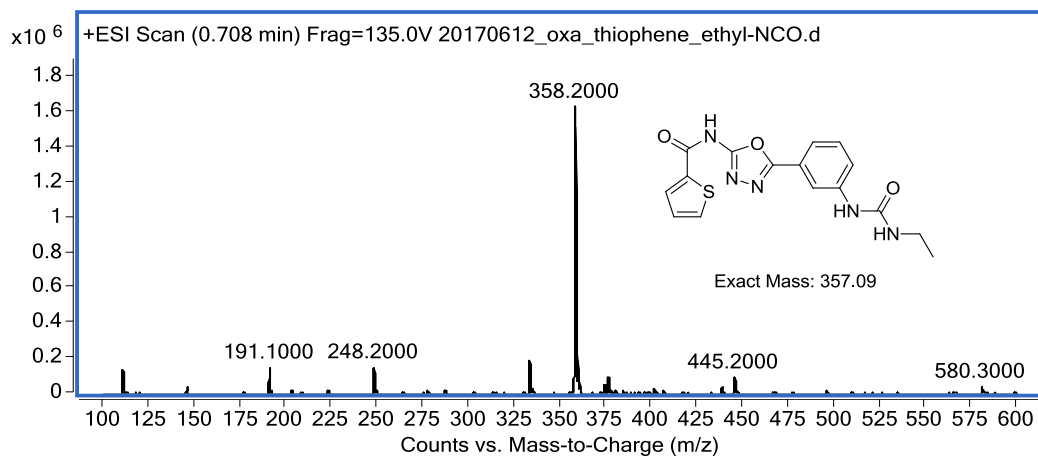
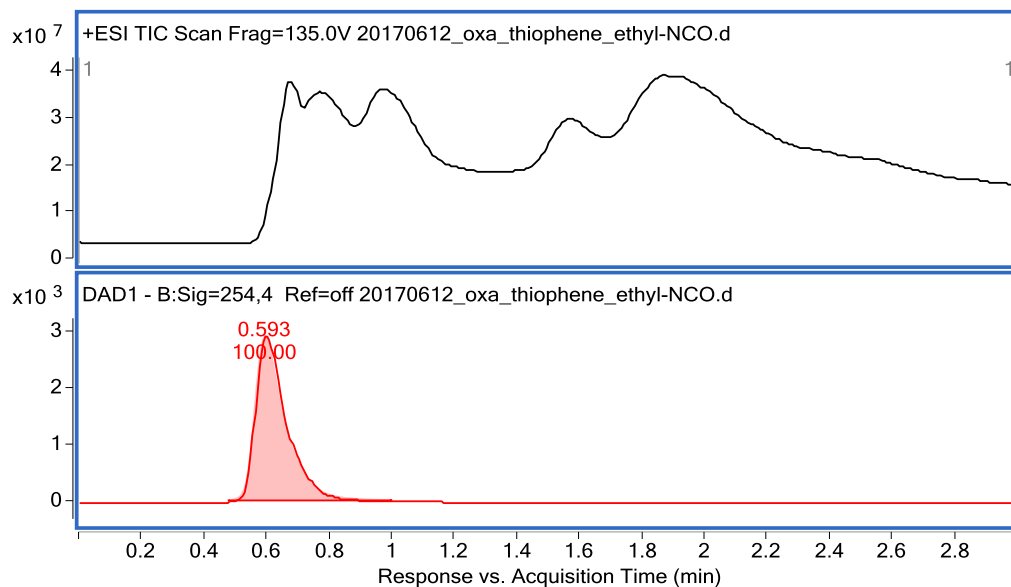
HR/MS – 12{3,2}



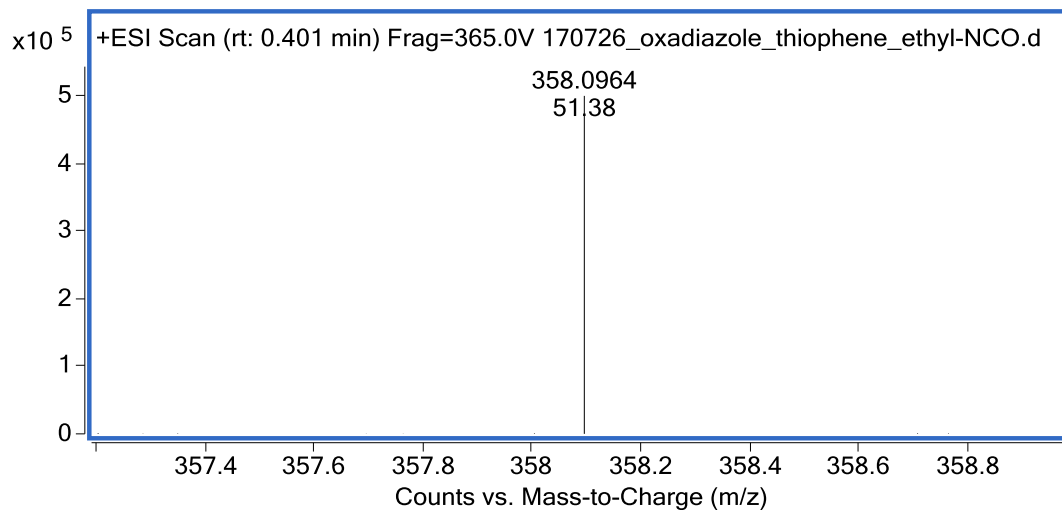
¹H NMR – 12{3,3}



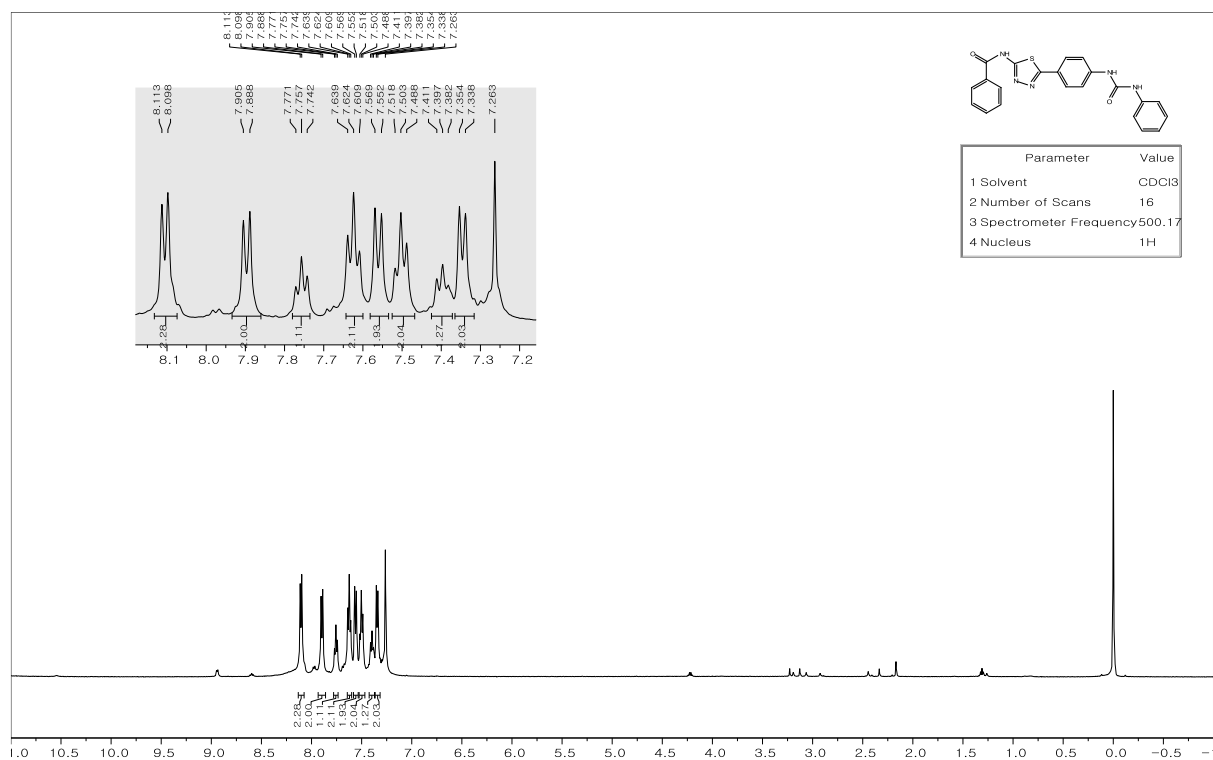
¹³C NMR – 12{3,3}



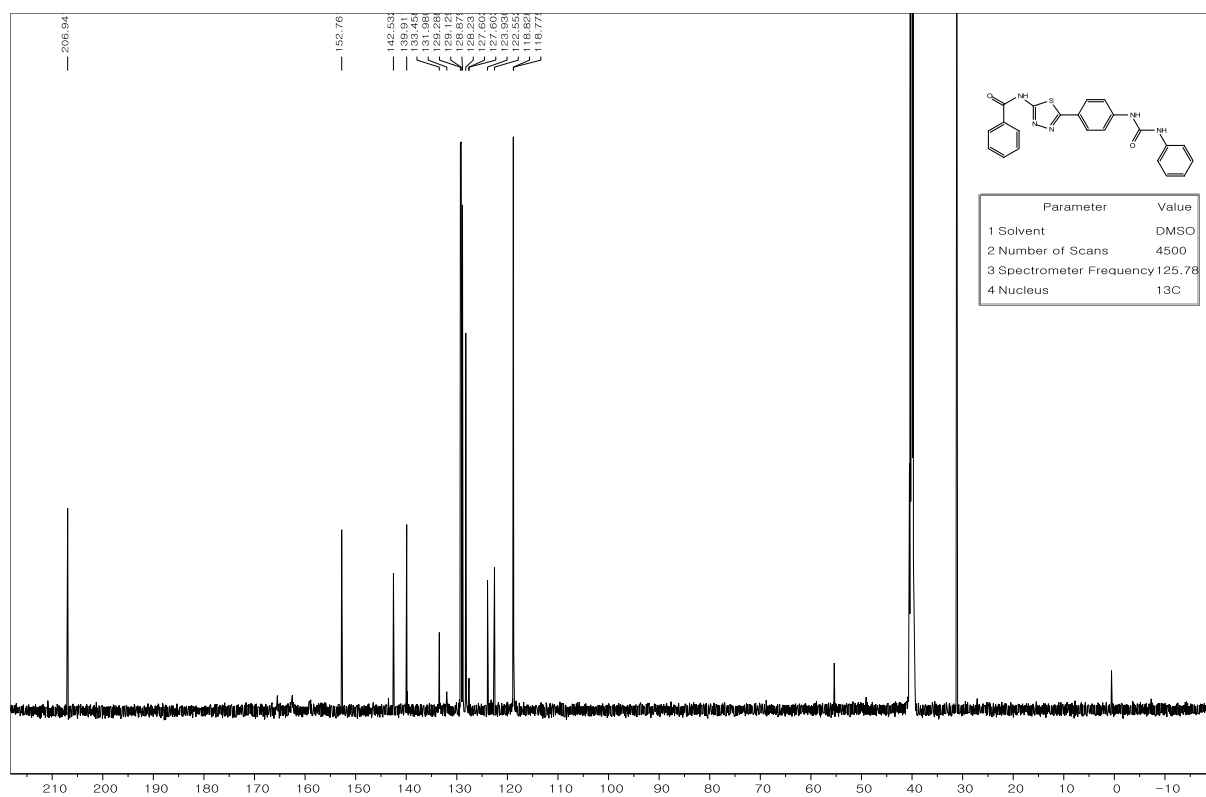
LC/MS – 12{3,3}



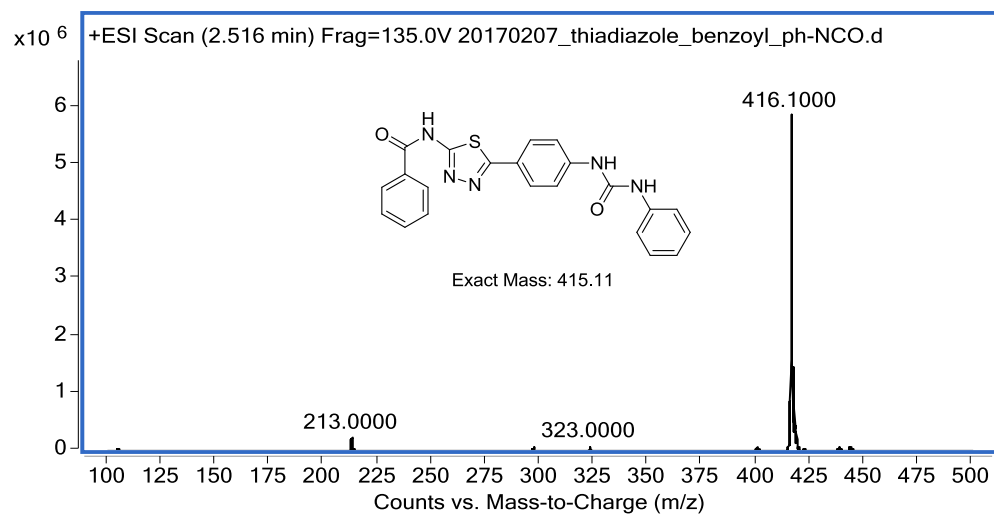
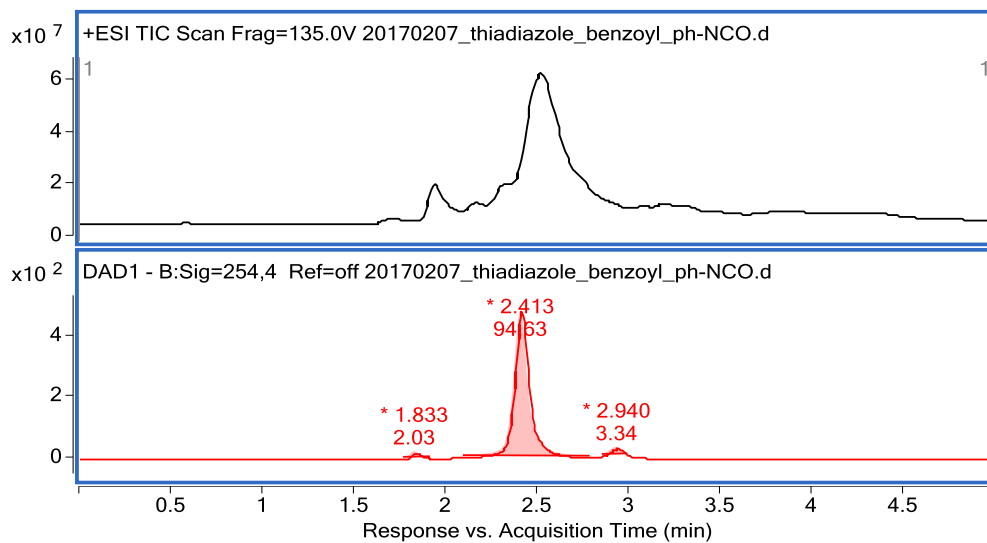
HR/MS – 12{3,3}



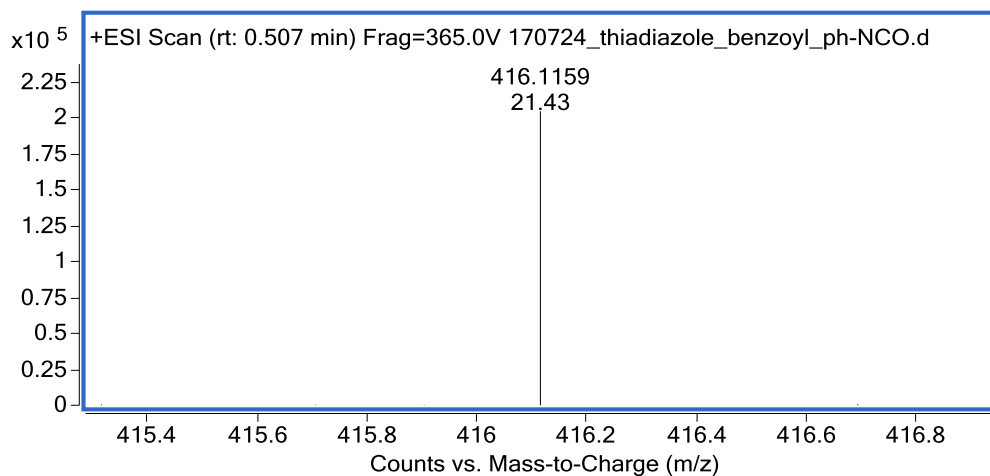
¹H NMR – 13{1,1}



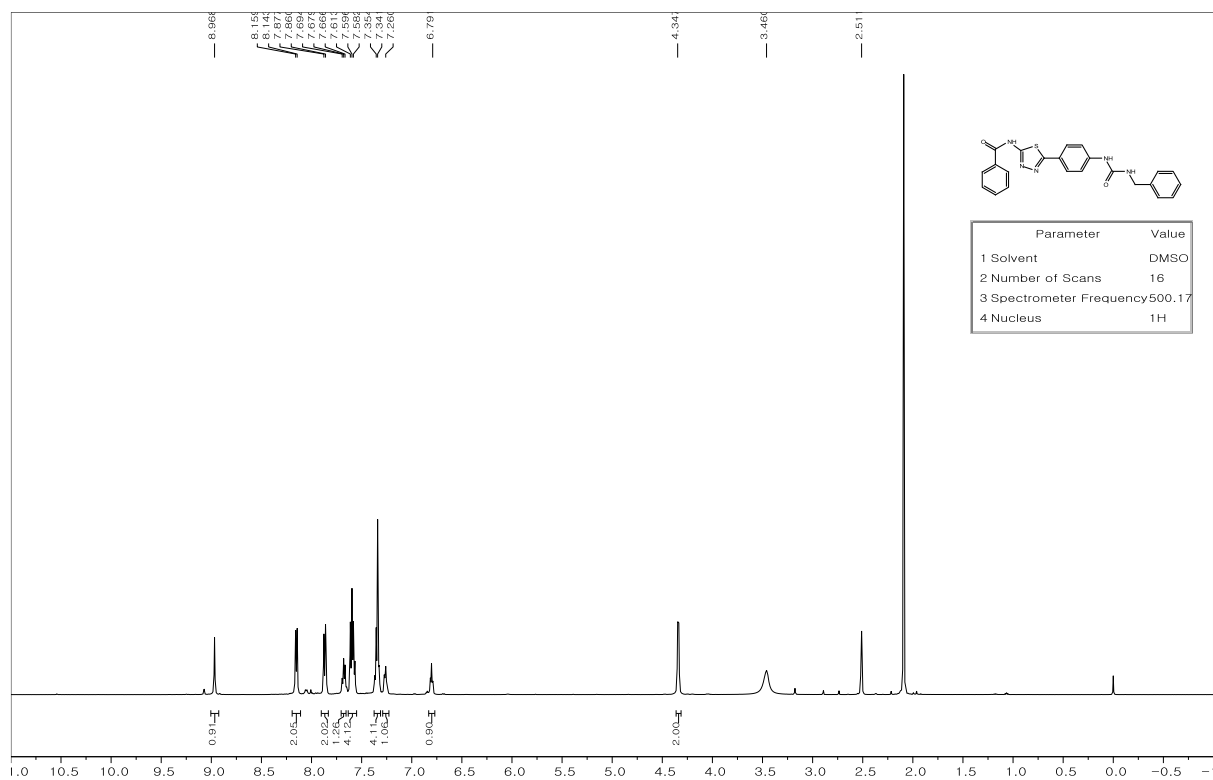
¹³C NMR – 13{1,1}



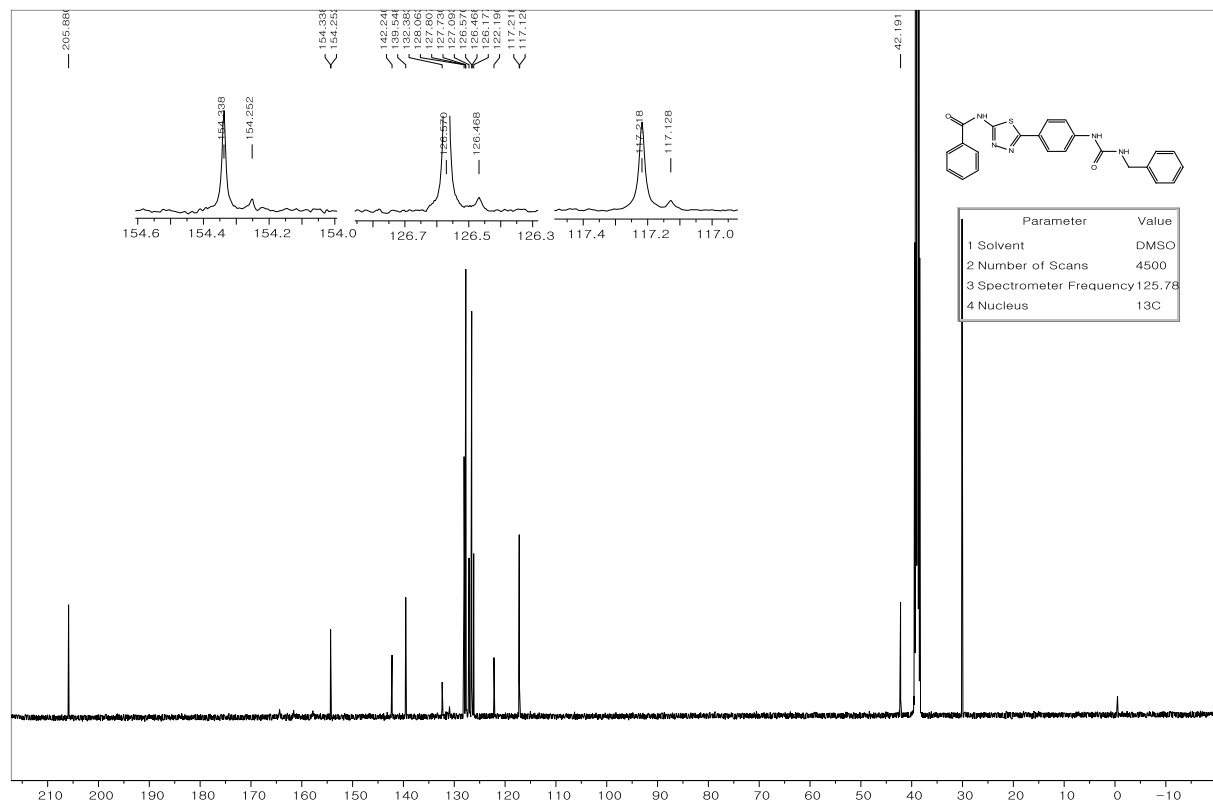
LC/MS – 13{1,1}



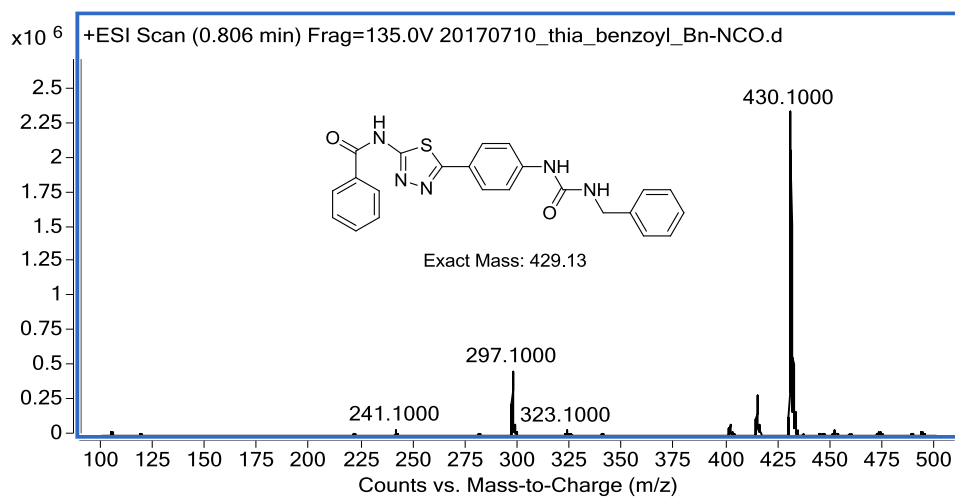
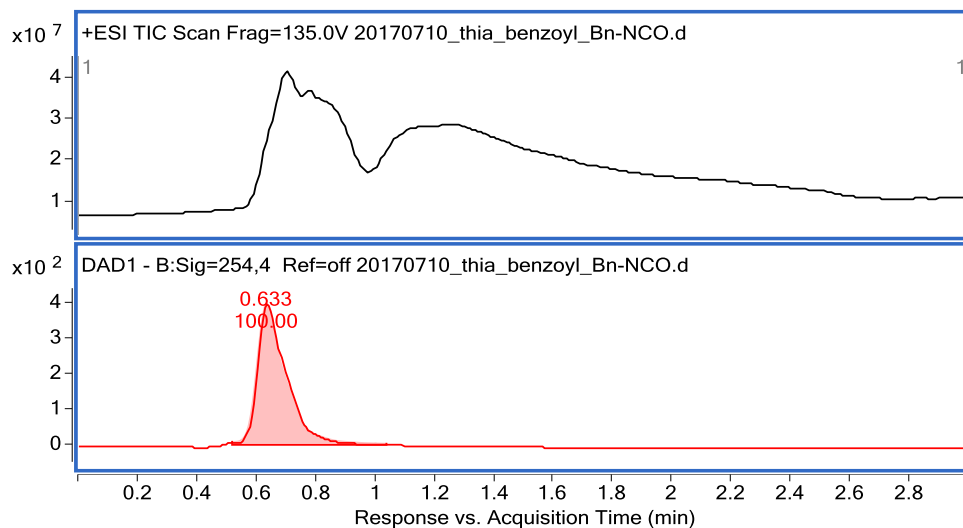
HR/MS – 13{1,1}



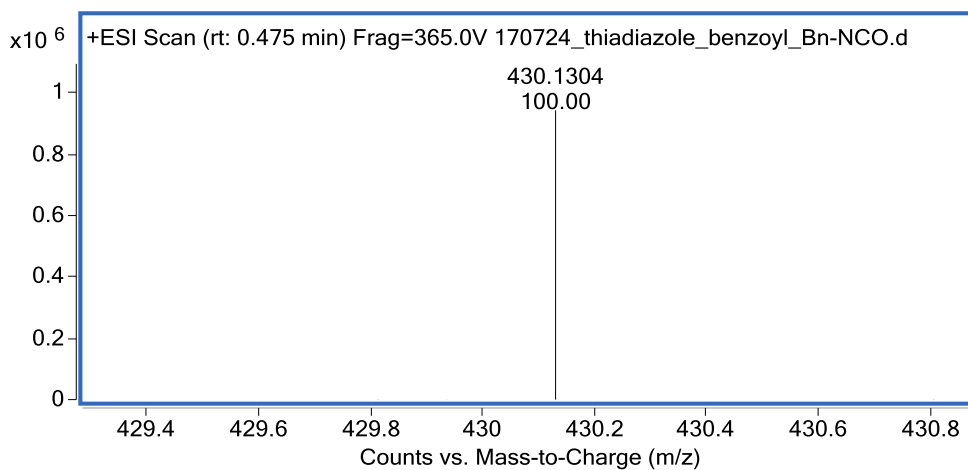
¹H NMR – 13{1,2}



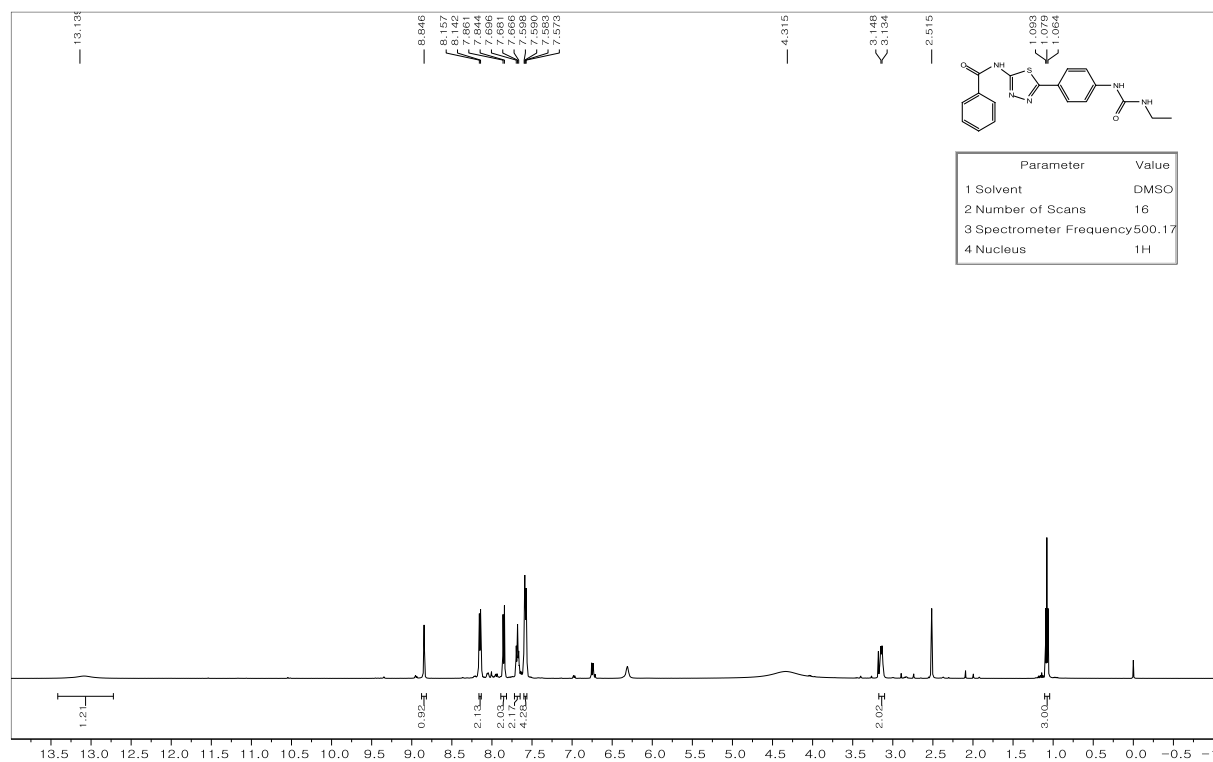
¹³C NMR – 13{1,2}



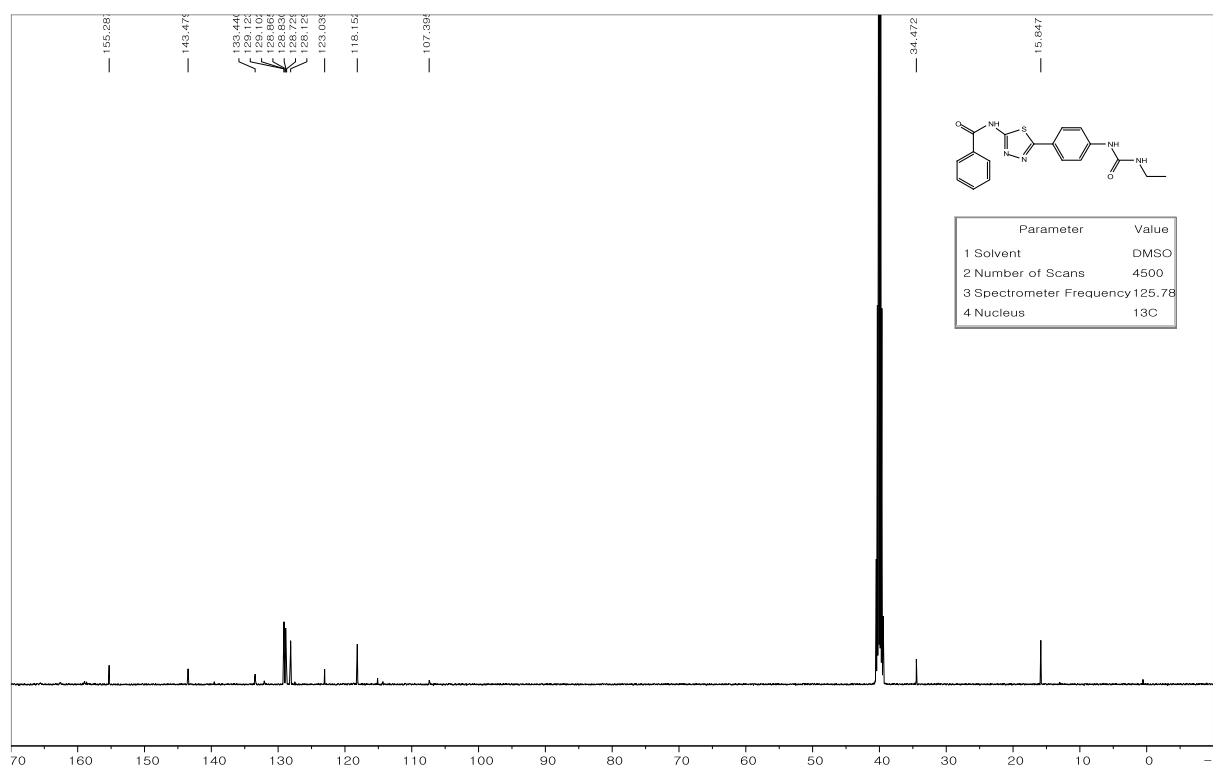
LC/MS – 13{1,2}



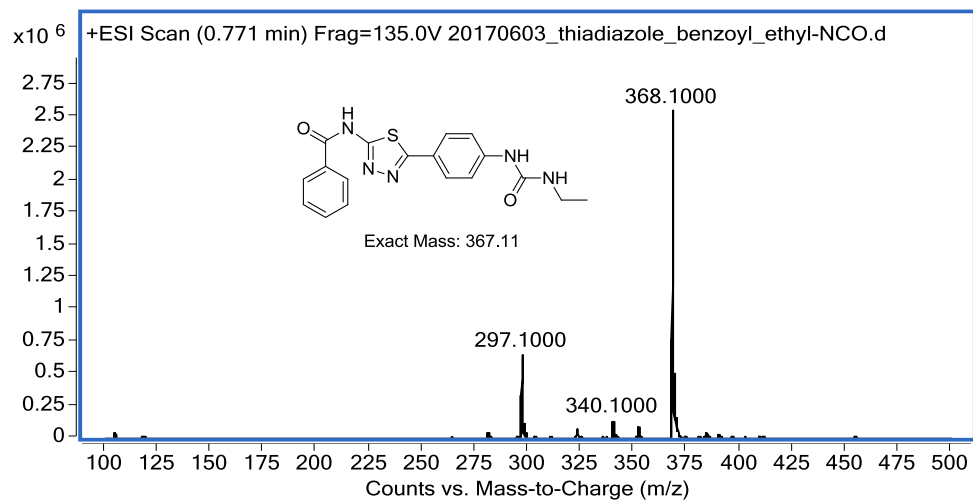
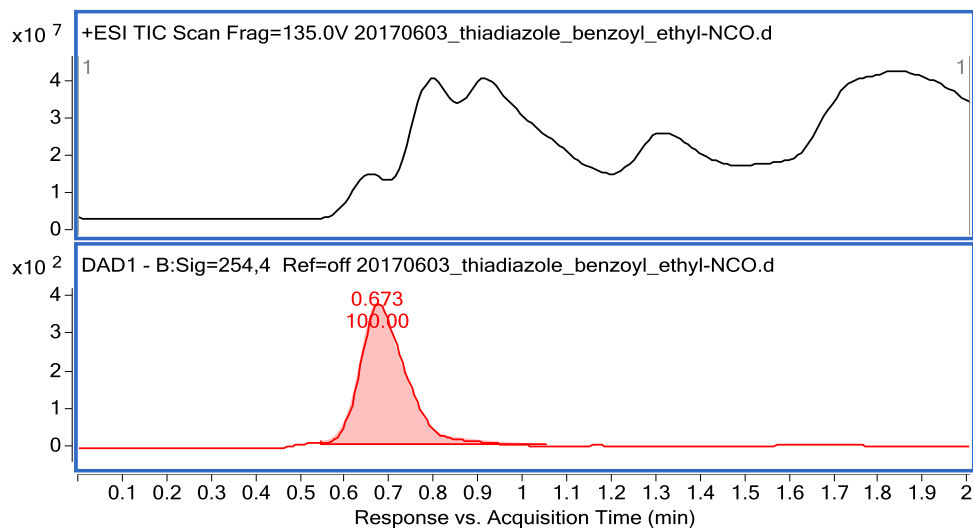
HR/MS – 13{1,2}



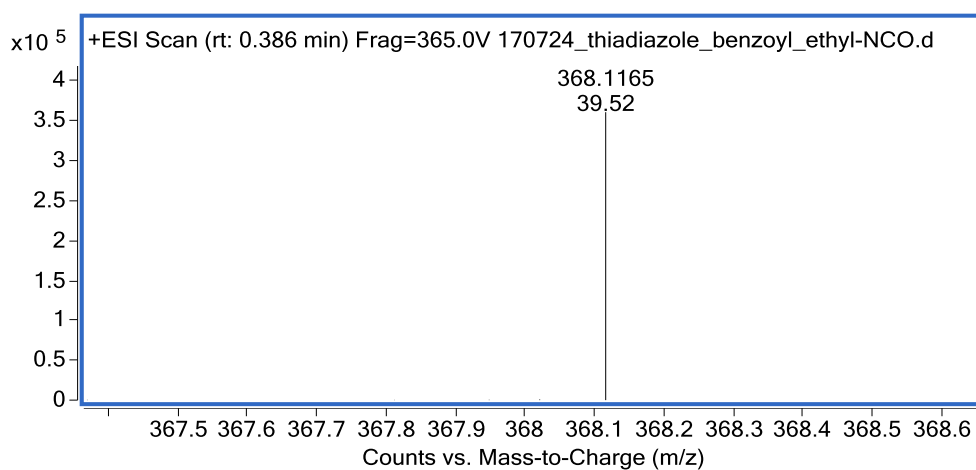
¹H NMR – 13{1,3}



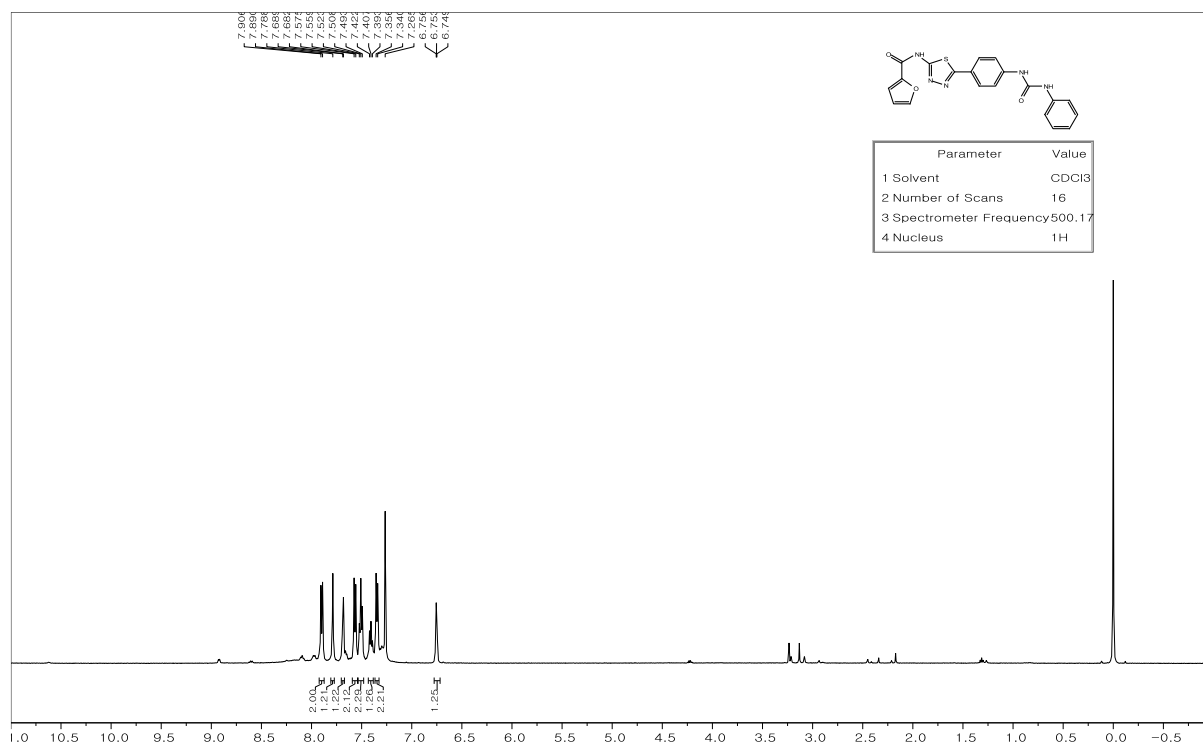
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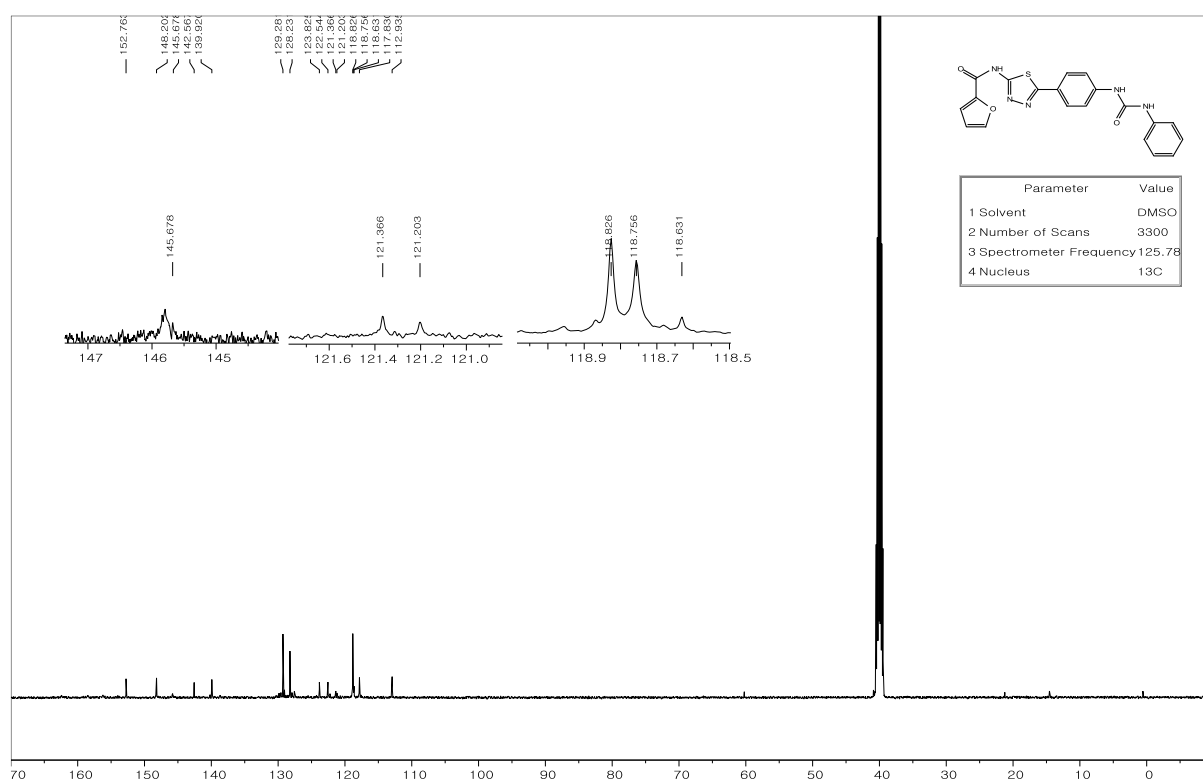
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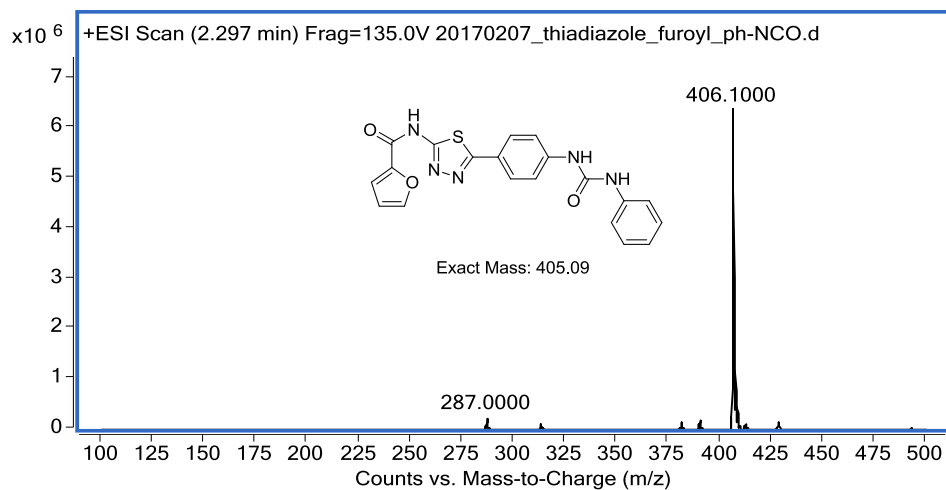
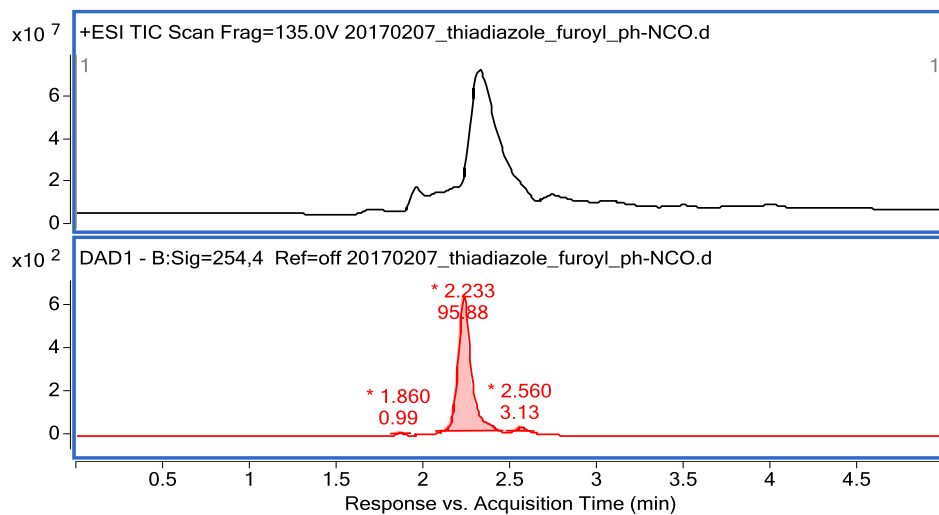
HR/MS – 13{1,3}



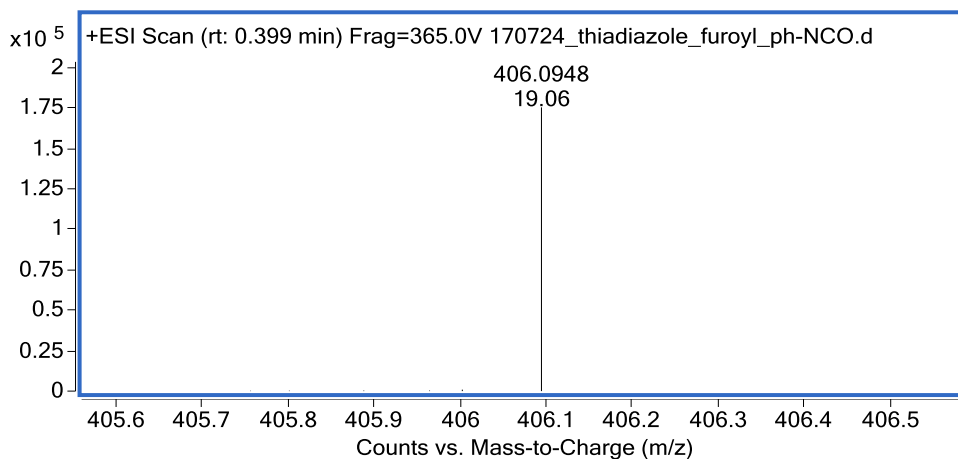
¹H NMR – 13{2,1}



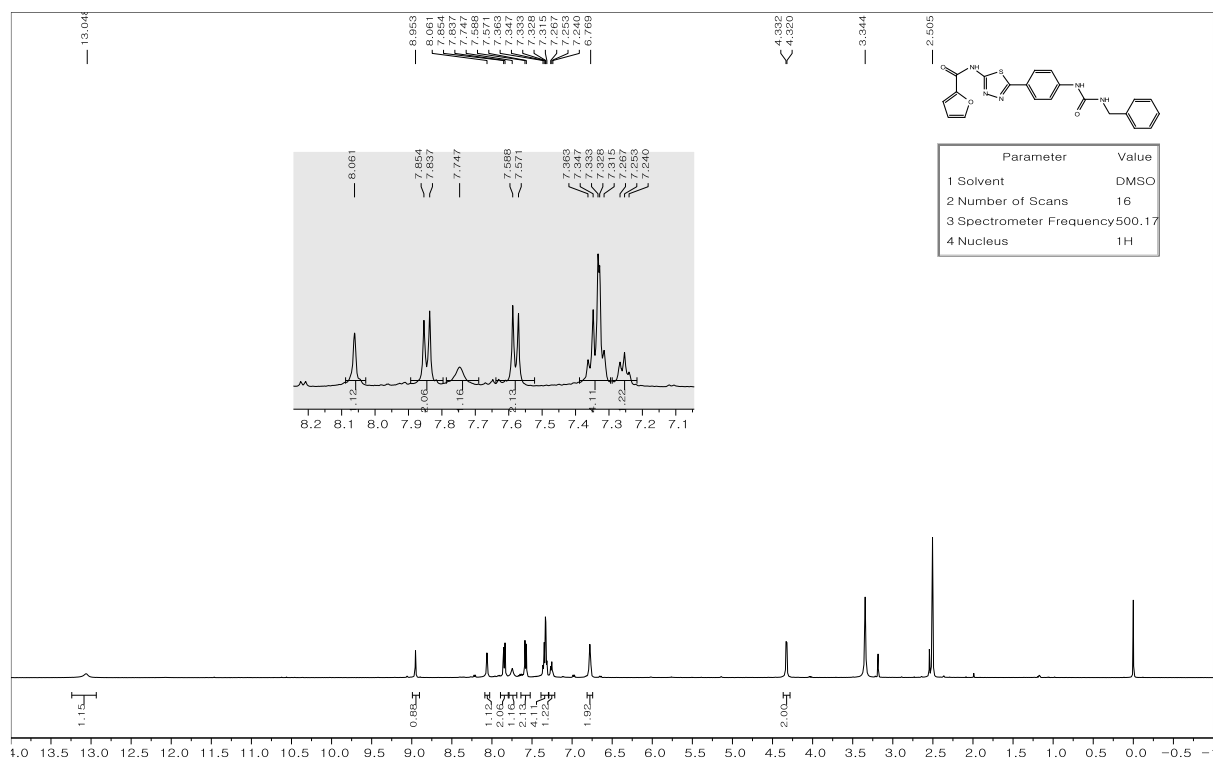
¹³C NMR – 13{2,1}



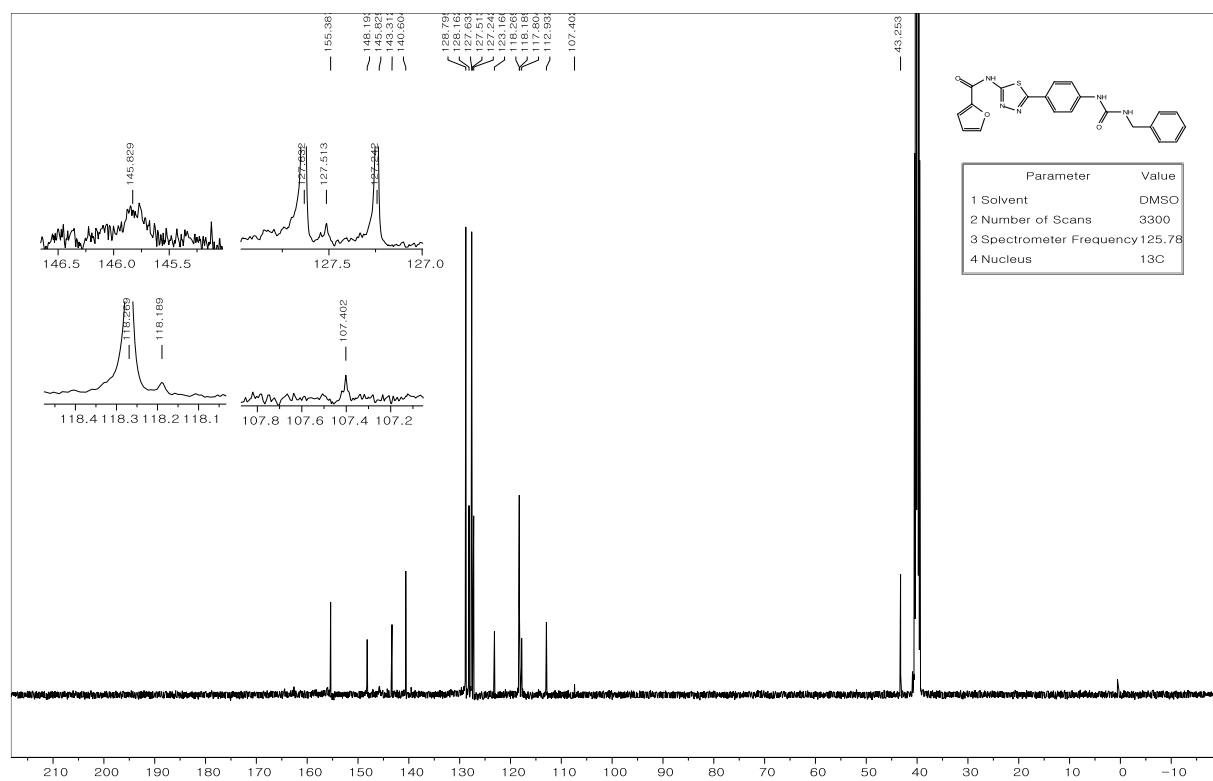
LC/MS – 13{2,1}



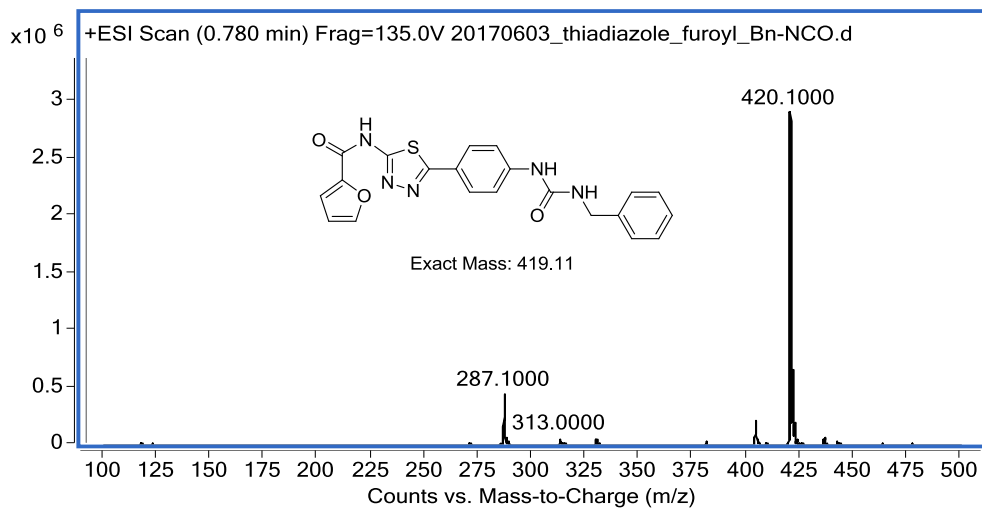
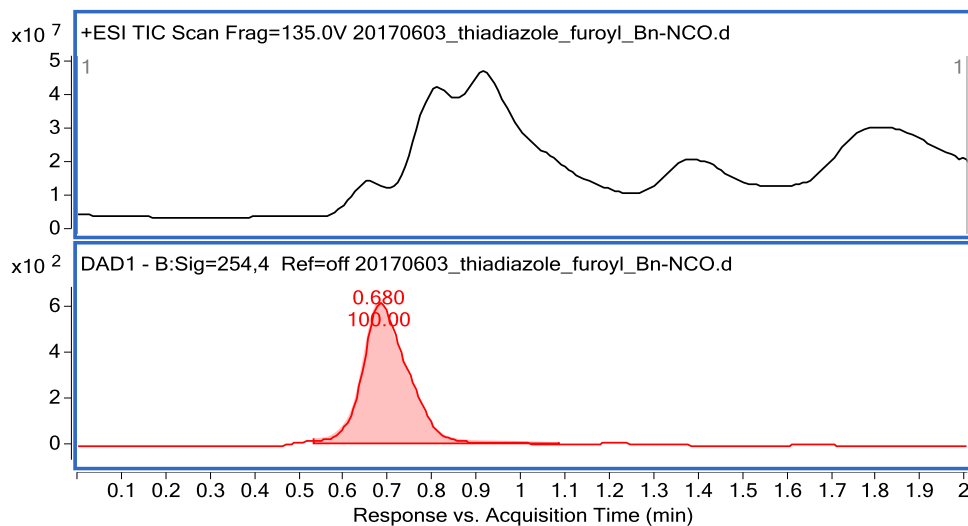
HR/MS – 13{2,1}



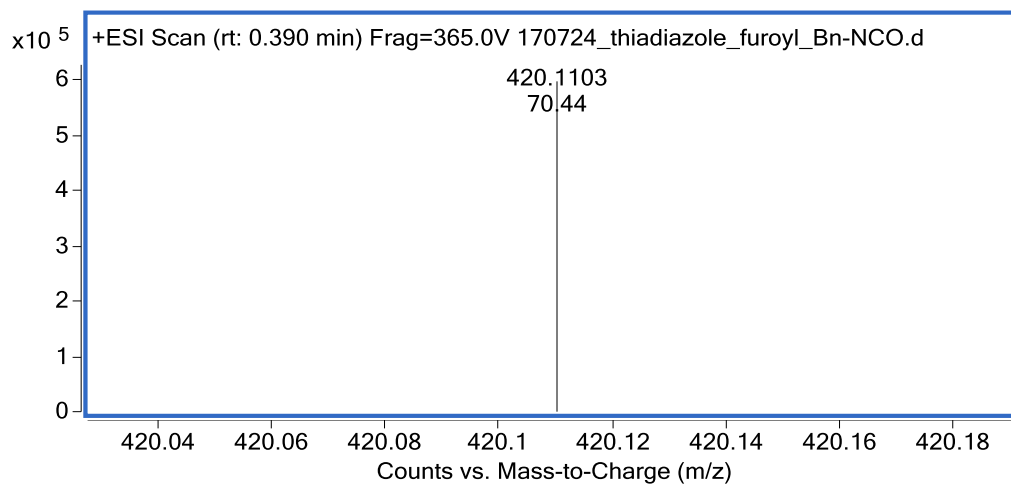
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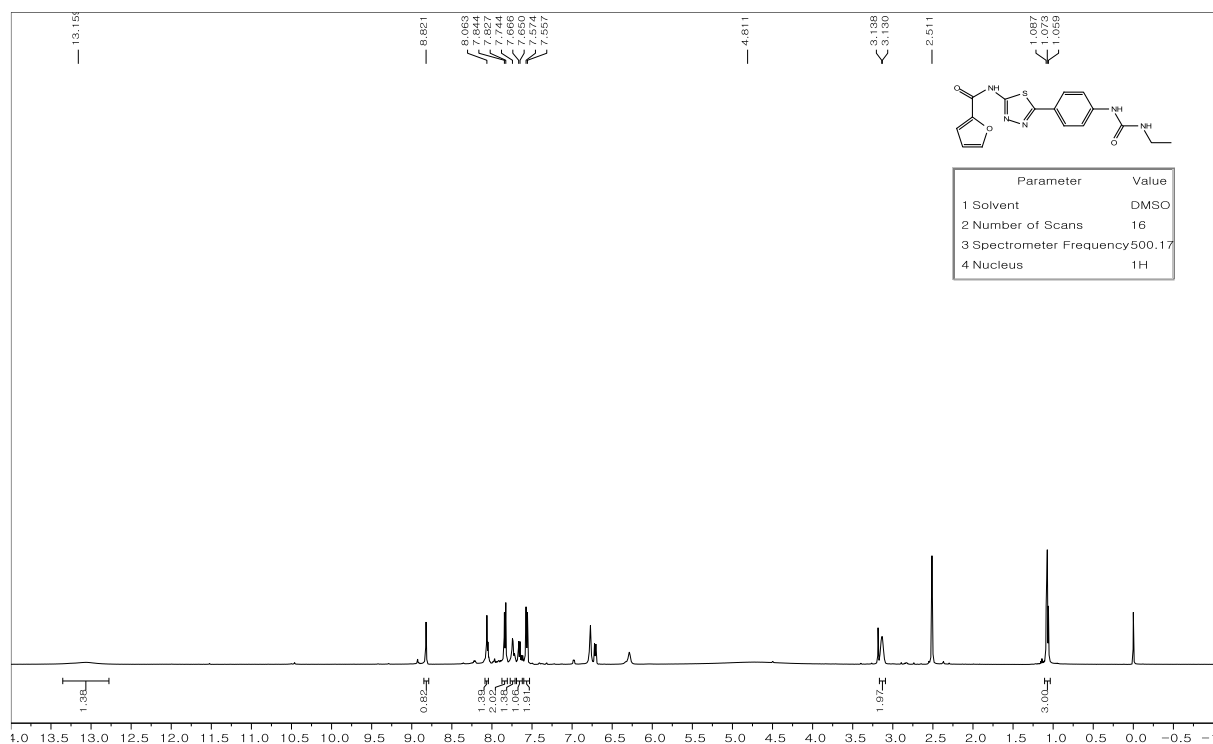
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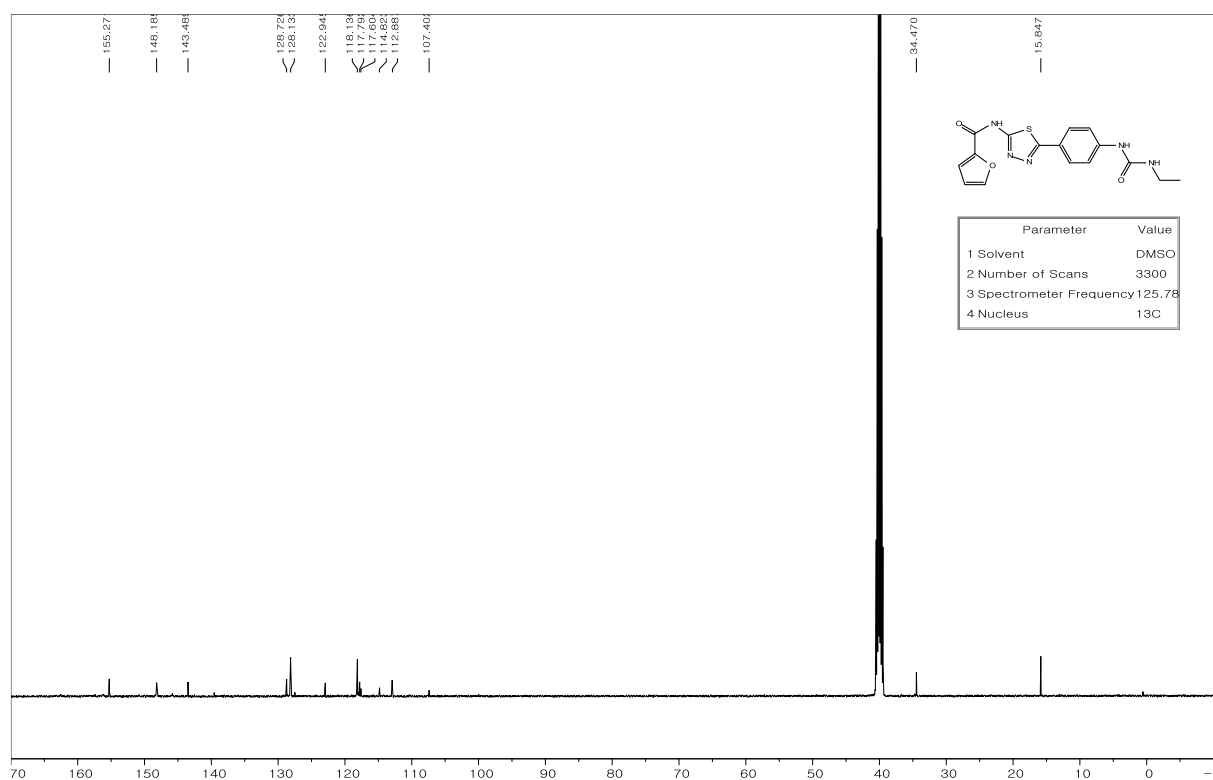
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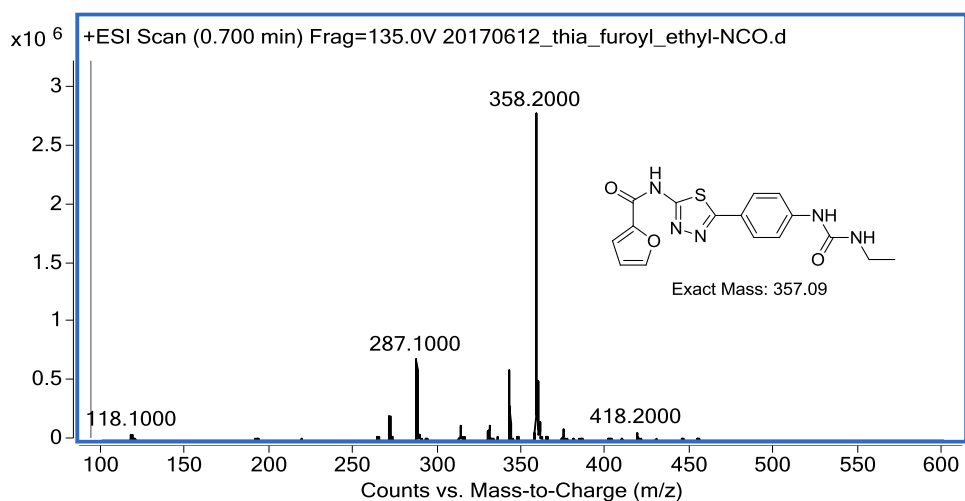
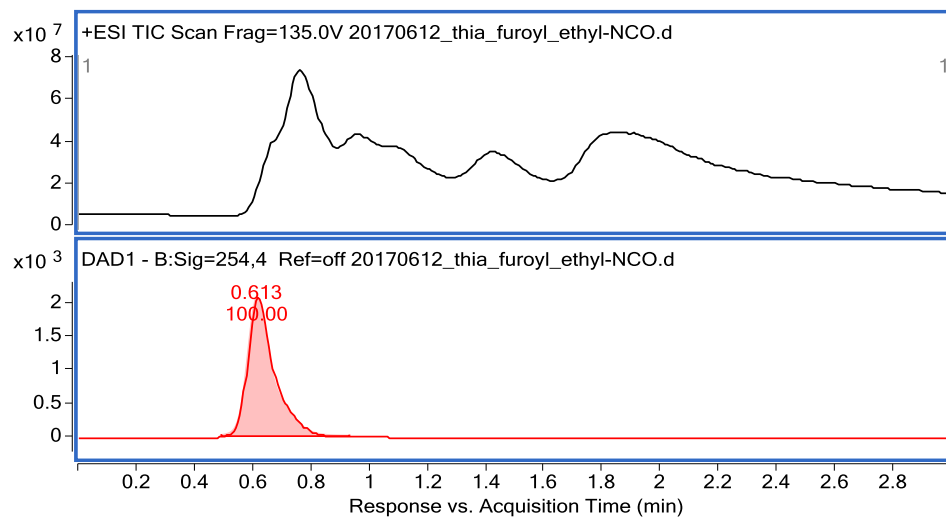
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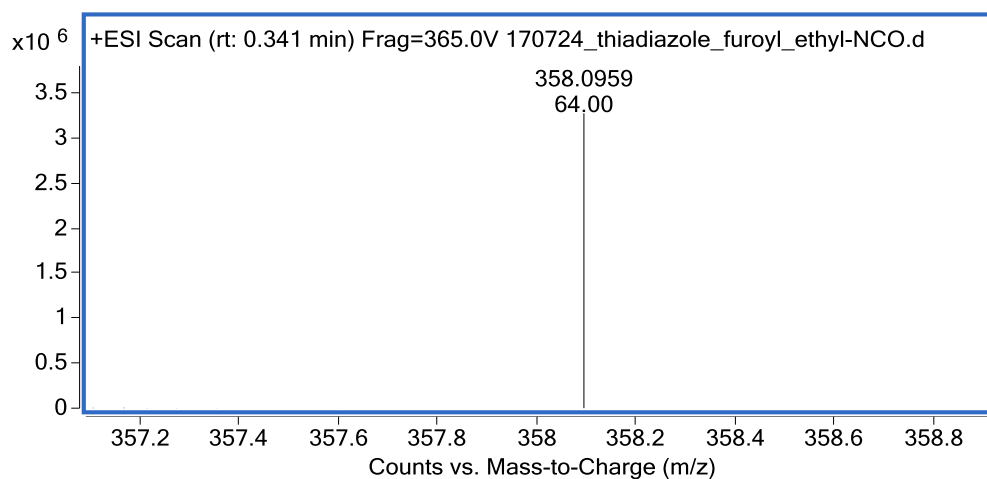
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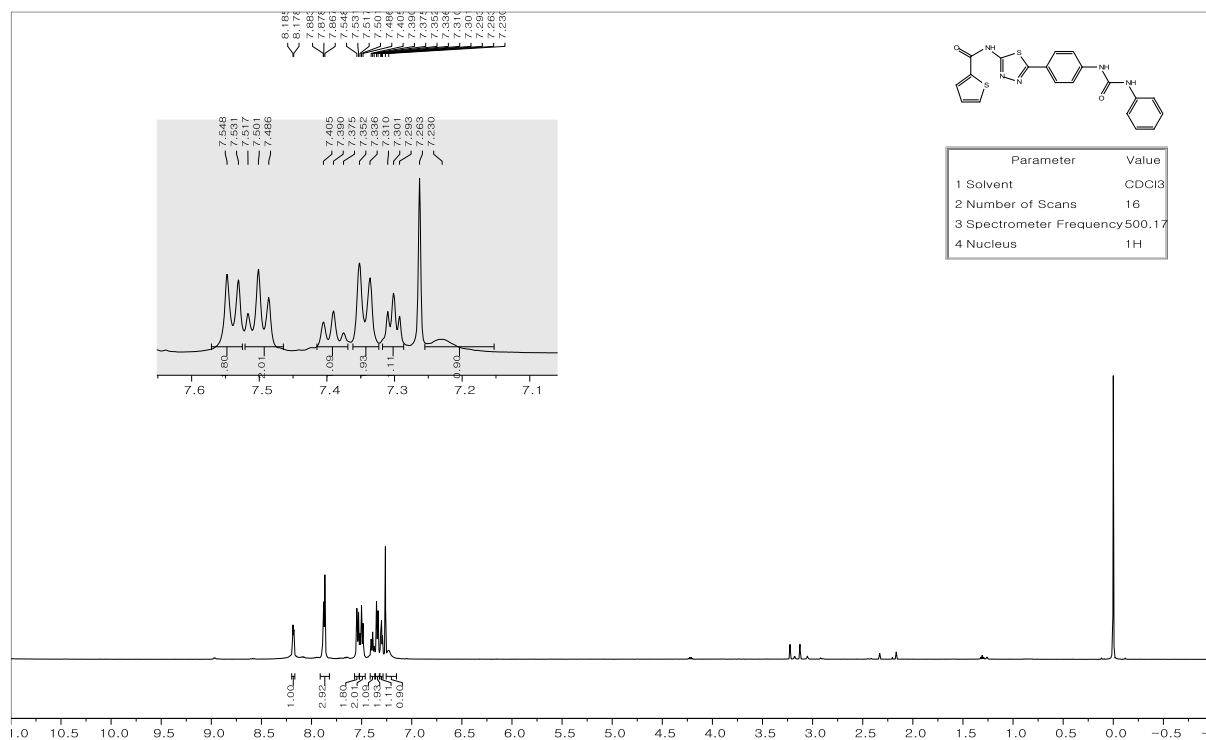
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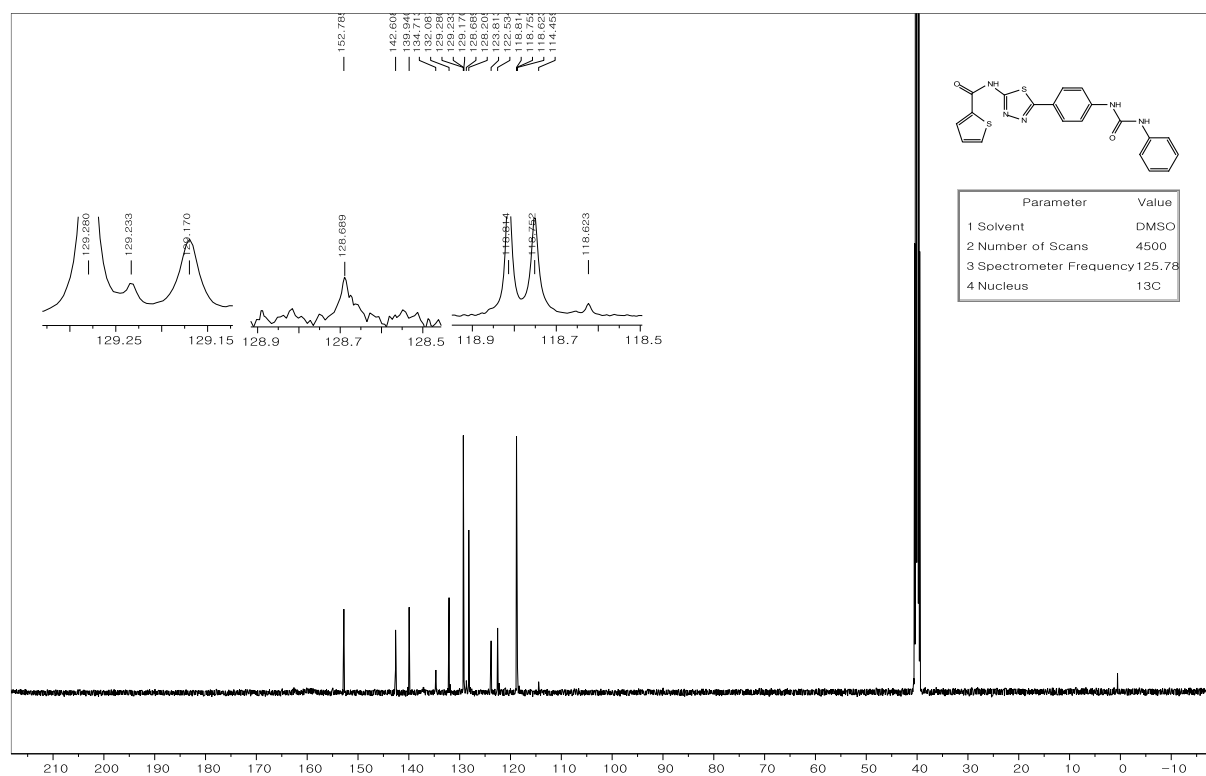
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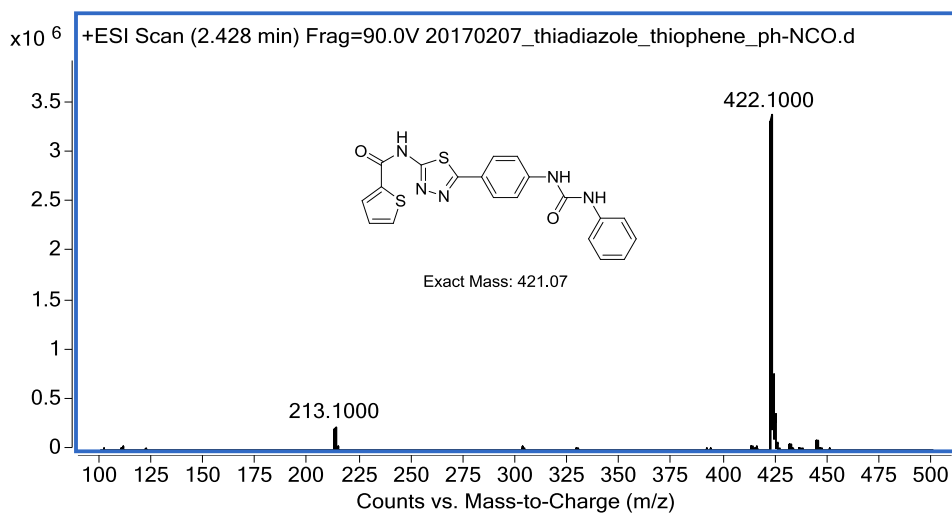
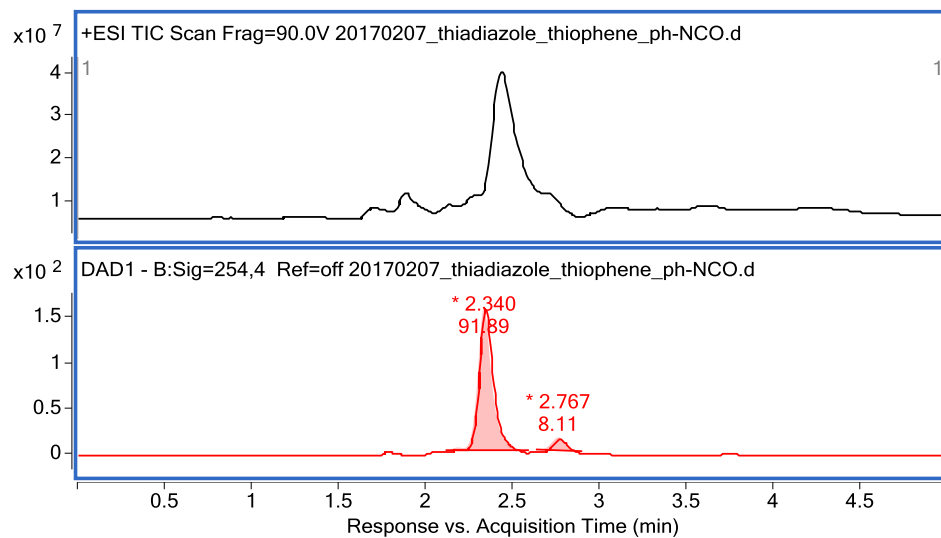
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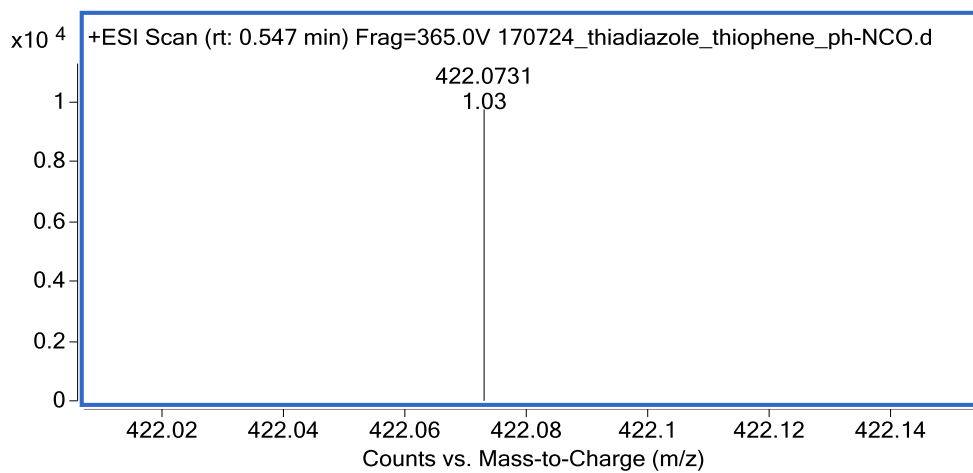
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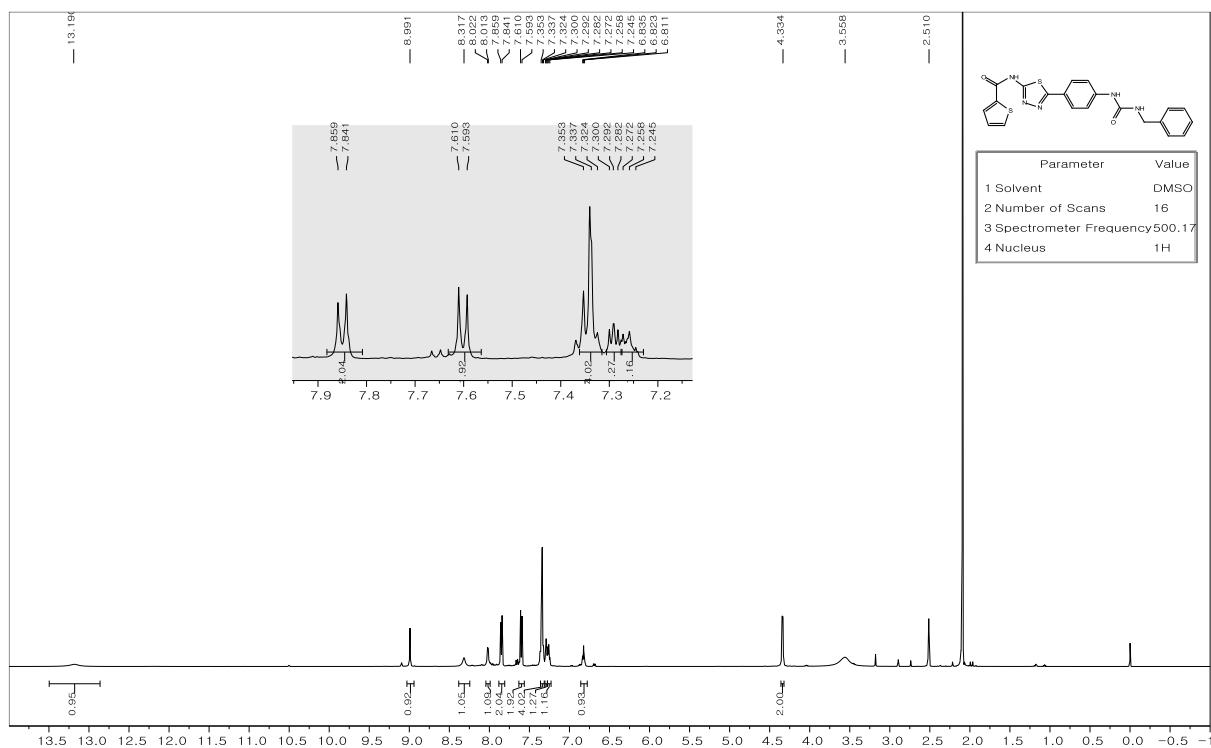
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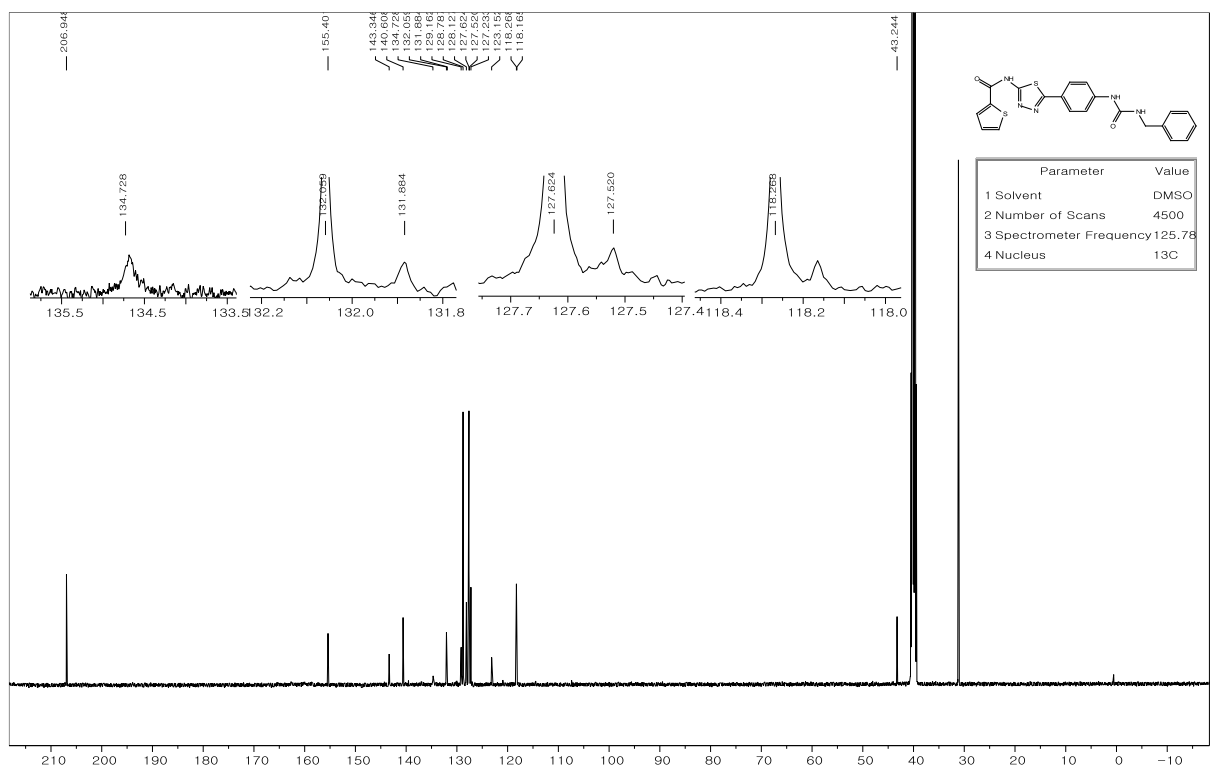
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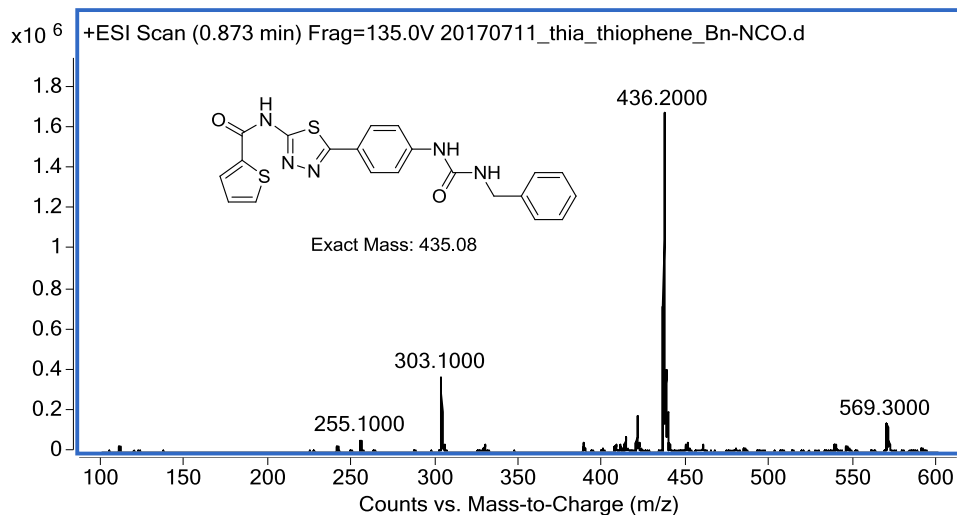
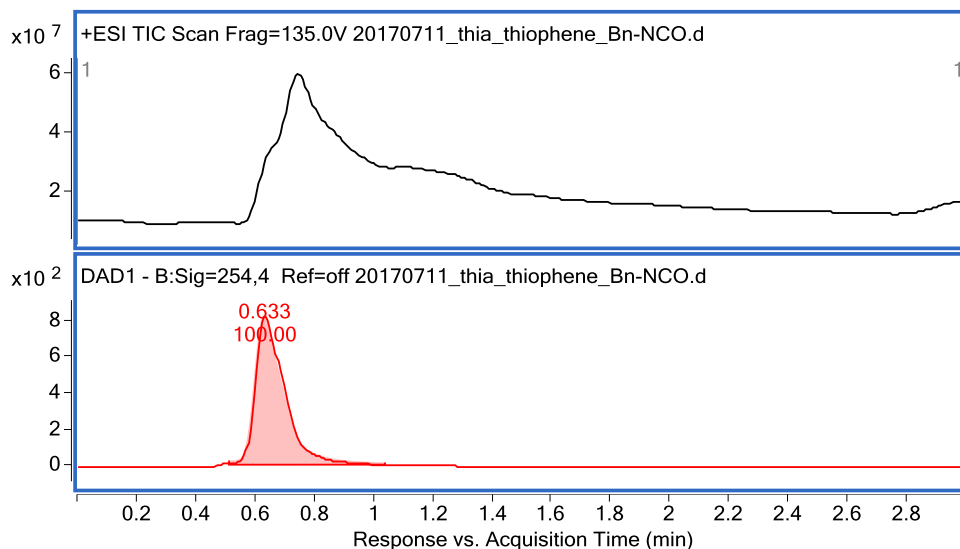
HR/MS – 13{3,1}



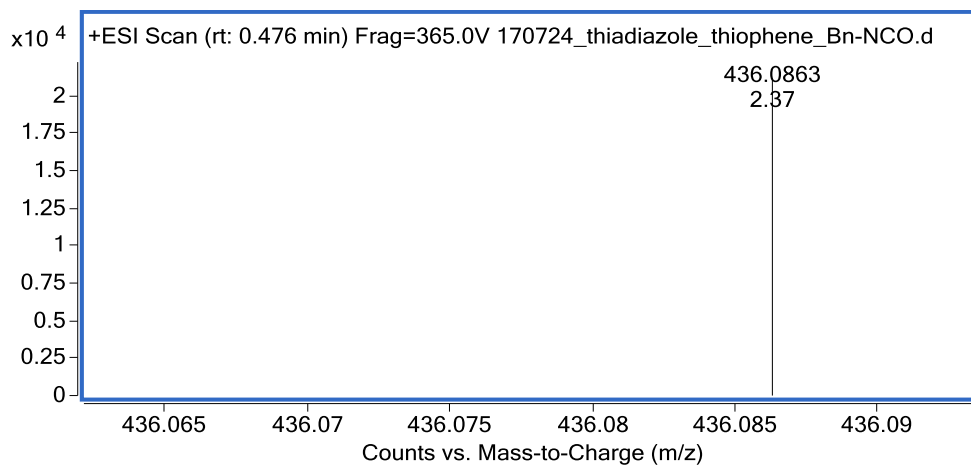
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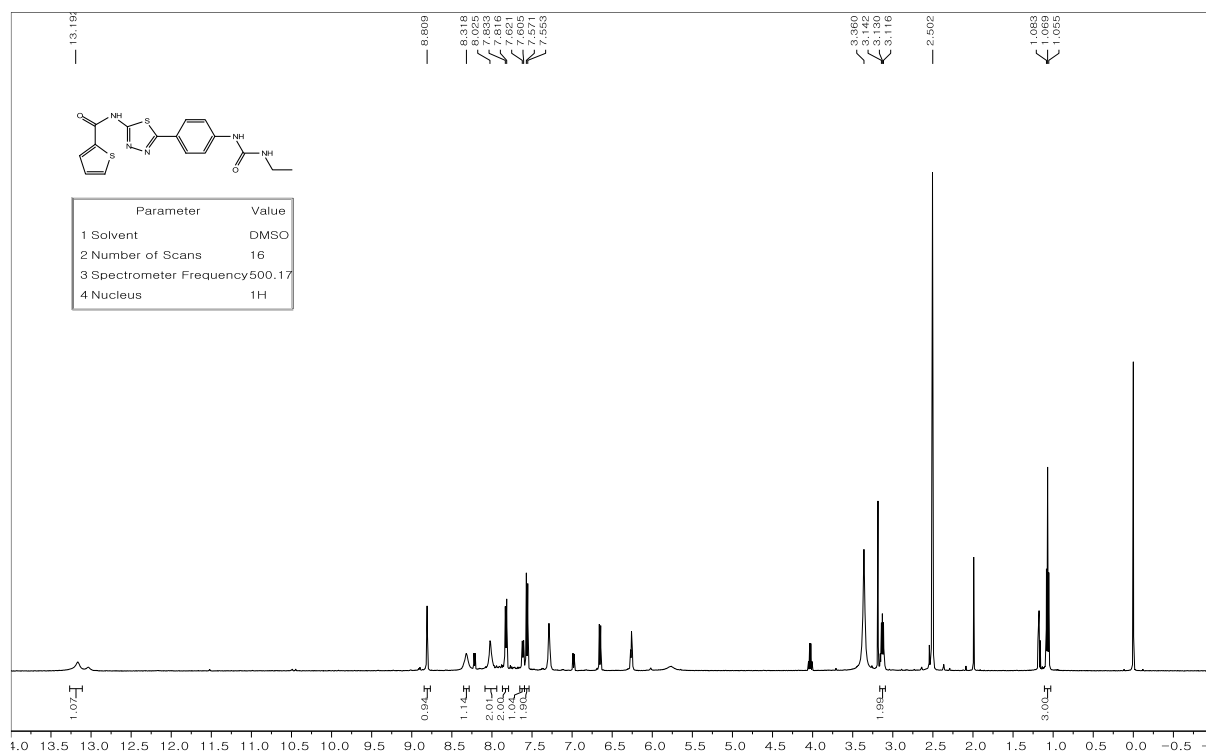
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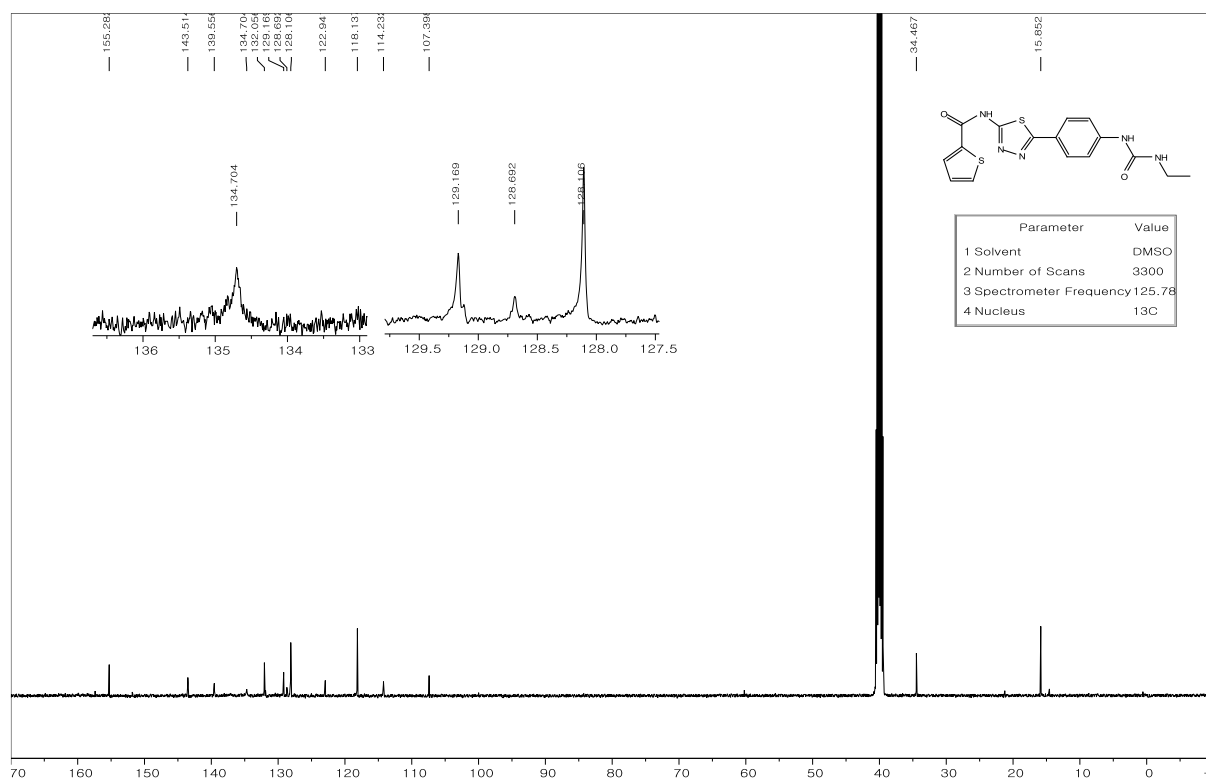
LC/MS – 13{3,2}



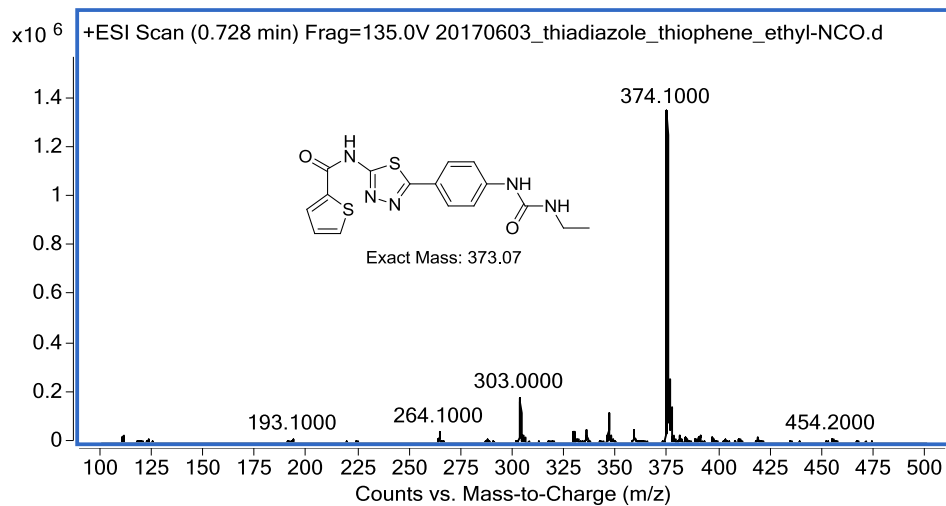
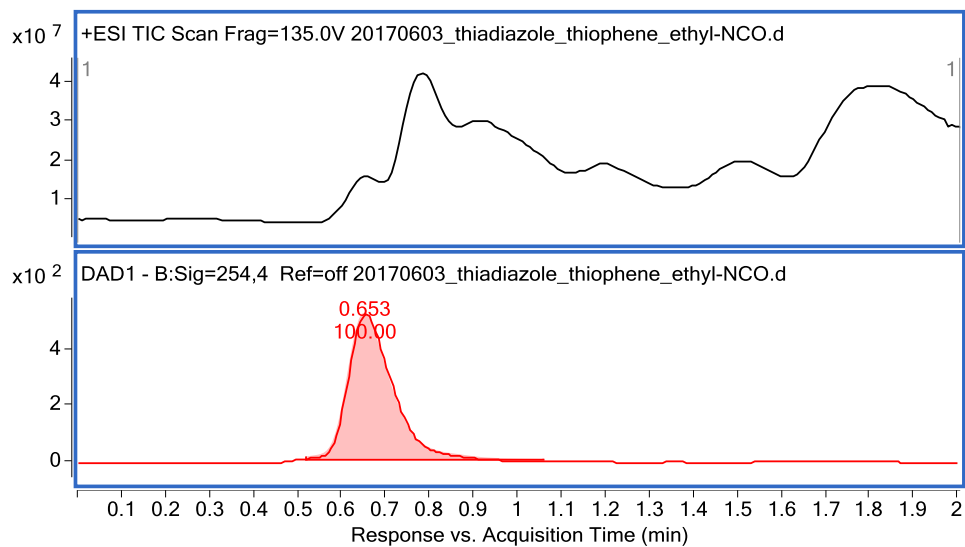
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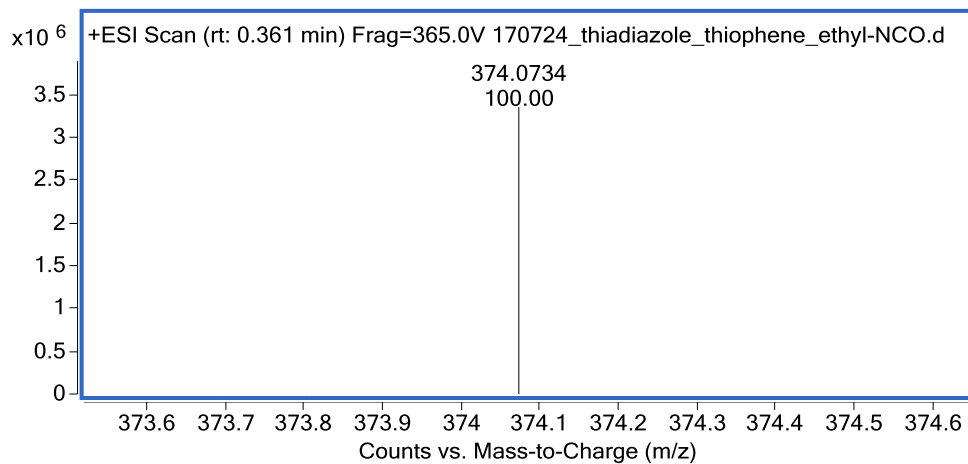
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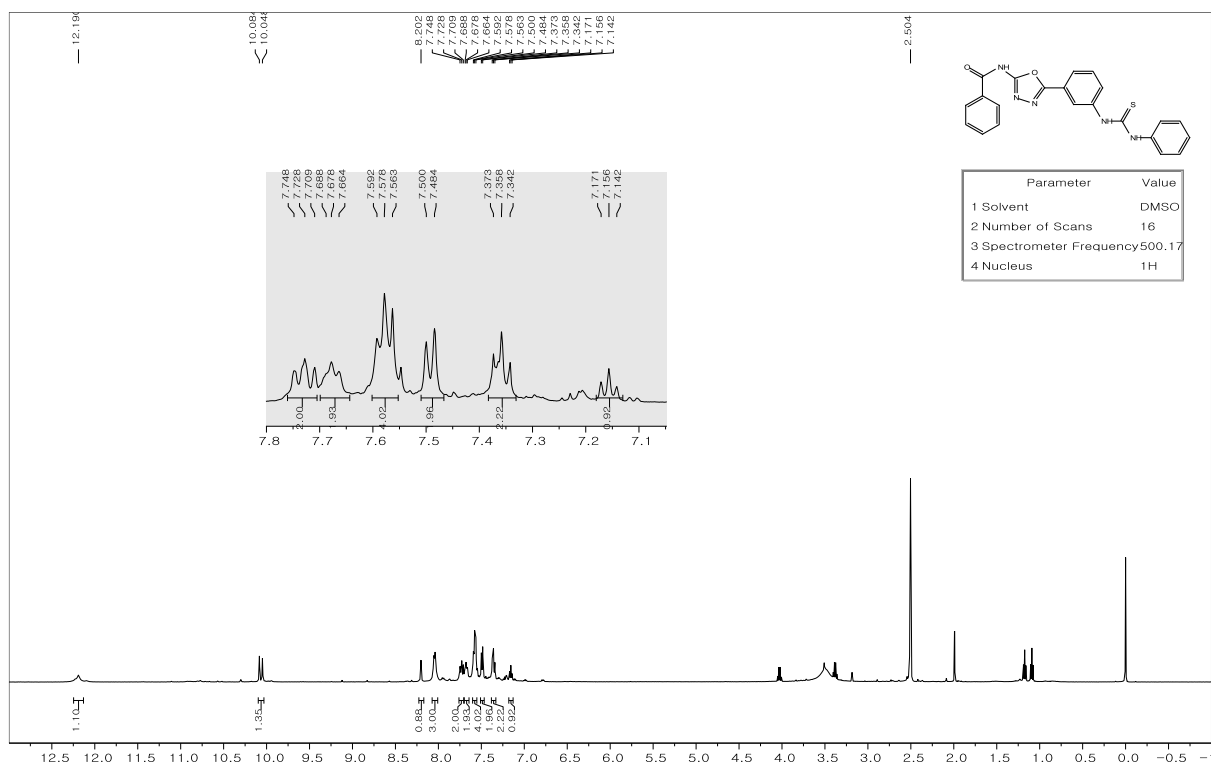
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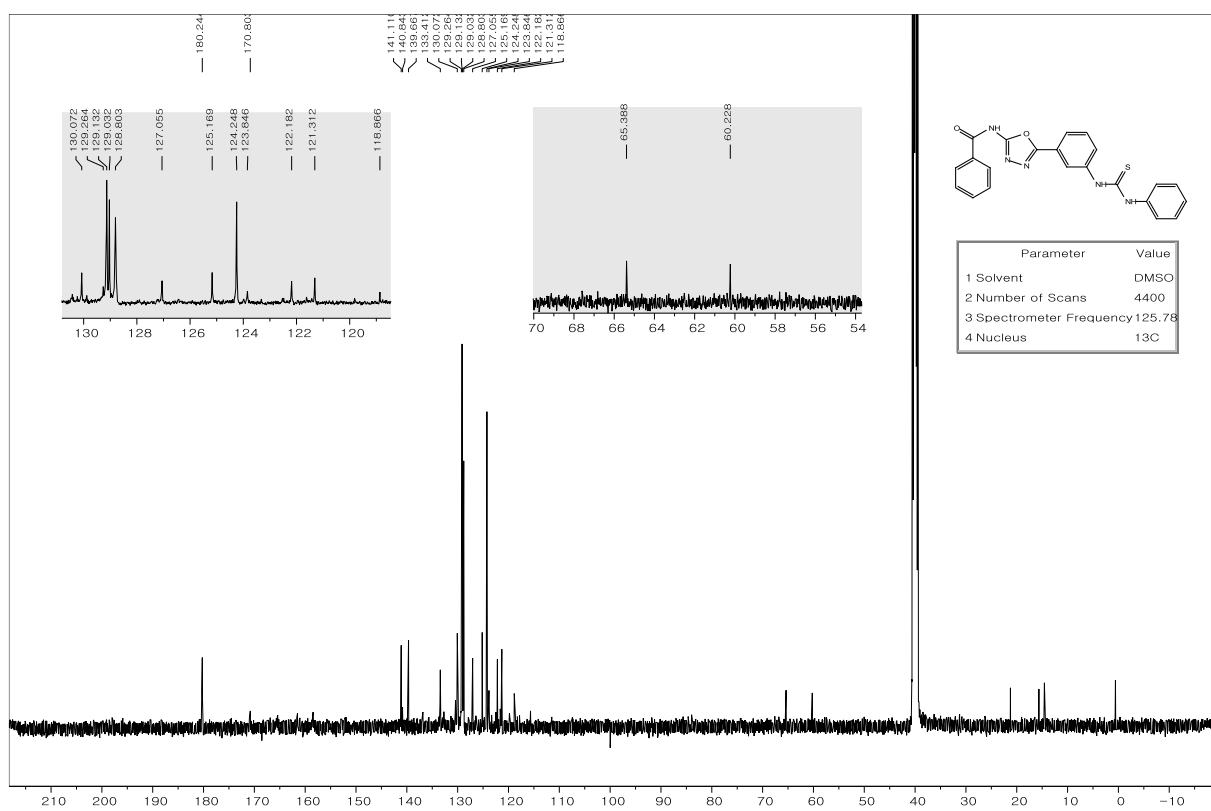
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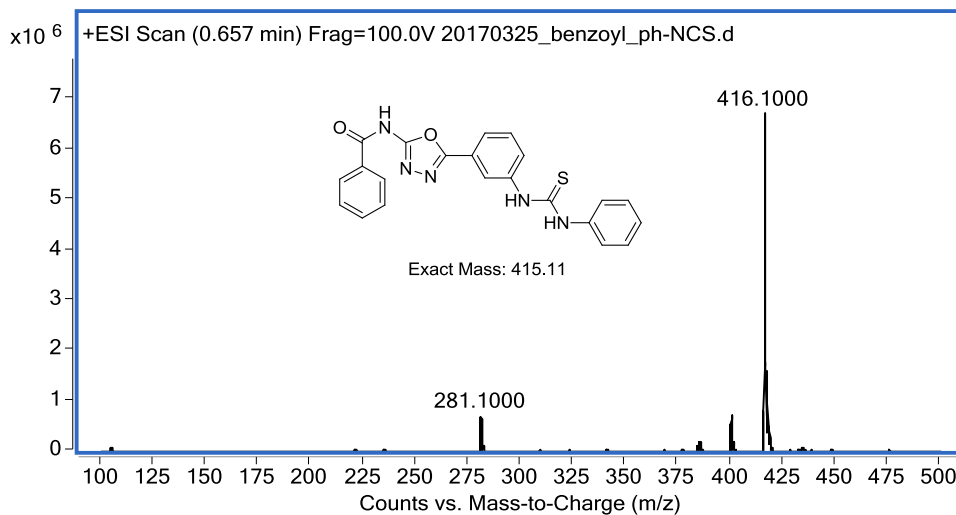
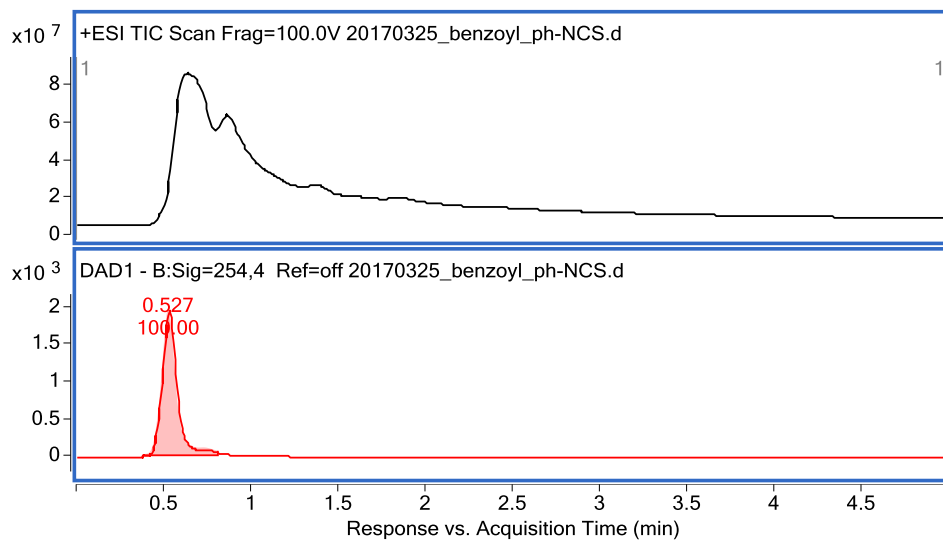
HR/MS – 13{3,3}



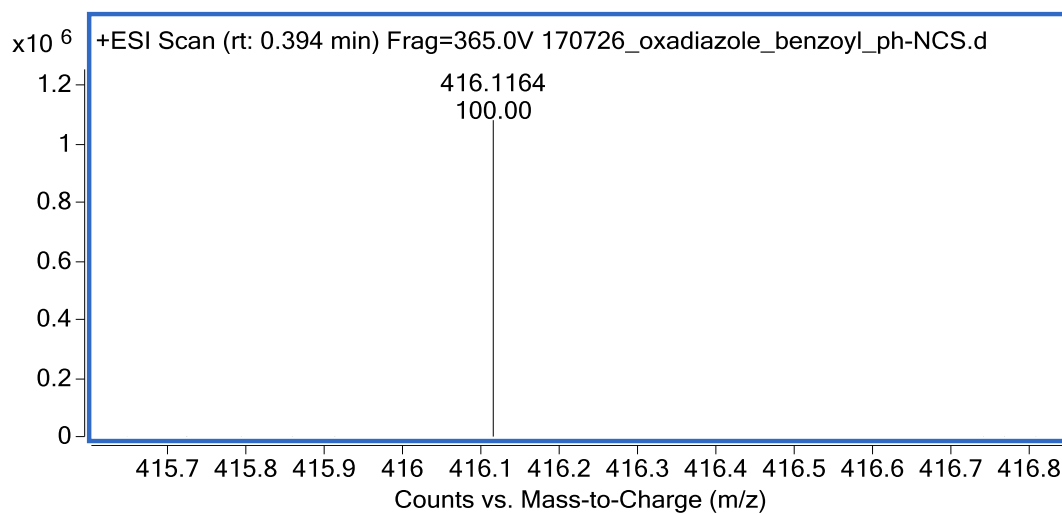
¹H NMR – 14{1,1}



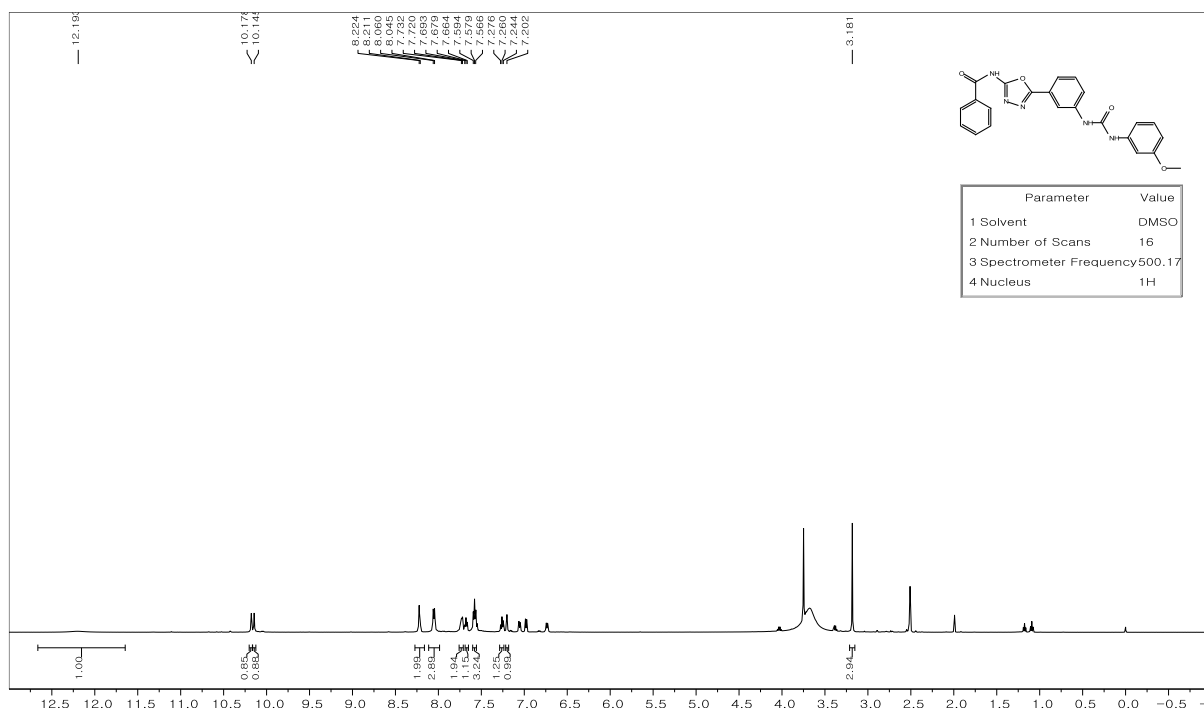
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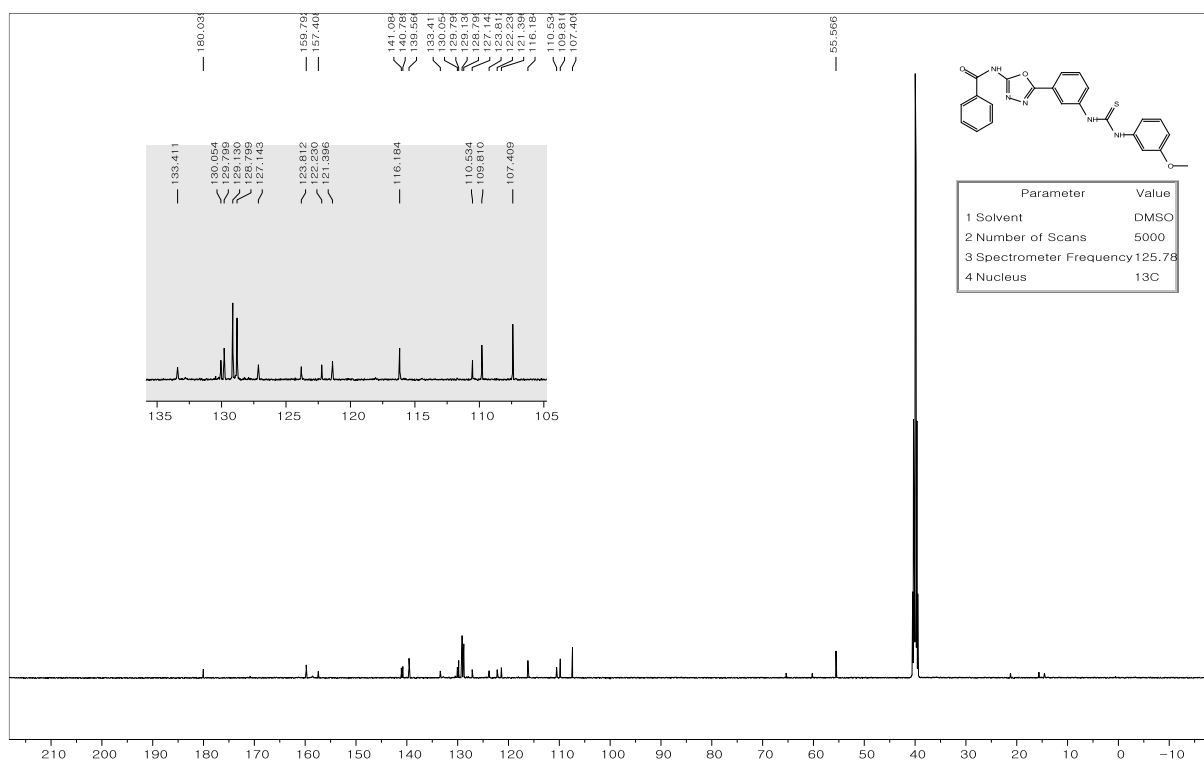
LC/MS – 14{1,1}



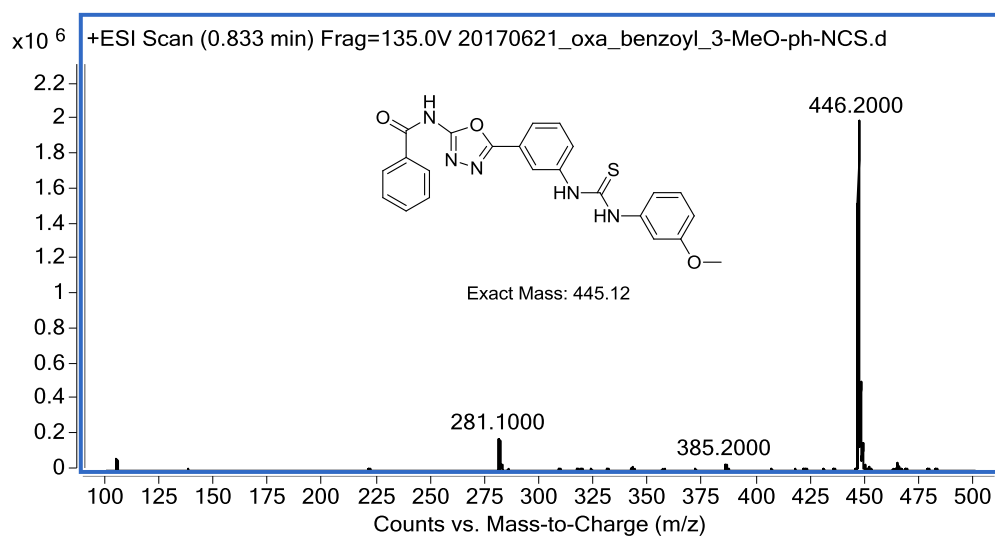
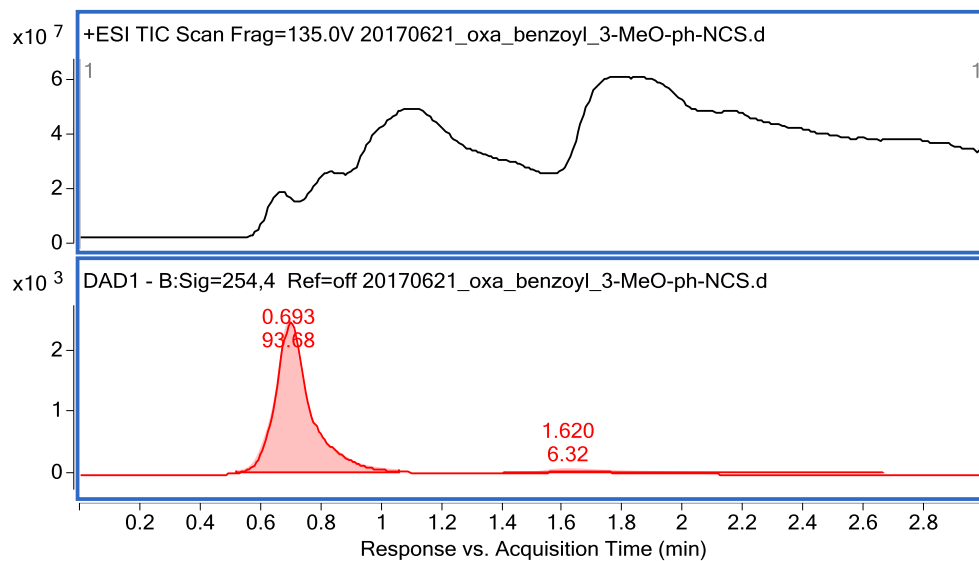
HR/MS – 14{1,1}



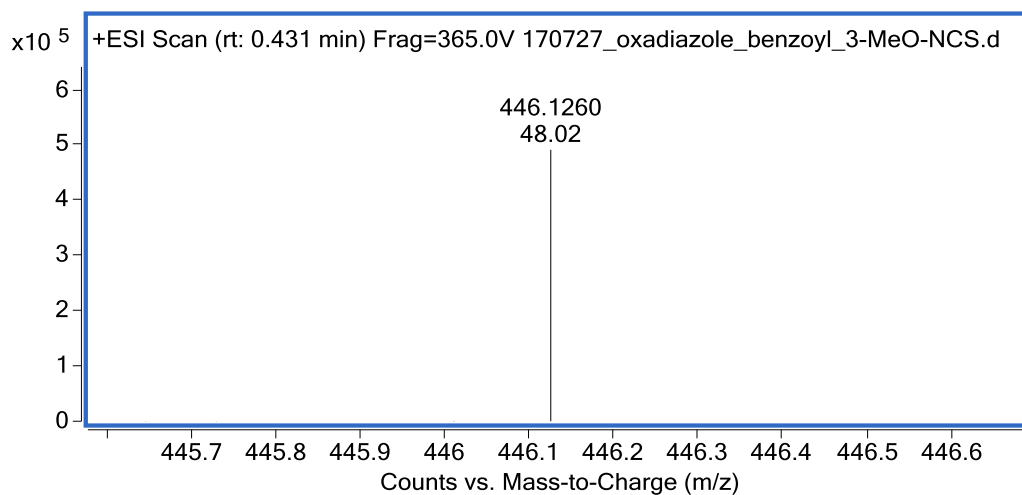
¹H NMR – 14{1,2}



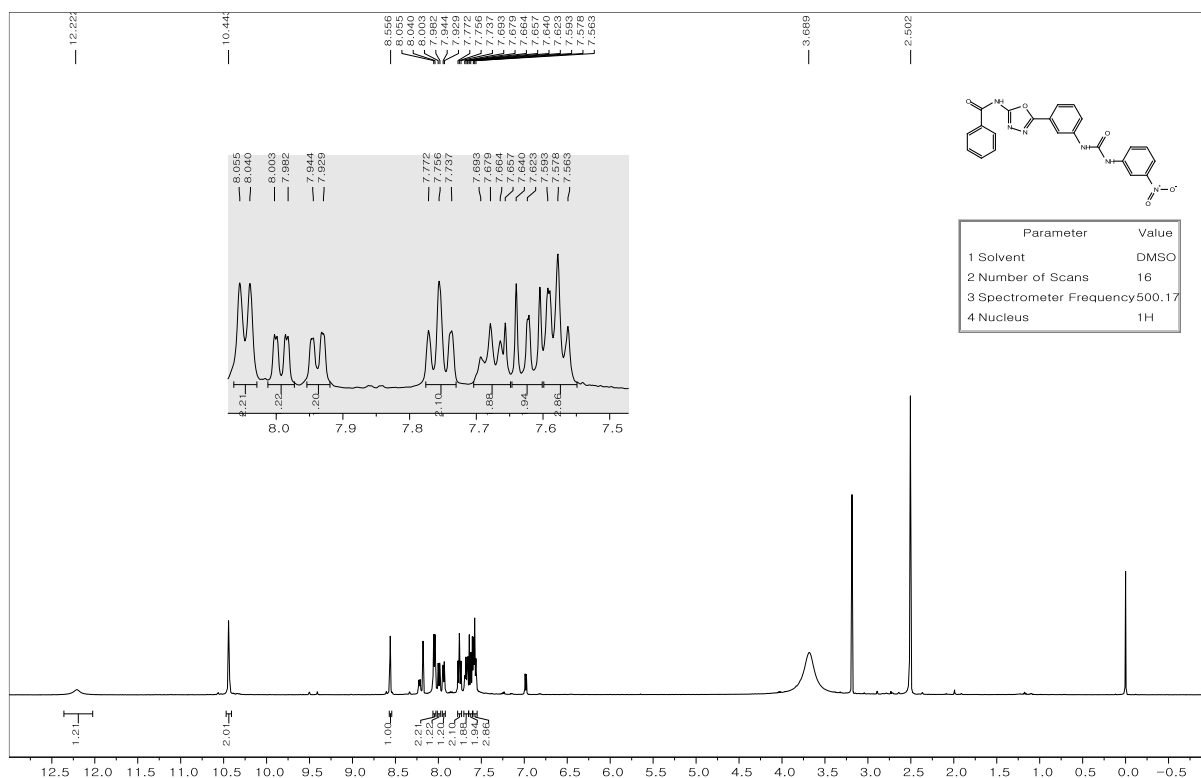
¹³C NMR – 14{1,2}



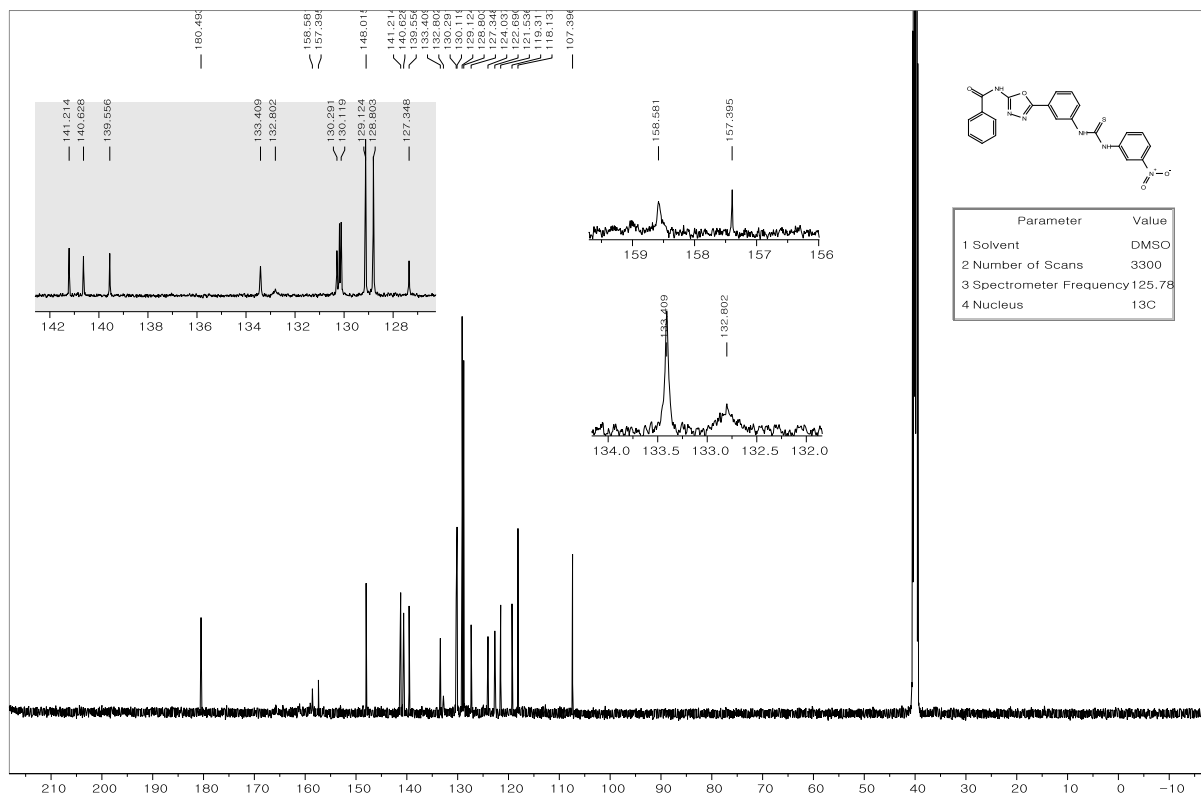
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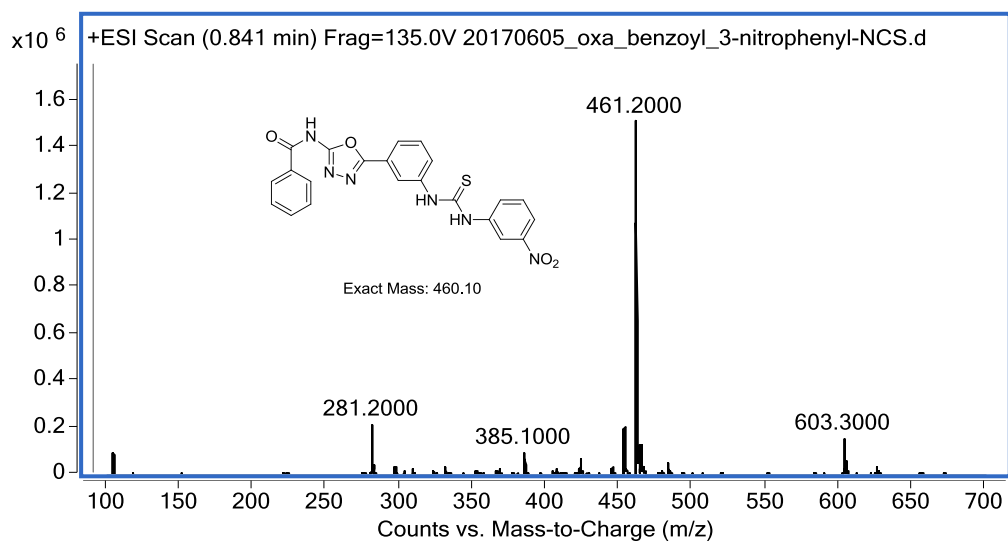
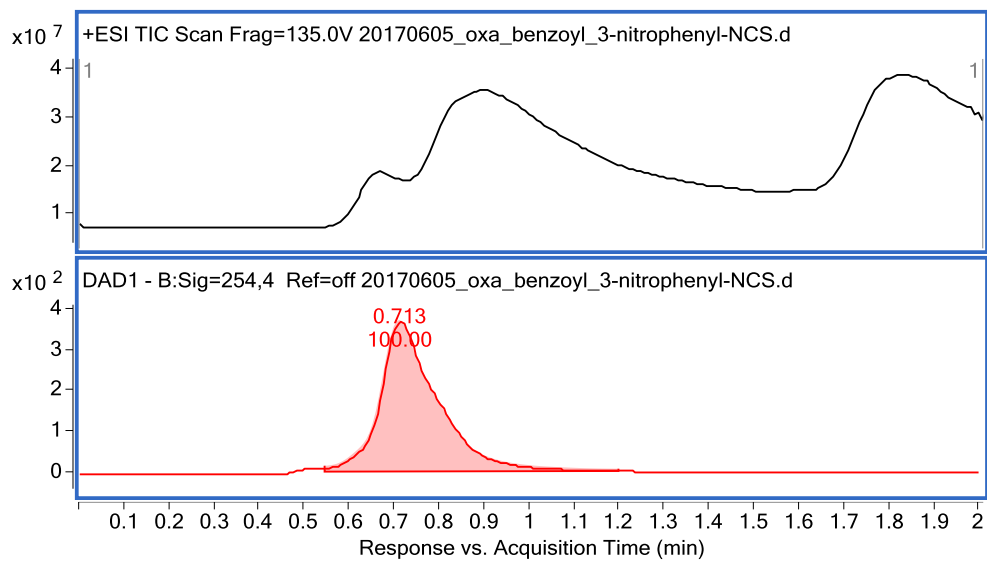
HR/MS – 14{1,2}



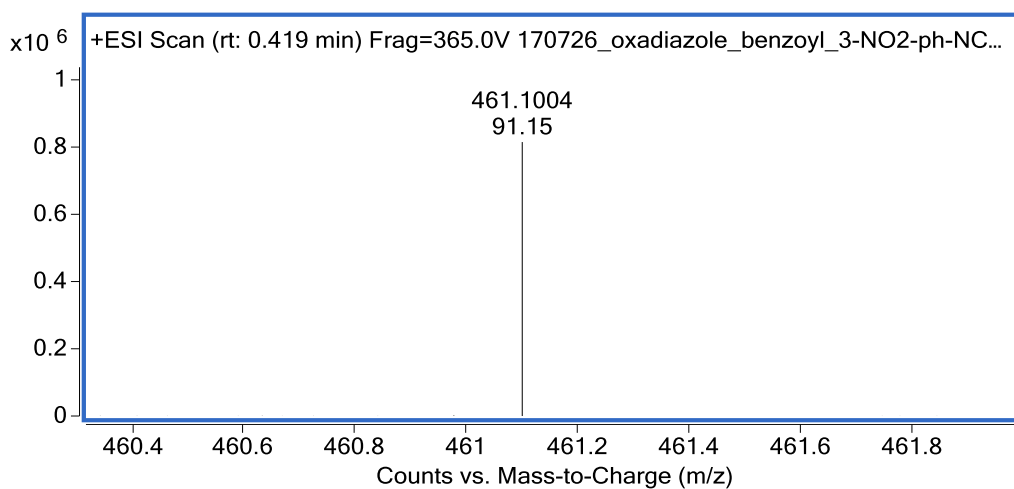
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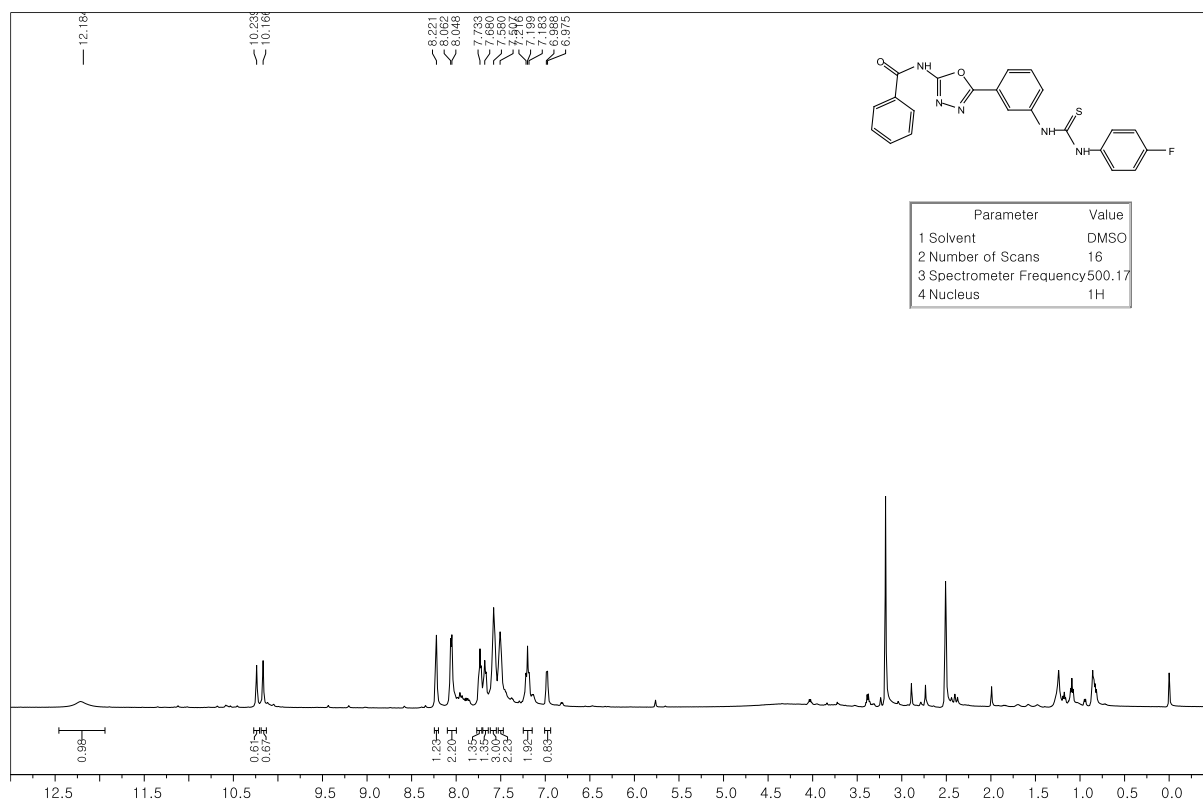
¹³C NMR – 14{1,3}



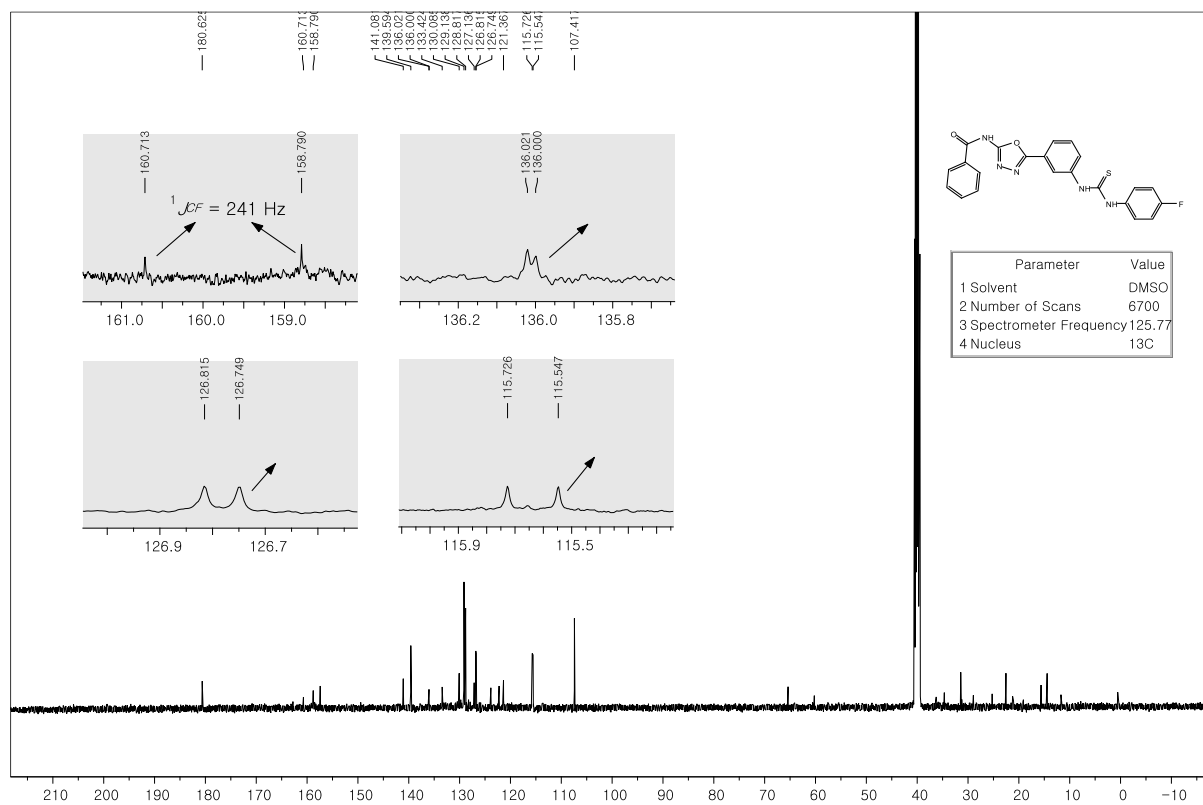
LC/MS – 14{1,3}



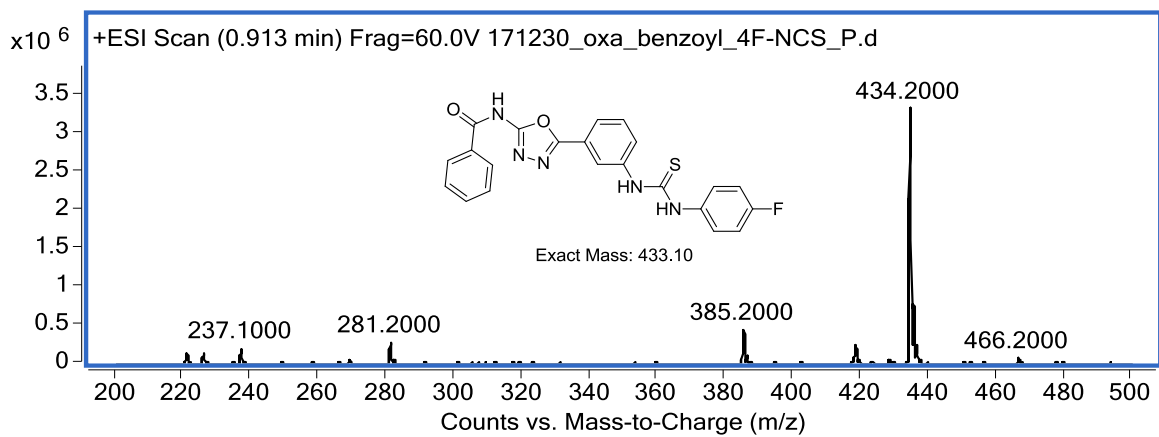
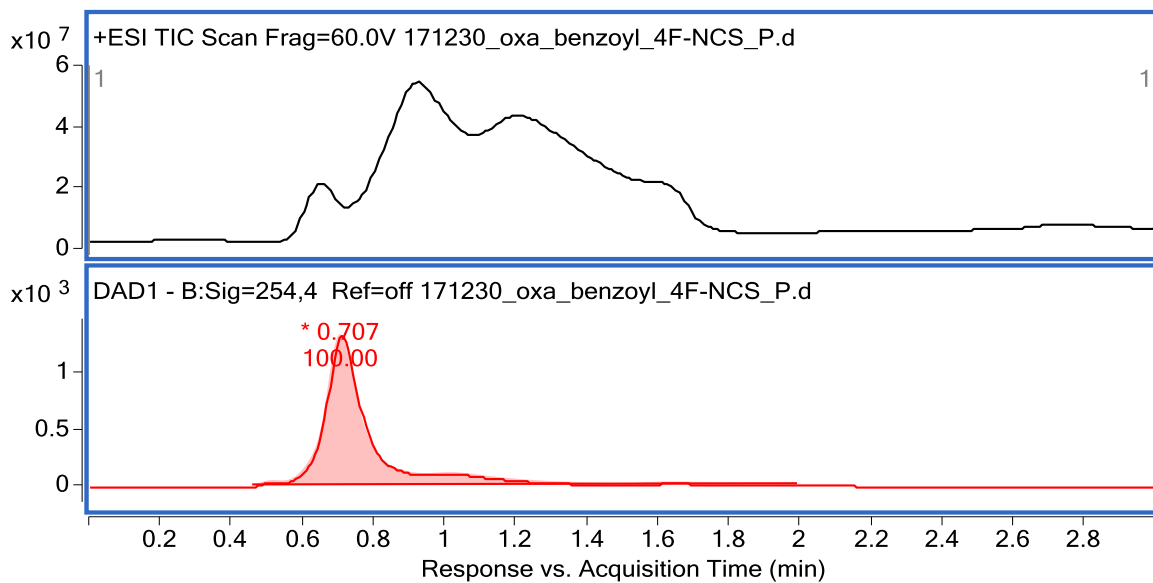
HR/MS – 14{1,3}



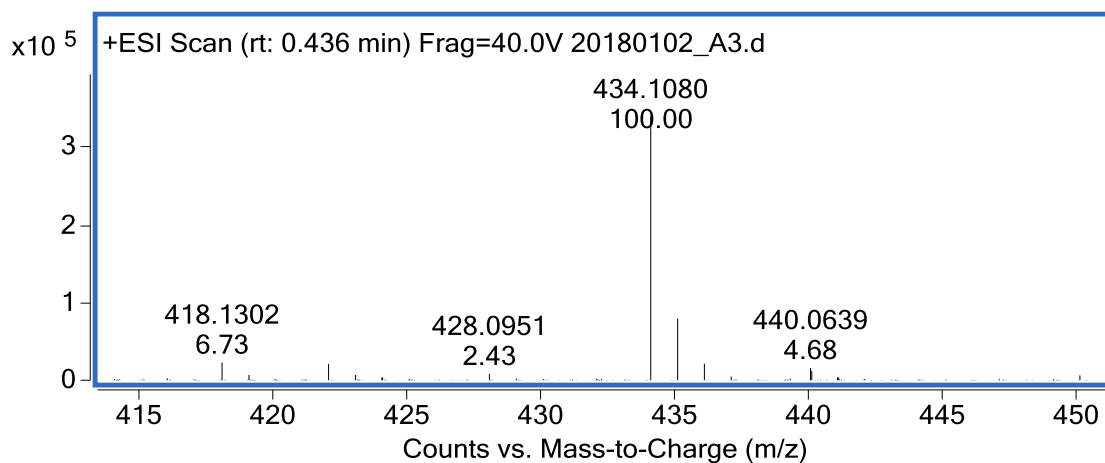
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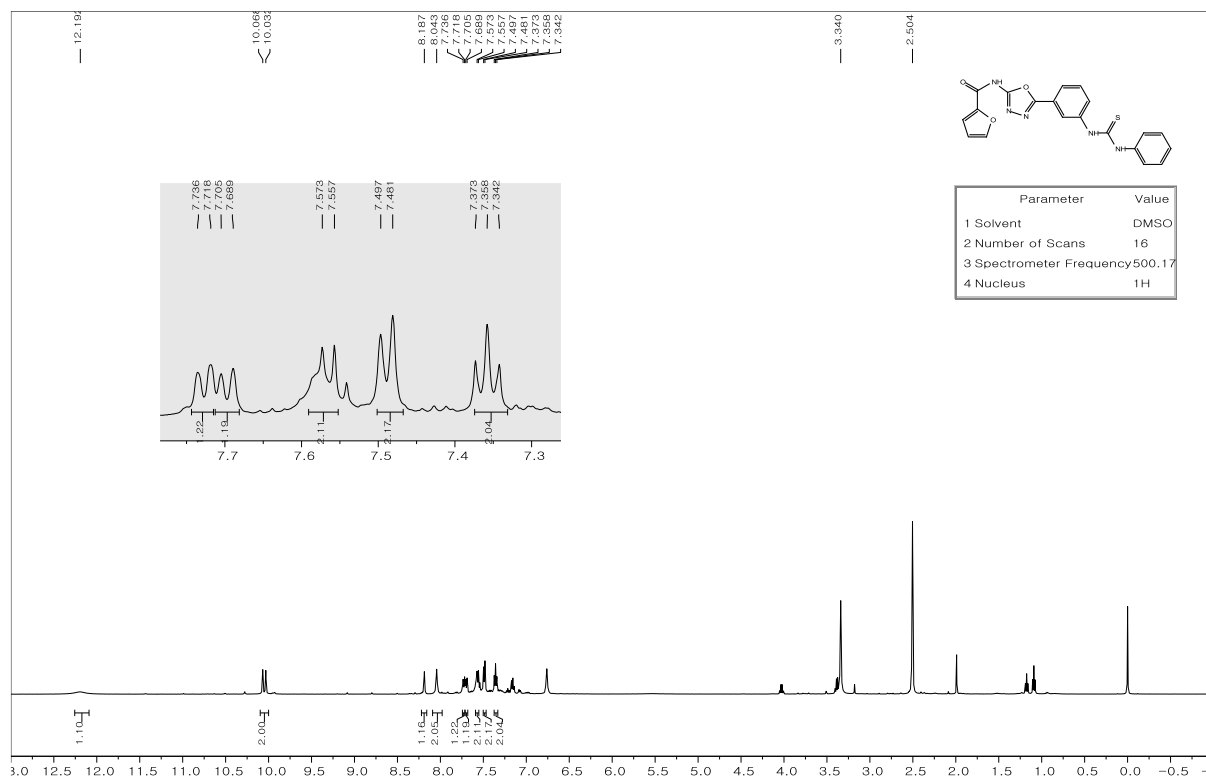
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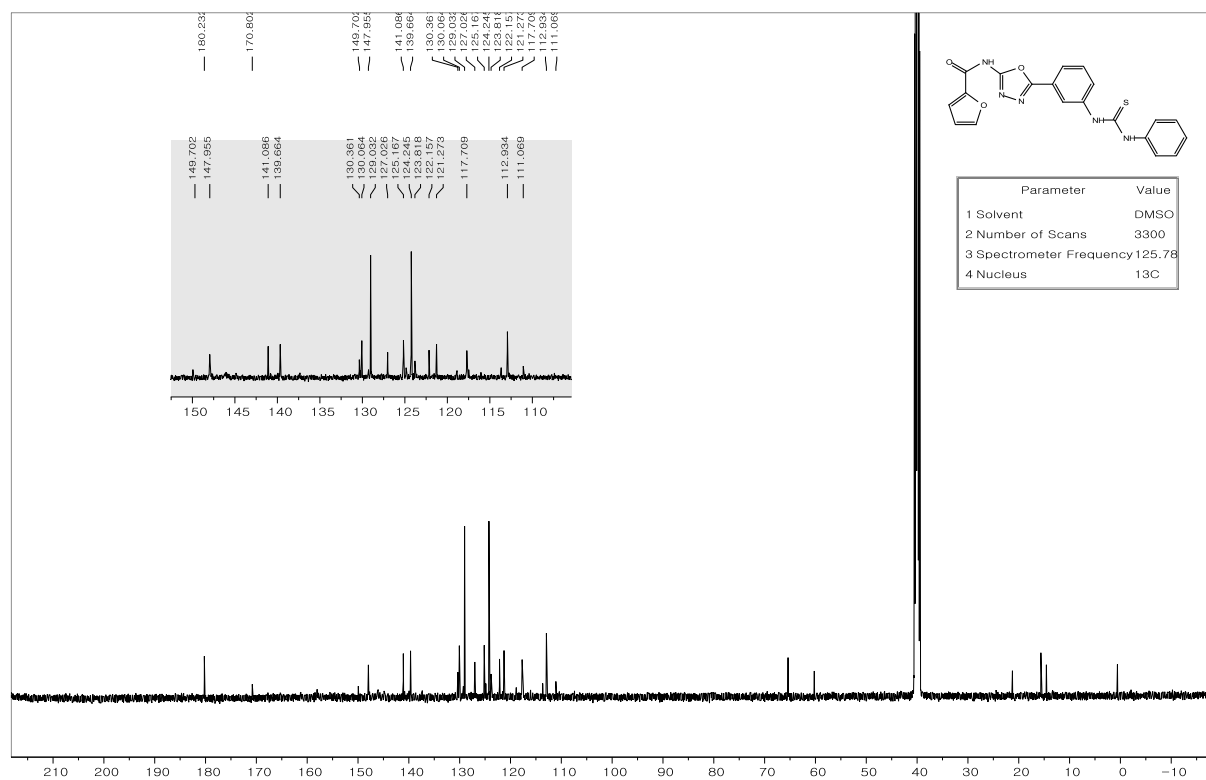
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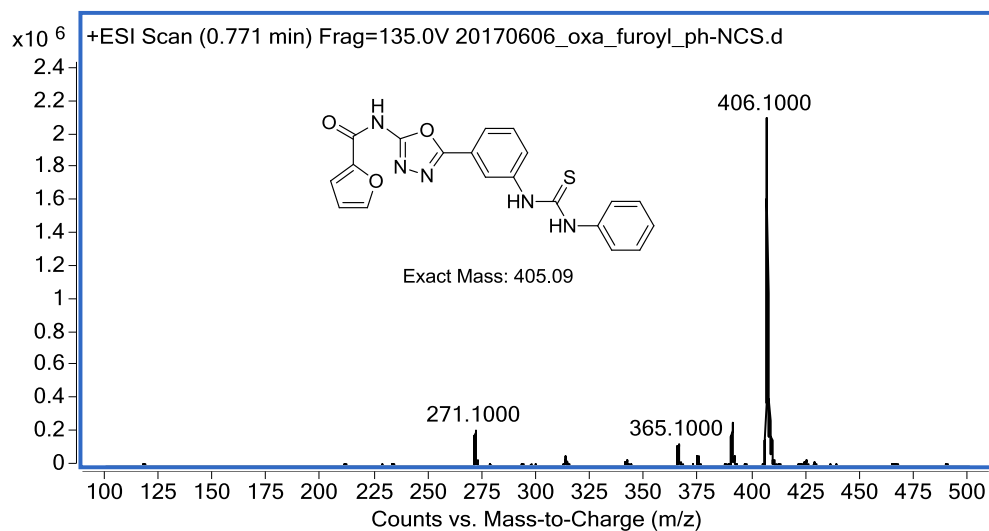
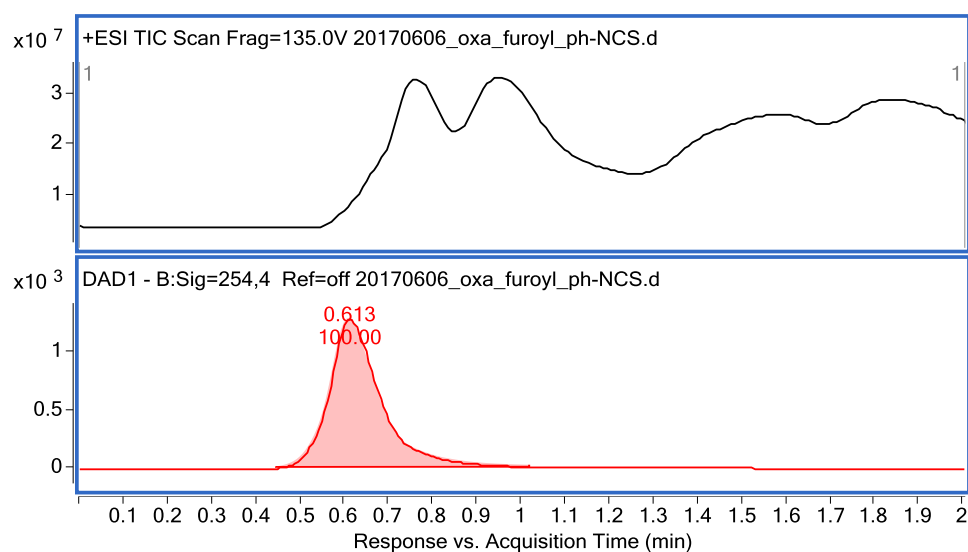
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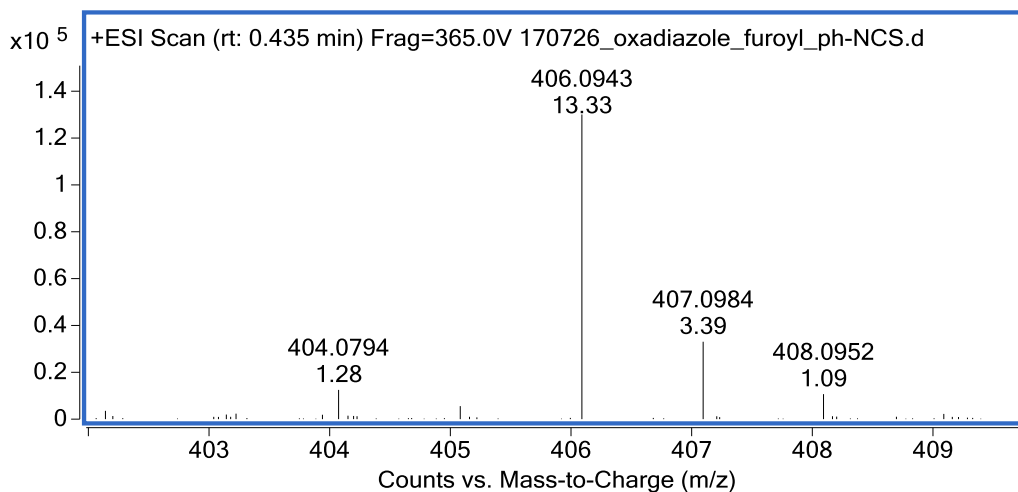
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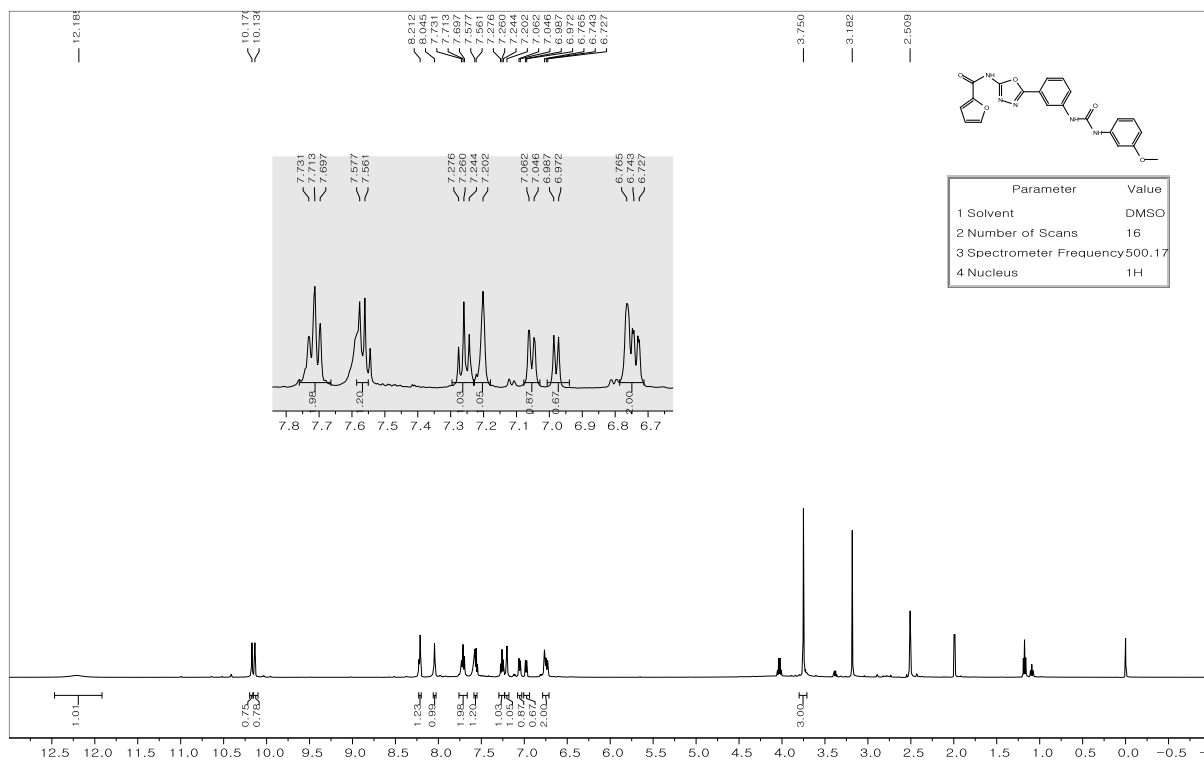
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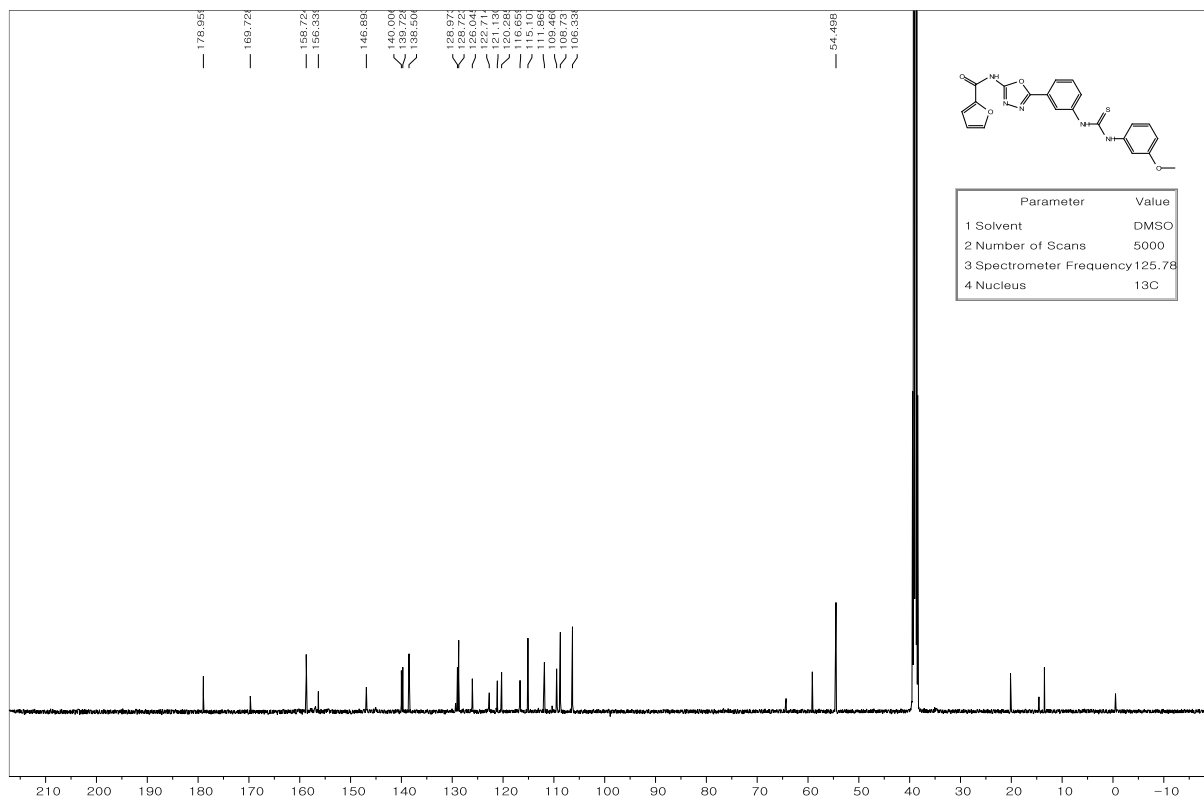
LC/MS – 14{2,1}



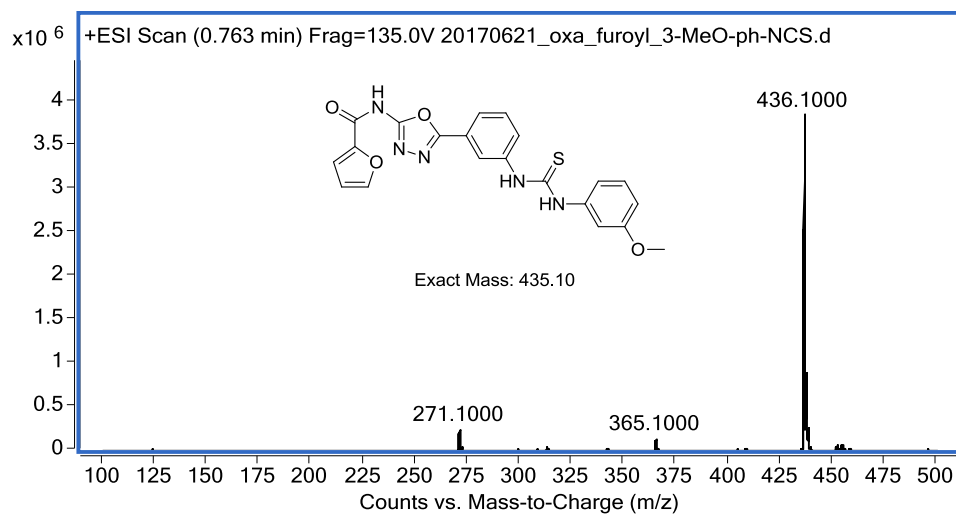
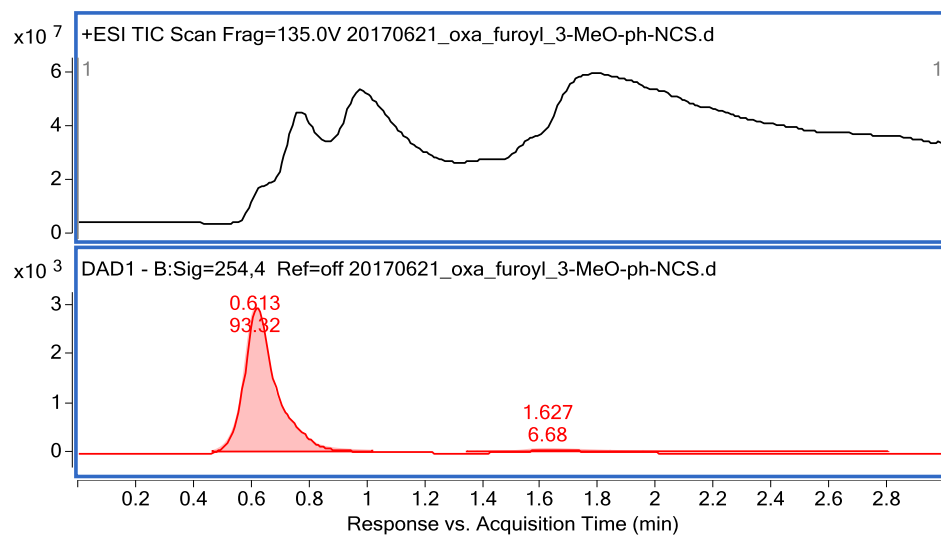
HR/MS – 14{2,1}



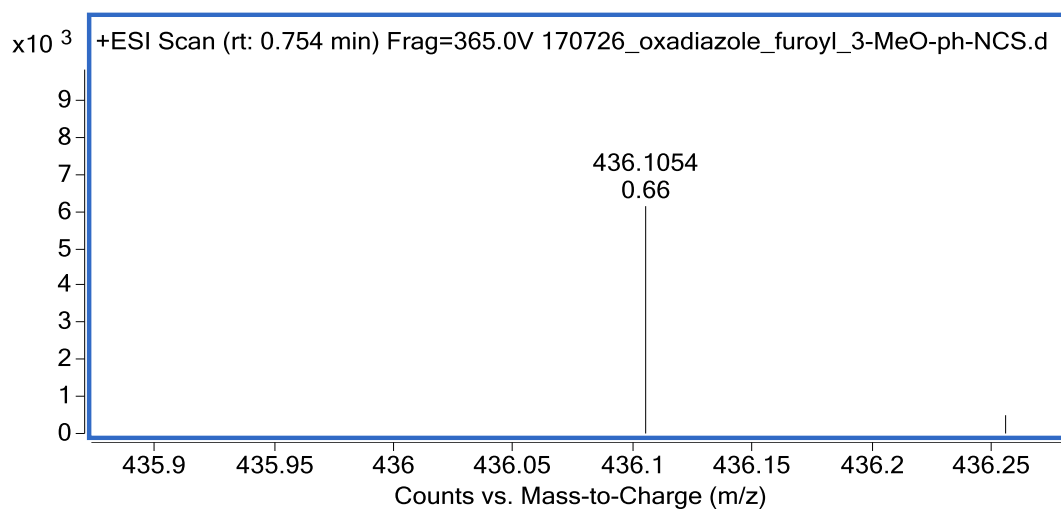
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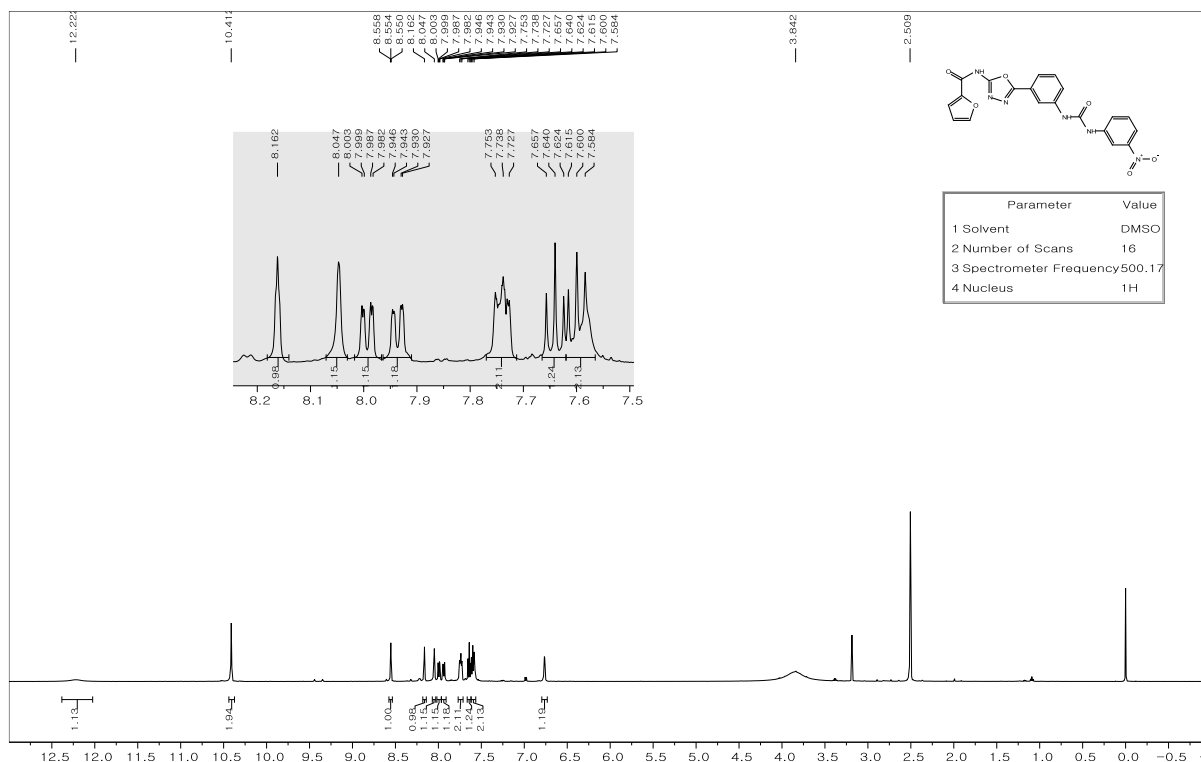
¹³C NMR – 14{2,2}



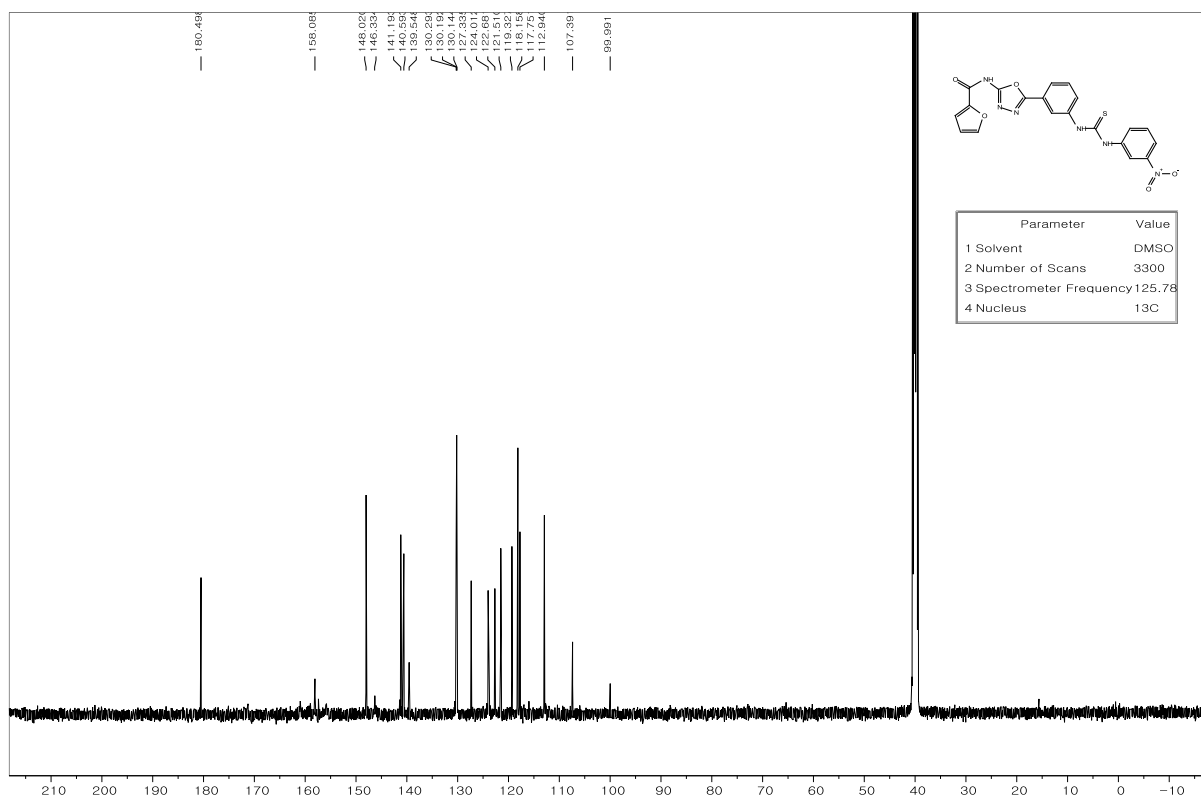
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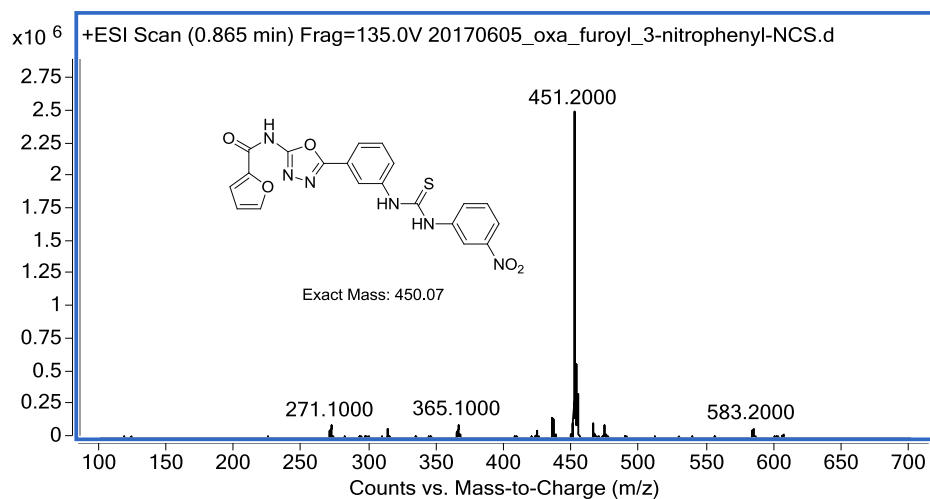
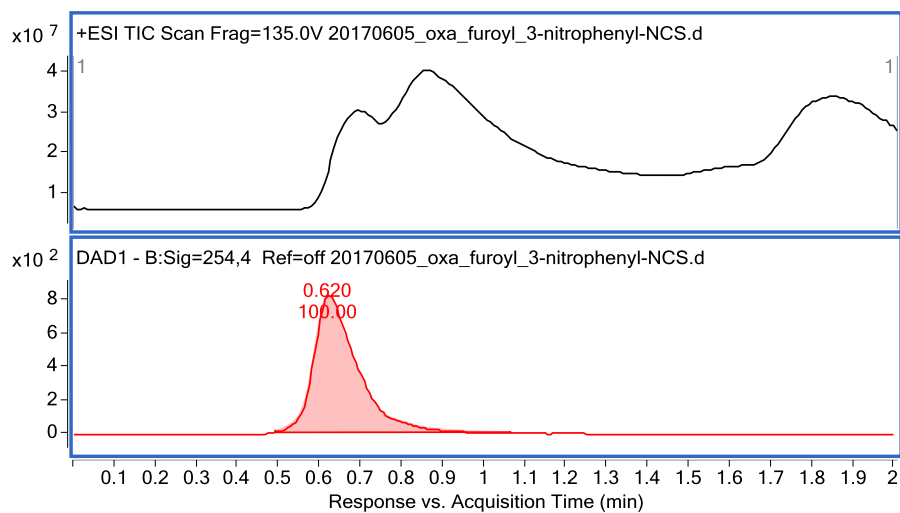
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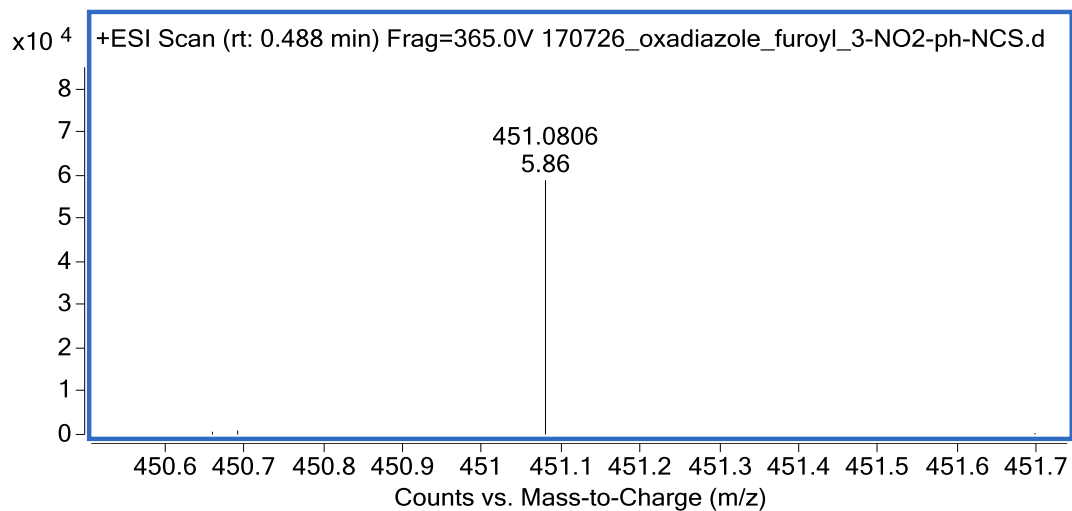
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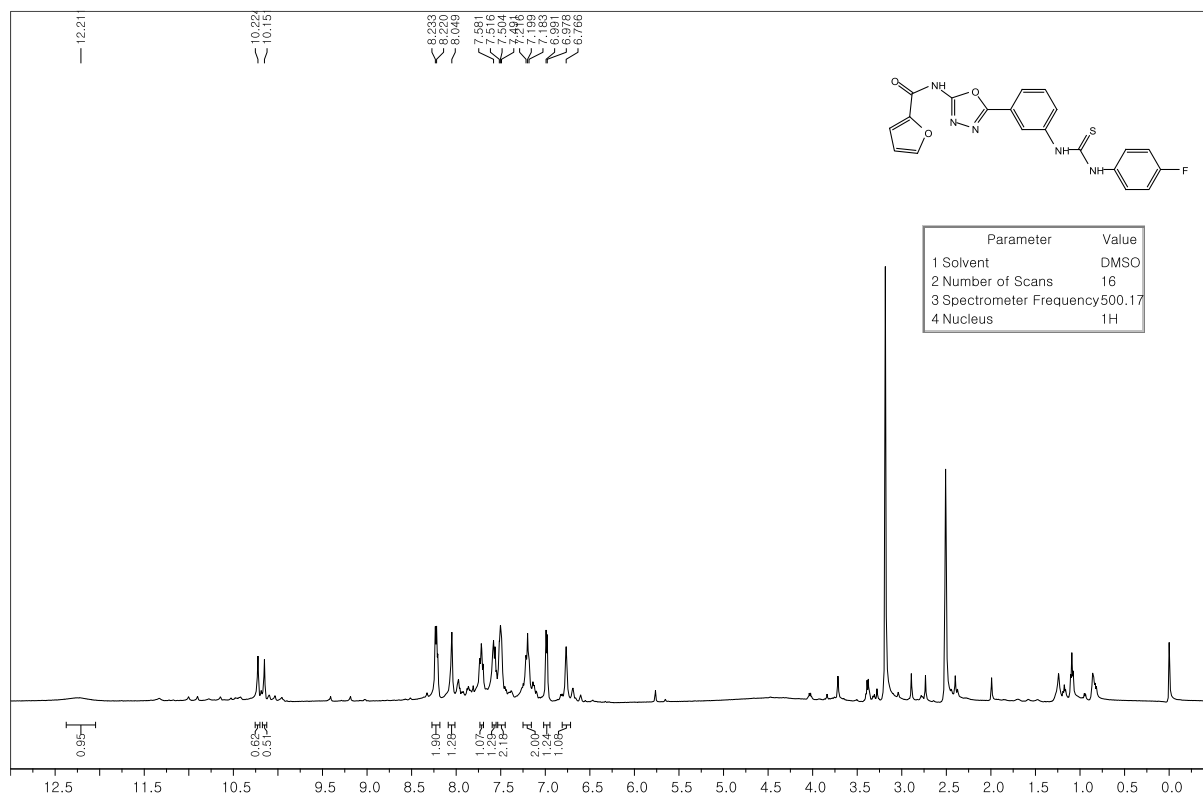
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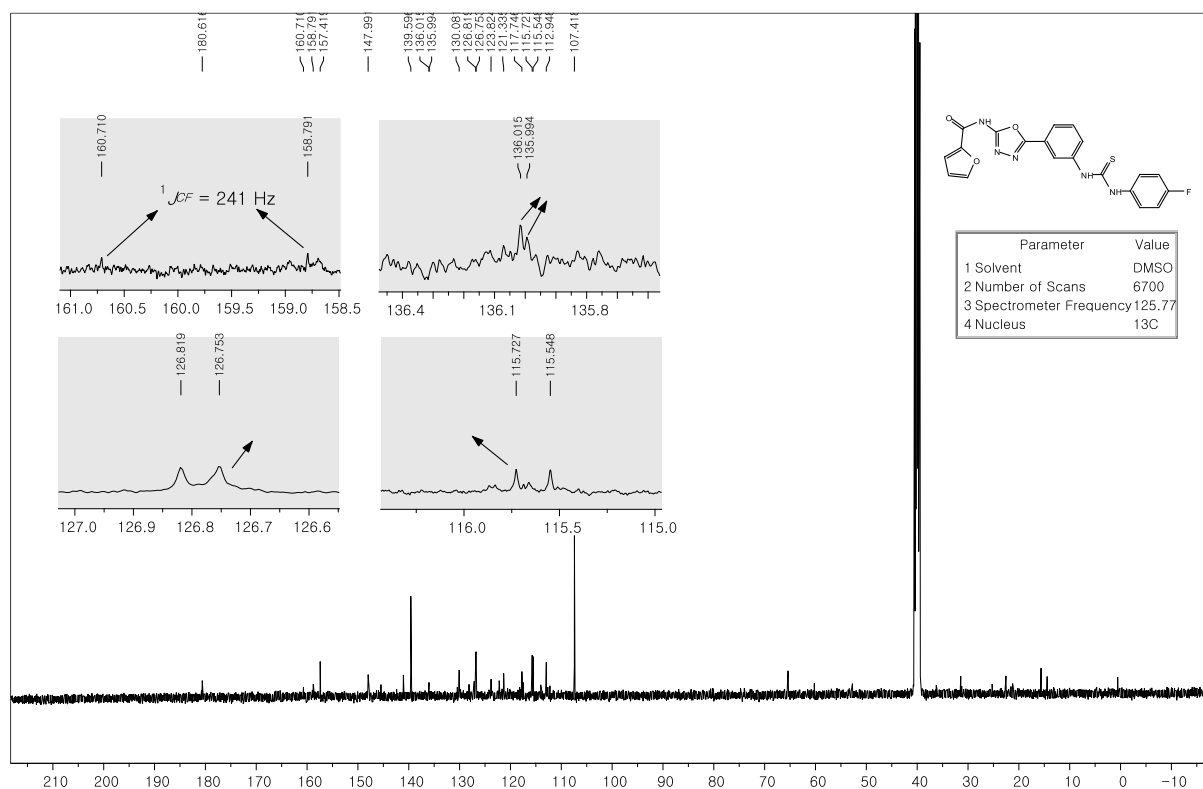
LC/MS – 14{2,3}



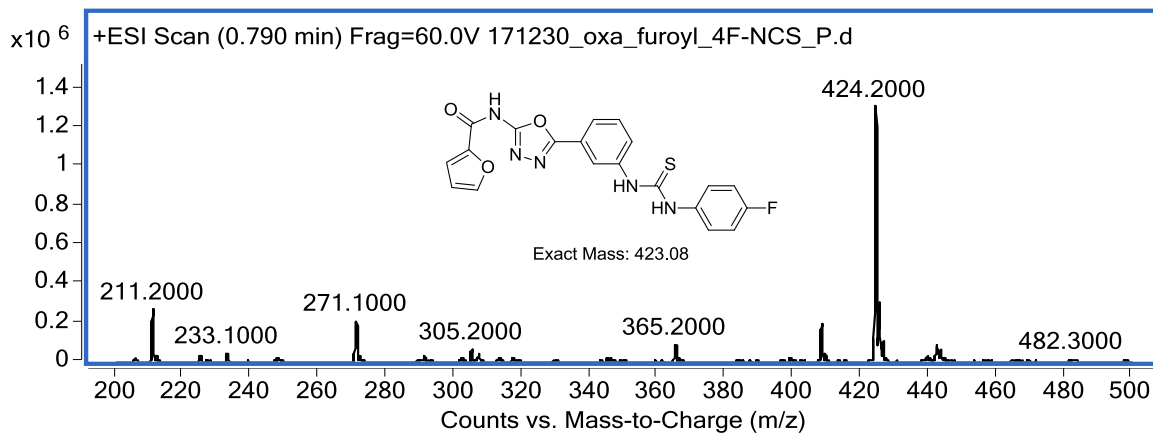
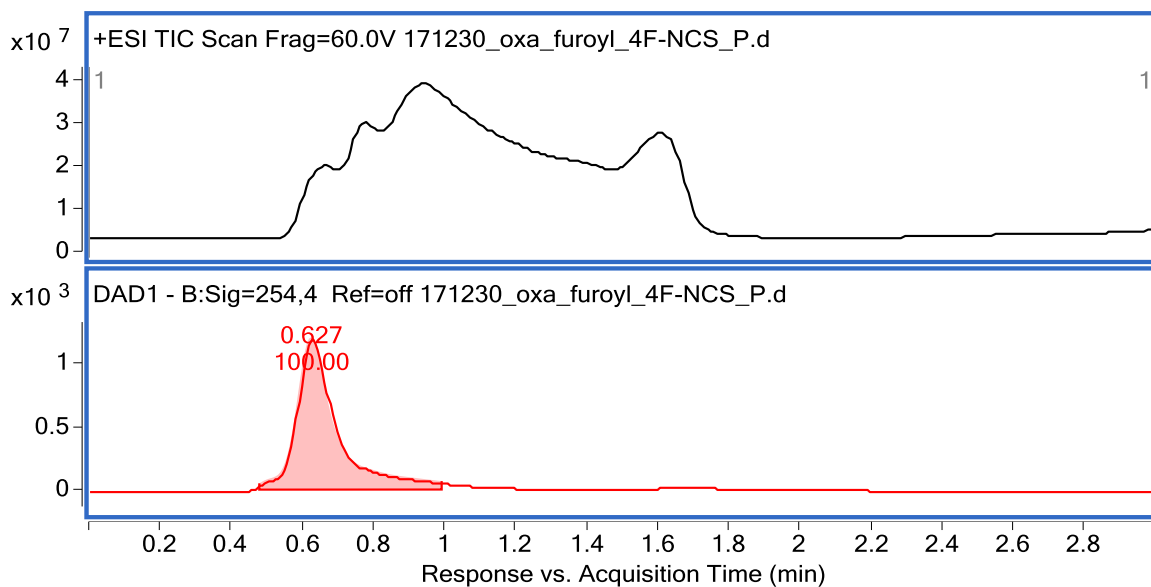
HR/MS – 14{2,3}



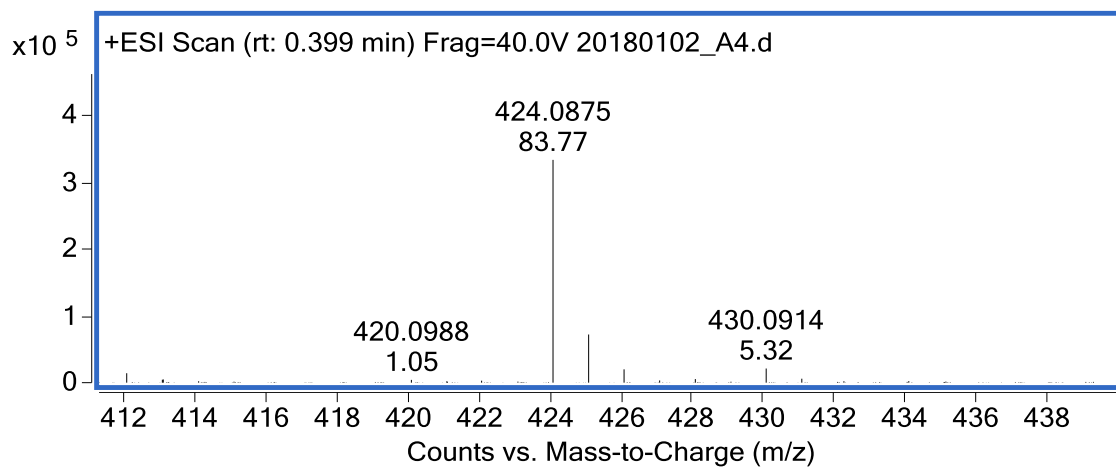
¹H NMR – 14{2,4}



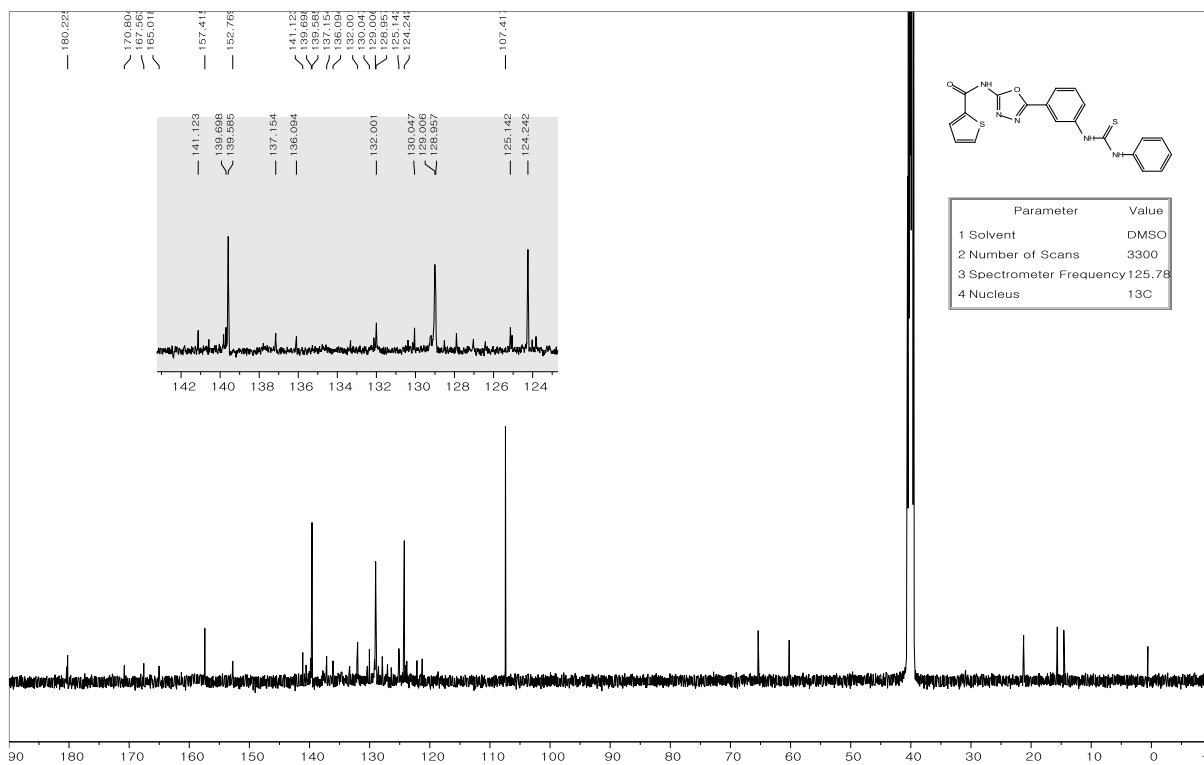
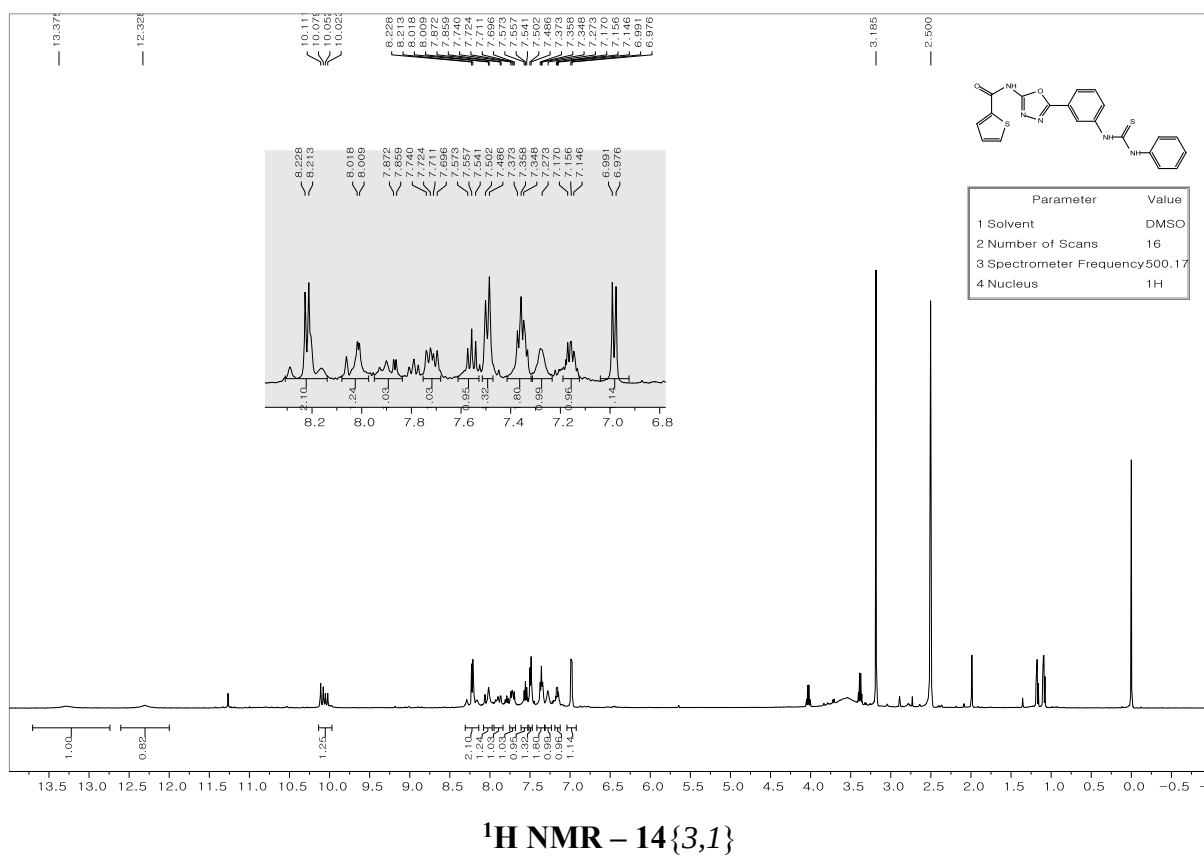
^{13}C NMR – 14{2,4}



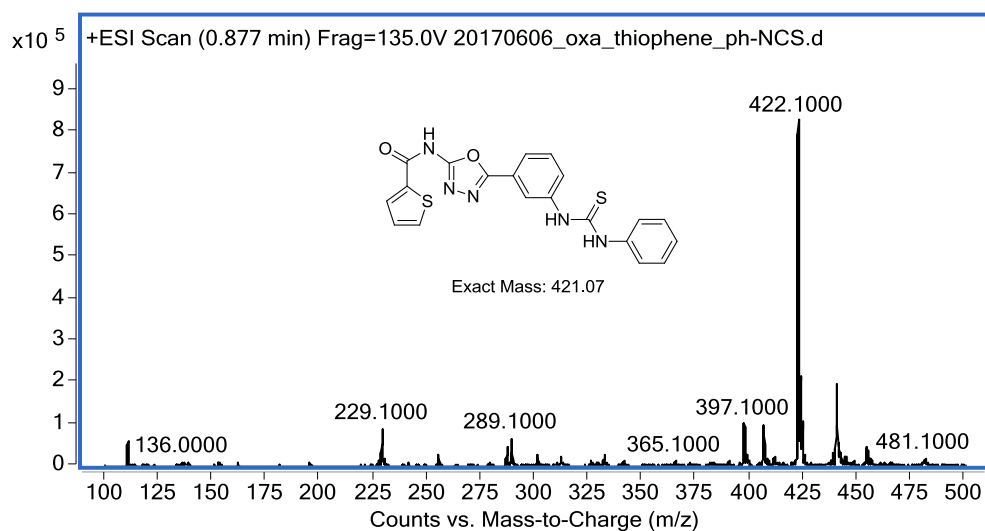
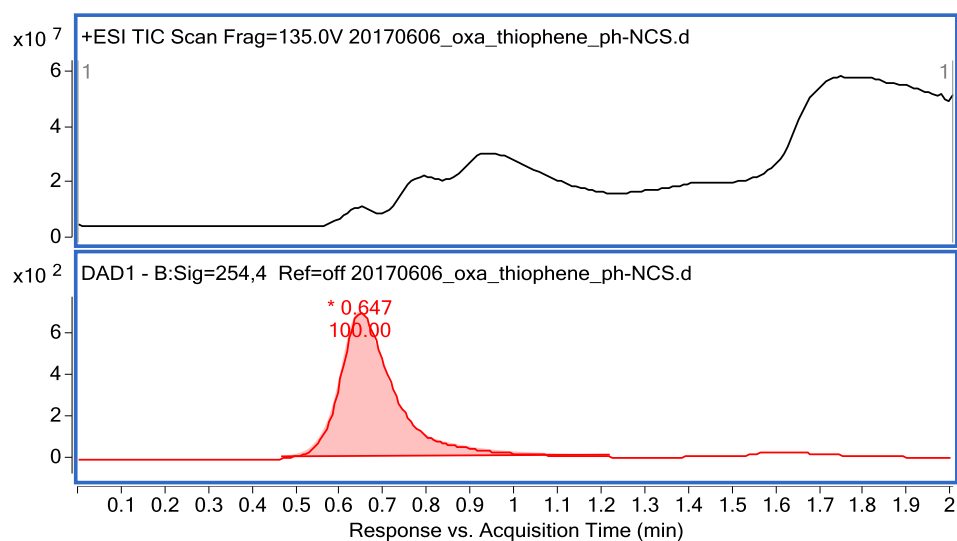
LC/MS – 14{2,4}



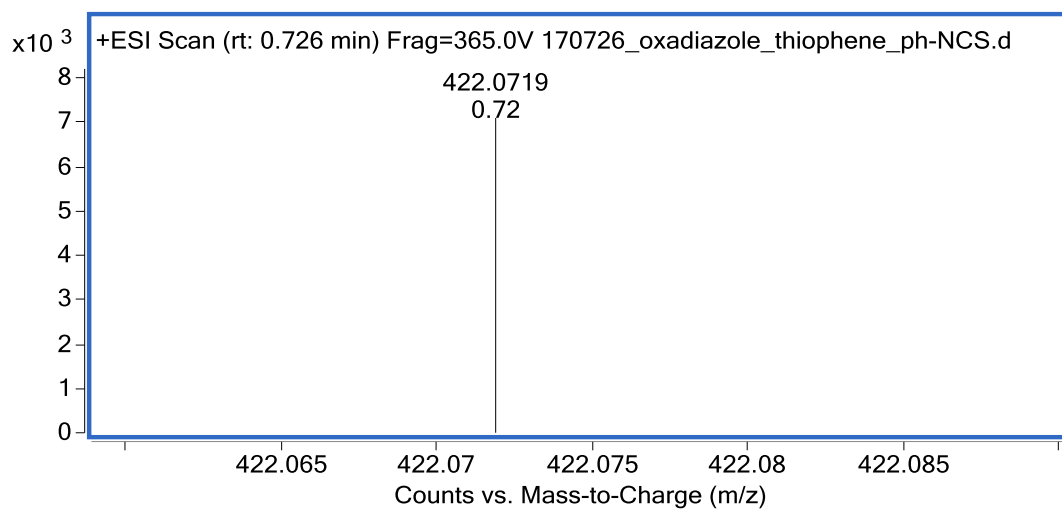
HR/MS – 14{2,4}



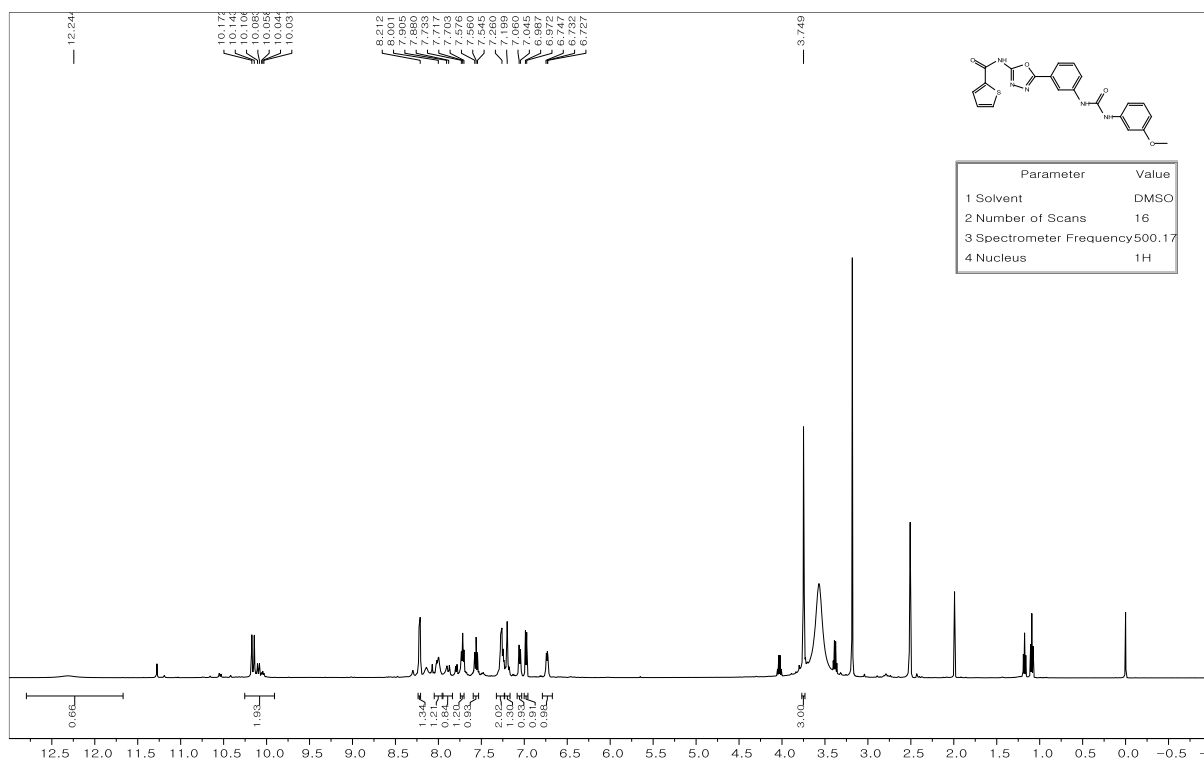
^{13}C NMR – 14{3,1}



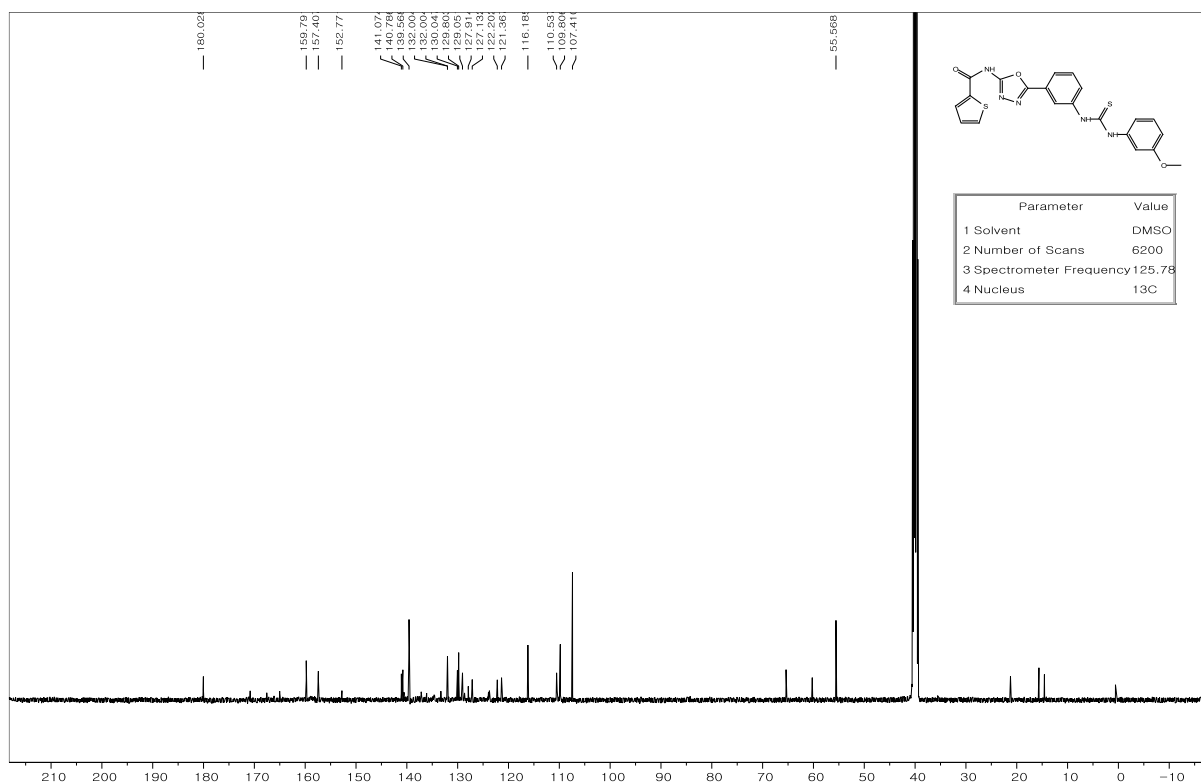
LC/MS – 14{3,1}



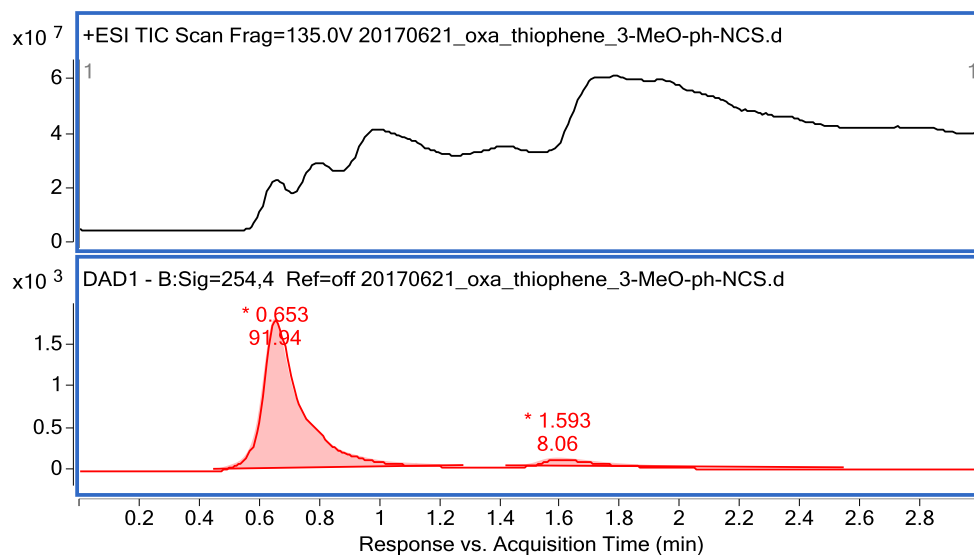
HR/MS – 14{3,1}

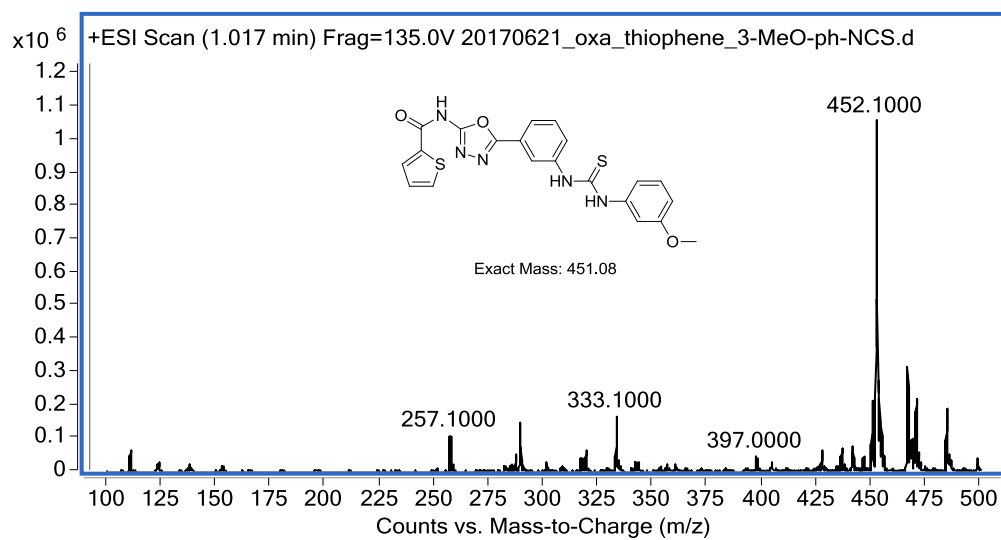


¹H NMR – 14{3,2}

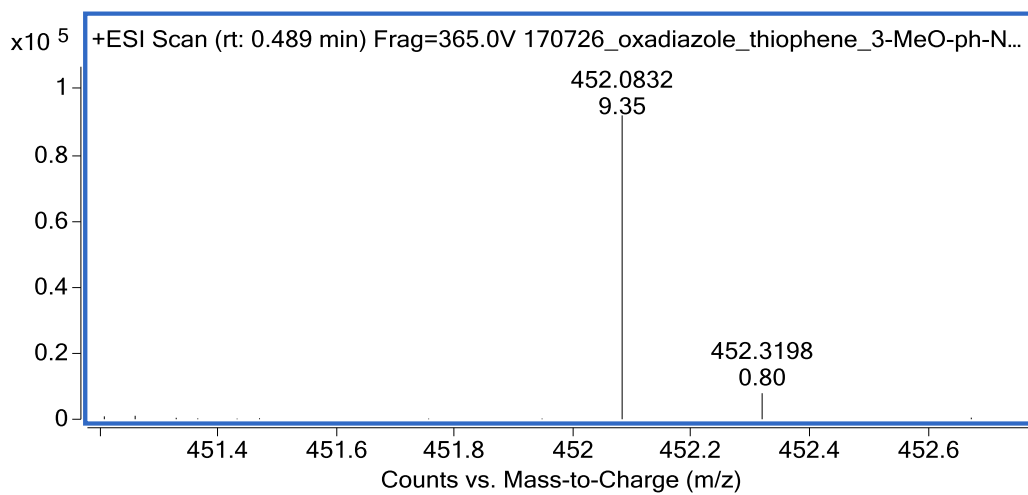


^{13}C NMR – 14{3,2}

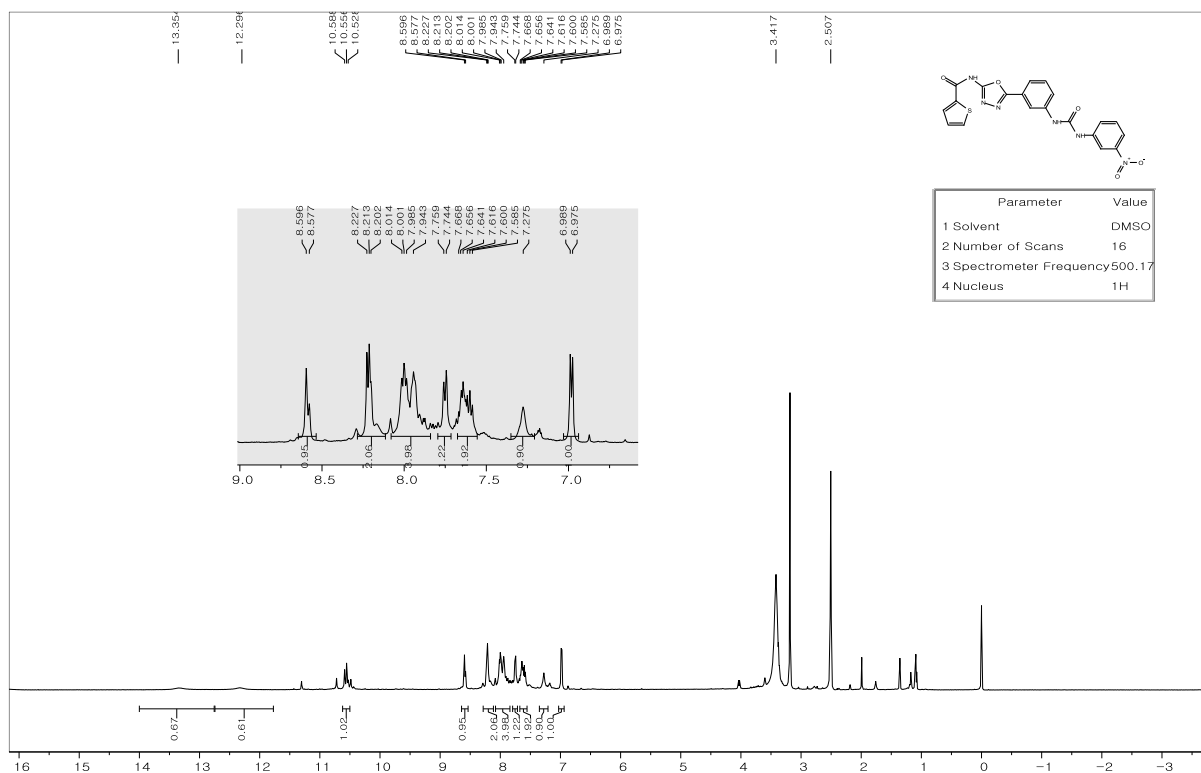




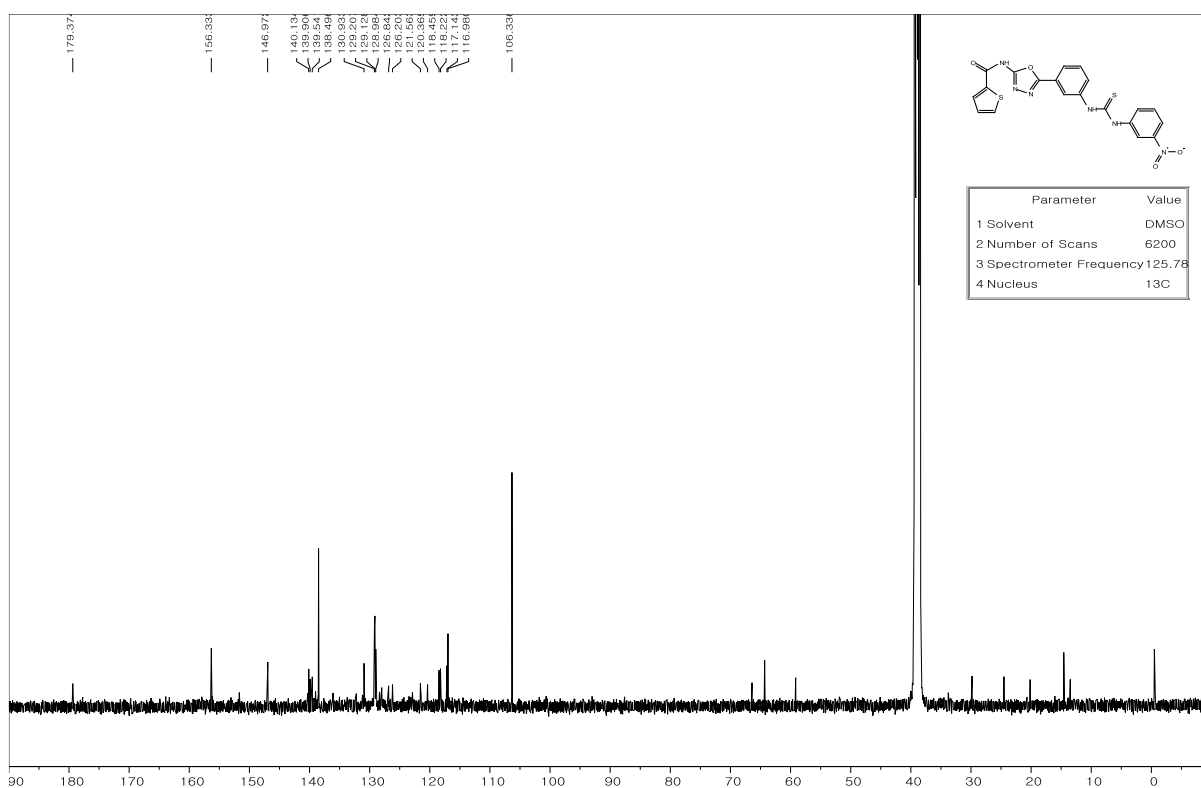
LC/MS – 14{3,2}



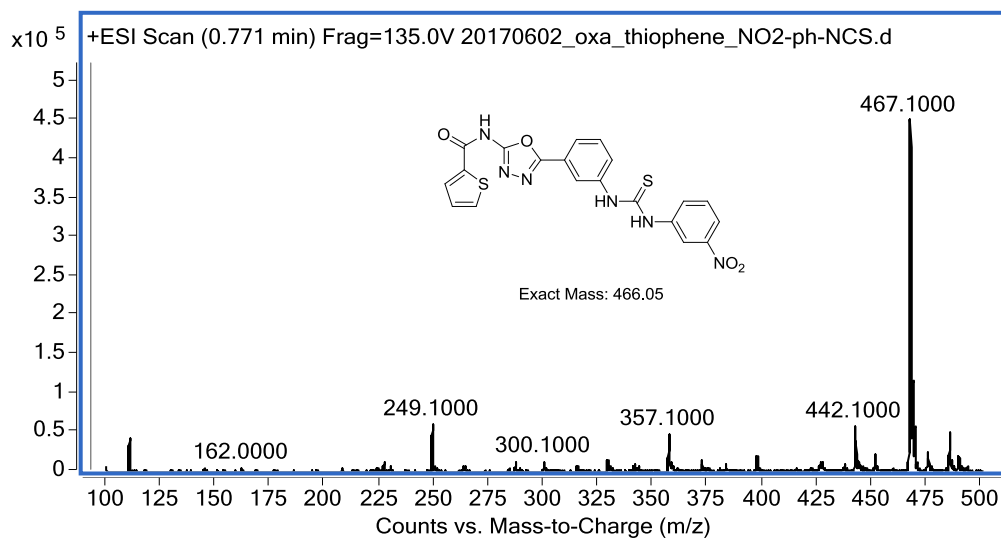
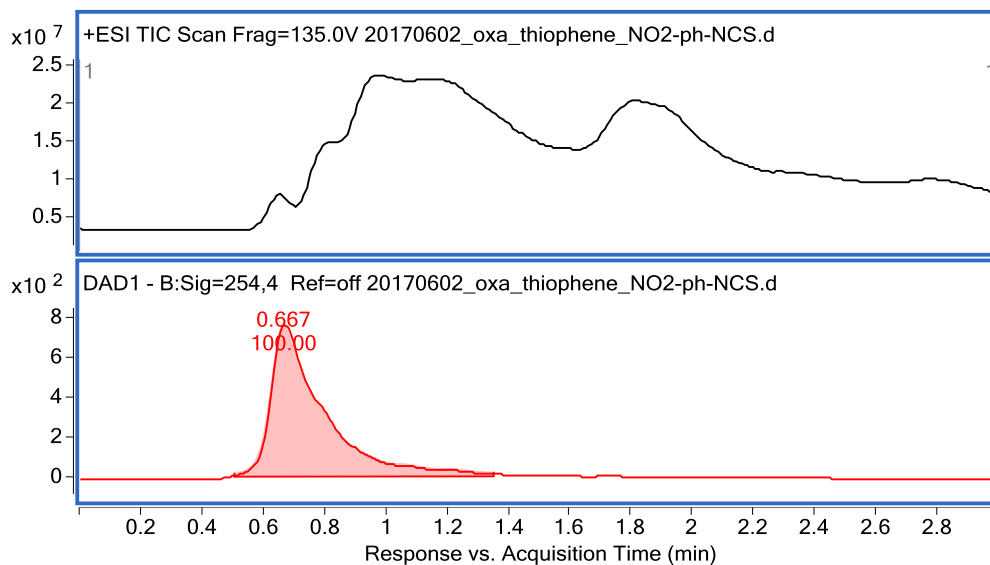
HR/MS – 14{3,2}



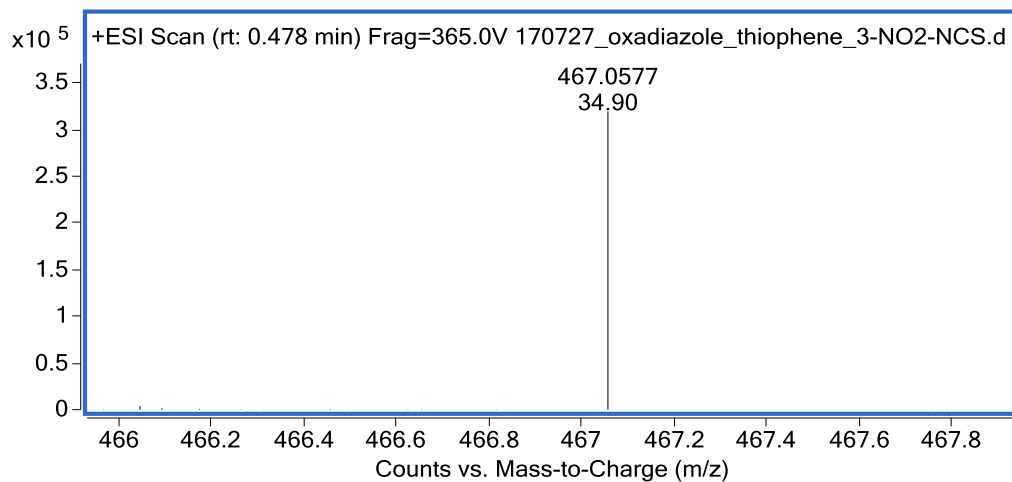
¹H NMR – 14{3,3}



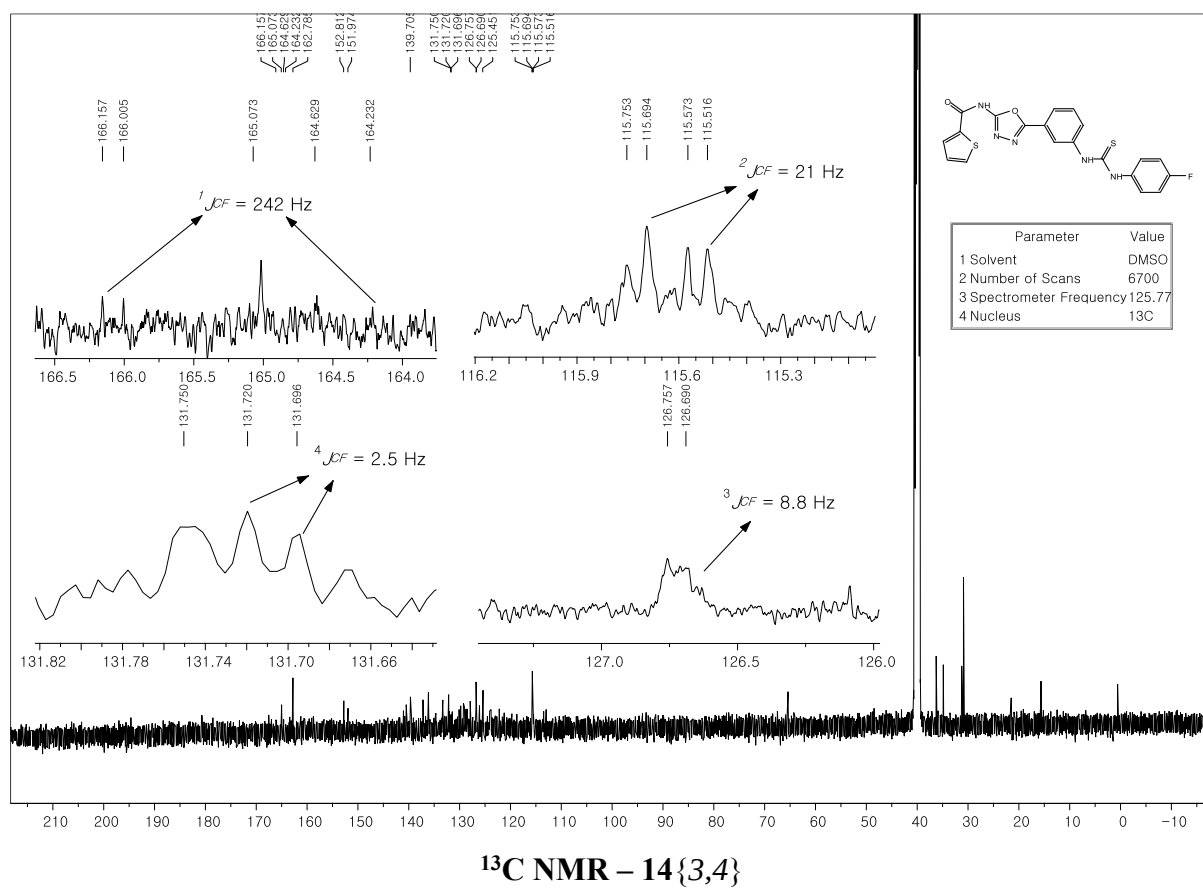
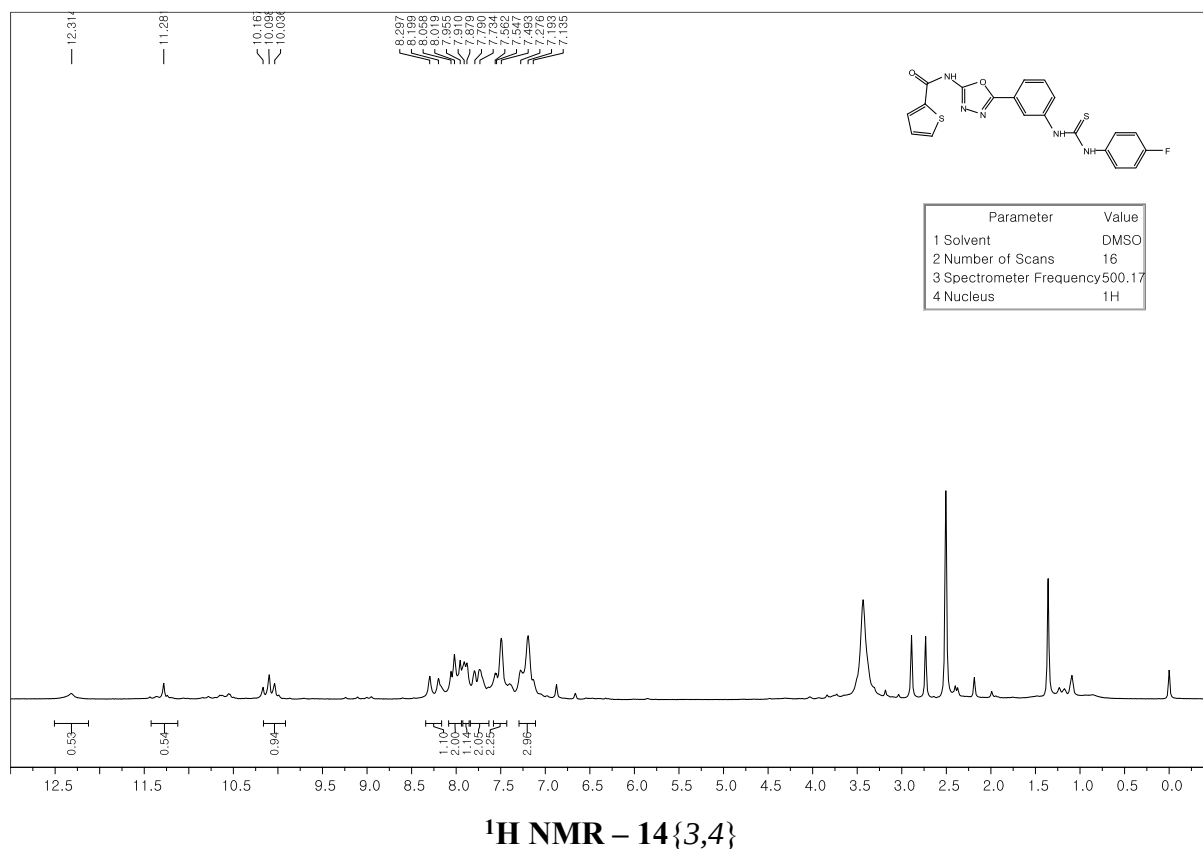
¹³C NMR – 14{3,3}

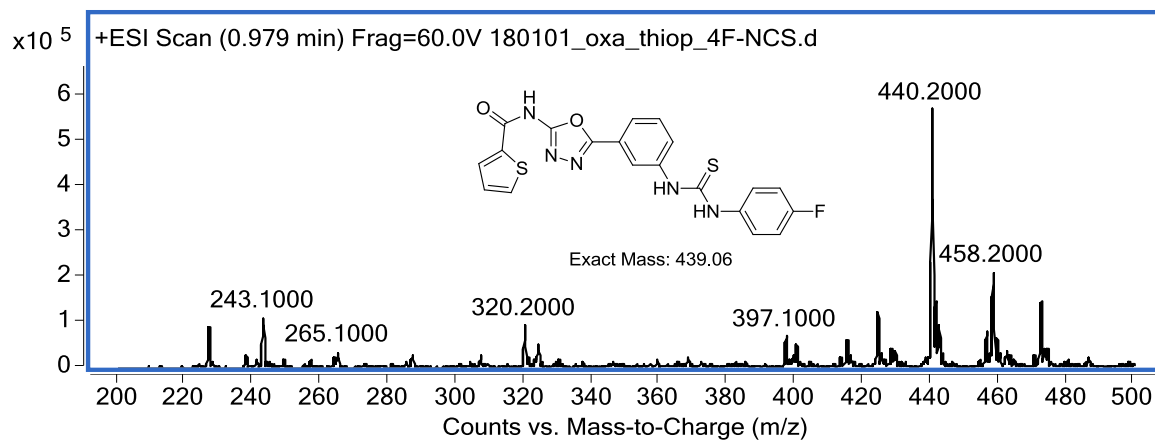
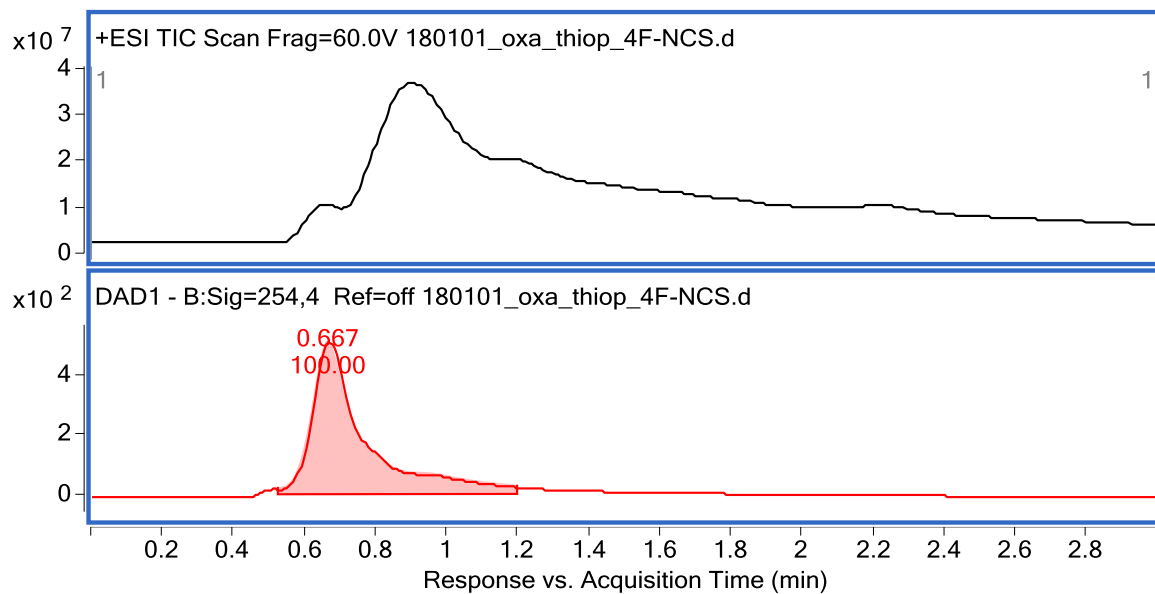


LC/MS – 14{3,3}

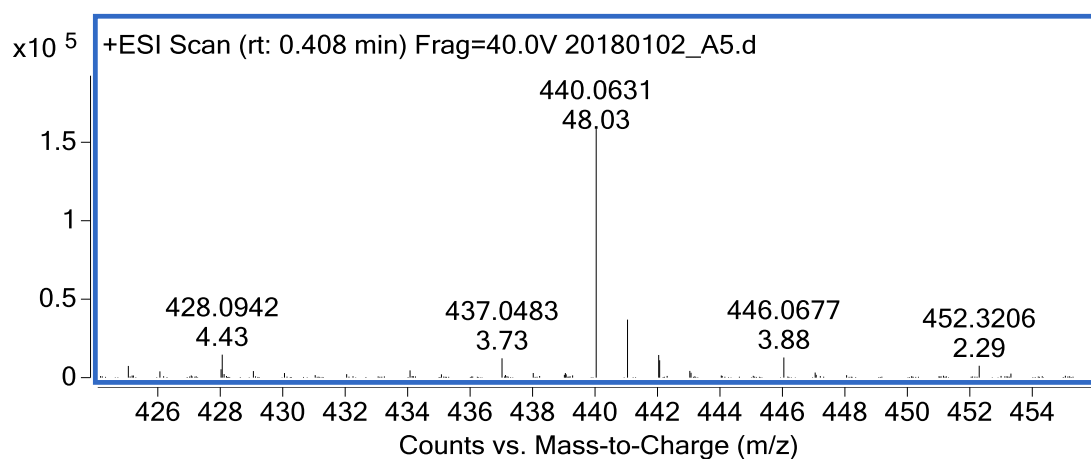


HR/MS – 14{3,3}

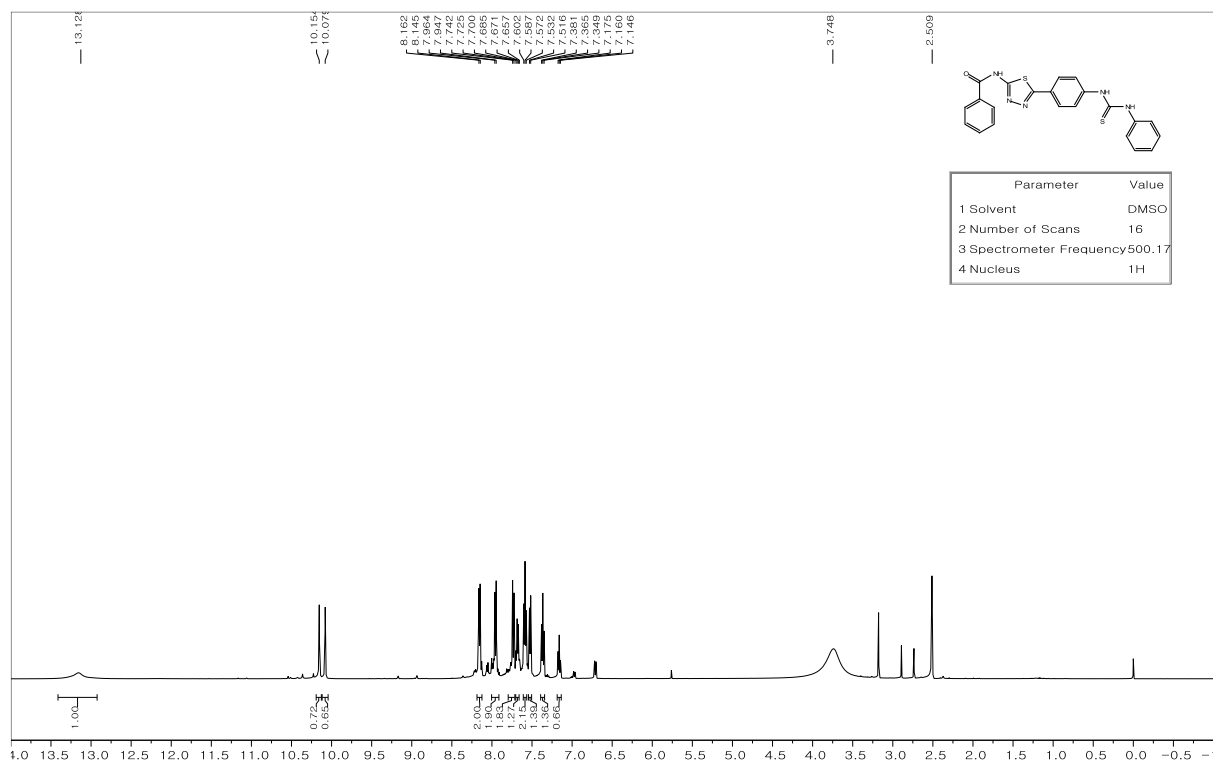




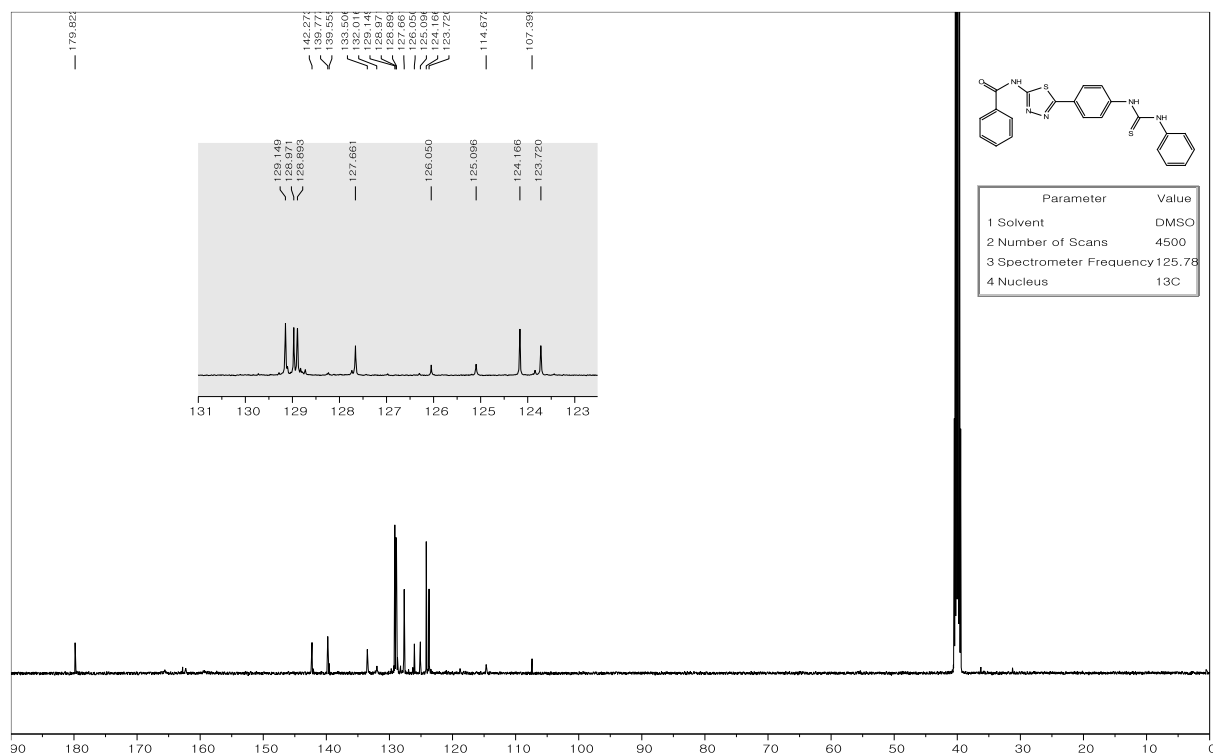
LC/MS – 14{3,4}



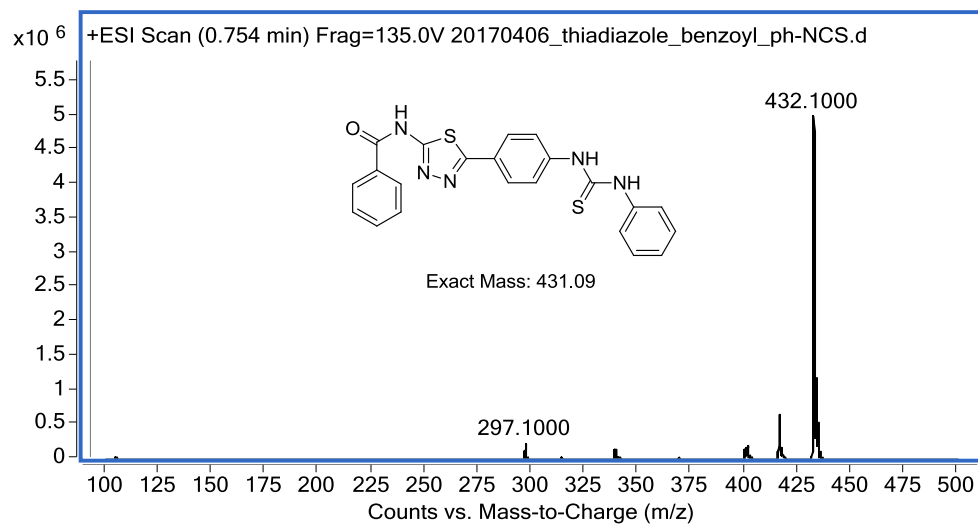
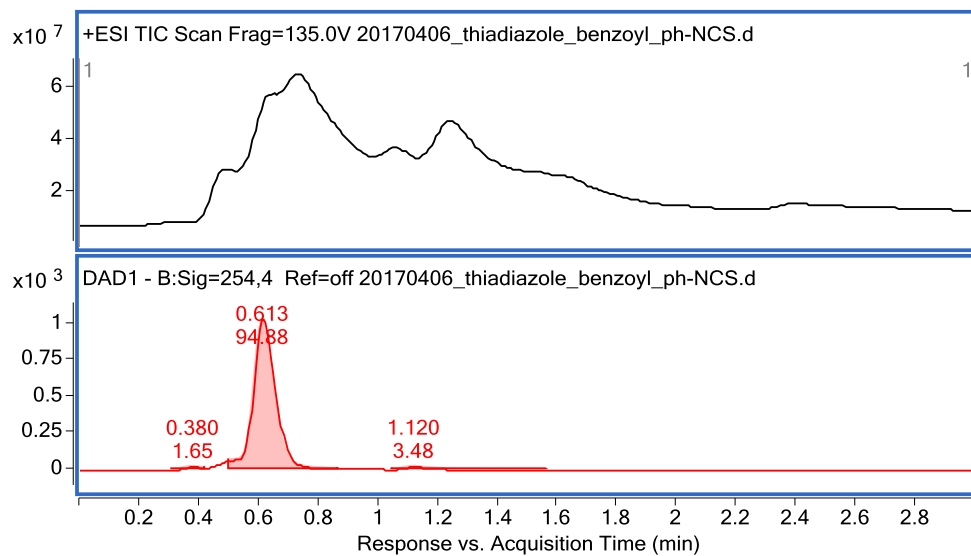
HR/MS – 14{3,4}



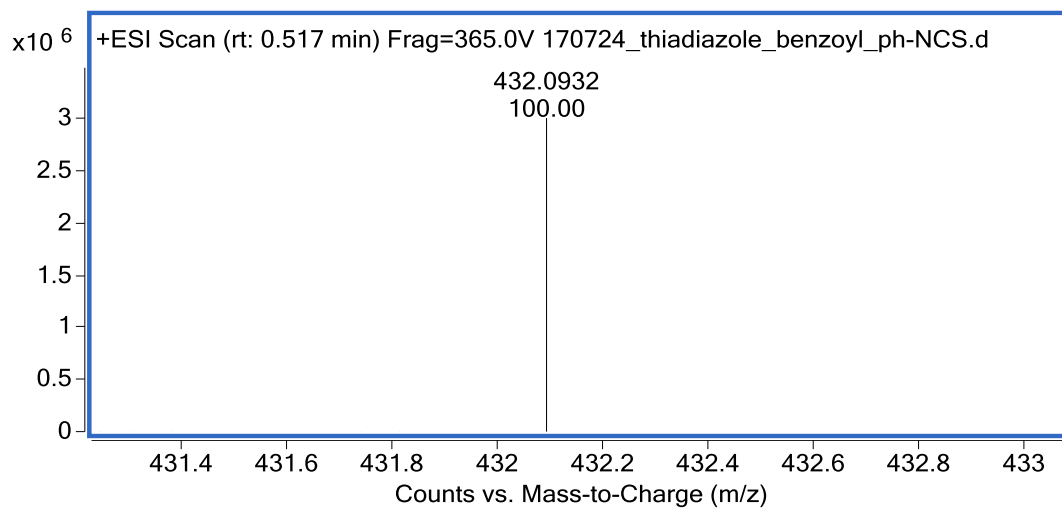
¹H NMR – 15{1,1}



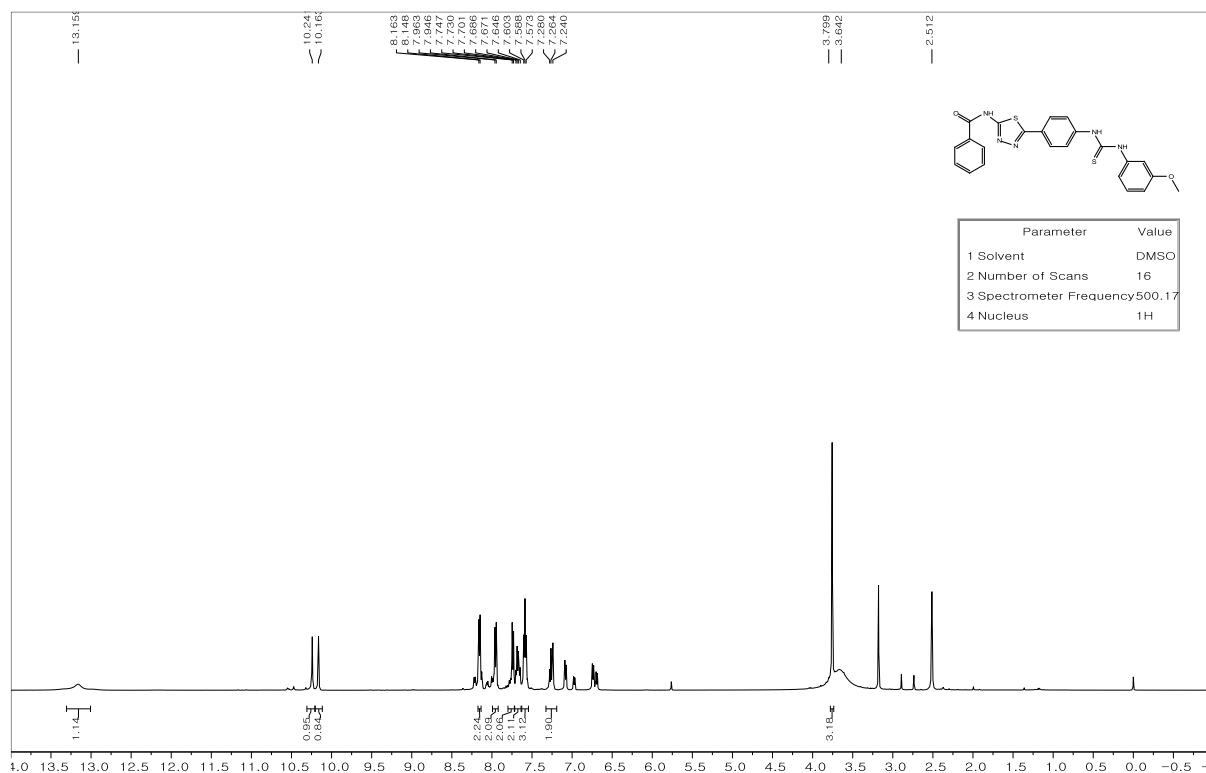
¹³C NMR – 15{1,1}



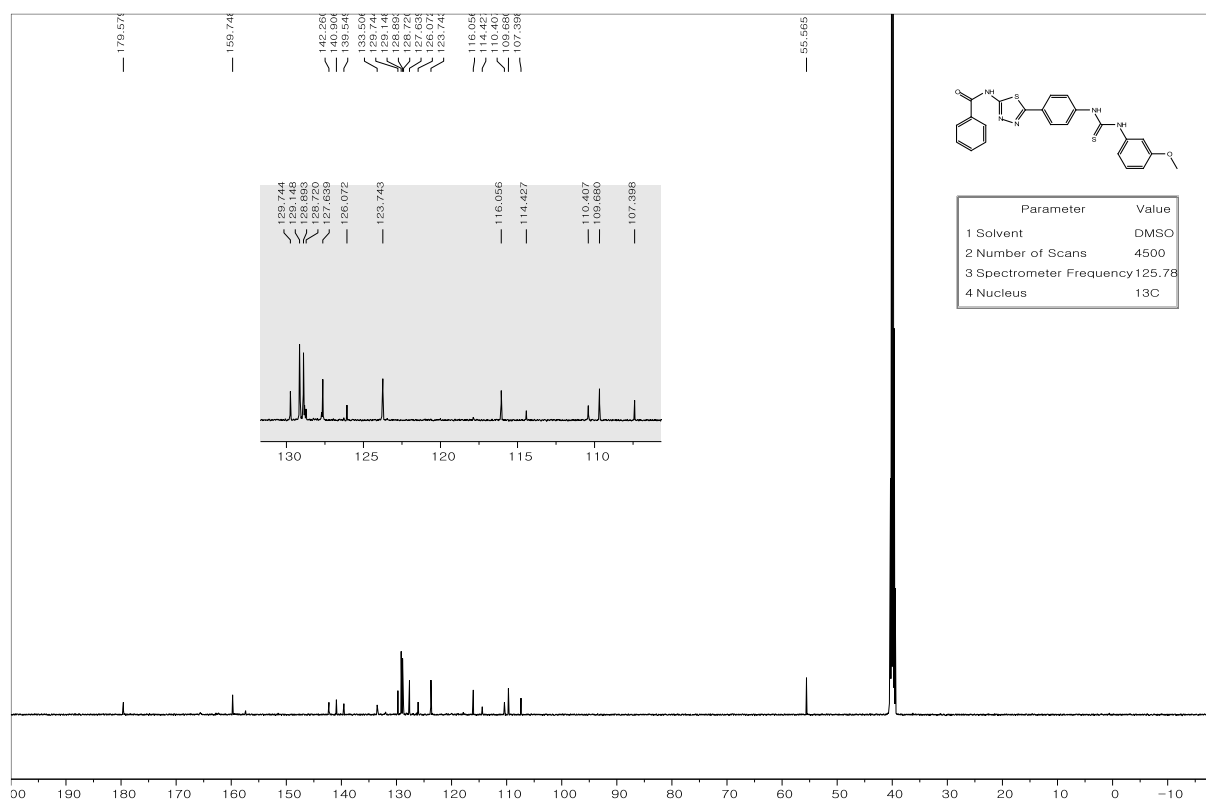
LC/MS – 15{1,1}



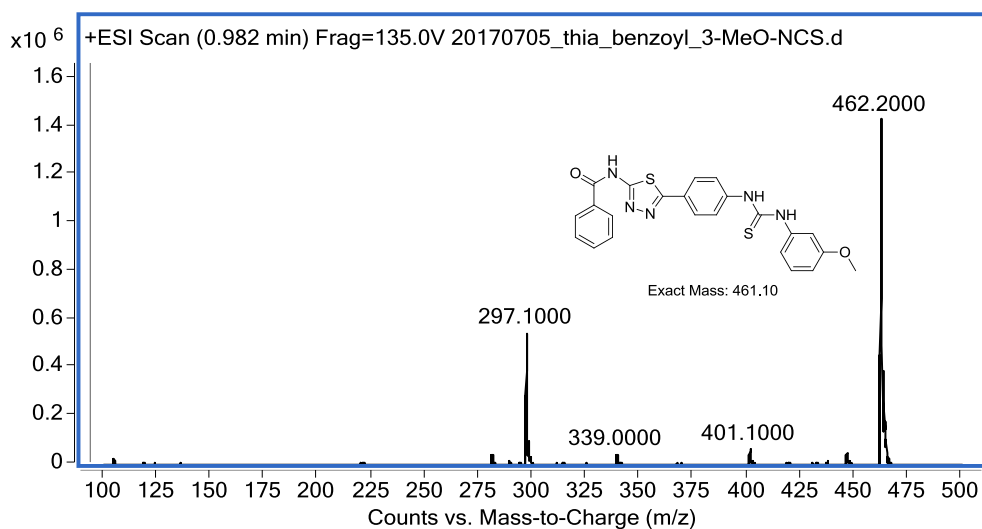
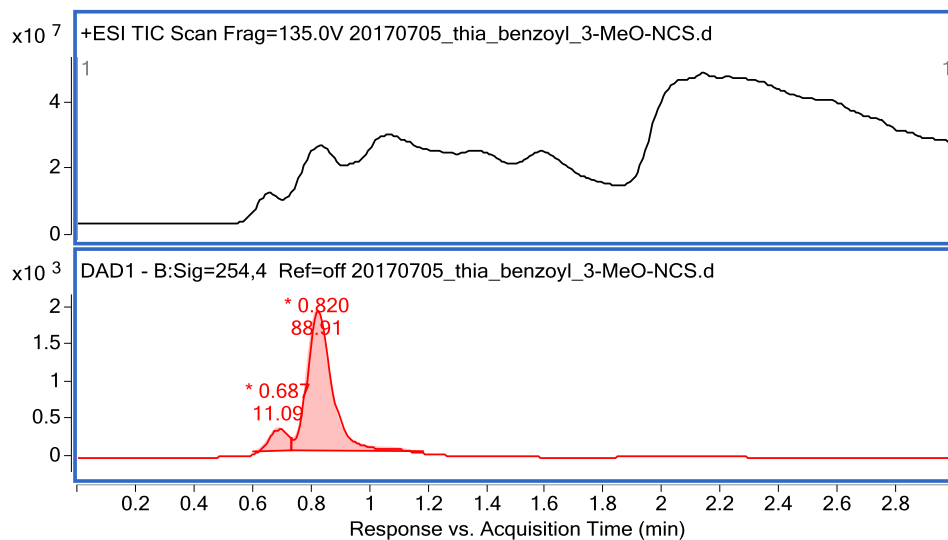
HR/MS – 15{1,1}



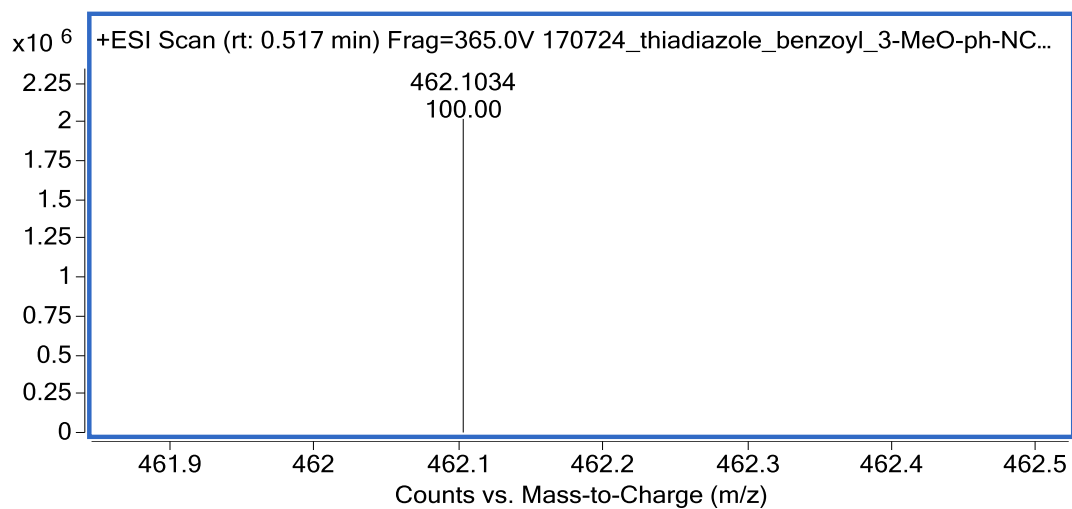
¹H NMR – 15{1,2}



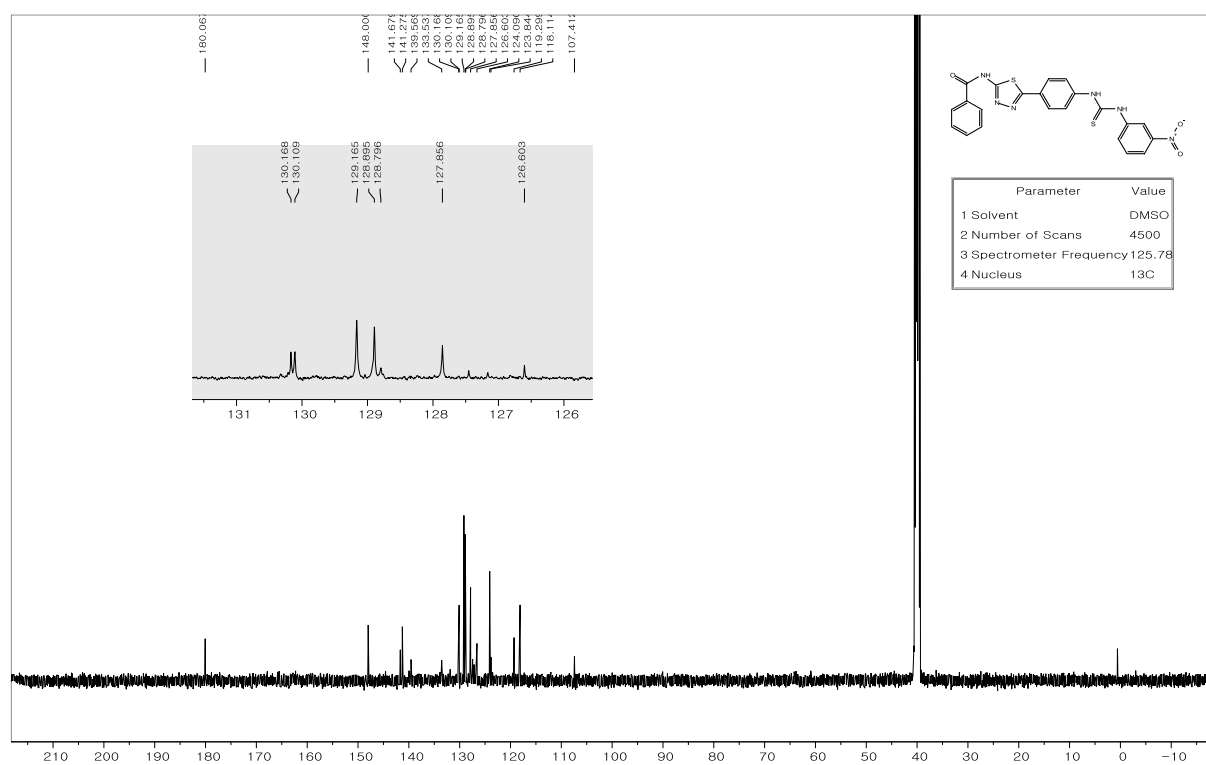
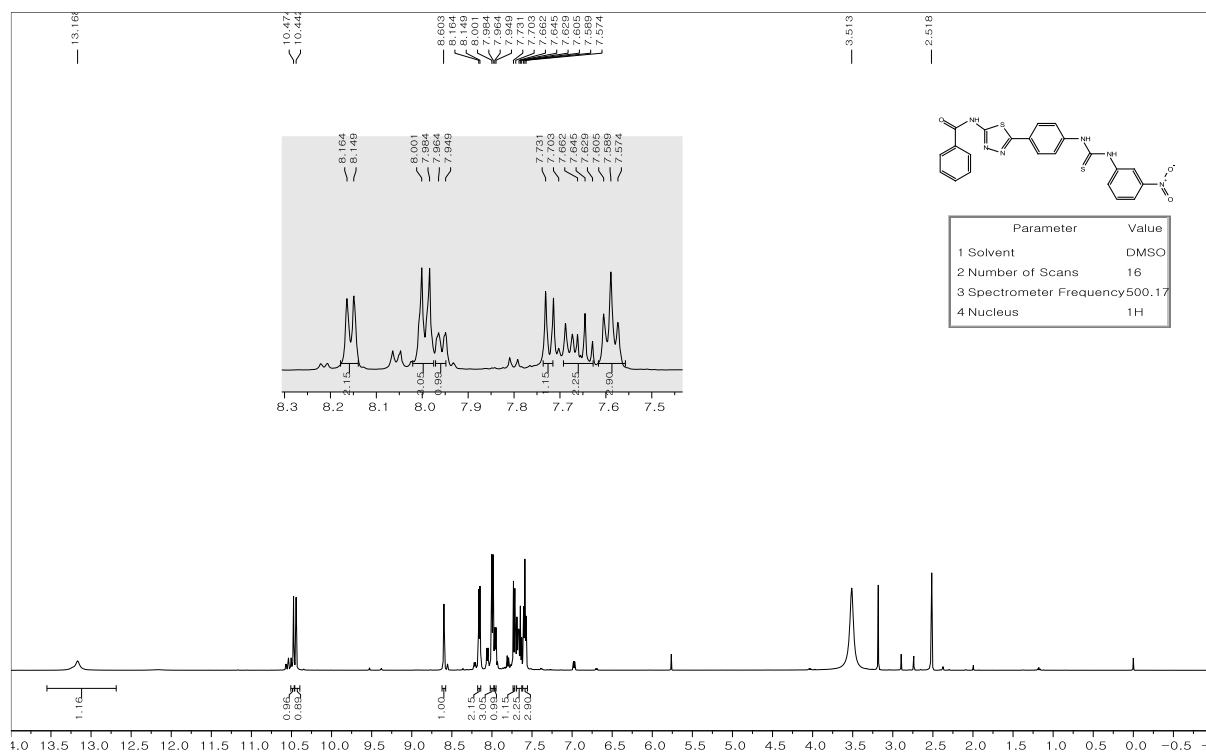
¹³C NMR – 15{1,2}

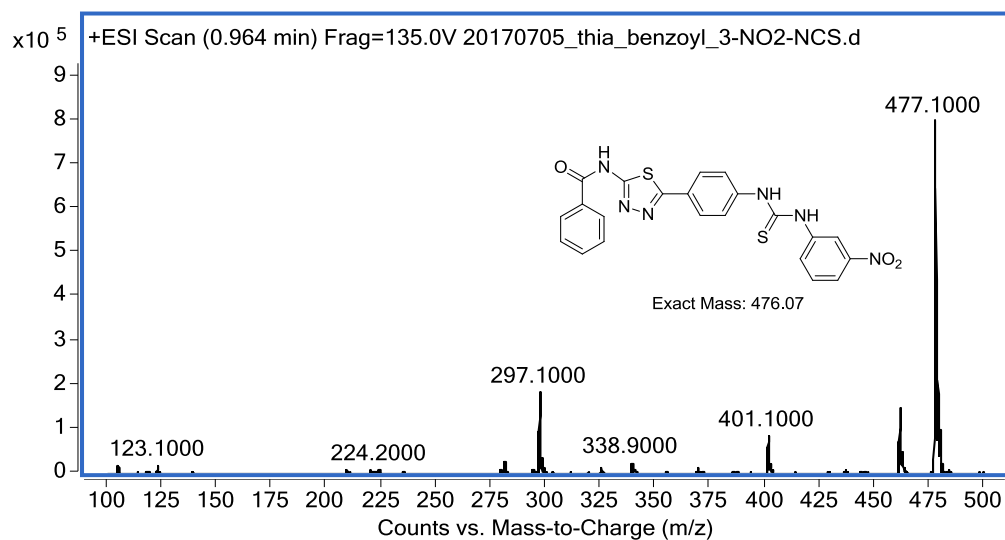
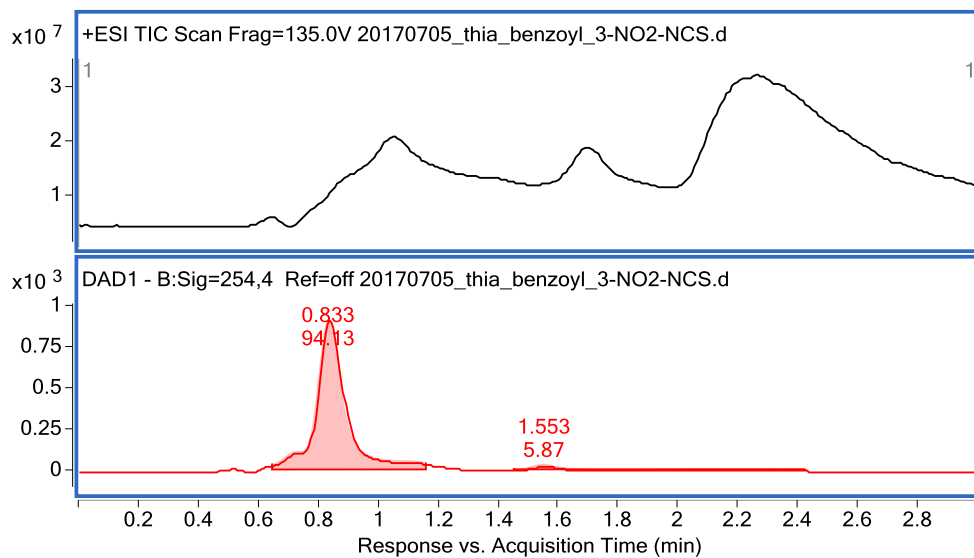


LC/MS – 15{1,2}

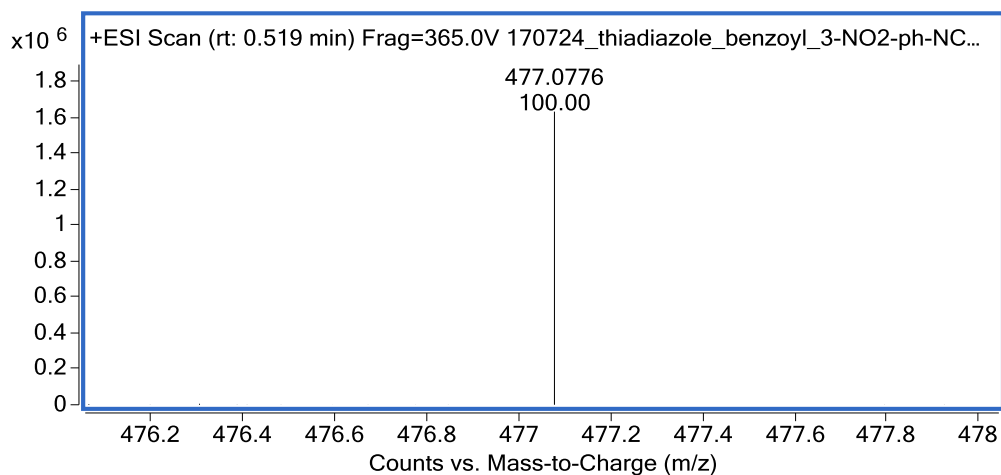


HR/MS – 15{1,2}

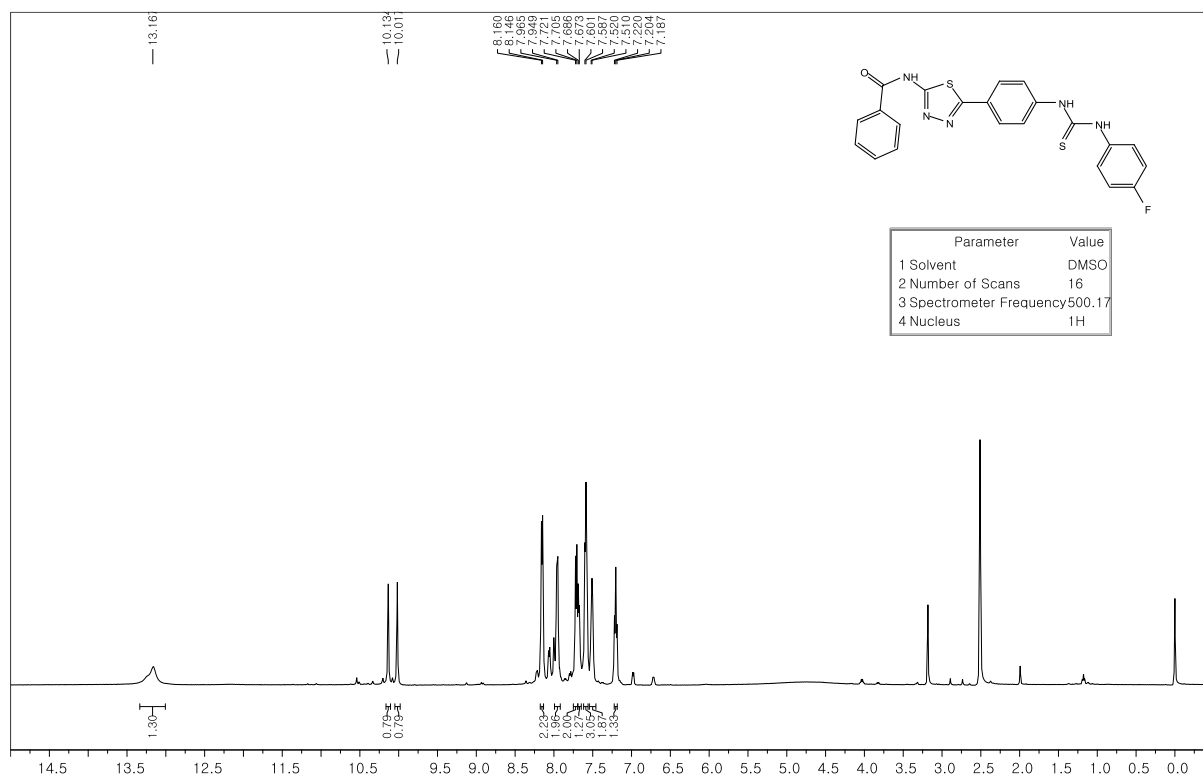




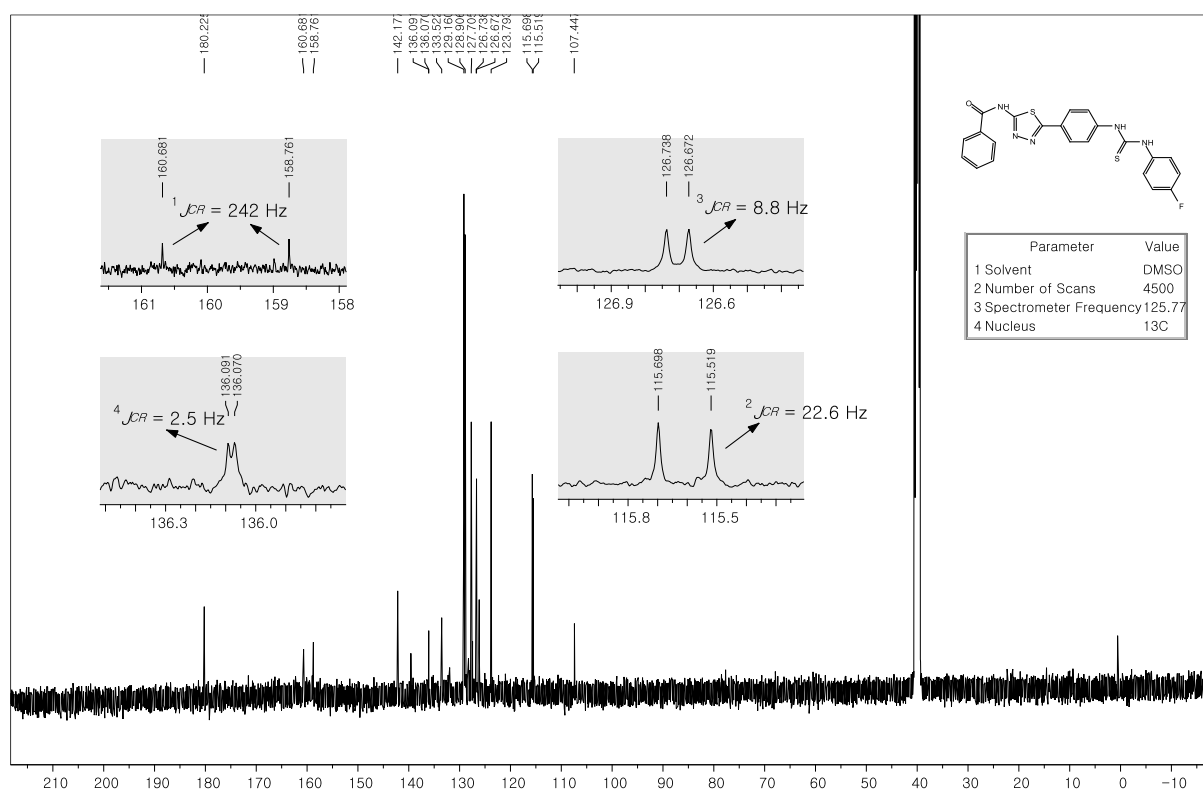
LC/MS – 15{1,3}



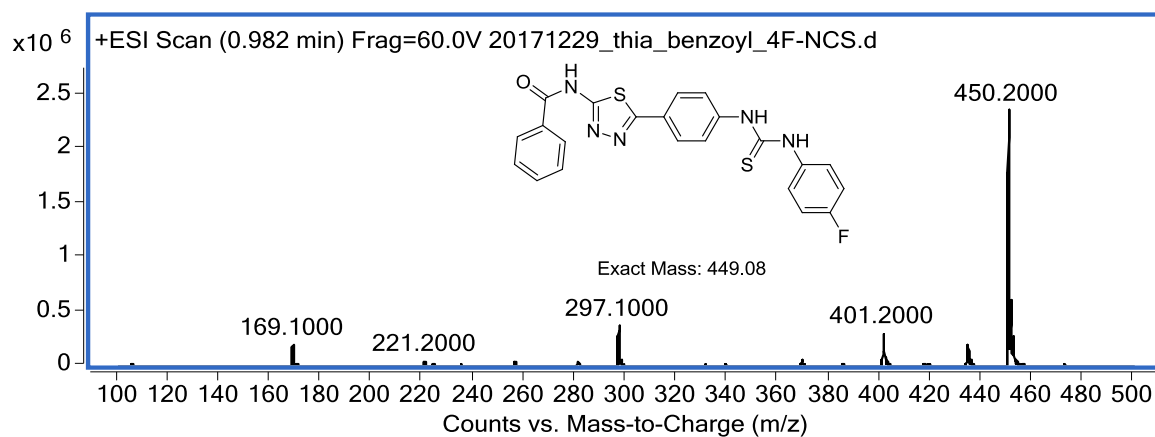
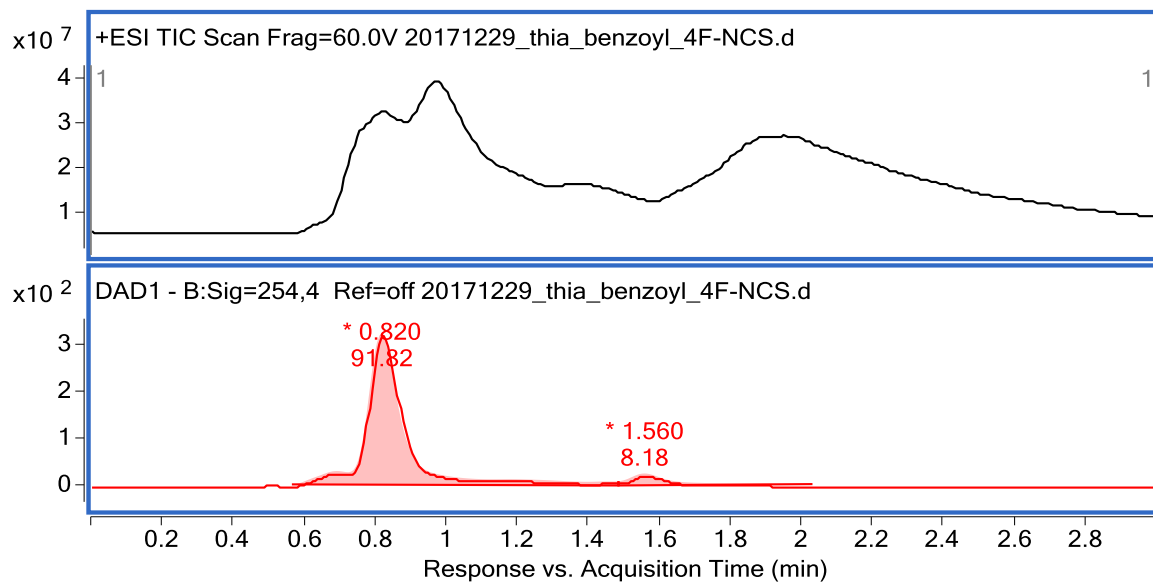
HR/MS – 15{1,3}



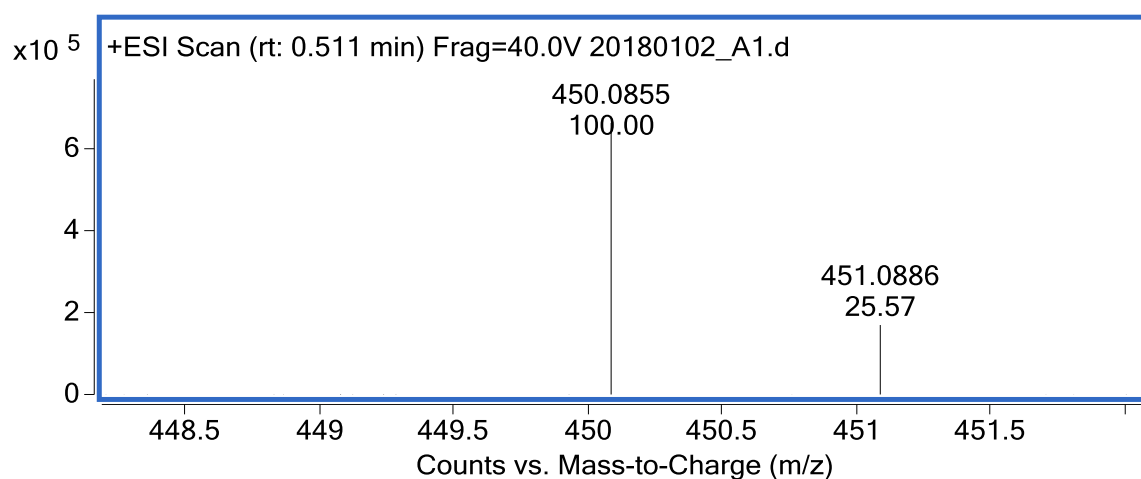
¹H NMR – 15{1,4}



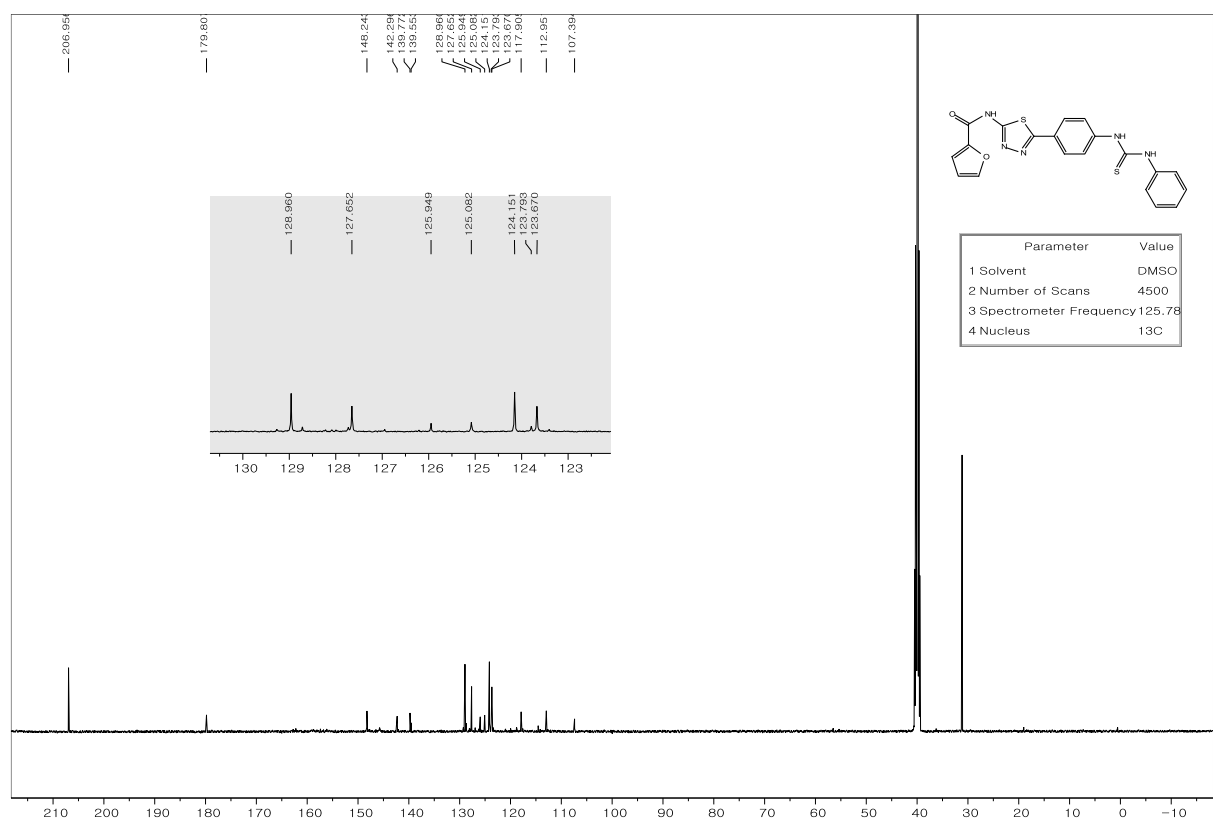
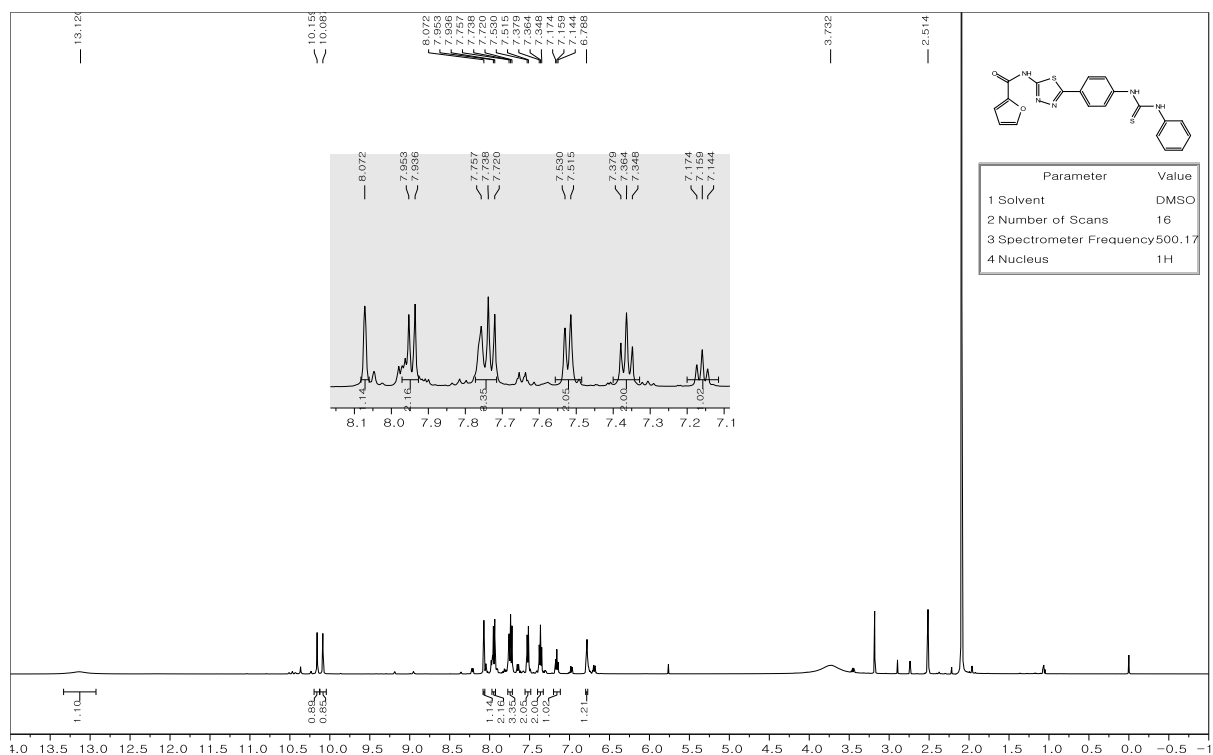
¹³C NMR – 15{1,4}

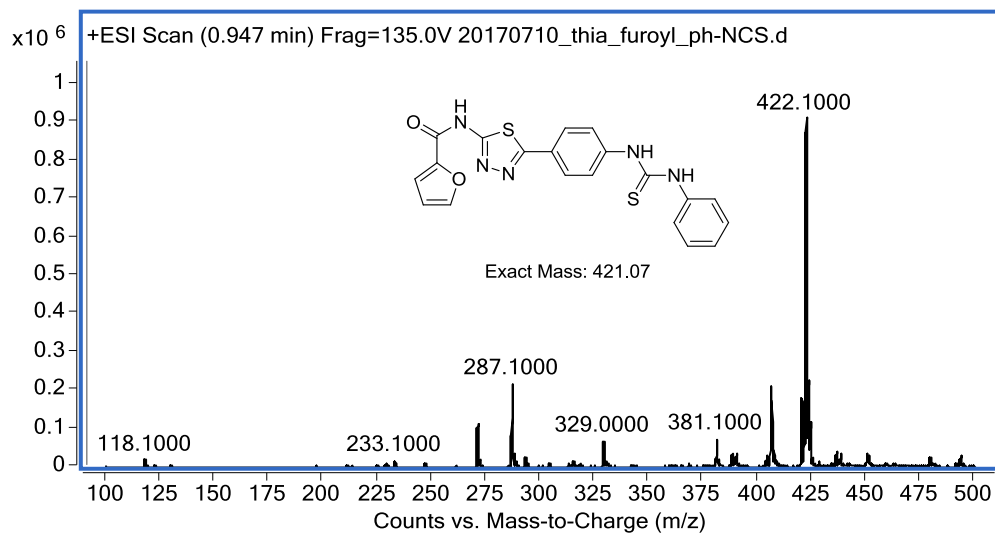
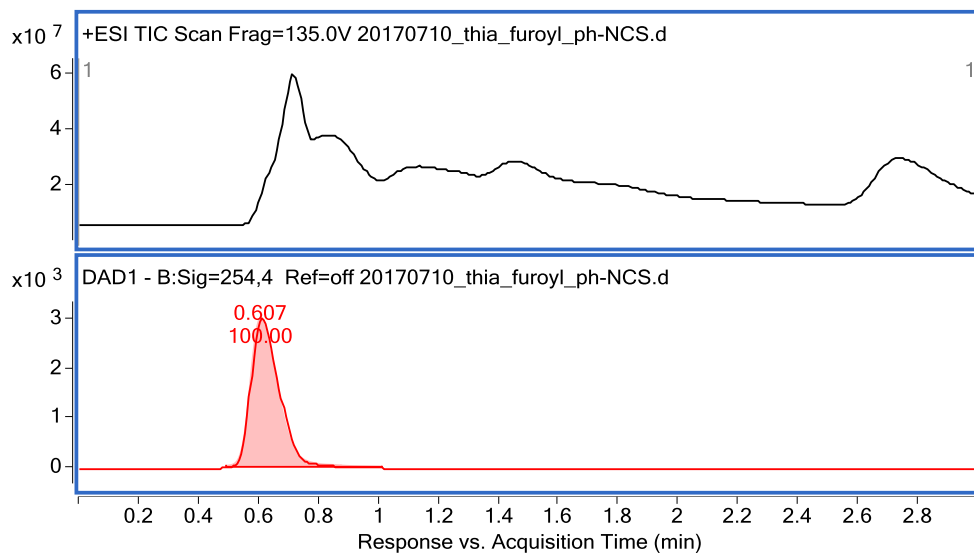


LC/MS – 15{1,4}

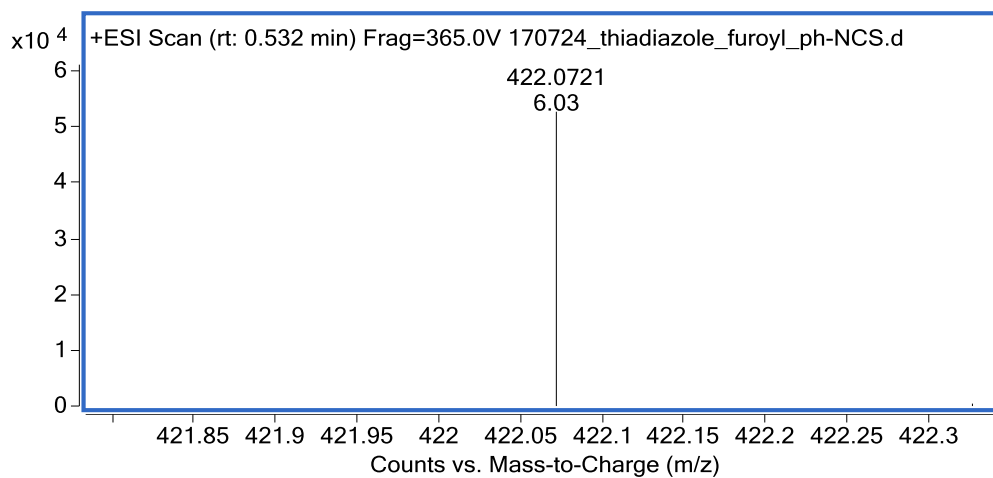


LC/MS – 15{1,4}

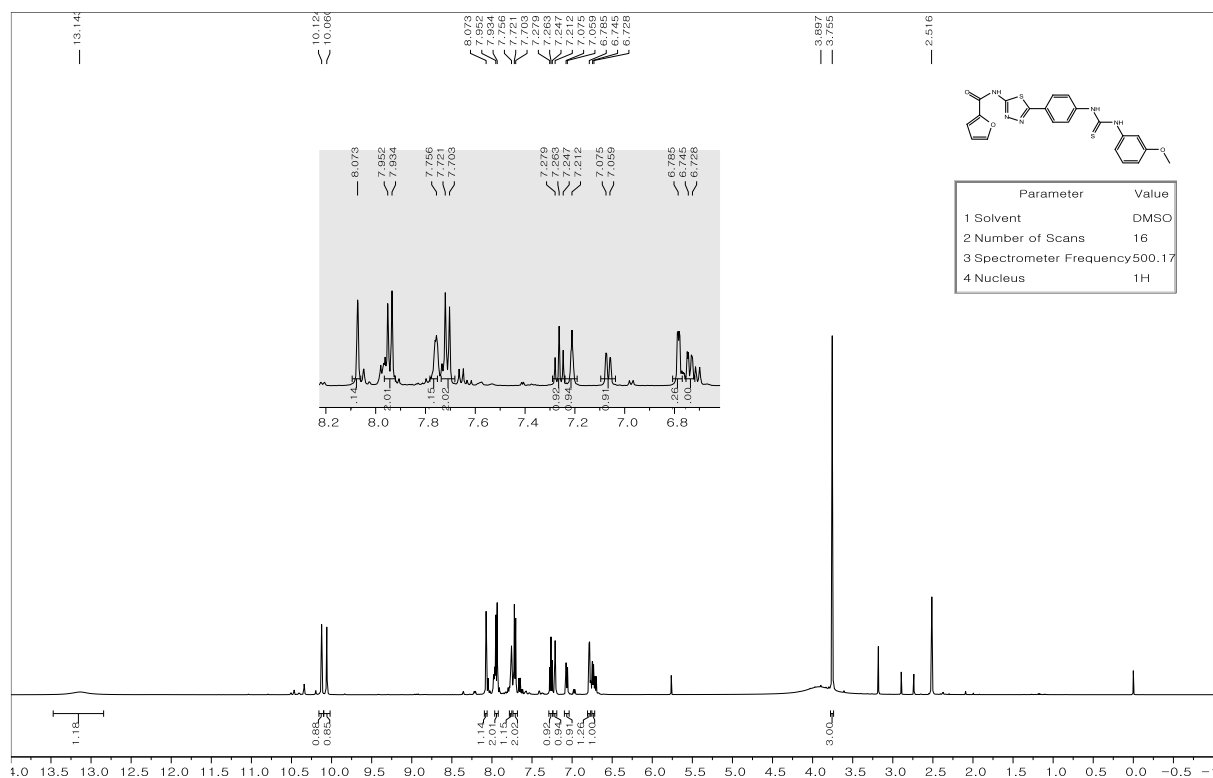




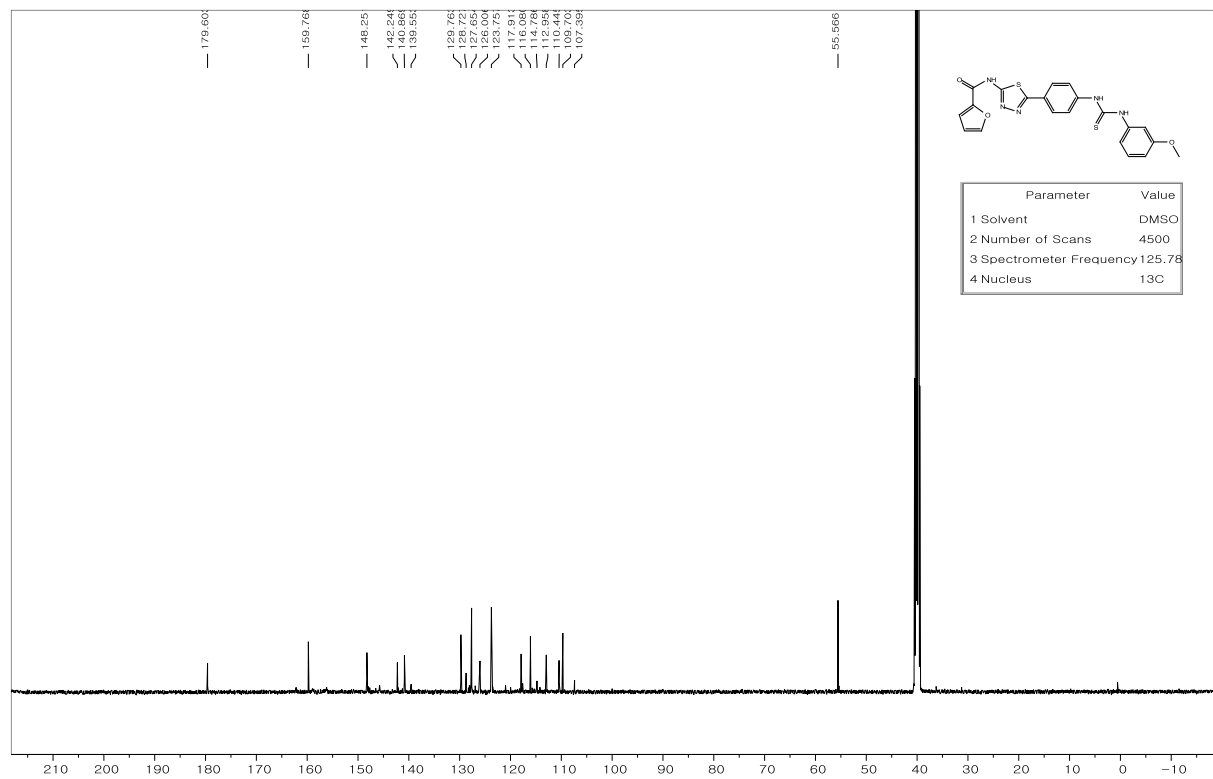
LC/MS – 15{2,1}



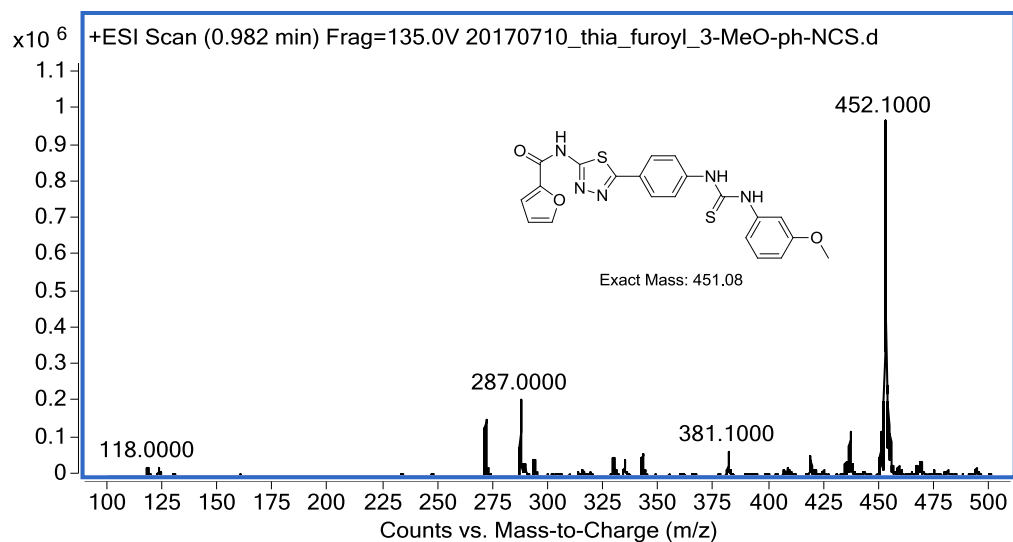
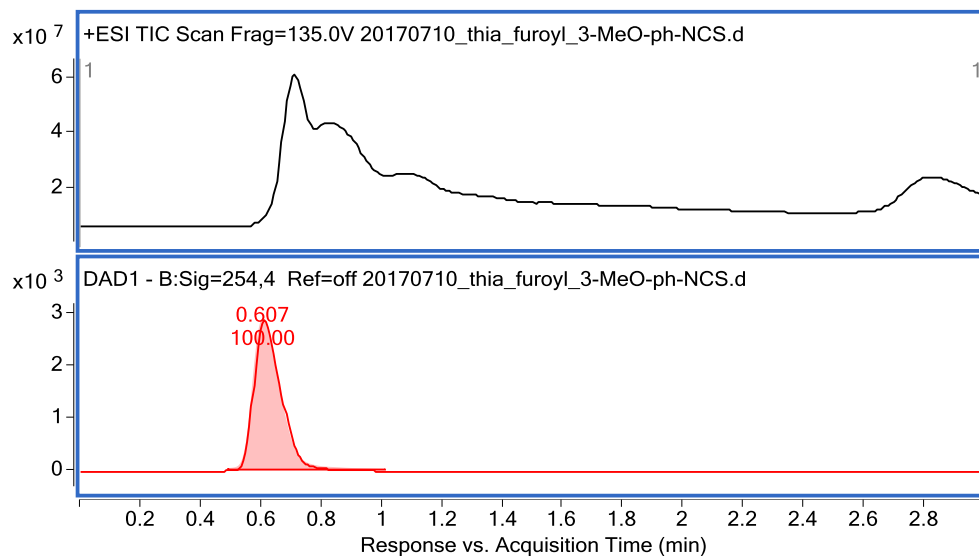
HR/MS – 15{2,1}



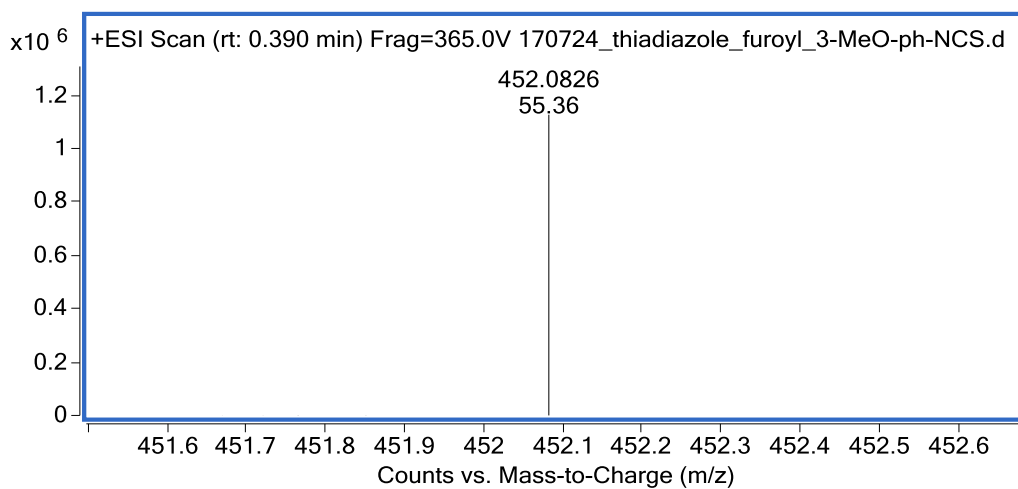
¹H NMR – 15{2,2}



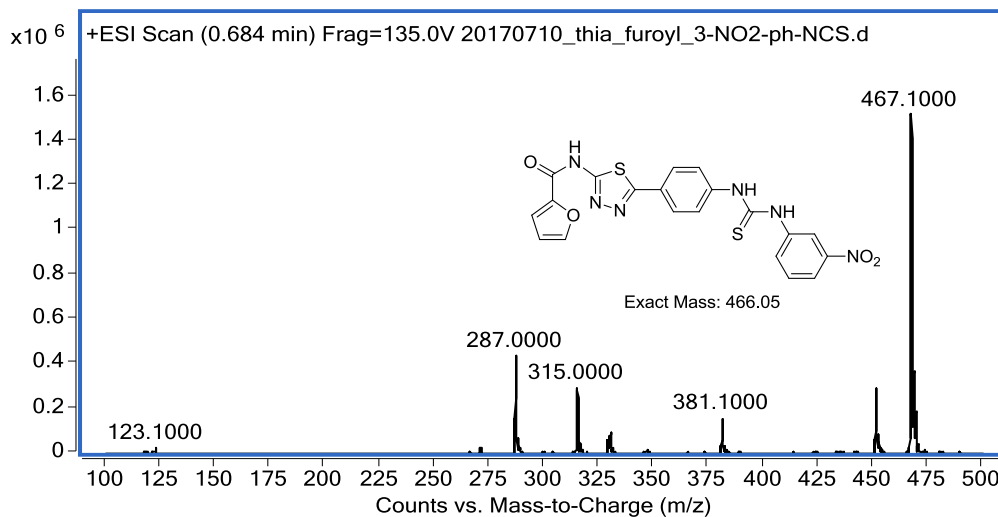
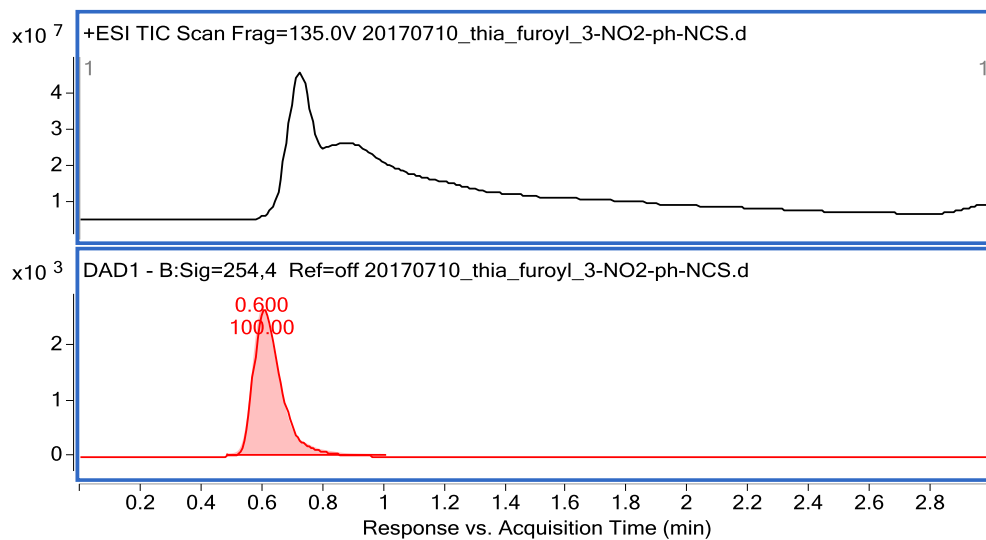
¹³C NMR – 15{2,2}



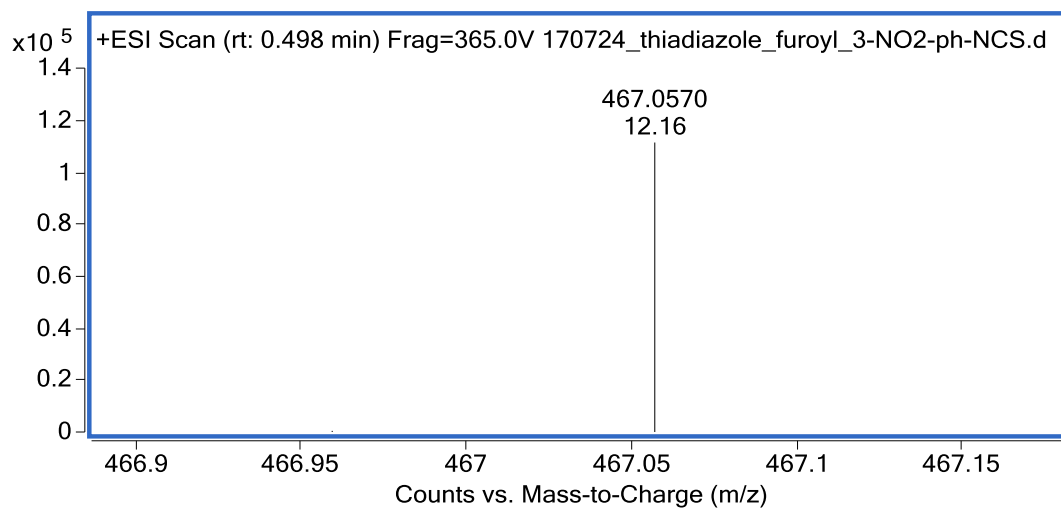
LC/MS – 15{2,2}



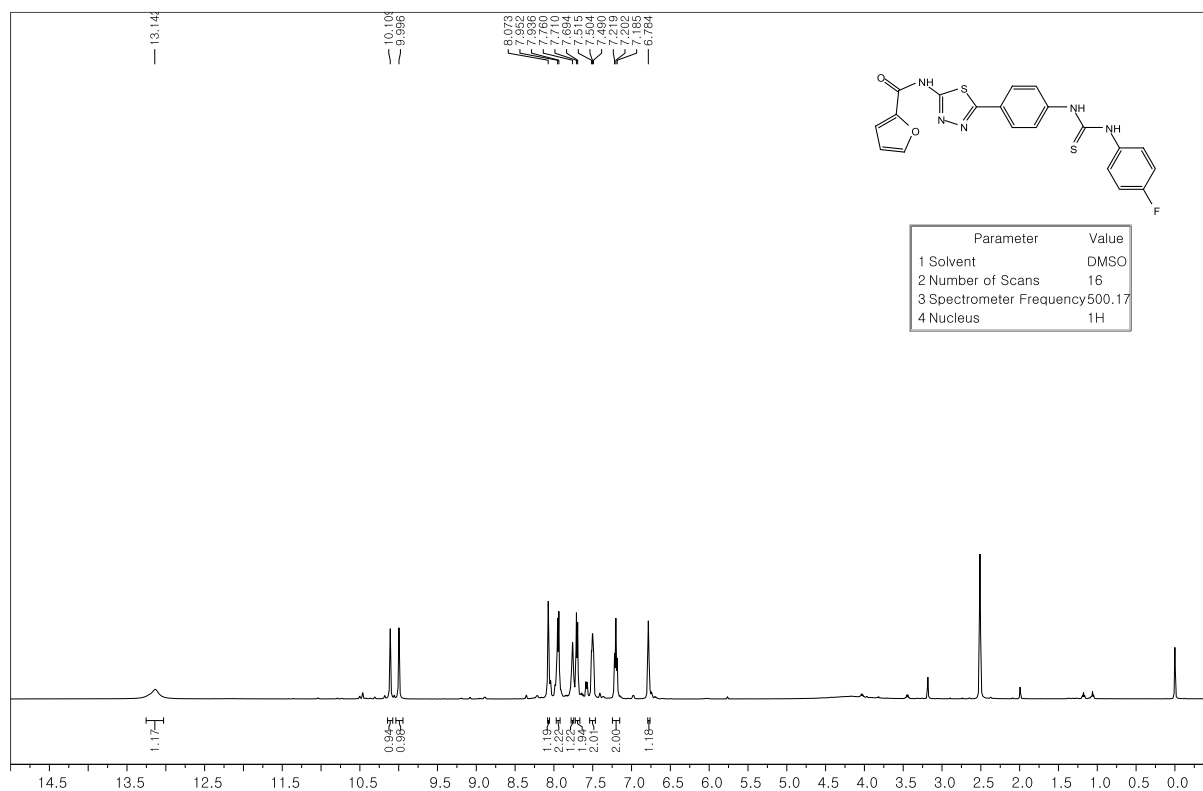
HR/MS – 15{2,2}



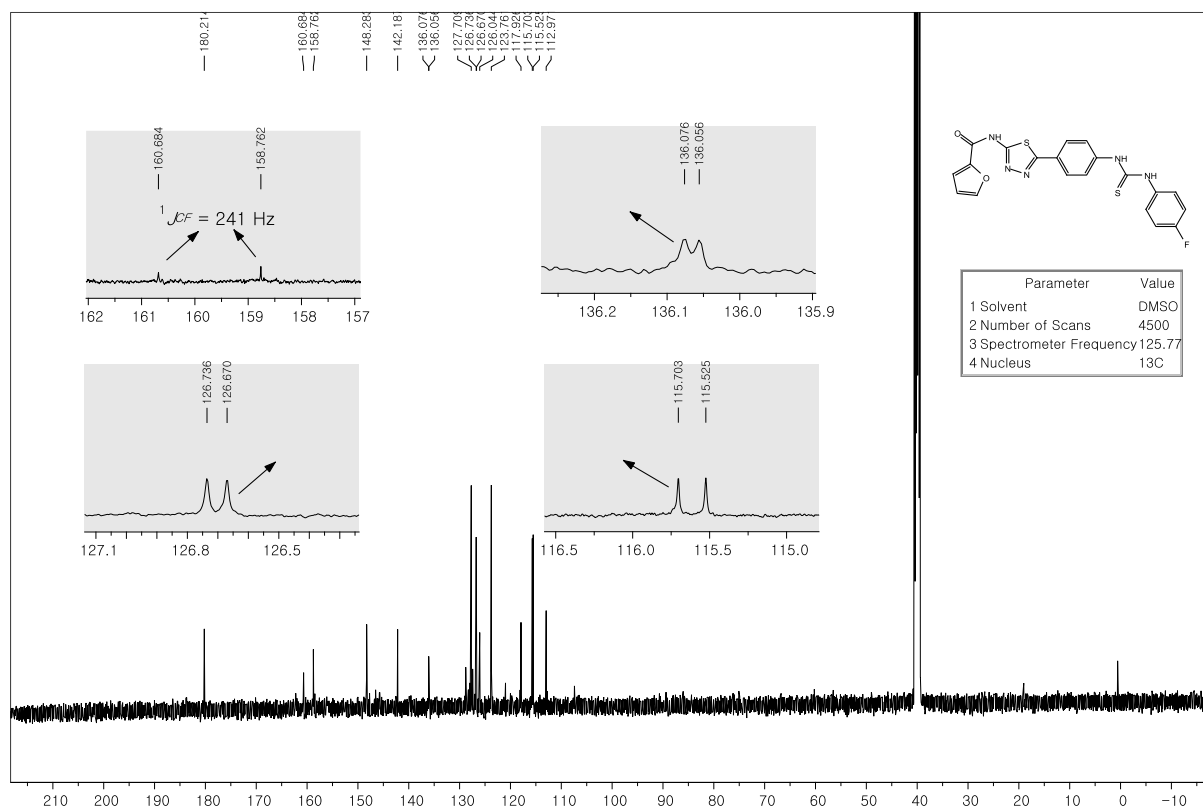
LC/MS – 15{2,3}

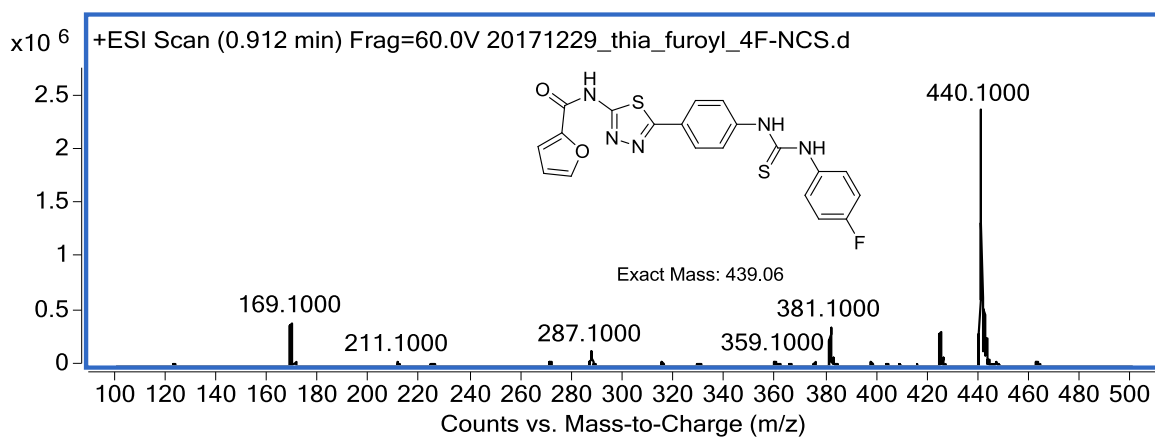
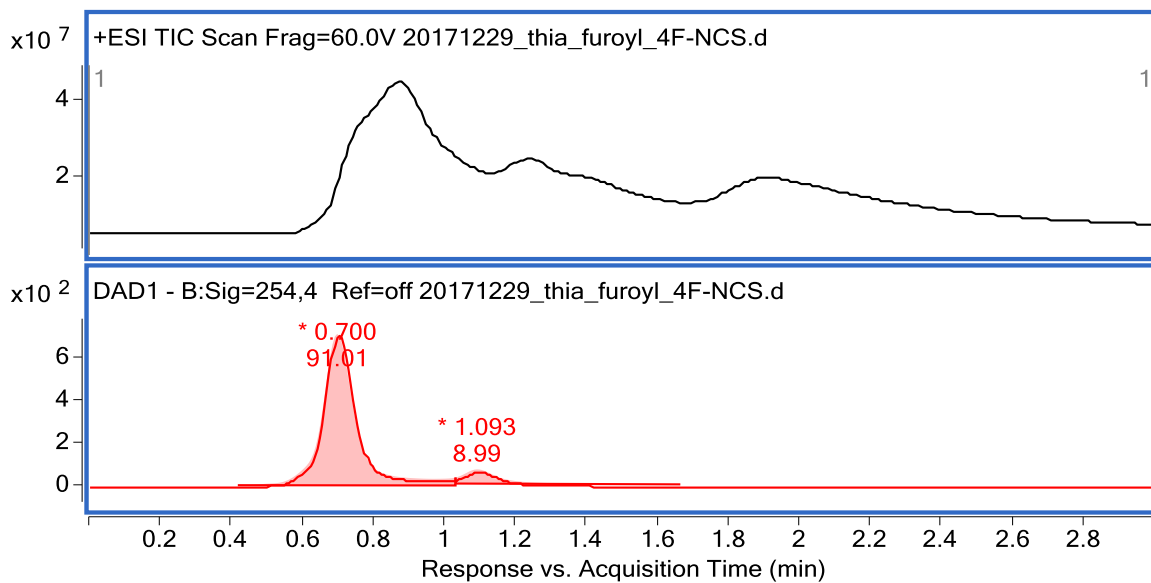


HR/MS – 15{2,3}

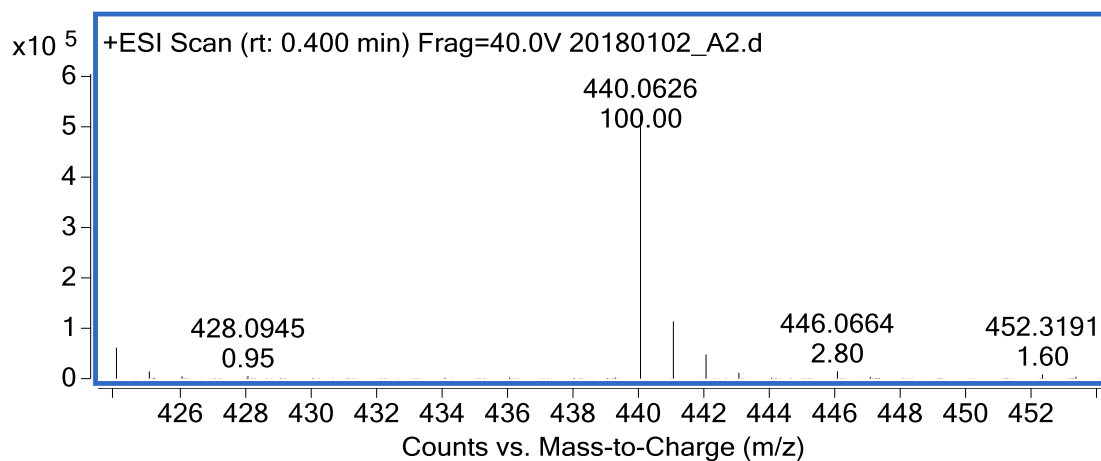


¹H NMR – 15{2,4}

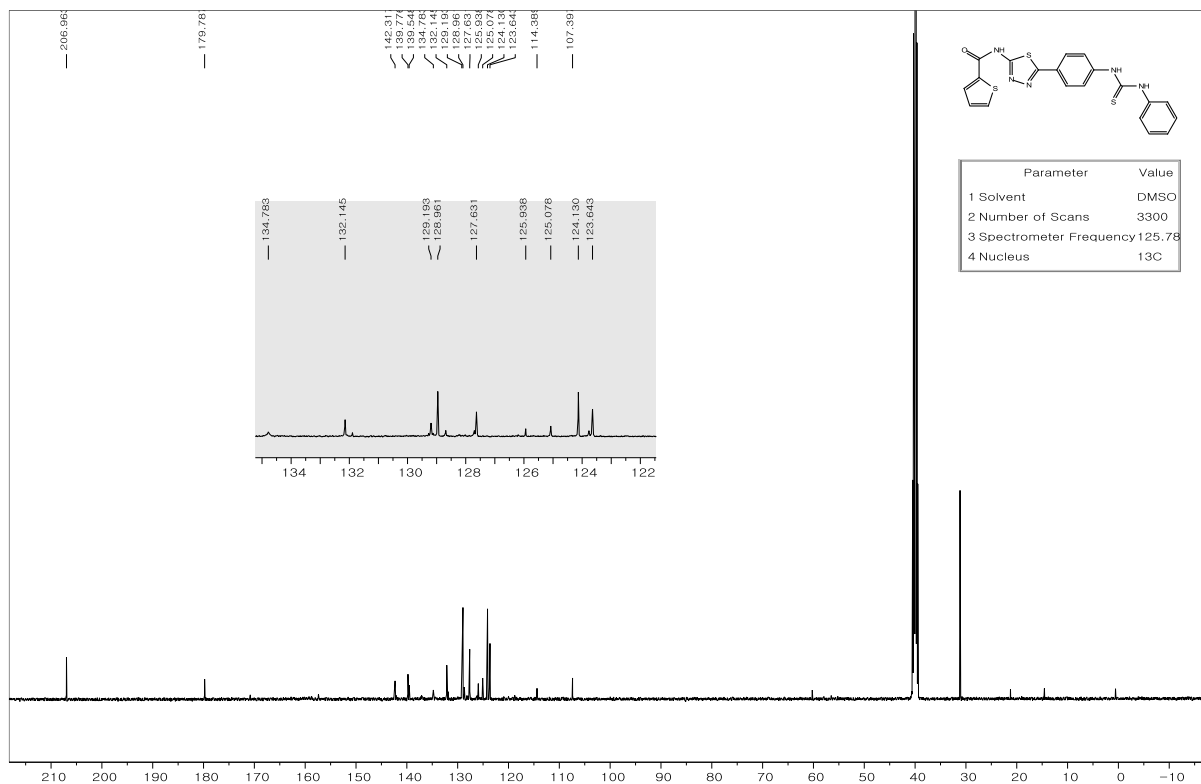
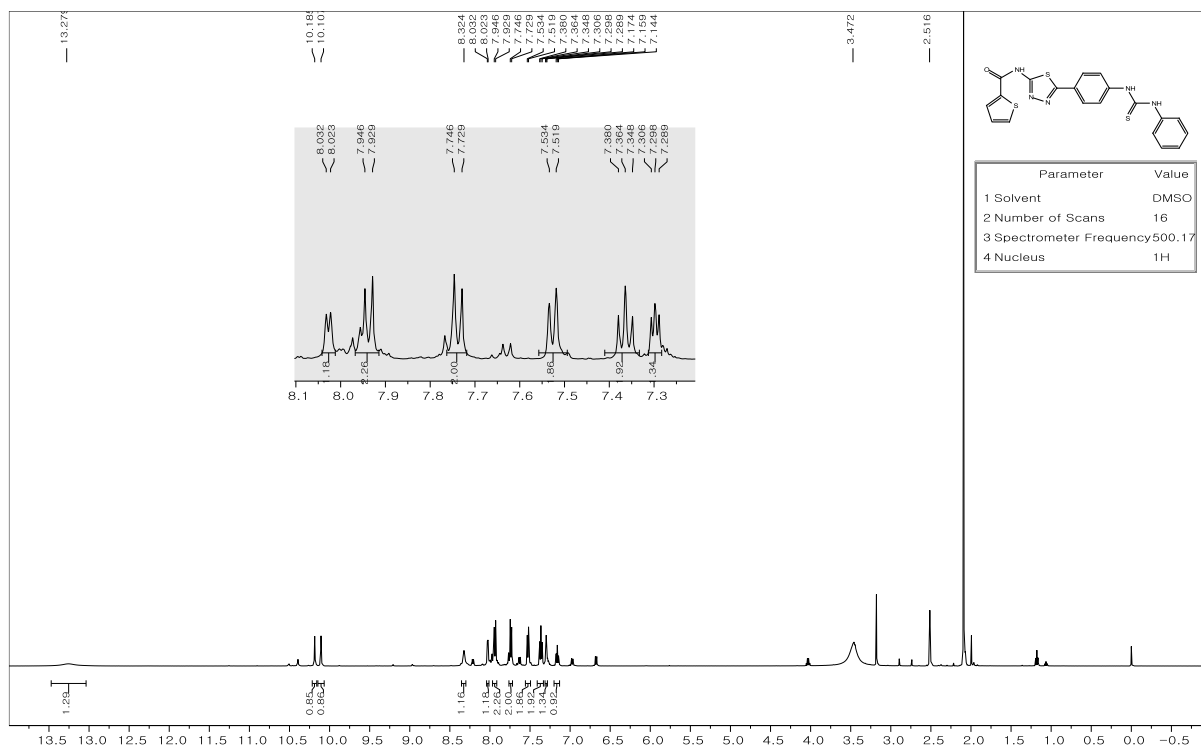
 ^{13}C NMR – 15{2,4}

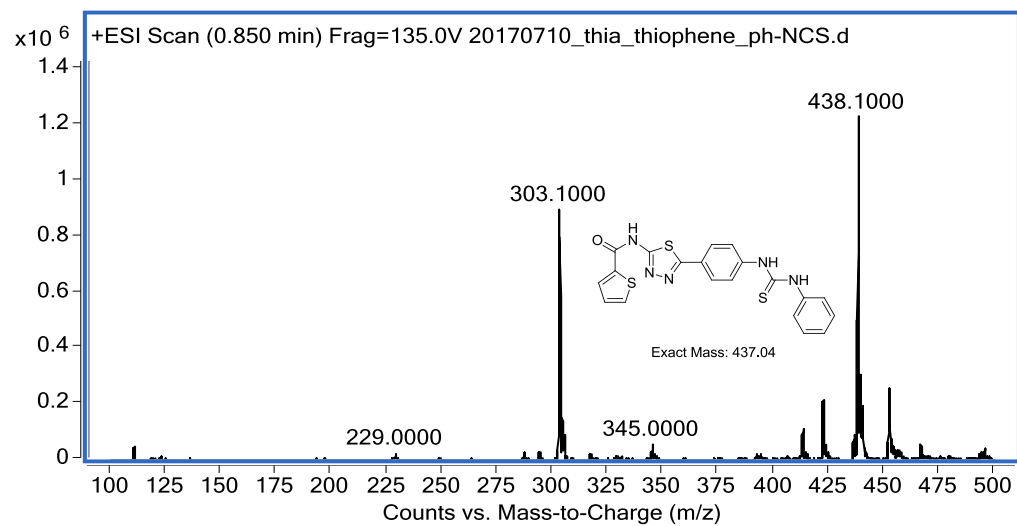
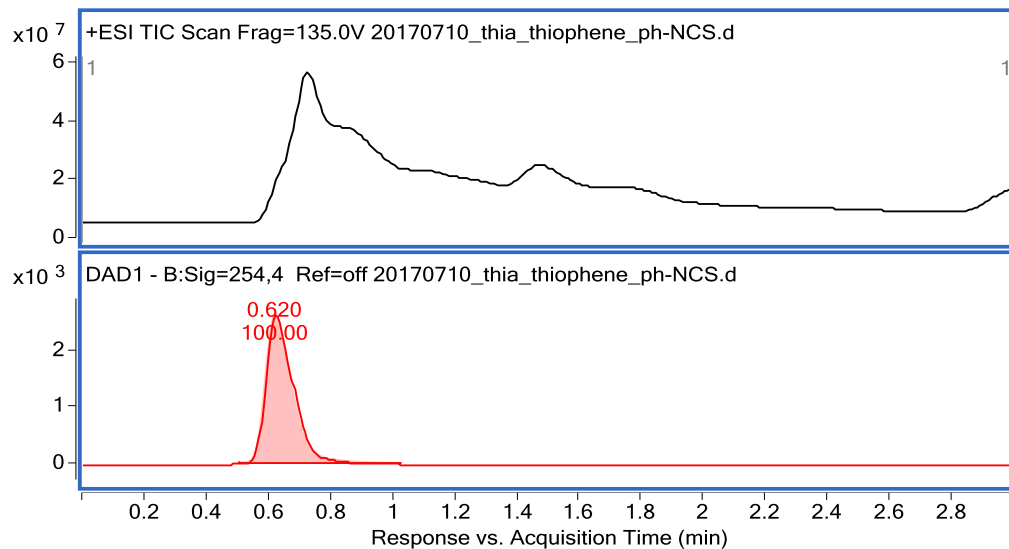


LC/MS – 15{2,4}

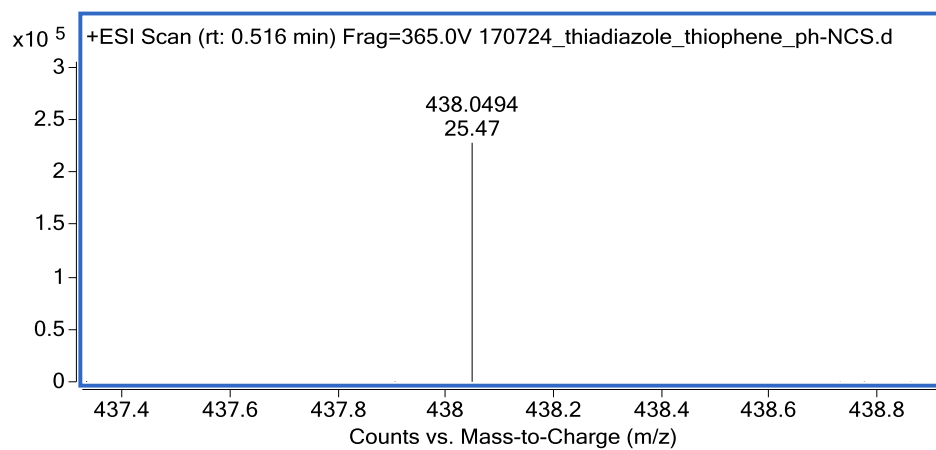


HR/MS – 15{2,4}

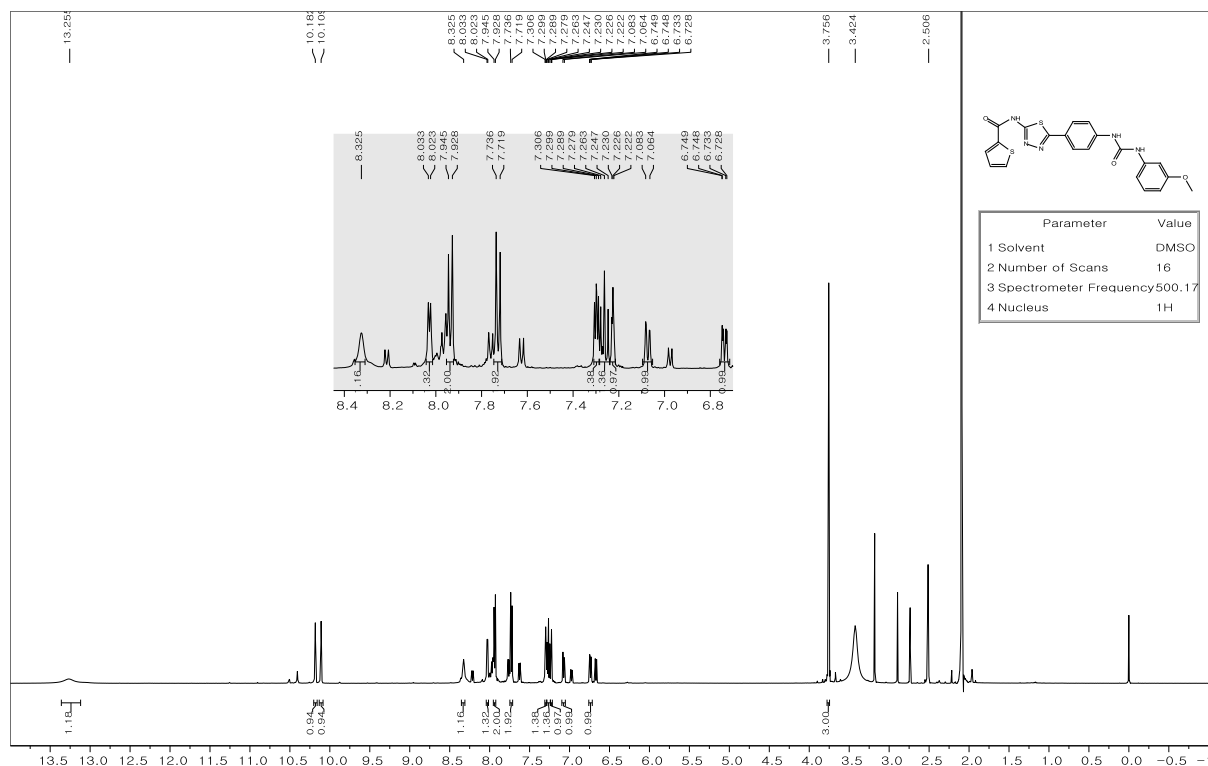




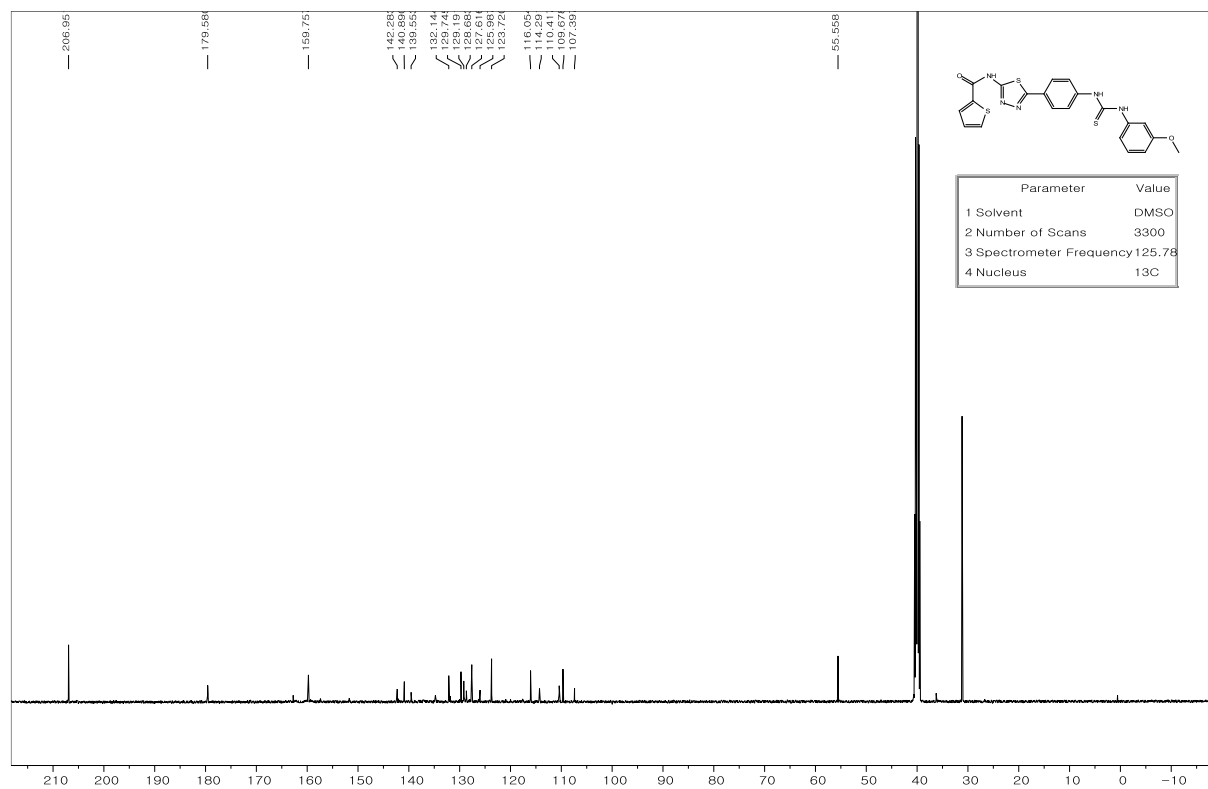
LC/MS – 15{3,1}



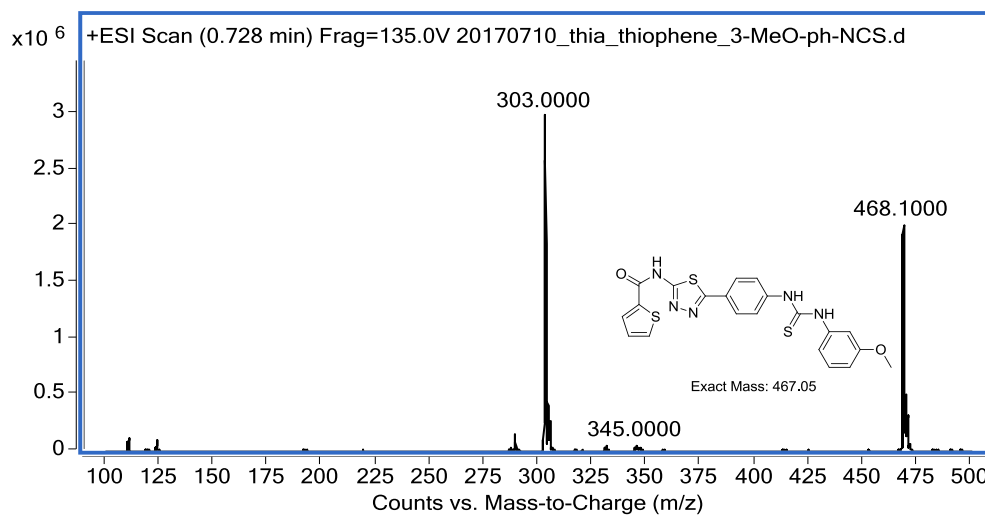
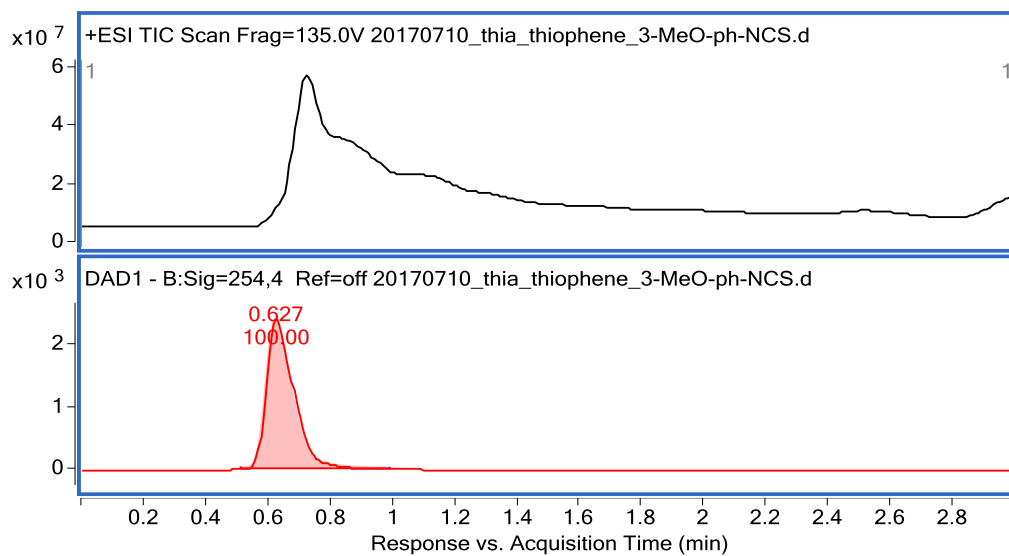
HR/MS – 15{3,1}



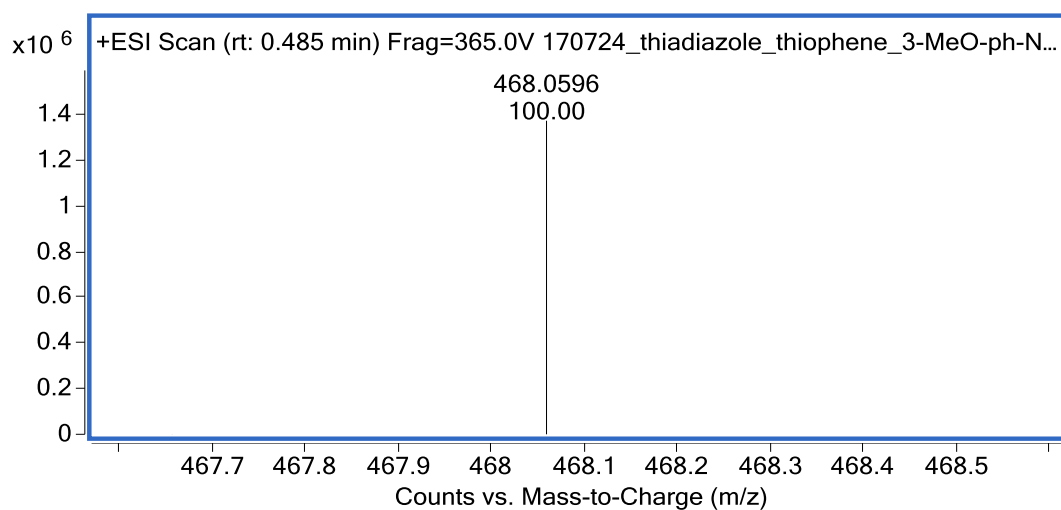
¹H NMR – 15{3,2}



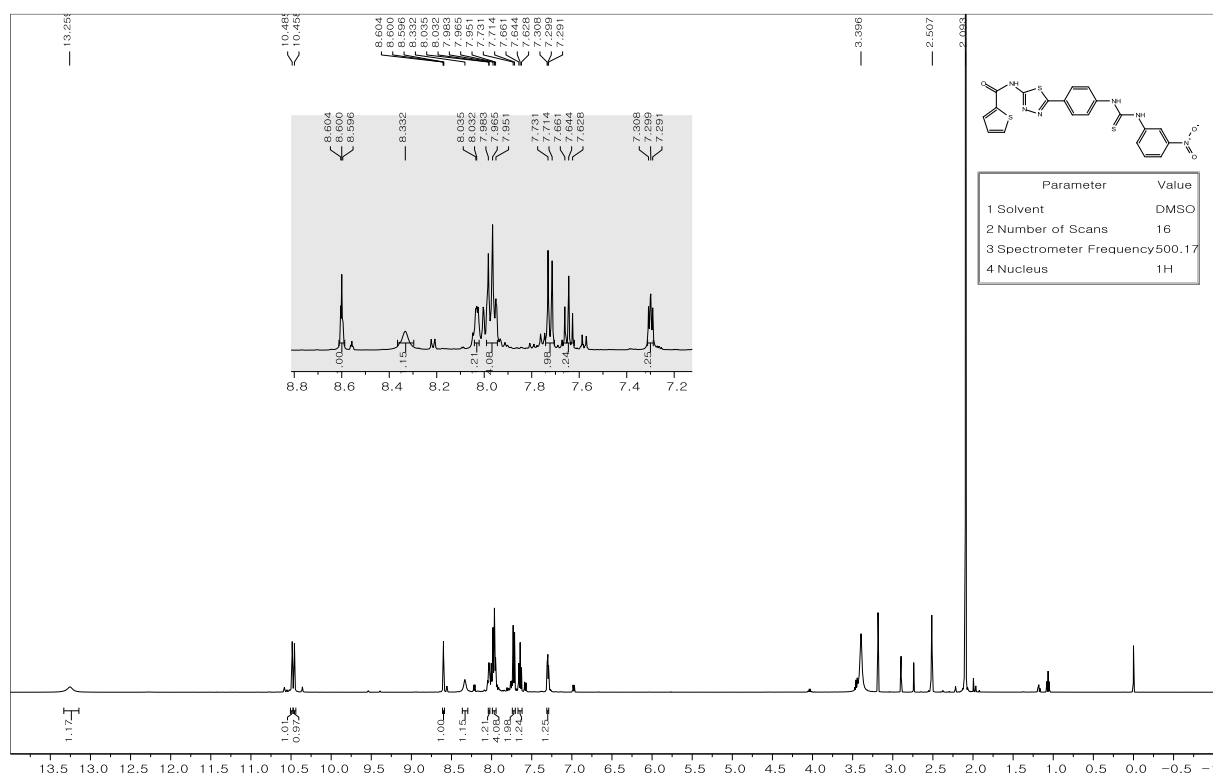
¹³C NMR – 15{3,2}



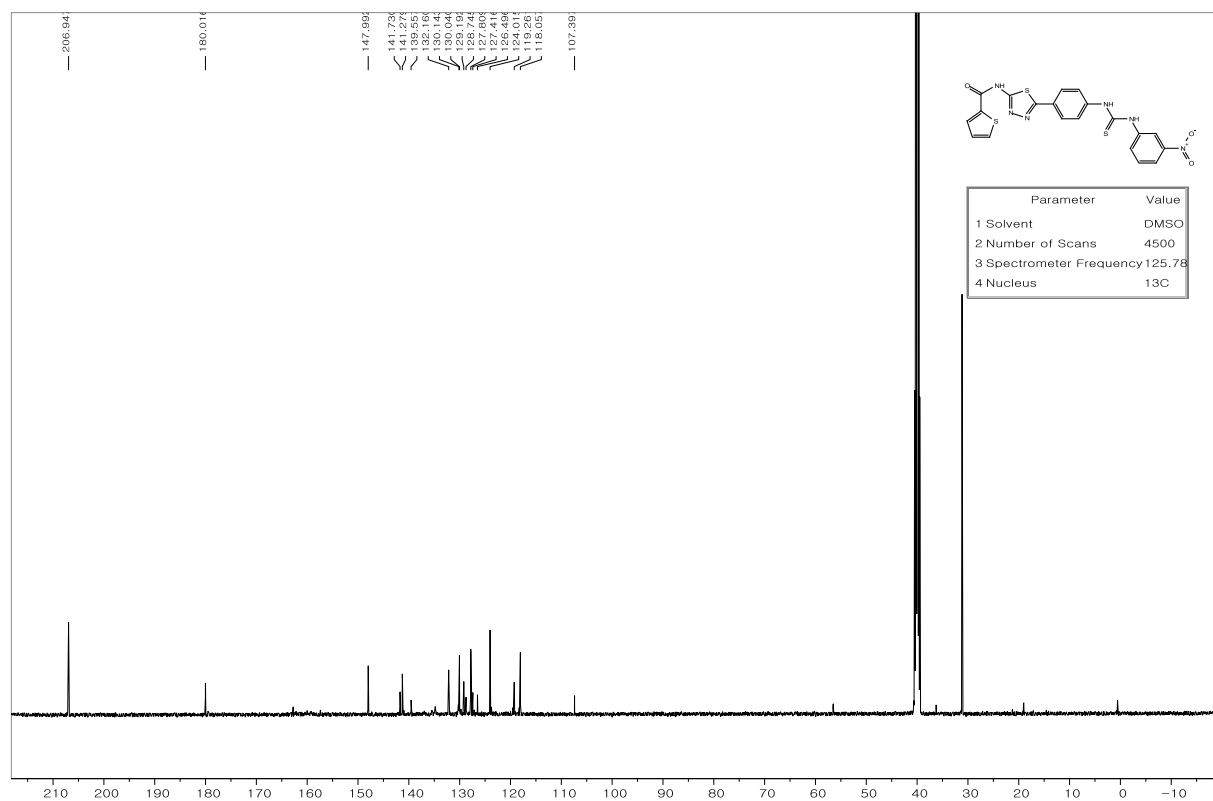
LC/MS – 15{3,2}



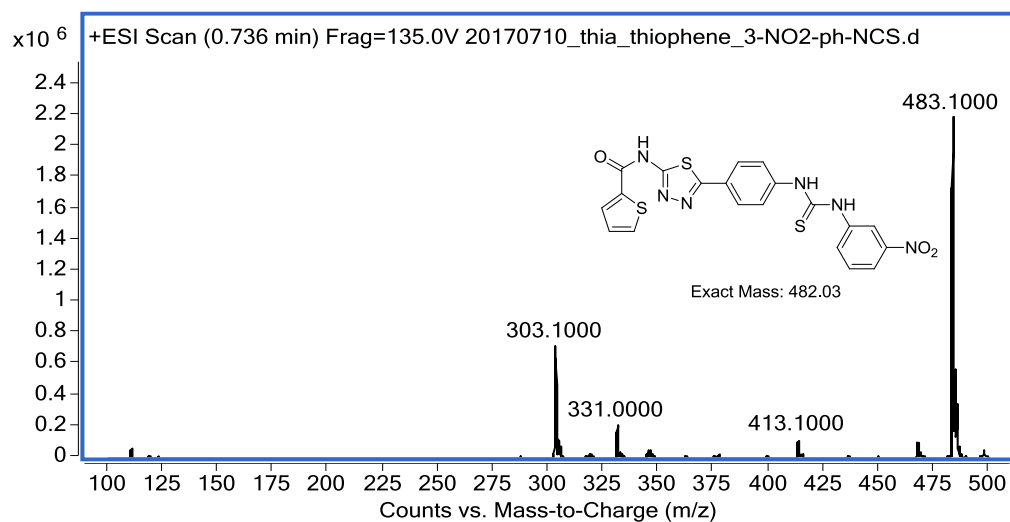
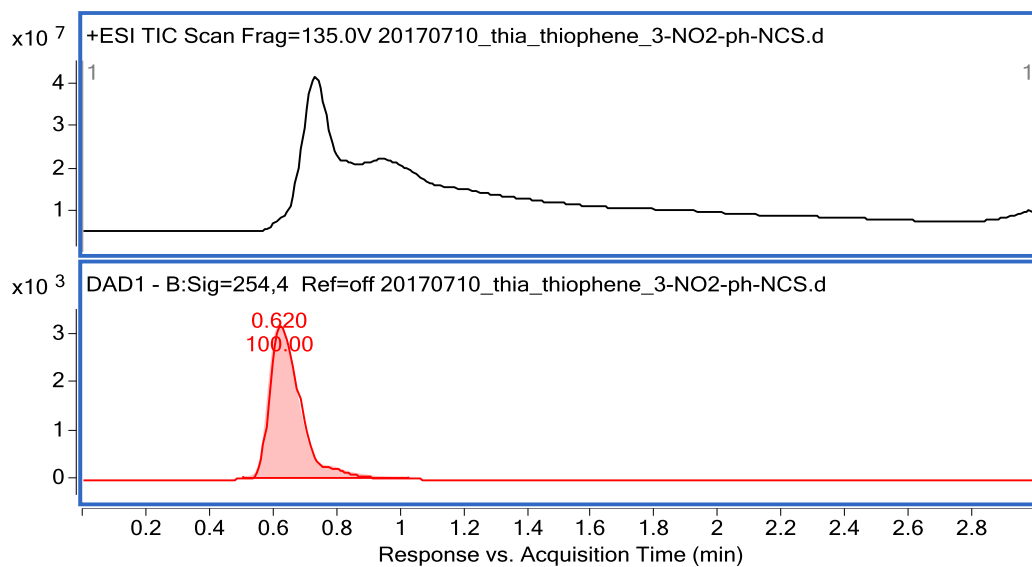
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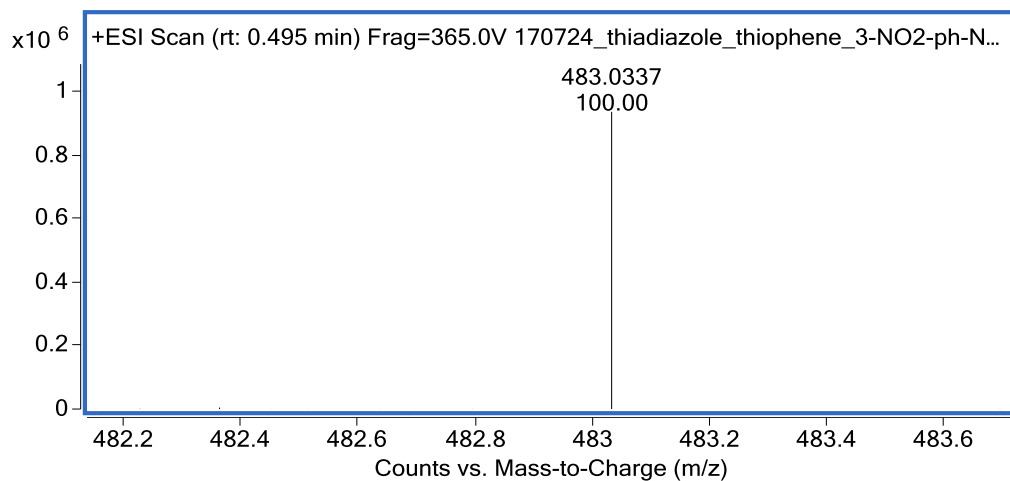
¹H NMR – 15{3,3}



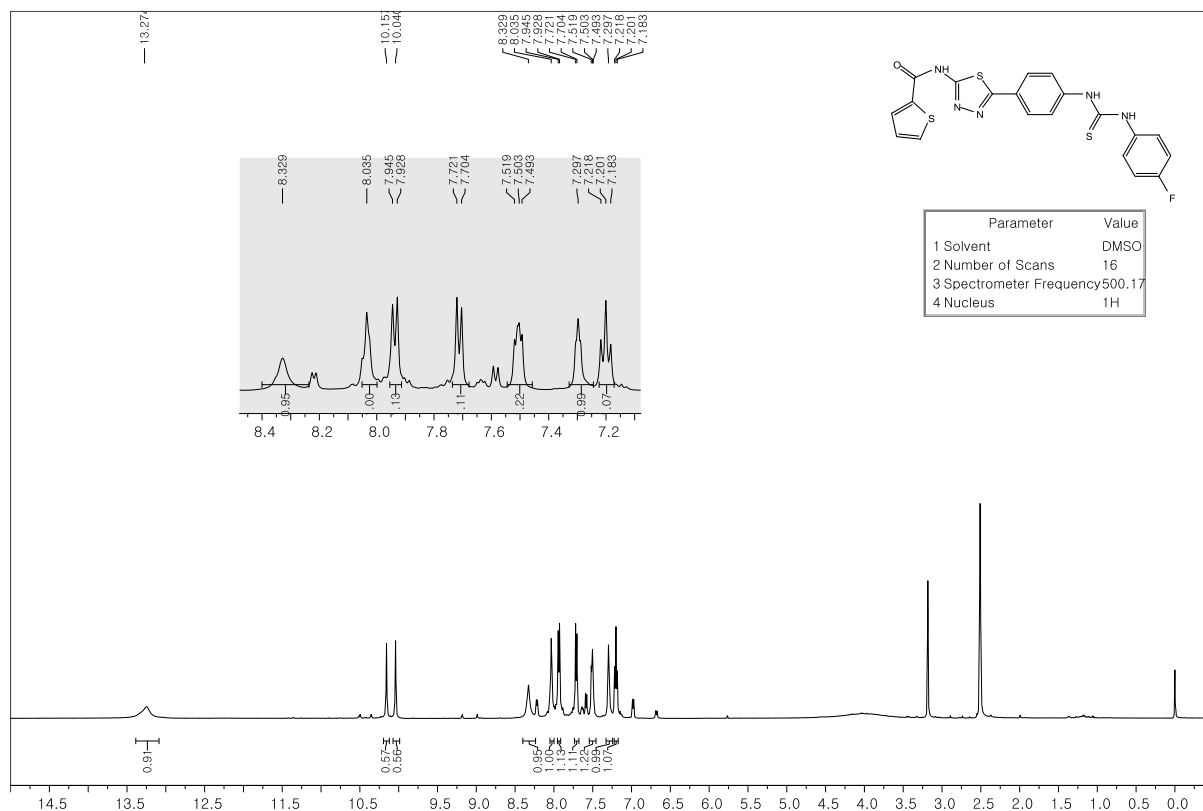
^{13}C NMR – 15{3,3}



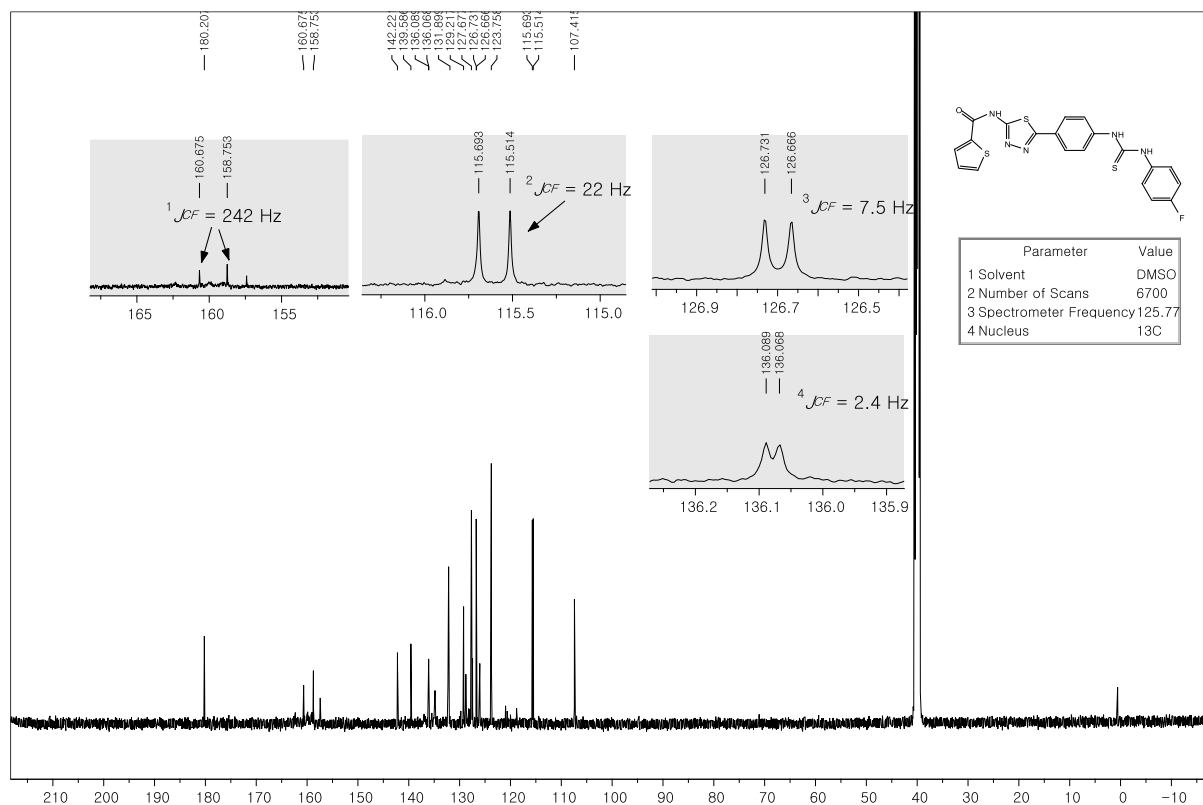
LC/MS – 15{3,3}



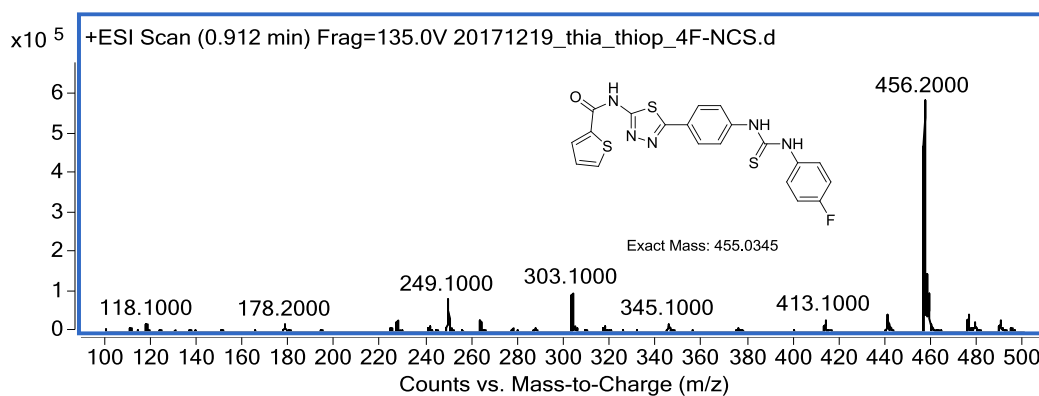
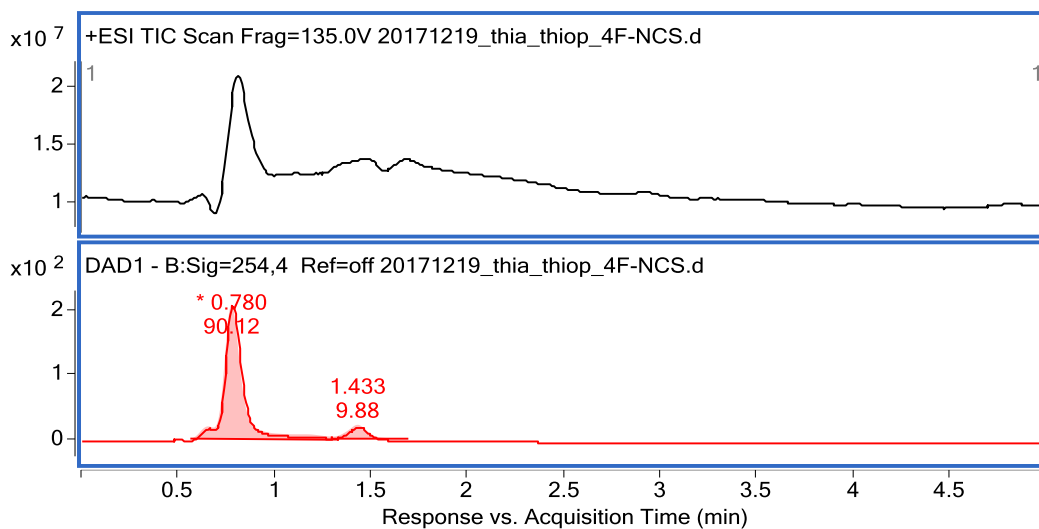
HR/MS – 15{3,3}



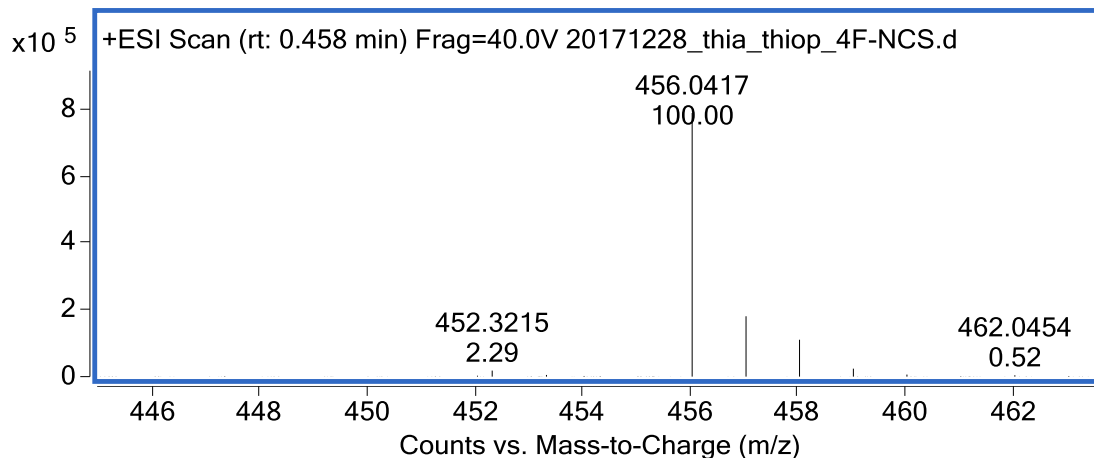
¹H NMR – 15{3,4}



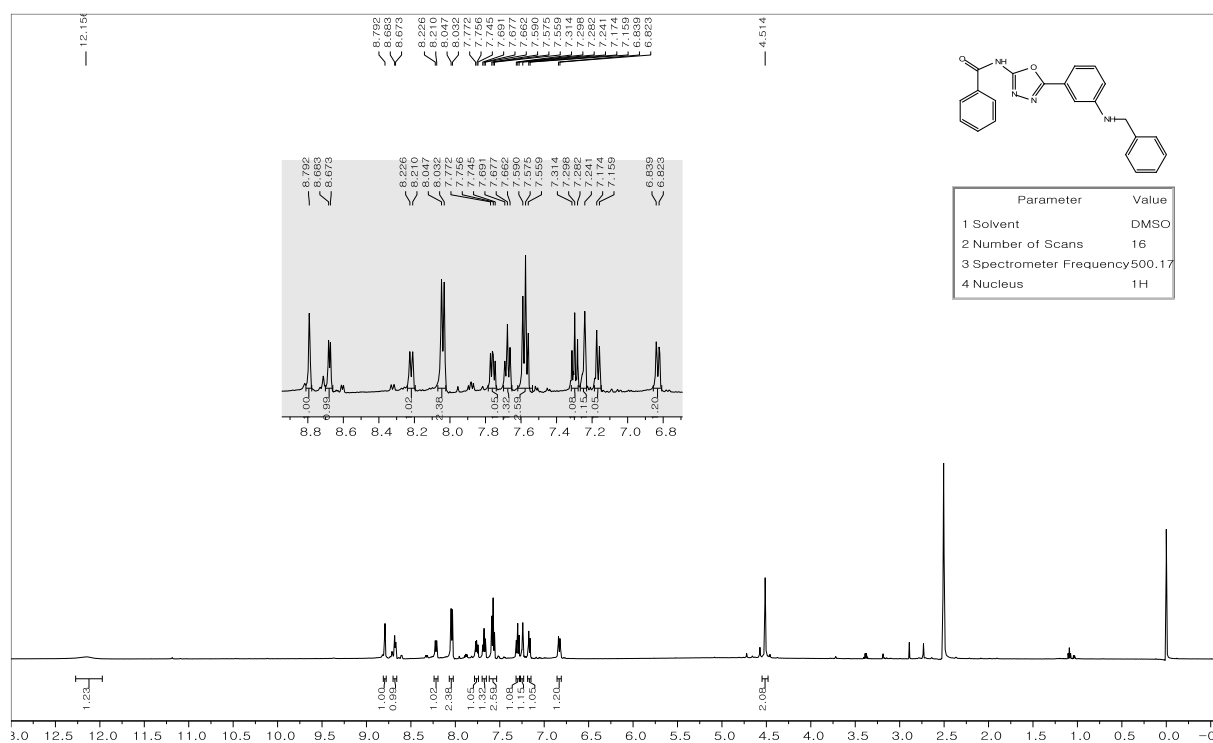
^{13}C NMR – 15{3,4}



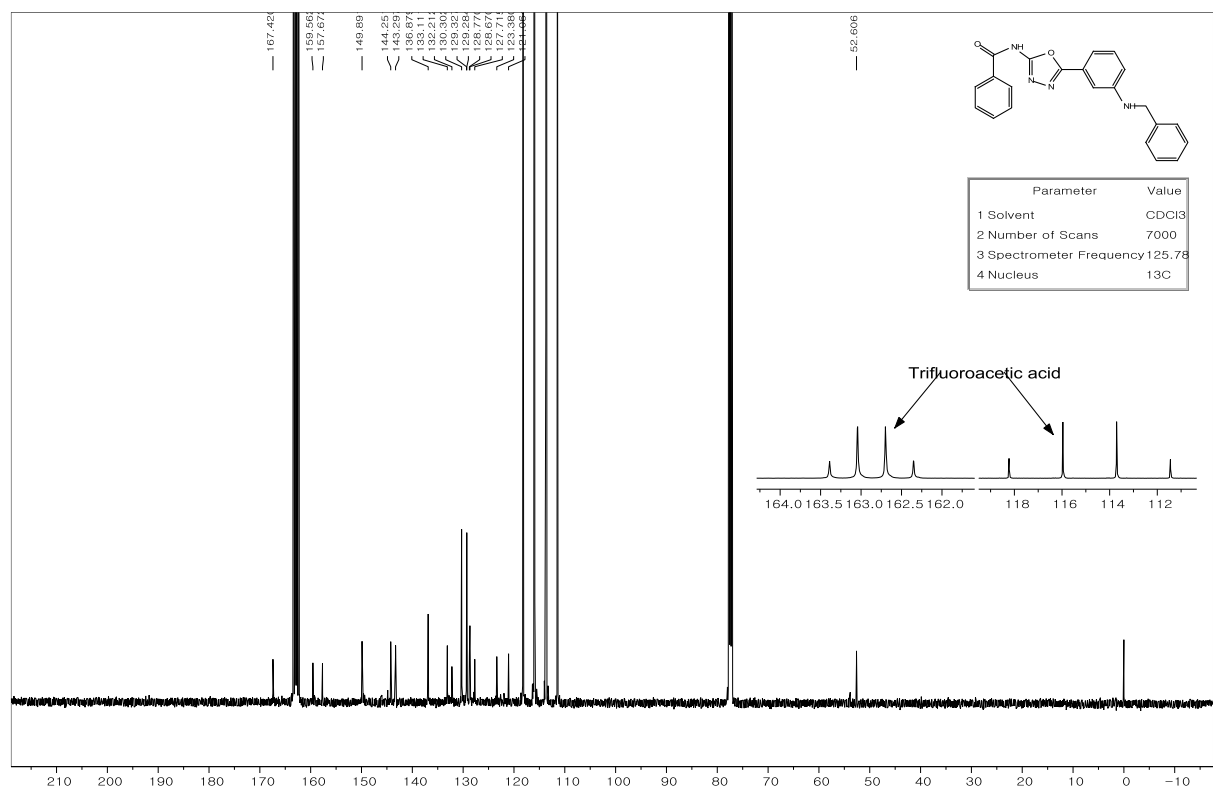
LC/MS – 15{3,4}



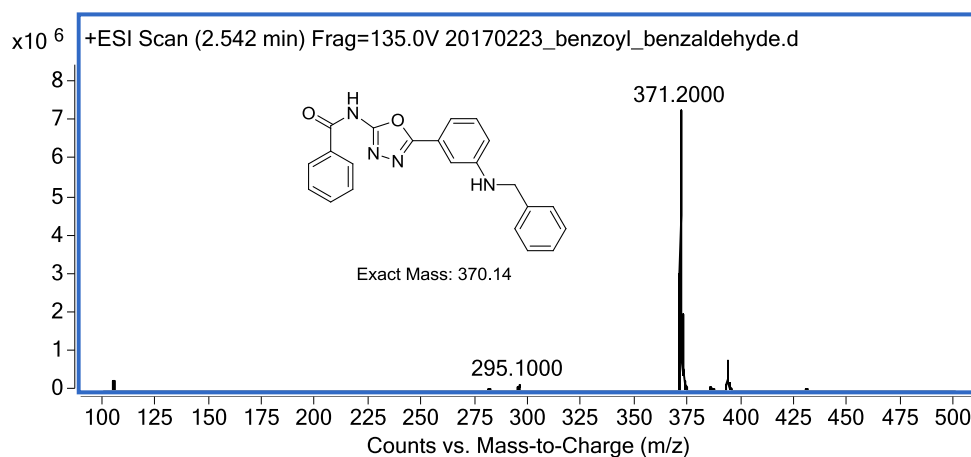
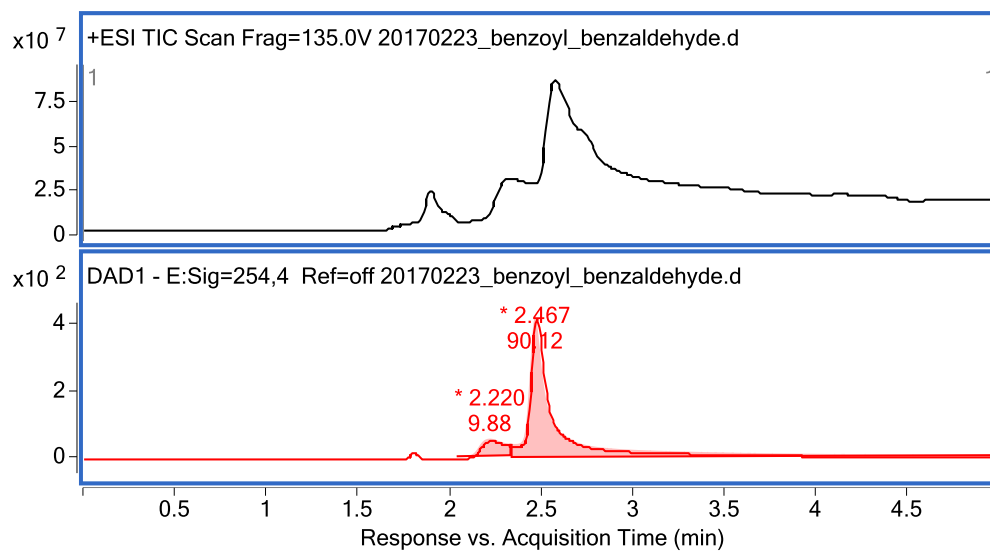
HR/MS – 15{3,4}



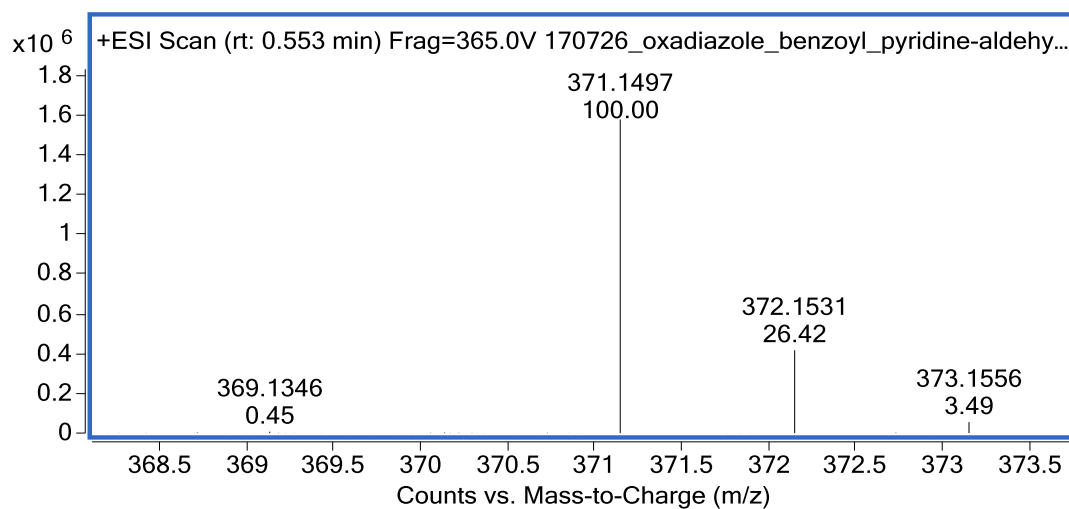
¹H NMR – 16{1,1}



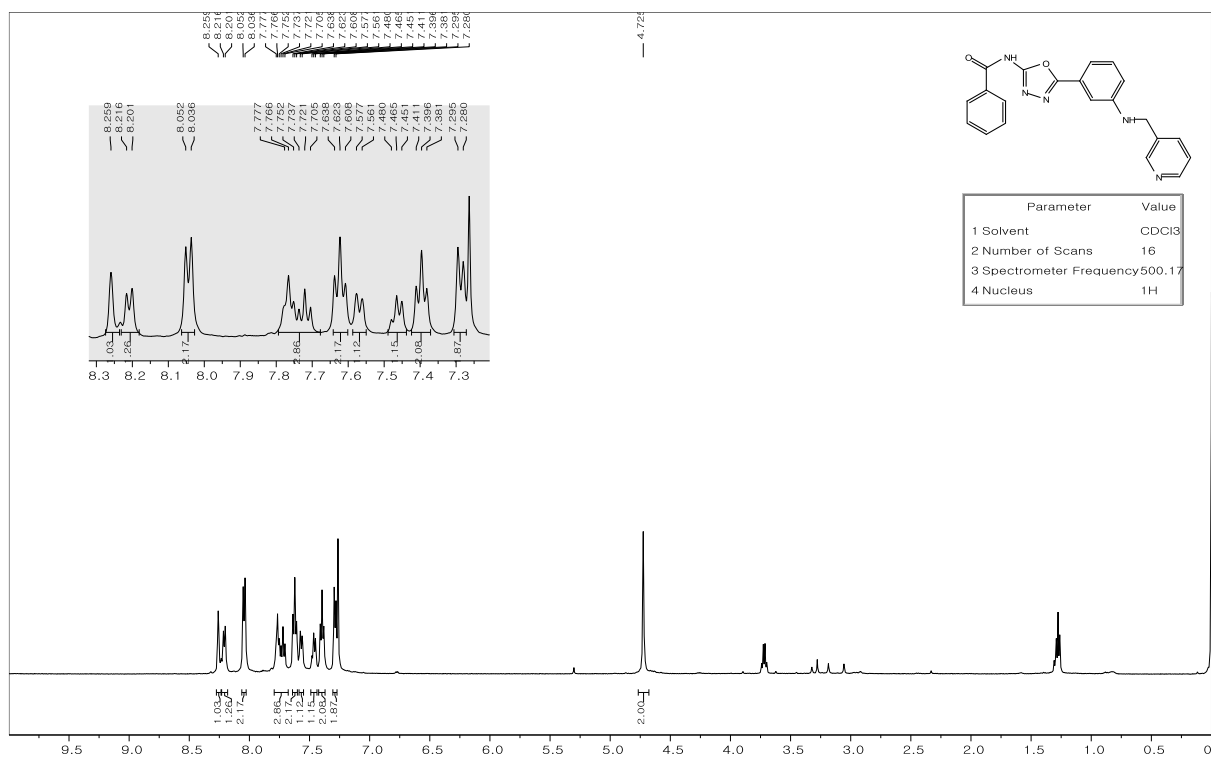
¹³C NMR – 16{1,1}

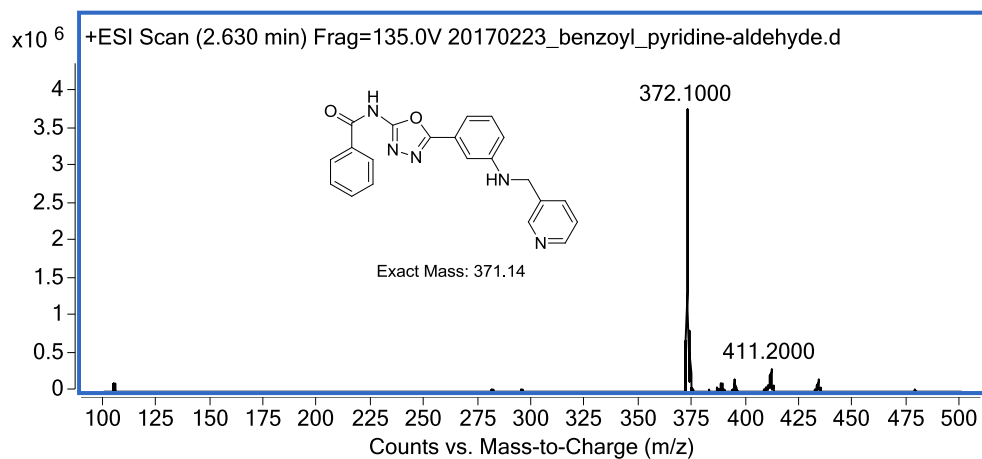
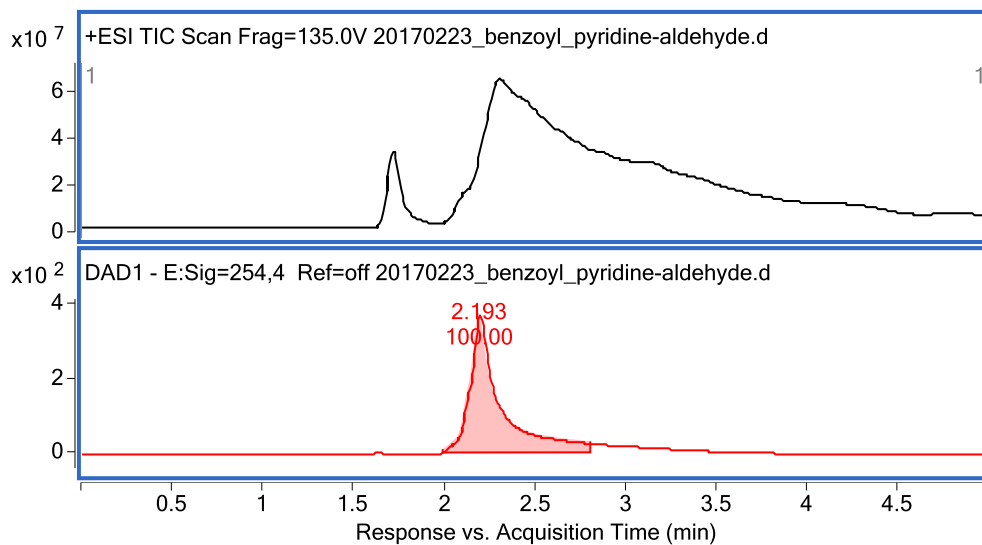


LC/MS – 16{1,1}

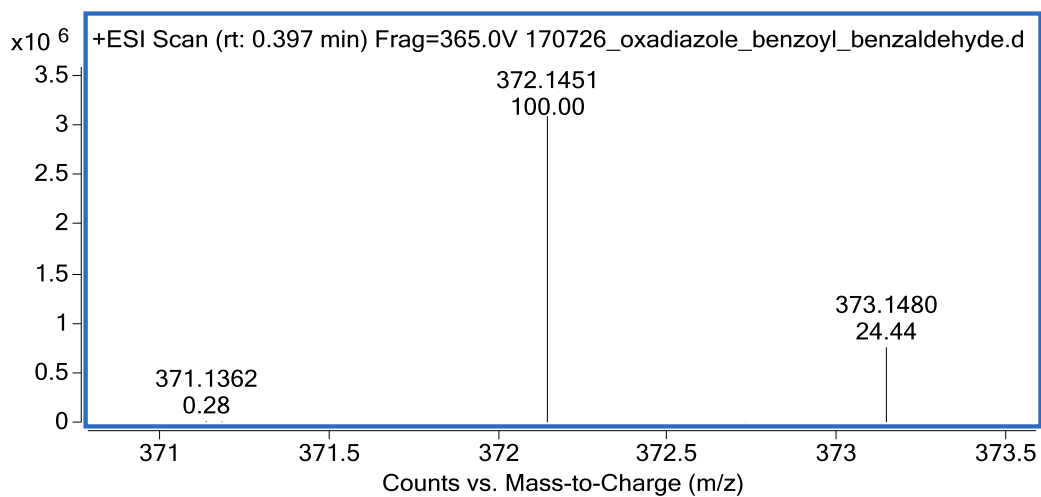


HR/MS – 16{1,1}

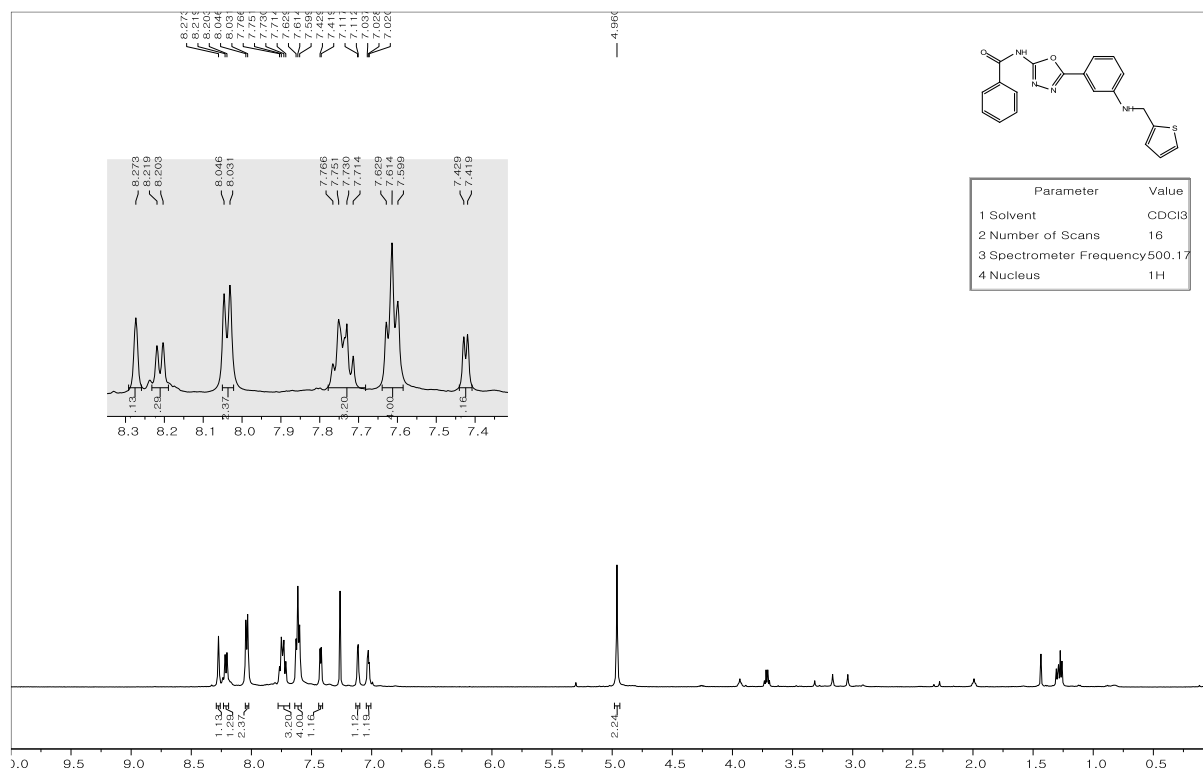




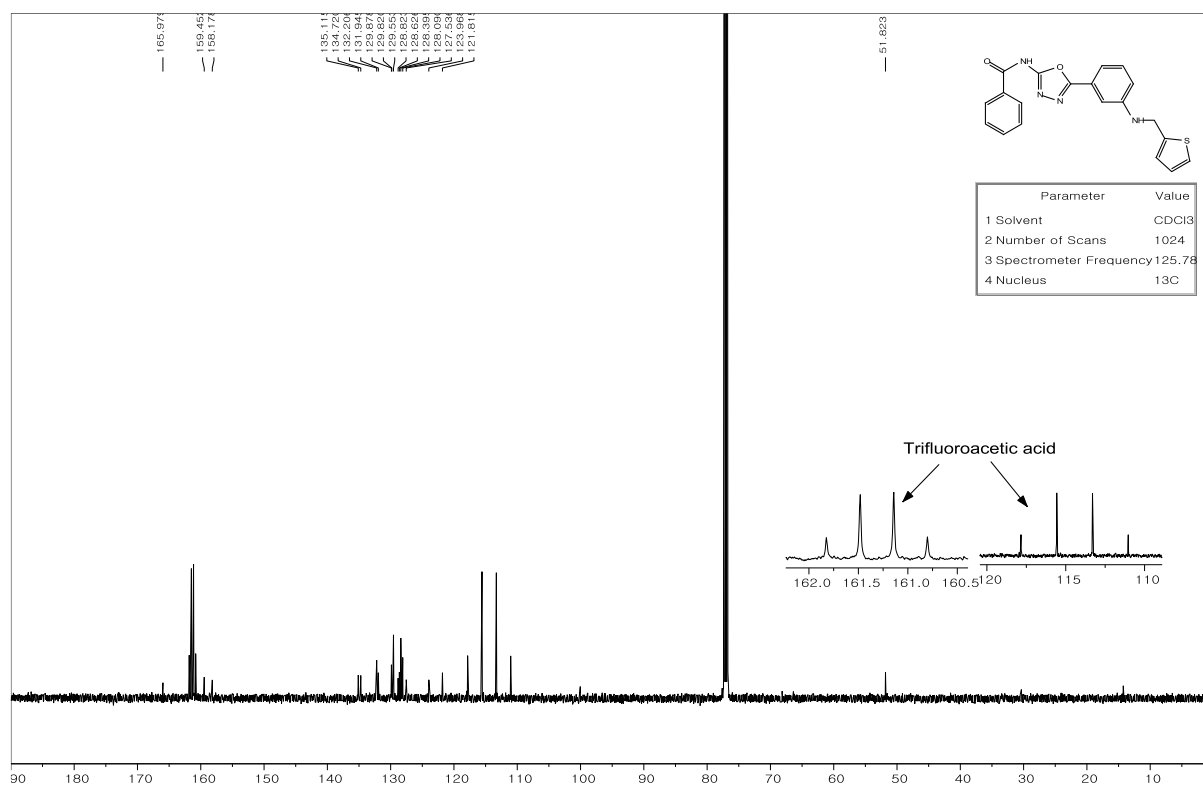
LC/MS – 16{1,2}



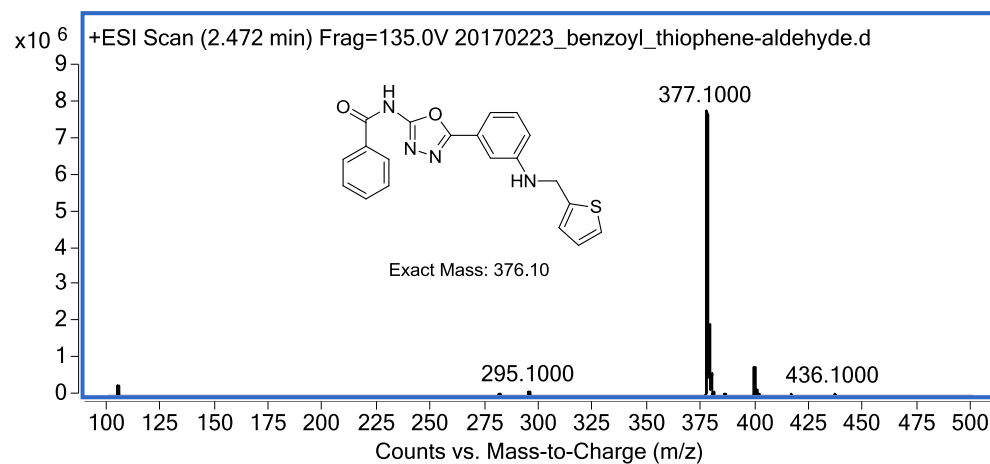
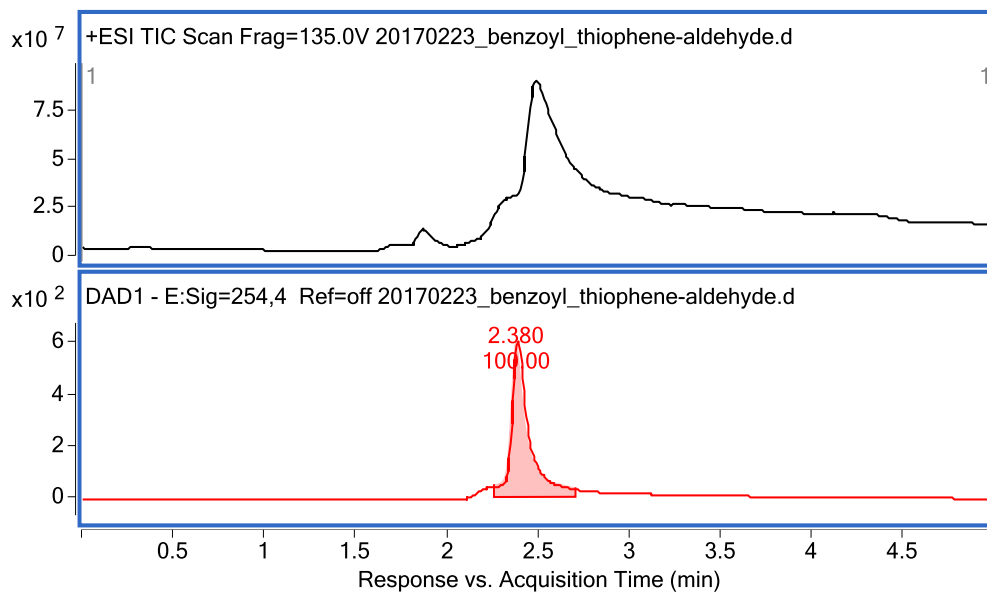
HR/MS – 16{1,2}



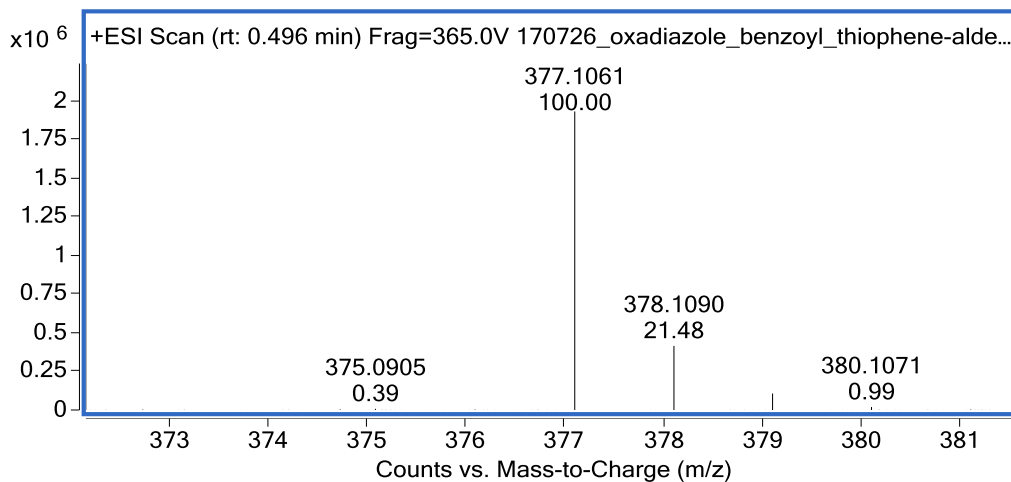
¹H NMR – 16{1,3}



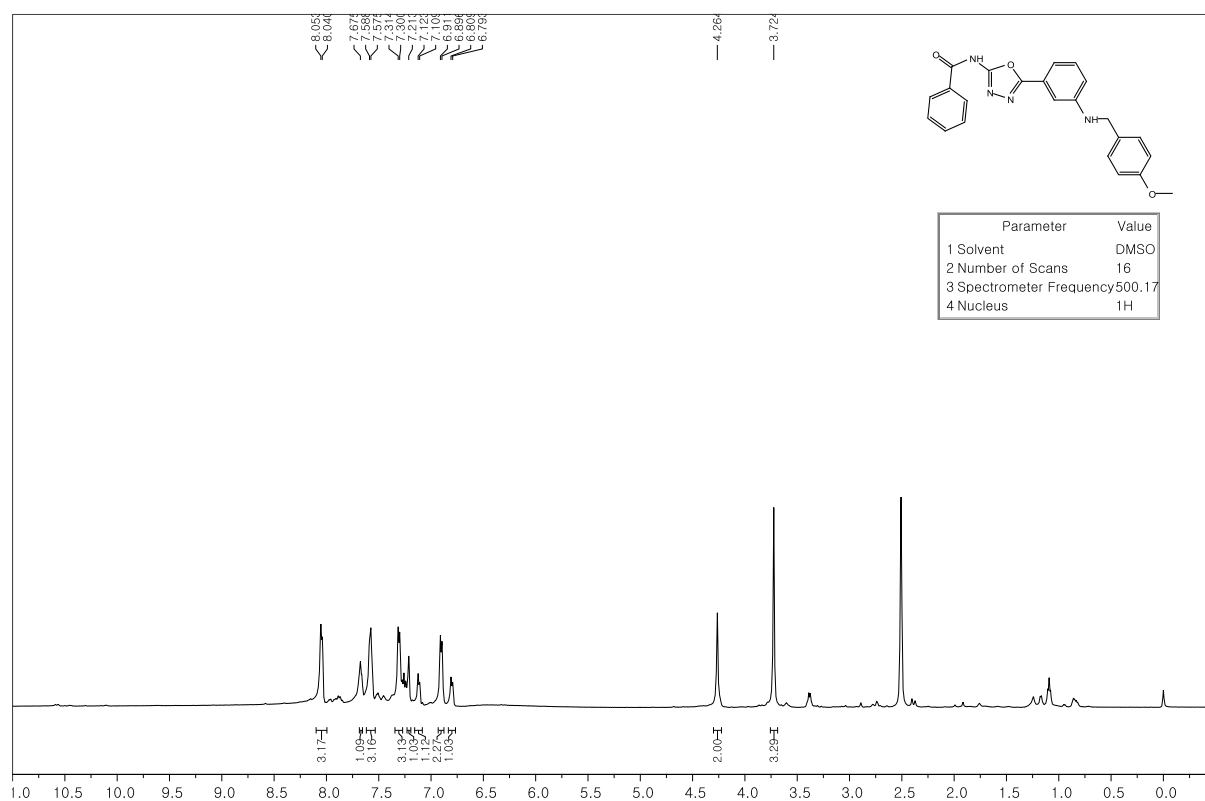
¹³C NMR – 16{1,3}



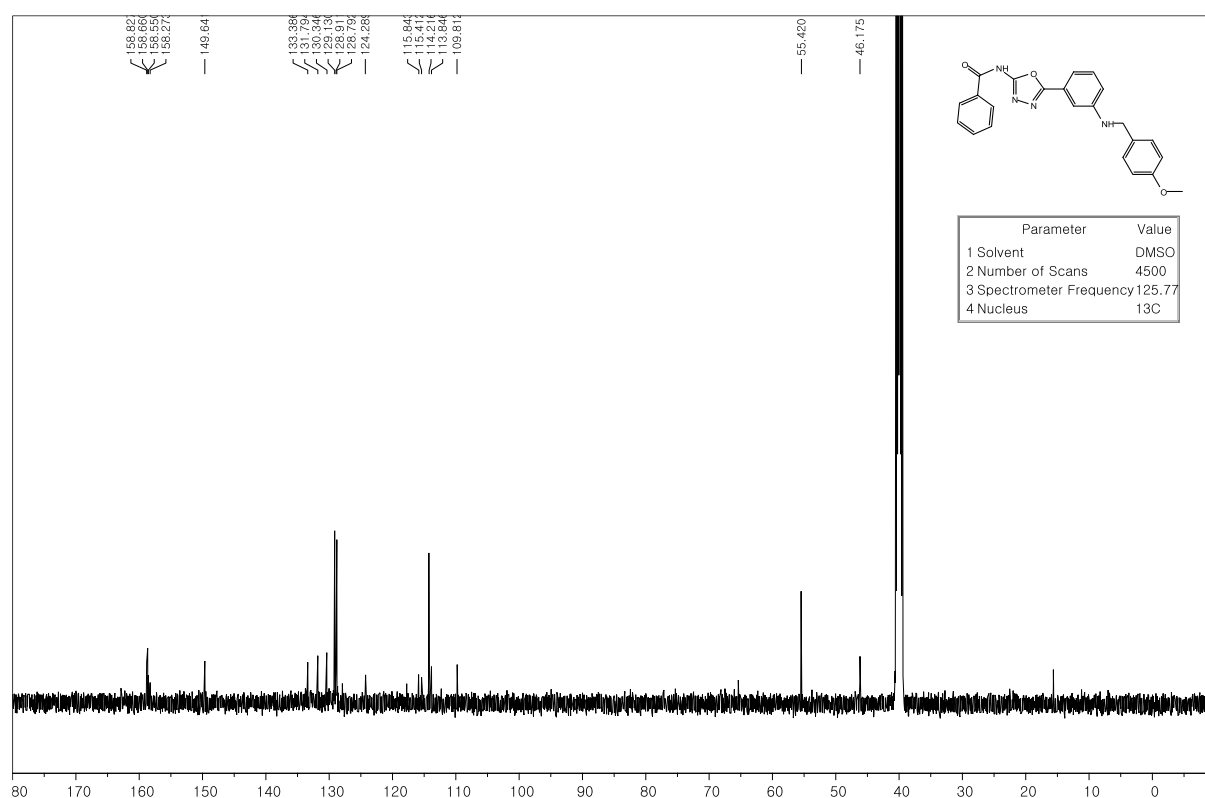
LC/MS – 16{1,3}



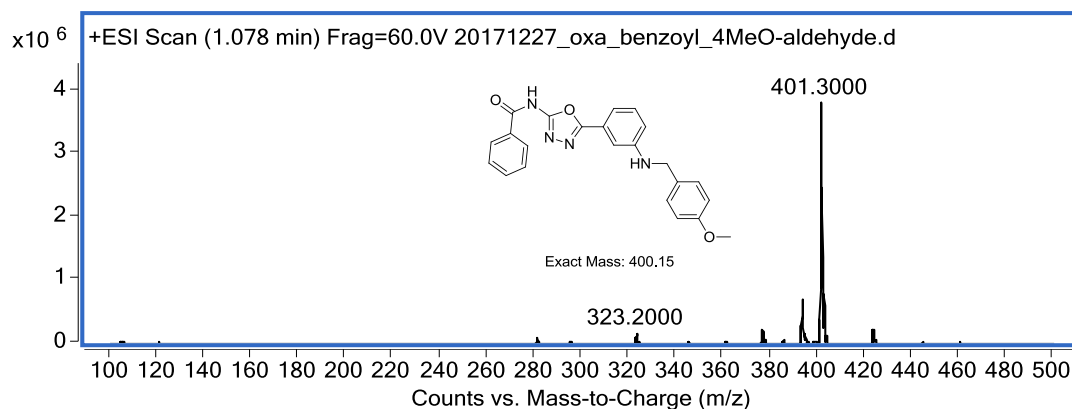
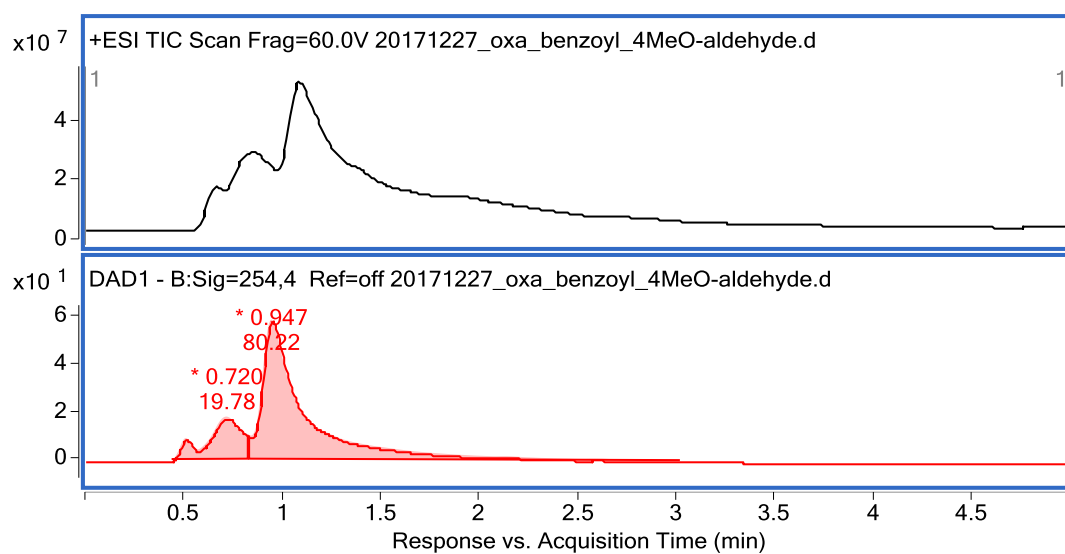
HR/MS – 16{1,3}



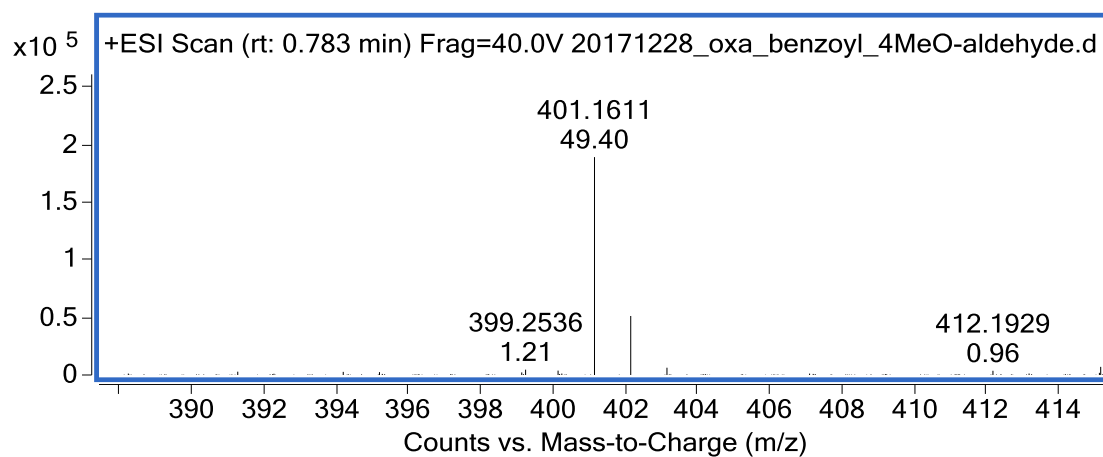
¹H NMR – 16{1,4}



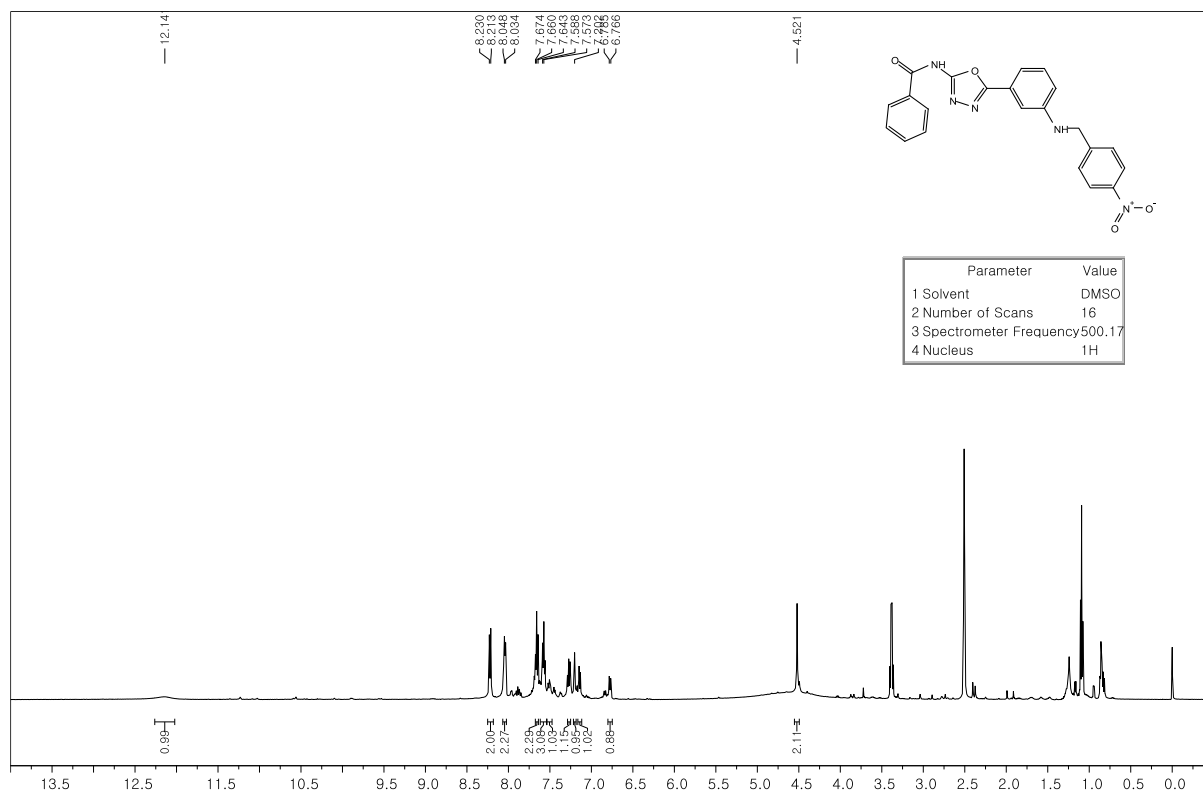
^{13}C NMR - 16{1,4}



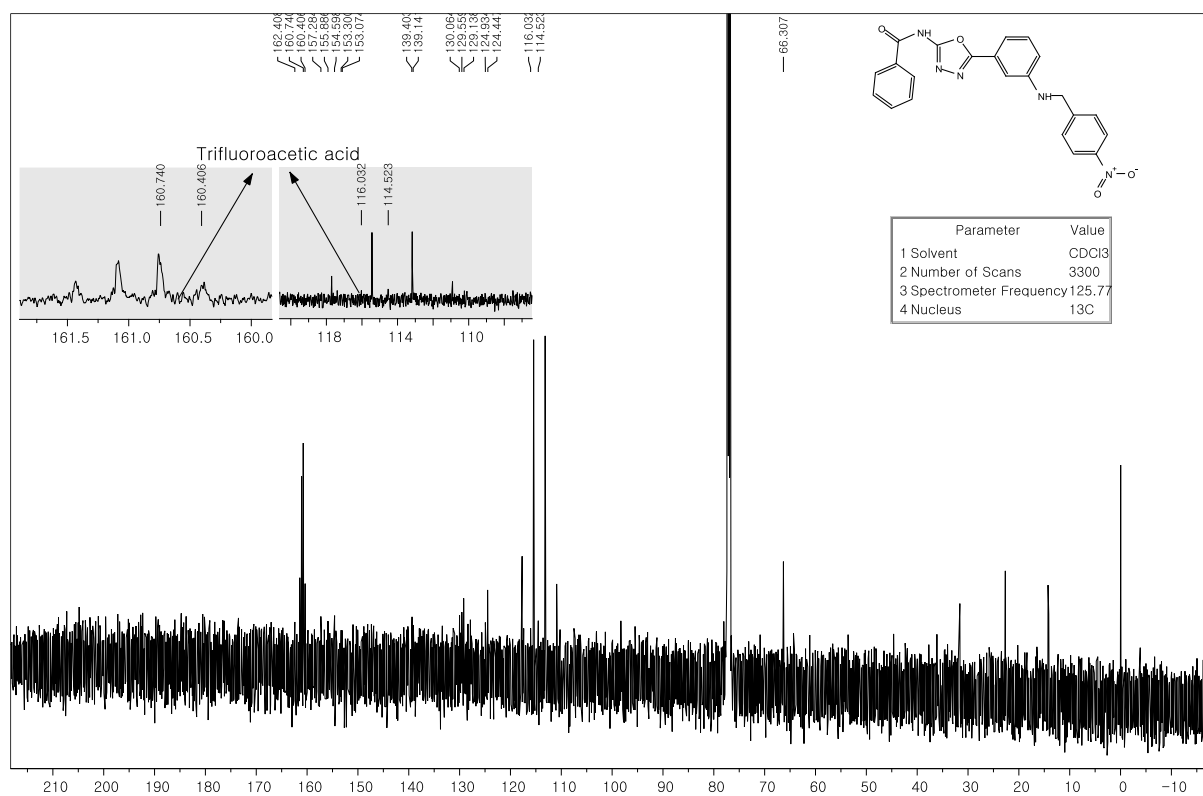
LC/MS - 16{1,4}



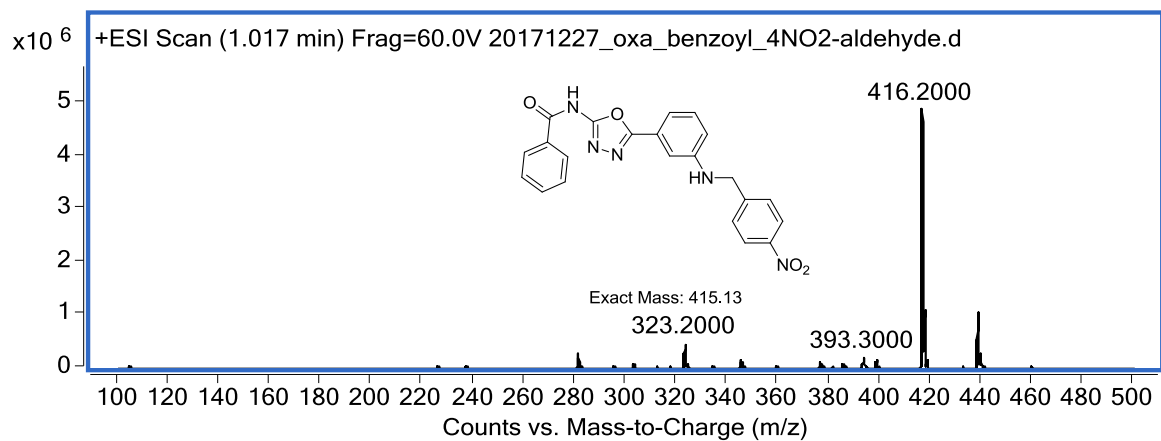
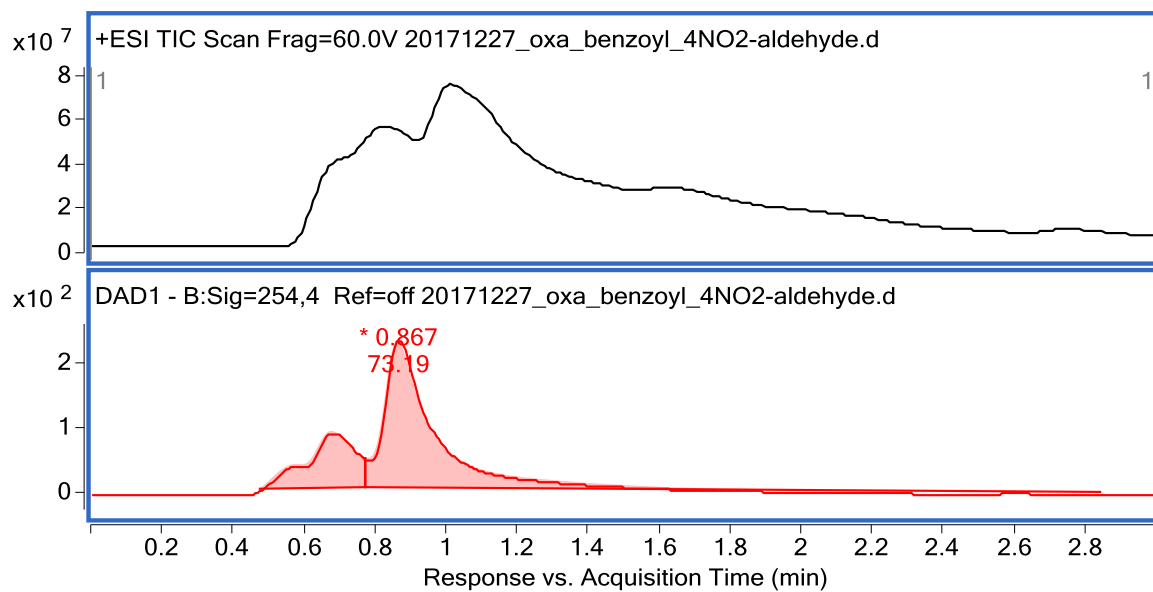
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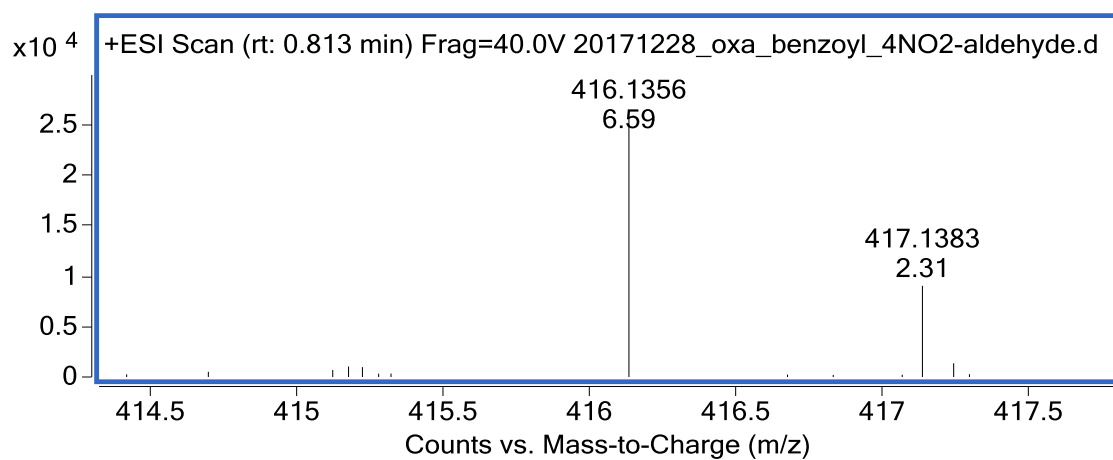
¹H NMR – 16{1,5}



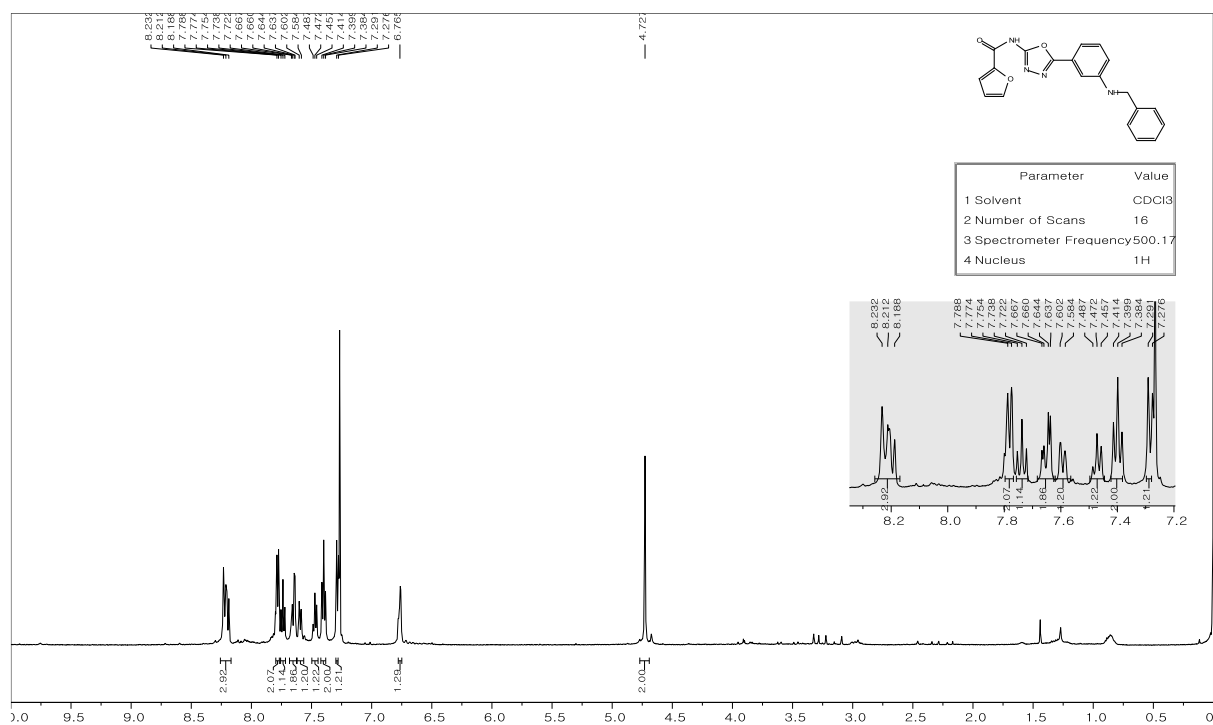
^{13}C NMR – 16{1,5}



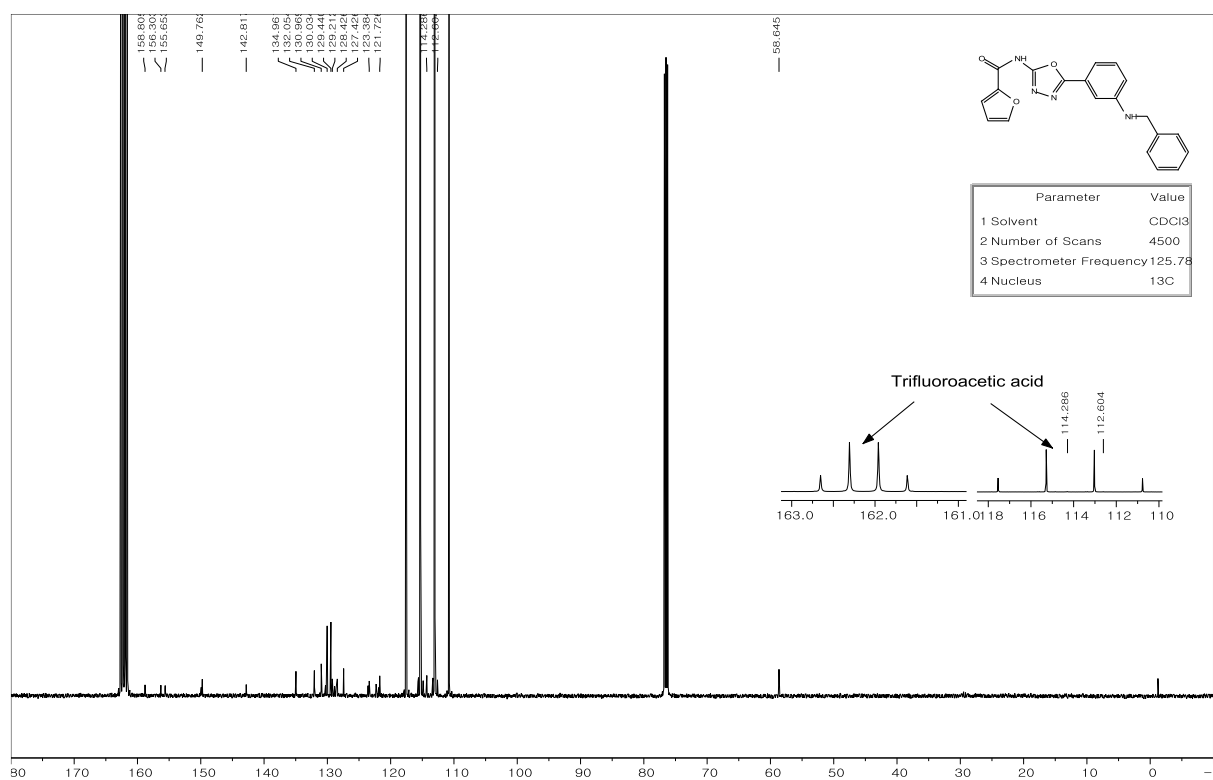
LC/MS – 16{1,5}



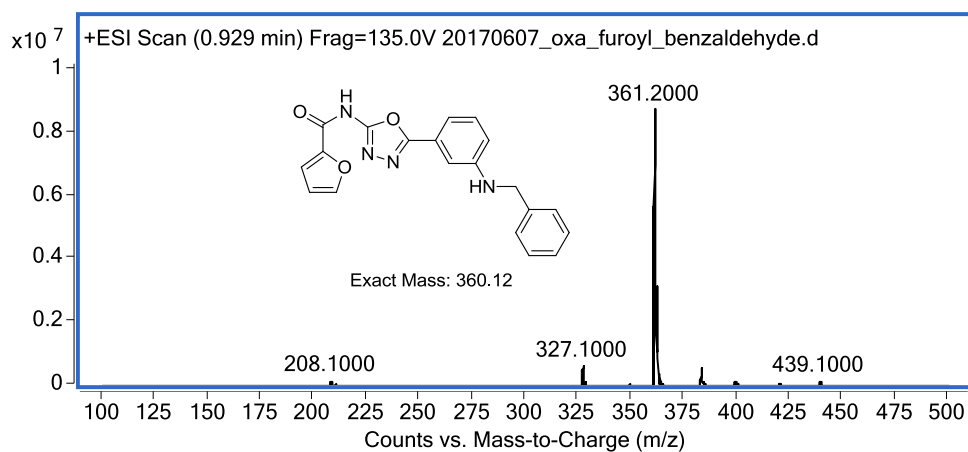
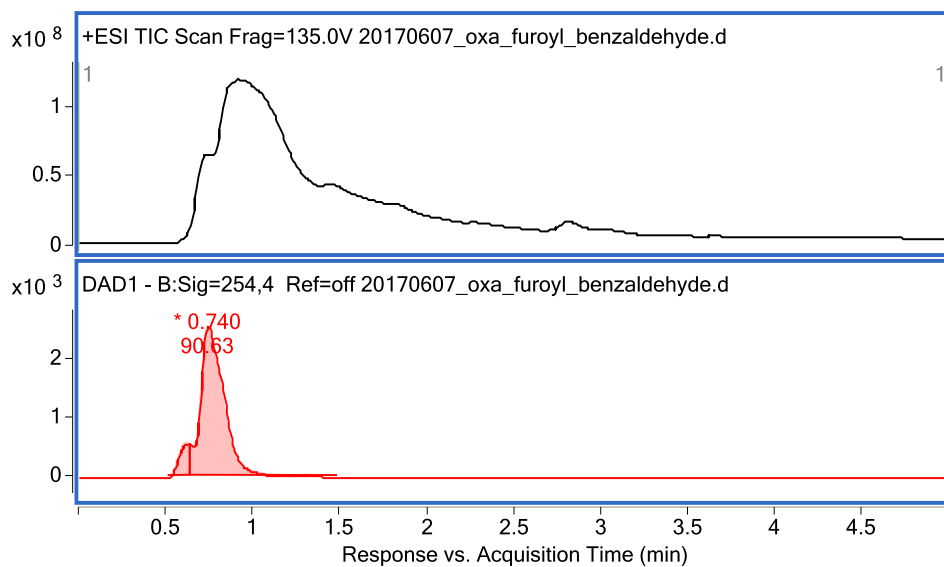
HR/MS – 16{1,5}



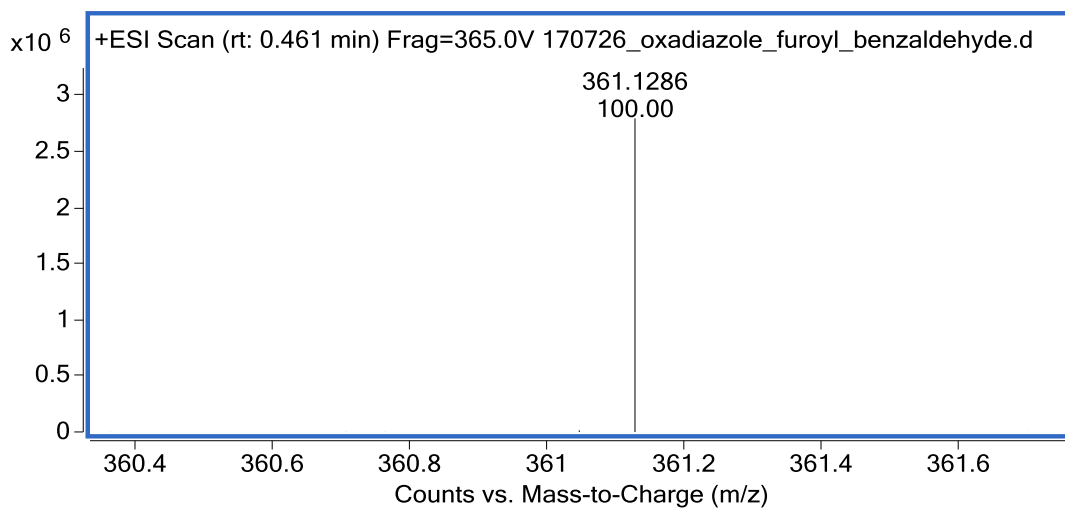
¹H NMR – 16{2,1}



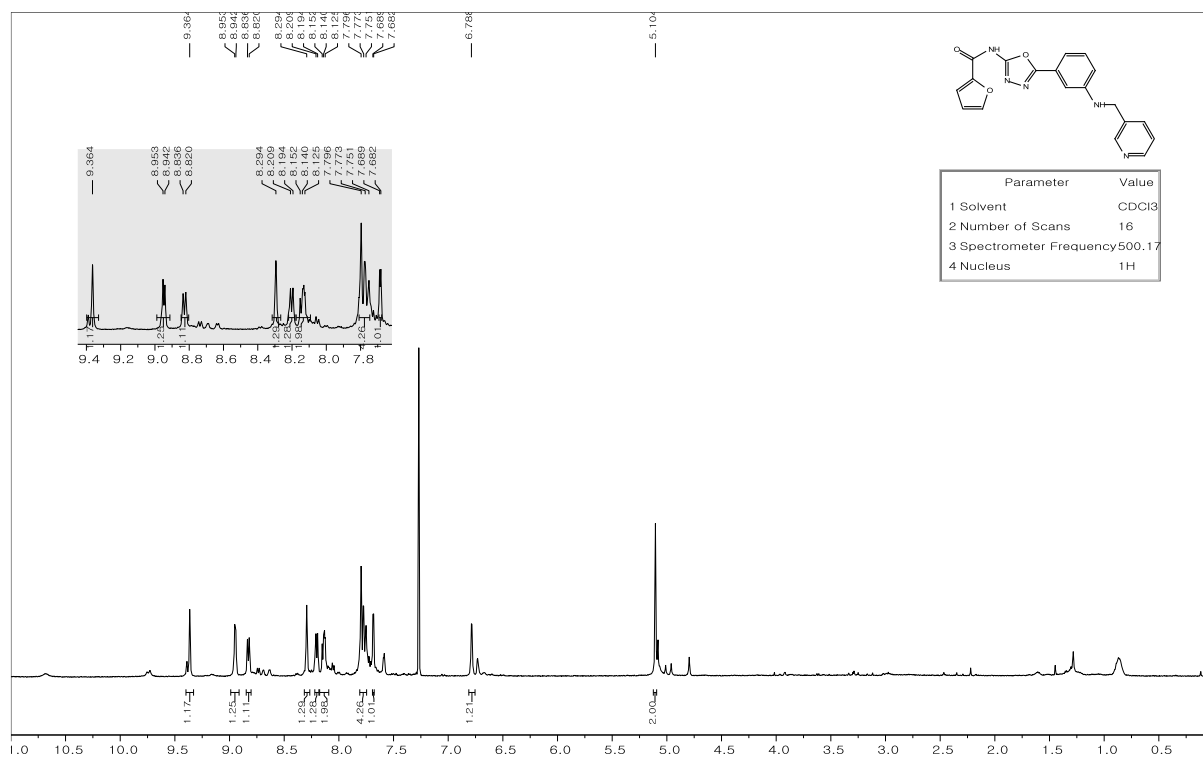
¹³C NMR – 16{2,1}



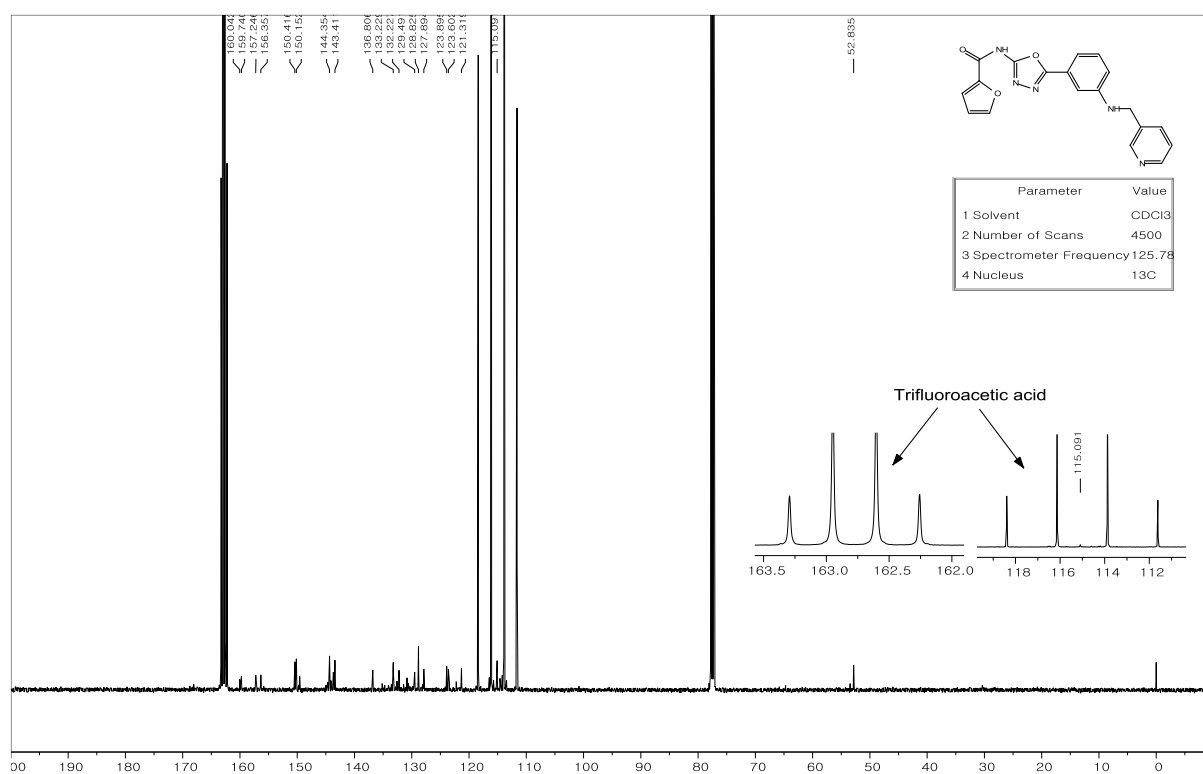
LC/MS – 16{2,1}



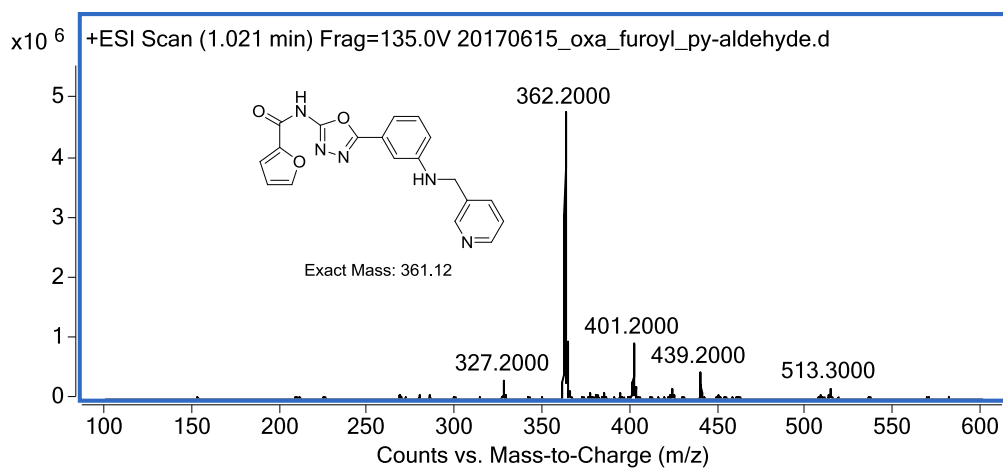
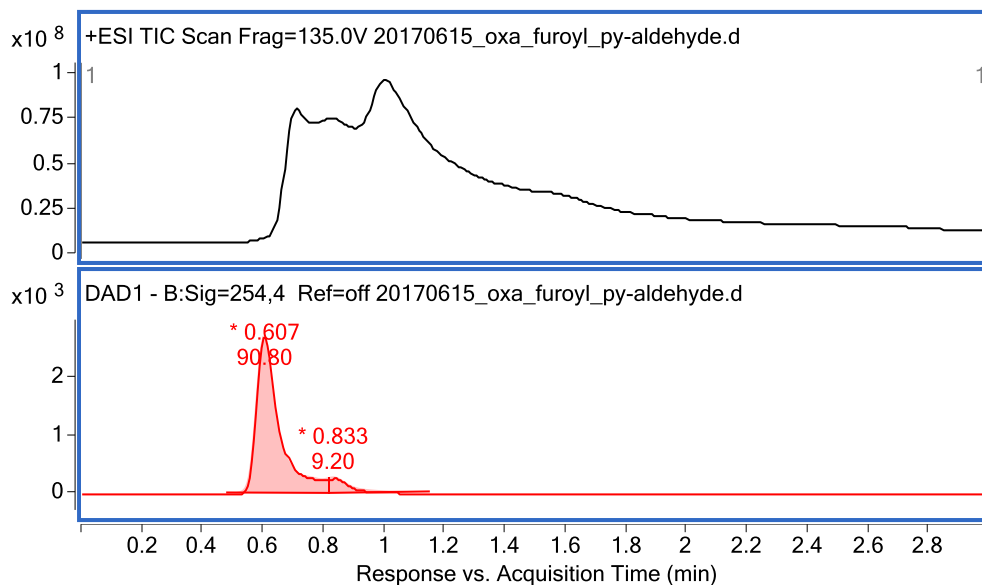
HR/MS – 16{2,1}



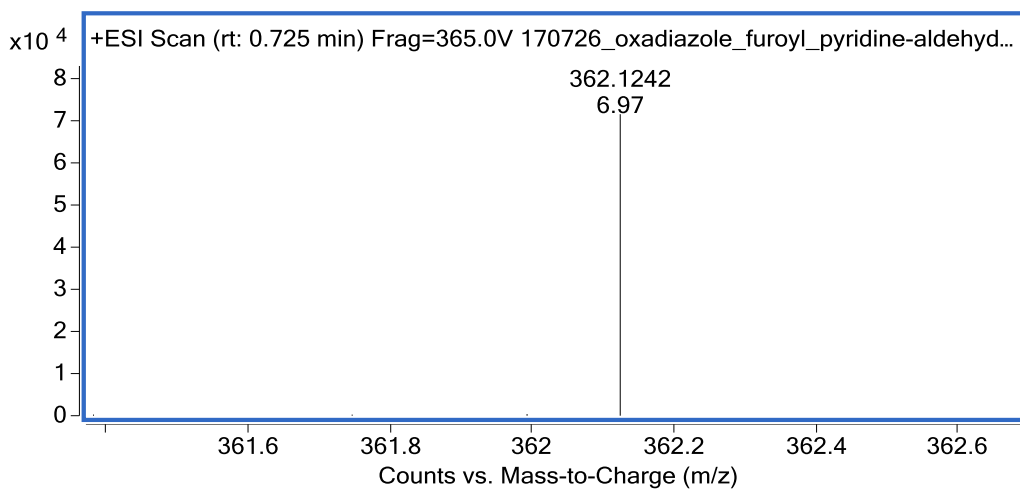
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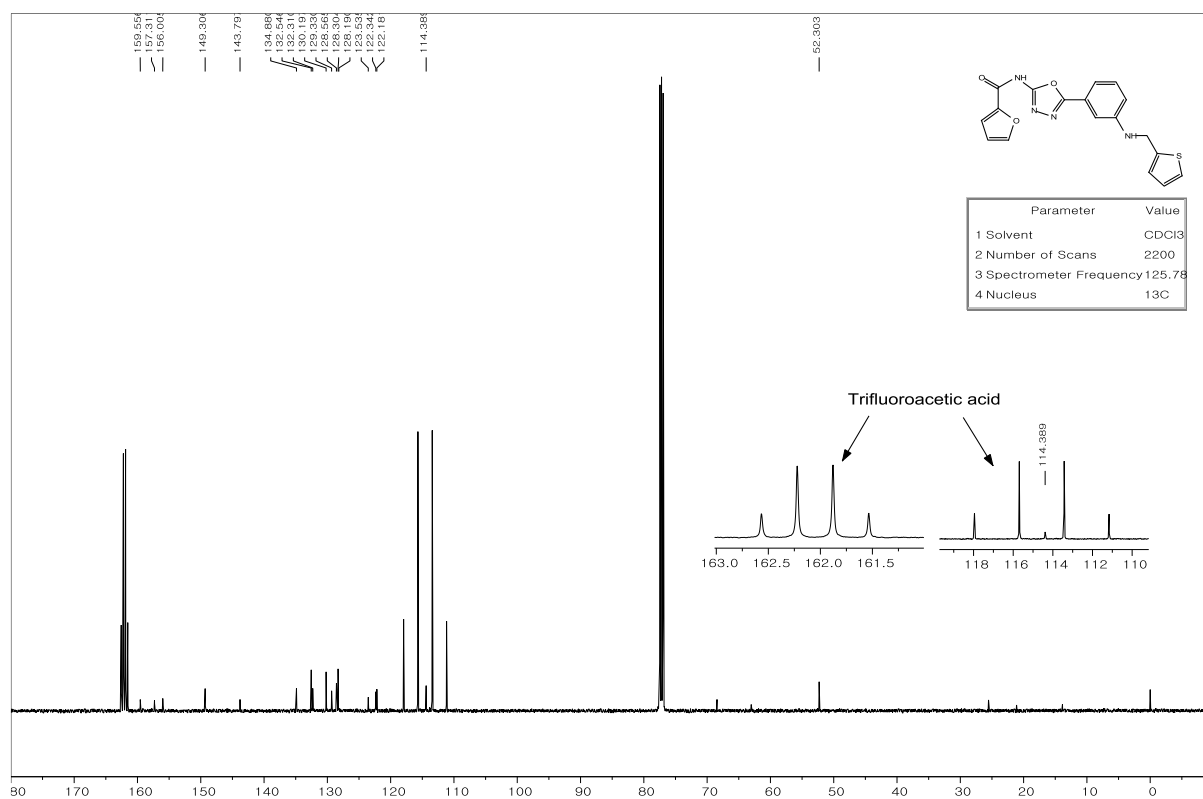
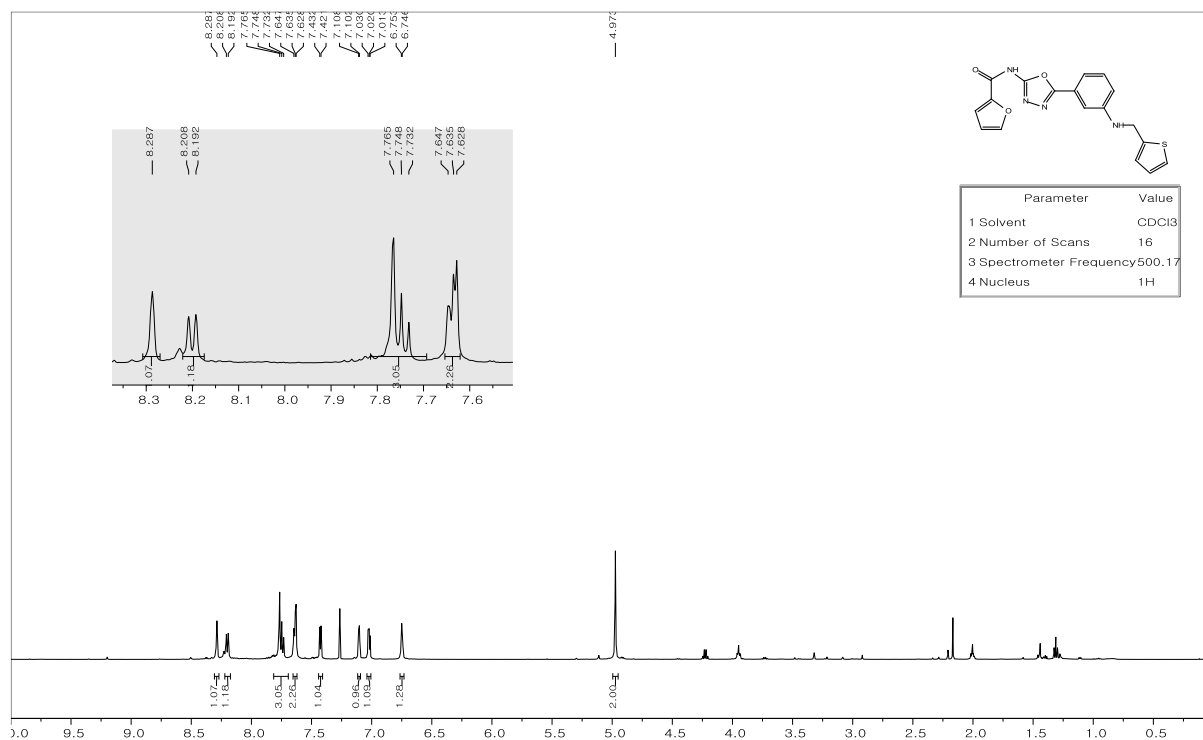
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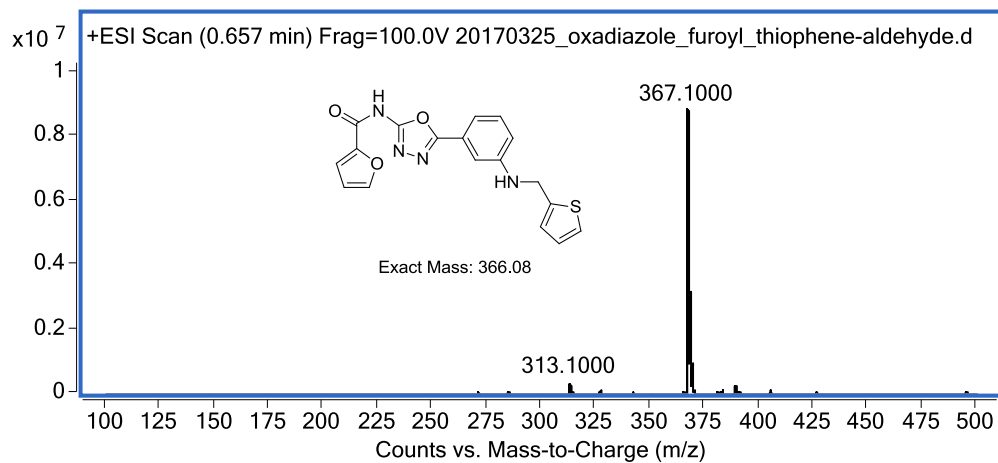
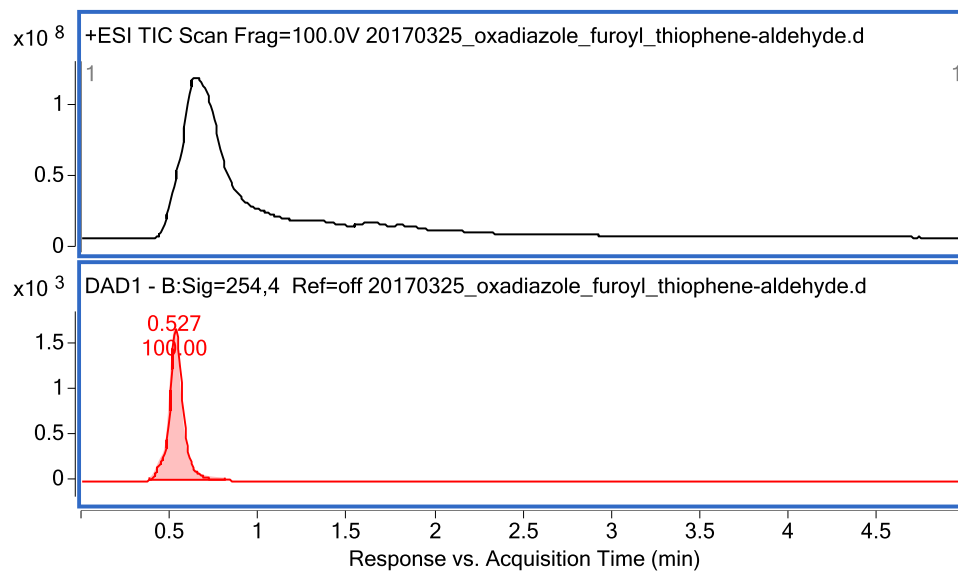


LC/MS – 16{2,2}

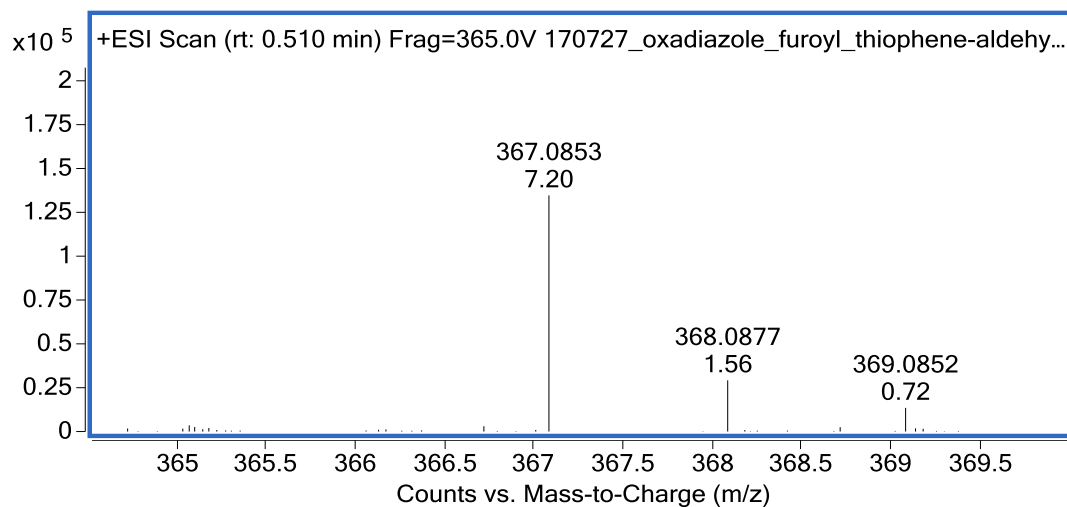


HR/MS – 16{2,2}



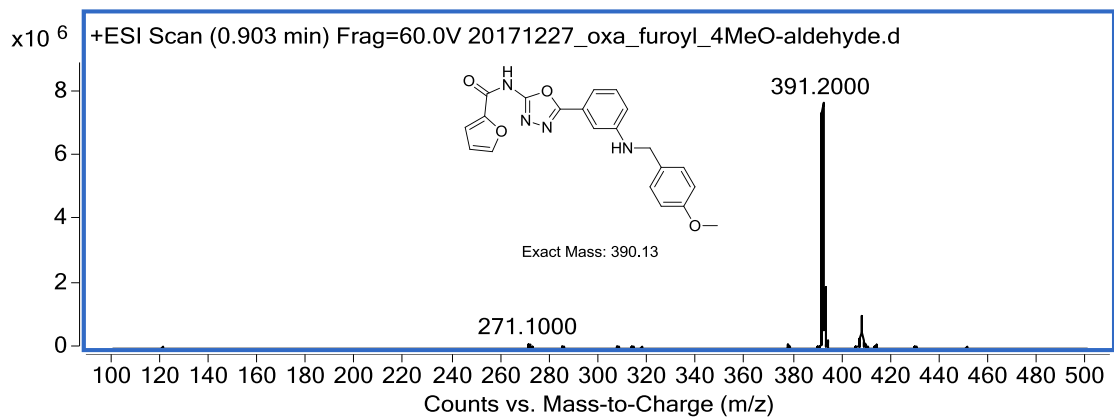
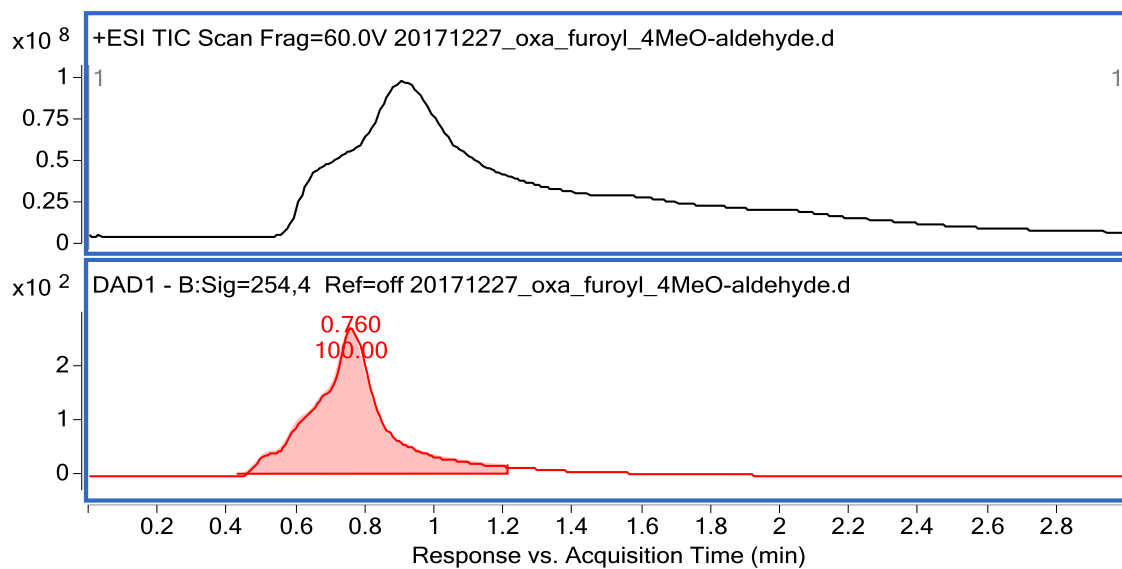


LC/MS – 16{2,3}

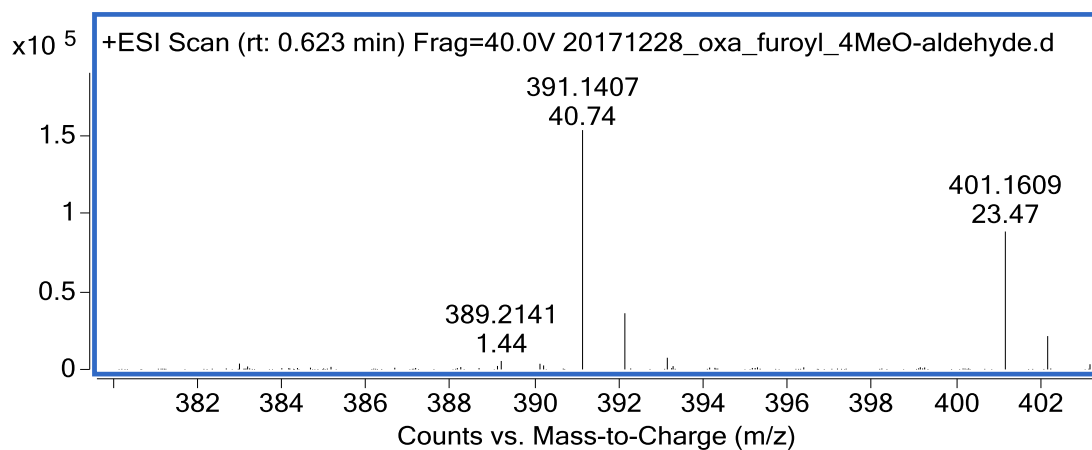


HR/MS – 16{2,3}

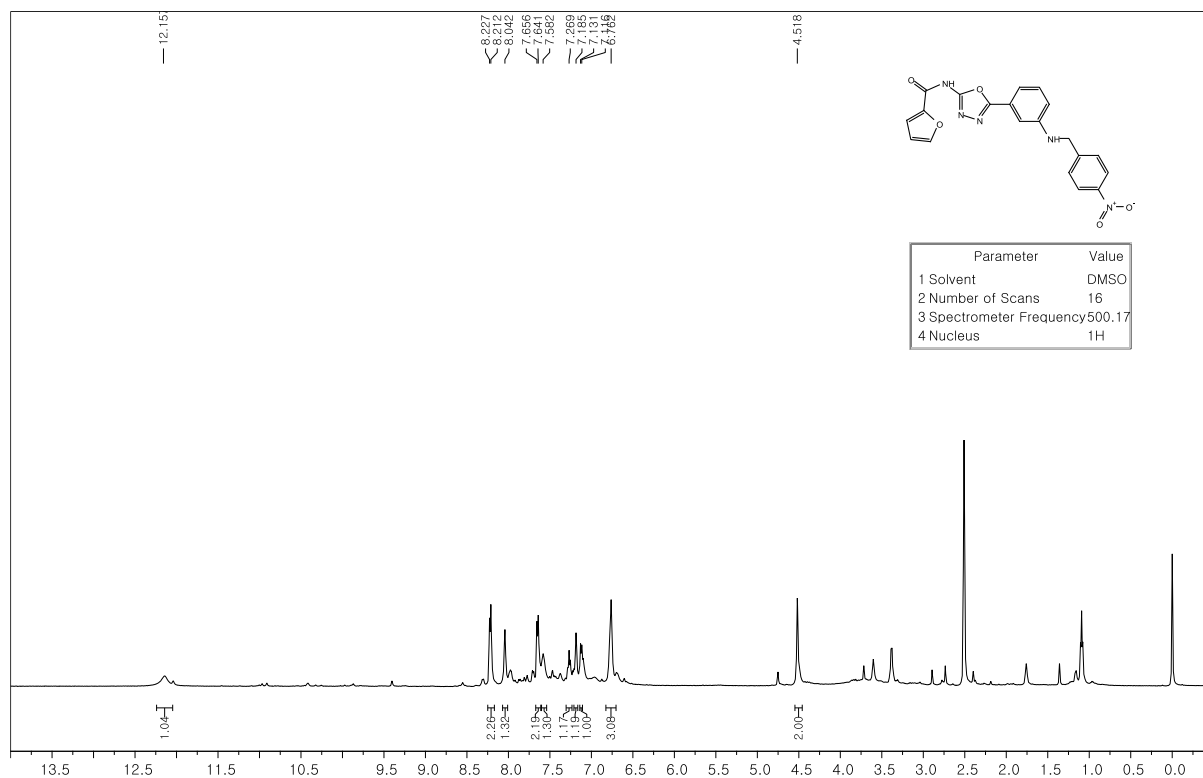
¹³C NMR – 16{2,4}



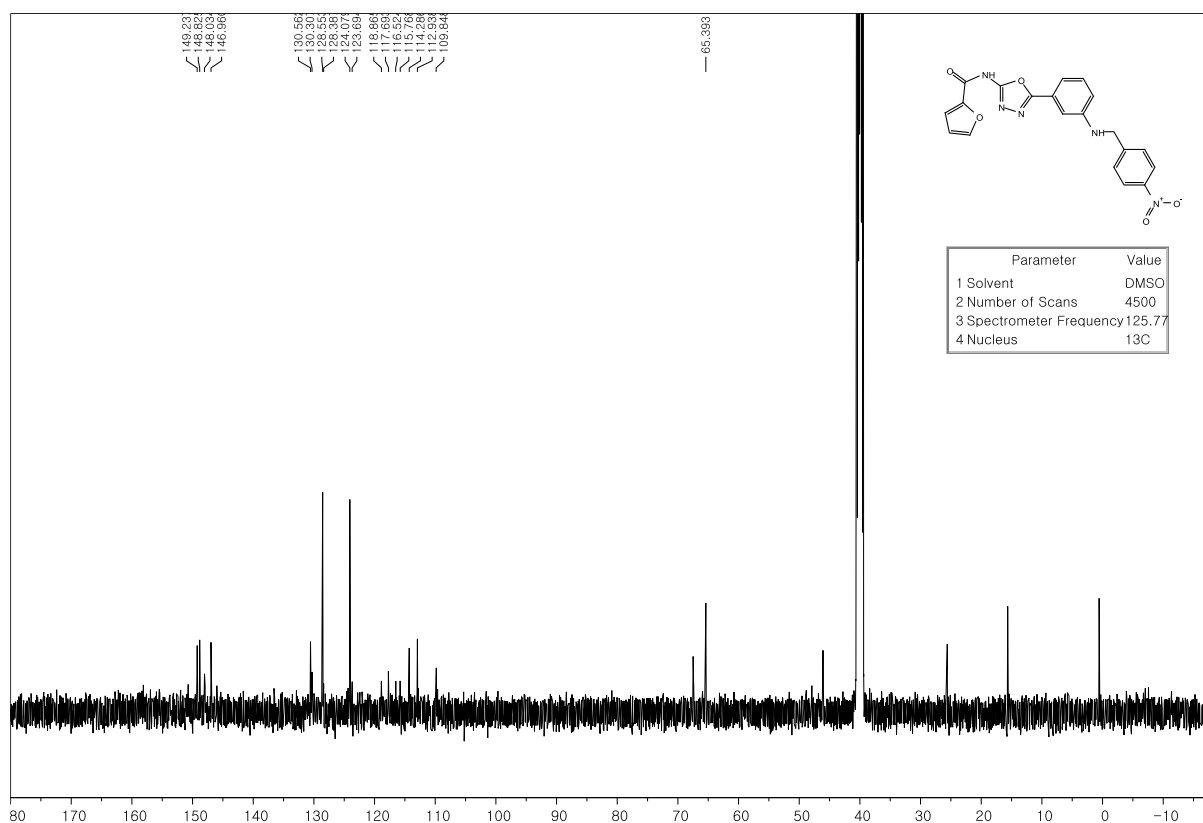
LC/MS – 16{2,4}



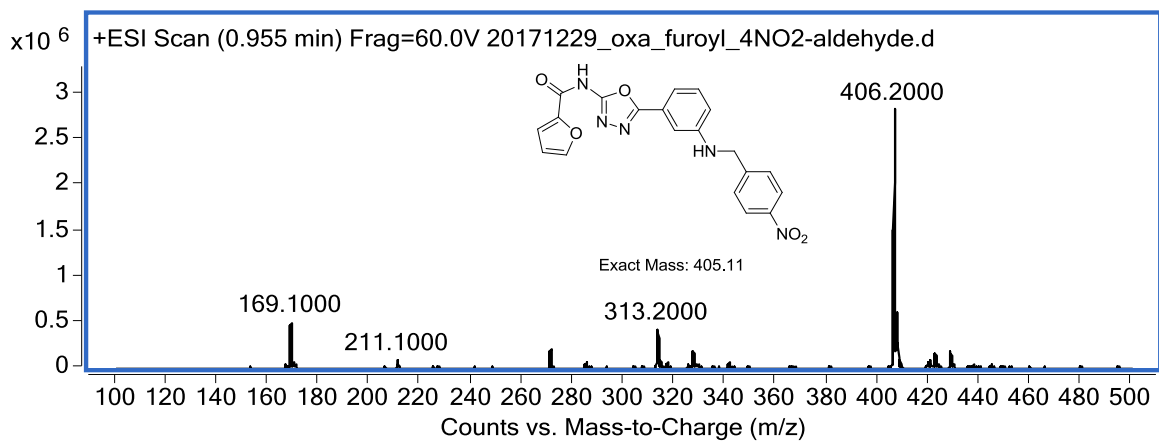
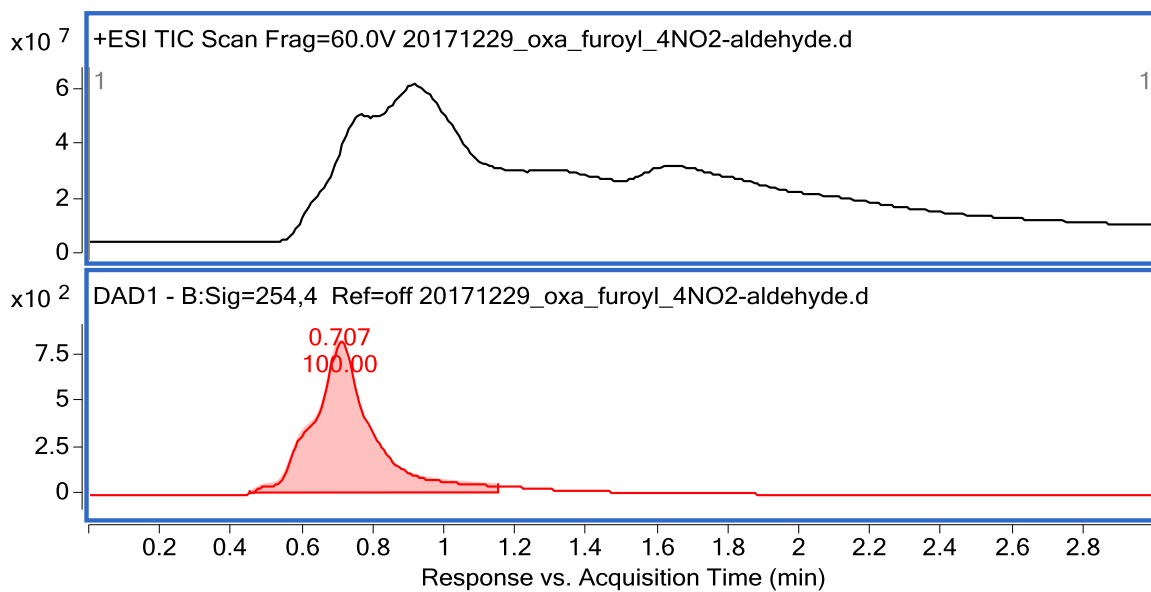
HR/MS – 16{2,4}



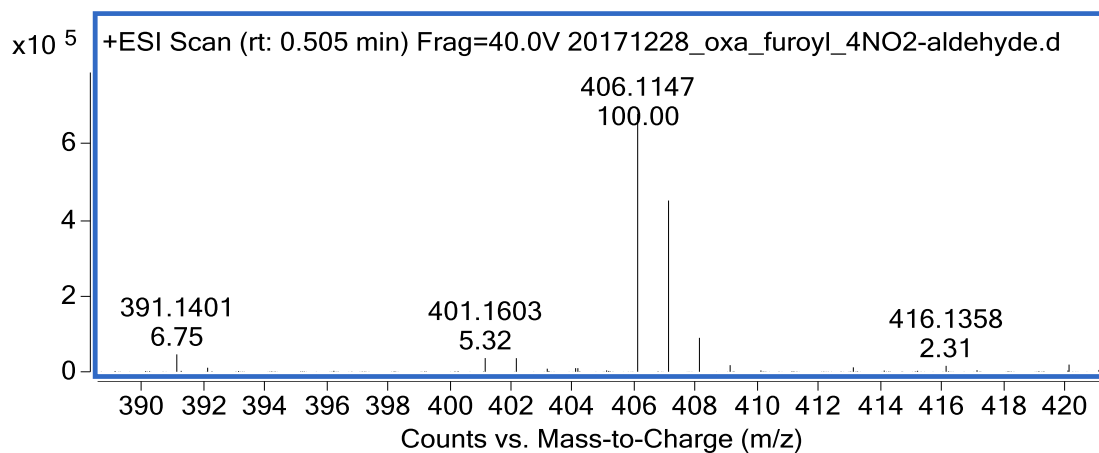
¹H NMR – 16{2,5}



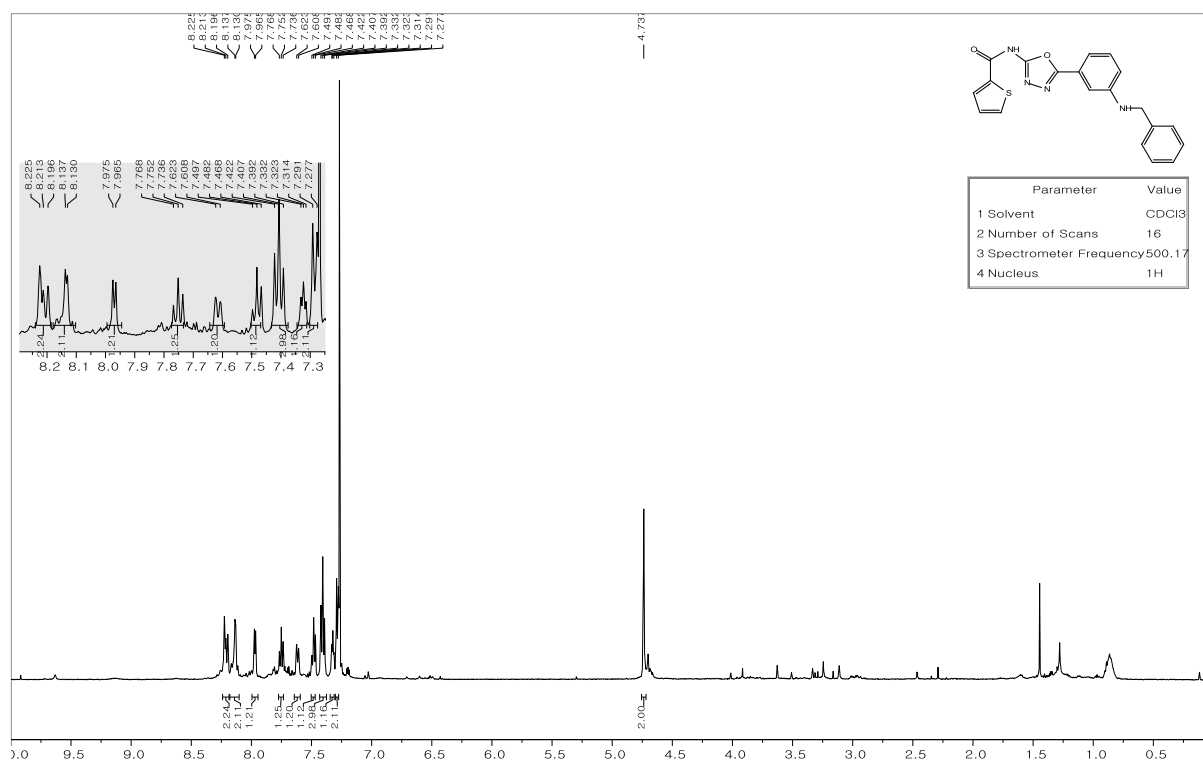
¹³C NMR – 16{2,5}



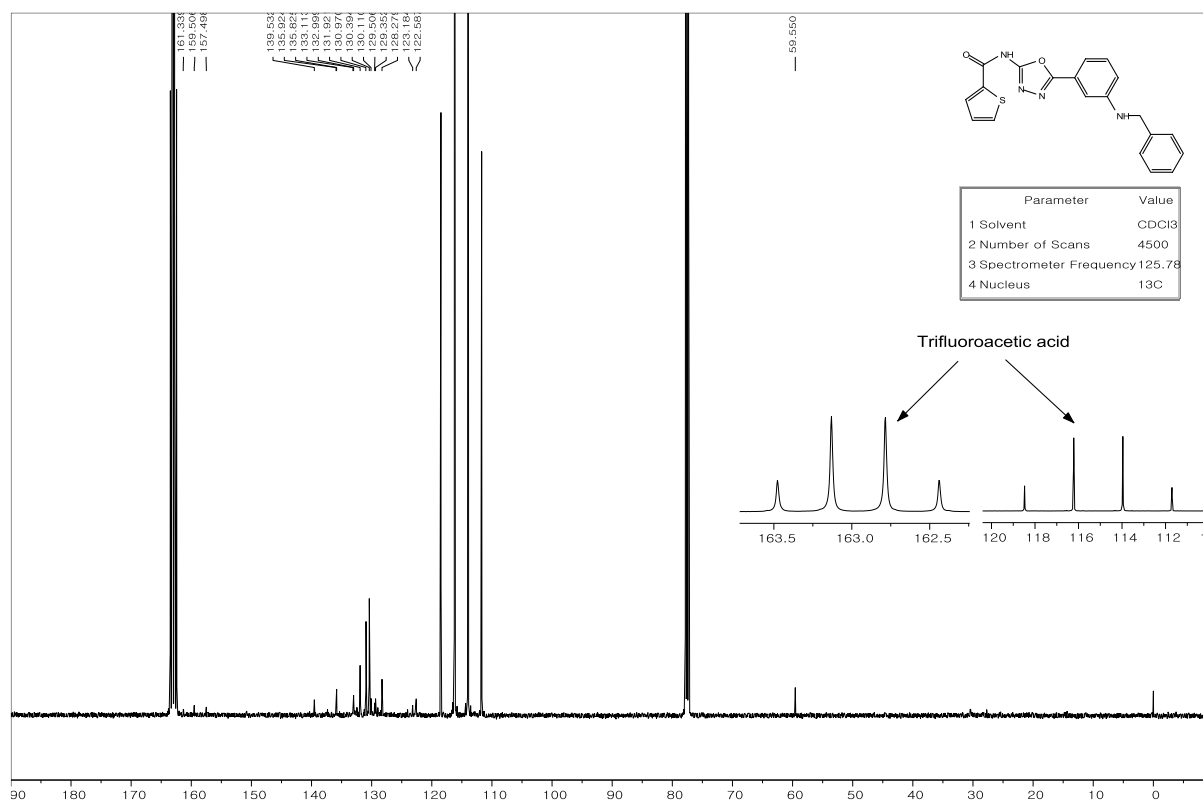
LC/MS – 16{2,5}



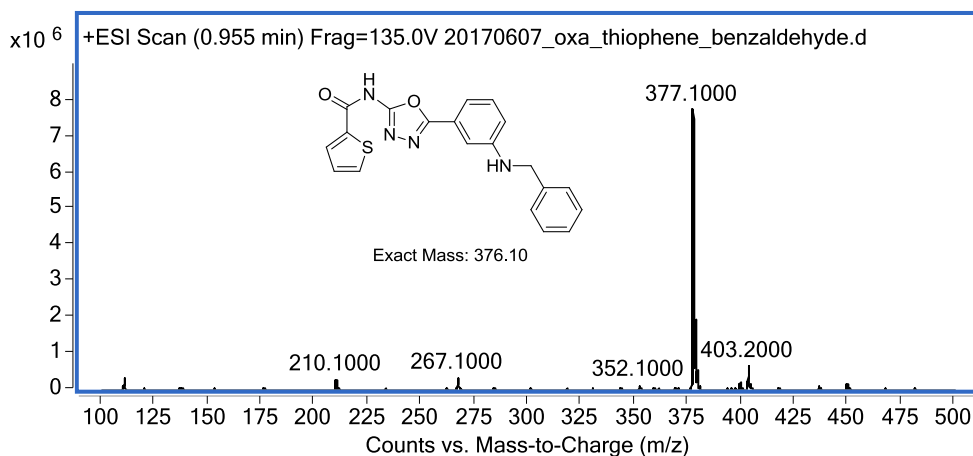
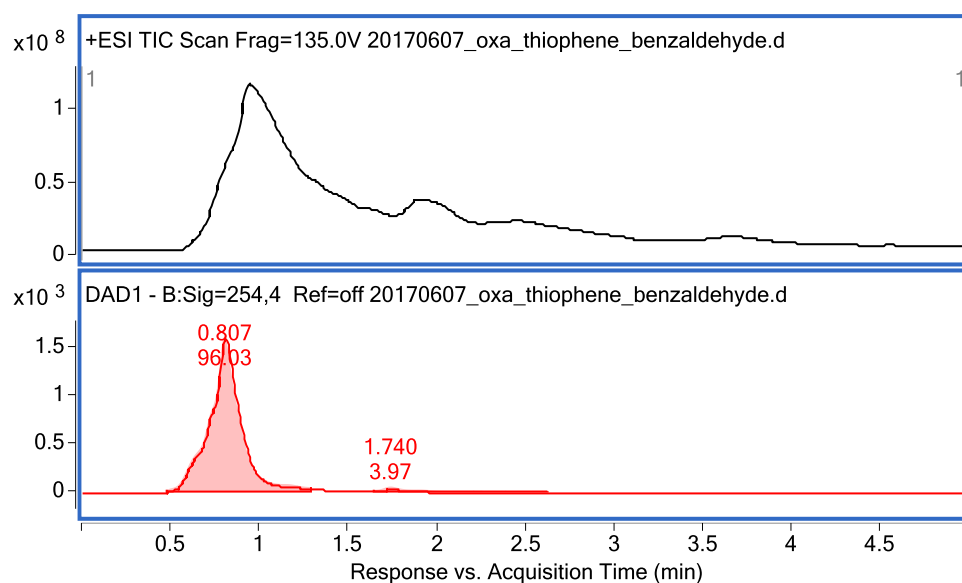
HR/MS – 16{2,5}



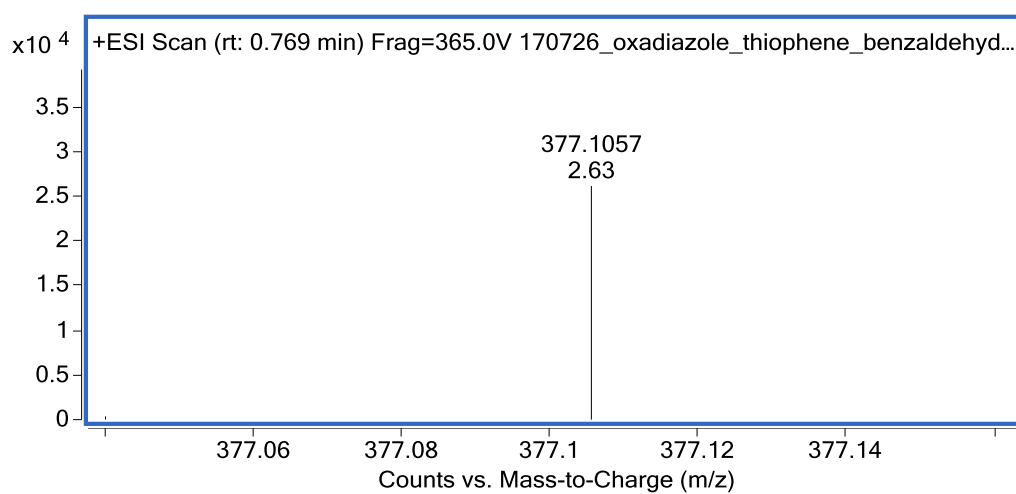
¹H NMR – 16{3,1}



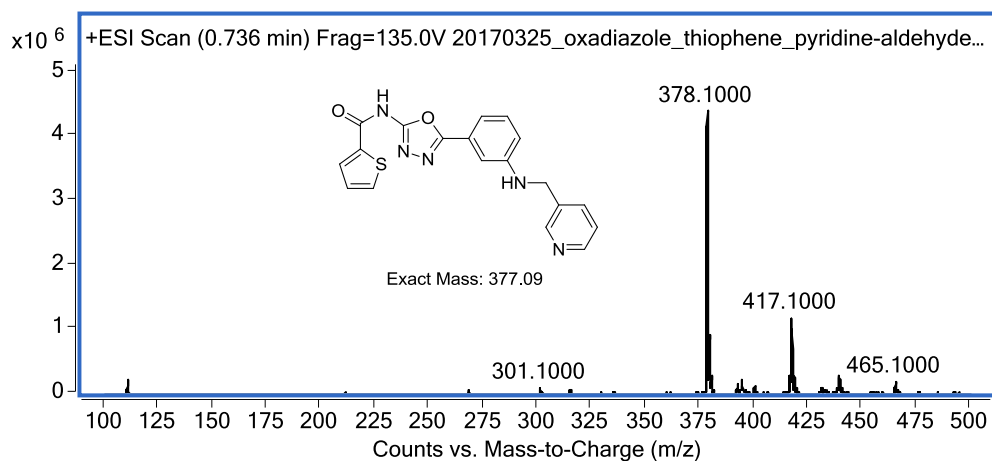
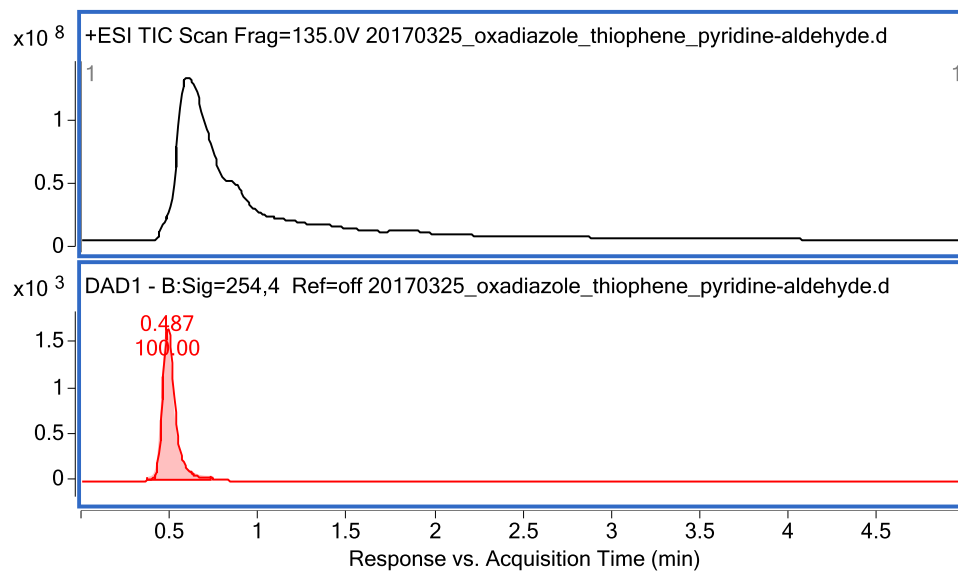
^{13}C NMR – 16{3,1}



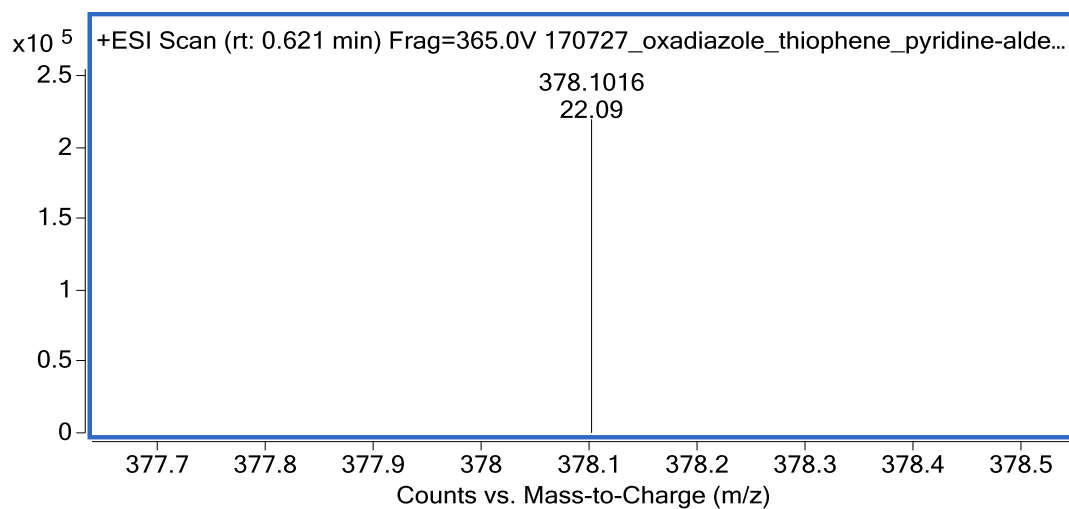
LC/MS – 16{3,1}



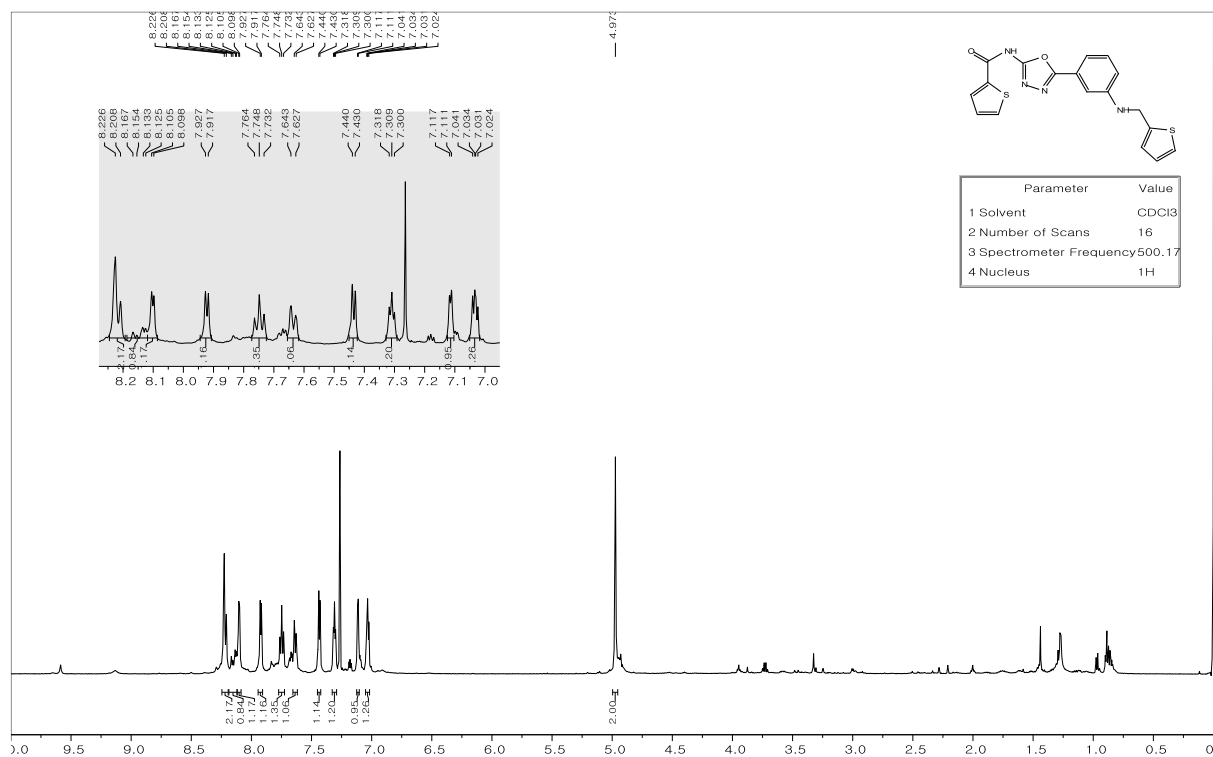
HR/MS – 16{3,1}



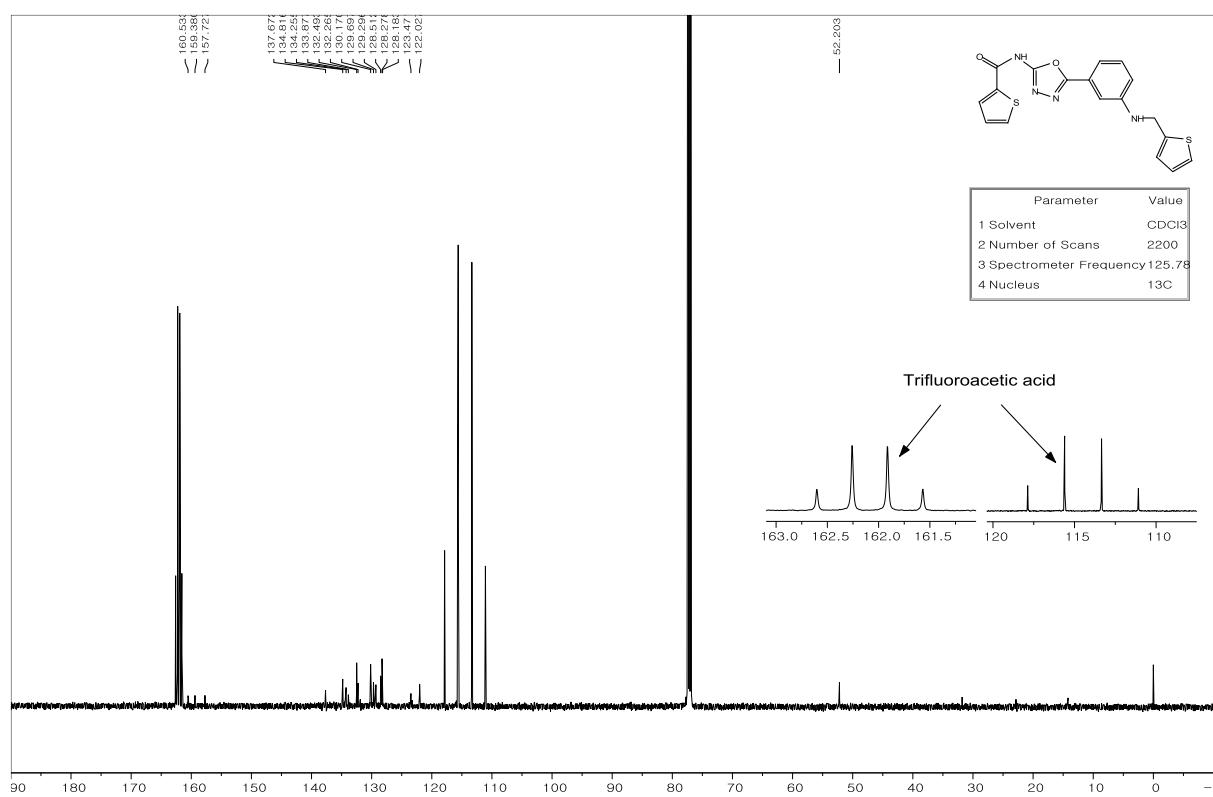
LC/MS – 16{3,2}



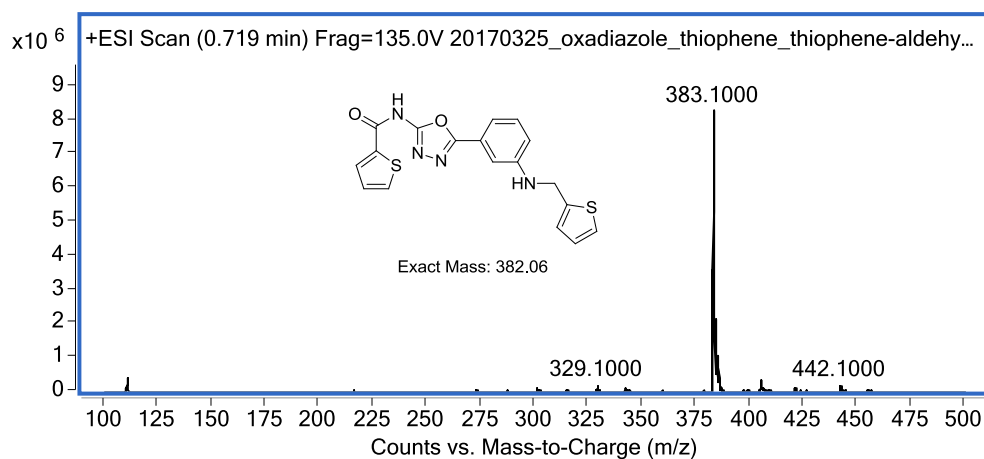
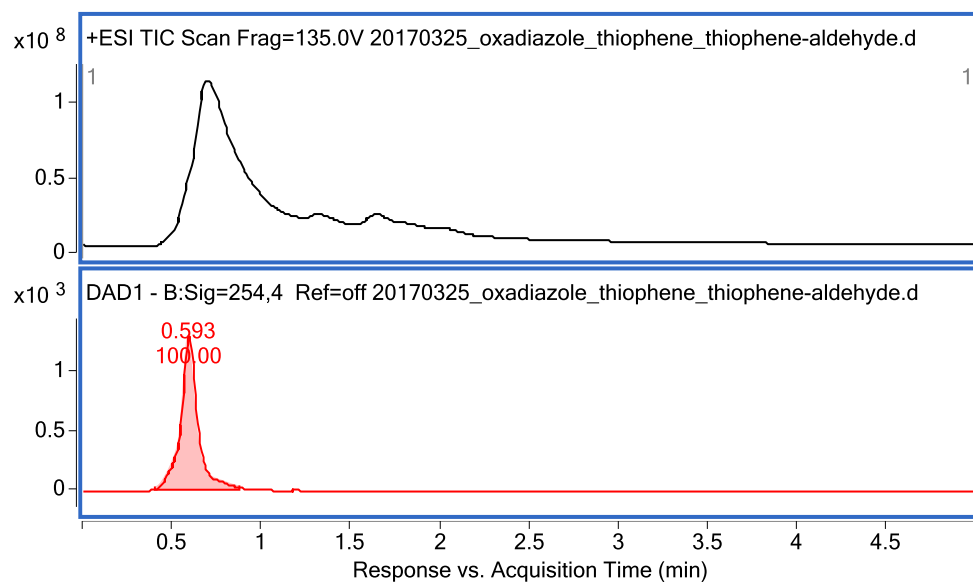
HR/MS – 16{3,2}



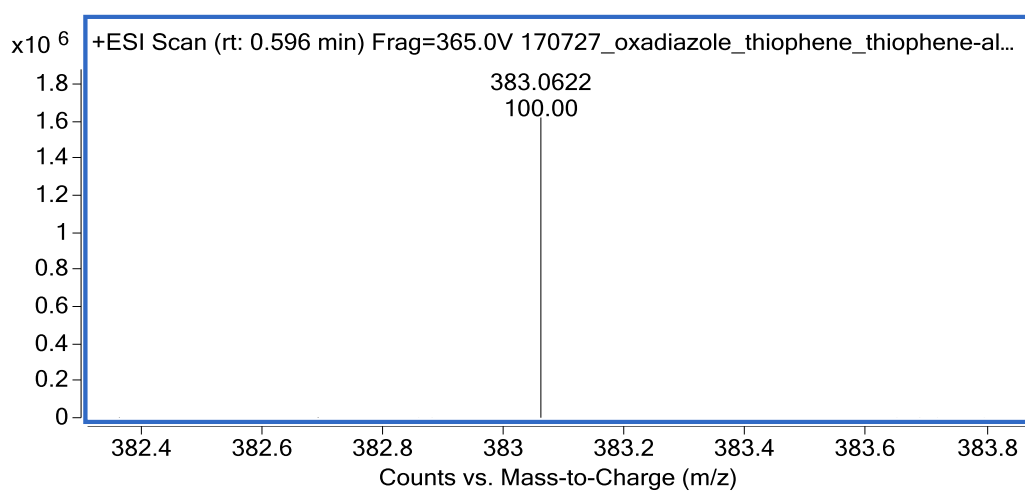
¹H NMR – 16{3,3}



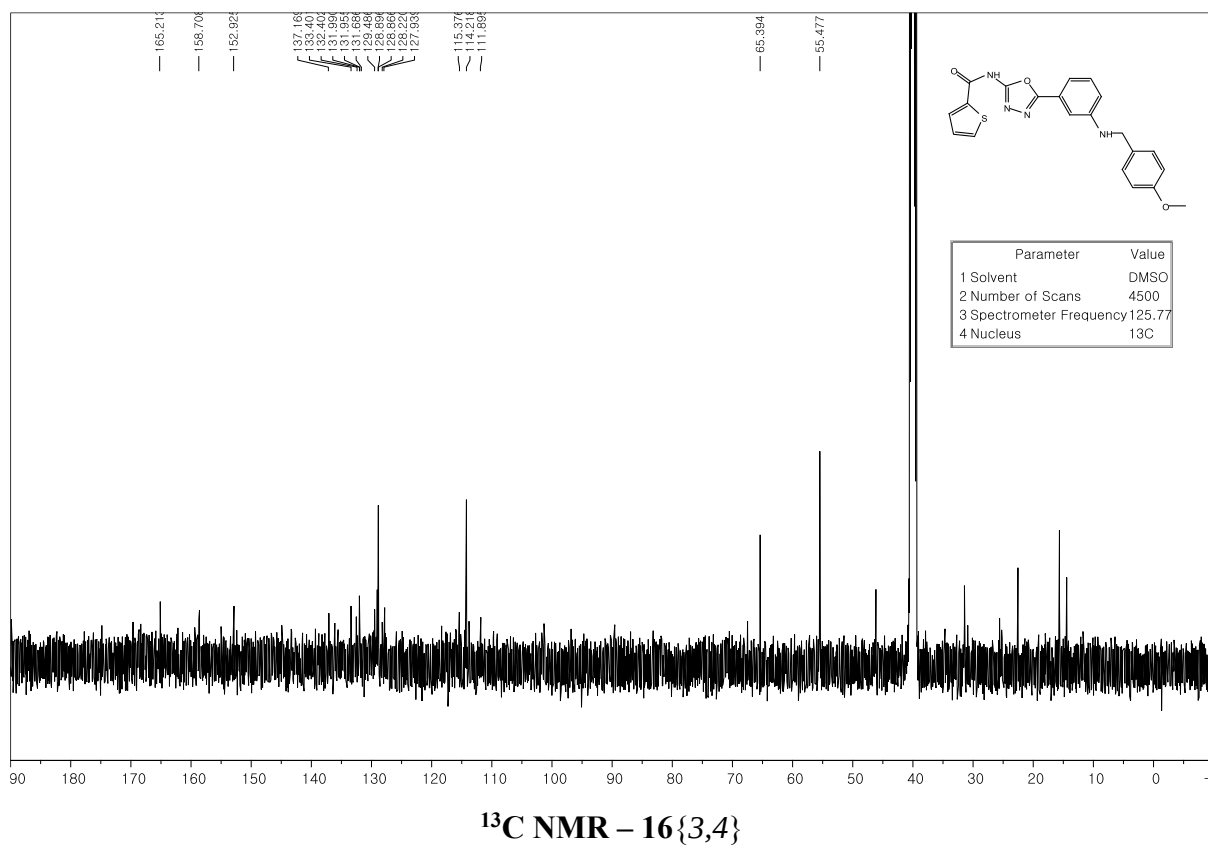
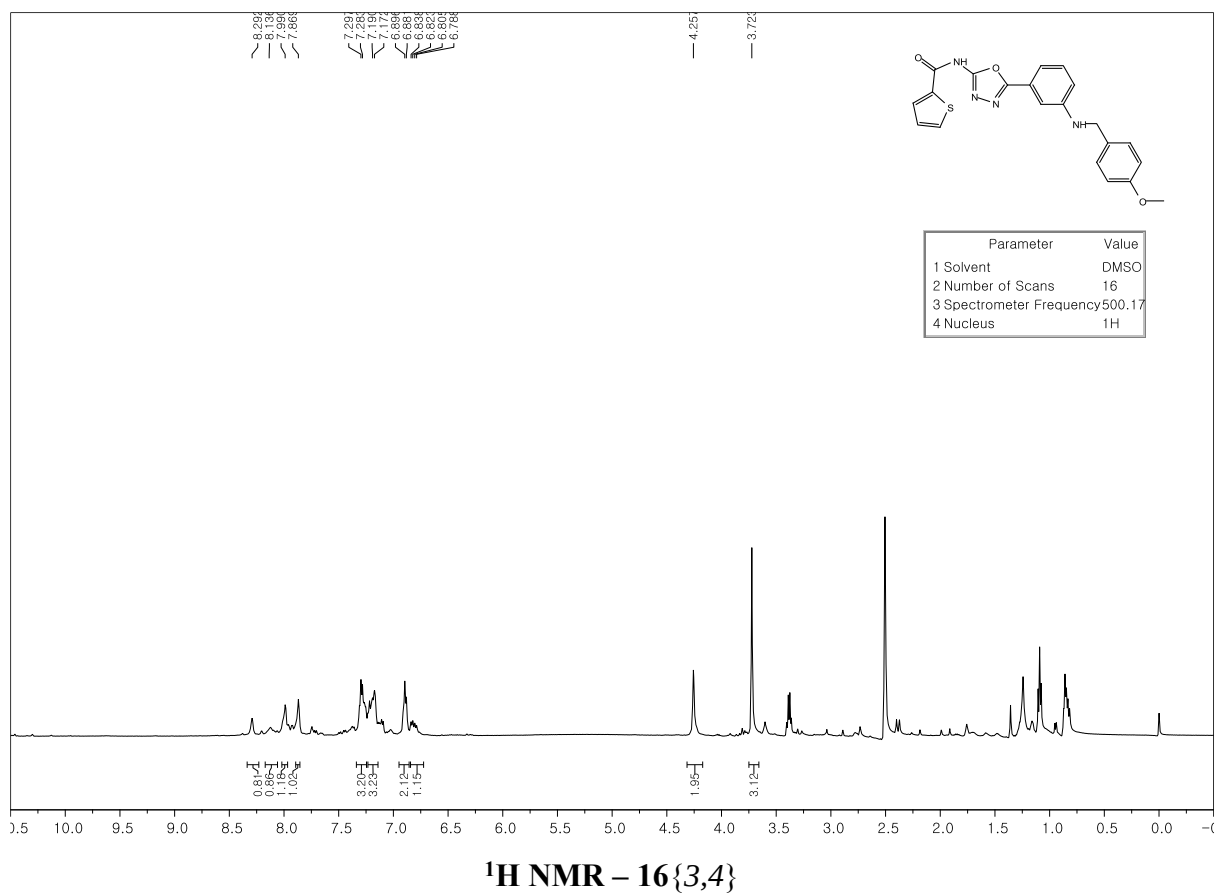
¹³C NMR – 16{3,3}

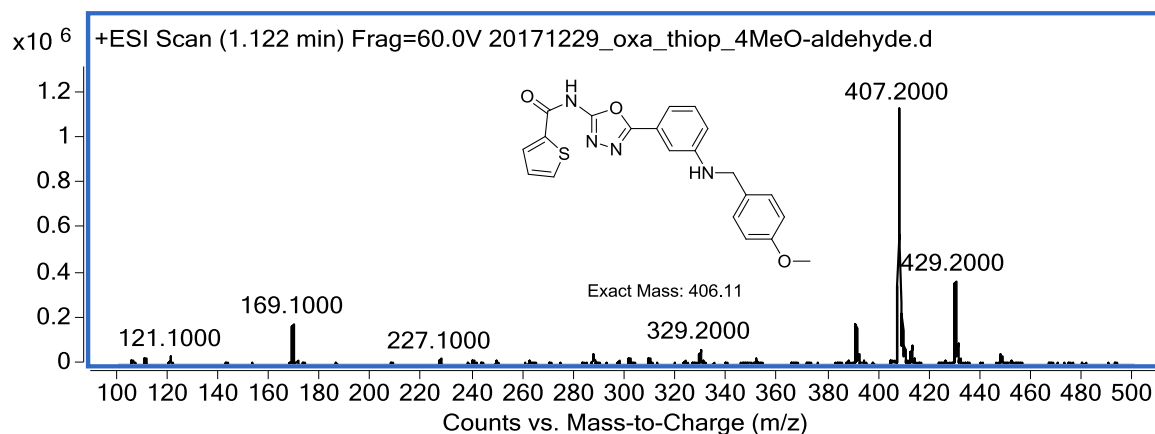
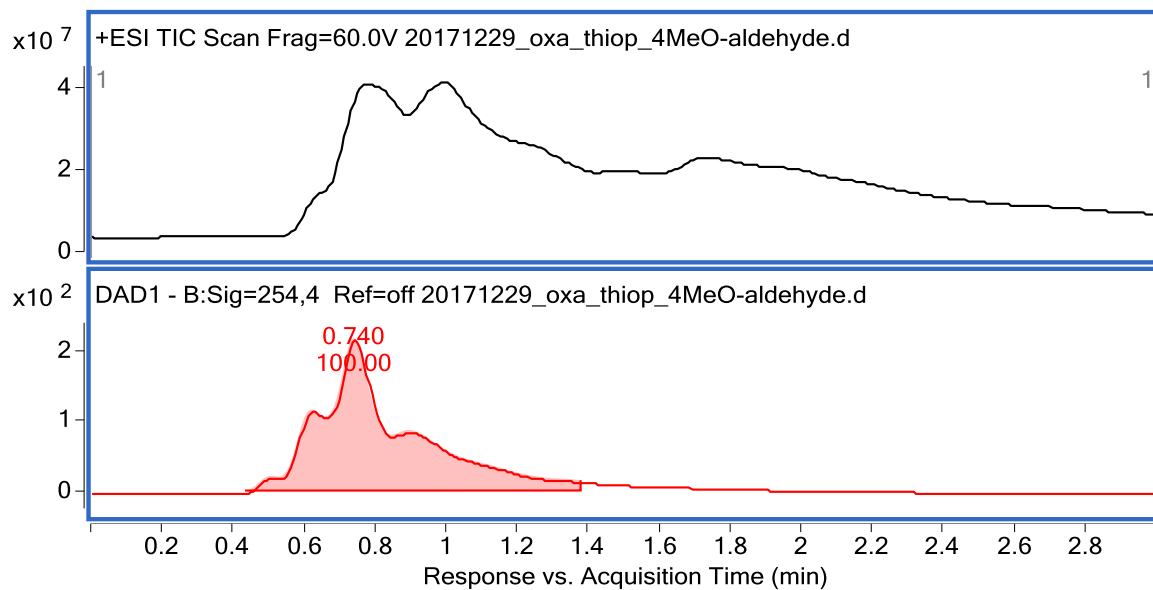


LC/MS – 16{3,3}

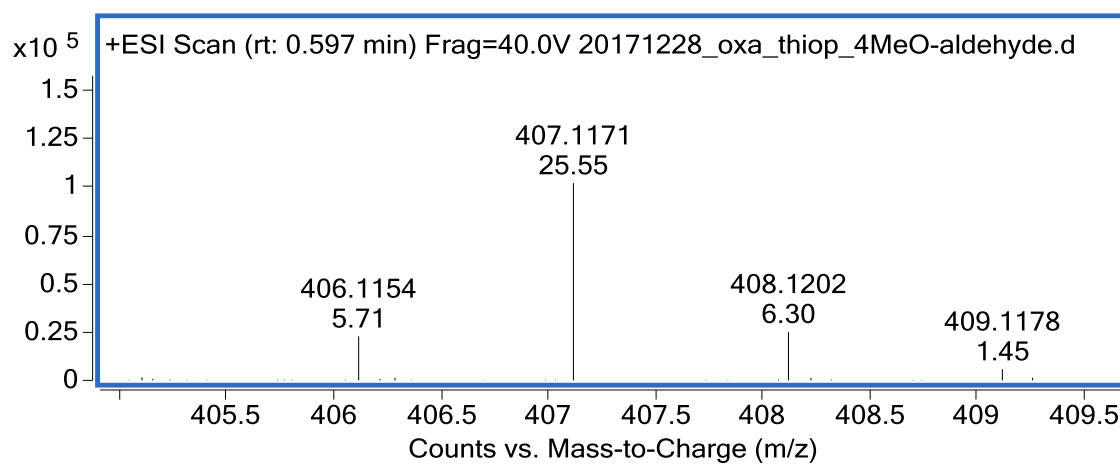


HR/MS – 16{3,3}

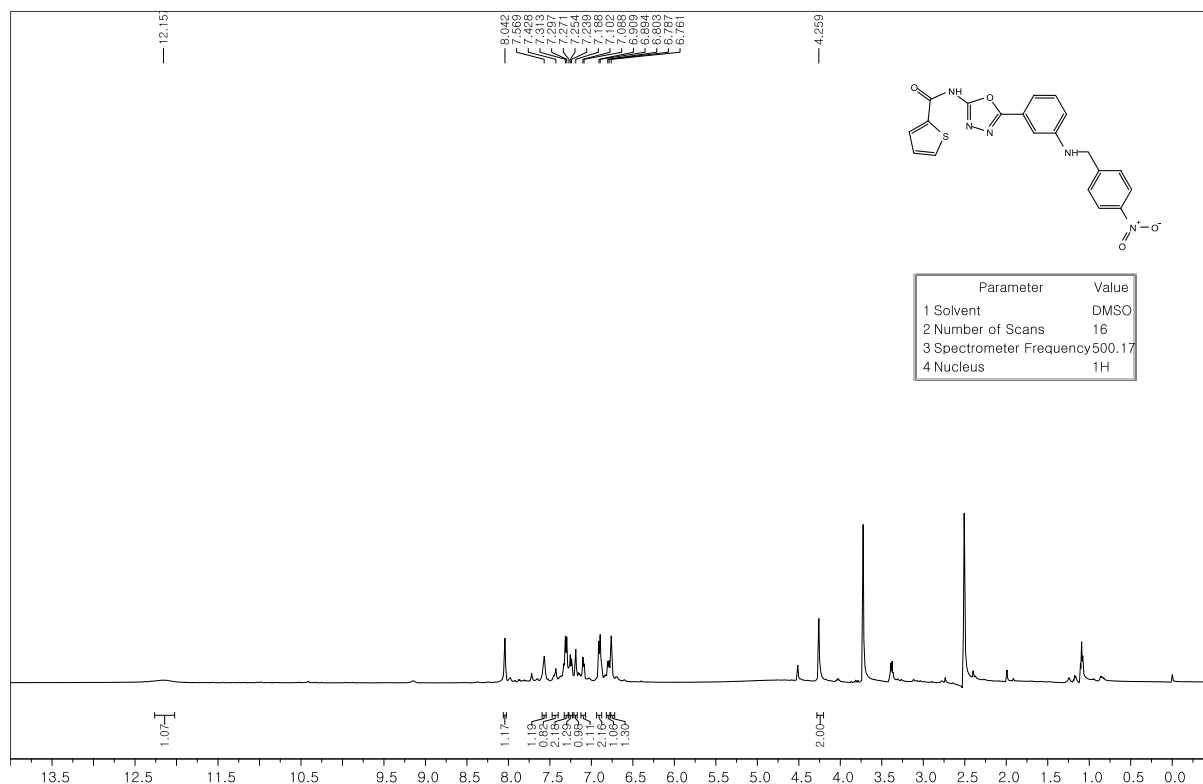




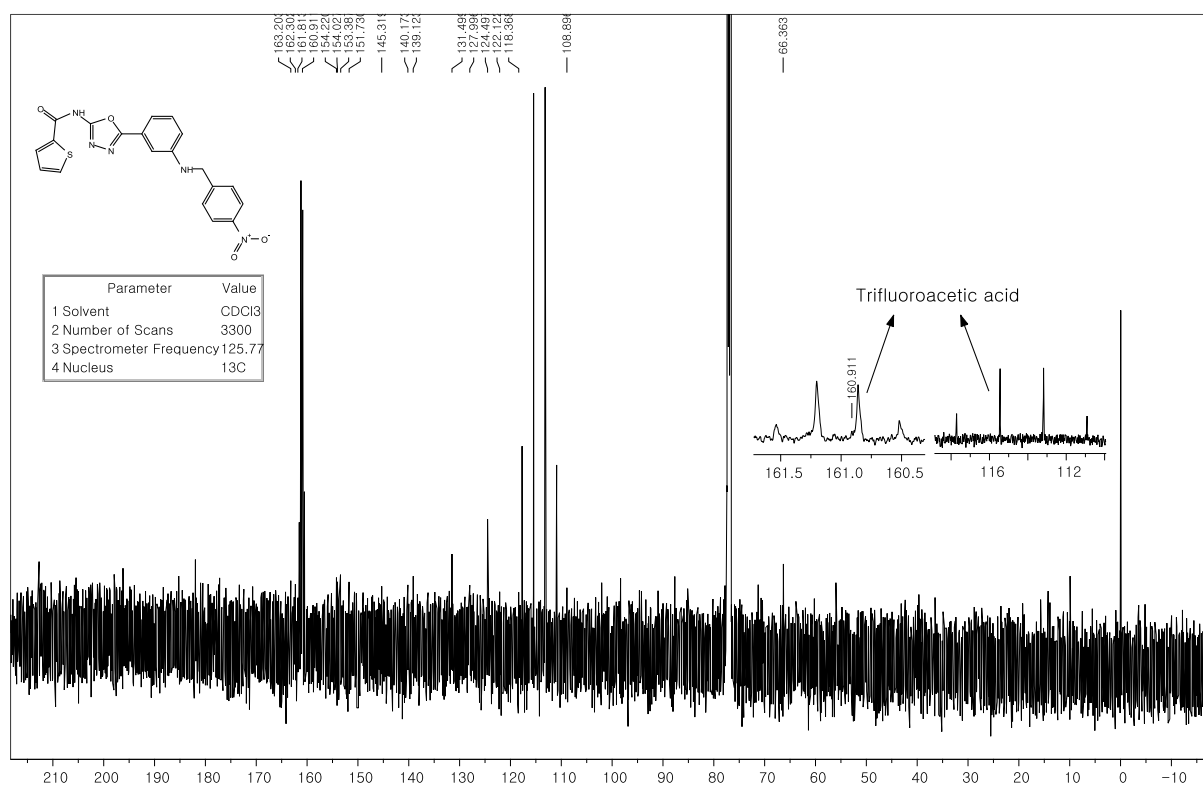
LC/MS – 16{3,4}



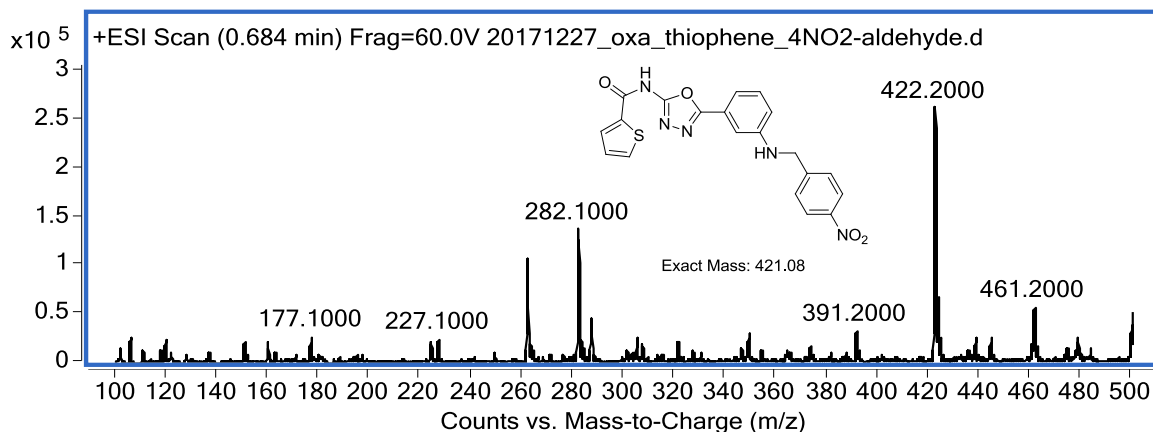
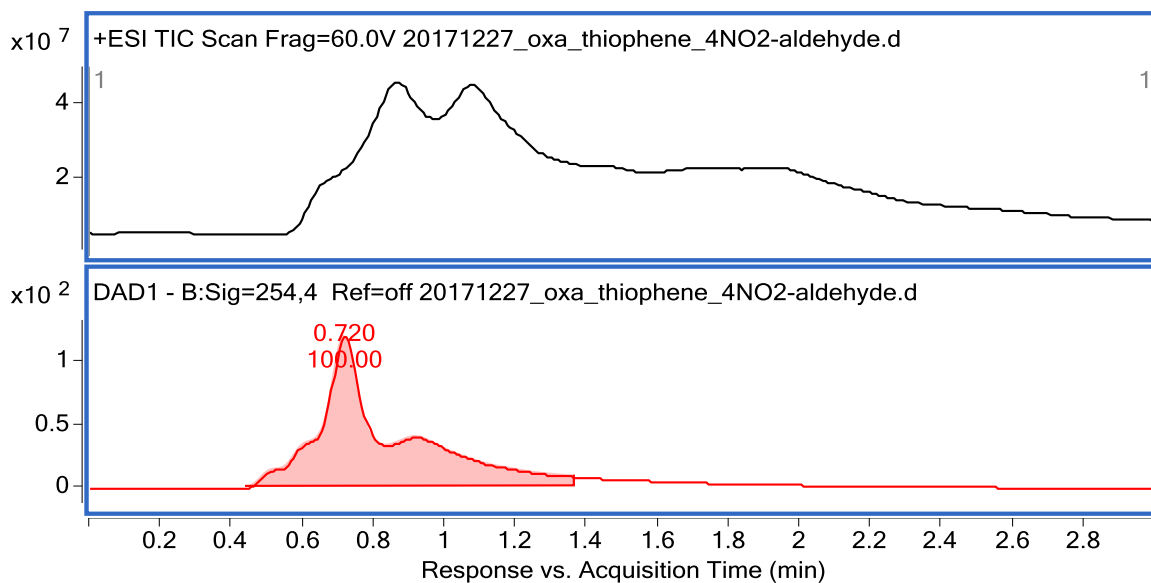
HR/MS – 16{3,4}



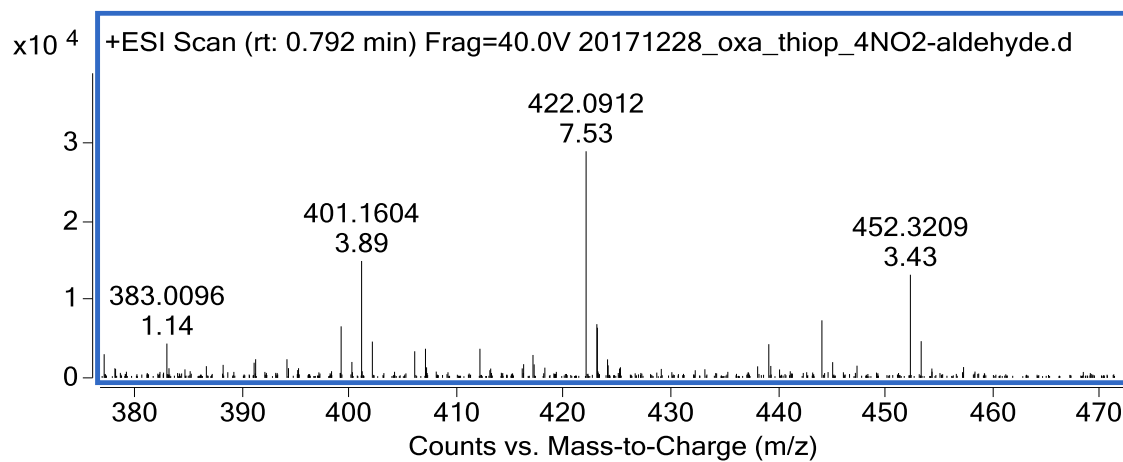
¹H NMR – 16{3,5}



¹³C NMR – 16{3,5}

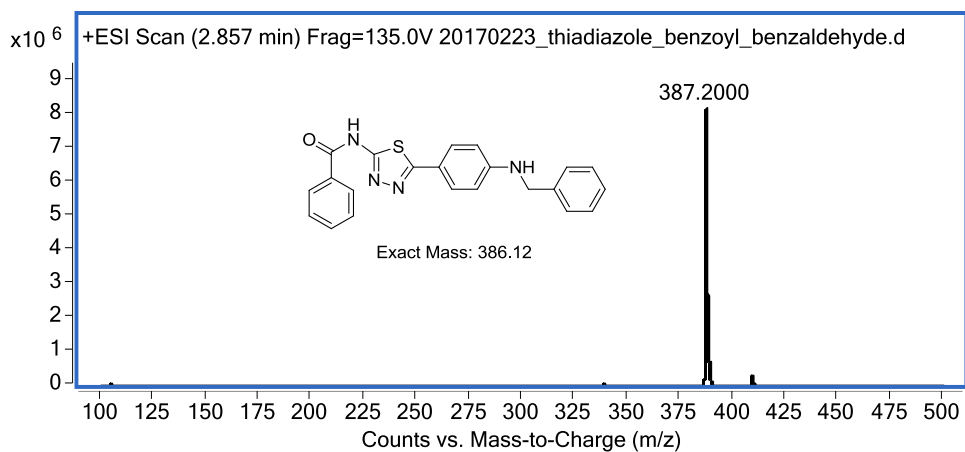
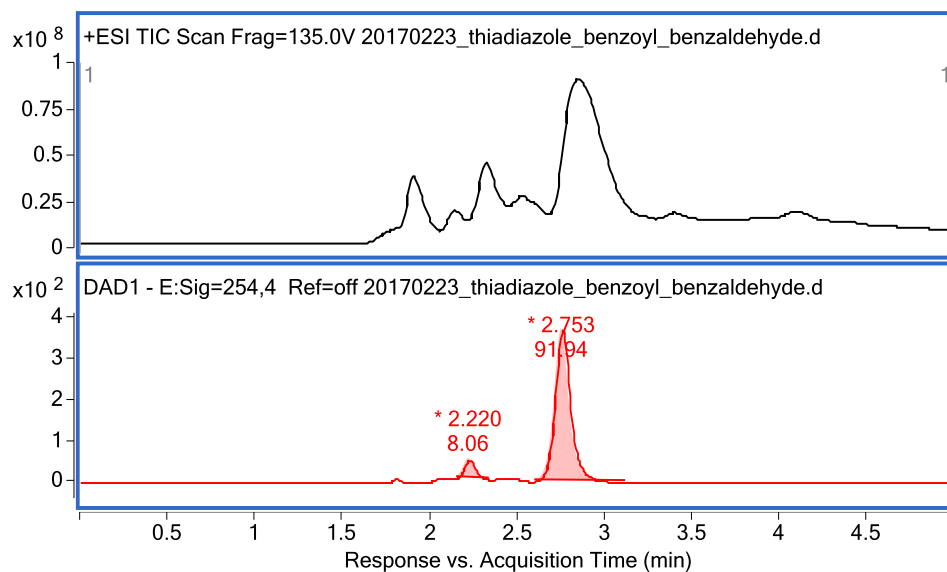


LC/MS – 16{3,5}

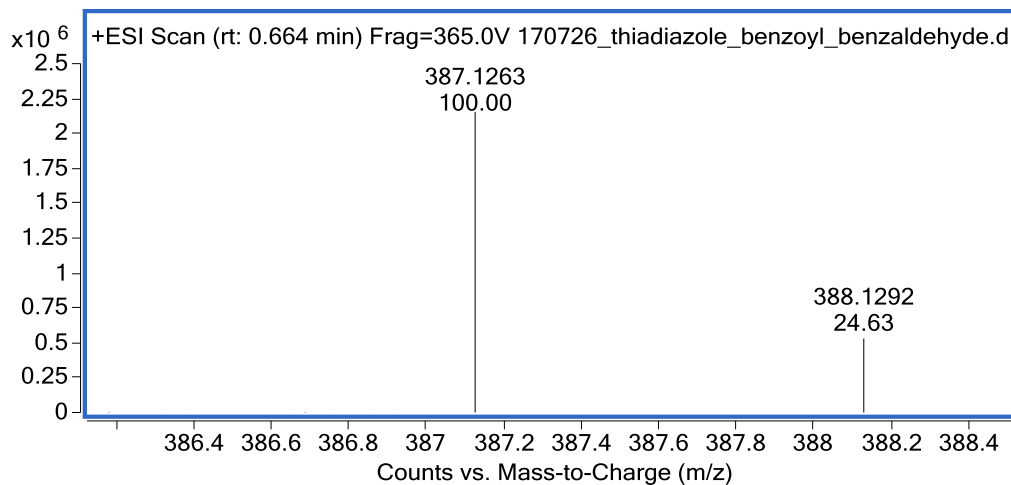


HR/MS – 16{3,5}

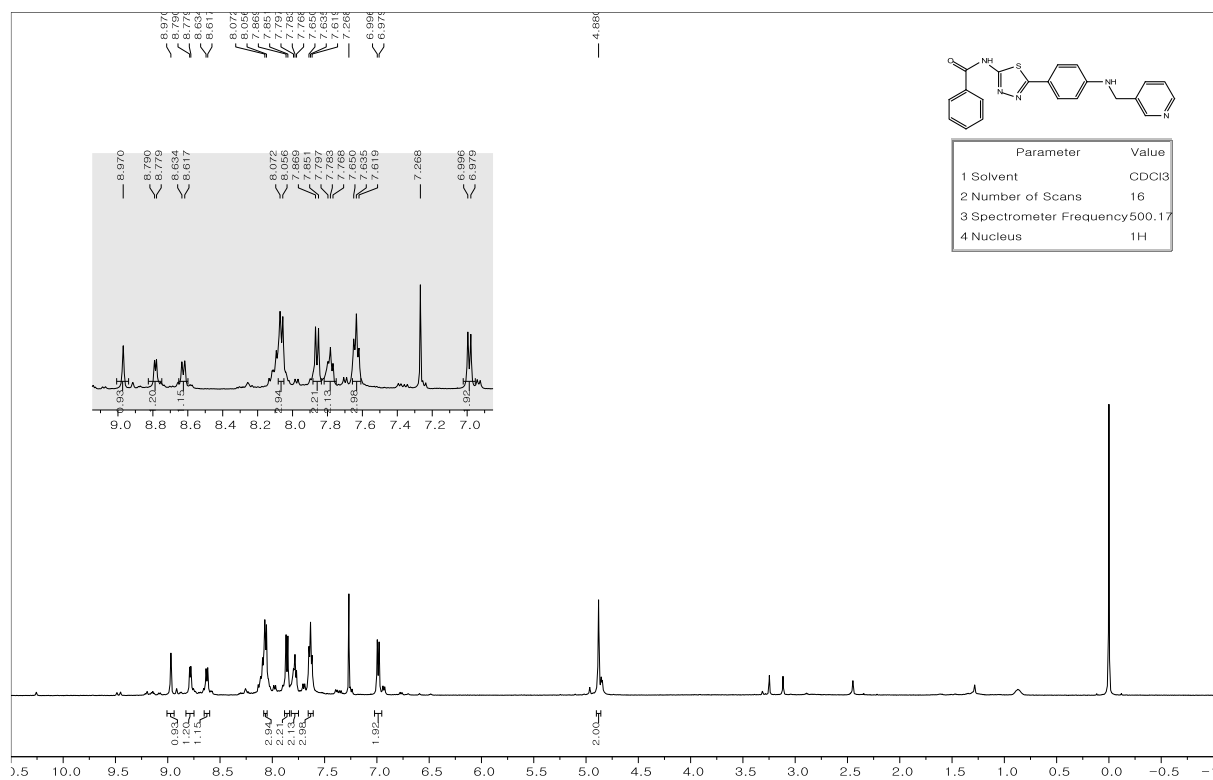
^{13}C NMR – 17{1,1}



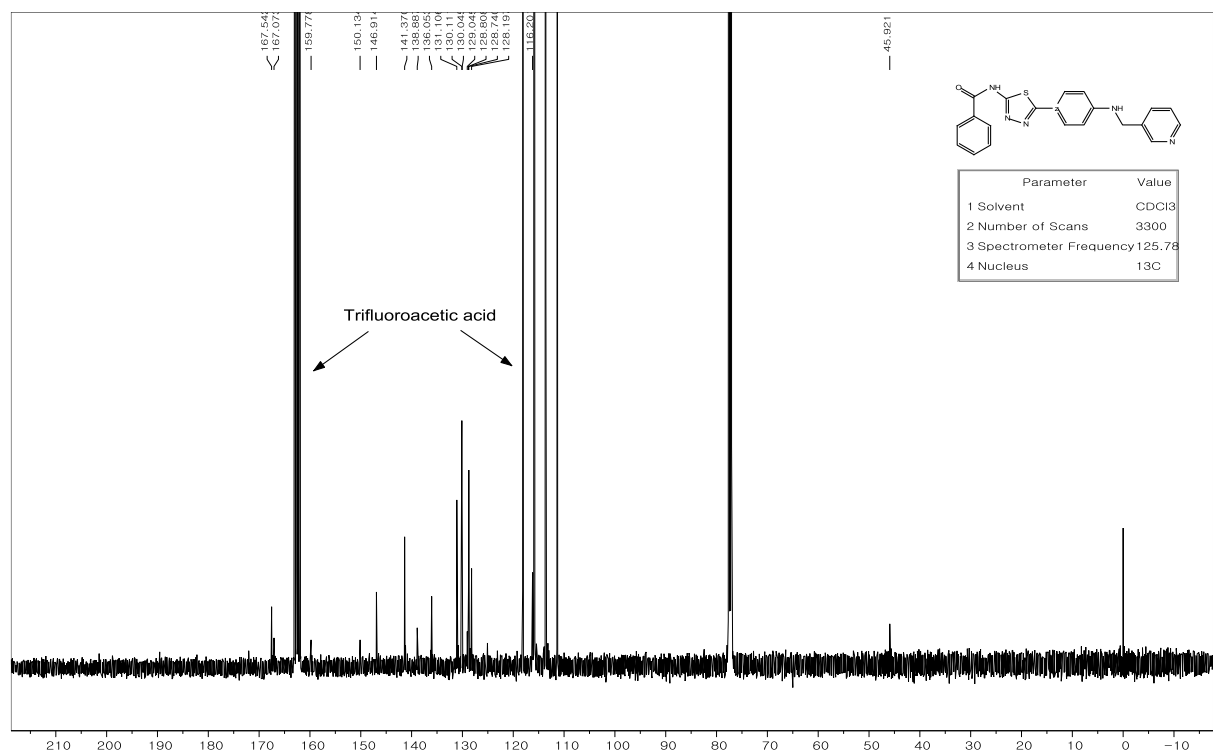
LC/MS – 17{1,1}



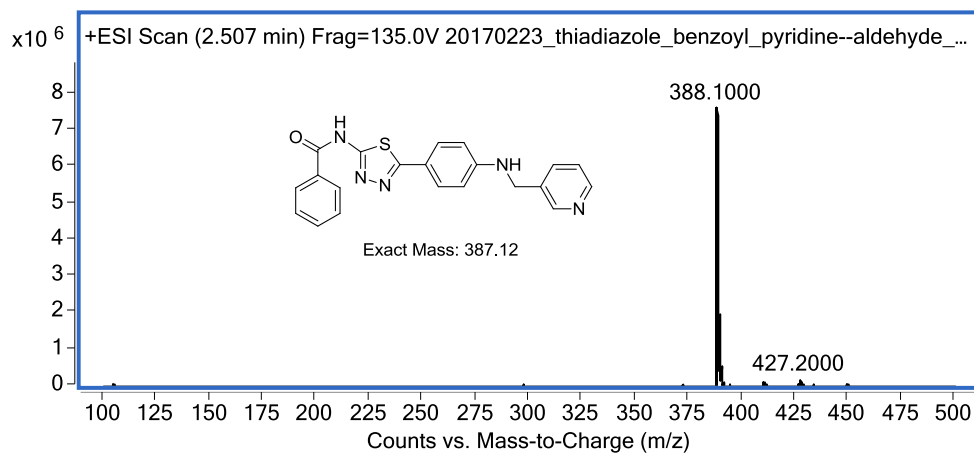
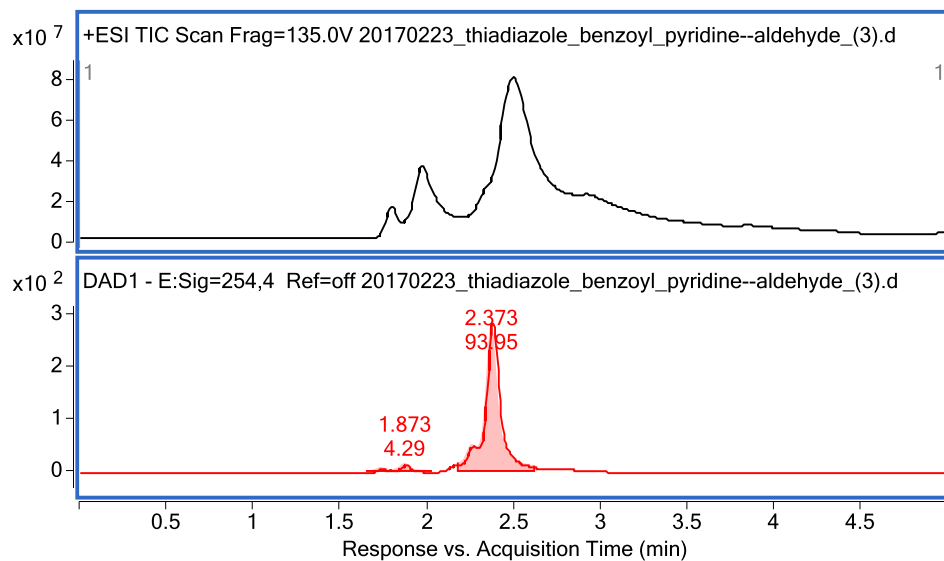
HR/MS – 17{1,1}



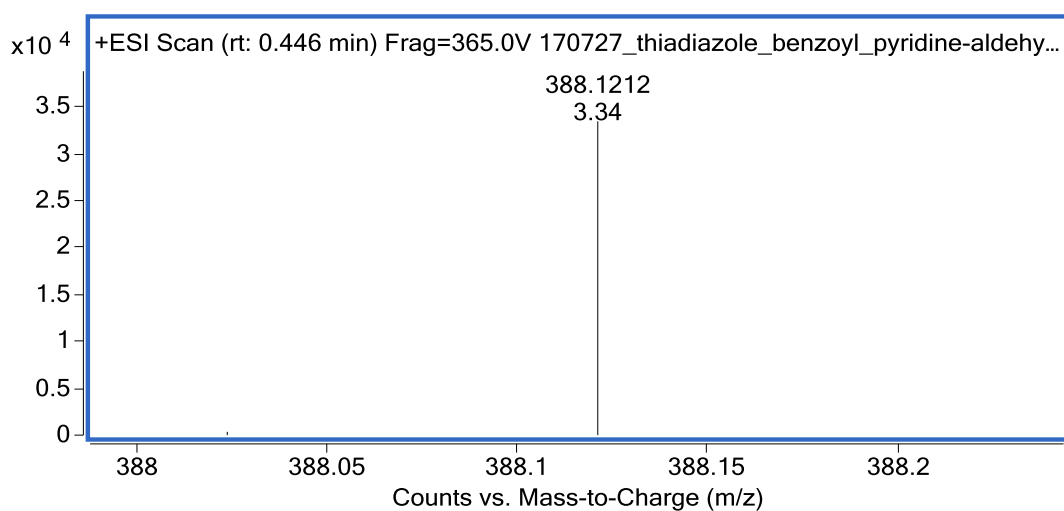
¹H NMR – 17{1,2}



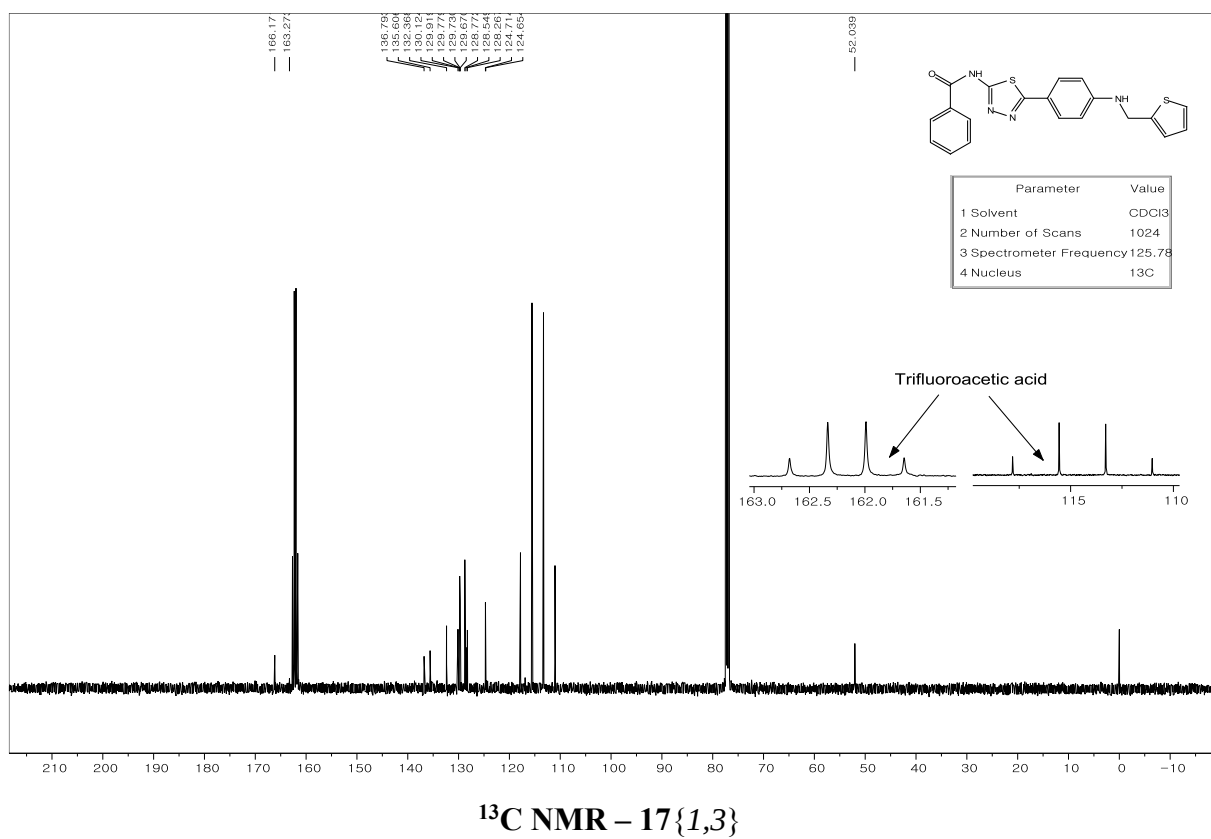
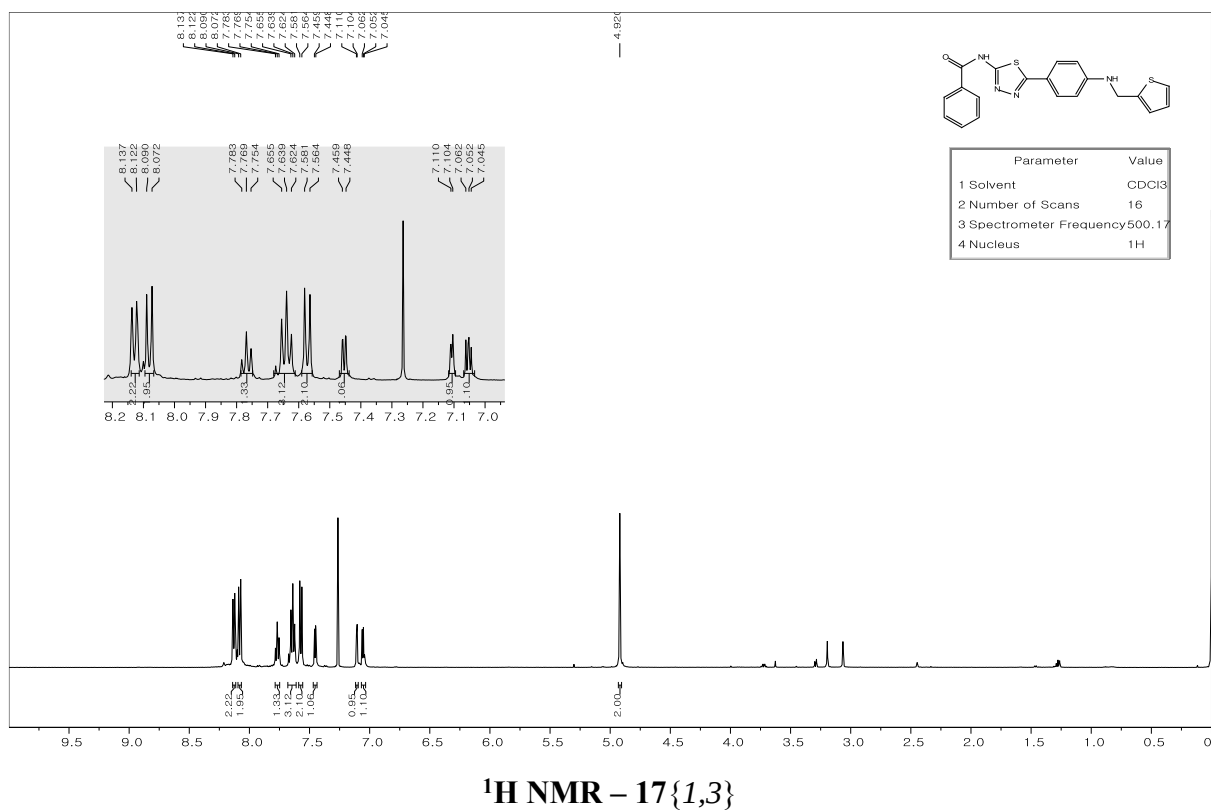
¹³C NMR – 17{1,2}

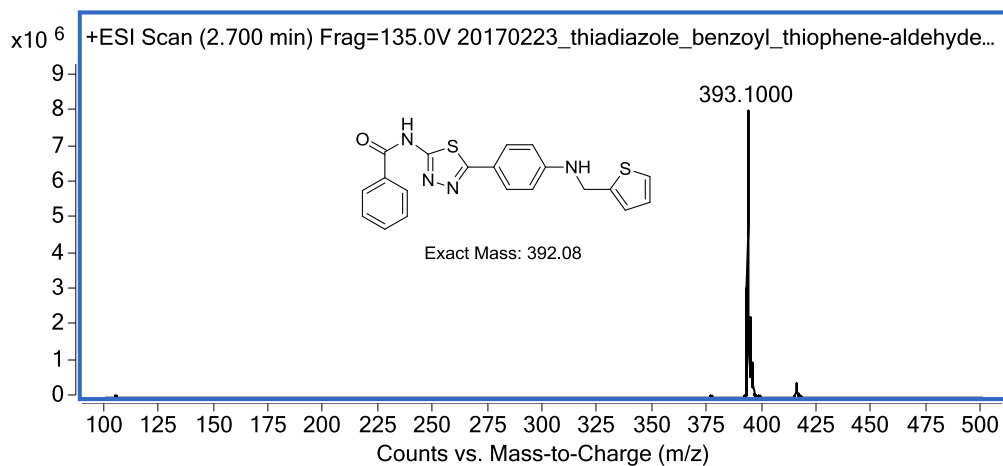
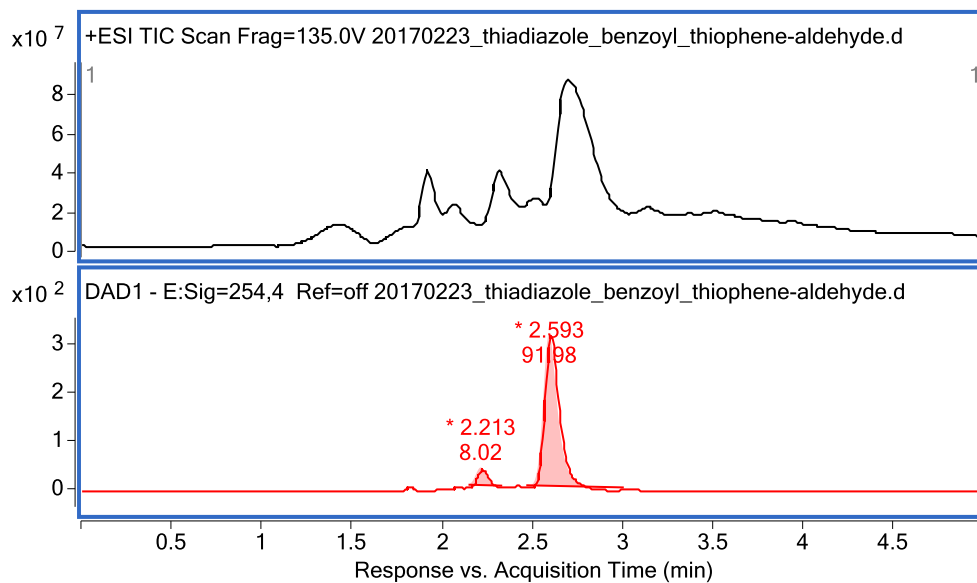


LC/MS – 17{1,2}

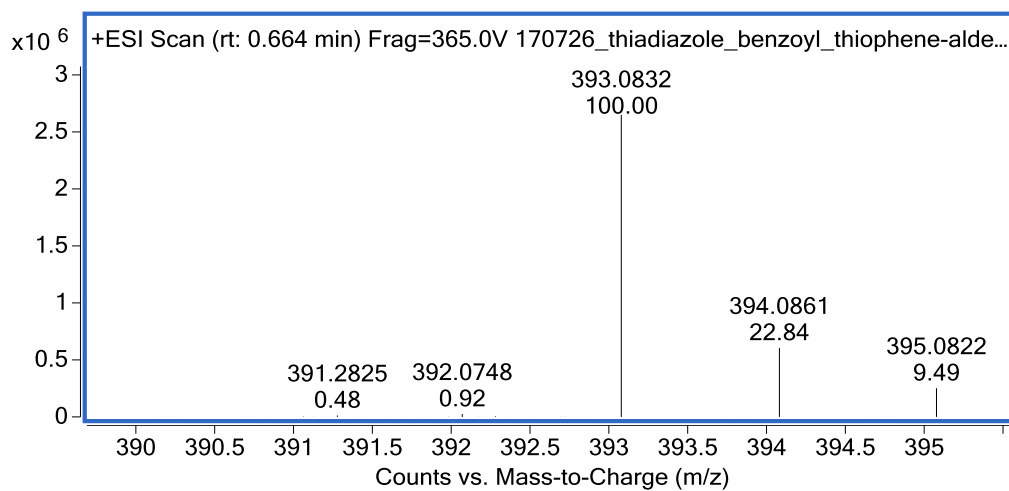


HR/MS – 17{1,2}

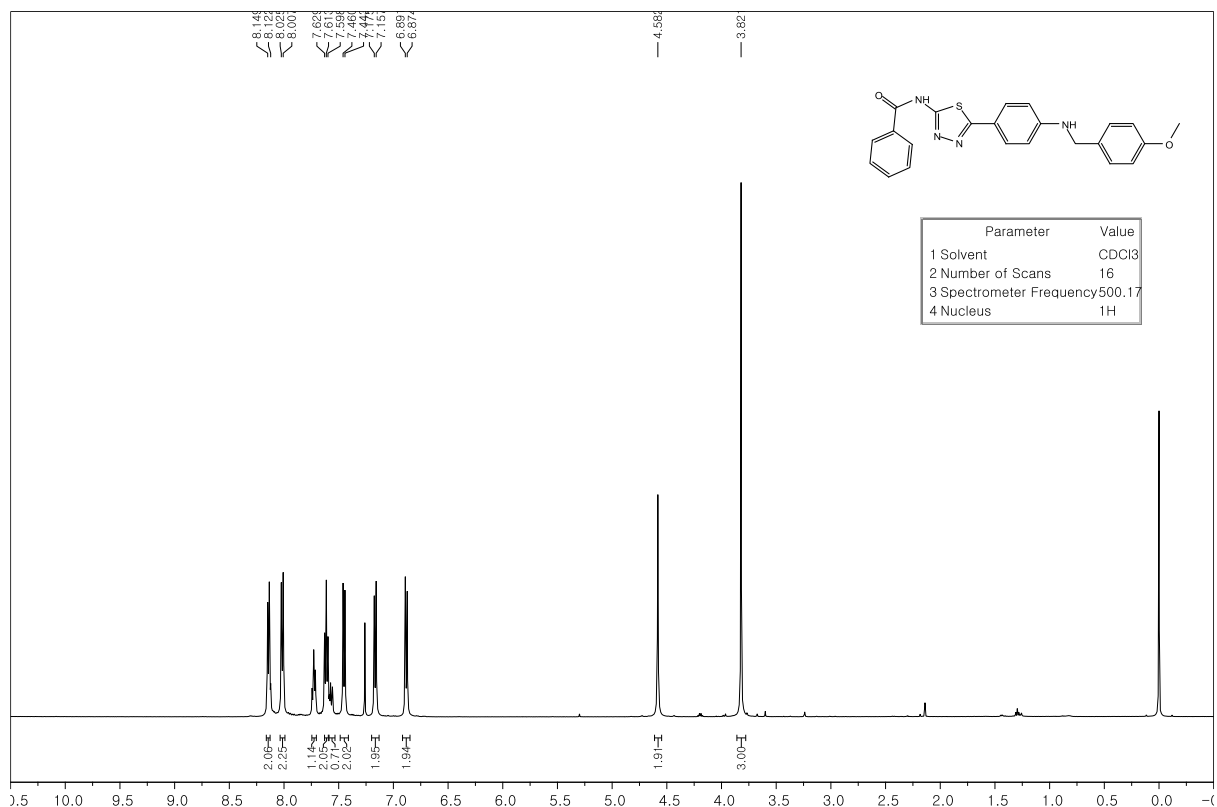




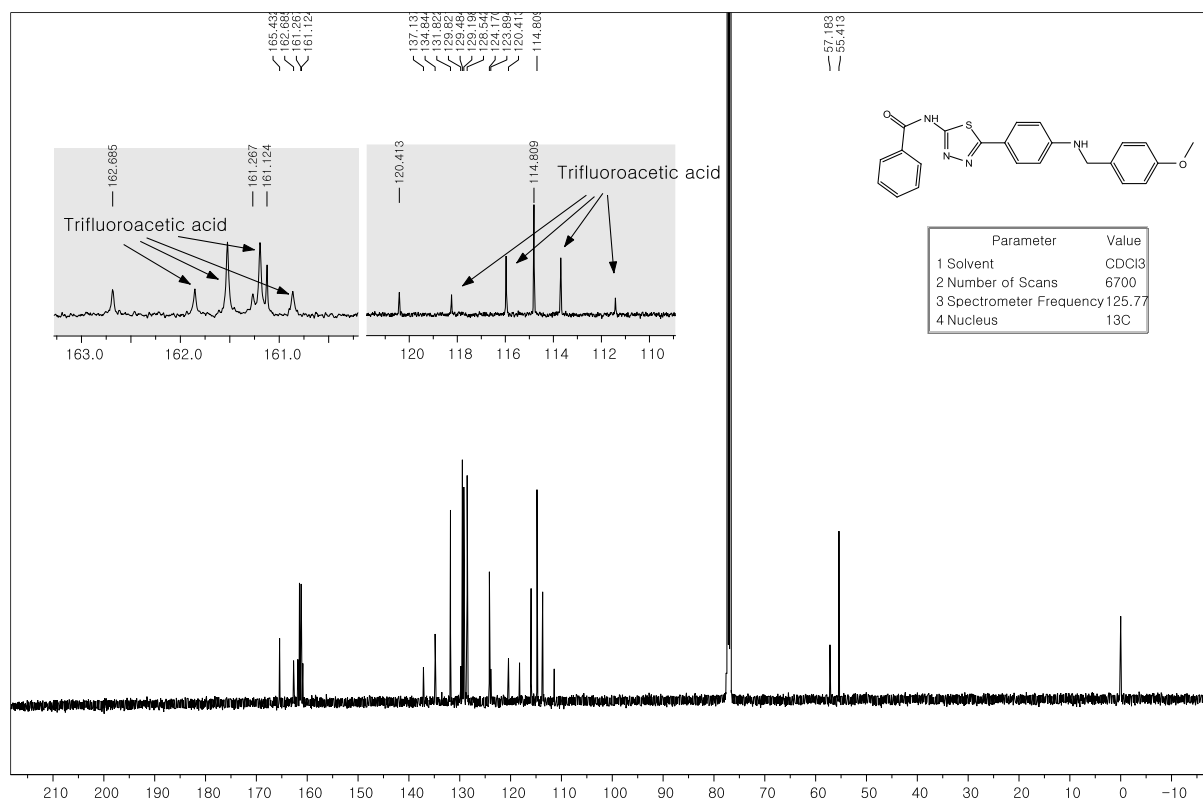
LC/MS – 17{1,3}



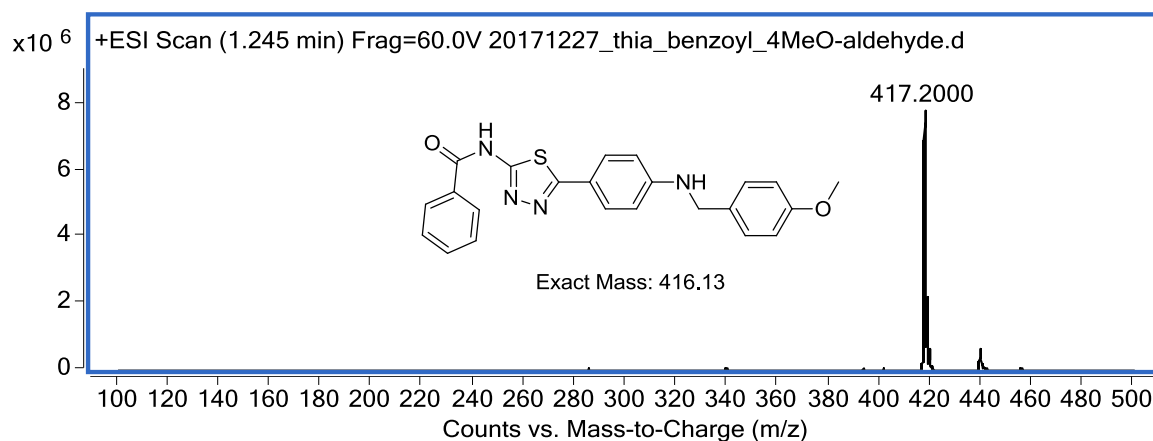
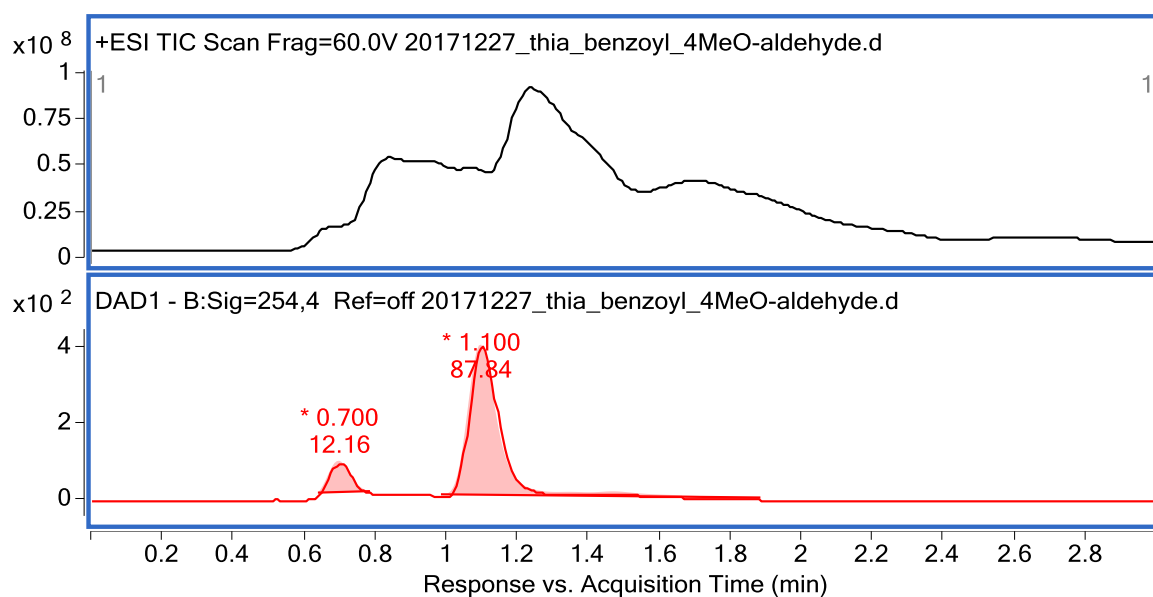
HR/MS – 17{1,3}



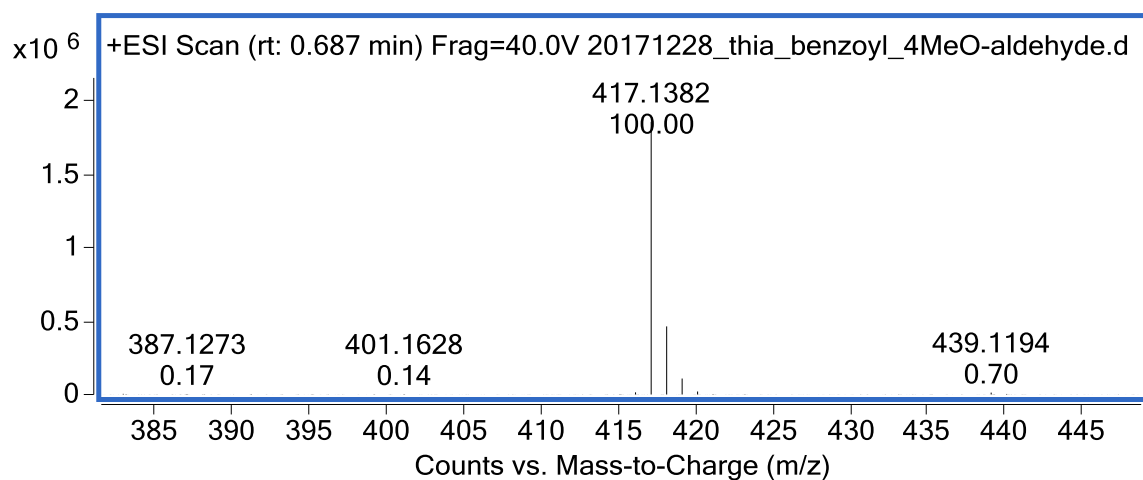
¹H NMR – 17{1,4}



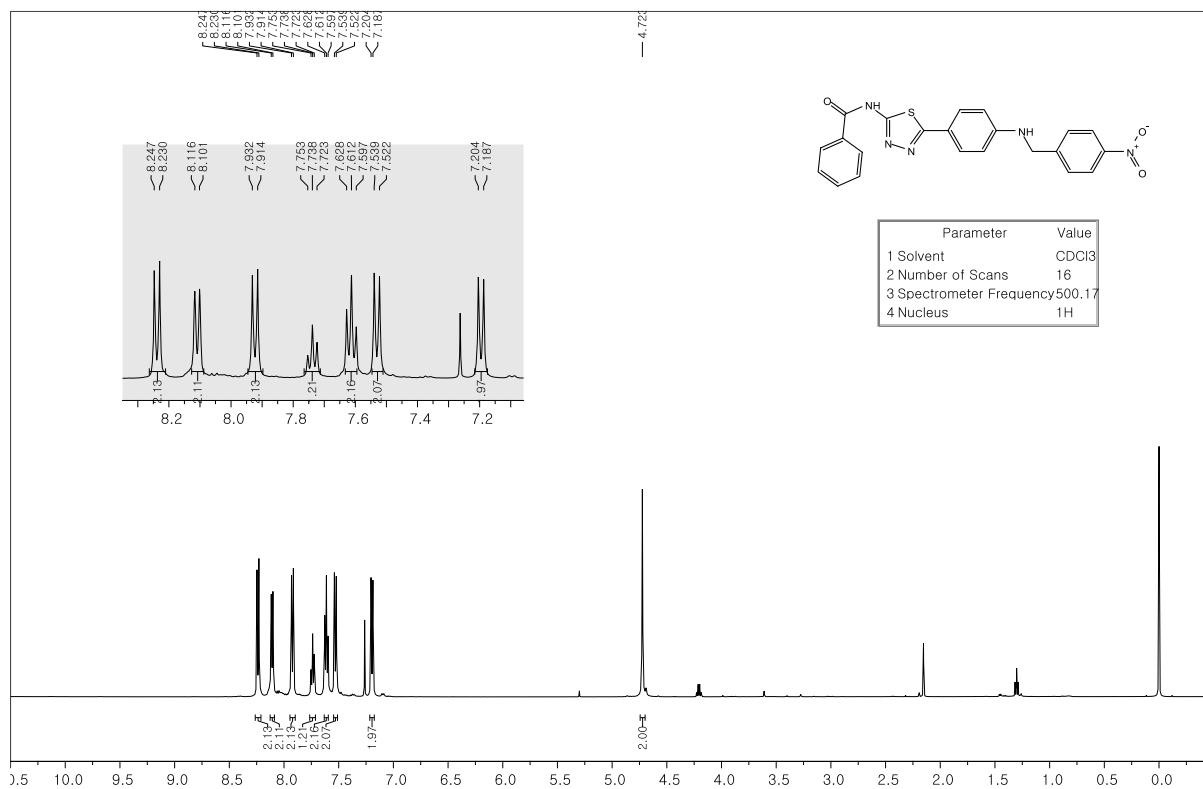
^{13}C NMR – 17{1,4}



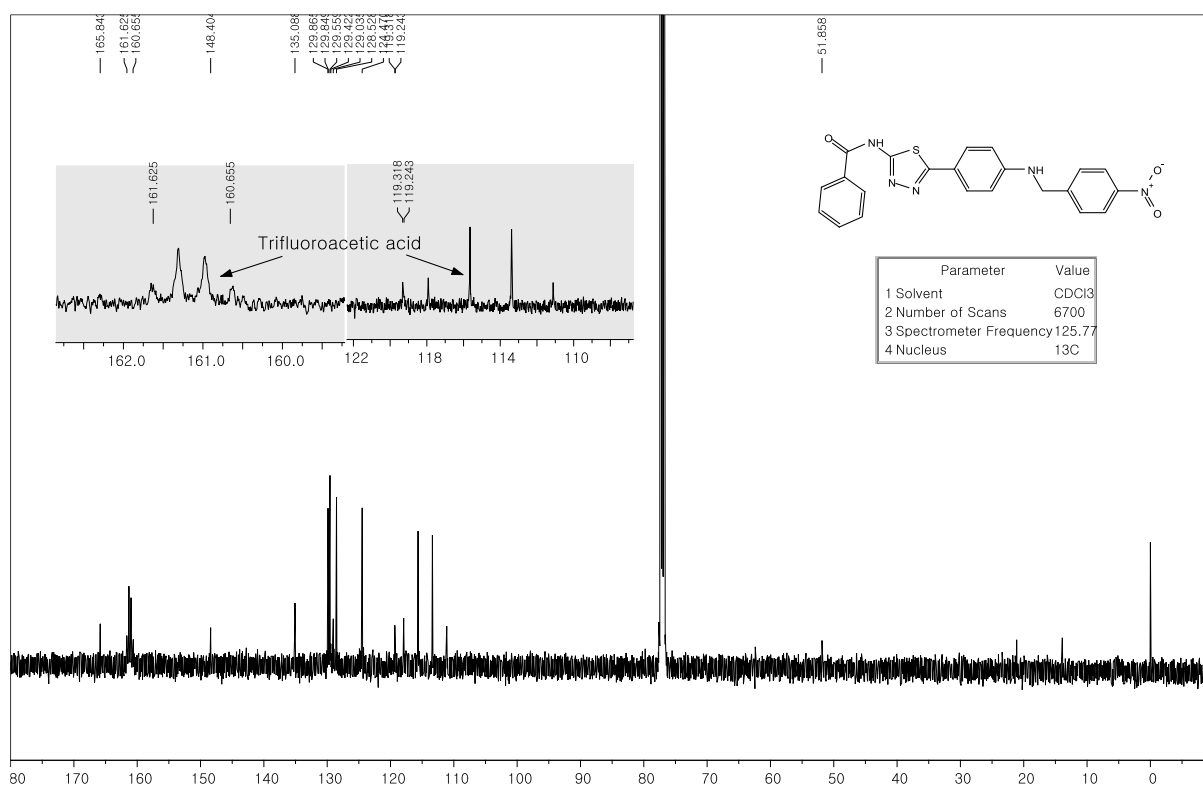
LC/MS – 17{1,4}



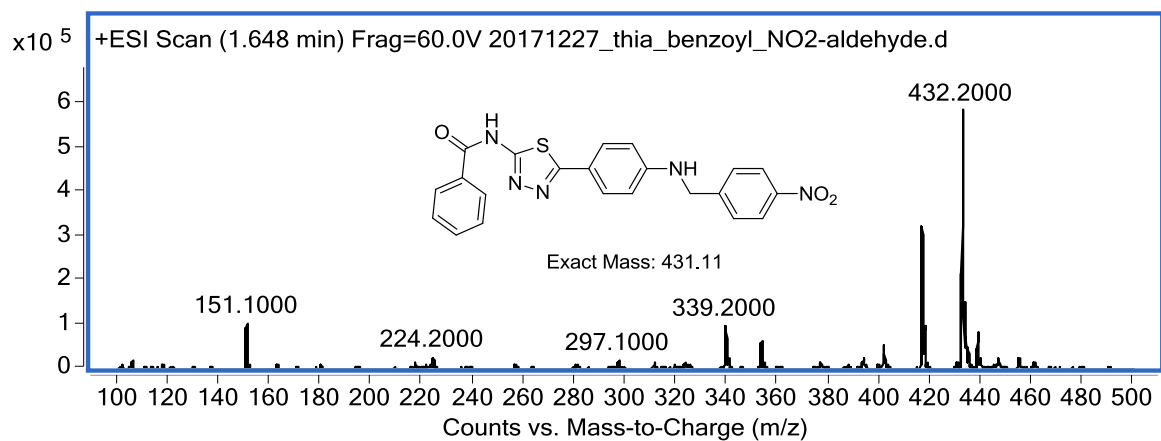
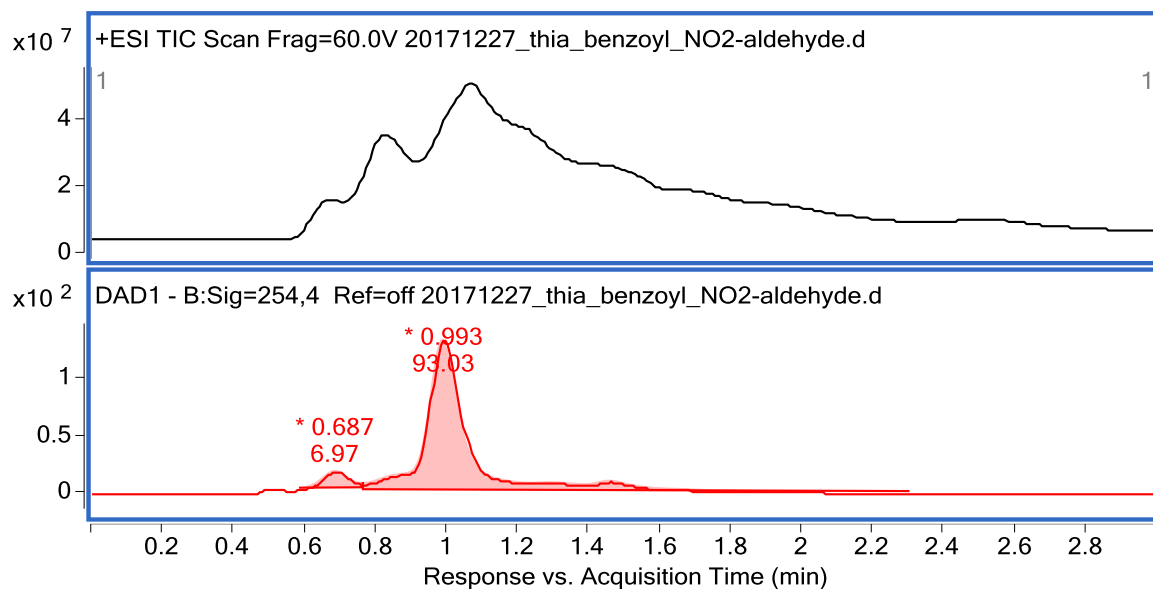
HR/MS – 17{1,4}



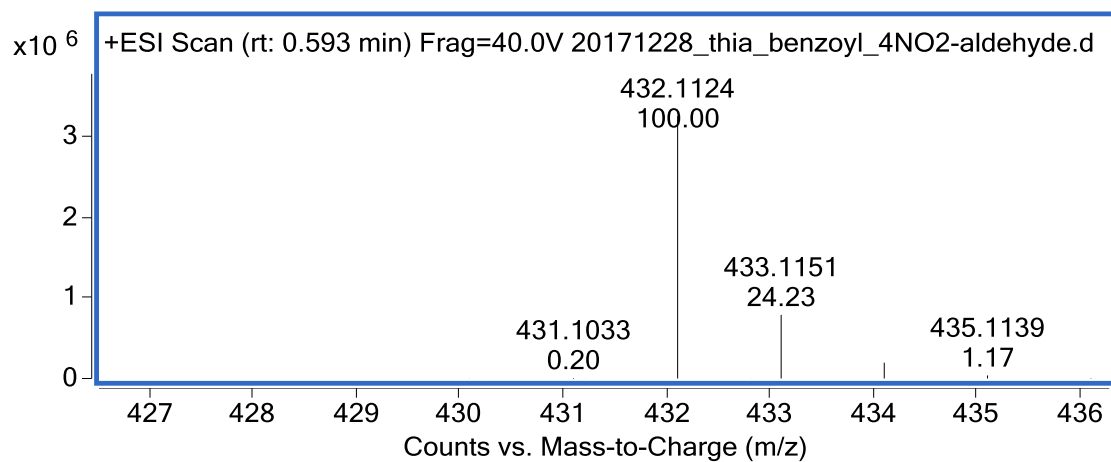
¹H NMR – 17{1,5}



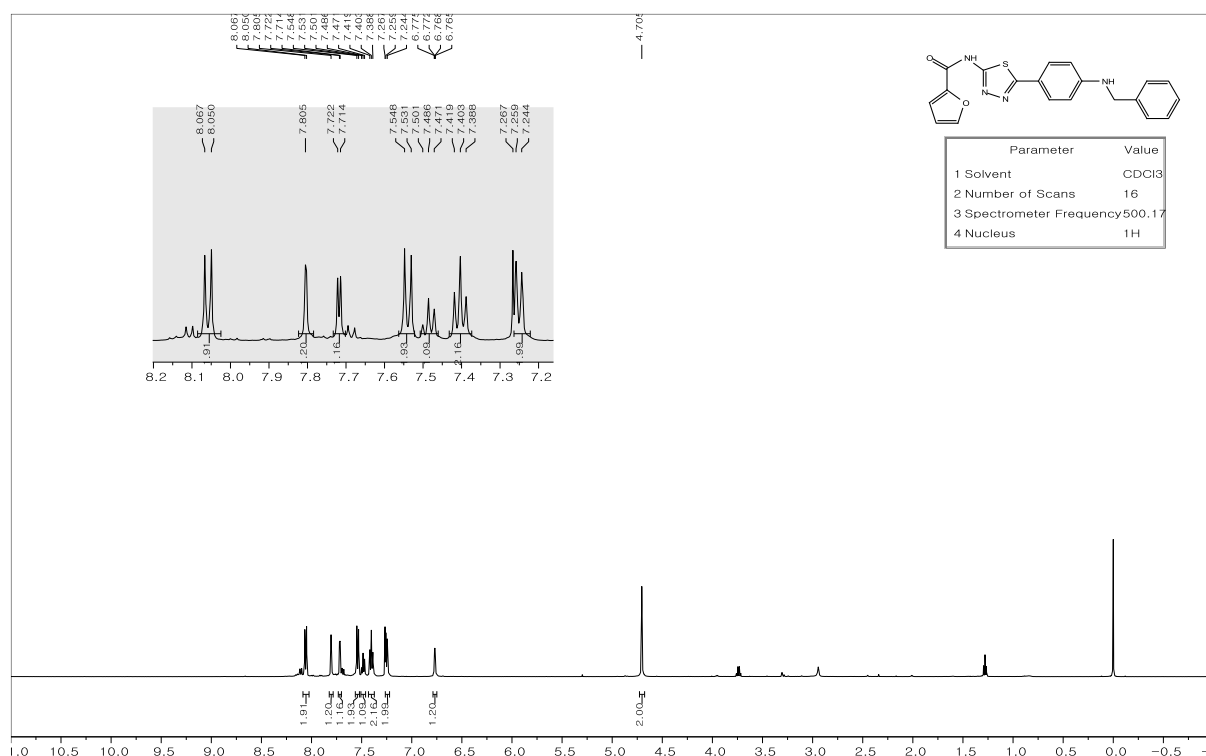
¹³C NMR – 17{1,5}



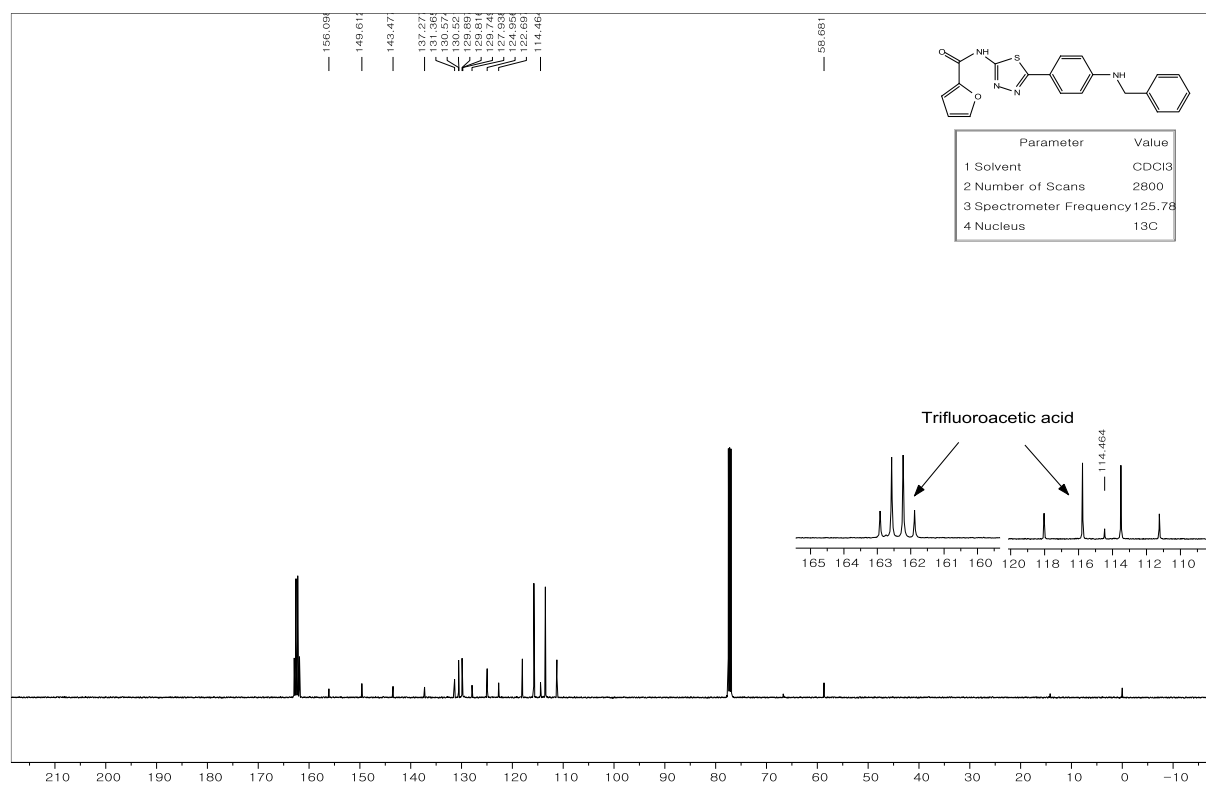
LC/MS – 17{1,5}



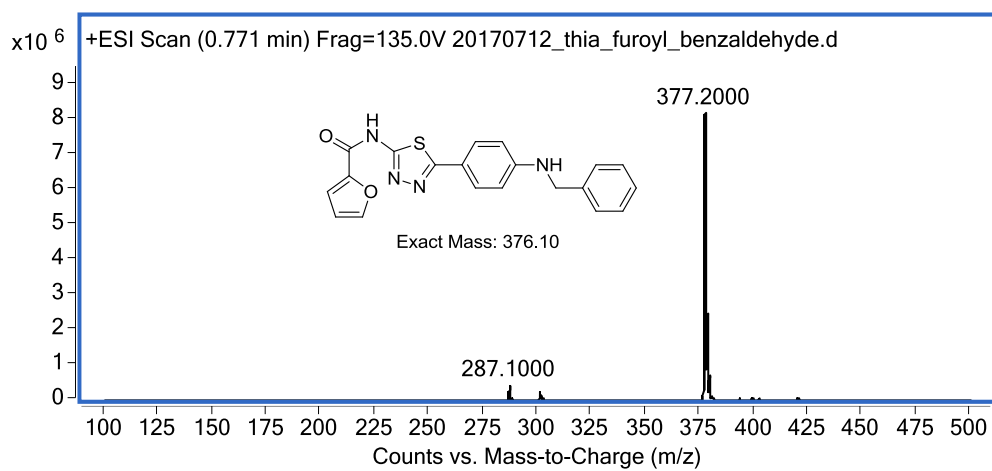
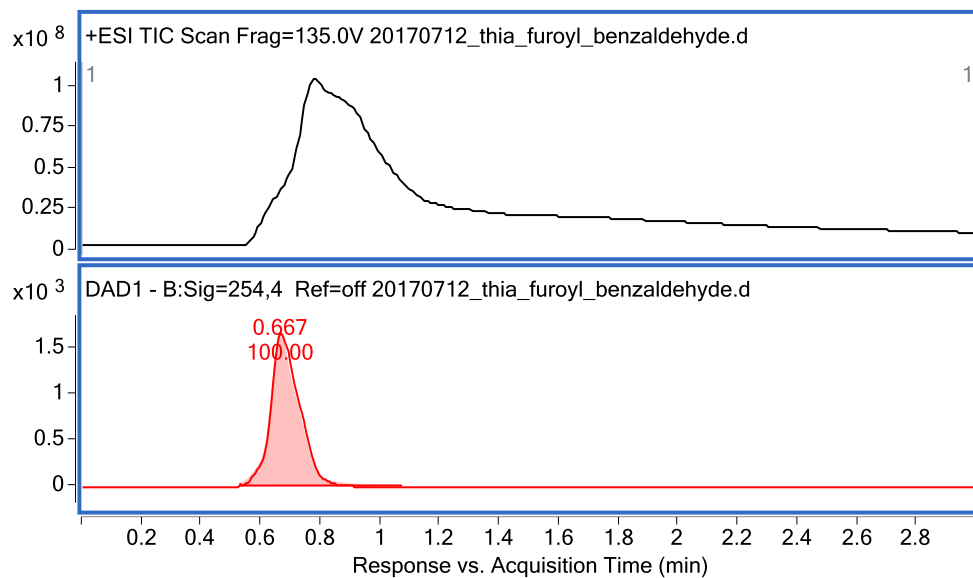
HR/MS – 17{1,5}



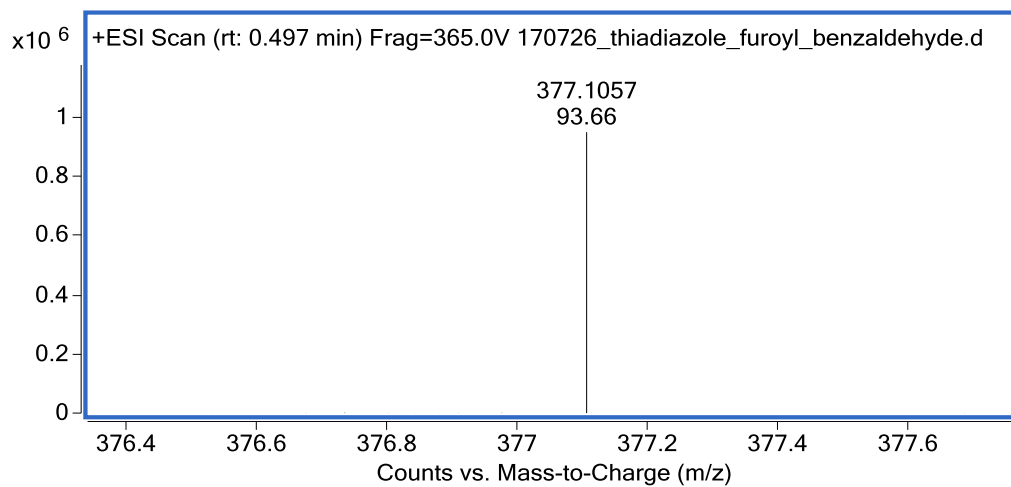
¹H NMR – 17{2,1}



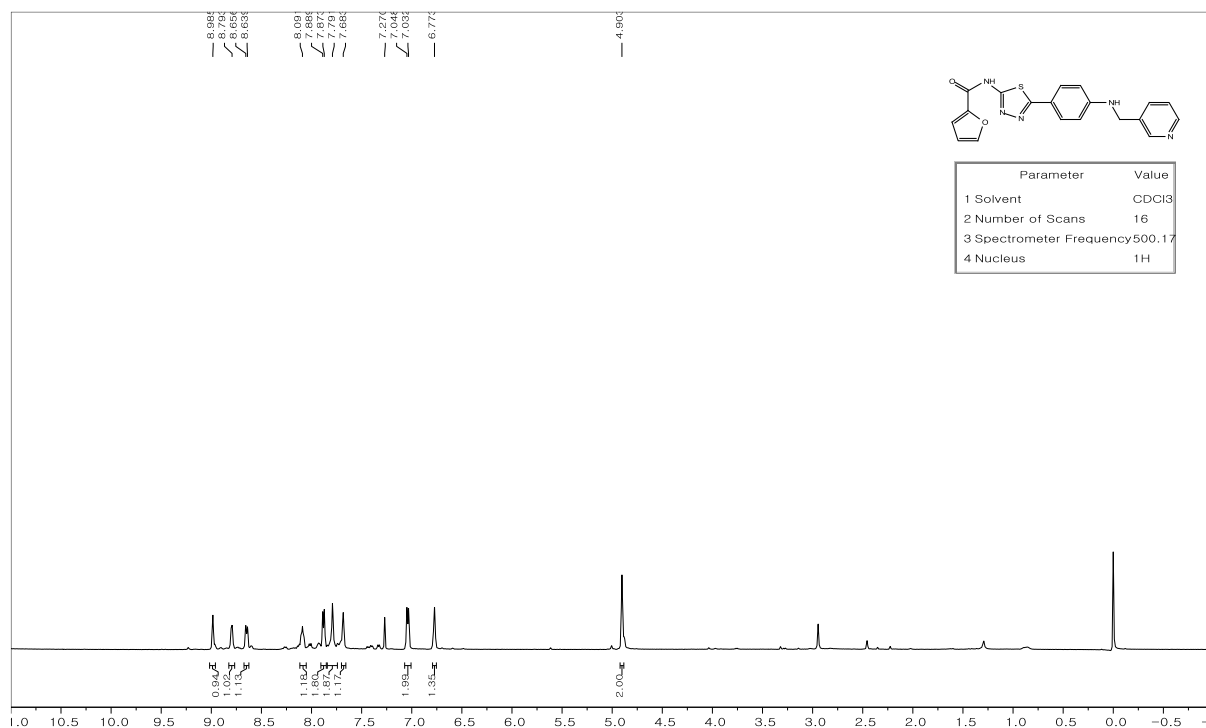
¹³C NMR – 17{2,1}



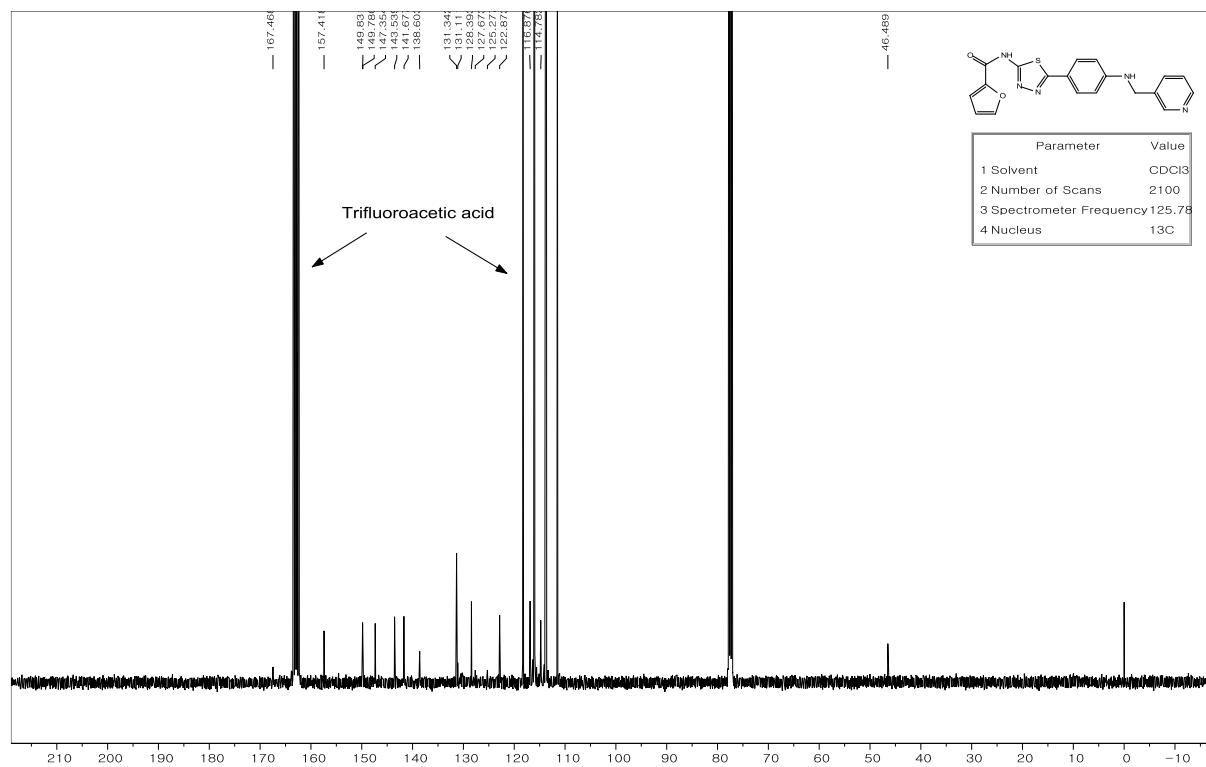
LC/MS – 17{2,1}



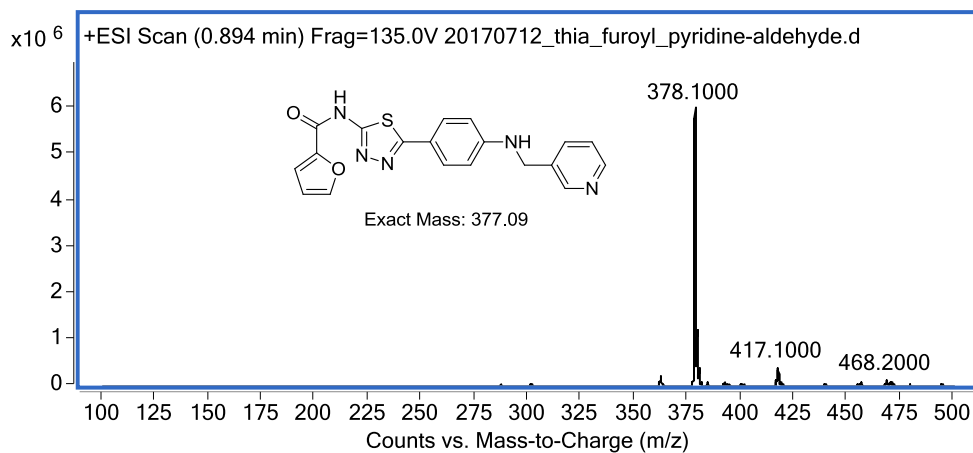
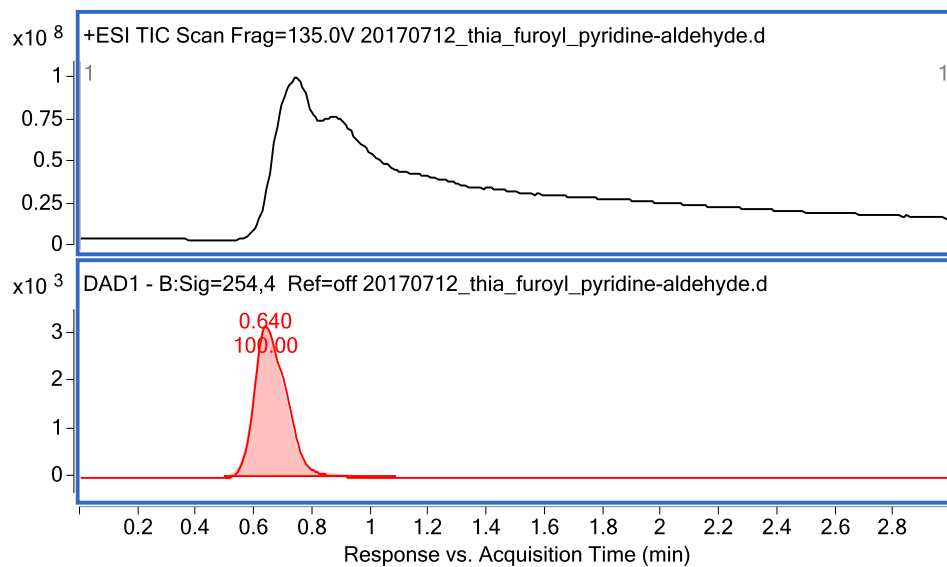
HR/MS – 17{2,1}



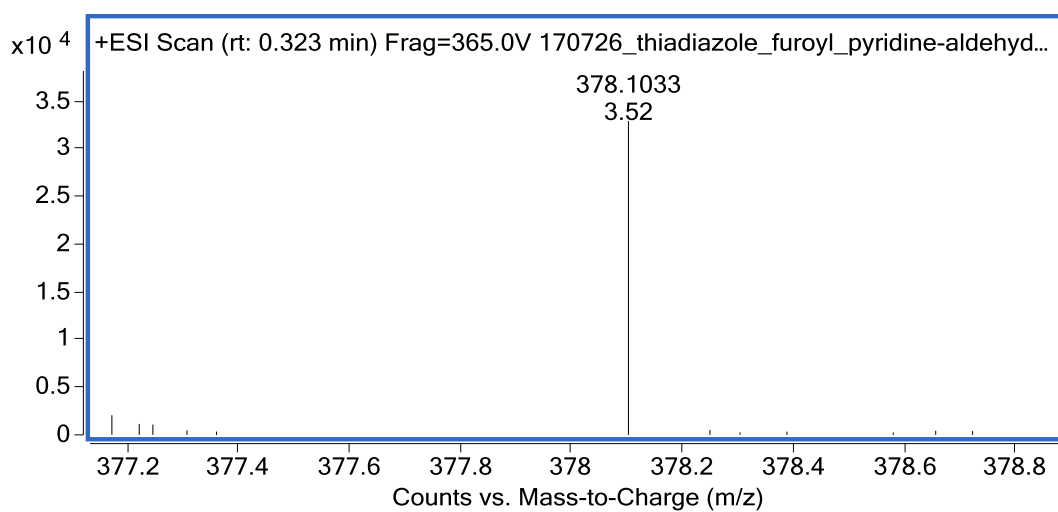
¹H NMR – 17{2,2}



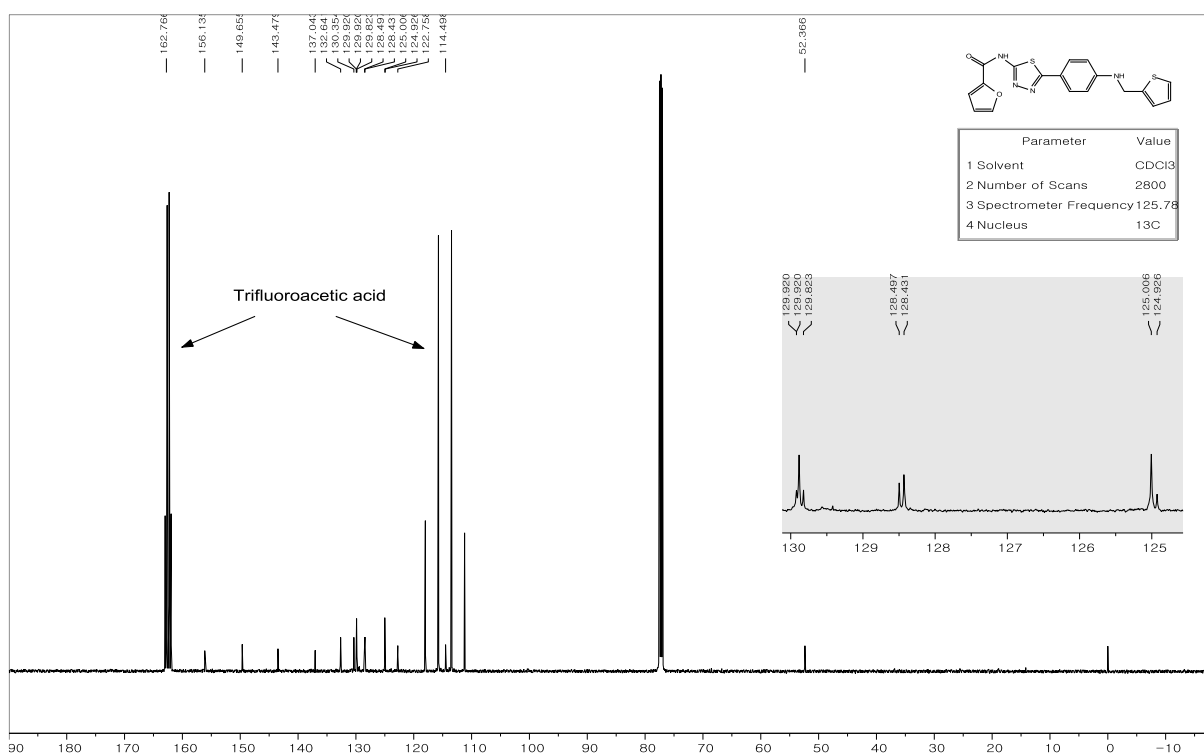
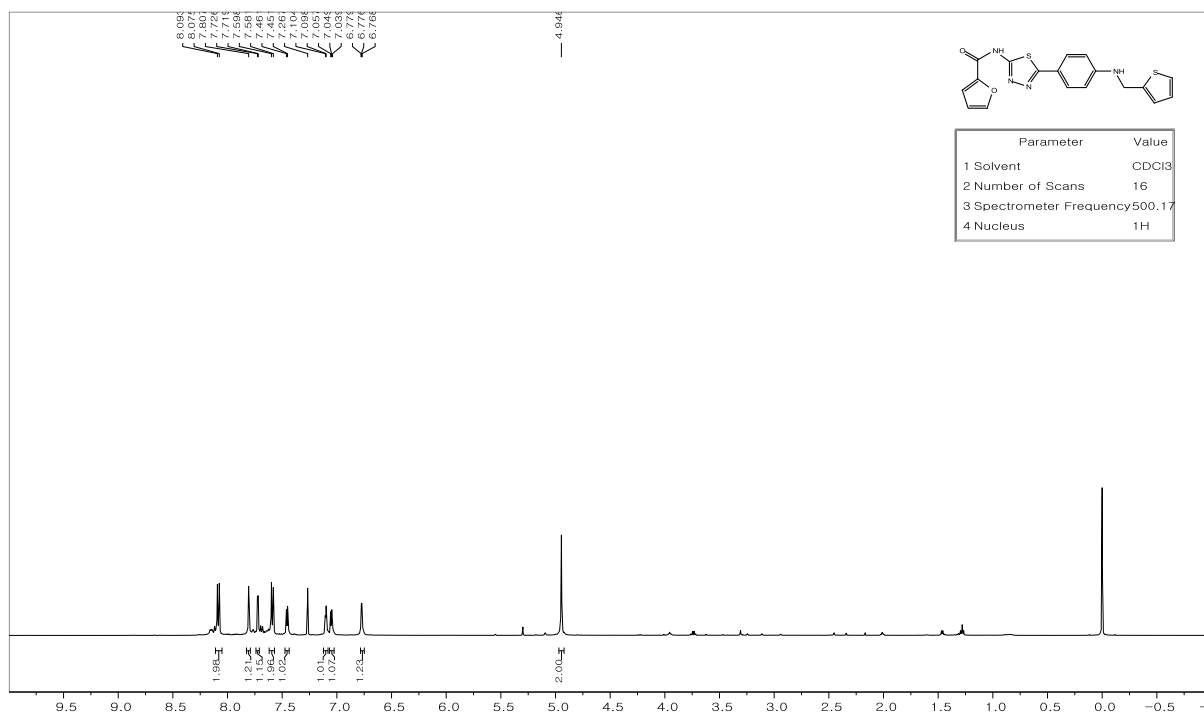
¹³C NMR – 17{2,2}

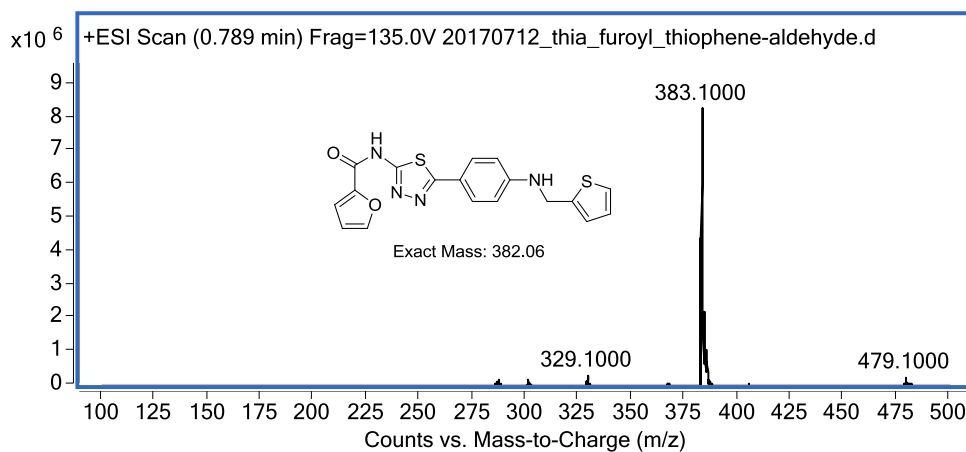
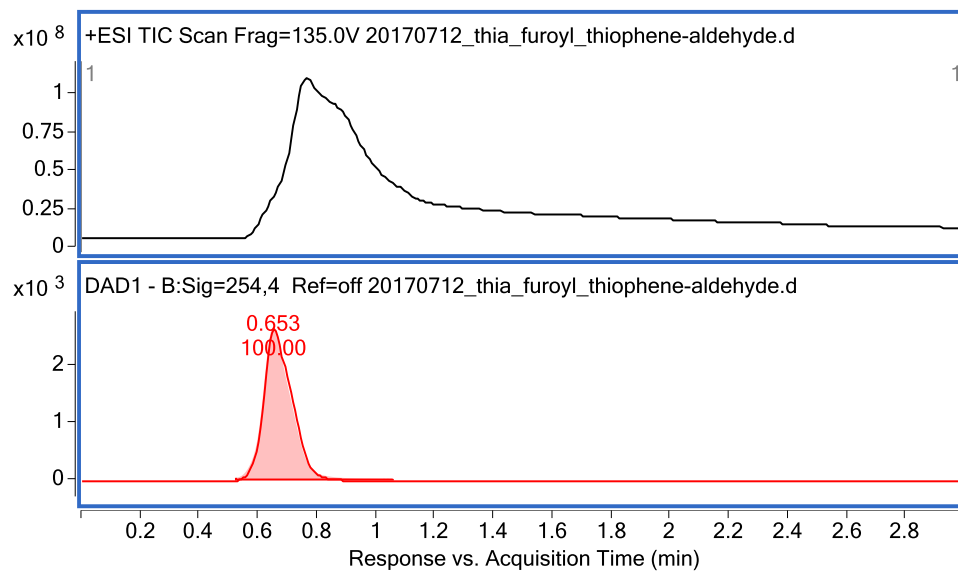


LC/MS – 17{2,2}

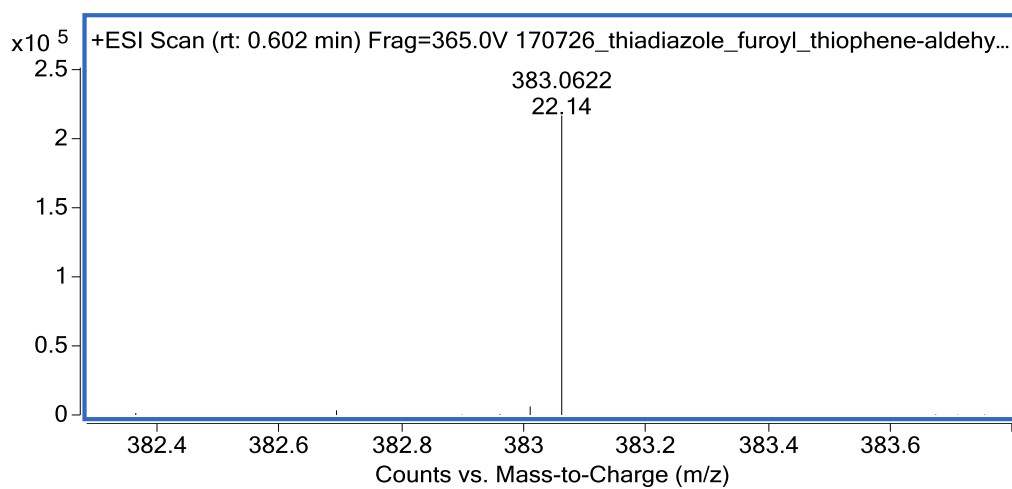


HR/MS – 17{2,2}

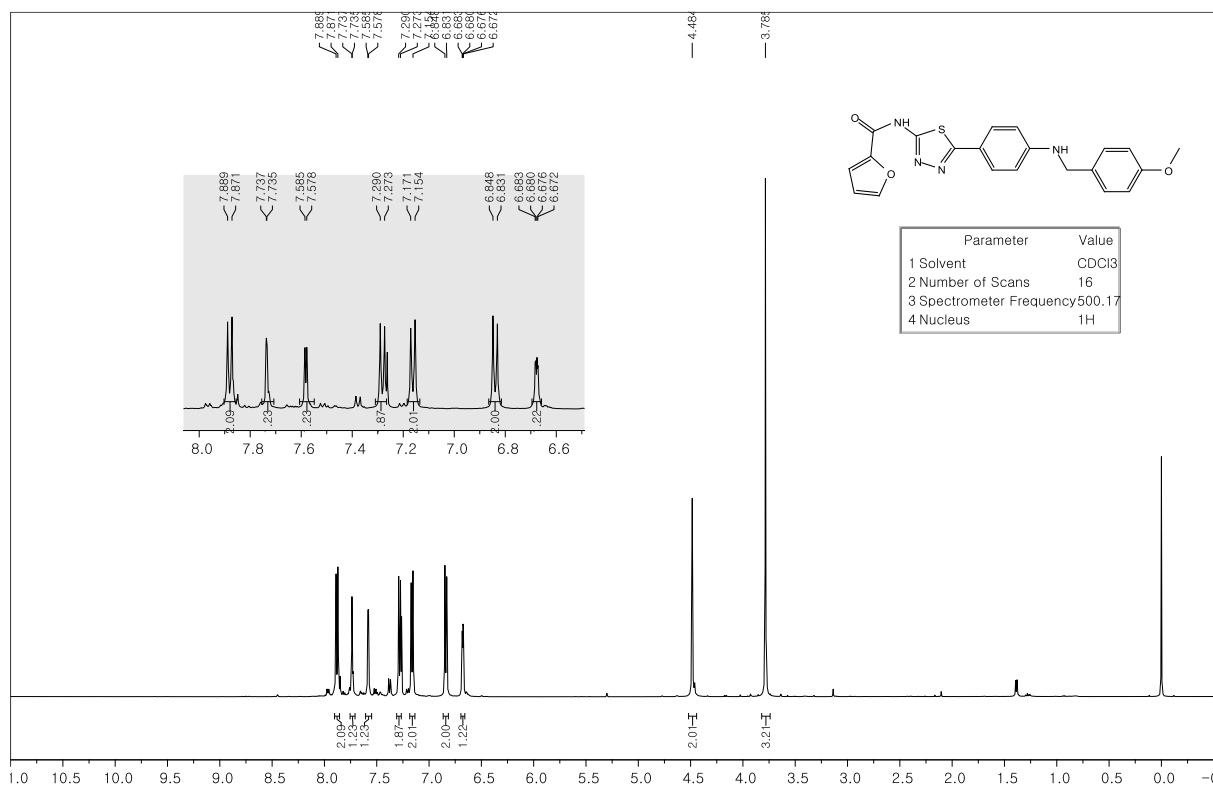




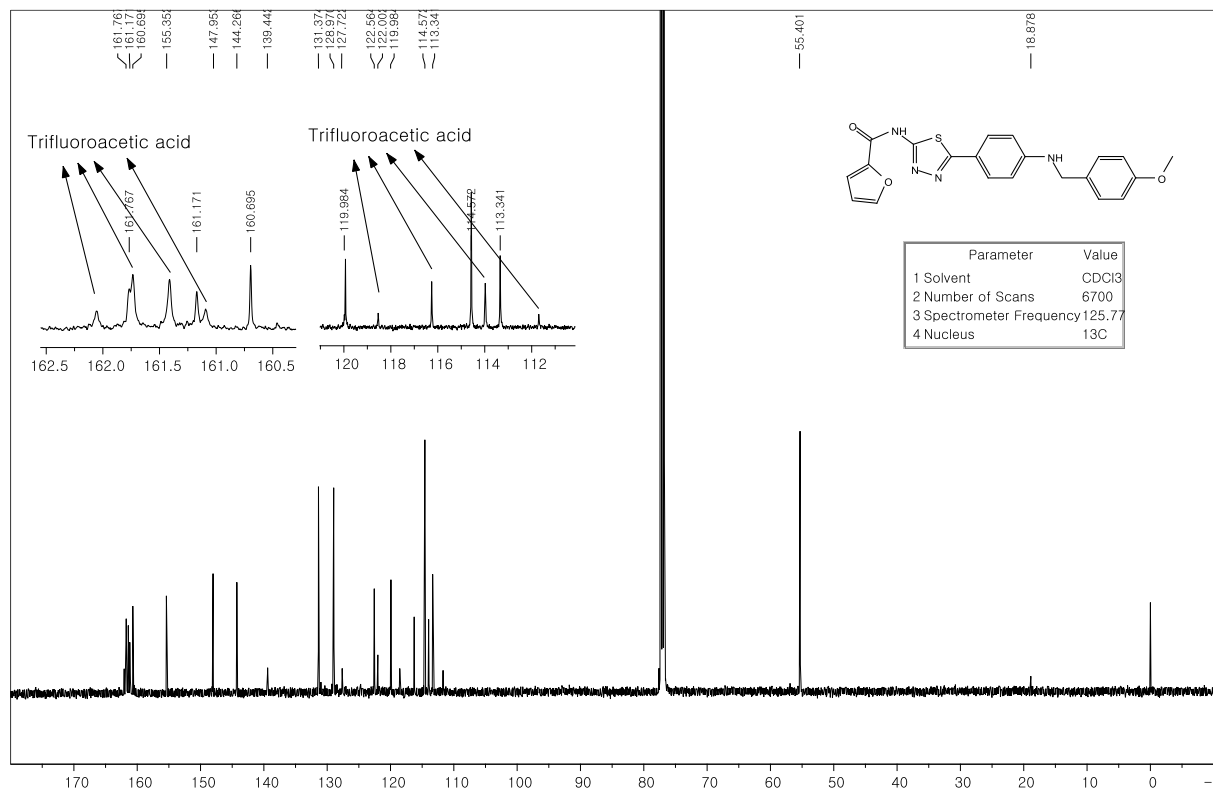
LC/MS – 17{2,3}



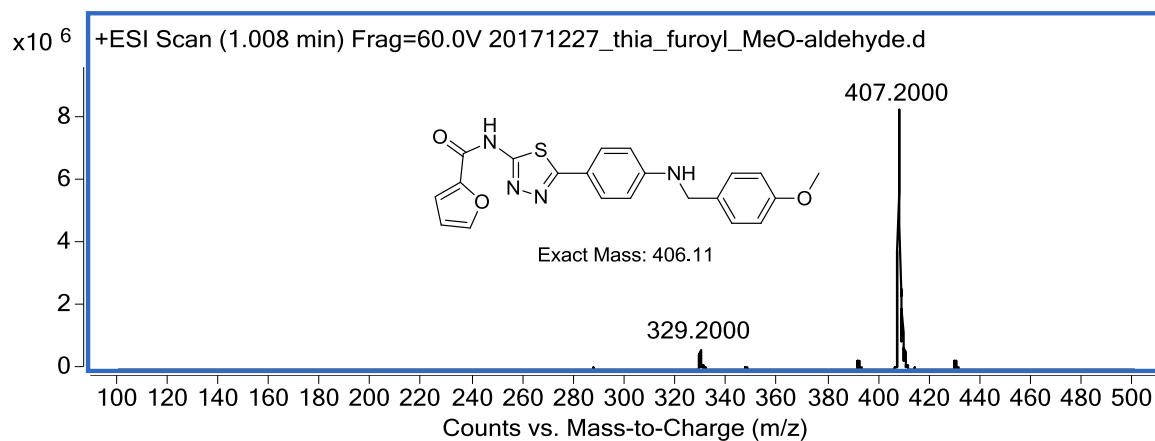
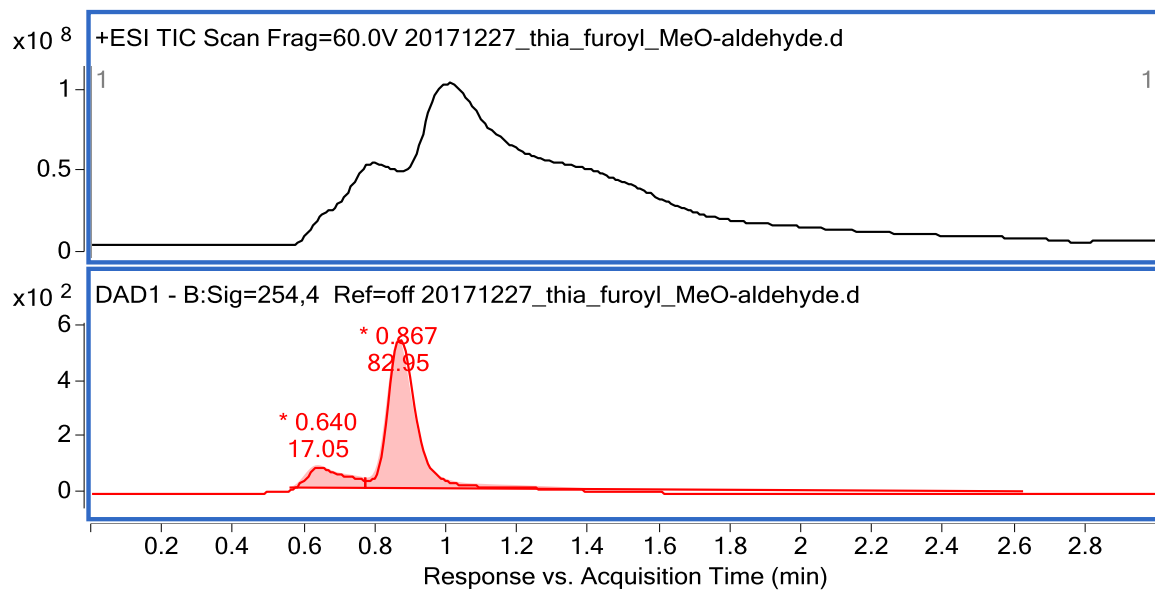
HR/MS – 17{2,3}



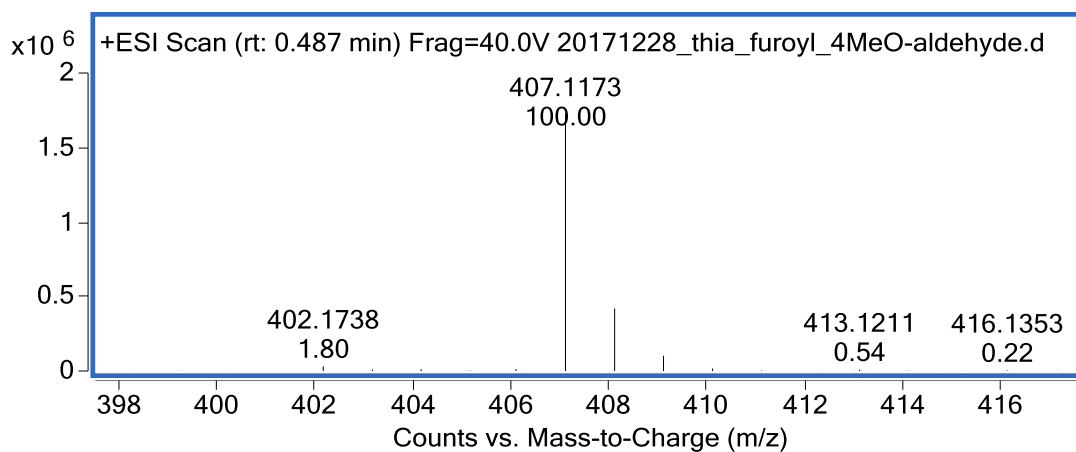
¹H NMR – 17{2,4}



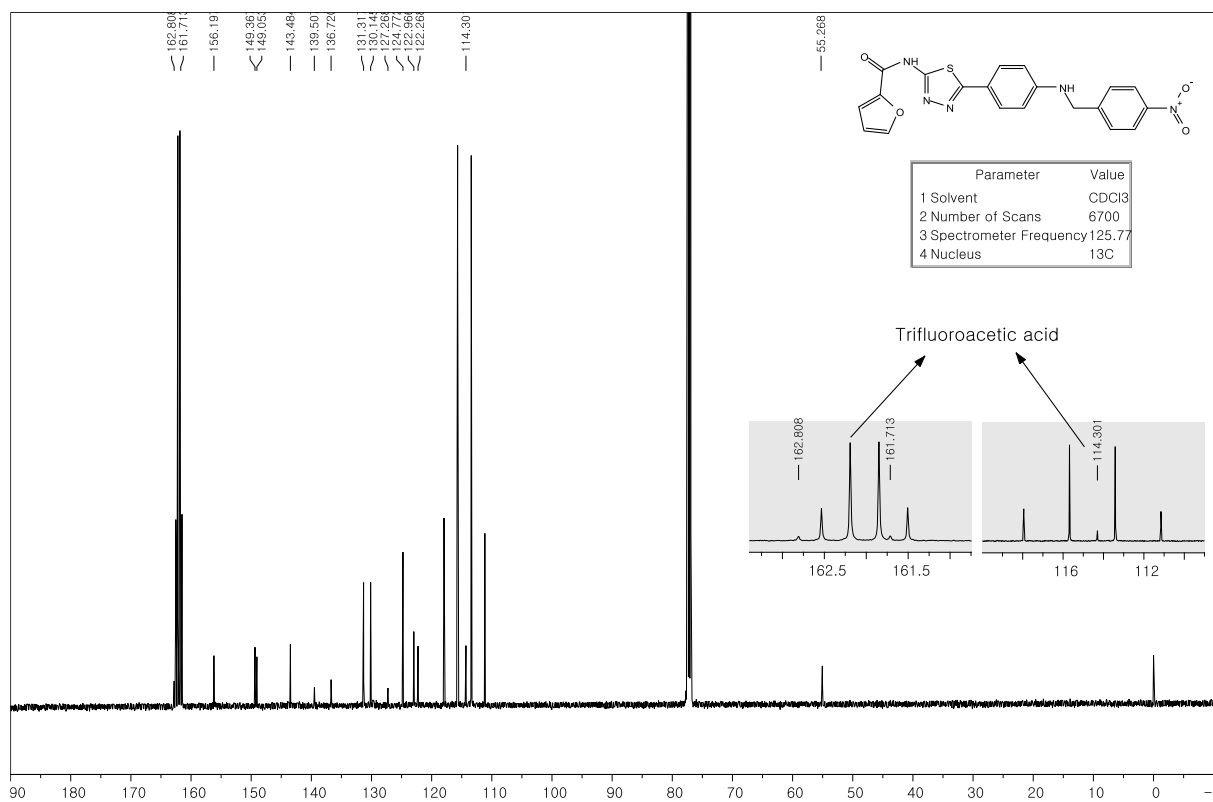
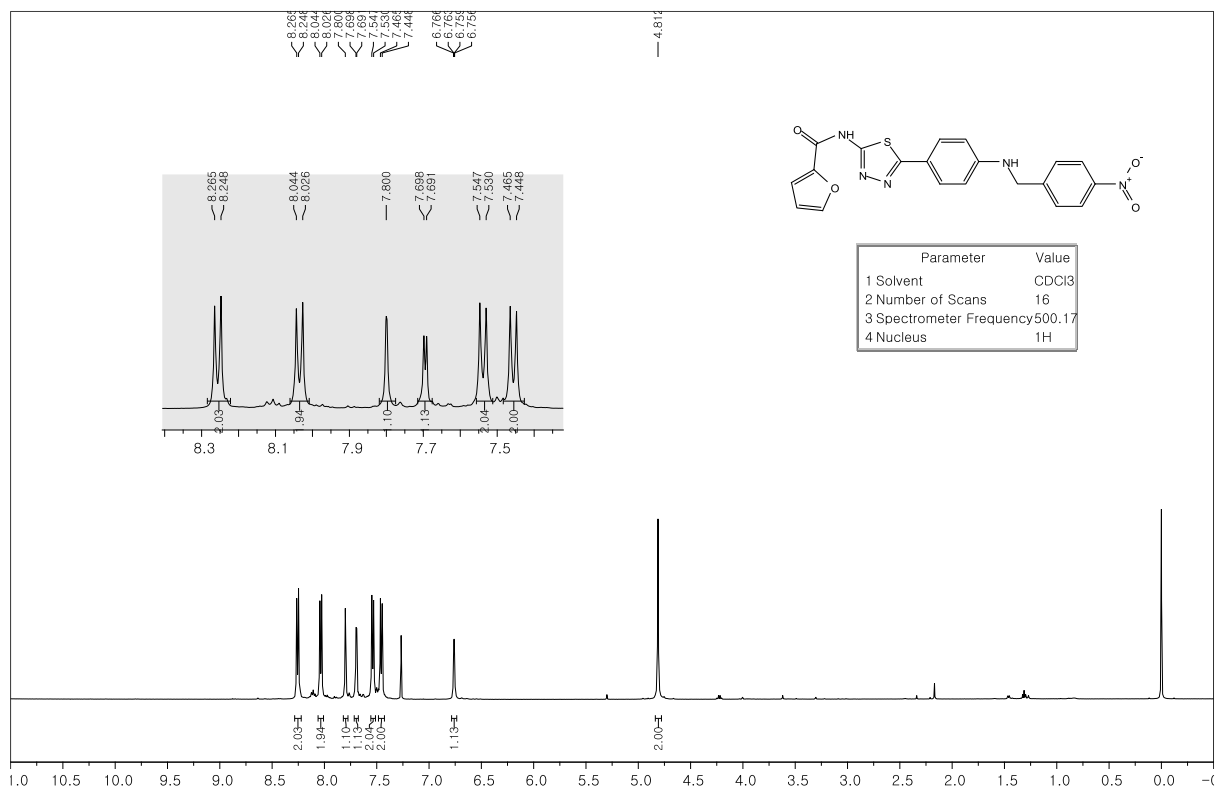
¹³C NMR – 17{2,4}



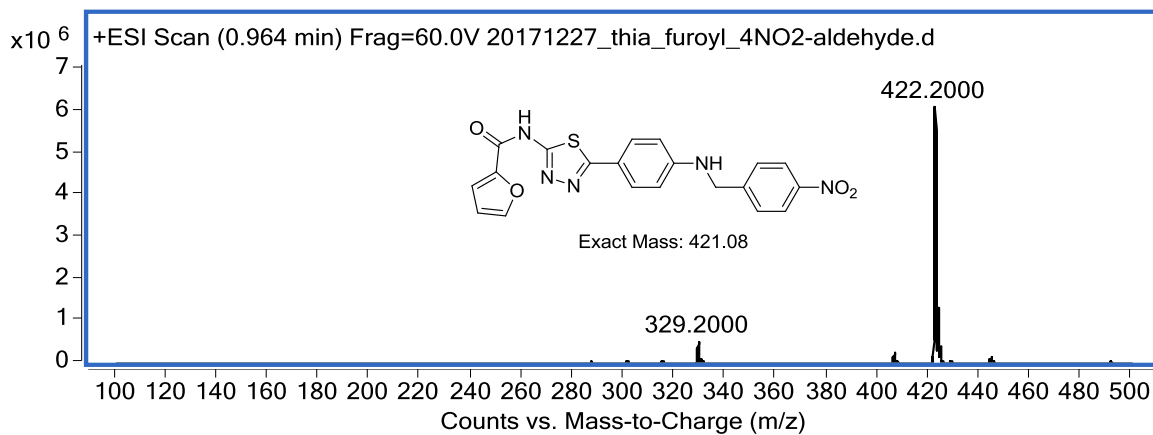
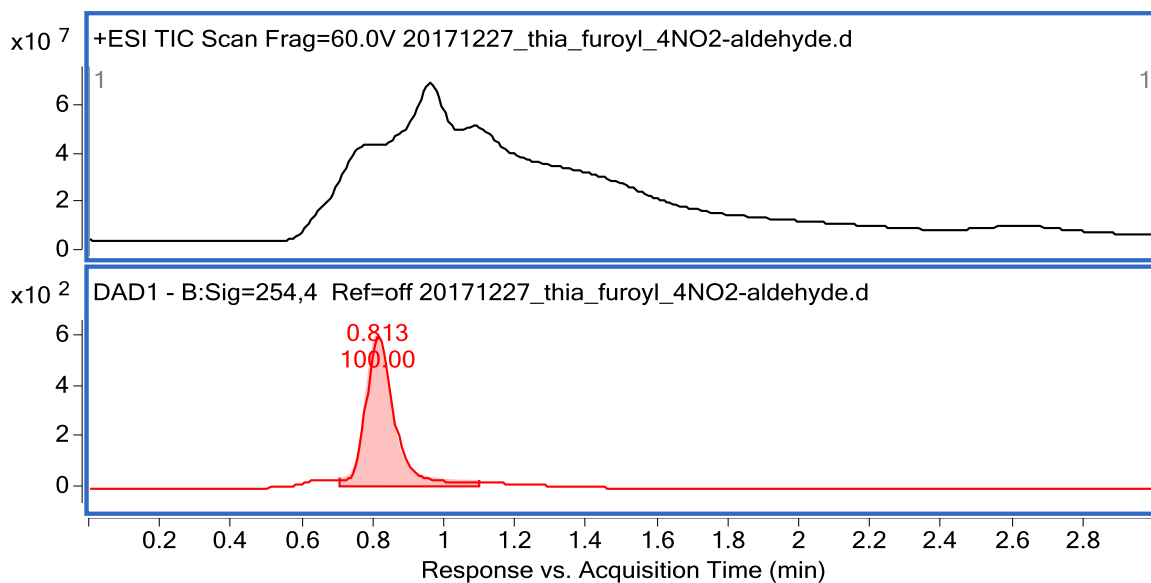
LC/MS – 17{2,4}



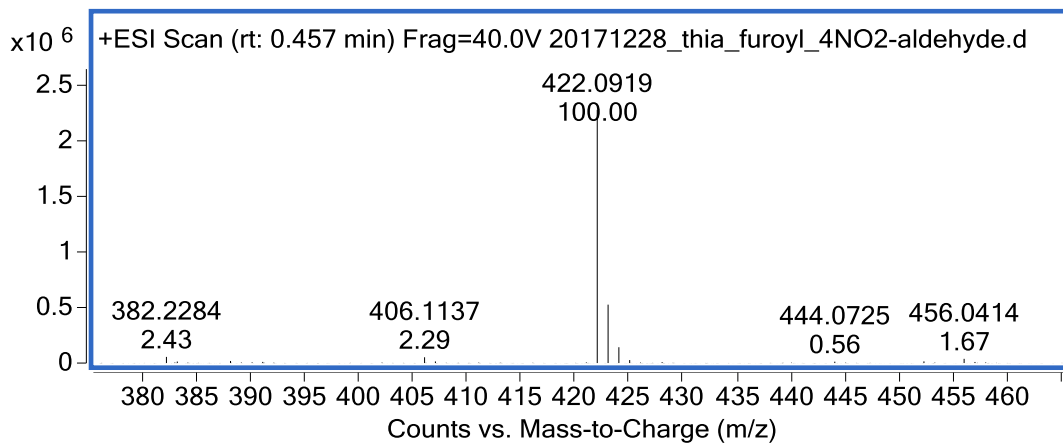
HR/MS – 17{2,4}



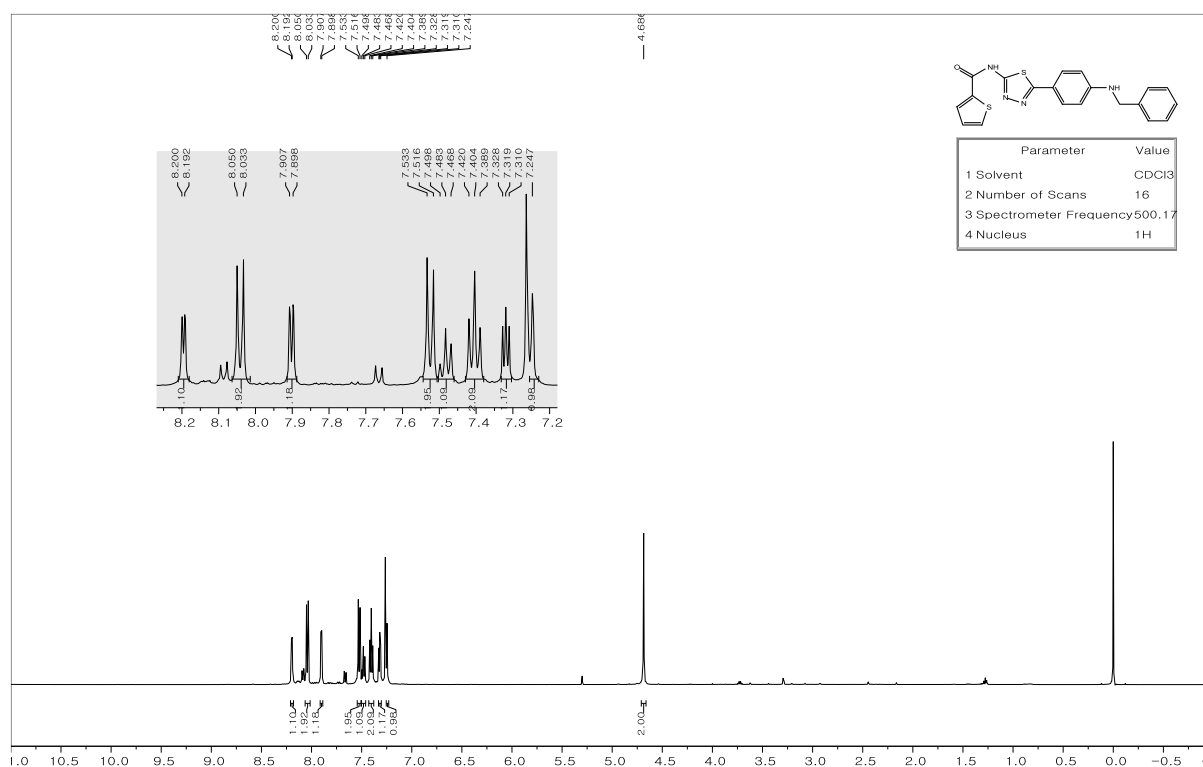
^{13}C NMR – 17{2,5}



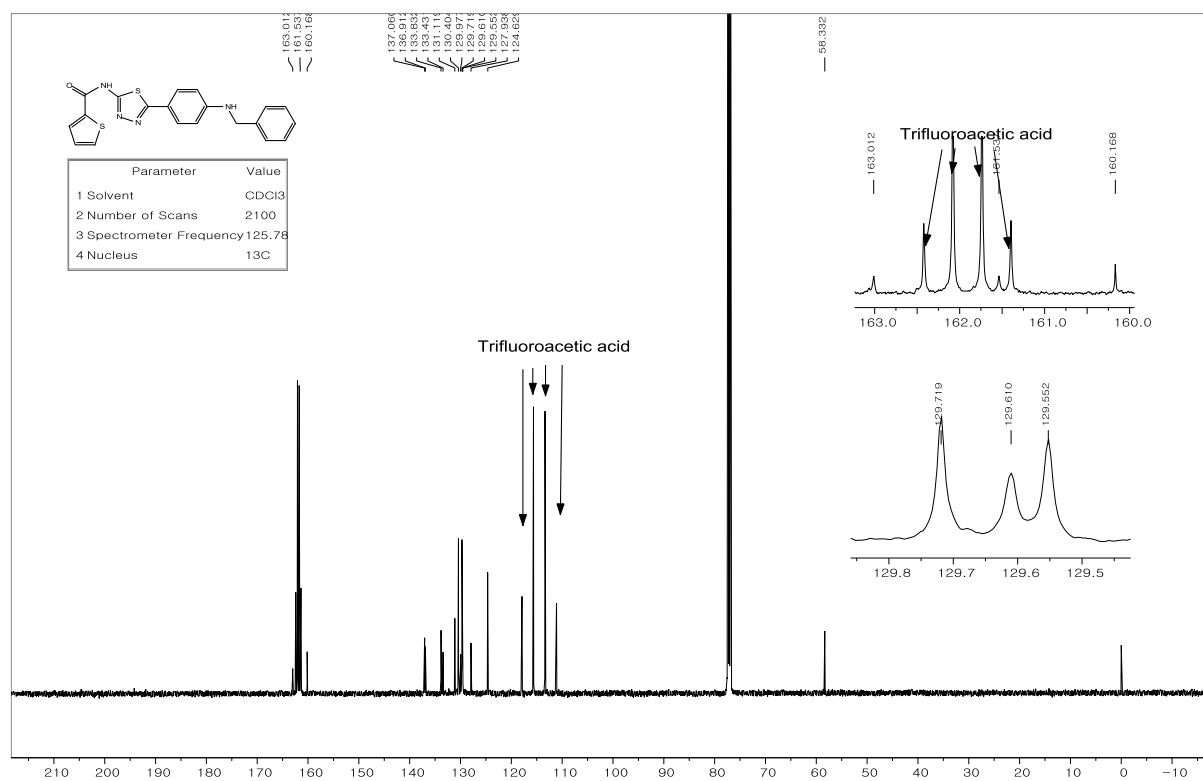
LC/MS – 17{2,5}



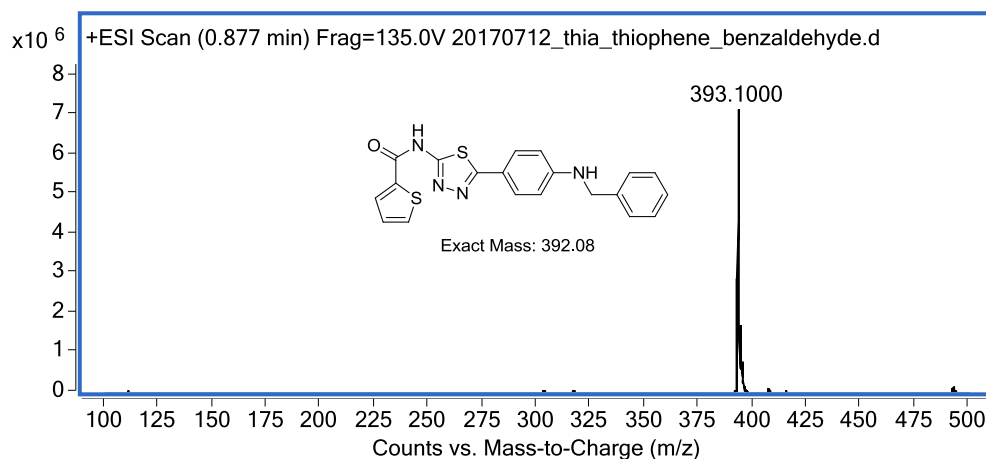
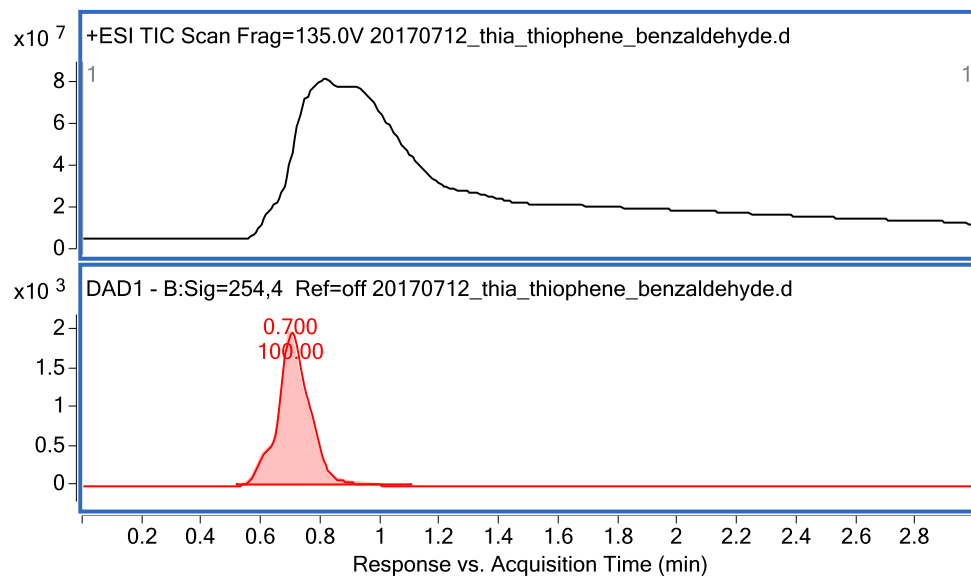
HR/MS – 17{2,5}



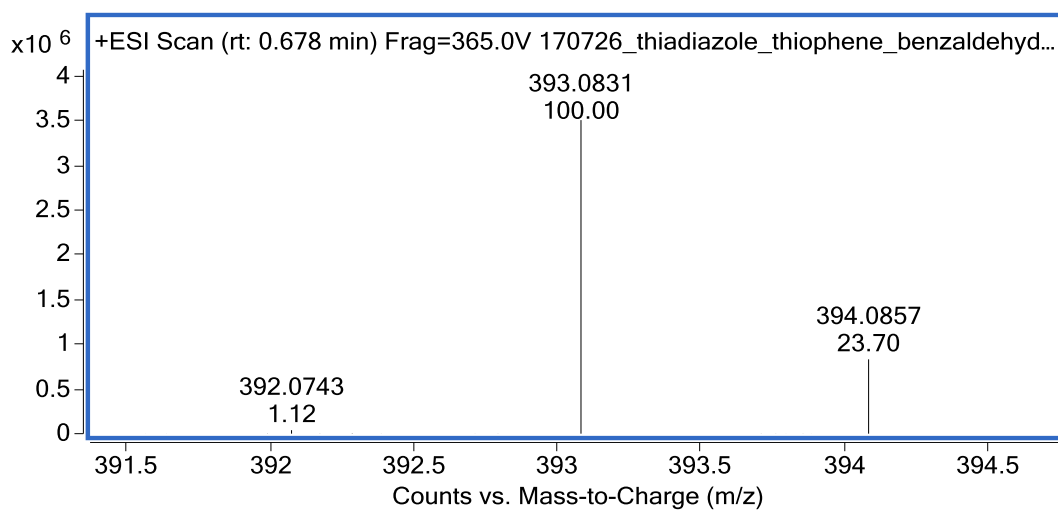
¹H NMR – 17{3,1}



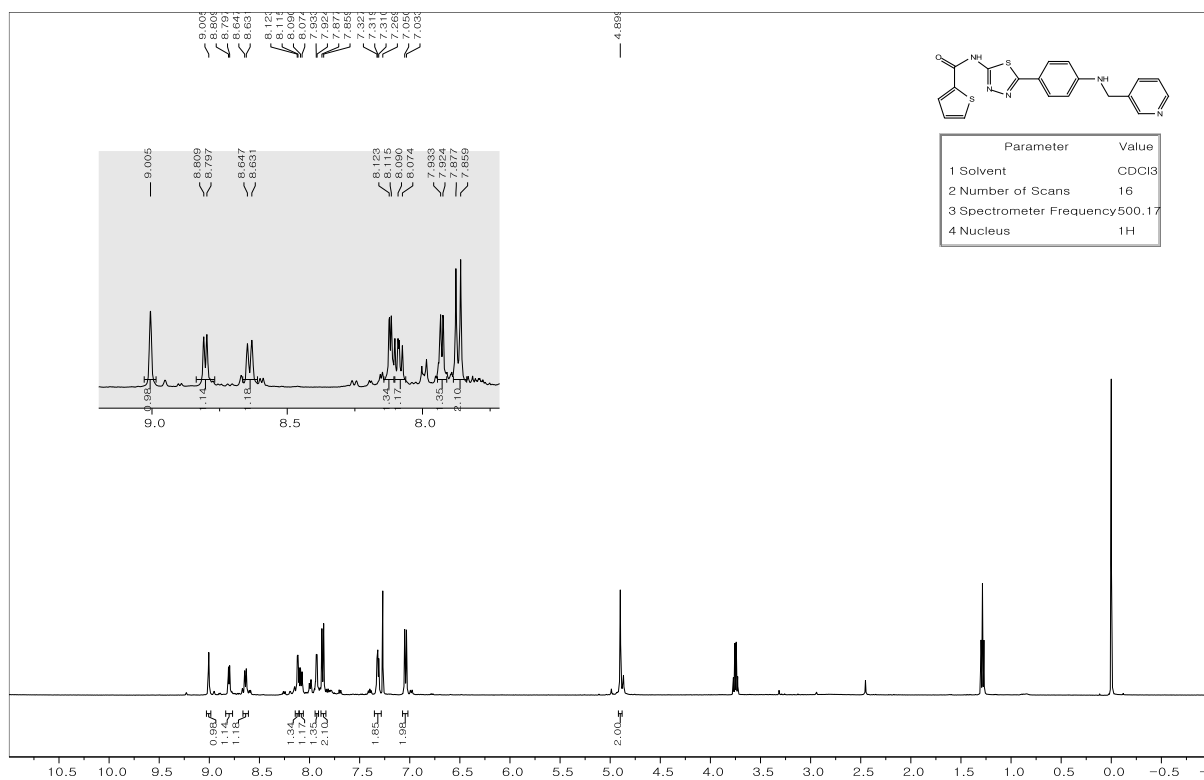
¹³C NMR – 17{3,1}



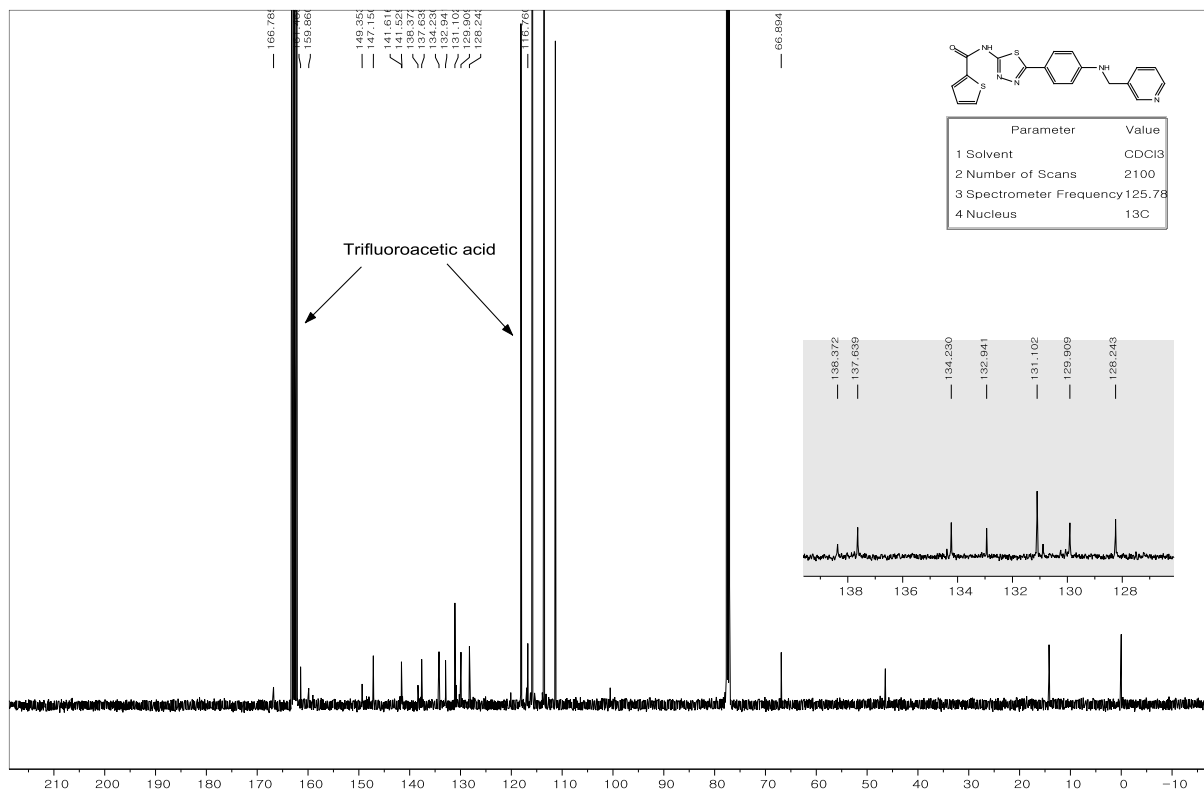
LC/MS – 17{3,1}



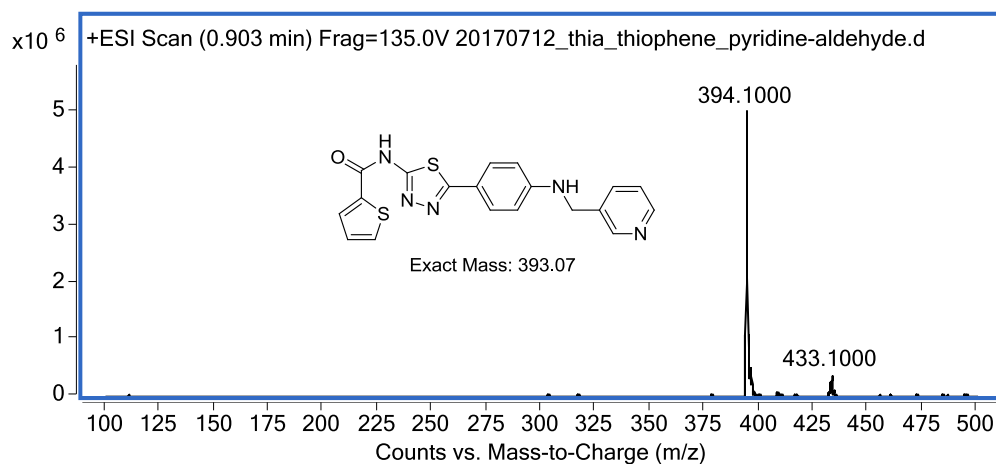
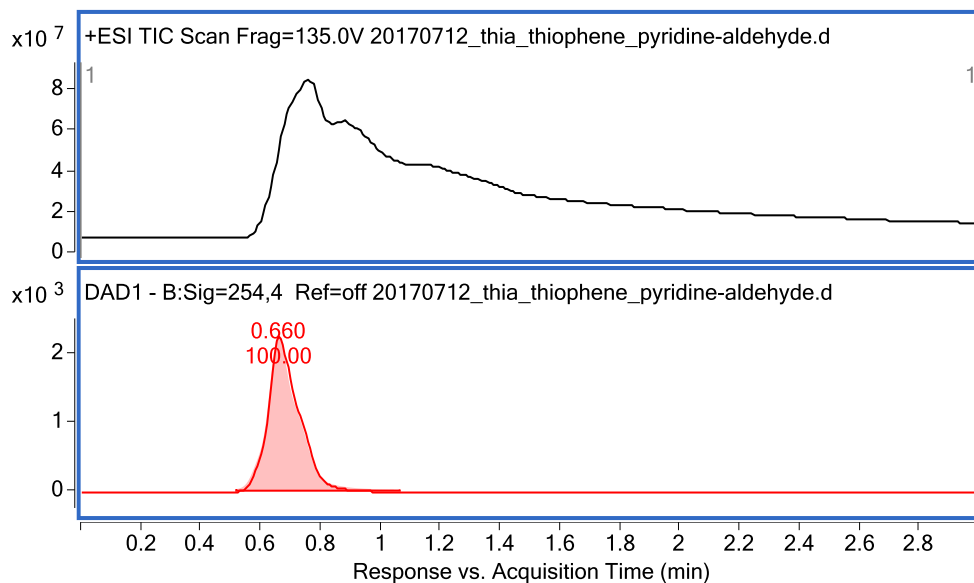
HR/MS – 17{3,1}



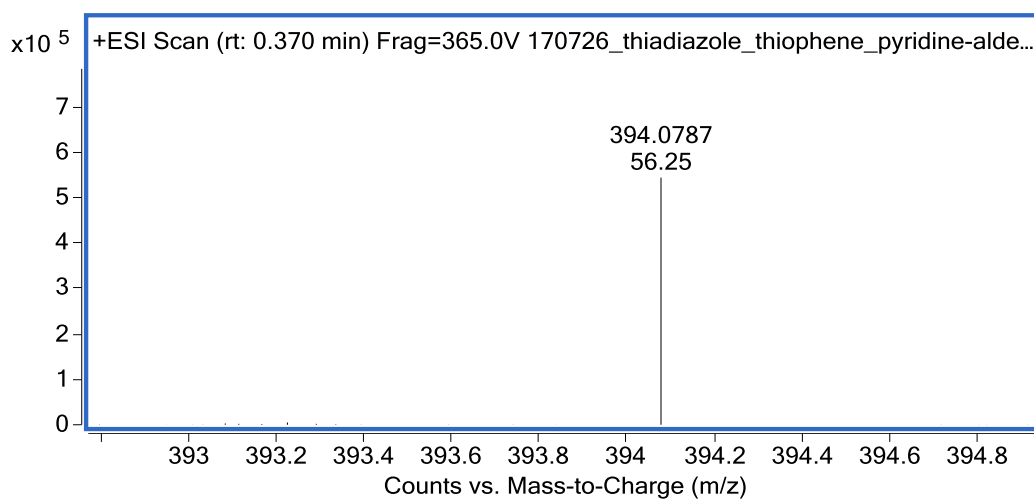
¹H NMR – 17{3,2}



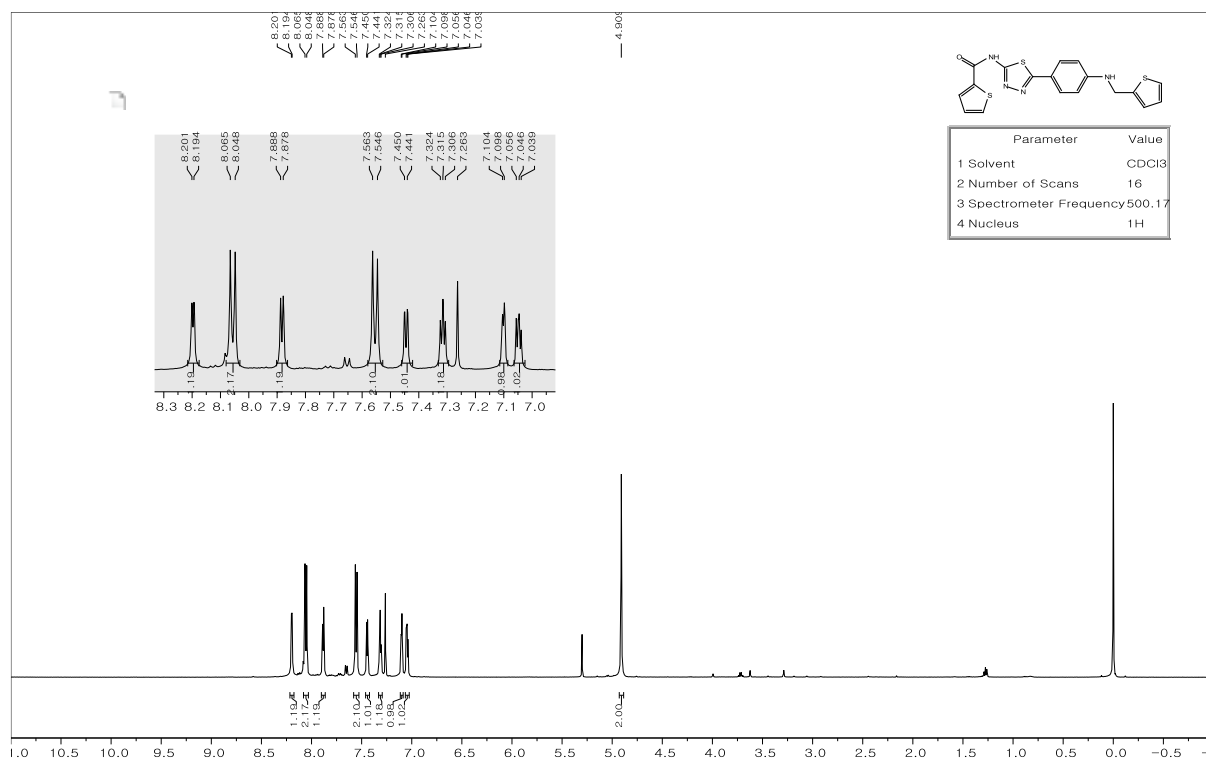
¹³C NMR – 17{3,2}



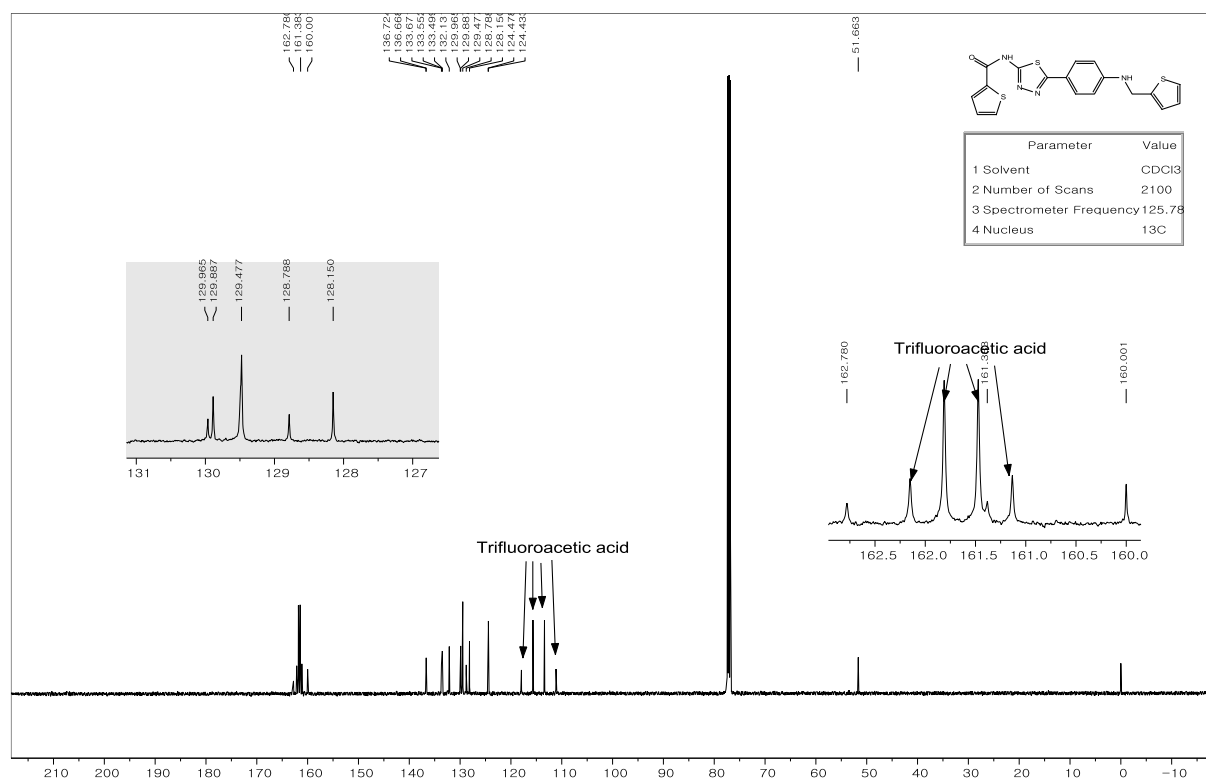
LC/MS – 17{3,2}



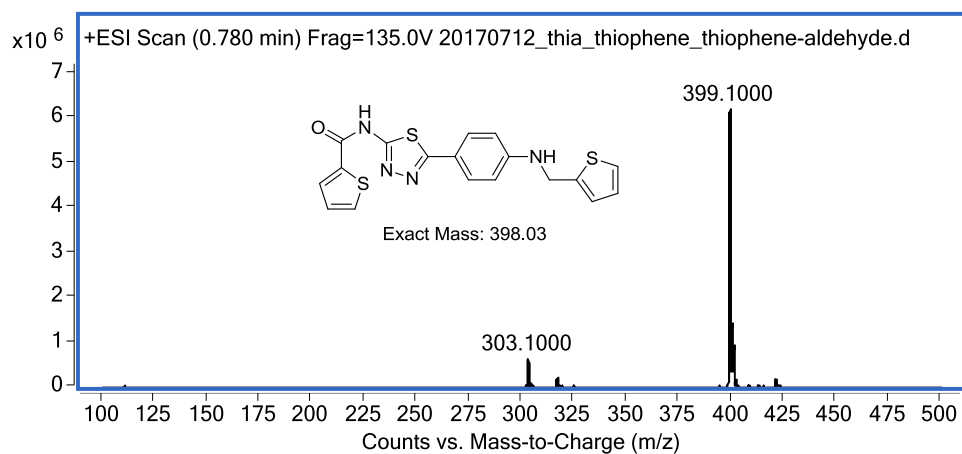
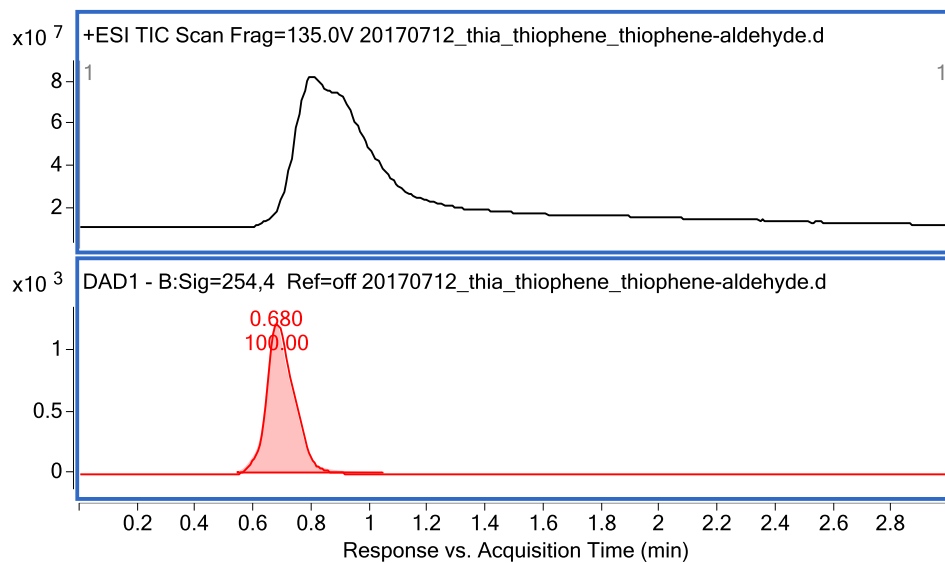
HR/MS – 17{3,2}



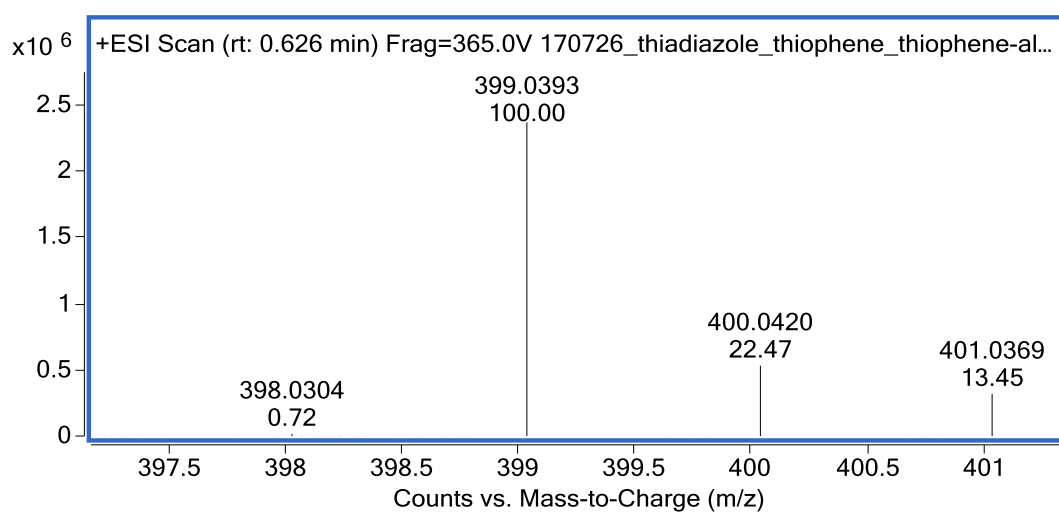
¹H NMR – 17{3,3}



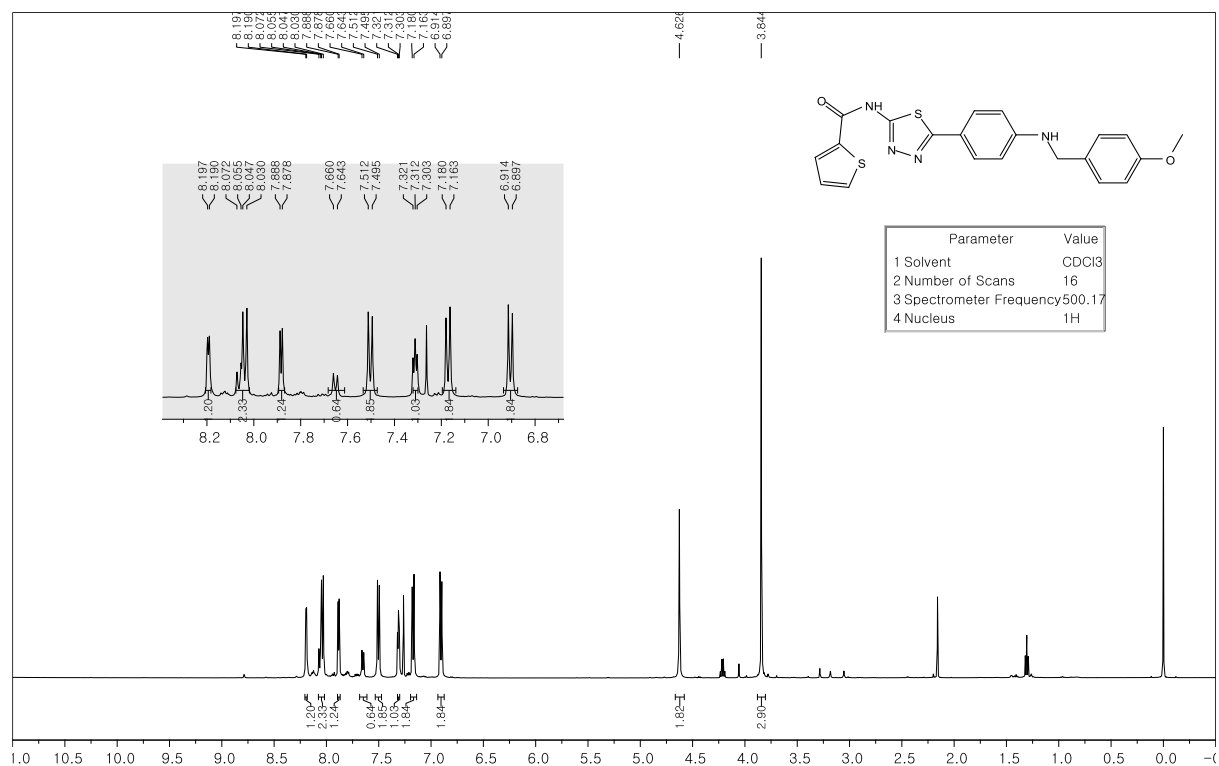
¹³C NMR – 17{3,3}



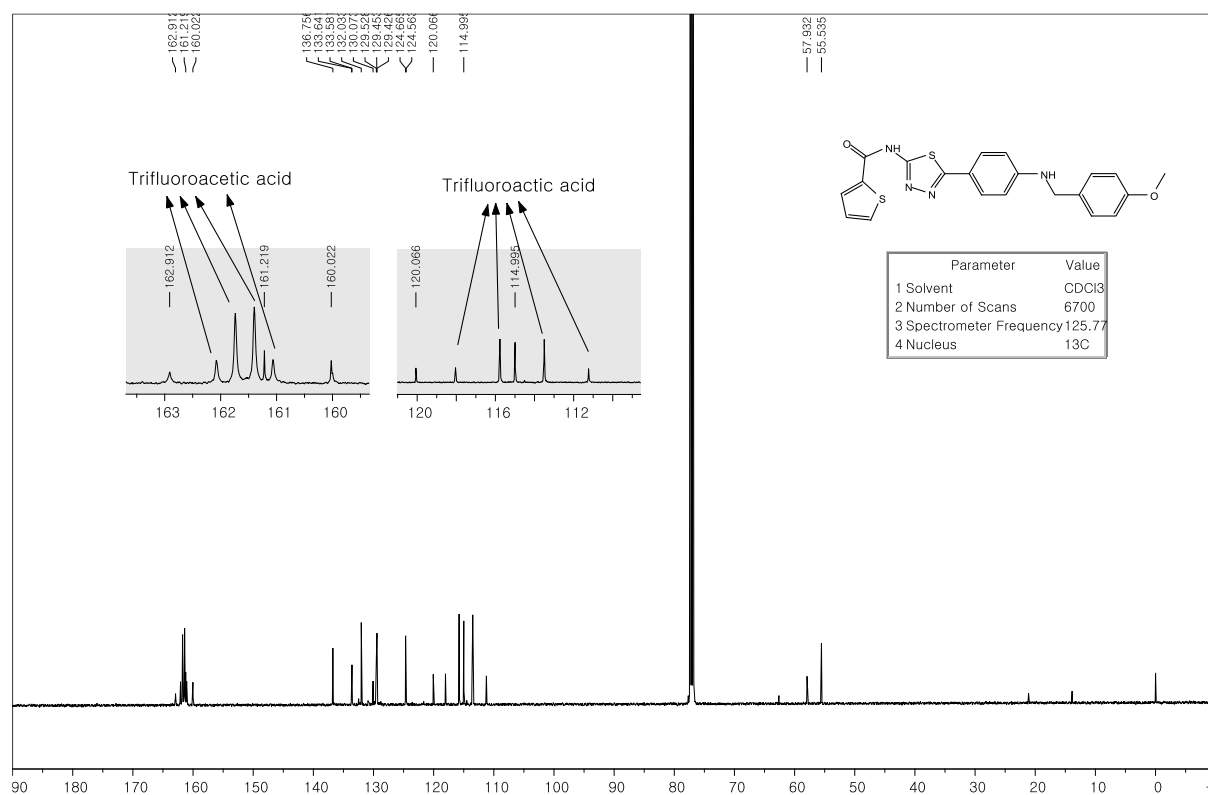
LC/MS – 17{3,3}



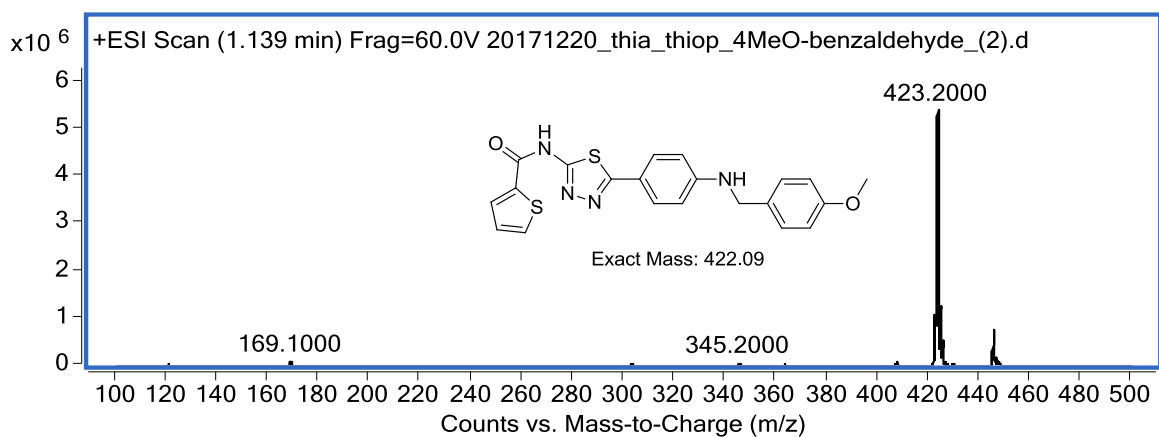
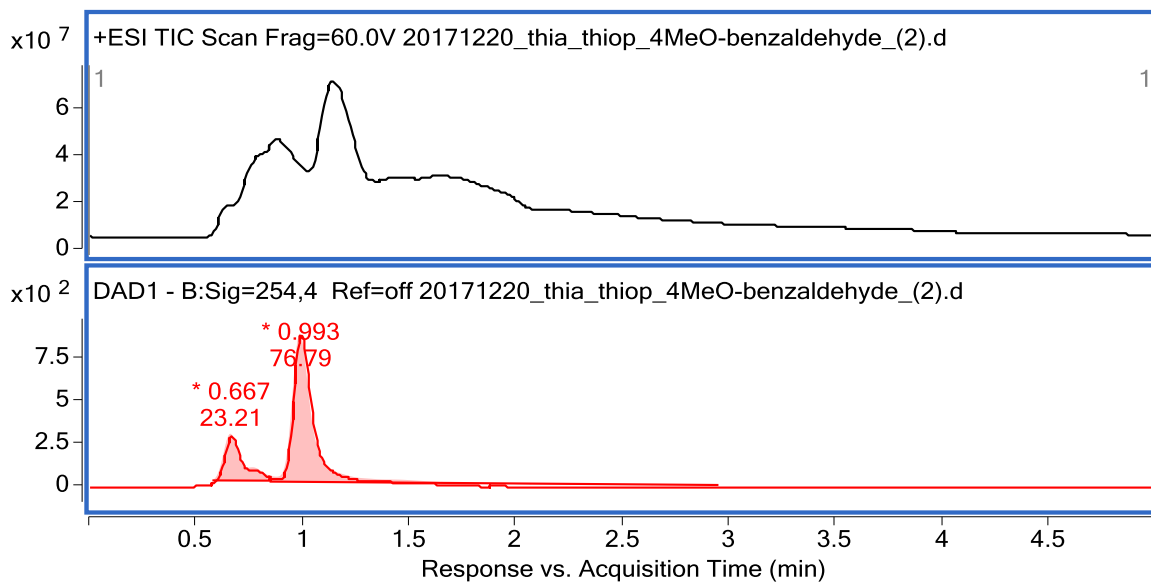
HR/MS – 17{3,3}



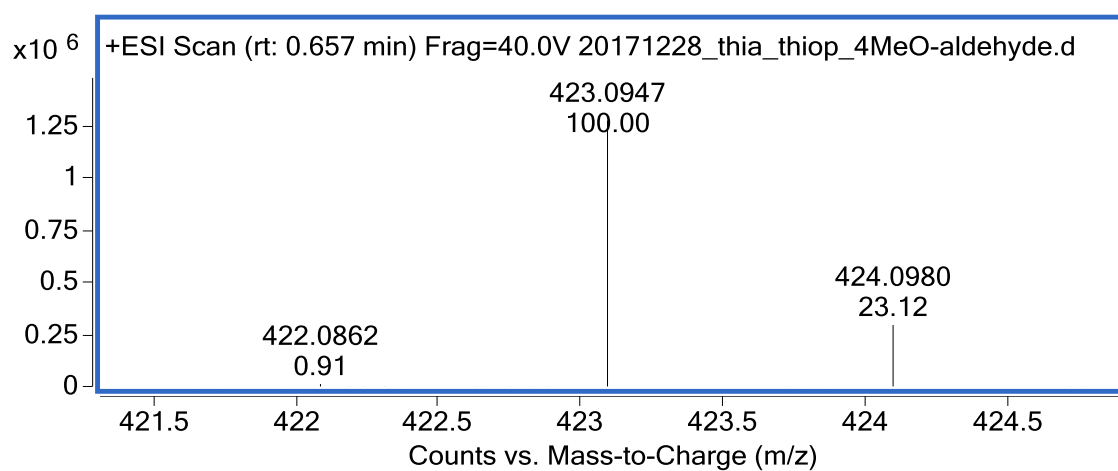
¹H NMR – 17{3,4}



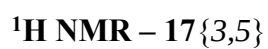
¹³C NMR – 17{3,4}



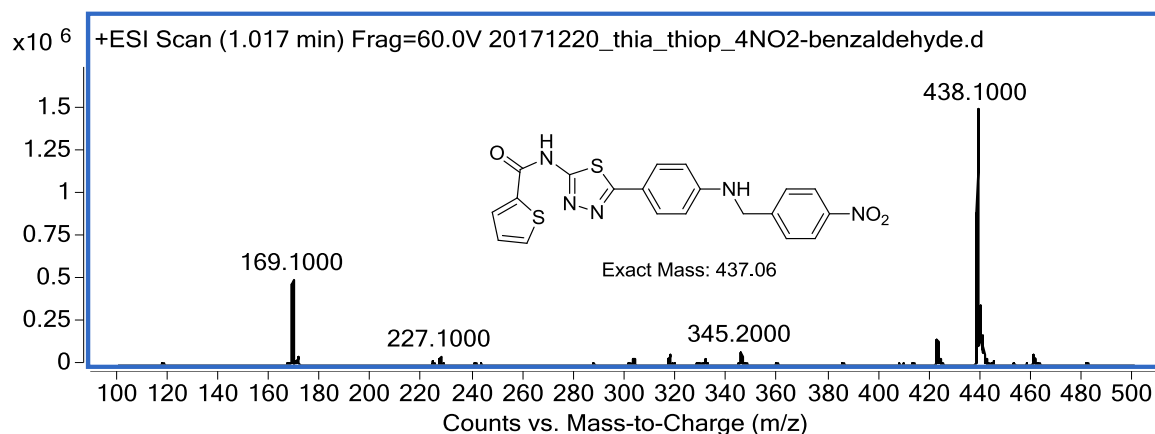
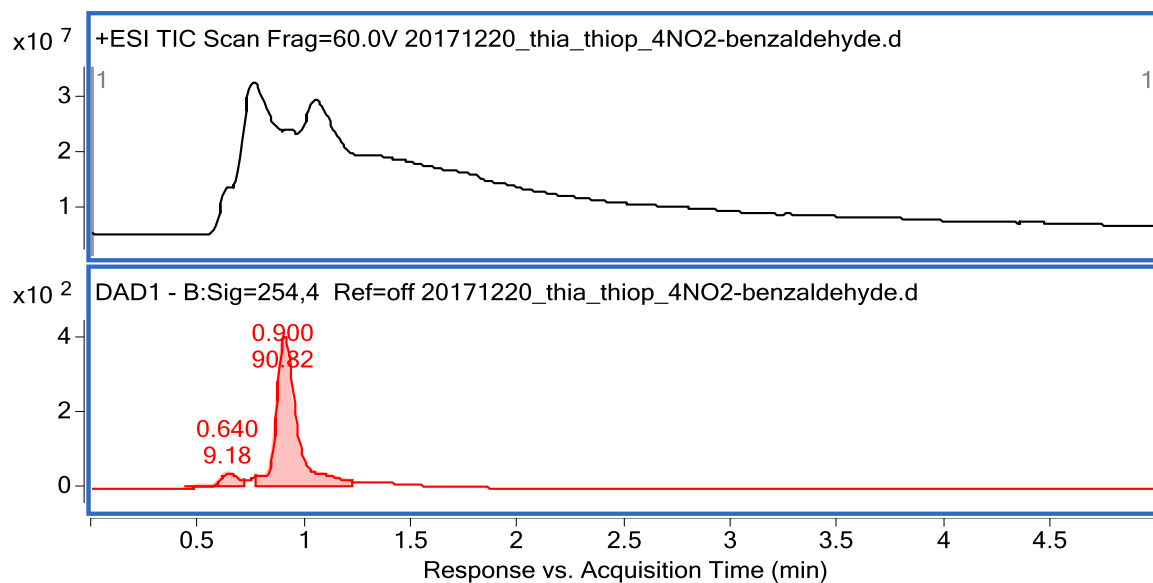
LC/MS – 17{3,4}



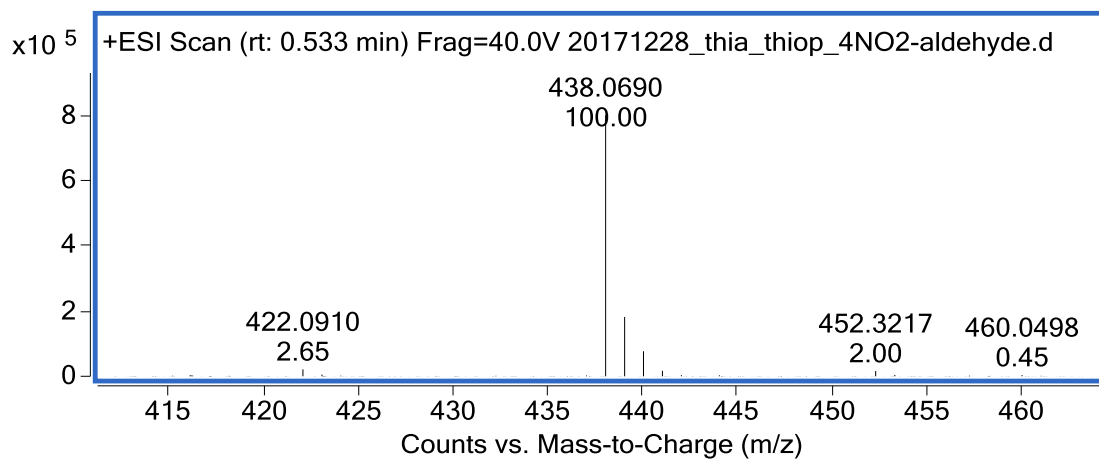
HR/MS – 17{3,4}



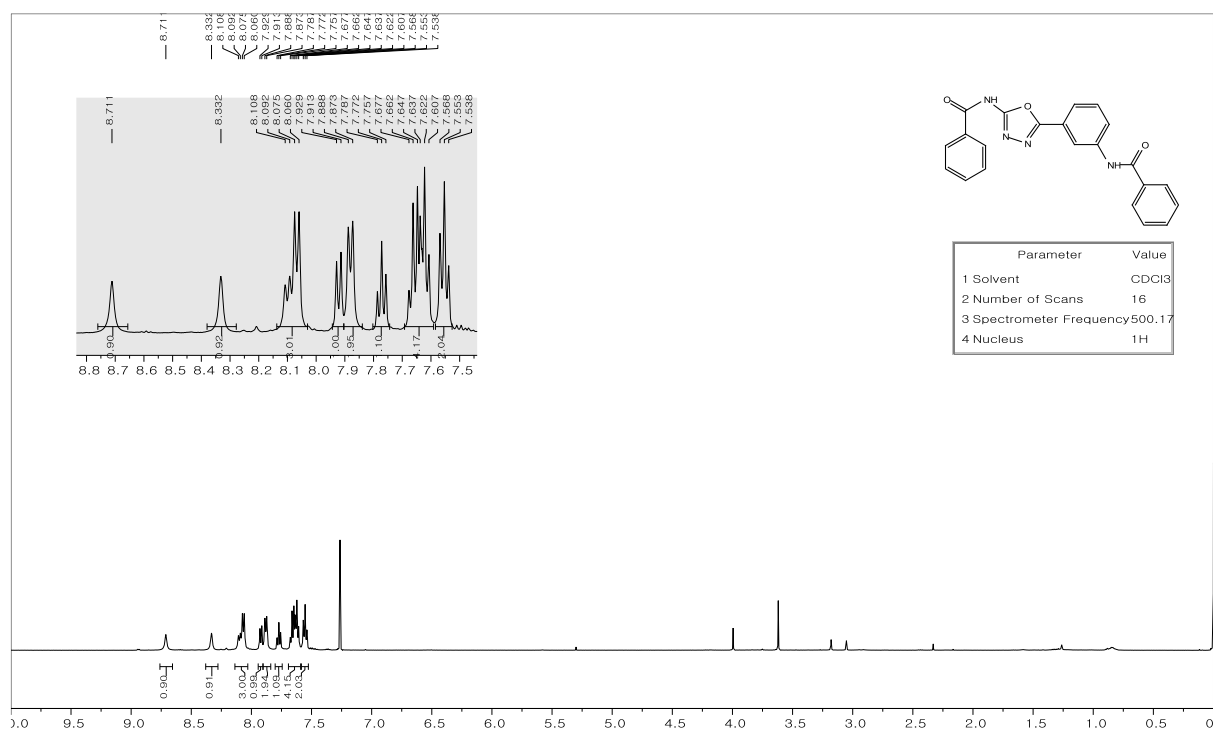
^{13}C NMR – 17{3,5}



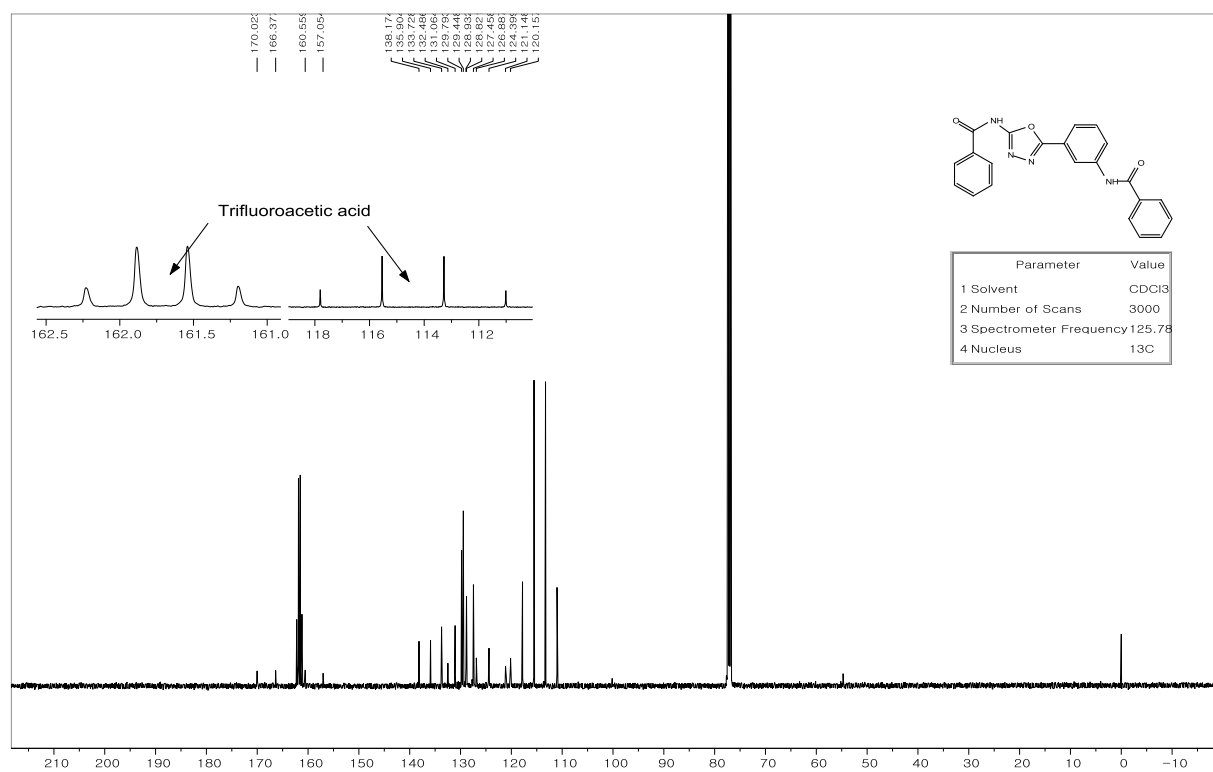
LC/MS – 17{3,5}



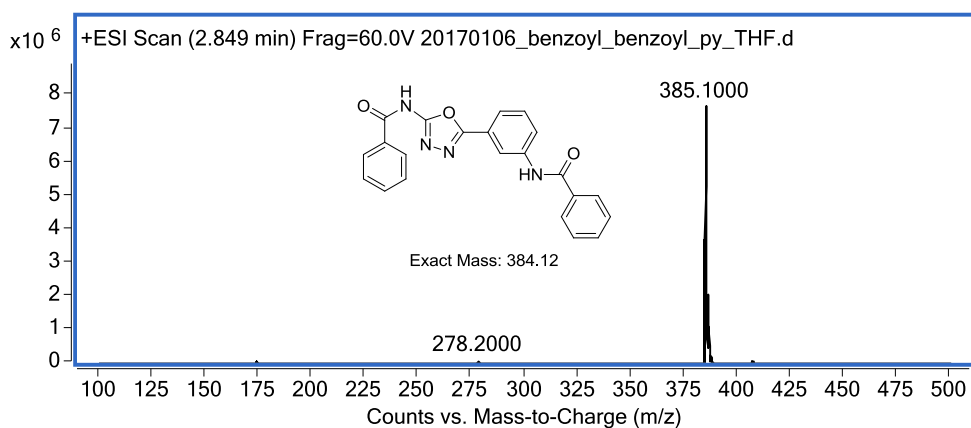
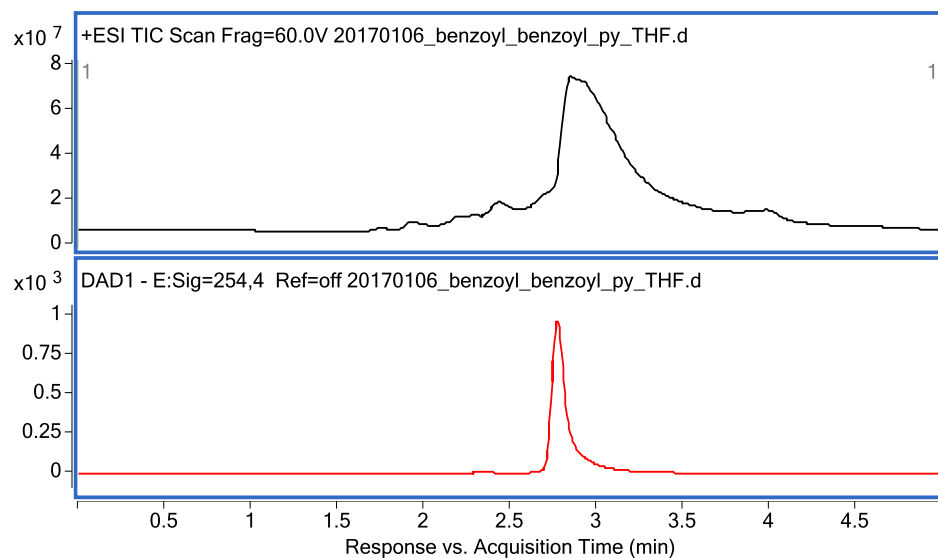
HR/MS – 17{3,5}



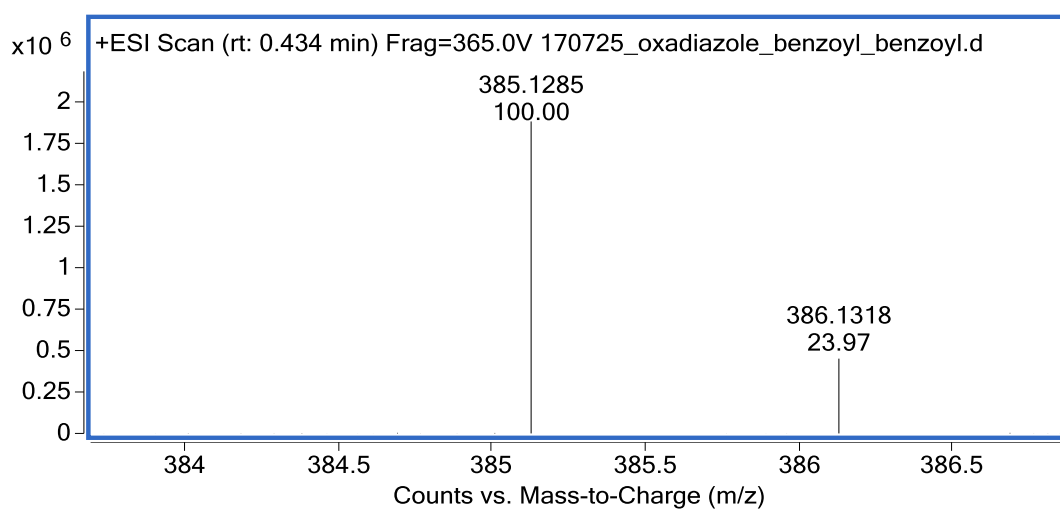
¹H NMR – 18{1,1}



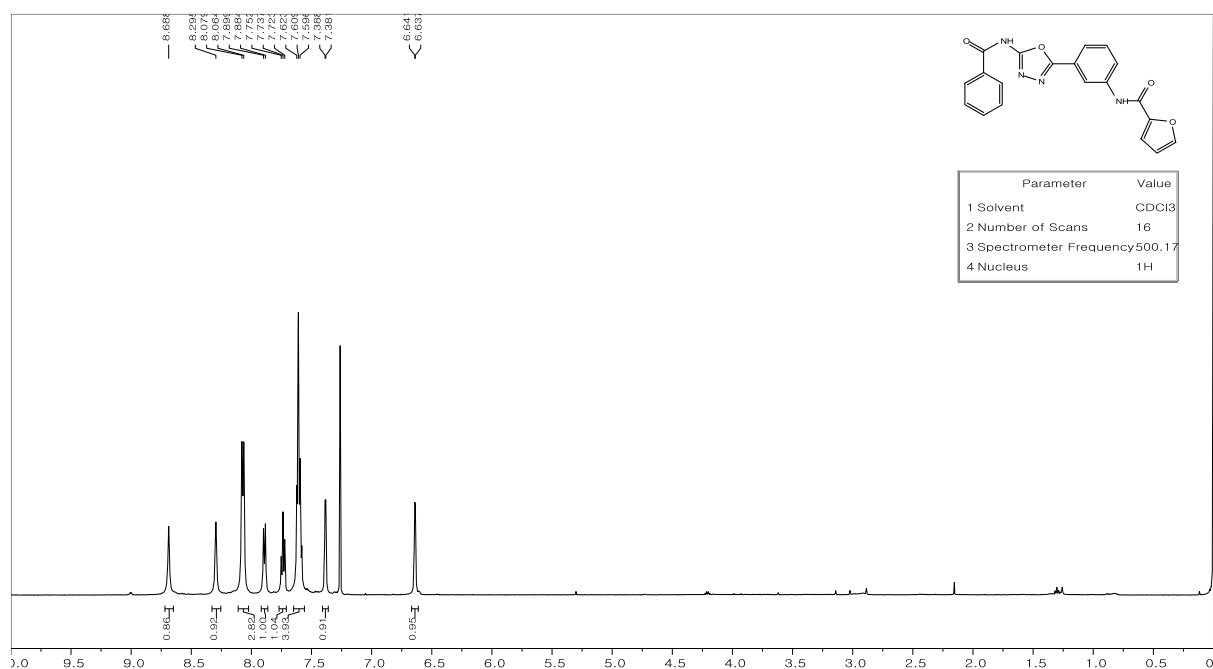
¹³C NMR – 18{1,1}



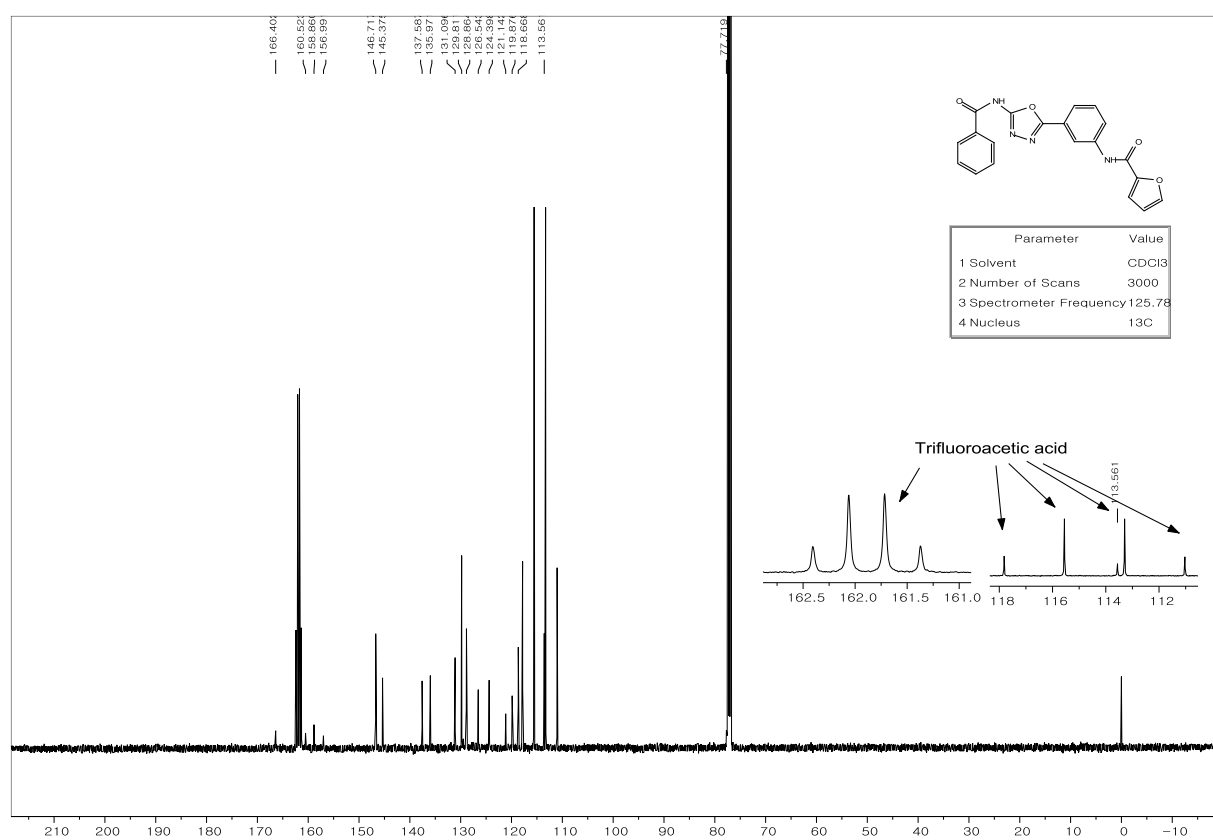
LC/MS – 18{1,1}



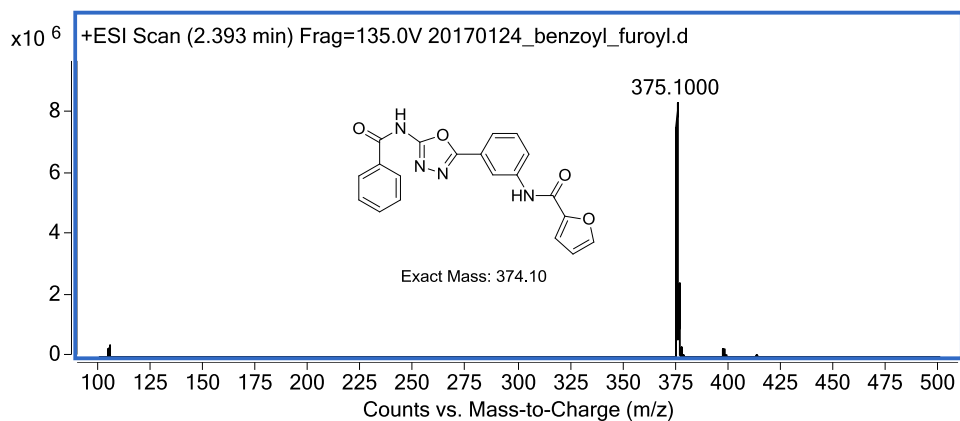
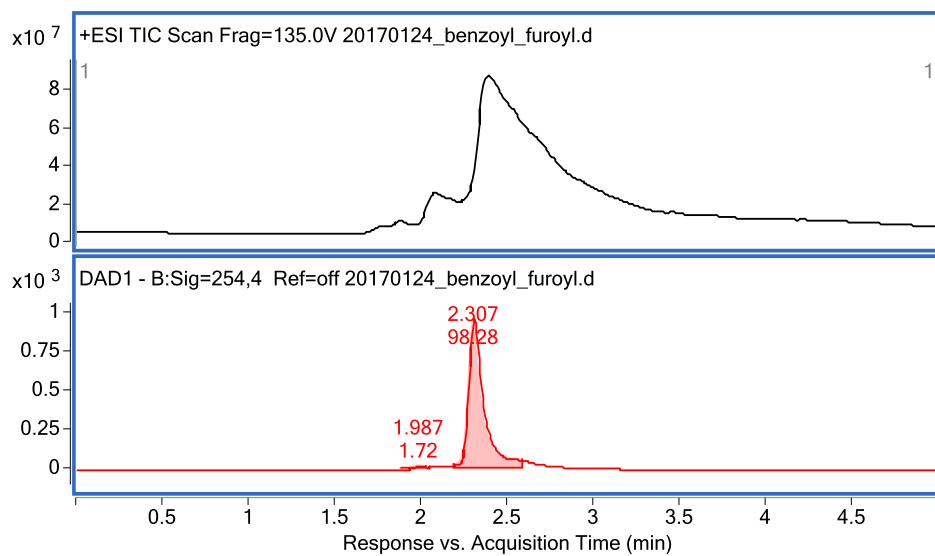
HR/MS – 18{1,1}



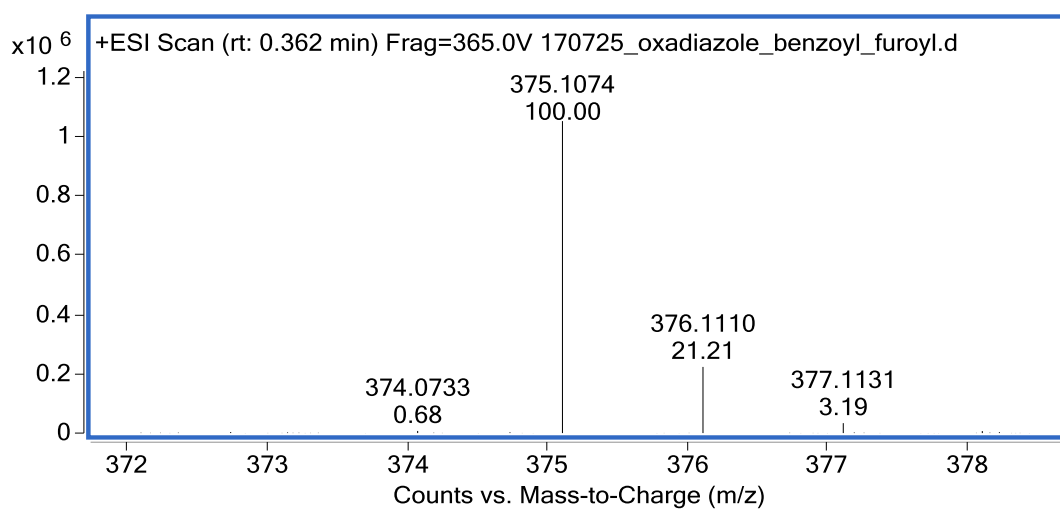
¹H NMR – 18{1,2}



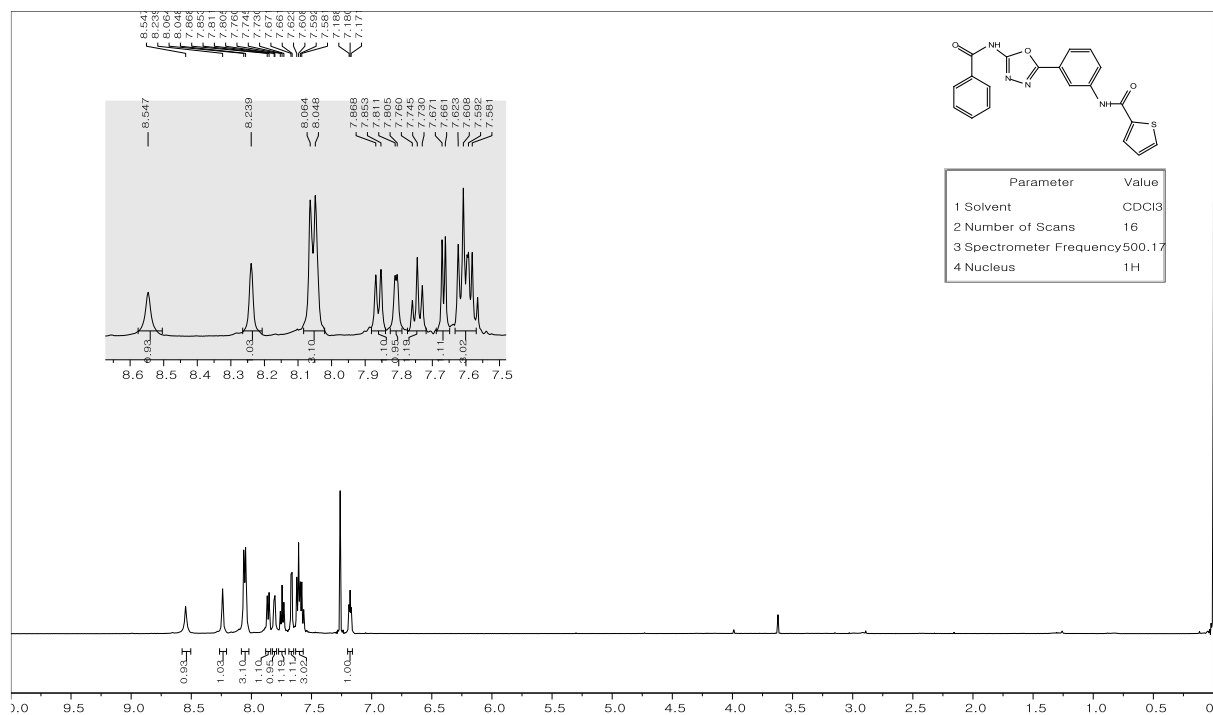
¹³C NMR – 18{1,2}



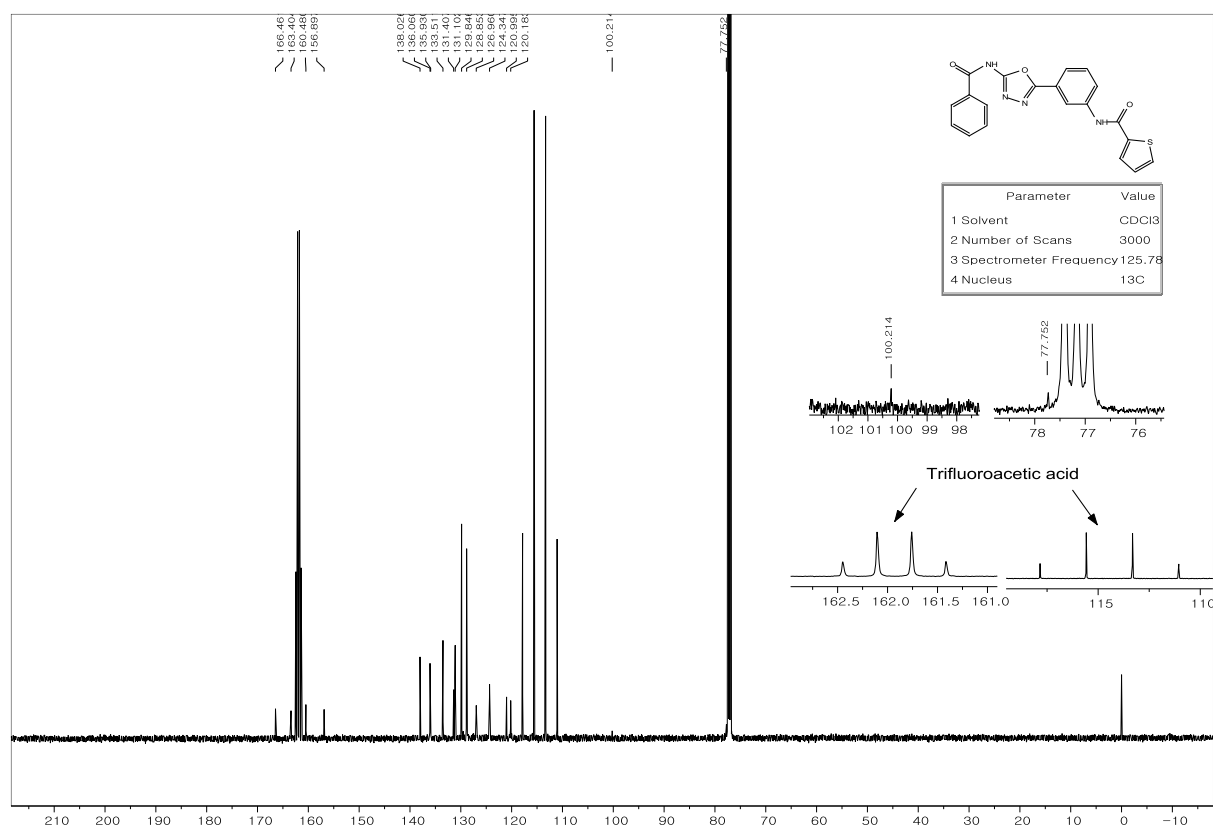
LC/MS – 18{1,2}



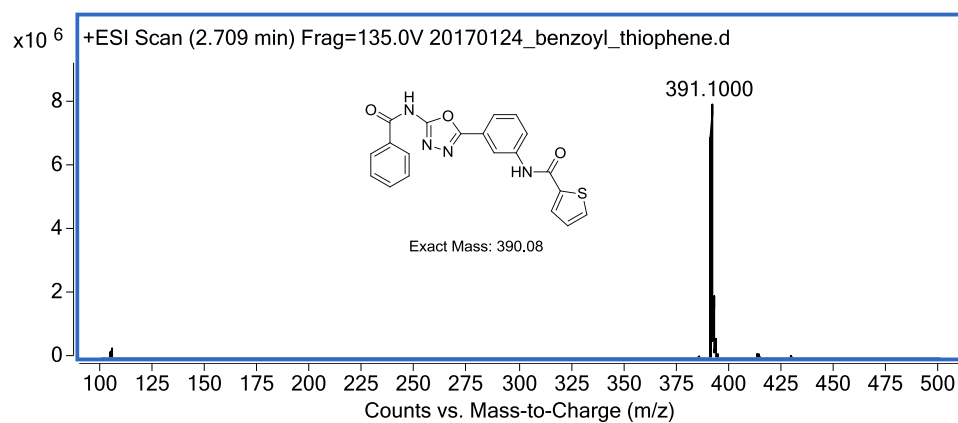
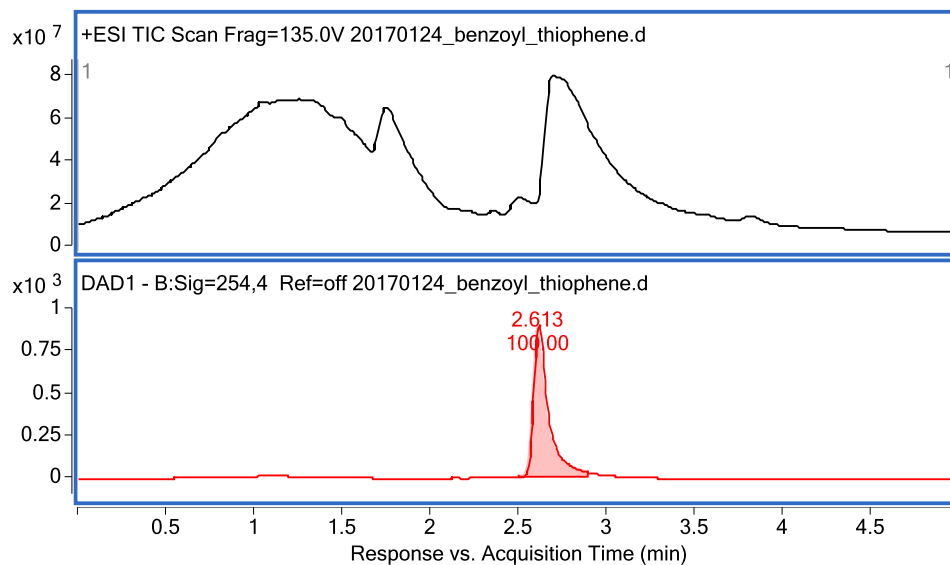
HR/MS – 18{1,2}



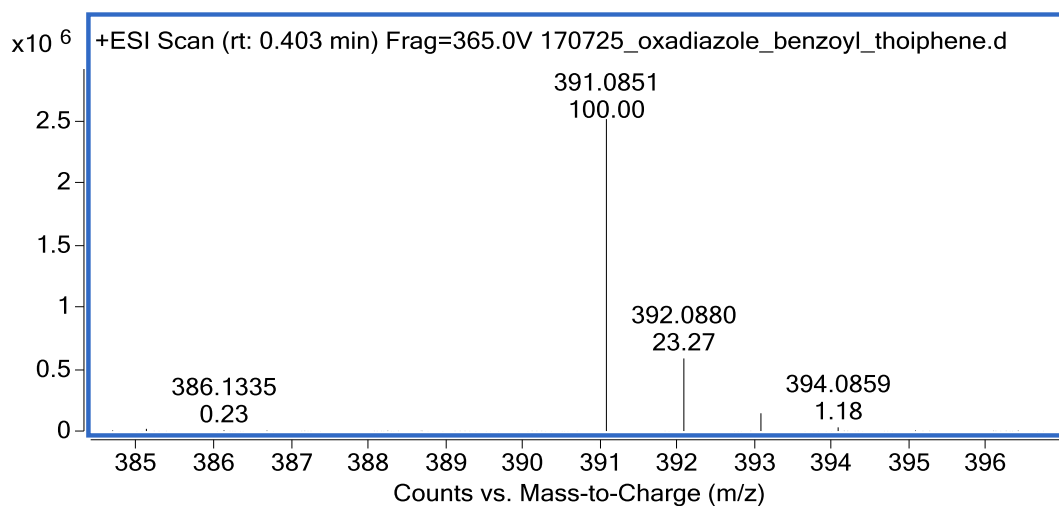
¹H NMR – 18{1,3}



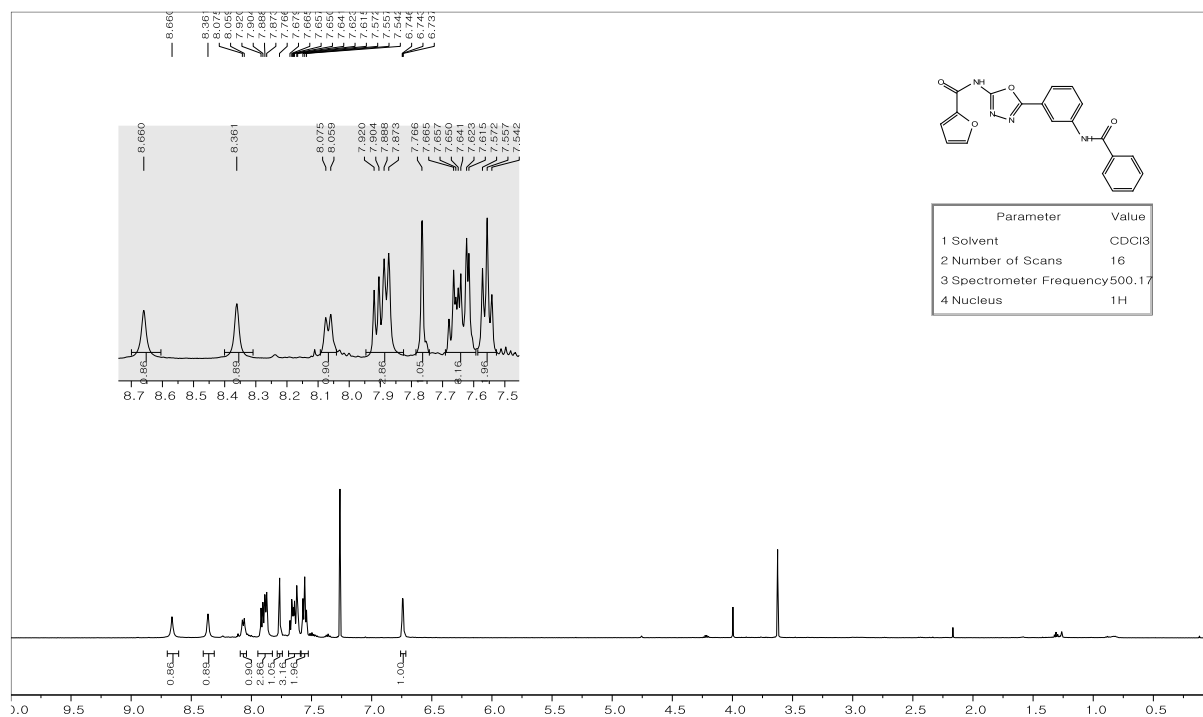
¹³C NMR – 18{1,3}



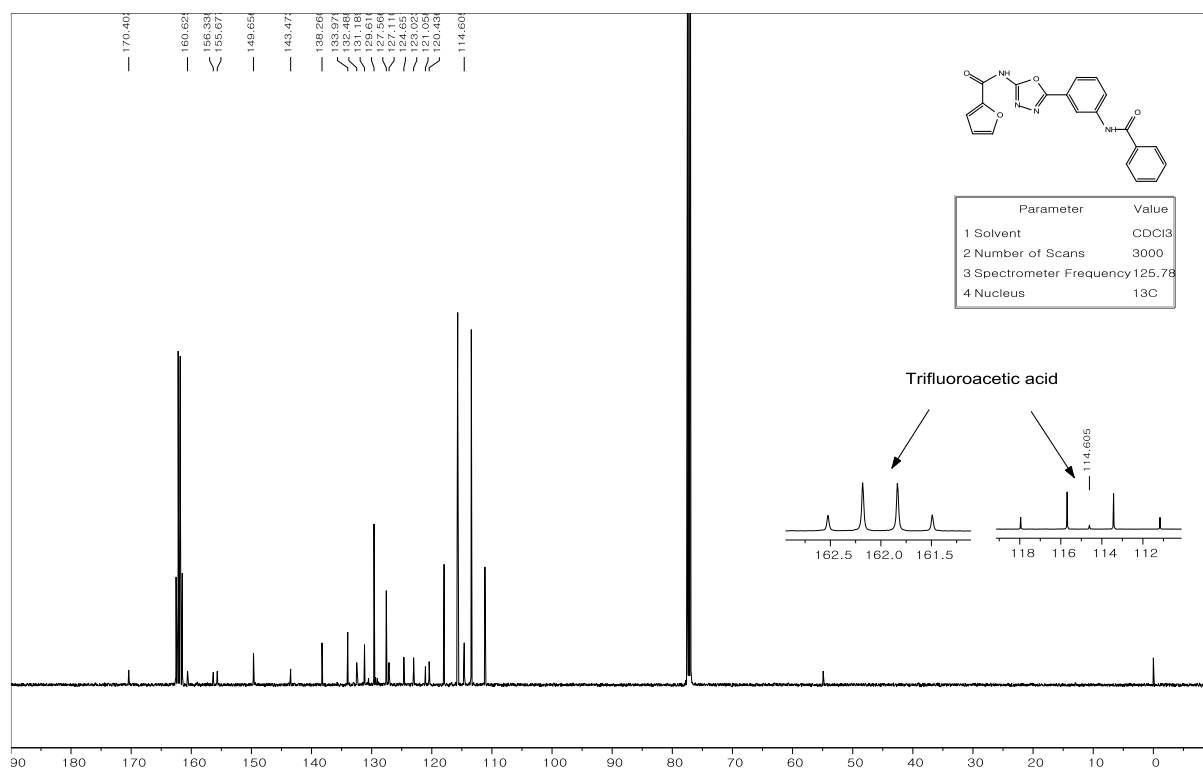
LC/MS – 18{1,3}



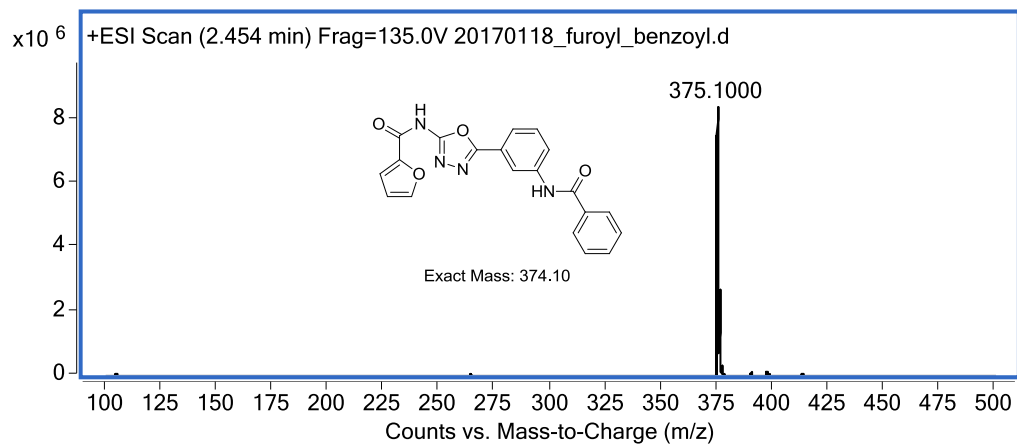
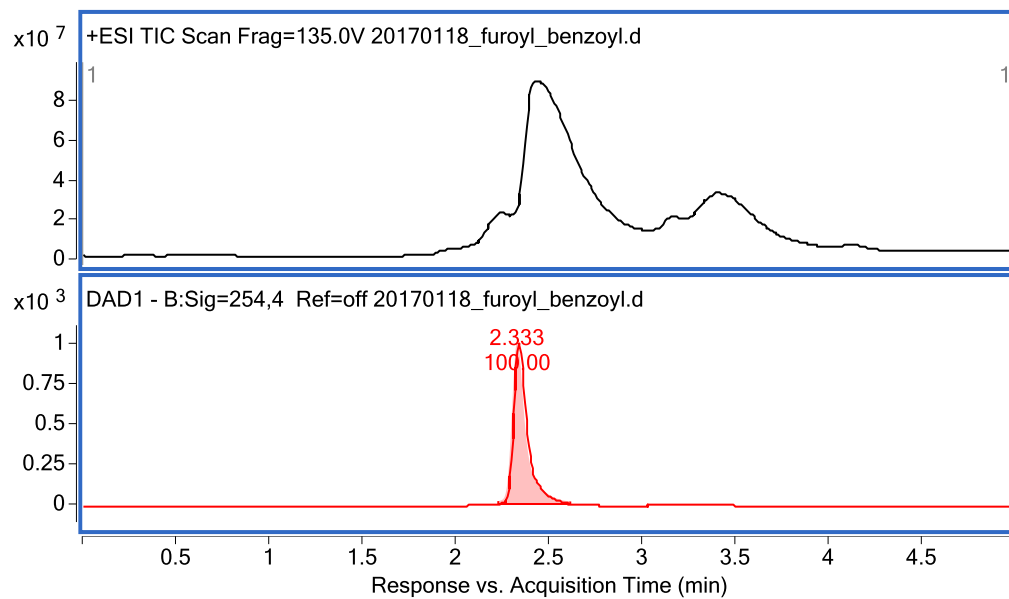
HR/MS – 18{1,3}



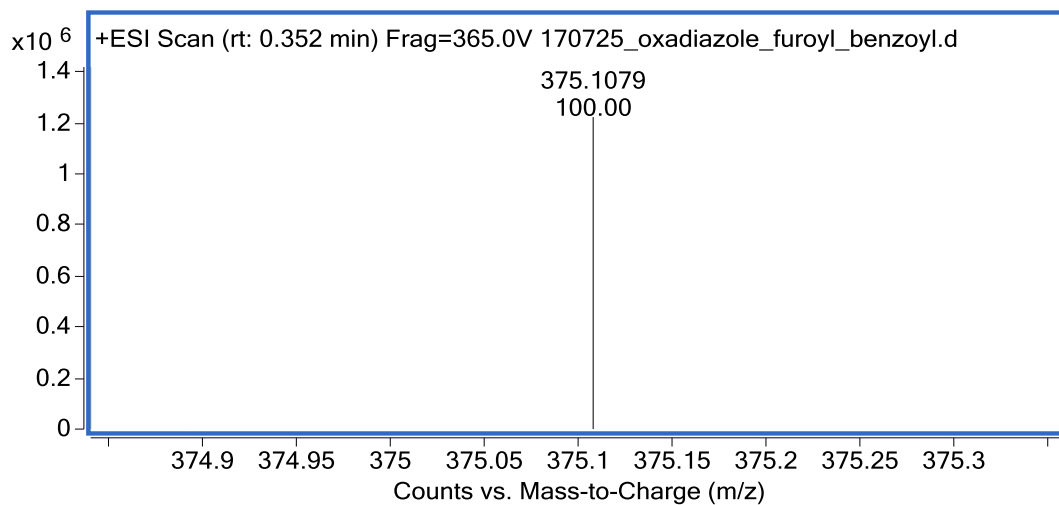
¹H NMR – 18{2,1}



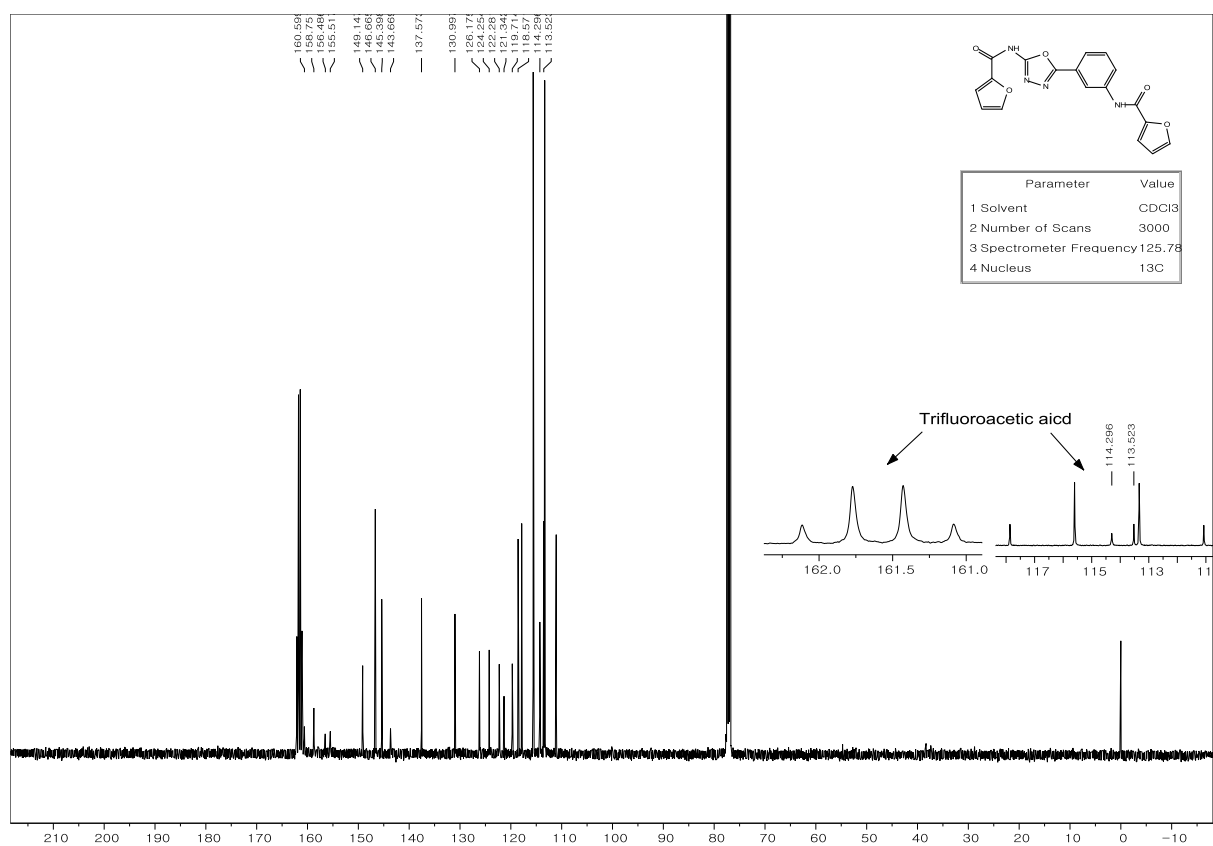
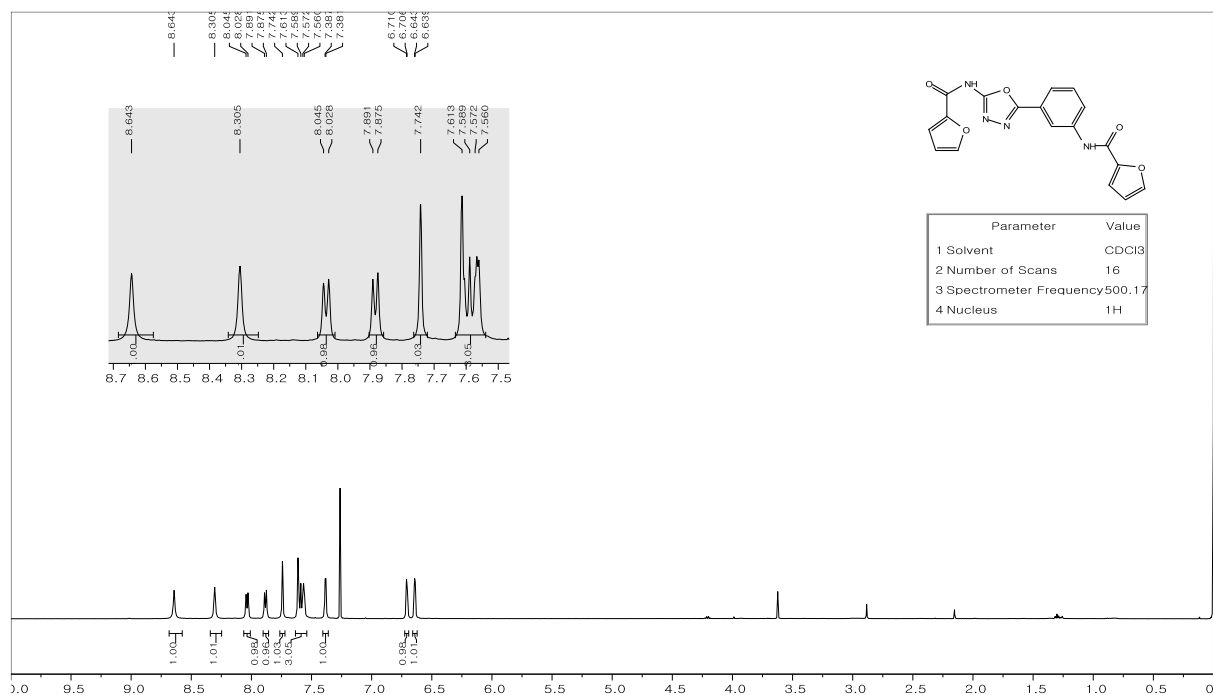
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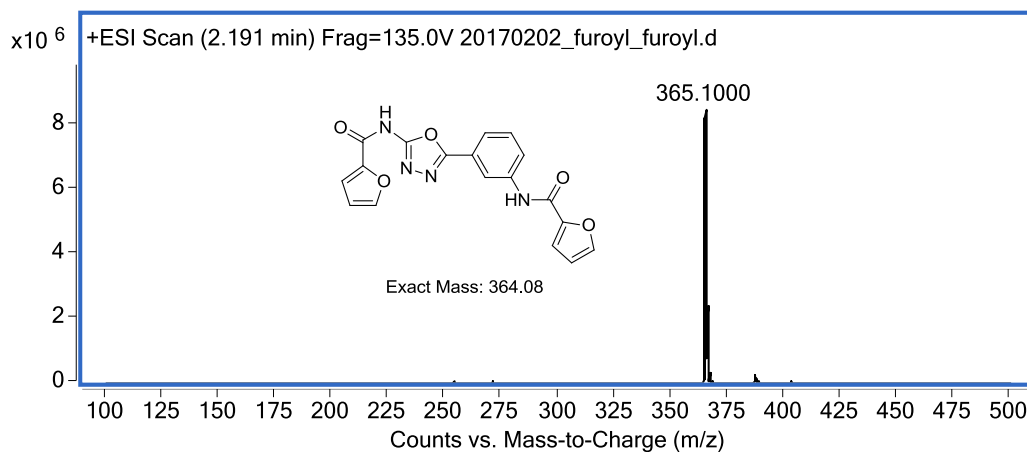
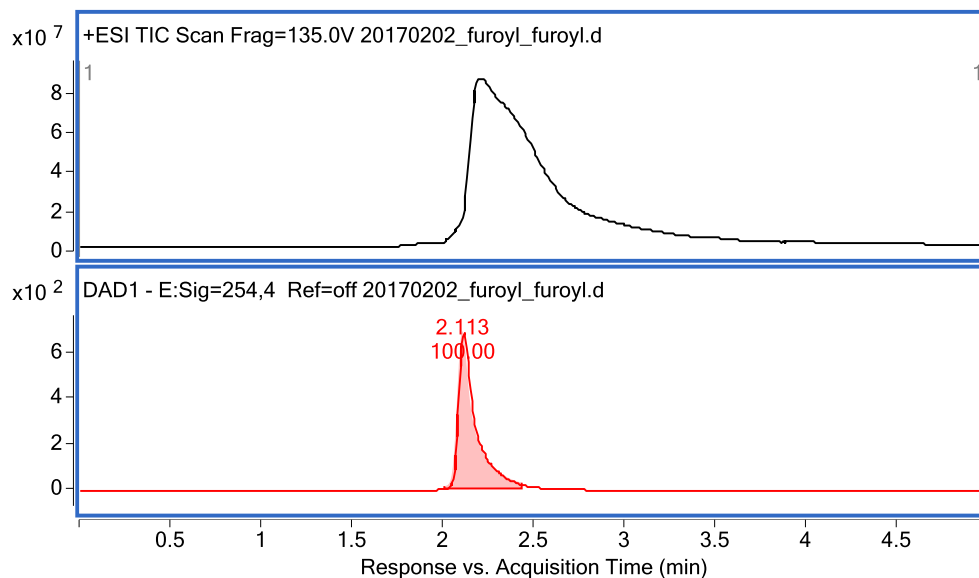


LC/MS – 18{2,1}

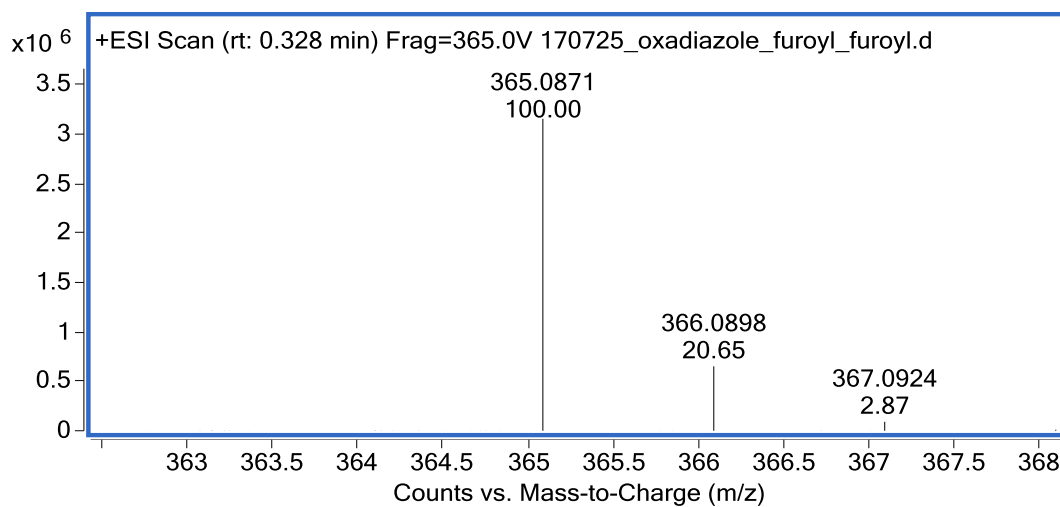


HR/MS – 18{2,1}

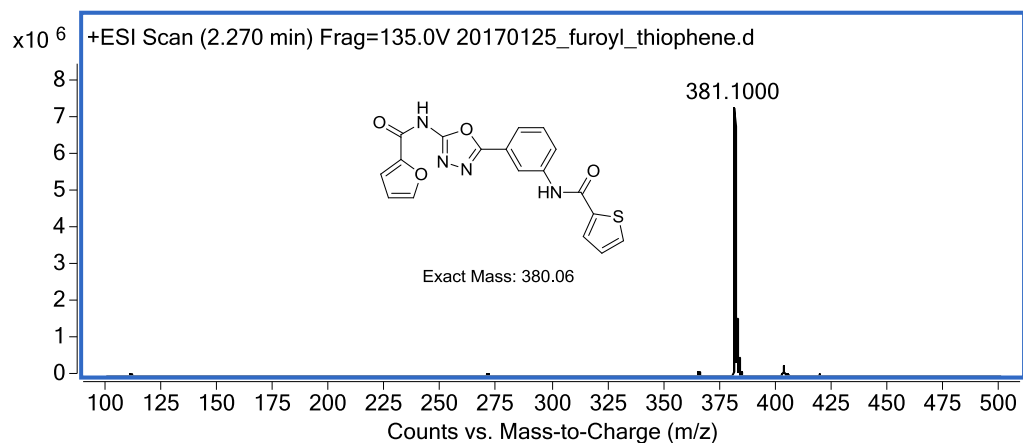
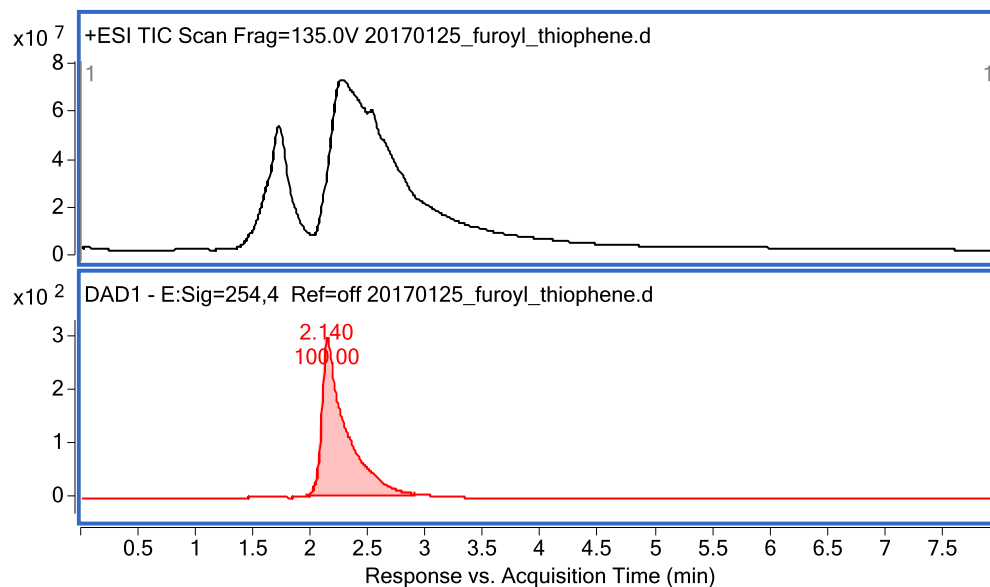




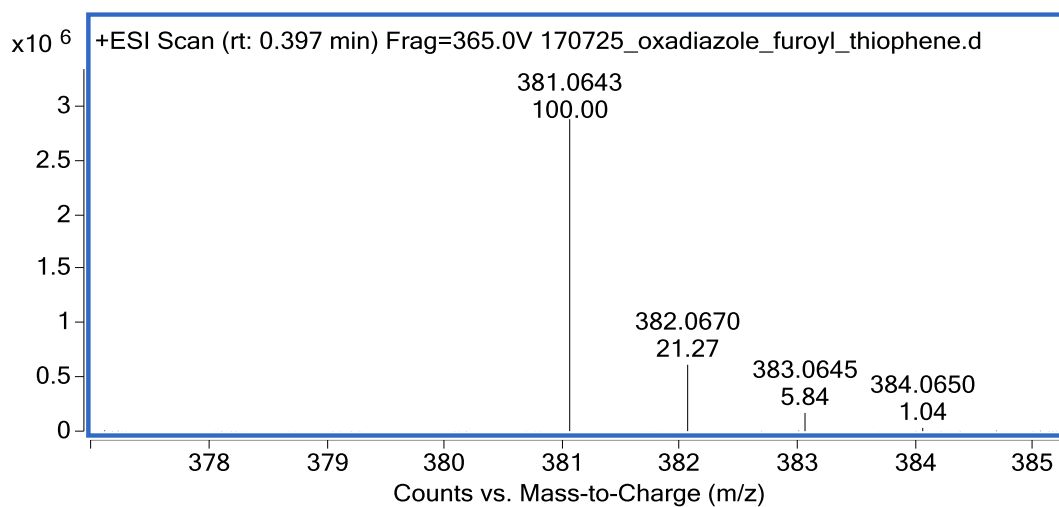
LC/MS – 18{2,2}



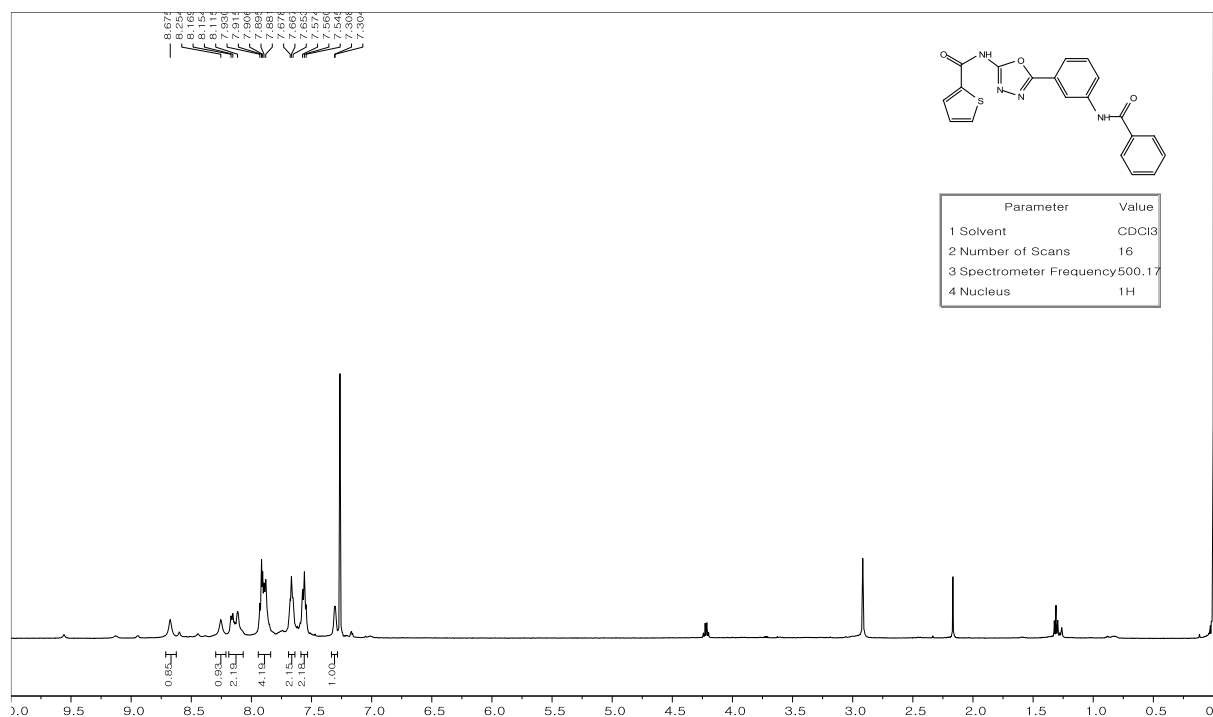
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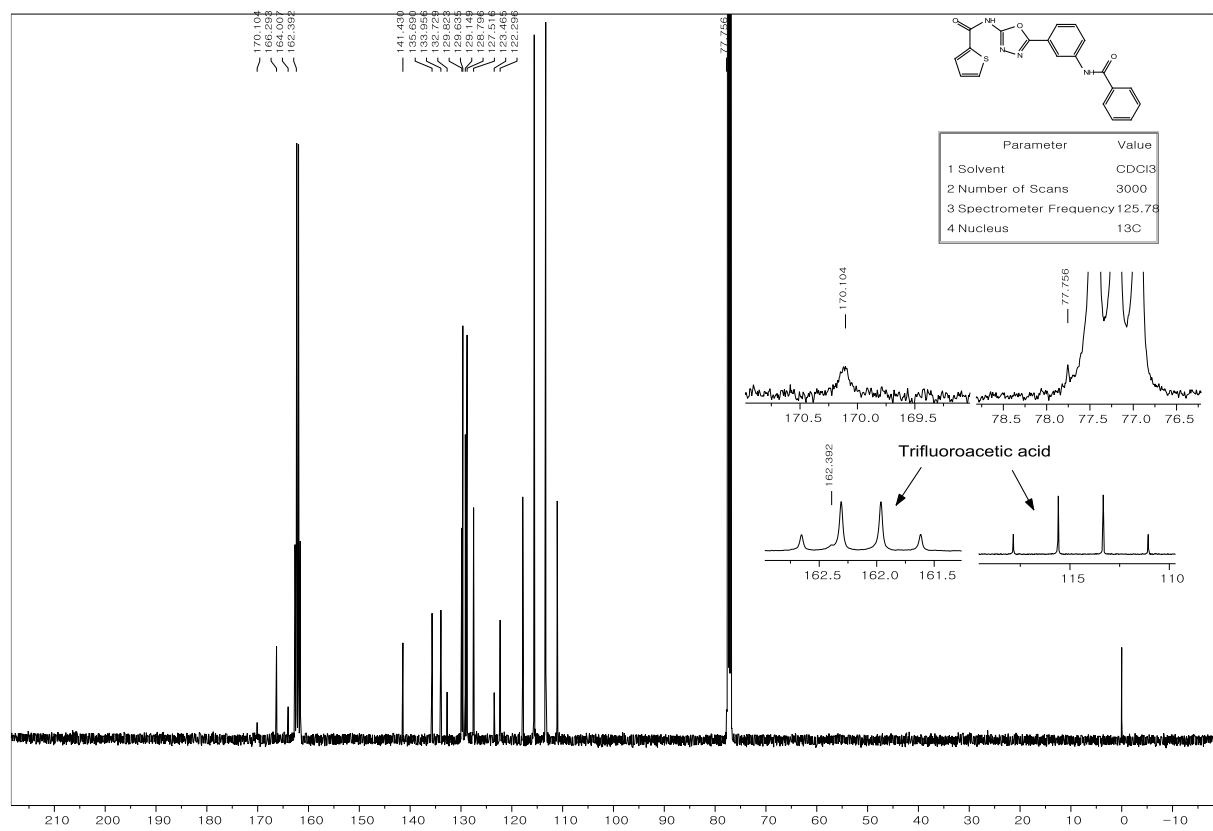
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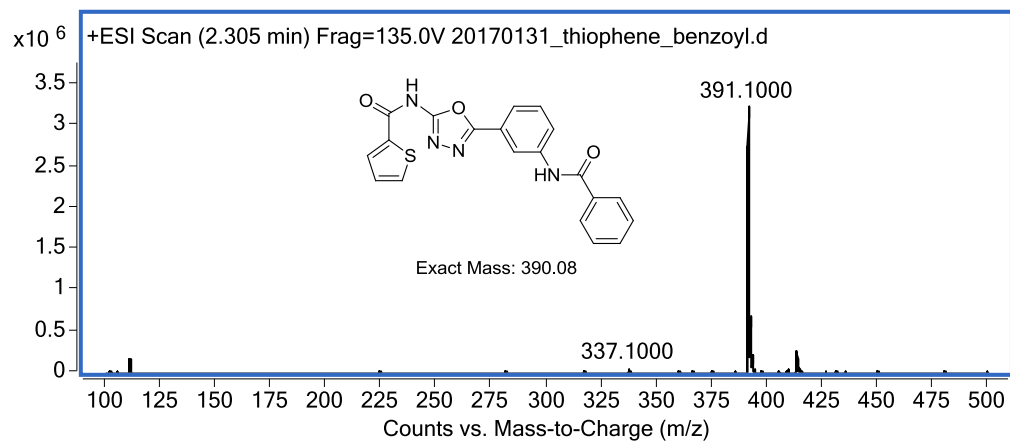
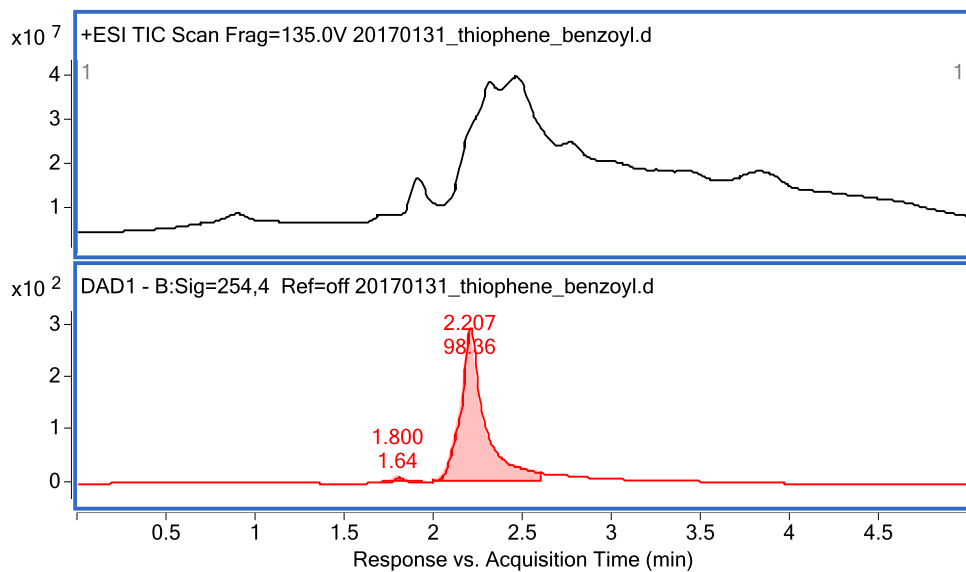
HR/MS – 18{2,3}



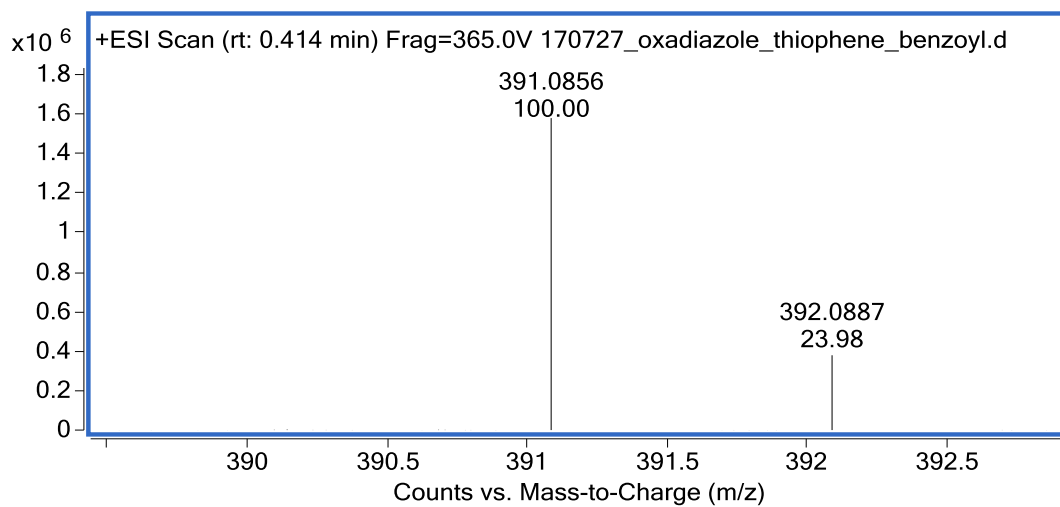
¹H NMR – 18{3,1}



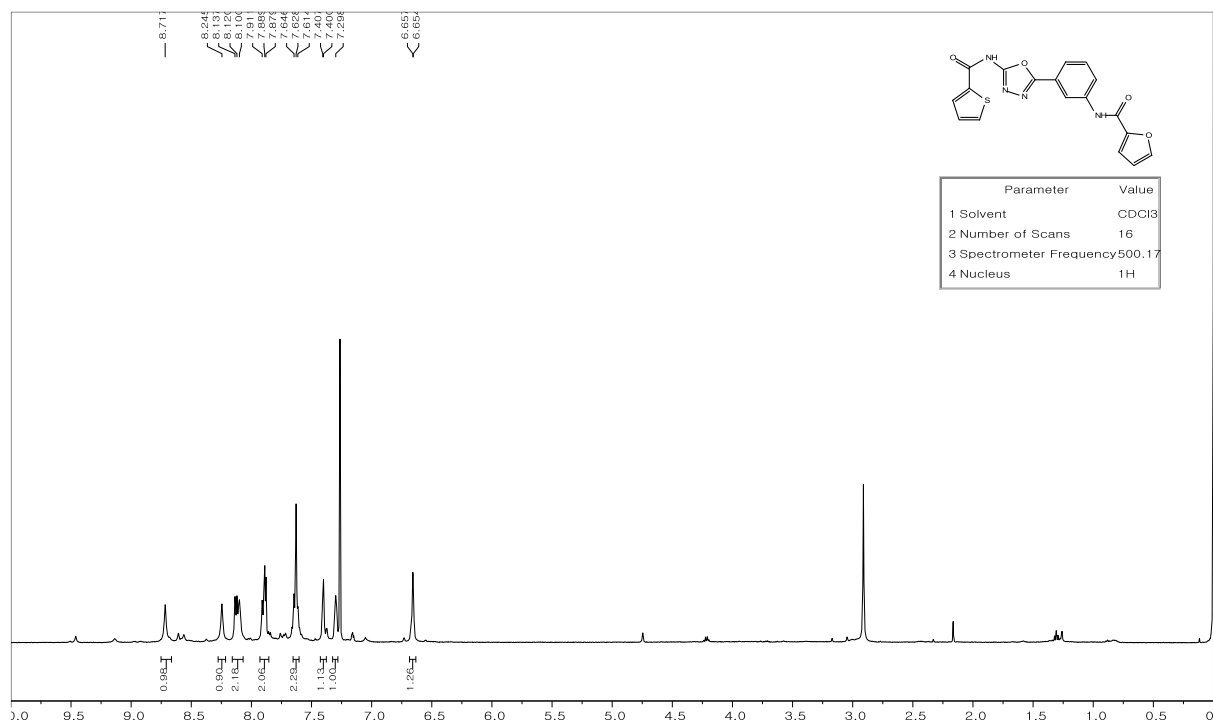
¹³C NMR – 18{3,1}



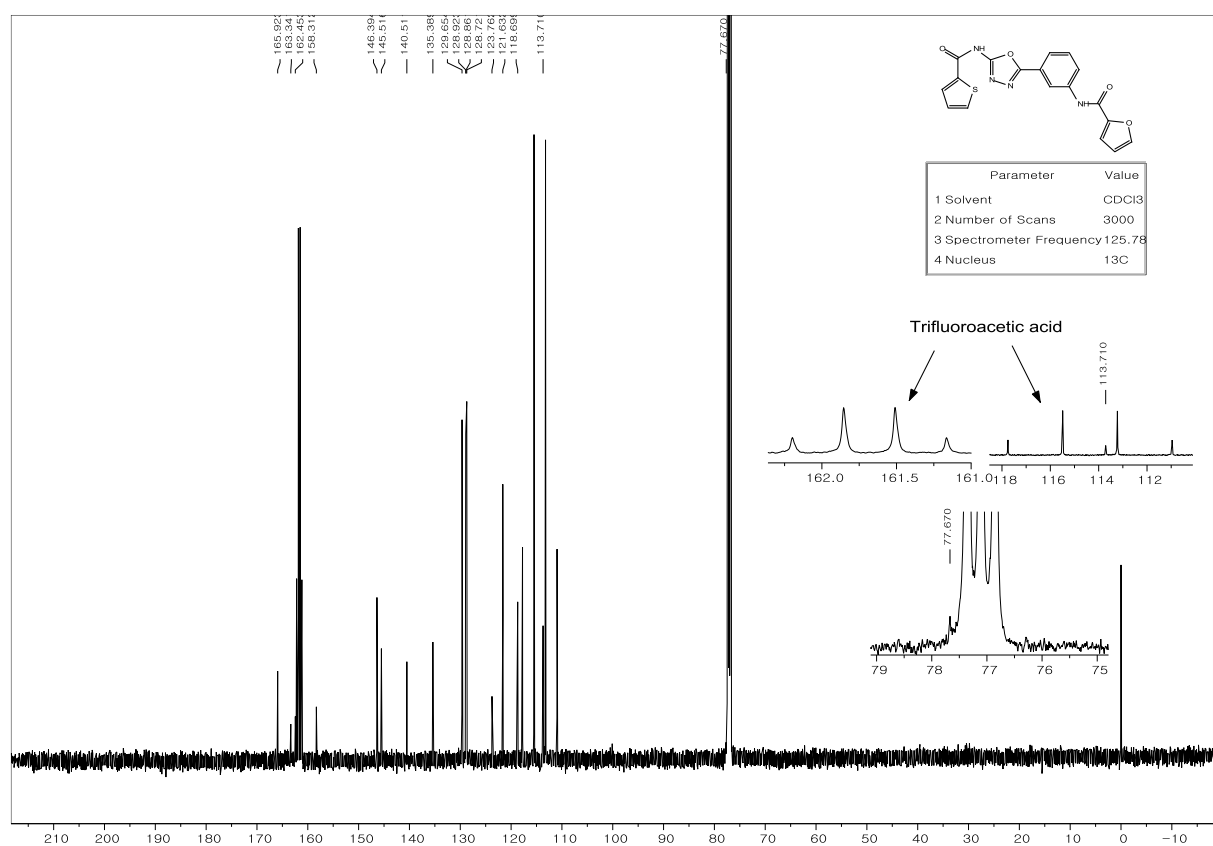
LC/MS – 18{3,1}



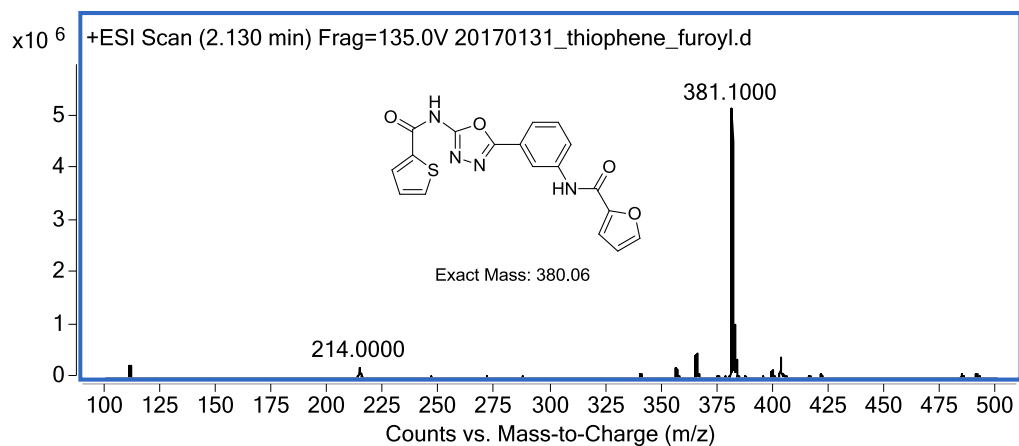
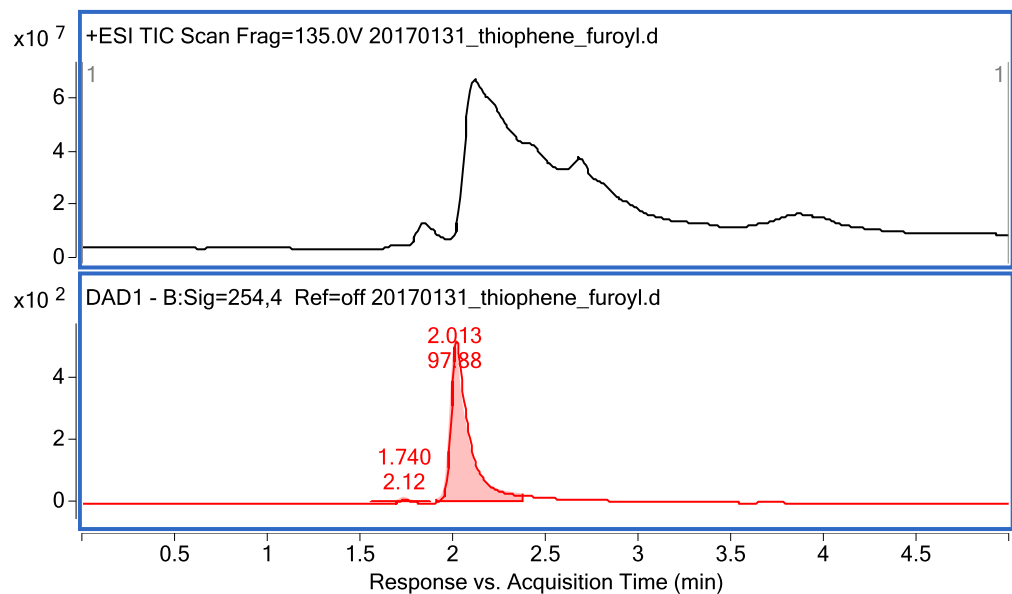
HR/MS – 18{3,1}



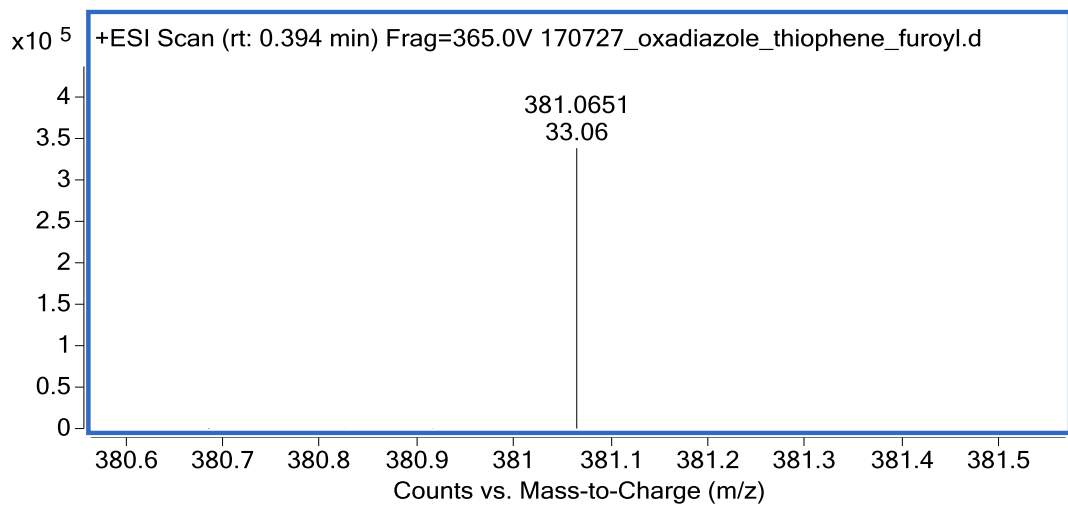
¹H NMR – 18{3,2}



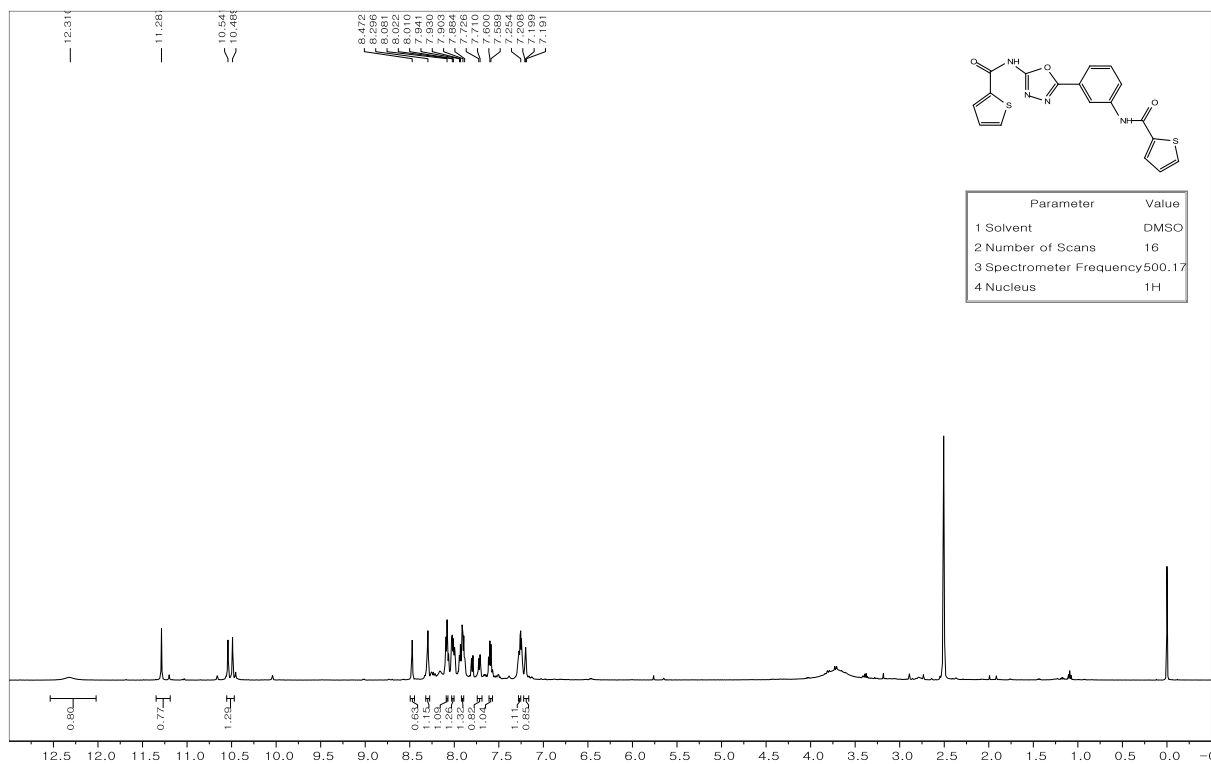
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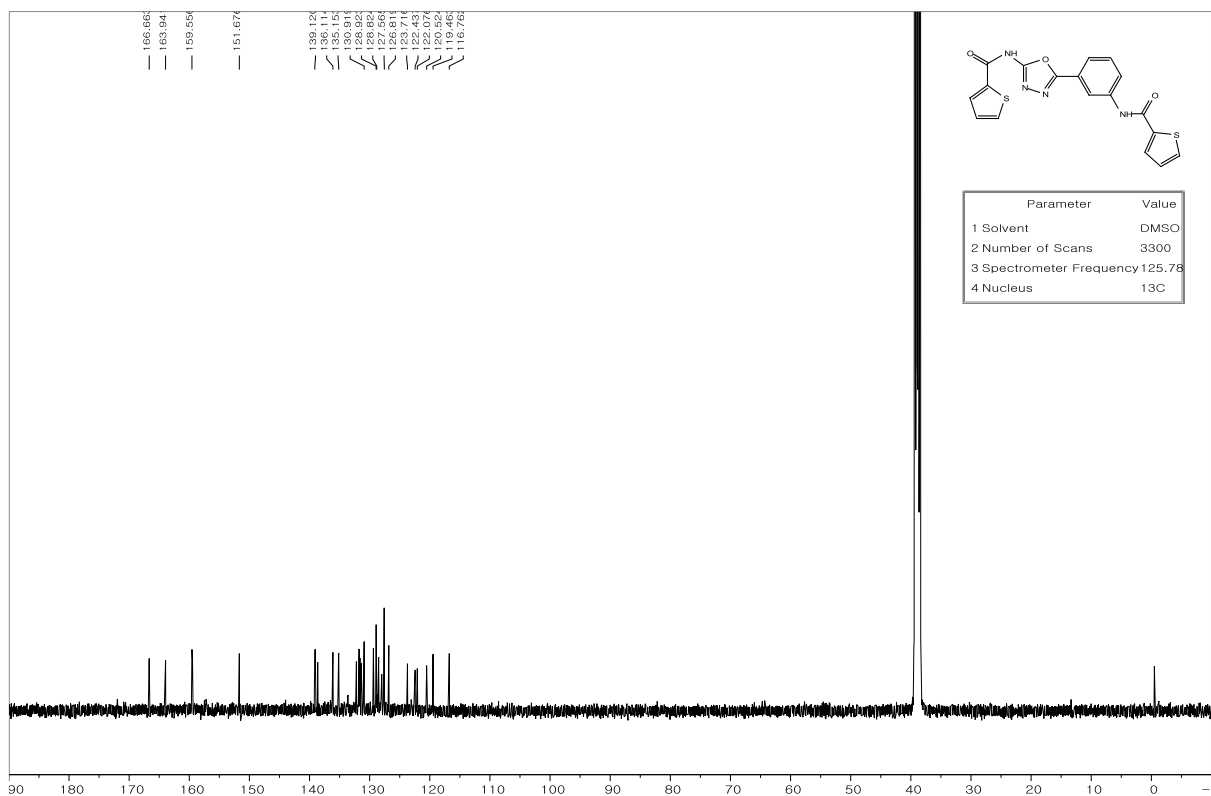
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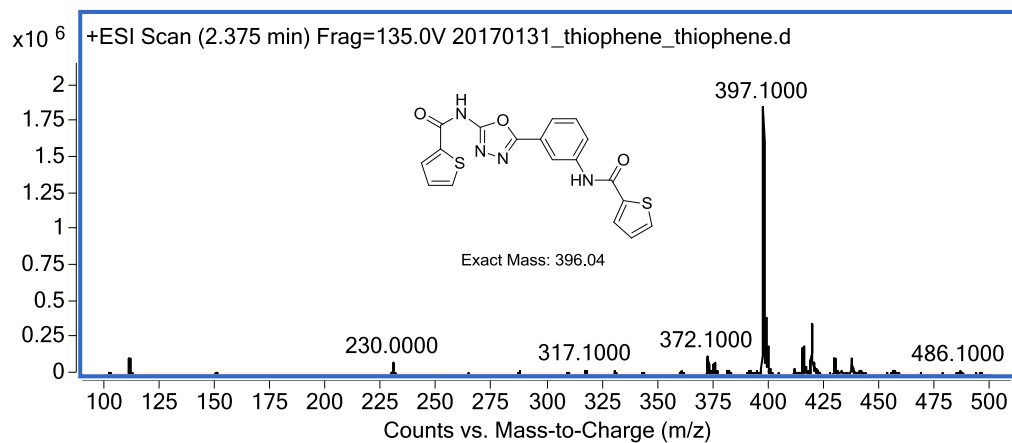
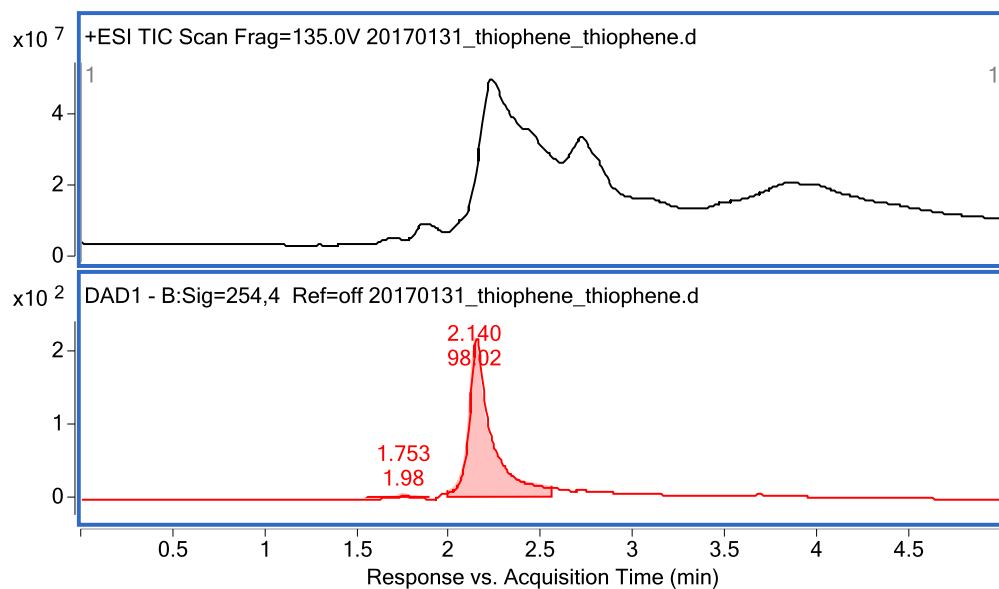
HR/MS – 18{3,2}



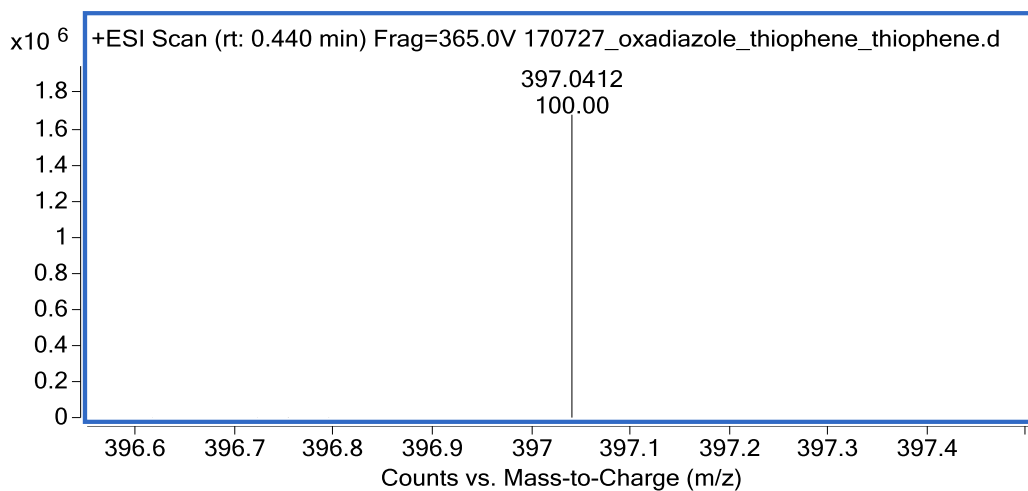
¹H NMR – 18{3,3}



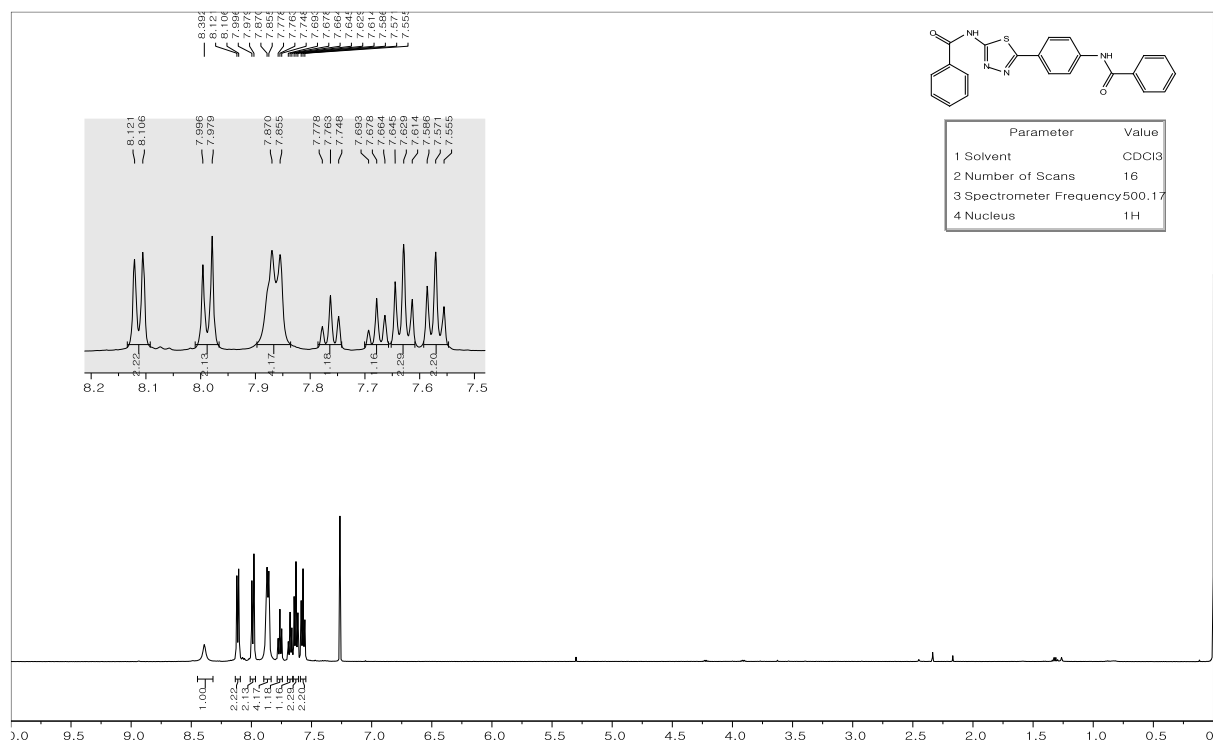
¹³C NMR – 18{3,3}



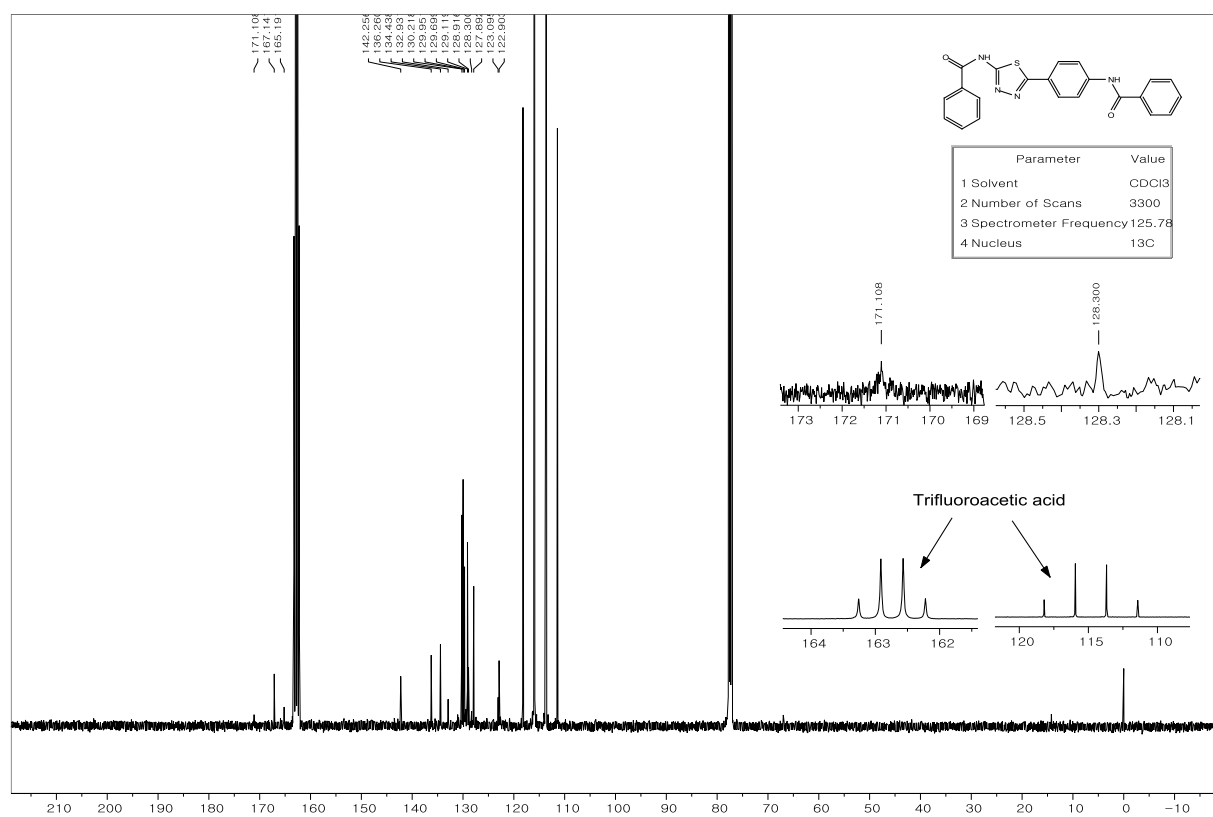
LC/MS – 18{3,3}



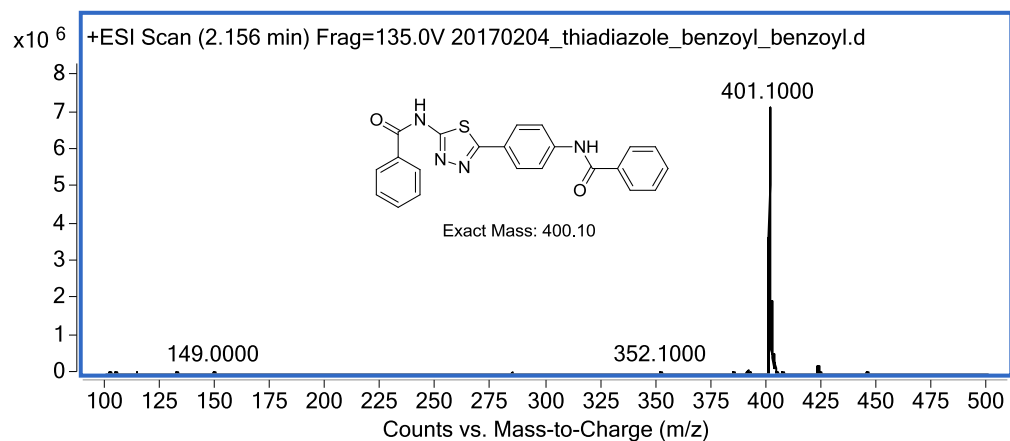
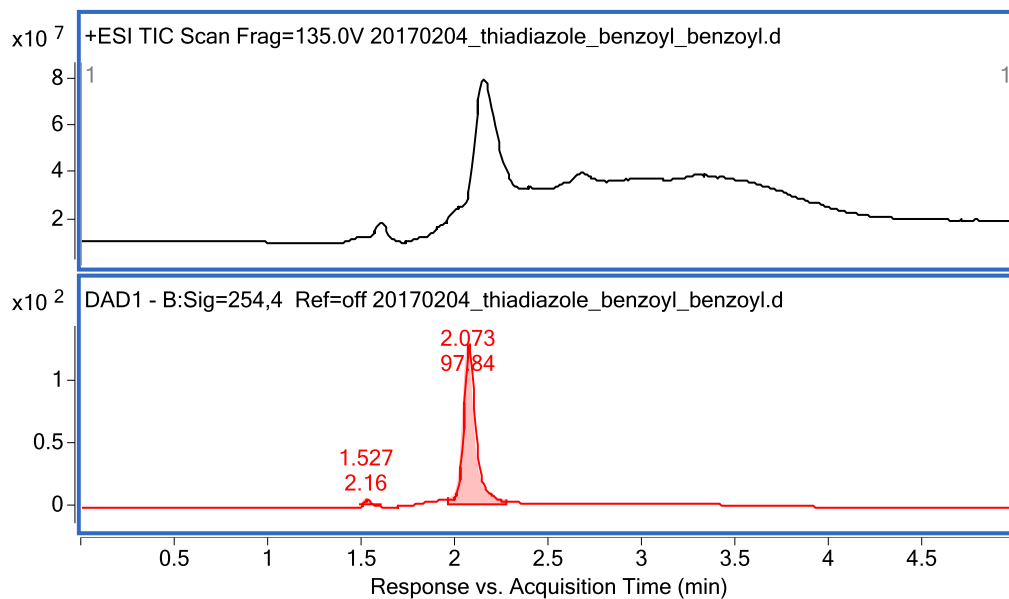
HR/MS – 18{3,3}



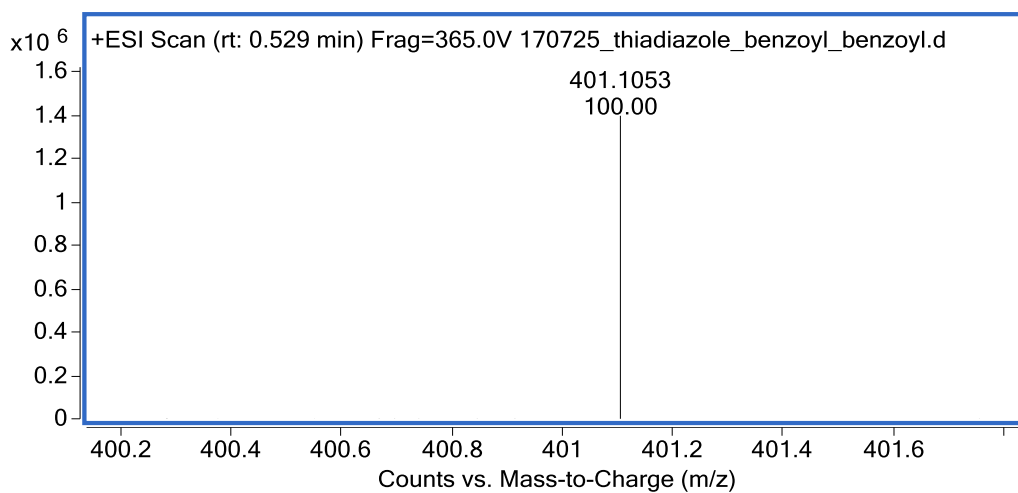
¹H NMR – 19{1,1}



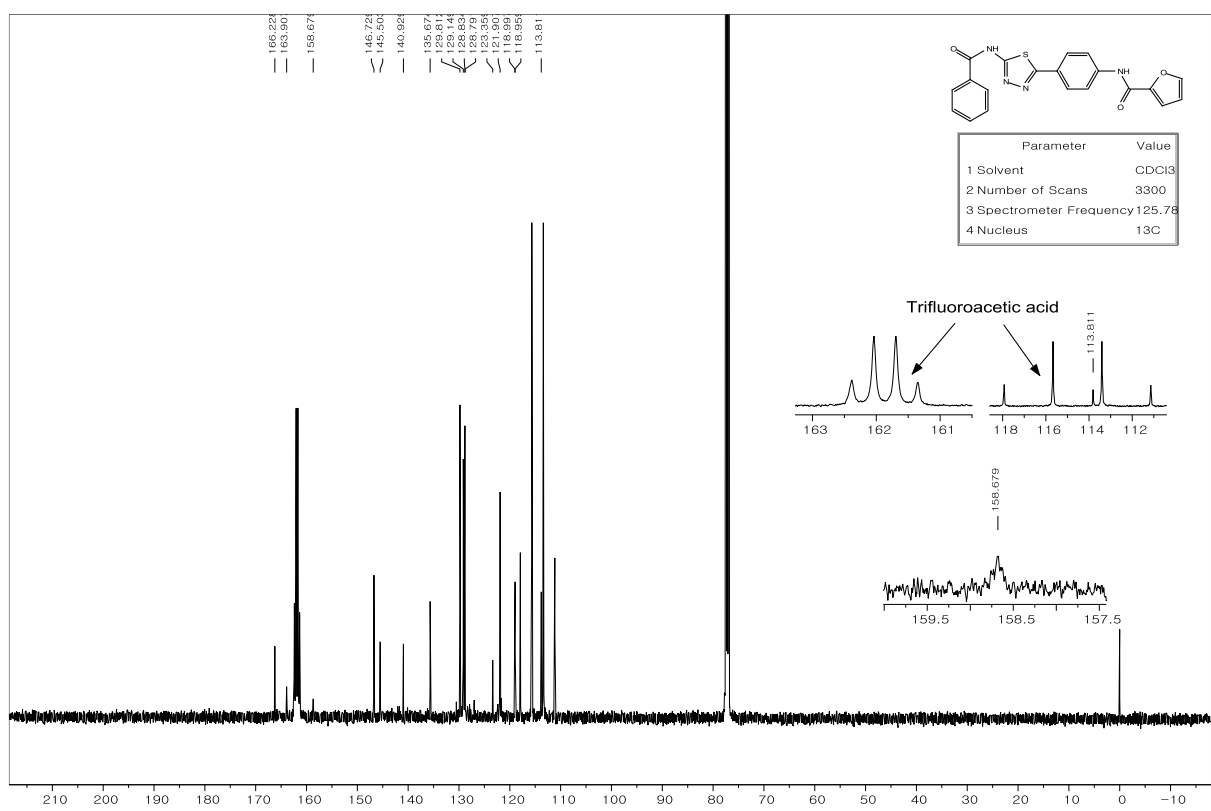
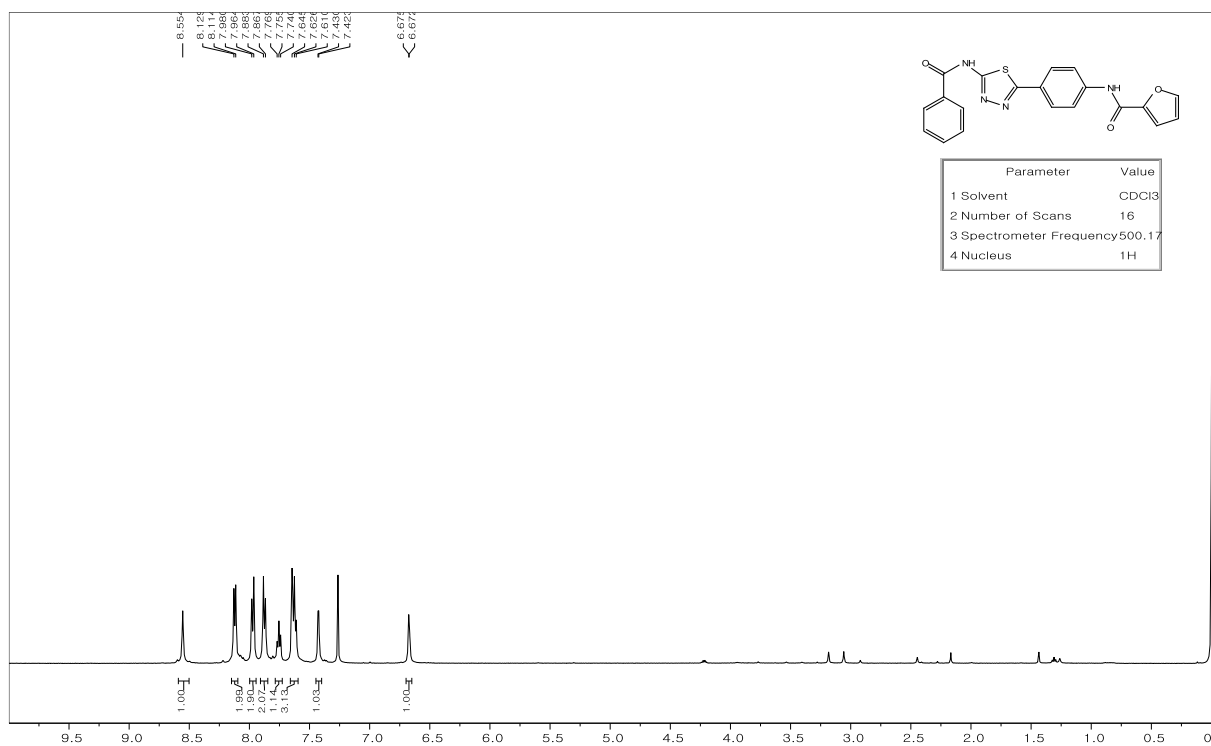
¹³C NMR – 19{1,1}

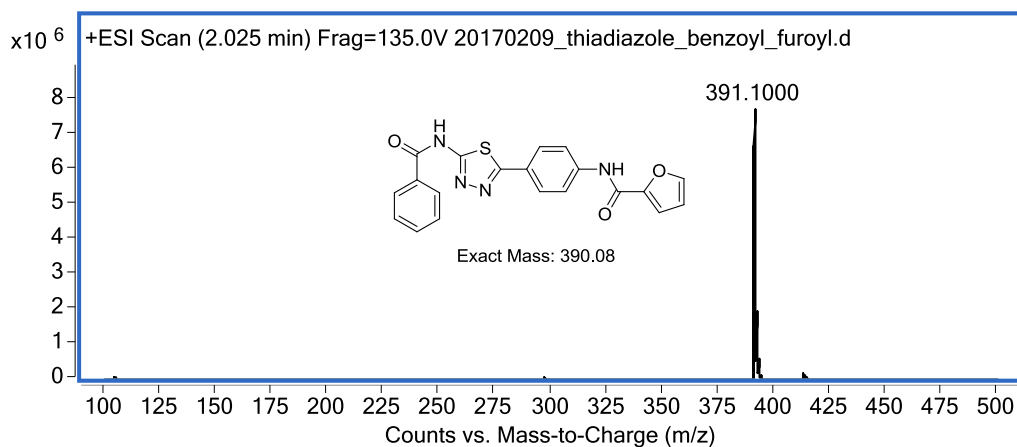
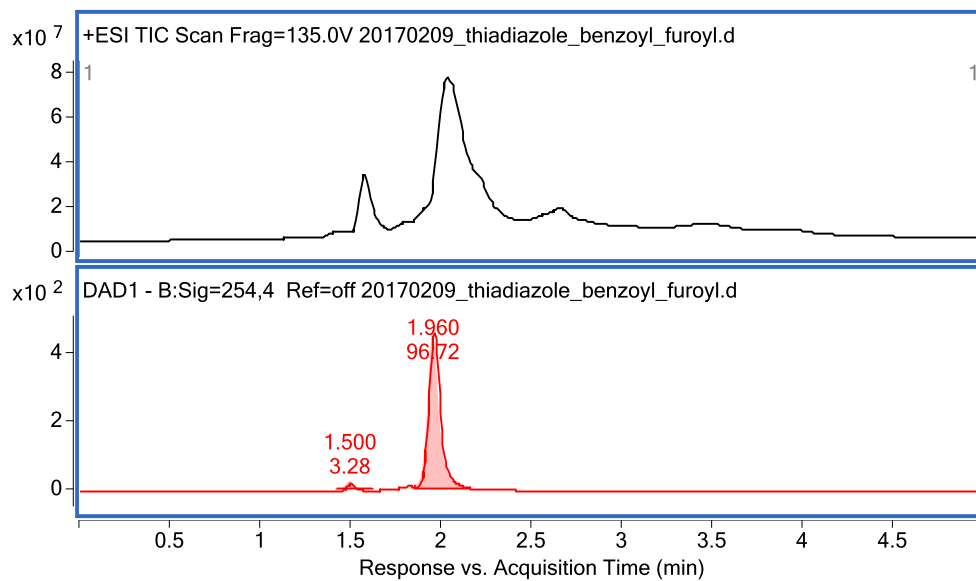


LC/MS – 19{1,1}

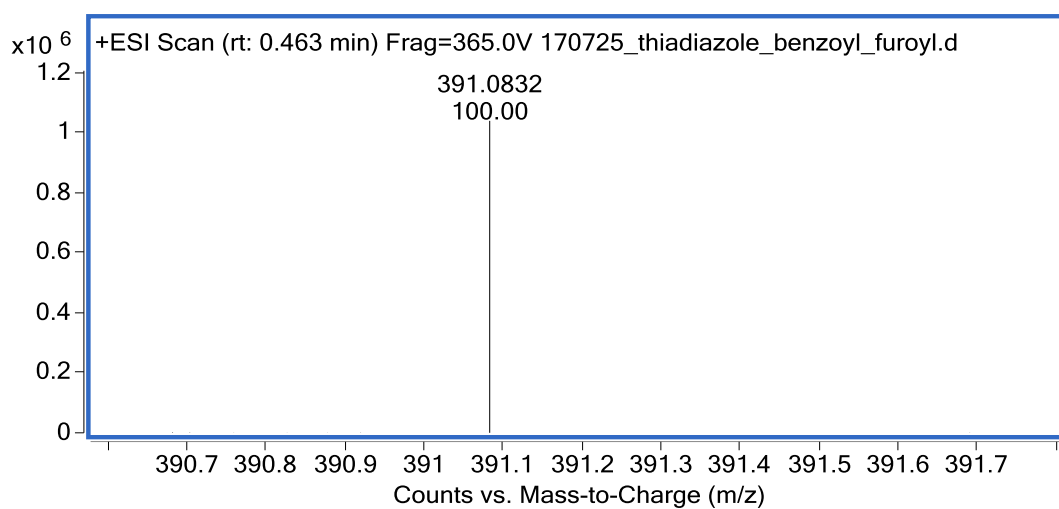


HR/MS – 19{1,1}

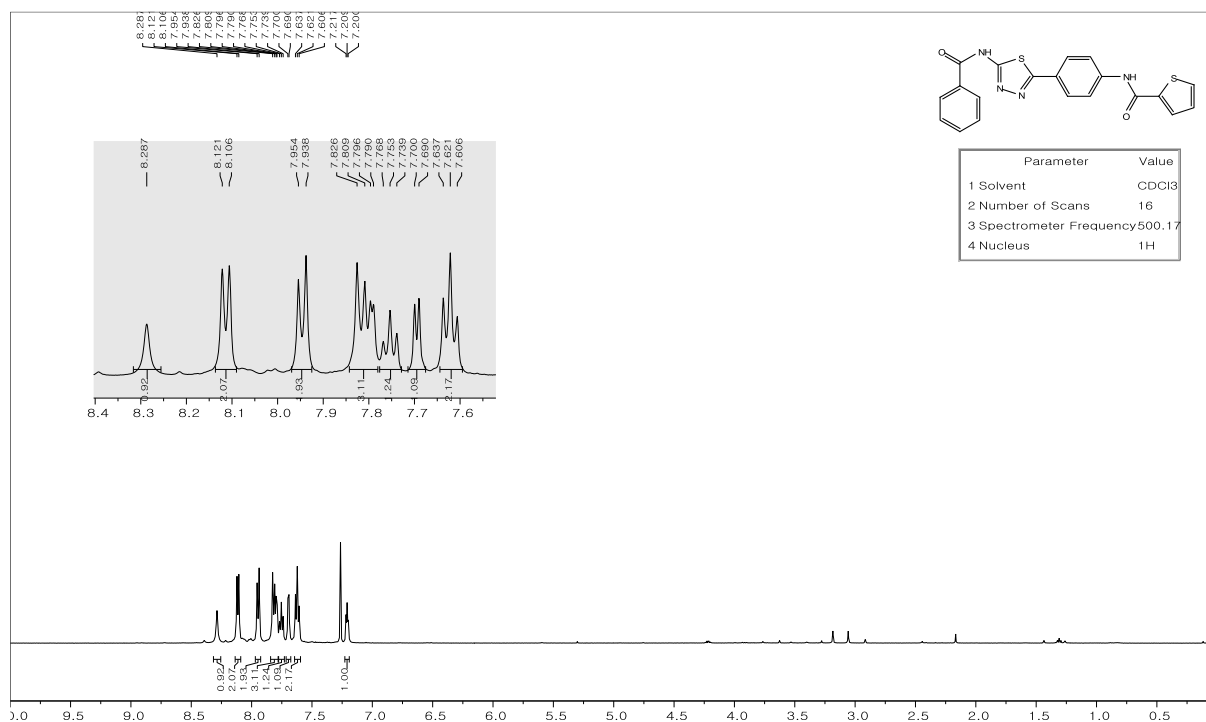




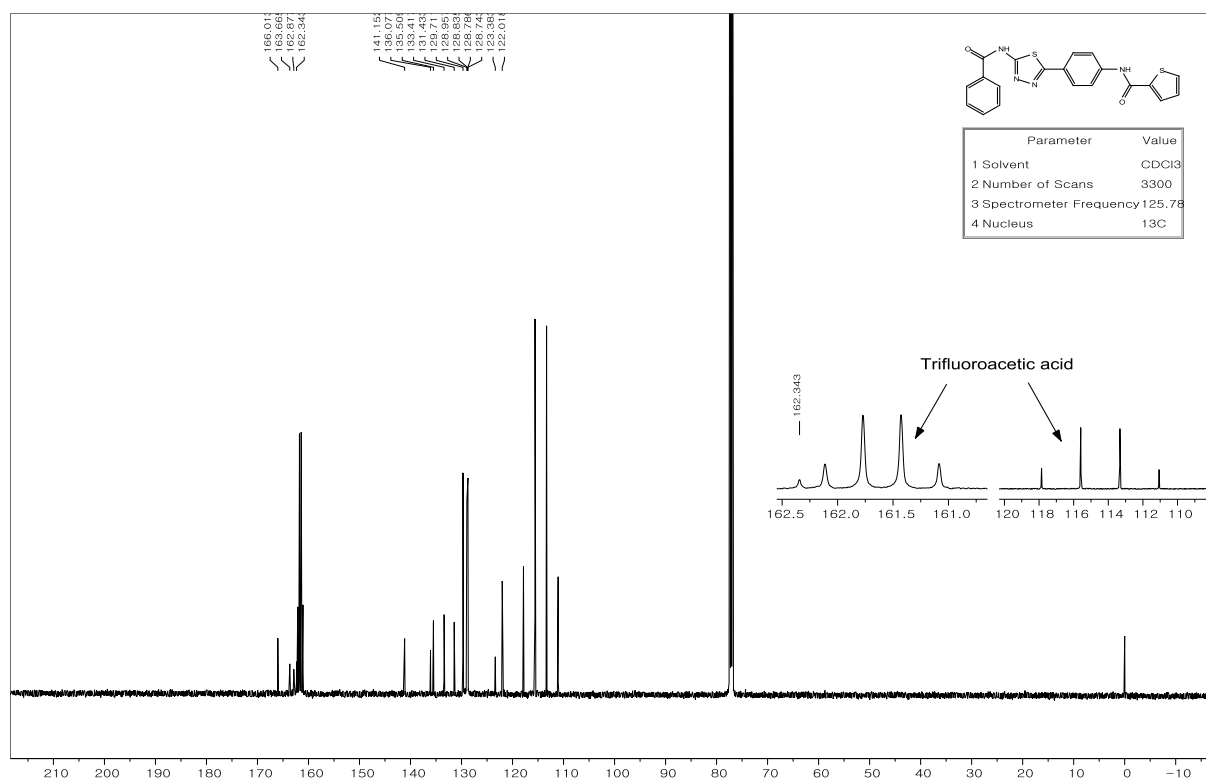
LC/MS – 19{1,2}



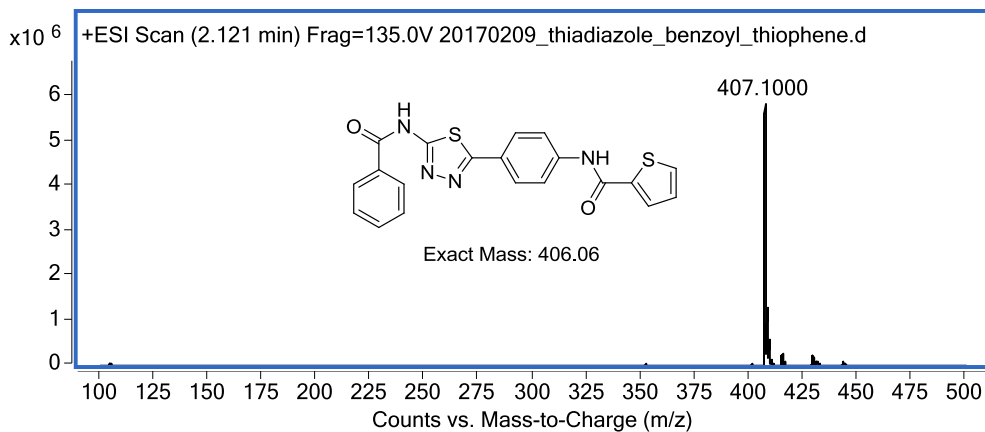
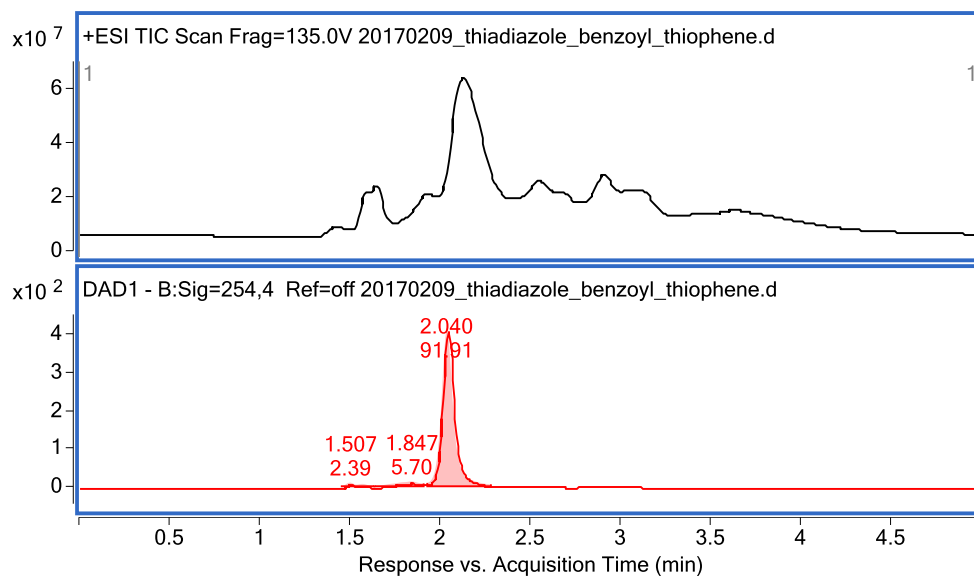
HR/MS – 19{1,2}



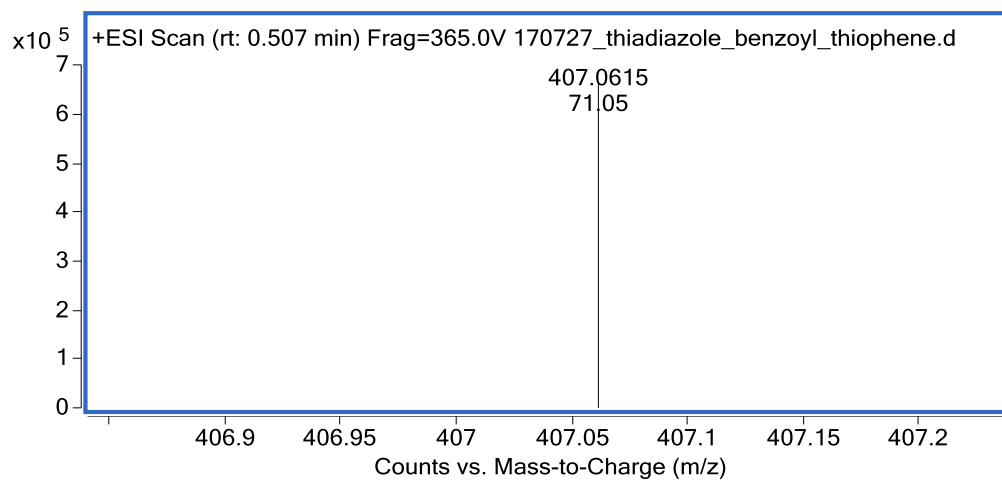
¹H NMR – 19{1,3}



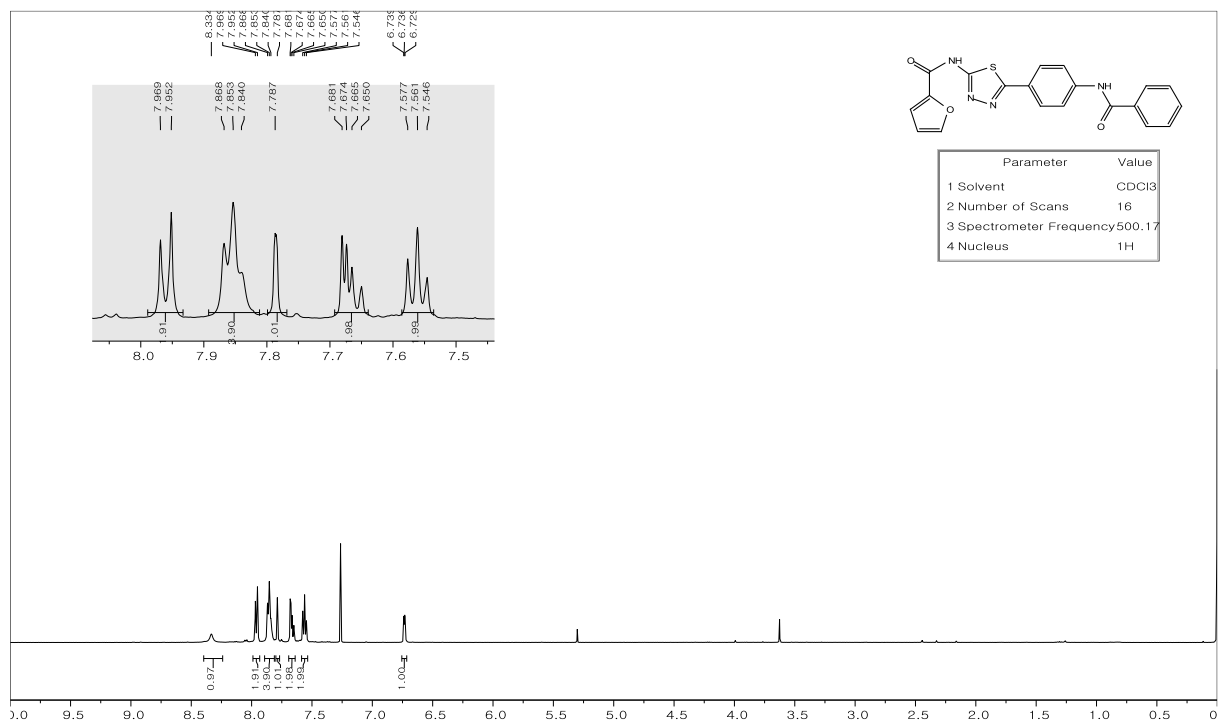
^{13}C NMR – 19{1,3}



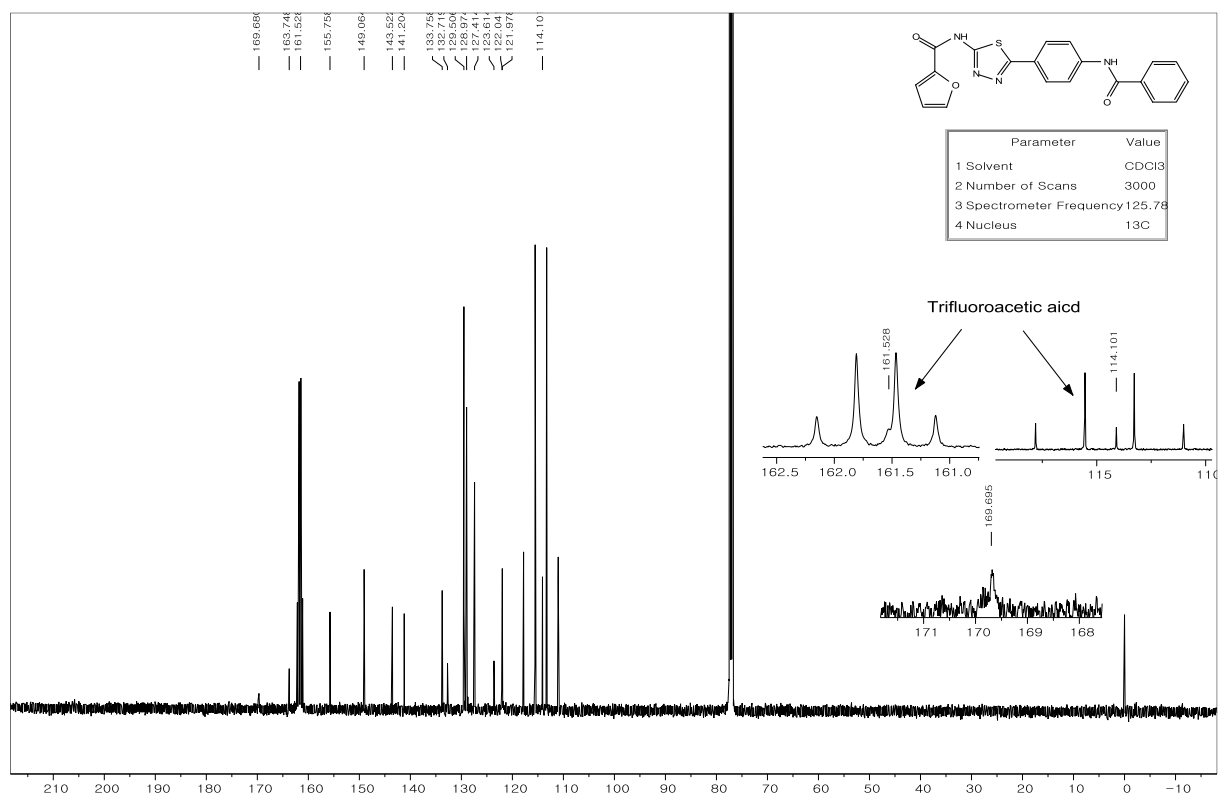
LC/MS – 19{1,3}



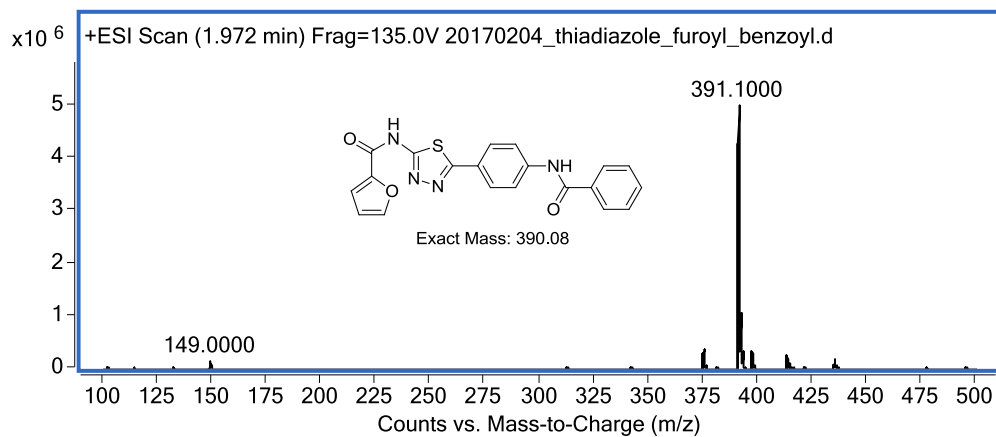
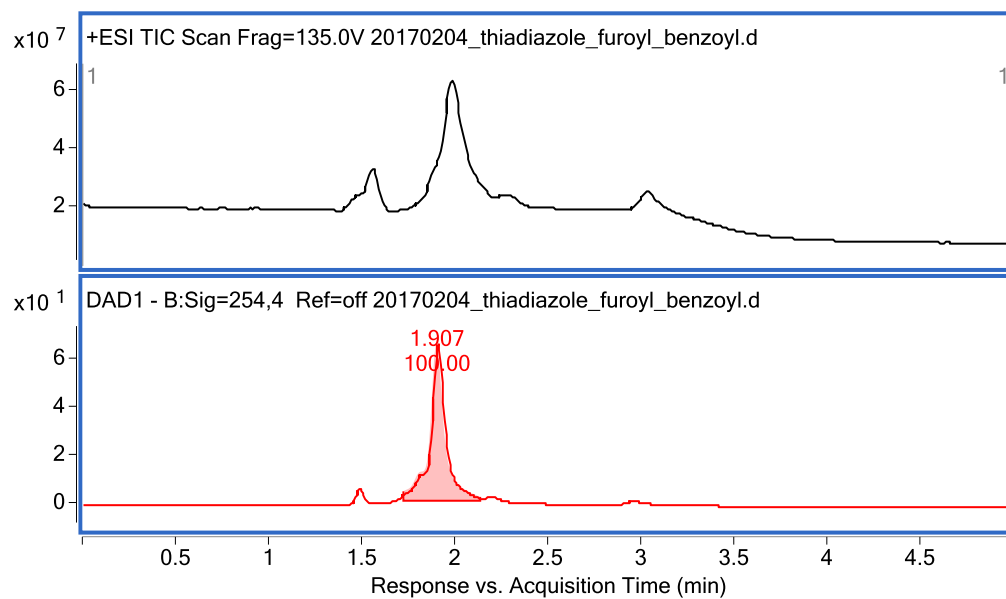
HR/MS – 19{1,3}



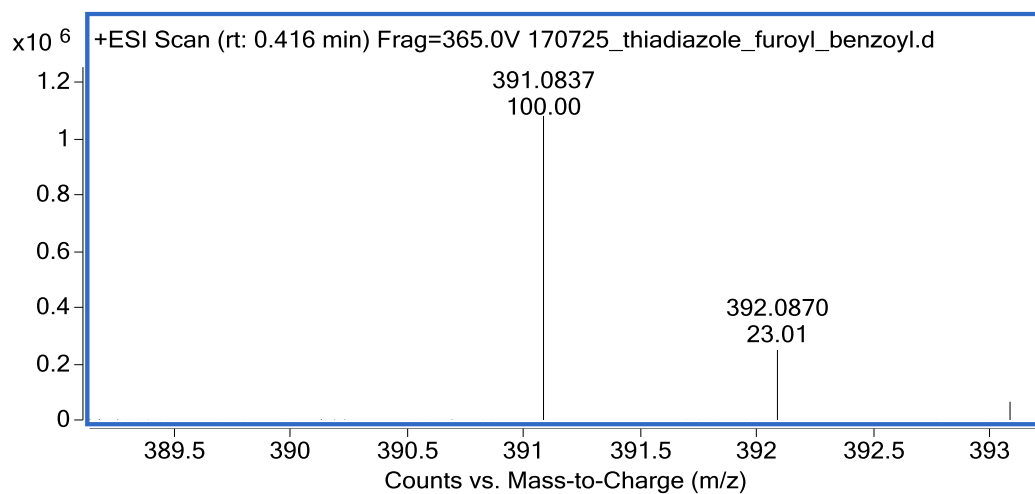
¹H NMR – 19{2,1}



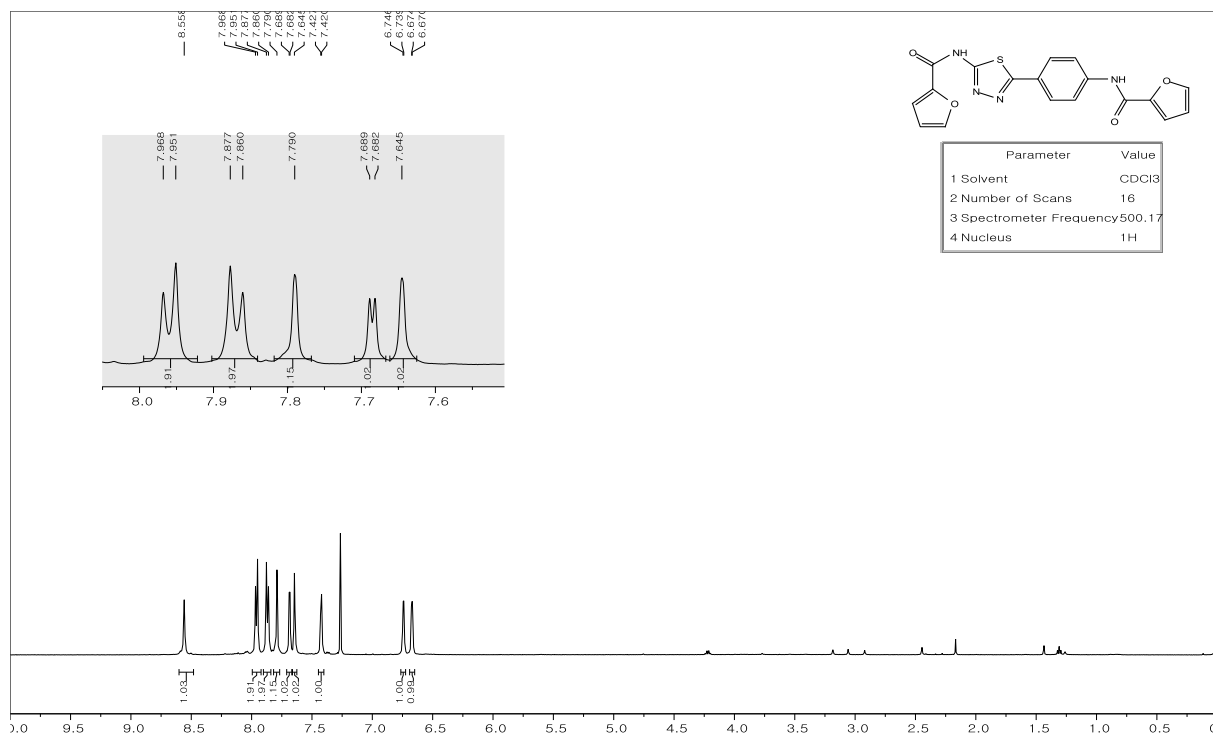
^{13}C NMR – 19{2,1}



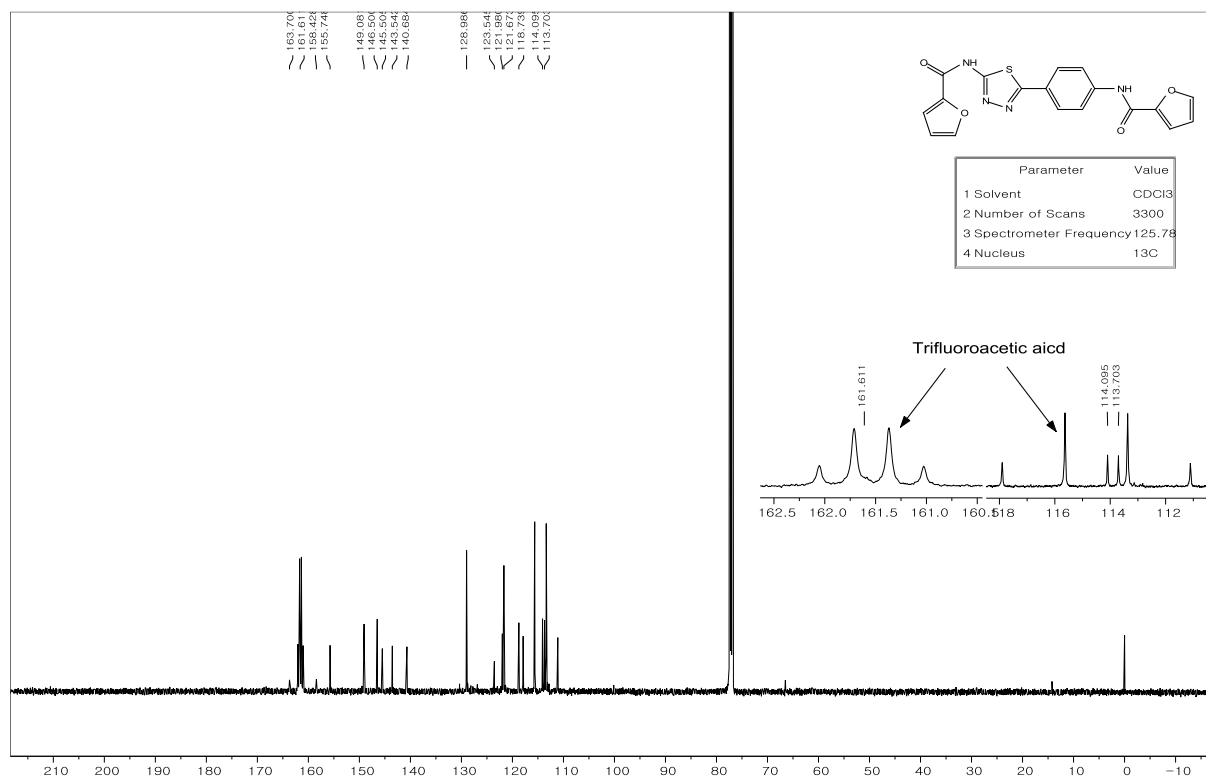
LC/MS – 19{2,1}



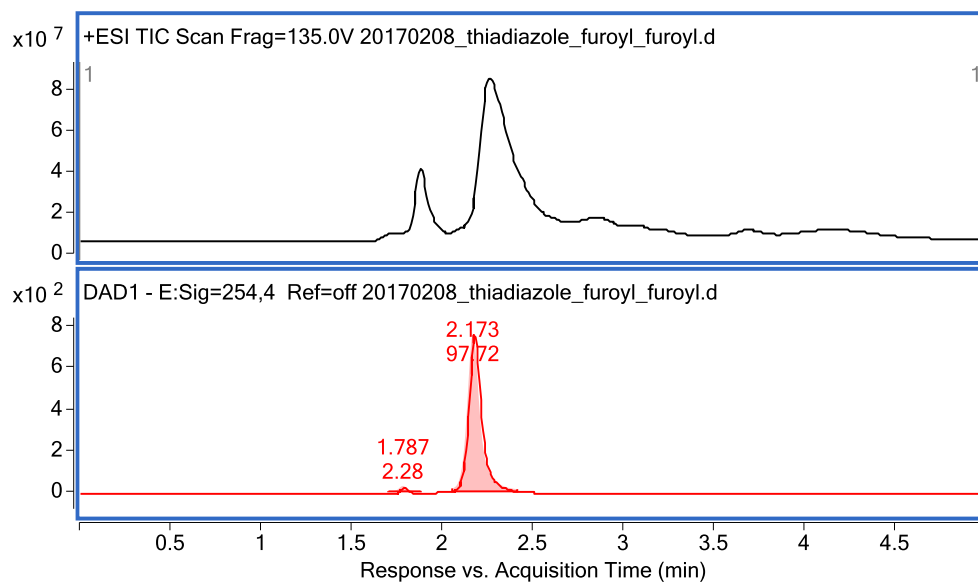
HR/MS – 19{2,1}

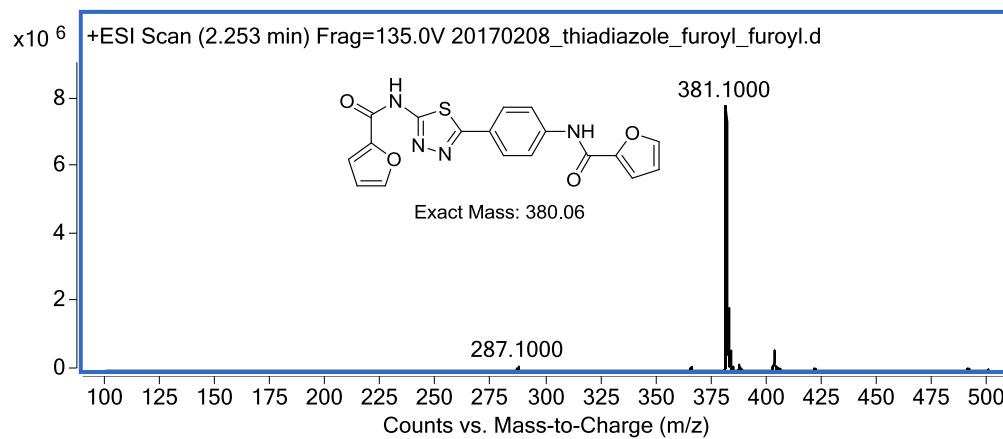


¹H NMR – 19{2,2}

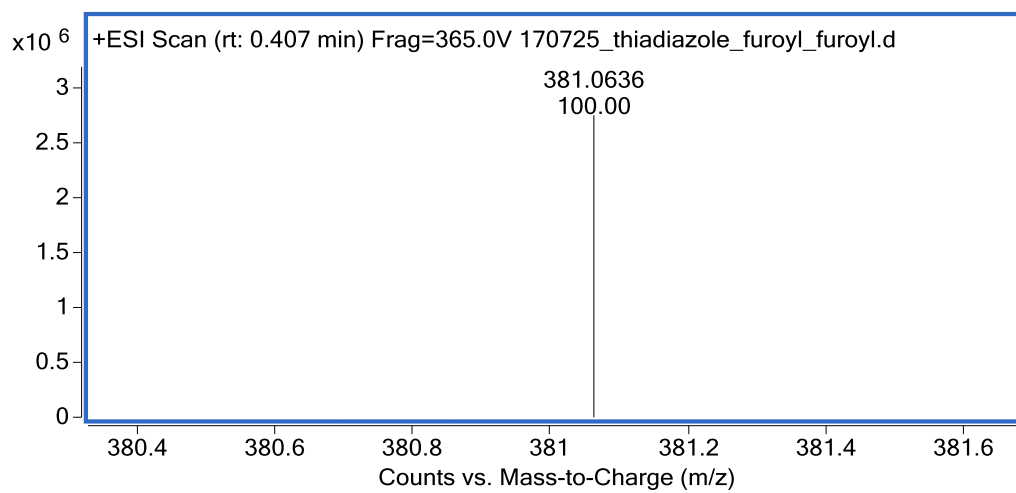


¹³C NMR – 19{2,2}

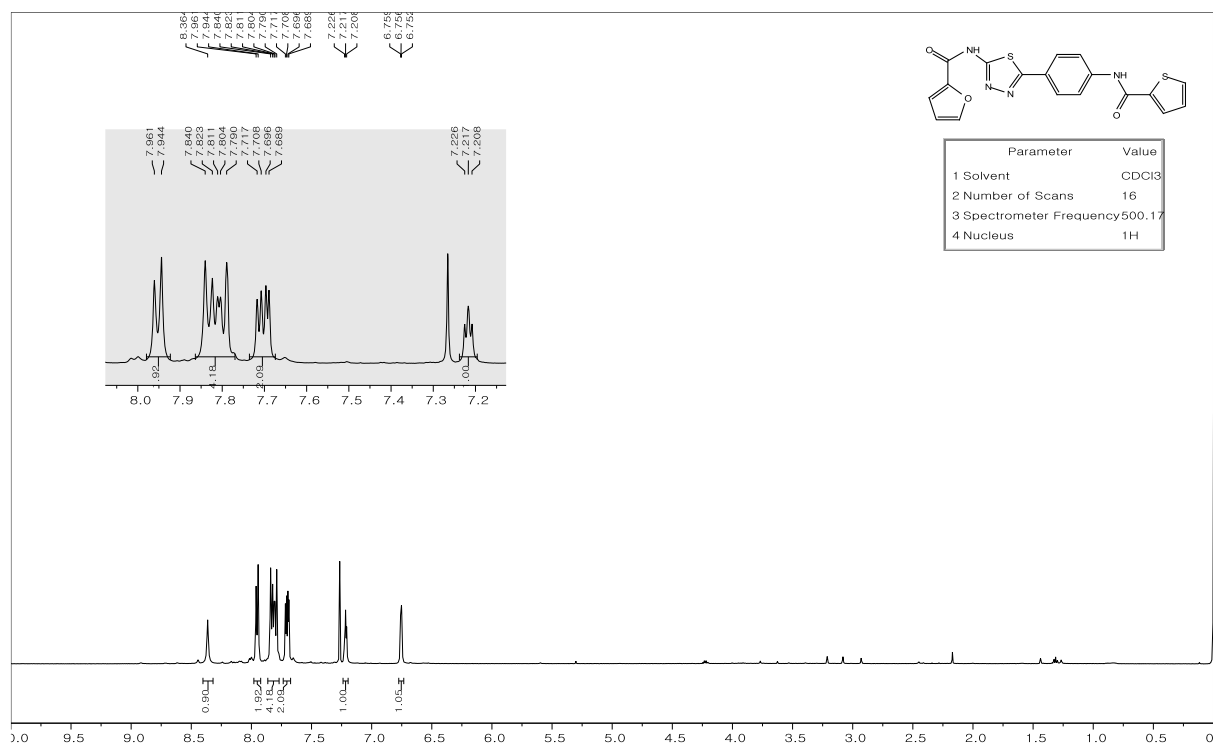




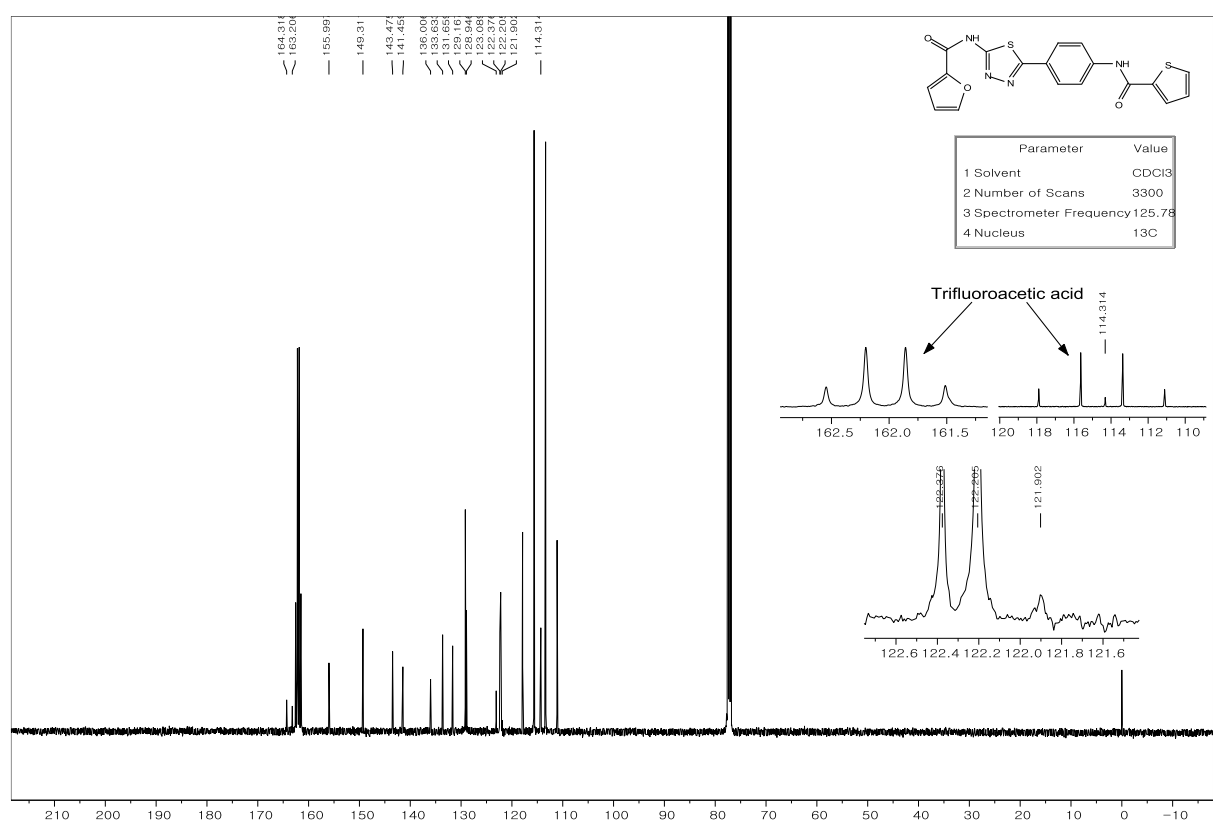
LC/MS – 19{2,2}



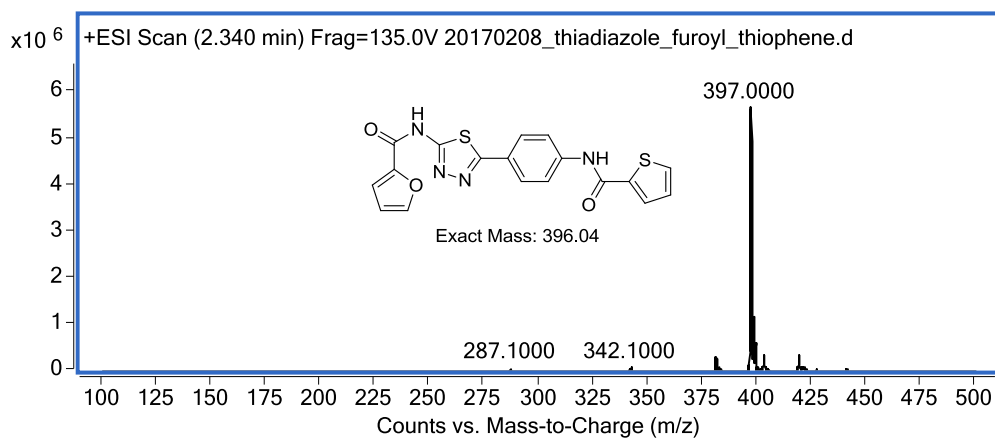
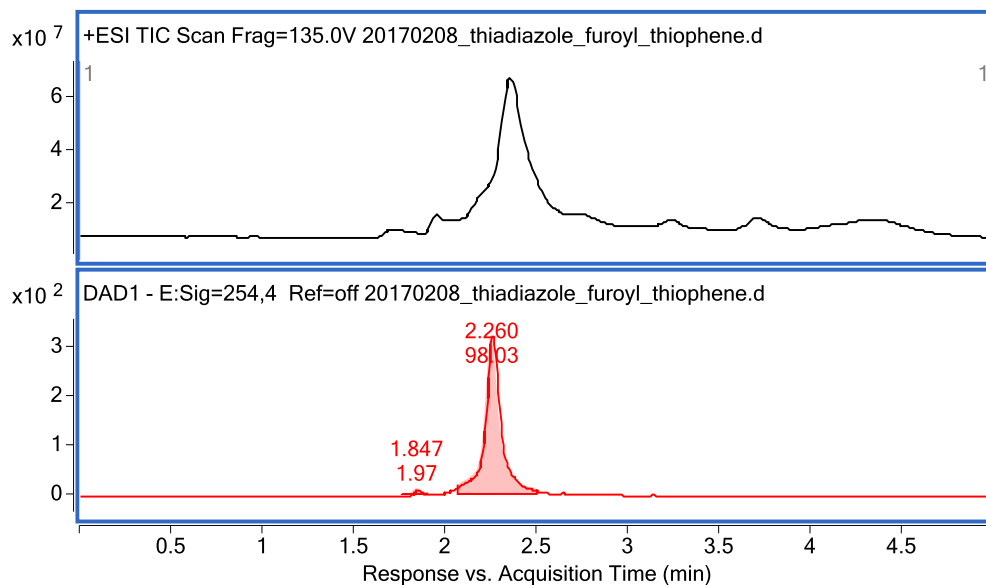
HR/MS – 19{2,2}



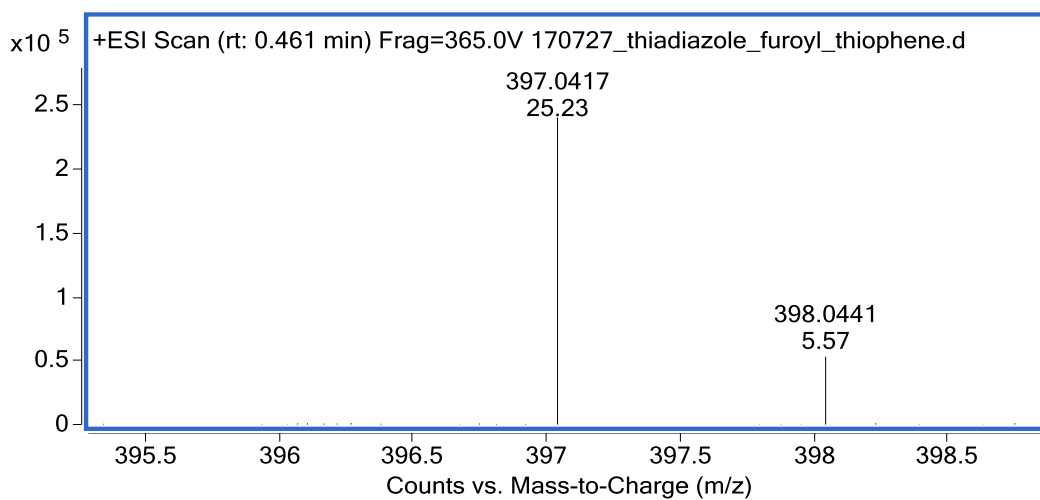
¹H NMR – 19{2,3}



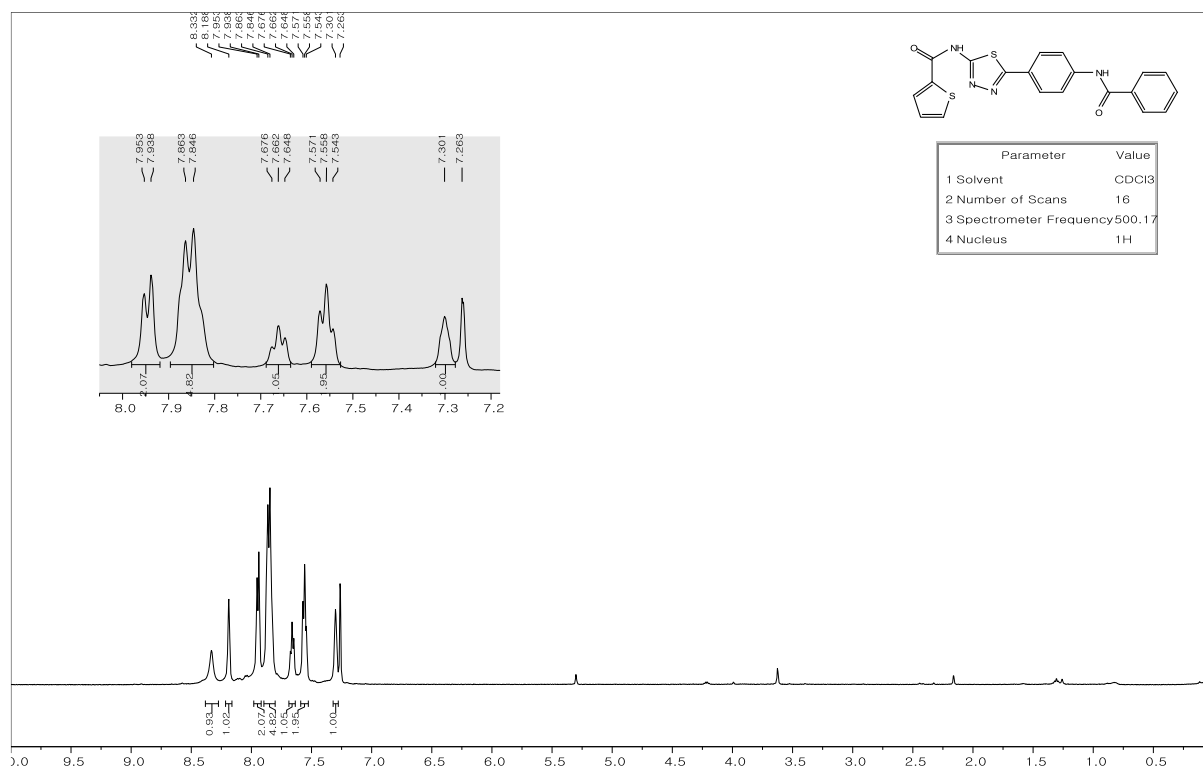
¹³C NMR – 19{2,3}



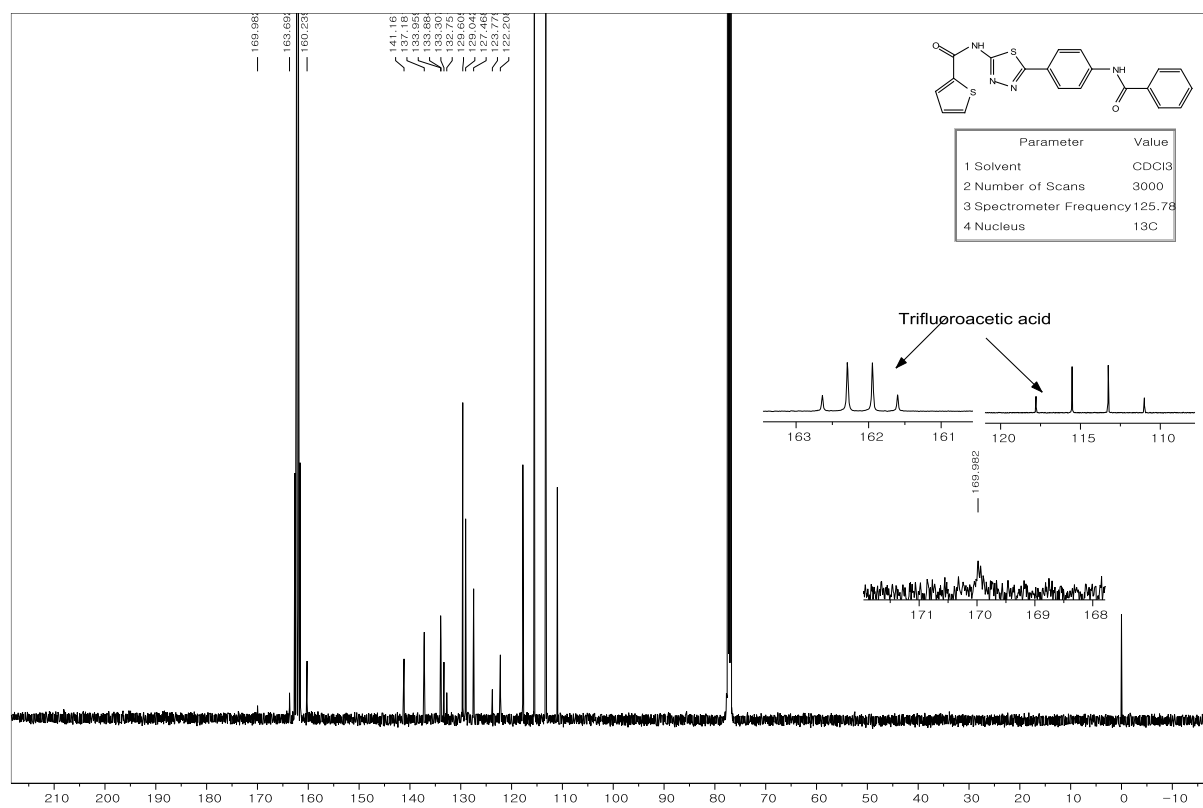
LC/MS – 19{2,3}



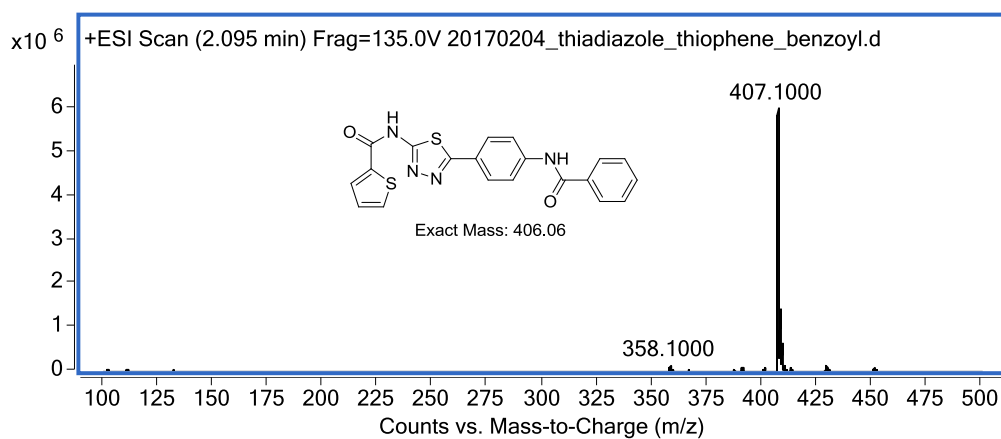
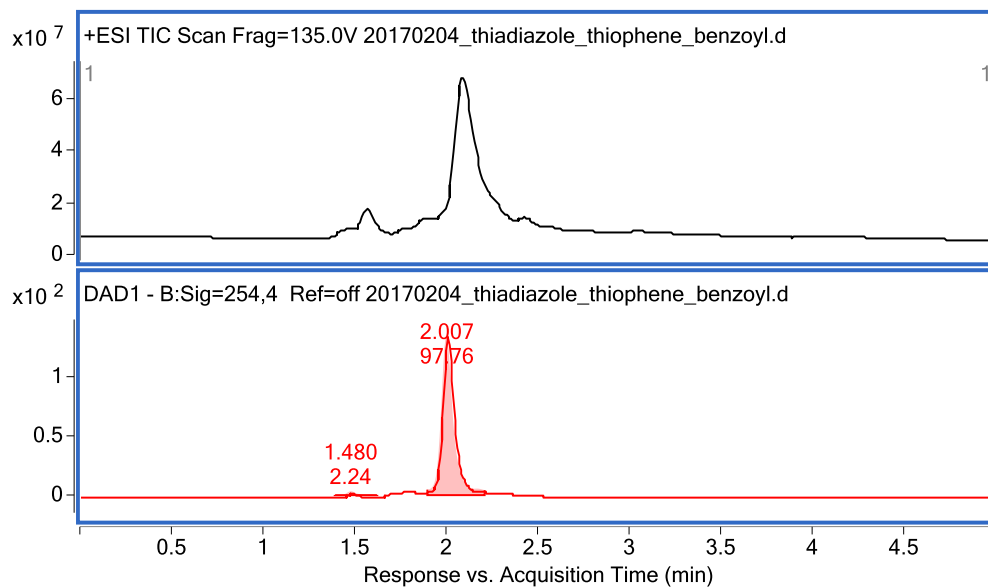
HR/MS – 19{2,3}



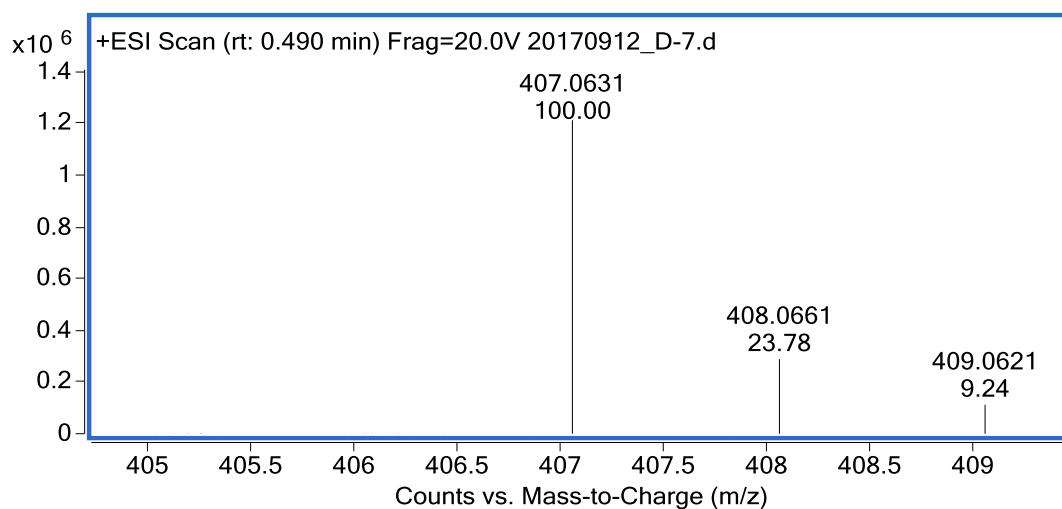
¹H NMR – 19{3,1}



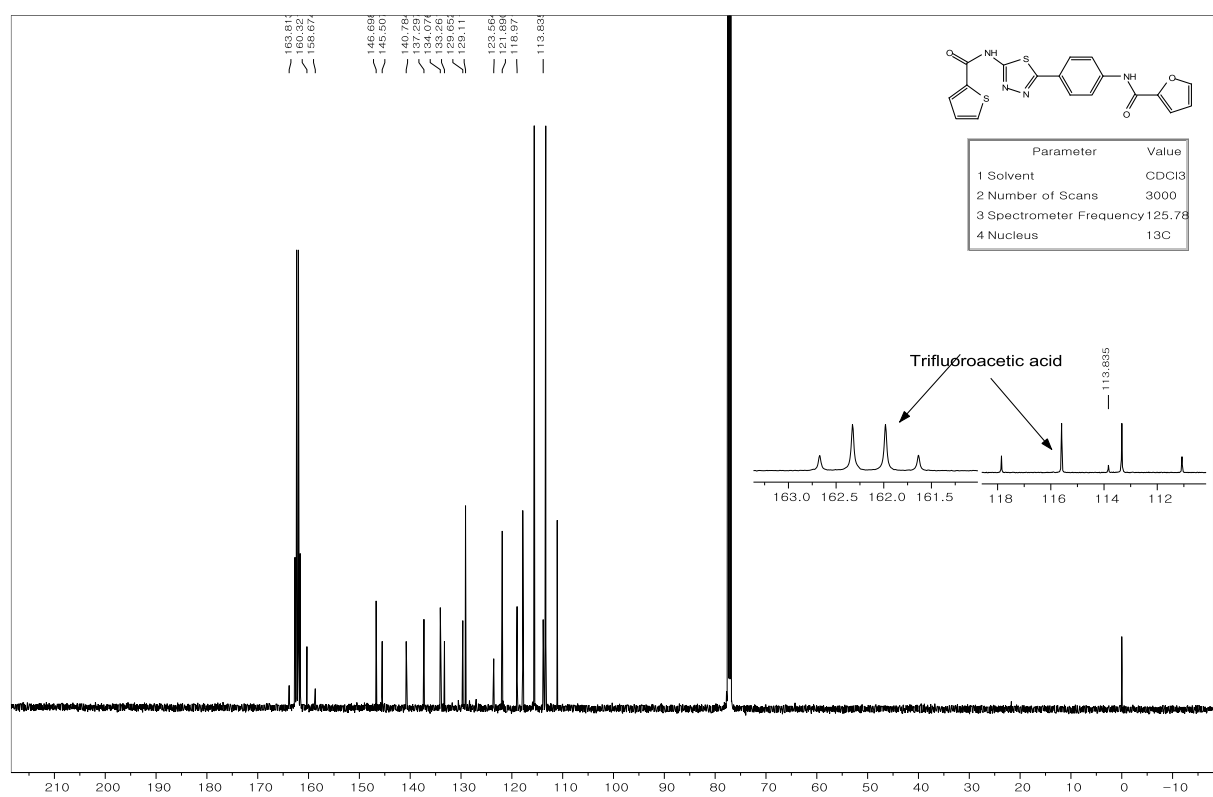
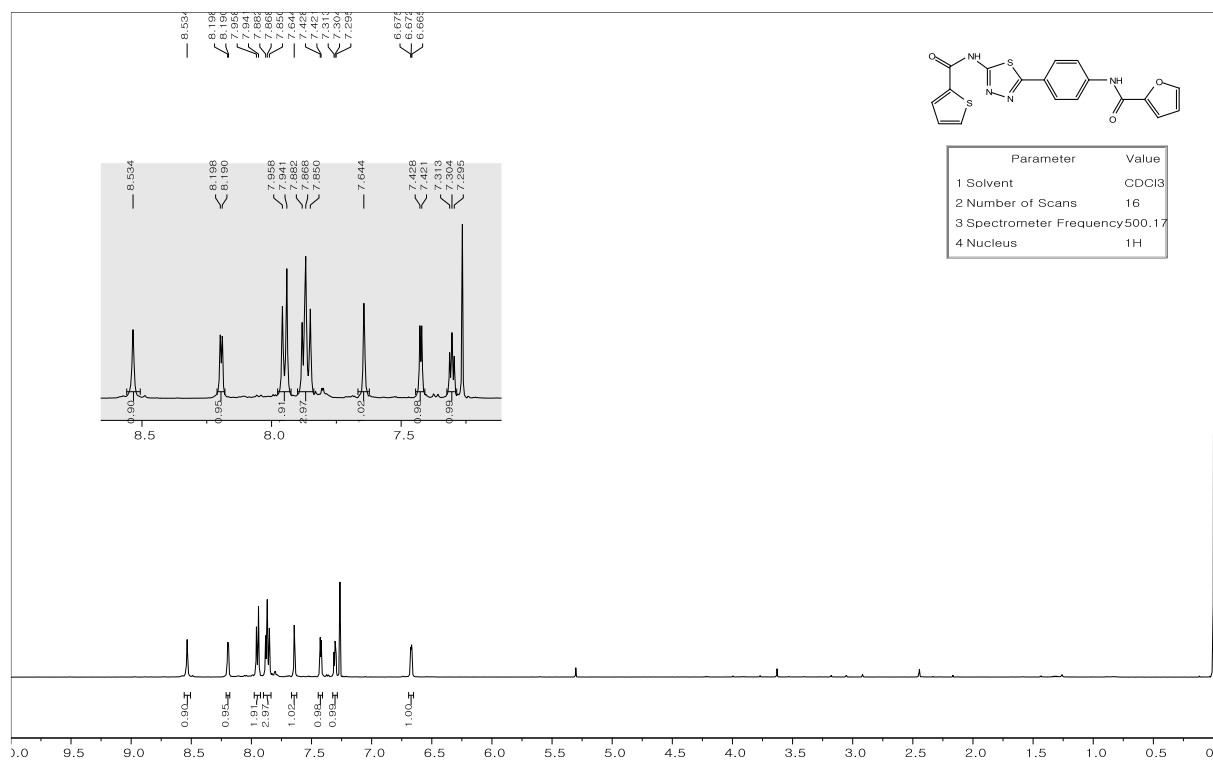
¹³C NMR – 19{3,1}

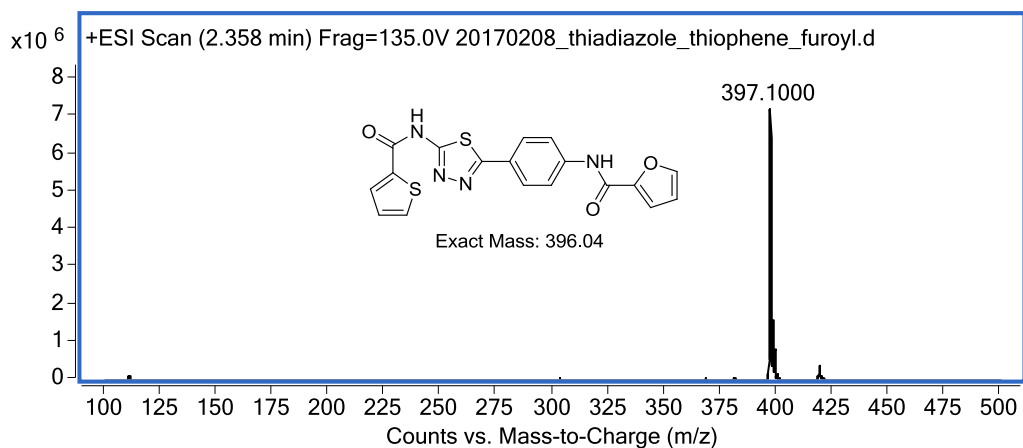
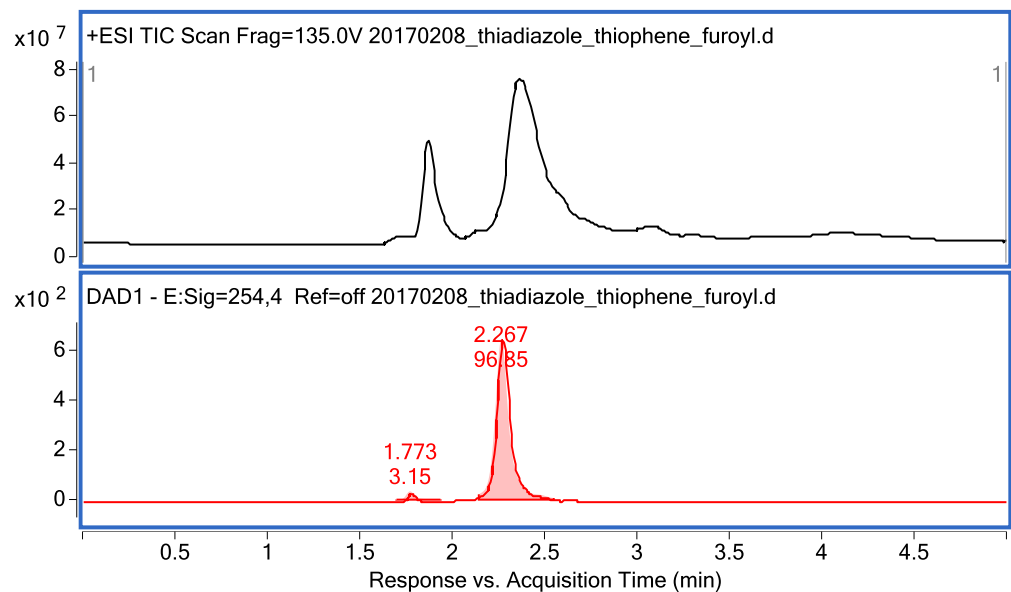


LC/MS – 19{3,1}

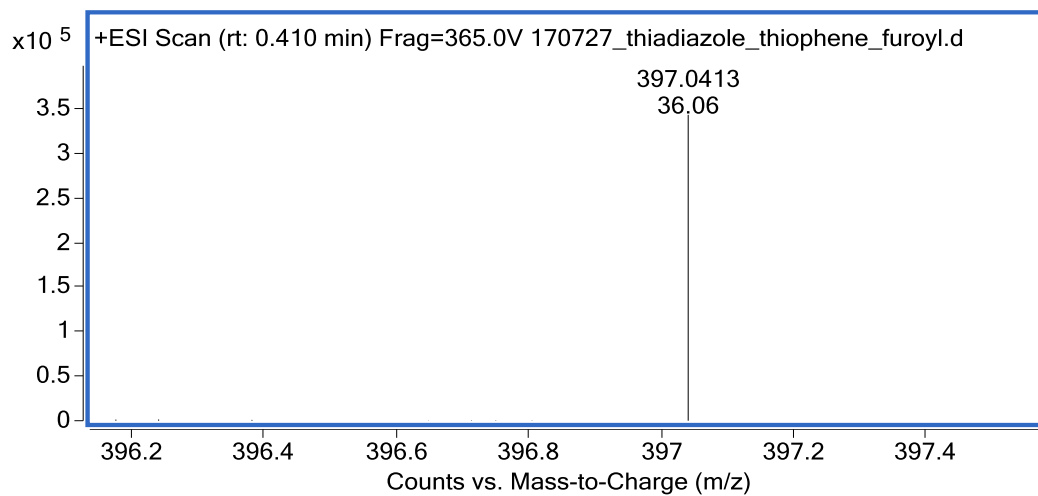


HR/MS – 19{3,1}

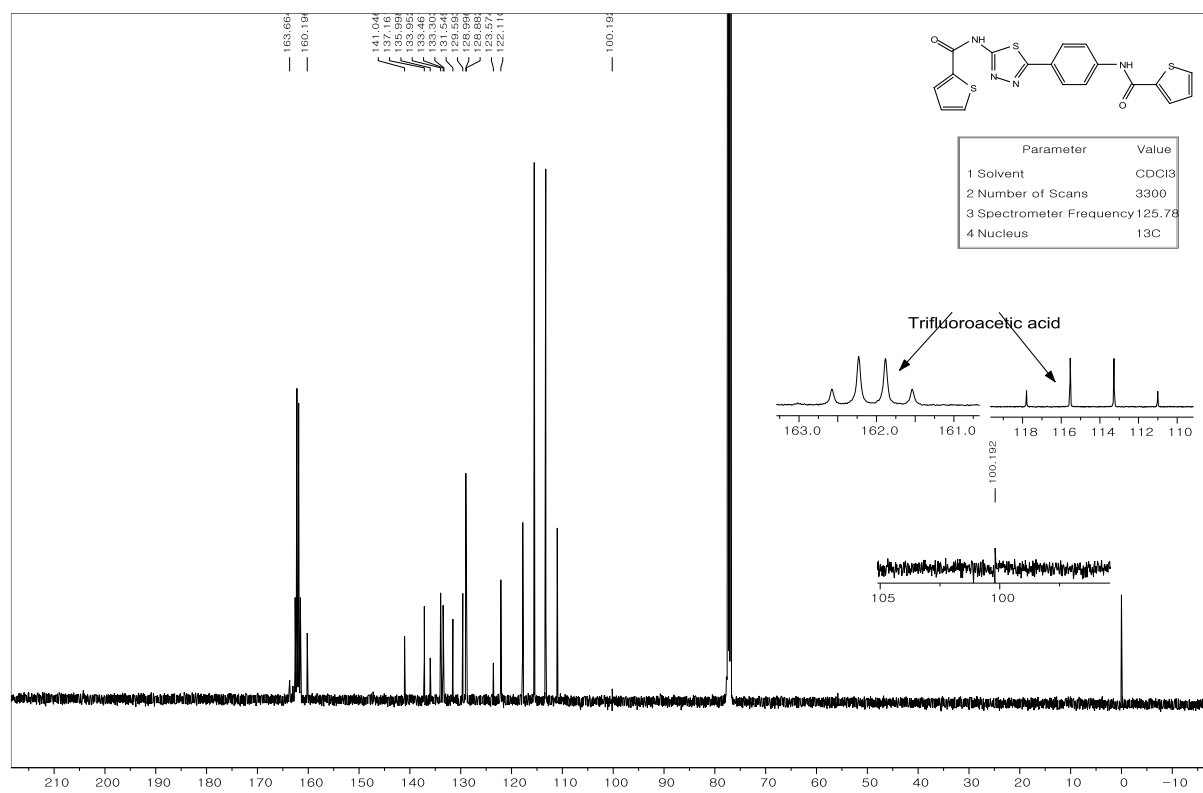
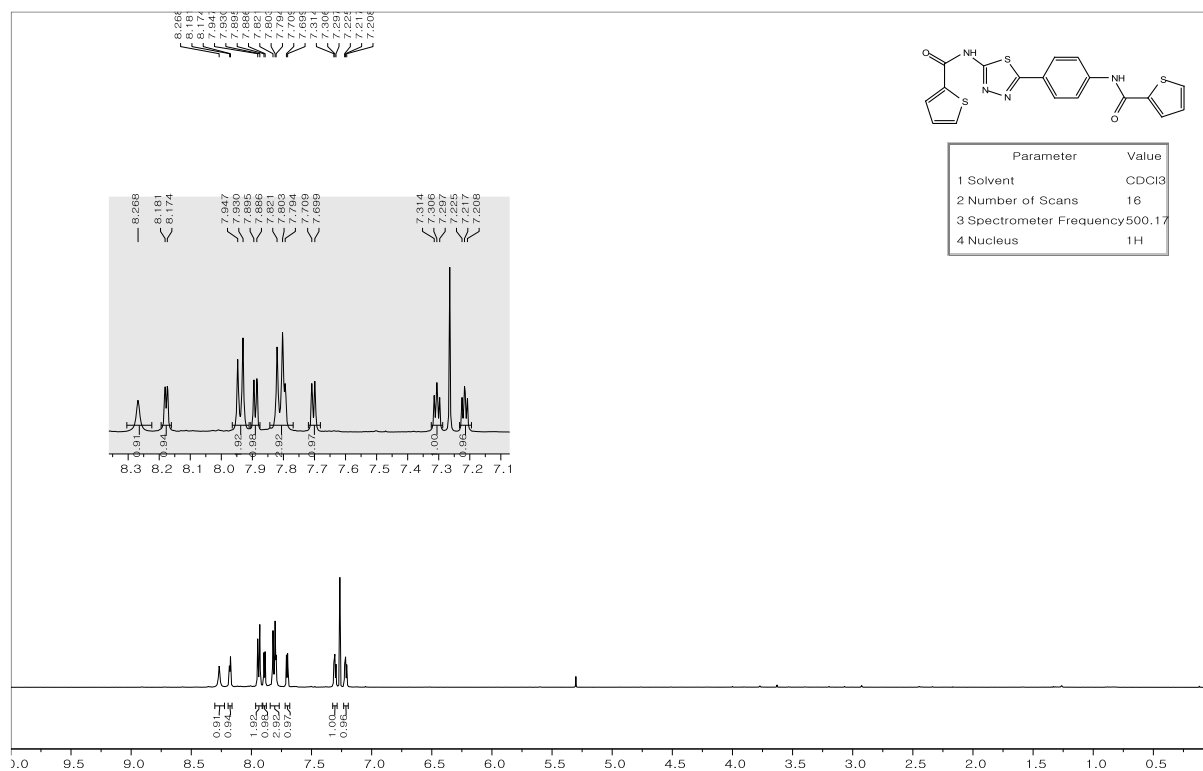


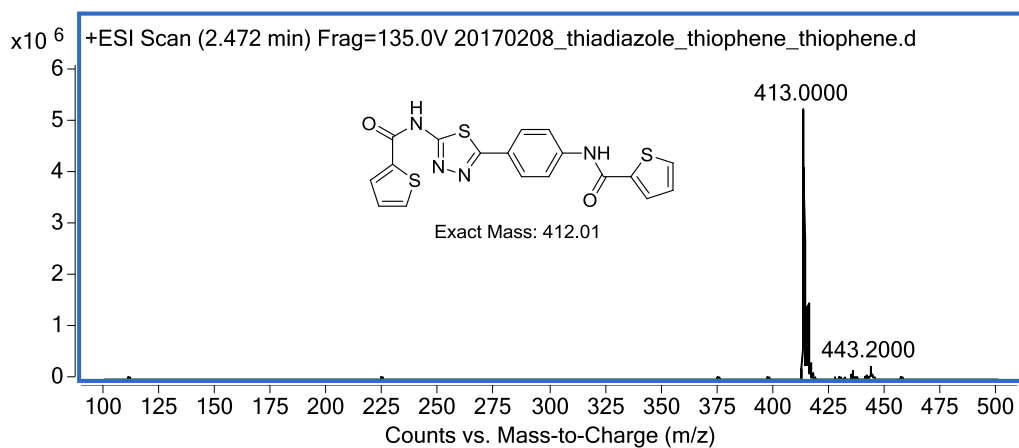
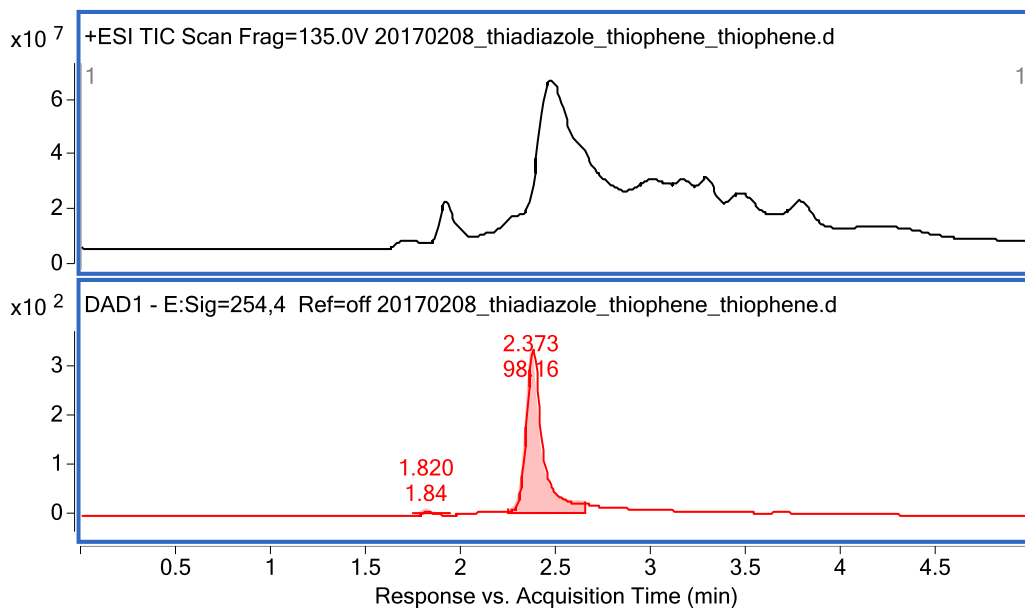


LC/MS – 19{3,2}

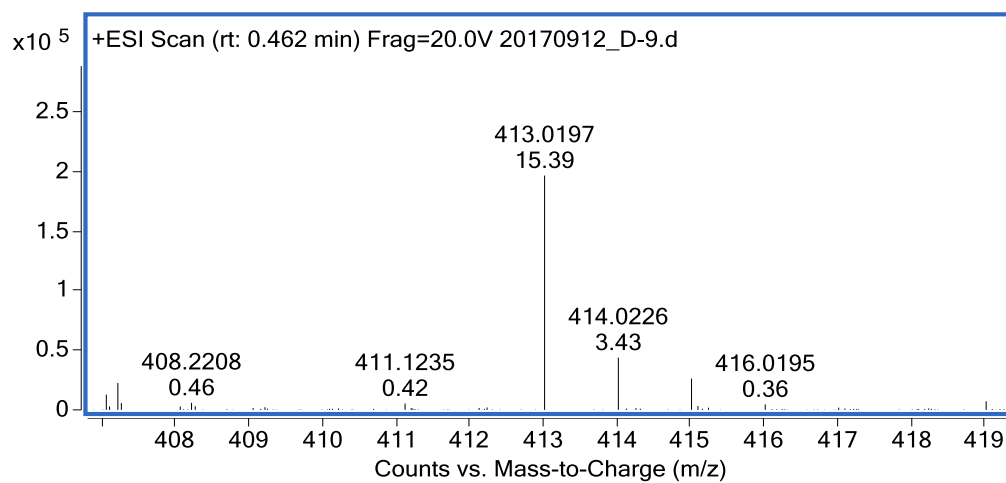


HR/MS – 19{3,2}

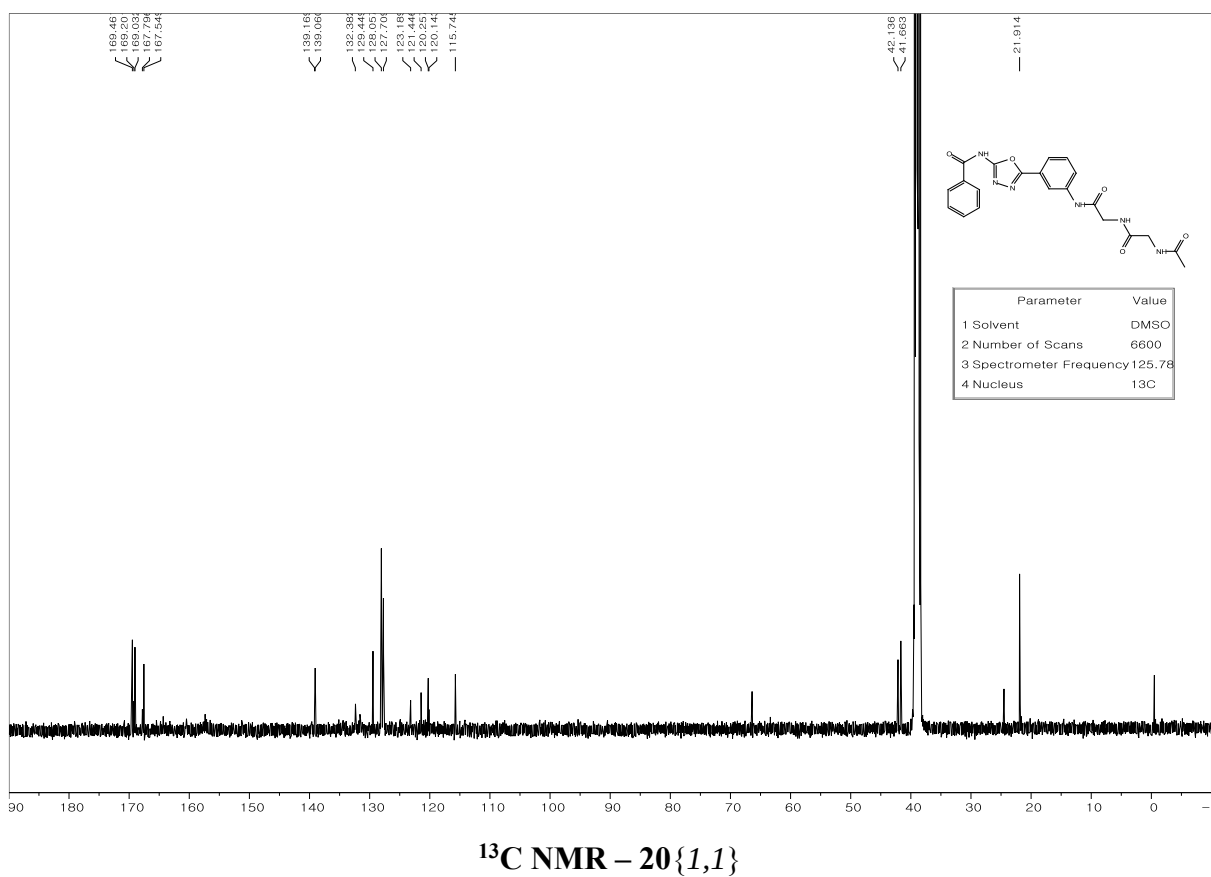
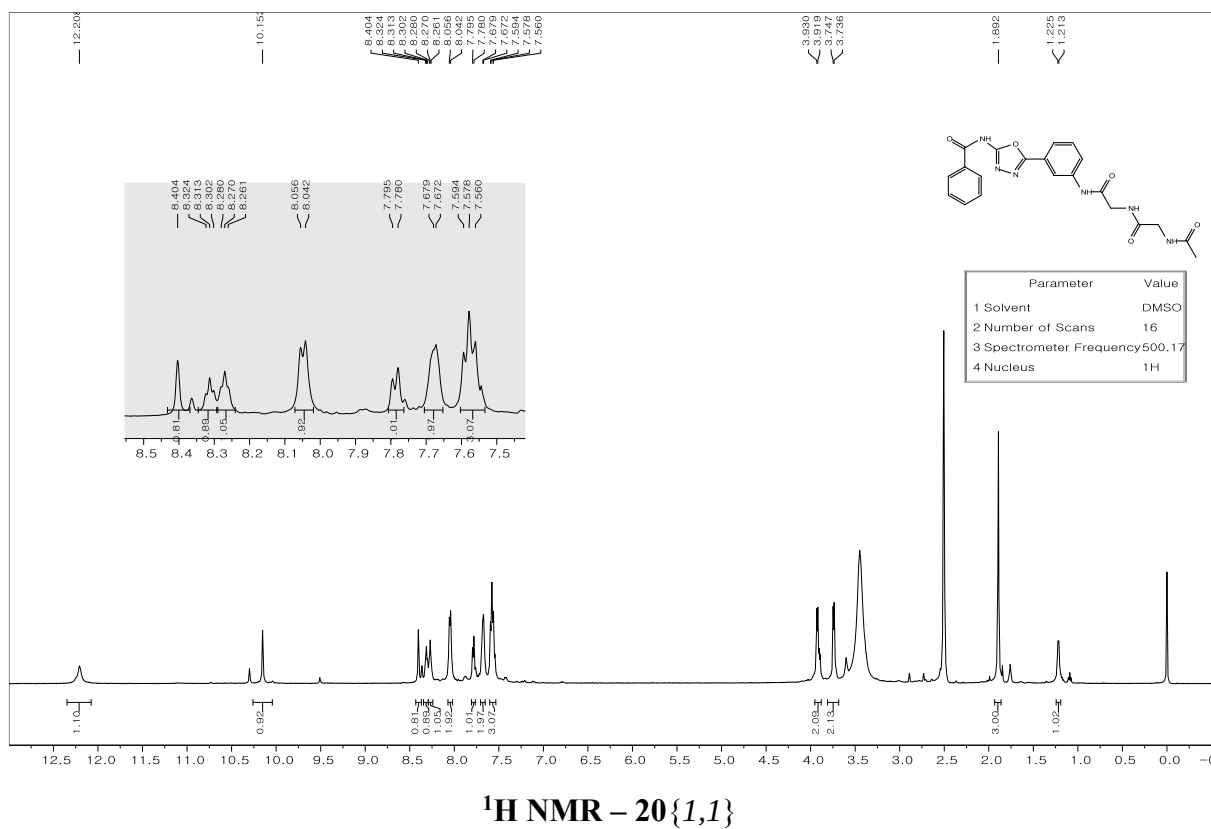


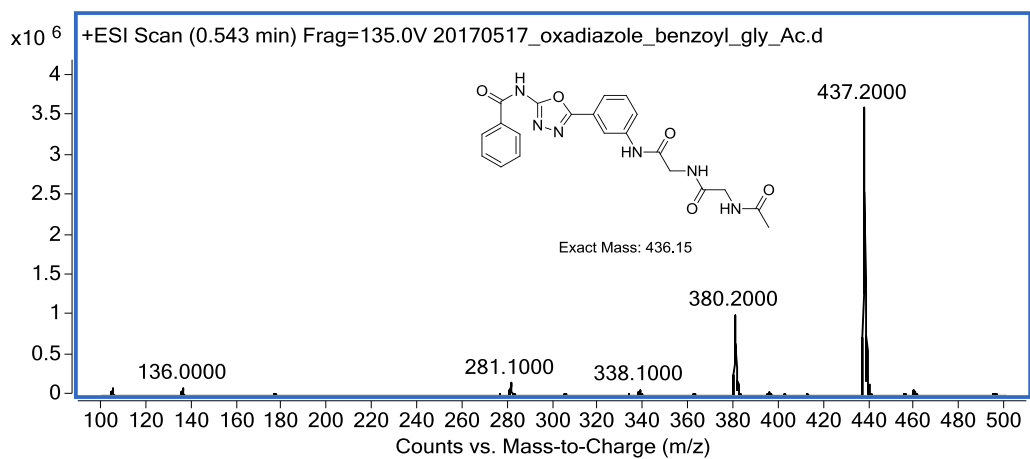
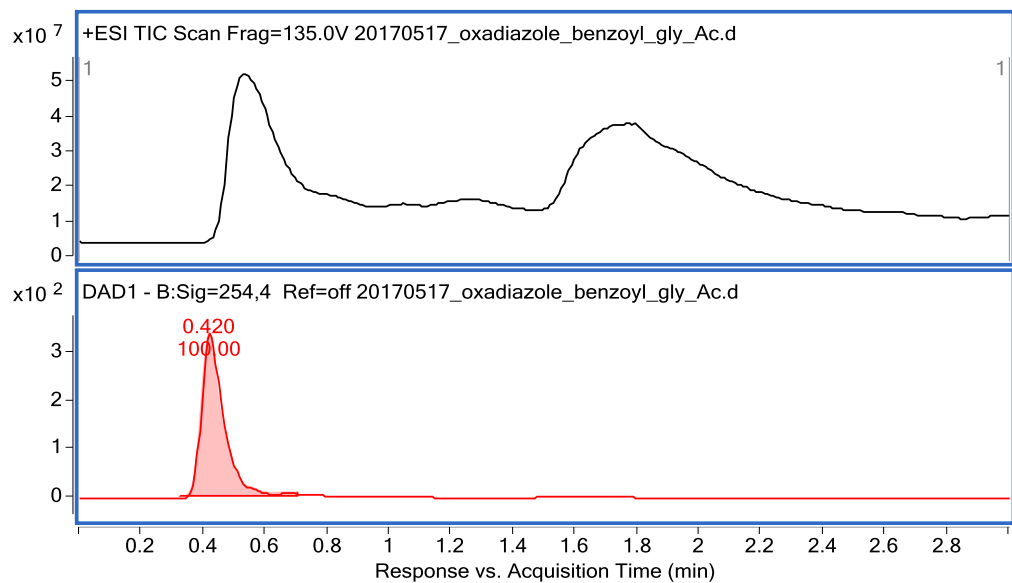


LC/MS – 19{3,3}

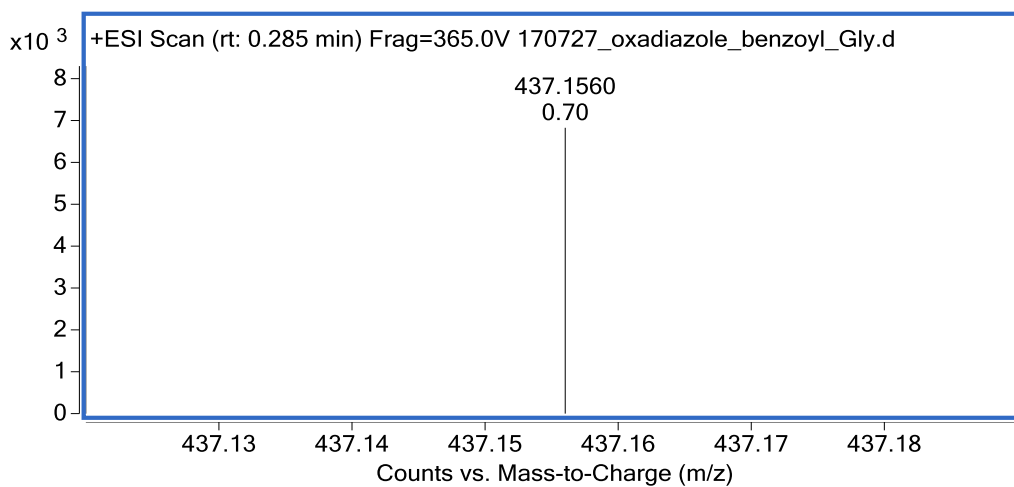


HR/MS – 19{3,3}

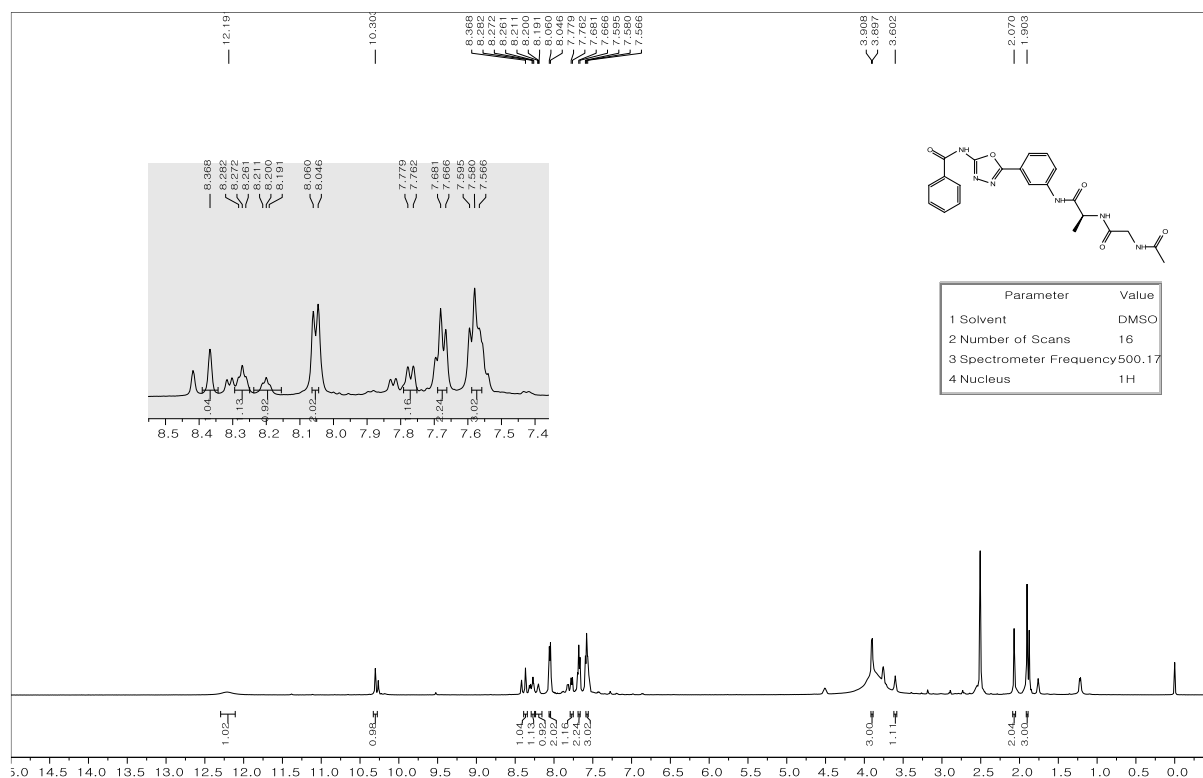




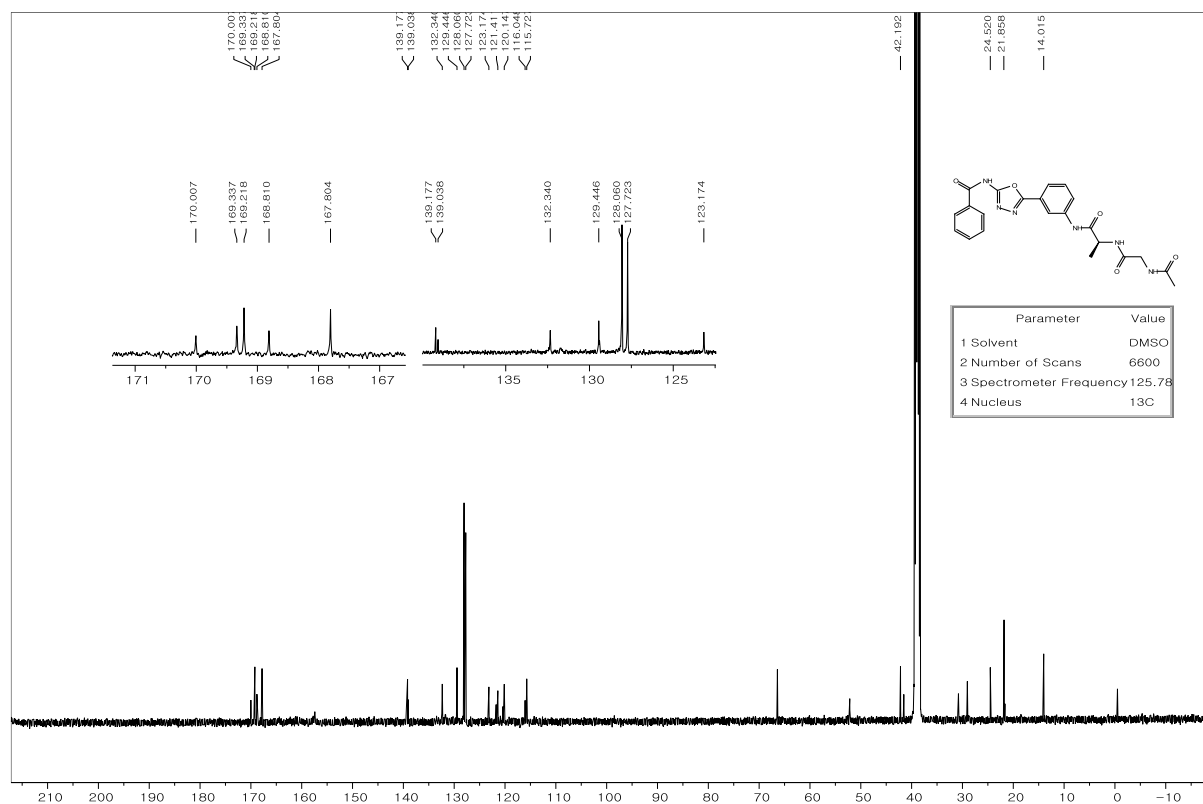
LC/MS – 20{1,1}



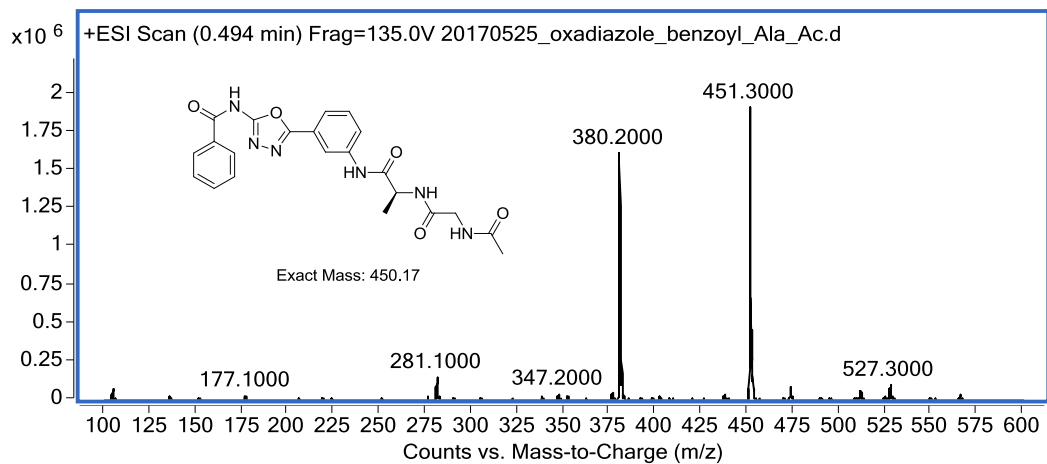
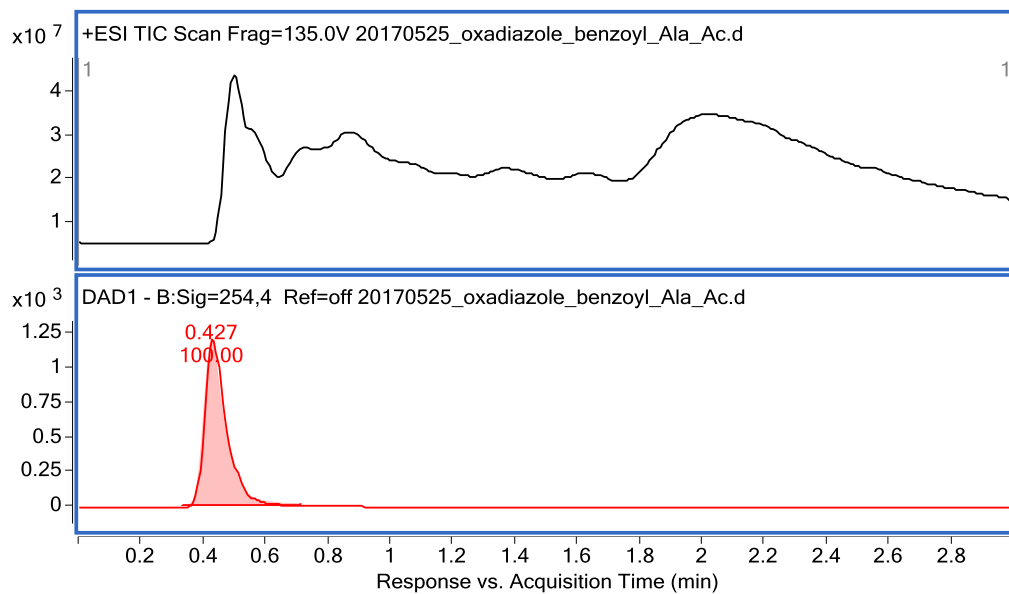
HR/MS – 20{1,1}



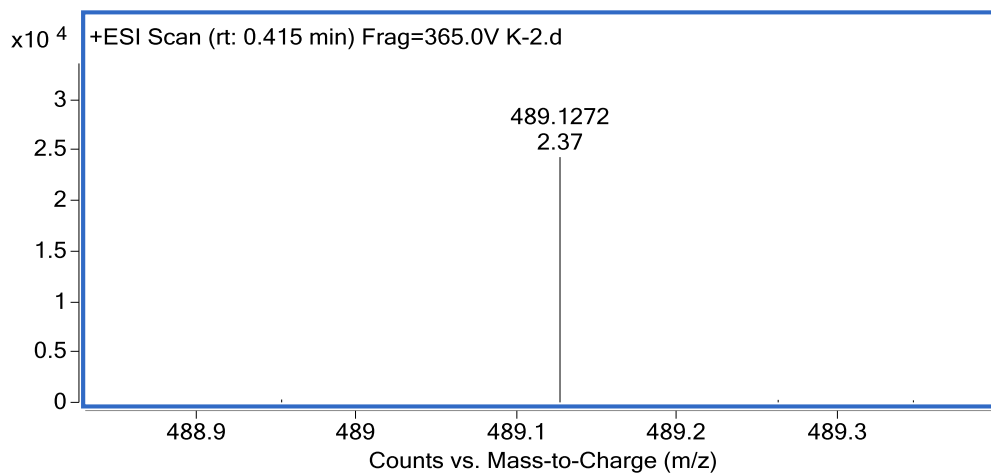
¹H NMR – 20{1,2}



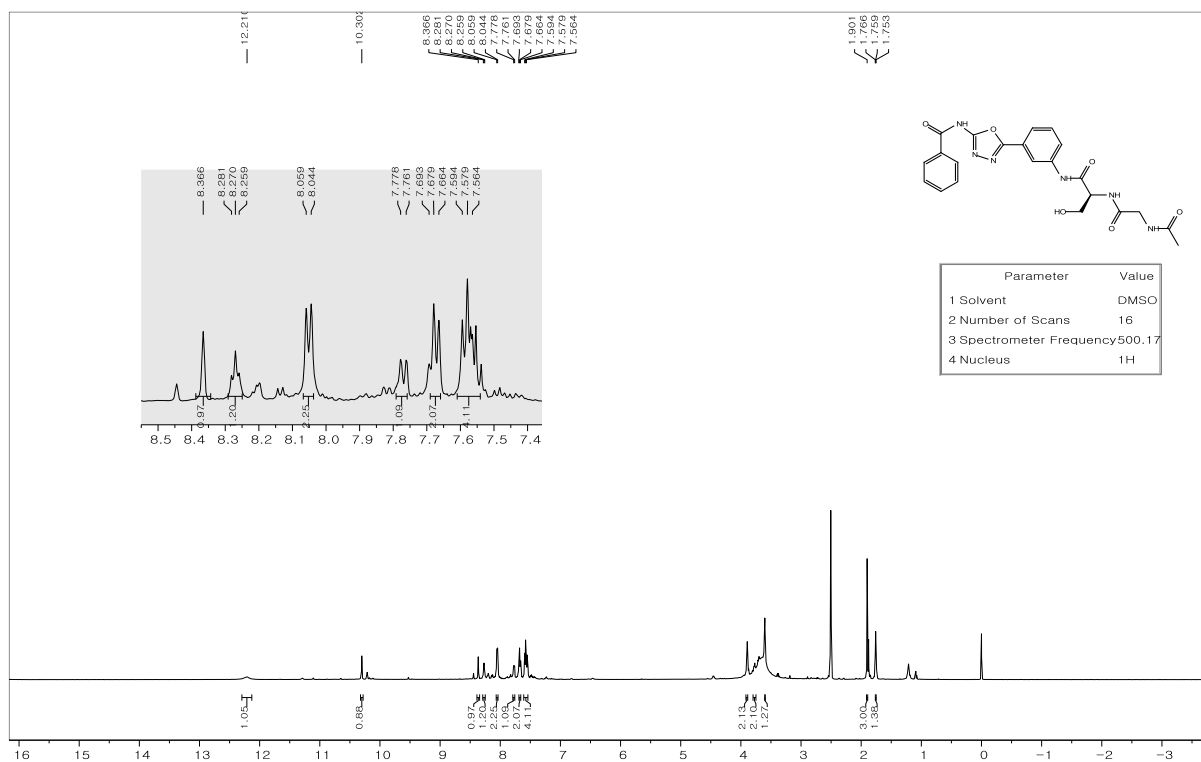
¹³C NMR – 20{1,2}



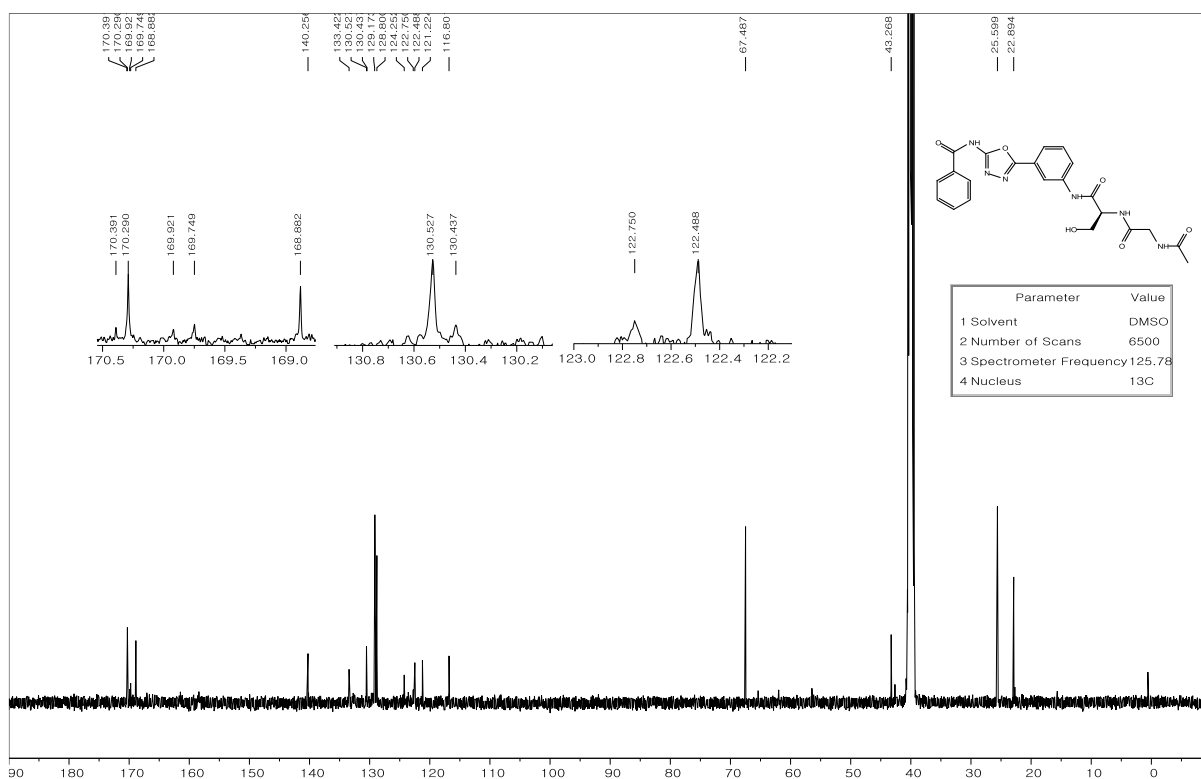
LC/MS – 20{1,2}



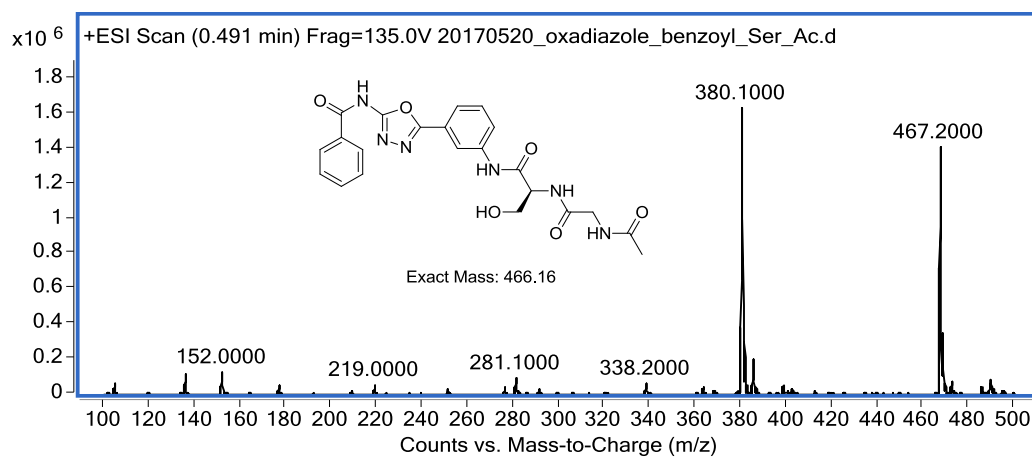
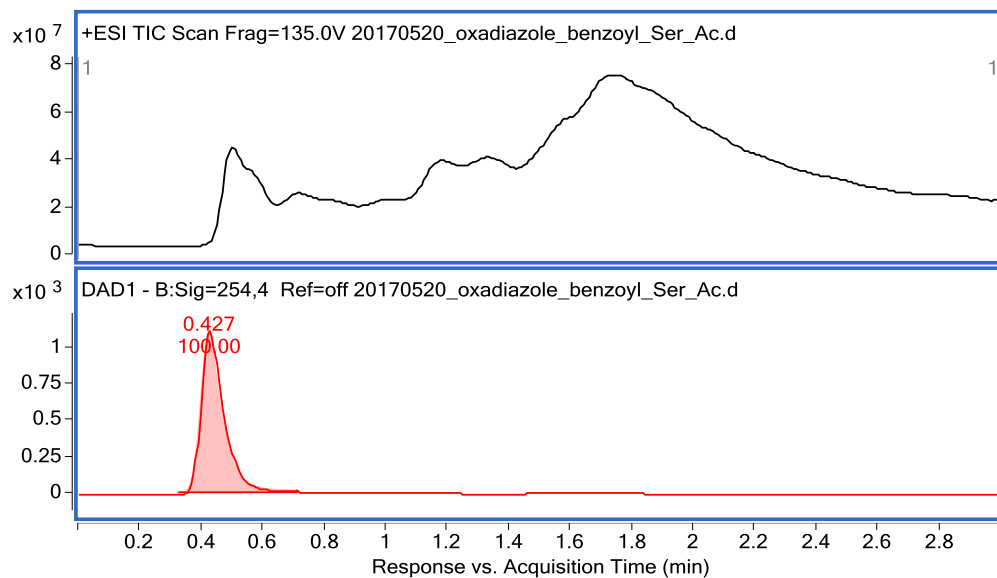
HR/MS – 20{1,2}



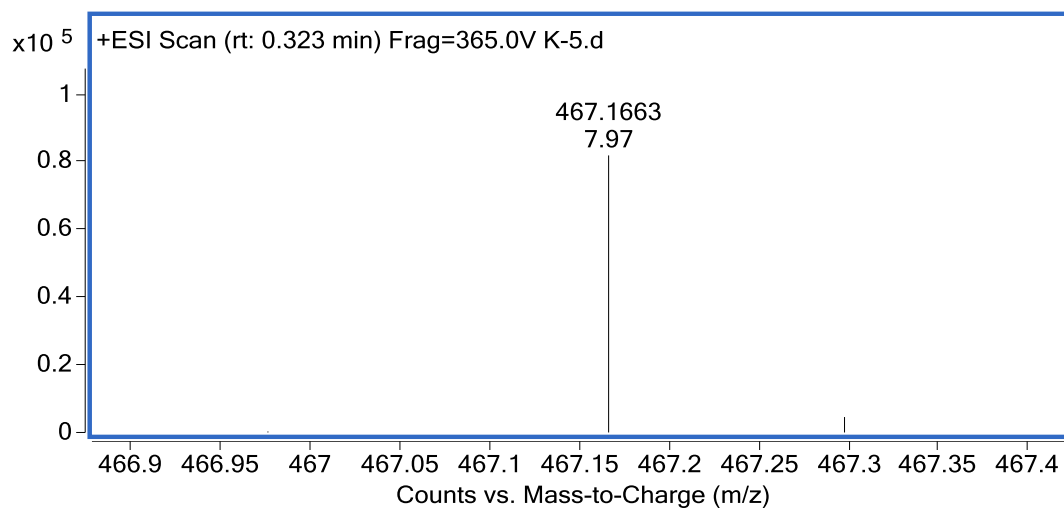
¹H NMR – 20{1,3}



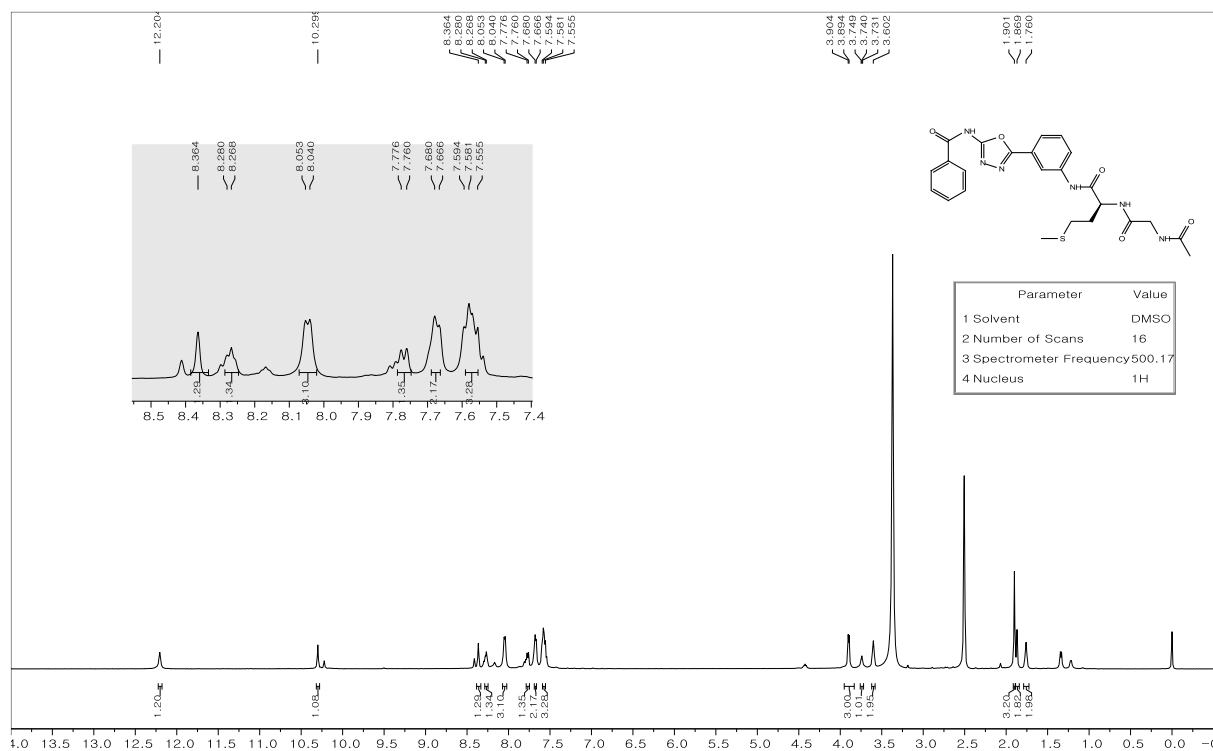
¹³C NMR – 20{1,3}



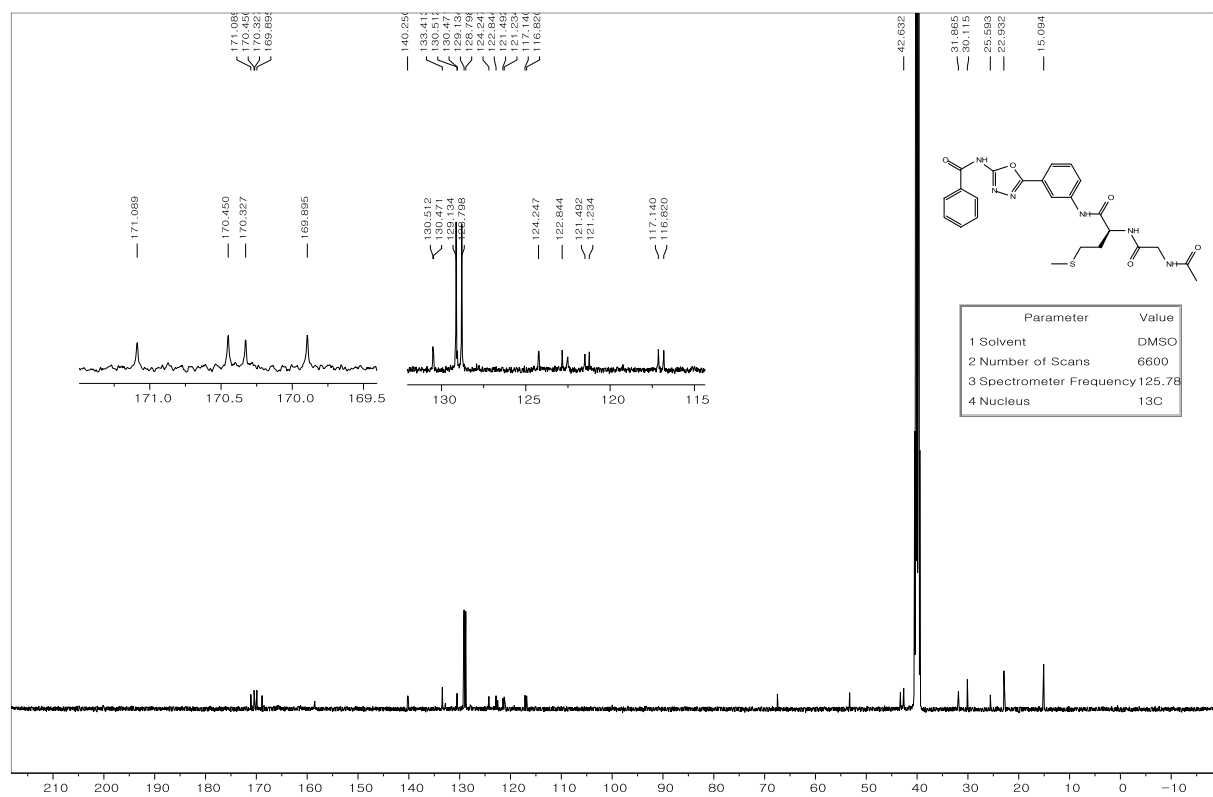
LC/MS – 20{1,3}



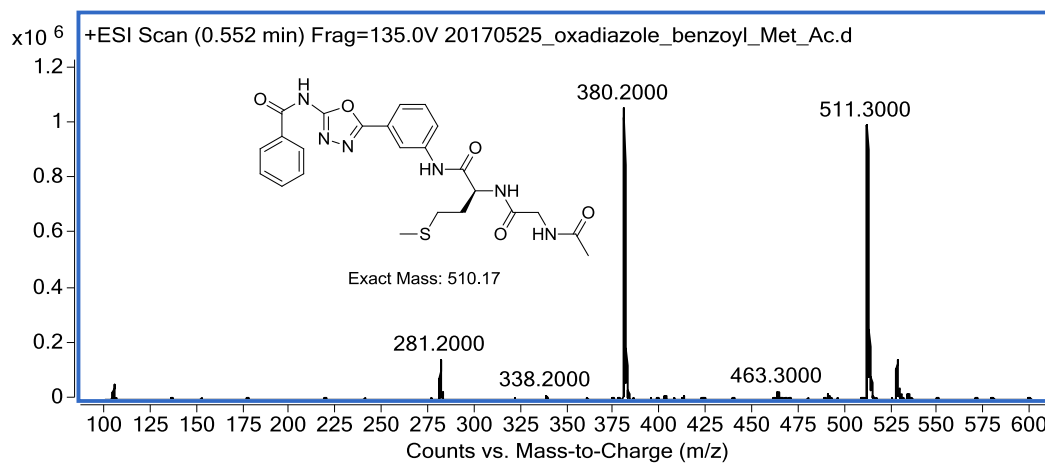
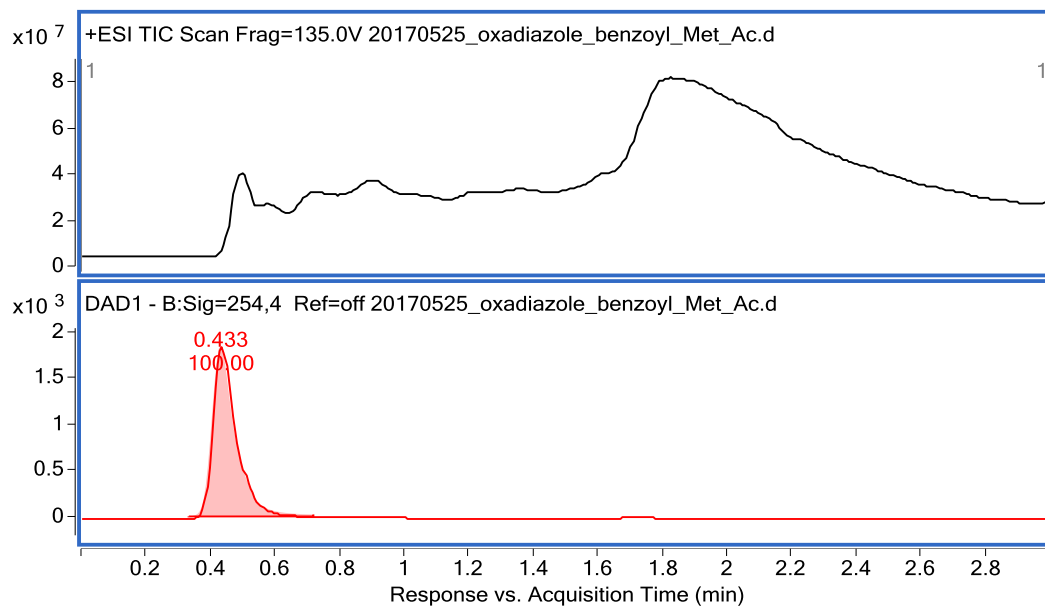
HR/MS – 20{1,3}



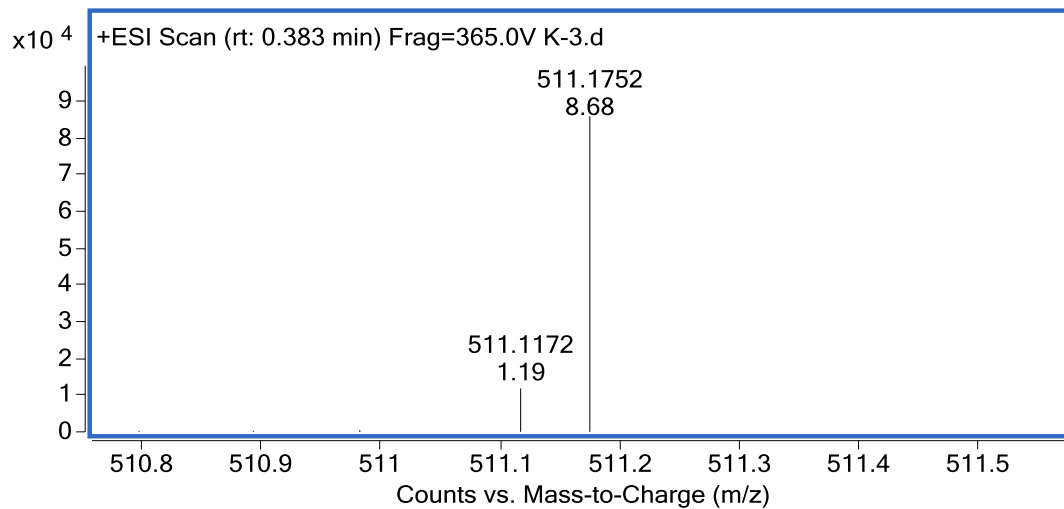
¹H NMR – 20{1,4}



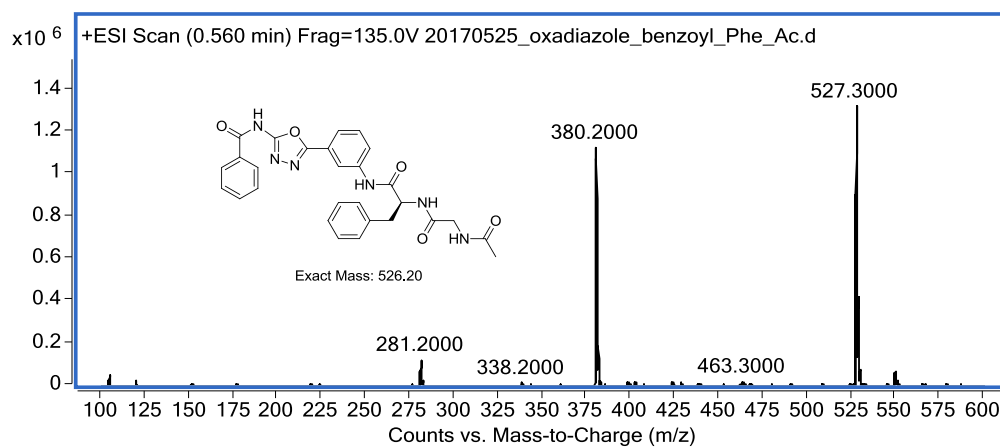
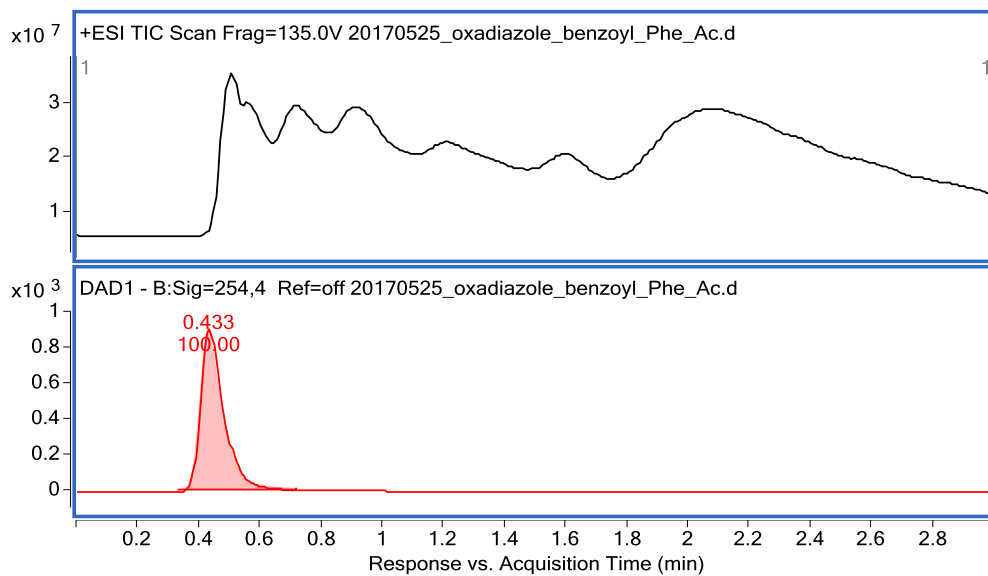
¹³C NMR – 20{1,4}



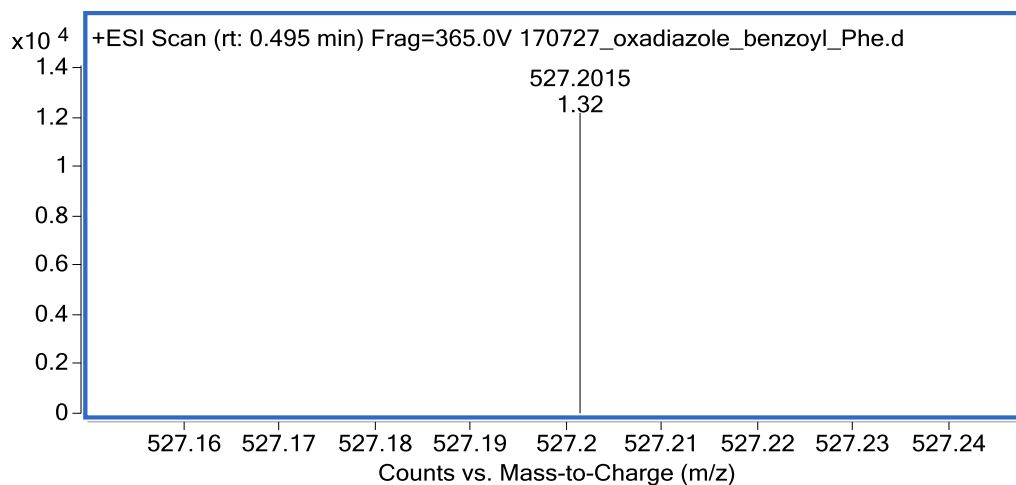
LC/MS – 20{1,4}



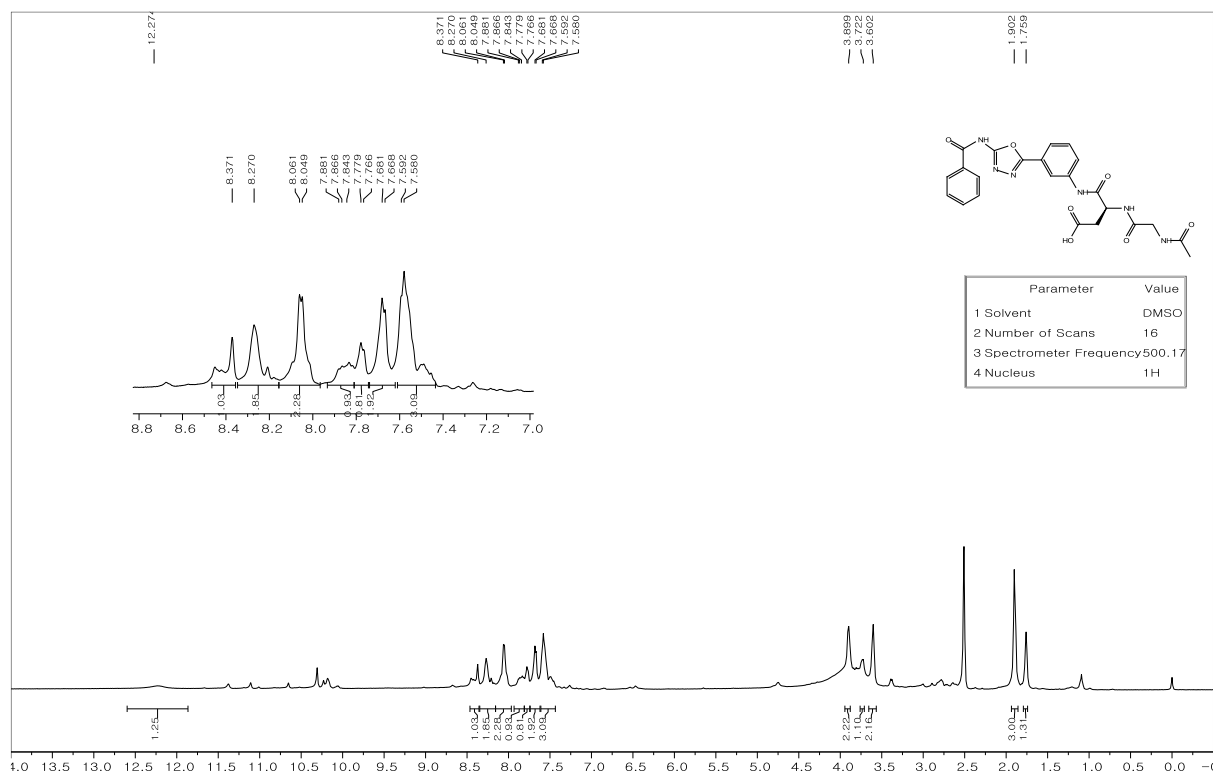
HR/MS – 20{1,4}



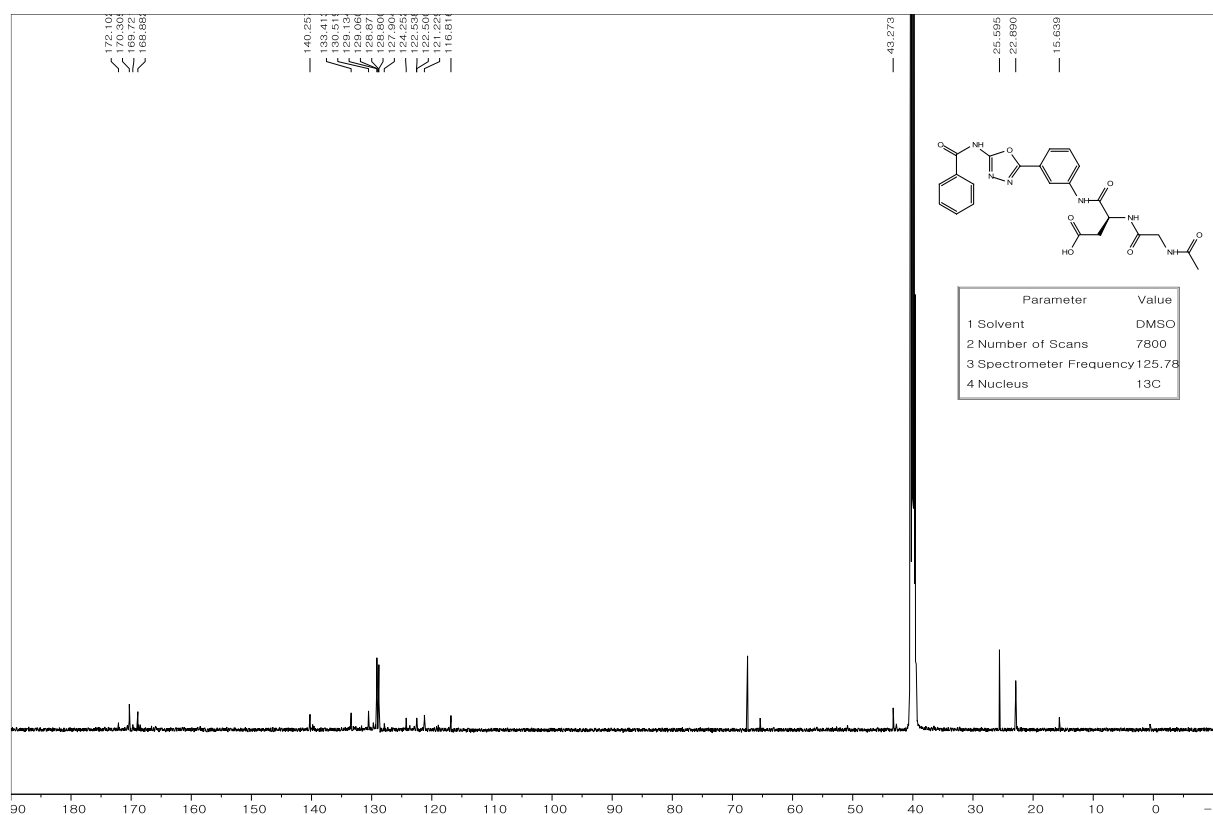
LC/MS – 20{1,5}



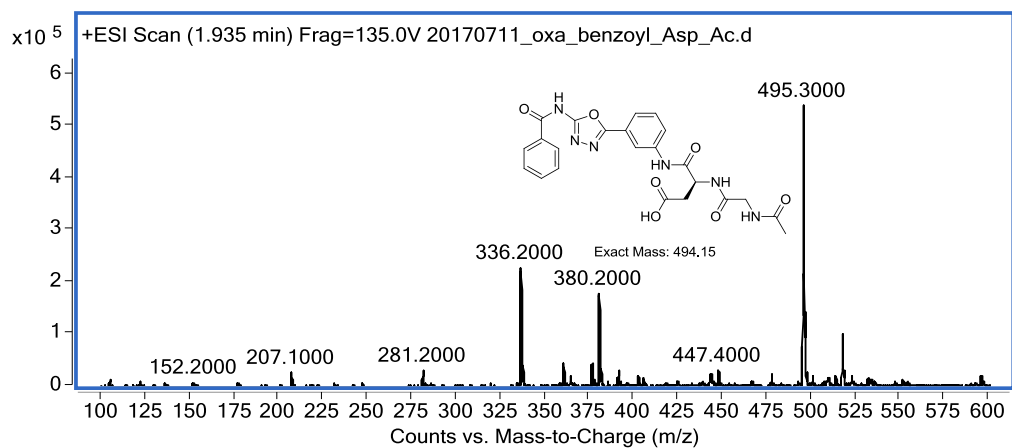
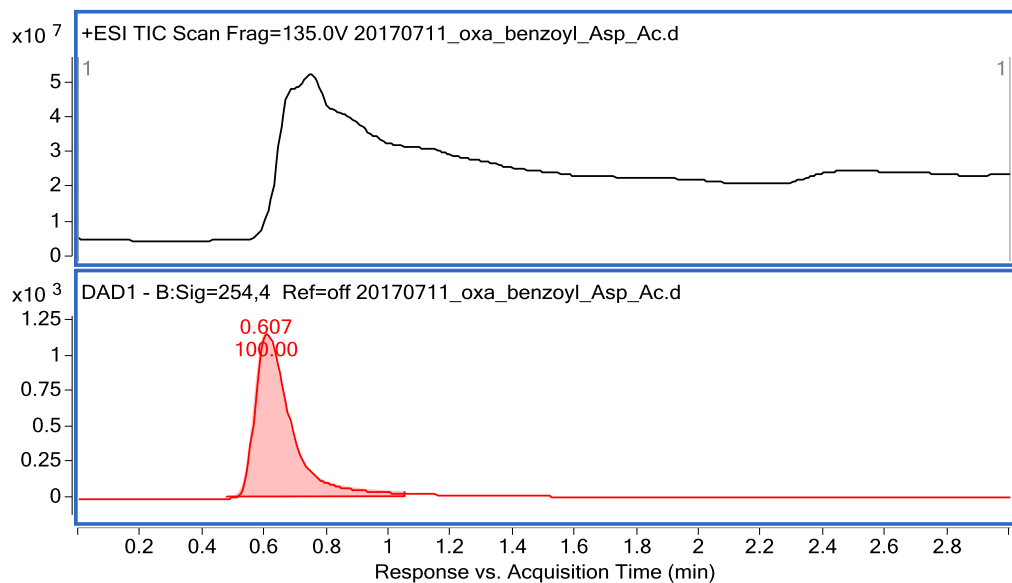
HR/MS – 20{1,5}



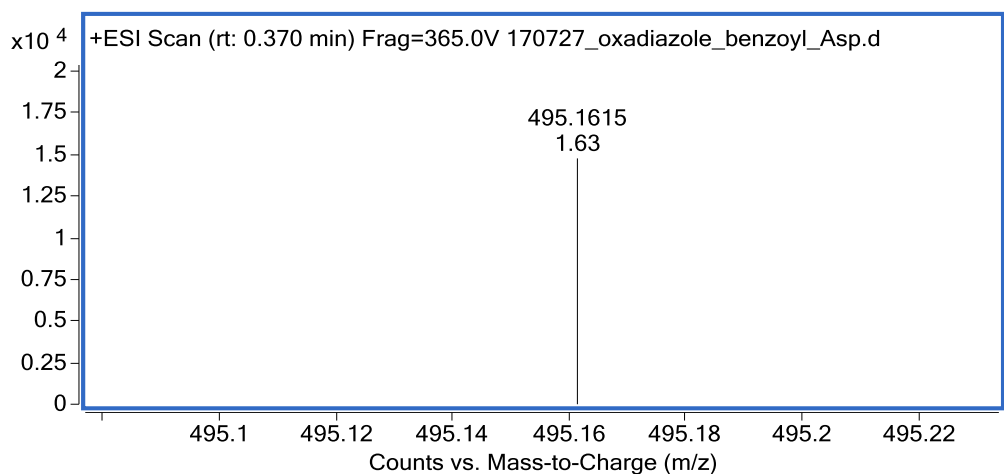
¹H NMR – 20{1,6}



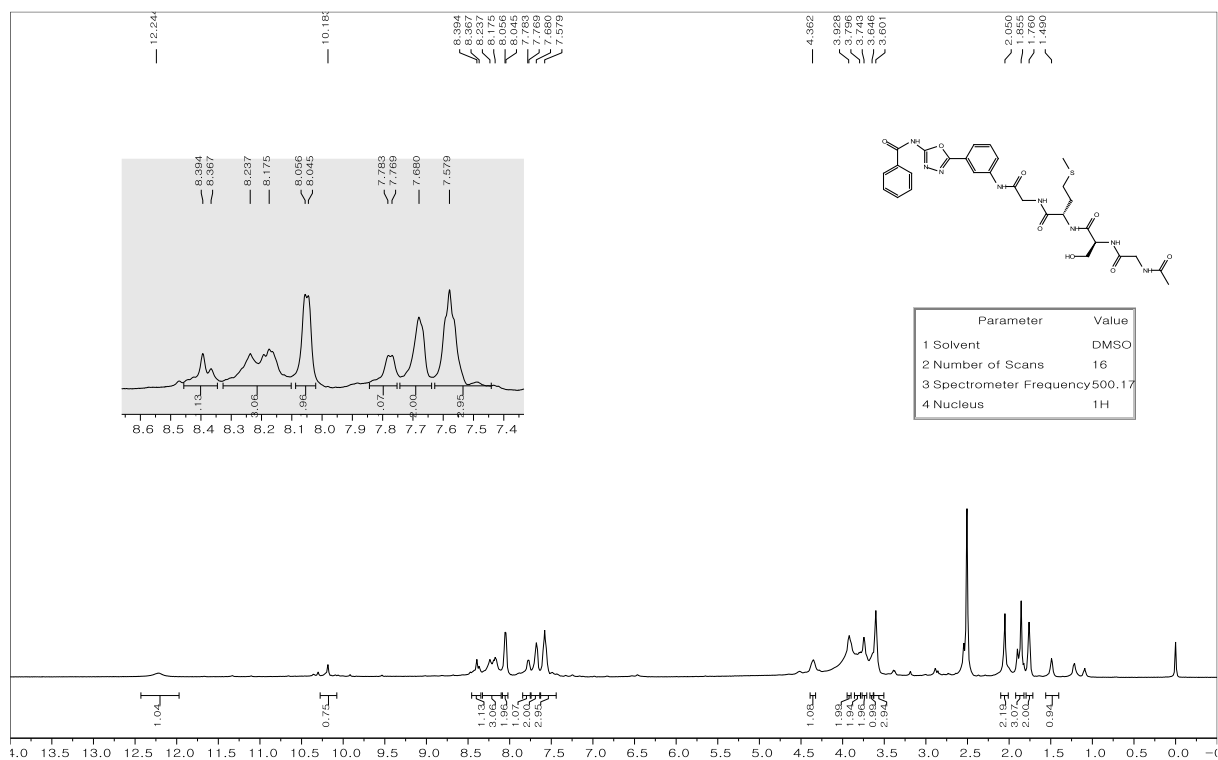
¹³C NMR – 20{1,6}



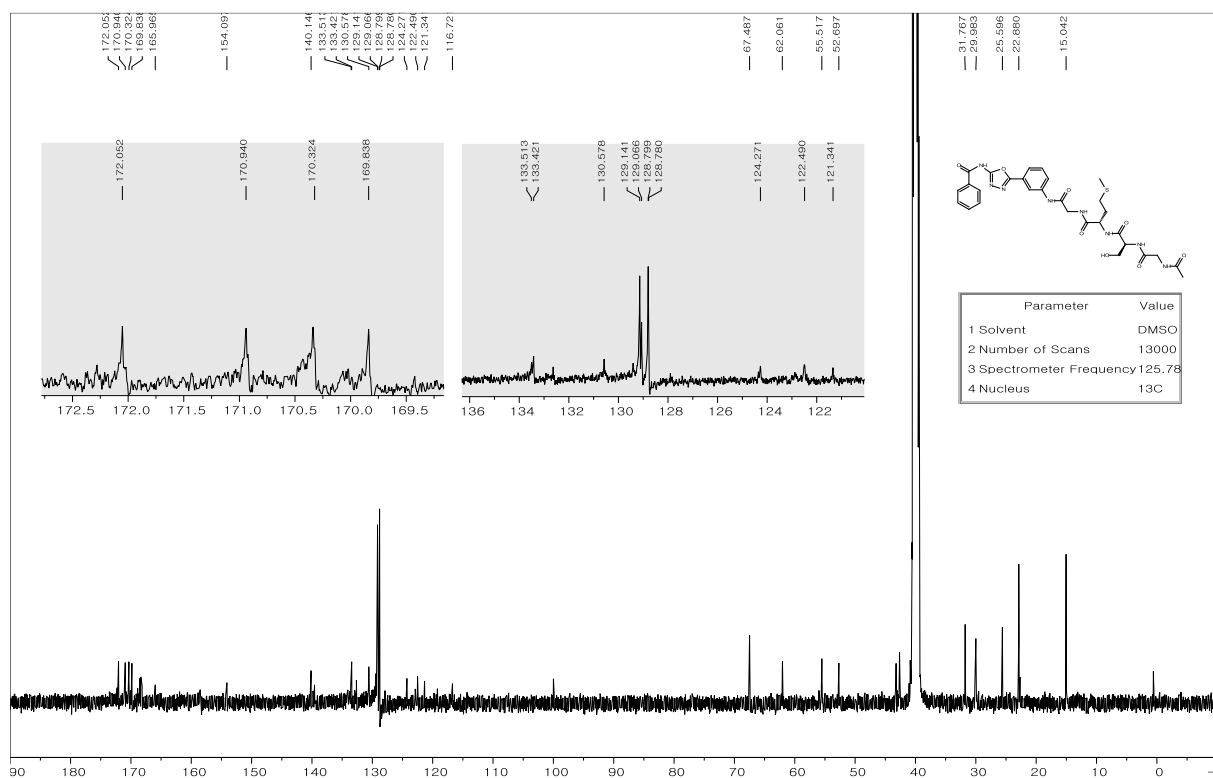
LC/MS – 20{1,6}



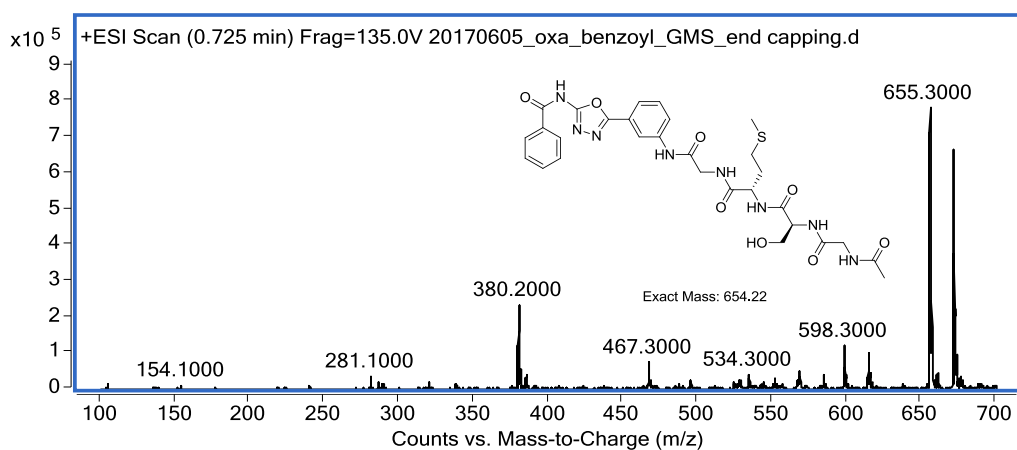
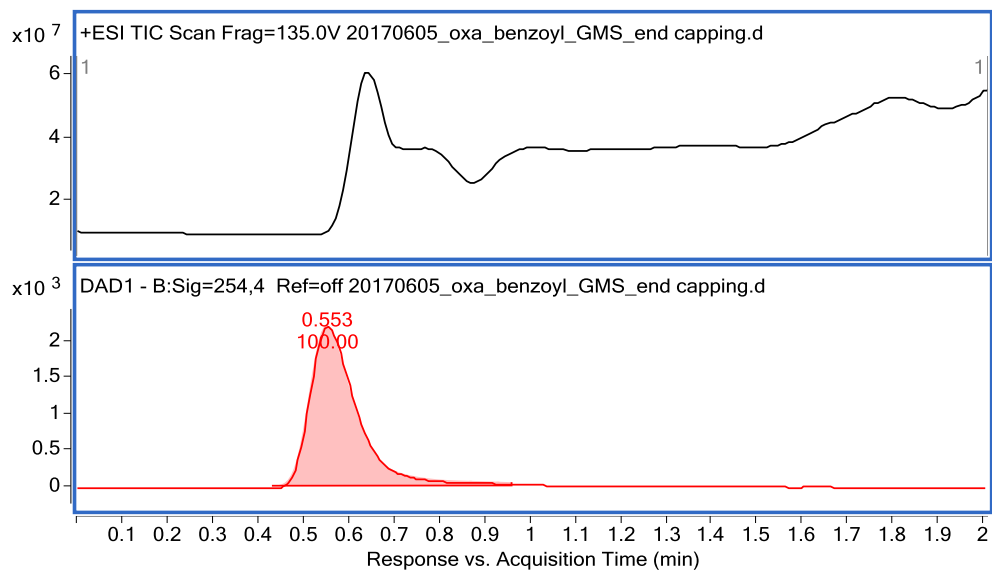
HR/MS – 20{1,6}



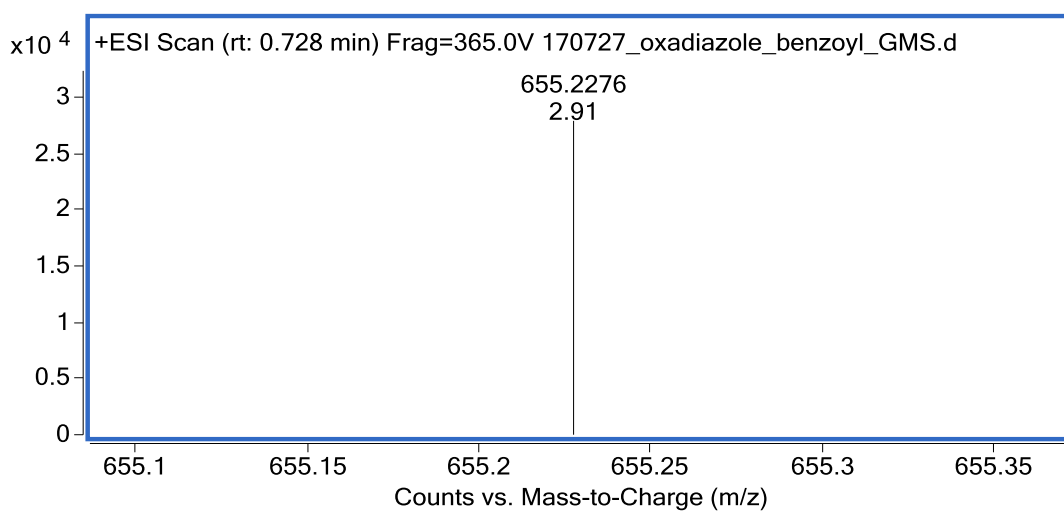
¹H NMR – 20' {1,1-4-3}



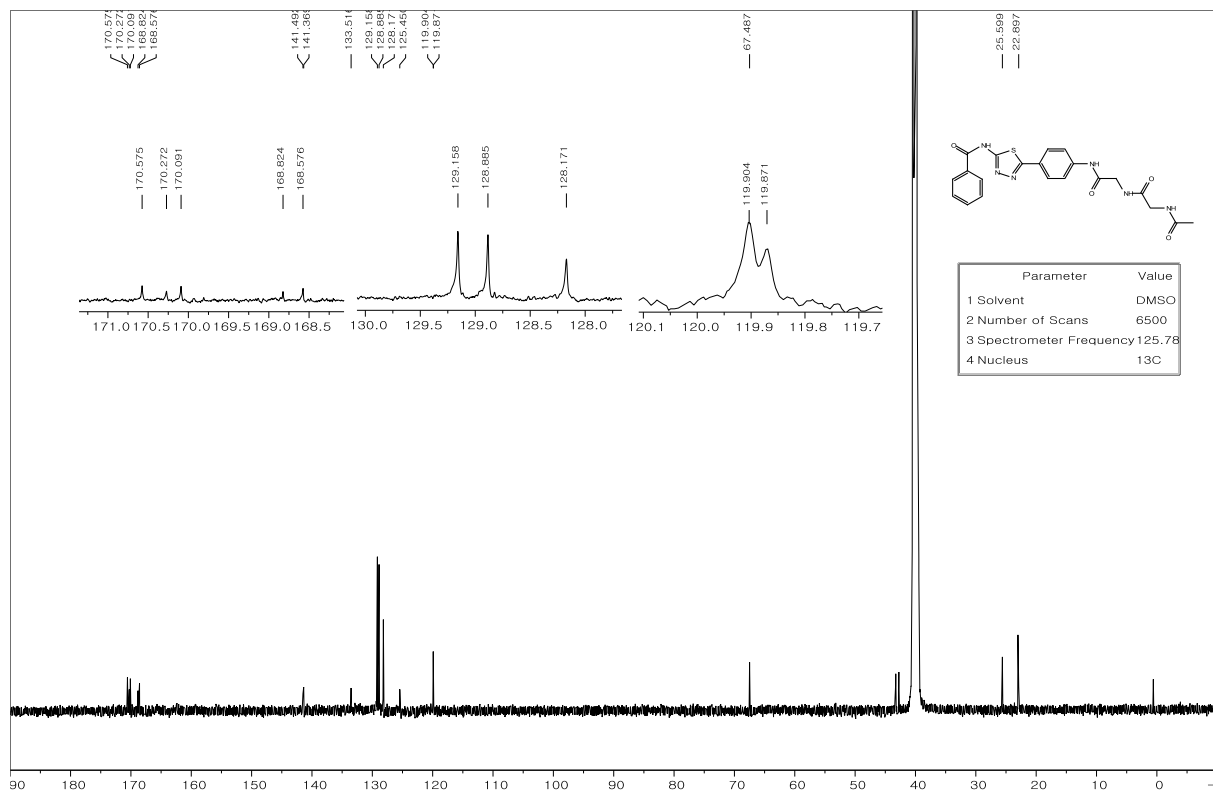
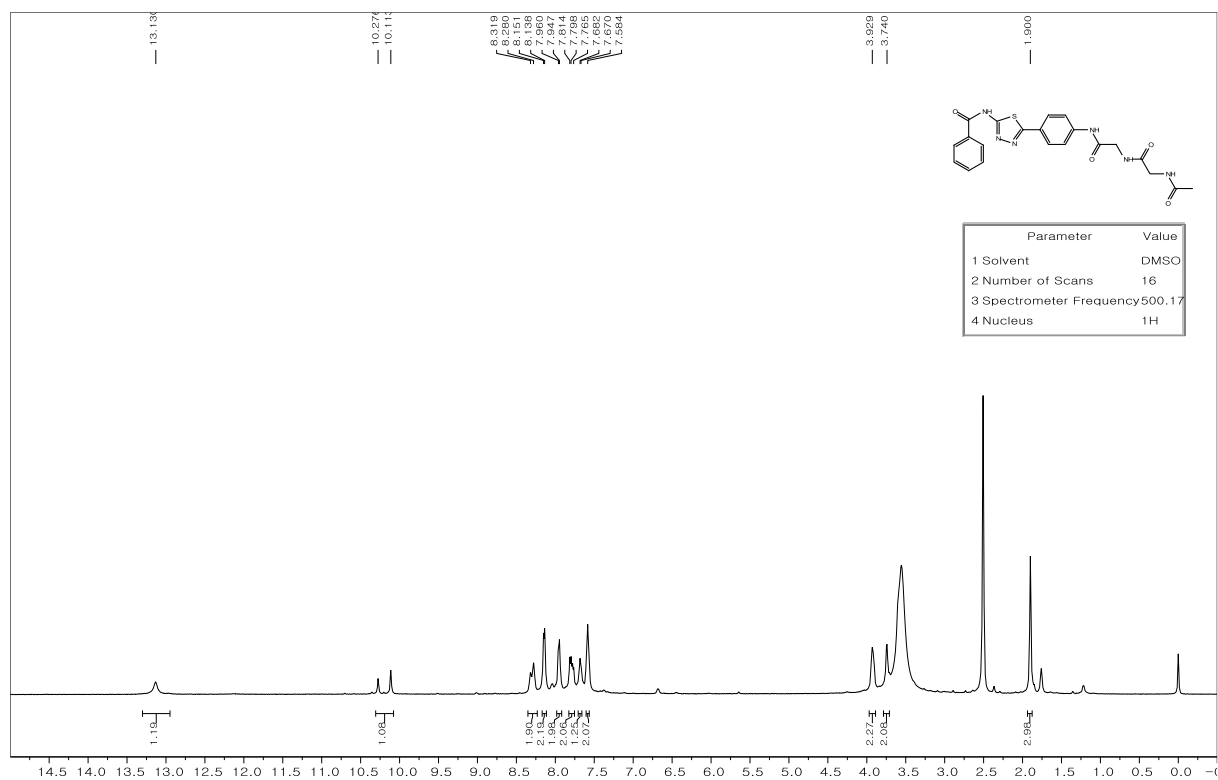
¹³C NMR – 20' {1,1-4-3}

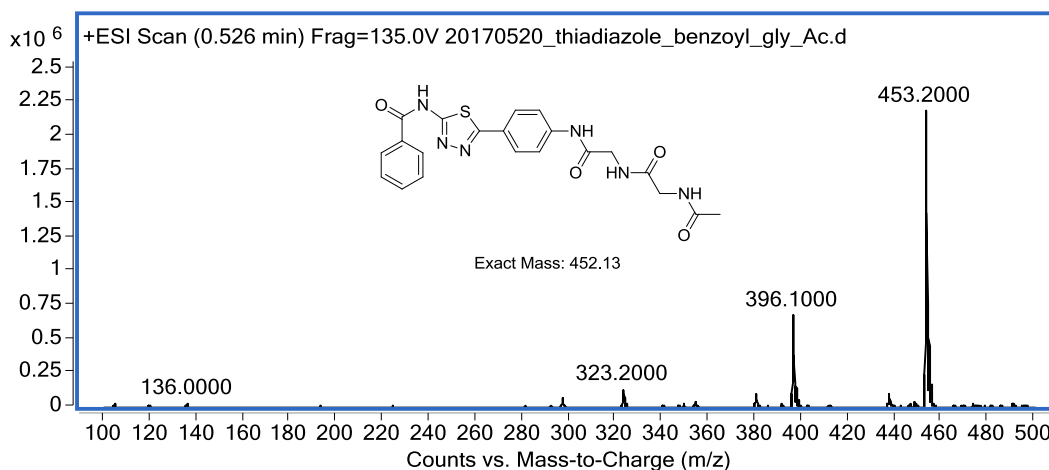
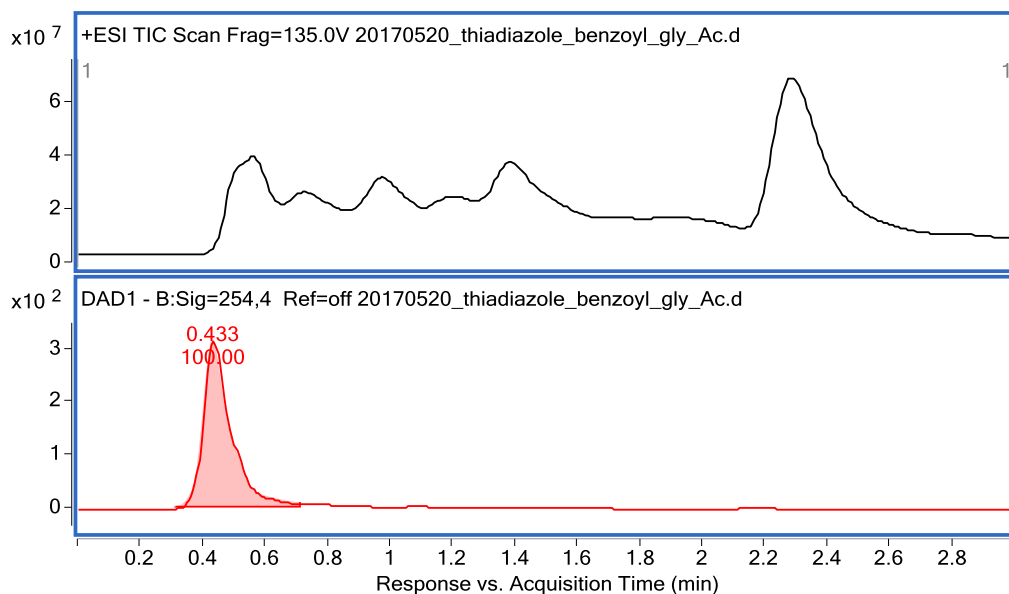


LC/MS – 20' {1,1-4-3}

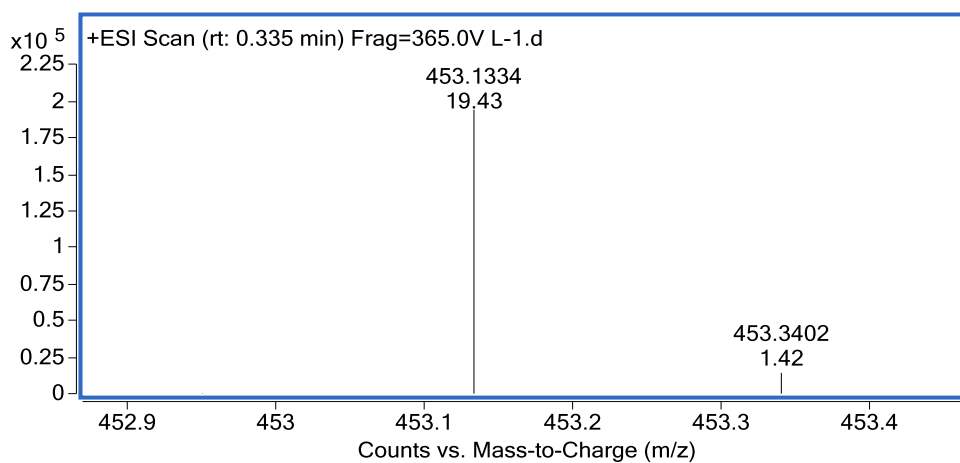


HR/MS – 20' {1,1-4-3}

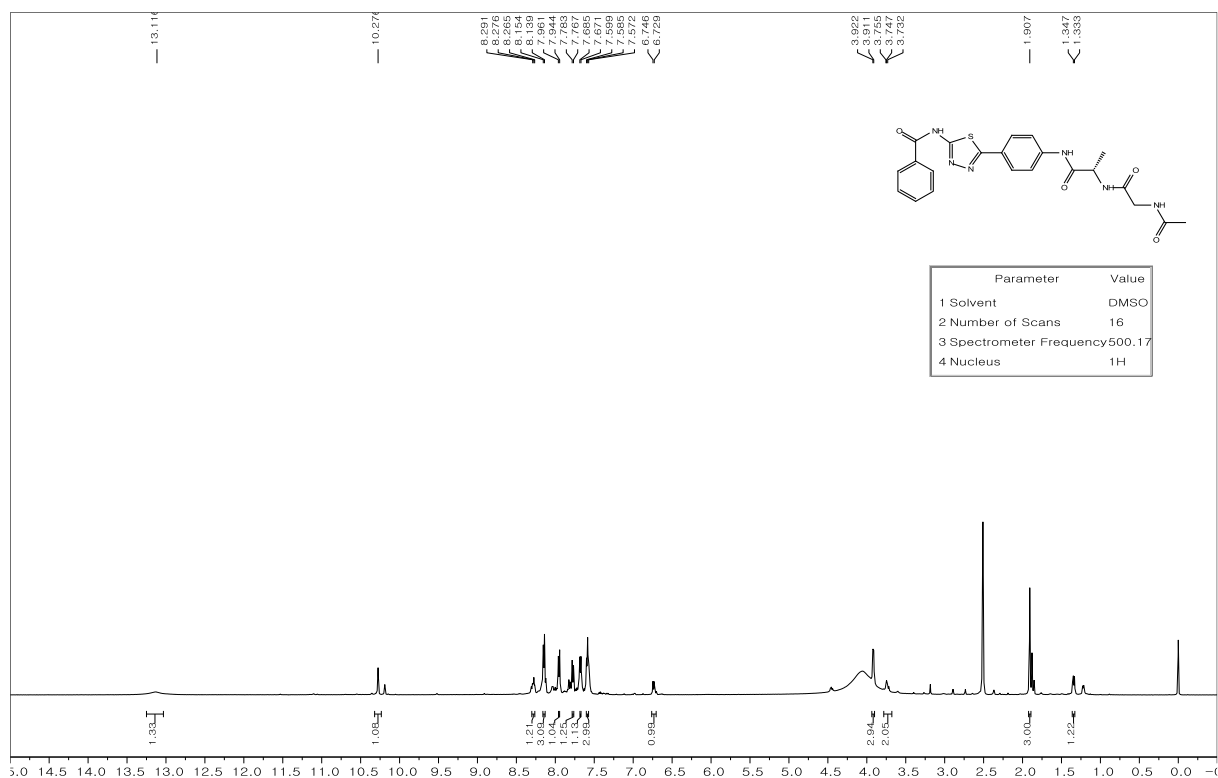




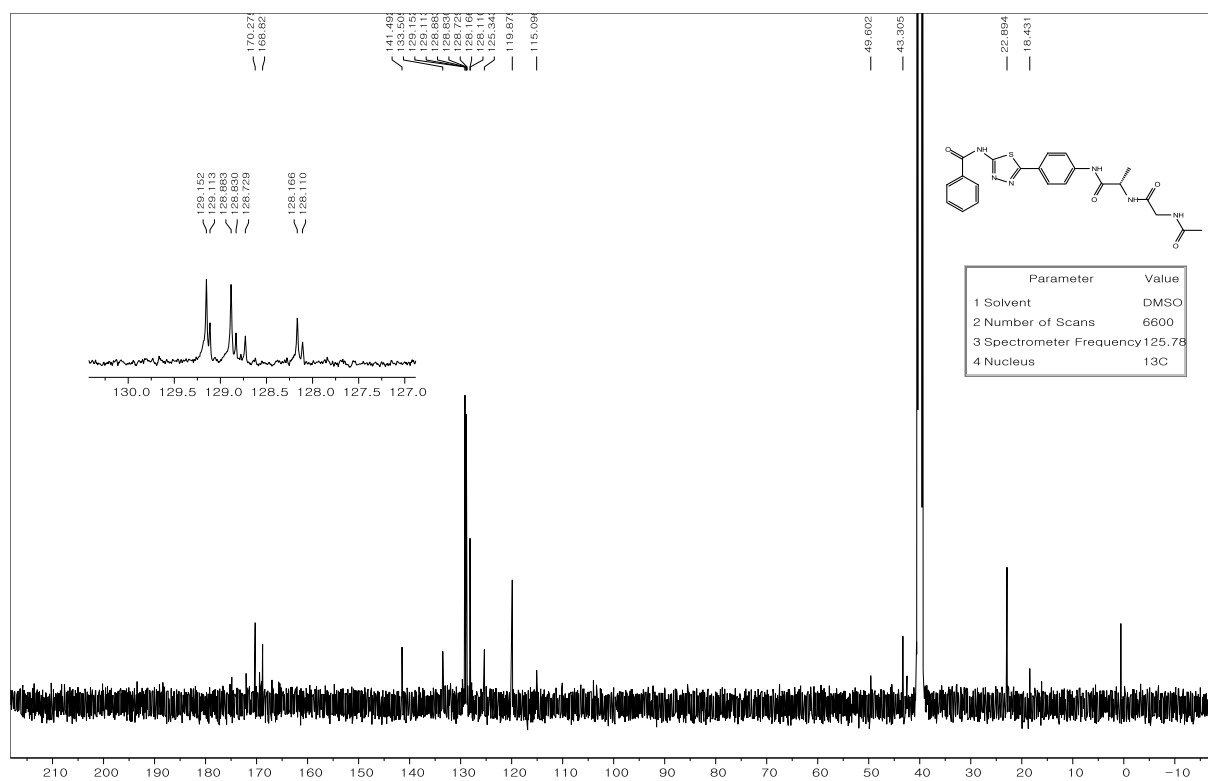
LC/MS – 21 {1,1}



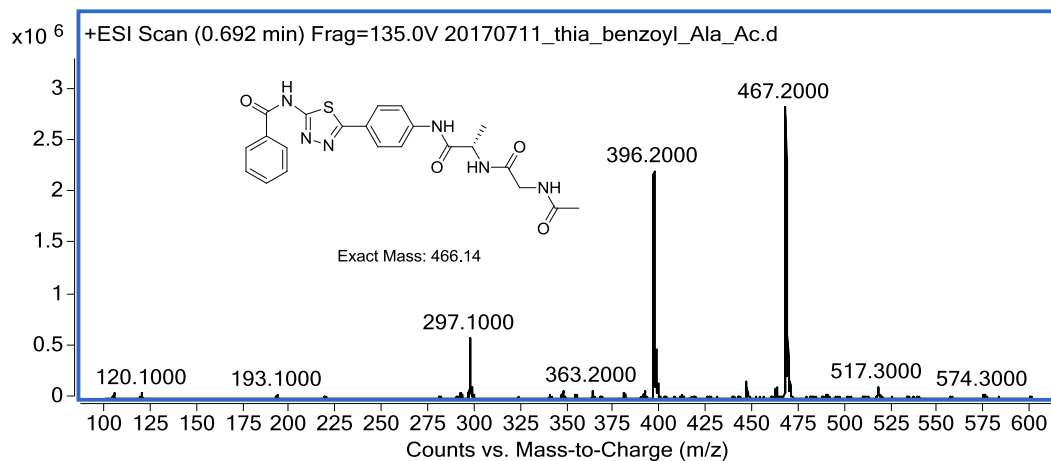
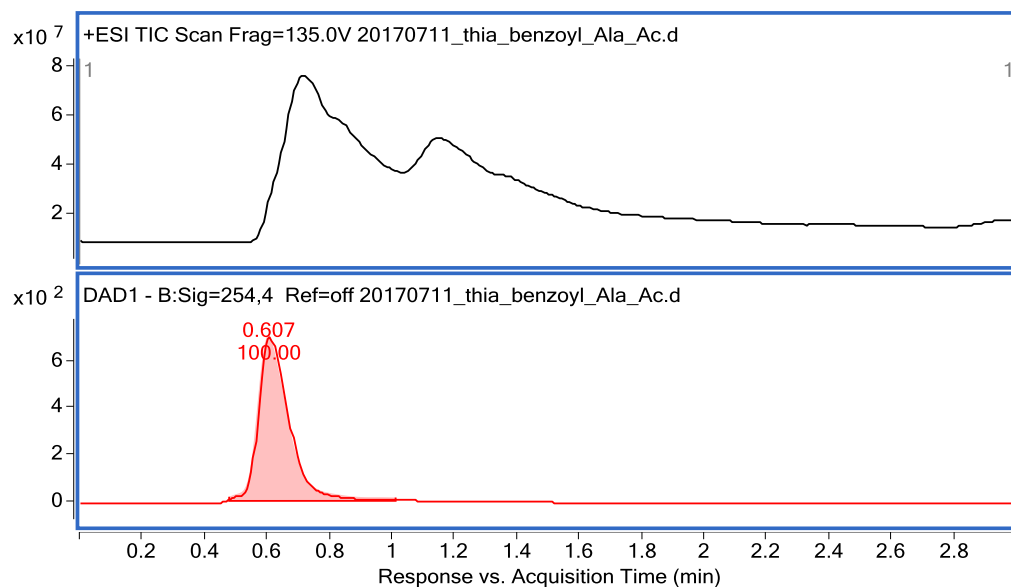
HR/MS – 21 {1,1}



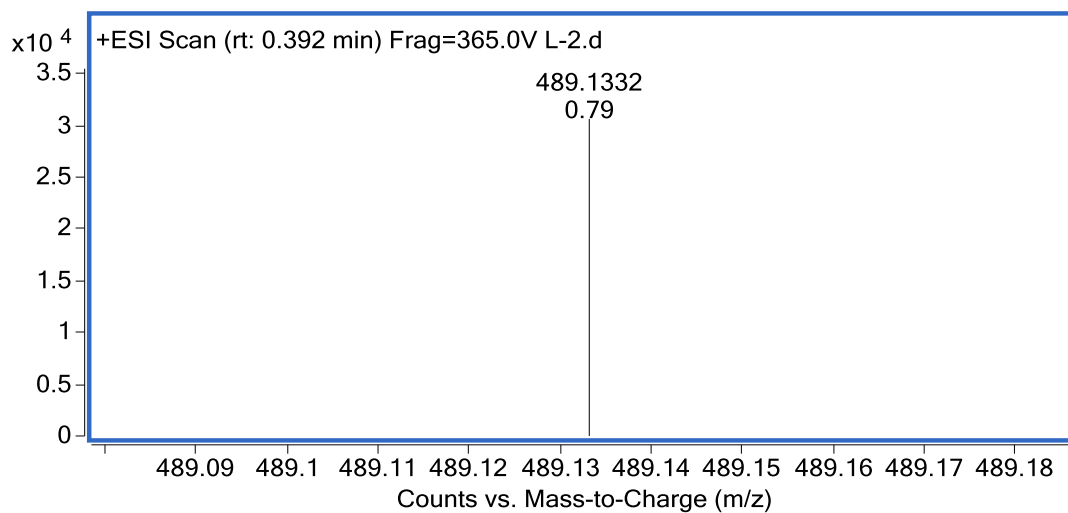
¹H NMR – 21 {1,2}



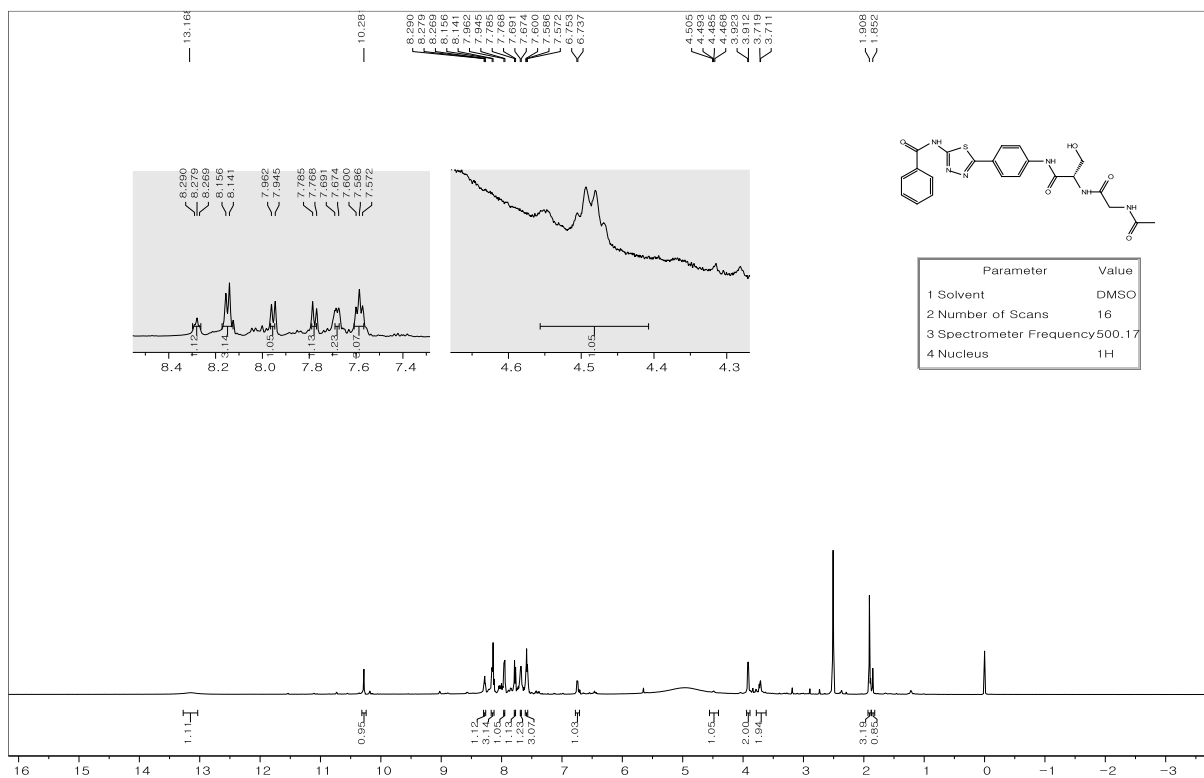
^{13}C NMR – 21 {1,2}



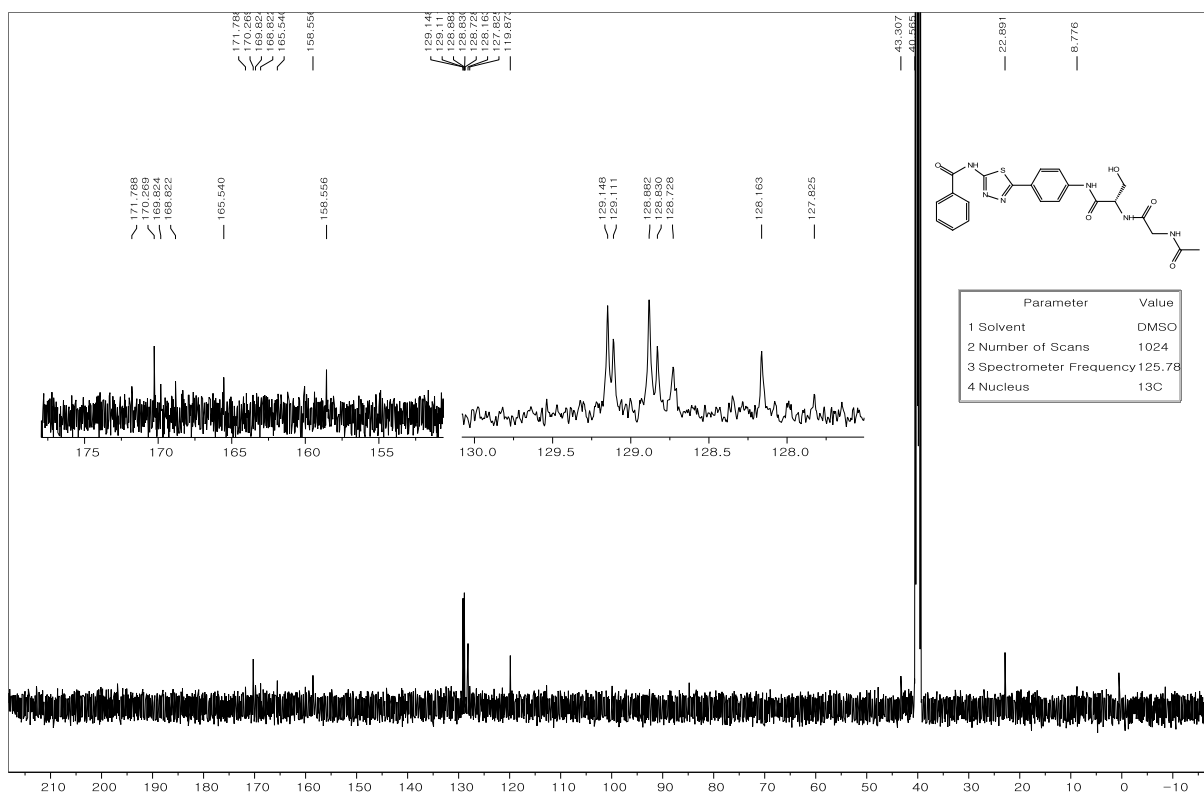
LC/MS – 21 {1,2}



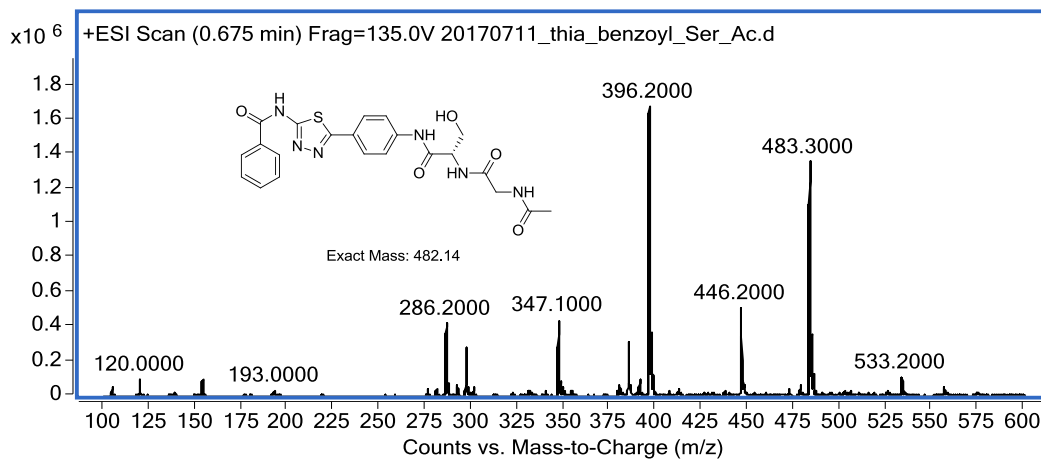
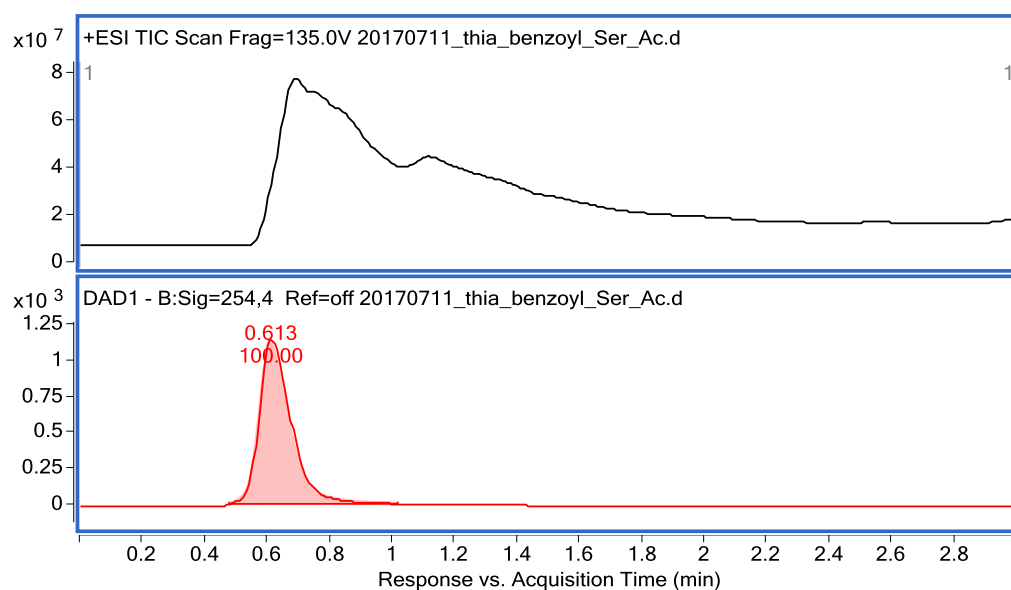
HR/MS – 21{1,2}



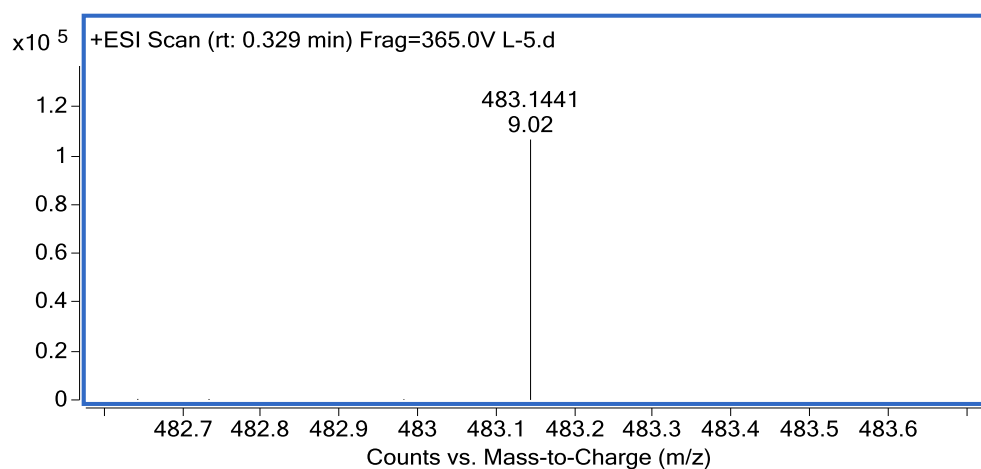
¹H NMR – 21{1,3}



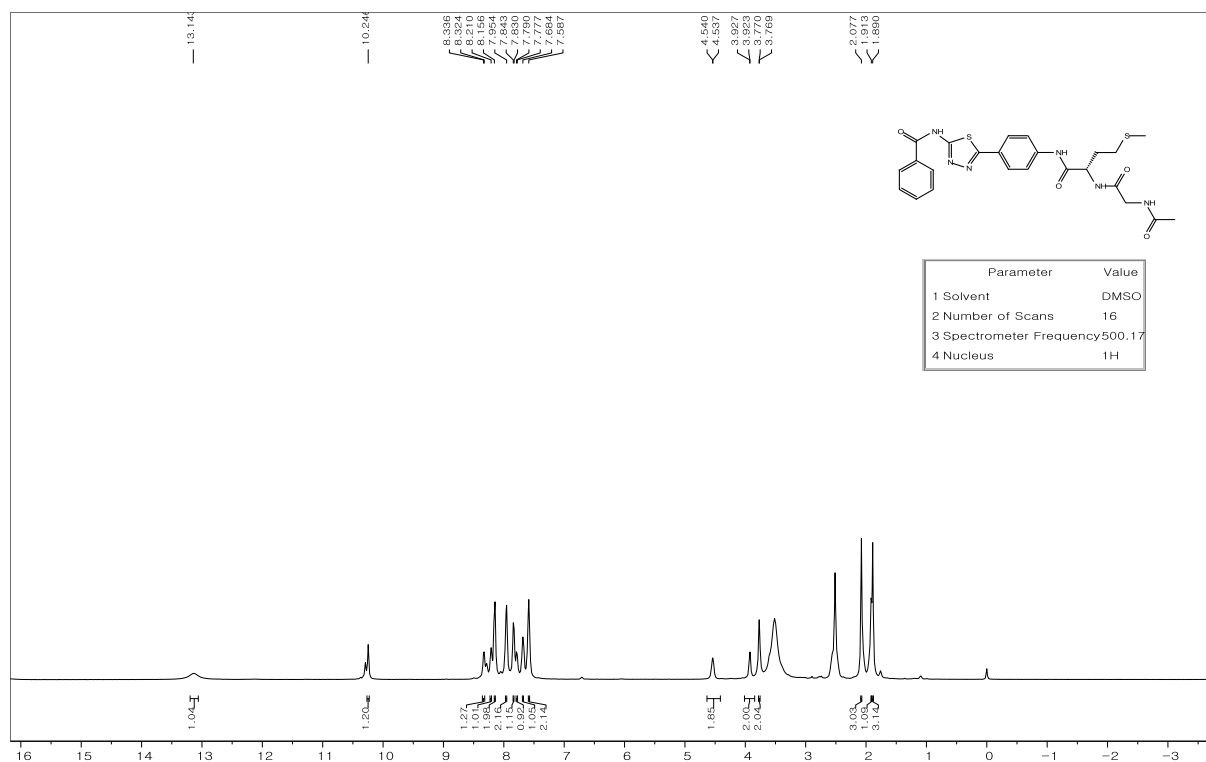
^{13}C NMR – 21 {1,3}



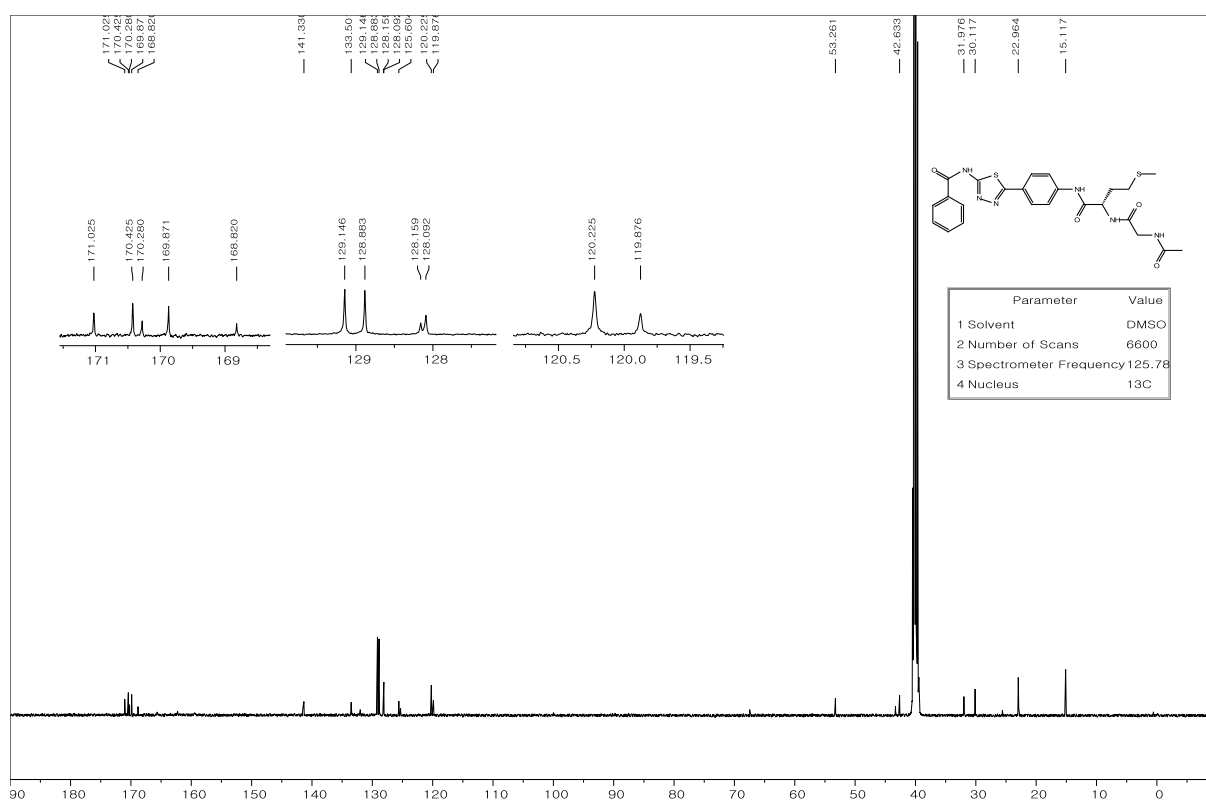
LC/MS – 21 {1,3}



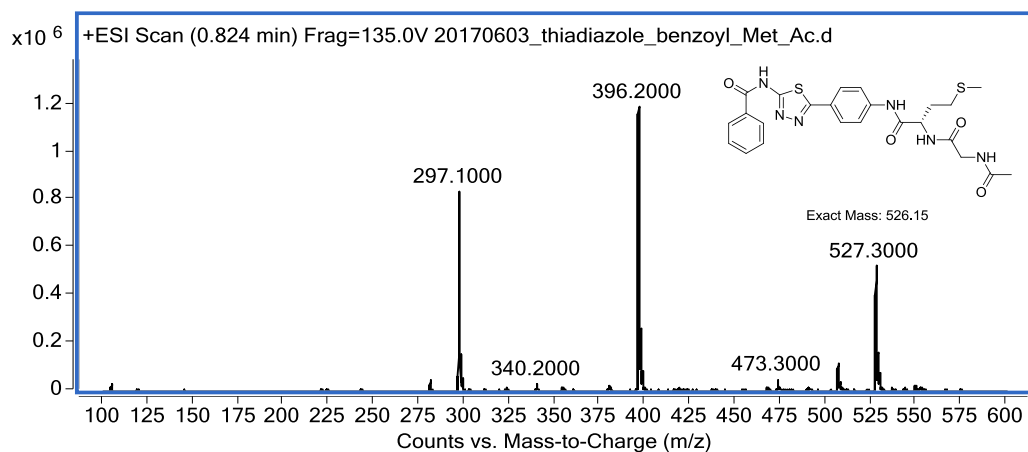
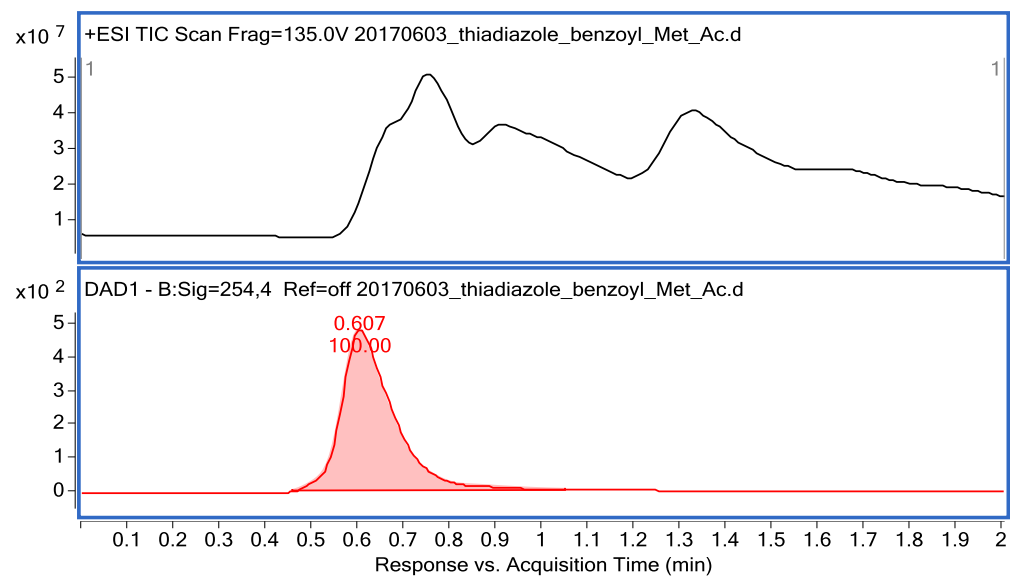
HR/MS – 21 {1,3}



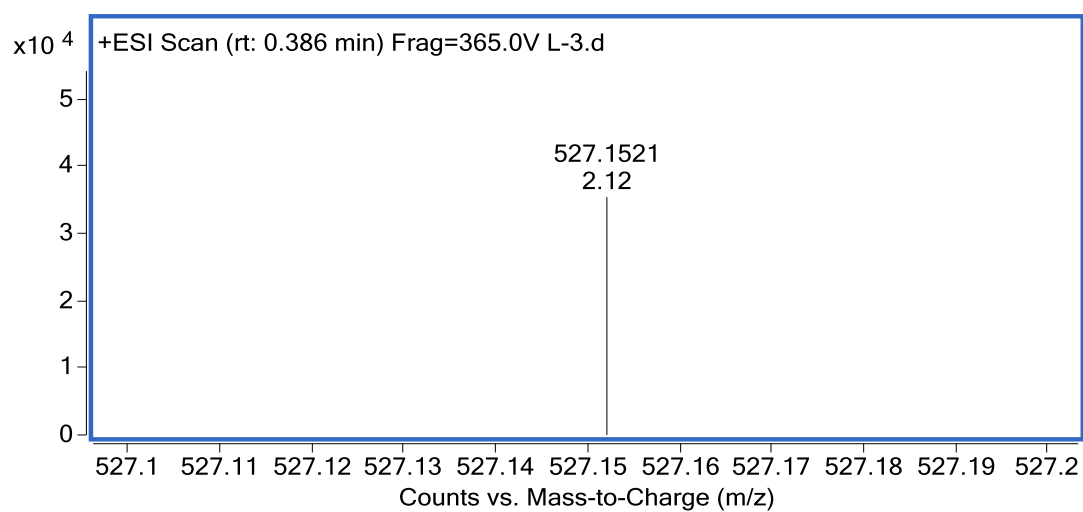
¹H NMR – 21 {1,4}



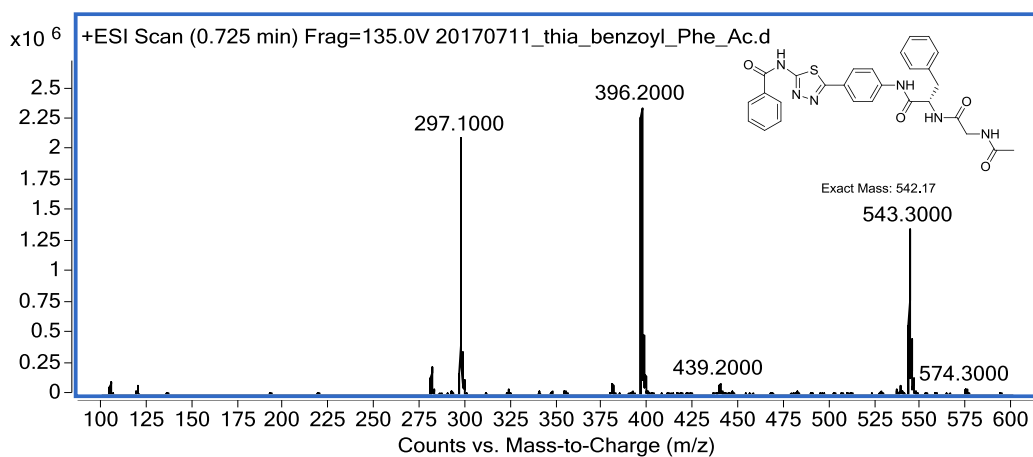
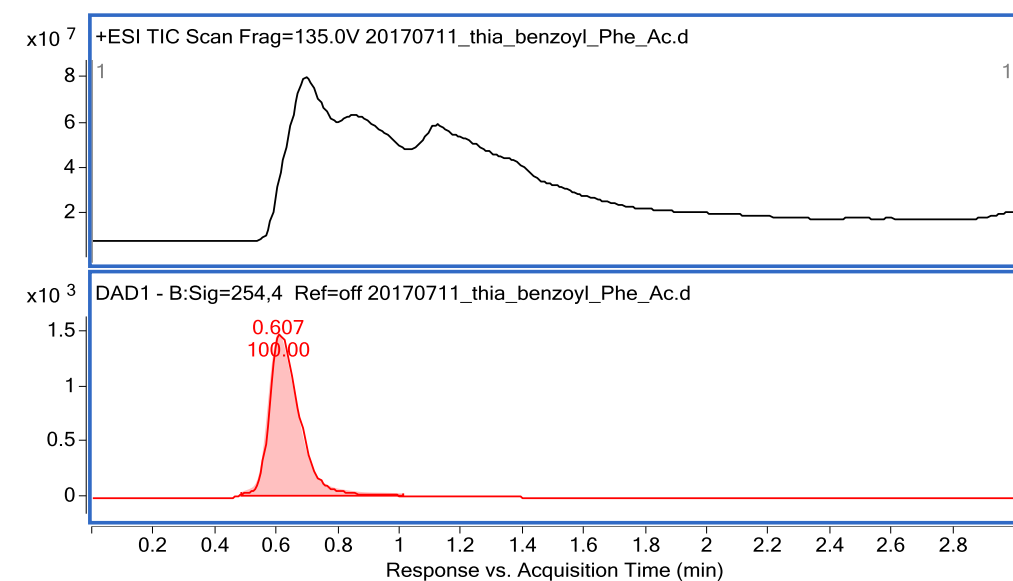
¹³C NMR – 21{1,4}



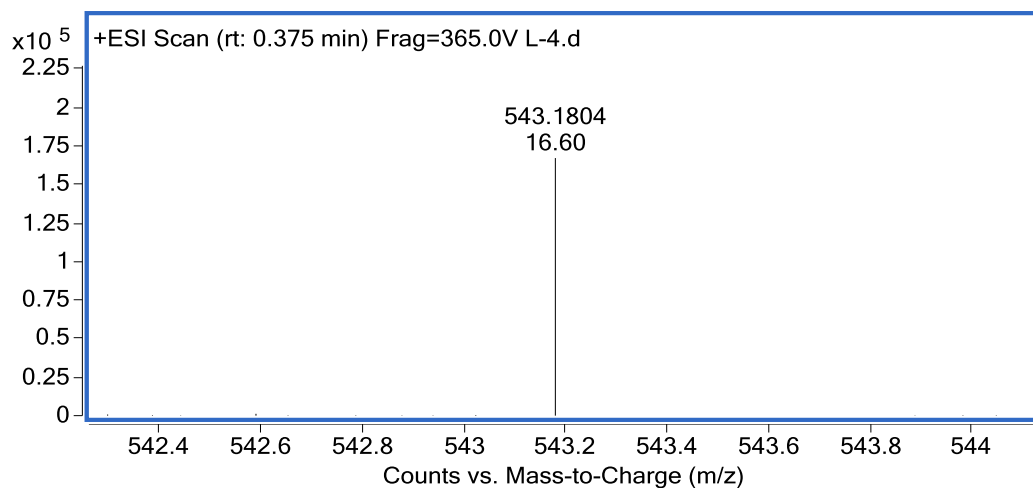
LC/MS – 21{1,4}



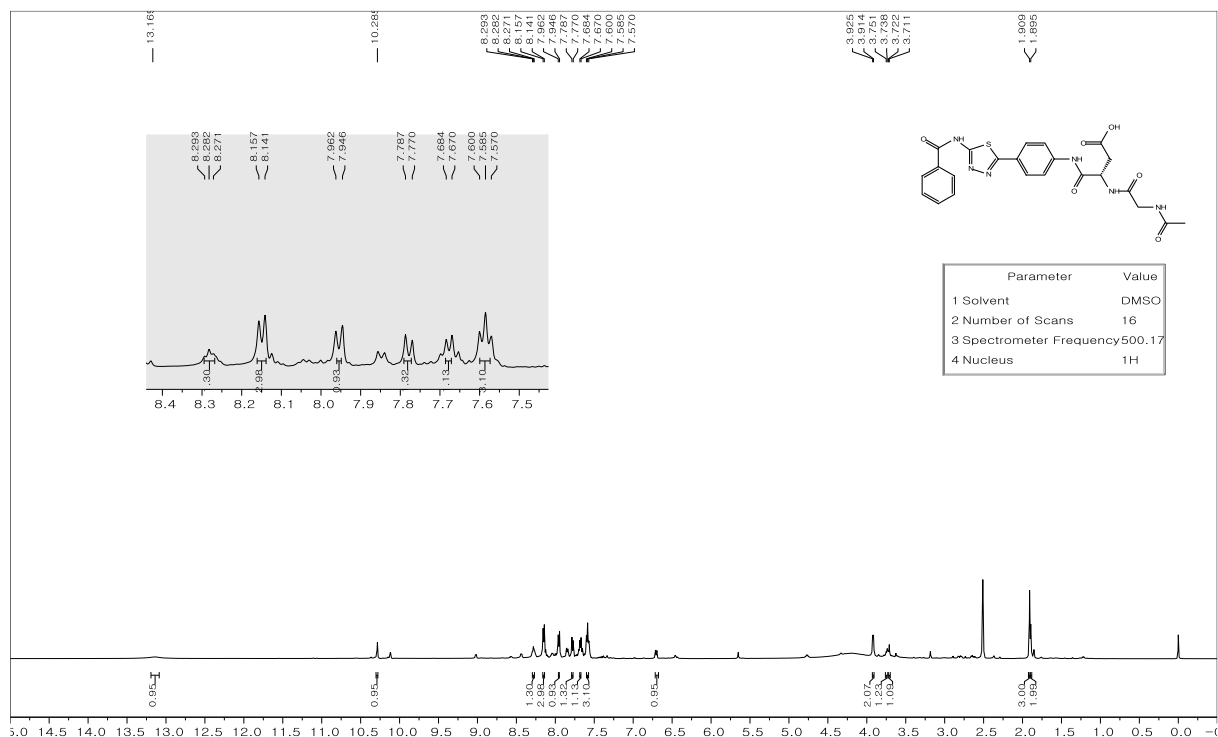
¹³C NMR – 21{1,5}



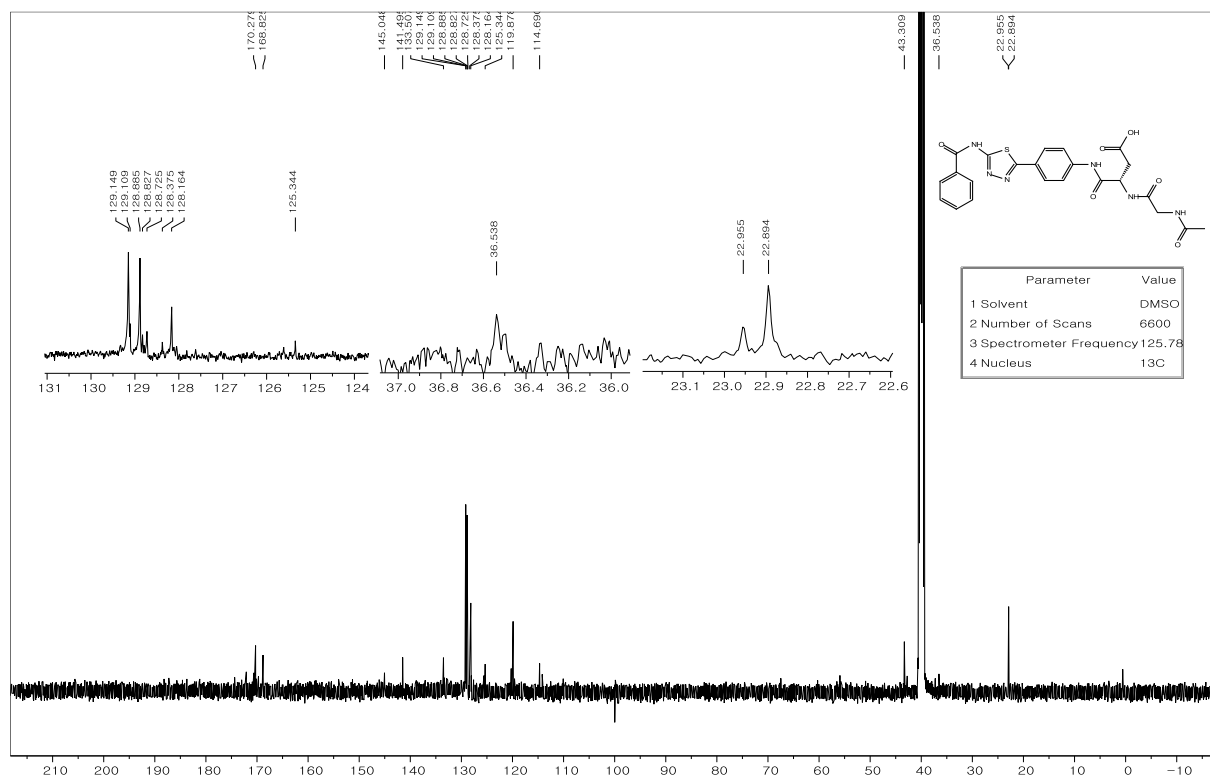
LC/MS – 21{1,5}



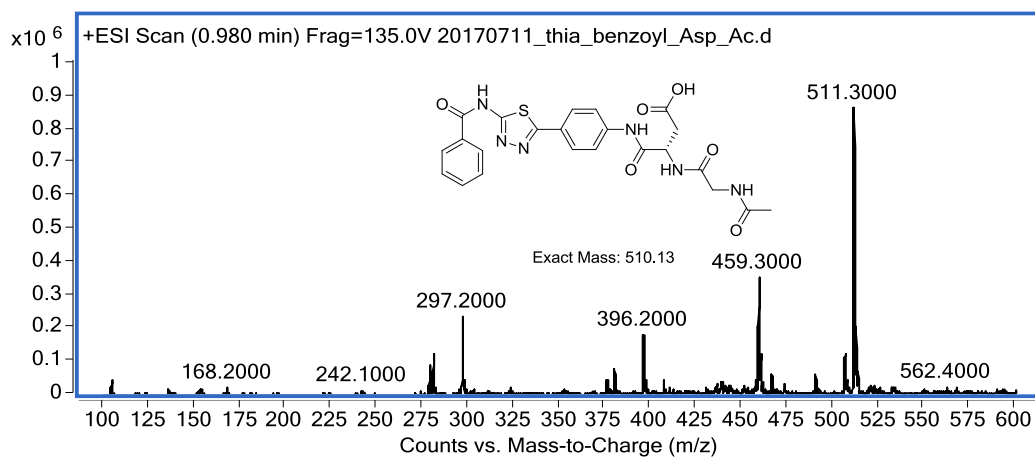
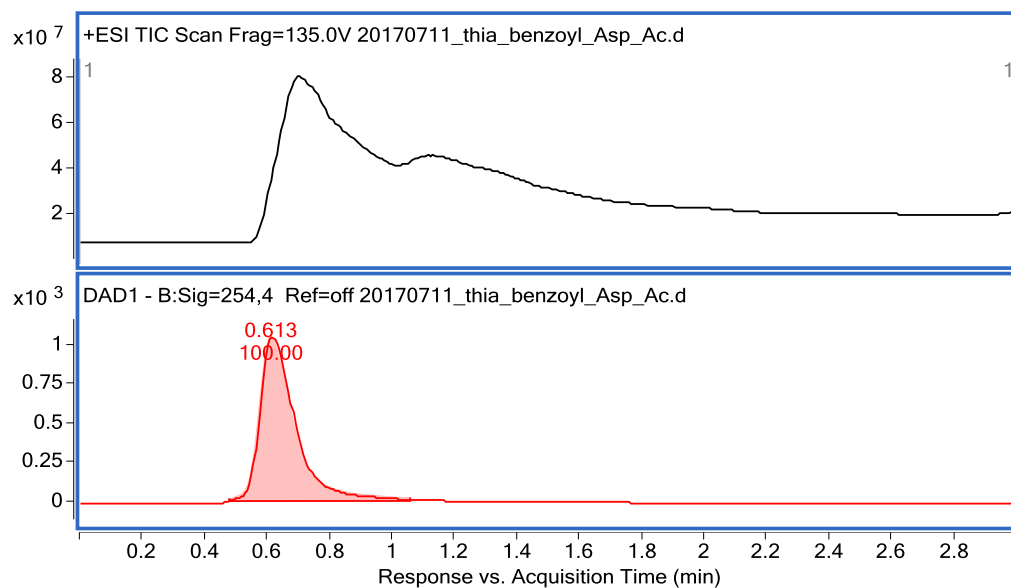
HR/MS – 21{1,5}



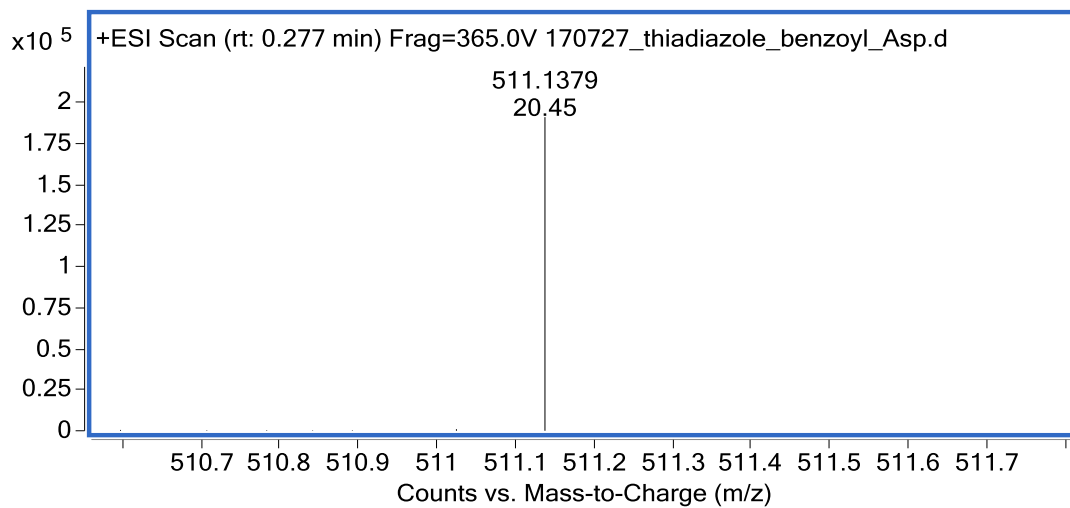
¹H NMR – 21{1,6}



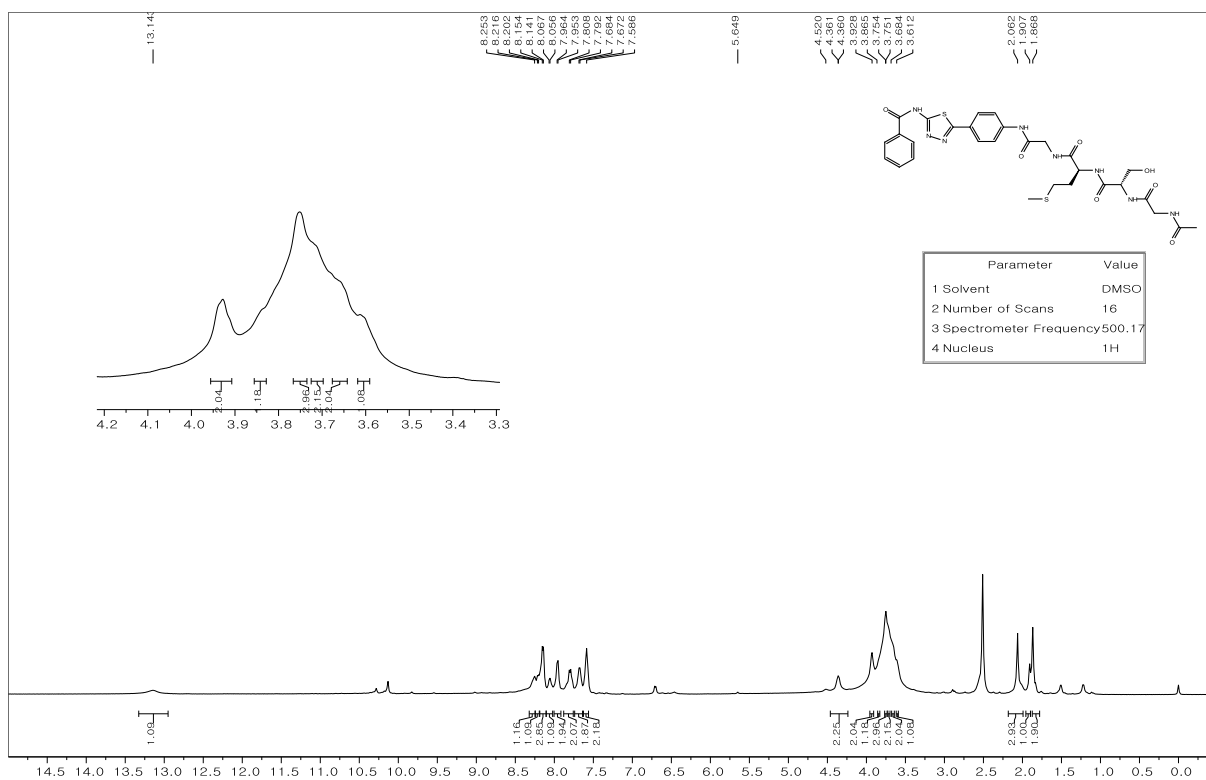
^{13}C NMR – 21 {1,6}



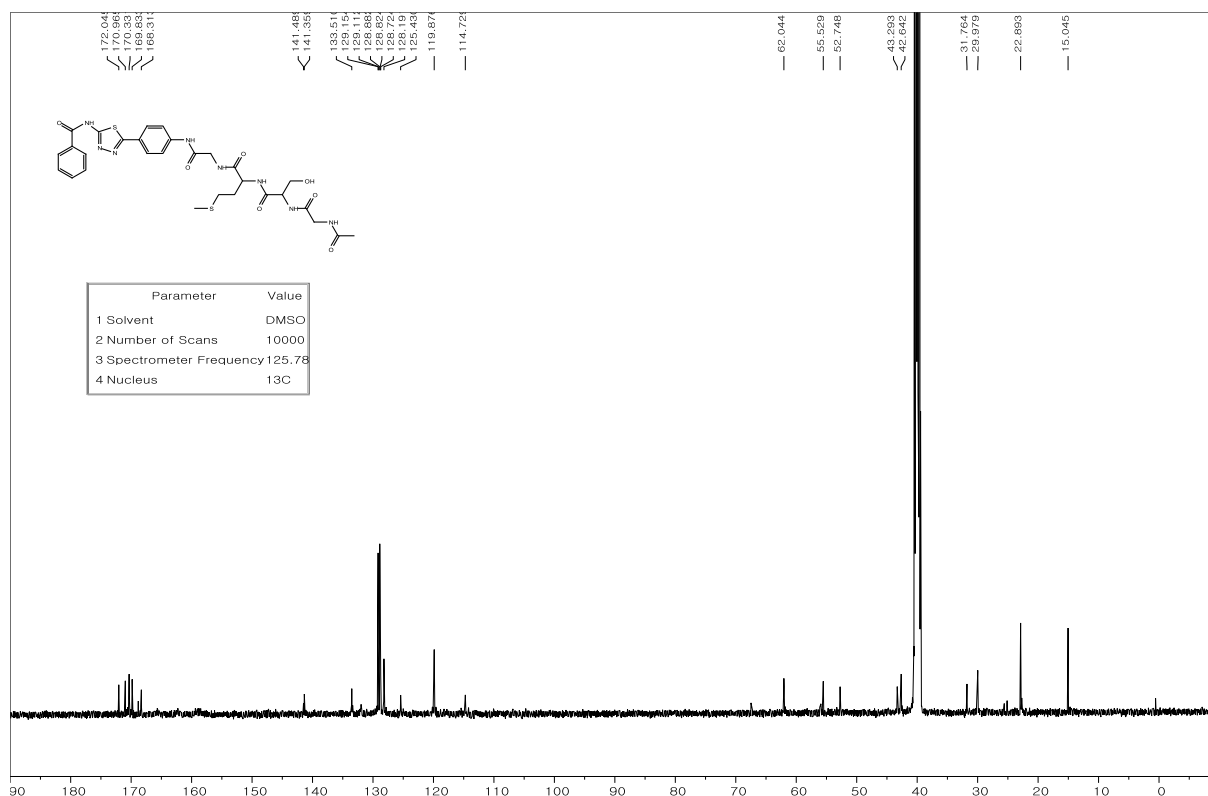
LC/MS – 21 {1,6}



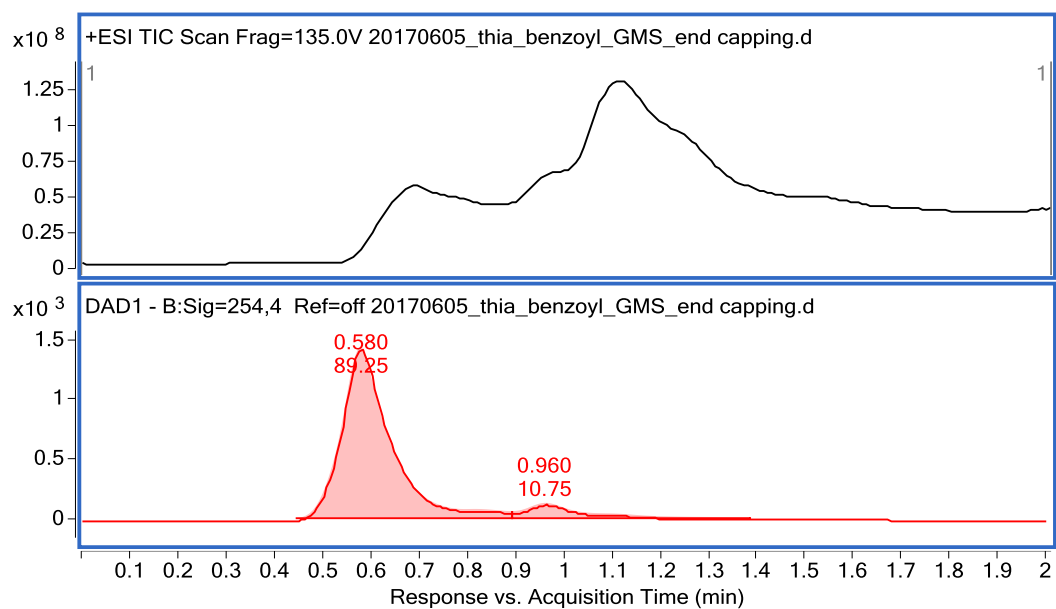
HR/MS – 21{1,6}

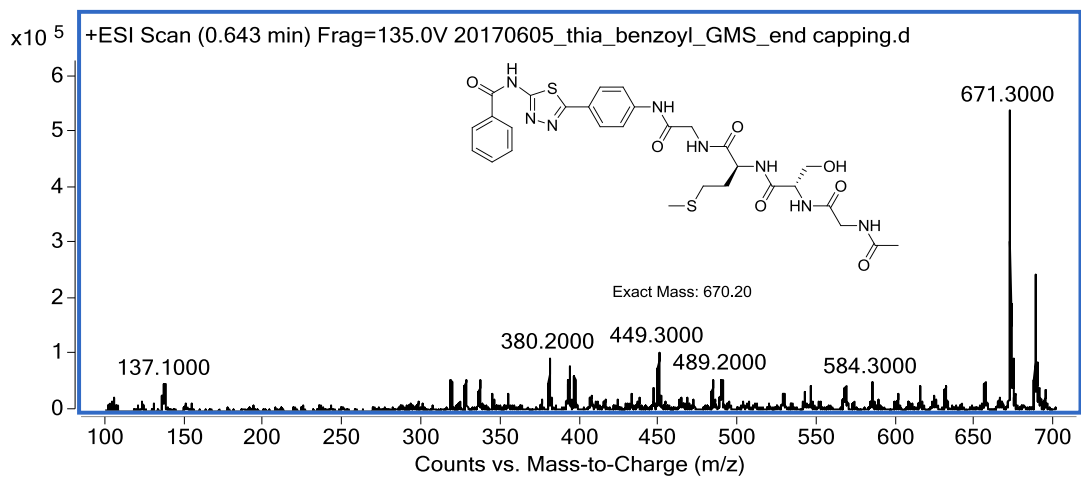


¹H NMR – 21' {1,1-4-3}

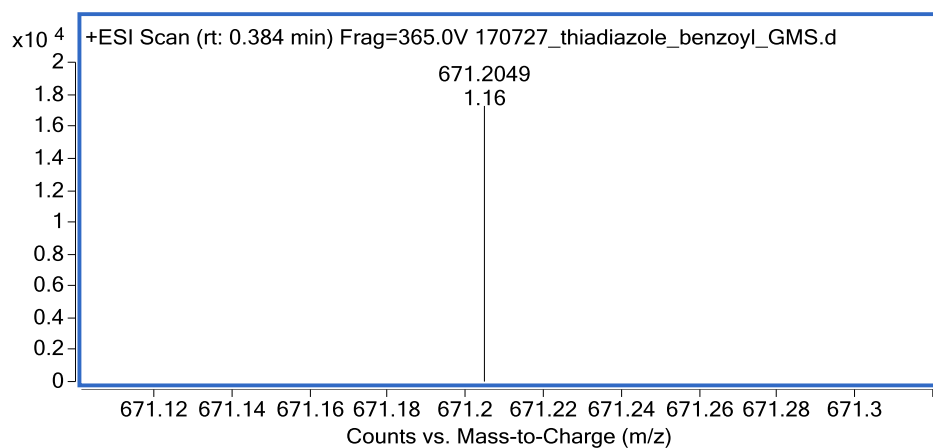


^{13}C NMR – 21' {1,1'-4-3}





LC/MS – 21' {1,1-4-3}



HR/MS – 21' {1,1-4-3}