Electronic Supplementary Information

Highly Enantioselective Synthesis of Cyclic Sulfamidates and Sulfamides via Rhodium-Catalyzed Transfer Hydrogenation

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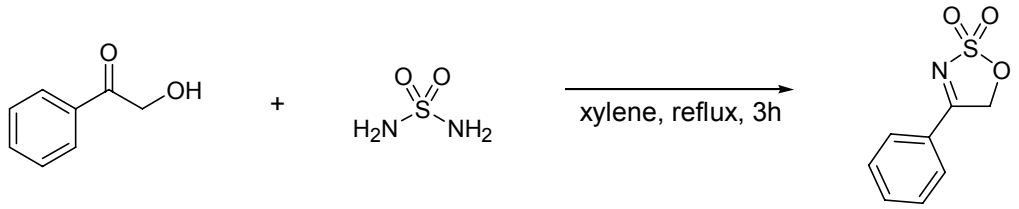
General for one-pot preparation of cyclic *N*-sulfonylimines. The starting α-hydroxy ketones are the known compounds and were prepared according to the reported procedures,[1-4] via direct α-hydroxylation of aryl methylketones under acidic conditions using [bis(trifluoroacetoxy)]iodobenzene[1] or hypervalent iodine oxidation of sily enol ethers.[2] It was found that aromatic and heteroaromatic substrates were uniformly converted to the corresponding oxathiazole derivatives **5**. For the synthesis of **5a-5g**, sulfamide **2** was employed in refluxing xylene, whereas, for **5h-5l**, trichloroethyl sulfamate **4** was better and then used in refluxing toluene. Remarkably, in the presence of gaseous hydrogen chloride,[5] the reaction of the same α-hydroxy ketones with sulfamide **2** furnished the thiadiazoles **6a-6k** in moderate yields.

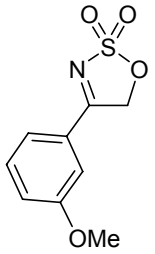
A representative procedure for the synthesis of 4-phenyl-5*H*-[1,2,3]-oxathiazole-2,2-dioxide (5a).[6,7]



2-Hydroxyacetophenone (100 mg, 0.73 mmol) and sulfamide (105.5 mg, 1.1 mmol) were charged in 10 mL of xylene and the combined contents were refluxed for 3 hr at 180℃. The reaction mixture was concentrated to dryness. The crude was diluted with EtOAc and washed with water and then brine. The organic layer was dried over Na_2SO_4 and the solvent was removed. The residue was purified by column chromatography on silica gel (hexane/EtOAc = 2/1) to give 89 mg (62%) of **5a**: ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.92 (d, 2H, J = 8.5 Hz), 7.75 (t, 1H, J = 7.4 Hz), 7.59 (t, 2H, J = 7.9 Hz), 5.58 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 175.4,

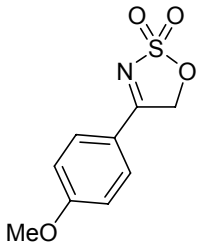
135.9, 129.7, 128.9, 127.2, 74.4; EIMS (70eV) *m/z* (rel intensity) 197 (M^+, 48), 103 (100); HRMS (EI) calcd for $C_8H_7NO_3S$: 197.0147, found: 197.0147.

4-(3-Methoxyphenyl)-5*H*-[1,2,3]-oxathiazole-2,2-dioxide (5b).[6,7]



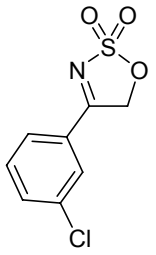
Yield: 57%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.50 (t, 1H, *J* = 2.5 Hz), 7.46 (d, 1H, *J* = 8.0 Hz), 7.39-7.35 (m, 1H), 7.28-7.24 (m, 1H), 5.57 (s, 2H), 3.89 (s, 3H); EIMS (70eV) *m/z* (rel intensity) 227 (M^+, 23), 133 (100), 103 (26), 90 (11).

4-(4-Methoxyphenyl)-5*H*-[1,2,3]-oxathiazole-2,2-dioxide (5c).[7]



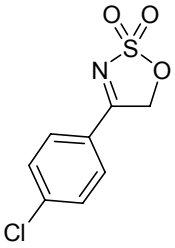
Yield: 59%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.87 (d, 2H, *J* = 9.1 Hz), 7.45 (d, 2H, *J* = 9.0 Hz), 5.54 (s, 2H), 3.93 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 174.3, 165.9, 131.4, 119.4, 115.2, 74.1, 55.9; EIMS (70eV) *m/z* (rel intensity) 227 (M^+, 19), 133 (100), 103 (21), 90 (18); HRMS (EI) calcd for $C_9H_9NO_4S$: 227.0252, found: 227.0250.

4-(3-Chlorophenyl)-5*H*-[1,2,3]-oxathiazole-2,2-dioxide (5d).[7]



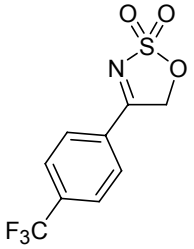
Yield: 50%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.92 (t, 1H, *J* = 1.9 Hz), 7.81-7.77 (m, 1H), 7.73-7.69 (m, 1H), 7.49 (t, 1H, *J* = 7.9 Hz), 5.57 (s, 2H); ^{13}C NMR (75 MHz, DMSO-d_6) δ 177.8, 135.2, 124.1, 131.4, 129.2, 128.9, 127.9, 77.0; EIMS (70eV) *m/z* (rel intensity) 231 (M^+, 19), 137 (100), 102 (13).

4-(4-Chlorophenyl)-5*H*-[1,2,3]-oxathiazole-2,2-dioxide (5e).[7]



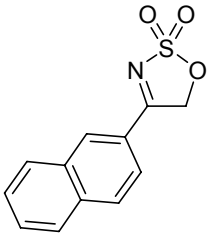
Yield: 46%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.85 (d, 2H, *J* = 8.8 Hz), 7.57 (d, 2H, *J* = 8.8 Hz), 5.56 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 177.7, 140.6, 131.1, 129.6, 126.0, 76.9; EIMS (70eV) *m/z* (rel intensity) 231 (M^+, 12), 136 (100), 102 (20), 75 (14); HRMS (EI) calcd for $C_8H_6ClNO_3S$: 230.9757, found: 230.9755.

4-(4-Trifluoromethylphenyl)-5*H*-[1,2,3]-oxathiazole-2,2-dioxide (5f).



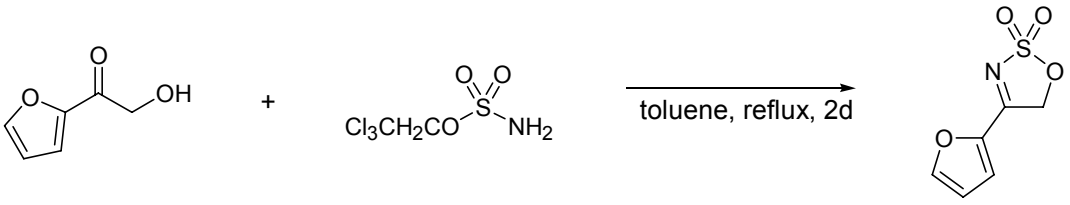
Yield: 65%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.05 (d, 2H, J = 8.2 Hz), 7.83 (d, 2H, J = 8.2 Hz), 5.62 (s, 2H); ^{13}C NMR (75 MHz, DMSO-d_6) δ 177.9, 134.3 (q, $J_{F\text{-}C}$ = 32.4 Hz), 130.9, 120.2, 126.2 (q, $J_{F\text{-}C}$ = 3.6 Hz), 123.4 (q, $J_{F\text{-}C}$ = 272.3 Hz), 77.2; EIMS (70eV) *m/z* (rel intensity) 265 (M^+, 6), 171 (100), 152 (24), 144 (12), 121 (38); HRMS (EI) calcd for $C_9H_6F_3NO_3S$: 265.0020, found: 265.0021.

4-(2-Naphthyl)-5*H*-[1,2,3]-oxathiazole-2,2-dioxide (5g).



Yield: 47%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.33 (s, 1H), 8.01 (d, 2H, J = 1.3 Hz), 7.95 (t, 2H, J = 9.4 Hz), 7.74-7.61 (m, 2H), 5.73 (s, 2H); ^{13}C NMR (75 MHz, DMSO-d_6) δ 178.3, 135.9, 132.4, 131.9, 129.9, 129.6, 129.2, 128.0, 127.7, 124.5, 123.7, 76.9; EIMS (70eV) *m/z* (rel intensity) 247 (M^+, 18), 153 (100), 126 (17); HRMS (EI) calcd for $C_{12}H_9NO_3S$: 247.0303, found: 247.0305.

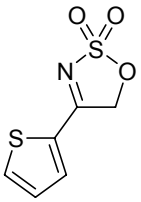
A representative procedure for the synthesis of 4-(2-furyl)-5*H*-[1,2,3]-oxathiazole-2,2-dioxide (5h).



1-(2-Furyl)-2-hydroxyethanone (200 mg, 1.59 mmol) and 2,2,2-trichloroethyl sulfamate (724.8 mg, 3.17 mmol) were charged in 15 mL of toluene and the combined contents were

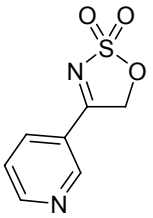
refluxed for 2 days at 130□. The reaction mixture was concentrated to dryness. The crude was diluted with EtOAc and washed with water and then brine. The organic layer was dried over Na_2SO_4 and the solvent was removed. The residue was purified by column chromatography on silica gel (hexane/EtOAc/methylene chloride = 2/1/1) to give 177 mg (60%) of **5h**: ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.83-7.82 (m, 1H), 7.57 (dd, 1H, *J* = 3.7 and 0.6 Hz), 6.77 (dd, 1H, *J* = 3.7 and 1.7 Hz), 5.49 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 164.5, 150.1, 144.0, 122.0, 114.3, 73.5; EIMS (70eV) *m/z* (rel intensity) 187 (M^+, 34), 93 (100), 64 (11).

4-(2-Thienyl)-5*H*-[1,2,3]oxathiazole-2,2-dioxide (5i).



Yield = 36%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.94 (d, 1H, *J* = 5.0 Hz), 7.75 (d, 1H, *J* = 3.9 Hz), 7.29 (t, 1H, *J* = 4.4 Hz), 5.53 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 168.9, 137.8, 135.1, 131.0, 129.5, 74.0; EIMS (70eV) *m/z* (rel intensity) 203 (M^+, 74), 109 (100), 82 (4).

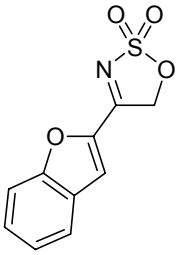
4-(3-Pyridinyl)-5*H*-[1,2,3]oxathiazole-2,2-dioxide (5j).



Yield = 24%; ^{1}H NMR (300 MHz, DMSO-d_6) δ 9.14 (d, 1H, *J* = 1.5 Hz), 8.93 (dd, 1H, *J* = 5.0 and 1.5 Hz), 8.41 (dt, 1H, *J* = 7.7 and 1.8 Hz), 7.70 (ddd, 1H, *J* = 8.1 and 4.9 and 0.7 Hz),

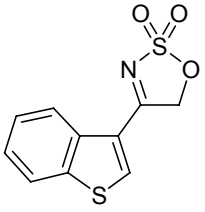
6.17 (s, 2H); ^{13}C NMR (75 MHz, DMSO-d_6) δ 177.7, 155.5, 150.0, 136.7, 124.4, 123.7, 77.0; EIMS (70eV) *m/z* (rel intensity) 198 (M^+, 22), 104 (100), 77 (27).

4-(2-Benzofuryl)-5*H*-[1,2,3]oxathiazole-2,2-dioxide (5k).



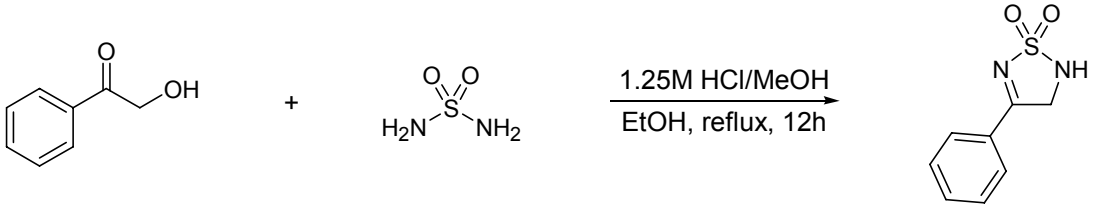
Yield = 52%; ^{1}H NMR (300 MHz, DMSO-d_6) δ 8.25 (s, 1H), 7.94 (d, 1H, *J* = 7.9 Hz), 7.84 (d, 1H, *J* = 7.9 Hz), 7.66 (t, 1H, *J* = 7.6 Hz), 7.46 (t, 1H, *J* = 7.7 Hz), 6.07 (s, 2H); ^{13}C NMR (75 MHz, DMSO-d_6) δ 168.0, 156.2, 144.1, 130.0, 126.7, 124.8, 123.9, 120.0, 112.4, 75.9; EIMS (70eV) *m/z* (rel intensity) 237 (M^+, 43), 143 (100), 115 (23).

4-(3-Benzothienyl)-5*H*-[1,2,3]oxathiazole-2,2-dioxide (5l).



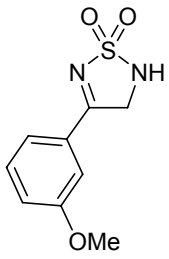
Yield = 41%: ^{1}H NMR (300 MHz, DMSO-d_6) δ 9.09 (s, 1H), 8.62 (d, 1H, *J* = 8.1 Hz), 8.23 (d, 1H, *J* = 8.1 Hz), 7.68-7.56 (m, 2H), 6.16 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 171.7, 144.2, 139.4, 135.0, 126.6, 126.2, 124.1, 123.7, 123.6, 76.8; EIMS (70eV) *m/z* (rel intensity) 253 (M^+, 72), 159 (100), 132 (3).

A representative procedure for the synthesis of 4-phenyl-2,3-dihydro-[1,2,5]-thiadiazole-1,1-dioxide (6a).[5]



2-Hydroxyacetophenone (500 mg, 3.67 mmol) and sulfamide (529 mg, 5.51 mmol) were charged in 20 mL of EtOH. To this mixture, 6 mL of 1.25M solution of alcoholic HCl was added and then the combined mixtures were refluxed overnight at 110 ^{o}C. The volatile materials were removed in vacuo. The crude was diluted in EtOAc and then washed with 5% $NaHCO_3$ solution and water. The organic layer was dried over Na_2SO_4 and the solvent was removed. The residue was purified by flash chromatography (hexane/EtOAc = 2/1) to give 605 mg (84%) of **6a**: ^{1}H NMR (300 MHz, DMSO-d_6) δ 8.01 (d, 2H, J = 4.8 Hz), 7.93 (t, 1H, J = 2.7 Hz), 7.73 (t, 1H, J = 4.5 Hz), 7.60 (t, 2H, J = 4.8 Hz), 4.87 (d, 2H, J = 3.0 Hz); ^{13}C NMR (75 MHz, DMSO-d_6) δ 177.4, 134.5, 129.3, 129.0, 128.9, 52.6; EIMS (70eV) *m/z* (rel intensity) 196 (M^{+}, 35), 132 (39), 105 (82), 77 (100); HRMS (EI) calcd for $C_8H_8N_2O_2S$: 196.0306, found: 196.0310.

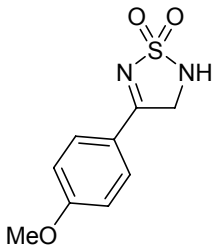
4-(3-Methoxyphenyl)-2,3-dihydro-[1,2,5]-thiadiazole-1,1-dioxide (6b).



Yield: 41%; ^{1}H NMR (300 MHz, DMSO-d_6) δ 7.94 (s, 1H), 7.60-7.57 (m, 1H), 7.53-7.47 (m, 2H), 7.31-7.27 (m, 1H), 4.84 (d, 2H, J = 2.9 Hz), 3.83 (s, 1H); ^{13}C NMR (75 MHz, DMSO-

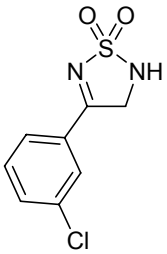
d_6) δ 177.6, 159.9, 130.8, 130.6, 121.7, 121.0, 113.6, 55.8, 53.1; EIMS (70eV) *m/z* (rel intensity) 226 (M^+, 17), 133 (100), 103 (30), 90 (13); HRMS (EI) calcd for $C_9H_{10}N_2O_3S$: 226.0412, found: 226.0407.

4-(4-Methoxyphenyl)-2,3-dihydro-[1,2,5]-thiadiazole-1,1-dioxide (6c).



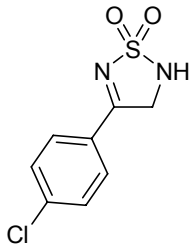
Yield: 30%; ^{1}H NMR (300 MHz, DMSO-d_6) δ 7.98 (d, *J* = 9.0 Hz, 2H), 7.79 (t, *J* = 5.2 Hz, 1H), 7.14 (d, *J* = 9.0 Hz, 2H), 4.81 (d, *J* = 5.0 Hz, 2H), 3.88 (s, 3H); ^{13}C NMR (75 MHz, DMSO-d_6) δ 176.2, 164.3, 131.3, 121.3, 114.7, 55.7, 52.3; EIMS (70eV) *m/z* (rel intensity) 226 (M^+, 7), 133 (100), 103 (22), 90 (22), 63 (11).

4-(3-Chlorophenyl)-2,3-dihydro-[1,2,5]-thiadiazole-1,1-dioxide (6d).



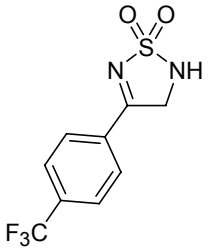
Yield: 43%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.92 (t, 1H, *J* = 1.9 Hz), 7.82-7.79 (m, 1H), 7.67-7.63 (m, 1H), 7.49 (t, 1H, *J* = 8.1 Hz), 4.84-4.76 (m, 1H), 4.74 (d, 2H, *J* = 5.4 Hz); ^{13}C NMR (75 MHz, DMSO-d_6) δ 176.5, 134.1, 133.9, 131.1, 131.0, 128.5, 127.5, 52.7; EIMS (70eV) *m/z* (rel intensity) 230 (M^+, 4), 128 (100), 101 (31), 75 (14); HRMS (EI) calcd for $C_8H_7ClN_2O_2S$: 229.9917, found: 229.9909.

4-(4-Chlorophenyl)-2,3-dihydro-[1,2,5]-thiadiazole-1,1-dioxide (6e).



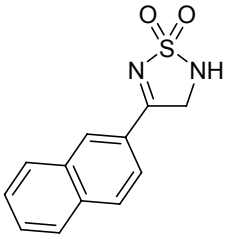
Yield: 53%; ^{1}H NMR (300 MHz, DMSO-d_6) δ 8.01 (d, 2H, J = 8.5 Hz), 7.99-7.92 (m, 1H), 7.66 (d, 2H, J = 8.5 Hz), 4.84 (d, 2H, J = 4.9 Hz); ^{13}C NMR (75 MHz, DMSO-d_6) δ 176.8, 139.8, 131.1, 129.7, 128.3, 53.0; EIMS (70eV) *m/z* (rel intensity) 230 (M^+, 7), 137 (100), 102 (24), 75 (16); HRMS (EI) calcd for $C_8H_7ClN_2O_2S$: 229.9917, found: 229.9909.

4-(4-Trifluoromethylphenyl)-2,3-dihydro-[1,2,5]-thiadiazole-1,1-dioxide (6f).



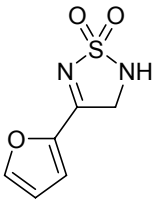
Yield: 42%; ^{1}H NMR (300 MHz, DMSO-d_6) δ 8.23 (d, 2H, J = 9.0 Hz), 8.12 (t, 1H, J = 4.5 Hz), 7.99 (d, 2H, J = 9.0 Hz), 4.94 (d, 2H, J = 4.7 Hz); ^{13}C NMR (75 MHz, DMSO-d_6) δ 176.5, 133.5 (q, $J_{F\text{-}C}$ = 32.3 Hz), 132.8, 129.7, 126.0 (q, $J_{F\text{-}C}$ = 3.7 Hz), 123.6 (q, $J_{F\text{-}C}$ = 272.8 Hz), 52.8; EIMS (70eV) *m/z* (rel intensity) 265 (M^+, 1), 172 (100), 152 (24), 144 (15), 121 (34); HRMS (EI) calcd for $C_9H_7F_3N_2O_2S$: 264.0180, found: 264. 0175.

4-(2-Naphthyl)-2,3-dihydro-[1,2,5]-thiadiazole-1,1-dioxide (6g).



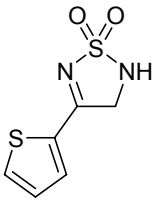
Yield: 66%; ^{1}H NMR (300 MHz, DMSO-d_6) δ 8.71 (s, 1H), 8.15-8.05 (m, 4H), 7.77-7.65 (m, 2H), 7.31 (brs, 1H), 5.02 (s, 2H); ^{13}C NMR (75 MHz, DMSO-d_6) δ 177.2, 135.5, 132.1, 131.3, 129.5, 129.3, 128.9, 127.9, 127.4, 126.4, 123.9, 52.6; EIMS (70eV) *m/z* (rel intensity) 246 (M^+, 11), 153 (100), 125 (20); HRMS (EI) calcd for $C_{12}H_{10}N_2O_2S$: 246.0463, found: 246.0463.

4-(2-Furyl)-2,3-dihydro-[1,2,5]-thiadiazole-1,1-dioxide (6h).



Yield: 9%; ^{1}H NMR (300 MHz, DMSO-d_6) δ 8.22 (dd, 1H, *J* = 1,7 and 0.7 Hz), 7.76 (t, 1H, *J* = 5.2 Hz), 7.69 (dd, 1H, *J* = 3.7 and 0.7 Hz), 6.88 (dd, 1H, *J*= 3.7 and 1.7 Hz), 4.68 (d, 2H, *J* = 5.4 Hz); ^{13}C NMR (75 MHz, DMSO-d_6) δ 165.8, 150.1, 144.8, 122.0, 113.7, 51.6; EIMS (70eV) *m/z* (rel intensity) 186 (M^+, 31), 93 (100), 64 (7).

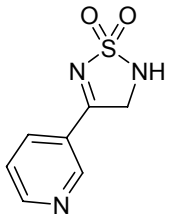
4-(2-Thienyl)-2,3-dihydro-[1,2,5]-thiadiazole-1,1-dioxide (6i).



Yield: 27%; ^{1}H NMR (300 MHz, DMSO-d_6) δ 8.20 (dd, 1H, *J* = 5.1 and 1.2 Hz), 8.05 (dd,

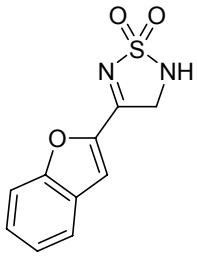
1H, *J* = 3.9 and 1.1 Hz), 7.85 (t, 1H, *J* = 5.4 Hz), 7.36 (dd, 1H, *J* = 5.0 and 3.9 Hz), 4.82 (d, 2H, *J* = 5.4 Hz); ^{13}C NMR (75 MHz, DMSO-d_6) δ 171.2, 136.9, 136.3, 132.4, 129.4, 52.5; EIMS (70eV) *m/z* (rel intensity) 202 (M^+, 12), 109 (100), 58 (12).

4-(3-Pyridinyl)-2,3-dihydro-[1,2,5]-thiadiazole-1,1-dioxide (6j).



Yield: 20%; ^{1}H NMR (300 MHz, DMSO-d_6) δ 9.13 (d, 1H, *J* = 2.1 Hz), 8.85 (dd, 1H, *J* = 4.8 and 1.6 Hz), 8.37 (dt, 1H, *J* = 8.1 and 1.9 Hz), 8.04 (t, 1H, *J* = 4.7 Hz), 7.6 (dd, 1H, *J* = 8.0 and 4.8 Hz), 4.9 (d, 2H, *J* = 4.8 Hz); ^{13}C NMR (75 MHz, DMSO-d_6) δ 176.2, 154.6, 149.7, 136.4, 125.3, 124.2, 52.7; EIMS (70eV) *m/z* (rel intensity) 198 (M^+ + 1, 6), 133 (5), 105 (100), 77 (20);

4-(2-Benzofuryl)-2,3-dihydro-[1,2,5]-thiadiazole-1,1-dioxide (6k).

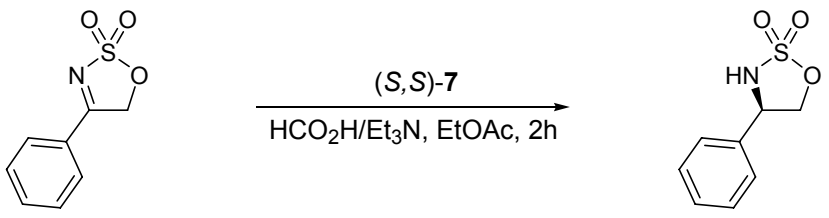


Yield: 18%; ^{1}H NMR (300 MHz, DMSO-d_6) δ 8.13 (s, 1H), 7.96 (t, 1H, *J* = 4.8 Hz), 7.89 (d, 1H, *J* = 7.9 Hz), 7.80 (d, 1H, *J* = 8.3 Hz), 7.61 (td, 1H, *J* = 7.1 and 1.2 Hz), 7.43 (t, 1H, *J* = 7.9 Hz), 4.83 (d, 2H, *J* = 4.9 Hz); ^{13}C NMR (75 MHz, $CDCl_3$) δ 167.8, 156.4, 146.5, 129.7, 127.3, 124.9, 124.0, 118.1, 112.7, 52.5; EIMS (70eV) *m/z* (rel intensity) 236 (M^+, 56), 143

(100), 115 (15).

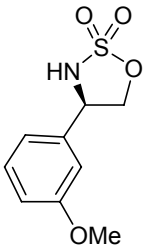
General for Rh-catalyzed asymmetric transfer hydrogenation. According to the literature procedure, the (*S,S*)-Rh **7** was prepared from the reaction of (1*S,*2*S*)-*N*-(*p*-toluenesulfonyl)-1,2-diphenylethylenediamine with dichloro(pentamethylcyclopentadienyl)rhodium (III) dimer in the presence of triethylamine.[8,9] It should be noted that the catalyst were used without any purification, so the catalyst includes an equal molar of hydrochloride/triethylamine salt. The catalyst is very stable and insensitive to atmospheric manipulations, and does not show any deterioration in the catalytic activity compared to that prepared from recrystalization. The formic acid/triethylamine (molar ratio = 5/2) azeotrope was prepared by the double distillation of the mixtures.[10] The *ee* values were measured by chiral HPLC analysis using a Daicel Chiralcel OD-H, OJ-H, or Chiralpak AD-H column at 215 nm. The racemic amines (±)-**8** and (±)-**10** were prepared respectively by sodium borohydride reduction of the corresponding amines in some cases, and used as standards for *ee* determination. The absolute configuration was determined by comparing the sign of the specific rotation with the literature data and/or chemical modifications to the known compounds.[6,7,11,12] Unless otherwise indicated, the absolute configuration was assigned by analogy.

A representative procedure for the synthesis of (*R*)-4-phenyl-[1,2,3]-oxathiazolidine-2,2-dioxide (8a).[6,7]



Into a two-neck flask, were added (*S,S*)-Rh **7** (3.9 mg, equivalent to 0.005 mmol) and **5a** (197 mg, 1 mmol) under a slight stream of argon. To this mixture, ethyl acetate (5 mL) and then an azeotropic mixture of HCO_2H/Et_3N (molar ratio = 5/2, 0.2 mL) were added via a syringe. The combined contents were stirred for 2h. The reaction mixture was diluted with ethyl acetate (10 mL) and washed with water (3x5 mL). The organic layer was dried over anhydrous sodium sulfate, filtered, and concentrated and then the residue was purified by column chromatography on silica gel (hexane/ethyl acetate = 2/1) to give 195 mg (98%) of **8a**. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.42 (m, 5H), 5.08 (dt, 1H, *J* = 8.4 and 6.9 Hz), 4.84 (dd, 1H, *J* = 8.7 and 6.8 Hz), 4.79 (br, 1H), 4.46 (t, 1H, *J* = 8.6 Hz); ^{13}C NMR (75 MHz, $CDCl_3$) δ 135.3, 129.6, 129.4, 126.7, 75.0, 59.6; EIMS (70eV) *m/z* (rel intensity) 199 (M^+, 7), 169 (33), 104 (100); HRMS (EI) calcd for $C_8H_9NO_3S$: 199.0303, found: 199.0302; $[\alpha]_D^{23}$ = -37.1 (*c* 0.70, $CHCl_3$); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 15/85, 0.8 mL/min): t_1 = 11.7 min (*R*), t_2 = 13.2 min (*S*); *ee* = 98%.

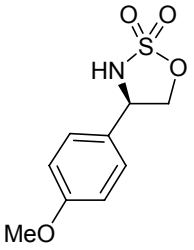
(*R*)-4-(3-Methoxyphenyl)-[1,2,3]- oxathiazolidine-2,2-dioxide (8b).[6,7]



Yield = 89%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.32 (t, 1H, *J* = 7.8 Hz), 6.98-6.89 (m, 3H), 5.07-5.01 (m, 2H), 4.82 (t, 1H, *J* = 8.5 Hz), 4.42 (t, 1H, *J* = 8.5 Hz), 3.81 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) 160.2, 136.9, 130.5, 118.7, 114.9, 112.2, 75.1, 59.4, 55.4; EIMS (70eV) *m/z* (rel intensity) 229 (M^+, 39), 134 (100), 105 (47), 77 (15), 65 (14); $[\alpha]_D^{23}$ = -32.1 (*c* 0.29,

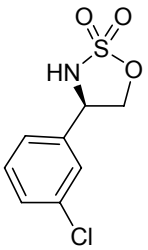
$CHCl_3$); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 20/80, 0.8 mL/min): t_1 = 10.5 min (*R*), t_2 = 11.7 min (*S*); *ee* = 97%.

(*R*)-4-(4-Methoxyphenyl)-[1,2,3]- oxathiazolidine-2,2-dioxide (8c).[7]



Yield = 86%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.35 (d, 2H, *J* = 8.7 Hz), 6.94 (d, 2H, *J* = 8.7 Hz), 5.03 (q, 1H, *J* = 6.8 Hz), 4.79 (dd, 1H, *J* = 8.7 and 6.7 Hz), 4.64 (d, 1H, *J* = 6.2 Hz), 4.44 (t, 1H, *J* = 8.7 Hz), 3.82 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) 160.5, 128.2, 126.9, 114.7, 75.3, 59.3, 55.4; EIMS (70eV) *m/z* (rel intensity) 229 (M^+, 4), 135 (100), 91 (12), 77 (18), 65 (60); $[\alpha]_D^{23}$ = -34.4 (*c* 0.50, $CHCl_3$); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 20/80, 0.8 mL/min): t_1 = 11.0 min (*R*), t_2 = 12.7 min (*S*); *ee* = 97%.

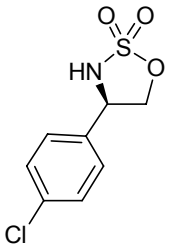
(*R*)-4-(3-Chlorophenyl)-[1,2,3]- oxathiazolidine-2,2-dioxide (8d).[7]



Yield = 96%; ^{1}H NMR (300 MHz, DMSO-d_6) δ 8.58 (d, 1H, *J* = 5.5 Hz), 7.53-7.52 (m, 1H), 7.49-7.40 (m, 3H), 5.17-5.11 (m, 1H), 4.96 (dd, 1H, *J* = 8.7 and 7.0 Hz), 4.38 (dd, 1H, *J* = 8.7

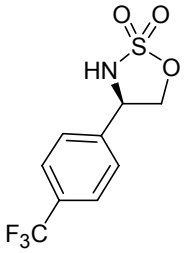
and 6.9 Hz); ^{13}C NMR (75 MHz, DMSO-d_6): 140.2, 133.3, 130.6, 128.3, 126.6, 125.4, 74.6, 57.6; EIMS (70eV) *m/z* (rel intensity) 233 (M^+, 6), 202 (12), 138 (100), 111 (16), 75 (19); HRMS (EI) calcd for $C_8H_8ClNO_3S$: 232.9913, found: 232.9913; $[\alpha]_D^{23}$ = -33.6 (*c* 0.42, $CHCl_3$); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 20/80, 0.8 mL/min): t_1 = 8.5 min (*R*), t_2 = 9.4 min (*S*); *ee* = 99%.

(*R*)-4-(4-Chlorophenyl)-[1,2,3]- oxathiazolidine-2,2-dioxide (8e).[7]



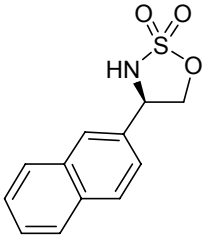
Yield = 82%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.43-7.35 (m, 4H), 5.06 (q, 1H, *J* = 6.9 Hz), 4.90 (d, 1H, *J* = 5.0 Hz), 4.84 (dd, 1H, *J* = 8.7 and 6.9 Hz), 4.39 (t, 1H, *J* = 8.4 Hz); ^{13}C NMR (75 MHz, $CDCl_3$) 135.5, 134.2, 129.6, 128.1, 74.6, 58.9; EIMS (70eV) *m/z* (rel intensity) 233 (M^+, 10), 203 (14), 139 (100), 110 (13), 75 (14); $[\alpha]_D^{23}$ = -31.9 (*c* 0.36, $CHCl_3$); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 20/80, 0.8 mL/min) t_1 = 8.9 min (*R*), t_2 = 11.3 min (*S*); ee = 97%.

(*R*)-4-(4-Trifluoromethylphenyl)-[1,2,3]- oxathiazolidine-2,2-dioxide (8f).



Yield = 77%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.71 (d, 2H, *J* = 8.2 Hz), 7.58 (d, 2H, *J* = 8.1 Hz), 5.16 (q, 1H, *J* = 7.4 Hz), 4.95 (brs, 1H), 4.90 (dd, 1H, *J* = 8.8 and 7.2 Hz), 4.41 (dd, 1H, *J* = 8.8 and 7.8 Hz); ^{13}C NMR (75 MHz, $CDCl_3$) 139.9, 131.7 (q, $J_{F\text{-}C}$ = 32.6 Hz), 127.1, 126.4 (q, $J_{F\text{-}C}$ = 3.6 Hz), 123.5 (q, $J_{F\text{-}C}$ = 272.7 Hz), 74.5, 58.9; EIMS (70eV) *m/z* (rel intensity) 267 (M^+, 1), 139 (7), 111 (20), 97 (28), 71 (47), 57 (100); $[\alpha]_D^{23}$ = -26.1 (*c* 0.33, $CHCl_3$); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 20/80, 0.8 mL/min): t_1 = 7.4 min (*R*), t_2 = 9.7 min (*S*); *ee* = 97%.

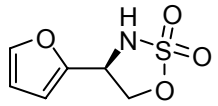
(*R*)-4-(2-Naphthyl)-[1,2,3]- oxathiazolidine-2,2-dioxide (8g).



Yield = 86%, ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.93 (d, 1H, *J* = 8.6 Hz), 7.88-7.83 (m, 3H), 7.58-7.50 (m, 3H), 5.25 (q, 1H, *J* = 7.1 Hz), 4.91 (dd, 1H, *J* = 8.8 and 6.9 Hz), 4.79 (d, 1H, *J* = 6.2 Hz), 4.55 (t, 1H, *J* = 8.6 Hz); ^{13}C NMR (75 MHz, $CDCl_3$) 133.6, 133.1, 132.5, 129.7, 128.0, 127.9, 127.1, 127.0, 126.5, 123.3, 74.7, 59.8; EIMS (70eV) *m/z* (rel intensity) 249 (M^+,

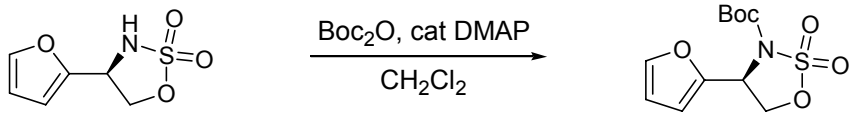
15), 155 (100), 127 (29), 77 (11); $[\alpha]_D^{23}$ = -31.5 (*c* 0.36, $CHCl_3$); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 20/80, 0.8 mL/min): t_1 = 11.3 min (*R*), t_2 = 14.0 min (*S*); *ee* = 97%.

(*S*)-4-(2-Furyl)-[1,2,3]-oxathiazolidine-2,2-dioxide (8h).



Yield = 97%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.48 (dd, 1H, *J* = 1.8 and 0.7 Hz), 6.51 (d, 1H, *J* = 3.3 Hz), 6.42 (dd, 1H, *J* = 3.3 and 1.8 Hz), 5.12 (q, 1H, *J* = 7.2 Hz), 4.79-4.63 (m, 3H); ^{13}C NMR (75 MHz, DMSO-d_6) δ 149.6, 143.7, 110.7, 109.0, 72.1, 52.1; EIMS (70eV) *m/z* (rel intensity) 189 (M^+, 15), 159 (11), 95 (100); $[\alpha]_D^{23}$ = -8.6 (*c* 0.25, $CHCl_3$); HPLC separation failed.

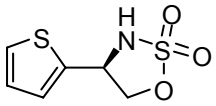
Preparation of (*S*)-*N*-boc-4-(2-furyl)-[1,2,3]-oxathiazolidine-2,2-dioxide (8h')



8h **8h'**

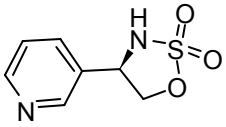
N-Boc-**8h** was obtained in 72% yield, by the treatment of Boc_2O (1.2 equiv) with **8h** in the presence of the catalytic amount of DMAP in dichloromethane. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.44 (dd, 1H, *J* = 1.8 and 0.8 Hz), 6.48 (d, 1H, *J* = 3.3 Hz), 6.39 (dd, 1H, *J* = 3.3 and 1.8 Hz), 5.40 (dd, 1H, *J* = 6.3 and 3.3 Hz), 4.81 (dd, 1H, *J* = 9.2 and 6.4 Hz), 4.65 (dd, 1H, *J* = 9.2 and 3.3 Hz), 1.51 (s, 9H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 148.5, 148.1, 110.9, 109.6, 85.9, 69.2, 54.3; HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 15/85, 0.8 mL/min): t_1 = 9.8 min (*R*), t_2 = 10.4 min (*S*); *ee* = 98%.

(*S*)-4-(2-Thienyl)-[1,2,3]-oxathiazolidine-2,2-dioxide (8i).



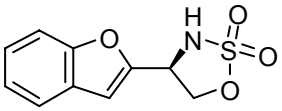
Yield = 98%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.40 (dd, 1H, *J* = 5.1 and 1.2 Hz), 7.21-7.13 (m, 1H), 7.05 (dd, 1H, *J* = 5.1 and 3.6 Hz), 5.34 (q, 1H, *J* = 6.6 Hz), 4.85 (dd, 1H, *J* = 8.7 and 6.6 Hz), 4.83 (br, 1H), 4.56 (t, 1H, *J* = 8.6 Hz); ^{13}C NMR (75 MHz, $CDCl_3$) δ 137.3, 127.6, 127.2, 127.1, 75.3, 55.4; EIMS (70eV) *m/z* (rel intensity) 205 (M^+, 19), 175 (24), 111(100); $[\alpha]_D^{23}$ = -7.4 (*c* 0.67, $CHCl_3$); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 15/85, 0.8 mL/min): t_1 = 13.7 min (*R*), t_2 = 14.9 min (*S*); *ee* = 99%.

(*R*)-4-(3-Pyridinyl)-[1,2,3]-oxathiazolidine-2,2-dioxide (8j).



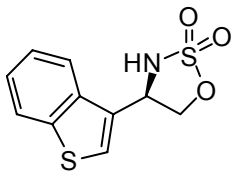
Yield = 91%; ^{1}H NMR (300 MHz, CD_3OD) δ 8.64 (d, 1H, *J* = 2.3 Hz), 8.54 (dd, 1H, *J* = 4.9 and 1.6 Hz), 8.02-7.98 (m, 1H), 7.49 (ddd, 1H, *J* = 8.0, 4.9 and 0.6 Hz), 5.16 (t, 1H, *J* = 7.0 Hz), 4.96 (dd, 1H, *J* = 8.8 and 7.1 Hz), 4.41 (dd, 1H, *J* = 8.8 and 6.8 Hz); ^{13}C NMR (75 MHz, CD_3OD) δ 150.3, 148.9, 136.7, 140.0, 125.5, 75.6, 58.0; EIMS (70eV) m/z (rel intensity) 200 (M^+, 9), 170 (26), 106 (100); Determination of optical rotation was failed due to the solubility problem; HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 15/85, 0.8 mL/min): t_1 = 14.2 min (*R*), t_2 = 16.6 min (*S*); *ee* = 99%.

(*S*)-4-(2-Benzofuryl)-[1,2,3]-oxathiazolidine-2,2-dioxide (8k).



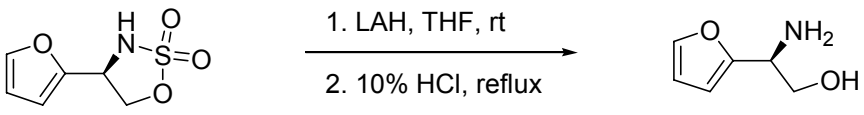
Yield = 84%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.59 (d, 1H, *J* = 7.6 Hz), 7.49 (d, 1H, *J* = 8.5 Hz), 7.36 (dt, 1H, *J* = 7.3 and 1.4 Hz), 7.27 (dt, 1H, *J* = 7.5 and 1.0 Hz), 6.89 (s, 1H), 5.23 (q, 1H, *J* = 7.4 Hz), 4.94 (d, 1H, *J* = 7.3 Hz), 4.85 (dd, 1H, *J* = 8.6 and 8.8 Hz), 4.76 (dd, 1H, *J* = 8.4 and 7.7); ^{13}C NMR (75 MHz, $CDCl_3$) δ 155.2, 149.4, 127.3, 125.6, 123.6, 121.7, 111.5, 107.0, 72.7, 53.7; EIMS (70eV) *m/z* (rel intensity) 239 (M^+, 29), 145 (100); $[\alpha]_D^{23}$ = -23.0 (*c* 0.50, $CHCl_3$); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 15/85, 0.8 mL/min): t_1 = 12.0 min (*R*), t_2 = 14.0 min (*S*); *ee* = 98%.

(*R*)-4-(3-Benzofuryl)-[1,2,3]-oxathiazolidine-2,2-dioxide (8l).



Yield = 30%; ^{1}H NMR (300 MHz, DMSO-d_6) δ 8.56 (d, 1H, *J* = 6.8 Hz), 8.09-7.93 (m, 2H), 7.87 (d, 1H, *J* = 0.7 Hz), 7.50-7.39 (m, 2H), 5.48 (dq, 1H, *J* = 6.9 and 0.9 Hz), 5.08 (dd, 1H, *J* = 8.6 and 6.8 Hz), 4.65 (dd, 1H, *J* = 8.6 and 7.2 Hz); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 15/85, 0.8 mL/min): t_1 = 15.3 min (*R*), t_2 = 16.5 min (*S*); *ee* = 98%.

Synthesis of (*S*)-2-(2-furyl)-2-aminoethanol (*S*)-9.[11]



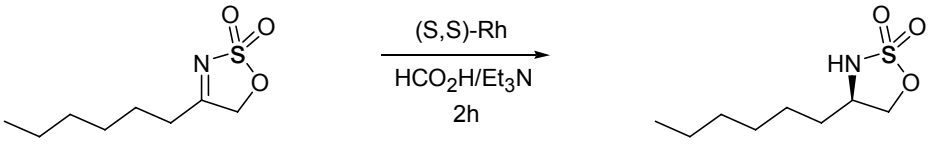
8h (*S*)-**9**

To a suspension of LAH (78 mg, 2.06 mmol) in THF (5 mL), **8h** (130mg, 0.68 mmol) in THF (2 mL) was added dropwise at 0□. The mixture was allowed to stir at room temperature for

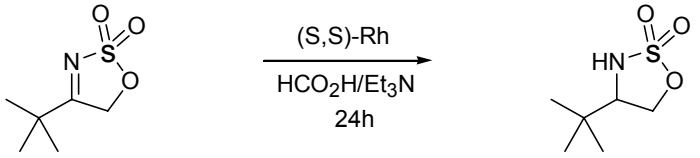
1h, and then 10% HCl solution was added slowly to this mixture. The resulting mixtures were refluxed for 1h, and then cooled to room temperature. To this mixture, 3*N* NaOH solution was introduced. The aqueous layer was extracted with CH_2Cl_2 three times. The combined organic layers were dried and concentrated. The crude was purified by column chromatography on silica gel (CH_2Cl_2/MeOH = 3/1) to give 54 mg (62%) of (*S*)-**9**. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.36 (dd, 1H, *J* = 1.7 and 0.8 Hz), 6.33 (dd, 1H, *J* = 3.2 and 1.9 Hz), 6.19 (d, 1H, *J* = 3.2 Hz), 4.04 (dd, 1H, *J* = 7.7 and 4.5 Hz), 3,82 (dd, 1H, *J* = 10.7 and 4.5 Hz), 3.66 (dd, 1H, *J* = 10.7 and 7.8 Hz), 1.99 (brs, 3H); $[\alpha]_D^{20}$ = -12.4 (*c* 0.33, MeOH).

Transfer hydrogenation on the substrates with alkyl-substituents.

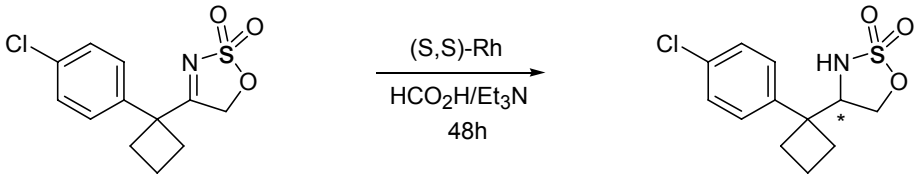
Several substrates with alkyl substituent had been examined within the transfer hydrogenation conditions; however, enantioselectivity of alkyl substrates was poor comparing to that of the aromatic substrates described in this manuscript. The reaction was sluggish and, furthermore, higher degrees of substitution ultimately led to a dramatic drop in enantioselectivity. The results are not surprising, since an attractive interaction between arene ligand of the catalyst and aryl substrate is of great importance in the favoured transition state.[13]



95% yield, 92% ee

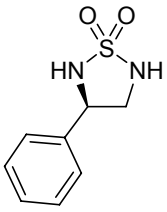


40% conversion, 32% yield
(ee and absolute streochemistry were not dertermined)



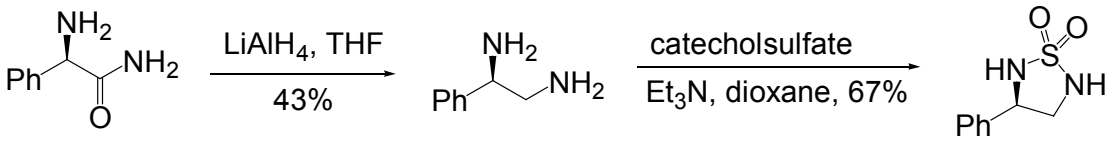
70% yield, 17% ee
(absolute stereochemistry was not determined)

(*R*)-3-Phenyl-1,2,5-thiadiazolidine-1,1-dioxide (10a).



Yield = 93%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.38 (m, 5H), 4.94 (q, 1H, *J* = 6.3 Hz), 4.65 (d, 1H, *J* = 5.8 Hz), 4.59 (t, 1H, *J* = 6.4 Hz), 3.89 (dt, 1H, *J* = 11.8 and 6.6 Hz), 3.50 (dt, 1H, *J* = 11.7 and 7.8 Hz); ^{13}C NMR (75 MHz, $CDCl_3$) δ 137.7, 129.2, 128.9, 126.4, 61.3, 51.8; HRMS (EI) calcd for $C_8H_{10}N_2O_2S$: 198.0463, found: 198.0462; $[\alpha]_D^{23}$ = -49.2 (*c* 0.59, MeOH); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 20/80, 0.8 mL/min): t_1 = 13.2 min (*R*), t_2 = 15.1 min (*S*); *ee* = 98%.

Determination of the absolute configuration of (*R*)-10a.[12]



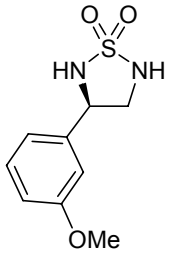
(*R*)-2-Ph-GlyNH$_2$ **11** (*R*)-**10a**

Synthesis of (*R*)-**10a** was carried out according to the known procedures. The synthesis included LAH reduction of (*R*)-2-phenylglycinamide[14] and transformation of the resulting diamine **11** into the desired thiadiazolidine (*R*)-**10a**, employing catecholsulfate with triethylamine in dioxane. The synthetic product was fully matched in the spectral and optical data of the catalytic one.[12]

Deprotection of 10a to 11.

The deprotection of the sulfamide **10a** was easily achieved according to the previously reported procedure.[15]

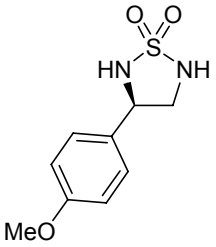
(*R*)-3-(3-Methoxyphenyl)-1,2,5-thiadiazolidine-1,1-dioxide (10b).



Yield = 86%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.29 (t, 1H, *J* = 8.1 Hz), 6.97-6.96 (m, 2H), 6.87-6.84 (m, 1H), 4.96 (brs, 1H), 4.91-4,87 (m, 2H), 3.88-3.82 (m, 1H), 3.79 (s, 1H), 3.46-3.40 (m, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) 159.9, 139.6, 130.1, 118.4, 113.9, 111.87, 61.07, 55.25, 51.52; EIMS (70eV) *m/z* (rel intensity) 228 (M^+, 7), 134 (100), 105 (43); HRMS calcd for $C_9H_{12}N_2O_3S$: 228.0569, found: 228.0571; $[\alpha]_D^{28}$ = -34.1 (*c* 0.40, $CHCl_3$); HPLC

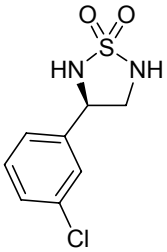
(Chiralcel AD-H column, ^{i}PrOH/hexane = 20/80, 0.8 mL/min): t_1 = 14.8 min (*R*), t_2 = 16.7 min (*S*); *ee* = 83%.

(*R*)-3-(4-Methoxyphenyl)-1,2,5-thiadiazolidine-1,1-dioxide (10c).



Yield = 86%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.34 (d, 2H, *J* = 8.8 Hz), 6.93 (d, 2H, *J* = 8.6 Hz), 4.88 (dd, 1H, *J* = 14.0 and 6.5 Hz), 4.53 (d, 2H, *J* = 5.7 Hz), 3.89-3.77 (m, 3H), 3.82 (s, 3H), 3.49 (dt, 1H, *J* = 11.7 and 8.1 Hz); ^{13}C NMR (75 MHz, CD_3OD) δ 161.1, 132.8, 128.9, 115.1, 62.1, 55.7, 52.6; HRMS (EI) calcd for $C_9H_{12}N_2O_3S$: 228.0569, found: 228.0569; $[\alpha]_D^{21}$ = -43.7 (*c* 0.27, MeOH); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 30/70, 0.8 mL/min): t_1 = 10.4 min (*S*), t_2 = 12.1 min (*R*); *ee* = 98%.

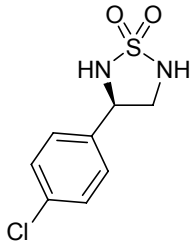
(*R*)-3-(3-chlorophenyl)-1,2,5-thiadiazolidine-1,1-dioxide (10d).



Yield = 84%; ^{1}H NMR (300 MHz, DMSO-d_6) δ 7.63 (brs, 1H), 7.49 (t, 1H, *J* = 1.8 Hz), 7.43-7.34 (m, 3H), 7.18 (brs, 1H), 4.80 (t, 1H, *J* = 6.8 Hz), 3.80-3.74 (m, 1H), 3.09-3.03 (m, 1H); ^{13}C NMR (75 MHz, DMSO-d_6) 143.5, 133.1, 130.3, 127.5, 126.2, 125.1, 59.0, 50.4; EIMS (70eV) *m/z* (rel intensity) 233 (M^+, 1), 138 (100), 111 (19), 77 (24); $[\alpha]_D^{27}$ = -48.9 (*c* 0.50,

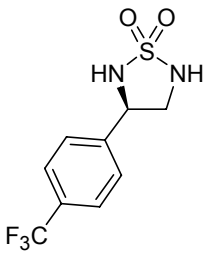
$CHCl_3$); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 20/80, 0.8 mL/min): t_1 = 10.6 min (*R*), t_2 = 12.6 min (*S*); *ee* = 97%.

(*R*)-3-(4-chlorophenyl)-1,2,5-thiadiazolidine-1,1-dioxide (10e).



Yield = 87%; ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41-7.35 (m, 4H), 4.92 (q, 1H, *J* = 6.4 Hz), 4.64 (brs, 1H), 4.50 (brs, 1H), 3.94-3.85 (m, 1H), 3.49-3.40 (m, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) 136.4,134.6, 129.3, 127.6, 60.4, 51.5; EIMS (70eV) *m/z* (rel intensity) 232 (M^+, 0.1), 138 (100), 112 (16), 75 (14); Positive-ion FAB-MS *m/z* 233 ($[M + H]^+$, 37); $[\alpha]_D^{28}$ = -33.6 (*c* 0.55, $CHCl_3$); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 20/80, 0.8 mL/min): t_1 = 11.9 min (*R*), t_2 = 15.8 min (*S*); *ee* = 98%.

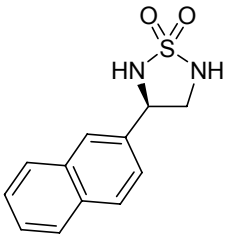
(*R*)-3-(4-trifluoromethylphenyl)-1,2,5-thiadiazolidine-1,1-dioxide (10f).



Yield = 86%; ^{1}H NMR (300 MHz, DMSO-d_6) δ 7.62 (dd, 4H, *J* = 32.3 and 8.3 Hz), 7.68 (d, 1H, *J* = 6.7 Hz), 7.18 (t, 1H, *J* = 7.5 Hz), 4.90 (q, 1H, *J* = 6.5 Hz), 3.85-3.77 (m, 1H), 3.13-3.04 (m, 1H); ^{13}C NMR (75 MHz, DMSO-d_6) 145.6, 128.2 (q, $J_{F\text{-}C}$ = 32.2 Hz), 127.2, 125.3

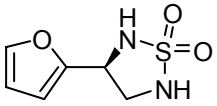
(q, $J_{F\text{-}C}$ = 3.6 Hz), 124.1 (q, $J_{F\text{-}C}$ = 272.0 Hz), 59.2, 50.4; EIMS (70eV) *m/z* (rel intensity) 266 (M^+, 1), 172 (67), 144 (16), 63 (25), 56 (45); $[\alpha]_D^{27}$ = -42.7 (*c* 0.41, MeOH); HRMS (EI) calcd for $C_9H_9F_3N_2O_2S$: 266.0337, found: 266.0340; HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 20/80, 0.8 mL/min): t_1 = 8.8 min (*R*), t_2 = 13.1 min (*S*); *ee* = 97%.

(*R*)-3-(2-Naphthyl)-1,2,5-thiadiazolidine-1,1-dioxide (10g).



Yield = 91%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.92-7.83 (m, 4H), 7.55-7.48 (m, 3H), 5.10 (q, 1H, *J* = 6.6 Hz), 4.65 (d, 1H, *J* = 5.9 Hz), 4.49 (t, 1H, *J* = 6.9 Hz), 4.00-3.91 (m, 1H), 3.64-3.55 (m, 1H); ^{13}C NMR (75 MHz, DMSO-d_6) 138.0, 132.6, 132.4, 128.2, 127.7, 127.5, 126.3, 126.0, 125.0, 124.5, 59.9, 50.4; EIMS (70eV) *m/z* (rel intensity) 248 (M^+, 3), 155 (100), 127 (25), 77 (7); HRMS (EI) calcd for $C_{12}H_{12}N_2O_2S$: 248.0619, found: 248.0638; $[\alpha]_D^{27}$ = -30.6 (*c* 0.38, MeOH); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 20/80, 0.8 mL/min): t_1 = 15.1 min (*R*), t_2 = 20.3 min (*S*); *ee* = 90%.

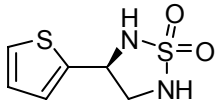
(*S*)-3-(2-Furyl)-1,2,5-thiadiazolidine-1,1-dioxide (10h).



Yield = 87%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.44 (dd, 1H, *J* = 1.8 and 0.8 Hz), 6.47-6.34 (m,

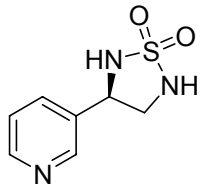
2H), 4.94 (t, 1H, *J* = 6.0 Hz), 4.65 (s, 2H), 3.89-3.61 (m, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 149.8, 143.5, 110.8, 109.0, 55.4, 49.2; EIMS (70eV) *m/z* (rel intensity) 189 (M^+ + 1, 47), 121 (23), 95 (100); $[\alpha]_D^{22}$ = -1.2 (*c* 0.45, $CHCl_3$); HPLC separation failed.

(*S*)-3-(2-thienyl)-1,2,5-thiadiazolidine-1,1-dioxide (10i).



Yield = 93%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.34 (dd, 1H, *J* = 5.1 and 1.2 Hz), 7.16-7.10 (m, 1H), 7.02 (dd, 1H, *J* = 5.1 and 3.6 Hz), 5.17 (q, 1H, *J* = 6.4 Hz), 4.66 (s, 2H), 3.91 (dt, 1H, *J* = 12.0 and 6.6 Hz), 3.61 (dt, 1H, *J* = 11.8 and 7.5 Hz); ^{13}C NMR (75 MHz, $CDCl_3$) δ 140.5, 127.5, 126.3, 126.0, 57.4, 52.2; EIMS (70eV) *m/z* (rel intensity) 205 (M^+ + 1, 2), 140 (5), 123 (9), 110 (100); $[\alpha]_D^{23}$ = -8.8 (*c* 0.45, $CHCl_3$); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 15/85, 0.8 mL/min): t_1 = 22.7 min (*R*), t_2 = 24.2 min (*S*); *ee* = 98%.

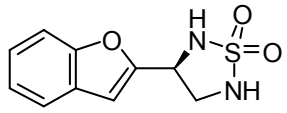
(*R*)-3-(3-Pyridinyl)-1,2,5-thiadiazolidine-1,1-dioxide (10j).



Yield = 45%; ^{1}H NMR (300 MHz, CD_3OD) δ 8.59 (d, 2H, *J* = 42.1 Hz), 8.00 (d, 1H, *J* = 8.0 Hz), 7.48 (dd, 1H, *J* = 7.6 and 4.9 Hz), 4.97 (t, 1H, *J* = 6.6 Hz), 3.91 (dd, 1H, *J* = 11.8 and 7.0 Hz), 3.35-3.29 (m, 1H); ^{13}C NMR (75 MHz, CD_3OD) δ 149.6, 148.6, 136.5, 125.4, 68.4, 59.7; 52.0; EIMS (70eV) *m/z* (rel intensity) 200 (M^+ + 1, 4), 106 (100), 79 (35); $[\alpha]_D^{27}$ = -

46.1 (*c* 0.17, MeOH); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 20/80, 0.8 mL/min): t_1 = 15.1 min (*R*), t_2 = 16.0 min (*S*); *ee* = 73%.

(*S*)-3-(Benzofuran-2-yl)-1,2,5-thiadiazolidine-1,1-dioxide (10k).



Yield = 87%; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.57 (d, 1H, *J* = 7.8 Hz), 7.47(d, 1H, *J* = 7.6 Hz), 7.37-7.21 (m, 2H), 6.85 (s, 1H), 5.07 (q, 1H, *J* = 6.0 Hz), 4.73 (d, 1H, *J*= 6.3 Hz), 6.85 (s, 1H, *J* = 7.7 Hz), 3.96-3.76 (m, 2H); ^{13}C NMR (75 MHz, CD_3OD) δ 156.7, 156.6, 129.5, 125.6, 124.1, 122.2, 112.1, 105.7, 56.7, 49.3; EIMS (70eV) *m/z* (rel intensity) 238 (M^+, 3), 174 (3), 145 (100), 118 (16); $[\alpha]_D^{23}$ = -32.0 (*c* 0.30, MeOH); HPLC (Chiralcel AD-H column, ^{i}PrOH/hexane = 20/80, 0.8 mL/min): t_1 = 12.2 min (*R*), t_2 = 14.1 min (*S*); *ee* = 91%.

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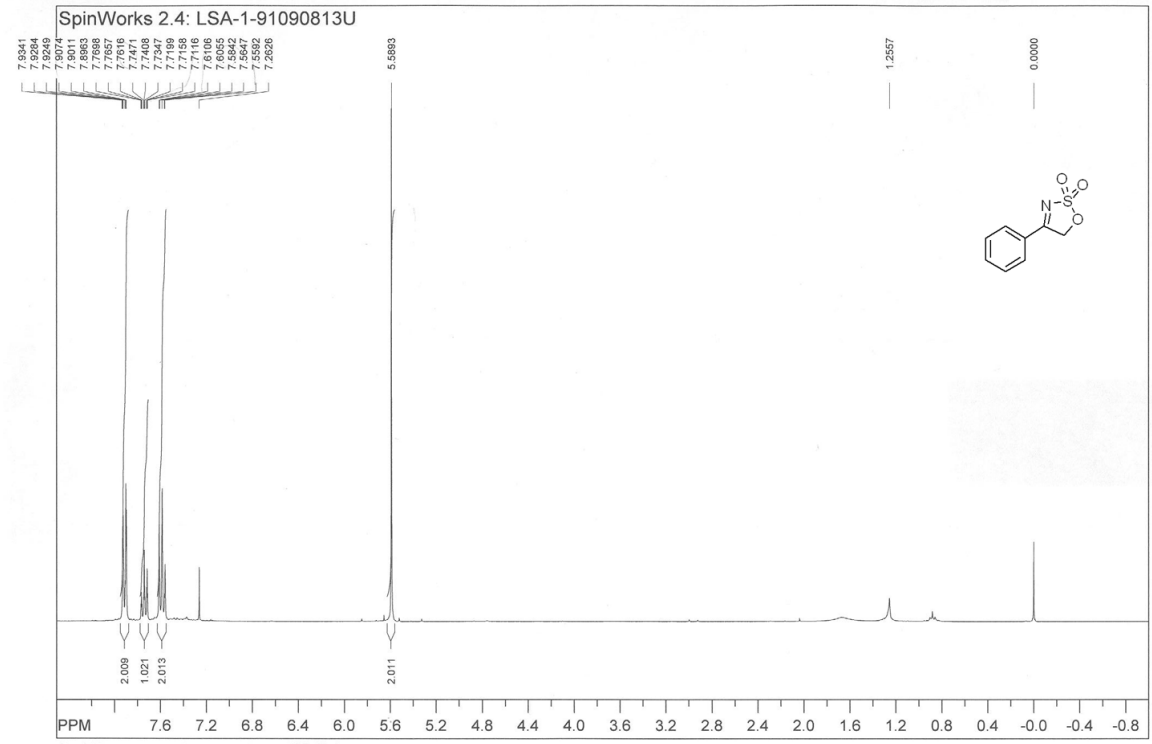

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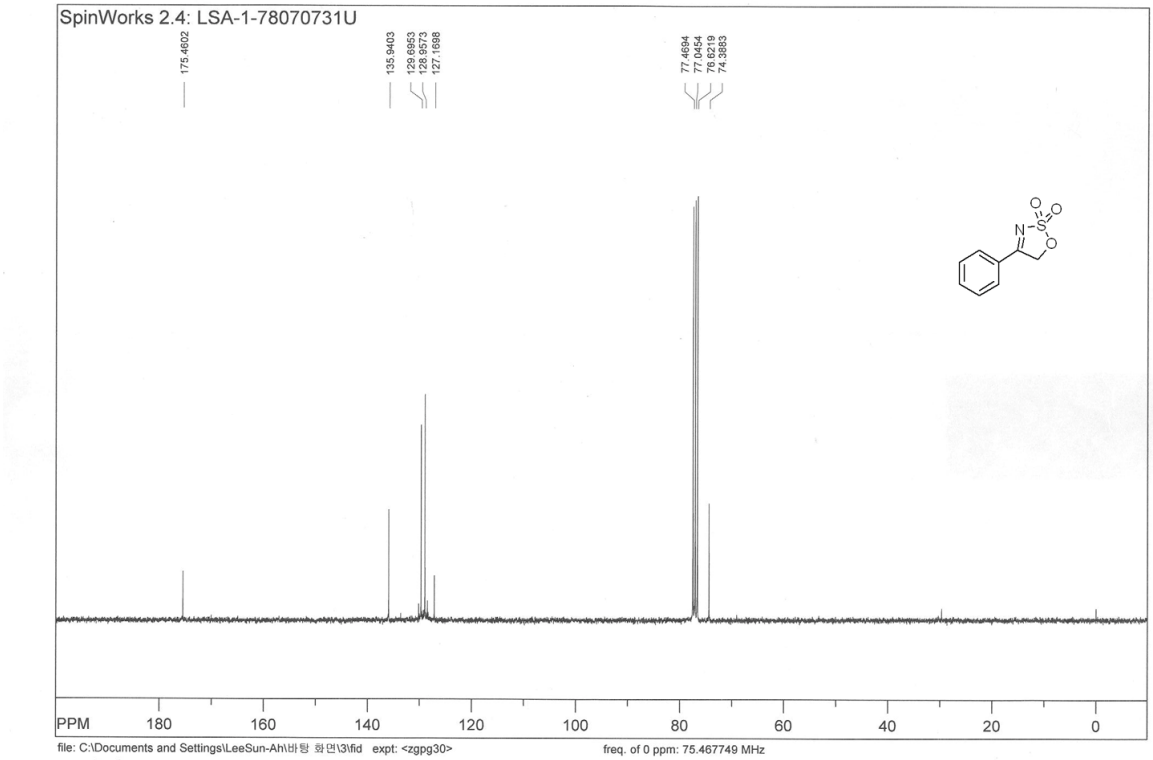

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number of scans: 1024

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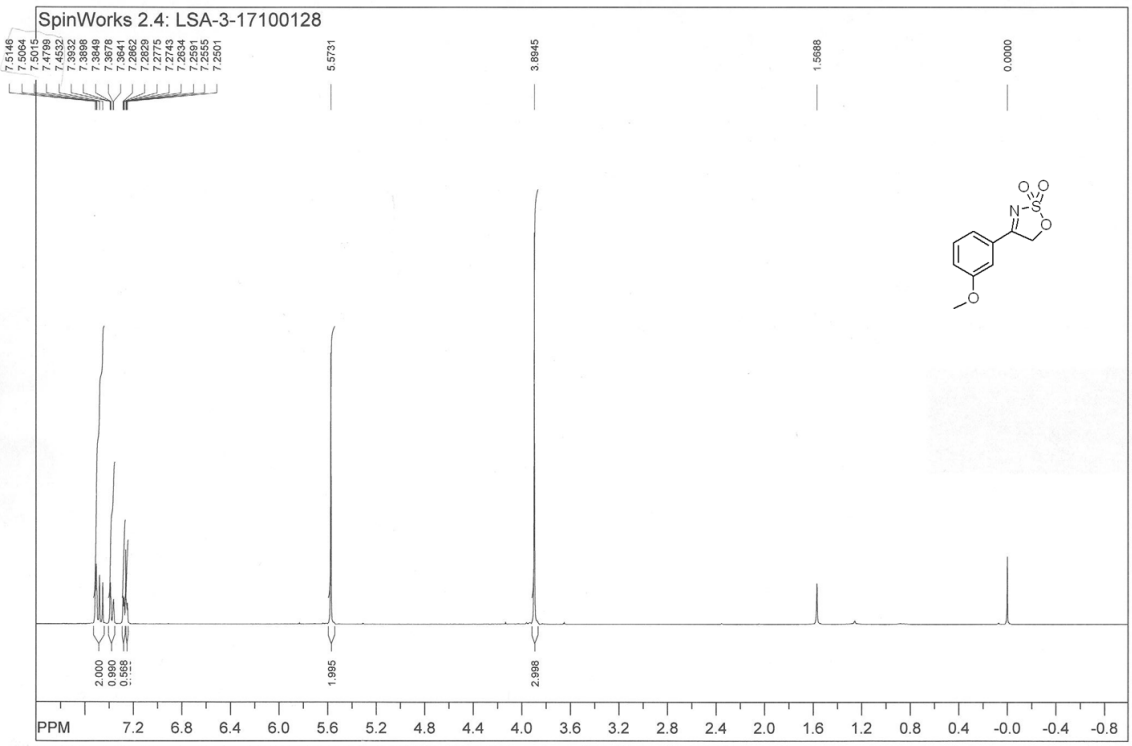
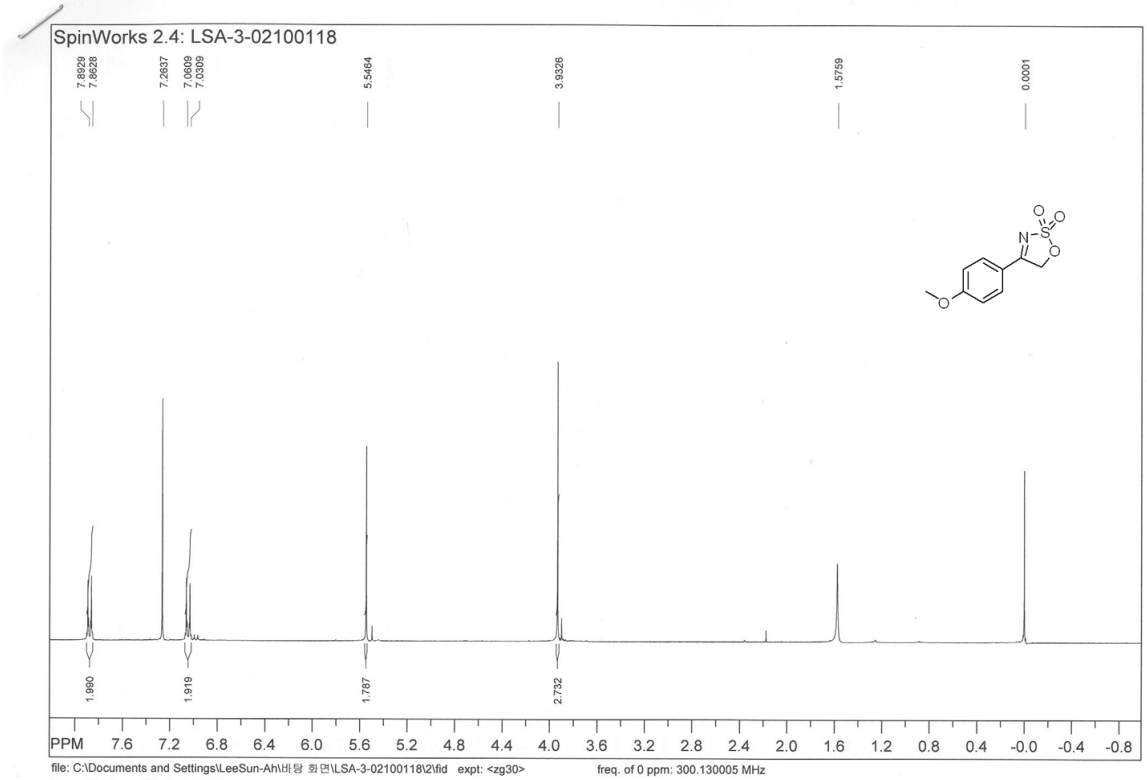
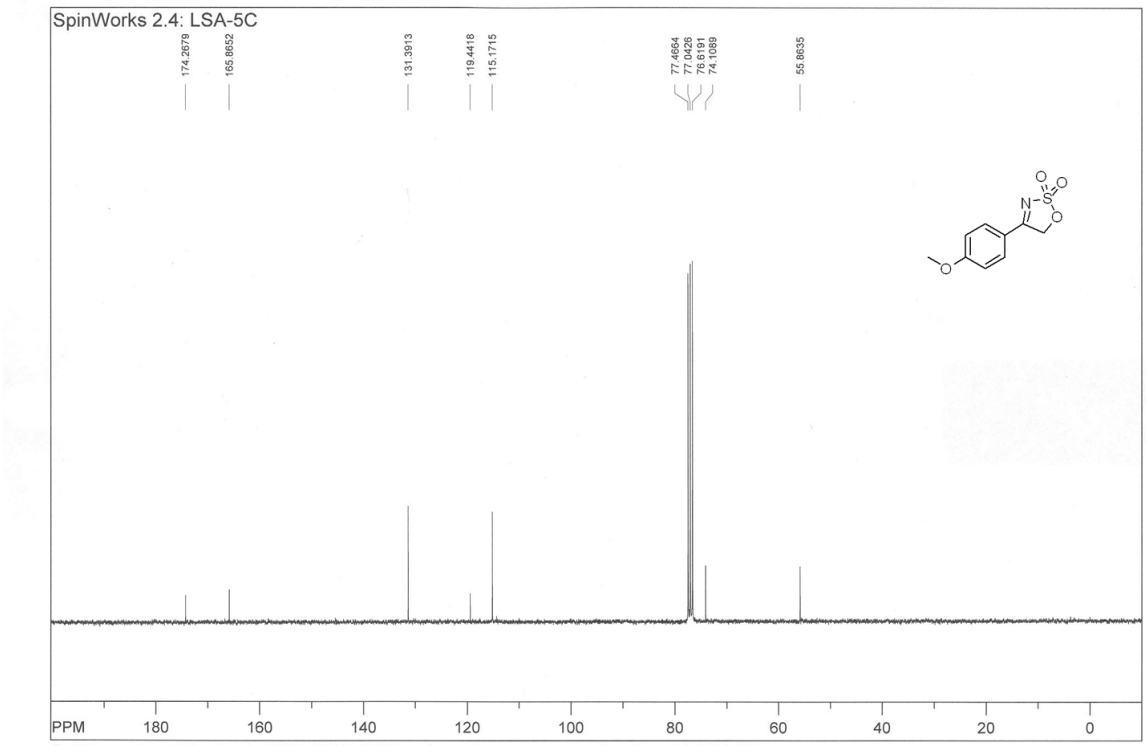
LB: 1.000 GB: 0.0000
Hz/cm: 633.094 ppm/cm: 8.38809


SpinWorks 2.4: LSA-3-17100128
7.5146
7.5064
7.5015
7.4709
7.4532
7.3932
7.3898
7.3849
7.3678
7.3641
7.2862
7.2828
7.2775
7.2743
7.2634
7.2591
7.2555
7.2501
5.5731
3.8945
1.5688
0.0000
2.000
0.990
0.568
1.995
2.998
PPM
7.2 6.8 6.4 6.0 5.6 5.2 4.8 4.4 4.0 3.6 3.2 2.8 2.4 2.0 1.6 1.2 0.8 0.4 -0.0 -0.4 -0.8
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-17100128\1\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16
freq. of 0 ppm: 300.130007 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 107.994 ppm/cm: 0.35982



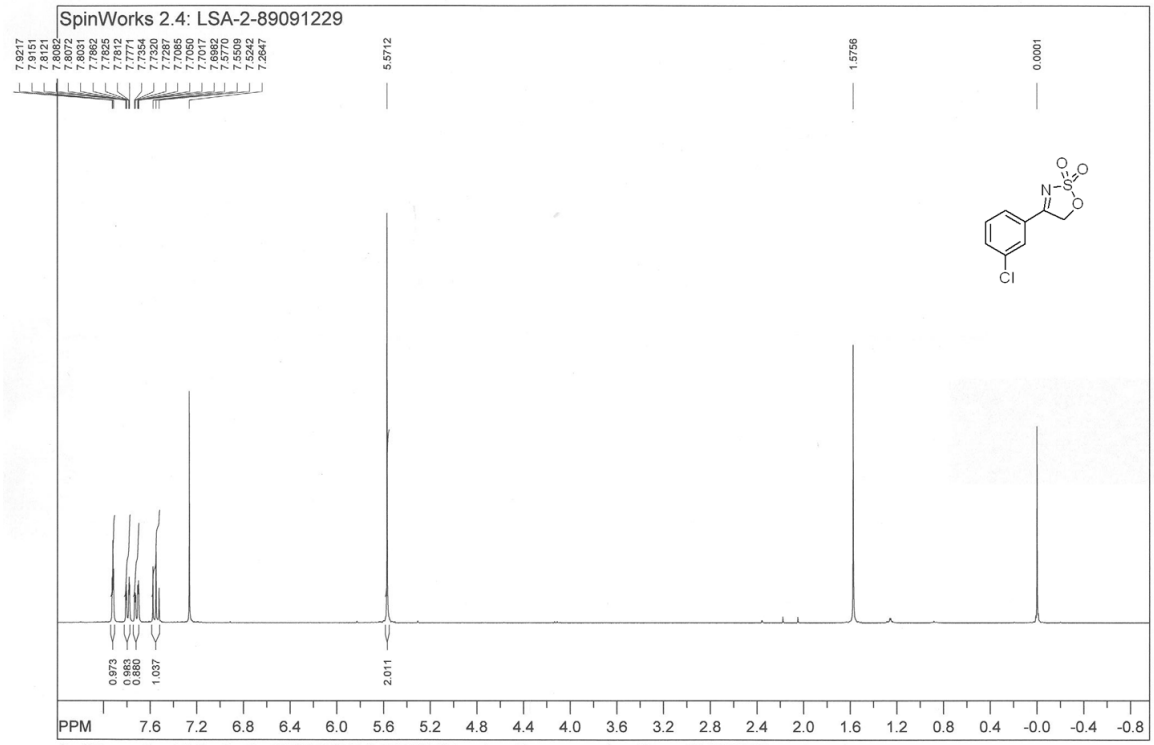
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-02100118\2\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16

freq. of 0 ppm: 300.130005 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 110.451 ppm/cm: 0.36801



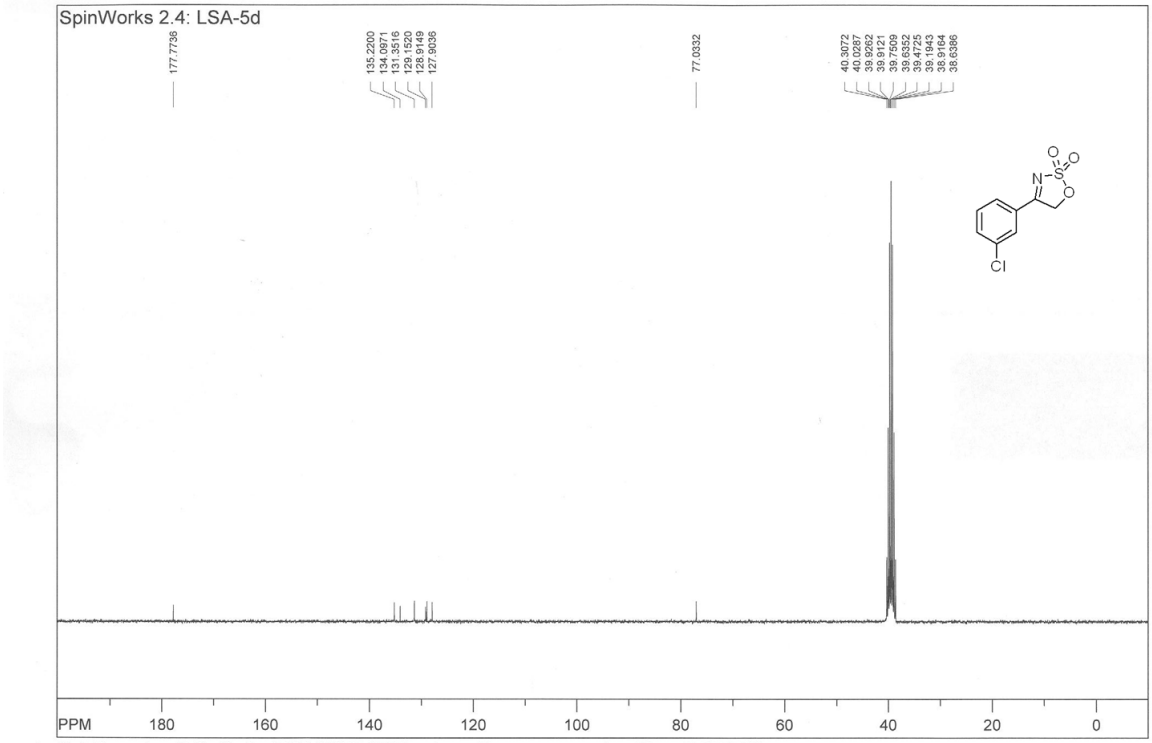
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-5C\1\fid expt: <zgpg30>
transmitter freq.: 75.475295 MHz
time domain size: 65536 points
width: 17985.61 Hz = 238.297995 ppm = 0.274439 Hz/pt
number of scans: 1024

freq. of 0 ppm: 75.467749 MHz
processed size: 32768 complex points
LB: 1.000 GB: 0.0000
Hz/cm: 634.723 ppm/cm: 8.40968



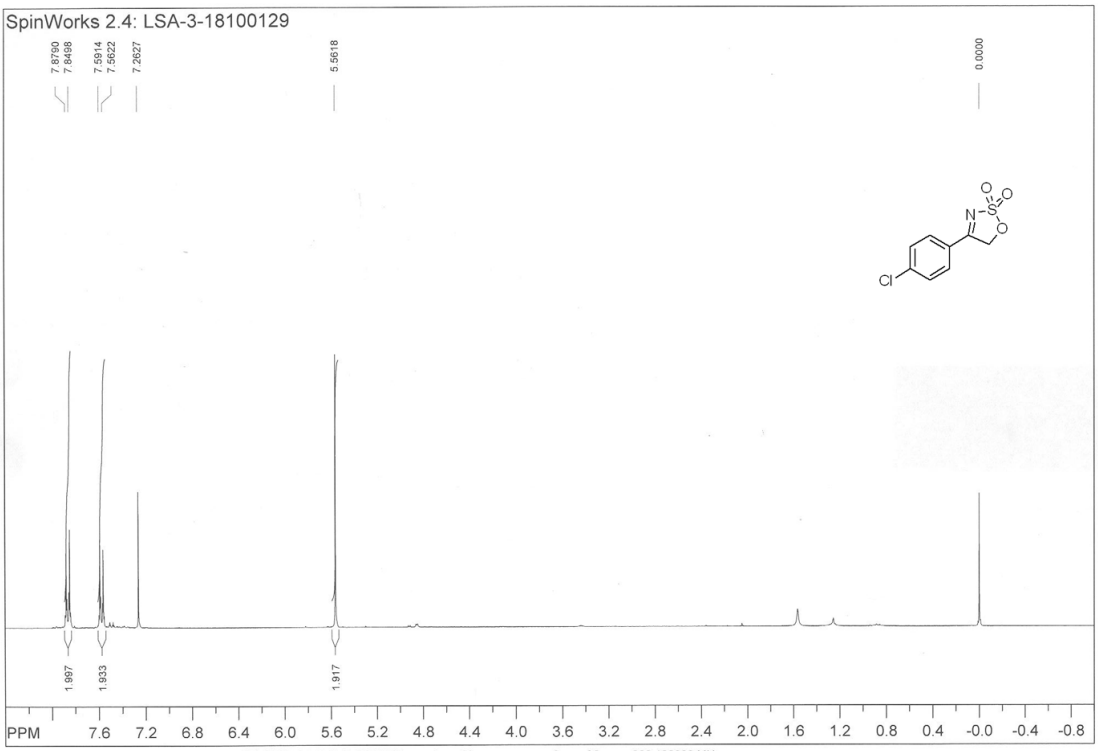
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-2-89091229\1\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16

freq. of 0 ppm: 300.130007 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 112.353 ppm/cm: 0.37434



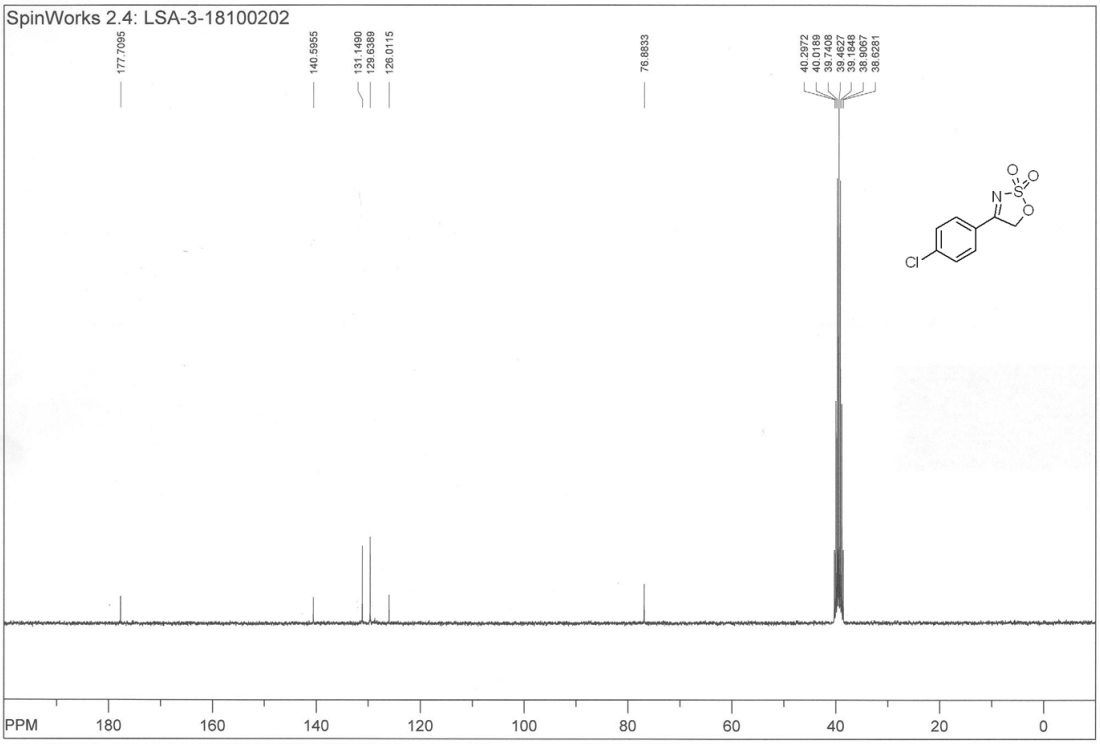
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-5d\1\fid expt: <zgpg30>
transmitter freq.: 75.475295 MHz
time domain size: 65536 points
width: 17985.61 Hz = 238.297995 ppm = 0.274439 Hz/pt
number of scans: 1500

freq. of 0 ppm: 75.467787 MHz
processed size: 32768 complex points
LB: 1.000 GB: 0.0000
Hz/cm: 634.159 ppm/cm: 8.40221



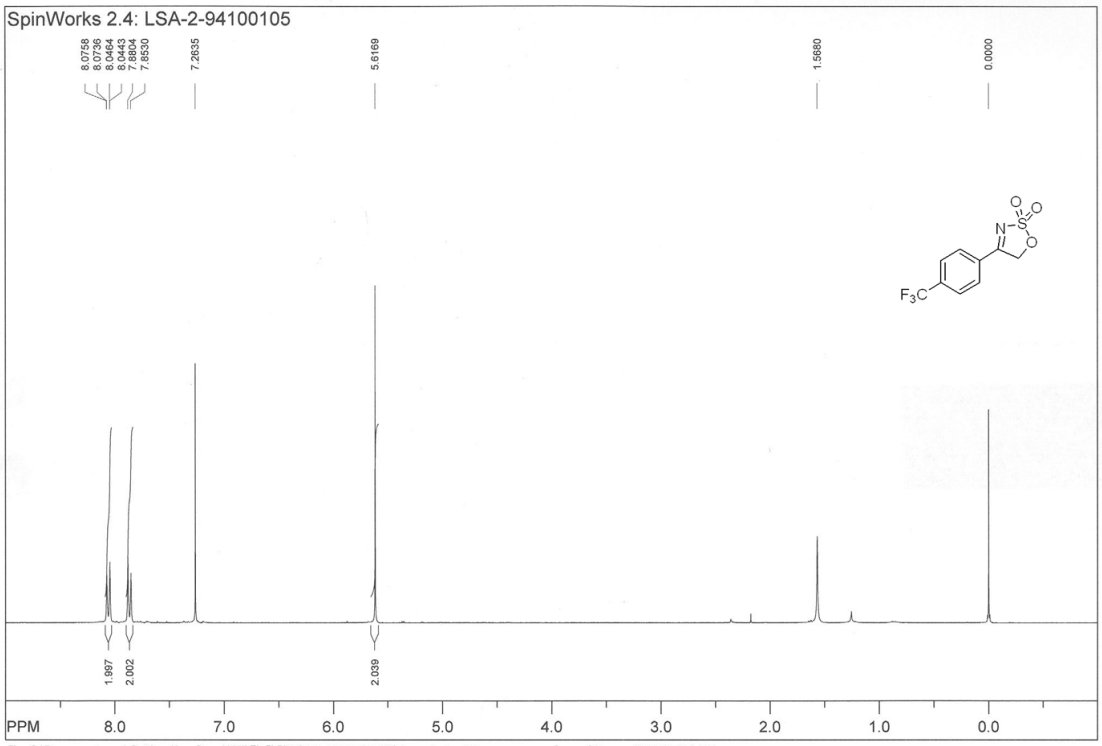
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-18100129\6\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16

freq. of 0 ppm: 300.130006 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 112.922 ppm/cm: 0.37624



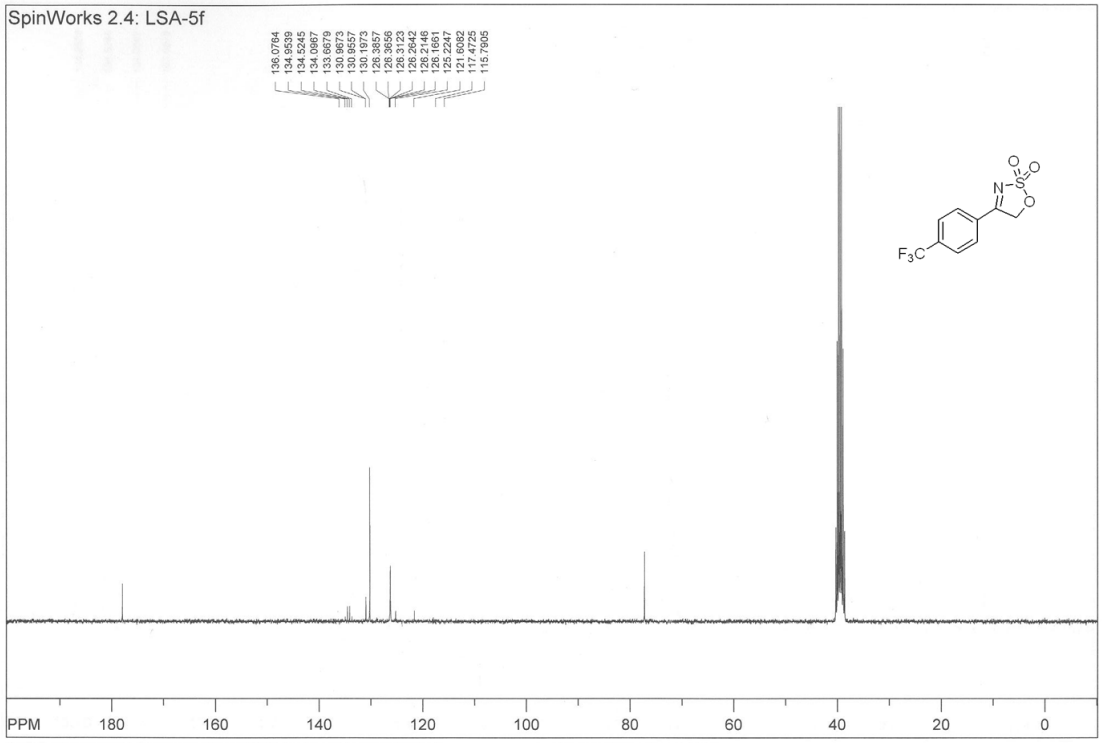
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-18100202\1\fid expt: <zgpg30>
transmitter freq.: 75.475295 MHz
time domain size: 65536 points
width: 17985.61 Hz = 238.297995 ppm = 0.274439 Hz/pt
number of scans: 1024

freq. of 0 ppm: 75.467787 MHz
processed size: 32768 complex points
LB: 1.000 GB: 0.0000
Hz/cm: 634.222 ppm/cm: 8.40304



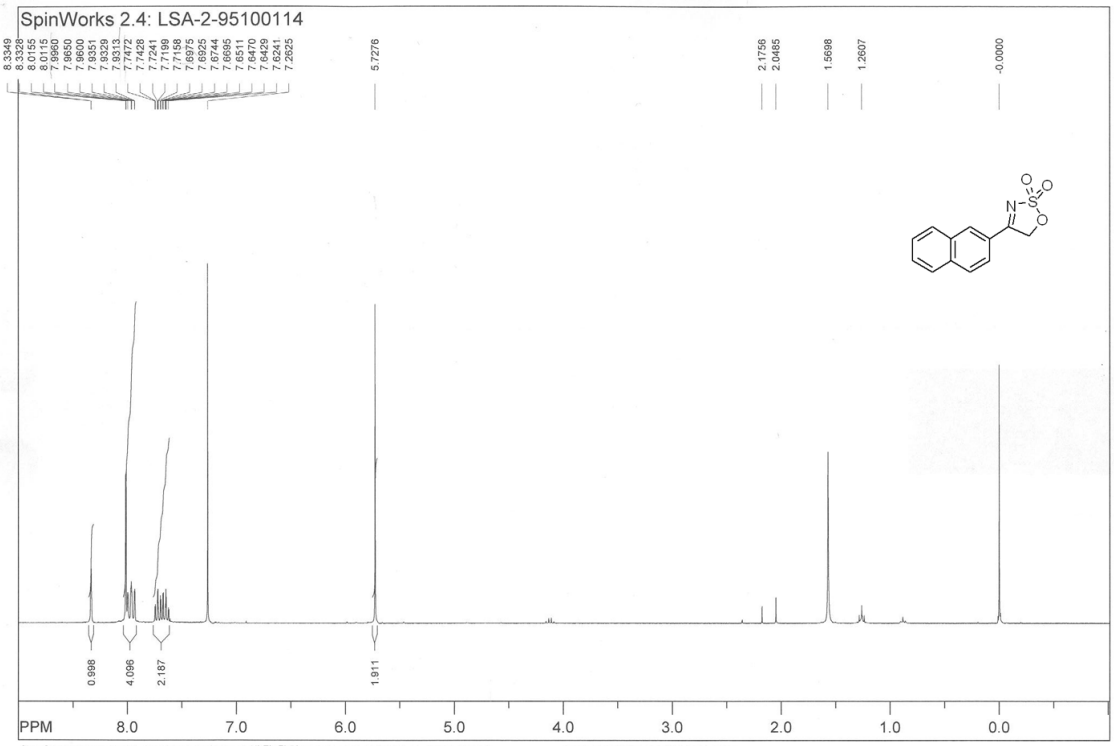
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-2-94100105\2\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16

freq. of 0 ppm: 300.130006 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 120.068 ppm/cm: 0.40005



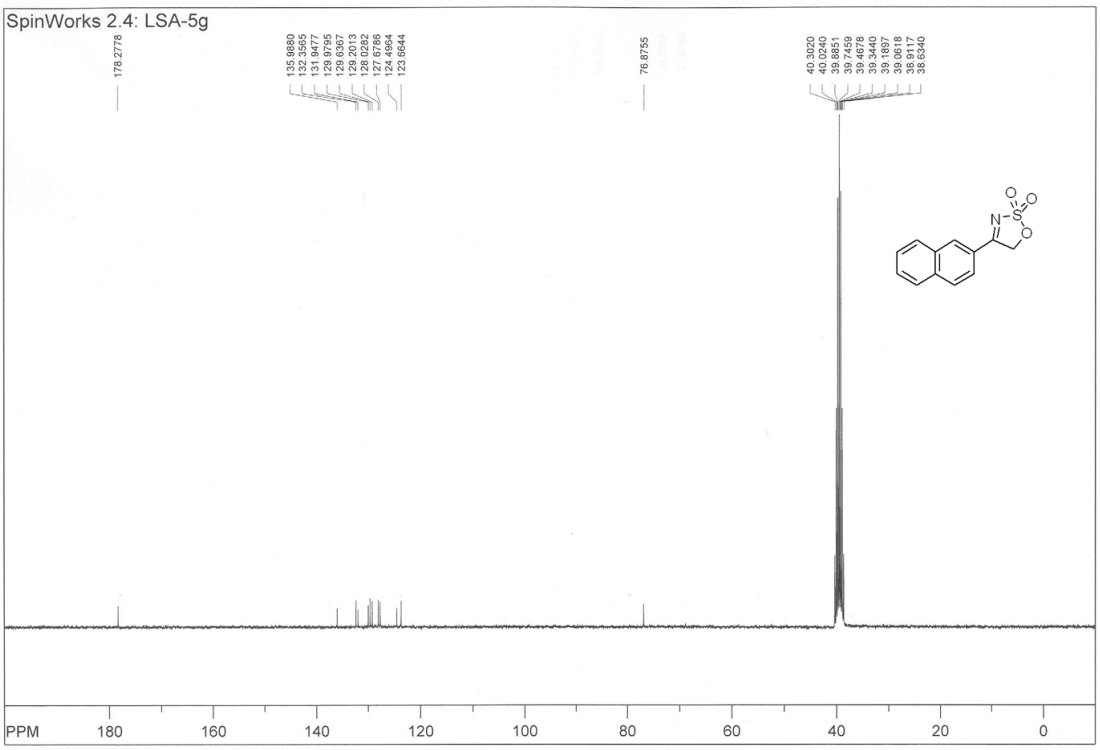
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-5f\1\fid expt: <zgpg30>
transmitter freq.: 75.475295 MHz
time domain size: 65536 points
width: 17985.61 Hz = 238.297995 ppm = 0.274439 Hz/pt
number of scans: 2048

freq. of 0 ppm: 75.467787 MHz
processed size: 32768 complex points
LB: 1.000 GB: 0.0000
Hz/cm: 635.351 ppm/cm: 8.41799



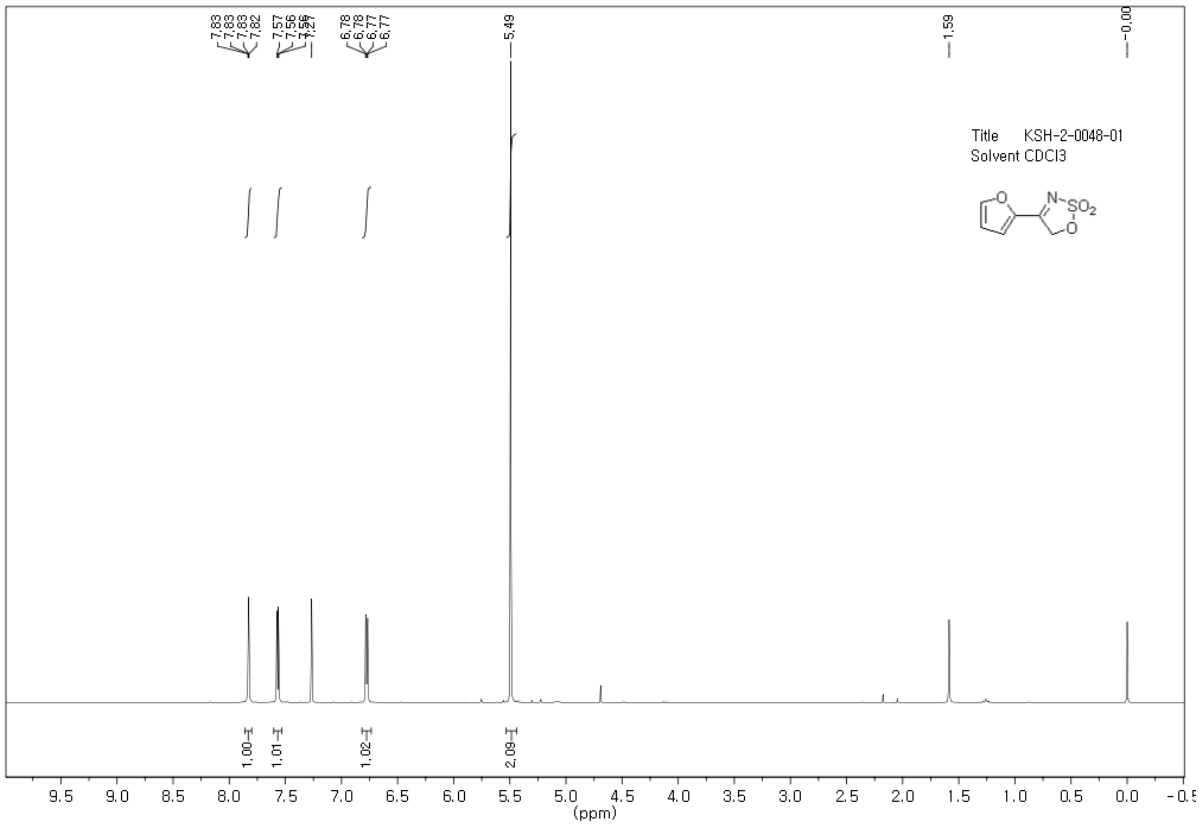
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-2-95100114\1\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16

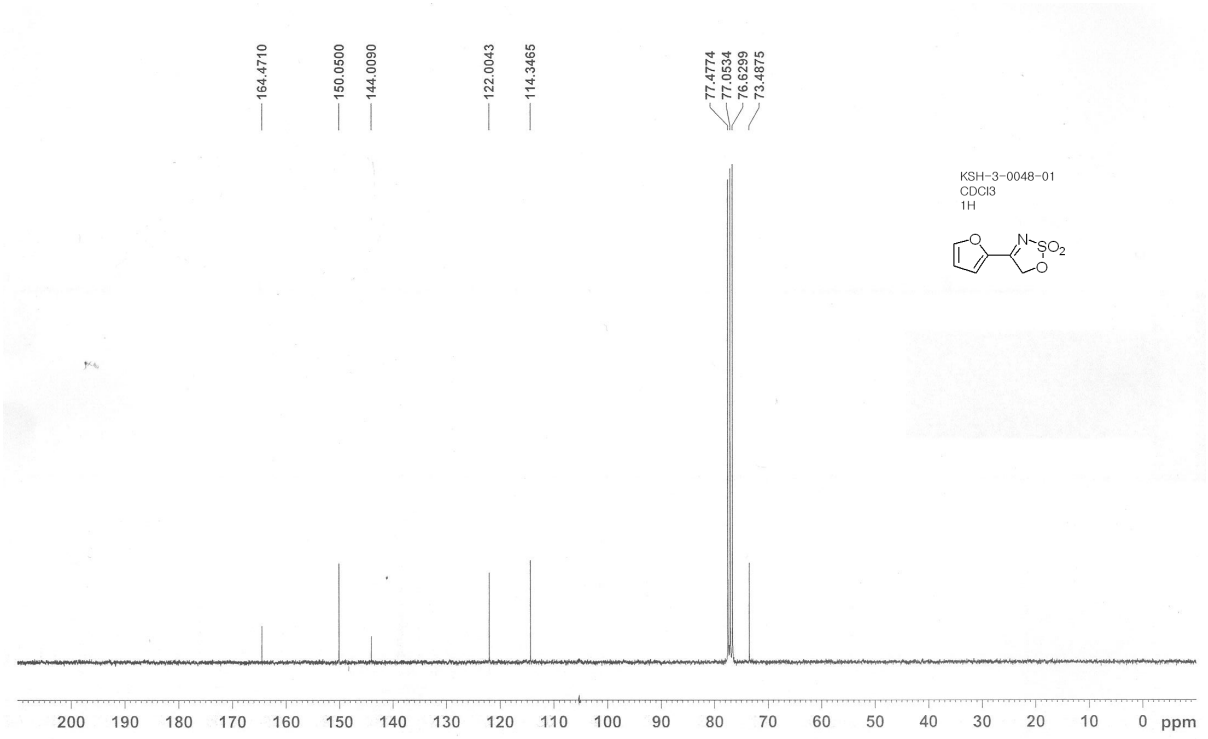
freq. of 0 ppm: 300.130006 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 120.261 ppm/cm: 0.40070

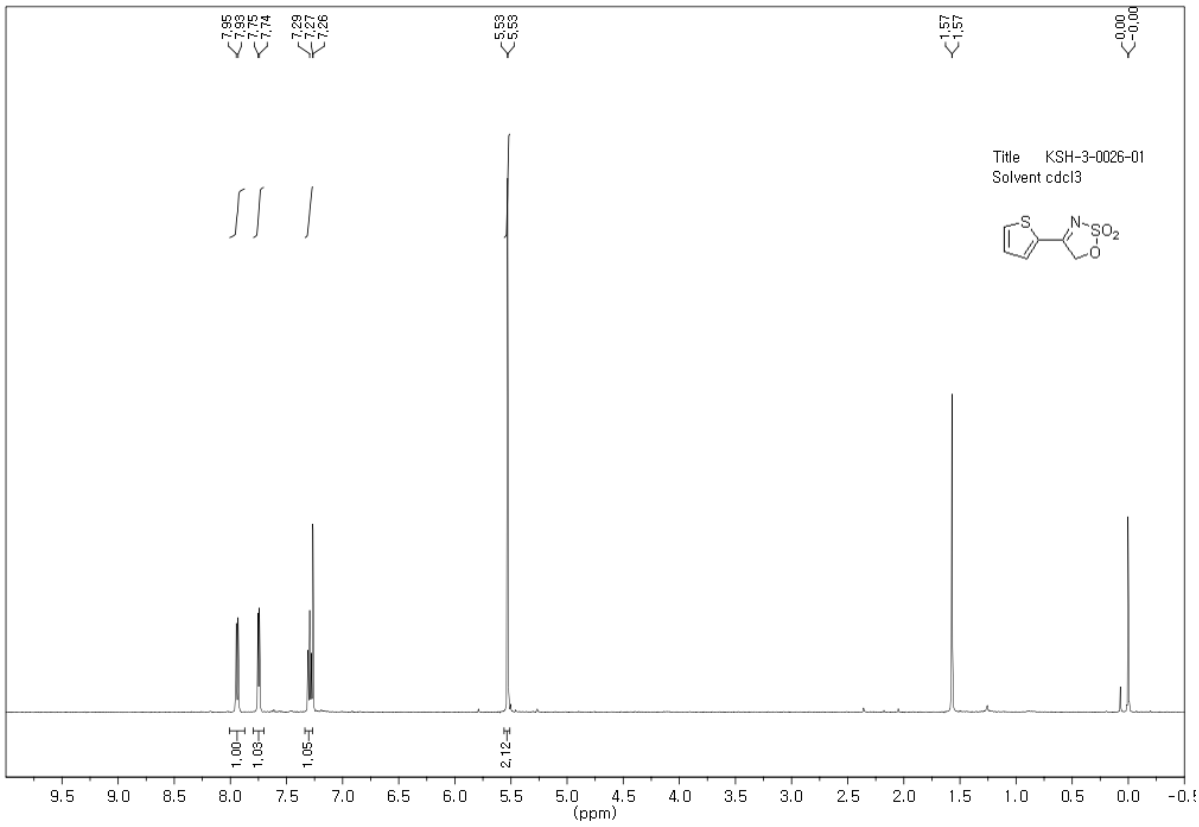


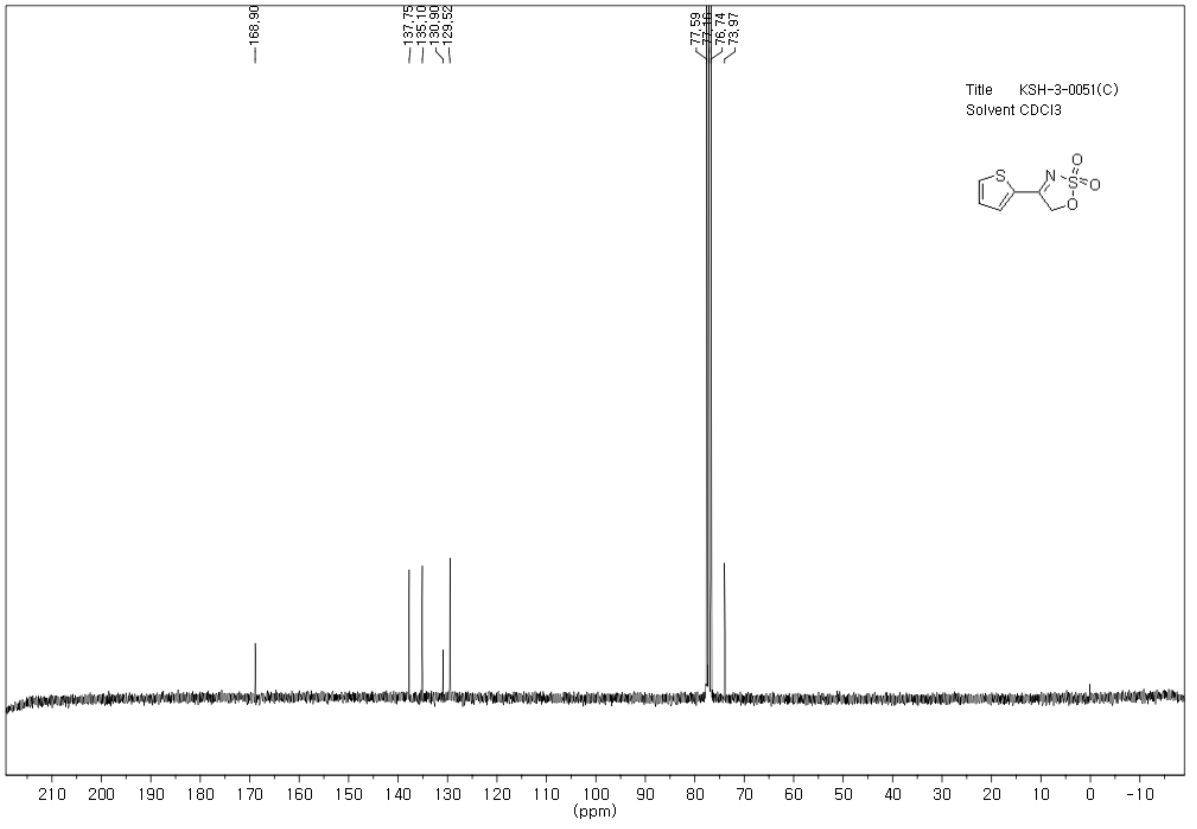
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-5g\1\fid expt: <zgpg30>
transmitter freq.: 75.475295 MHz
time domain size: 65536 points
width: 17985.61 Hz = 238.297995 ppm = 0.274439 Hz/pt
number of scans: 1500

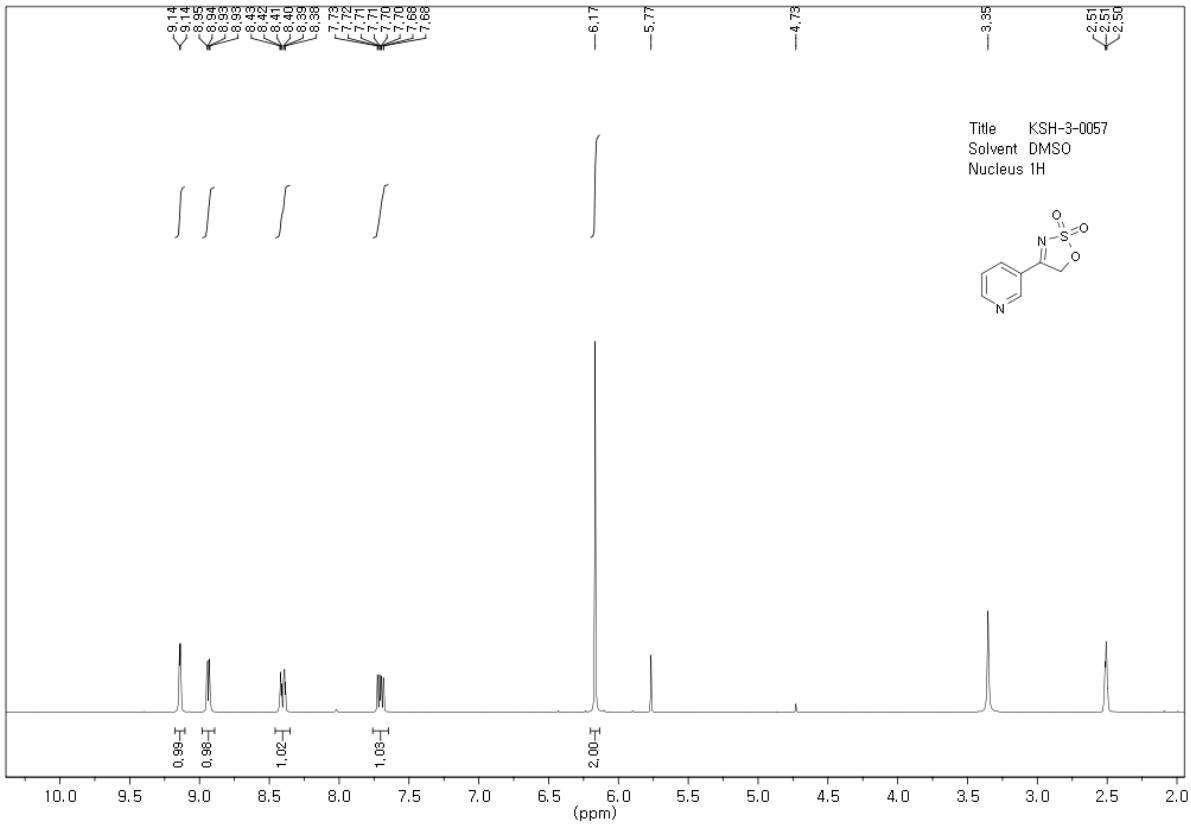
freq. of 0 ppm: 75.467787 MHz
processed size: 32768 complex points
LB: 0.000 GB: 0.0000
Hz/cm: 633.595 ppm/cm: 8.39473

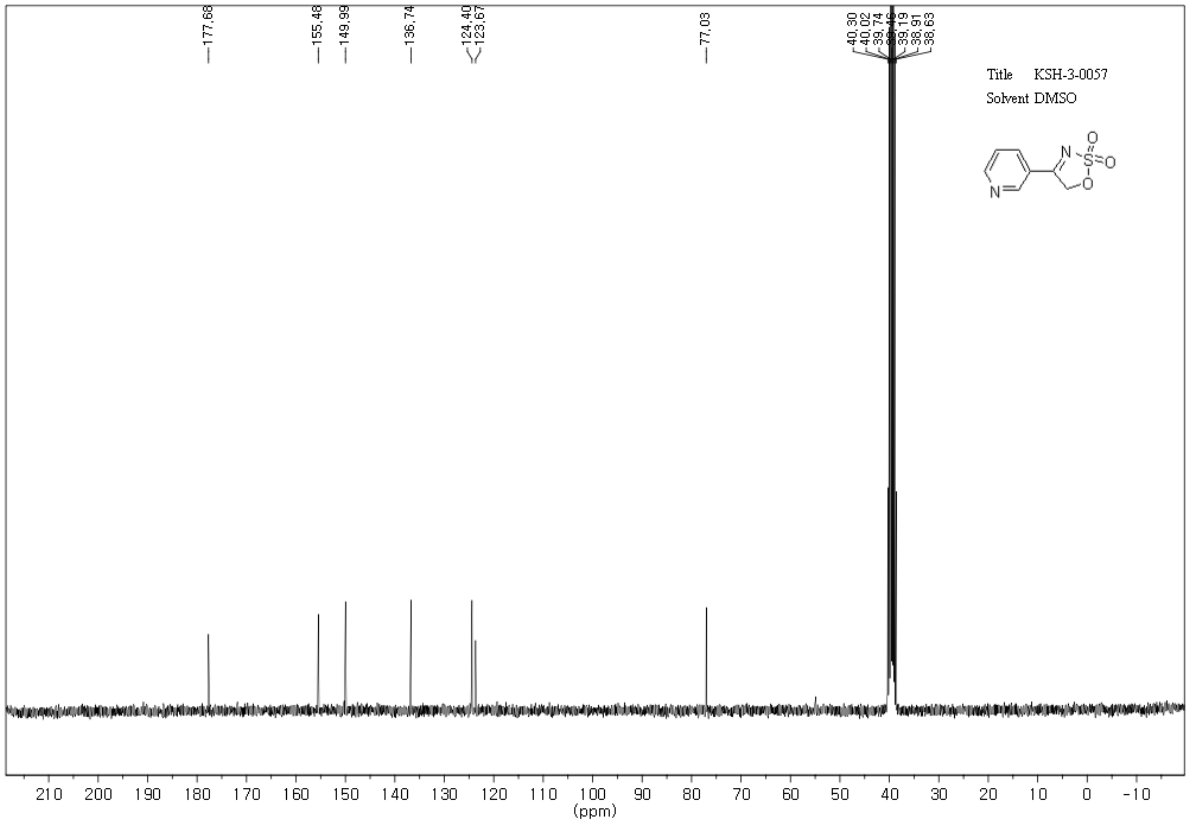

7.83
7.83
7.83
7.82
7.57
7.56
7.56
7.27
6.78
6.78
6.77
6.77
5.49
1.59
0.00
Title KSH-2-0048-01
Solvent CDCl3
1.00
1.01
1.02
2.09
(ppm)

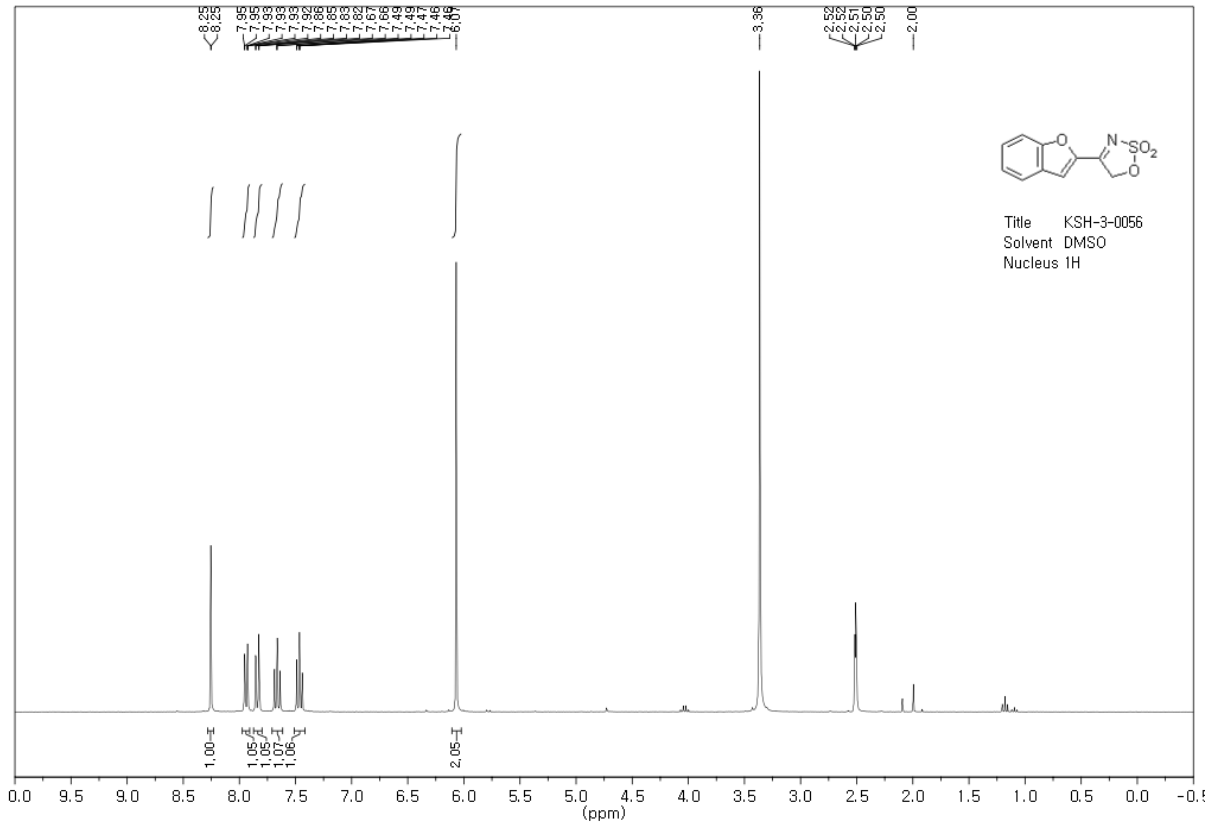

164.4710
150.0500
144.0090
122.0043
114.3465
77.4774
77.0534
76.6299
73.4875
KSH-3-0048-01
CDCl3
1H
ppm

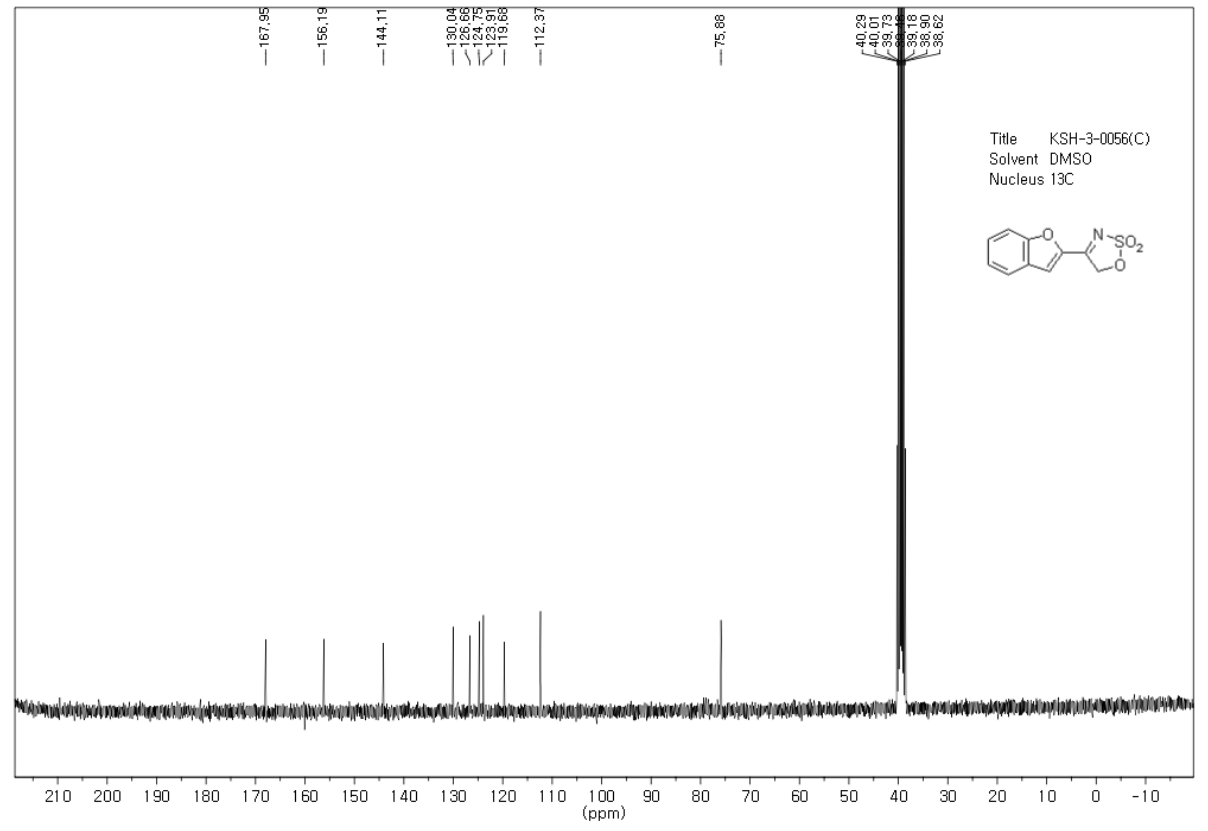

7.95
7.93
7.75
7.74
7.29
7.27
7.26
5.53
5.53
1.57
1.57
0.00
-0.00
Title KSH-3-0026-01
Solvent cdcl3
1.00
1.03
1.05
2.12
(ppm)

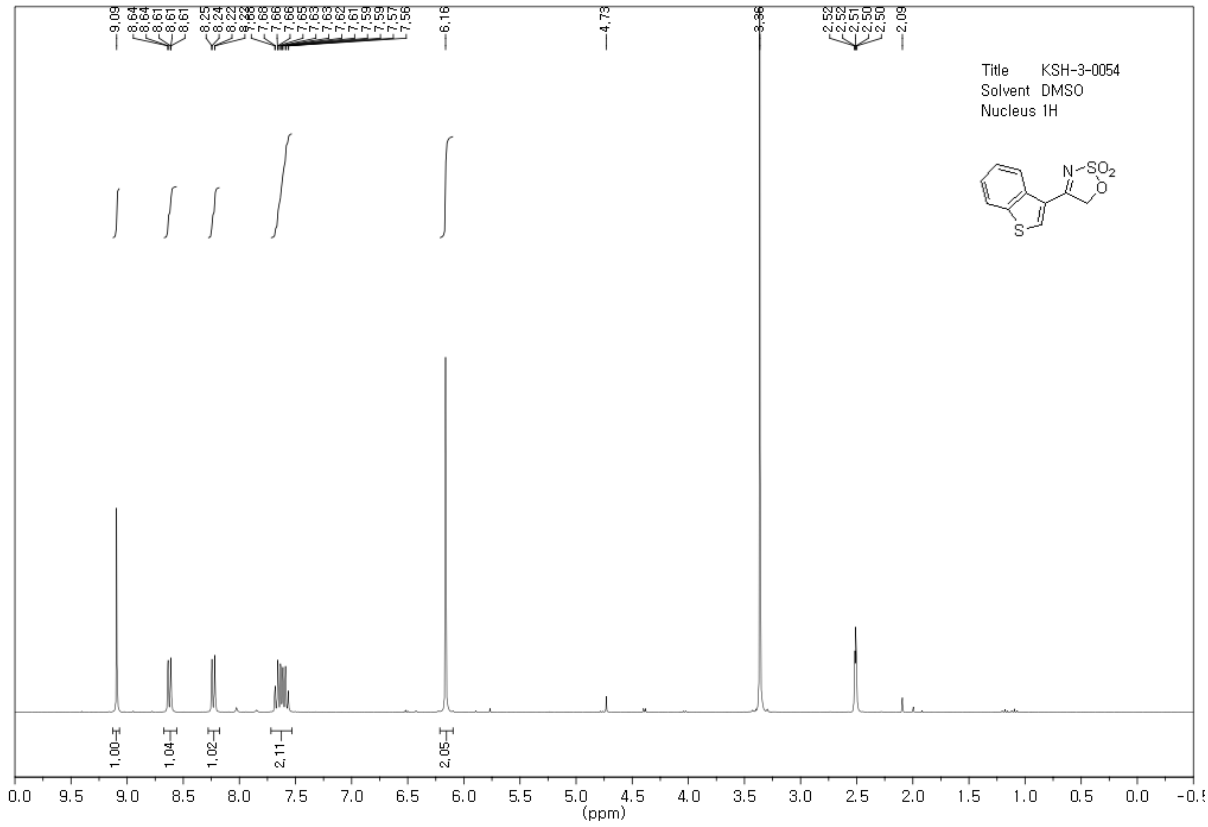

168.90
137.75
135.10
130.90
129.52
77.59
77.16
76.74
73.97
Title KSH-3-0051(C)
Solvent CDCl3
(ppm)

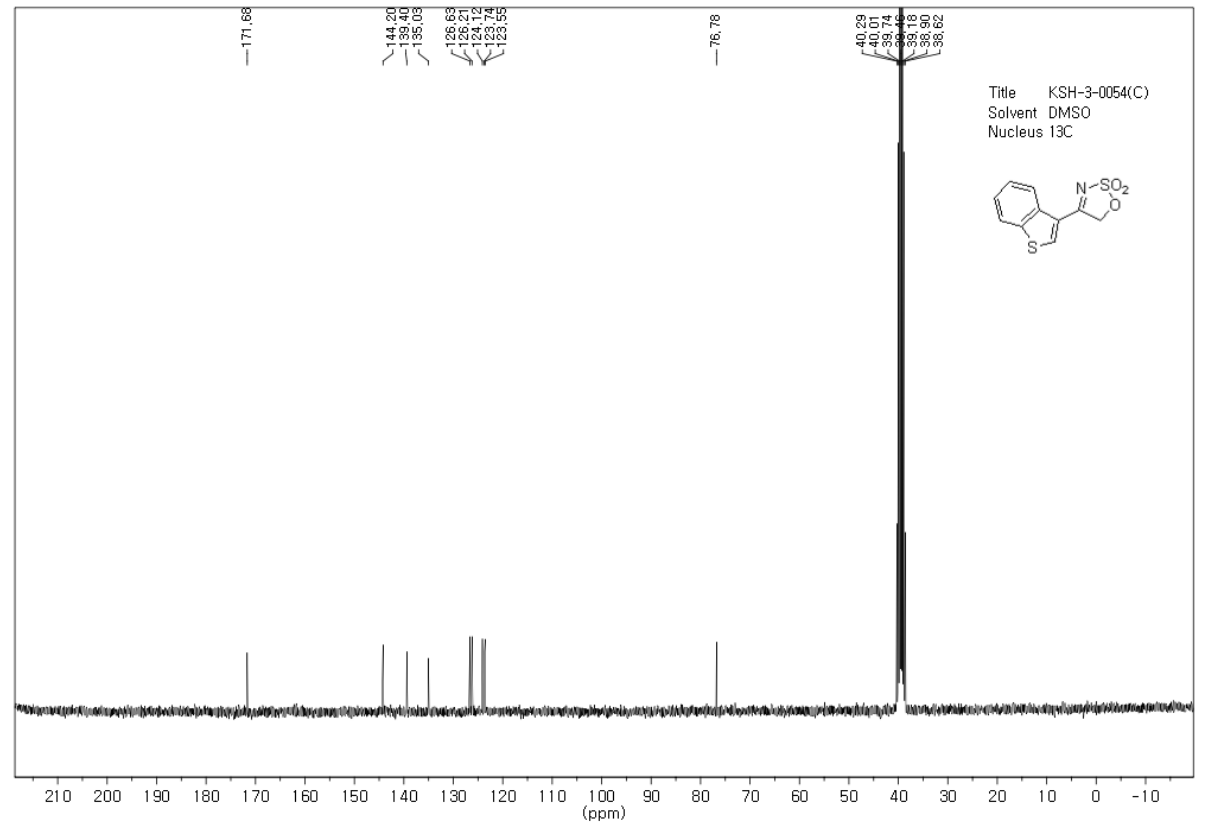

9.14
9.14
8.95
8.94
8.93
8.43
8.42
8.41
8.40
8.39
8.38
7.73
7.72
7.71
7.71
7.70
7.70
7.68
7.68
6.17
5.77
4.73
3.35
2.51
2.51
2.50
Title KSH-3-0057
Solvent DMSO
Nucleus 1H
0.99
0.98
1.02
1.03
2.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0
(ppm)

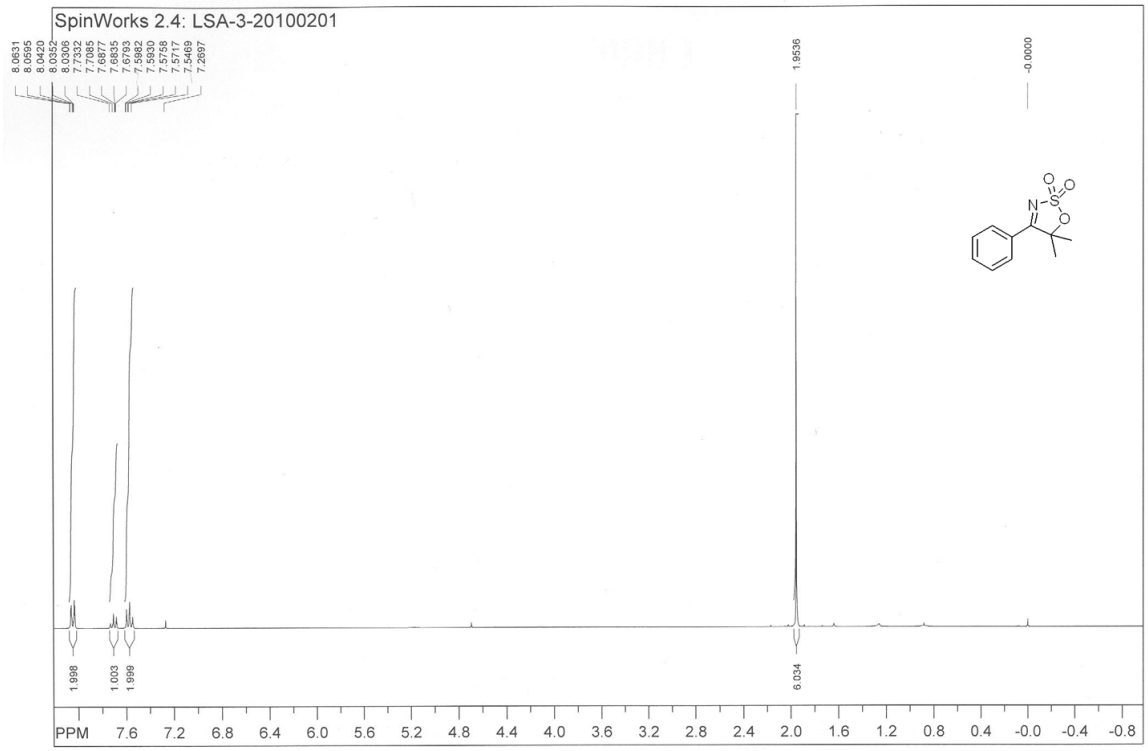

177.68
155.48
149.99
136.74
124.40
123.67
77.03
40.30
40.02
39.74
39.46
39.19
38.91
38.63
Title KSH-3-0057
Solvent DMSO
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
(ppm)


8.25
8.25
7.95
7.95
7.93
7.93
7.92
7.88
7.85
7.83
7.82
7.67
7.66
7.49
7.47
7.46
6.01
3.36
2.52
2.52
2.51
2.50
2.50
2.00
1.00
1.05
1.05
1.07
1.06
2.05
Title KSH-3-0056
Solvent DMSO
Nucleus 1H
(ppm)


167.95
156.19
144.11
130.04
126.66
124.75
123.91
119.68
112.37
75.88
40.29
40.01
39.73
39.18
38.90
38.62
Title KSH-3-0056(C)
Solvent DMSO
Nucleus 13C
(ppm)

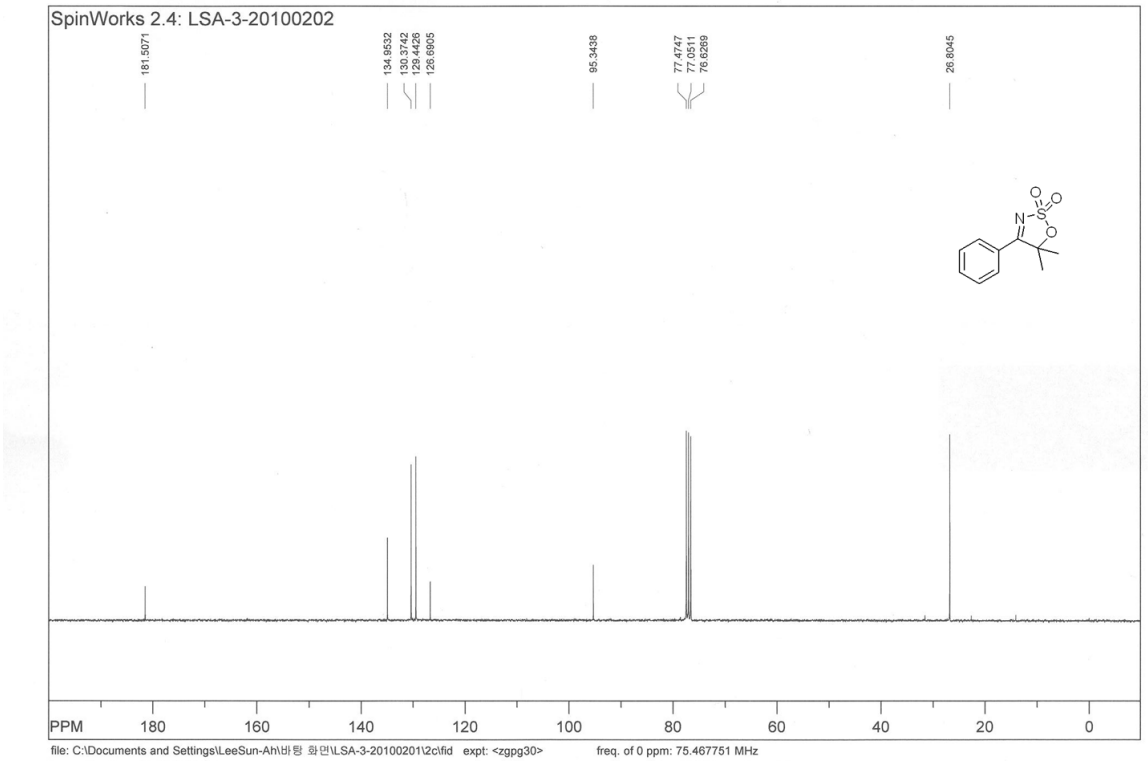

Title KSH-3-0054
Solvent DMSO
Nucleus 1H
(ppm)


Title KSH-3-0054(C)
Solvent DMSO
Nucleus 13C
(ppm)



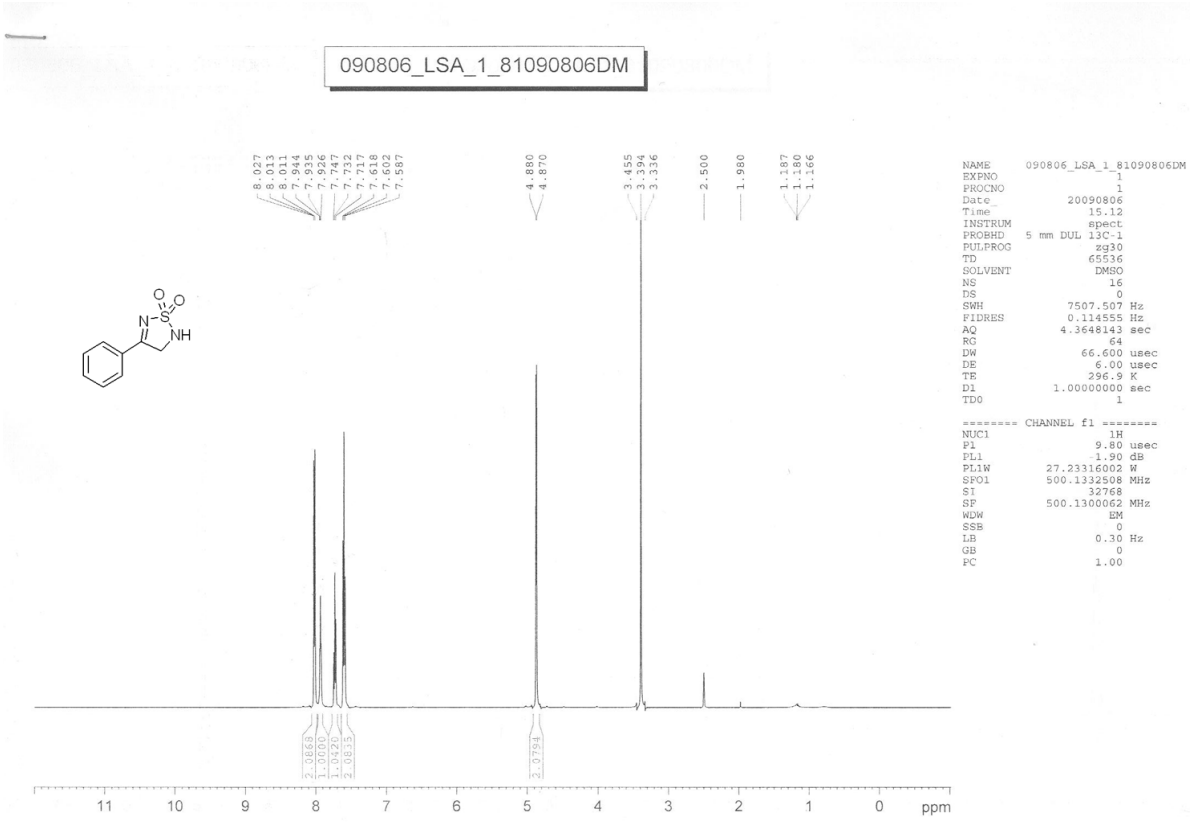
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-20100201\4\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16

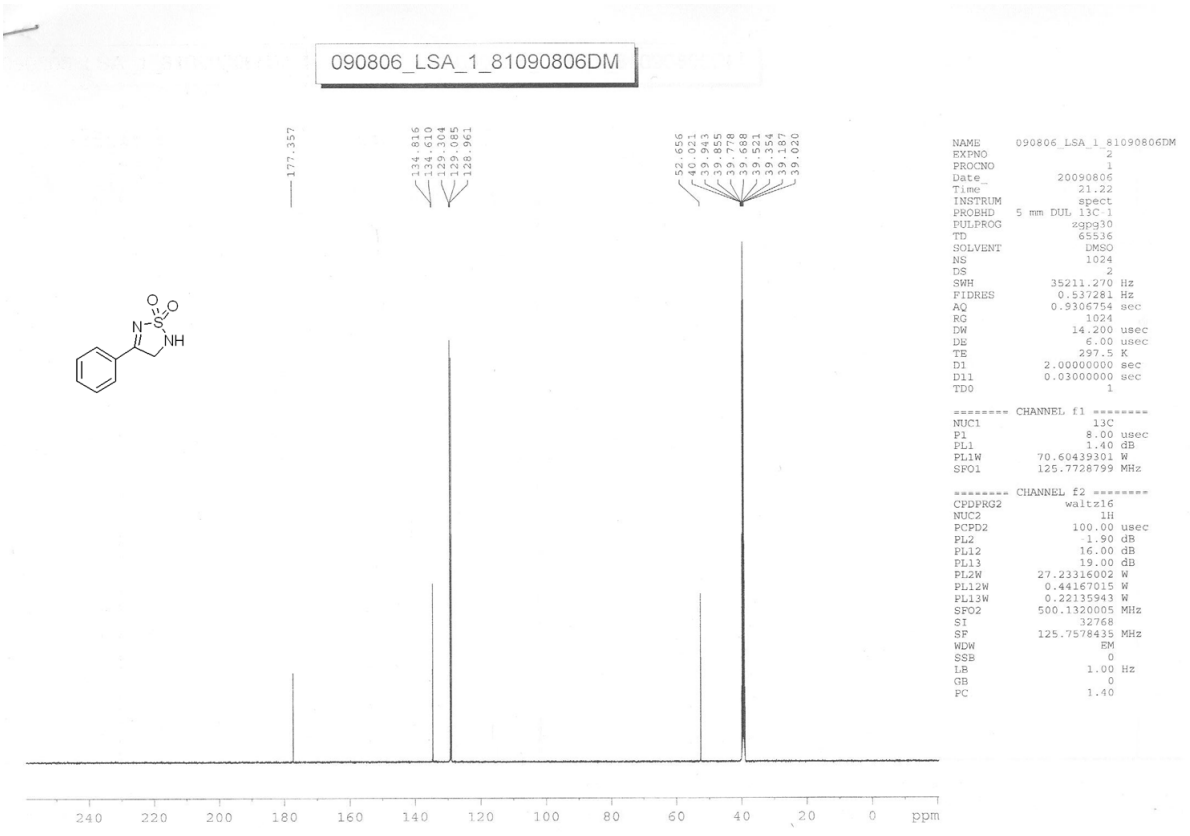
freq. of 0 ppm: 300.130003 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 110.264 ppm/cm: 0.36738

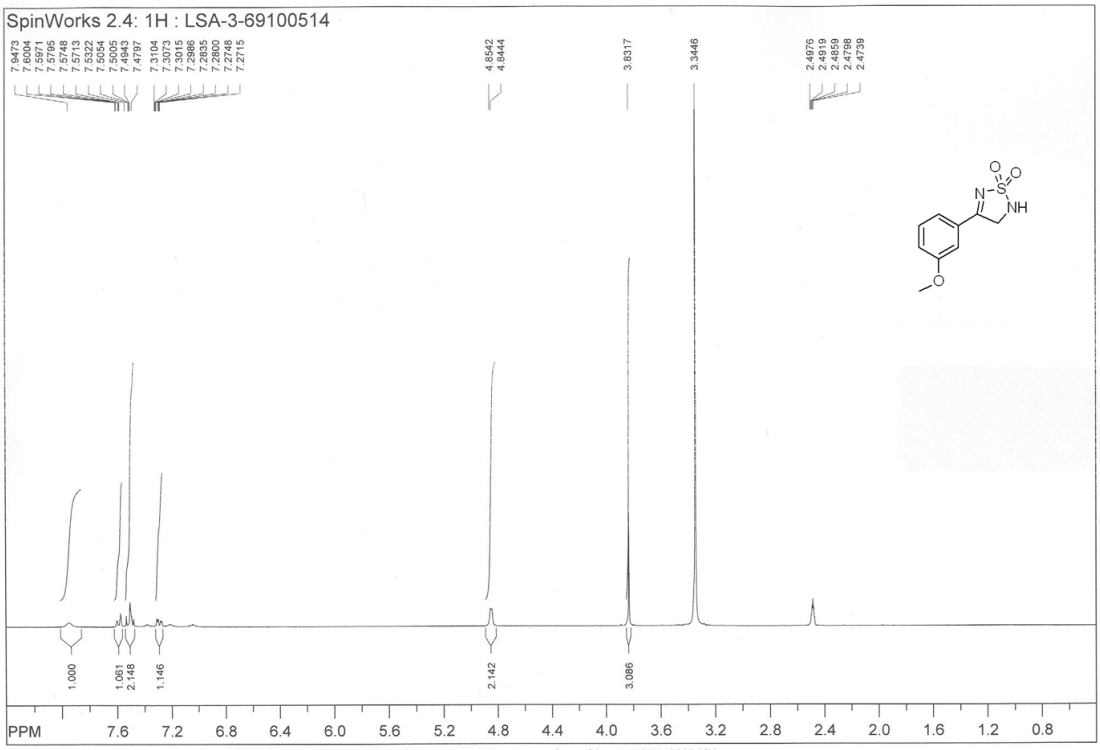


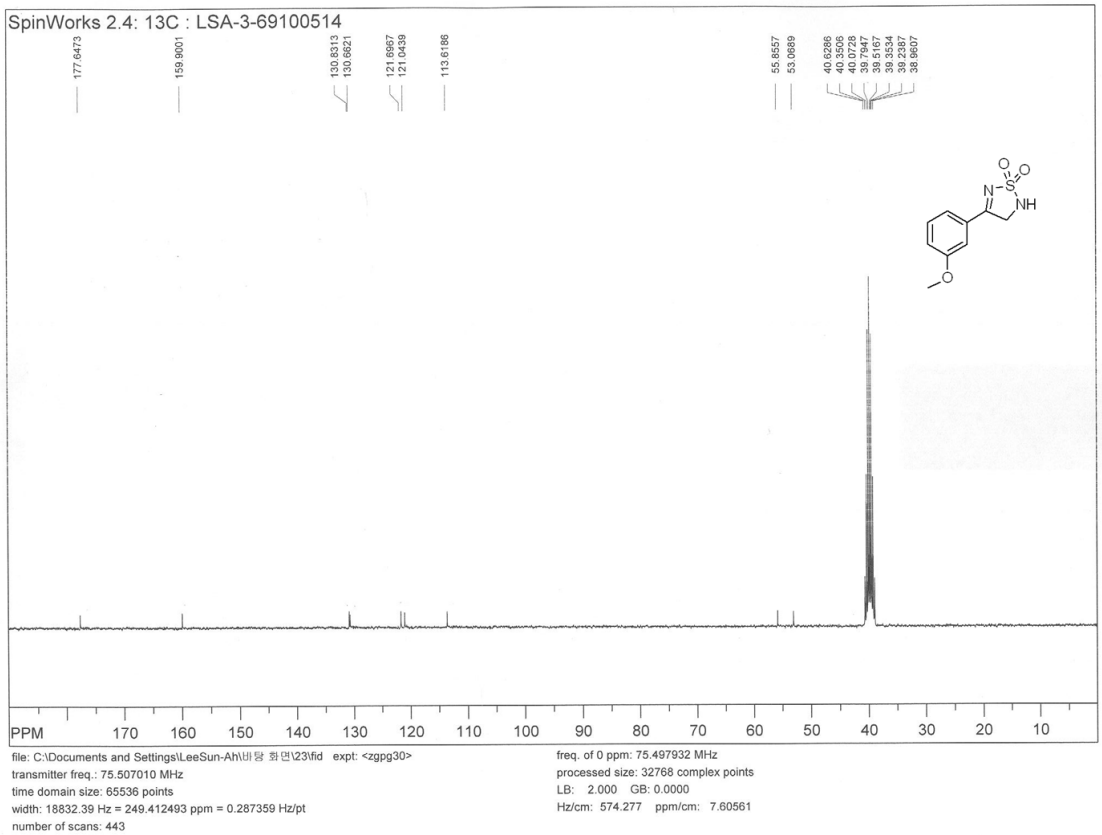
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-20100201\2c\fid expt: <zgpg30>
transmitter freq.: 75.475295 MHz
time domain size: 65536 points
width: 17985.61 Hz = 238.297995 ppm = 0.274439 Hz/pt
number of scans: 1024

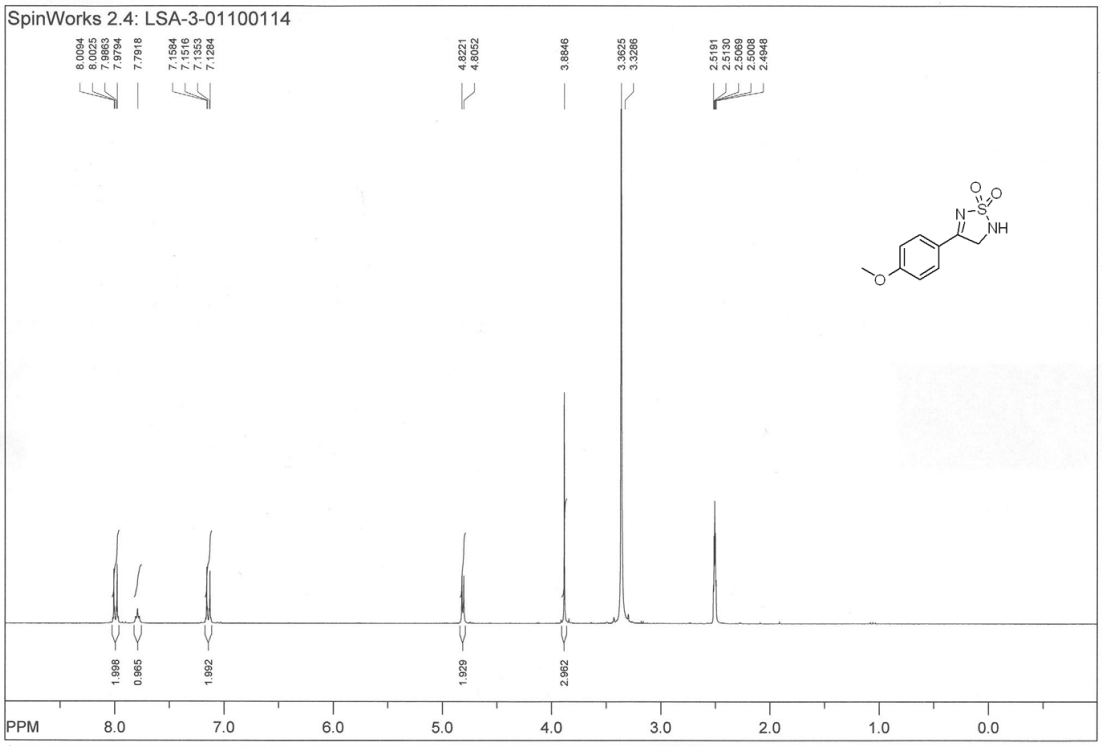
freq. of 0 ppm: 75.467751 MHz
processed size: 32768 complex points
LB: 1.000 GB: 0.0000
Hz/cm: 633.658 ppm/cm: 8.39557


090806_LSA_1_81090806DM
8.027
8.013
8.011
7.944
7.935
7.926
7.747
7.732
7.717
7.618
7.602
7.587
4.880
4.870
3.455
3.394
3.336
2.500
1.980
1.187
1.180
1.166
2.0669
1.0000
1.0420
2.0833
2.0794
11 10 9 8 7 6 5 4 3 2 1 0 ppm
NAME 090806_LSA_1_81090806DM
EXPNO 1
PROCNO 1
Date_ 20090806
Time 15.12
INSTRUM spect
PROBHD 5 mm DUL 13C-1
PULPROG zg30
TD 65536
SOLVENT DMSO
NS 16
DS 0
SWH 7507.507 Hz
FIDRES 0.114555 Hz
AQ 4.3648143 sec
RG 64
DW 66.600 usec
DE 6.00 usec
TE 296.9 K
D1 1.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 9.80 usec
PL1 -1.90 dB
PL1W 27.23316002 W
SFO1 500.1332508 MHz
SI 32768
SF 500.1300062 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00


090806_LSA_1_81090806DM
177.357
134.816
134.610
129.304
129.085
128.961
52.656
40.021
39.943
39.855
39.778
39.688
39.521
39.354
39.187
39.020
240 220 200 180 160 140 120 100 80 60 40 20 0 ppm
NAME 090806_LSA_1_81090806DM
EXPNO 2
PROCNO 1
Date_ 20090806
Time 21.22
INSTRUM spect
PROBHD 5 mm DUL 13C-1
PULPROG zgpg30
TD 65536
SOLVENT DMSO
NS 1024
DS 2
SWH 35211.270 Hz
FIDRES 0.537281 Hz
AQ 0.9306754 sec
RG 1024
DW 14.200 usec
DE 6.00 usec
TE 297.5 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.00 usec
PL1 1.40 dB
PL1W 70.60439301 W
SFO1 125.7728799 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 100.00 usec
PL2 -1.90 dB
PL12 16.00 dB
PL13 19.00 dB
PL2W 27.23316002 W
PL12W 0.44167015 W
PL13W 0.22135943 W
SFO2 500.1320005 MHz
SI 32768
SF 125.7578435 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

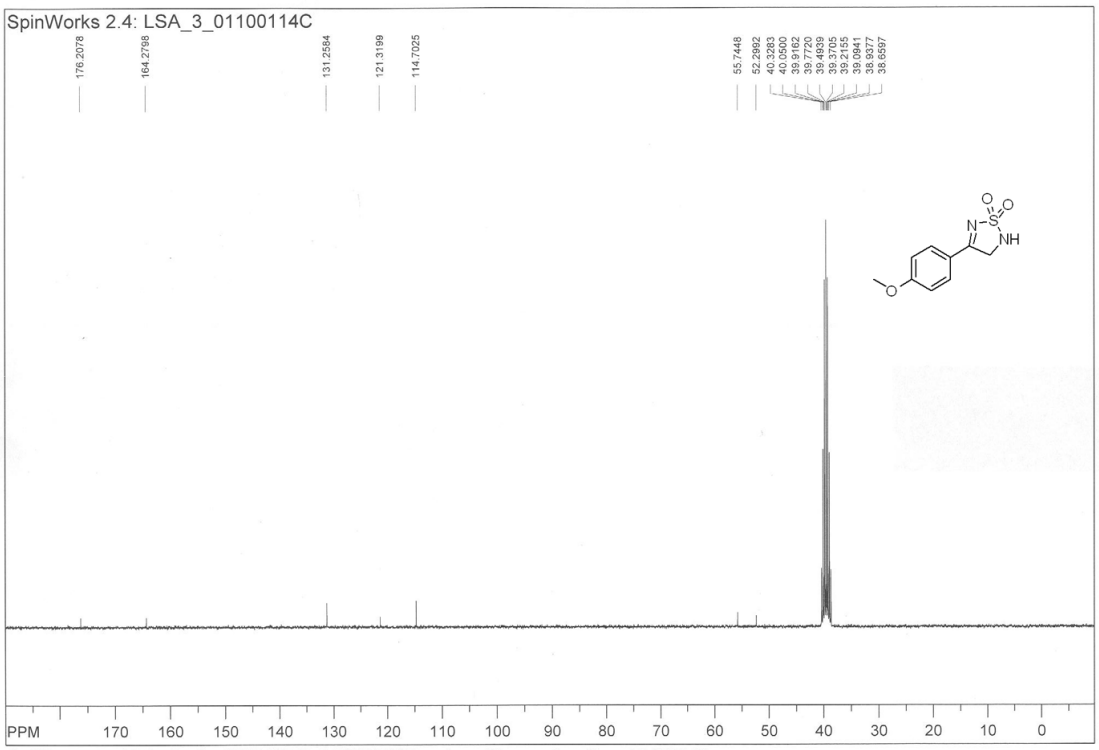

SpinWorks 2.4: 1H : LSA-3-69100514
7.9473
7.6004
7.5971
7.5795
7.5748
7.5713
7.5322
7.5054
7.5005
7.4943
7.4797
7.3104
7.3073
7.3015
7.2986
7.2835
7.2800
7.2748
7.2715
4.8542
4.8444
3.8317
3.3446
2.4976
2.4919
2.4859
2.4798
2.4739
1.000
1.061
2.148
1.146
2.142
3.086
PPM
7.6
7.2
6.8
6.4
6.0
5.6
5.2
4.8
4.4
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
0.8
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\NMR\LSA-3-69100514\fid expt: <zg30>
transmitter freq.: 300.251381 MHz
time domain size: 65536 points
width: 2670.94 Hz = 8.895680 ppm = 0.040755 Hz/pt
number of scans: 22
freq. of 0 ppm: 300.250008 MHz
processed size: 32768 complex points
LB: 0.000 GB: 0.0000
Hz/cm: 96.112 ppm/cm: 0.32010


SpinWorks 2.4: 13C : LSA-3-69100514
177.6473
159.9001
130.8313
130.6621
121.6967
121.0439
113.6186
55.8557
53.0689
40.6286
40.3505
40.0728
39.7947
39.5167
39.3534
39.2387
38.9607
PPM
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\23\fid expt: <zgpg30>
transmitter freq.: 75.507010 MHz
time domain size: 65536 points
width: 18832.39 Hz = 249.412493 ppm = 0.287359 Hz/pt
number of scans: 443
freq. of 0 ppm: 75.497932 MHz
processed size: 32768 complex points
LB: 2.000 GB: 0.0000
Hz/cm: 574.277 ppm/cm: 7.60561



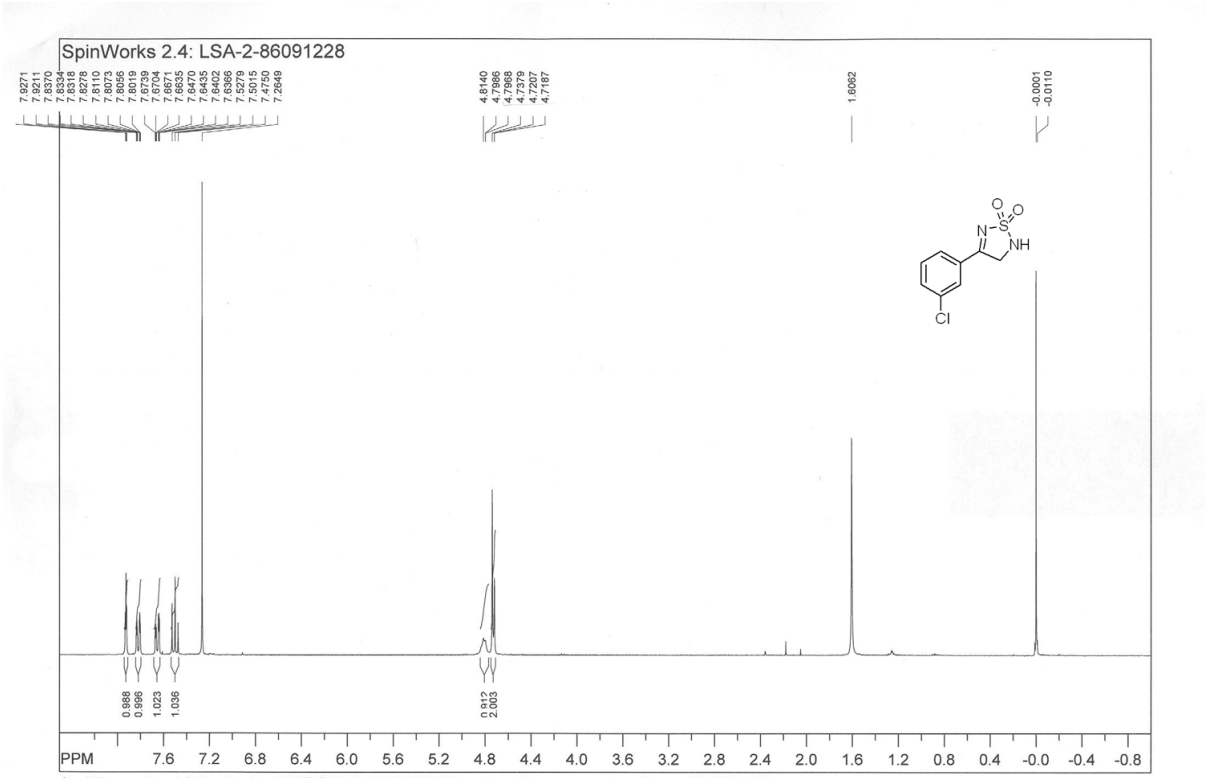
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-01100114\1\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16

freq. of 0 ppm: 300.130000 MHz
processed size: 32768 complex points
LB: 0.000 GB: 0.0000
Hz/cm: 120.068 ppm/cm: 0.40005



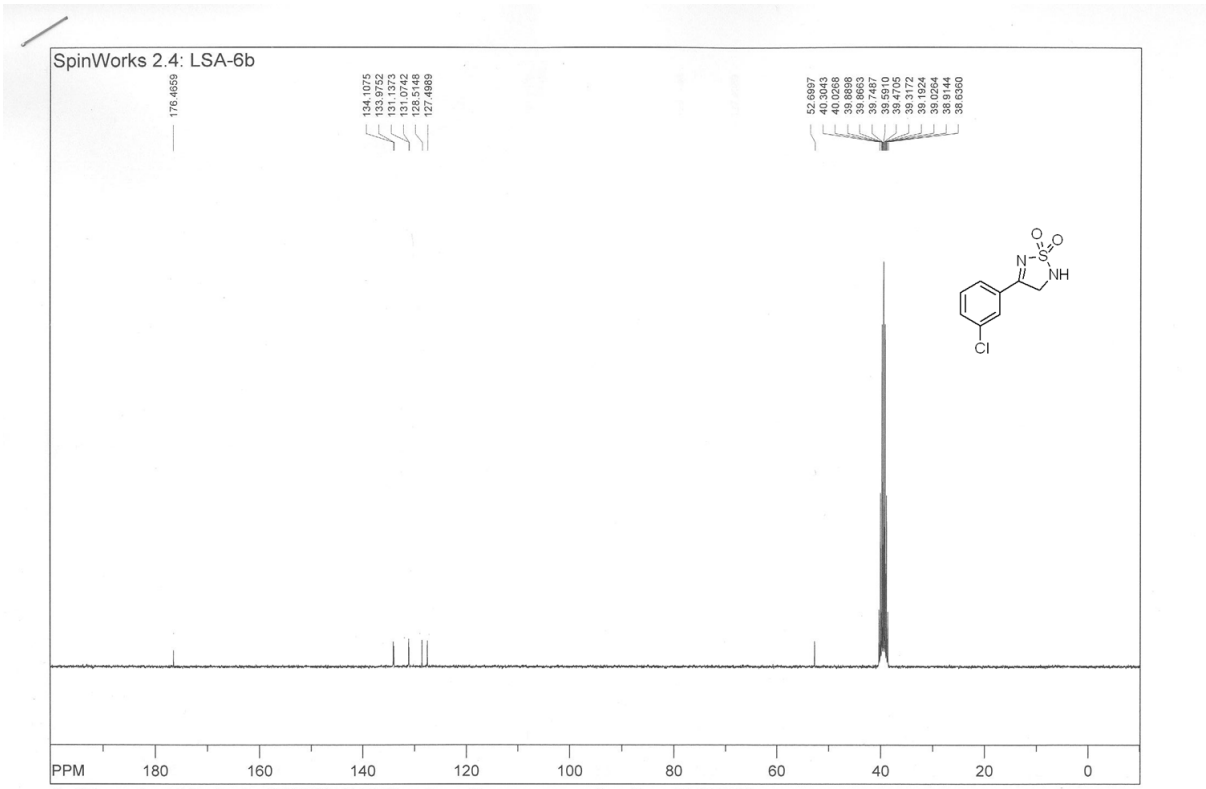
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA_3_01100114C\1\fid expt: <zgpg30>
transmitter freq.: 75.475295 MHz
time domain size: 65536 points
width: 17985.61 Hz = 238.297995 ppm = 0.274439 Hz/pt
number of scans: 1024

freq. of 0 ppm: 75.467787 MHz
processed size: 32768 complex points
LB: 1.000 GB: 0.0000
Hz/cm: 603.128 ppm/cm: 7.99107



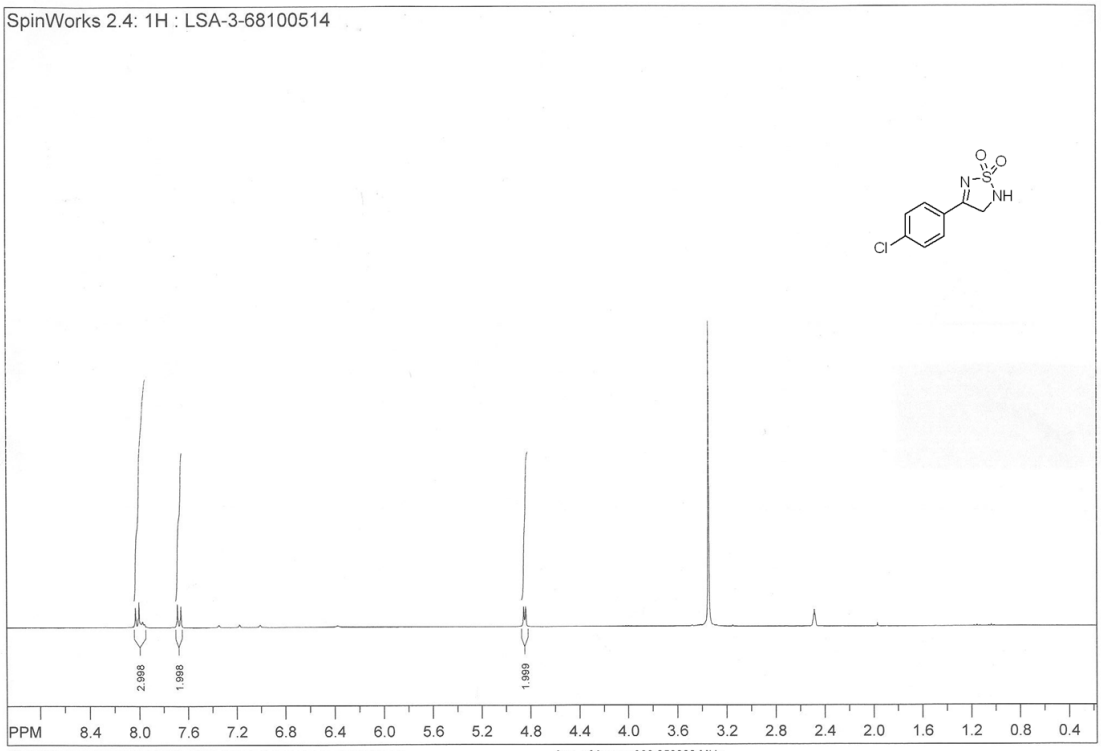
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-2-86091228\1\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16

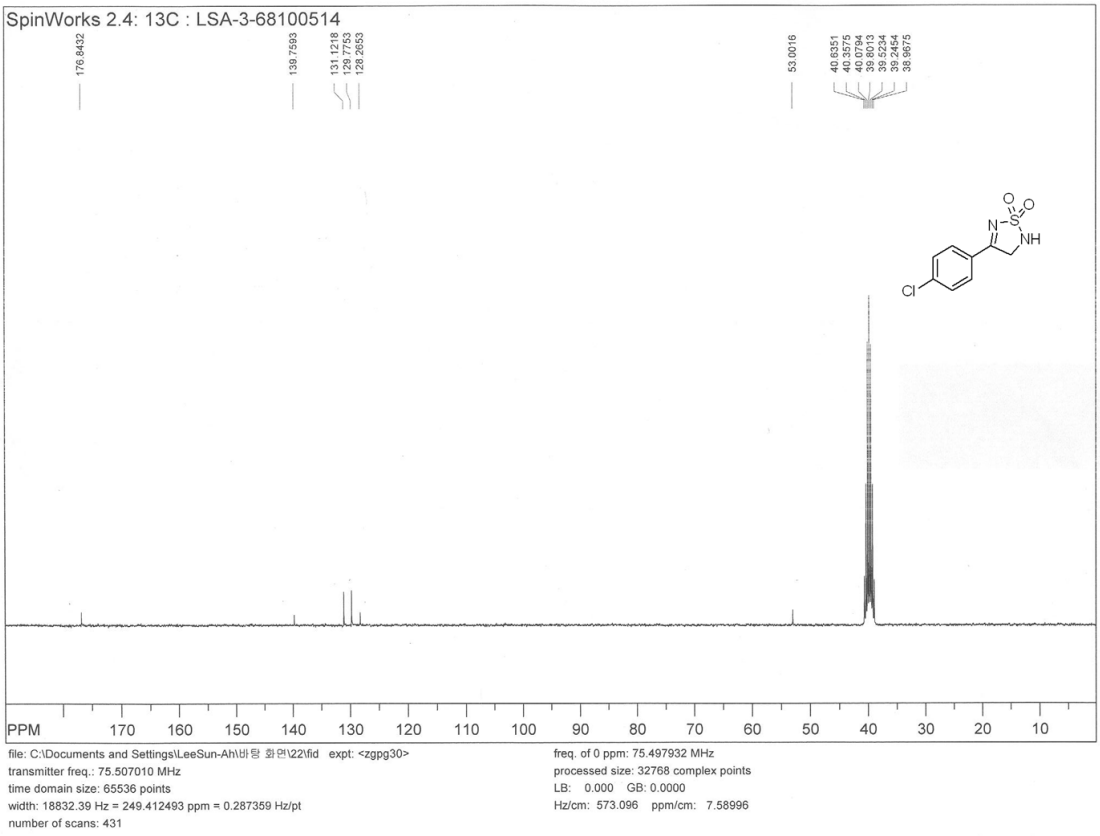
freq. of 0 ppm: 300.130007 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 114.129 ppm/cm: 0.38026

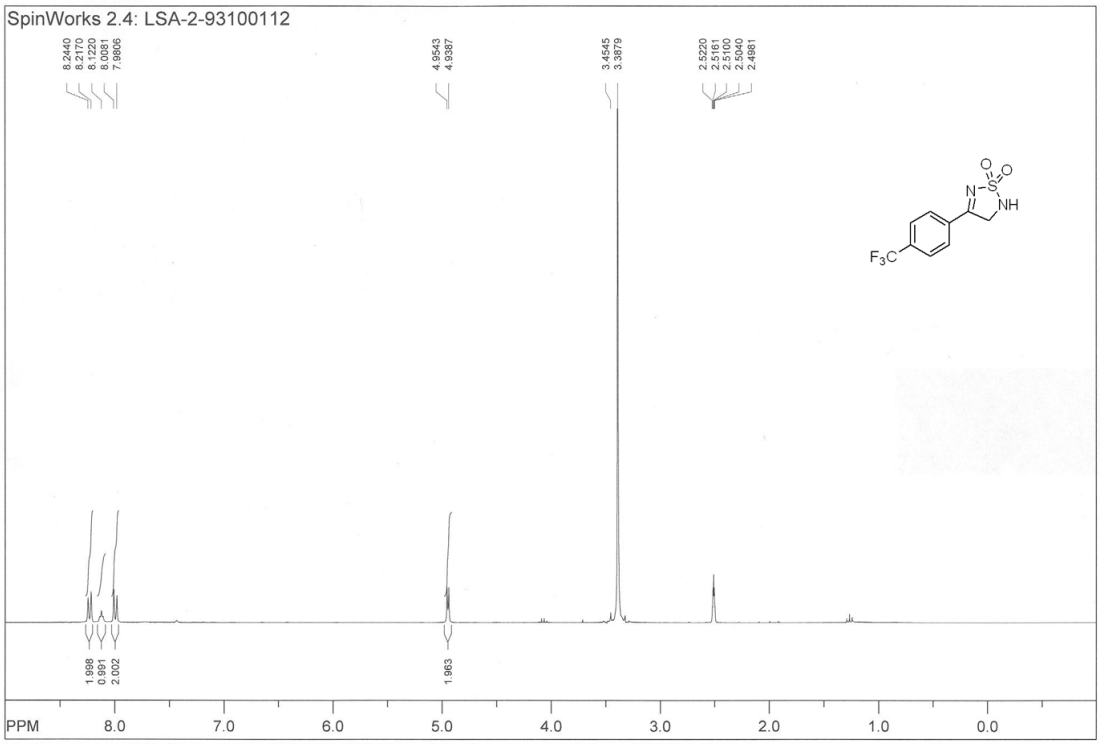


file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-6b\1\fid expt: <zgpg30>
transmitter freq.: 75.475295 MHz
time domain size: 65536 points
width: 17985.61 Hz = 238.297995 ppm = 0.274439 Hz/pt
number of scans: 1500

freq. of 0 ppm: 75.467787 MHz
processed size: 32768 complex points
LB: 1.000 GB: 0.0000
Hz/cm: 634.723 ppm/cm: 8.40968

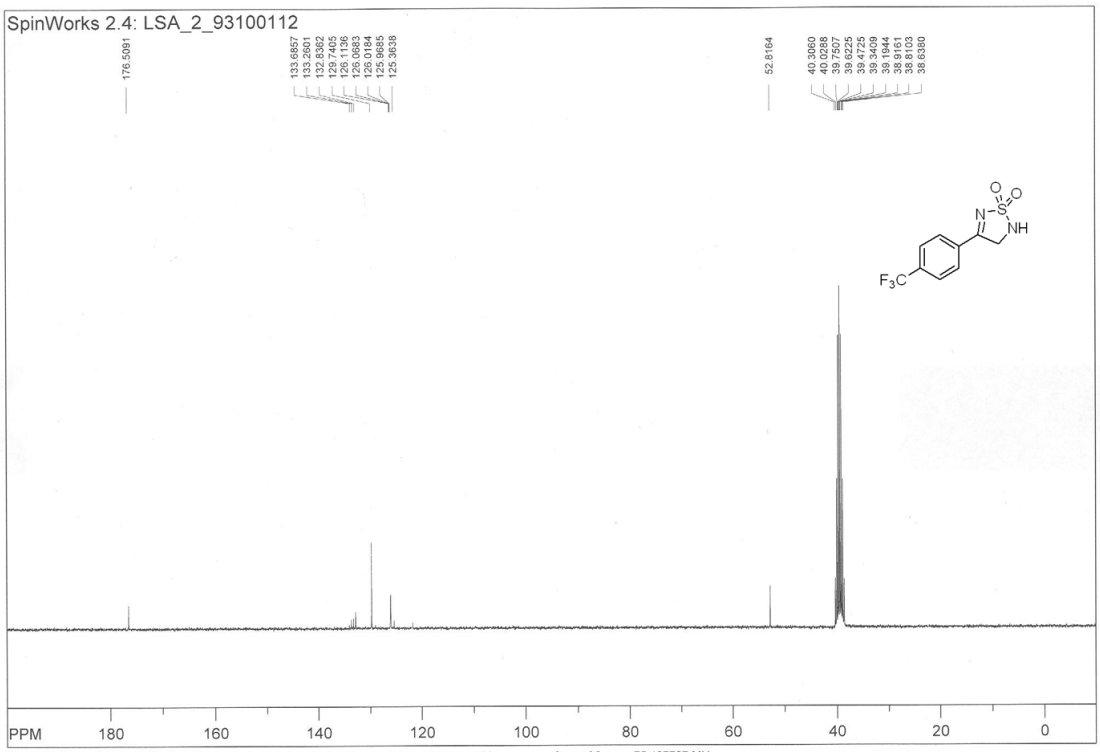

SpinWorks 2.4: 1H : LSA-3-68100514
2.998
1.998
1.999
PPM 8.4 8.0 7.6 7.2 6.8 6.4 6.0 5.6 5.2 4.8 4.4 4.0 3.6 3.2 2.8 2.4 2.0 1.6 1.2 0.8 0.4
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\235\fid expt: <zg30>
transmitter freq.: 300.251395 MHz
time domain size: 65536 points
width: 2670.94 Hz = 8.895679 ppm = 0.040755 Hz/pt
number of scans: 10
freq. of 0 ppm: 300.250008 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 106.838 ppm/cm: 0.35583


SpinWorks 2.4: 13C : LSA-3-68100514
176.8432
139.7593
131.1218
129.7753
128.2653
53.0016
40.8351
40.3575
40.0794
39.8013
39.5234
39.2454
38.9675
PPM 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\22\fid expt: <zgpg30>
transmitter freq.: 75.507010 MHz
time domain size: 65536 points
width: 18832.39 Hz = 249.412493 ppm = 0.287359 Hz/pt
number of scans: 431
freq. of 0 ppm: 75.497932 MHz
processed size: 32768 complex points
LB: 0.000 GB: 0.0000
Hz/cm: 573.096 ppm/cm: 7.58996



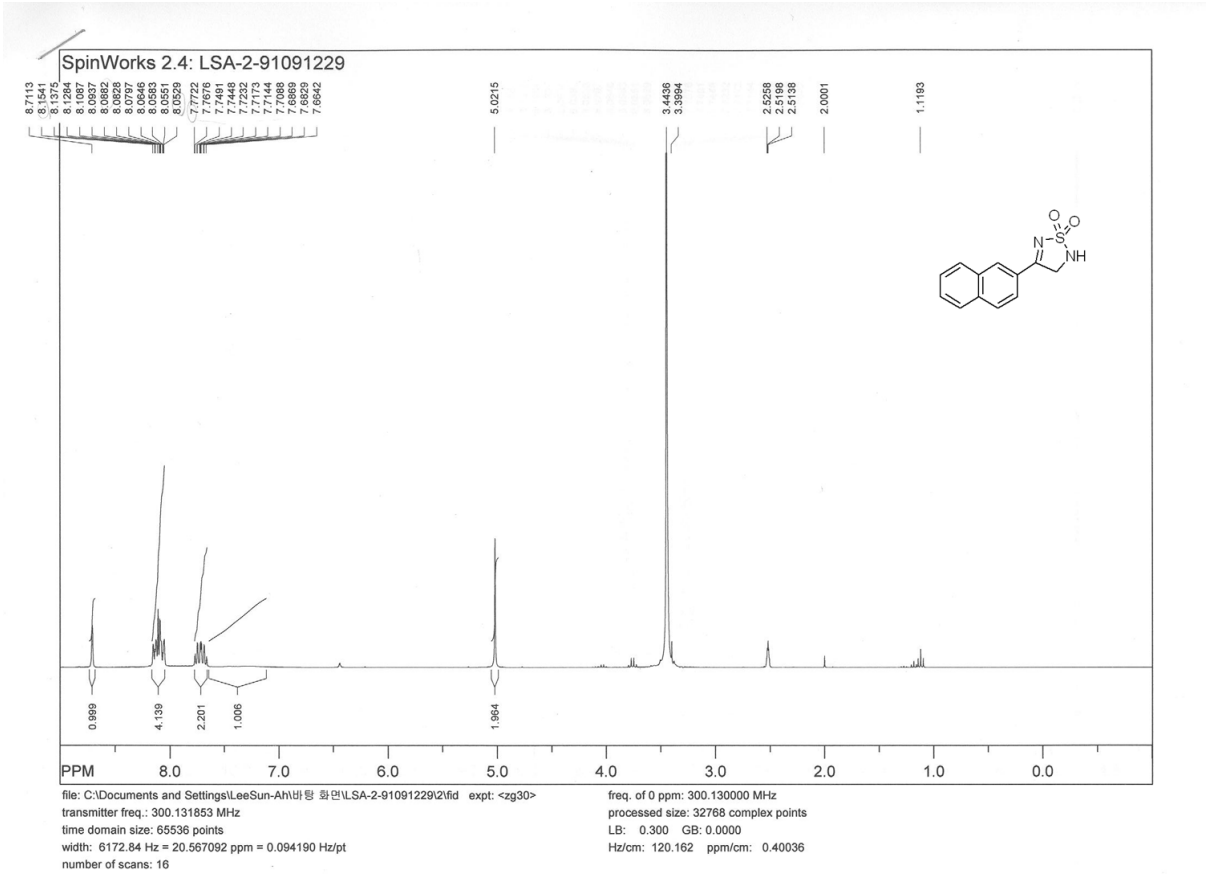
file: C:\Documents and Settings\LeeSun-Ah\내 당 화면\LSA-2-93100112\2\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16

freq. of 0 ppm: 300.130000 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 120.068 ppm/cm: 0.40005



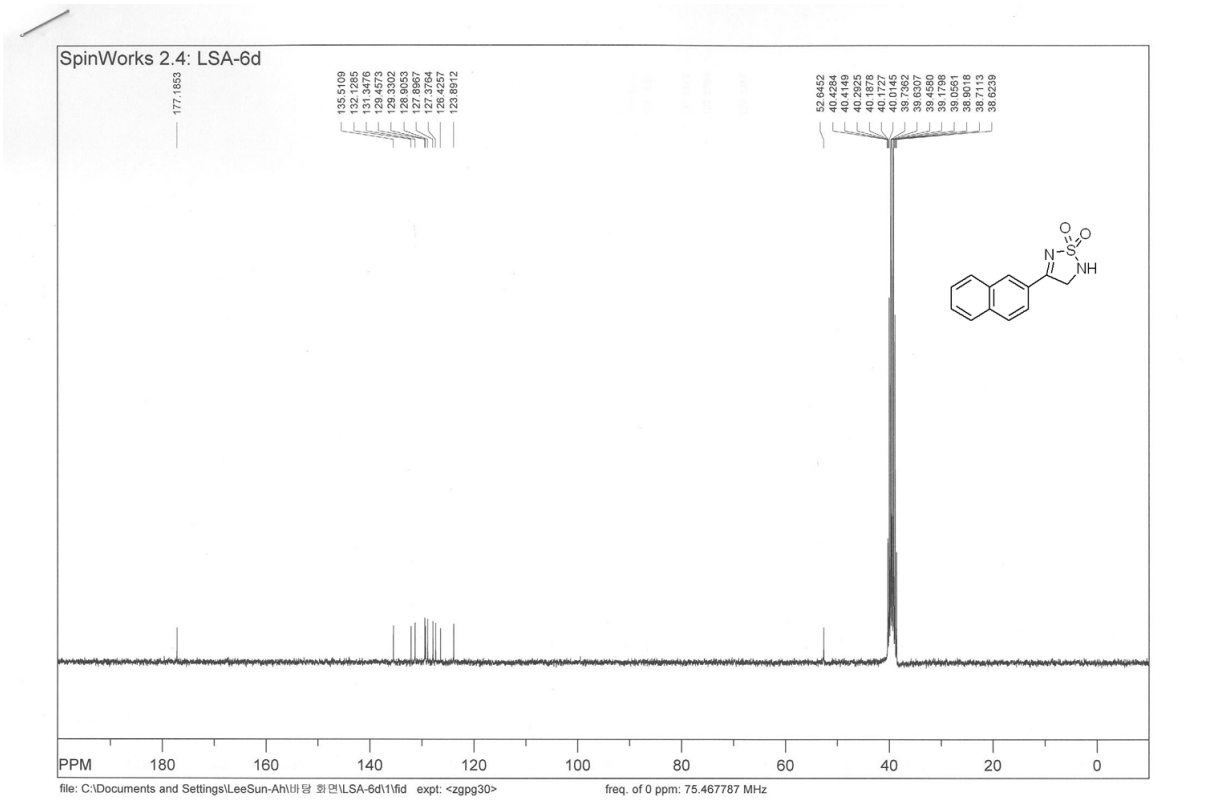
file: C:\Documents and Settings\LeeSun-Ah\내 당 화면\LSA_2_93100112\1\fid expt: <zgpg30>
transmitter freq.: 75.475295 MHz
time domain size: 65536 points
width: 17985.61 Hz = 238.297995 ppm = 0.274439 Hz/pt
number of scans: 1024

freq. of 0 ppm: 75.467787 MHz
processed size: 32768 complex points
LB: 1.000 GB: 0.0000
Hz/cm: 633.595 ppm/cm: 8.39473



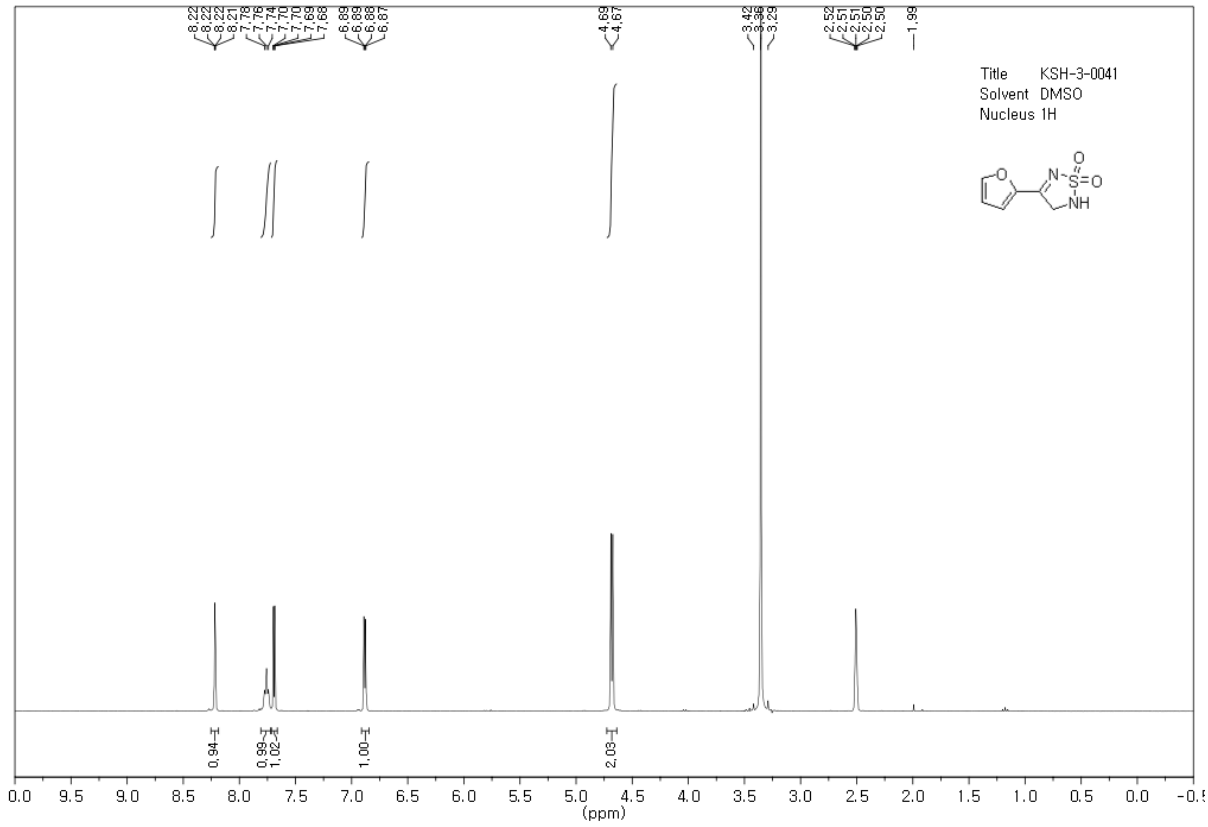
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-2-91091229\2\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16

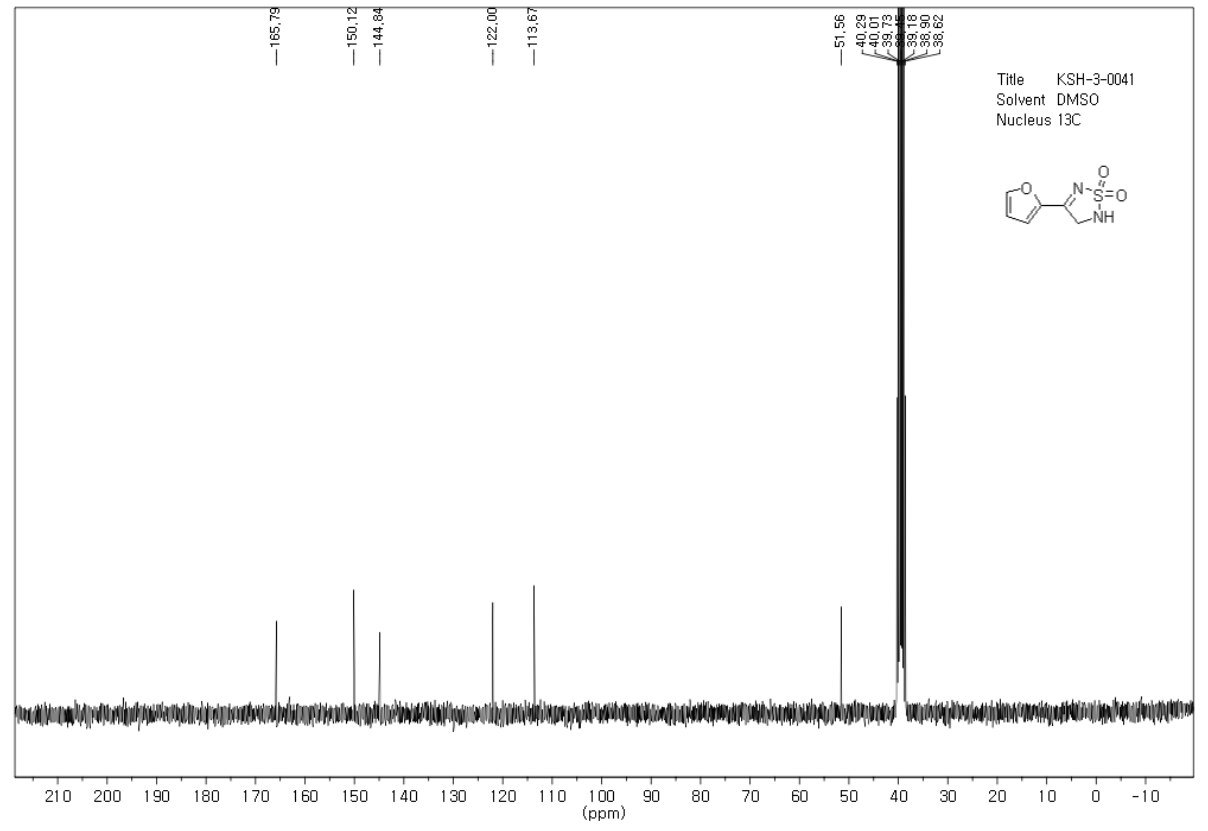
freq. of 0 ppm: 300.130000 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 120.162 ppm/cm: 0.40036

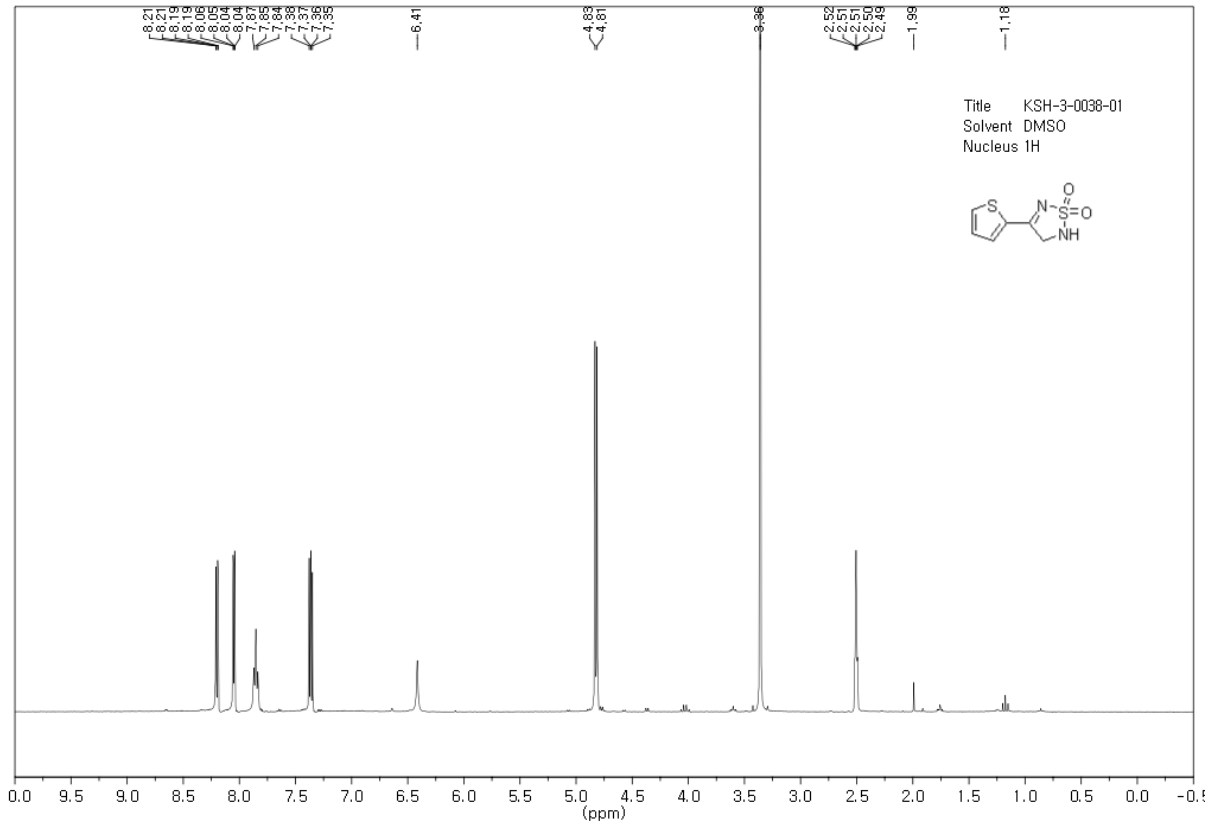


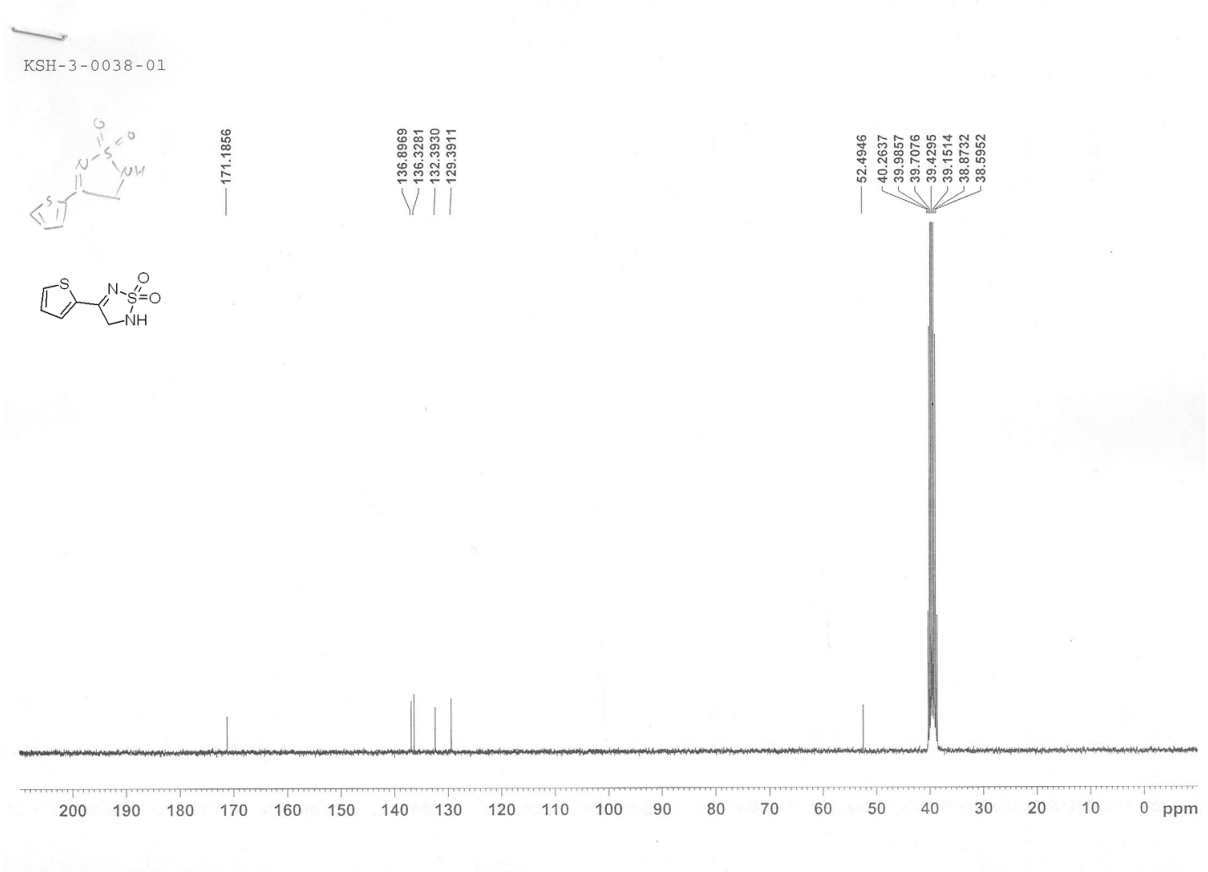
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-6d\1\fid expt: <zgpg30>
transmitter freq.: 75.475295 MHz
time domain size: 65536 points
width: 17985.61 Hz = 238.297995 ppm = 0.274439 Hz/pt
number of scans: 1300

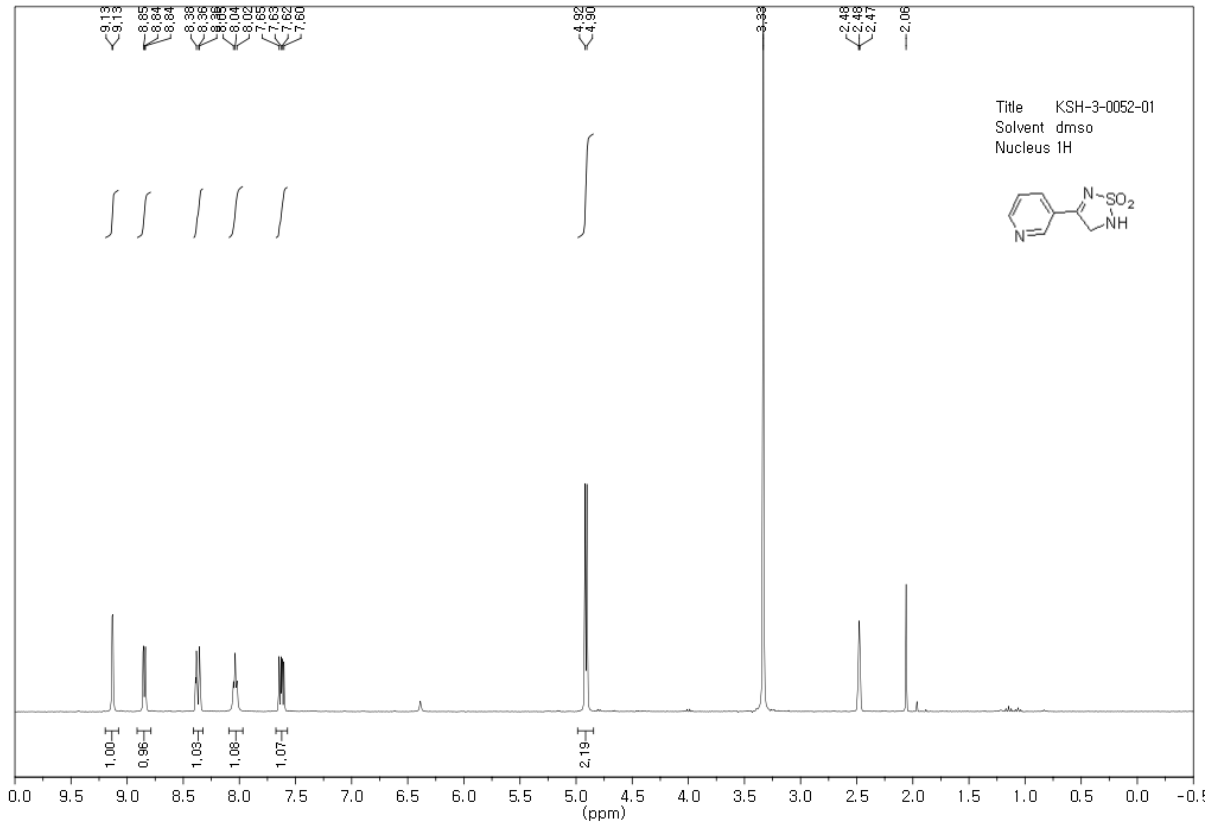
freq. of 0 ppm: 75.467787 MHz
processed size: 32768 complex points
LB: 1.000 GB: 0.0000
Hz/cm: 634.222 ppm/cm: 8.40304

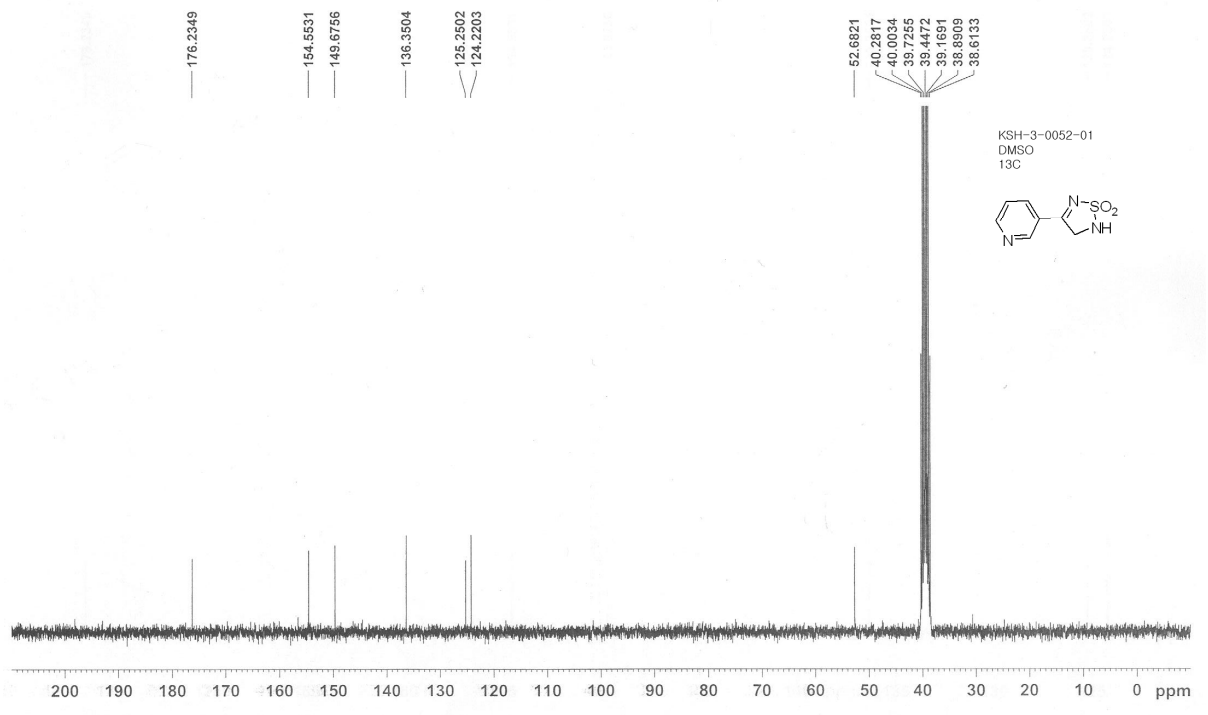

Title KSH-3-0041
Solvent DMSO
Nucleus 1H
(ppm)

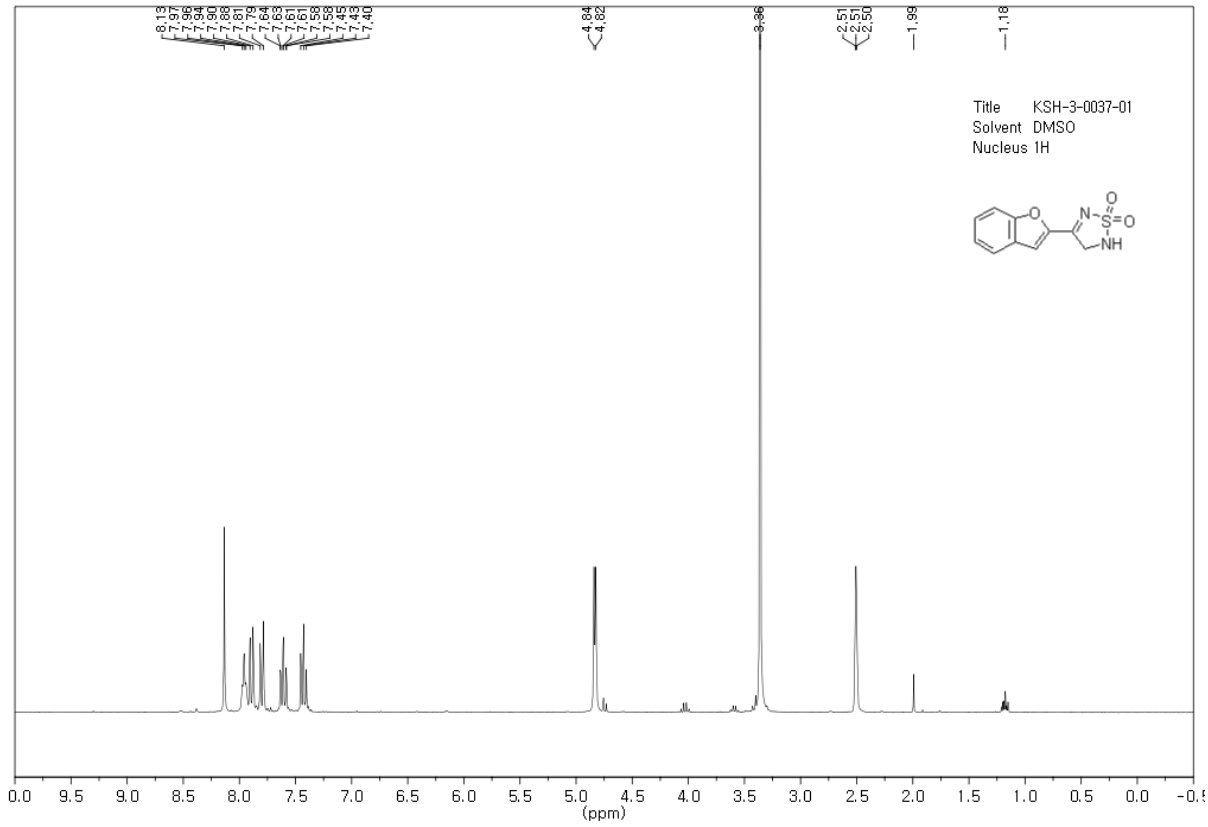

Title KSH-3-0041
Solvent DMSO
Nucleus 13C
(ppm)

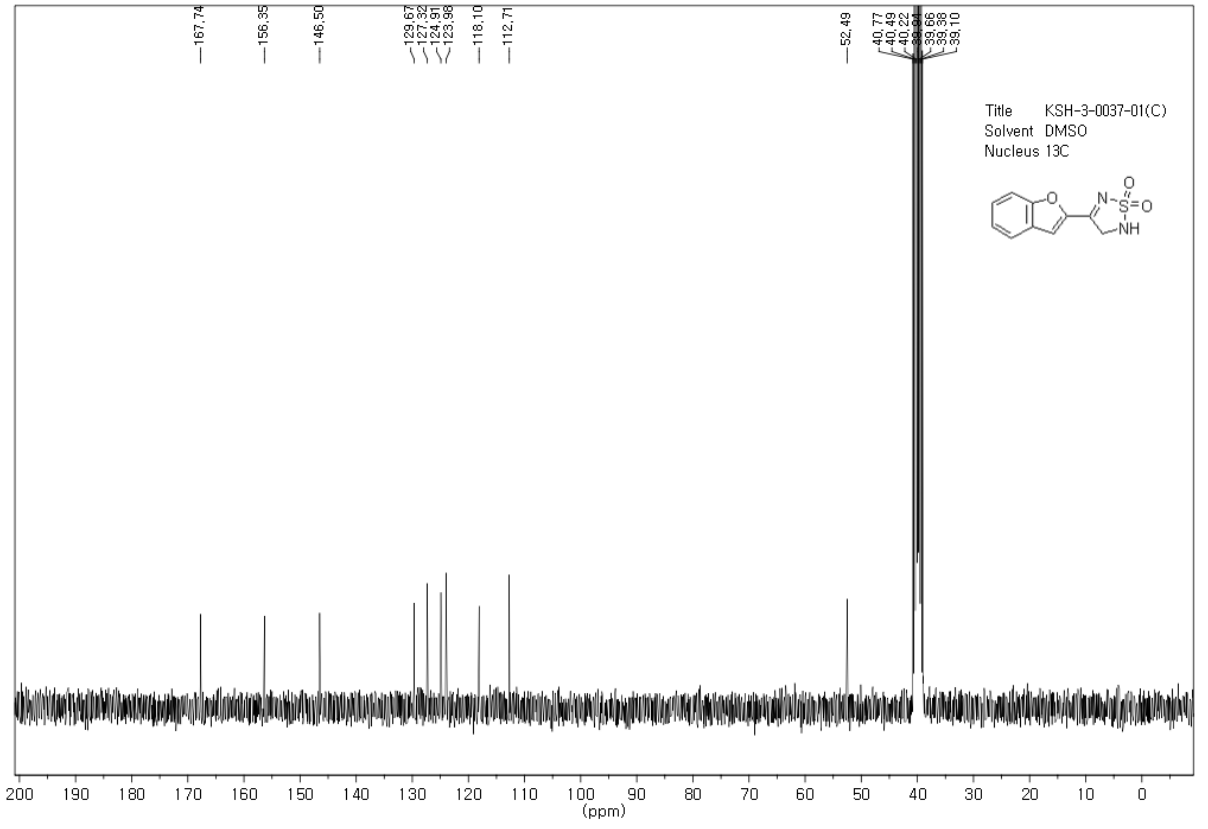

8.21
8.21
8.19
8.19
8.06
8.05
8.04
8.04
7.87
7.85
7.84
7.39
7.37
7.36
7.35
6.41
4.83
4.81
3.96
2.52
2.51
2.51
2.50
2.49
1.99
1.18
Title KSH-3-0038-01
Solvent DMSO
Nucleus 1H
O
N
S
O
S
NH
0.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
(ppm)

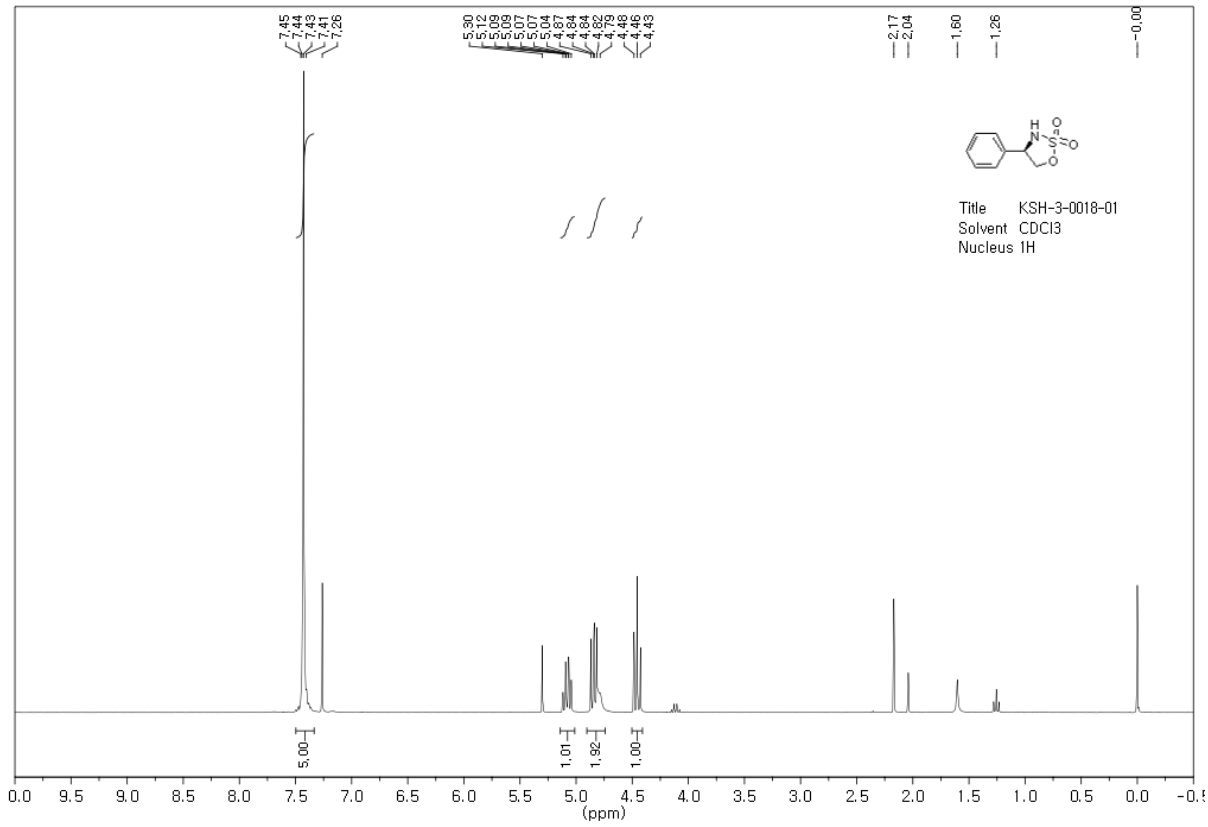

KSH-3-0038-01
171.1856
136.8969
136.3281
132.3930
129.3911
52.4946
40.2637
39.9857
39.7076
39.4295
39.1514
38.8732
38.5952
O
N
S
O
S
NH
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm

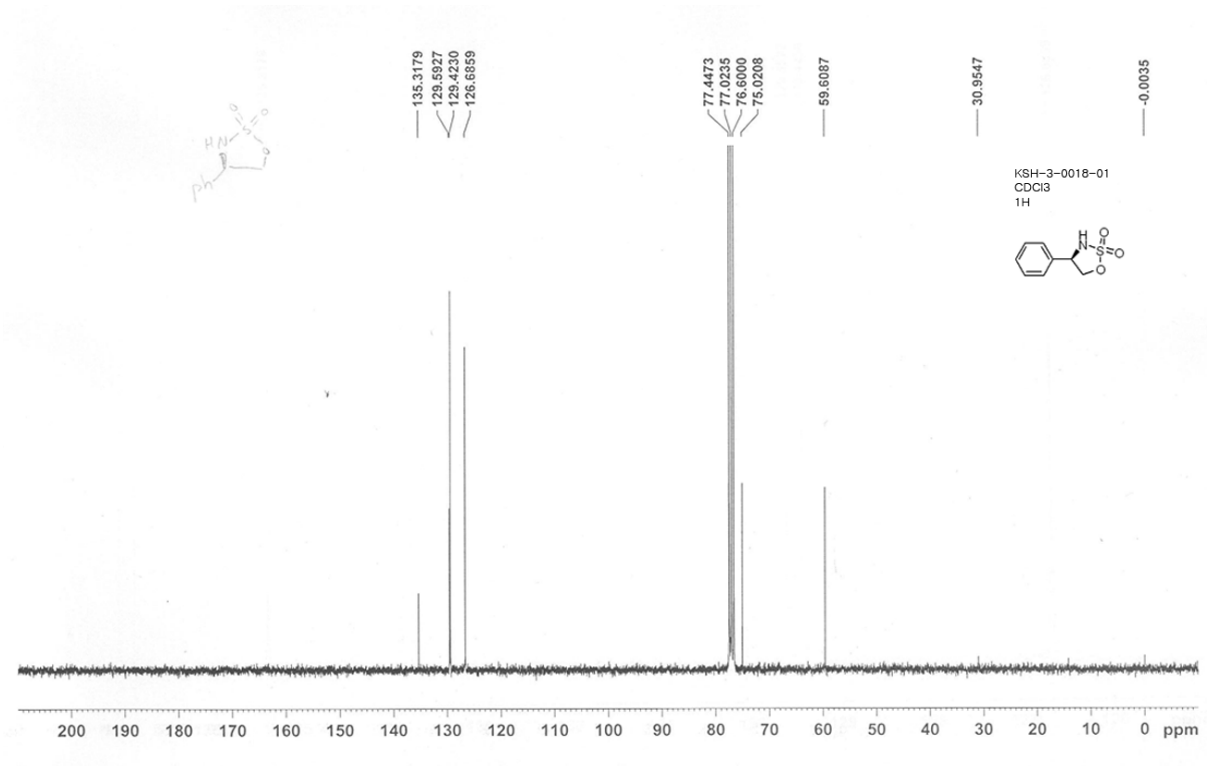

9.13
9.13
8.85
8.84
8.84
8.38
8.36
8.06
8.04
7.65
7.63
7.62
7.60
4.92
4.90
3.33
2.48
2.48
2.47
2.06
Title KSH-3-0052-01
Solvent dmso
Nucleus 1H
1.00
0.96
1.03
1.08
1.07
2.19
(ppm)

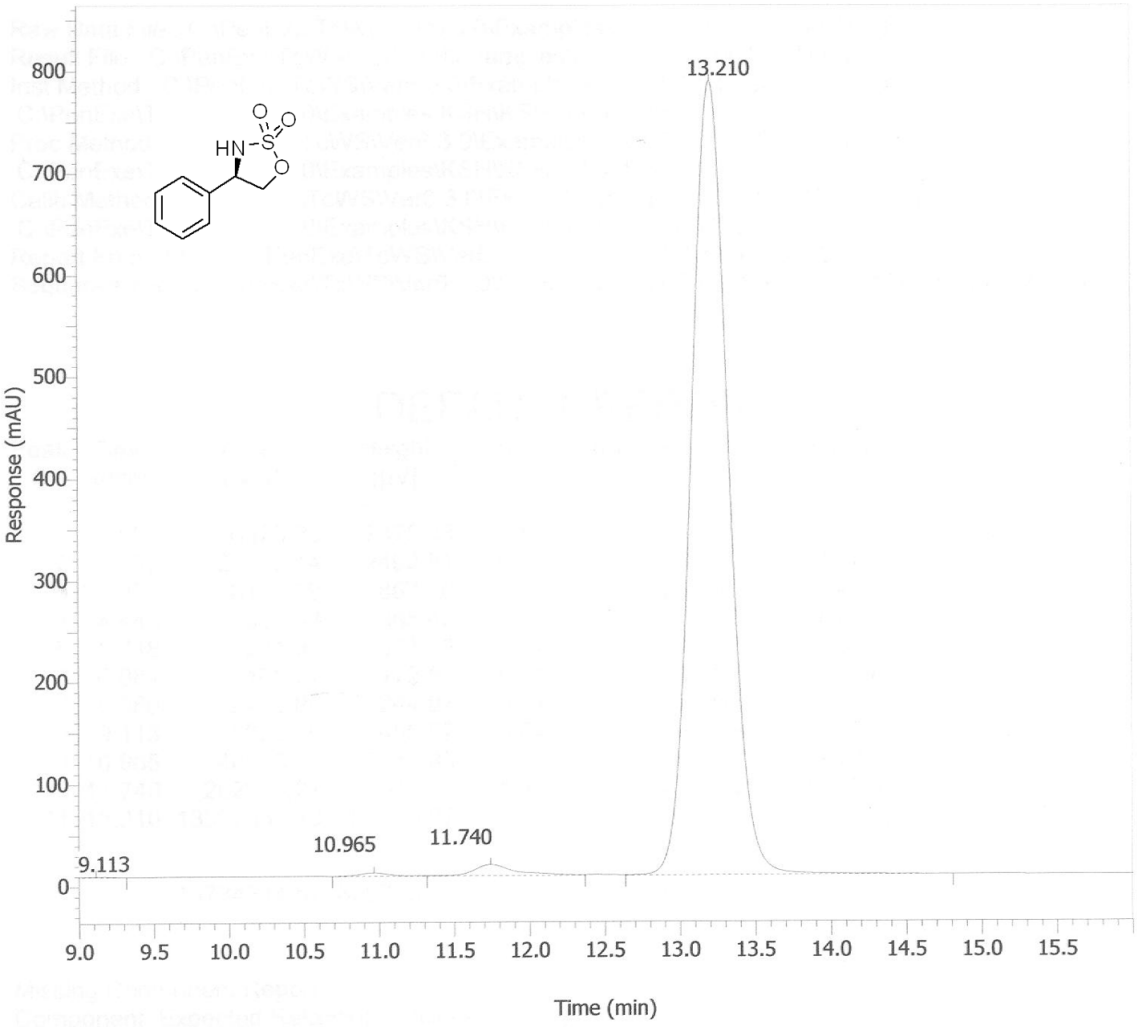

176.2349
154.5531
149.6756
136.3504
125.2502
124.2203
52.6821
40.2817
40.0034
39.7255
39.4472
39.1691
38.8909
38.6133
KSH-3-0052-01
DMSO
13C
ppm

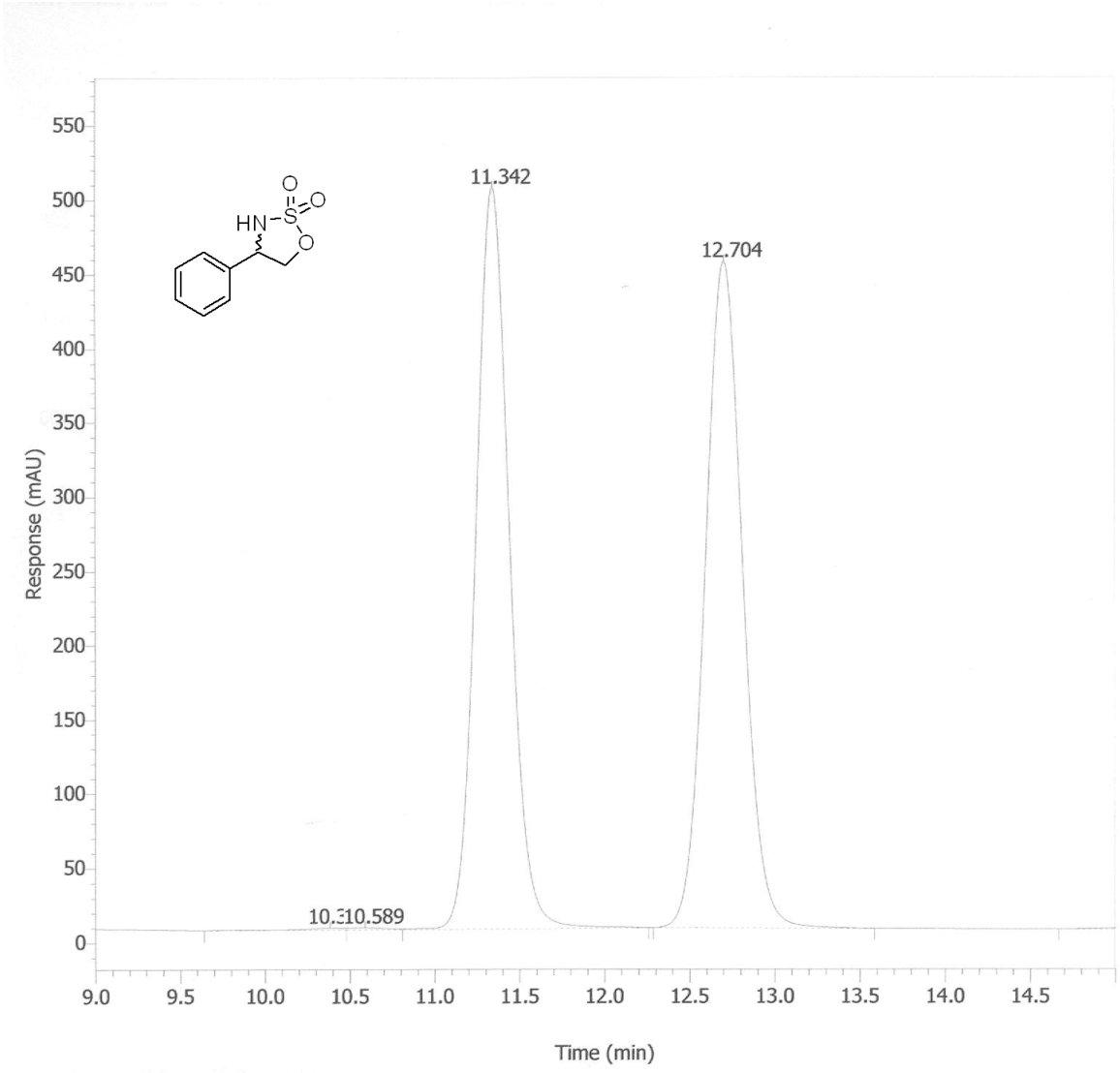

Title KSH-3-0037-01
Solvent DMSO
Nucleus 1H
(ppm)

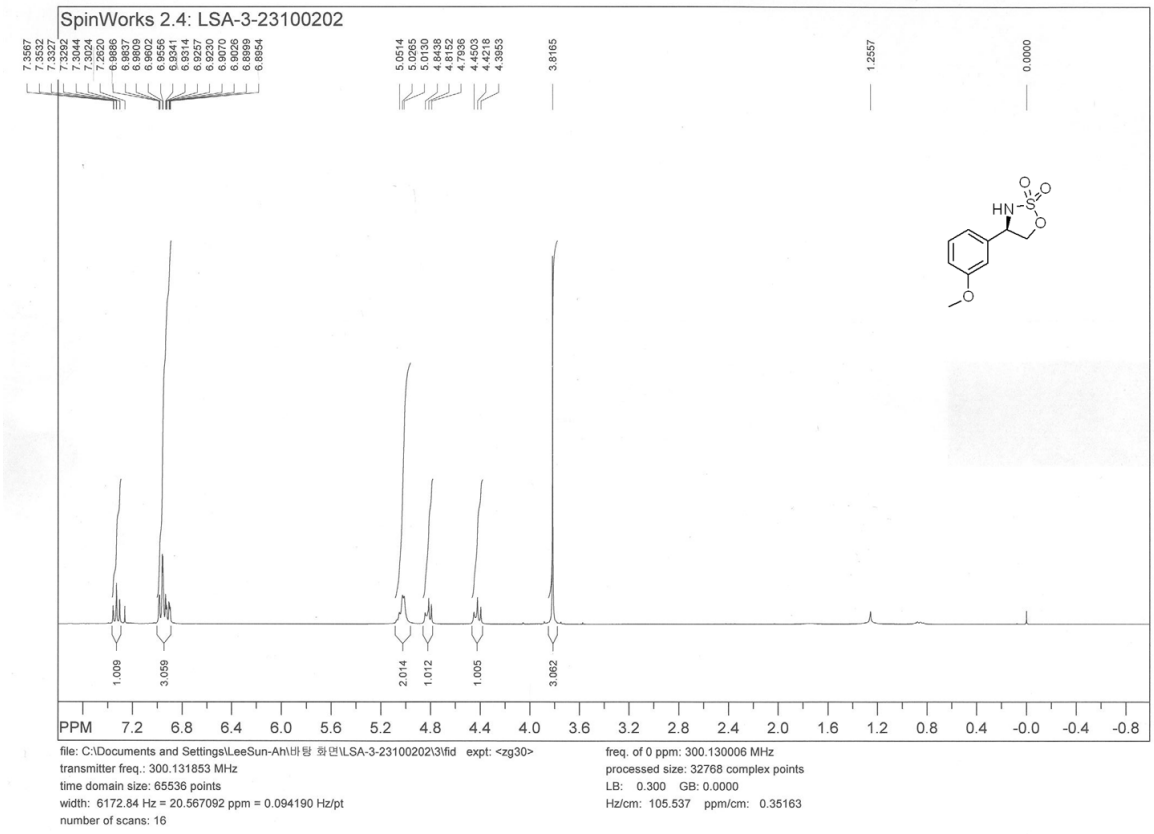

Title KSH-3-0037-01(C)
Solvent DMSO
Nucleus 13C
(ppm)

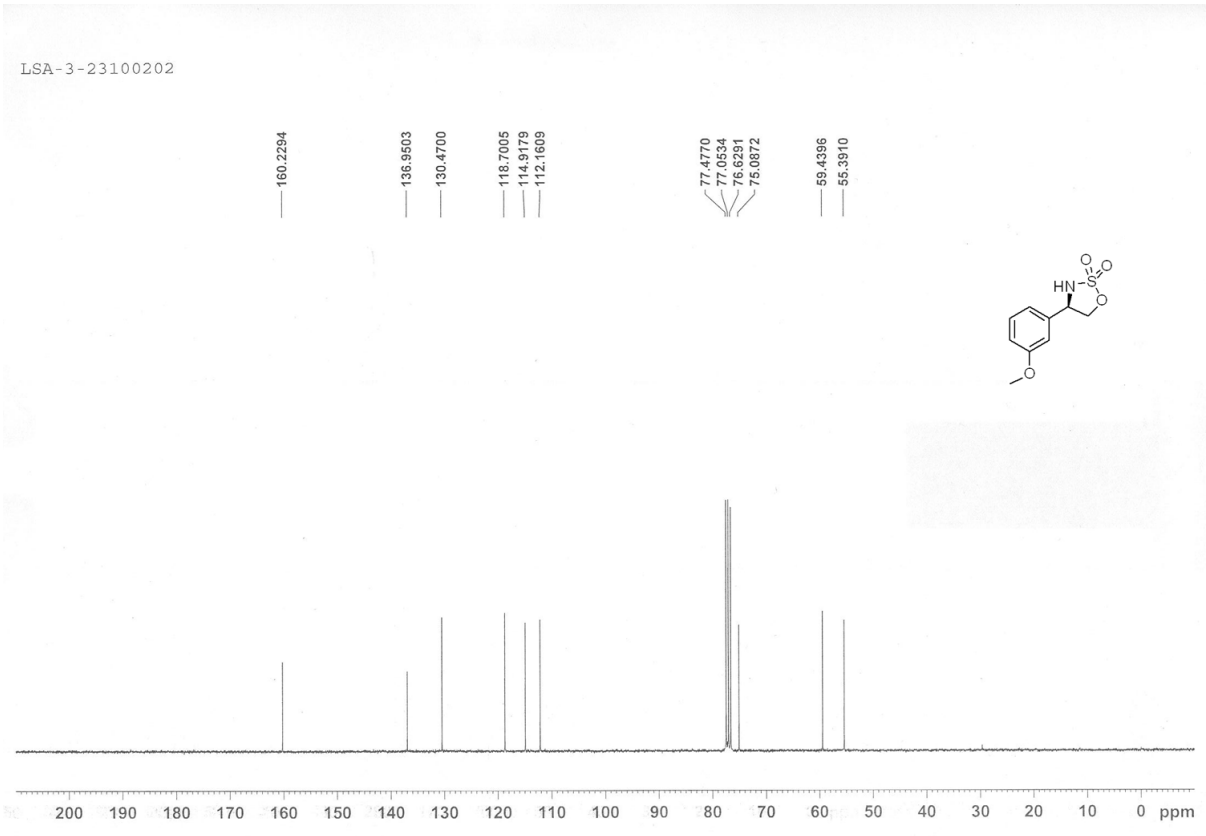

7.45
7.44
7.43
7.41
7.26
5.30
5.12
5.09
5.09
5.09
5.07
5.07
5.04
4.87
4.84
4.84
4.82
4.79
4.48
4.46
4.43
2.17
2.04
1.60
1.26
0.00
Title KSH-3-0018-01
Solvent CDCl3
Nucleus 1H
5.00
1.01
1.92
1.00
(ppm)

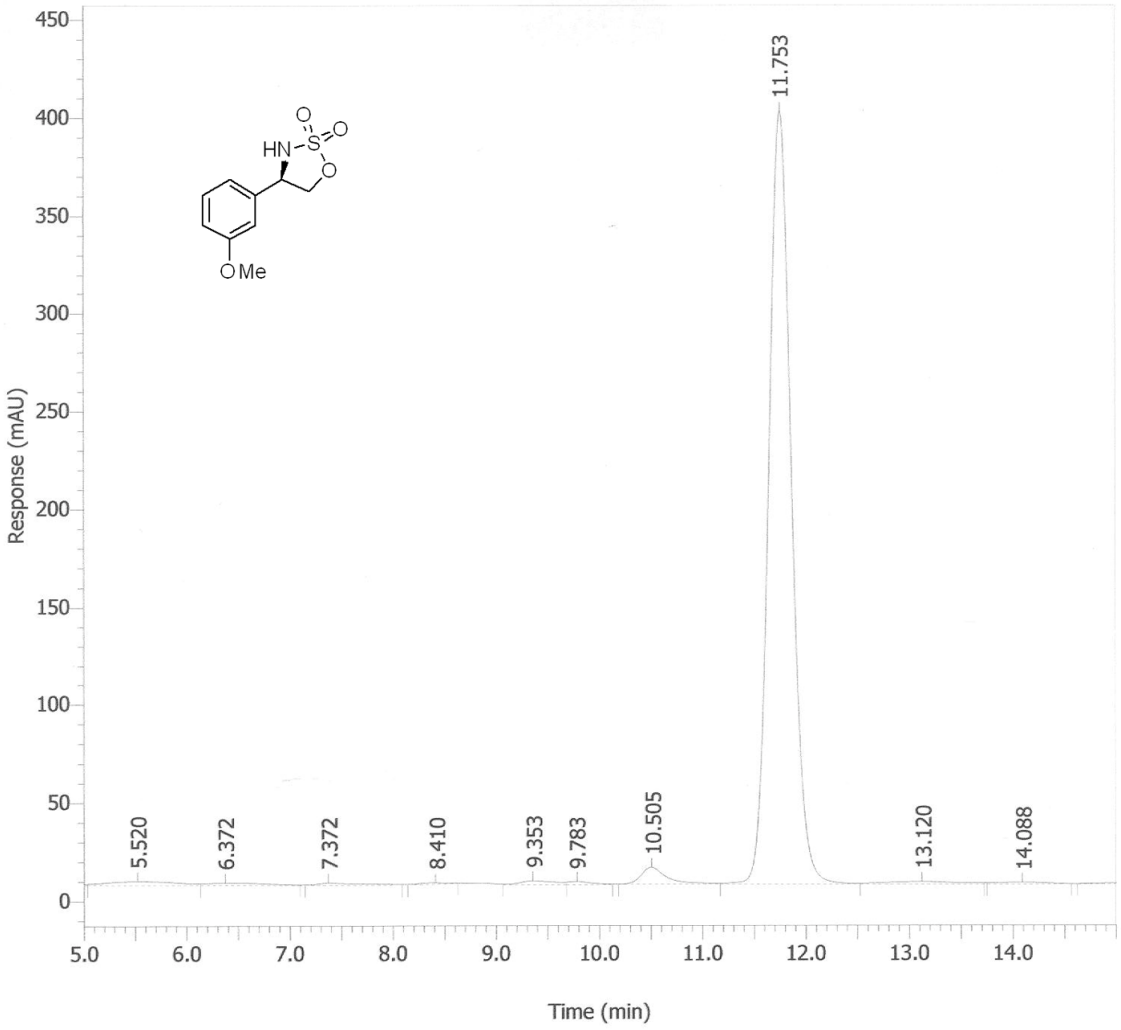

135.3179
129.5927
129.4230
126.6859
77.4473
77.0235
76.6000
75.0208
59.6087
30.9547
0.0035
KSH-3-0018-01
CDCl3
1H
ppm

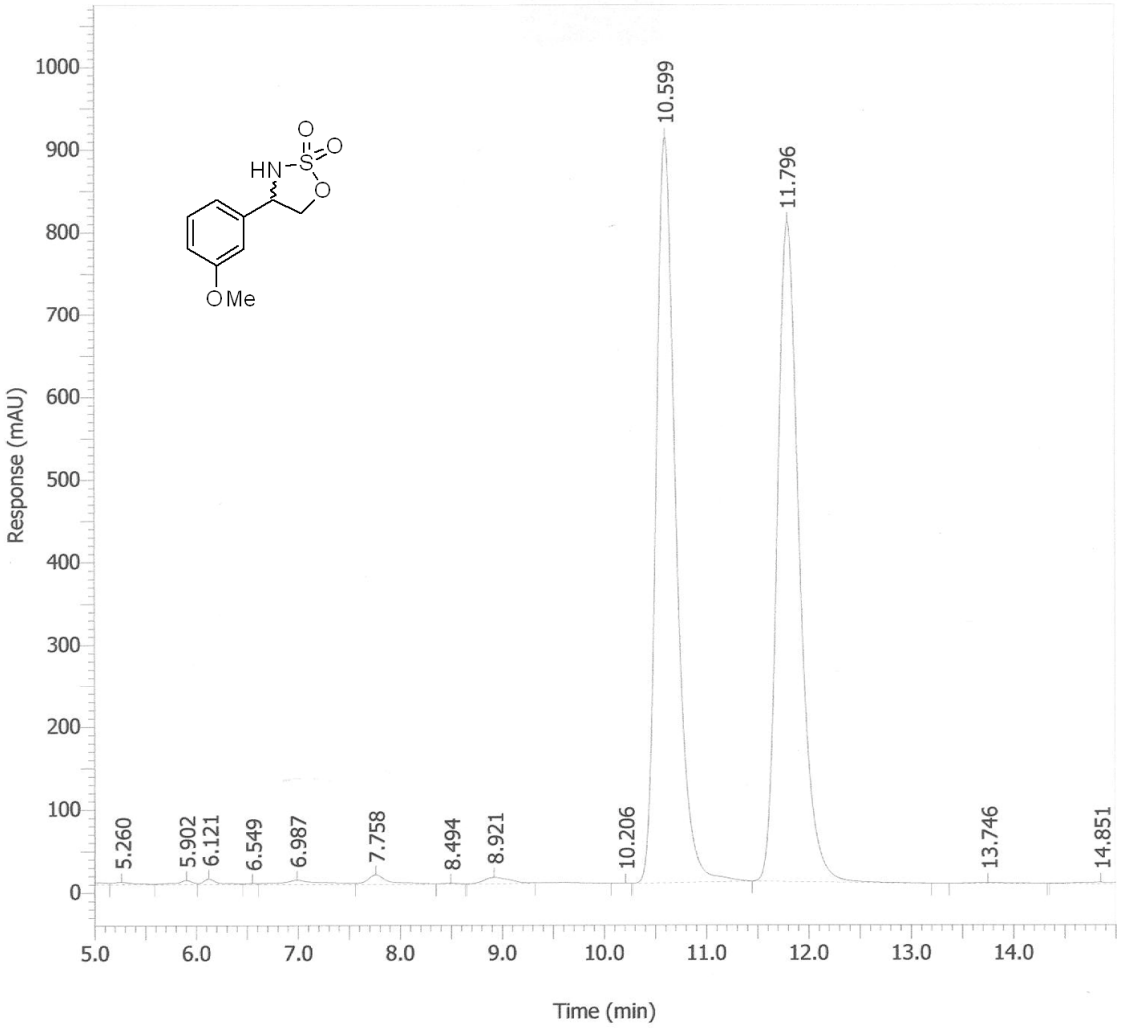

13.210
10.965
11.740
9.113
Response (mAU)
Time (min)
HN
S
O
O
O
800
700
600
500
400
300
200
100
0
9.0
9.5
10.0
10.5
11.0
11.5
12.0
12.5
13.0
13.5
14.0
14.5
15.0
15.5

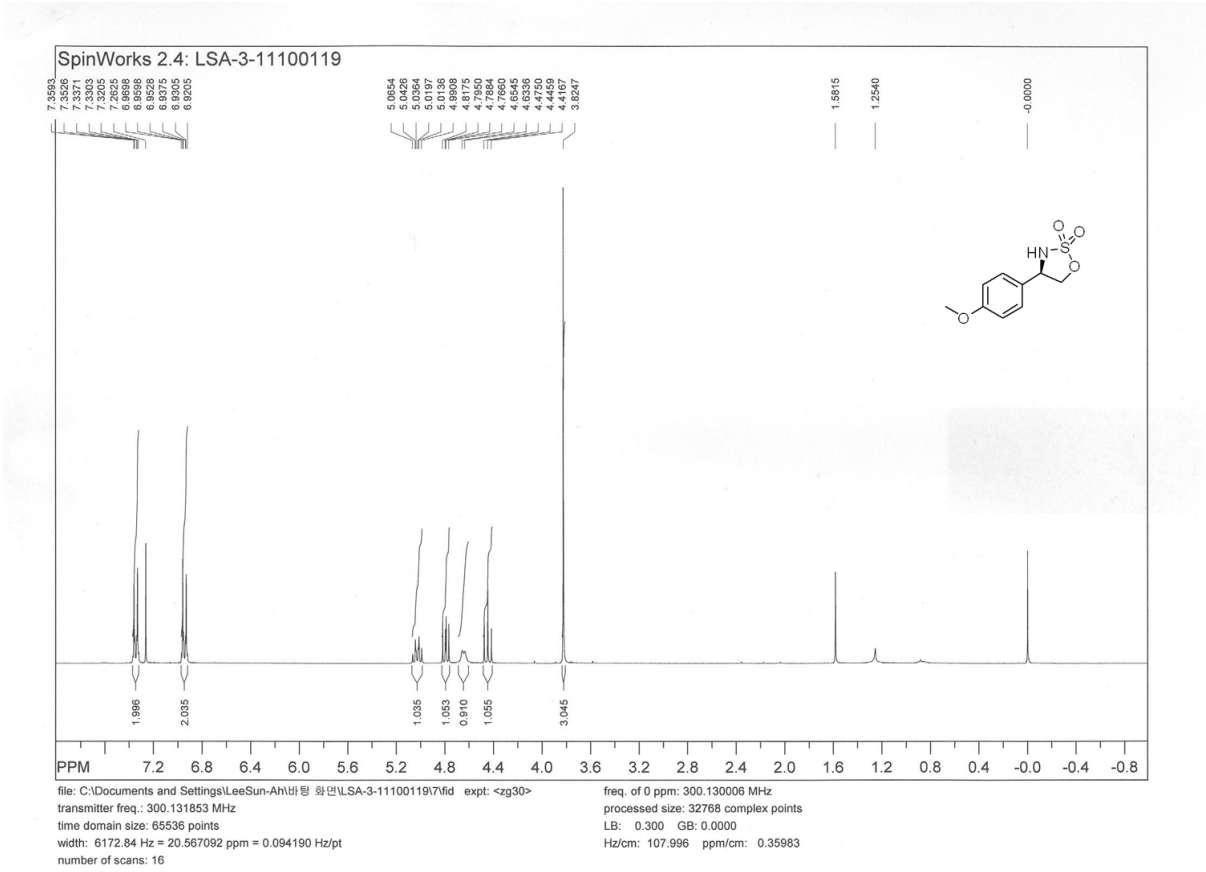

11.342
12.704
10.589
Response (mAU)
Time (min)
550
500
450
400
350
300
250
200
150
100
50
0
9.0
9.5
10.0
10.5
11.0
11.5
12.0
12.5
13.0
13.5
14.0
14.5
HN
S
O

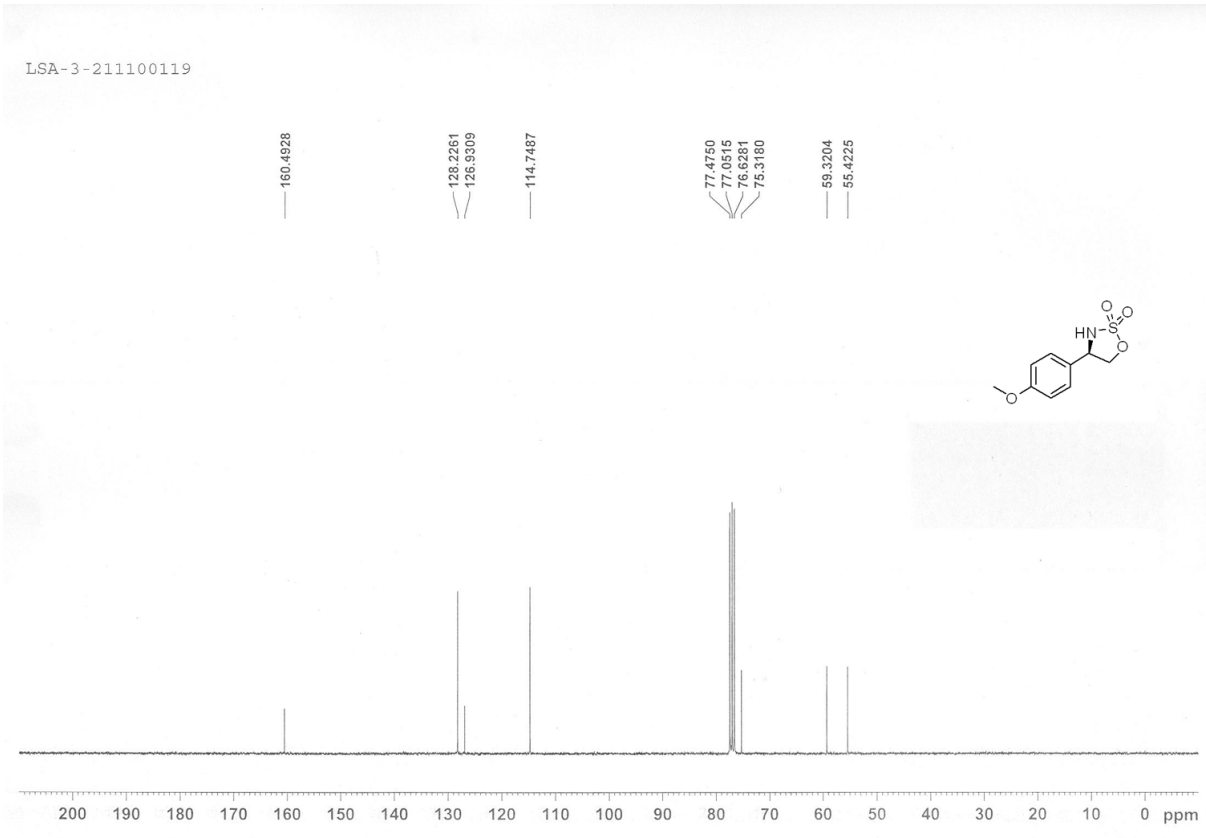

SpinWorks 2.4: LSA-3-23100202
7.3567
7.3522
7.3377
7.3292
7.3044
7.3024
7.2620
6.9886
6.9837
6.9609
6.9602
6.9556
6.9341
6.9314
6.9257
6.9230
6.9070
6.9065
6.8969
6.8854
5.0514
5.0265
5.0130
4.8438
4.8152
4.7936
4.4503
4.4218
4.3953
3.8165
1.2557
0.0000
1.009
3.059
2.014
1.012
1.005
3.062
PPM 7.2 6.8 6.4 6.0 5.6 5.2 4.8 4.4 4.0 3.6 3.2 2.8 2.4 2.0 1.6 1.2 0.8 0.4 -0.0 -0.4 -0.8
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-23100202\3\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16
freq. of 0 ppm: 300.130006 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 105.537 ppm/cm: 0.35163

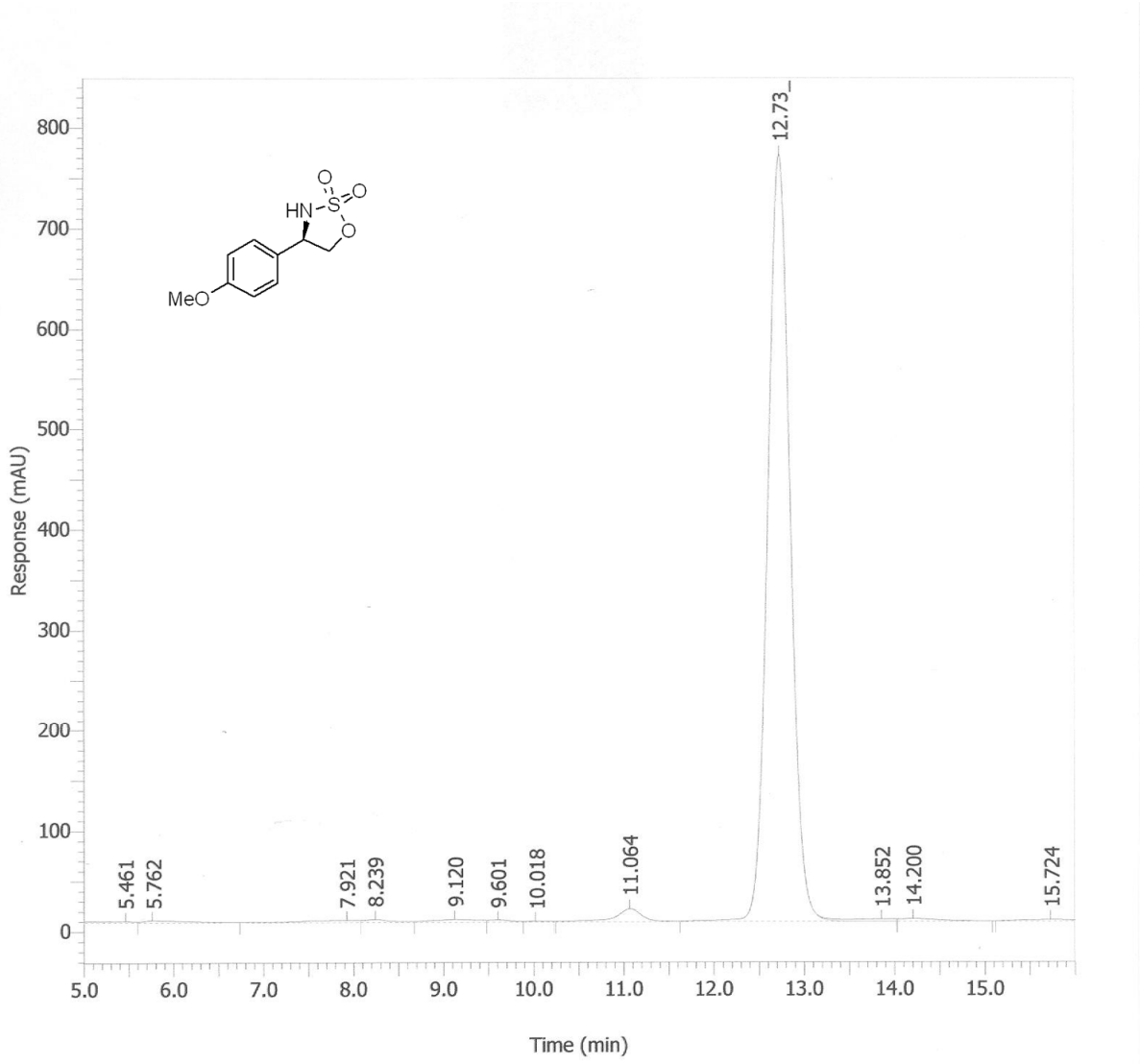

LSA-3-23100202
160.2294
136.9503
130.4700
118.7005
114.9179
112.1609
77.4770
77.0534
76.6291
75.0872
59.4396
55.3910
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm

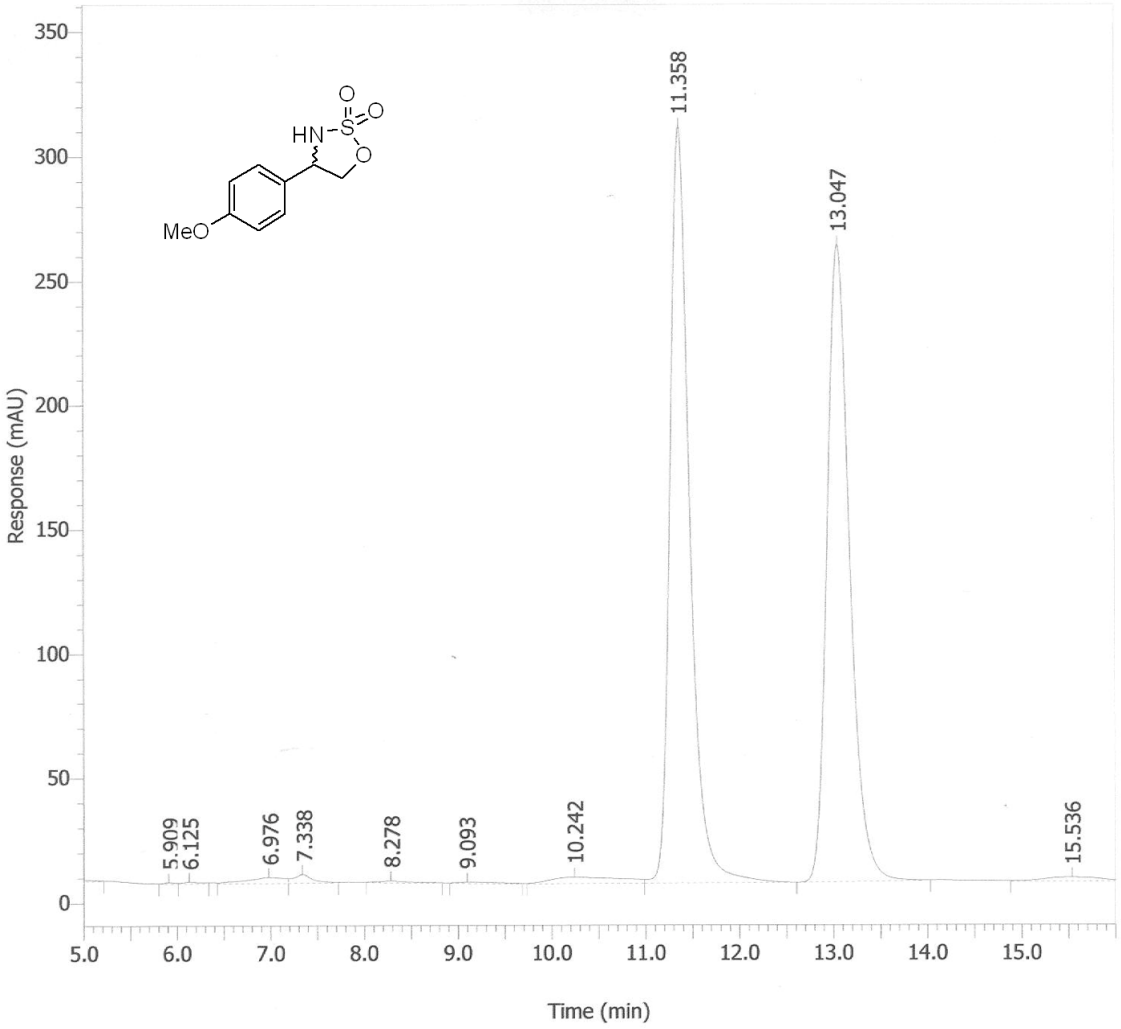

11.753
5.520
6.372
7.372
8.410
9.353
9.783
10.505
13.120
14.088
Response (mAU)
Time (min)
HN
O
S
O
O
O
Me

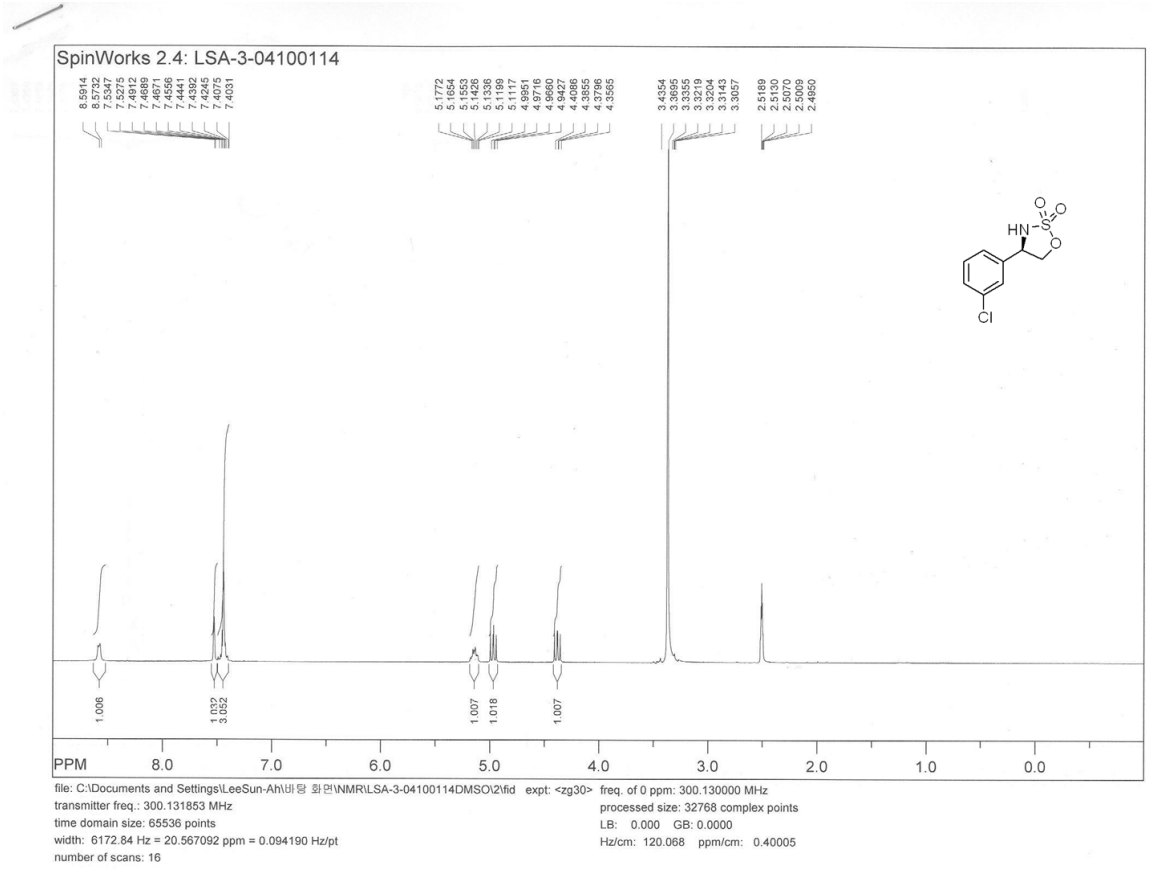

Response (mAU)
Time (min)
10.599
11.796
5.260
5.902
6.121
6.549
6.987
7.758
8.494
8.921
10.206
13.746
14.851
HN
S
O
O
O
OMe

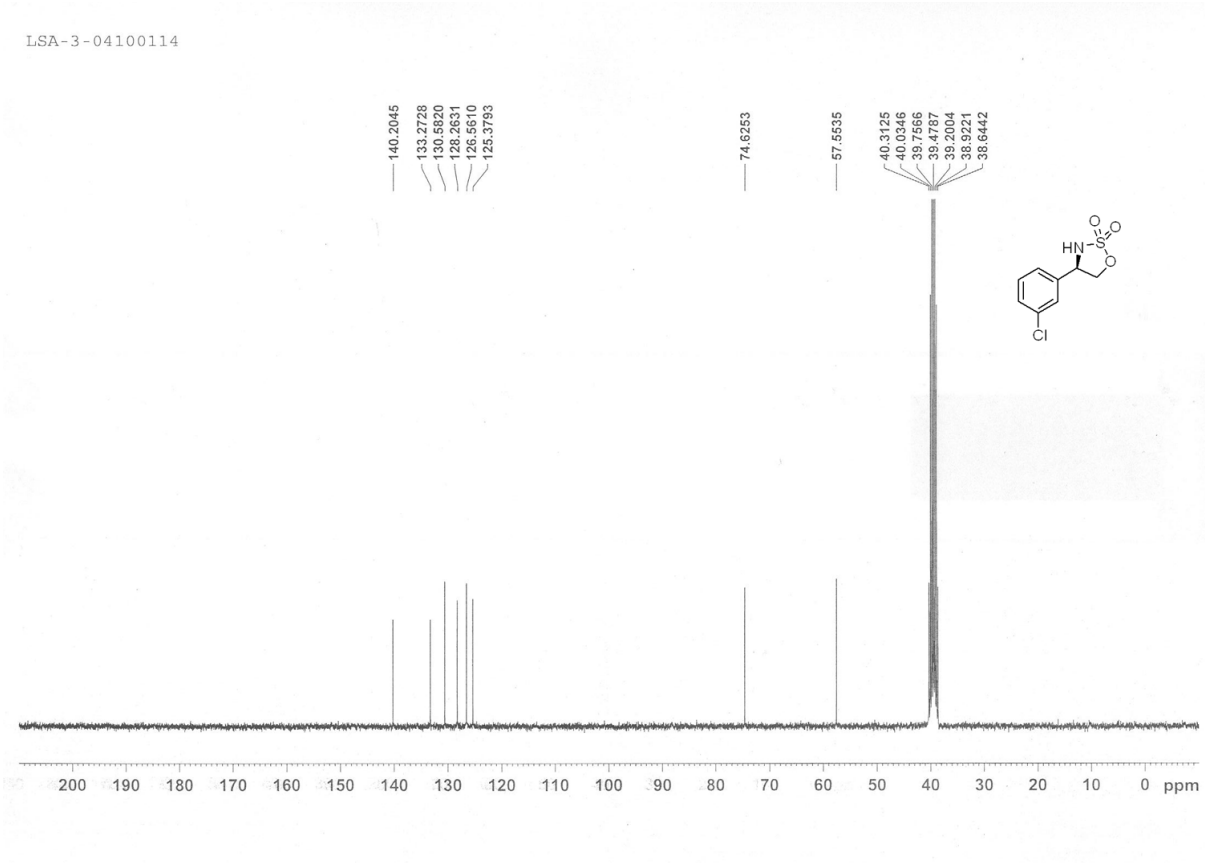

SpinWorks 2.4: LSA-3-11100119
7.3593
7.3526
7.3371
7.3303
7.3205
7.2825
6.9698
6.9598
6.9538
6.9375
6.9305
6.9205
5.0654
5.0426
5.0354
5.0197
5.0136
4.9908
4.8175
4.7950
4.7884
4.7660
4.6545
4.6335
4.4750
4.4459
4.4167
3.8247
1.5815
1.2540
-0.0000
1.996
2.035
1.035
1.053
0.910
1.055
3.045
PPM
7.2 6.8 6.4 6.0 5.6 5.2 4.8 4.4 4.0 3.6 3.2 2.8 2.4 2.0 1.6 1.2 0.8 0.4 -0.0 -0.4 -0.8
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-11100119\7\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16
freq. of 0 ppm: 300.130006 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 107.996 ppm/cm: 0.35983

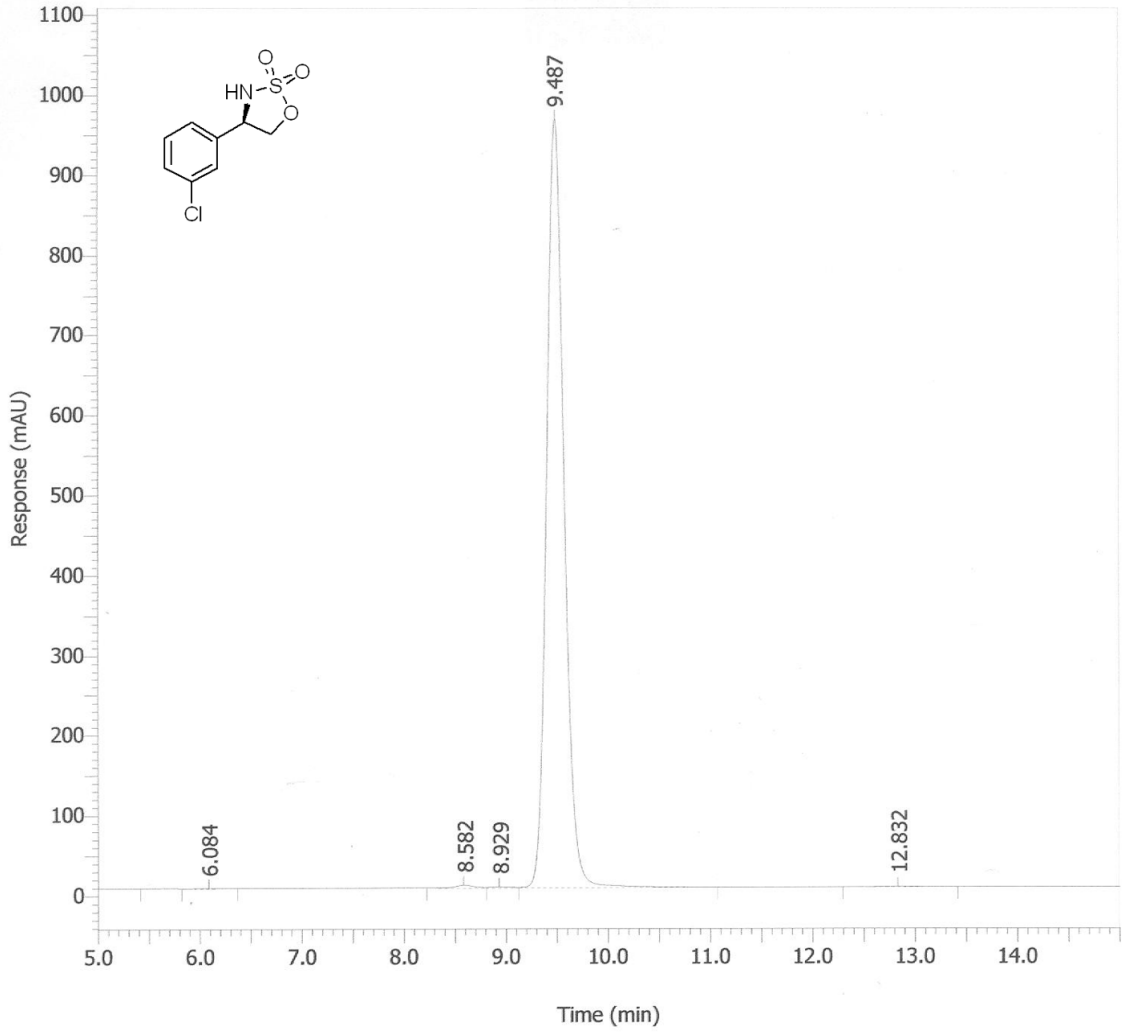

LSA-3-211100119
160.4928
128.2261
126.9309
114.7487
77.4750
77.0515
76.6281
75.3180
59.3204
55.4225
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm

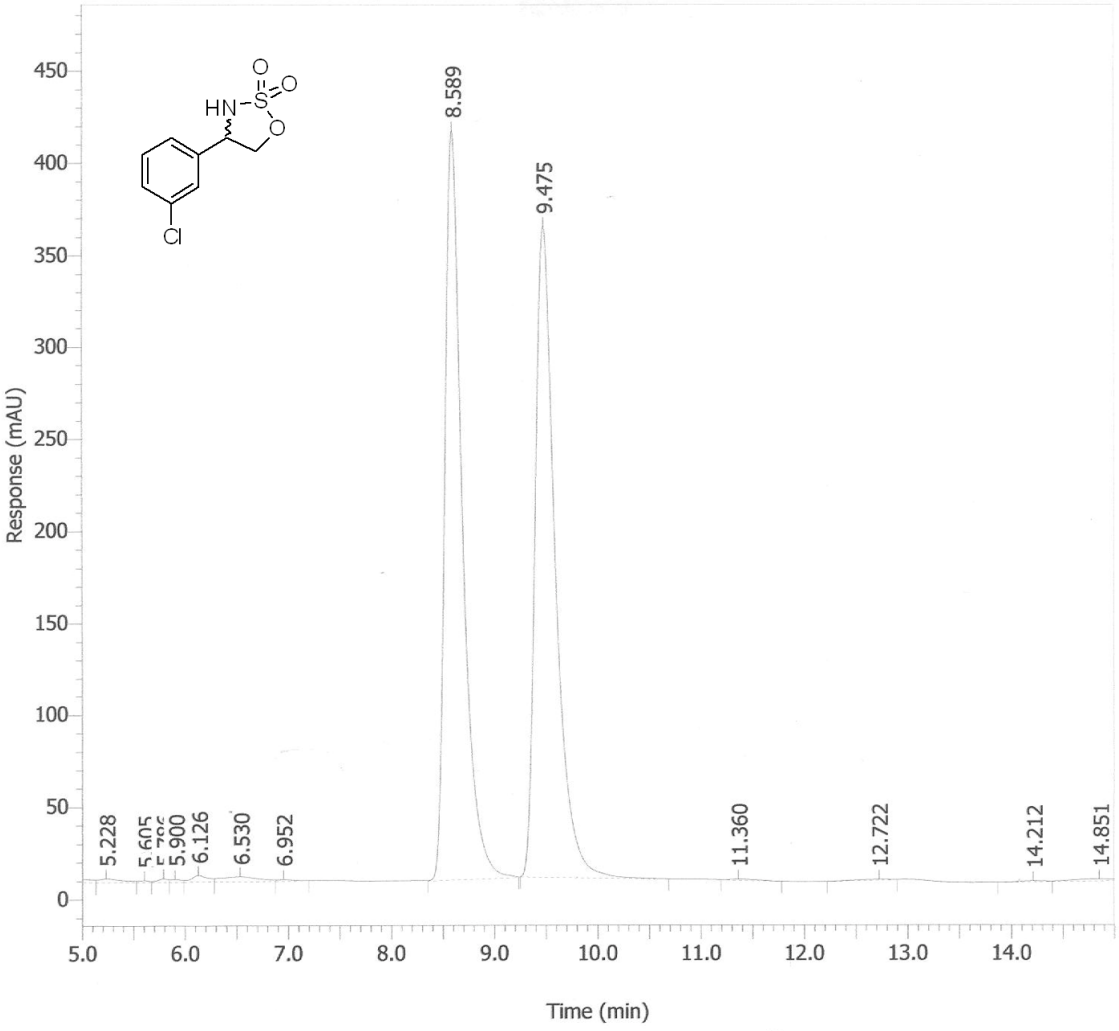

12.73
HN
S
O
O
O
MeO
Response (mAU)
800
700
600
500
400
300
200
100
0
5.461
5.762
7.921
8.239
9.120
9.601
10.018
11.064
13.852
14.200
15.724
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0
Time (min)

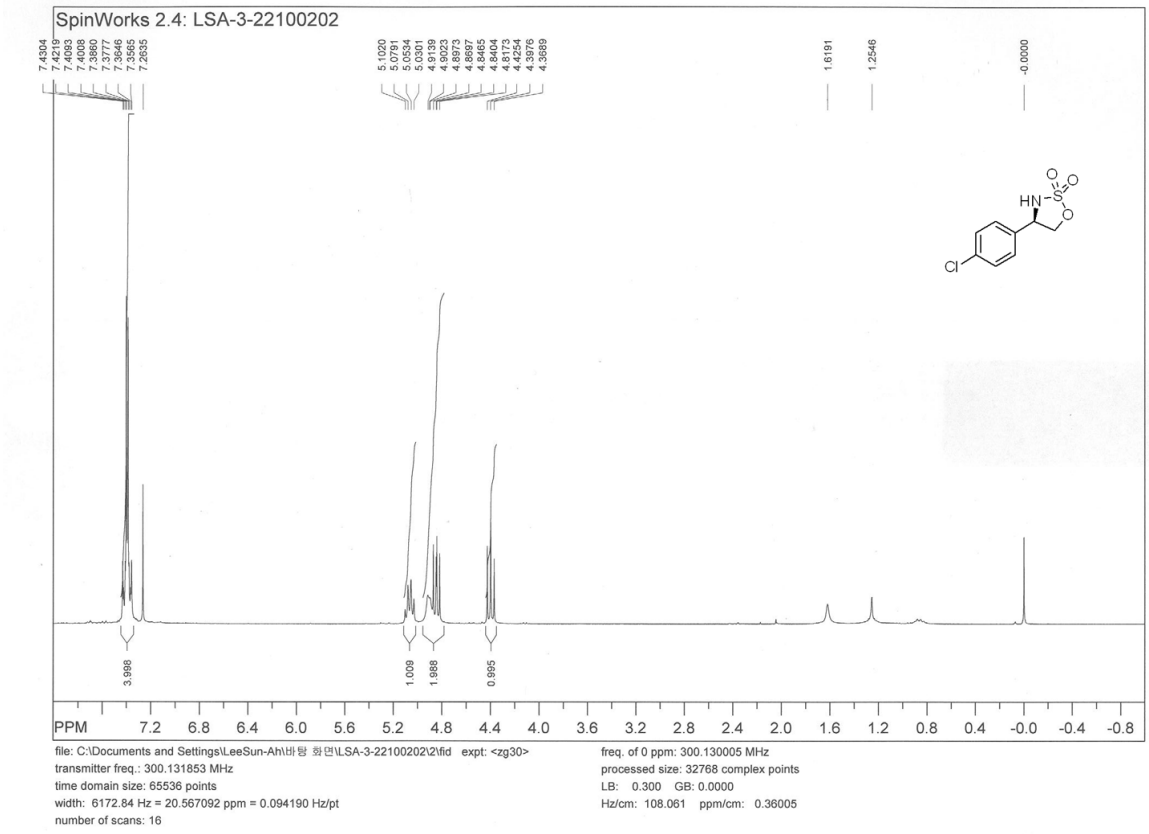

11.358
13.047
5.909
6.125
6.976
7.338
8.278
9.093
10.242
15.536
Response (mAU)
Time (min)
MeO
HN
S
O

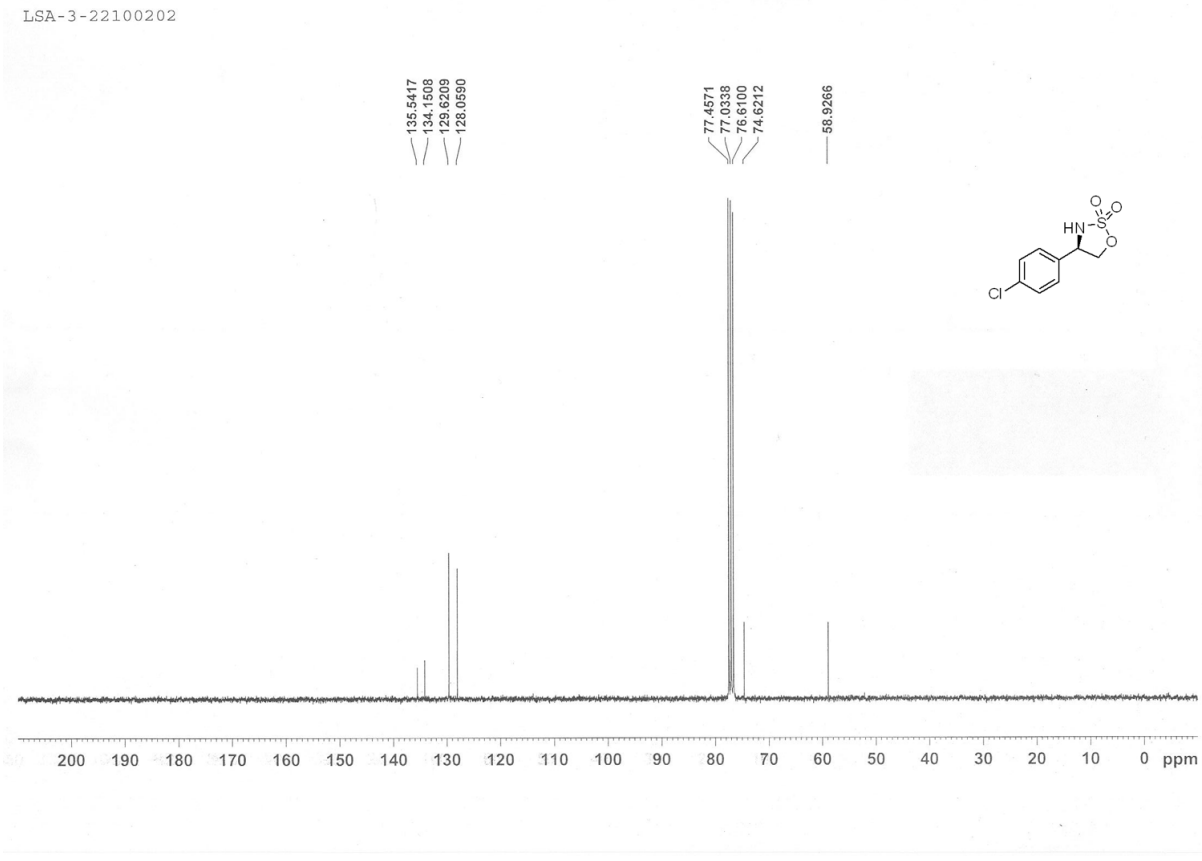

SpinWorks 2.4: LSA-3-04100114
8.5914
8.5732
7.5477
7.5275
7.4912
7.4689
7.4671
7.4556
7.4441
7.4392
7.4245
7.4075
7.4031
5.1772
5.1654
5.1553
5.1428
5.1336
5.1169
5.1117
4.9951
4.9716
4.9660
4.9427
4.4086
4.3855
4.3706
4.3585
3.4354
3.3695
3.3355
3.3219
3.3094
3.3145
3.3057
2.5189
2.5130
2.5070
2.5009
2.4950
HN
S
O
O
O
Cl
1.006
1.032
3.052
1.007
1.018
1.007
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\NMR\LSA-3-04100114DMSO\2\fid expt: <zg30> freq. of 0 ppm: 300.130000 MHz
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16
processed size: 32768 complex points
LB: 0.000 GB: 0.0000
Hz/cm: 120.068 ppm/cm: 0.40005

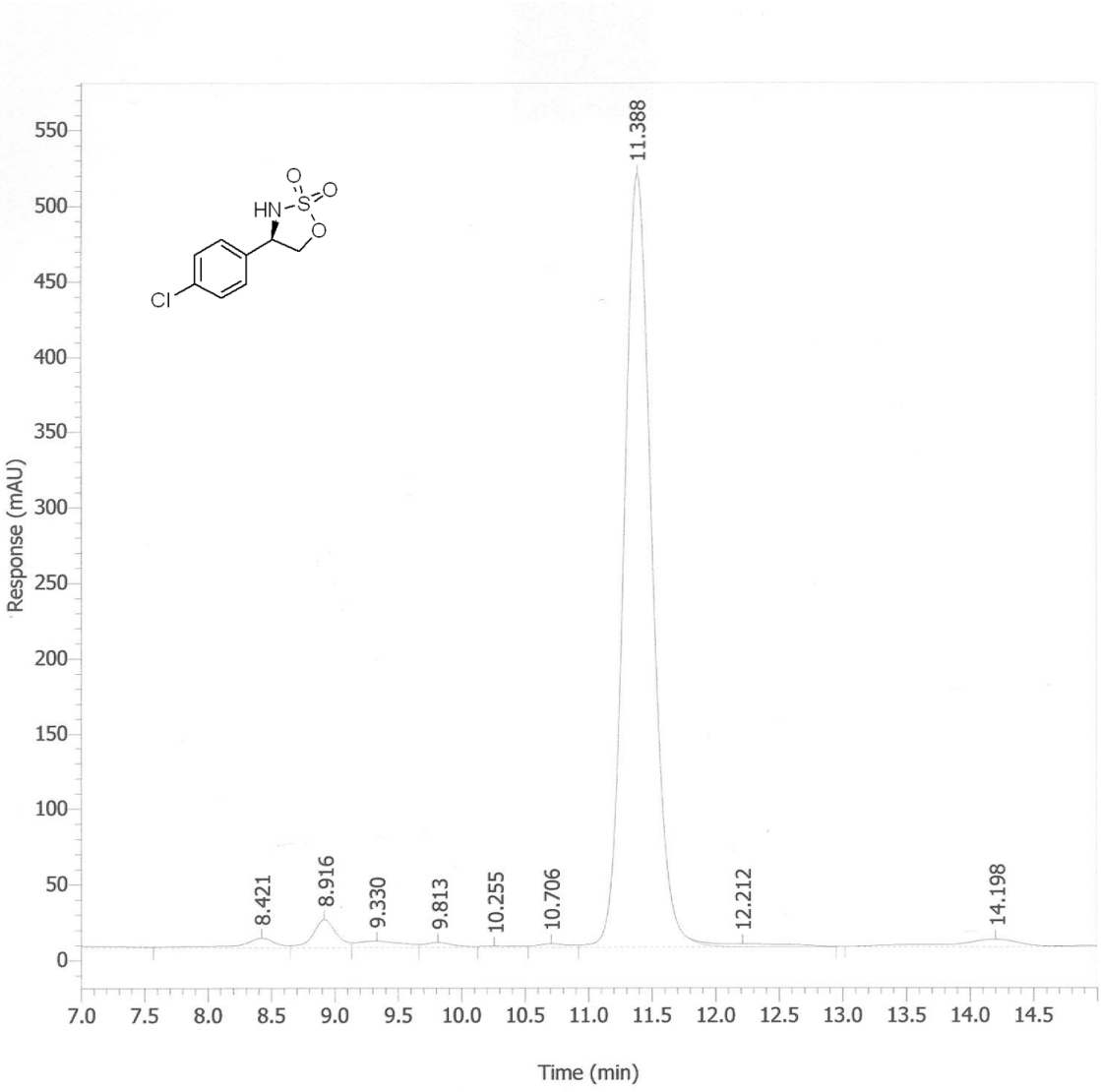

LSA-3-04100114
140.2045
133.2728
130.5820
128.2631
126.5610
125.3793
74.6253
57.5535
40.3125
40.0346
39.7566
39.4787
39.2004
38.9221
38.6442
HN
S
O
O
O
Cl
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

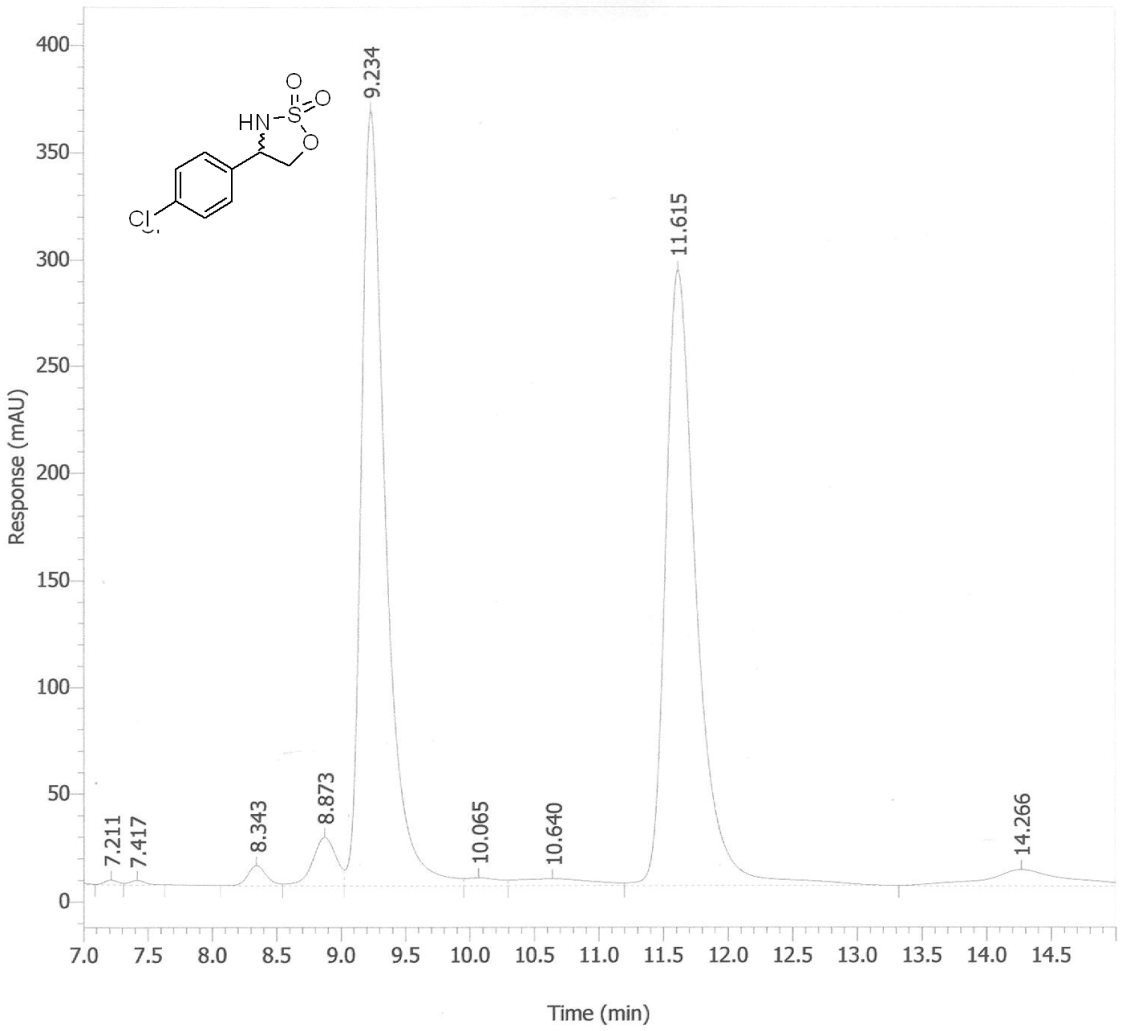

1100
1000
900
800
700
600
500
400
300
200
100
0
Response (mAU)
HN
O
S
O
O
Cl
9.487
6.084
8.582
8.929
12.832
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
Time (min)

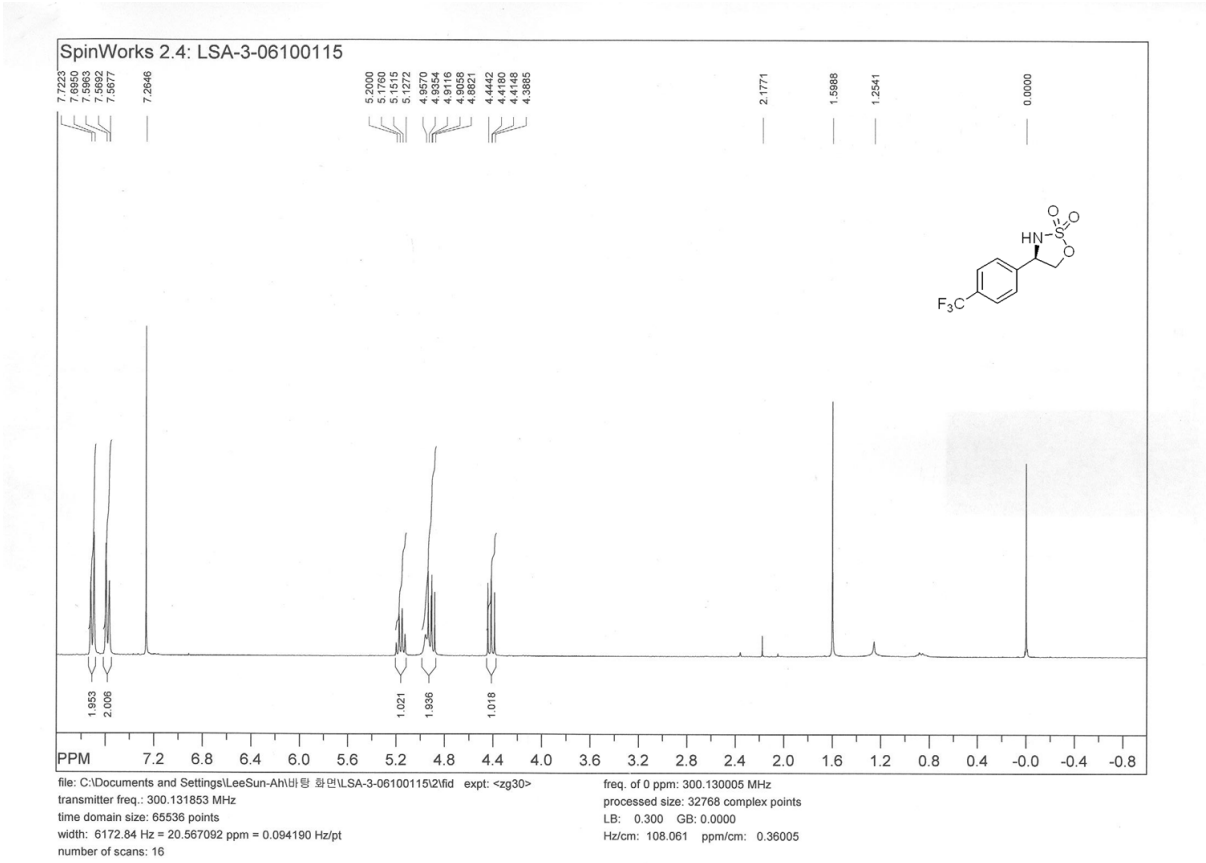

HN
S
O
O
O
Cl
8.589
9.475
5.228
5.605
5.786
5.900
6.126
6.530
6.952
11.360
12.722
14.212
14.851
Response (mAU)
Time (min)
0
50
100
150
200
250
300
350
400
450
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0

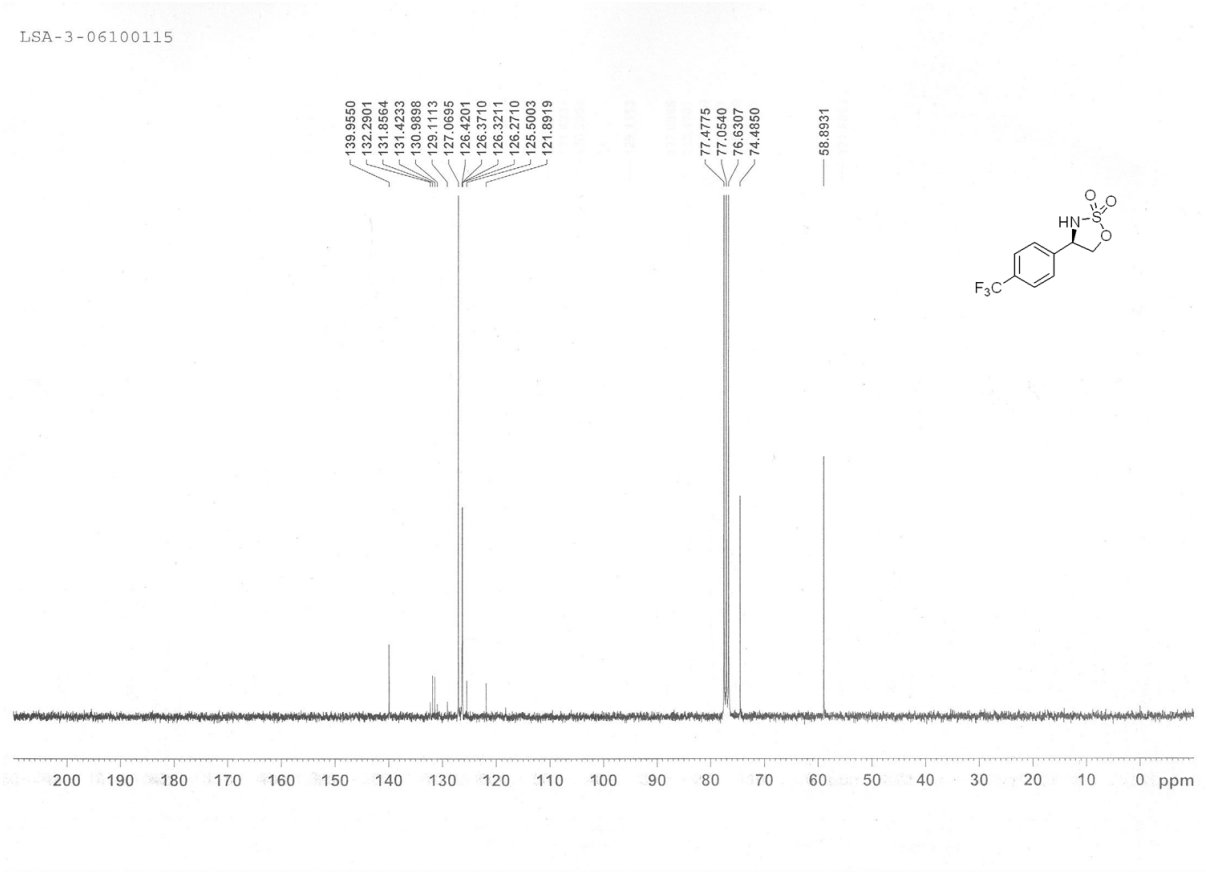

SpinWorks 2.4: LSA-3-22100202
7.4304
7.4219
7.4093
7.4008
7.3960
7.3777
7.3646
7.3565
7.2635
5.1020
5.0791
5.0534
5.0301
4.9139
4.8973
4.8897
4.8465
4.8404
4.8173
4.4254
4.3976
4.3689
1.6191
1.2546
-0.0000
HN
S
O
O
O
Cl
3.998
1.009
1.988
0.995
PPM
7.2 6.8 6.4 6.0 5.6 5.2 4.8 4.4 4.0 3.6 3.2 2.8 2.4 2.0 1.6 1.2 0.8 0.4 -0.0 -0.4 -0.8
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-22100202\2\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16
freq. of 0 ppm: 300.130005 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 108.061 ppm/cm: 0.36005

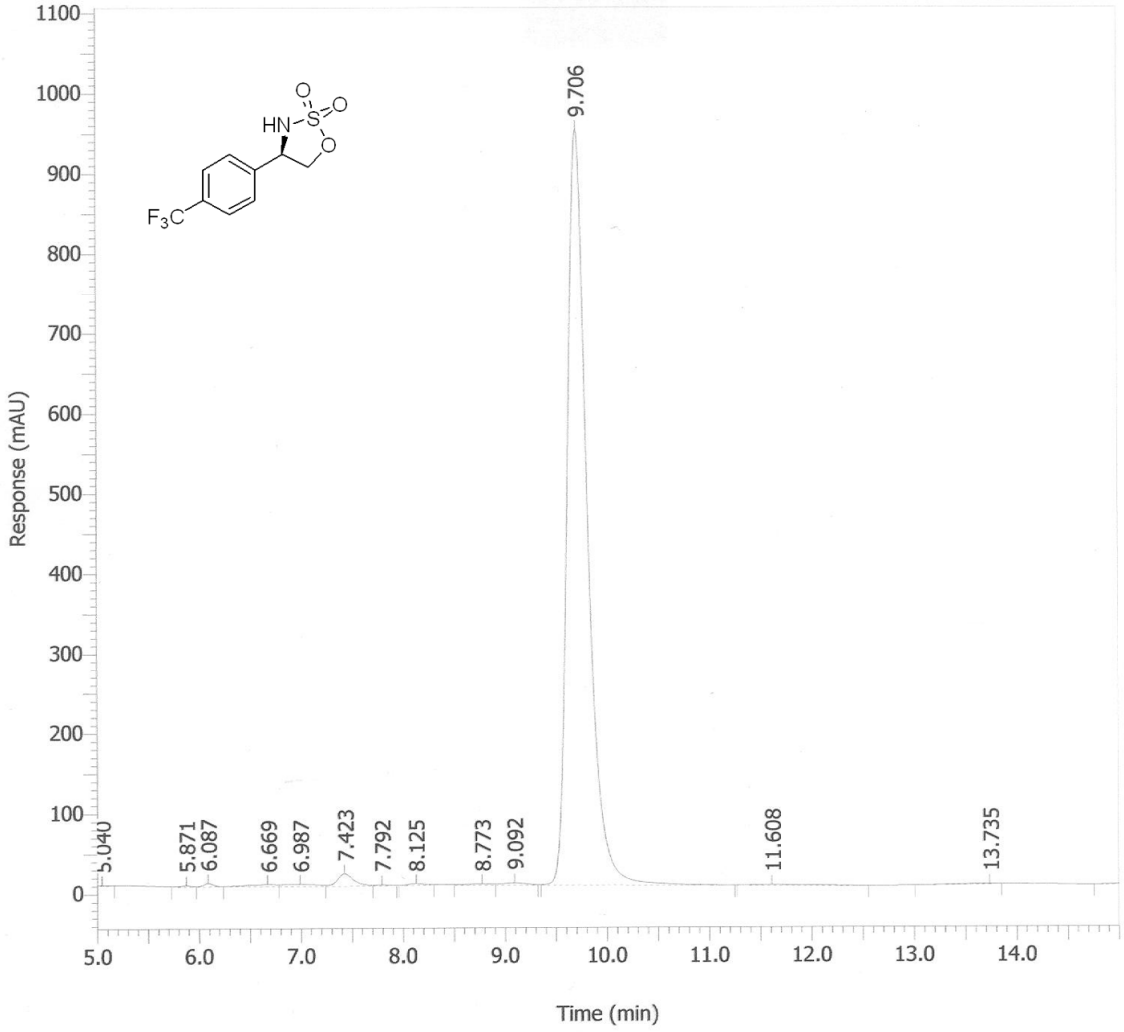

LSA-3-22100202
135.5417
134.1508
129.6209
128.0590
77.4571
77.0338
76.6100
74.6212
58.9266
HN
S
O
O
O
Cl
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm

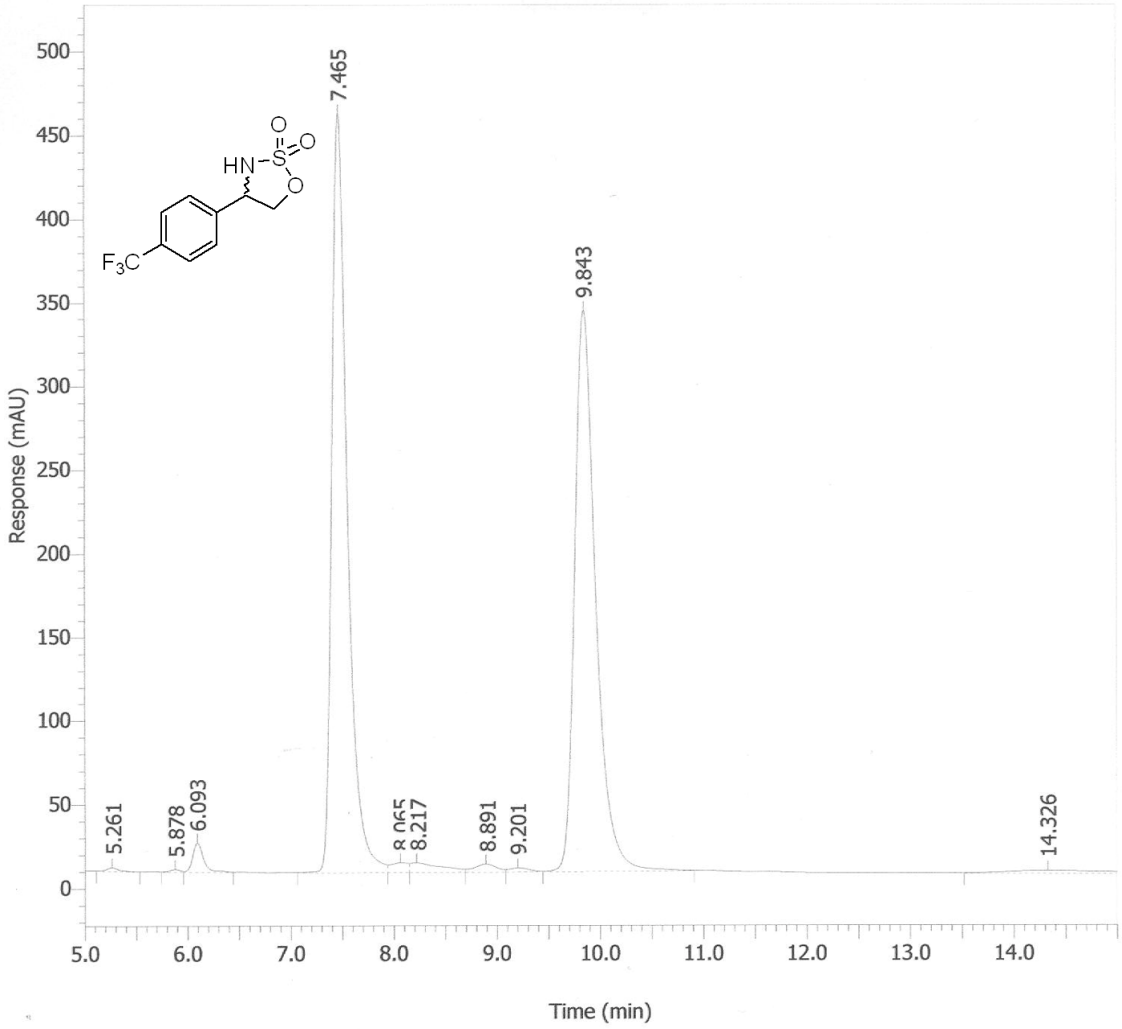

11.388
8.421
8.916
9.330
9.813
10.255
10.706
12.212
14.198
Response (mAU)
Time (min)
HN
O
S
O
O
Cl

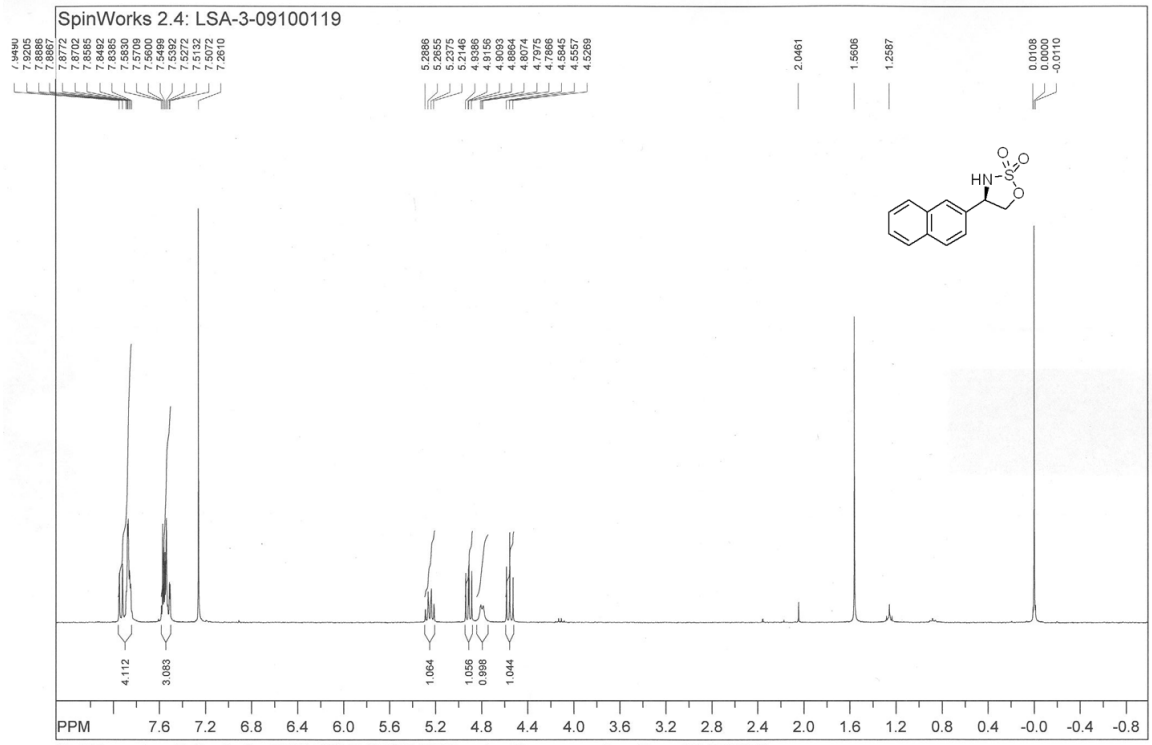

Response (mAU)
Time (min)
9.234
11.615
8.873
8.343
7.211
7.417
10.065
10.640
14.266
HN
O
S
O
O
Cl


SpinWorks 2.4: LSA-3-06100115
7.7223
7.6950
7.5963
7.5692
7.5677
7.2646
5.2000
5.1760
5.1515
5.1272
4.9570
4.9354
4.9116
4.9058
4.8821
4.4442
4.4180
4.4148
4.3885
2.1771
1.5988
1.2541
0.0000
HN
O
S
O
O
F3C
1.953
2.006
1.021
1.936
1.018
PPM
7.2 6.8 6.4 6.0 5.6 5.2 4.8 4.4 4.0 3.6 3.2 2.8 2.4 2.0 1.6 1.2 0.8 0.4 -0.0 -0.4 -0.8
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-06100115\2\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16
freq. of 0 ppm: 300.130005 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 108.061 ppm/cm: 0.36005


LSA-3-06100115
139.9550
132.2901
131.8564
131.4233
130.9898
129.1113
127.0695
126.4201
126.3710
126.3211
126.2710
125.5003
121.8919
77.4775
77.0540
76.6307
74.4850
58.8931
HN
O
S
O
O
F3C
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm

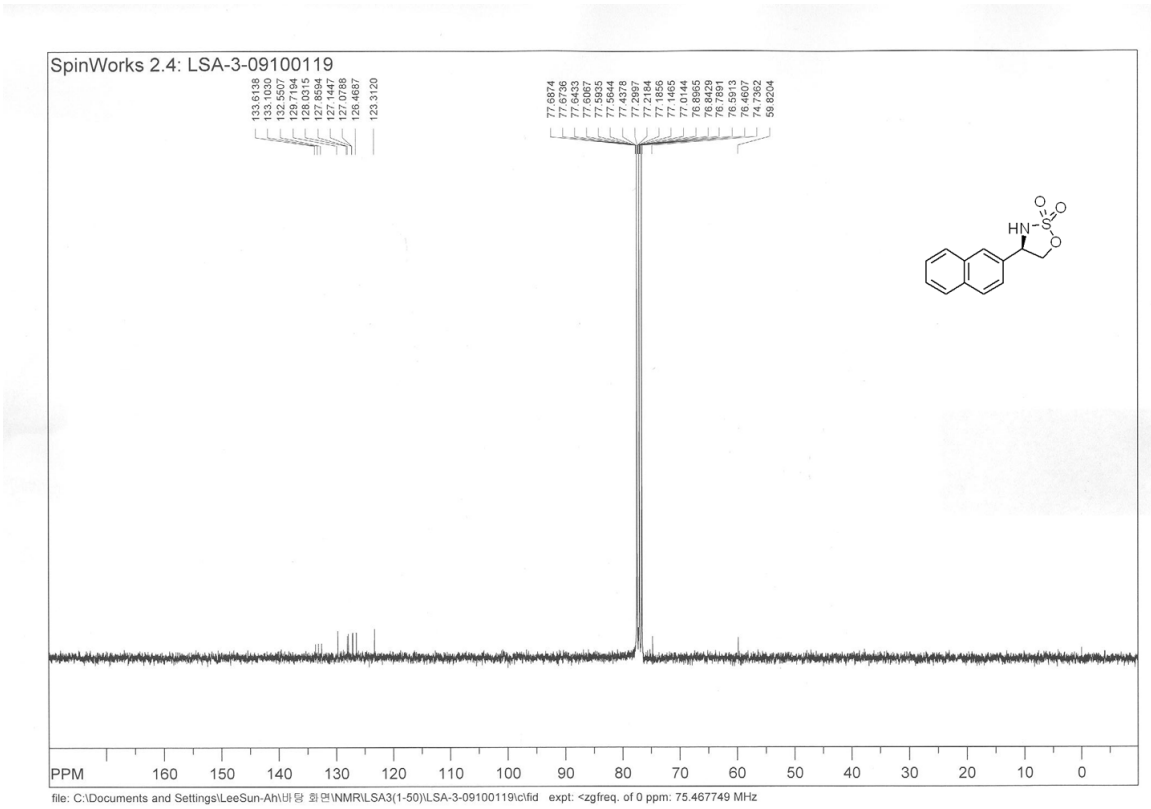

1100
1000
900
800
700
600
500
400
300
200
100
0
Response (mAU)
HN
O
S
O
O
F3C
9.706
5.040
5.871
6.087
6.669
6.987
7.423
7.792
8.125
8.773
9.092
11.608
13.735
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
Time (min)


7.465
9.843
5.261
5.878
6.093
8.065
8.217
8.891
9.201
14.326
Response (mAU)
Time (min)
HN
O
S
O
O
F3C



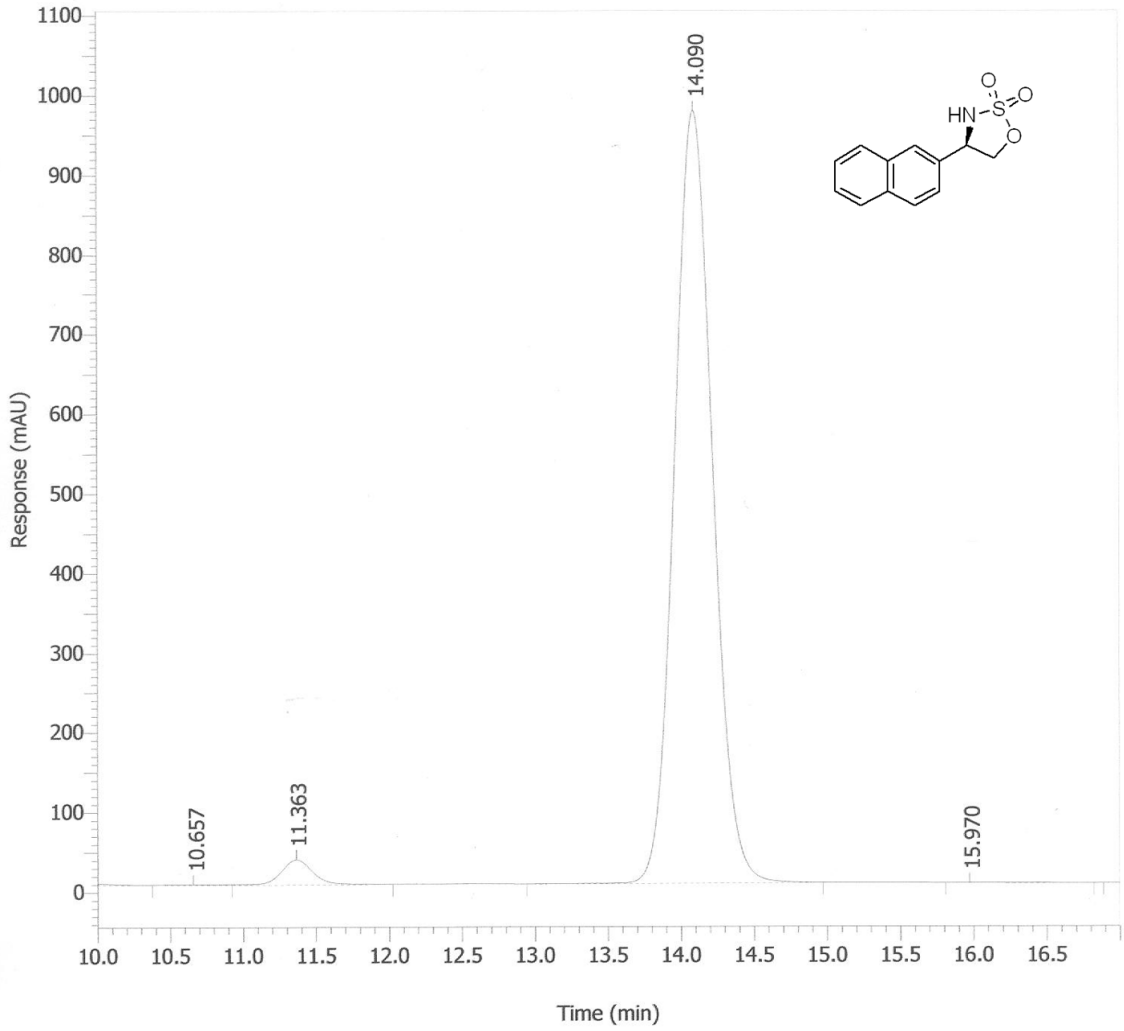
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-09100119\5\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16

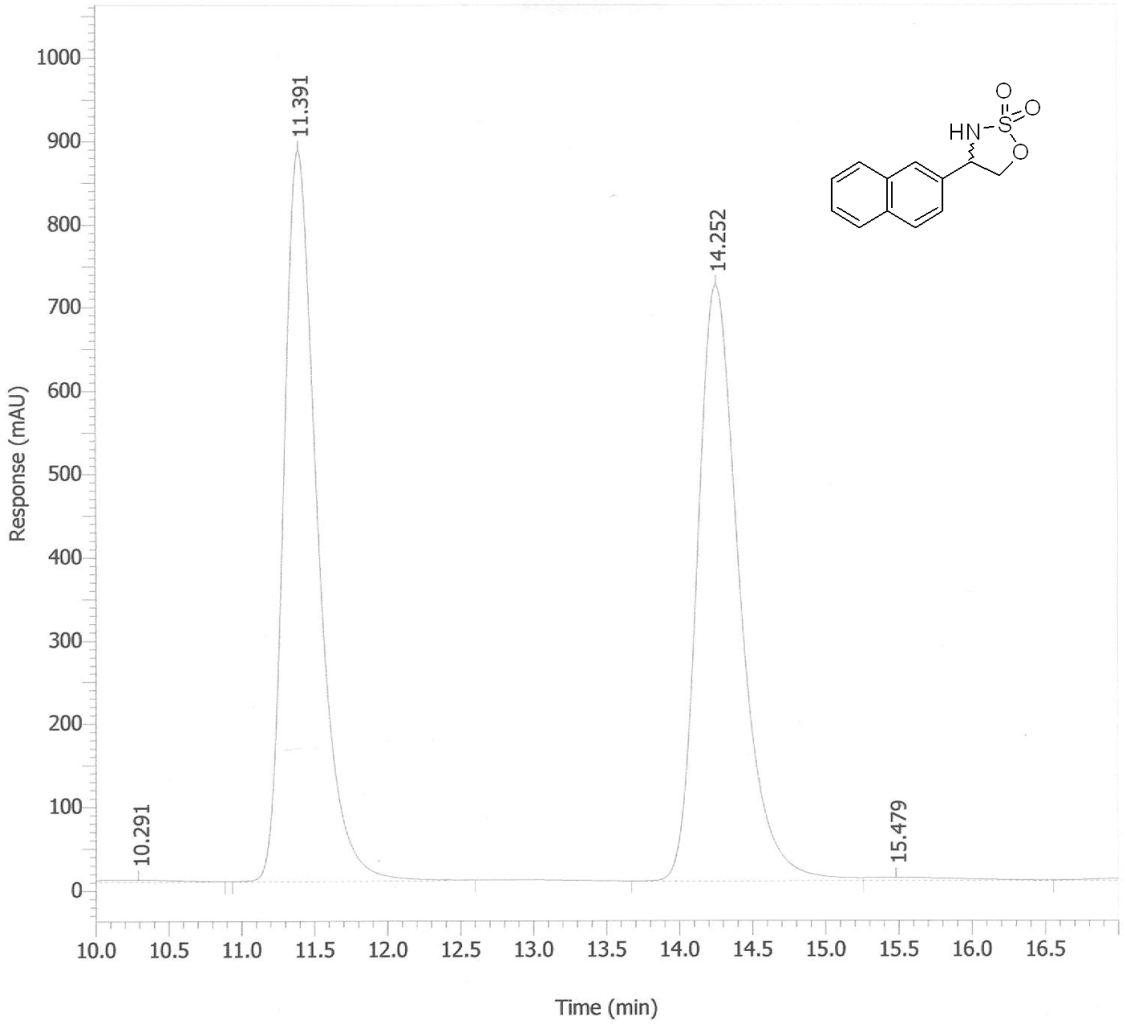
freq. of 0 ppm: 300.130006 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 113.909 ppm/cm: 0.37953

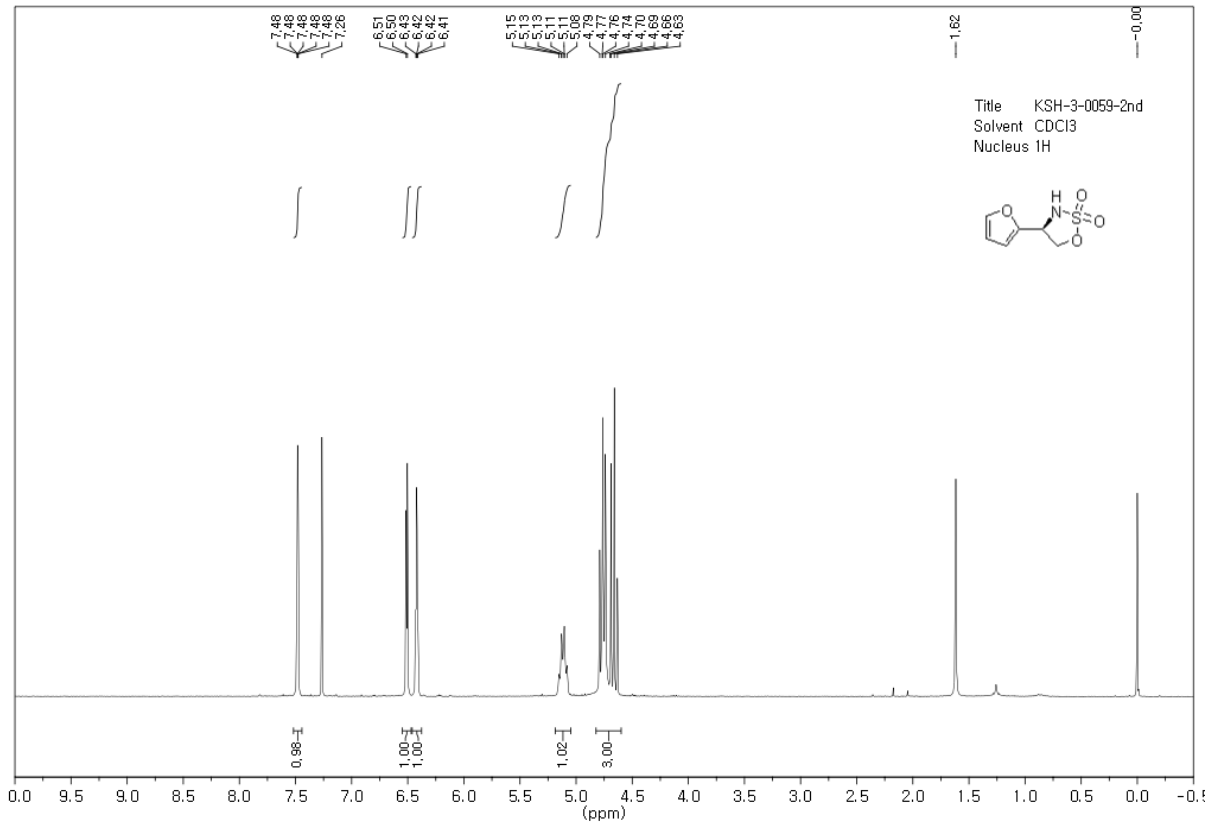


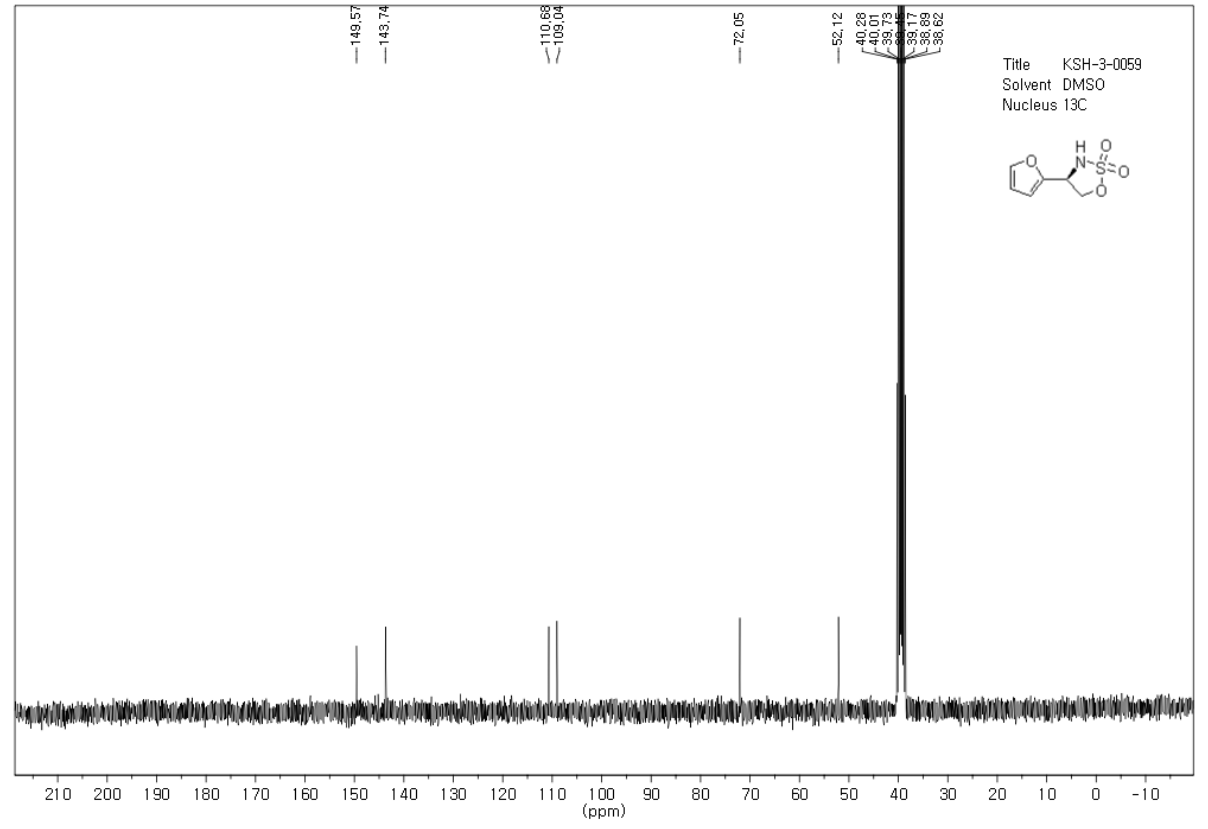
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\NMR\LSA3(1-50)\LSA-3-09100119\c\fid expt: <zgfreq. of 0 ppm: 75.467749 MHz
transmitter freq.: 75.475295 MHz
time domain size: 65536 points
width: 17985.61 Hz = 238.297995 ppm = 0.274439 Hz/pt
number of scans: 1024

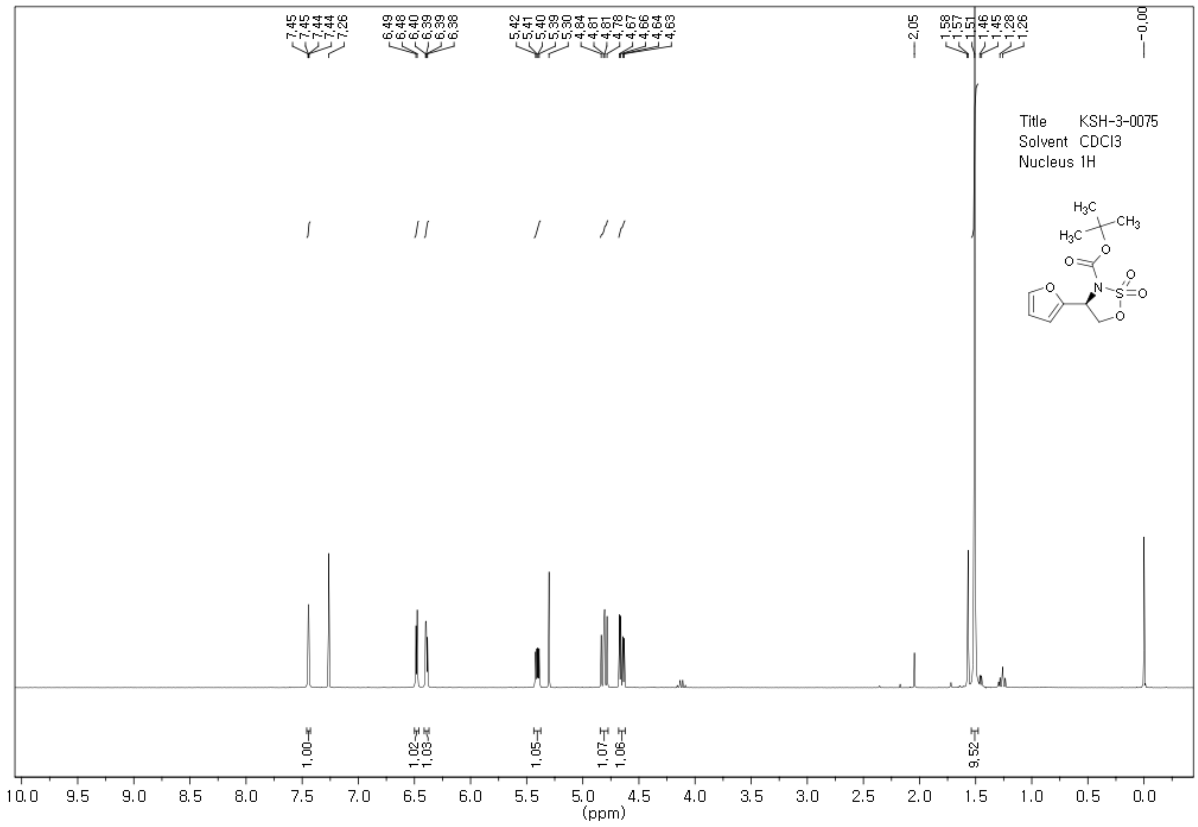
processed size: 32768 complex points
LB: 1.000 GB: 0.0000
Hz/cm: 572.718 ppm/cm: 7.58816

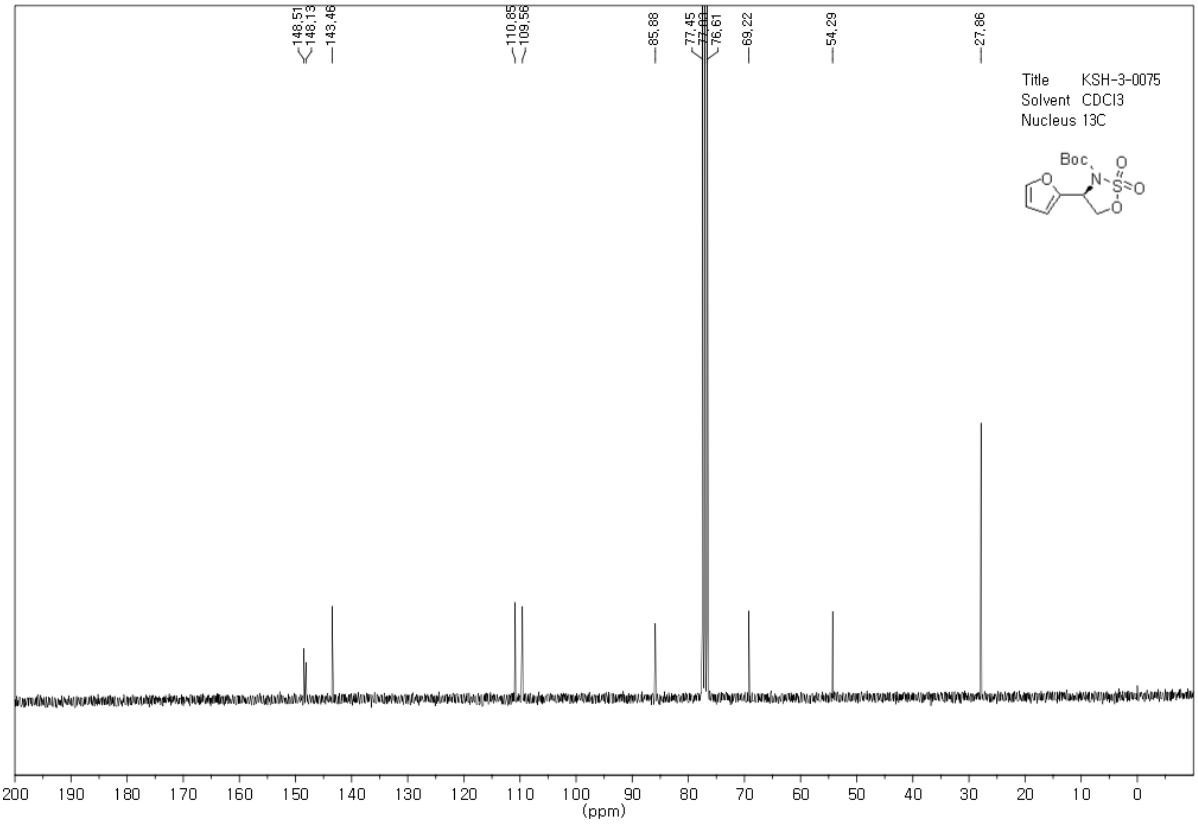

1100
1000
900
800
700
600
500
400
300
200
100
0
Response (mAU)
14.090
10.657
11.363
15.970
10.0
10.5
11.0
11.5
12.0
12.5
13.0
13.5
14.0
14.5
15.0
15.5
16.0
16.5
Time (min)
HN
S
O
O
O

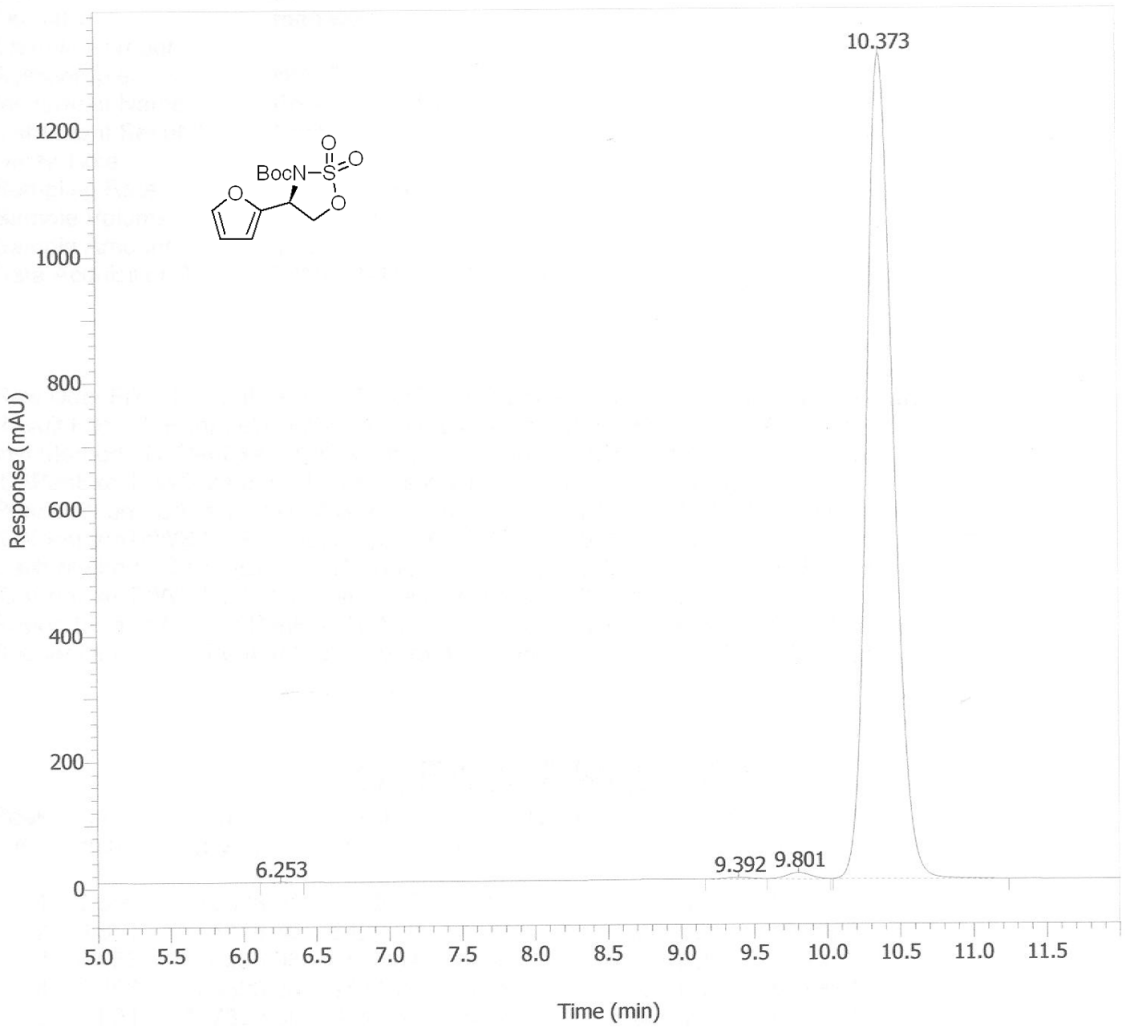

11.391
14.252
10.291
15.479
Response (mAU)
Time (min)
HN
S
O
O
O

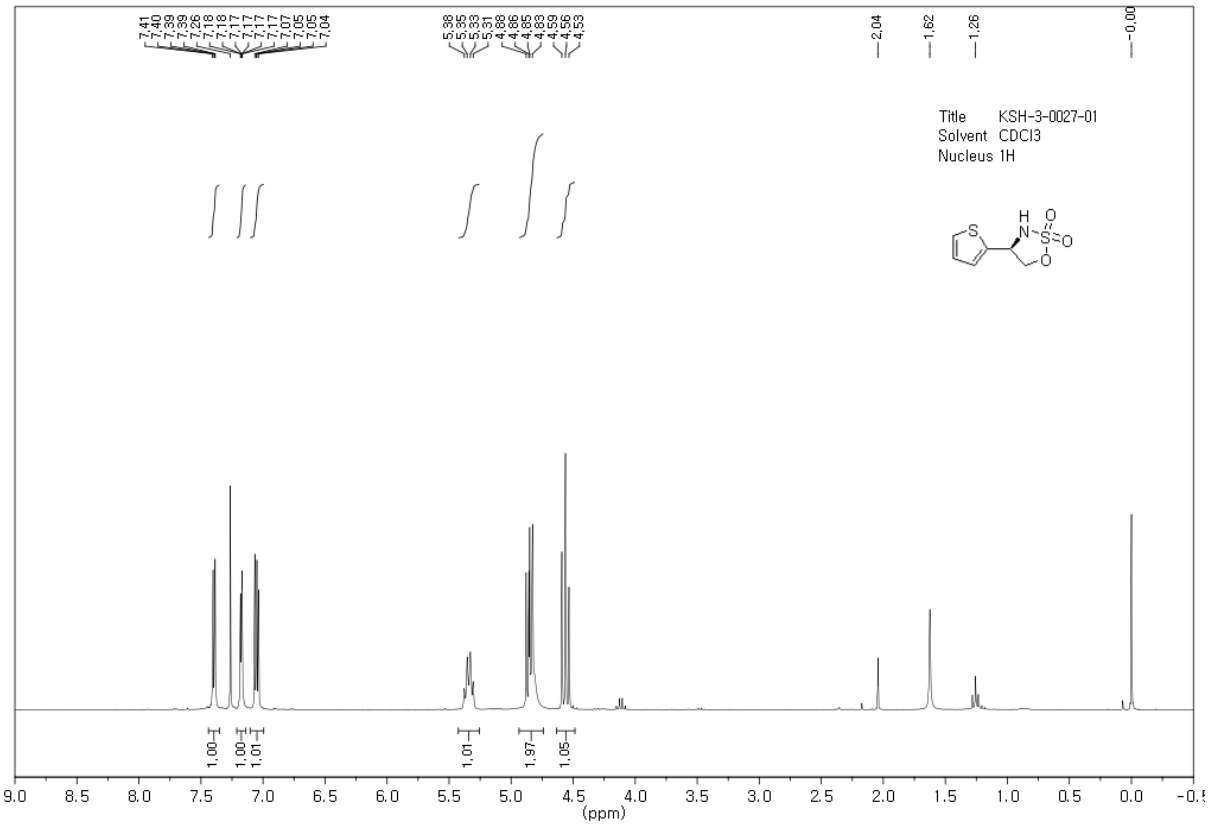

Title KSH-3-0059-2nd
Solvent CDCl3
Nucleus 1H
(ppm)

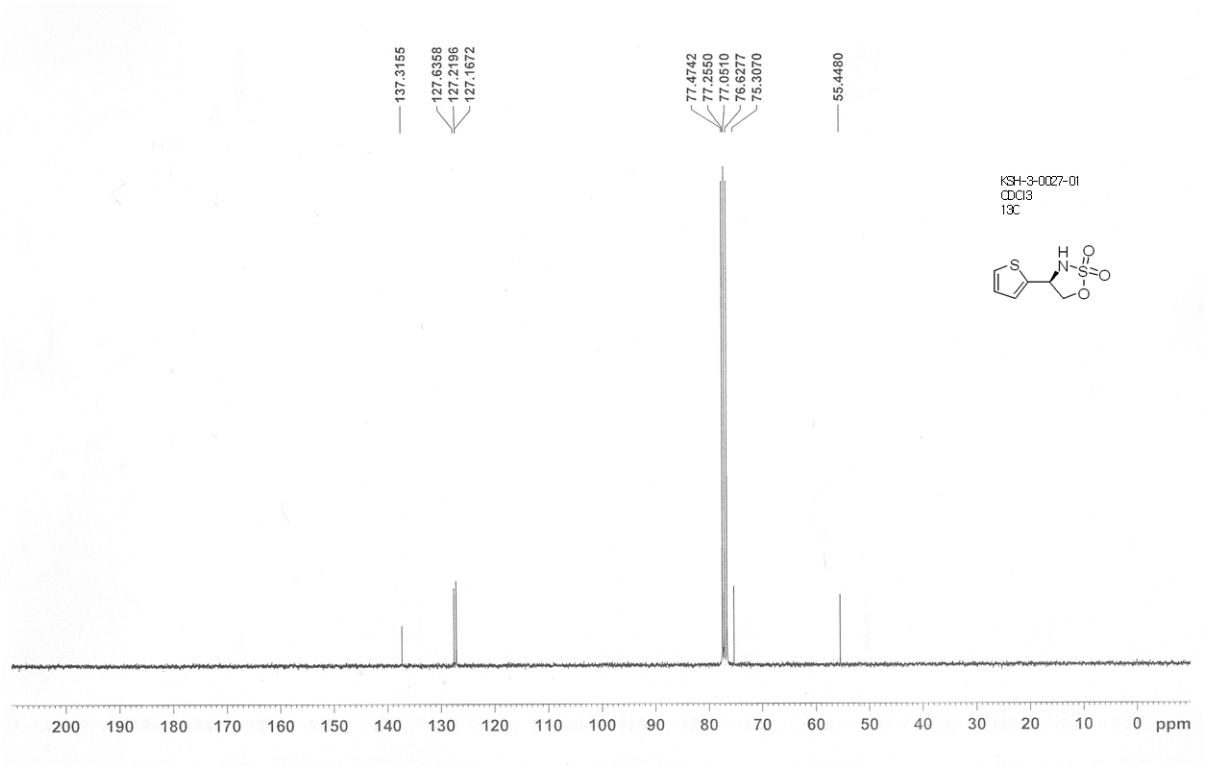

Title KSH-3-0059
Solvent DMSO
Nucleus 13C
(ppm)

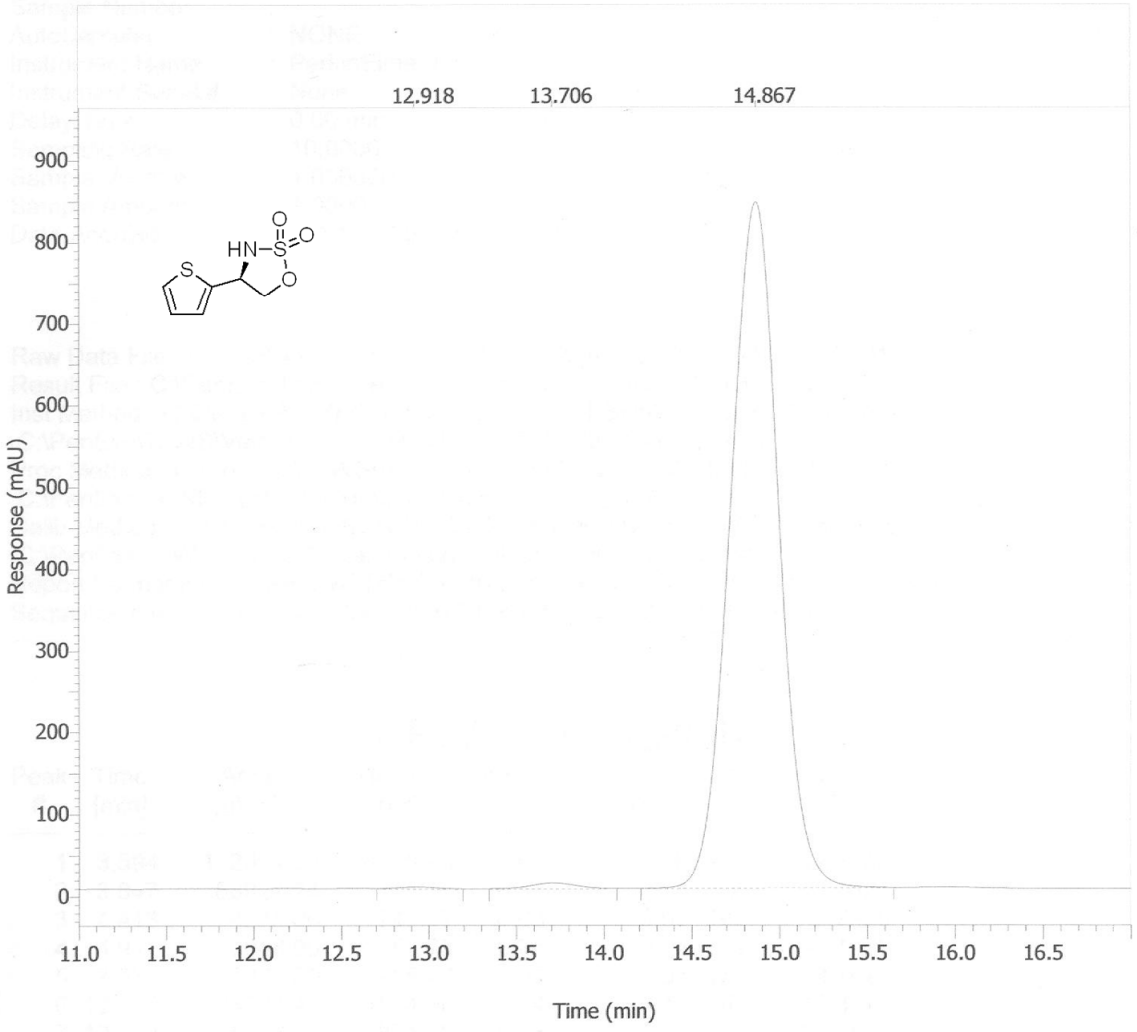

Title KSH-3-0075
Solvent CDCl3
Nucleus 1H
(ppm)

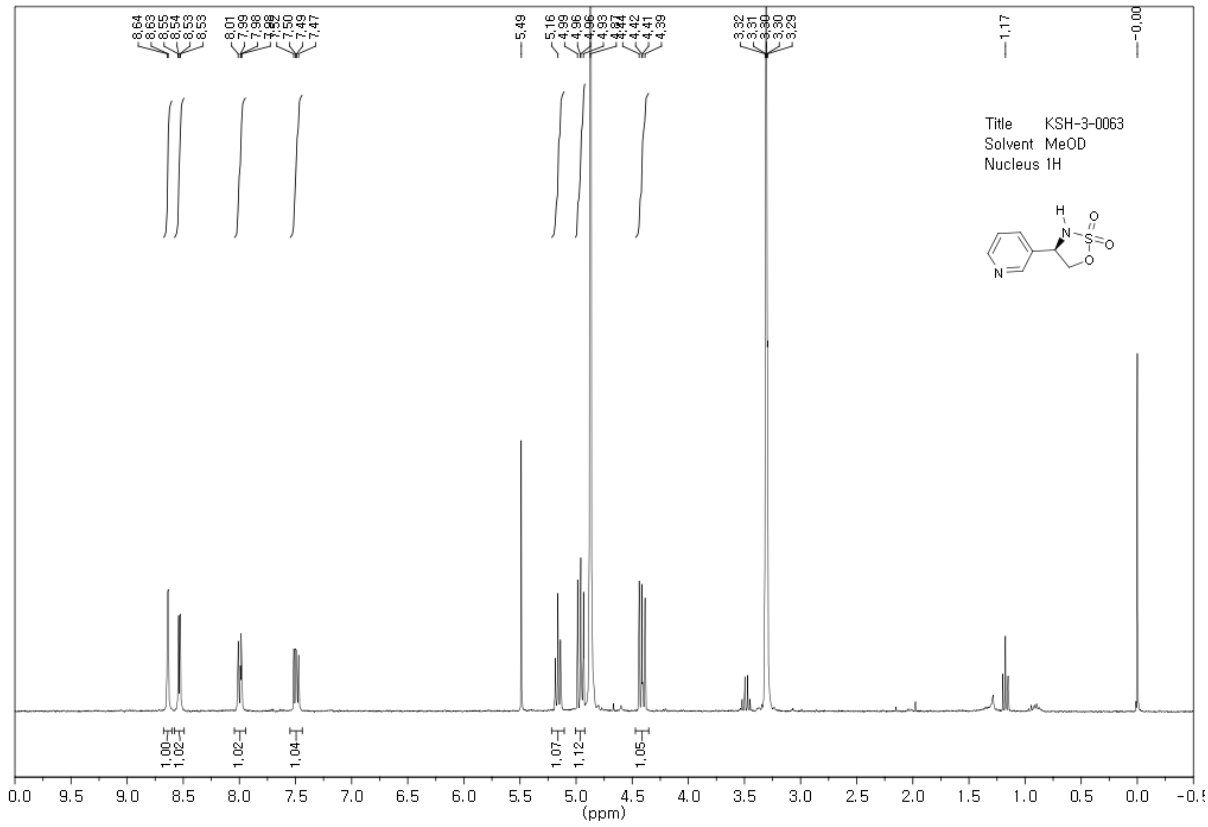

Title KSH-3-0075
Solvent CDCl3
Nucleus 13C
Boc
(ppm)

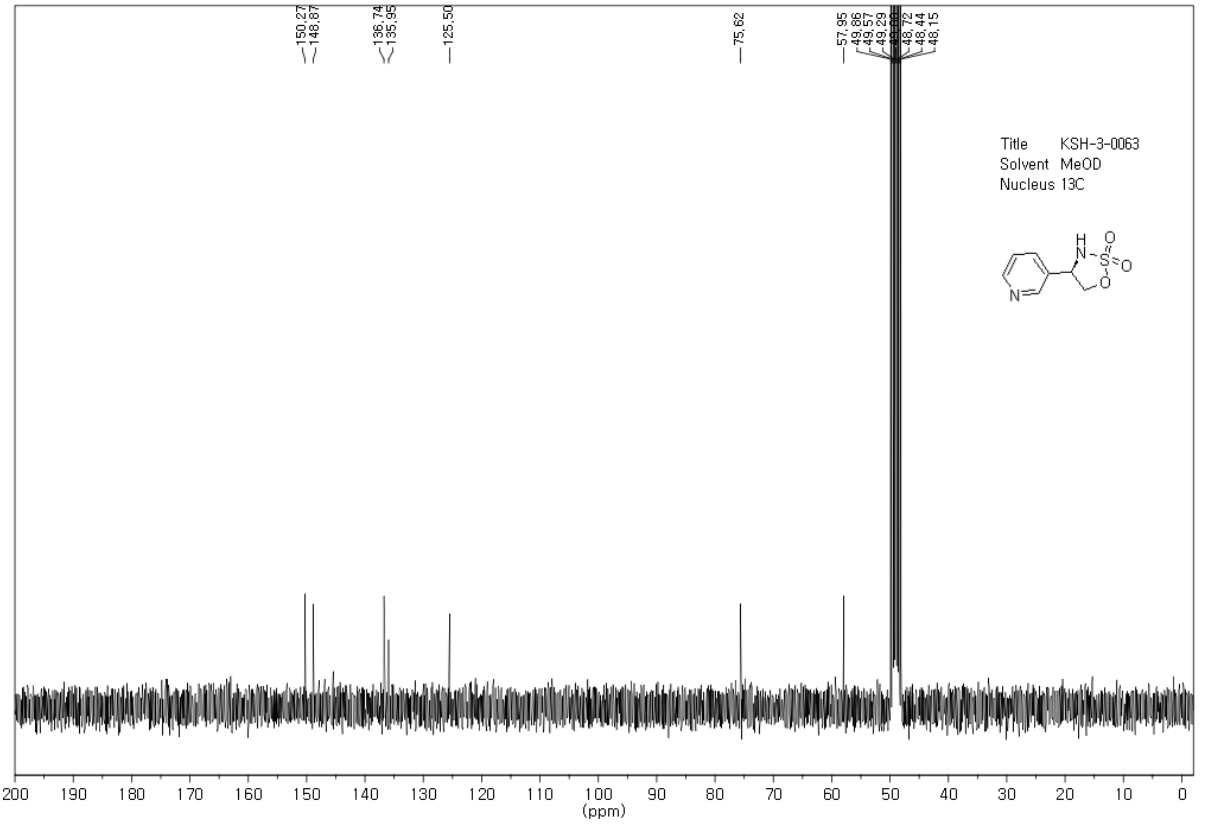

10.373
BocN
S
O
O
O
O
1200
1000
800
600
400
200
0
Response (mAU)
6.253
9.392
9.801
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
10.5
11.0
11.5
Time (min)

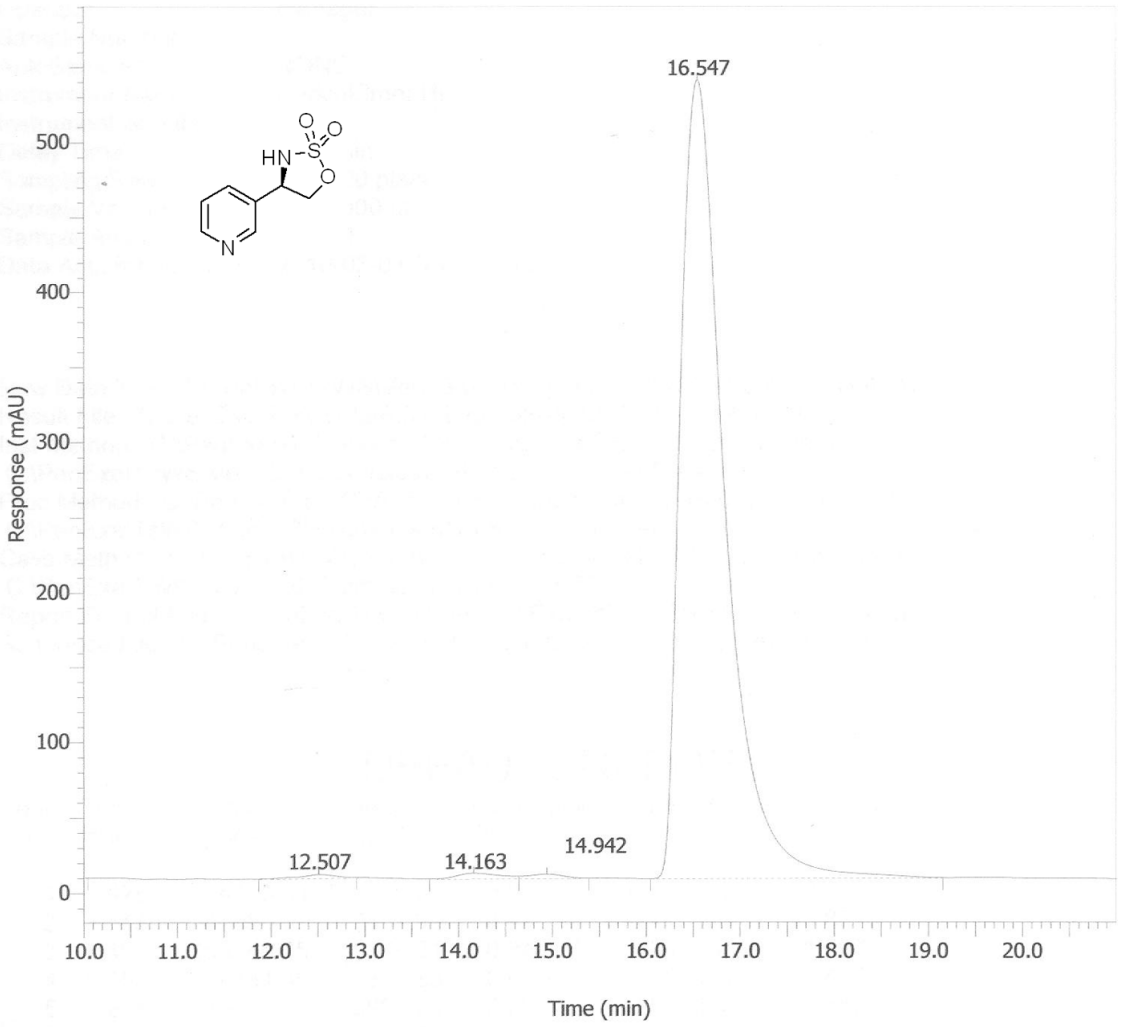

7.41
7.40
7.39
7.39
7.26
7.18
7.18
7.17
7.17
7.17
7.07
7.05
7.05
7.04
5.38
5.35
5.33
5.31
4.88
4.86
4.85
4.83
4.59
4.56
4.53
2.04
1.62
1.26
0.00
Title KSH-3-0027-01
Solvent CDCl3
Nucleus 1H
1.00
1.00
1.01
1.01
1.97
1.05
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
(ppm)

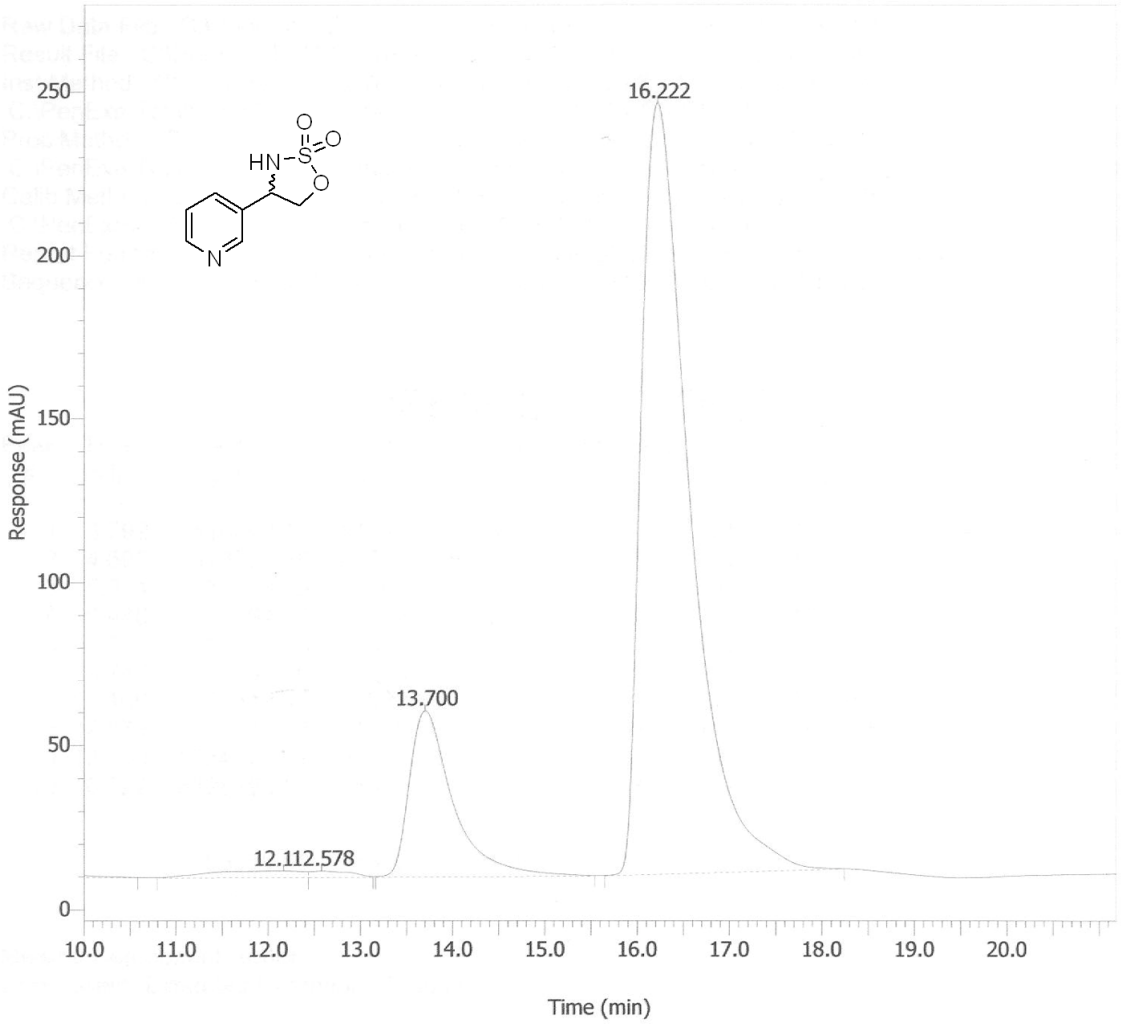

137.3155
127.6358
127.2196
127.1672
77.4742
77.2550
77.0510
76.6277
75.3070
55.4480
KSH-3-0027-01
CDCl3
13C
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm

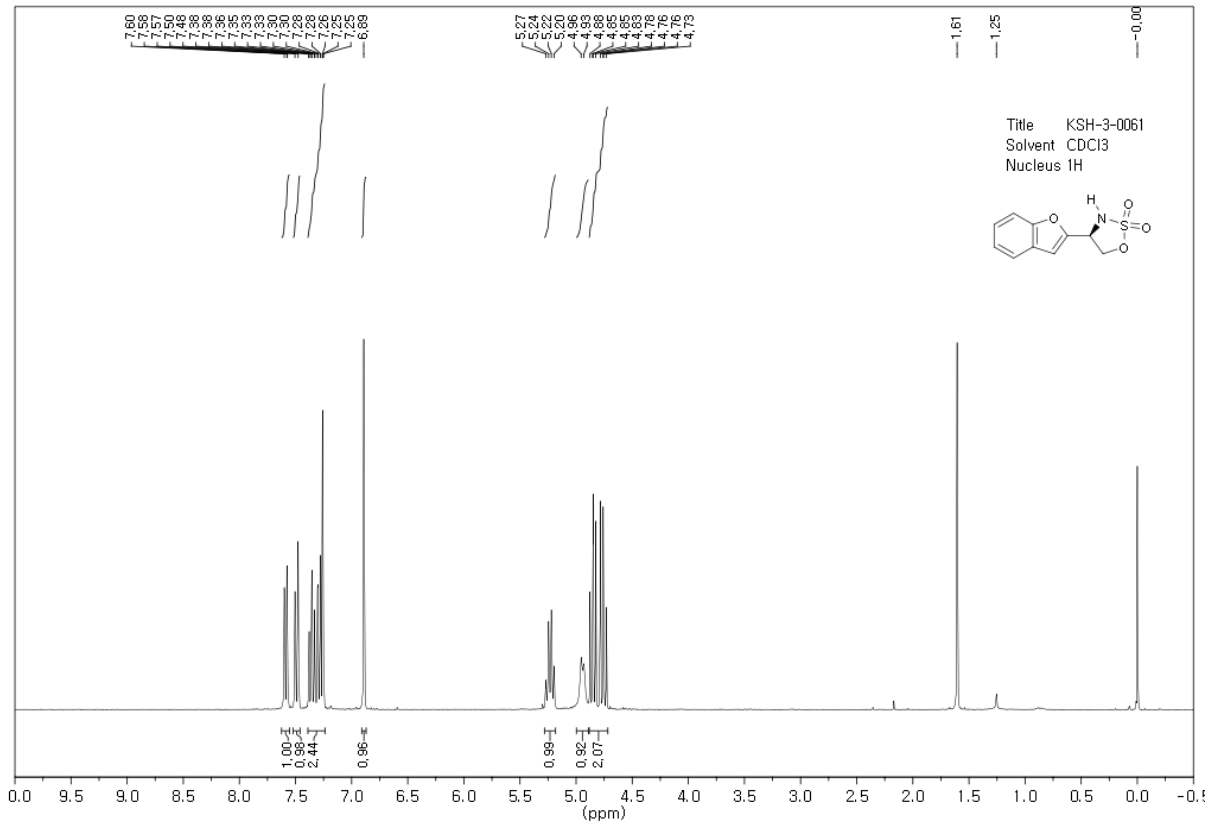

12.918
13.706
14.867
HN
S
O
O
S
O
Response (mAU)
900
800
700
600
500
400
300
200
100
0
11.0
11.5
12.0
12.5
13.0
13.5
14.0
14.5
15.0
15.5
16.0
16.5
Time (min)

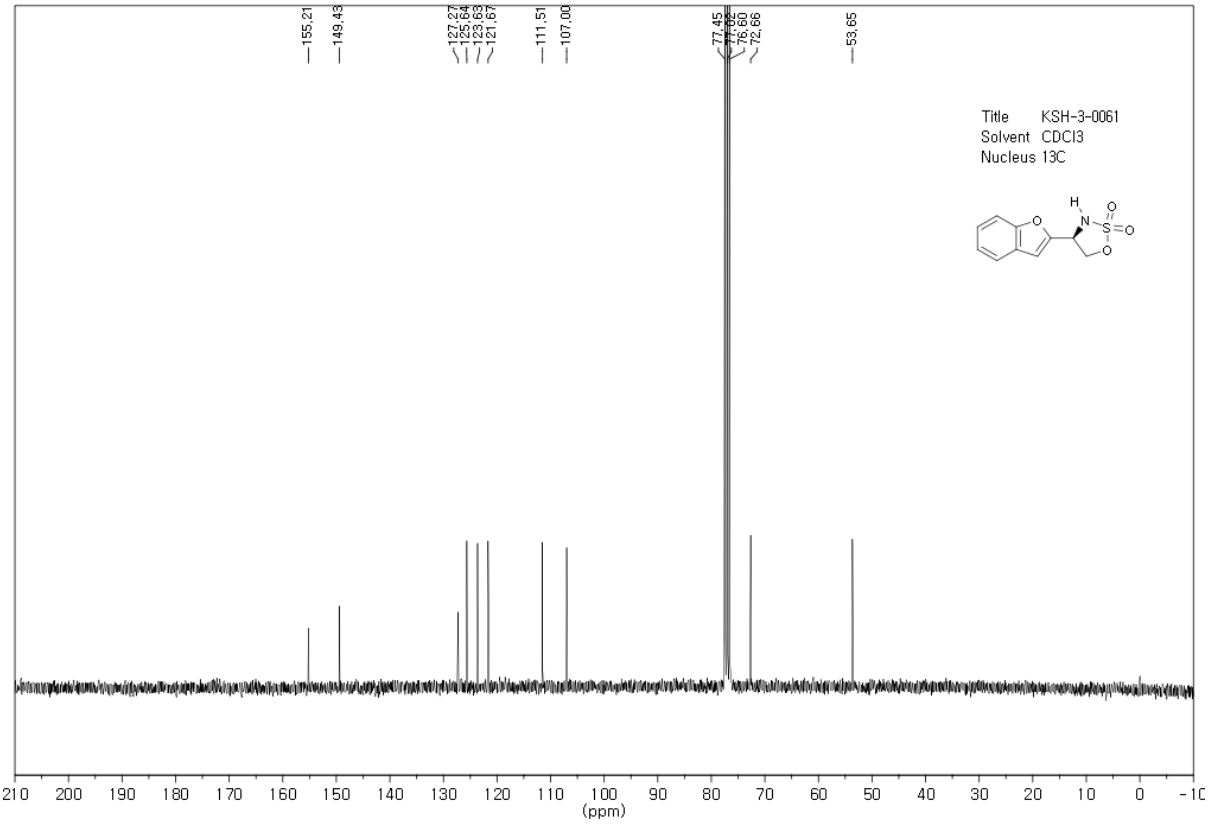

Title KSH-3-0063
Solvent MeOD
Nucleus 1H
(ppm)

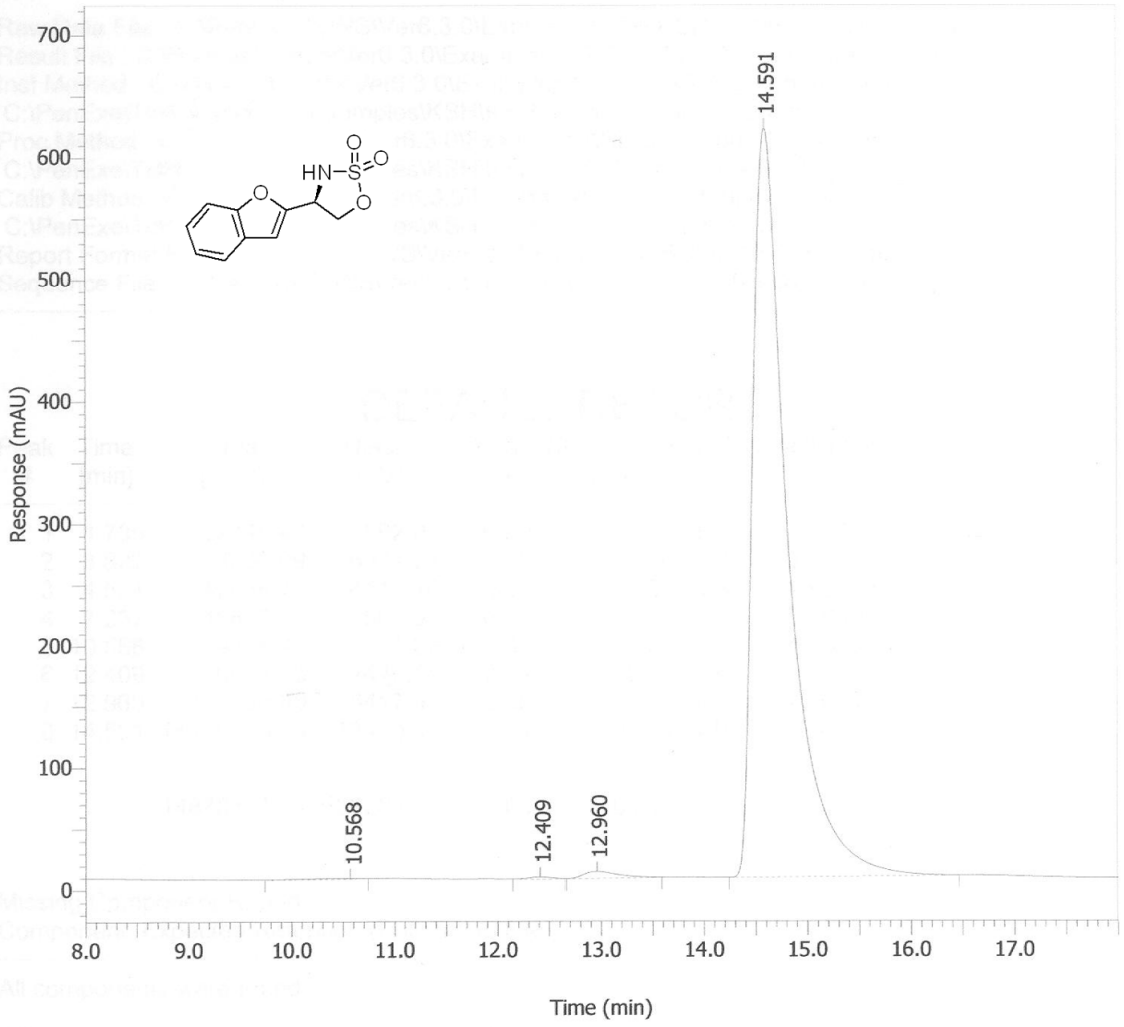

Title KSH-3-0063
Solvent MeOD
Nucleus 13C
(ppm)

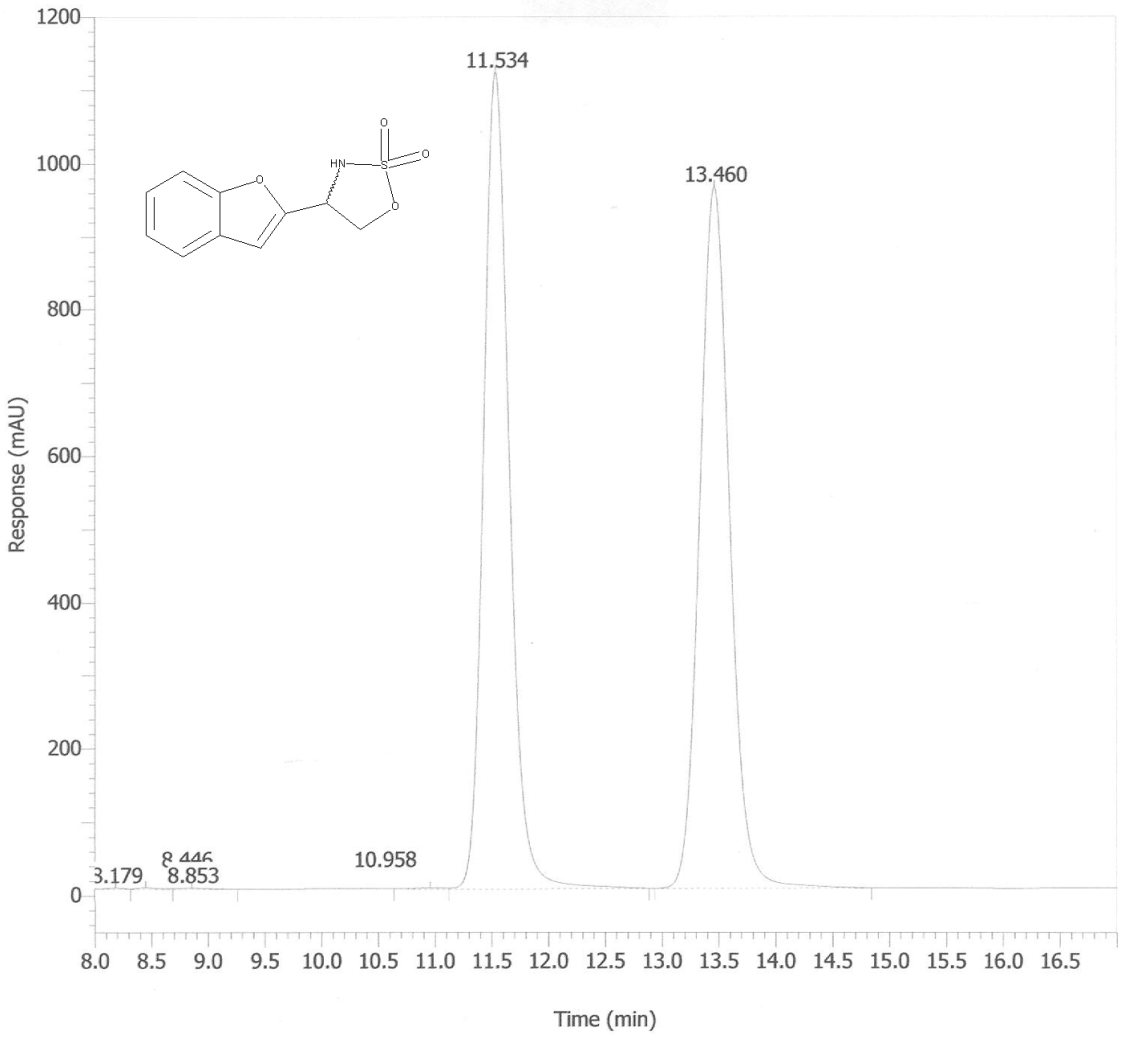

16.547
12.507
14.163
14.942
Response (mAU)
Time (min)
0
100
200
300
400
500
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0
19.0
20.0
HN
S
O
O
O
N

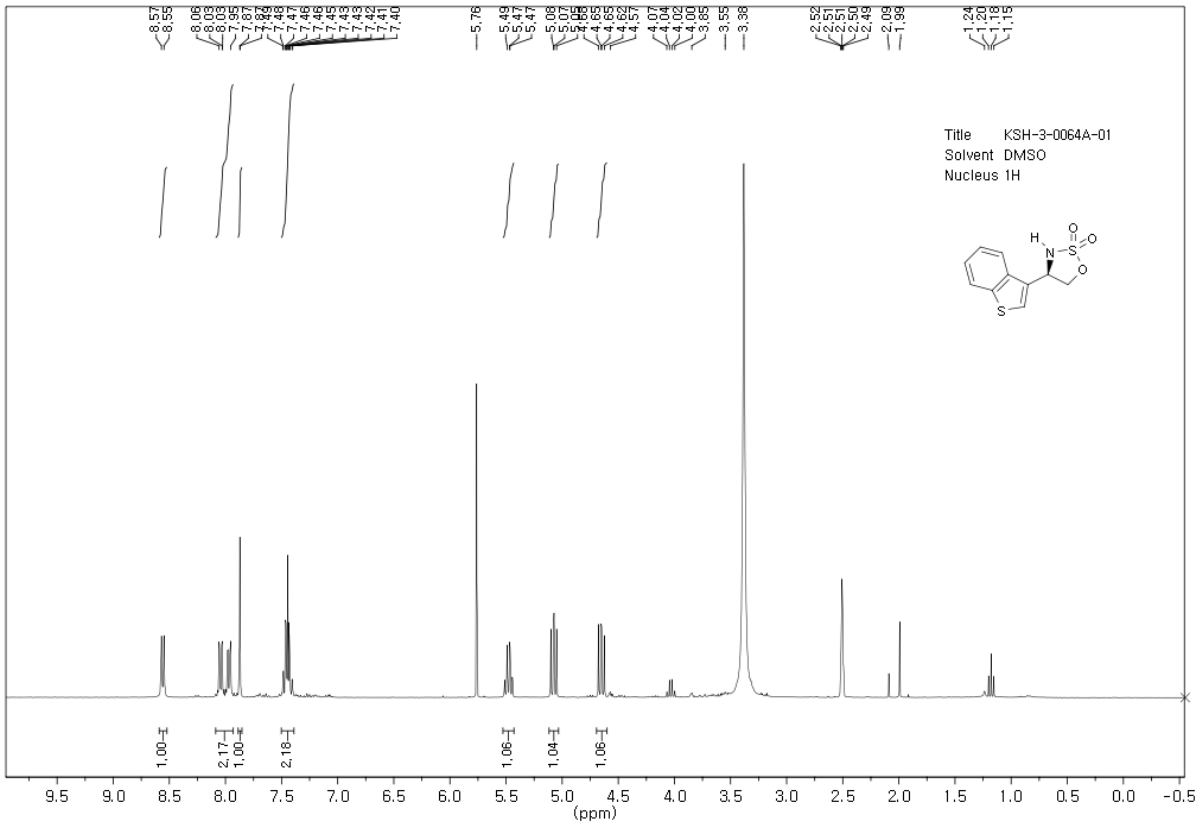

16.222
13.700
12.112.578
Response (mAU)
Time (min)
250
200
150
100
50
0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0
19.0
20.0
HN
S
O
O
O
N

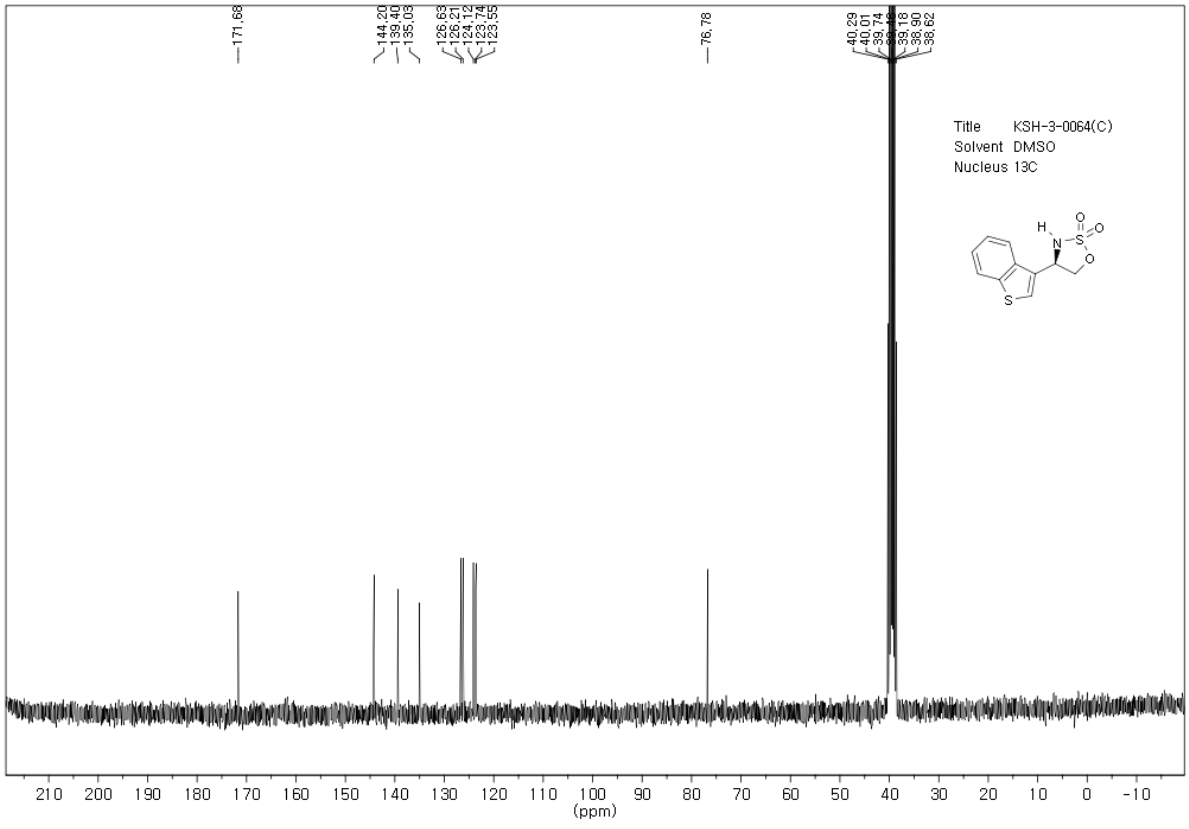

7.60
7.58
7.57
7.50
7.48
7.38
7.36
7.35
7.33
7.30
7.28
7.26
7.25
6.89
5.27
5.24
5.22
5.20
4.96
4.93
4.88
4.85
4.83
4.78
4.76
4.73
1.61
1.25
0.00
Title KSH-3-0061
Solvent CDCl3
Nucleus 1H
1.00
0.98
2.44
0.96
0.99
0.92
2.07
(ppm)

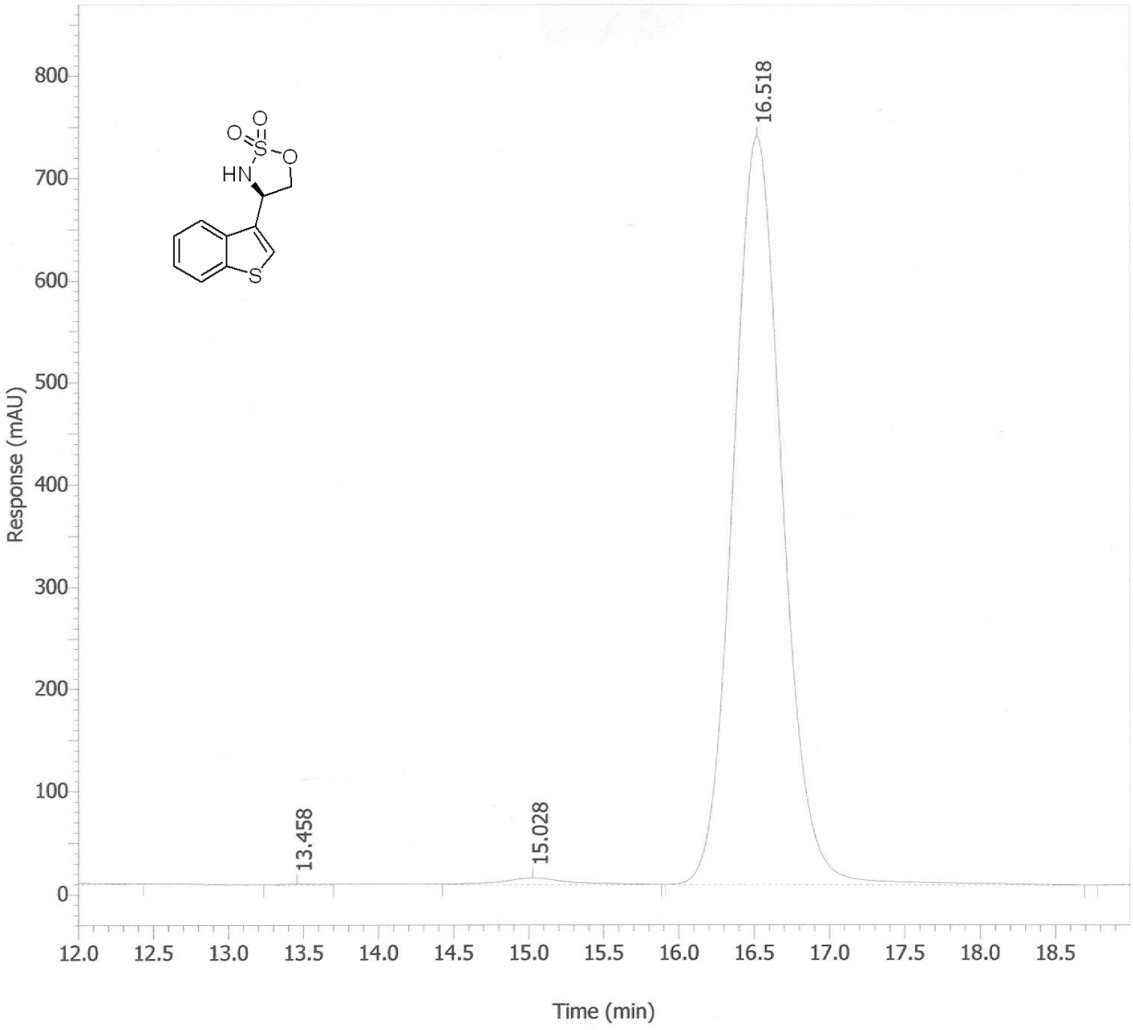

155.21
149.43
127.27
125.64
123.63
121.67
111.51
107.00
77.45
77.02
76.60
72.66
53.65
Title KSH-3-0061
Solvent CDCl3
Nucleus 13C
(ppm)

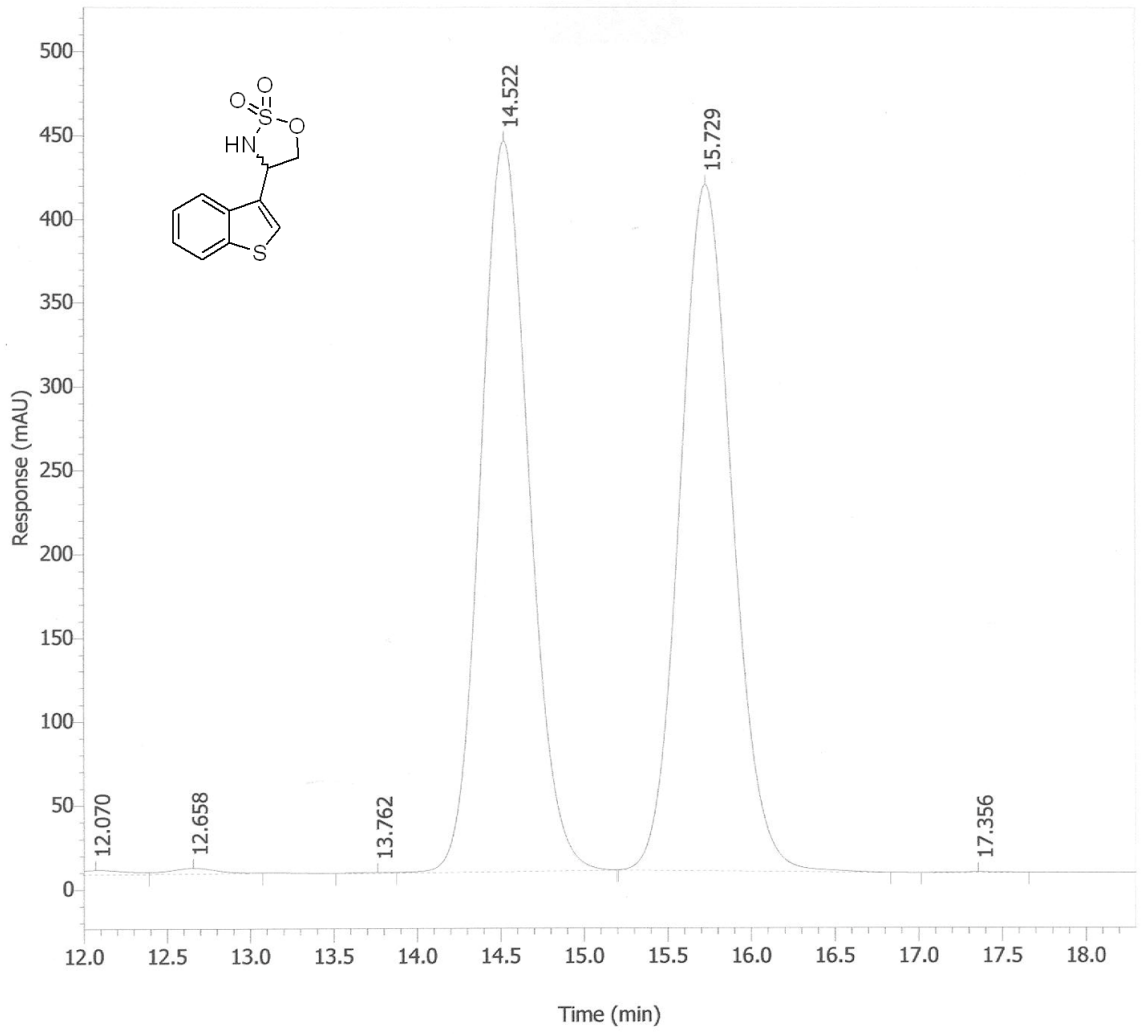

14.591
10.568
12.409
12.960
Response (mAU)
Time (min)
700
600
500
400
300
200
100
0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
HN
S
O
O
O
O

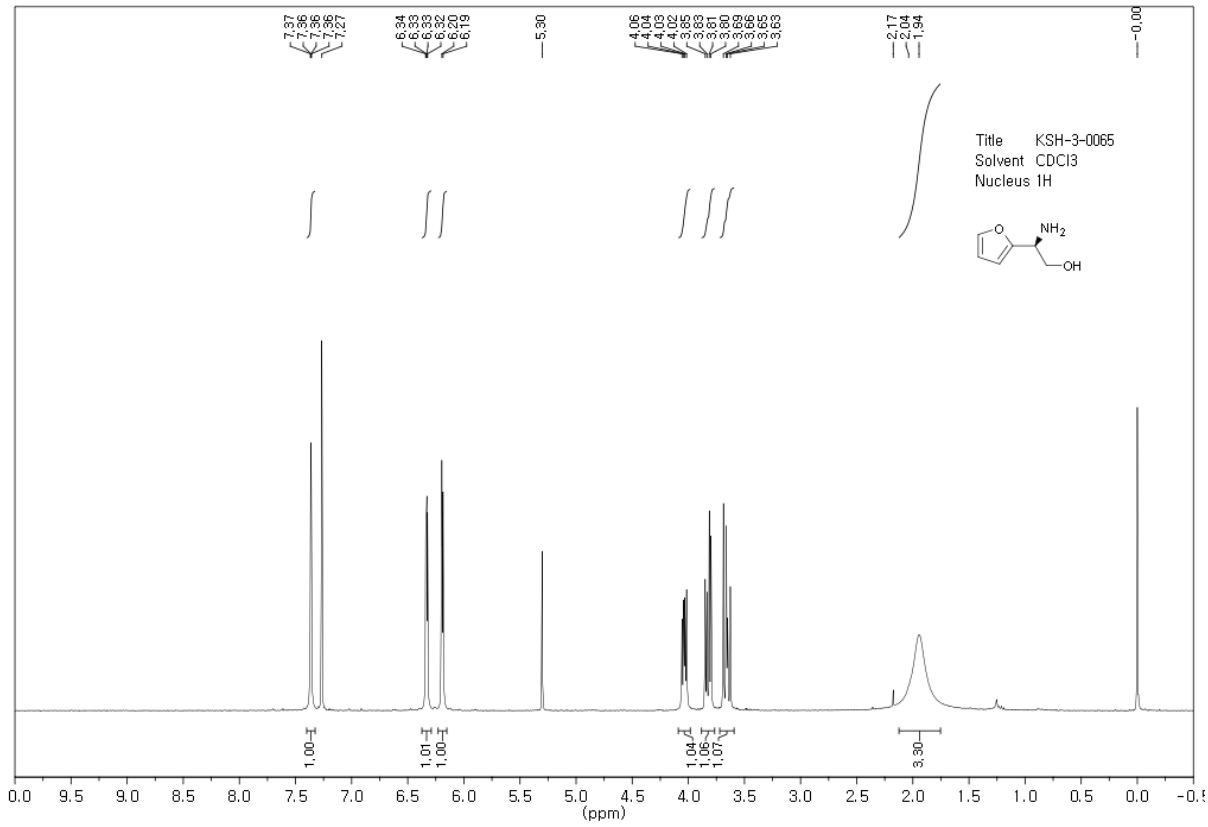

1200
1000
800
600
400
200
0
Response (mAU)
11.534
13.460
10.958
8.853
3.179
HN
O
S
8.0
8.5
9.0
9.5
10.0
10.5
11.0
11.5
12.0
12.5
13.0
13.5
14.0
14.5
15.0
15.5
16.0
16.5
Time (min)

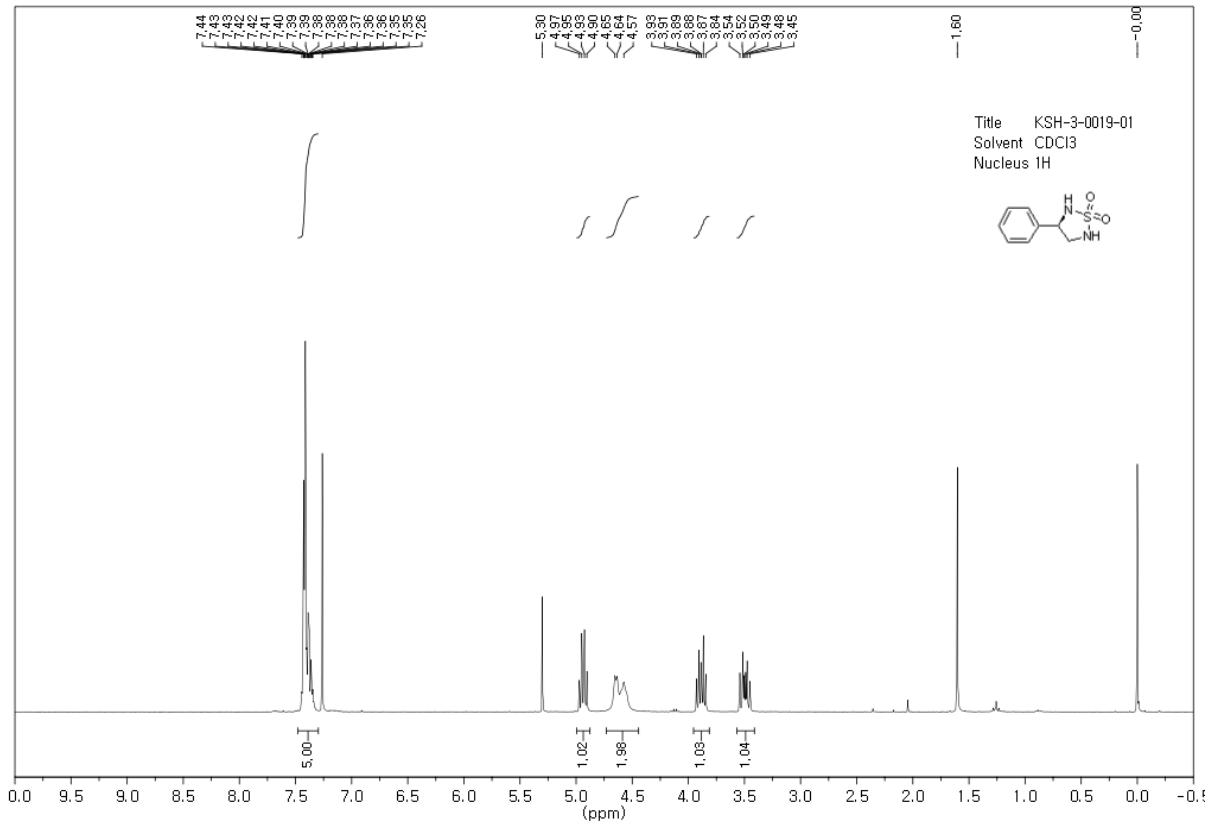

Title KSH-3-0064A-01
Solvent DMSO
Nucleus 1H
(ppm)

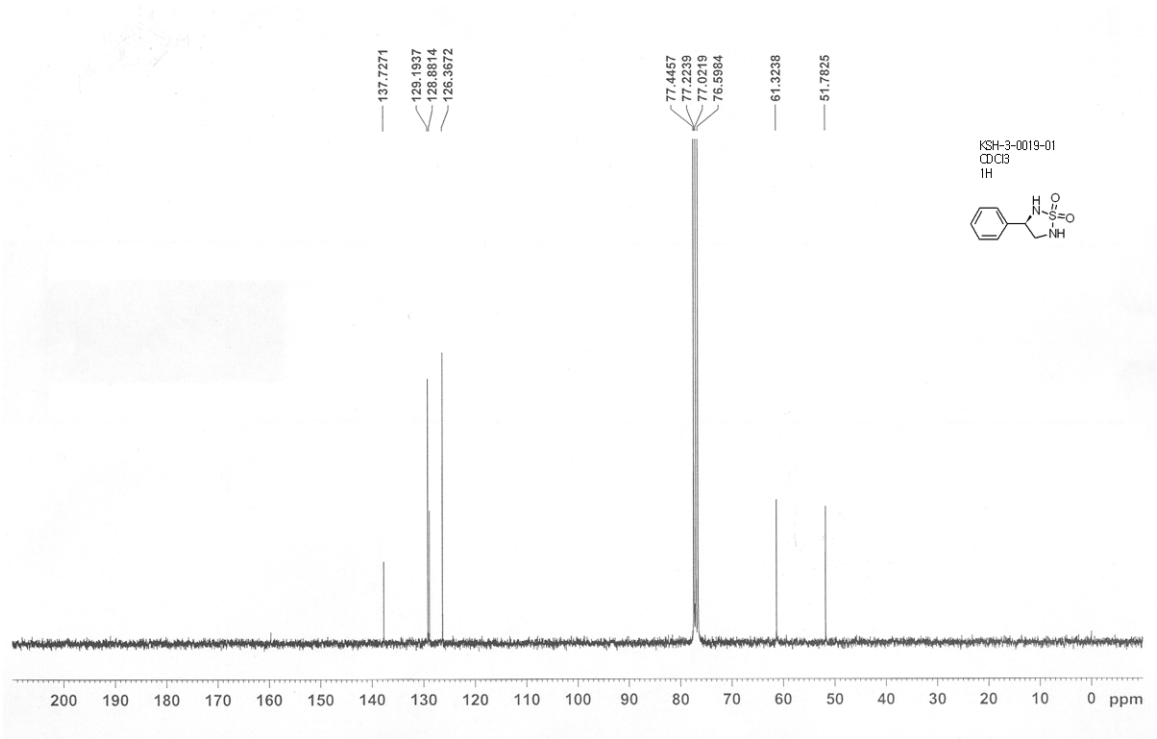

Title KSH-3-0064(C)
Solvent DMSO
Nucleus 13C
(ppm)

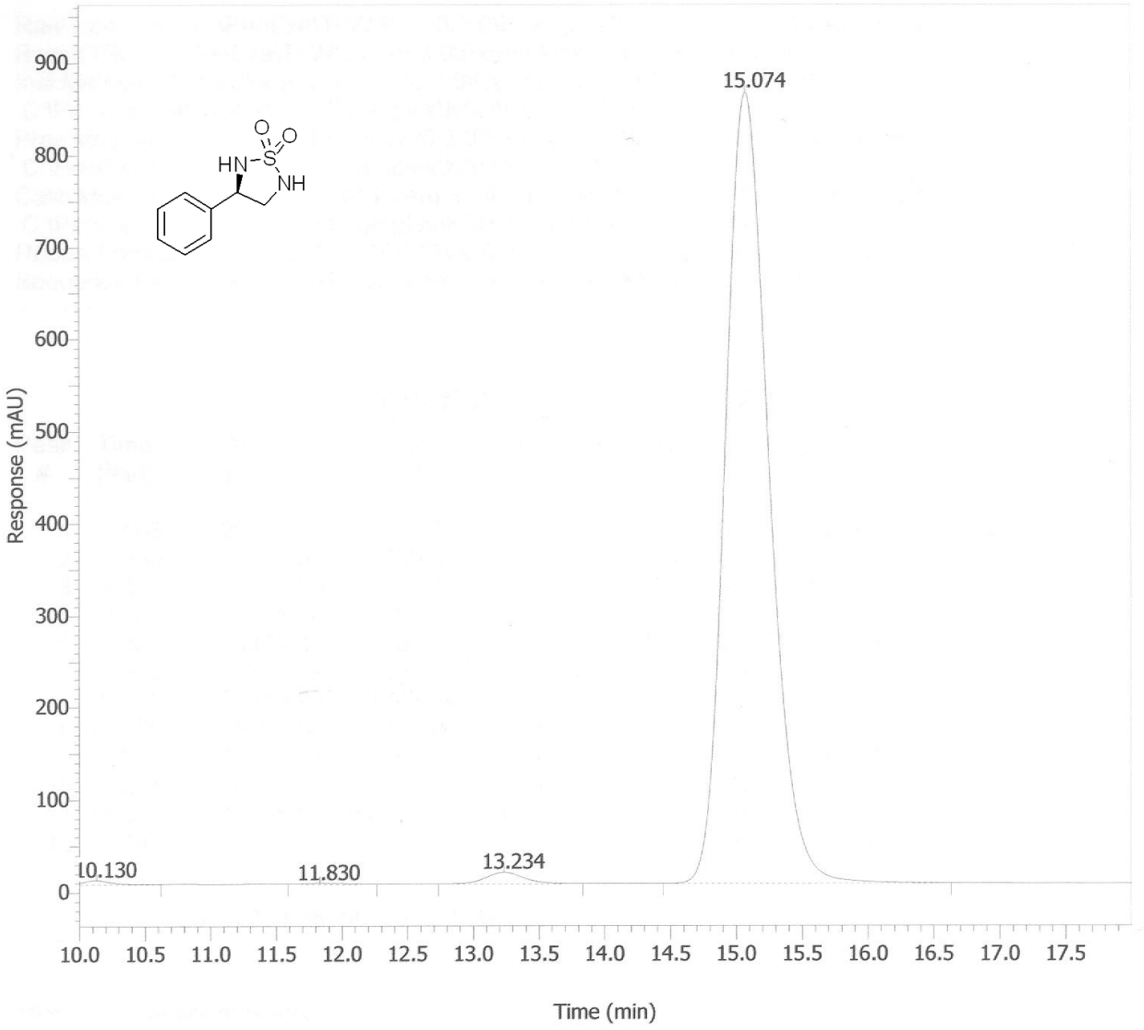

16.518
13.458
15.028
Response (mAU)
Time (min)
HN

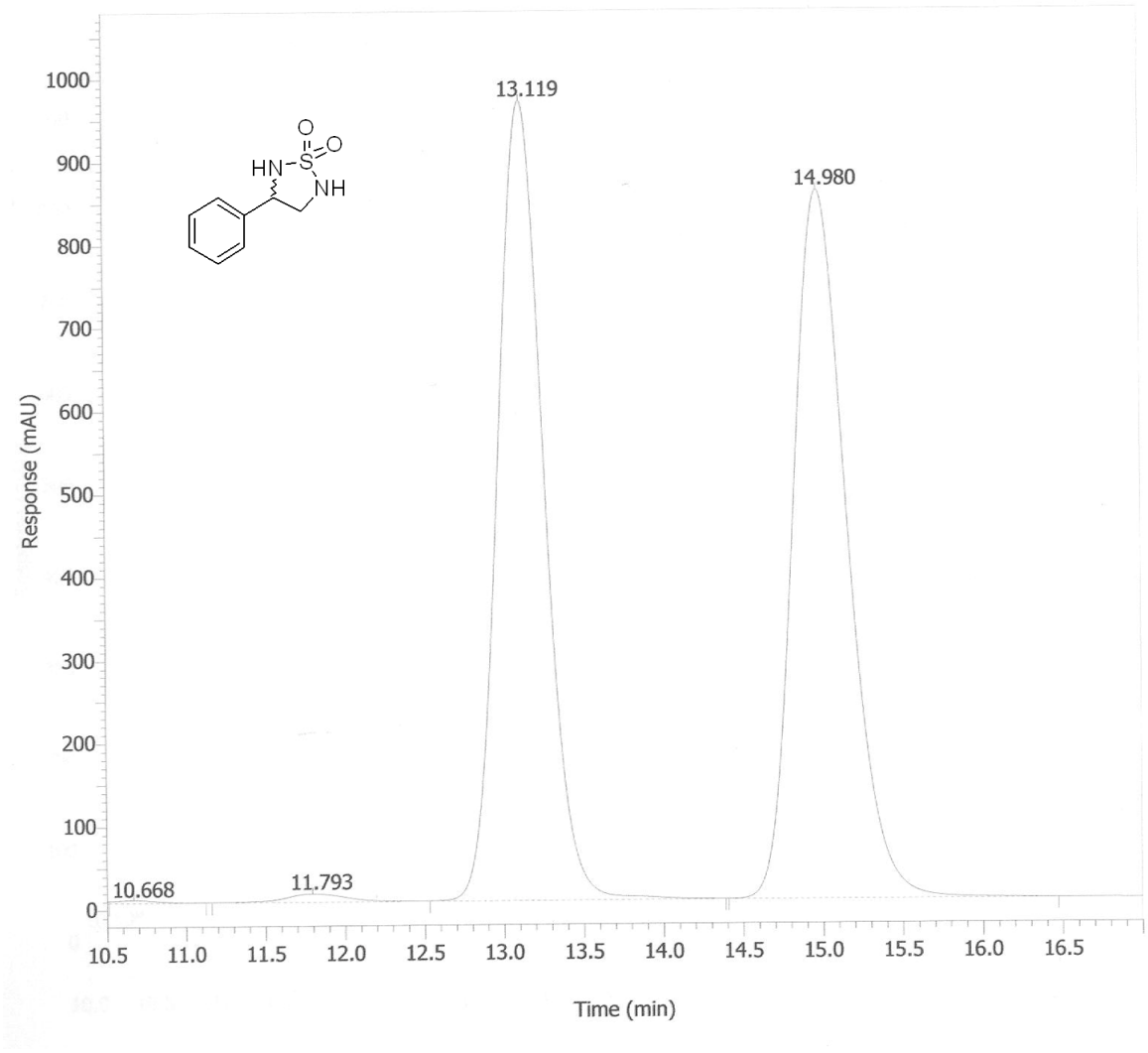

14.522
15.729
12.070
12.658
13.762
17.356
Response (mAU)
Time (min)
HN
O
O
S
O
S

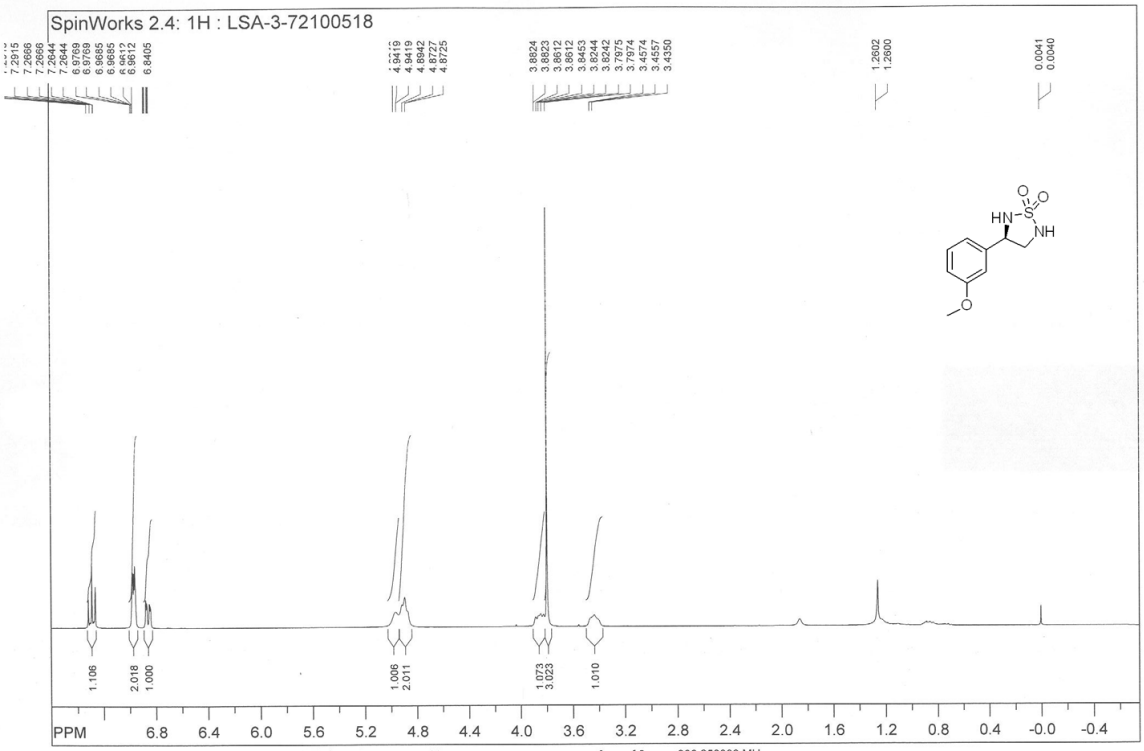

7.37
7.36
7.36
7.36
7.27
6.34
6.33
6.33
6.32
6.20
6.19
5.30
4.06
4.04
4.03
4.02
3.85
3.83
3.81
3.80
3.68
3.66
3.65
3.63
2.17
2.04
1.94
0.00
Title KSH-3-0065
Solvent CDCl3
Nucleus 1H
NH2
OH
1.00
1.01
1.00
1.04
1.06
1.07
3.30
(ppm)


Title KSH-3-0019-01
Solvent CDCl3
Nucleus 1H
(ppm)


KSH-3-0019-01
CDCl3
1H
ppm

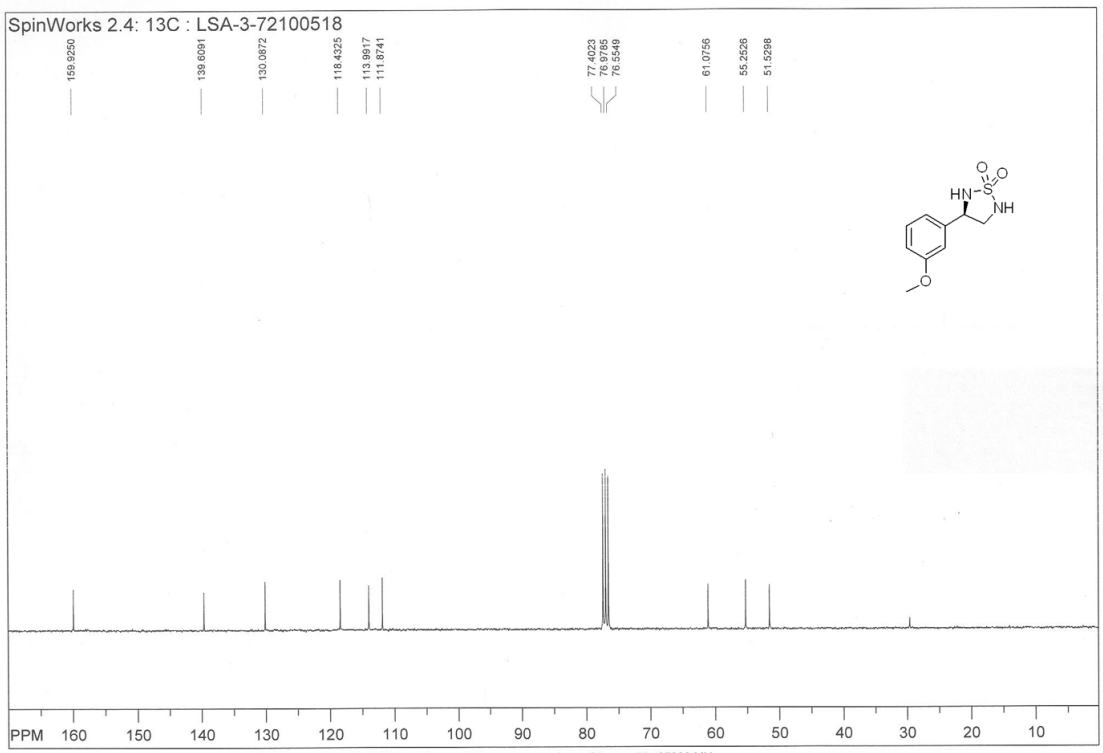

15.074
10.130
11.830
13.234
Response (mAU)
Time (min)


1000
900
800
700
600
500
400
300
200
100
0
Response (mAU)
13.119
14.980
10.668
11.793
HN
S
O
O
NH
10.5
11.0
11.5
12.0
12.5
13.0
13.5
14.0
14.5
15.0
15.5
16.0
16.5
Time (min)



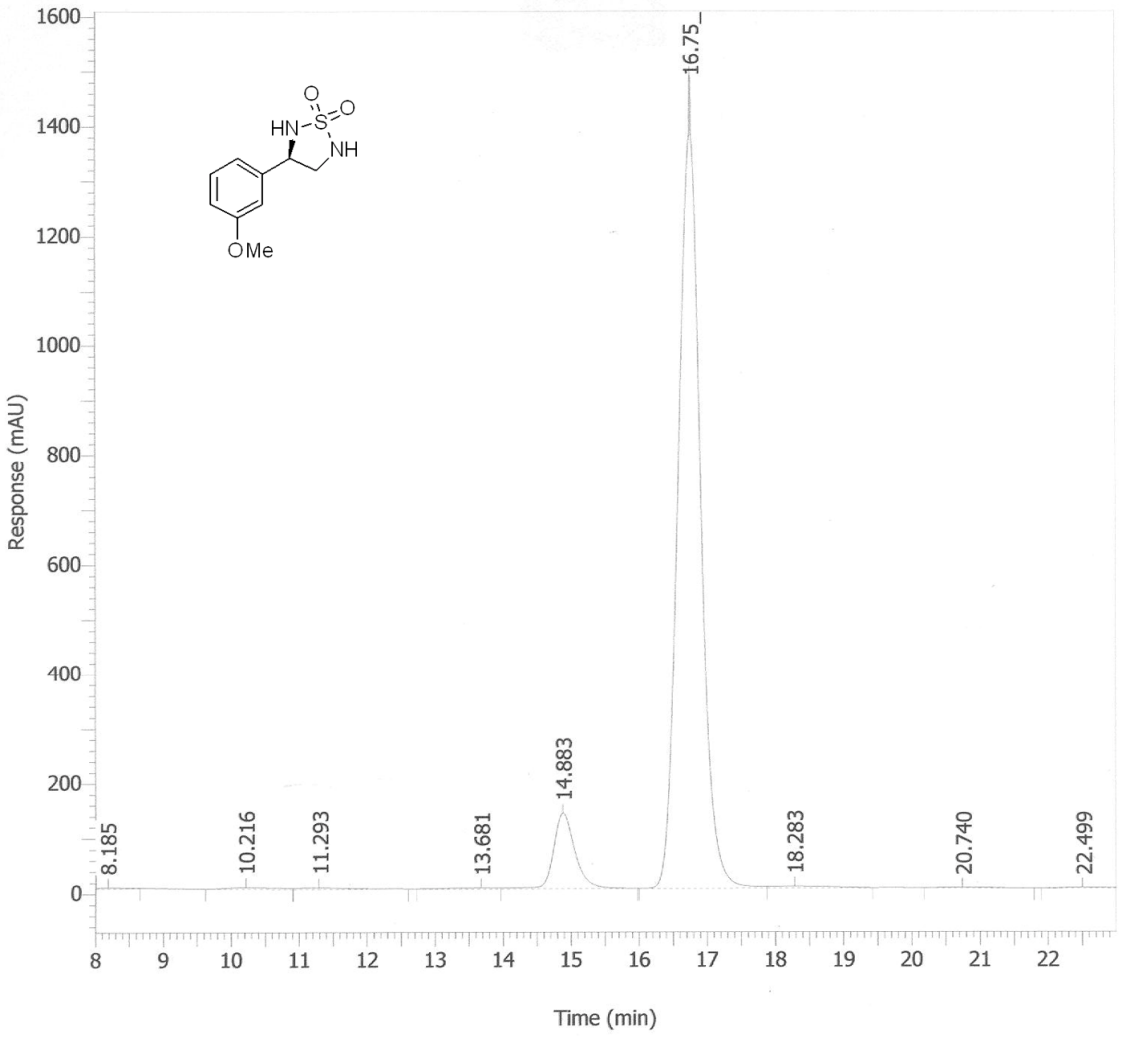
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\299\fid expt: <zg30>
transmitter freq.: 300.251168 MHz
time domain size: 65536 points
width: 2777.78 Hz = 9.251514 ppm = 0.042386 Hz/pt
number of scans: 9

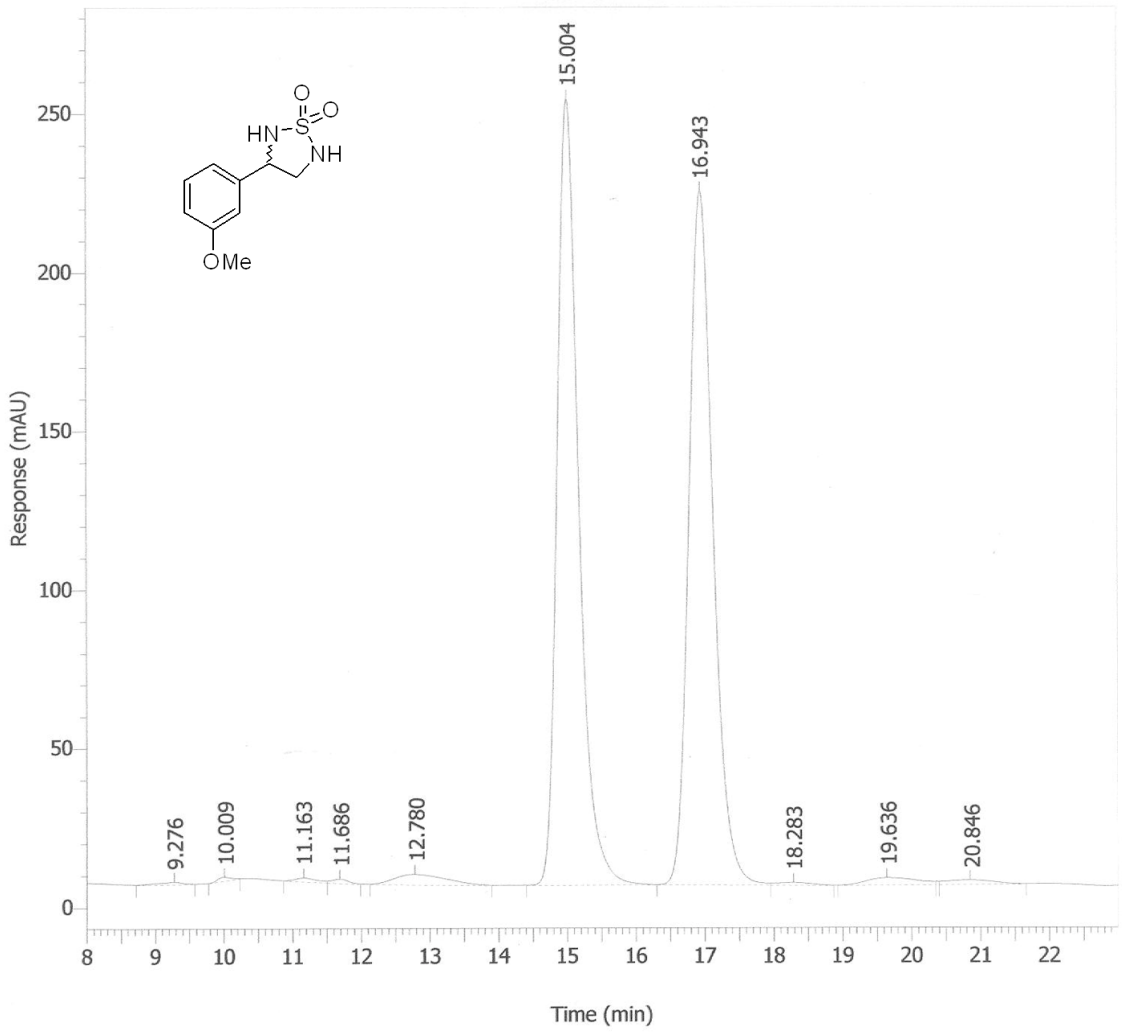
freq. of 0 ppm: 300.250006 MHz
processed size: 32768 complex points
LB: 0.000 GB: 0.0000
Hz/cm: 100.305 ppm/cm: 0.33407

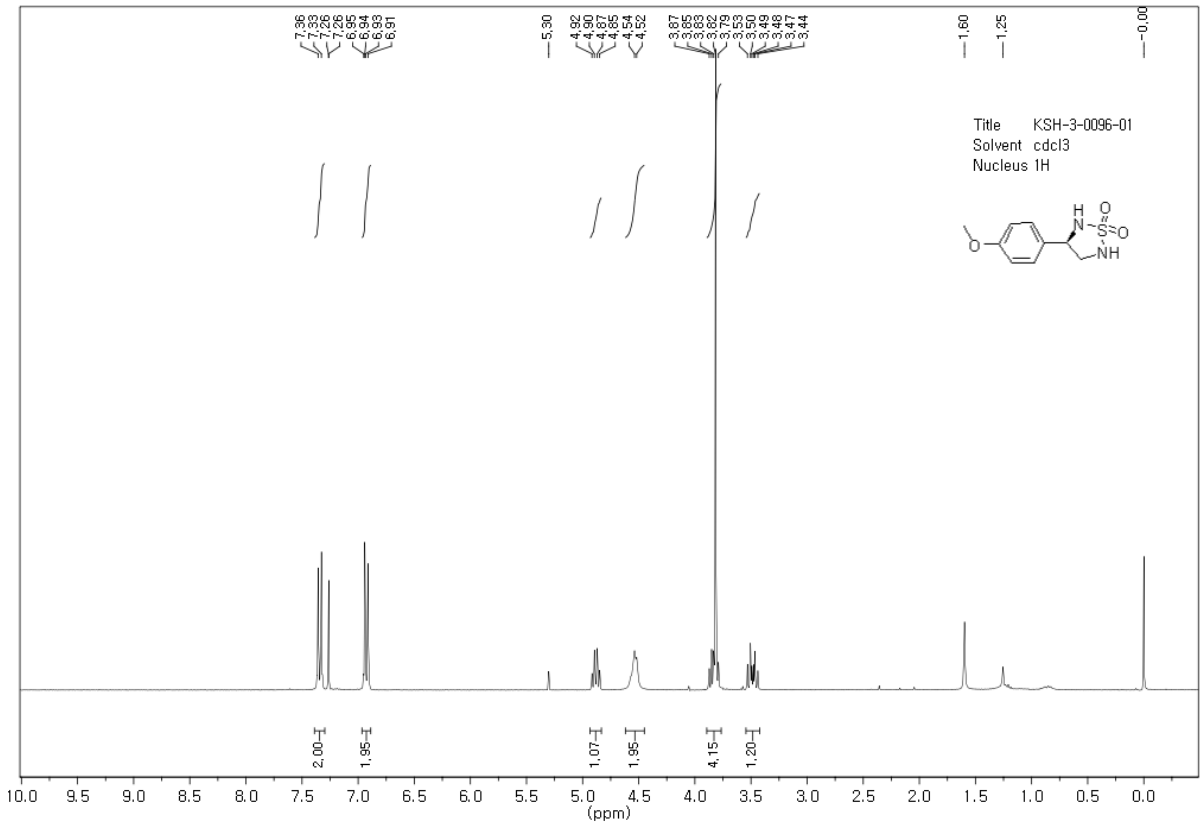


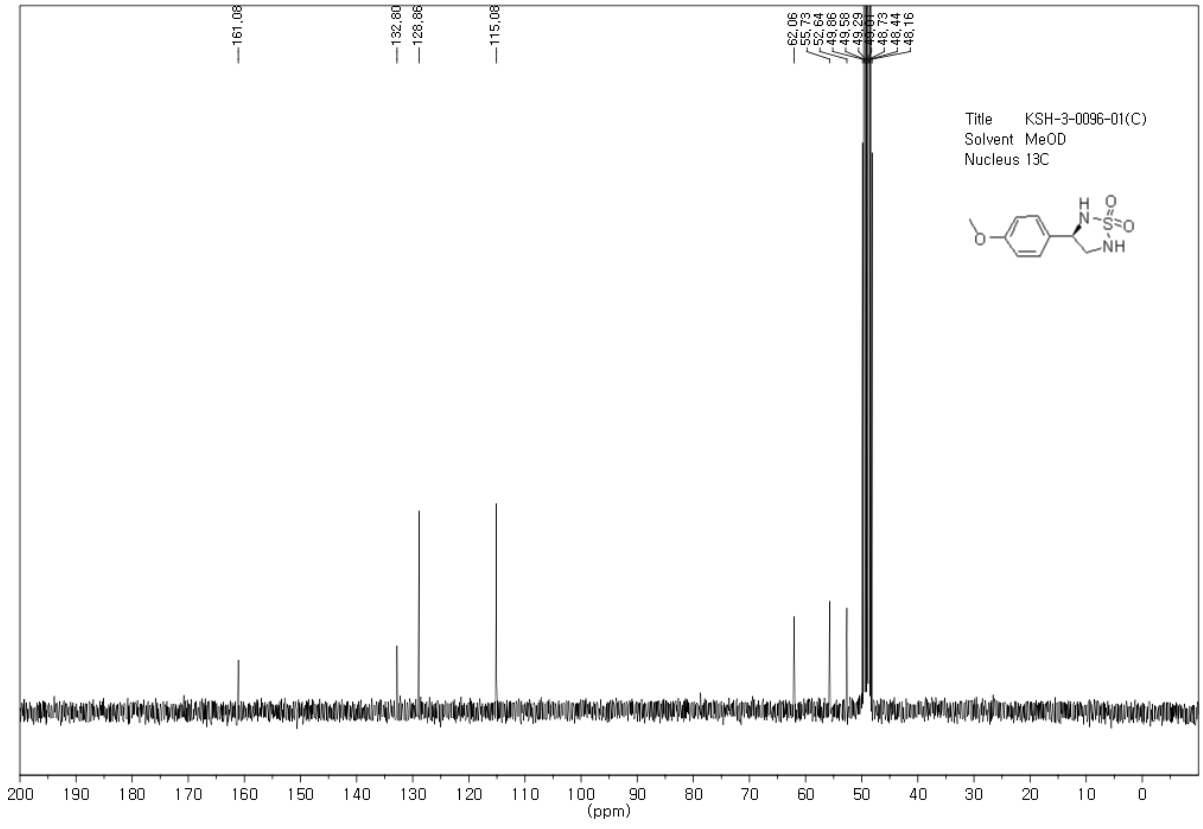
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-72100518\fid expt: <zgpg30>
transmitter freq.: 75.507010 MHz
time domain size: 65536 points
width: 18832.39 Hz = 249.412493 ppm = 0.287359 Hz/pt
number of scans: 475

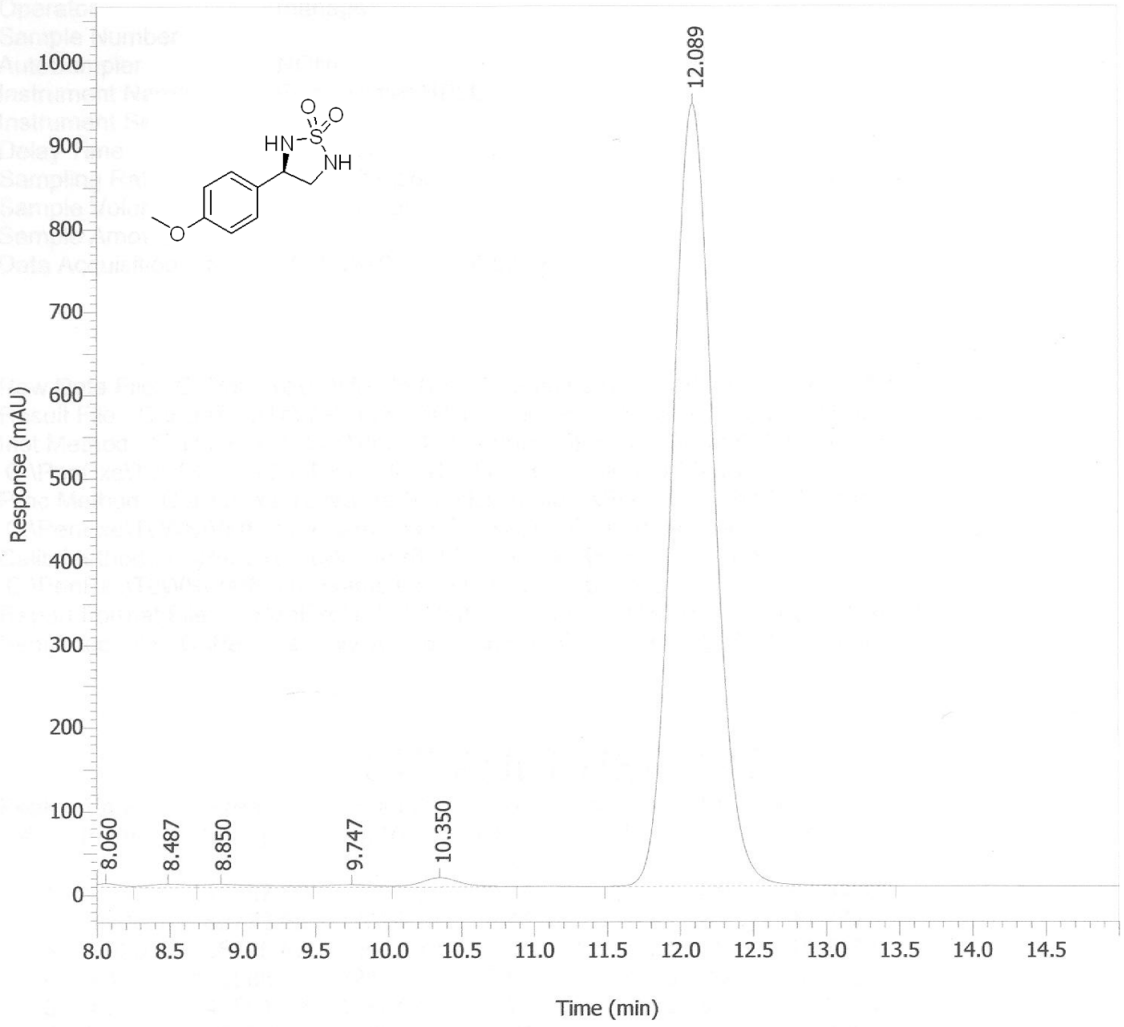
freq. of 0 ppm: 75.497932 MHz
processed size: 32768 complex points
LB: 0.000 GB: 0.0000
Hz/cm: 512.770 ppm/cm: 6.79103

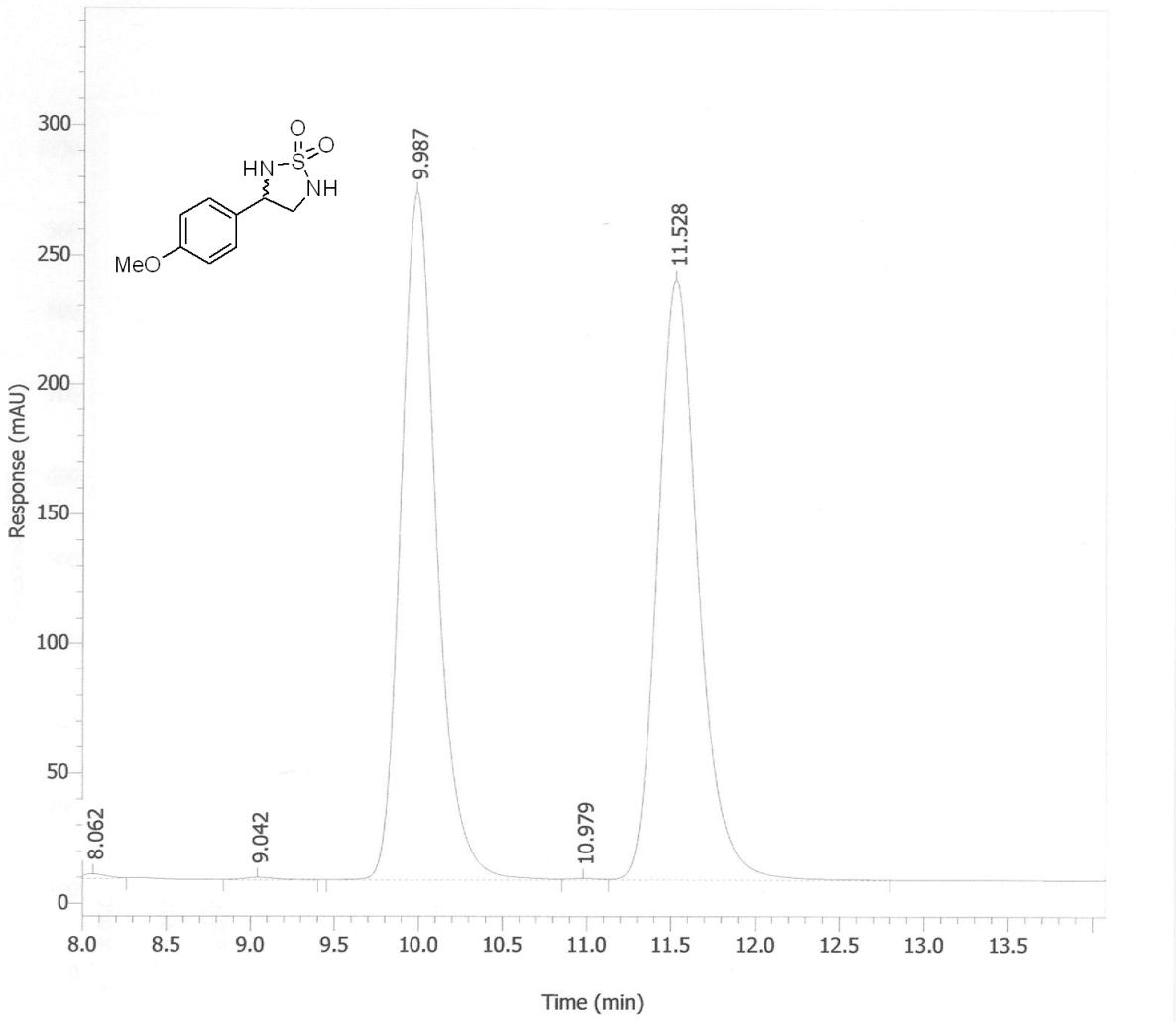

1600
1400
1200
1000
800
600
400
200
0
Response (mAU)
8.185
10.216
11.293
13.681
14.883
16.75
18.283
20.740
22.499
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
Time (min)
HN
S
O
O
NH
OMe

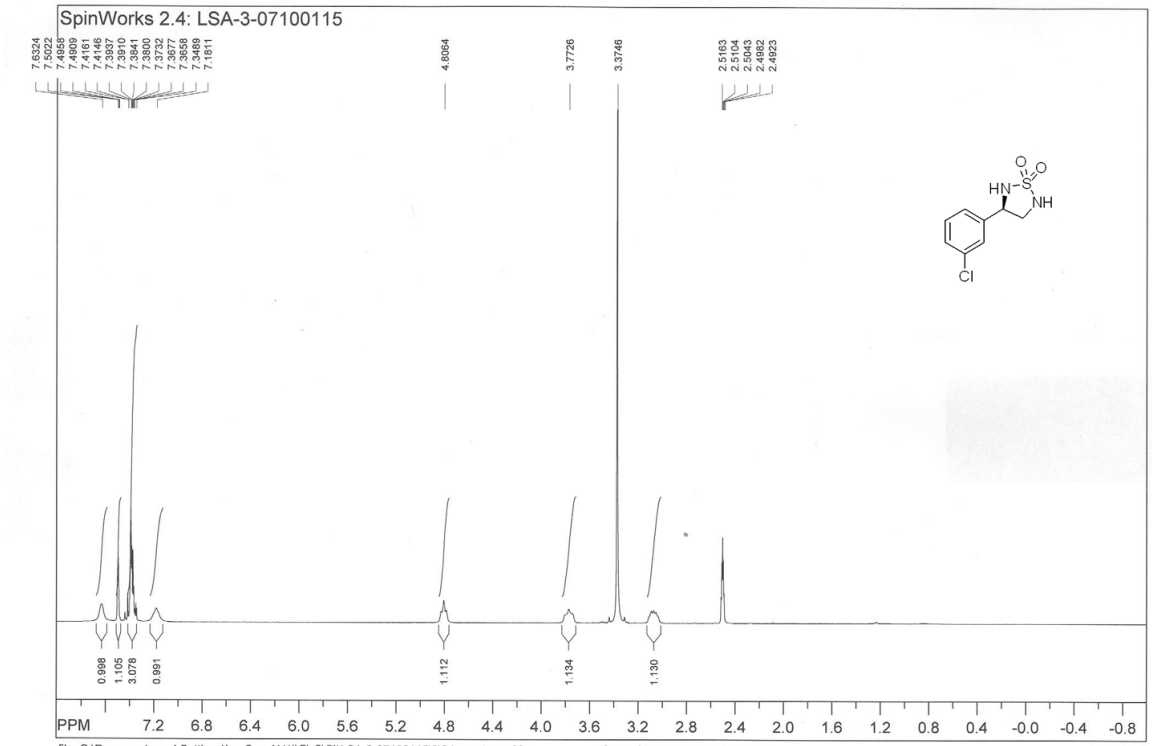

15.004
16.943
9.276
10.009
11.163
11.686
12.780
18.283
19.636
20.846
HN
S
O
O
NH
OMe
Response (mAU)
Time (min)
0
50
100
150
200
250
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22


Title KSH-3-0096-01
Solvent cdcl3
Nucleus 1H
(ppm)


Title KSH-3-0096-01(C)
Solvent MeOD
Nucleus 13C
(ppm)

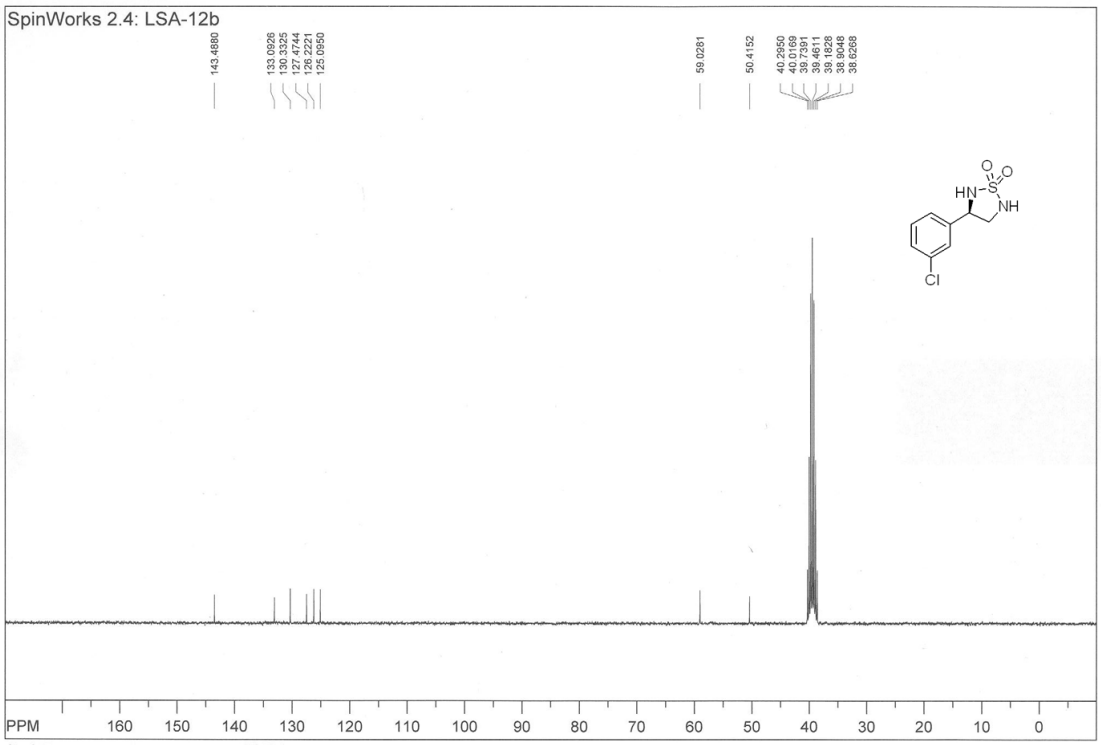

12.089
8.060
8.487
8.850
9.747
10.350
Response (mAU)
Time (min)
HN
S
O
O
NH
O


300
250
200
150
100
50
0
Response (mAU)
8.062
9.042
9.987
10.979
11.528
8.0
8.5
9.0
9.5
10.0
10.5
11.0
11.5
12.0
12.5
13.0
13.5
Time (min)
HN
S
O
O
NH
MeO



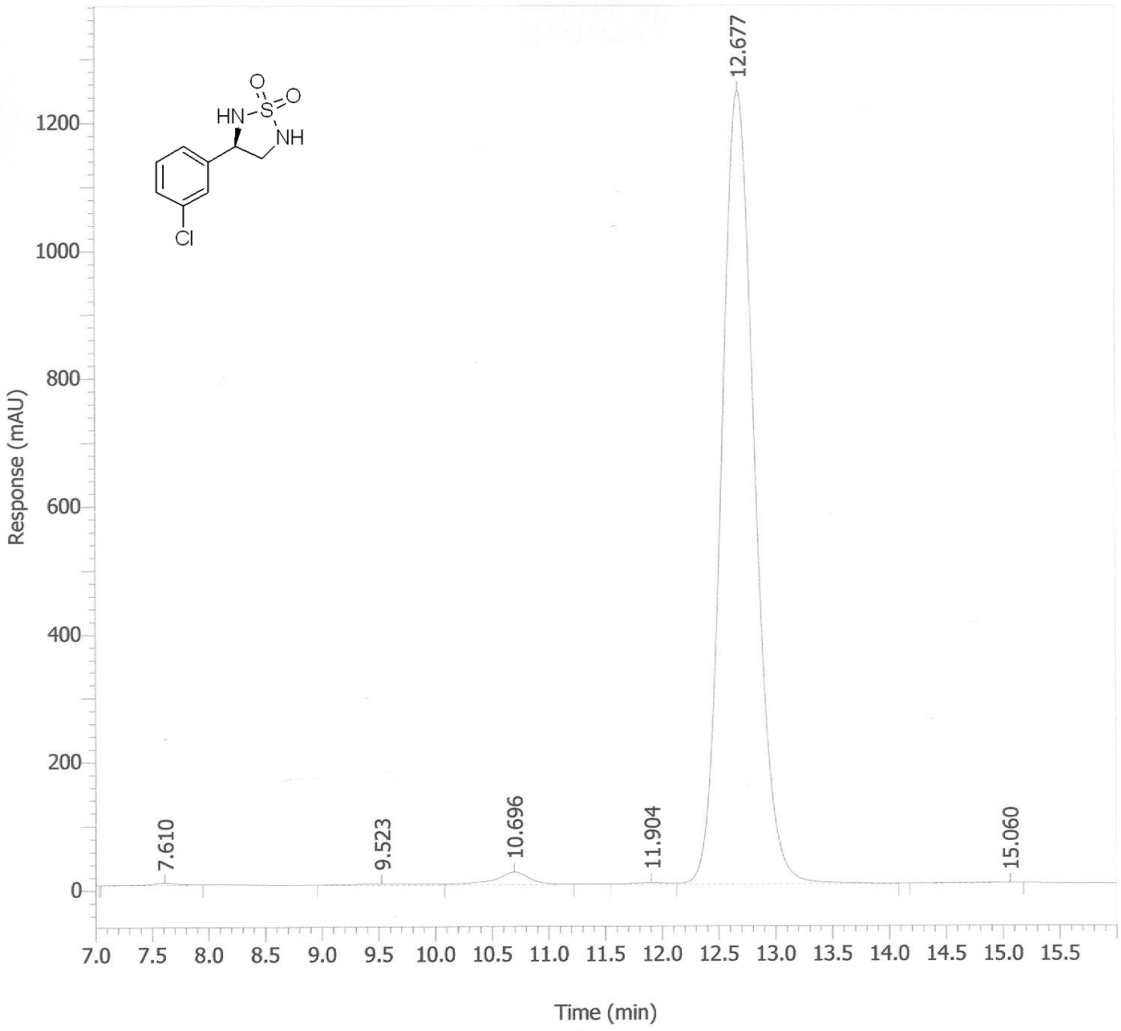
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-07100115\3\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16

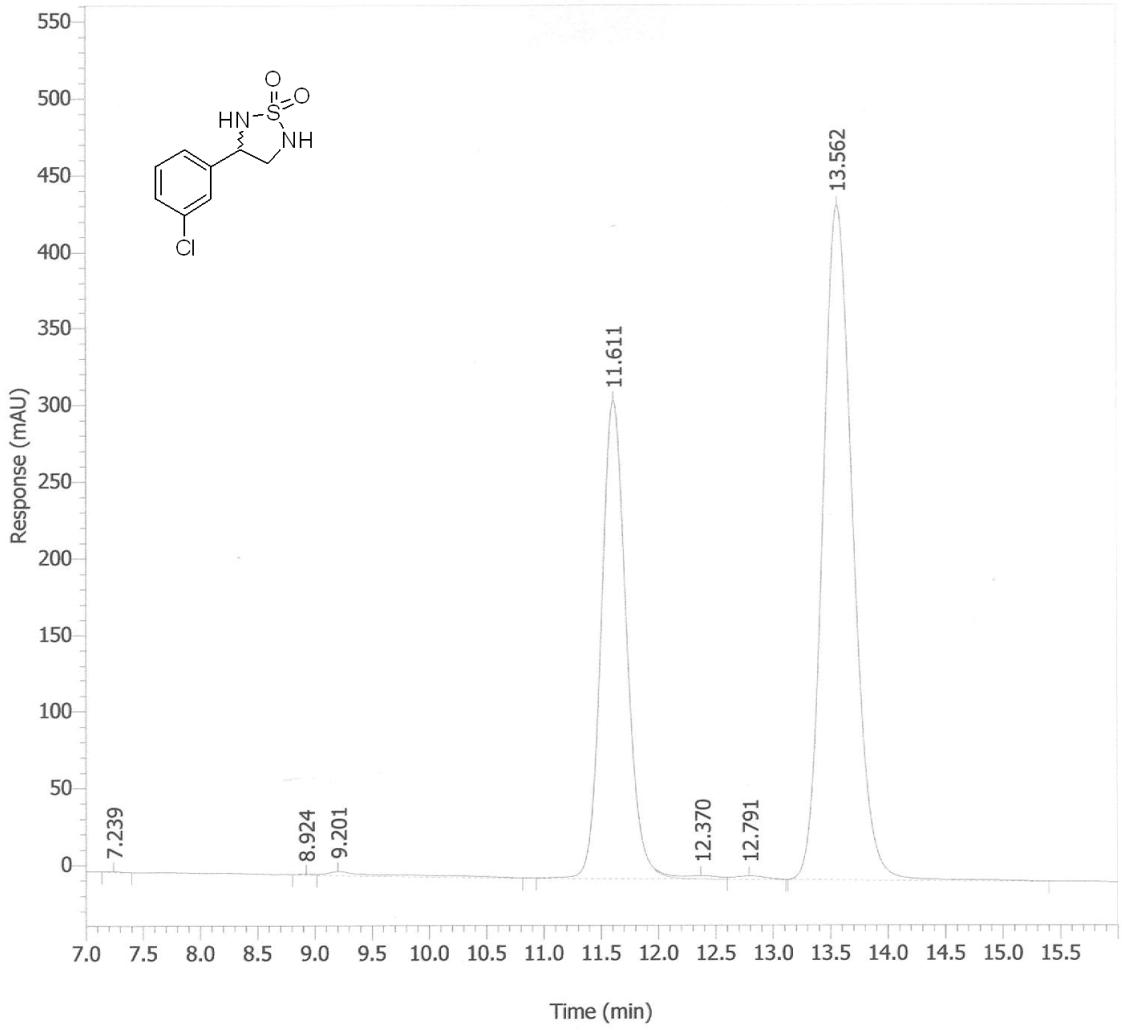
freq. of 0 ppm: 300.130000 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 108.061 ppm/cm: 0.36005

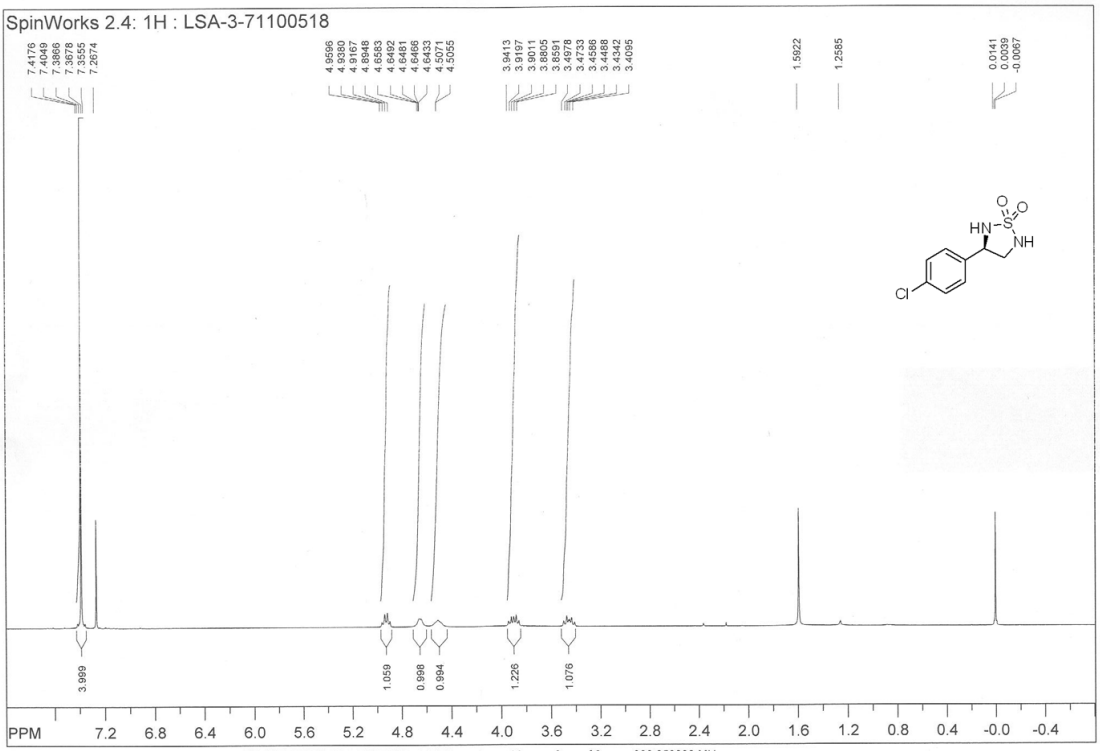


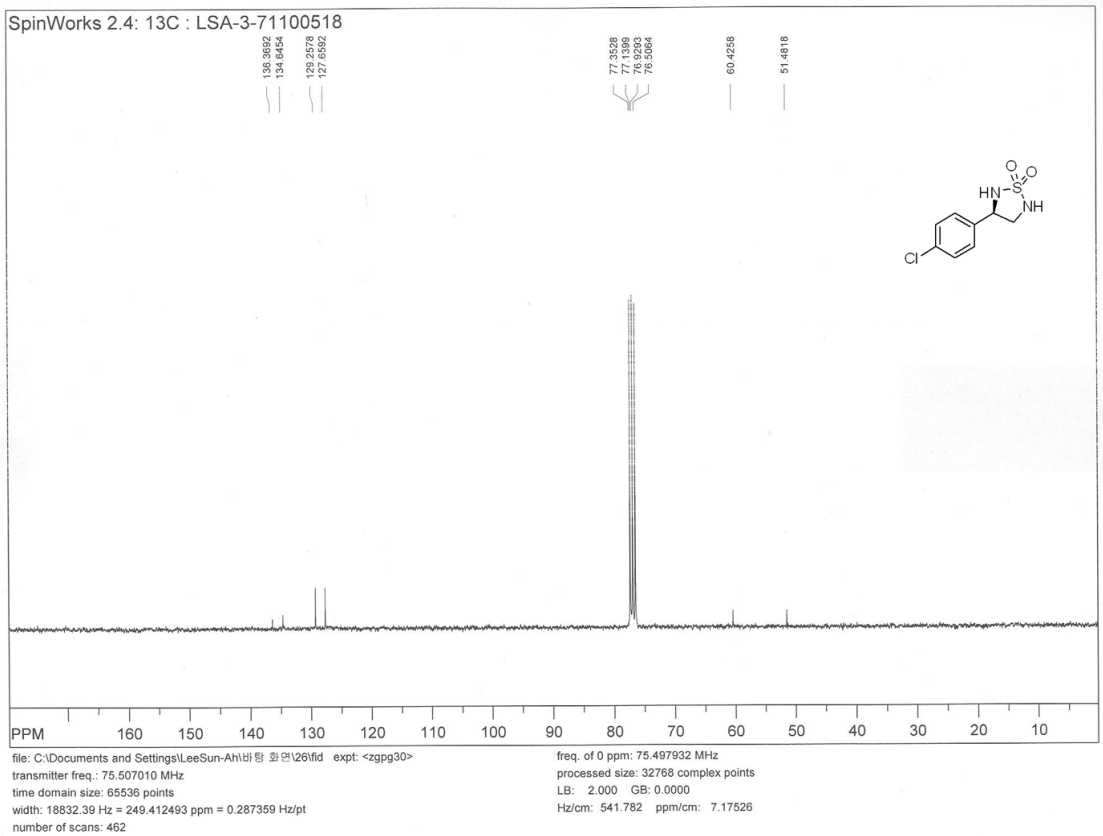
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-12b\1\fid expt: <zgpg30>
transmitter freq.: 75.475295 MHz
time domain size: 65536 points
width: 17985.61 Hz = 238.297995 ppm = 0.274439 Hz/pt
number of scans: 1024

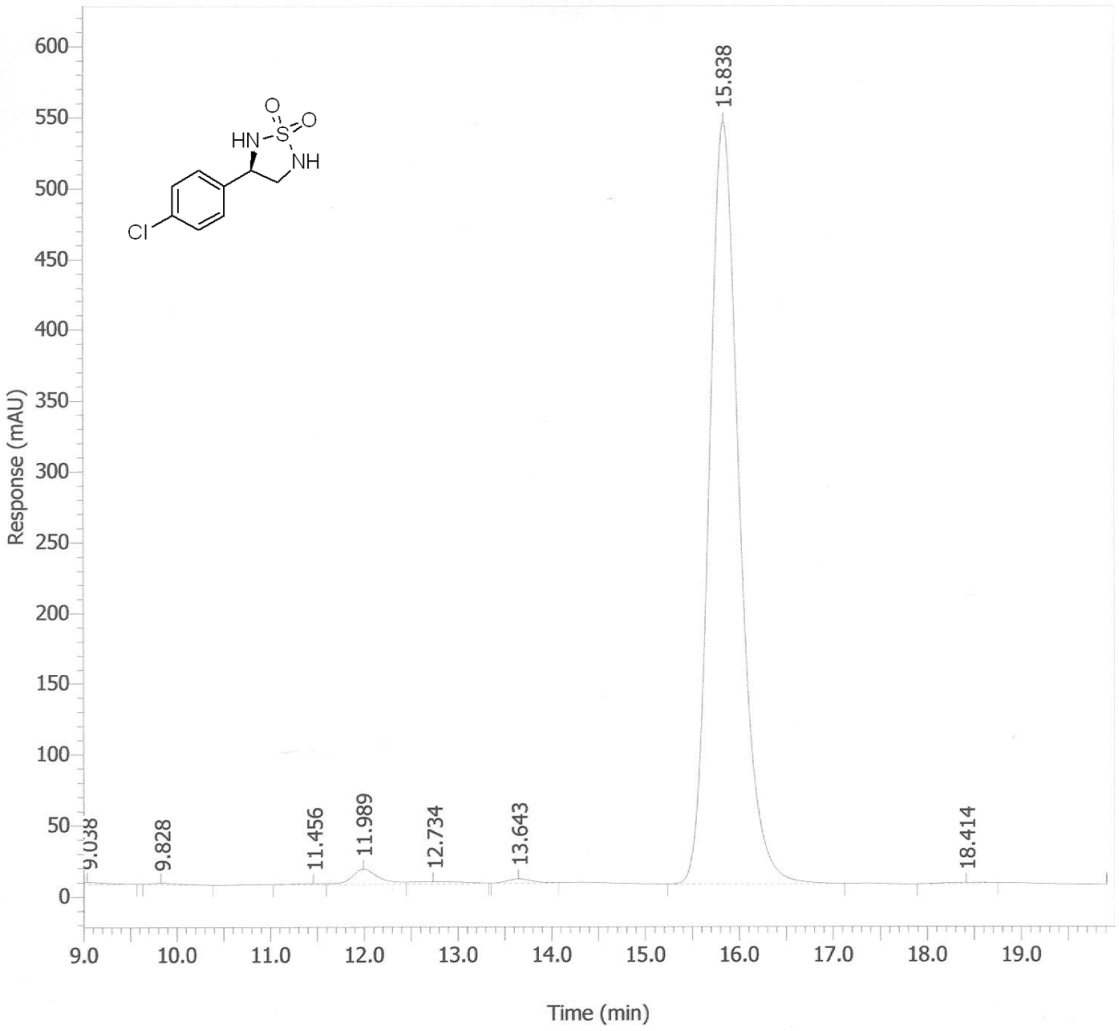
freq. of 0 ppm: 75.467787 MHz
processed size: 32768 complex points
LB: 1.000 GB: 0.0000
Hz/cm: 573.283 ppm/cm: 7.59563

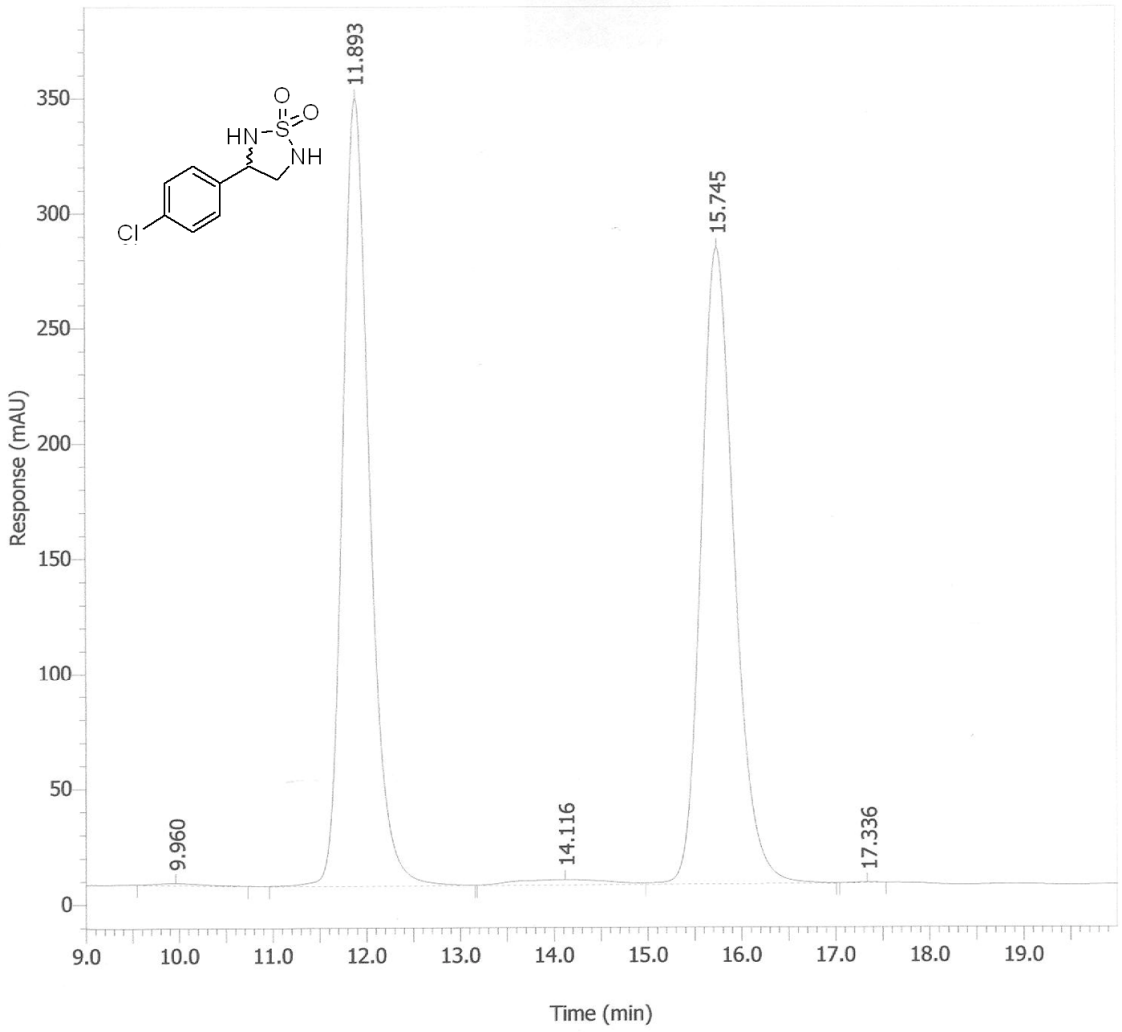

12.677
7.610
9.523
10.696
11.904
15.060
Response (mAU)
Time (min)
HN
S
O
O
NH
Cl

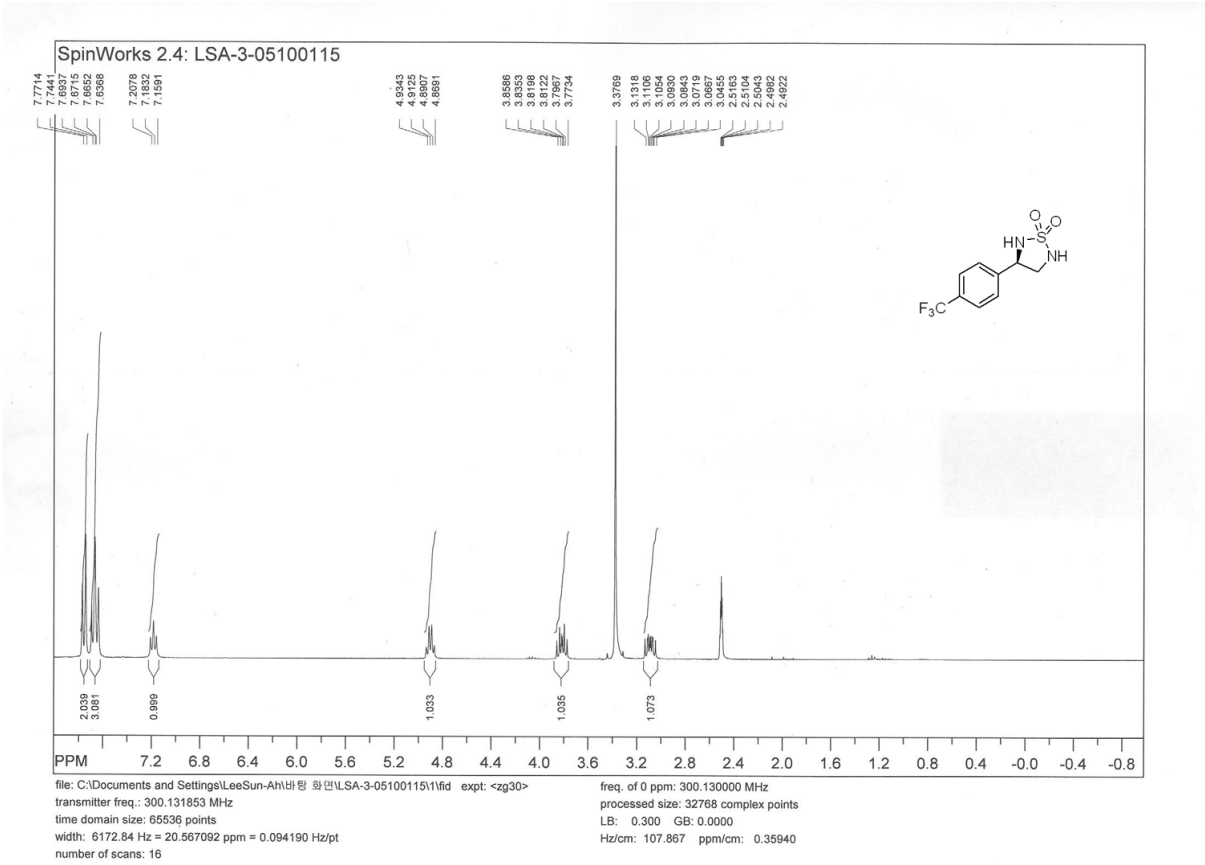

Response (mAU)
Time (min)
7.239
8.924
9.201
11.611
12.370
12.791
13.562
HN
S
O
O
NH
Cl


SpinWorks 2.4: 1H : LSA-3-71100518
7.4176
7.4049
7.3968
7.3878
7.3555
7.2674
4.9596
4.9380
4.9167
4.6648
4.6585
4.6492
4.6481
4.6466
4.6433
4.5071
4.5055
3.9413
3.9177
3.9011
3.8805
3.8591
3.4978
3.4733
3.4586
3.4468
3.4442
3.4095
1.5922
1.2585
0.0141
0.0039
-0.0067
3.999
1.059
0.998
0.994
1.226
1.076
PPM
7.2 6.8 6.4 6.0 5.6 5.2 4.8 4.4 4.0 3.6 3.2 2.8 2.4 2.0 1.6 1.2 0.8 0.4 -0.0 -0.4
HN
S
O
O
NH
Cl
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\NMR\LSA-3-71100518cdcl3\fid expt: <zg30>
transmitter freq.: 300.251197 MHz
time domain size: 65536 points
width: 2934.27 Hz = 9.772725 ppm = 0.044773 Hz/pt
number of scans: 64
freq. of 0 ppm: 300.250006 MHz
processed size: 32768 complex points
LB: 0.000 GB: 0.0000
Hz/cm: 105.680 ppm/cm: 0.35197


SpinWorks 2.4: 13C : LSA-3-71100518
136.3692
134.6454
129.2578
127.6592
77.3528
77.1399
76.9269
76.5084
60.4258
51.4818
PPM
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
HN
S
O
O
NH
Cl
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\26\fid expt: <zgpg30>
transmitter freq.: 75.507010 MHz
time domain size: 65536 points
width: 18832.39 Hz = 249.412493 ppm = 0.287359 Hz/pt
number of scans: 462
freq. of 0 ppm: 75.497932 MHz
processed size: 32768 complex points
LB: 2.000 GB: 0.0000
Hz/cm: 541.782 ppm/cm: 7.17526

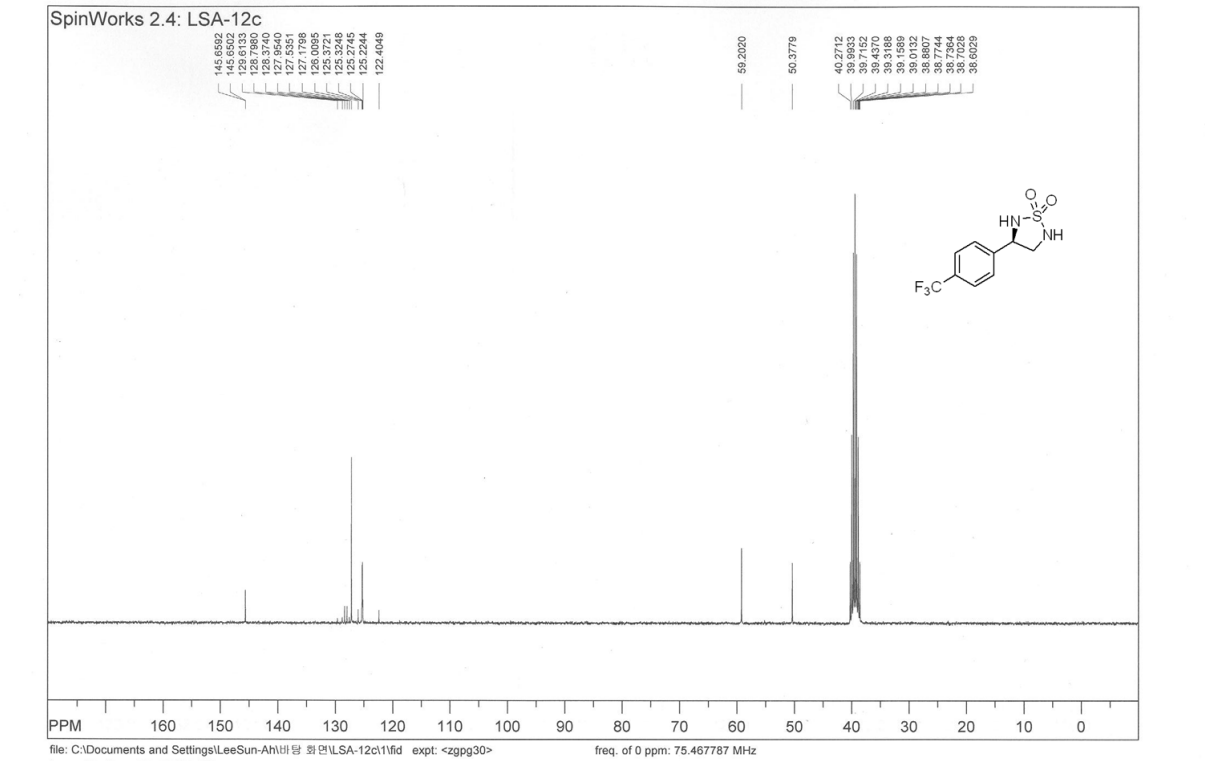

15.838
9.038
9.828
11.456
11.989
12.734
13.643
18.414
Response (mAU)
Time (min)
HN
S
O
O
NH
Cl


11.893
15.745
9.960
14.116
17.336
Response (mAU)
Time (min)
HN
NH
O
O
Cl



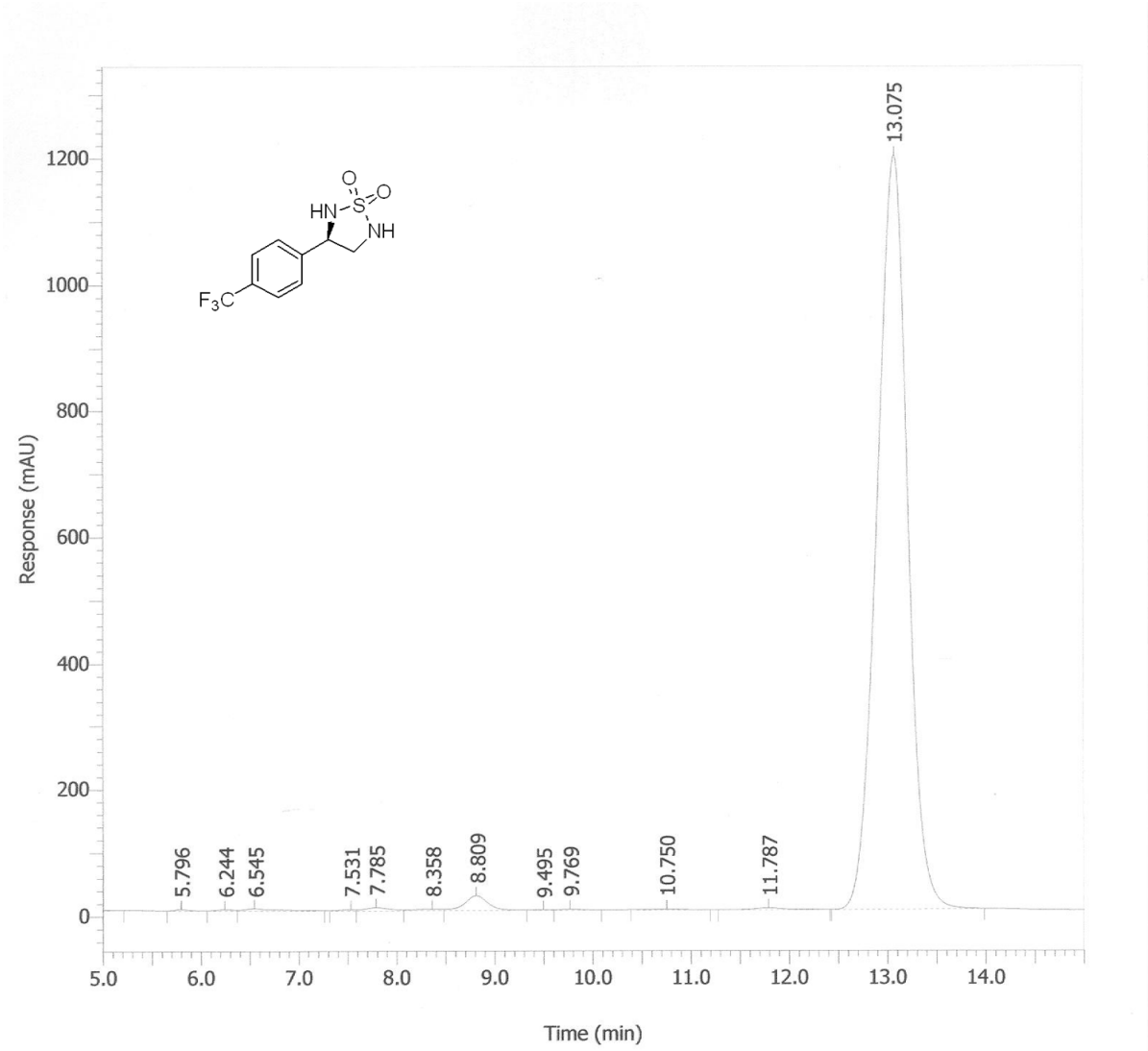
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-05100115\1\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16

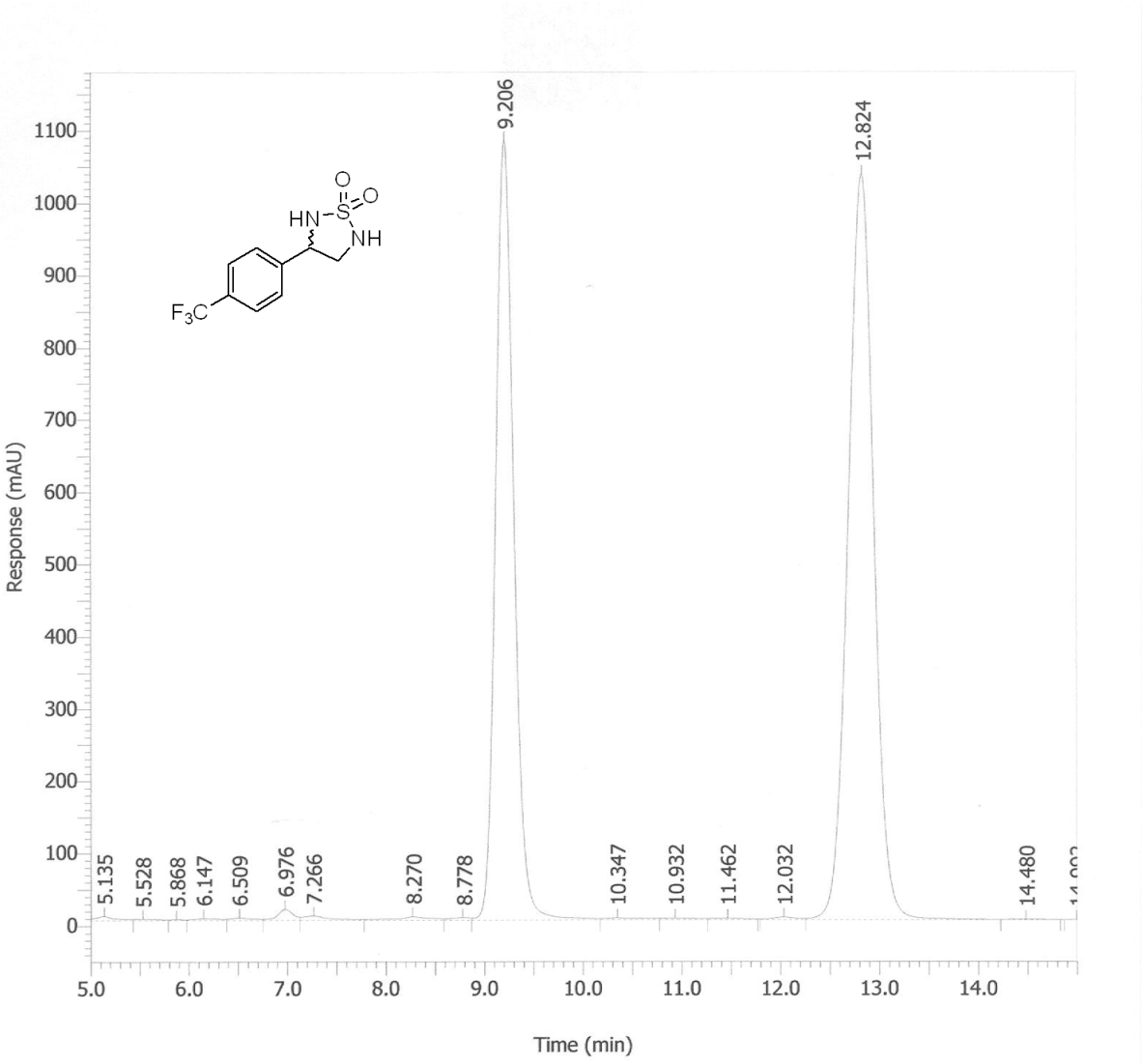
freq. of 0 ppm: 300.130000 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 107.867 ppm/cm: 0.35940

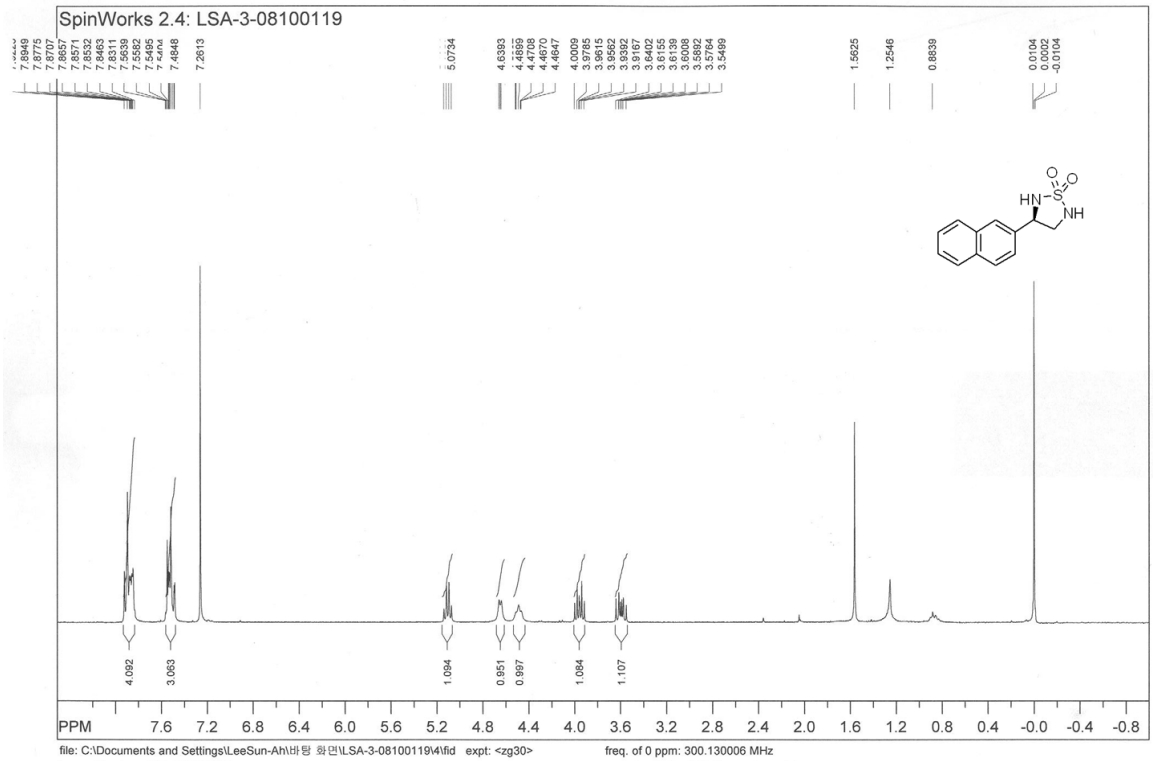


file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-12c\1\fid expt: <zgpg30>
transmitter freq.: 75.475295 MHz
time domain size: 65536 points
width: 17985.61 Hz = 238.297995 ppm = 0.274439 Hz/pt
number of scans: 1500

freq. of 0 ppm: 75.467787 MHz
processed size: 32768 complex points
LB: 1.000 GB: 0.0000
Hz/cm: 573.790 ppm/cm: 7.60235

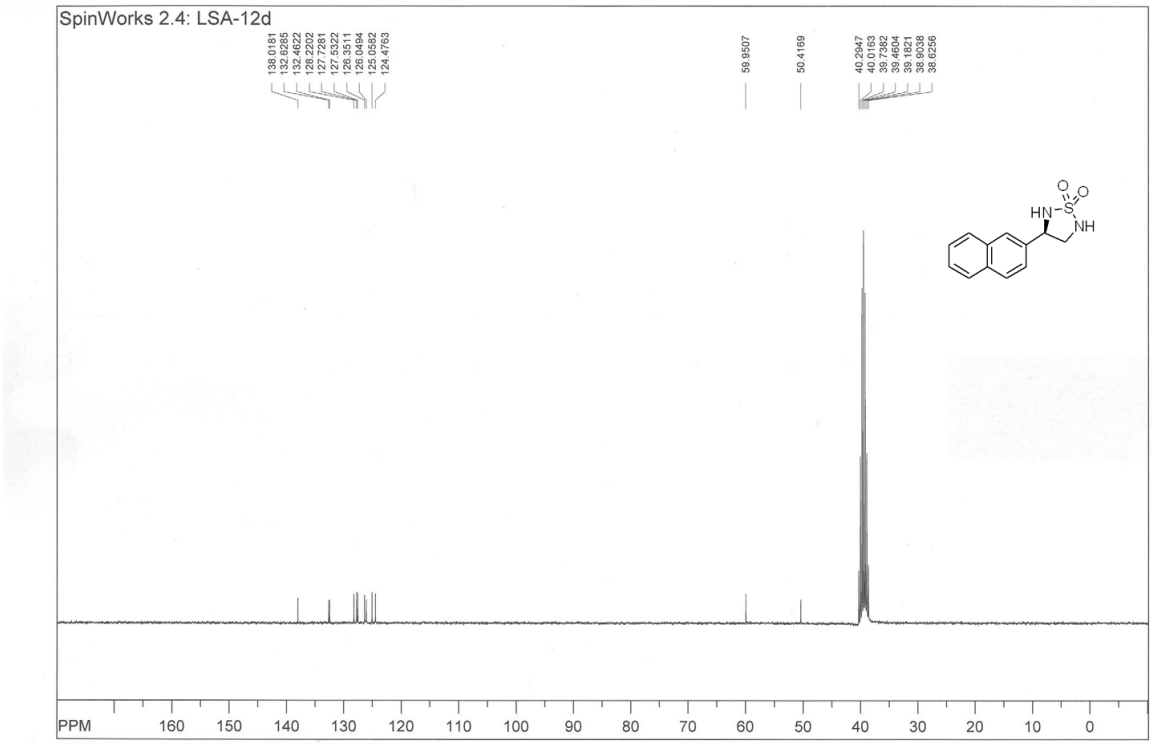

13.075
1200
1000
800
600
400
200
0
Response (mAU)
5.796
6.244
6.545
7.531
7.785
8.358
8.809
9.495
9.769
10.750
11.787
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
Time (min)
O
HN
S
O
NH
F3C


9.206
12.824
HN
S
O
O
NH
F3C
Response (mAU)
1100
1000
900
800
700
600
500
400
300
200
100
0
5.135
5.528
5.868
6.147
6.509
6.976
7.266
8.270
8.778
10.347
10.932
11.462
12.032
14.480
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
Time (min)



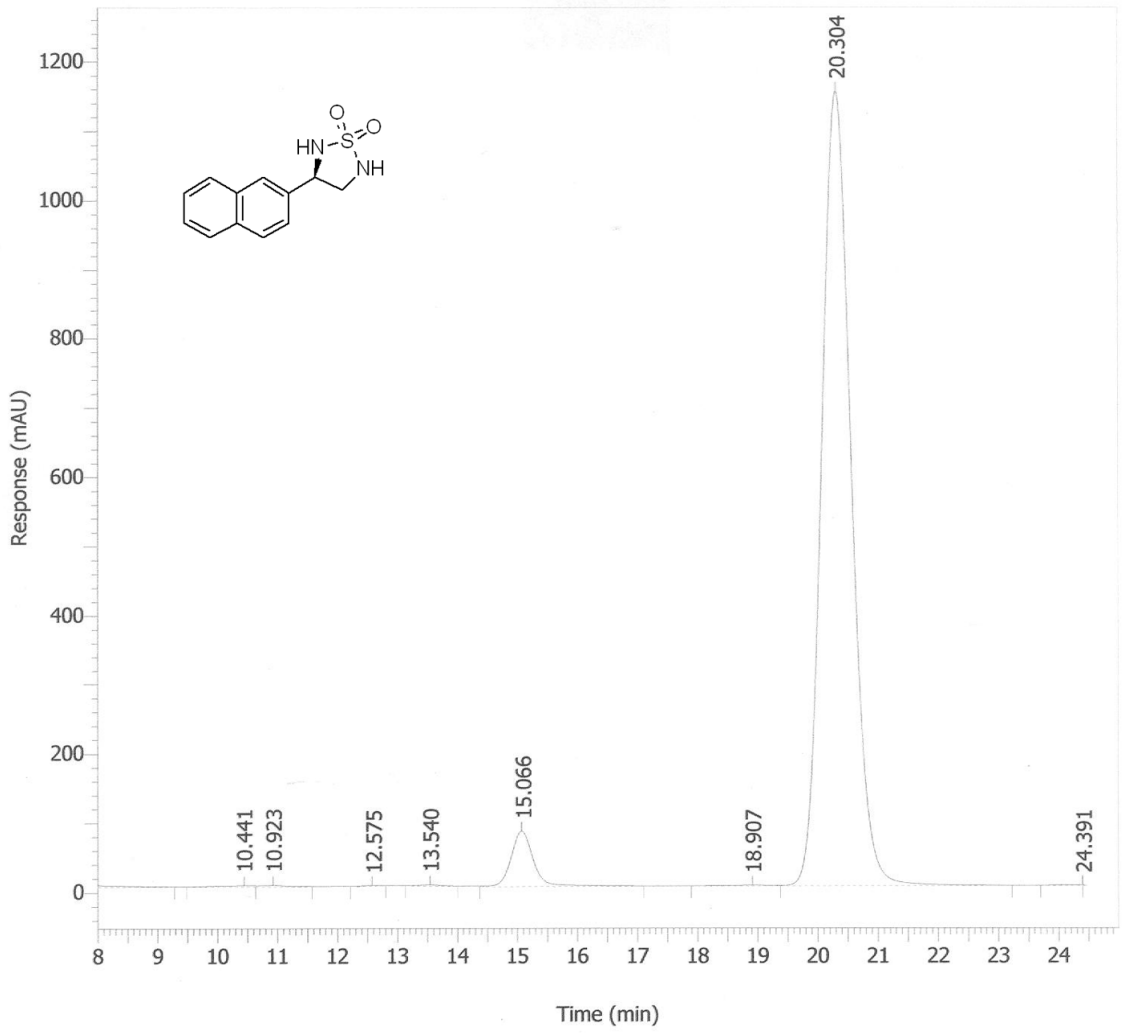
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-3-08100119\4\fid expt: <zg30>
transmitter freq.: 300.131853 MHz
time domain size: 65536 points
width: 6172.84 Hz = 20.567092 ppm = 0.094190 Hz/pt
number of scans: 16

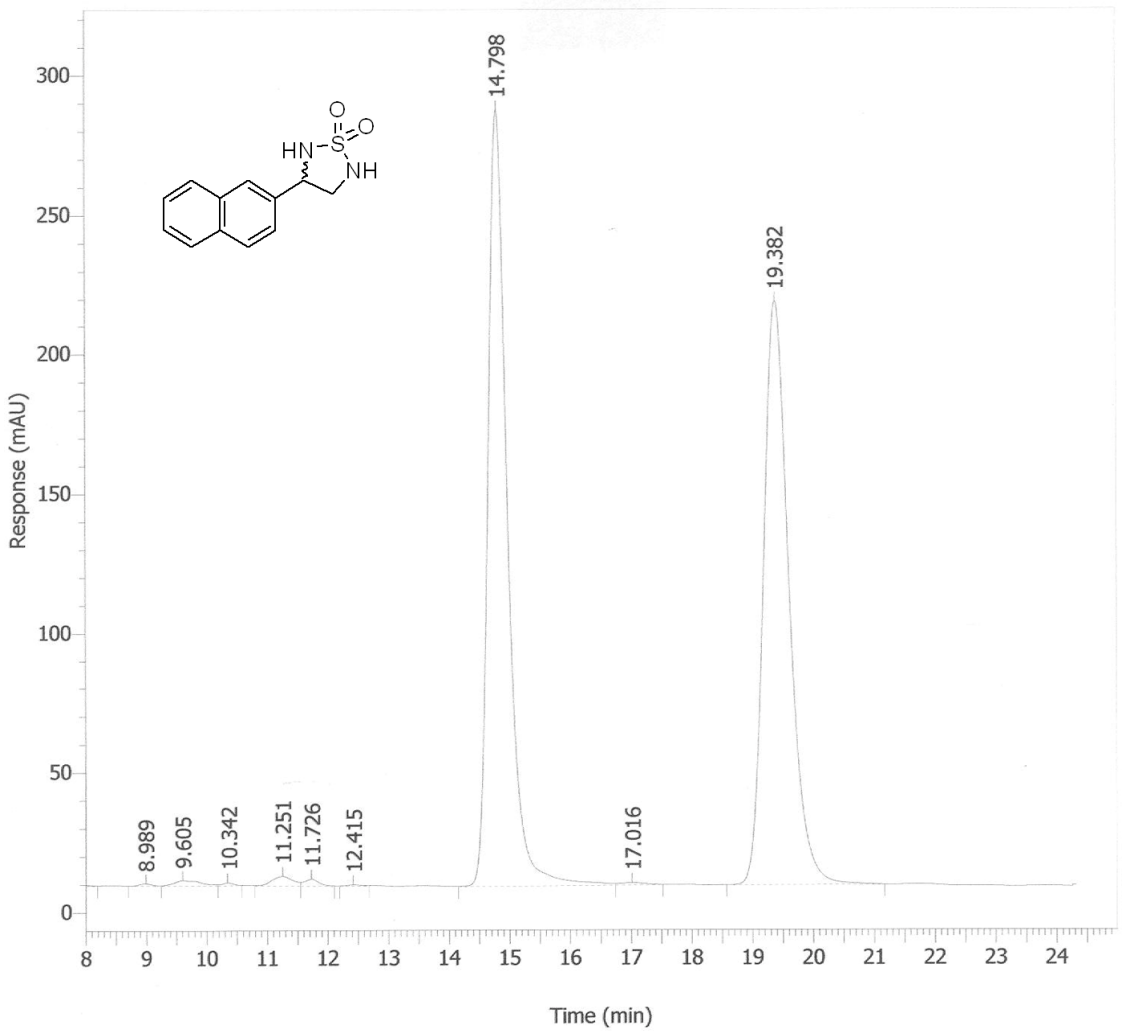
freq. of 0 ppm: 300.130006 MHz
processed size: 32768 complex points
LB: 0.300 GB: 0.0000
Hz/cm: 114.134 ppm/cm: 0.38028

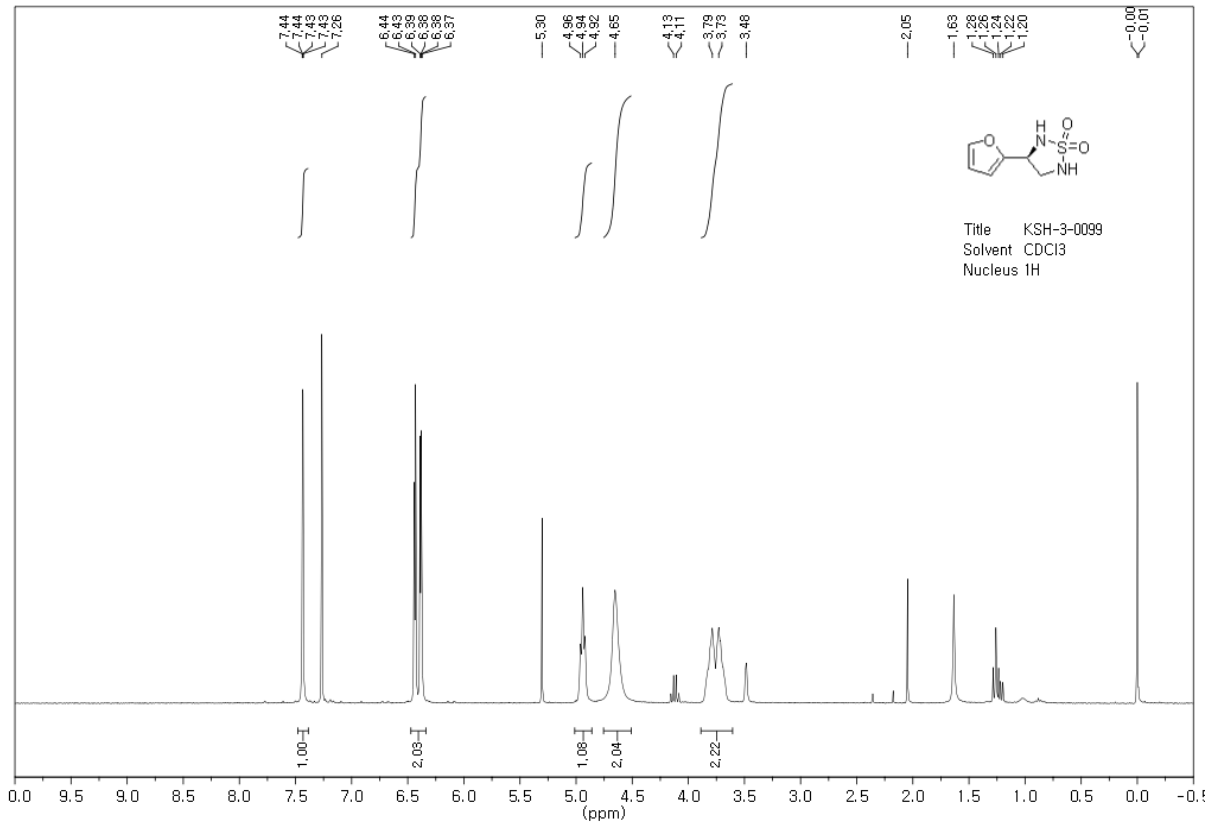


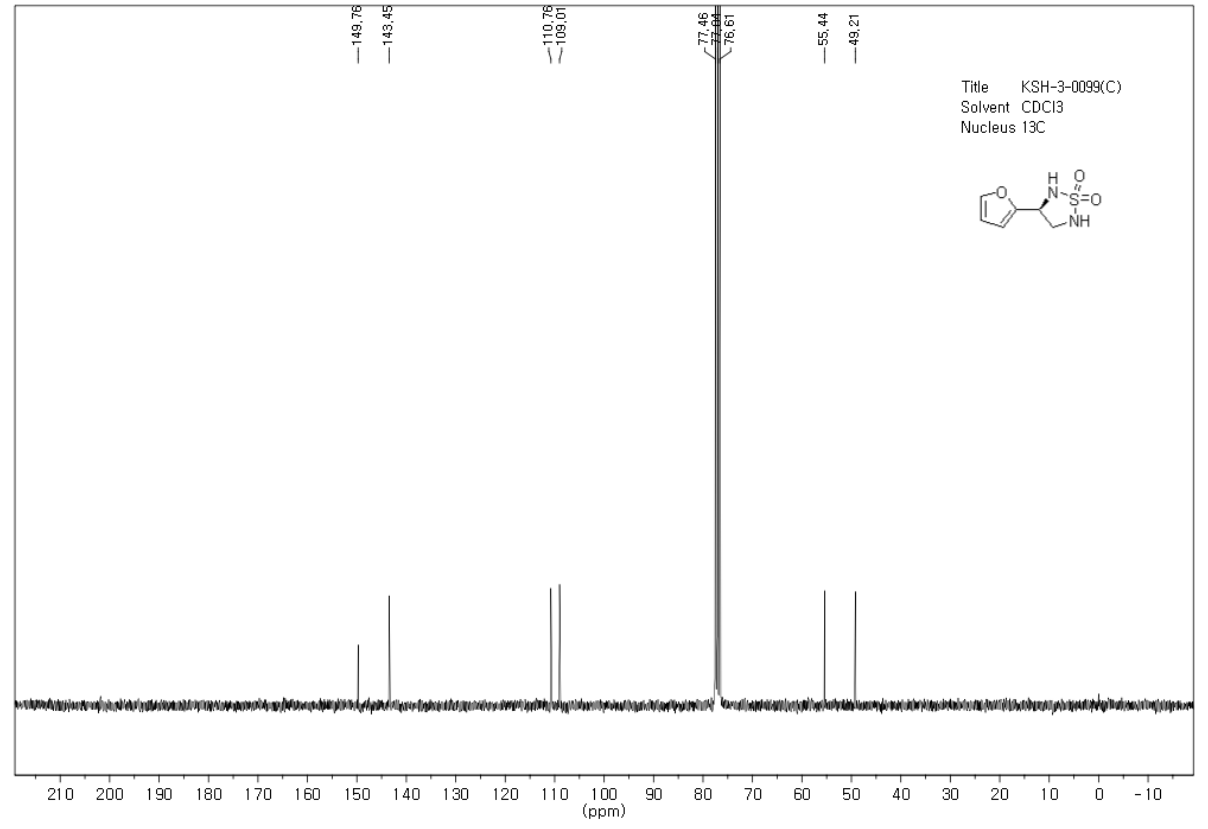
file: C:\Documents and Settings\LeeSun-Ah\바탕 화면\LSA-12d\1\fid expt: <zgpg30>
transmitter freq.: 75.475295 MHz
time domain size: 65536 points
width: 17985.61 Hz = 238.297995 ppm = 0.274439 Hz/pt
number of scans: 1300

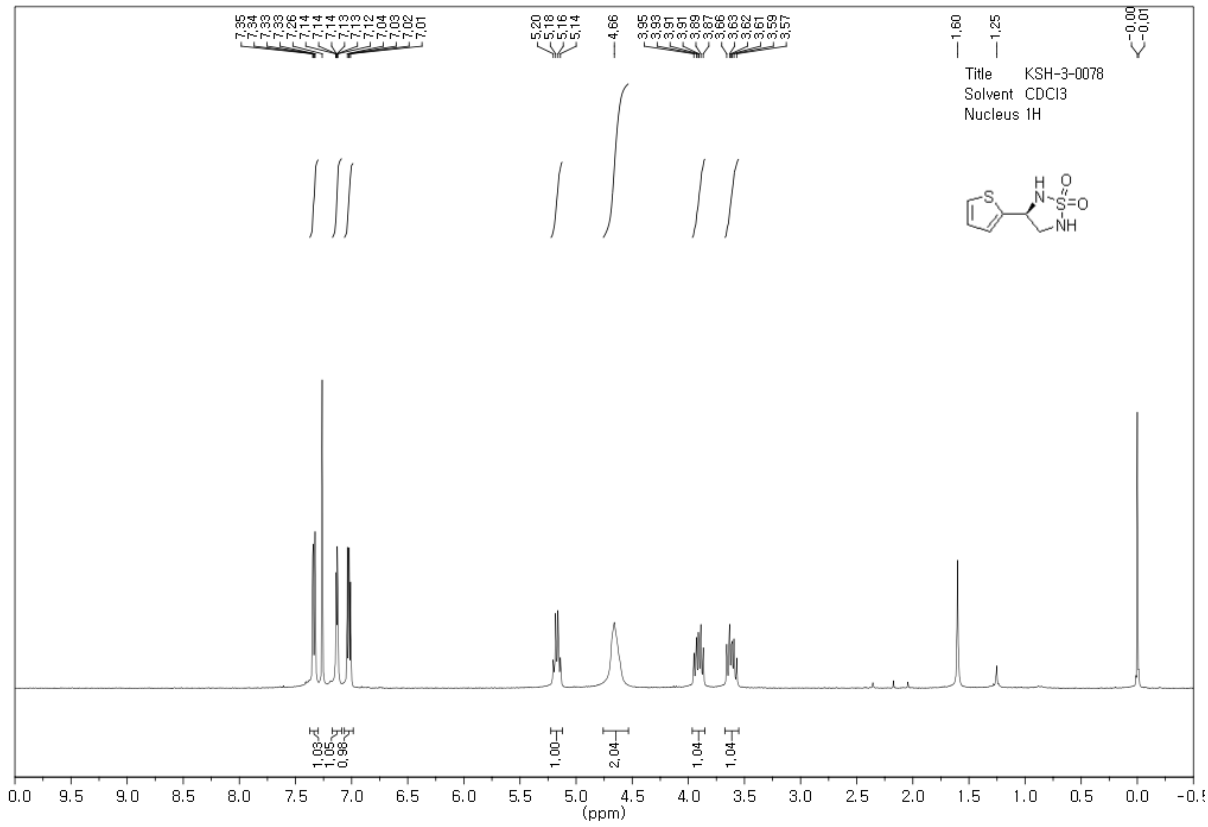
freq. of 0 ppm: 75.467787 MHz
processed size: 32768 complex points
LB: 1.000 GB: 0.0000
Hz/cm: 573.847 ppm/cm: 7.60311

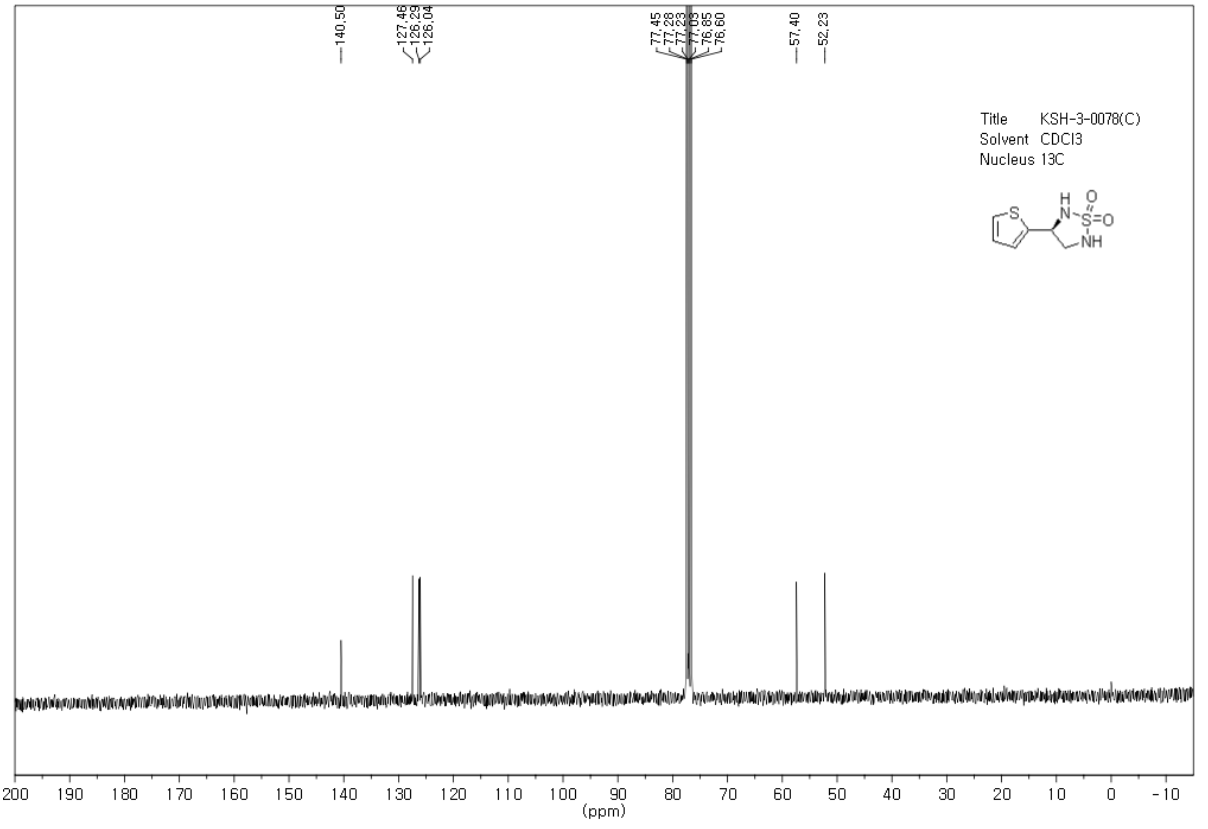

1200
1000
800
600
400
200
0
Response (mAU)
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Time (min)
10.441
10.923
12.575
13.540
15.066
18.907
20.304
24.391
HN
S
O
O
NH

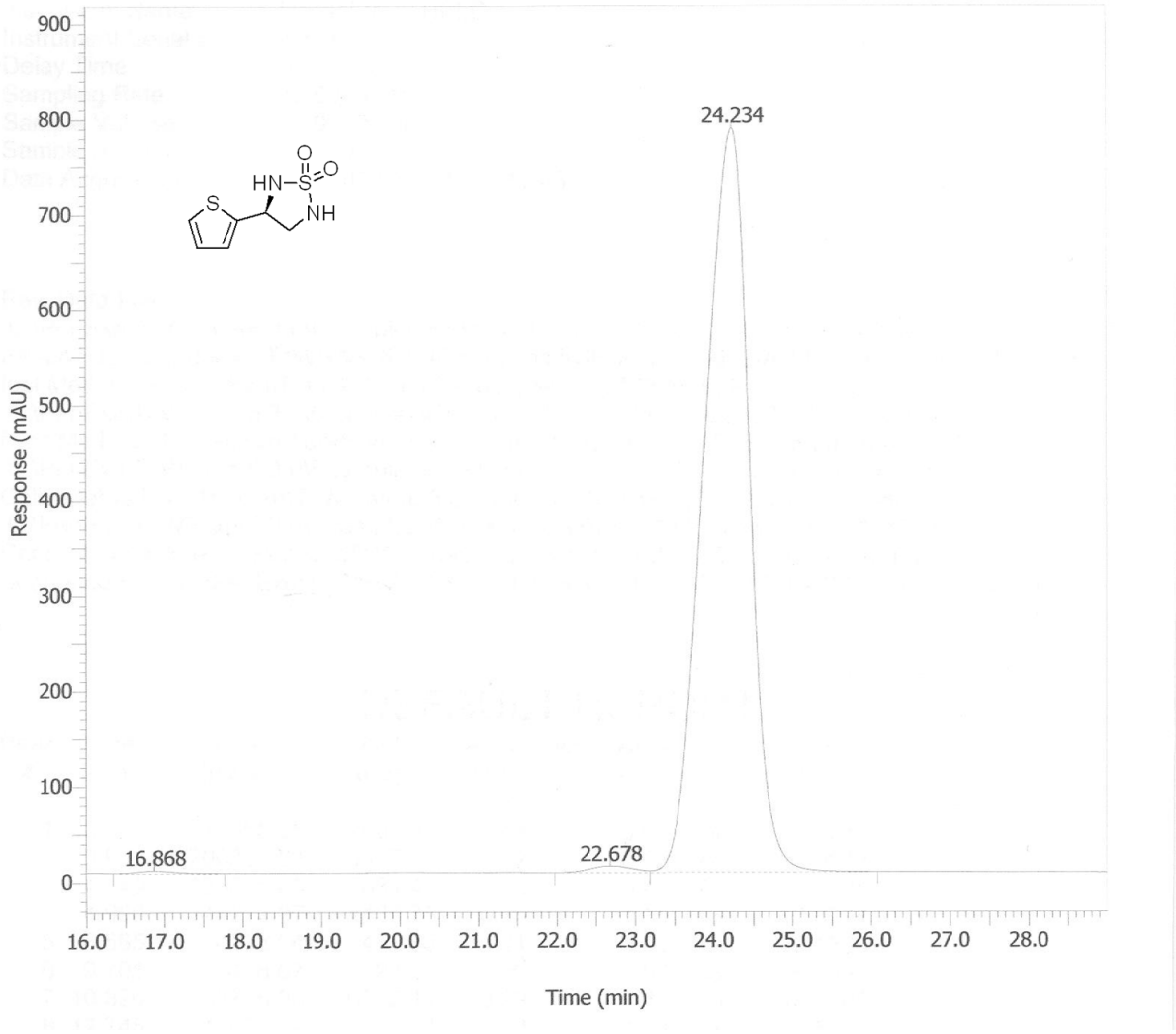

14.798
19.382
8.989
9.605
10.342
11.251
11.726
12.415
17.016
HN
S
O
O
NH
Response (mAU)
Time (min)
0
50
100
150
200
250
300
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

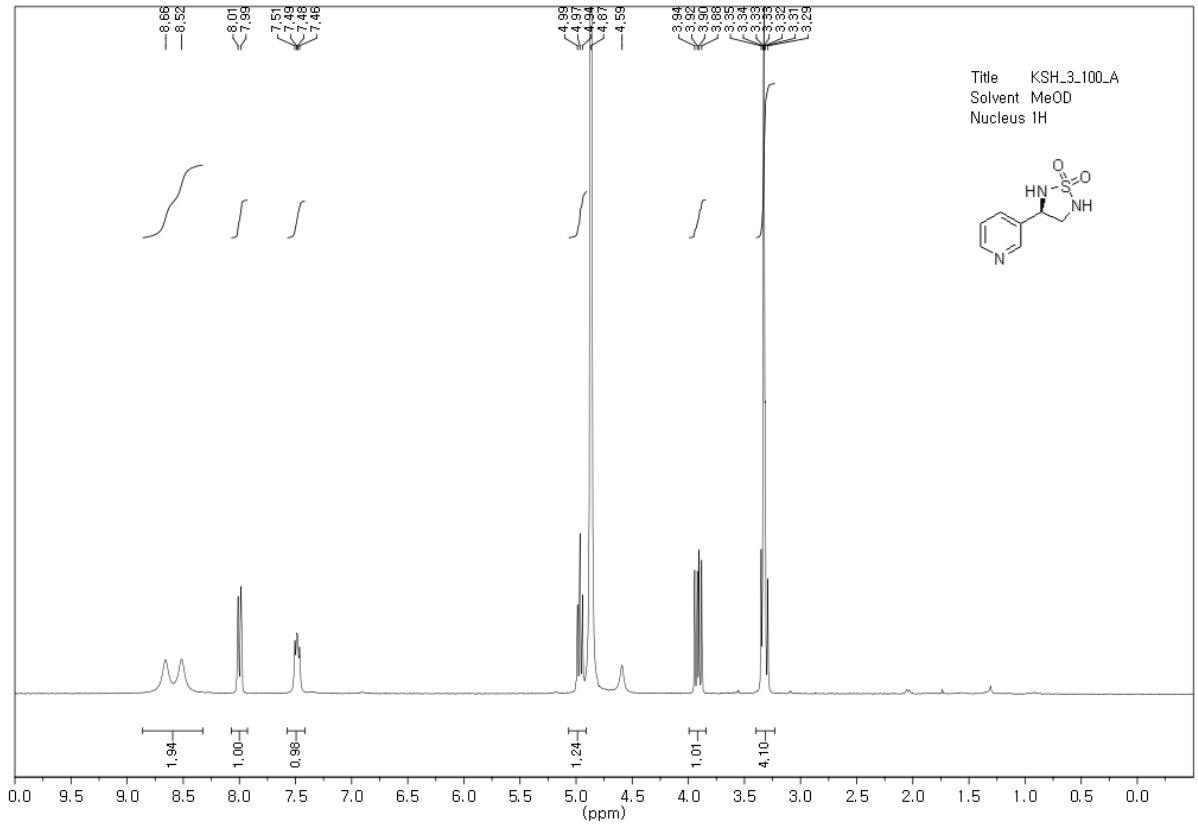

7.44
7.44
7.43
7.43
7.26
6.44
6.43
6.39
6.38
6.38
6.37
5.30
4.96
4.94
4.92
4.65
4.13
4.11
3.79
3.73
3.48
2.05
1.63
1.28
1.26
1.24
1.22
1.20
0.00
0.01
Title KSH-3-0099
Solvent CDCl3
Nucleus 1H
1.00
2.03
1.08
2.04
2.22
(ppm)

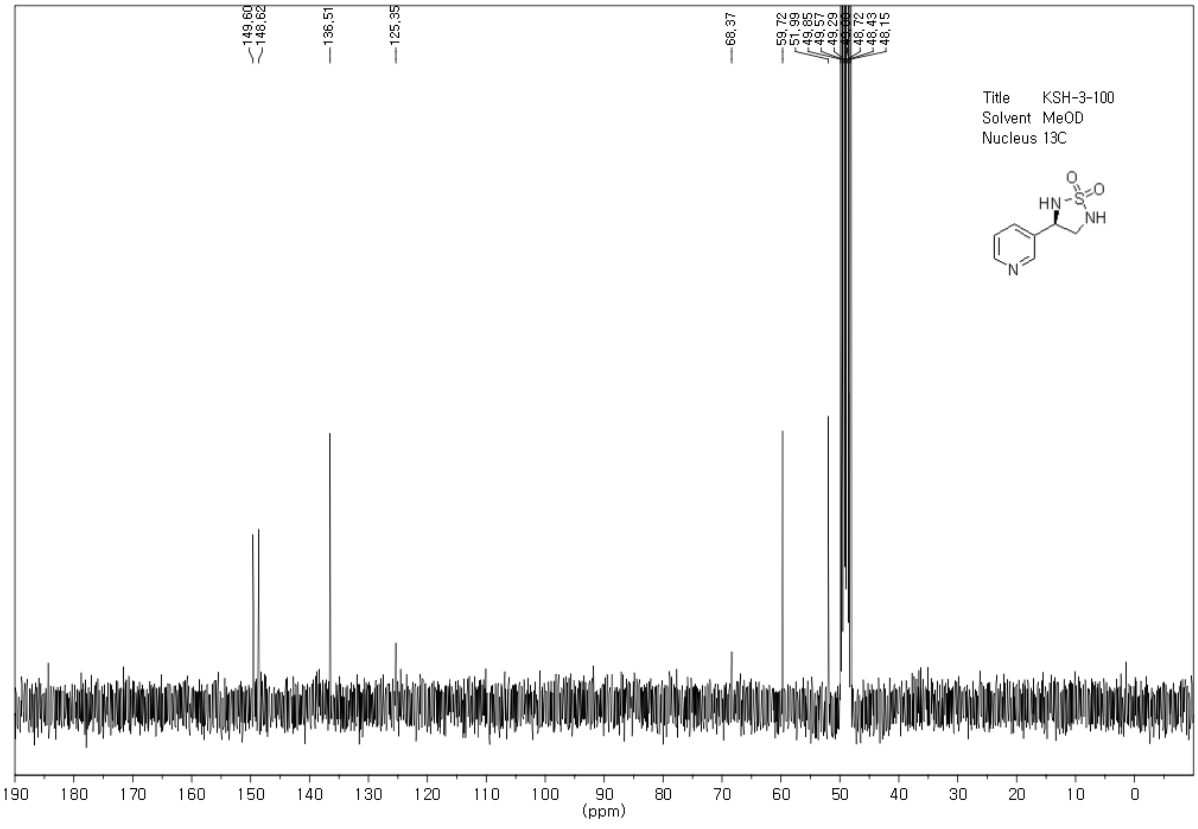

149.76
143.45
110.76
109.01
77.46
77.04
76.61
55.44
49.21
Title KSH-3-0099(C)
Solvent CDCl3
Nucleus 13C
(ppm)

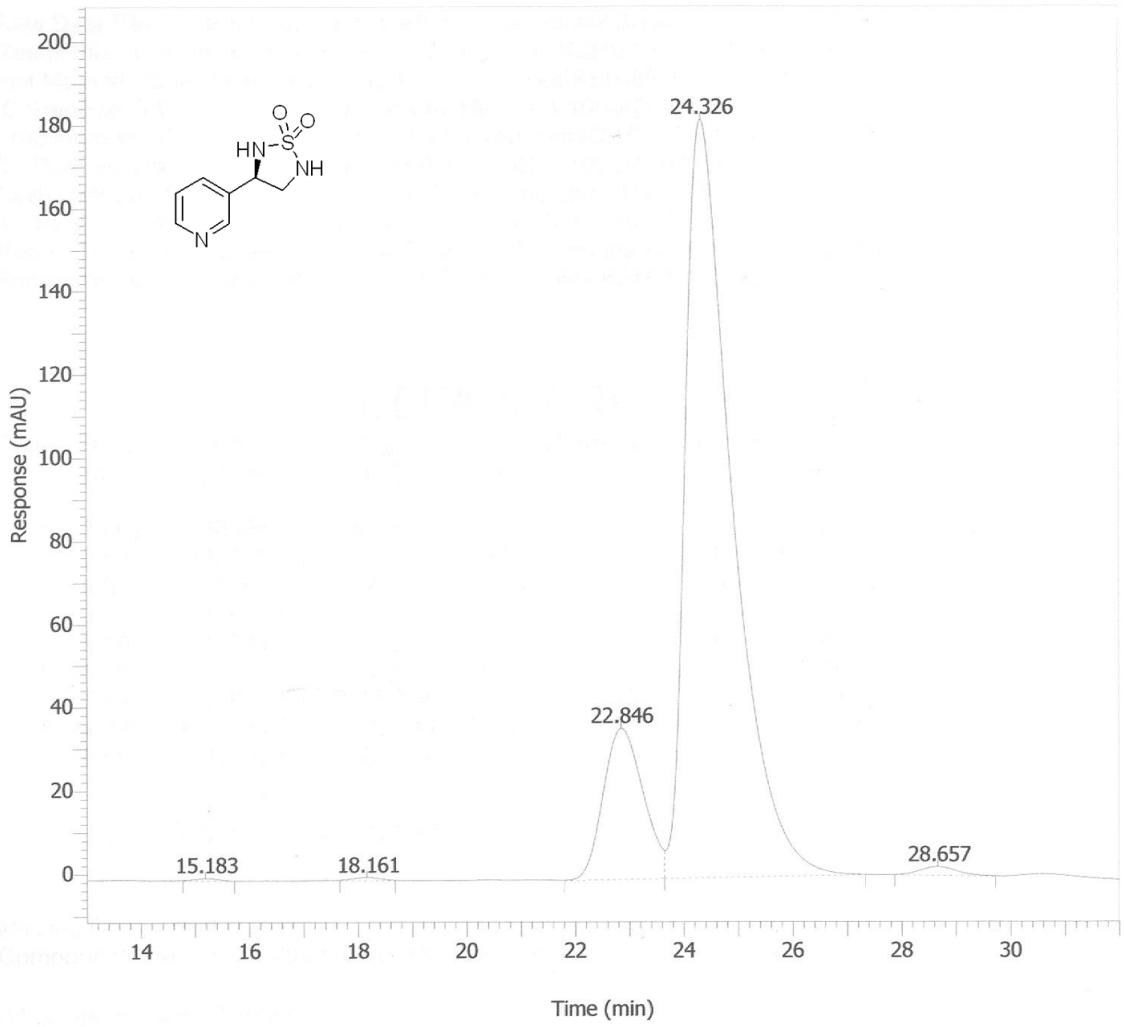

Title KSH-3-0078
Solvent CDCl3
Nucleus 1H
(ppm)

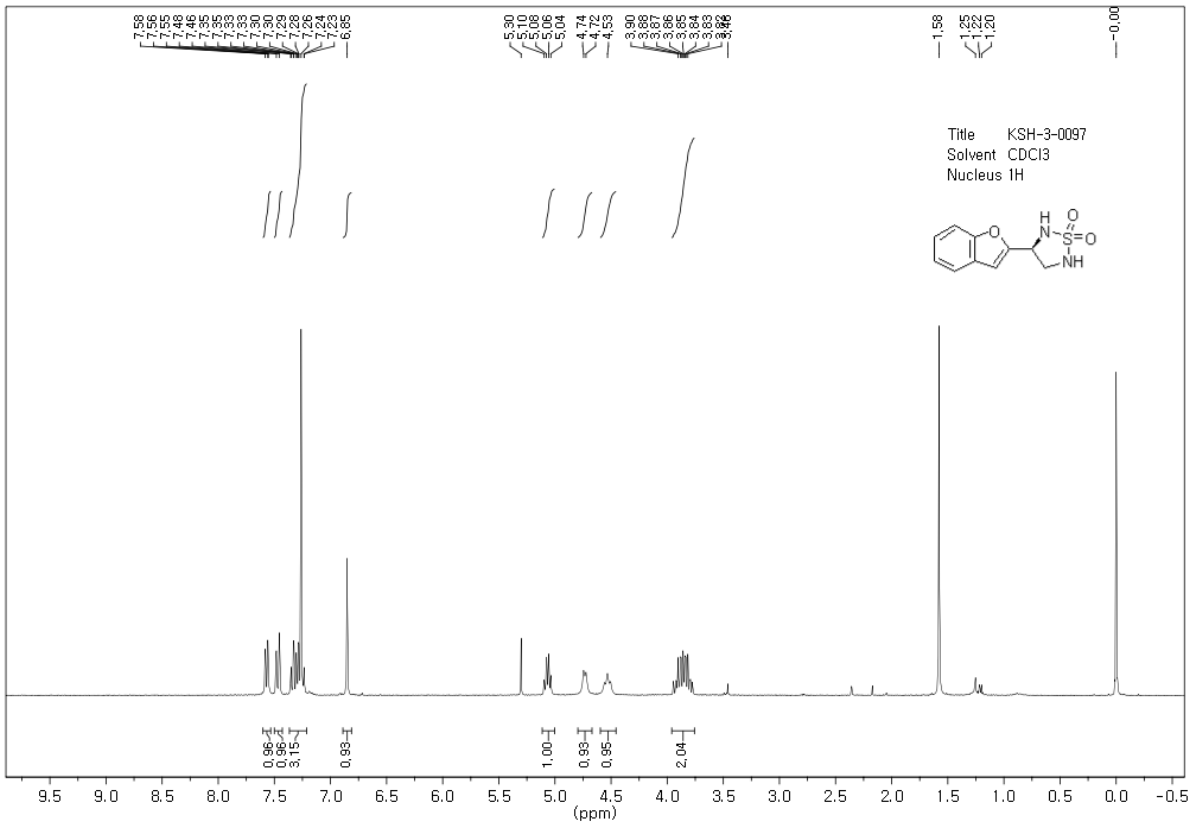

Title KSH-3-0078(C)
Solvent CDCl3
Nucleus 13C
(ppm)

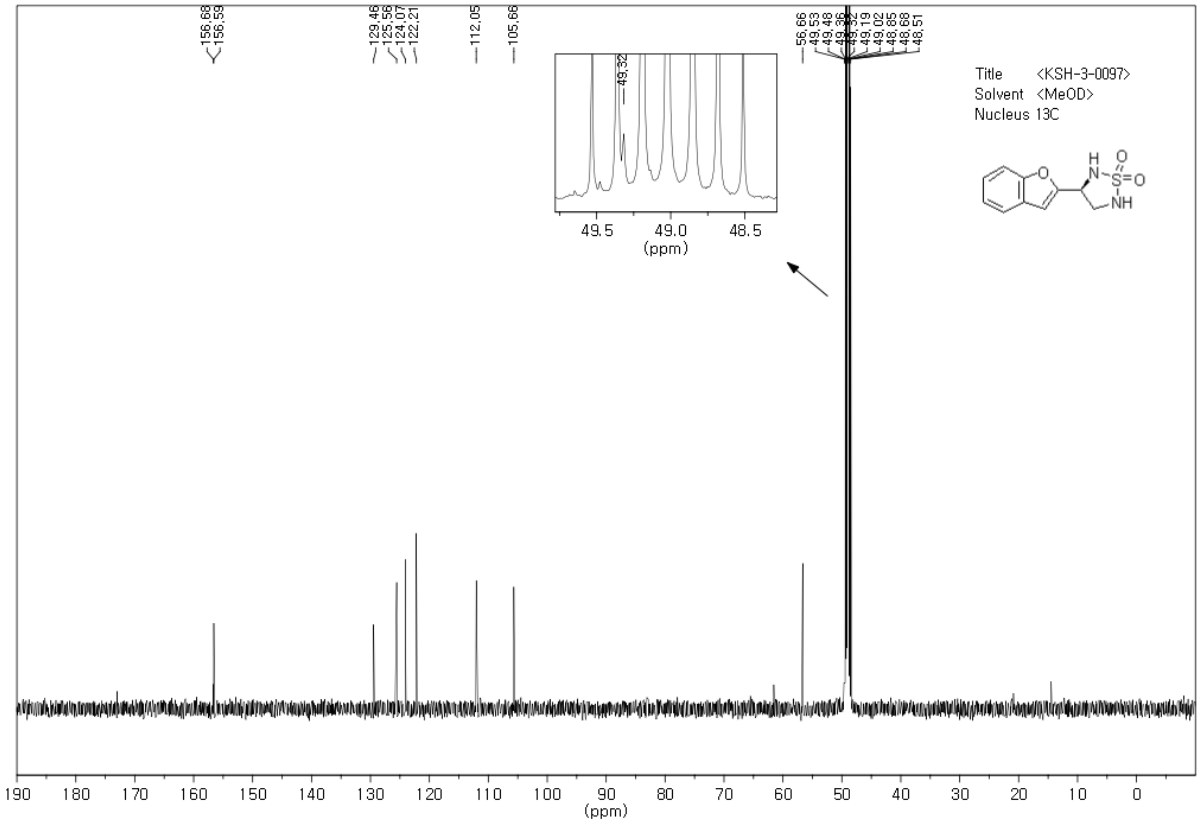

24.234
16.868
22.678
Response (mAU)
Time (min)
900
800
700
600
500
400
300
200
100
0
16.0
17.0
18.0
19.0
20.0
21.0
22.0
23.0
24.0
25.0
26.0
27.0
28.0
HN
S
O
O
NH
S

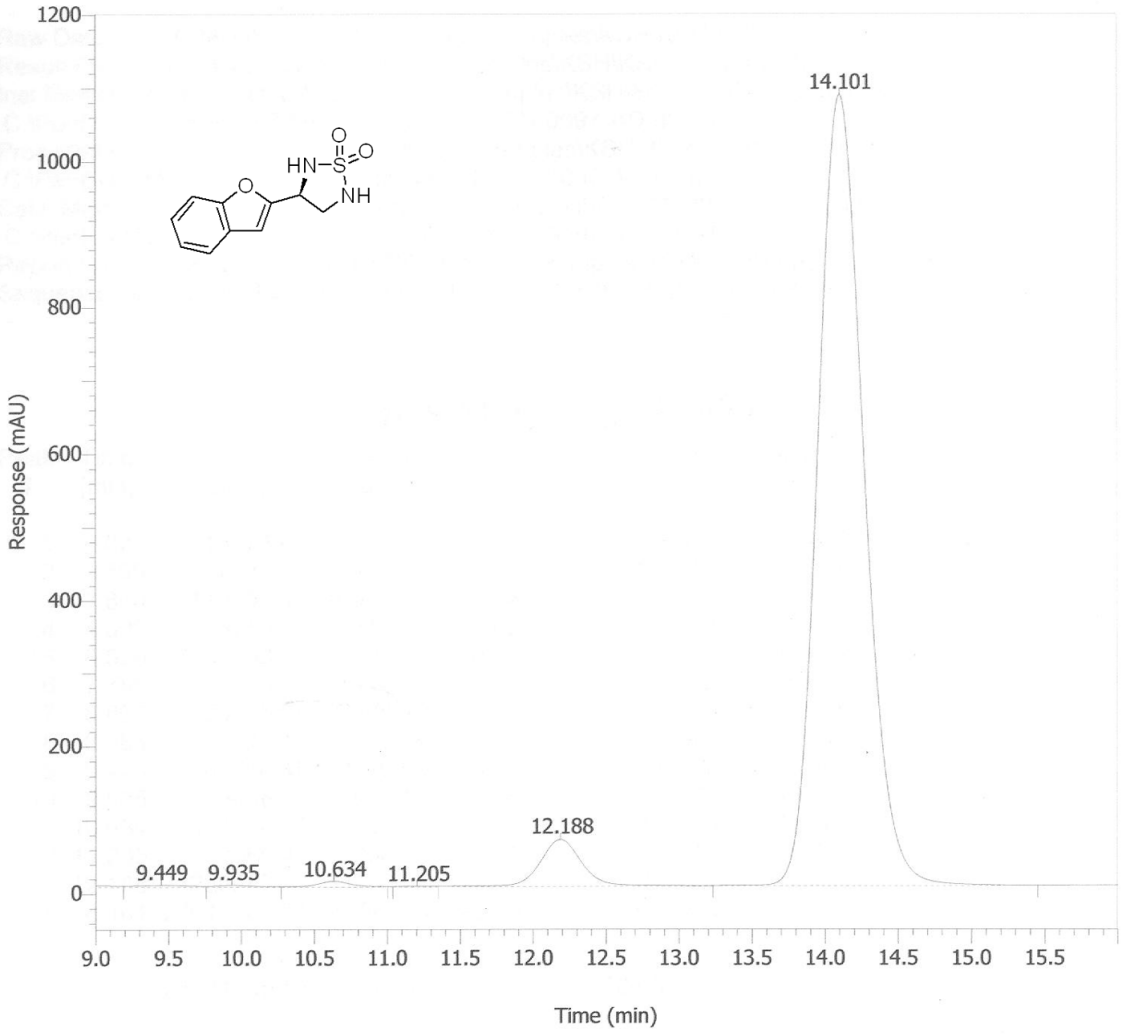

Title KSH_3_100_A
Solvent MeOD
Nucleus 1H
(ppm)


Title KSH-3-100
Solvent MeOD
Nucleus 13C
(ppm)


24.326
22.846
15.183
18.161
28.657
Response (mAU)
Time (min)
HN
NH
O
O
N


Title KSH-3-0097
Solvent CDCl3
Nucleus 1H
(ppm)


Title <KSH-3-0097>
Solvent <MeOD>
Nucleus 13C
(ppm)


1200
1000
800
600
400
200
0
Response (mAU)
14.101
12.188
9.449
9.935
10.634
11.205
HN
S
O
O
NH
O
9.0
9.5
10.0
10.5
11.0
11.5
12.0
12.5
13.0
13.5
14.0
14.5
15.0
15.5
Time (min)