Supporting Information

One-pot synthesis of functionalized isoxazole-thiolane hybrids *via* Knoevenagel condensation and domino sulfa-1,6-Michael / intramolecular vinylogous Henry reactions†

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Experimental procedure (Stepwise synthesis):

To a stirred solution of isoxazole styrene (1eq) in chloroform (3 mL) 1,4-dithiane-2,5-diol (0.7 eq) and piperidine (0.3 eq) were added the reaction mixture was continued to being stirred at room temperature until disappearance of starting materials (confirming by TLC). Then saturated NH_4Cl solution (10 mL) was added to the reaction mixture and extracted with EtOAc (3X15mL). The solvent was evaporated and the crude product obtained was purified by column chromatography.

Experimental procedure (One-pot synthesis):

To a stirred solution of benzaldehdye (1eq) in ethanol (3 mL), 3,5-dimethyl-4-nitroisoxazole (1.2 eq) and piperidine (0.3 eq) were added and the mixture was stirred at 65^{o}C for 2 h. After consumption of the starting materials (confirming by TLC), the reaction mixture was cooled to room temperature and 1,4-dithiane-2,5-diol (0.7 eq) was added, and stirring continued (RT) 5-30 min. (confirming by TLC). Then saturated NH_4Cl solution (10 mL) was added to the reaction mixture and extracted with EtOAc (3X15mL). The solvent was evaporated and the crude product obtained was purified by column chromatography.

X-ray Crystallography:

X-ray data for the compounds were collected at room temperature using a Bruker Smart Apex CCD diffractometer with graphite monochromated MoKα radiation (λ=0.71073Å) with ω-scan method.[1] Preliminary lattice parameters and orientation matrices were obtained from four sets of frames.

Integration and scaling of intensity data were accomplished using SAINT program.[1] The structure was solved by direct methods using SHELXS[2] and refinement was carried out by full-matrix least-squares technique using SHELXL.[2] Anisotropic displacement parameters were included for all non-hydrogen atoms. The O-bound H atom of the water

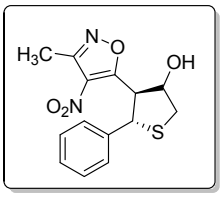
molecule was located in a difference density map and was refined isotropically. All other H atoms were positioned geometrically and treated as riding on their parent C atoms [C-H = 0.93-0.97 Å and Uiso(H) = 1.5Ueq(C) for methyl H or 1.2Ueq(c) for other H atoms]. The methyl groups were allowed to rotate but not to tip.

Crystal Data for BB20m: C14H13N2O4SBr (M =385.23): monoclinic, space group P21/c (no. 14), a = 10.5148(12) Å, b = 10.3818(12) Å, c = 14.6235(17) Å, β = 106.108(2)°, V = 1533.7(3) Å3, Z = 4, T = 294.15 K, μ(MoKα) = 2.835 mm-1, Dcalc = 1.668 g/mm3, 17186 reflections measured (4.032 ≤ 2Θ ≤ 56.186), 3647 unique (Rint = 0.0266) which were used in all calculations. The final R1 was 0.0343 (I > 2σ(I)) and wR2 was 0.0943 (all data). CCDC 1426687 contains supplementary Crystallographic data for the structure. These data can be obtained free of charge at www.ccdc.cam.ac.uk/conts/retrieving.html [or from the Cambridge Crystallographic Data Centre (CCDC), 12 Union Road, Cambridge CB2 1EZ, UK; fax: +44(0) 1223 336 033; email: deposit@ccdc.cam.ac.uk].

References:

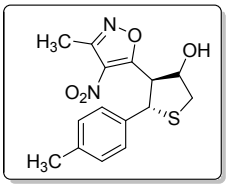
1. Bruker (2001). SAINT (Version 6.28a) & SMART (Version 5.625). Bruker AXS Inc., Madison, Wisconsin, USA.
2. Sheldrick G. M. (2015) *Acta Crystallogr* C71: 3-8.

4-(3-methyl-4-nitroisoxazol-5-yl)-5-phenyltetrahydrothiophen-3-ol



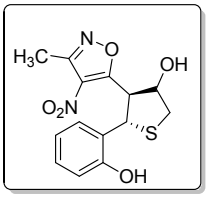
Yield = 95% (pale yellow semi solid); ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.50 – 7.27 (m, 5H), 5.35 (d, *J* = 10 Hz, 1H), 5.08 (s, 1H), 4.37 (d, *J* = 15 Hz, 1H), 3.77 (dd, *J* = 5, 5 Hz, 1H), 3.15 (d, *J* = 11.7 Hz, 1H), 2.77 (s, 1H), 2.51 (s, 3H); ^{13}C- NMR (126 MHz, MeOD):170.83, 155.86, 138.22, 128.88, 128.14, 127.69, 56.61, 49.25, 40.75, 37.45, 11.62.: Mass (HRMS-ESI): m/z $[M-H]^+$ Calculated for: $C_{14}H_{14}O_4N_2S$-305.0547; Observed: 305.0590, IR (KBr) ν_{max}: 3429 (OH), 1146.7 (O-H), 1517.68 (NO_2), 1378 and 1363(-CH-S-CH_2-) cm^{-1}.

4-(3-methyl-4-nitroisoxazol-5-yl)-5-(p-tolyl) tetrahydrothiophen-3-ol



Yield = 96% (pale yellow semi solid); ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.35 – 7.33 (m, 2H), 7.08 (d, *J* = 10 Hz, 2H), 5.30 (d, *J* = 10 Hz, 1H), 5.060503 (m, 1H), 4.35 – 4.32 (m, 1H), 3.74 (dd, *J* = 5, 5 Hz, 1H), 3.12 (dd, *J* = 5, 5 Hz, 1H), 2.49 (s, 3H), 2.39 (d, *J* = 5 Hz, 1H), 2.28 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$): δ 170.87, 155.79, 138.04, 135.09, 129.54, 127.88, 76.93, 56.58, 48.97, 40.75, 21.07, 11.59. Mass (HRMS-ESI): m/z $[M-H]^+$ Calculated: 319.0689; Observed: 319.0747, IR (KBr) ν_{max}: 3557 (OH), 1145.4 (O-H), 1504.6 (NO_2), 1378.49 and1361 (-CH-S-CH_2-) cm^{-1}.

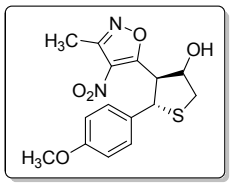
5-(2-hydroxyphenyl)-4-(3-methyl-4-nitroisoxazol-5-yl) tetrahydrothiophen-3-ol



Yield = 90% (yellow semi solid);
^{1}H NMR (500 MHz, $CDCl_3$): ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.86 (d, *J* = 10 Hz, 1H), 7.74-7.56 (m, 2H), 7.40 (t, *J* =10 Hz, 1H), 5.73 (d, *J* = 10 Hz, 1H), 5.29 (d, *J* = 10 Hz, 1H), 5.12 (s, 1H), 4.63 – 4.56 (m, 1H), 3.73 (dd, *J* = 5, 5 Hz, 1H), 3.40 – 3.17 (m, 1H), 3.18 (dd, *J* = 5, 5 Hz, 5H), 2.48 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$): δ 170.24, 155.94, 150.18, 133.27, 130.86, 129.84, 128.9, 124.71,

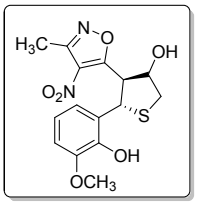
124.19, 55.12, 44.10, 43.72, 40.59, 37.83, 11.56. Mass (HRMS-ESI): m/z $[M-H]^+$ Calculated: 321.0540; Observed: 321.0539.

5-(4-methoxyphenyl)-4-(3-methyl-4-nitroisoxazol-5-yl) tetrahydrothiophen-3-ol



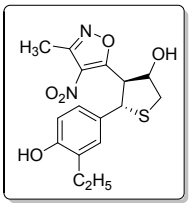
Yield = 95% (pale yellow semi solid);
Mass (HRMS-ESI): m/z $[M-H]^+$Calculated: 335.06891; Observed: 335.0696
IR (KBr) ν_{max}: 3435 (OH), 1175.24 (O-H), 1513.44 (NO_2), 1378.8 and 1363.4(-CH-S-CH_2-) cm^{-1}.

5-(2-hydroxy-3-methoxyphenyl)-4-(3-methyl-4-nitroisoxazol-5-)tetrahydrothiophen-3-ol



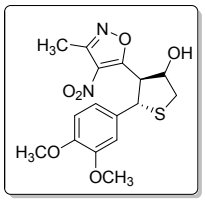
Yield = 90% (pale yellow semi solid);
^1H NMR (500 MHz, $CDCl_3$): δ 6.95 (d, *J* = 5 Hz,1H), 6.82 – 6.74 (m, 2H), 6.02 (s, 1H), 5.58 (d, *J* = 10 Hz, 1H), 5.04 – 5.03 (t, 1H), 4.76 – 4.62 (m, 1H), 3.85 (s, 3H), 3.73 (dd, *J* = 5, 5 Hz, 1H), 3.10 (t, *J* = 15 Hz, 1H), 2.66 (d, *J* = 5 Hz, 1H), 2.49 (s, 12H). ^{13}C NMR (126 MHz, $CDCl_3$): δ 171.41, 155.76, 146.71, 144.04, 123.90, 120.66, 119.89, 110.25, 77.13, 56.10, 52.96, 43.87, 40.97, 11.62, Mass (HRMS-ESI): m/z $[M-H]^+$Calculated: 351.0642; Observed: 351.0645.

5-(3-ethyl-4-hydroxyphenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol



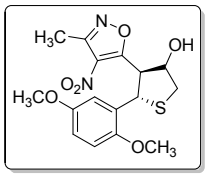
Yield = 90% (yellow semi solid);
^1H NMR (500 MHz, $CDCl_3$): δ 6.97 (s, 1H), 6.92 (d, *J* =10 Hz, 1H), 6.77 (d, *J* = 10 Hz, 1H), 5.77 (s, 1H), 5.29 – 5.24 (m, 1H), 5.01 (s, 1H), 4.32-4.29 (m, 1H), 4.10 (q, *J* = 10 Hz, 2H), 3.72 (d, *J* = 15.0 Hz, 1H), 3.09 (d, *J* = 10.0 Hz, 1H), 2.47 (s, 3H), 1.40 (t, *J* = 5 Hz, 3H). ^{13}C NMR (126 MHz, $CDCl_3$): δ 170.98, 155.80, 145.57, 129.36, 120.96, 114.49, 76.59, 56.61, 49.64, 40.55, 14.78, 11.56, Mass (ESI-ms): m/z $[M-H]^+$ Calculated: 336; Observed: 335(M-1). IR (KBr)ν_{max}: 3415 (OH), 1139.3 (O-H), 1516.4 (NO_2),1379.2 and1364(-CH-S-CH_2-) cm^{-1}.

5-(3,4-dimethoxyphenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol



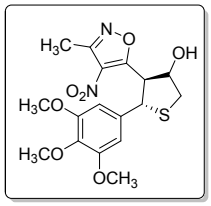
Yield = 99% (white semi solid);
^1H NMR (500 MHz, $CDCl_3$): δ 7.02 – 7.01 (m, 2H), 6.78 – 6.76 (m, 1H), 5.32 (d, *J* = 10 Hz, 1H), 5.07-506 (m, 1H), 4.36 (dd, *J* = 5, 5 Hz, 1H), 3.88 (s, 3H), 3.85 (s, 3H), 3.77 (dd, *J* = 5, 5 Hz, 1H), 3.15 (d, *J* = 10 Hz, 1H), 2.52 (s, 3H), 2.40 (d, *J* = 20 Hz, 1H). IR (KBr) ν_{max}: 3438.9 (OH), 1143.9 (O-H), 1521.22 (NO_2), 1378 and1330 (-CH-S-CH_2-) cm^{-1}, Mass (HRMS-ESI): m/z $[M-H]^+$Calculated: 365.0799; Observed: 365.0801.

5-(2,5-dimethoxyphenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol



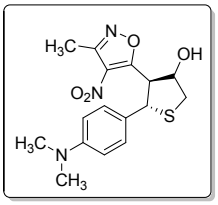
Yield = 95% (White powder); M.P. 153-154^oC;
^1H NMR (500 MHz, $CDCl_3$): δ 7.31 (d, *J* = 10 Hz, 1H), 6.61 (d, *J* = 10 Hz, 2H), 5.28 (d, *J* = 10 Hz, 1H), 5.00 (s, 1H), 4.33 (dd, *J* = 5, 5 Hz, 1H), 3.71 (dd, *J* = 5, 5 Hz, 1H), 3.07 (d, *J* = 10 Hz, 1H), 2.89 (s, 6H), 2.47 (s, 3H), 2.38 (s, 1H). ^{13}C NMR (126 MHz, $CDCl_3$): δ 171.35, 155.74, 150.30, 128.99, 128.80, 128.48, 124.90, 112.56, 112.05, 56.50, 53.84, 49.12, 40.45, 37.53, 11.60. IR (KBr)ν_{max}: 3438.9 (OH), 1143.9 (O-H), 1521.22 (NO_2),1378 and1330 (-CH-S-CH_2-) cm^{-1}.

4-(3-methyl-4-nitroisoxazol-5-yl)-5-(3,4,5-trimethoxyphenyl)tetrahydrothiophen-3-ol



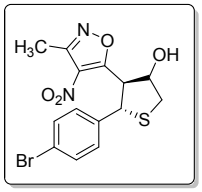
Yield = 90% (pale yellow solid); M.P. 162-161^{o}C;
^{1}H NMR (500 MHz, $CDCl_3$) δ 6.69 (s, 2H), 5.27 (d, *J* = 15 Hz, 1H), 5.04 (s, 1H), 4.31 (dd, *J* = 5,5 Hz, 1H), 3.82 – 3.78 (m, 9H), 3.73 (dd, *J* = 5, 5 Hz, 1H), 3.12 (d, *J* = 10 Hz, 1H), 2.76 (d, *J* = 5 Hz, 1H), 2.48 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.79, 155.82, 153.27, 137.58, 133.42, 130.78, 104.96, 76.57, 60.76 , 56.46, 56.17, 50.03, 40.55, 11.55. Mass (HRMS-ESI): m/z $[M-H]^+$ Calculated: 395.0903 ; Observed: 395.0907. IR (KBr) ν_{max}: 3426.2 (OH), 1128.2 (O-H), 1511.9 (NO_2), 1379.57 and 1361.36(-CH-S-CH_2-)cm^{-1}.

5-(4-(dimethylamino)phenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol



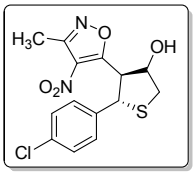
Yield = 90% (yellow semi solid);
^{1}H NMR (500 MHz, $CDCl_3$): δ 7.31 (d, *J* =10 Hz, 2H), 6.61 (d, *J* = 10 Hz, 2H), 5.28 (d, *J* = 10 Hz, 1H), 5.00 (s, 1H), 4.33 (dd, *J* = 5Hz, 1H), 3.71 (dd, *J* = 5, 5 Hz, 1H), 3.07 (d, *J* = 10 Hz, 1H), 2.89 (s, 6H), 2.47 (s, 3H), 2.38 (s, 1H). ^{13}C NMR (126 MHz, $CDCl_3$): δ 171.35, 155.74, 150.30, 128.80, 124.90, 112.56, 112.05, 56.50, 53.84, 49.12, 40.53, 37.53, 11.60. Mass (HRMS-ESI): m/z $[M+H]^+$Calculated: 350.1168; Observed: 350.1169.

5-(4-bromophenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol



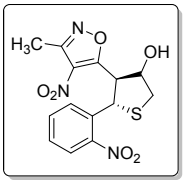
Yield = 98% (pale yellow- white solid); M.P. 174-175^{o}C;
1H NMR (500 MHz, DMSO): δ 7.45 (d, *J* =10 Hz, 2H), 7.33 (d, *J* = 10 Hz, 2H), 6.12 (d, *J* =10 Hz, 1H), 5.05 (d, *J* =5 Hz, 1H), 4.35-4.32 (m, 1H), 3.75-3.72 (m, 1H), 3.13-3.10 (m, 1H), 2.51 (s, 1H), 2.40 (s, 3H). 13C NMR (126 MHz, DMSO): δ 171.39, 156.42, 139.18, 131.96, 130.33, 121.47, 77.22, 55.20, 48.52, 36.93, 11.52. Mass (HRMS-ESI): m/z $[M-H]^+$Calculated: 382.9694; Observed: 382.9695. IR (KBr)ν_{max}: 3550.3 (OH), 1145.9 (O-H), 1507 (NO2),1377 and1362 (-CH-S-CH2-) cm-^{1}.

5-(4-chlorophenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol



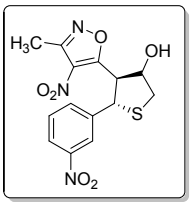
Yield = 98% (pale yellow solid); M.P. 133-134^{o}C;
1H NMR (500 MHz, CDCl3): δ 7.41 (d, *J* = 10 Hz, 1H), 7.28 (dd, *J* = 5, 5 Hz, 3H), 5.29 (d, *J* = 15 Hz, 1H), 5.05 (s, 1H), 4.28 (d, *J* = 10 Hz, 1H), 3.72 (d, *J* = 10 Hz, 1H), 3.12 (d, *J* = 10 Hz, 1H), 2.61 (s, 1H), 2.50 (s, 3H). Yield = % (Pale yellow solid); M.P: 133-134^{o}C. IR (KBr) ν_{max}: m/z $[M-H]^+$Calculated: 339.0211; Observed: 339.0200.

4-(3-methyl-4-nitroisoxazol-5-yl)-5-(2-nitrophenyl)tetrahydrothiophen-3-ol



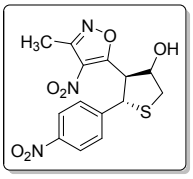
Yield = 99% ((pale yellow semi solid).
Mass (HRMS-ESI): m/z $[M-H]^+$Calculated: 350.0437; Observed: 350.0441
IR (KBr) ν_{max}: 3411.33 (OH), 1146.06 (O-H), 1516.04 (NO_2), 1365 and1352(-CH-S-CH_2-) cm^{-1}.

4-(3-methyl-4-nitroisoxazol-5-yl)-5-(3-nitrophenyl)tetrahydrothiophen-3-ol



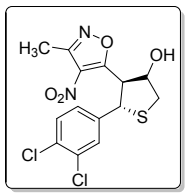
Yield = 99% (White powder); M.P. 147-148^{o}C;
^{1}H NMR (500 MHz, DMSO): δ 8.32 (d, *J* = 34.9 Hz,1H), 8.06 (d, *J* = 15 Hz, 1H), 7.97 – 7.83 (m, 1H), 7.58 (t, *J* =5 Hz, 1H),), 5.64 (d, *J* = 10 Hz, 1H), 5.03 (s, 1H), 4.35 (dd, *J* = 5, 5 Hz, 1H), 3.74 (dd, *J* = 5, 5 Hz, 1H), 3.11 (dd, *J* = 5, 5 Hz, 1H), 2.60 (d, *J* = 10 Hz, 1H), 2.52 (s, 3H). ^{13}C NMR (126 MHz, DMSO): δ 170.94, 156.27, 148.37, 141.63, 135.60, 130.66, 123.30, 77.21, 75.50, 56.01, 48.65, 11.49. Mass (HRMS-ESI): m/z [M-H]$^{+}$Calculated: 350.0438; Observed: 350.0441.

4-(3-methyl-4-nitroisoxazol-5-yl)-5-(4-nitrophenyl)tetrahydrothiophen-3-ol



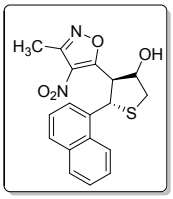
Yield = 99% (White powder); M.P. 189-190^{o}C;
1H NMR (500 MHz, DMSO): δ 8.9 (d, *J* = 5 Hz,2H), 7.77 (d, *J* = 5 Hz, 1H), 7.68 (d, *J* = 5 Hz, 1H), 5.93 (s, 1H), 5.31 (d, *J* = 10 Hz, 1H), 4.99 (s, 1H), 2.99 (d, *J* = 10 Hz, 18H), 2.51 (s, 1H), 2.38 (s, 3H). 13C NMR (126 MHz, DMSO): δ 170.86, 156.25, 147.40, 147.13, 130.04, 129.62, 124.14, 77.35, 75.52, 55.80, 48.65, 11.48. Mass (HRMS-ESI): m/z [M-H]$^{+}$ Calculated: 350.0436; Observed: 350.0441.
IR (KBr) ν_{max}: 3468 (OH), 1144.7 (O-H), 1517.30 (NO_2), 1379.4 and 1346.9(-CH-S-CH_2-) cm^{-1}.

5-(3,4-dichlorophenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol



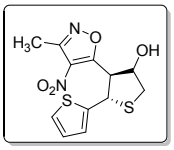
Yield = 99% (White solid); M.P. 113-114 ^{o}C;
Mass (HRMS-ESI): m/z [M-H]$^{+}$Calculated: 372.9805; Observed: 372.9811.
IR (KBr) νmax: 3414.5 (OH), 1149.1 (O-H), 1514.12(NO_2), 1378 and1369 (-CH-S-CH_2-) cm^{-1}.

4-(3-methyl-4-nitroisoxazol-5-yl)-5-(naphthalen-1-yl)tetrahydrothiophen-3-ol



Yield = 97% (White solid); M.P. 137-138^{o}C;
^{1}H NMR (500 MHz, $CDCl_3$): δ 8.24 (d, *J* = 10 Hz, 1H), 7.84 (d, *J* = 10 Hz, 1H), 7.75 (d, *J* = 10 Hz, 1H), 7.60 – 7.55 (m, 2H), 7.50 (t, *J* = 10 Hz, 1H), 7.38 (t, *J* = 10 Hz, 1H), 6.11 (d, *J* = 15 Hz, 1H), 5.14 (s, 1H), 4.84 (dd, *J* = 5, 5 Hz, 1H), 3.77 (dd, *J* = 5, 5 Hz, 1H), 3.22 (dd, *J* = 5, 5 Hz, 1H), 2.47 (s, 3H), 2.43 (s, 1H). ^{13}C NMR (126 MHz, $CDCl_3$): δ 170.88, 155.74, 133.92, 131.89, 128.83, 126.66, 126.11, 125.49, 123.22, 53.23, 40.65, 11.57. Mass (HRMS-ESI): m/z [M-H]$^{+}$Calculated: 355.0749; Observed: 355.0747.
IR (KBr) ν_{max}: 3566 (OH), 1148.14 (O-H), 1533.5 (NO_2), 1376.7 and1364.16 (-CH-S-CH_2-) cm^{-1}.

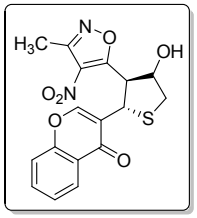
4-(3-methyl-4-nitroisoxazol-5-yl)-5-(thiophen-2-yl)tetrahydrothiophen-3-ol



Yield = 98% (White semi solid);
^{1}H NMR (500 MHz, $CDCl_3$): δ 7.19 (d, *J* = 5. Hz, 1H), 7.02 (d, *J* = 5 Hz, 1H), 6.85 (dd, *J* = 5, 5 Hz, 1H), 5.64 (d, *J* = 10 Hz, 1H), 5.03 (s, 1H), 4.35 (dd, *J* = 5, 5 Hz, 1H), 3.74 (dd, *J* = 5, 5 Hz, 1H), 3.11 (dd, *J* = 5, 5 Hz, 1H), 2.60 (d, *J* = 10 Hz, 1H), 2.52 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$): δ 170.49, 155.92, 142.68, 127.02, 126.45, 125.54, 76.67, 57.59, 44.81, 40.57, 11.60. Mass (HRMS-ESI): m/z [M-H]$^{+}$Calculated: 311.0154; Observed: 311.0154.

IR (KBr) ν_{max}: 3515.7 (OH), 1141.43 (O-H), 1515 (NO_2), 1378 and1361 (-CH-S-CH_2-) cm^{-1}

3-(4-hydroxy-3-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-2-yl)-4H-chromen-4-one

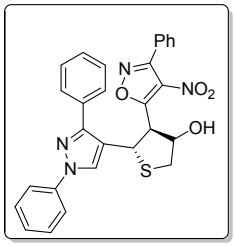


Yield = 99% (White solid)

^{1}H NMR (500 MHz, DMSO): δ 8.44 (d, *J* = 45.1 Hz, 1H), 8.08 – 7.98 (m, 1H), 7.80-7.75 (m, 1H), 7.58 (t, *J* = 5 Hz, 1H), 7.50 – 7.46 (m, 1H), 5.21 (d, *J* = 10 Hz, 1H), 4.96 (s, 1H), 3.27 (t, *J* = 10 Hz, 1H), 3.14 (dd, *J* = 5, 5 Hz, 1H), 2.94 (d, *J* = 15 Hz, 1H), 2.51 (s, 1H), 2.40 (s, 3H). ^{13}C NMR (126 MHz, DMSO): δ 176.22, 172.47, 171.63, 156.39, 155.28, 134.94, 126.21, 125.45, 123.42, 122.65, 121.27, 118.79, 77.79, 75.23, 50.80, 50.09, 11.59.

IR (KBr) ν_{max}: Mass (HRMS-ESI): m/z $[M-H]^+$Calculated: 373.0489; Observed: 373.0488.

5-(1,3-diphenyl-1H-pyrazol-4-yl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol

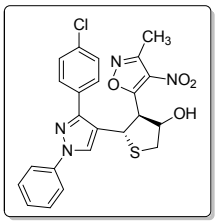


Yield = 99% (White powder); M.P. 184-185^{o}C;

^{1}H NMR (500 MHz, $CDCl_3$): δ 8.06 (s, 1H), 7.68 (d, *J* = 5 Hz, 2H), 7.63 – 7.59 (t, *J* = 2 Hz 2H), 7.45 – 7.36 (m, 5H), 7.28 (t, *J* = 15 Hz, 1H), 5.43 (d, *J* = 10 Hz,1H), 4.91 (s, 1H), 4.45 (dd, *J* = 5, 5 Hz, 1H), 3.62 (dd, *J* = 5,5 Hz, 1H), 3.10 (d, *J* = 10 Hz, 1H), 2.46 (s, 3H), 2.43 (d, *J* = 5 Hz, 1H). ^{13}C NMR (126 MHz, $CDCl_3$): δ 170.50, 155.61, 152.27, 139.64, 132.52, 129.45, 128.69, 128.43, 126.75, 126.24, 119.42, 119.02, 54.84, 40.62, 40.31, 11.57: Mass (HRMS-ESI): m/z $[M-H]^+$Calculated: 447.1117; Observed: 447.1121.

IR (KBr) ν_{max}: 3304 (OH), 1144 (O-H), 1519.38 (NO_2), 1380 and1364 (-CH-S-CH_2-) cm^{-1}.

5-(3-(4-chlorophenyl)-1-phenyl-1H-pyrazol-4-yl)-4-(3-methyl-4-nitroisoxazol-5-l)tetrahydrothiophen-3-ol

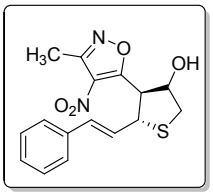


Yield = 99% (White powder); M.P. 190-191^{o}C;

^{1}H NMR (500 MHz, $CDCl_3$): δ 8.05 (s, 1H), 7.67 (d, *J* = 5 Hz, 2H), 7.58 (d, *J* = 10 Hz, 2H), 7.46-7.42 (m, 3H), 7.31-7.26 (m, 2H), 5.40 (d, *J* = 10 Hz, 1H), 4.96 (s, 1H), 4.46 (d, *J* = 15 Hz, 1H), 3.66 (dd, *J* = 5, 5 Hz, 1H), 3.13 (d, *J* = 10 Hz, 1H), 2.49 (s, 3H), 2.32 (s, 1H). ^{13}C NMR (126 MHz, $CDCl_3$): δ 170.38, 155.72, 139.54, 134.50, 131.03, 129.73, 129.49, 128.94, 126.91, 126.29, 119.33, 119.04, 54.96, 40.67, 40.22, 11.55. Mass (HRMS-ESI): m/z $[M-H]^+$Calculated: 481.0720; Observed: 481.0731.

IR (KBr) ν_{max}: 3389.3 (OH), 1149.92 (O-H), 1515.06 (NO_2), 1379 and1370 (-CH-S-CH_2-) cm^{-1}.

4-(3-methyl-4-nitroisoxazol-5-yl)-5-styryltetrahydrothiophen-3-ol compound with (E)-5-(4-methoxystyryl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol

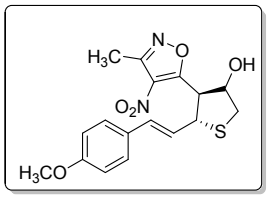


Yield = 90% (pale yellow powder); M.P. 153-154^{o}C;

H NMR (500 MHz, $CDCl_3$): δ 7.33 – 7.21 (m, 5H), 6.60 (d, *J* = 15 Hz, 1H), 6.10 (dd, *J* = 10, 10 Hz, 1H), 5.97 – 4.93 (m, 2H), 4.13 (dd, *J* = 5, 10 Hz, 1H), 3.57 (dd, *J* = 5, 5 Hz, 1H), 3.05 (d, *J* = 15 Hz, 1H), 2.54 (s, 3H), 2.44 (dd, *J* = 5, 5 Hz, 1H). ^{13}C NMR (126 MHz, $CDCl_3$): δ 170.87, 155.86, 135.81, 133.54, 128.62, 128.13, 126.59, 54.40, 48.49, 40.50, 11.59, Mass (HRMS-ESI): m/z $[M-H]^+$ Calculated: 331.0747; Observed: 331.0747.

IR (KBr) ν_{max}: 3476 (OH), 1147.3 (O-H), 1520.08 (NO_2), 1378 and1366 (-CH-S-CH_2-) cm^{-1}.

5-(4-methoxystyryl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol

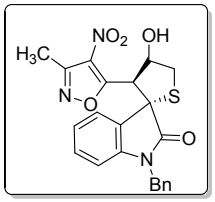


Yield = 85% (White semi solid);

^{1}H NMR (500 MHz, $CDCl_3$): δ 7.26 (d, *J* = 10.0 Hz, 2H), 6.82 (d, *J* = 5 Hz, 2H), 6.54 (d, *J* = 20 Hz, 1H), 5.94 (dd, *J* = 5, 10 Hz, 1H), 4.94 (dd, *J* = 5, 10 Hz, 2H), 4.12 (dd, *J* = 5, 5 Hz, 1H), 3.79 (s, 3H), 3.58 (dd, *J* = 5, 5 Hz, 1H), 3.05 (d, *J* = 10 Hz, 1H), 2.54 (s, 3H), 2.36 (d, *J* = 10 Hz, 1H). ^{13}C NMR (126 MHz, $CDCl_3$): δ 170.97, 159.61, 155.82, 132.98, 128.58, 127.82, 124.25, 114.03, 55. 32, 54.47, 48.67, 40.48, 11.62.

Mass (HRMS-ESI): m/z $[M-H]^+$ Calculated: 361.0851; Observed: 361.0852.

1-benzyl-4'-hydroxy-3'-(3-methyl-4-nitroisoxazol-5-yl)-4',5'-dihydro-3'H-spiro[indoline-3,2'-thiophen]-2-one

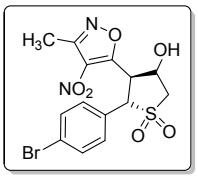


Yield = 99% (White semi solid);

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.82 (d, *J* = 10 Hz, 1H), 7.31 – 7.23 (m, 7H), 7.18-7.13 (m, 1H), 5.27 (d, *J* = 20 Hz, 2H), 5.13 – 5.11 (m, 1H), 3.72 (d, *J* = 10 Hz, 1H), 3.57 (d, *J* = 5 Hz, 1H), 3.16 (t, *J* = 10 Hz, 2H), 2.54 (s, 3H), 2.39 (s, 1H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 173.76, 171.70, 155.59, 143.05, 134.93, 129.92, 128.84, 127.67, 126.90, 124.85, 123.45, 109.82, 79.21, 63.42, 44.47, 44.09, 33.93, 11.69.

Mass (ESI-Ms): m/z Calculated: 437; Observed: 438(M+1).

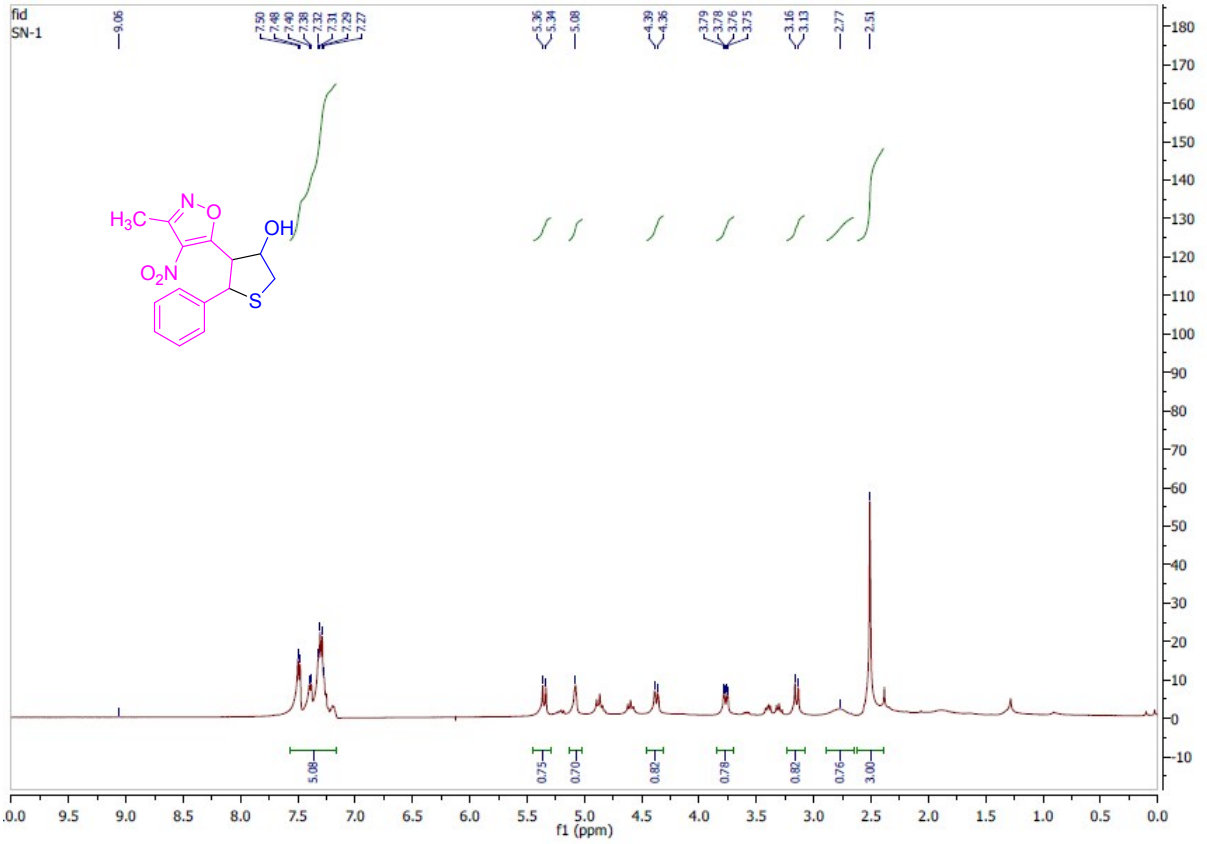
2-(4-bromophenyl)-4-hydroxy-3-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophene1,1-dioxide

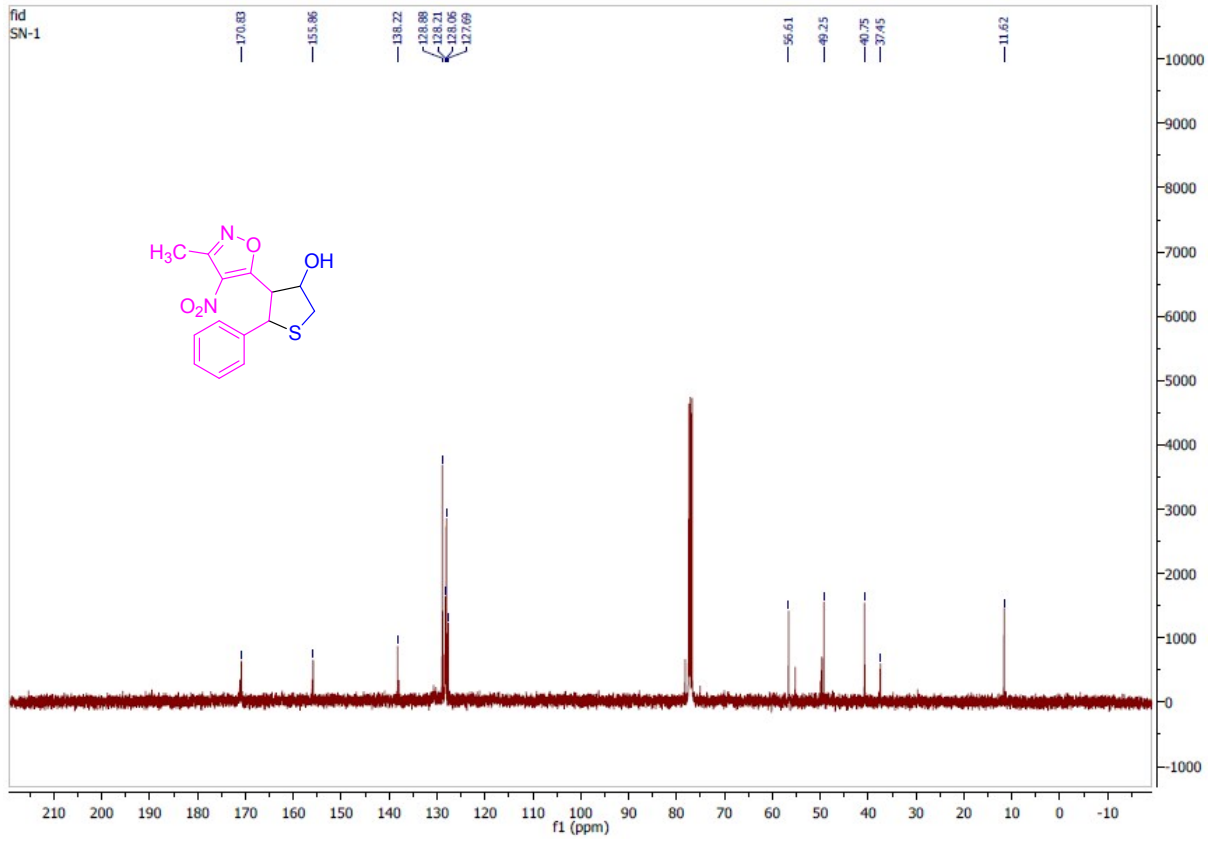


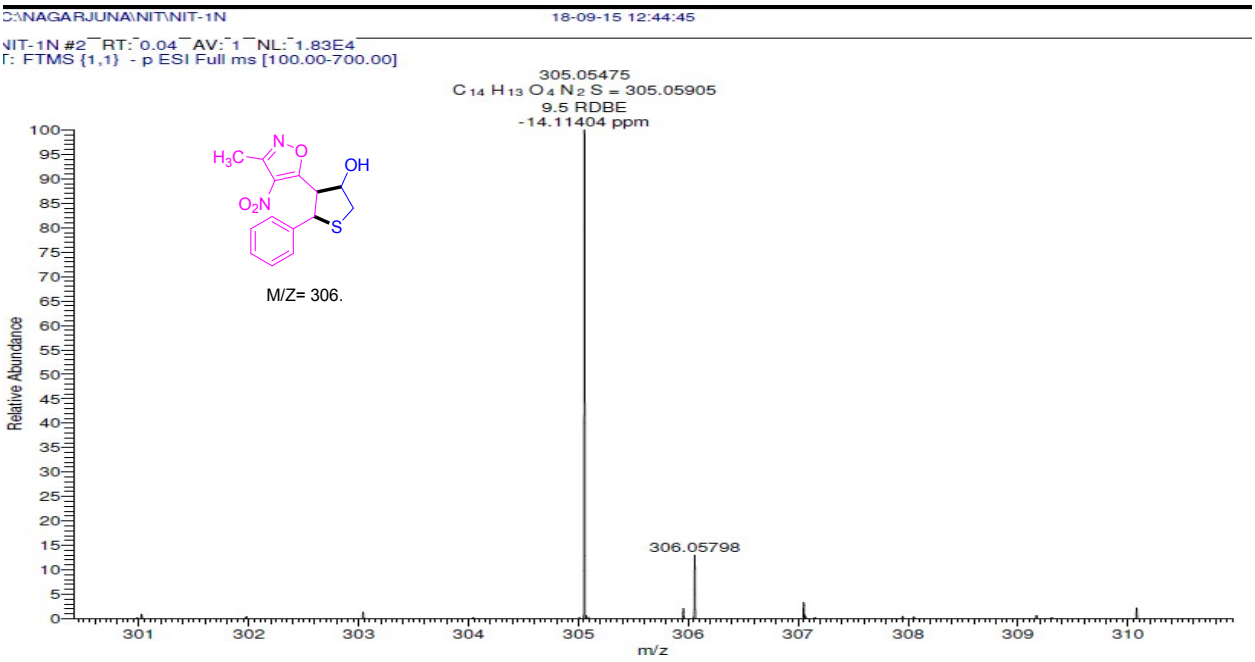
Mass (ESI-Ms): m/z Calculated: 414.9587; Observed: 414.9594

Mass (HRMS-ESI): m/z $[M-H]^+$ Calculated: 414; Observed: 414.

4-(3-methyl-4-nitroisoxazol-5-yl)-5-phenyltetrahydrothiophen-3-ol



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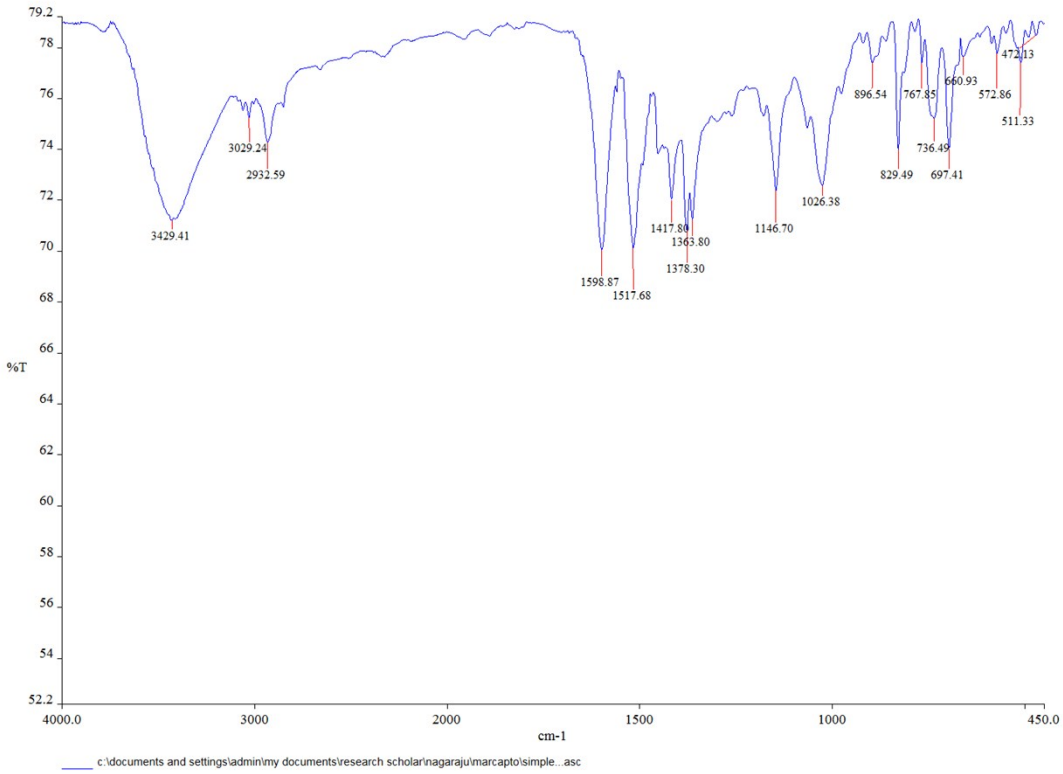
18-09-15 12:44:45
NIT-1N #2 RT: 0.04 AV: 1 NL: 1.83E4
T: FTMS {1,1} - p ESI Full ms [100.00-700.00]
305.05475
C14 H13 O4 N2 S = 305.05905
9.5 RDBE
-14.11404 ppm
306.05798
Relative Abundance
m/z

M/Z= 306.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1417.88
1363.80
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1146.70
1026.38
896.54
829.49
767.85
736.49
697.41
660.93
572.86
511.33
472.13
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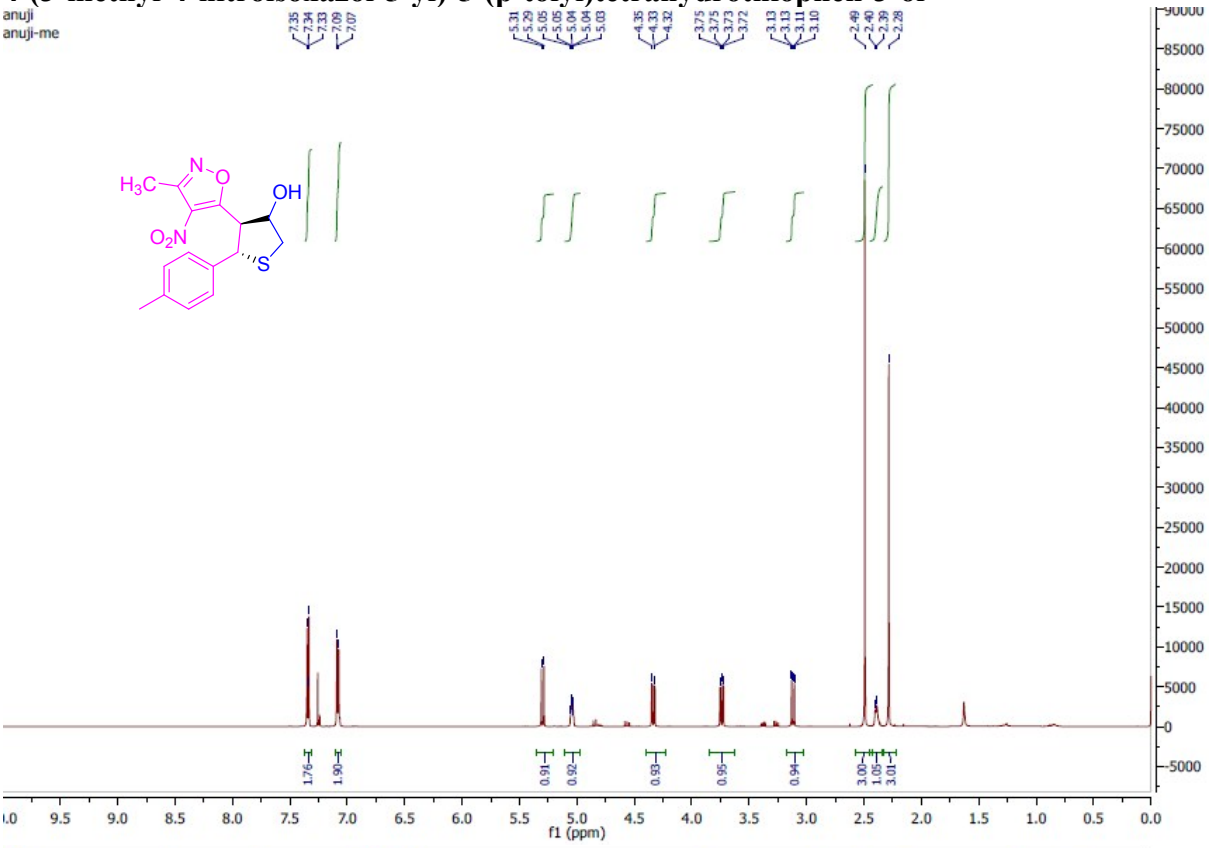
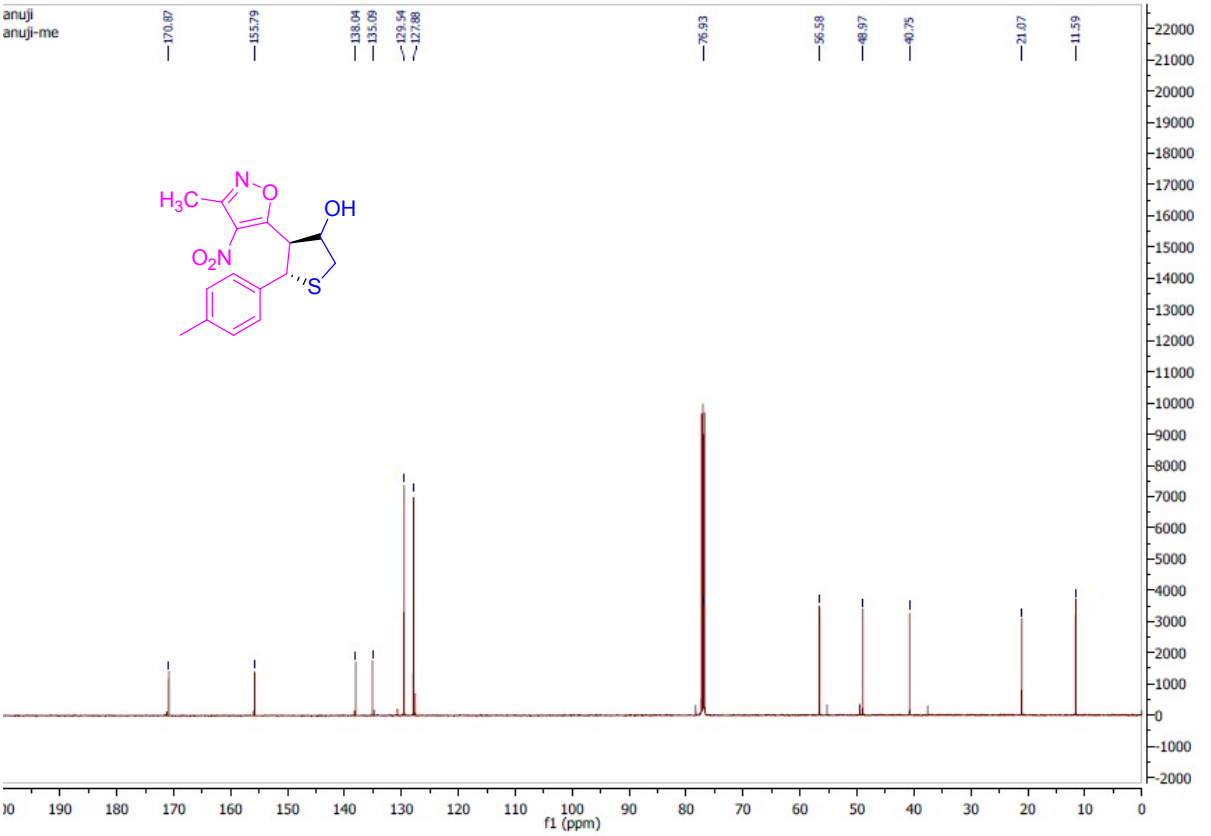
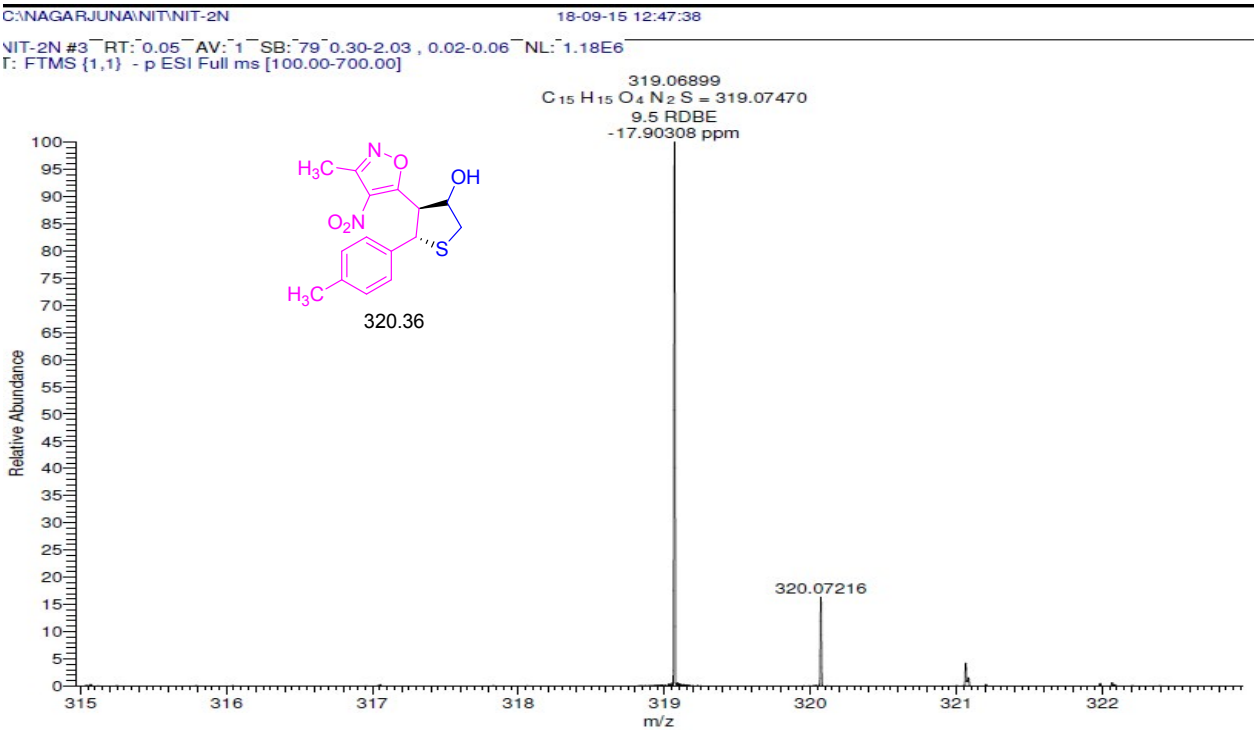
4-(3-methyl-4-nitroisoxazol-5-yl)-5-(p-tolyl)tetrahydrothiophen-3-ol



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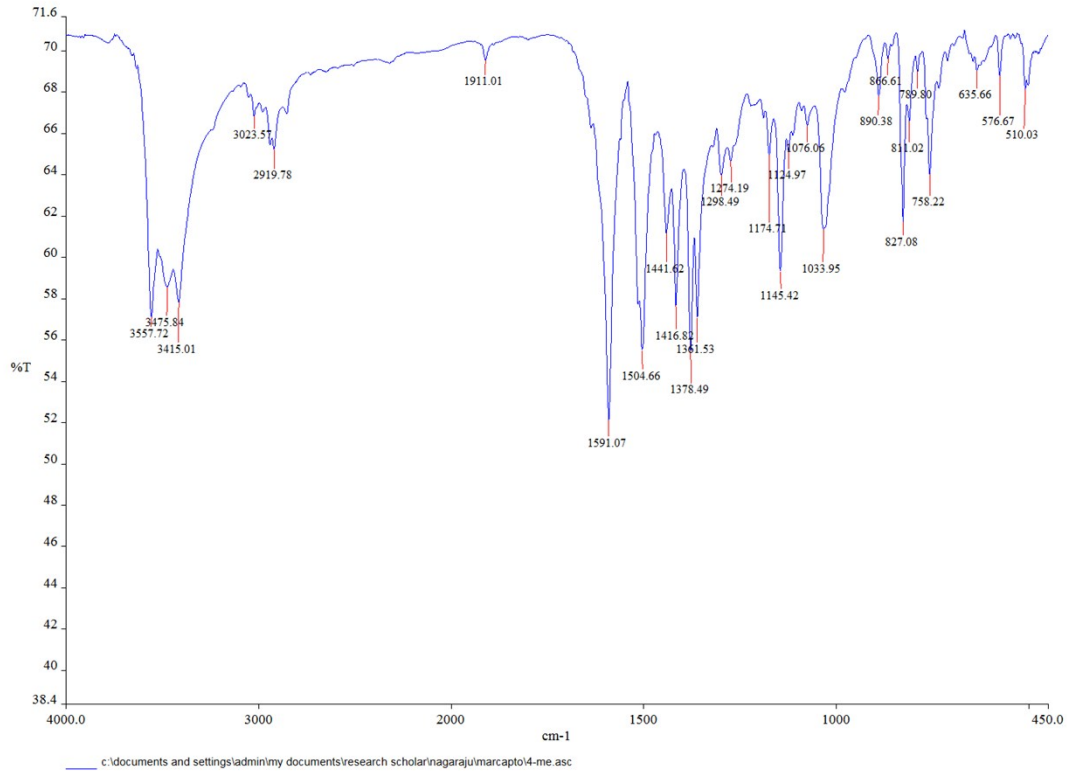
18-09-15 12:47:38
NIT-2N #3 RT: 0.05 AV: 1 SB: 79 0.30-2.03 , 0.02-0.06 NL: 1.18E6
T: FTMS {1,1} - p ESI Full ms [100.00-700.00]
319.06899
C15 H15 O4 N2 S = 319.07470
9.5 RDBE
-17.90308 ppm
320.36
320.07216
Relative Abundance
m/z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1361.53
1378.49
1298.49
1274.19
1174.71
1145.42
1124.97
1076.06
1033.95
890.38
866.61
827.08
811.02
789.80
758.22
635.66
576.67
510.03
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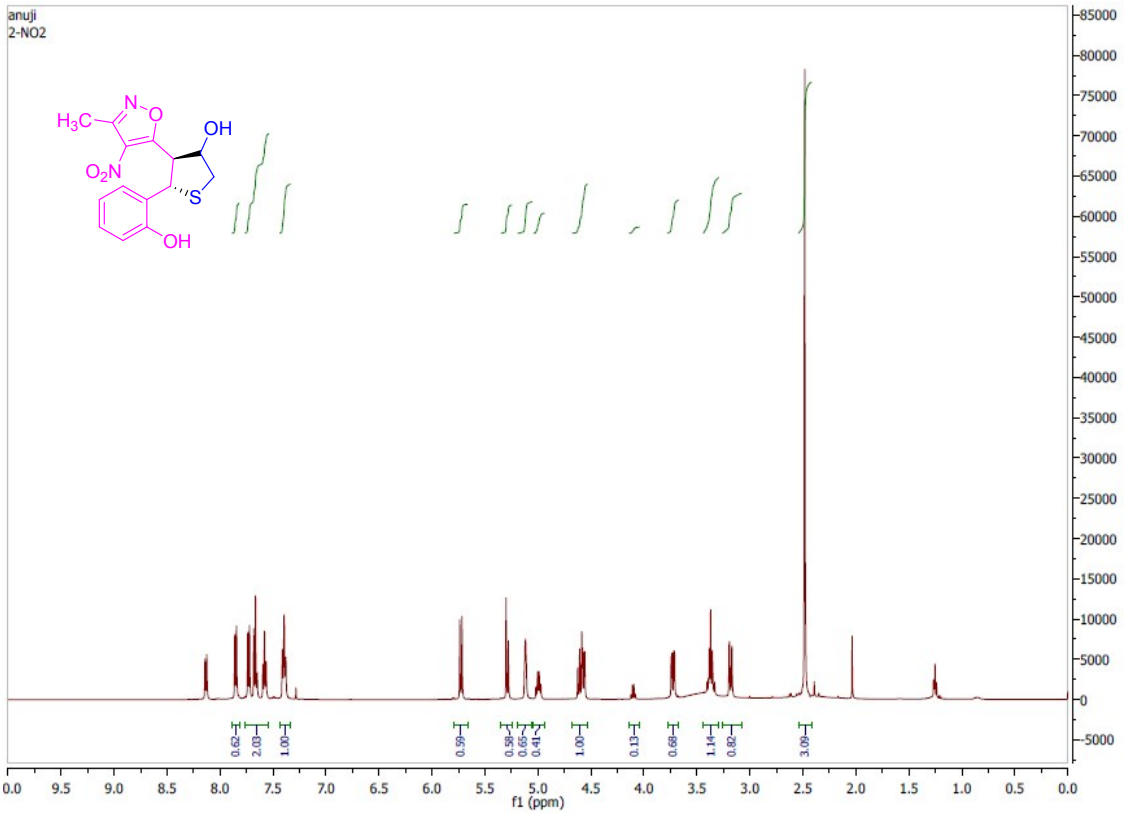
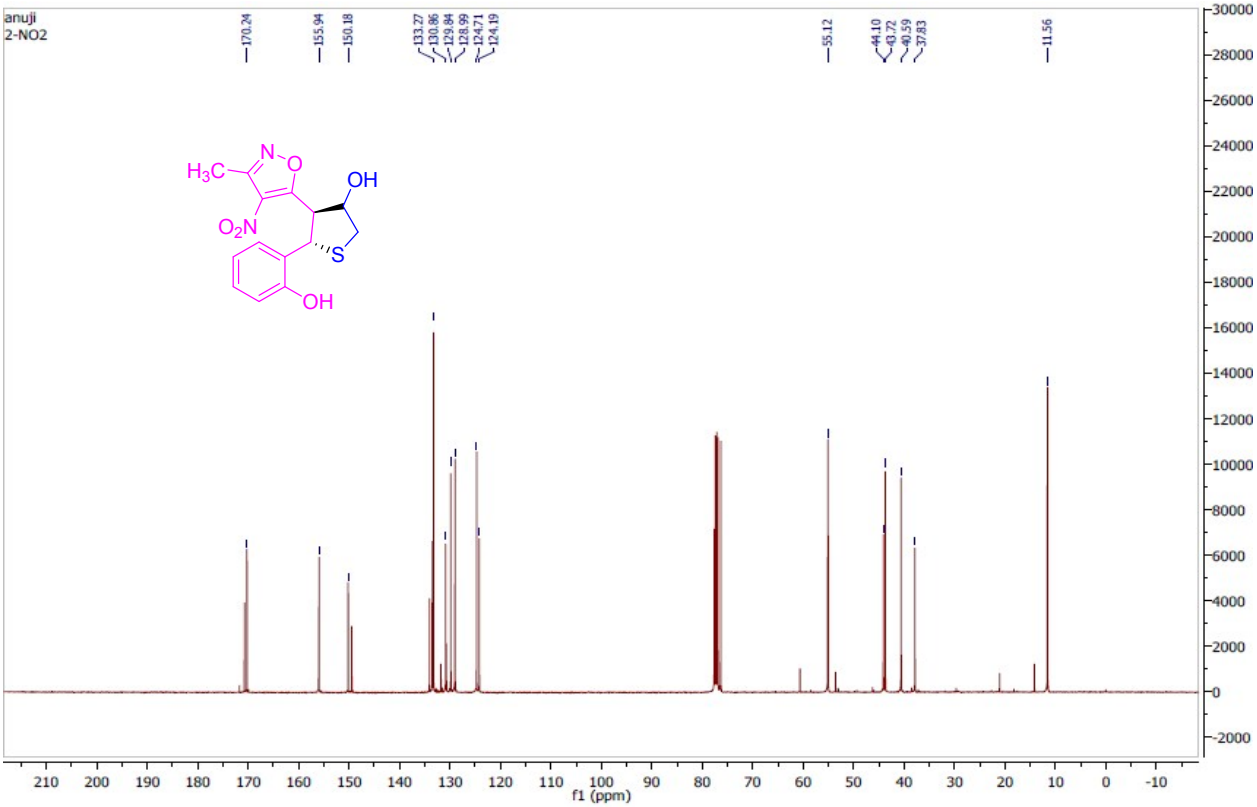
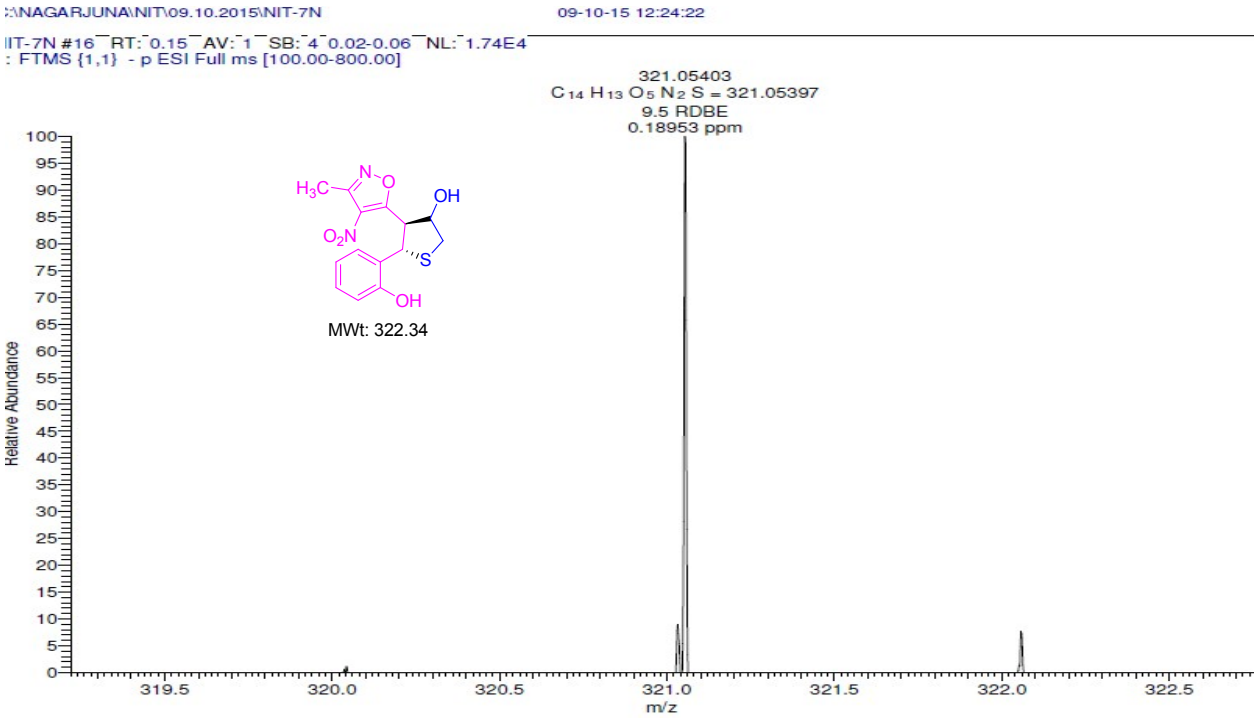
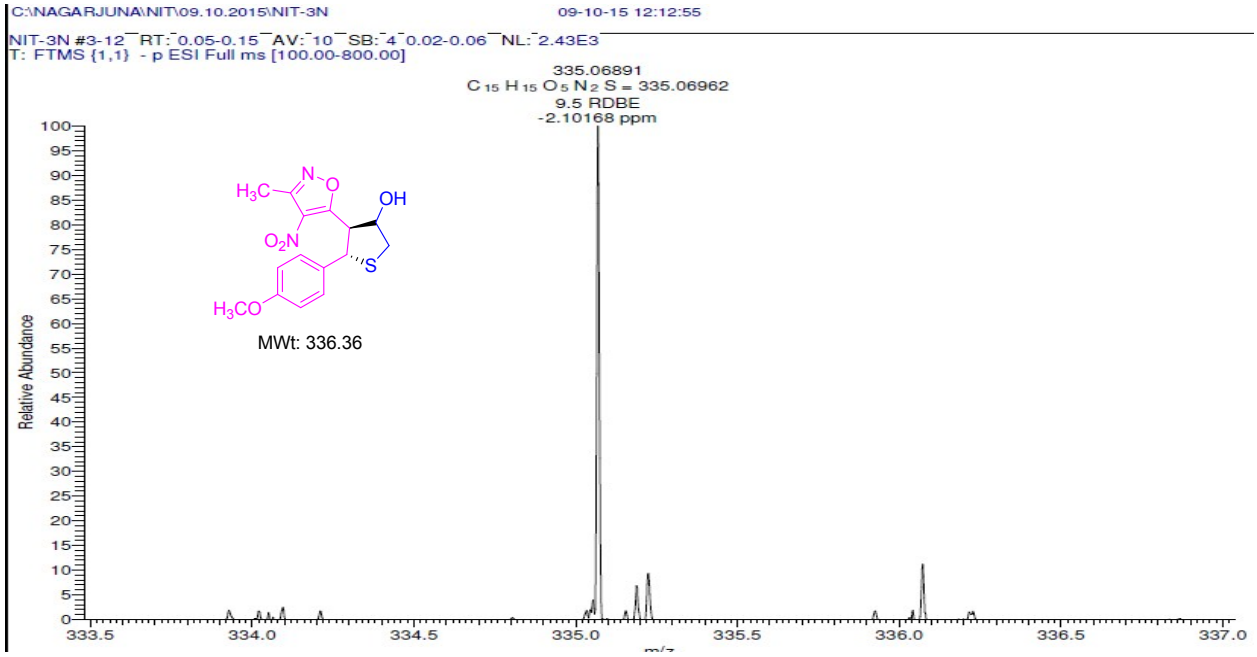
5-(2-hydroxyphenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol

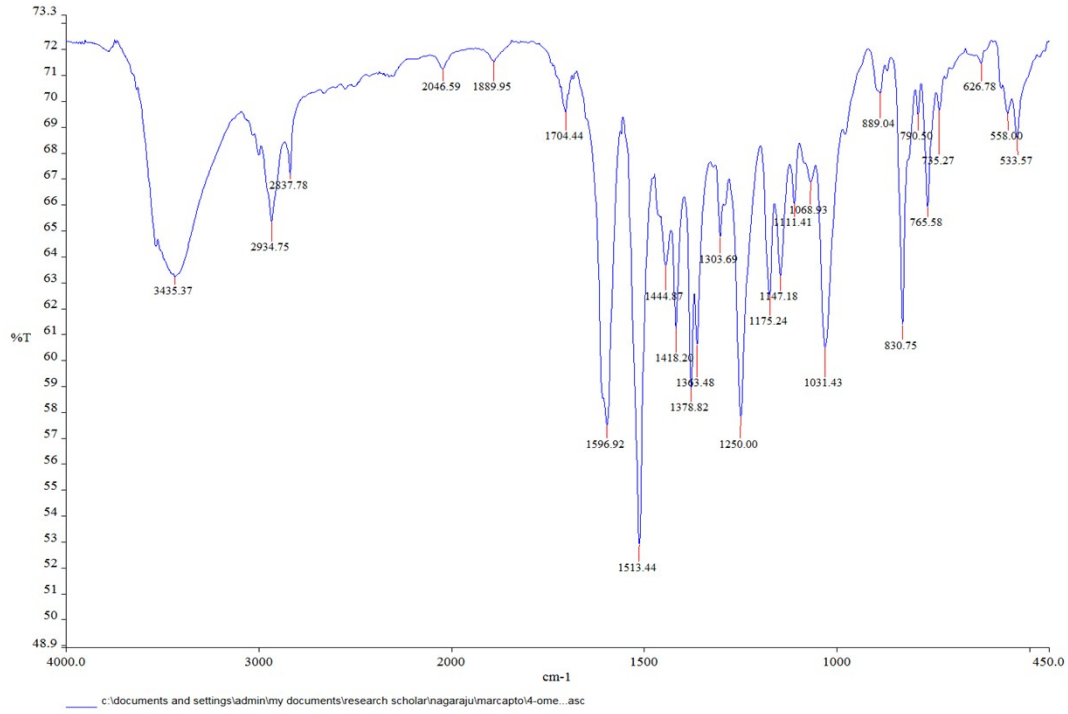




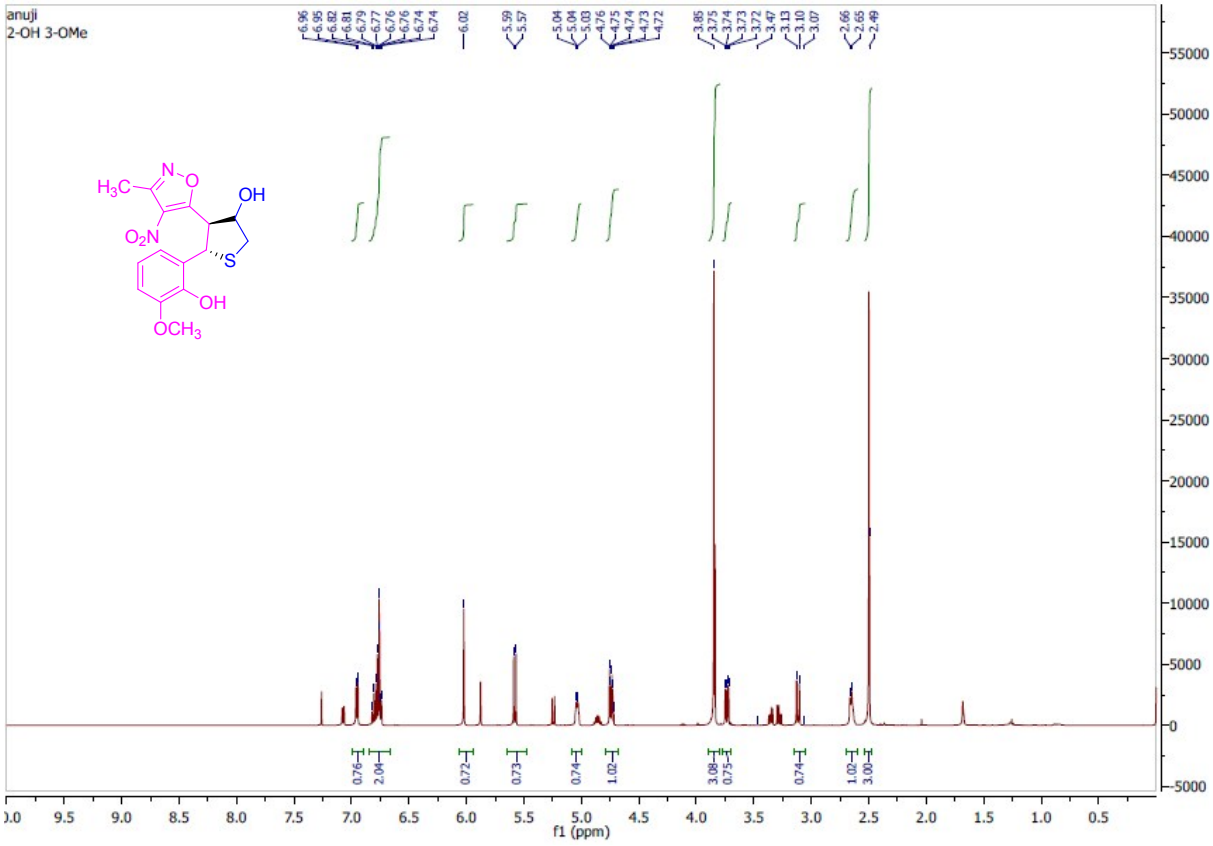


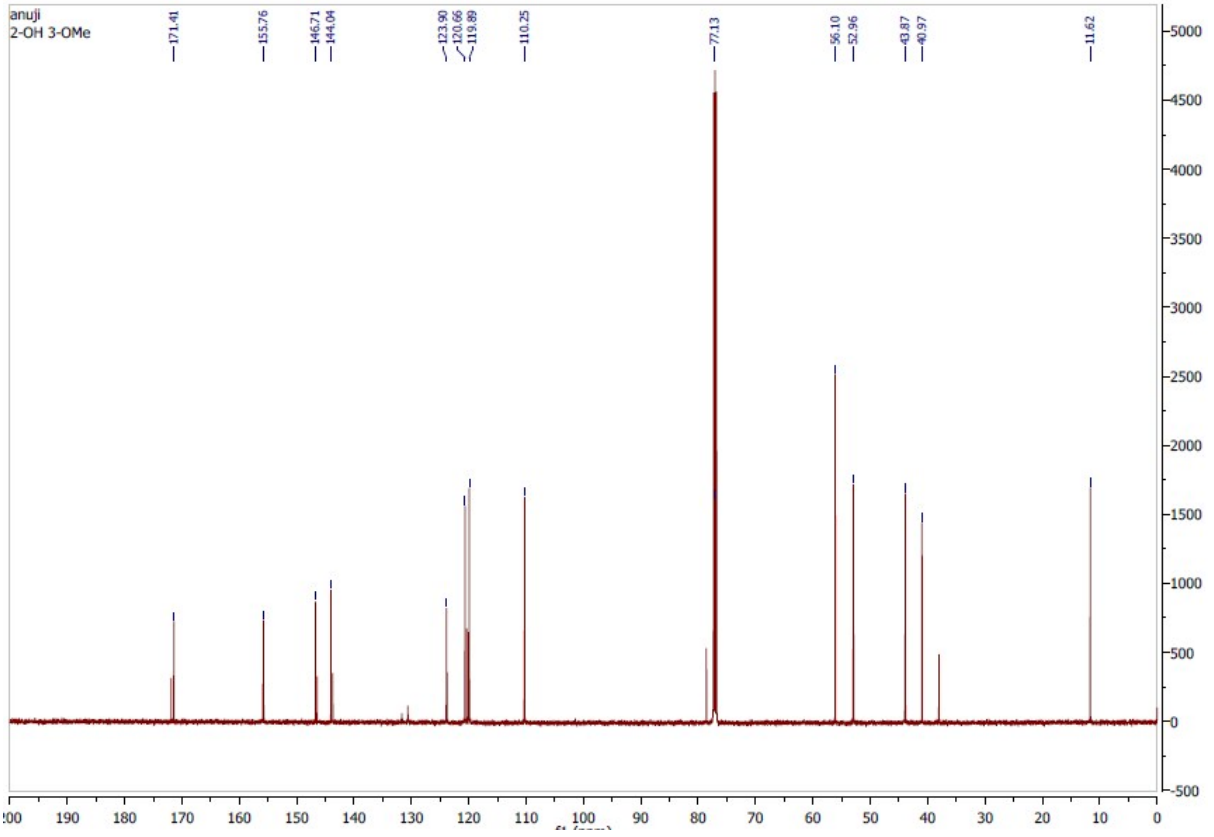
5-(4-methoxyphenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol

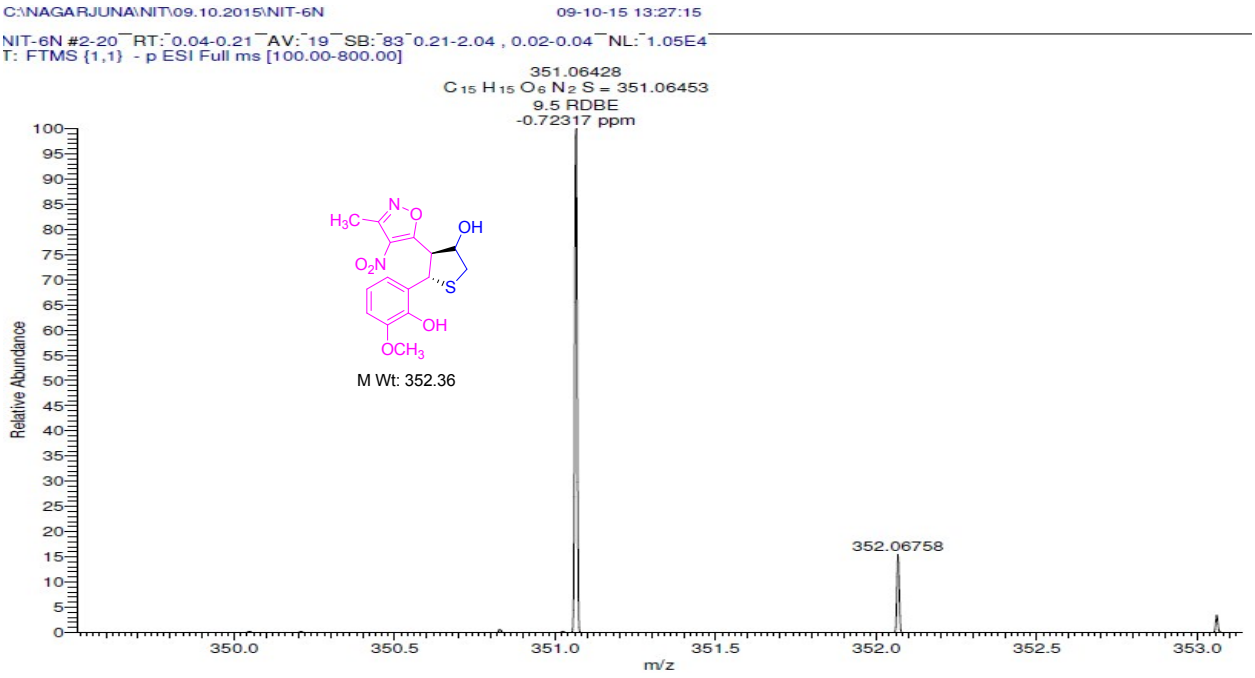




5-(2-hydroxy-3-methoxyphenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol




anuji
2-OH 3-OMe
171.41
155.76
146.71
144.04
123.90
120.66
119.89
110.25
77.13
56.10
52.96
43.87
40.97
11.62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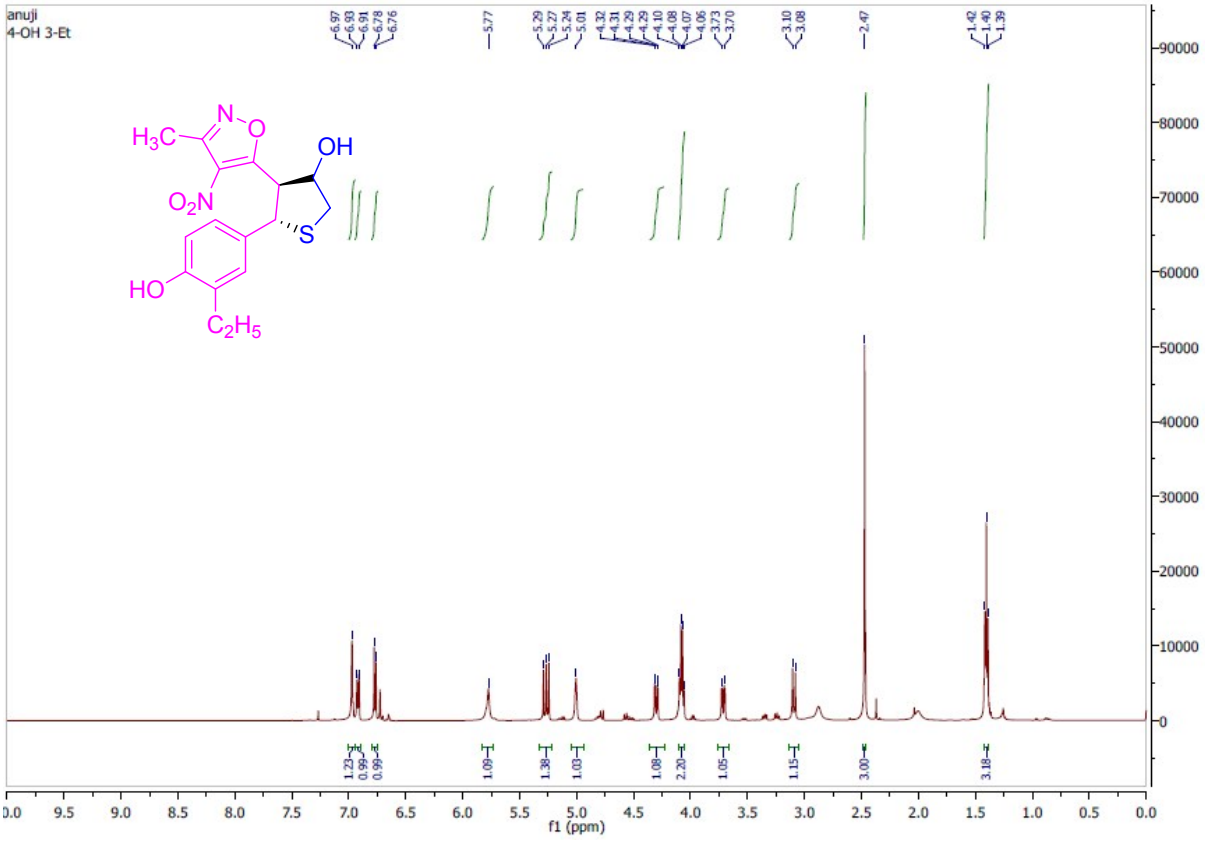
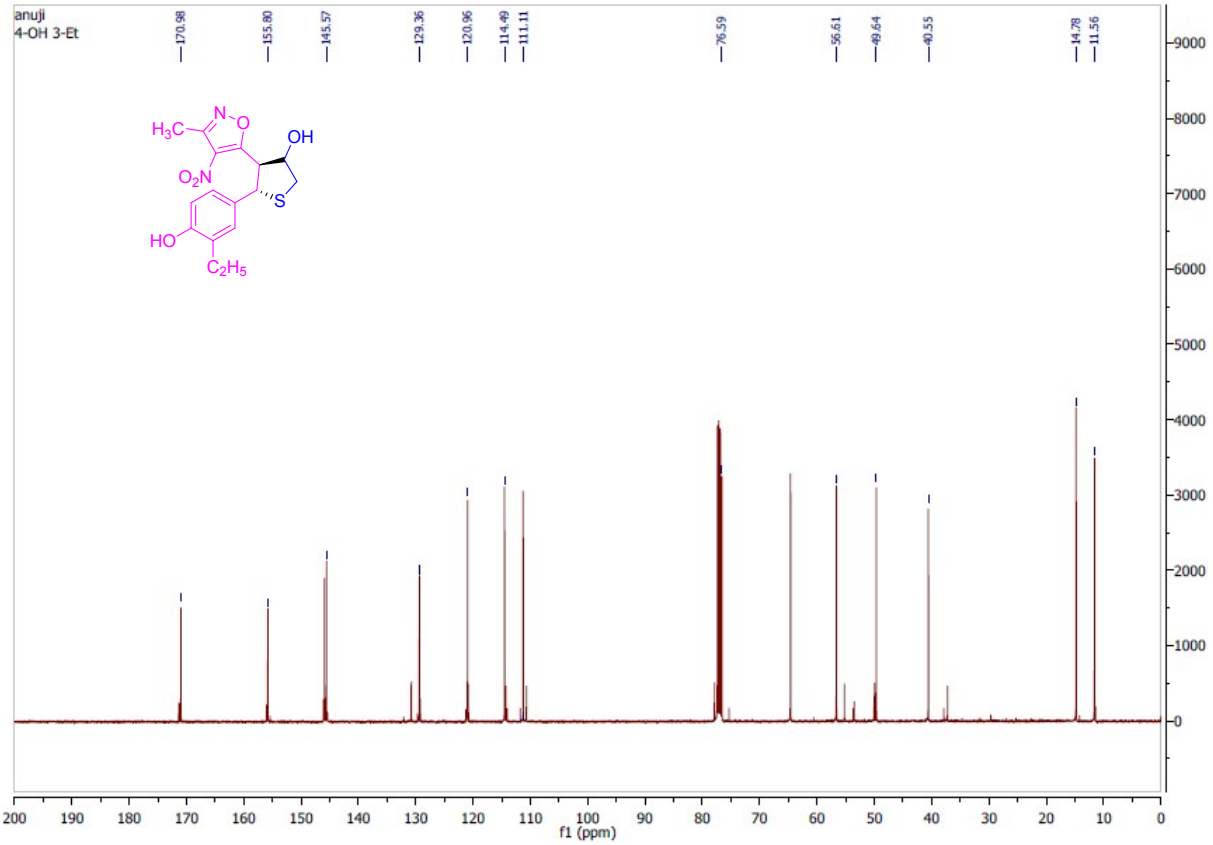
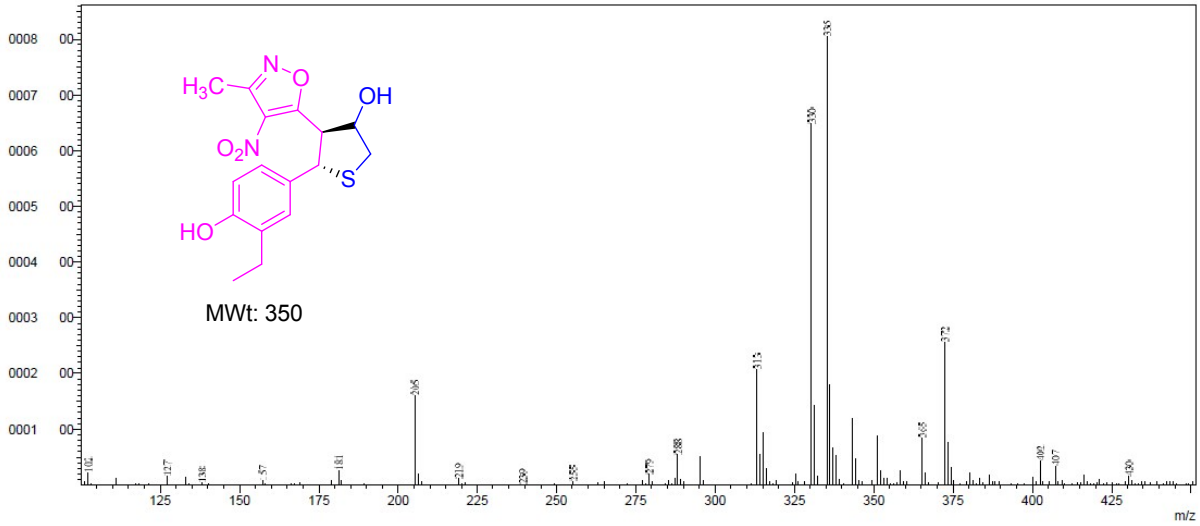
09-10-15 13:27:15
NIT-6N #2-20 RT: 0.04-0.21 AV: 19 SB: 83 0.21-2.04 , 0.02-0.04 NL: 1.05E4
T: FTMS {1,1} - p ESI Full ms [100.00-800.00]
351.06428
C15 H15 O6 N2 S = 351.06453
9.5 RDBE
-0.72317 ppm
352.06758
Relative Abundance
m/z
M Wt: 352.36

5-(3-ethyl-4-hydroxyphenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol



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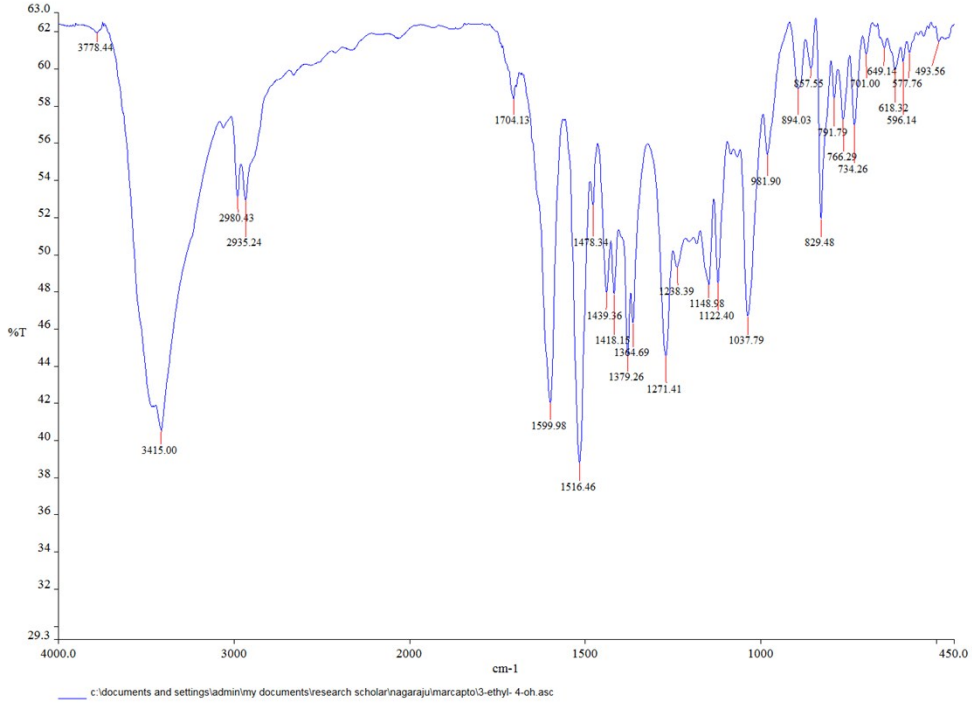
m/z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cm-1
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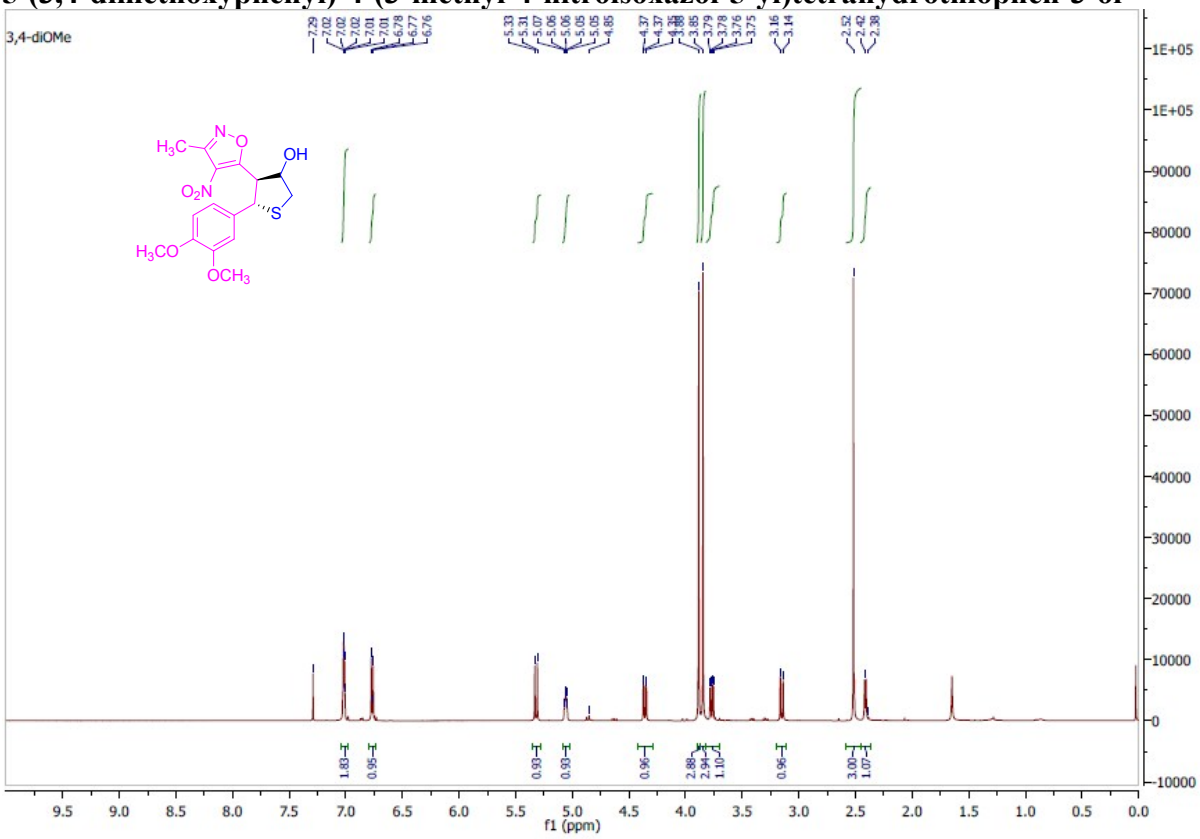
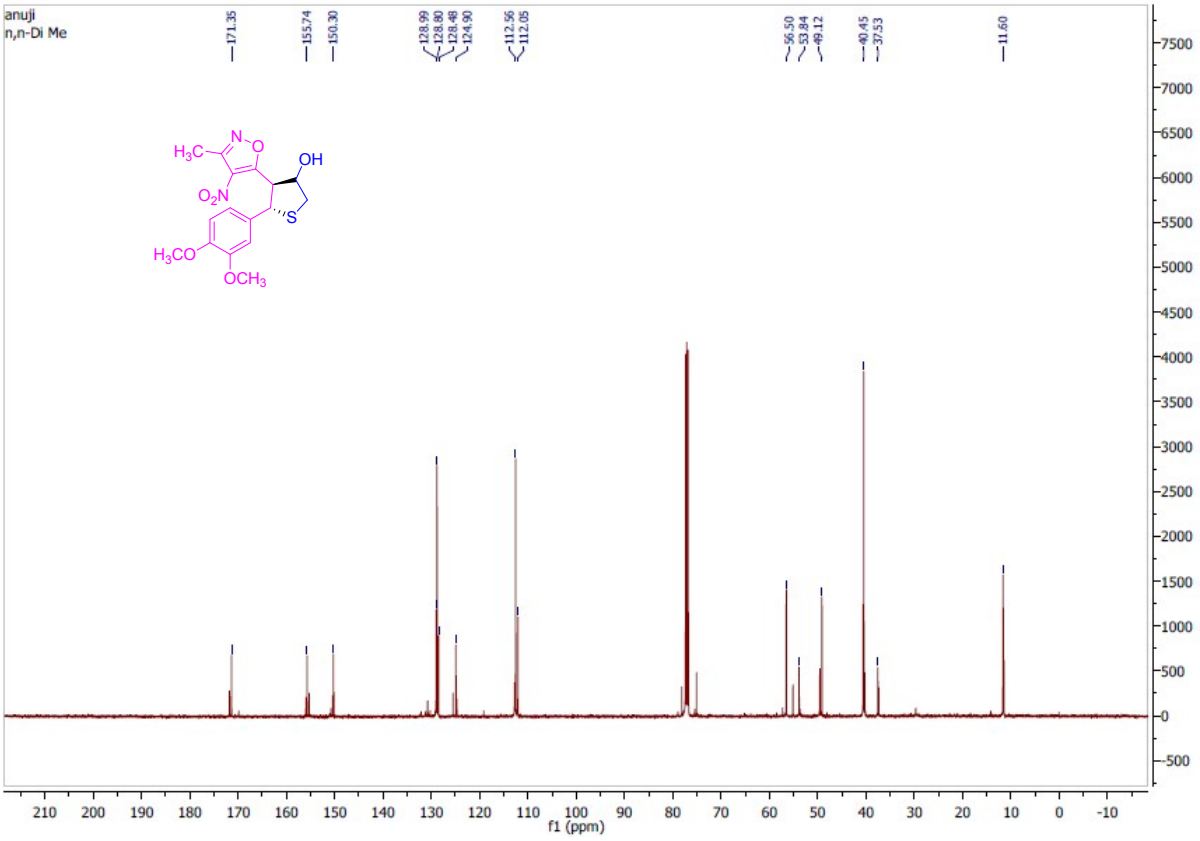
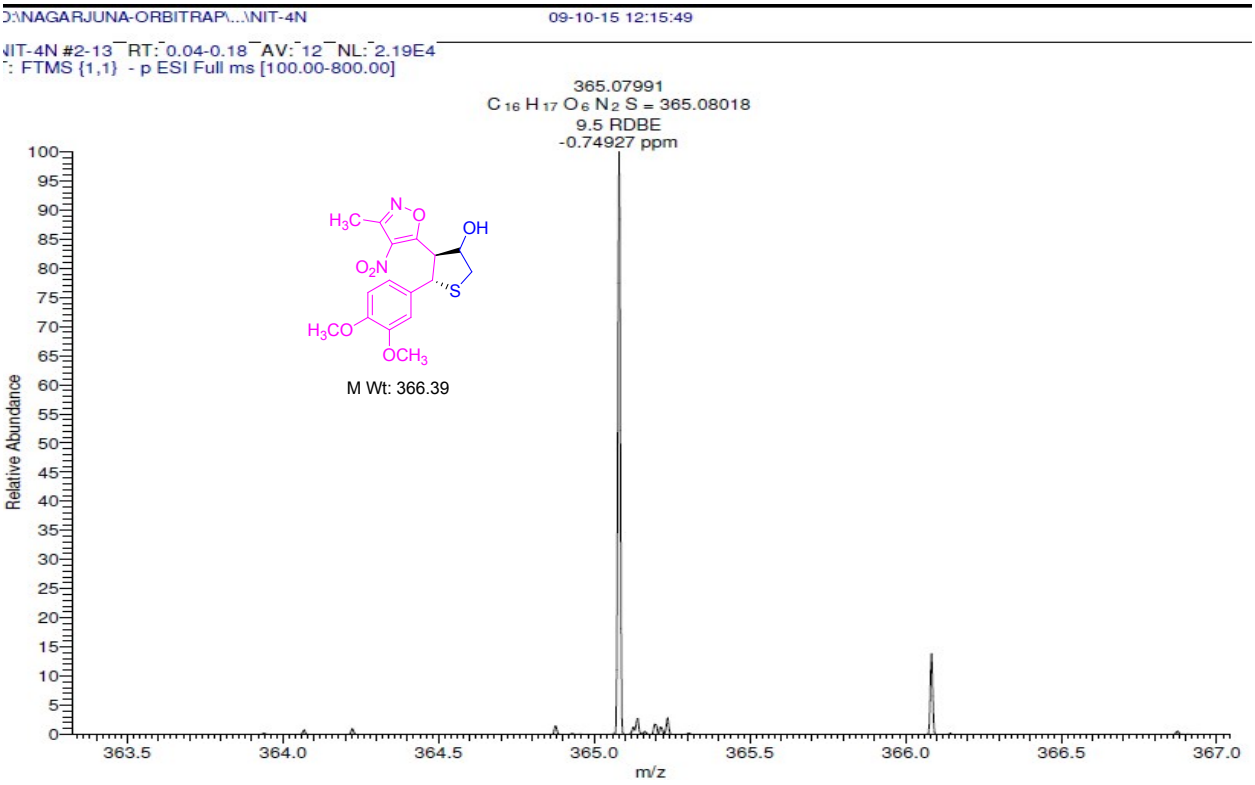
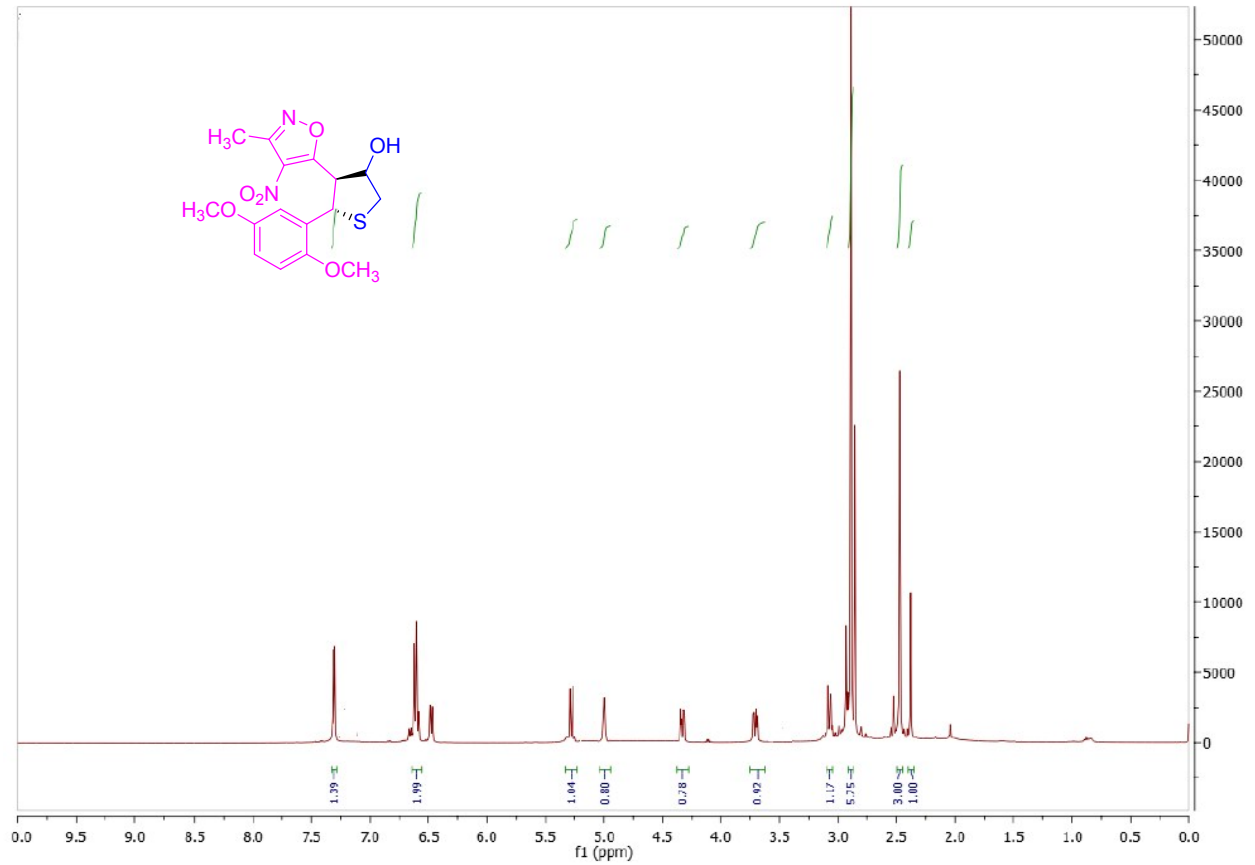
5-(3,4-dimethoxyphenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol

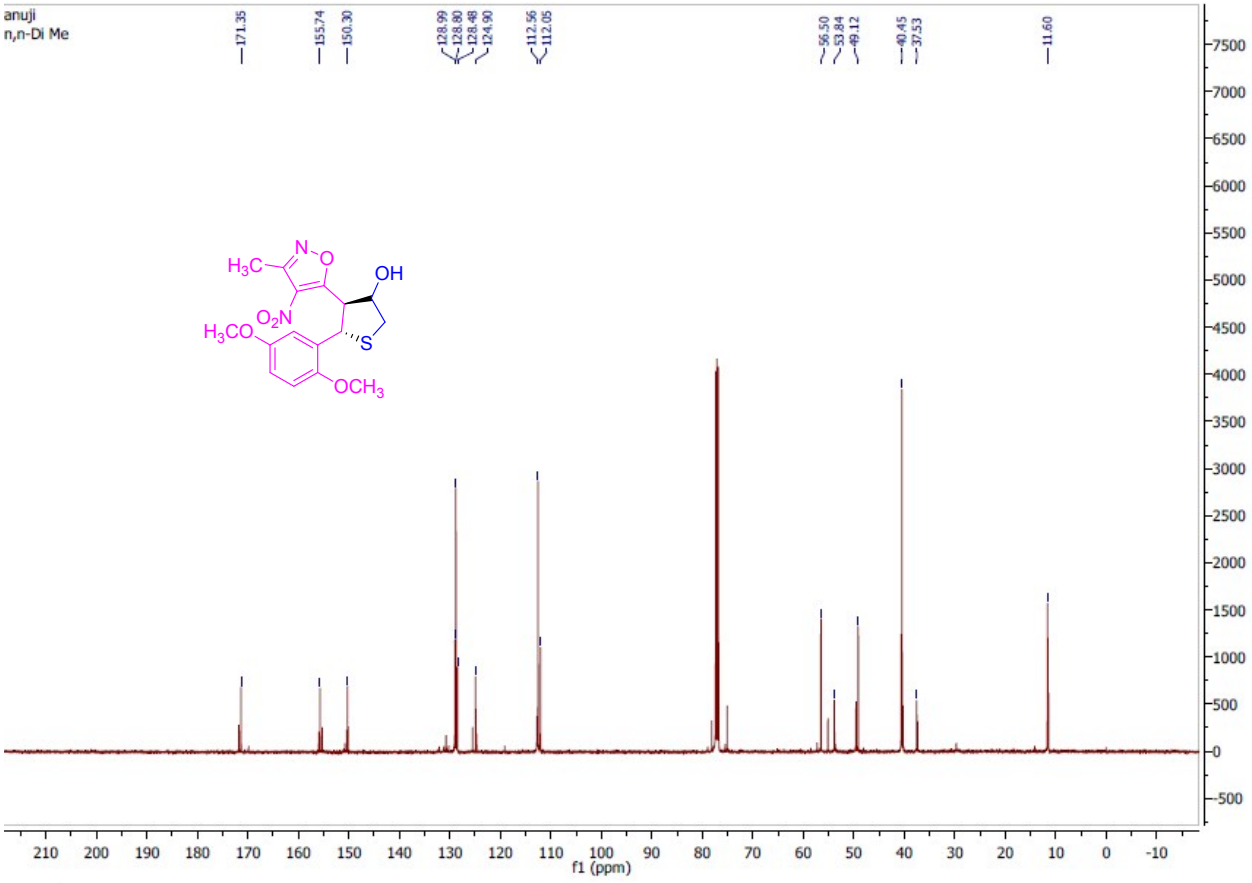


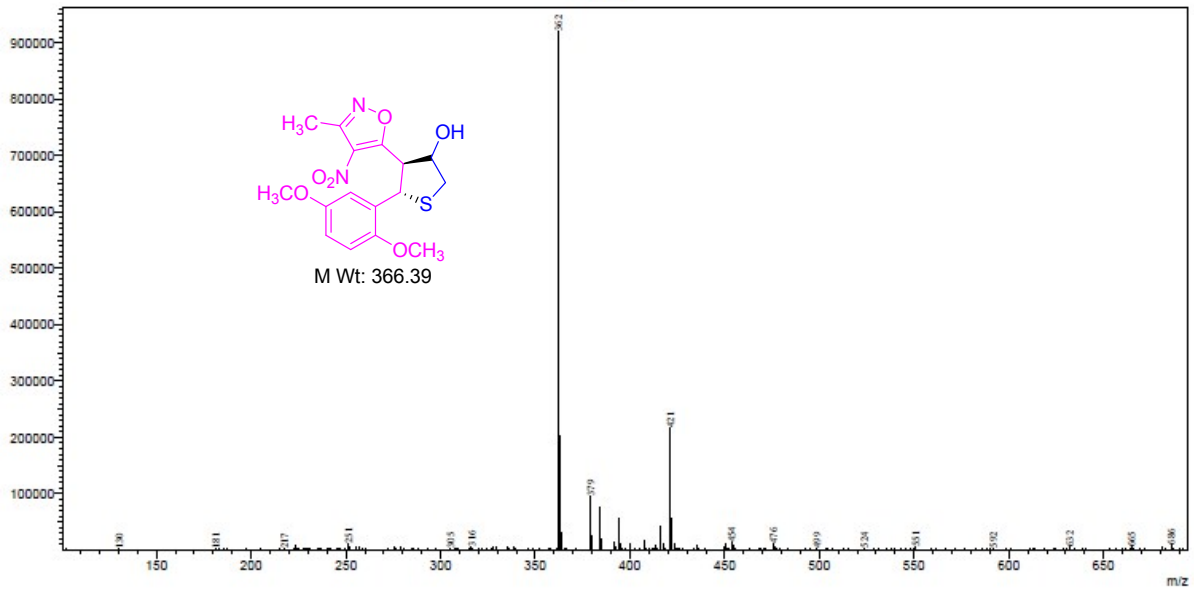


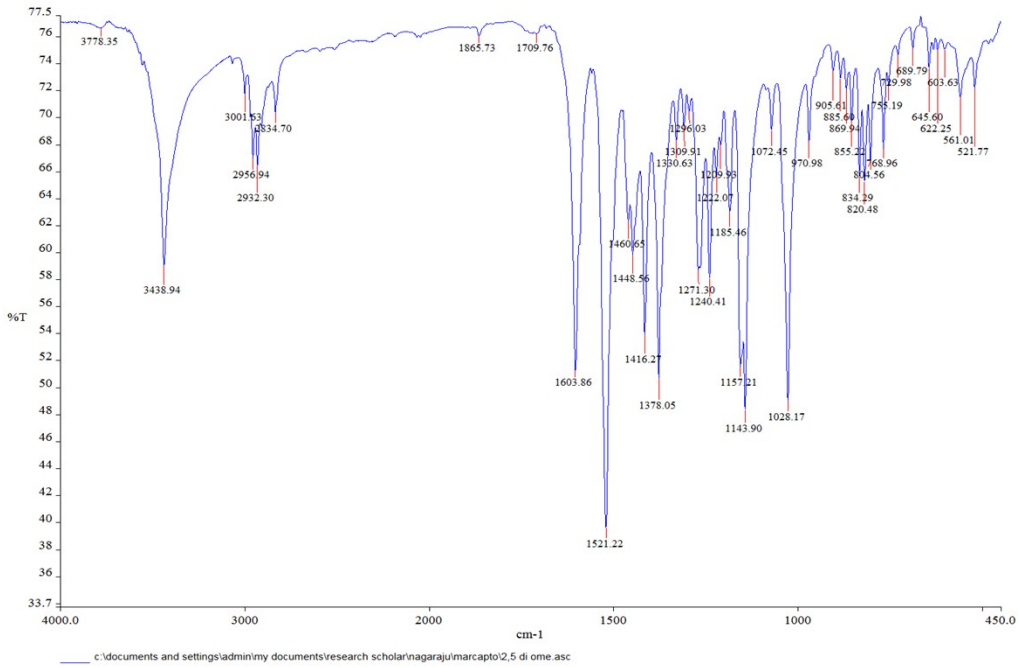


5-(2,5-dimethoxyphenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol

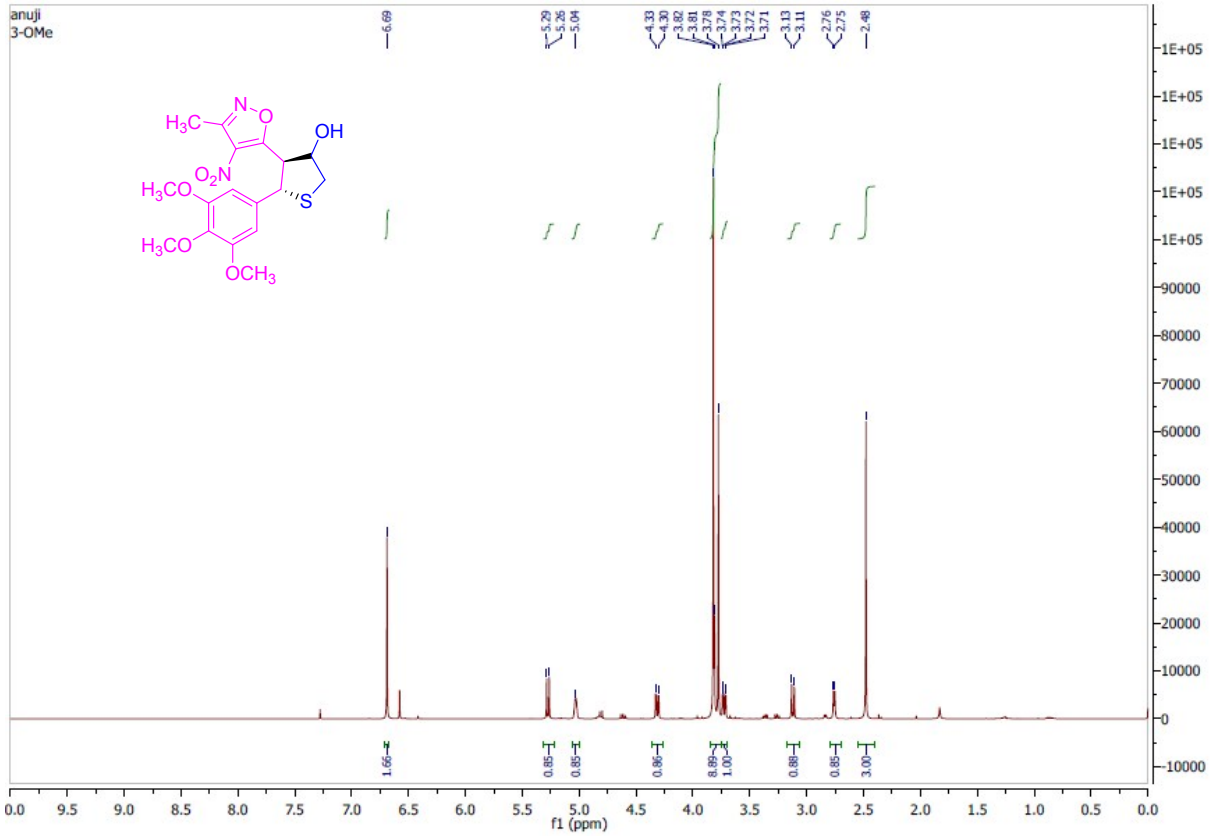


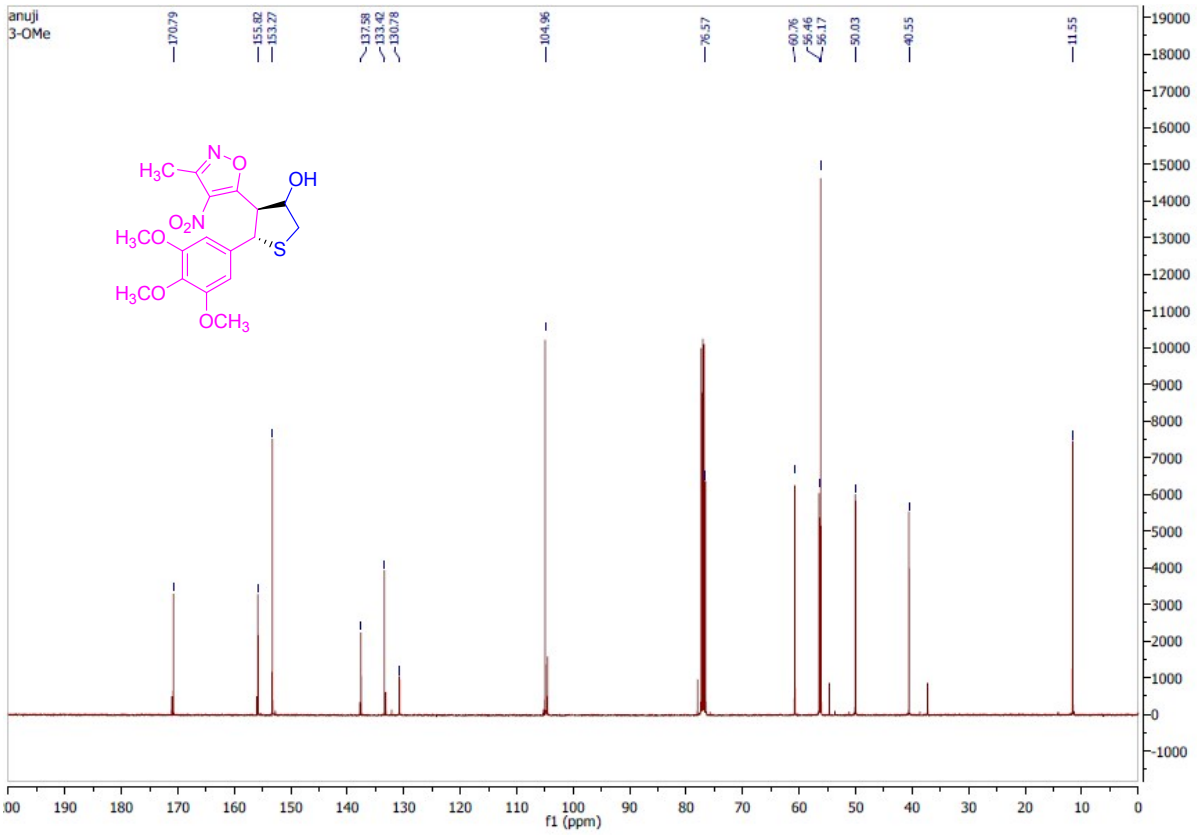

anuji
n,n-Di Me
171.35
155.74
150.30
128.99
128.80
128.48
124.90
112.56
112.05
56.50
53.84
49.12
40.45
37.53
11.60
f1 (ppm)


M Wt: 366.39
m/z



4-(3-methyl-4-nitroisoxazol-5-yl)-5-(3,4,5-trimethoxyphenyl)tetrahydrothiophen-3-ol



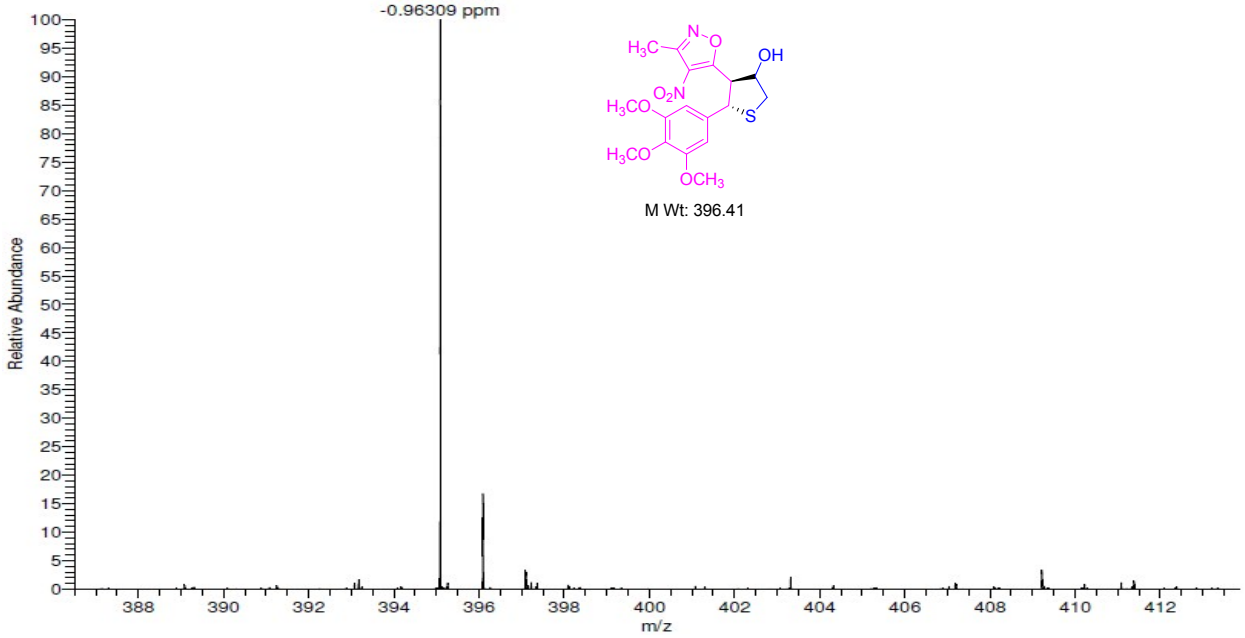


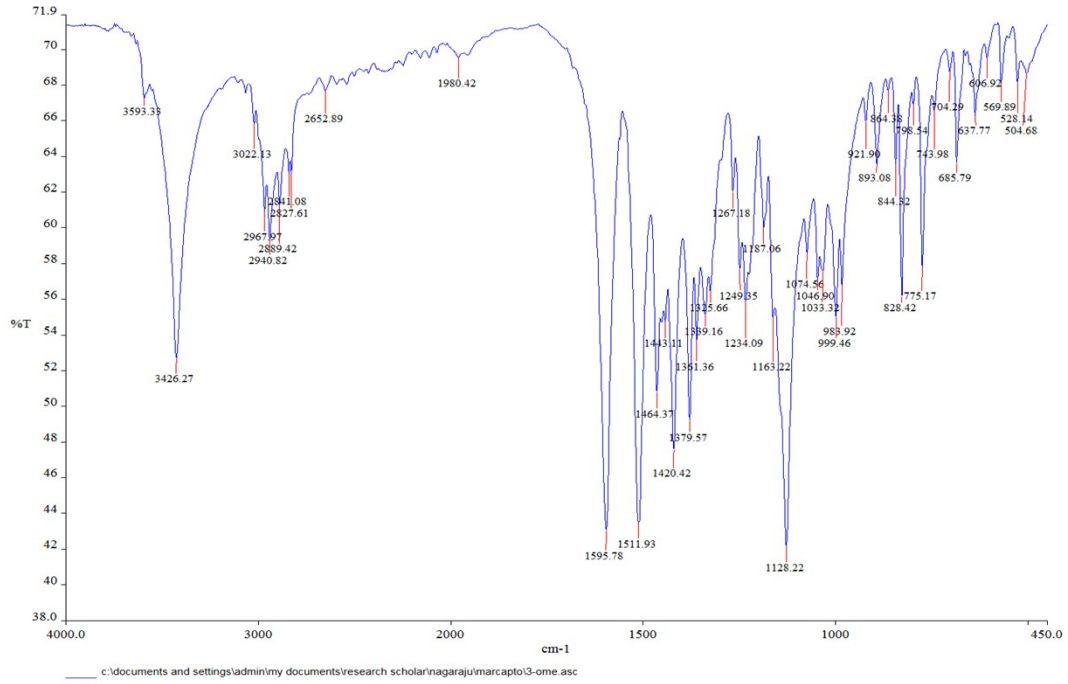
C:\NAGARJUNA\NIT\09.10.2015\NIT-5N 09-10-15 12:21:31

NIT-5N #2-16 RT: 0.04-0.22 AV: 15 NL: 1.75E5
T: FTMS {1,1} - p ESI Full ms [100.00-800.00]

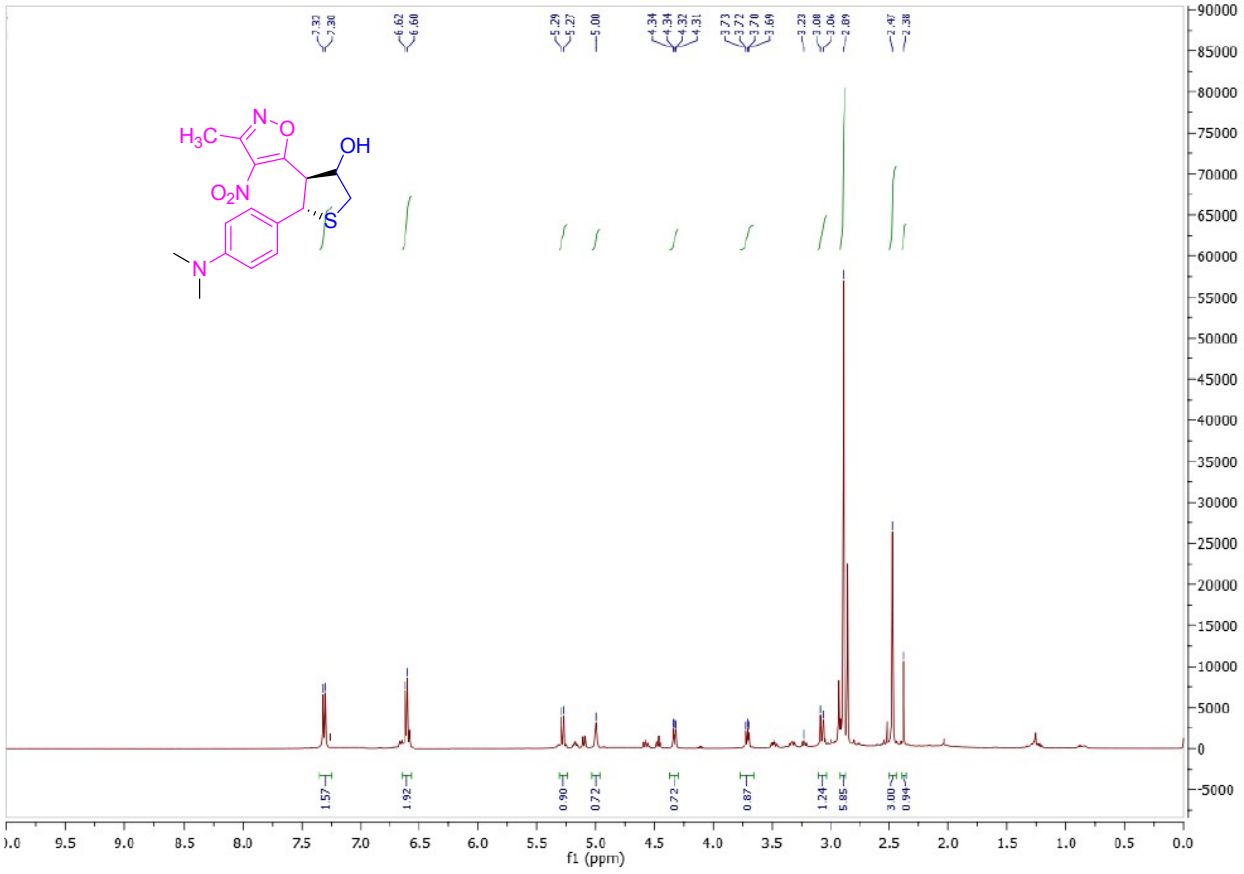
395.09037
$C_{17}H_{19}O_7N_2S$ = 395.09075
9.5 RDBE
-0.96309 ppm

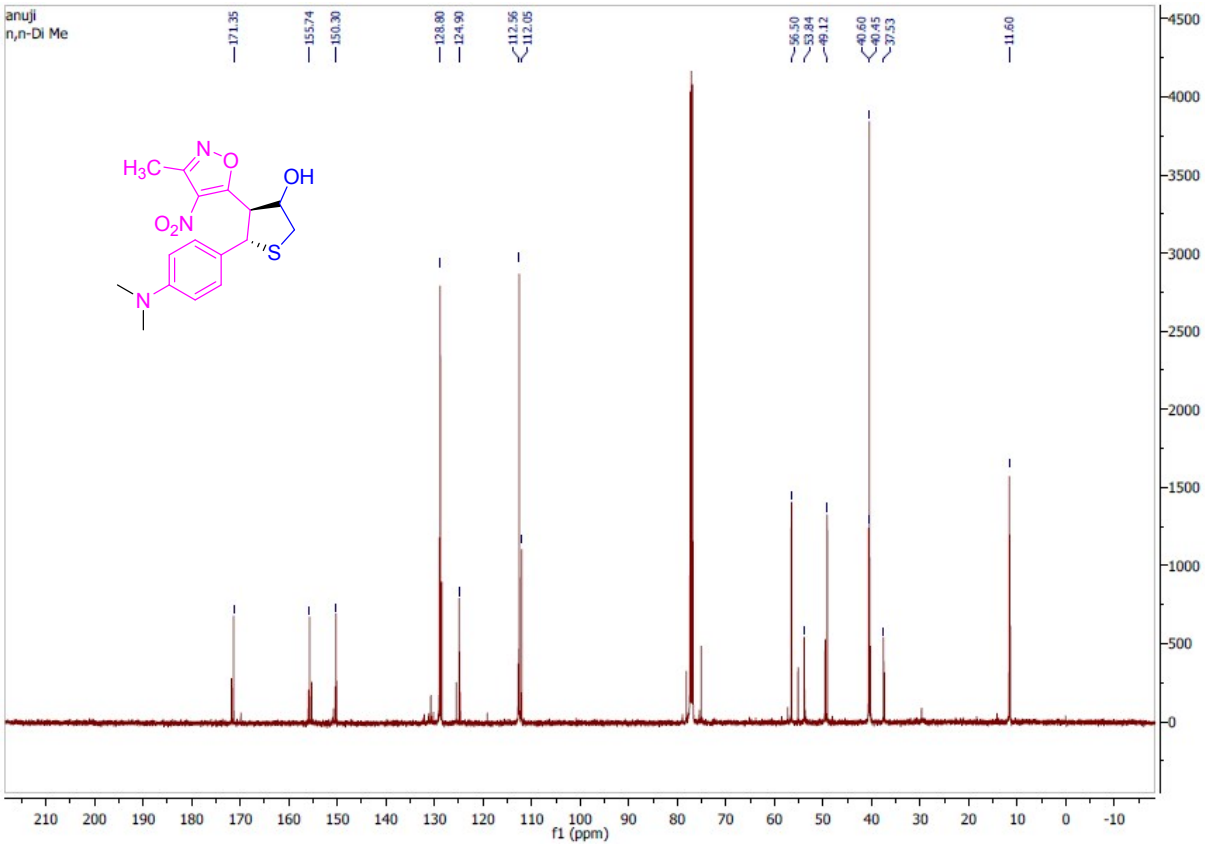
M Wt: 396.41

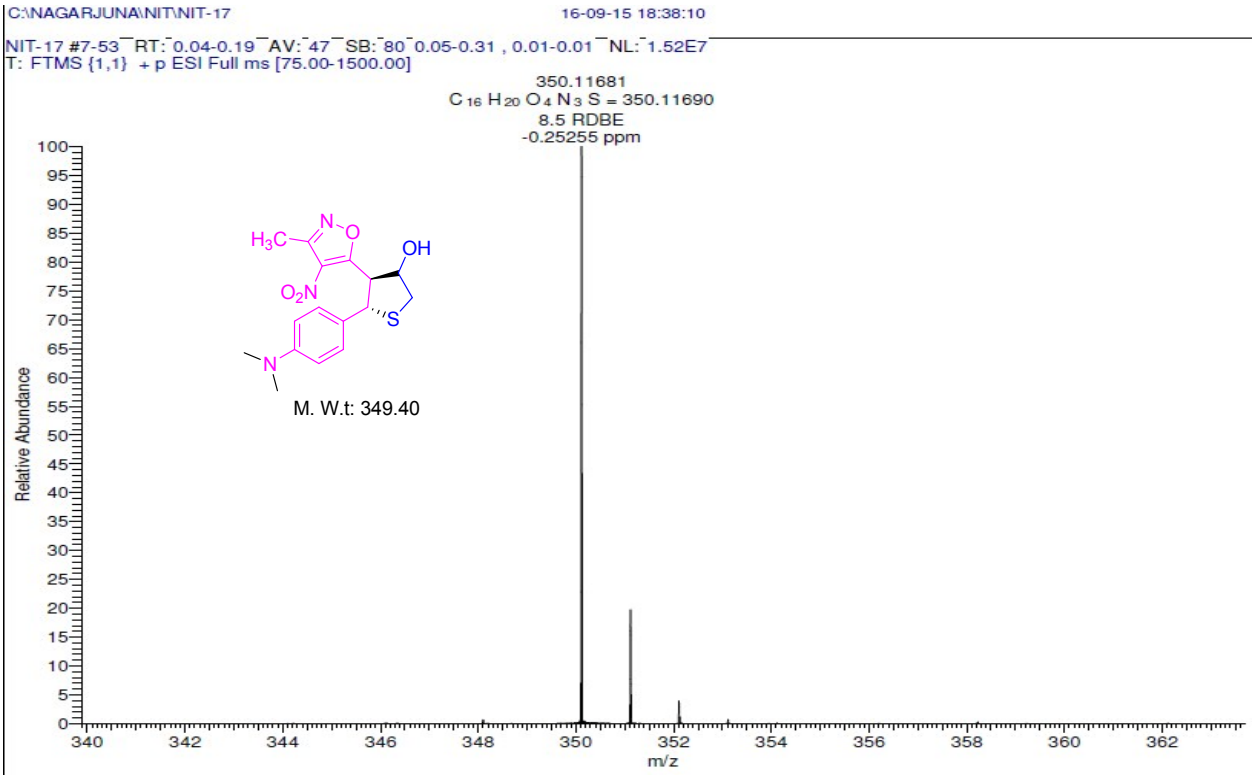




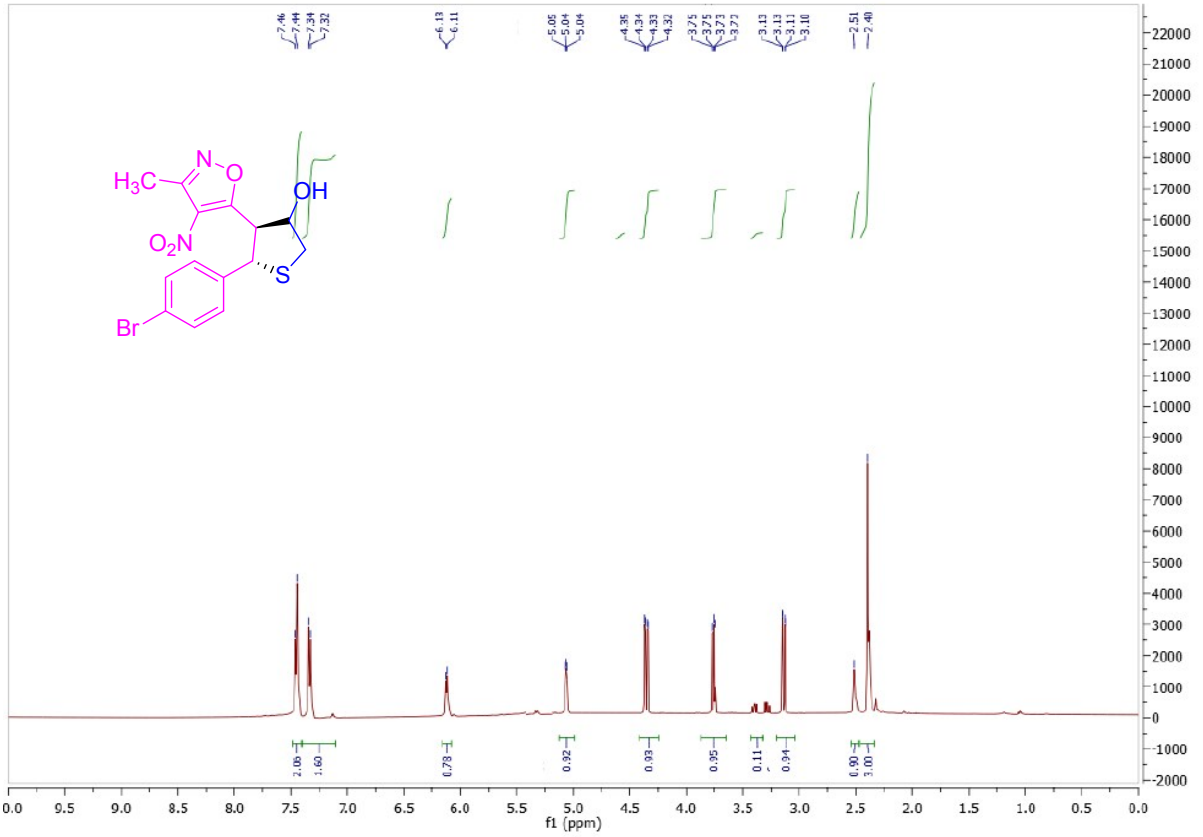
5-(4-(dimethylamino)phenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol

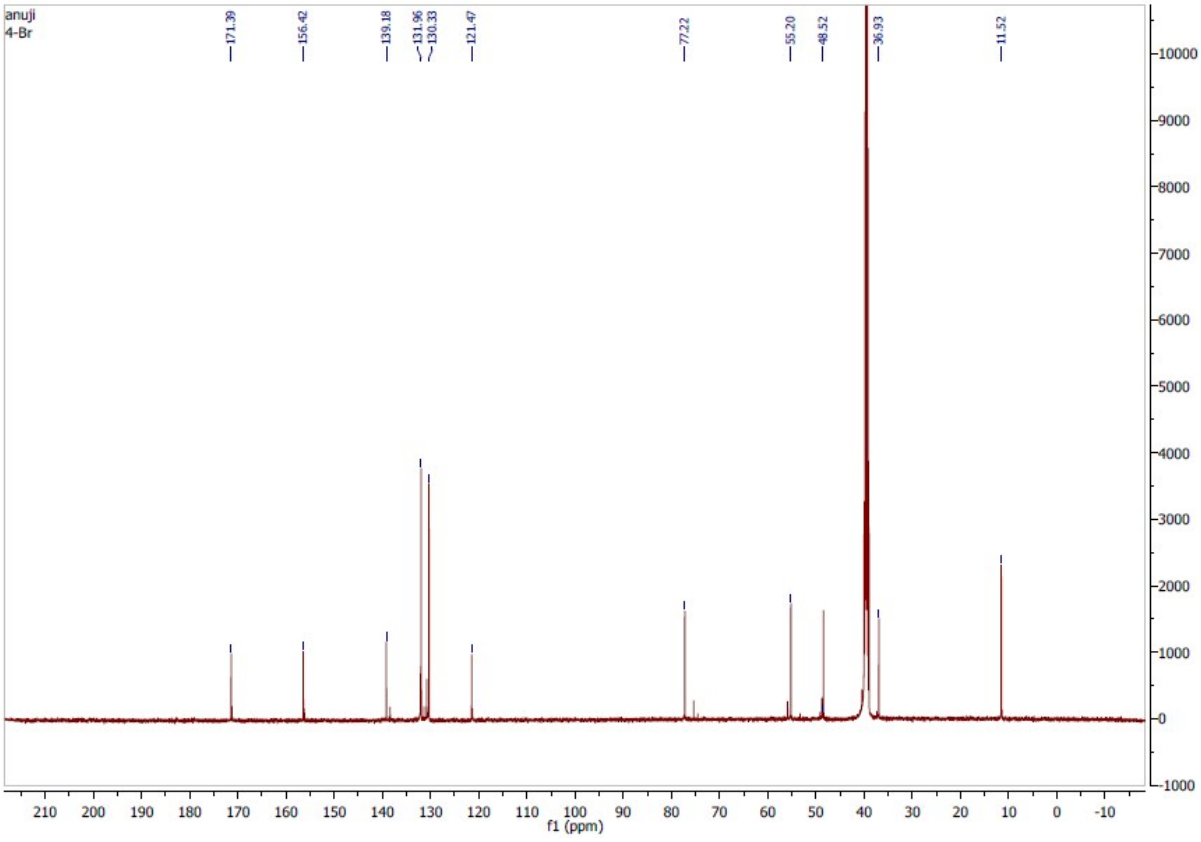



anuji
n,n-Di Me
171.35
155.74
150.30
128.80
124.90
112.56
112.05
56.50
53.84
49.12
40.60
40.45
37.53
11.60
f1 (ppm)


C:\NAGARJUNA\NIT\NIT-17
16-09-15 18:38:10
NIT-17 #7-53 RT: 0.04-0.19 AV: 47 SB: 80 0.05-0.31 , 0.01-0.01 NL: 1.52E7
T: FTMS {1,1} + p ESI Full ms [75.00-1500.00]
350.11681
C 16 H 20 O 4 N 3 S = 350.11690
8.5 RDBE
-0.25255 ppm
M. W.t: 349.40
Relative Abundance
m/z

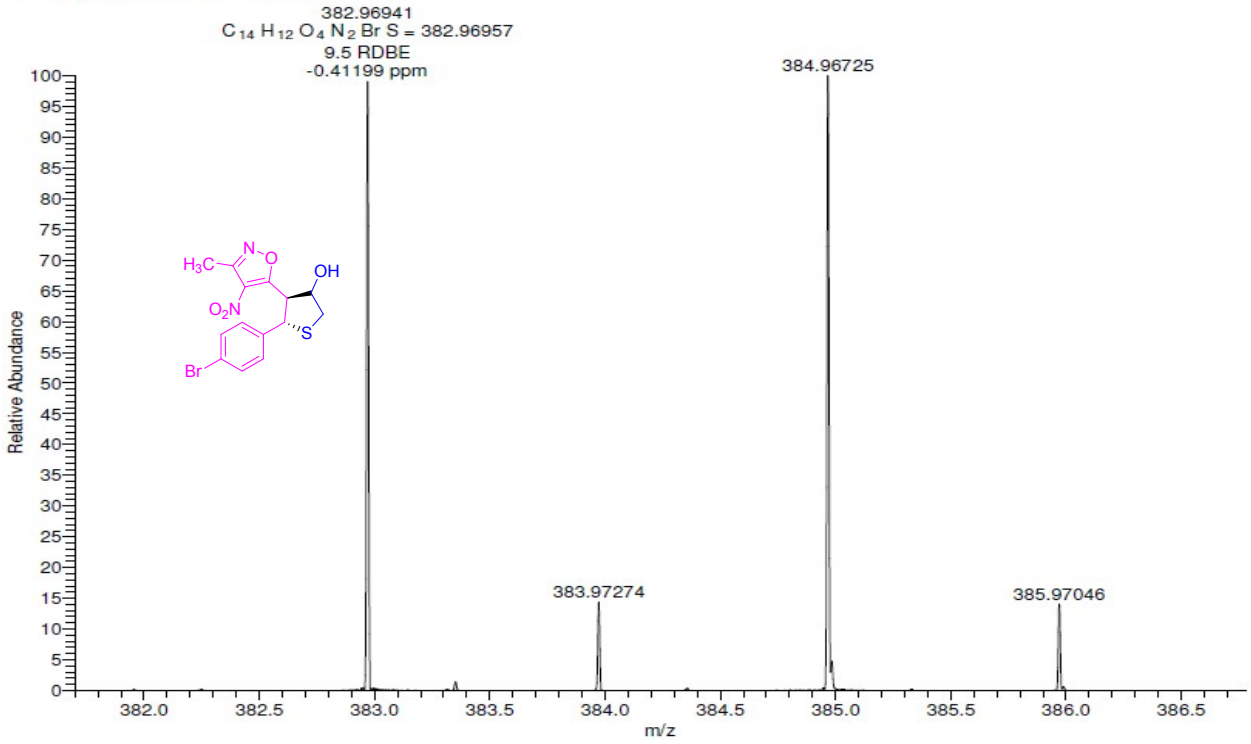
5-(4-bromophenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol

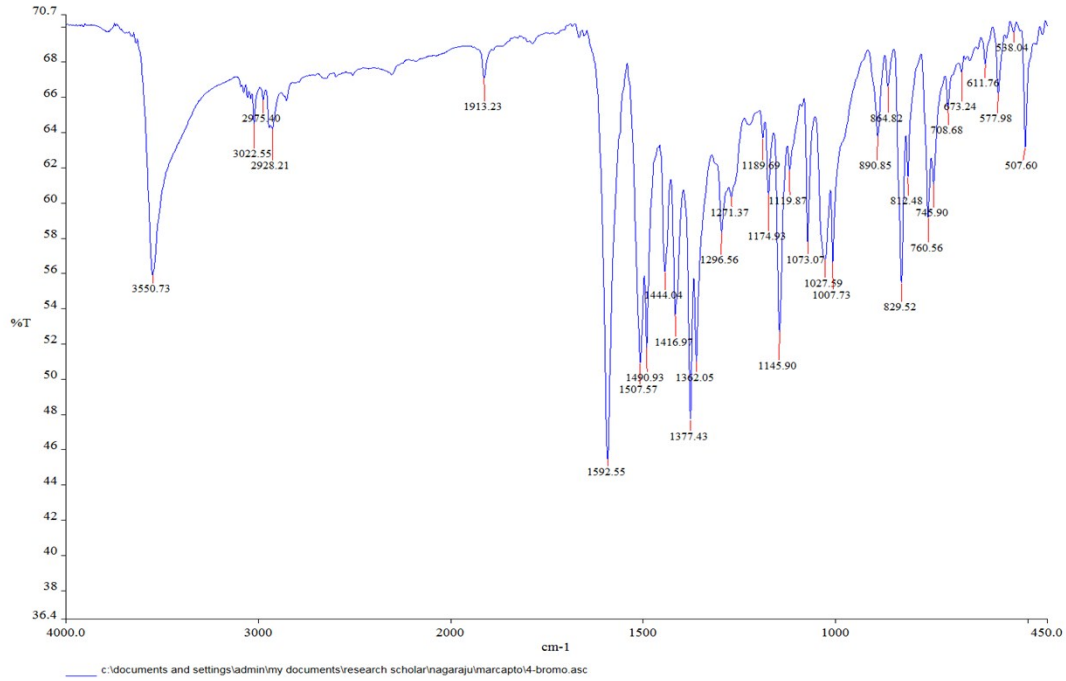




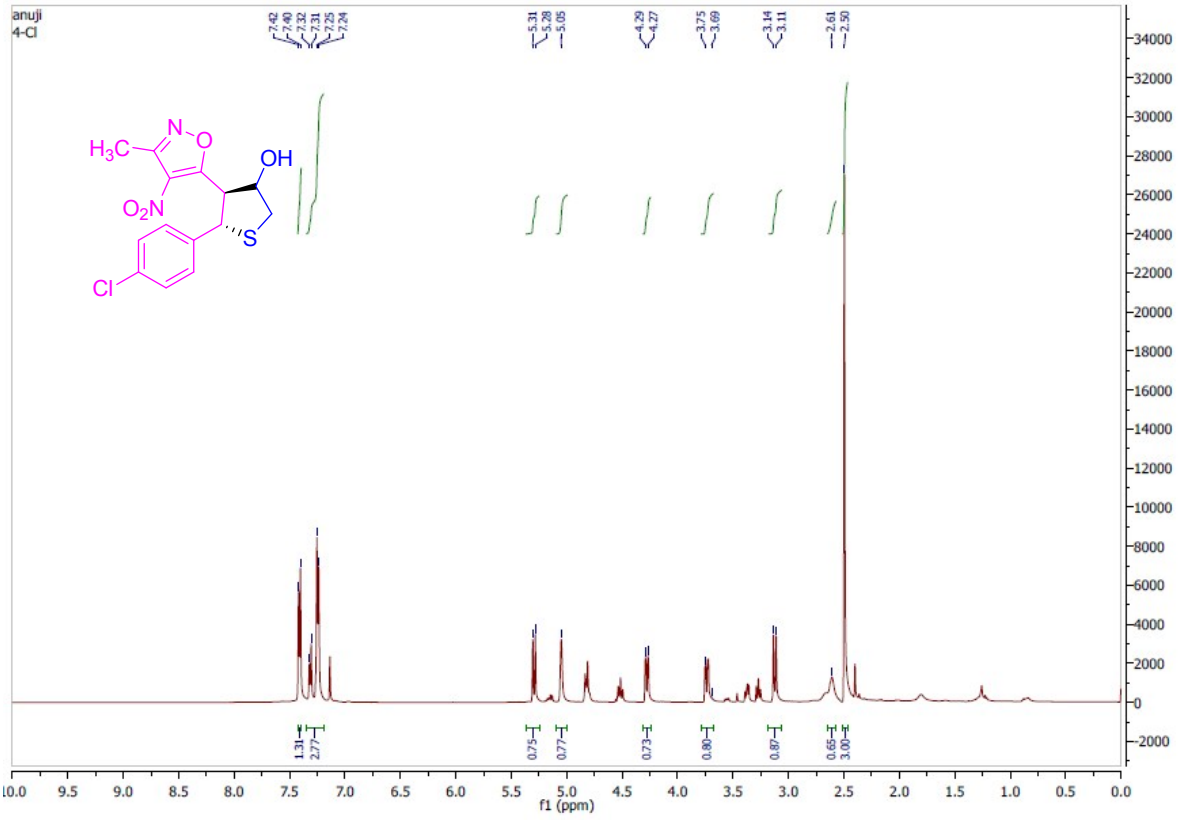
C:\NAGARJUNA\NIT\09.10.2015\NIT-9N 09-10-15 12:27:15

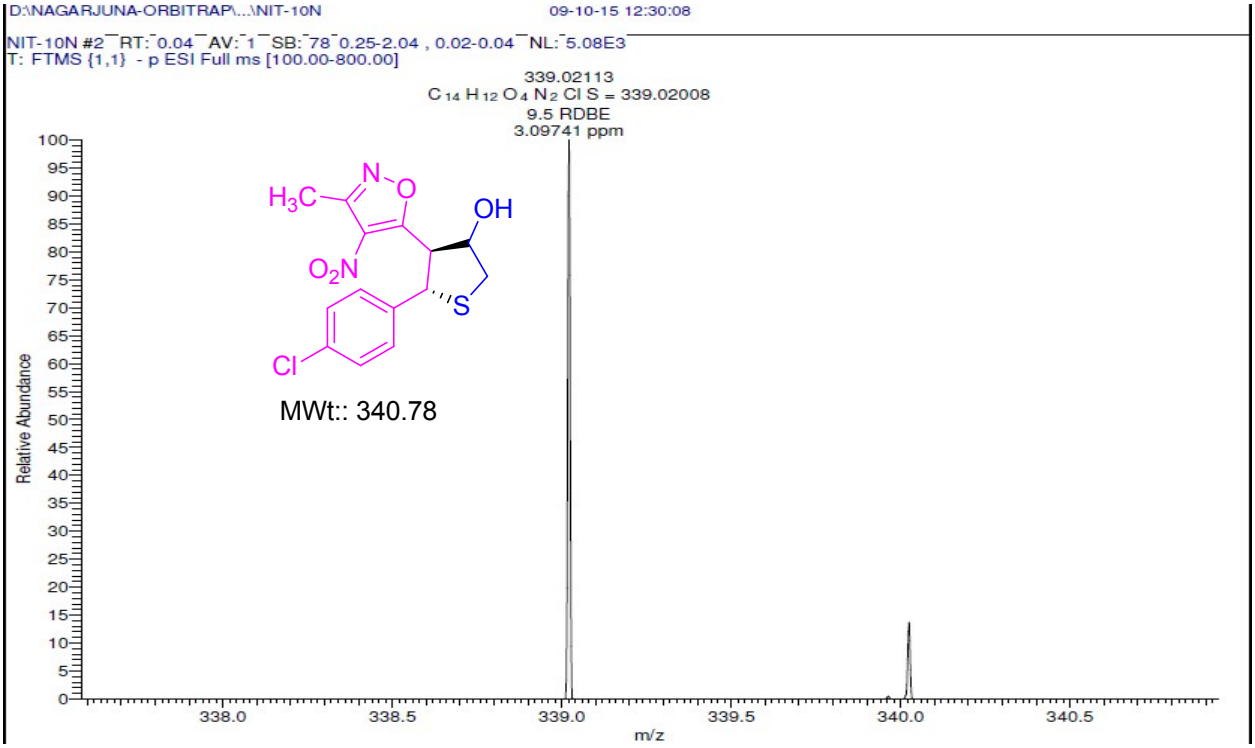
NIT-9N #1-19 RT: 0.02-0.23 AV: 19 NL: 3.34E5
T: FTMS {1,1} - p ESI Full ms [100.00-800.00]

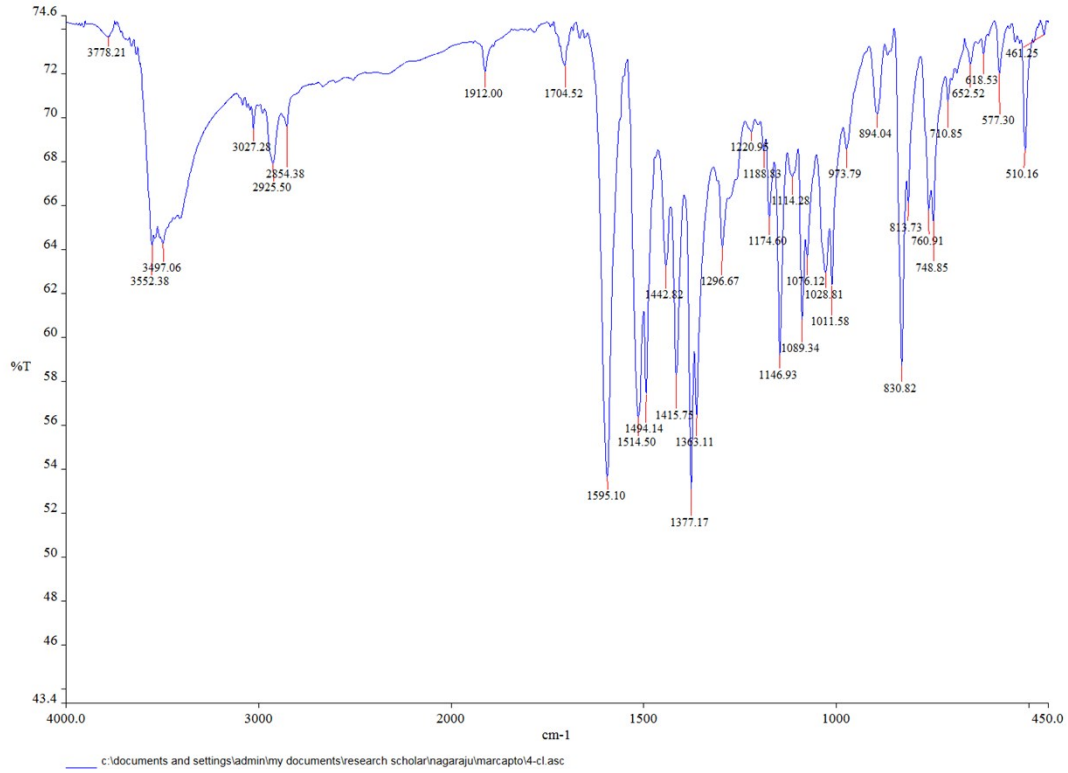




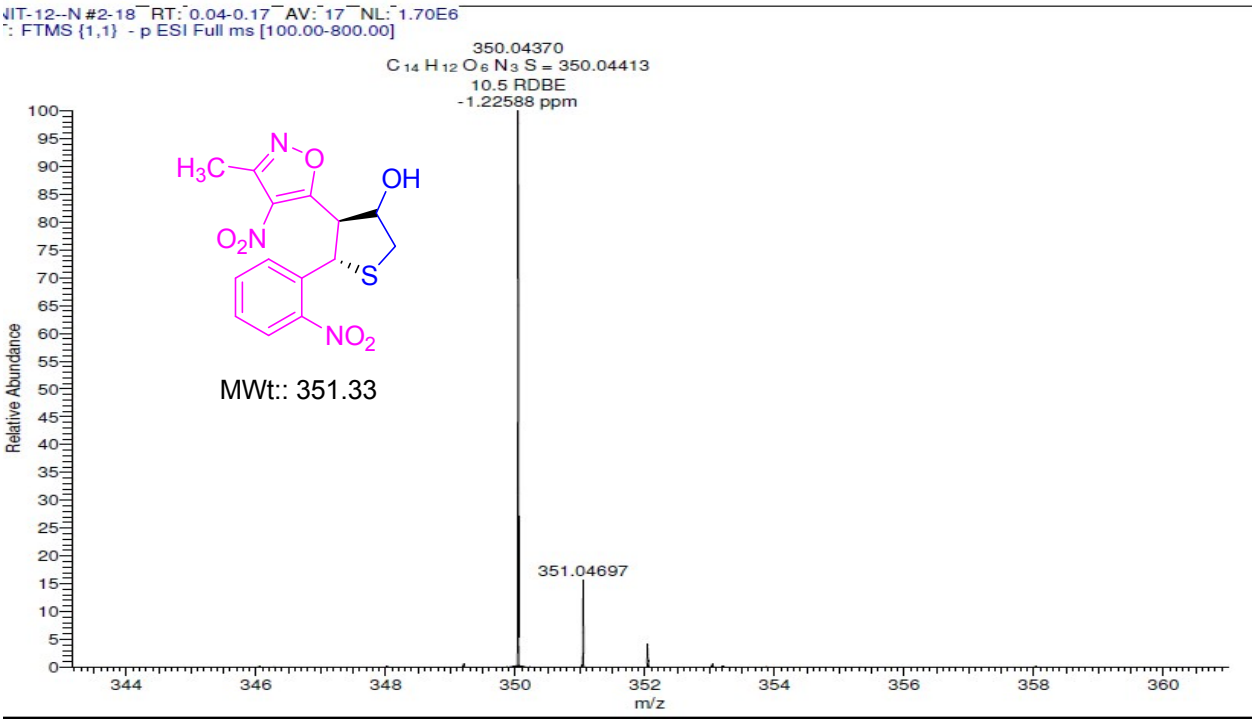
5-(4-chlorophenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol

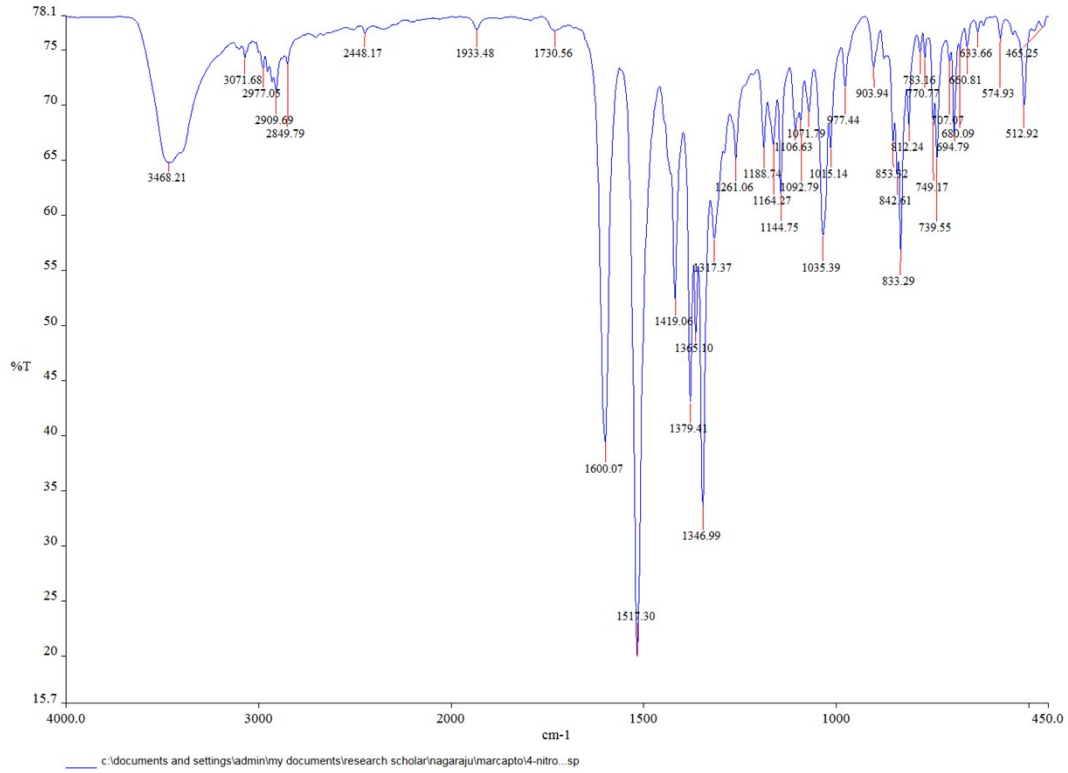




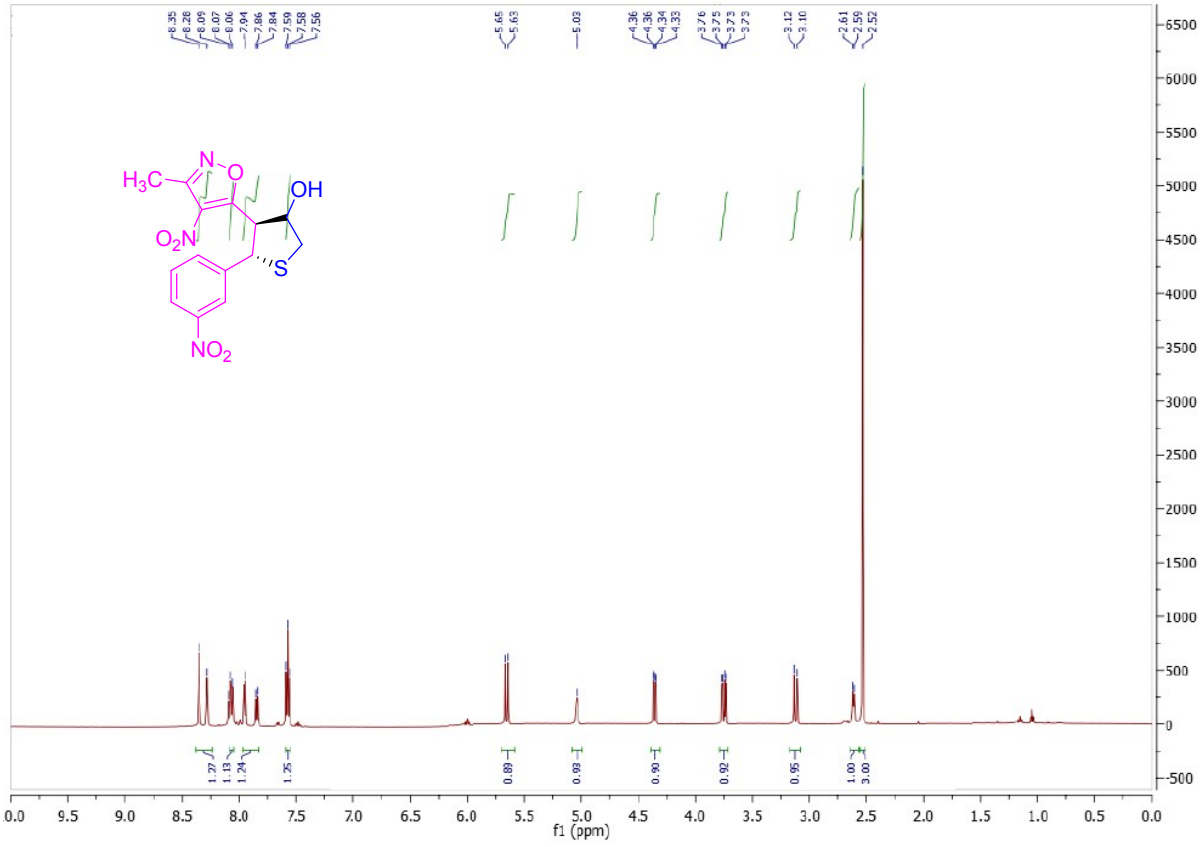


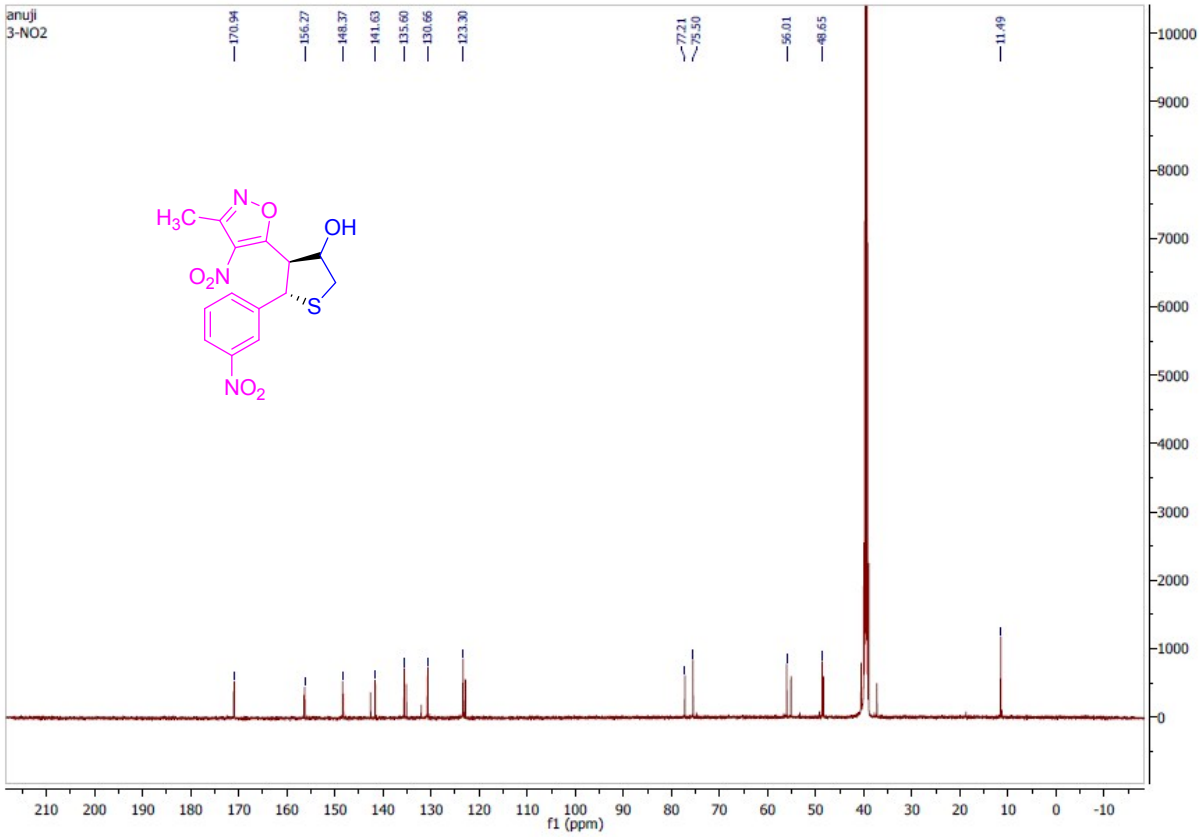
4-(3-methyl-4-nitroisoxazol-5-yl)-5-(2-nitrophenyl)tetrahydrothiophen-3-ol

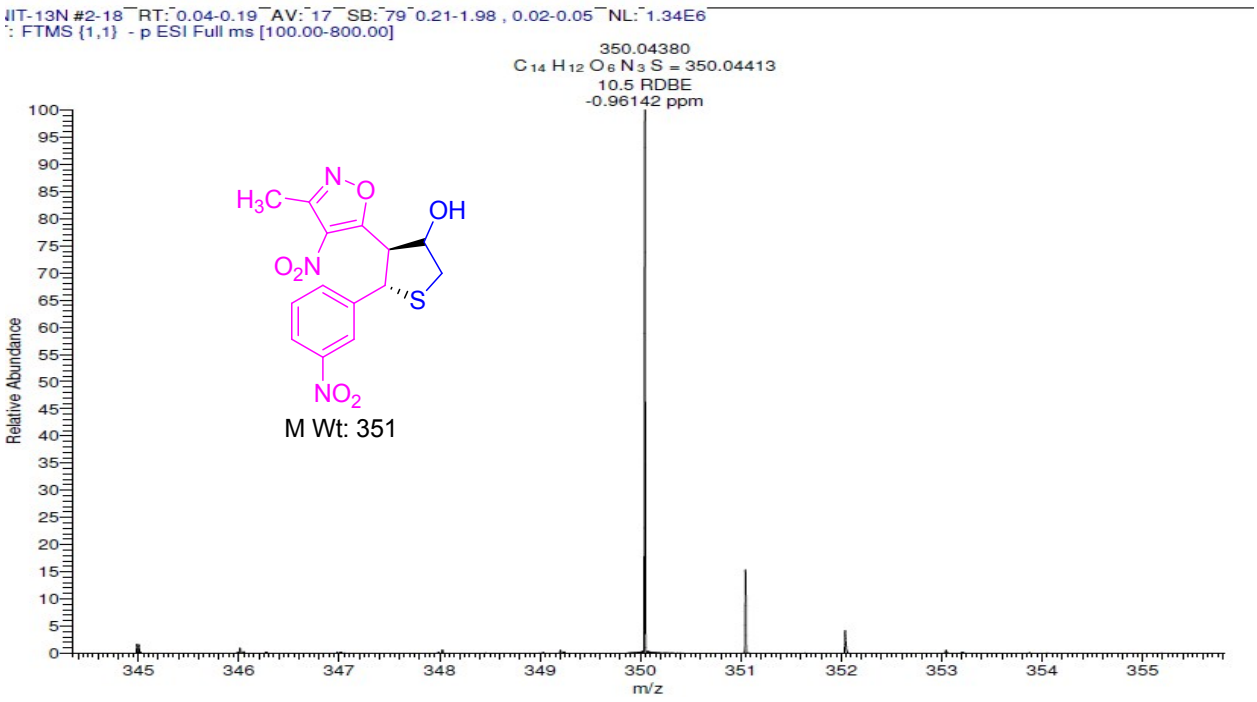


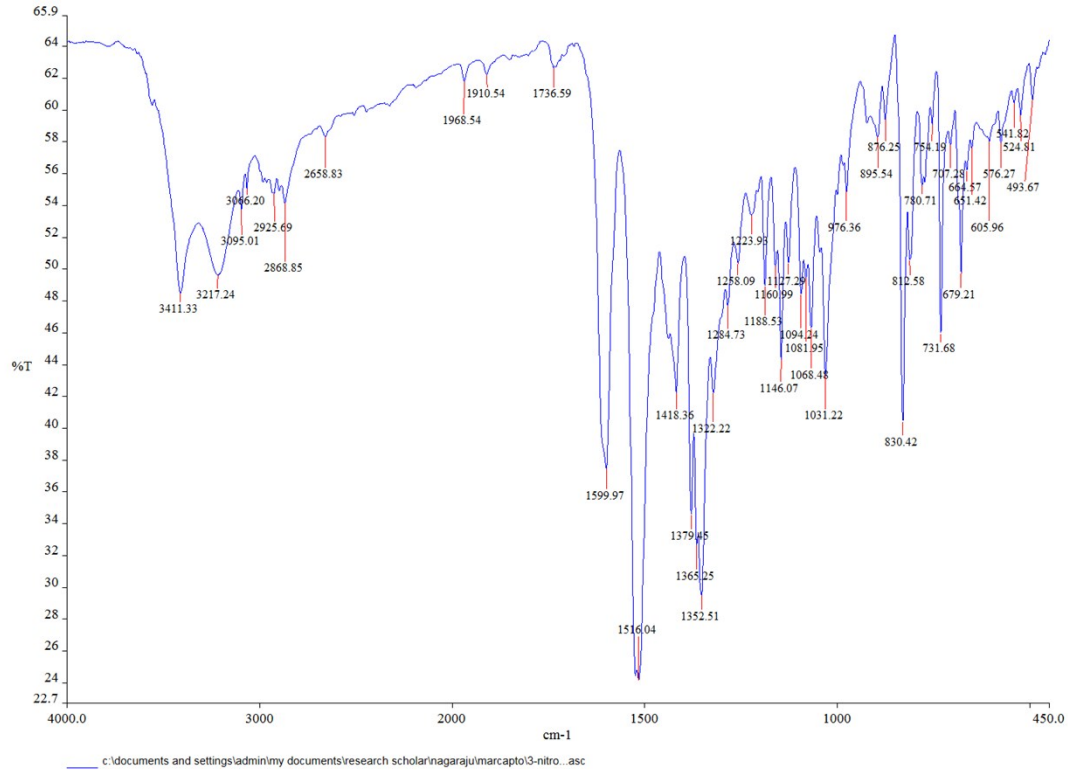


4-(3-methyl-4-nitroisoxazol-5-yl)-5-(3-nitrophenyl)tetrahydrothiophen-3-ol

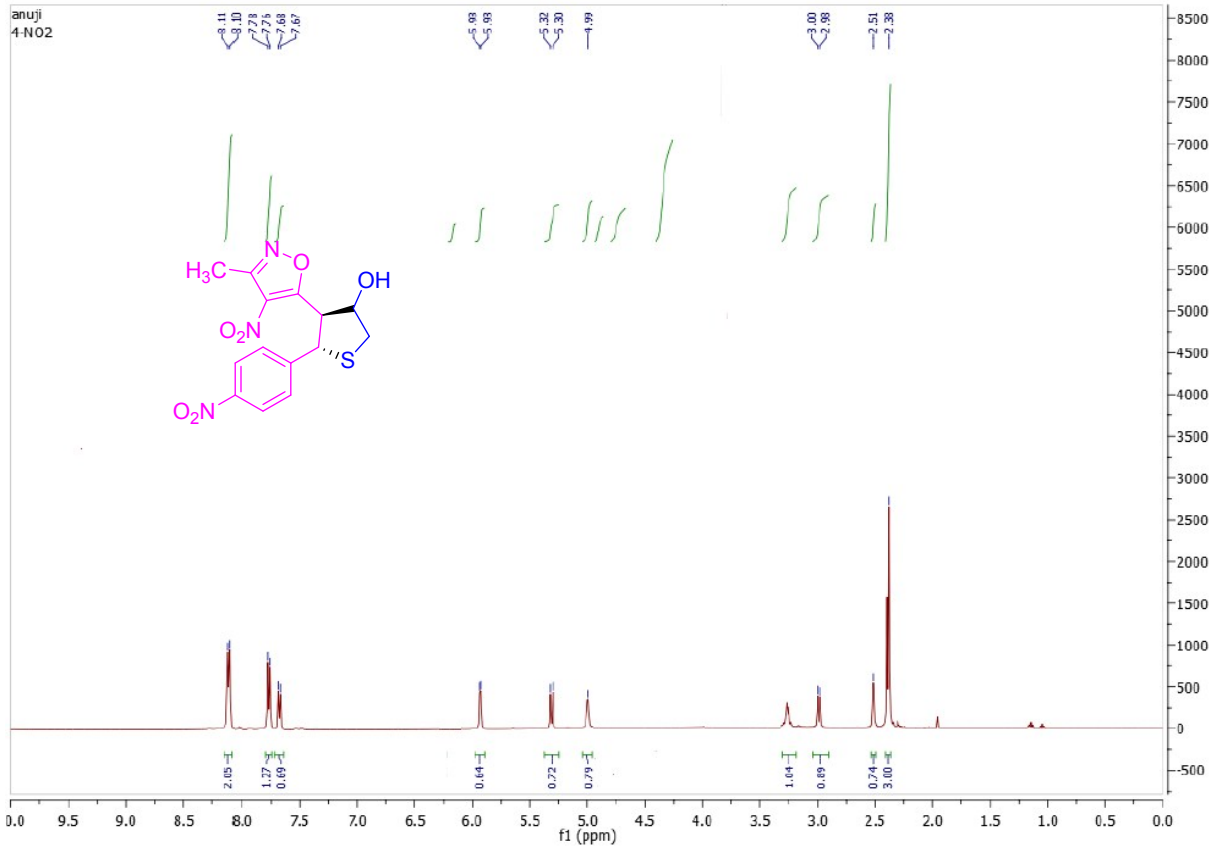


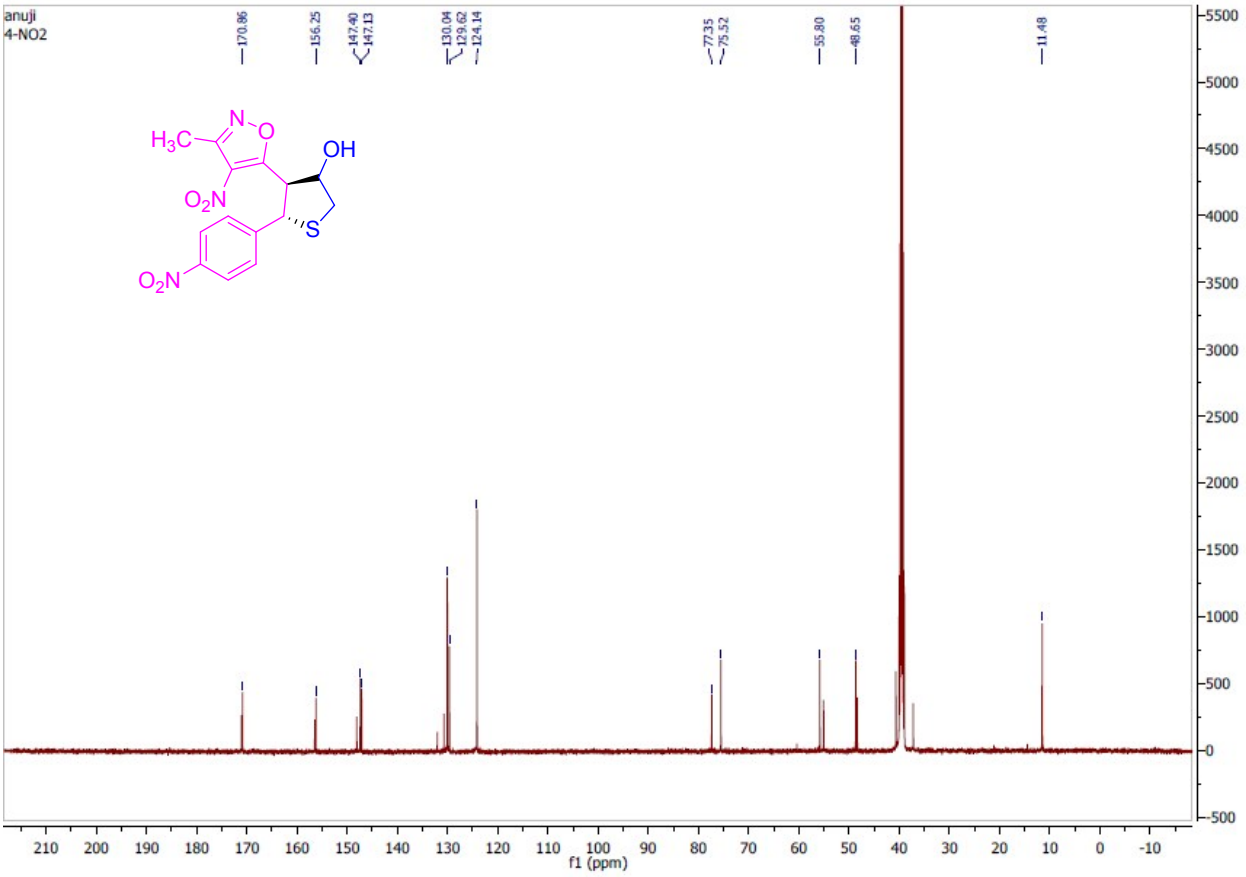

anuji
3-NO2
170.94
156.27
148.37
141.63
135.60
130.66
123.30
77.21
75.50
56.01
49.65
11.49
f1 (ppm)

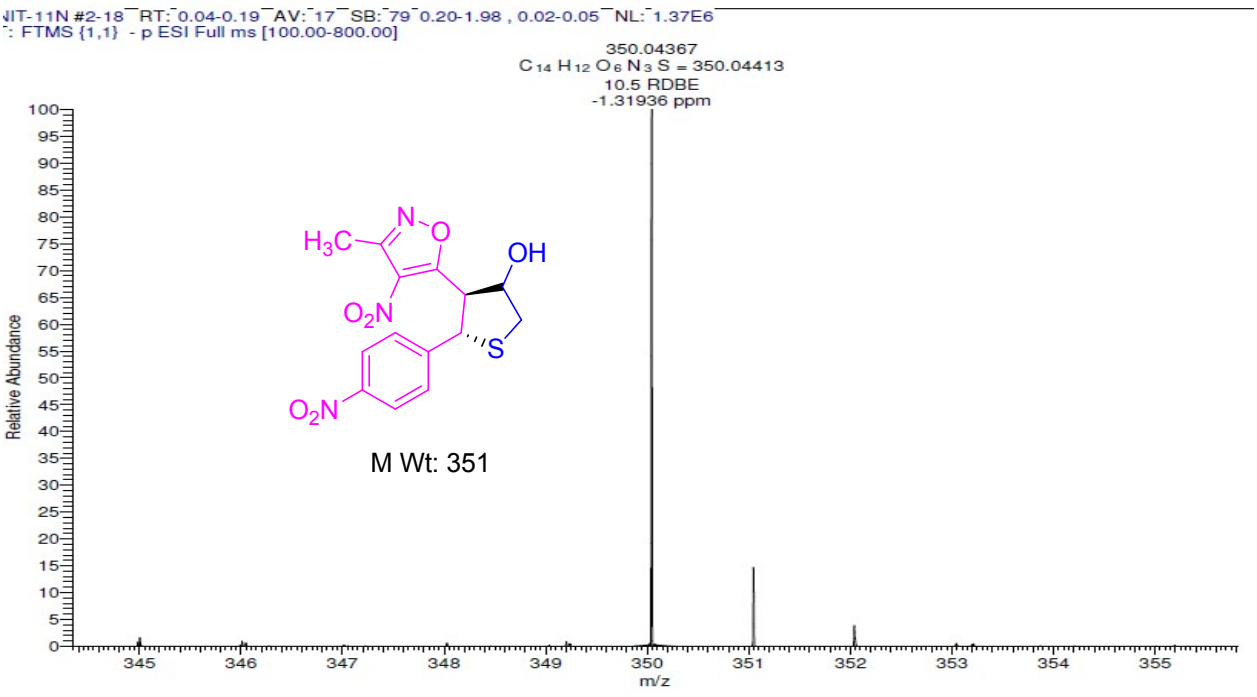

IIT-13N #2-18 RT: 0.04-0.19 AV: 17 SB: 79 0.21-1.98 , 0.02-0.05 NL: 1.34E6
: FTMS {1,1} - p ESI Full ms [100.00-800.00]
350.04380
C14 H12 O6 N3 S = 350.04413
10.5 RDBE
-0.96142 ppm
Relative Abundance
m/z
M Wt: 351



4-(3-methyl-4-nitroisoxazol-5-yl)-5-(4-nitrophenyl)tetrahydrothiophen-3-ol

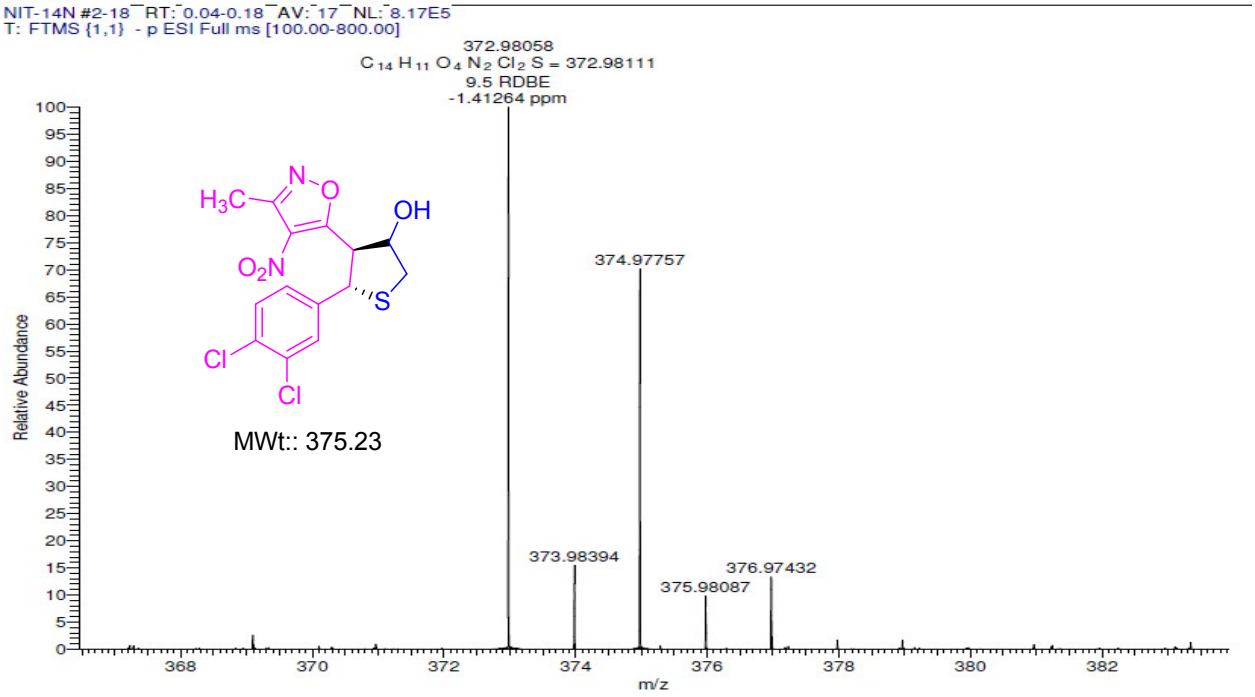


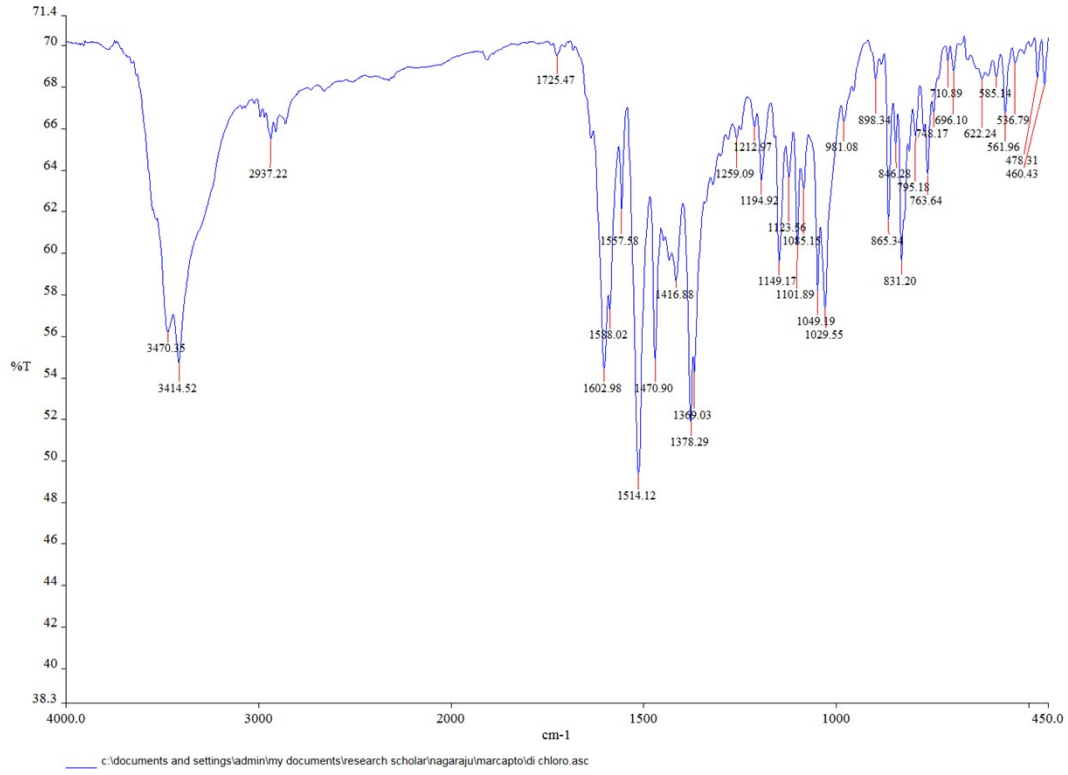

anuji
4-NO2
170.86
156.25
147.40
147.13
130.04
129.62
124.14
77.35
75.52
55.80
48.65
11.48
f1 (ppm)


FTMS {1,1} - p ESI Full ms [100.00-800.00]
350.04367
C14 H12 O6 N3 S = 350.04413
10.5 RDBE
-1.31936 ppm
Relative Abundance
m/z

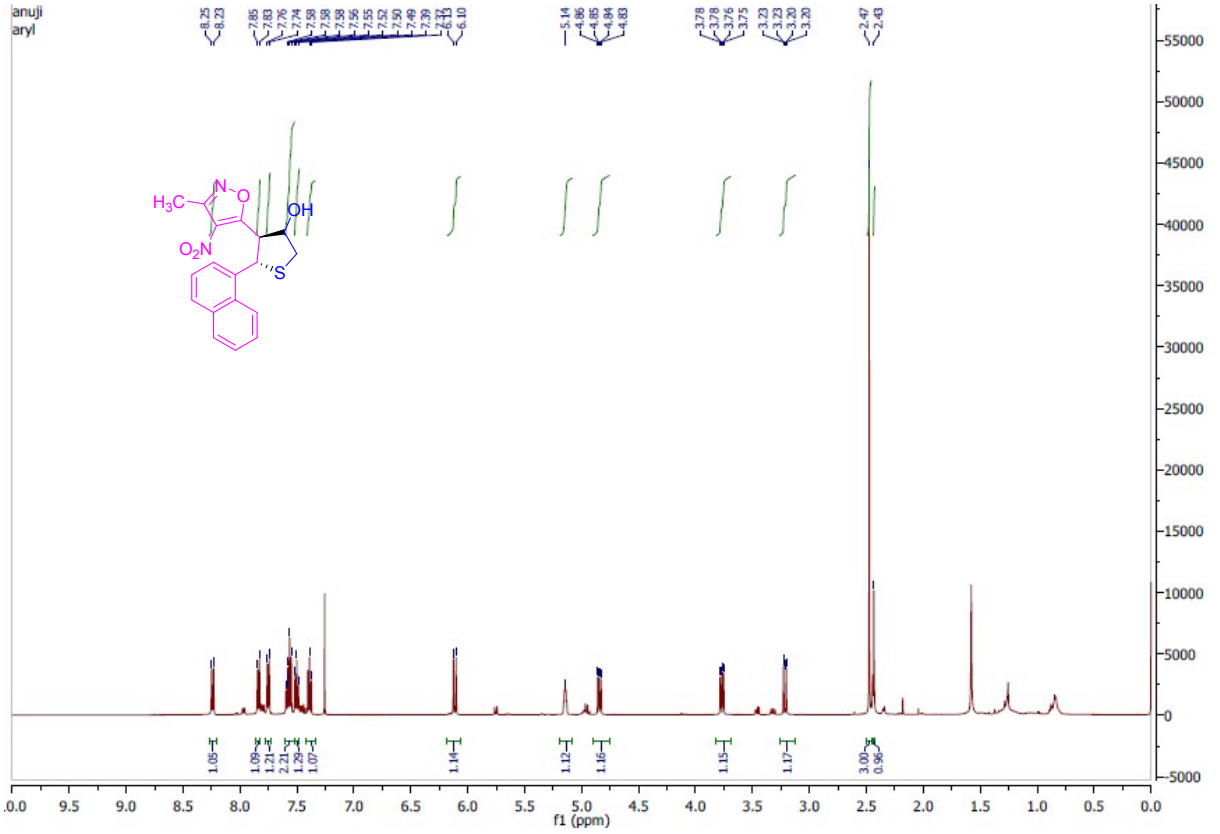
M Wt: 351

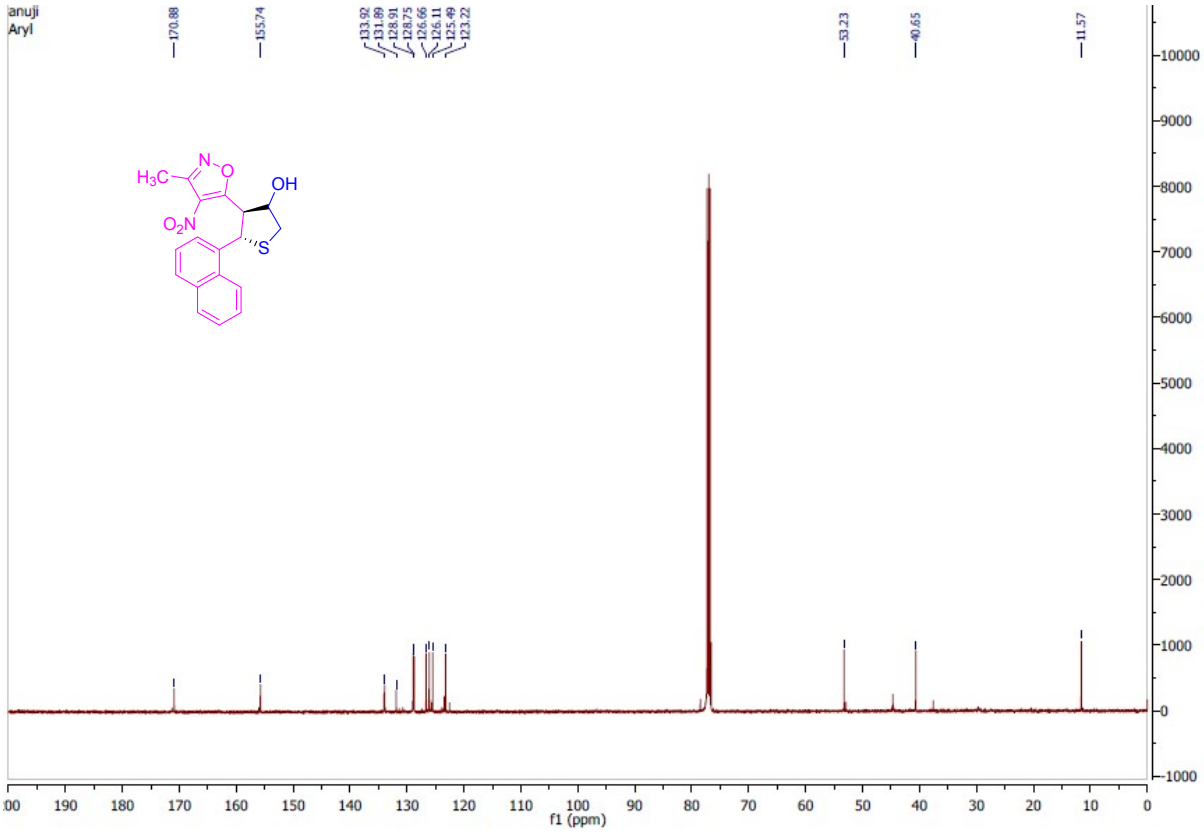
5-(3,4-dichlorophenyl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol

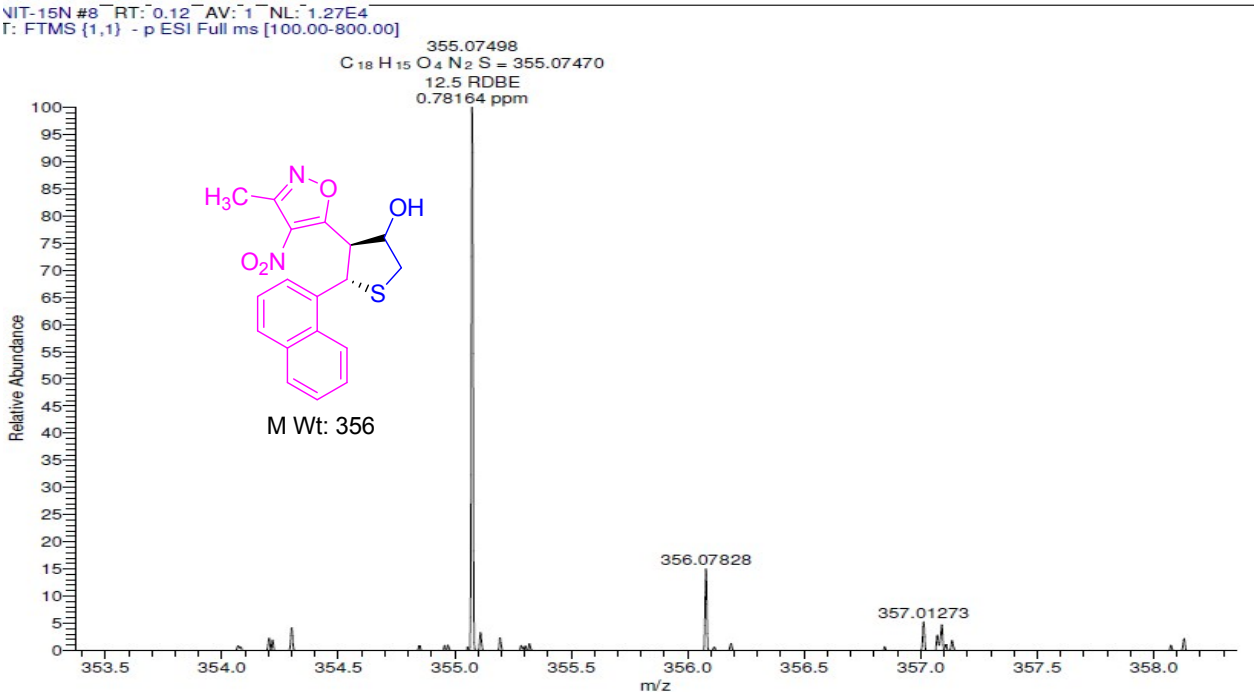


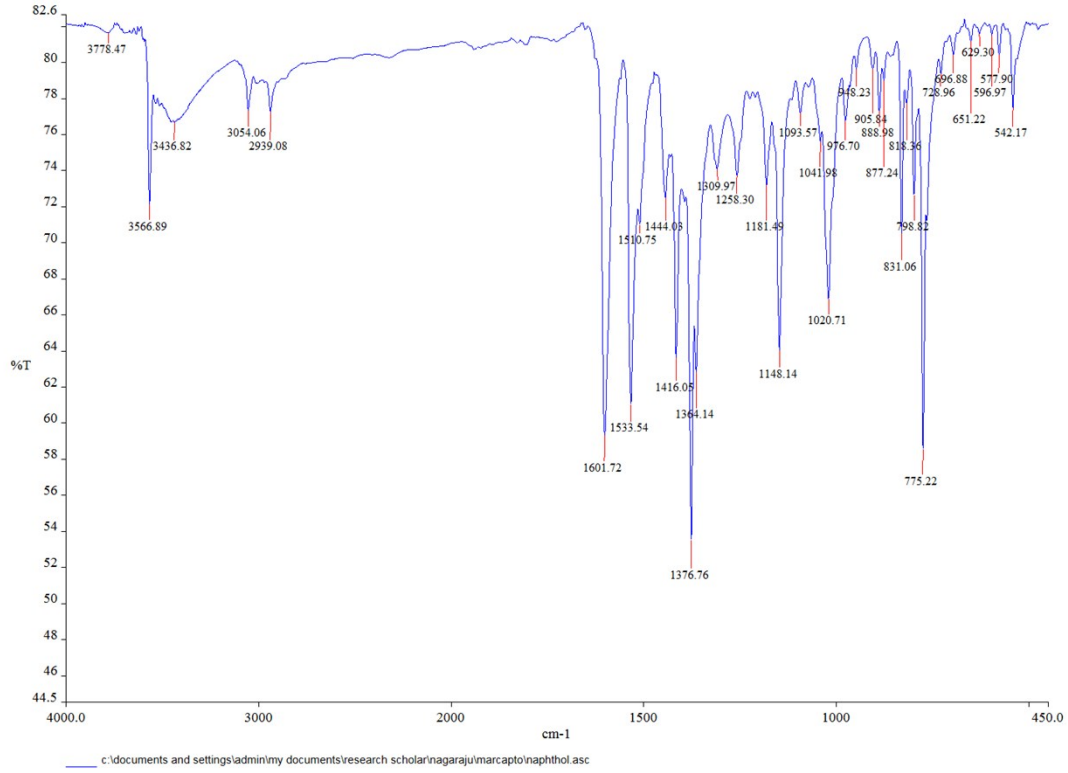


4-(3-methyl-4-nitroisoxazol-5-yl)-5-(naphthalen-1-yl)tetrahydrothiophen-3-ol






NIT-15N #8 RT: 0.12 AV: 1 NL: 1.27E4
T: FTMS {1,1} - p ESI Full ms [100.00-800.00]
355.07498
C 18 H 15 O 4 N 2 S = 355.07470
12.5 RDBE
0.78164 ppm
M Wt: 356
356.07828
357.01273
Relative Abundance
m/z


%T
cm-1
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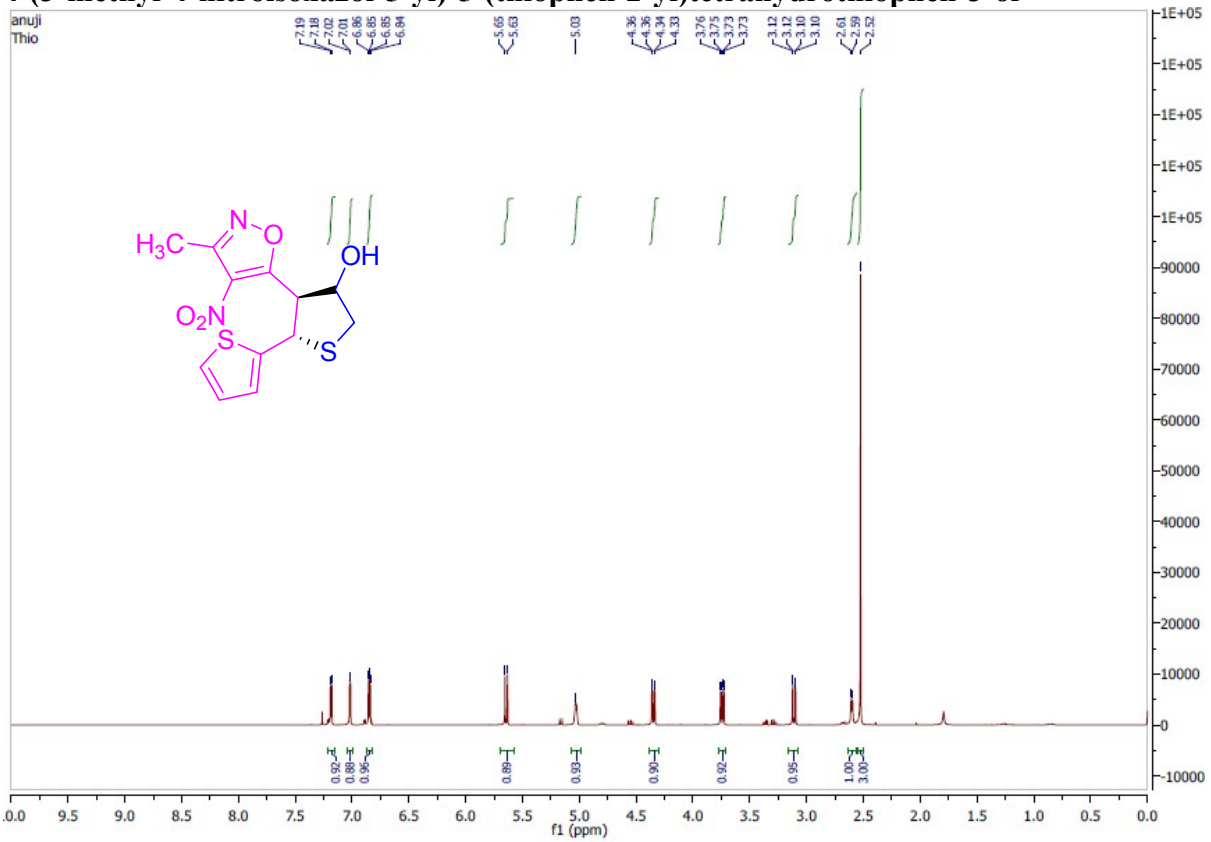
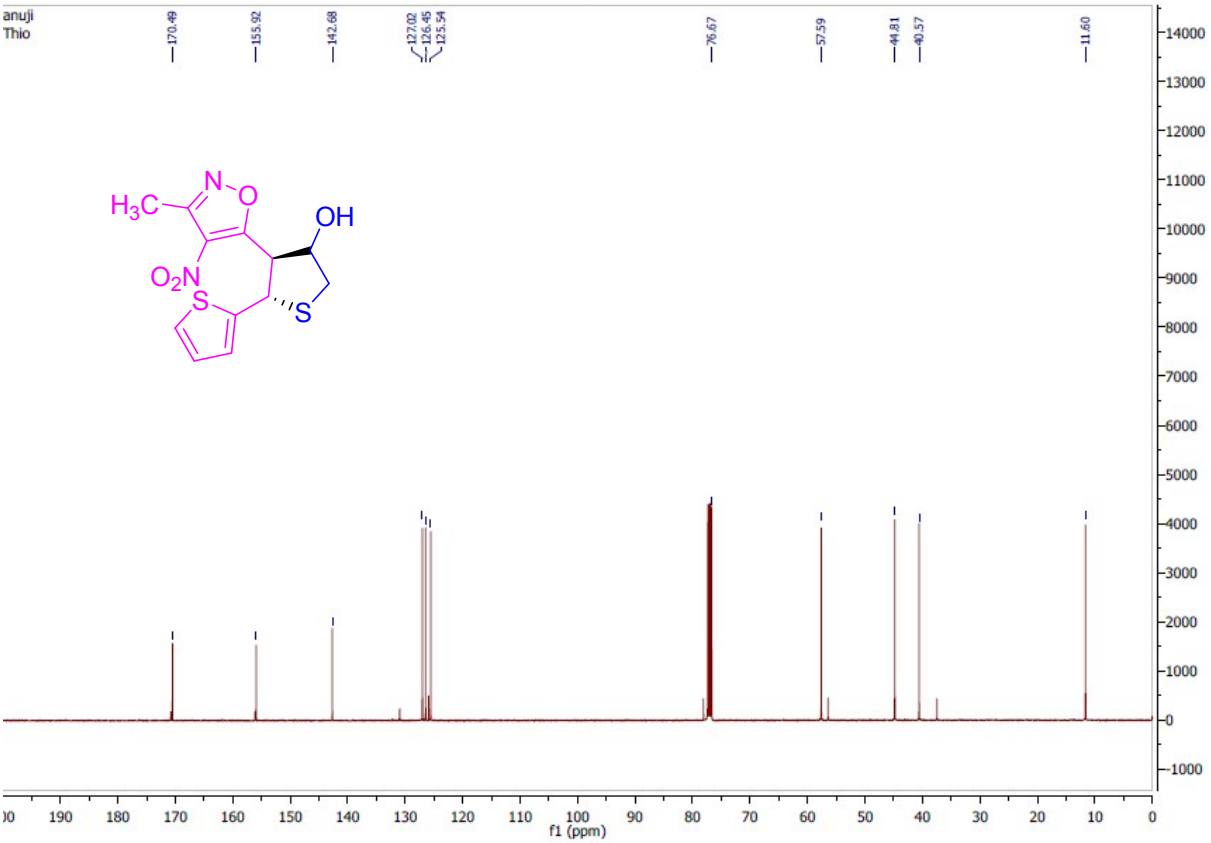
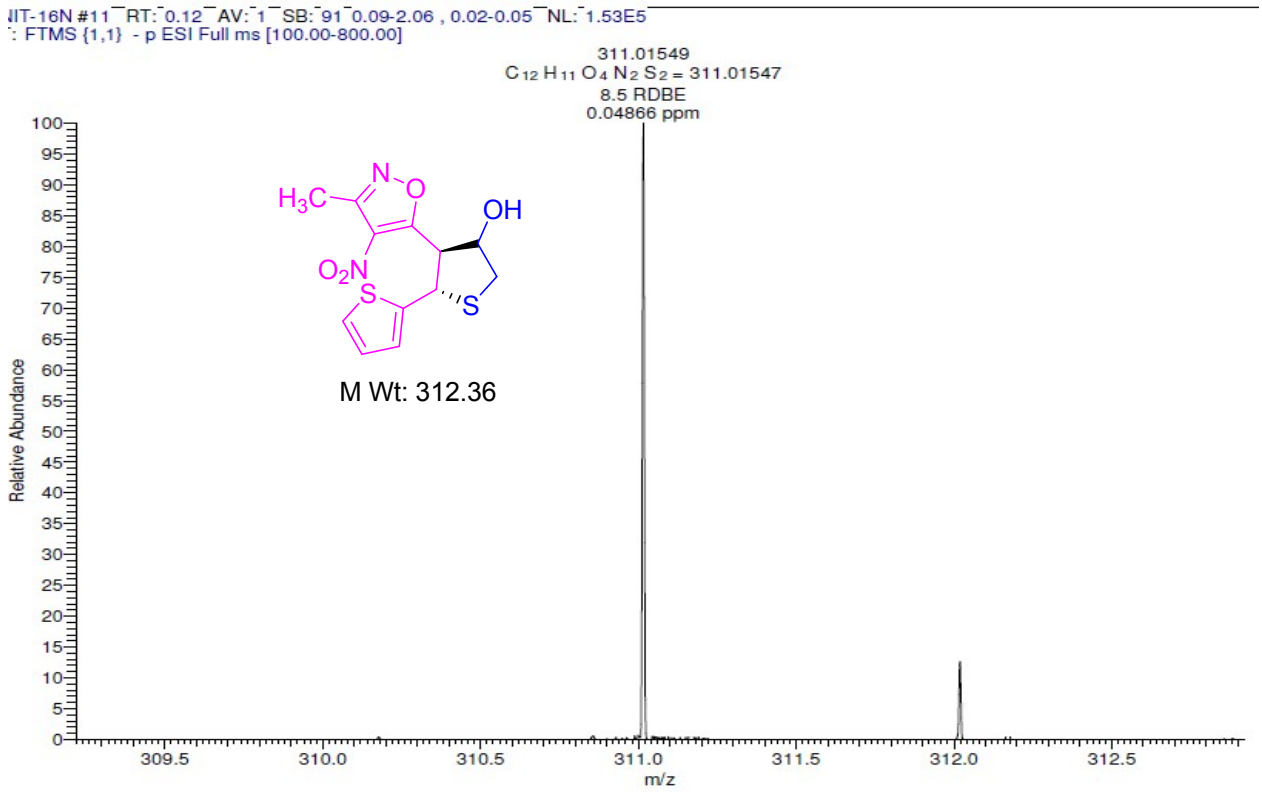
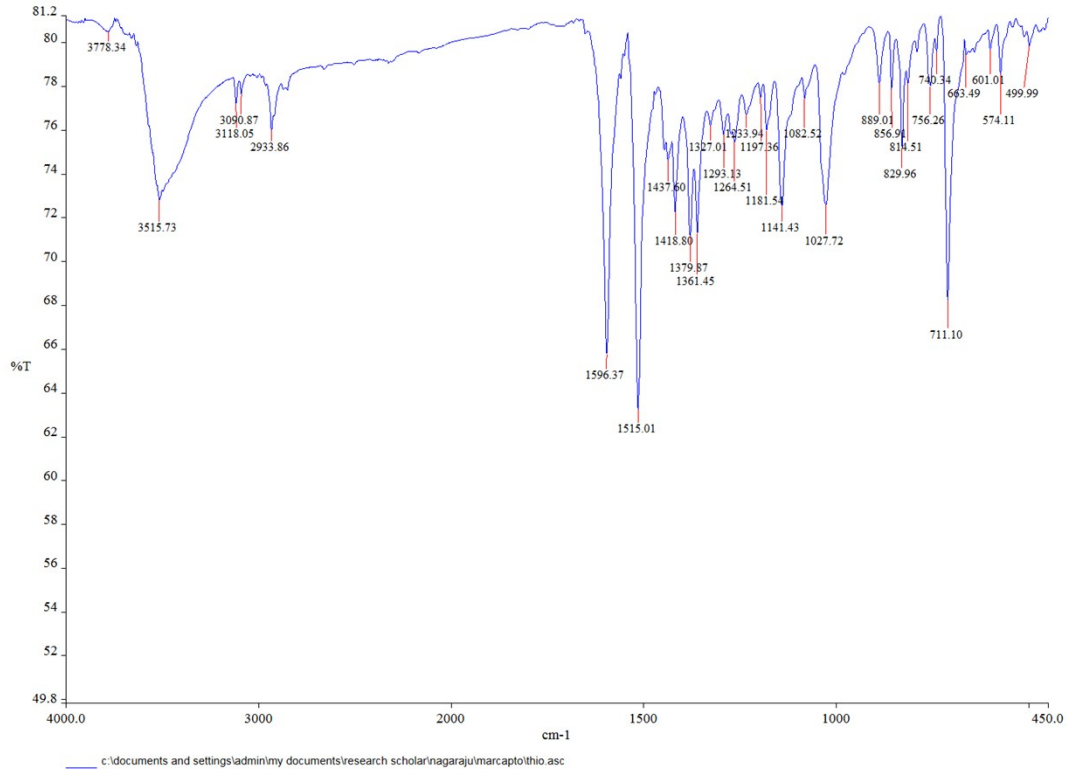
4-(3-methyl-4-nitroisoxazol-5-yl)-5-(thiophen-2-yl)tetrahydrothiophen-3-ol






IIT-16N #11 RT: 0.12 AV: 1 SB: 91 0.09-2.06 , 0.02-0.05 NL: 1.53E5
: FTMS {1,1} - p ESI Full ms [100.00-800.00]
311.01549
C12 H11 O4 N2 S2 = 311.01547
8.5 RDBE
0.04866 ppm
M Wt: 312.36
Relative Abundance
m/z


%T
cm-1
3778.34
3515.73
3090.87
3118.05
2933.86
1596.37
1515.01
1437.60
1418.80
1379.87
1361.45
1327.01
1293.13
1264.51
1197.36
1181.54
1141.43
1082.52
1027.72
889.01
856.98
814.51
829.96
756.26
740.34
711.10
663.49
601.01
574.11
499.99
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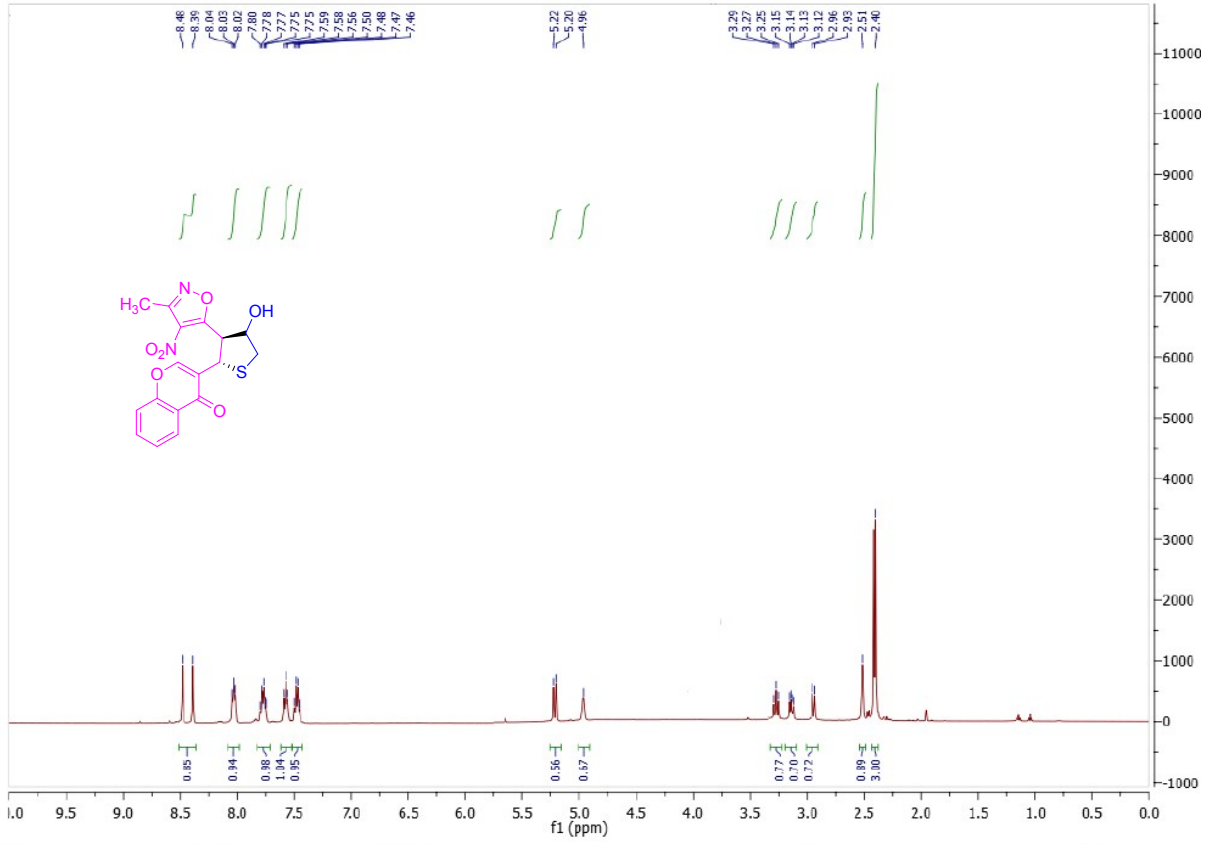
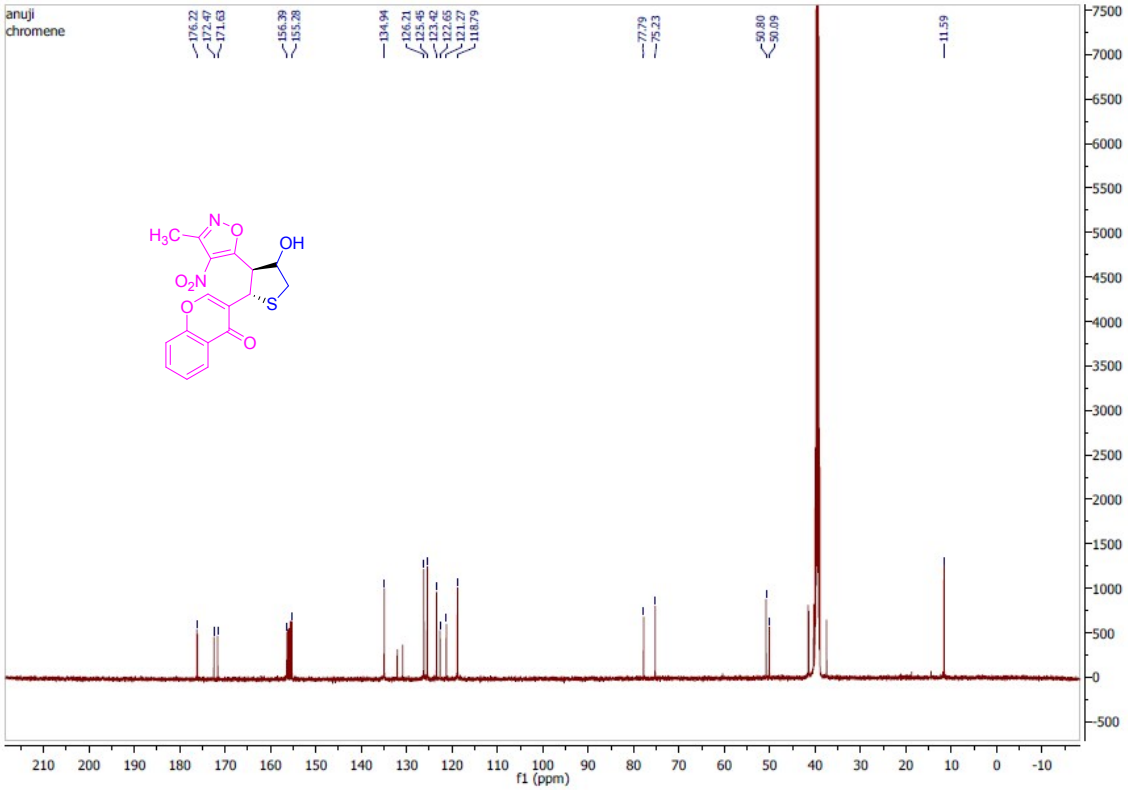
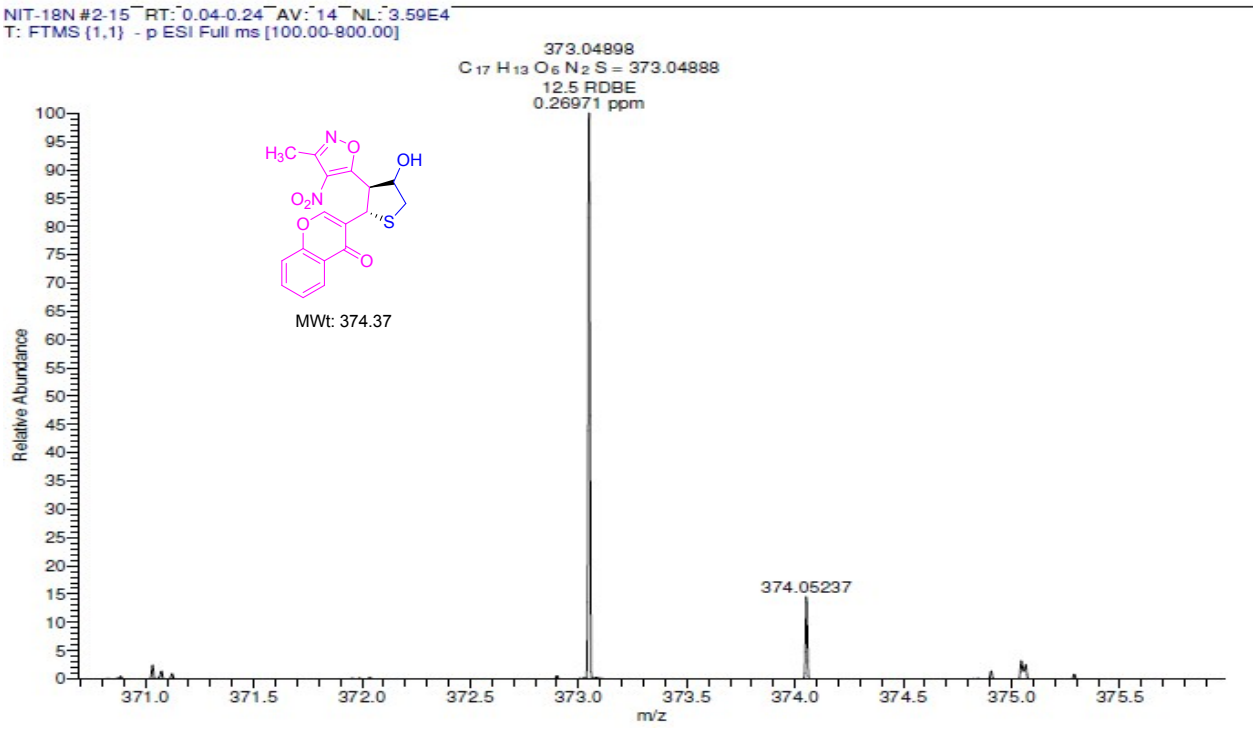
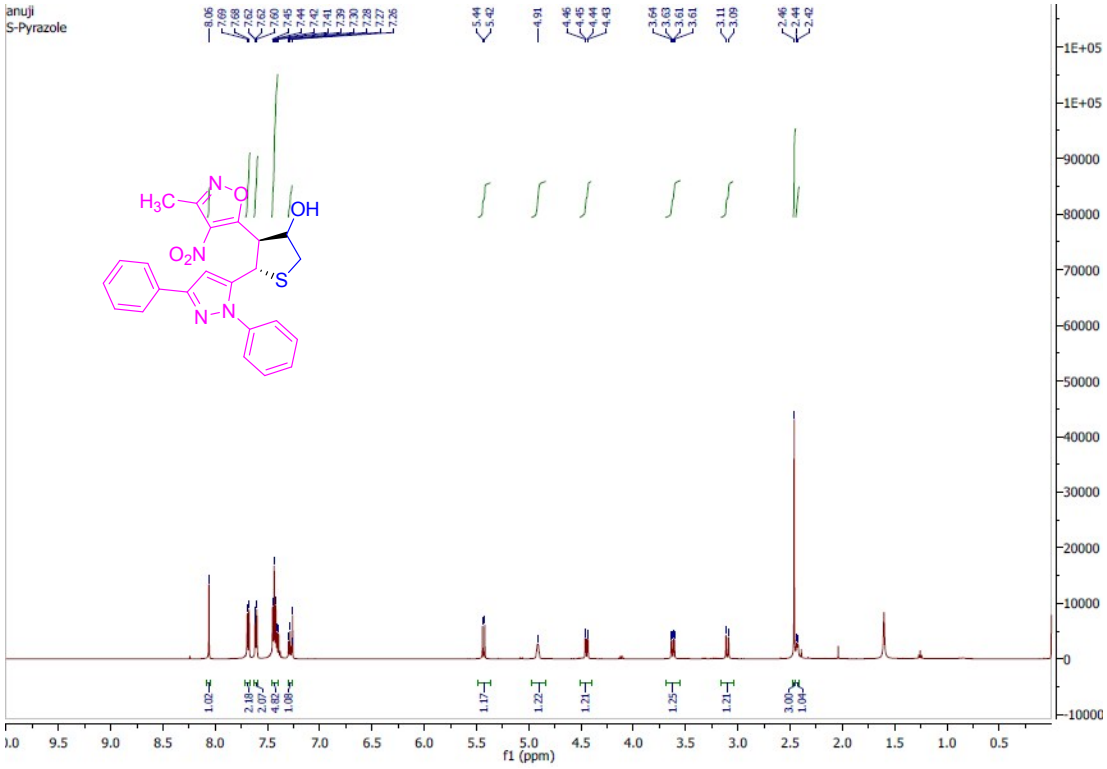
3-(4-hydroxy-3-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-2-yl)-4H-chromen-4-one

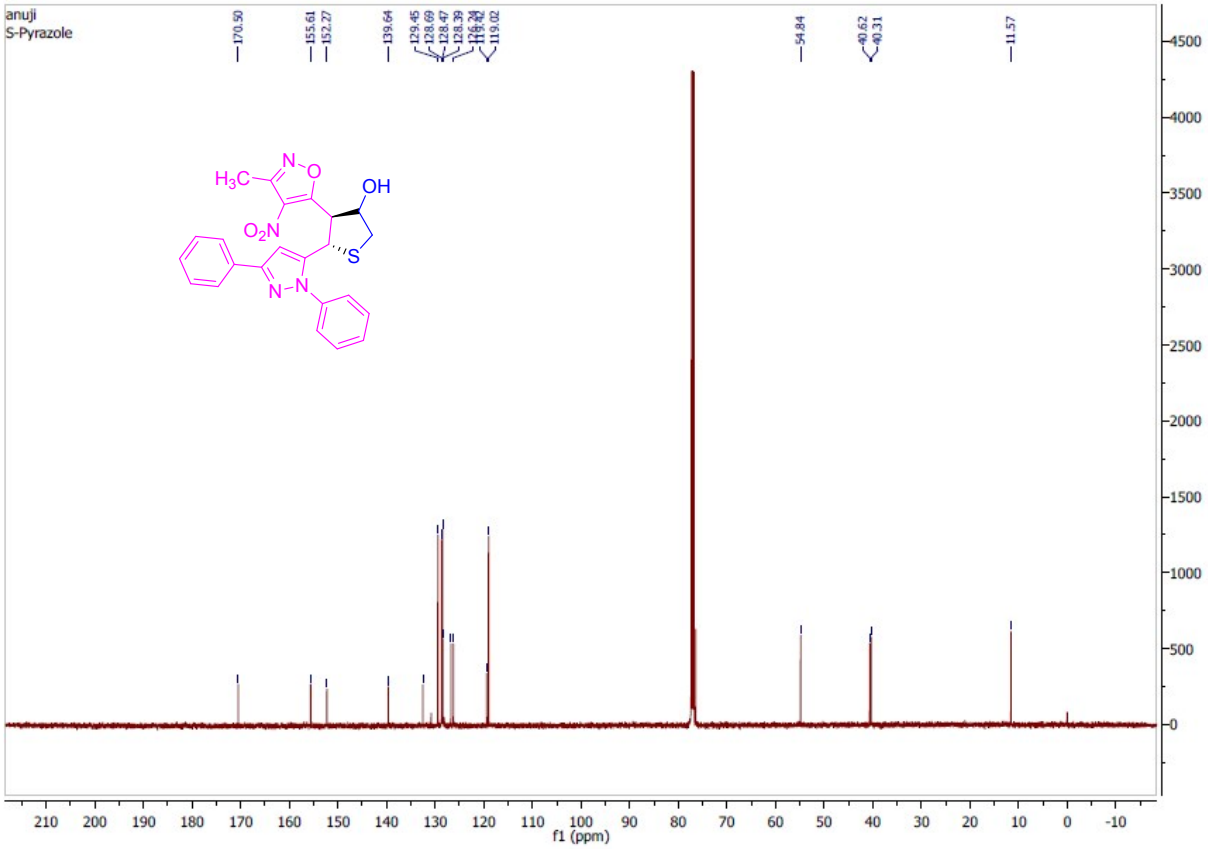


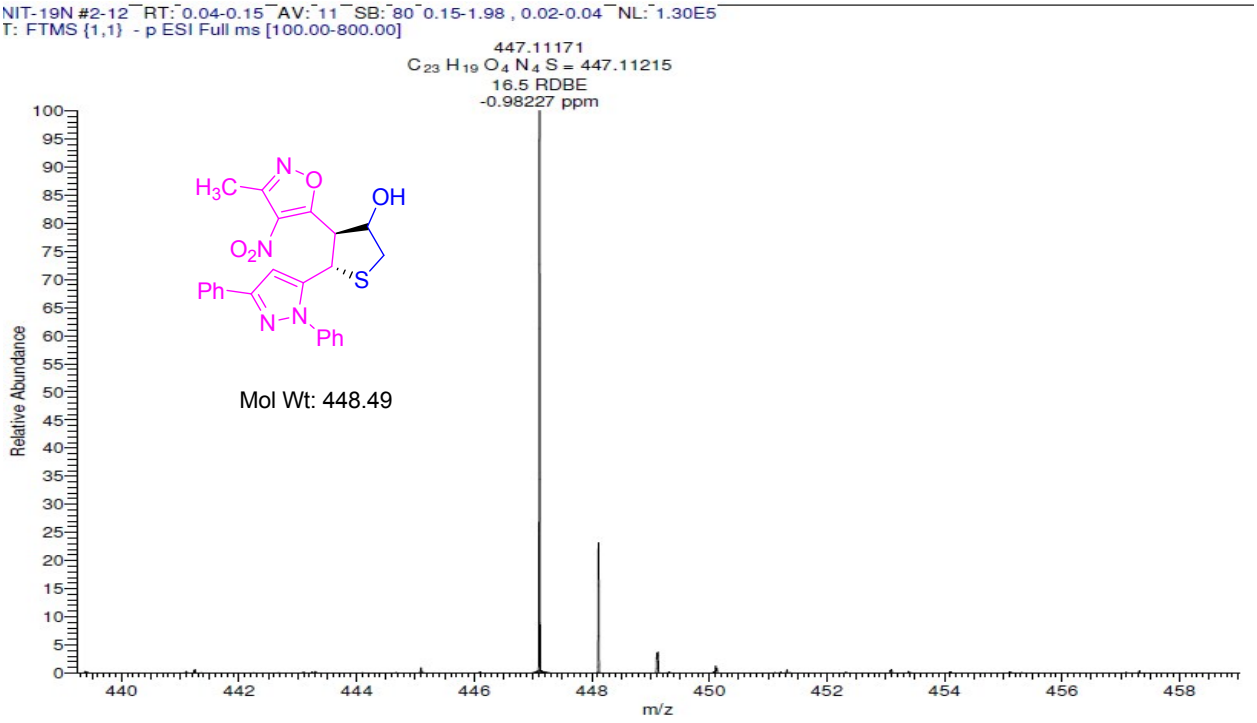




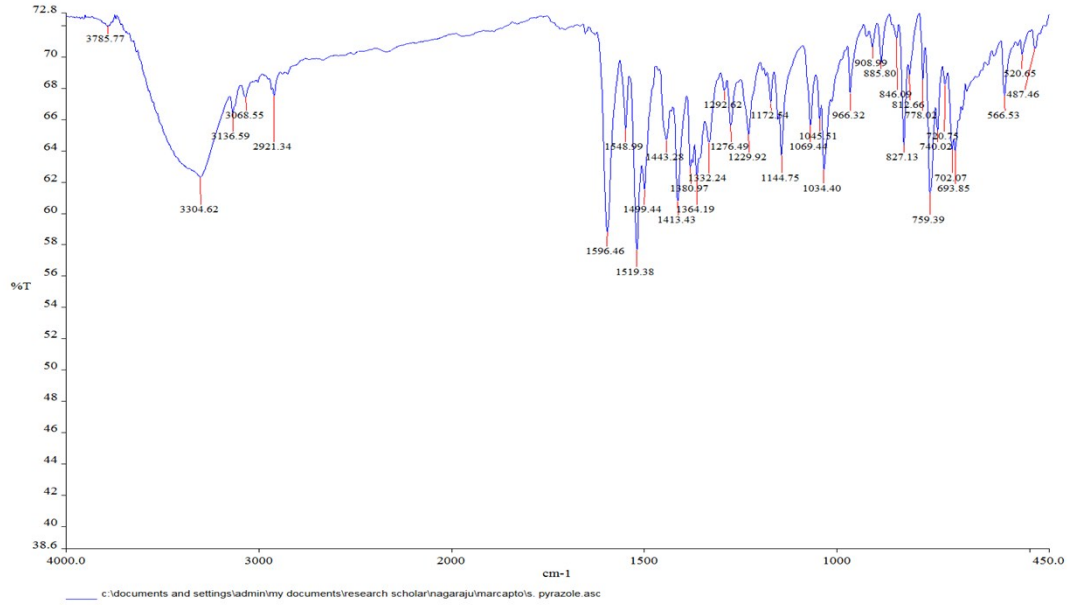
5-(1,3-diphenyl-1H-pyrazol-4-yl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol



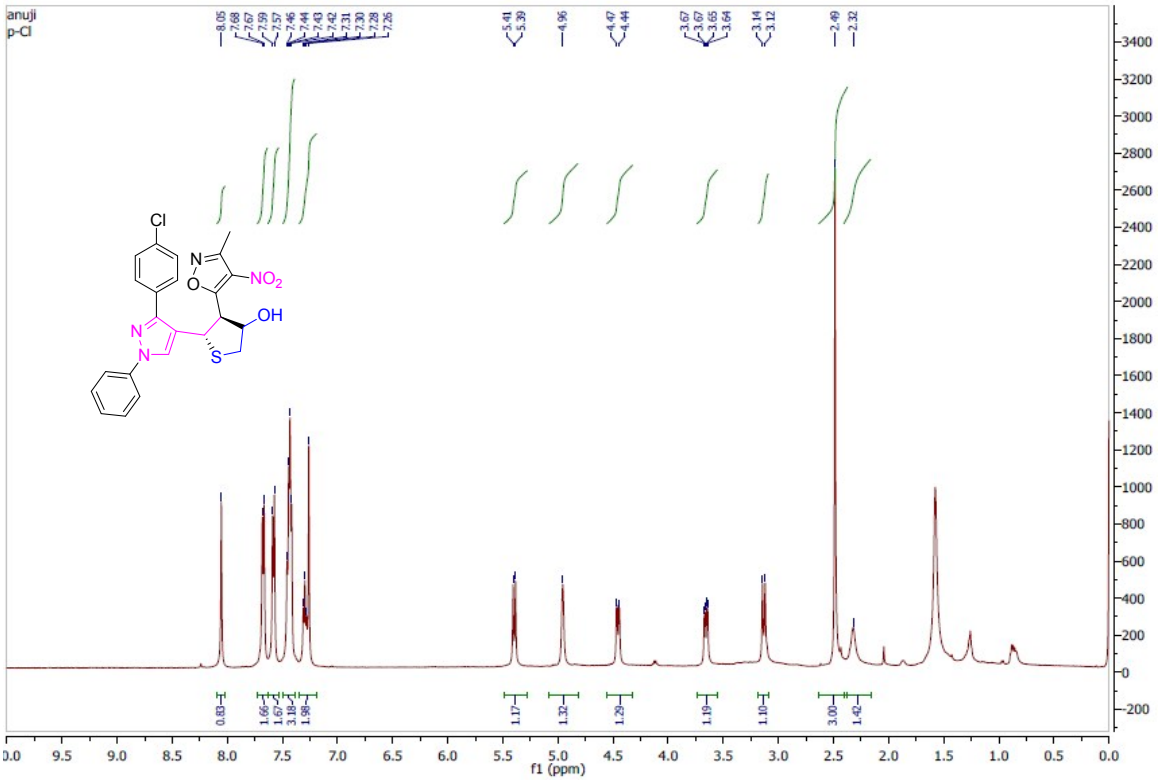

anuji
S-Pyrazole
170.50
155.61
152.27
139.64
129.45
128.69
128.47
128.39
119.02
54.84
40.62
40.31
11.57
f1 (ppm)

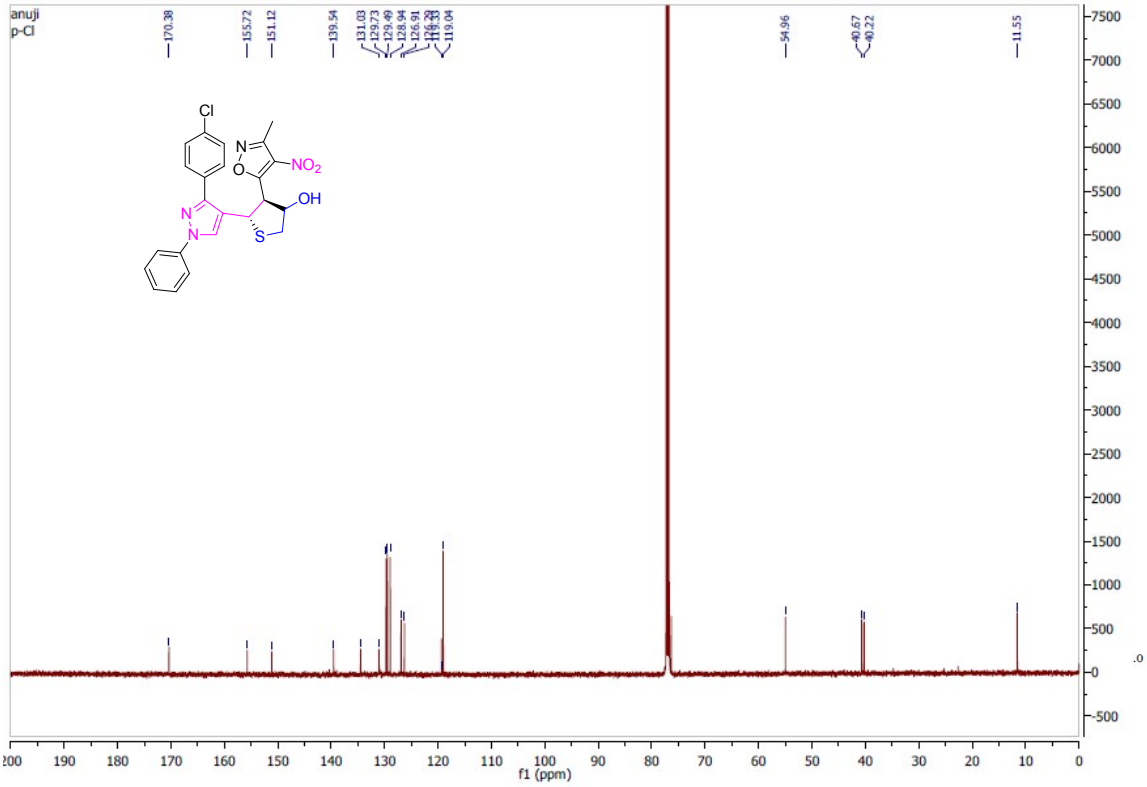

NIT-19N #2-12 RT: 0.04-0.15 AV: 11 SB: 80 0.15-1.98 , 0.02-0.04 NL: 1.30E5
T: FTMS {1,1} - p ESI Full ms [100.00-800.00]
447.11171
C23 H19 O4 N4 S = 447.11215
16.5 RDBE
-0.98227 ppm
Relative Abundance
m/z

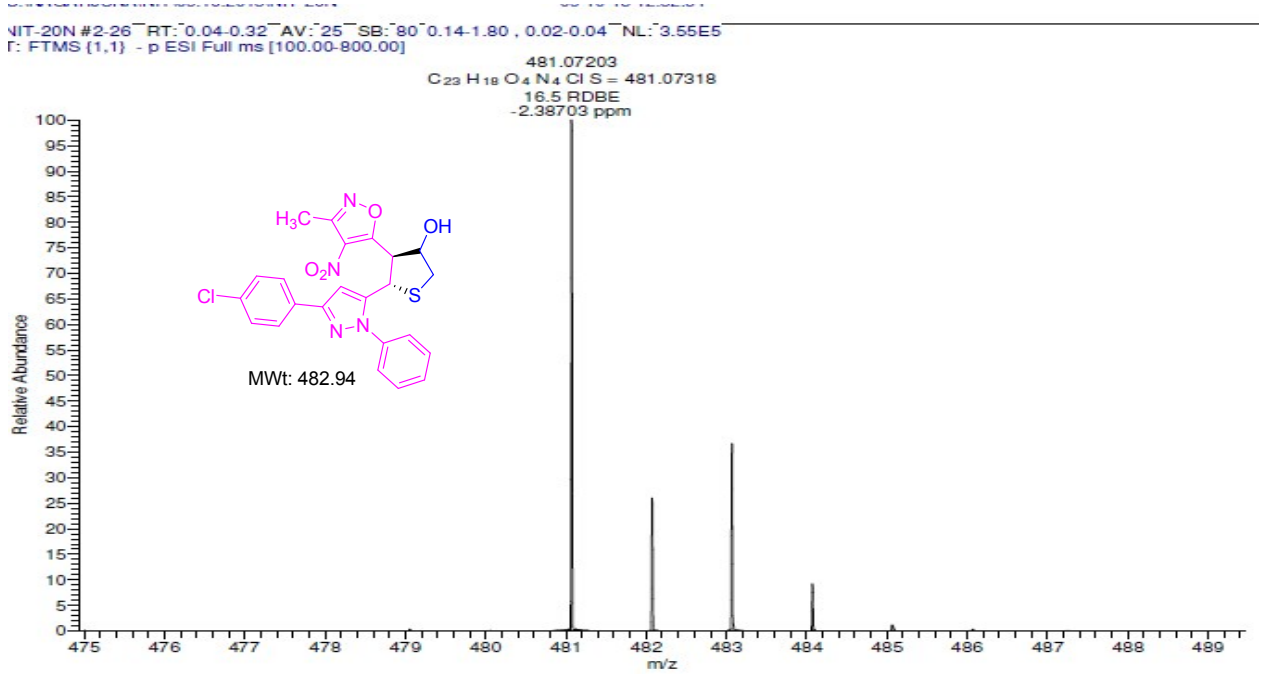
Mol Wt: 448.49



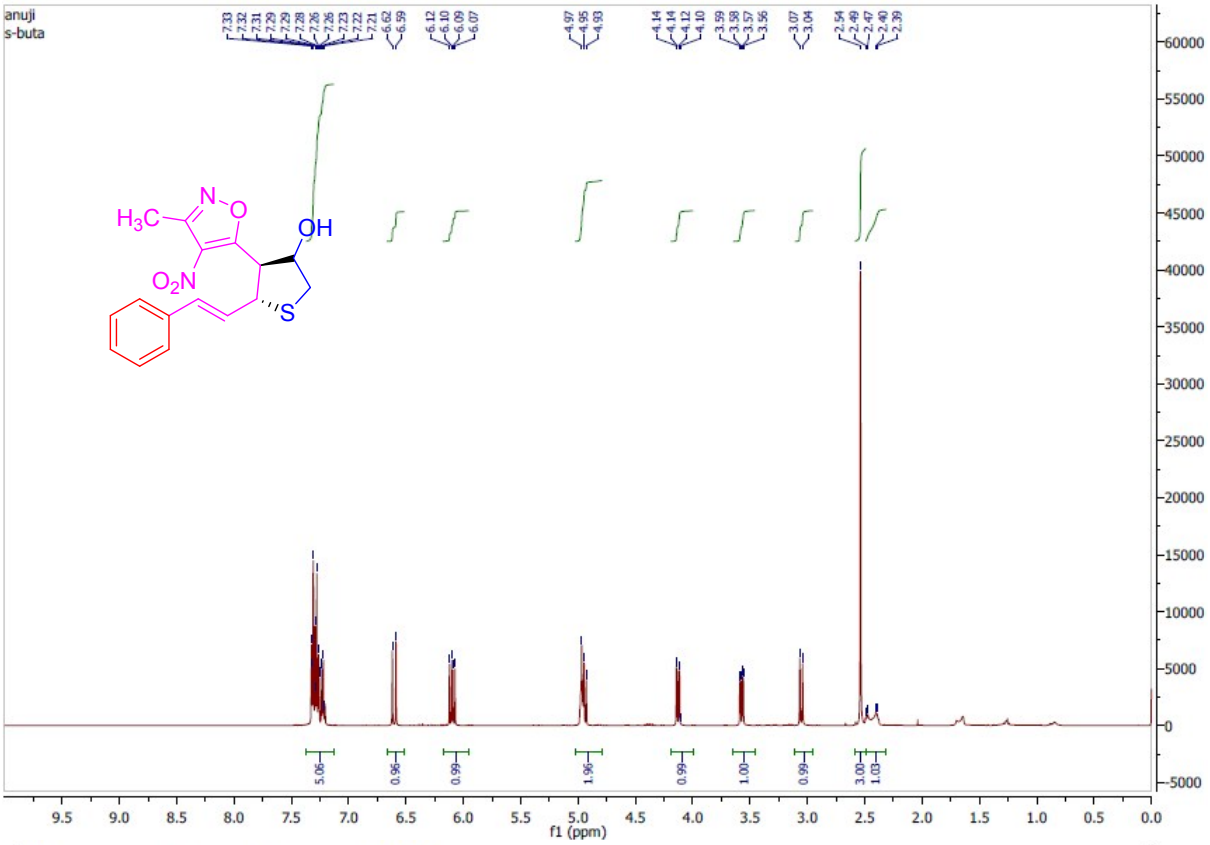
5-(3-(4-chlorophenyl)-1-phenyl-1H-pyrazol-4-yl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-ol

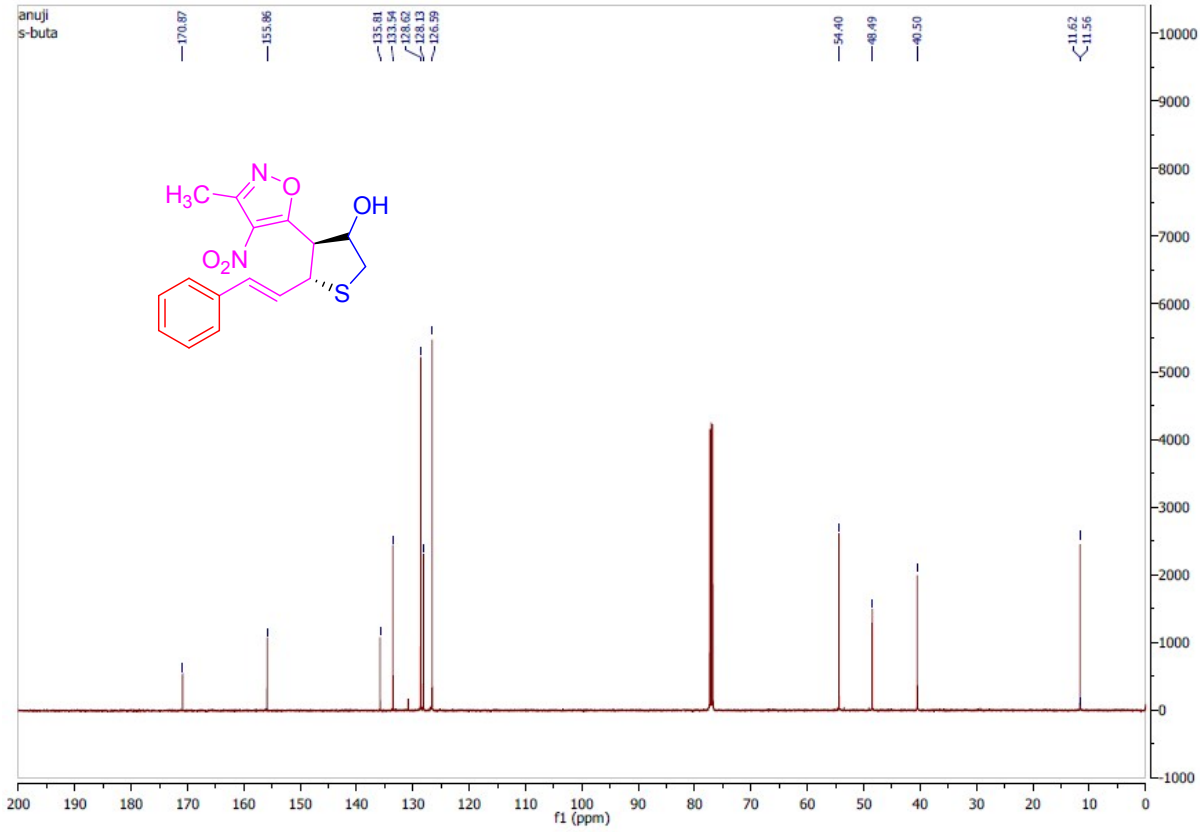


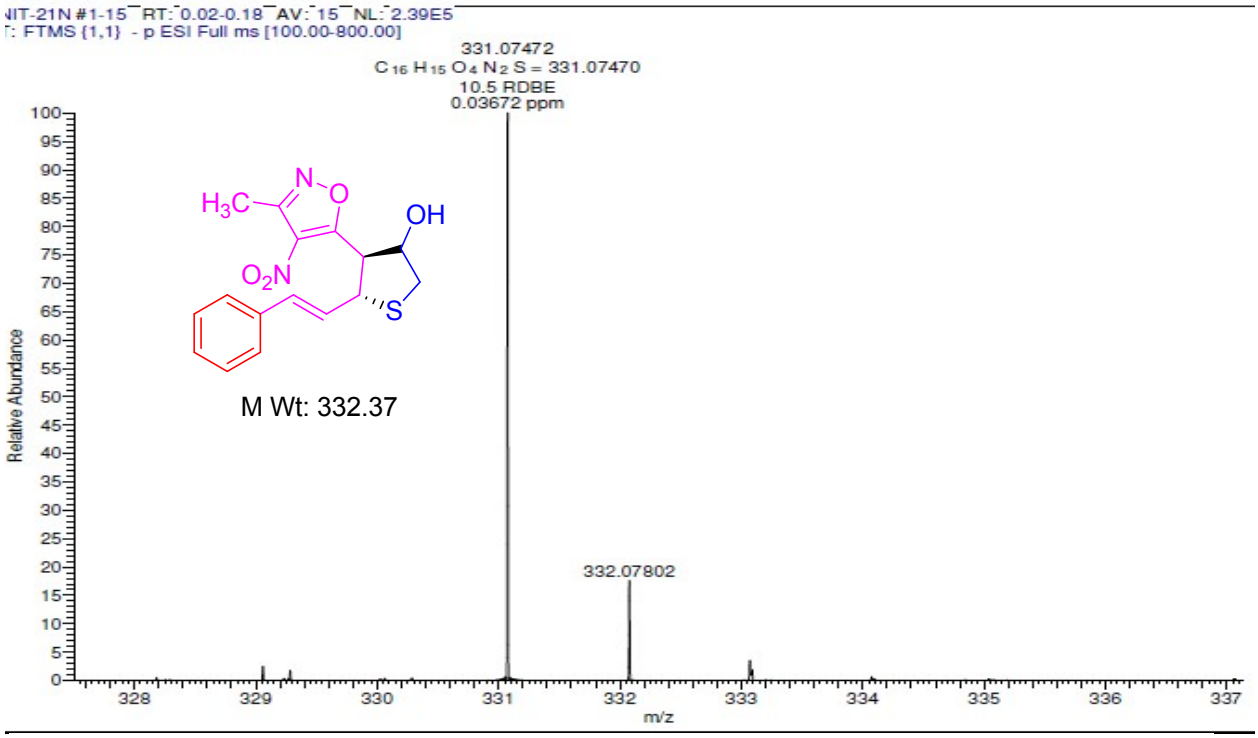

anuji
p-Cl
170.38
155.72
151.12
139.54
131.03
129.73
129.49
128.94
126.91
119.04
54.96
40.67
40.22
11.55
Cl
N
O
NO2
OH
N
N
S
f1 (ppm)

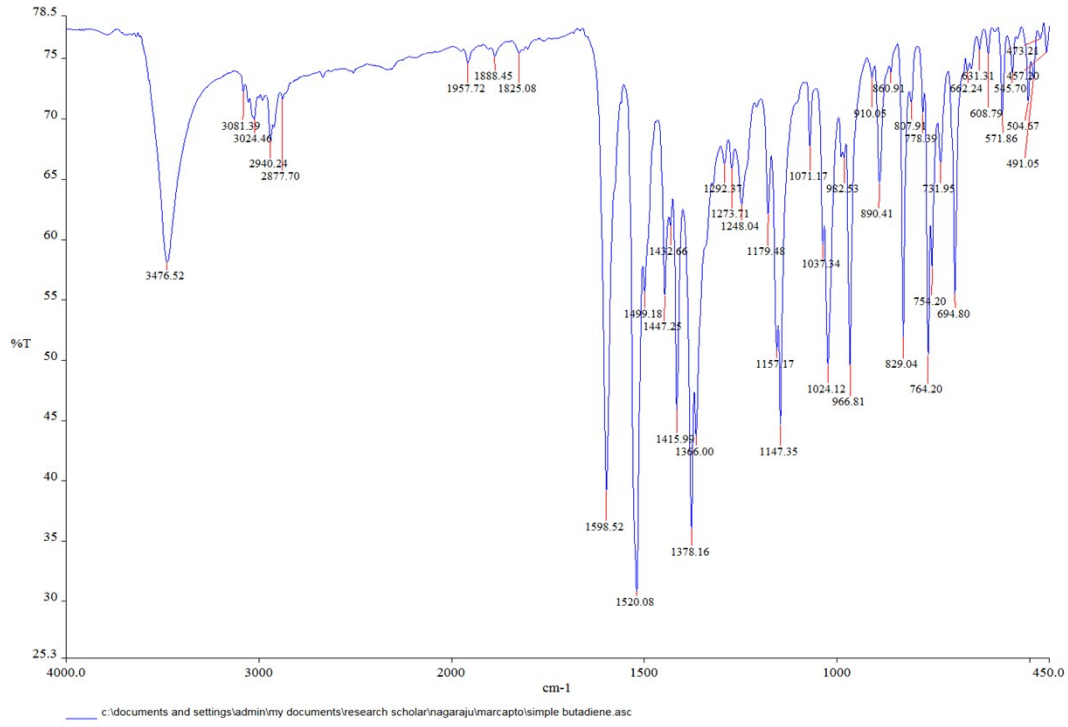

NIT-20N #2-26 RT: 0.04-0.32 AV: 25 SB: 80 0.14-1.80 , 0.02-0.04 NL: 3.55E5
T: FTMS {1,1} - p ESI Full ms [100.00-800.00]
481.07203
C23 H18 O4 N4 Cl S = 481.07318
16.5 RDBE
-2.38703 ppm
H3C
N
O
OH
O2N
Cl
S
N
N
MWt: 482.94
Relative Abundance
m/z

4-(3-methyl-4-nitroisoxazol-5-yl)-5-((E)-styryl)tetrahydrothiophen-3-ol

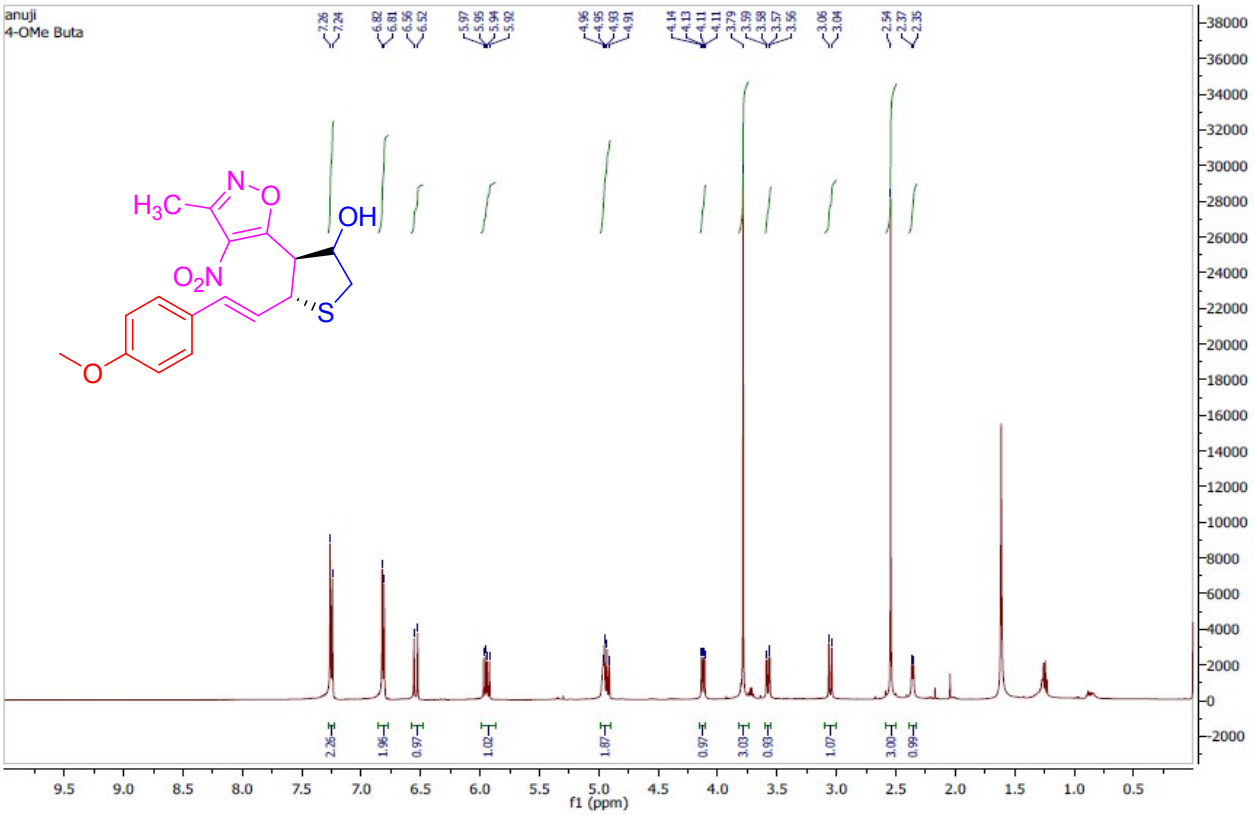


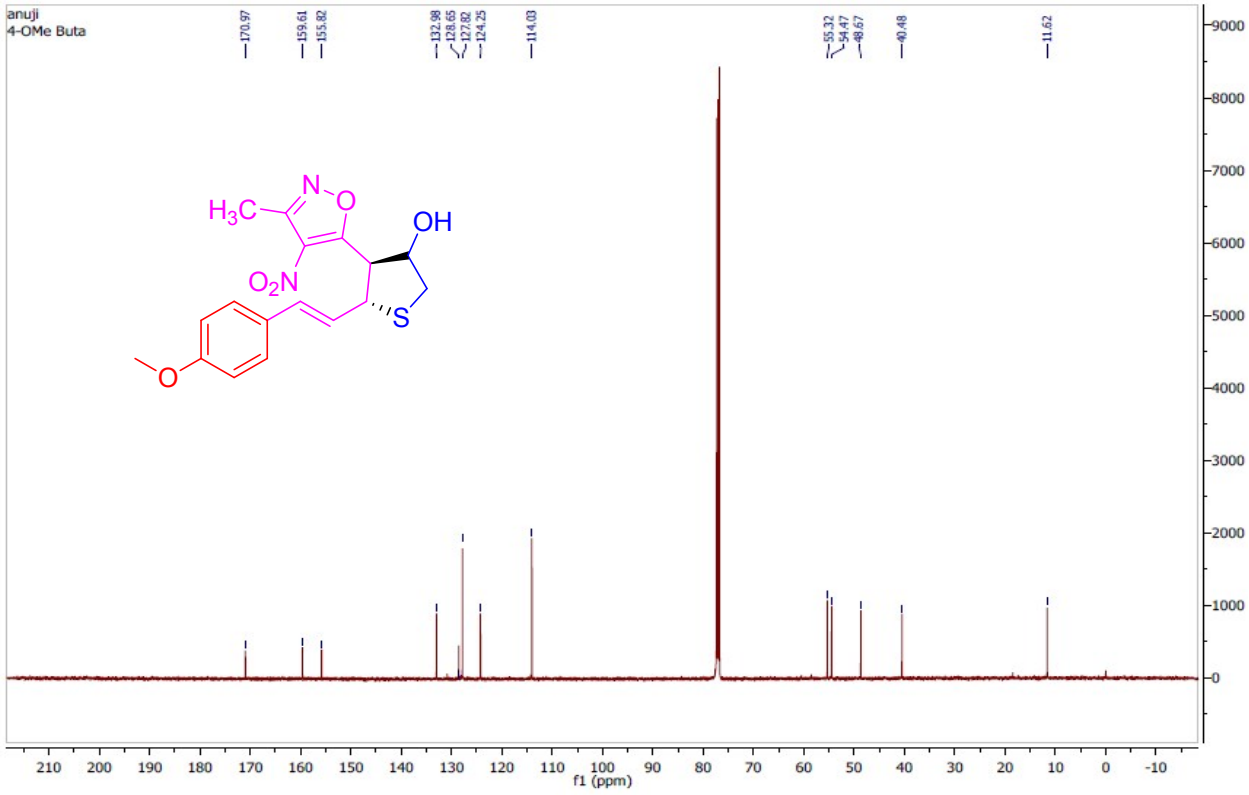


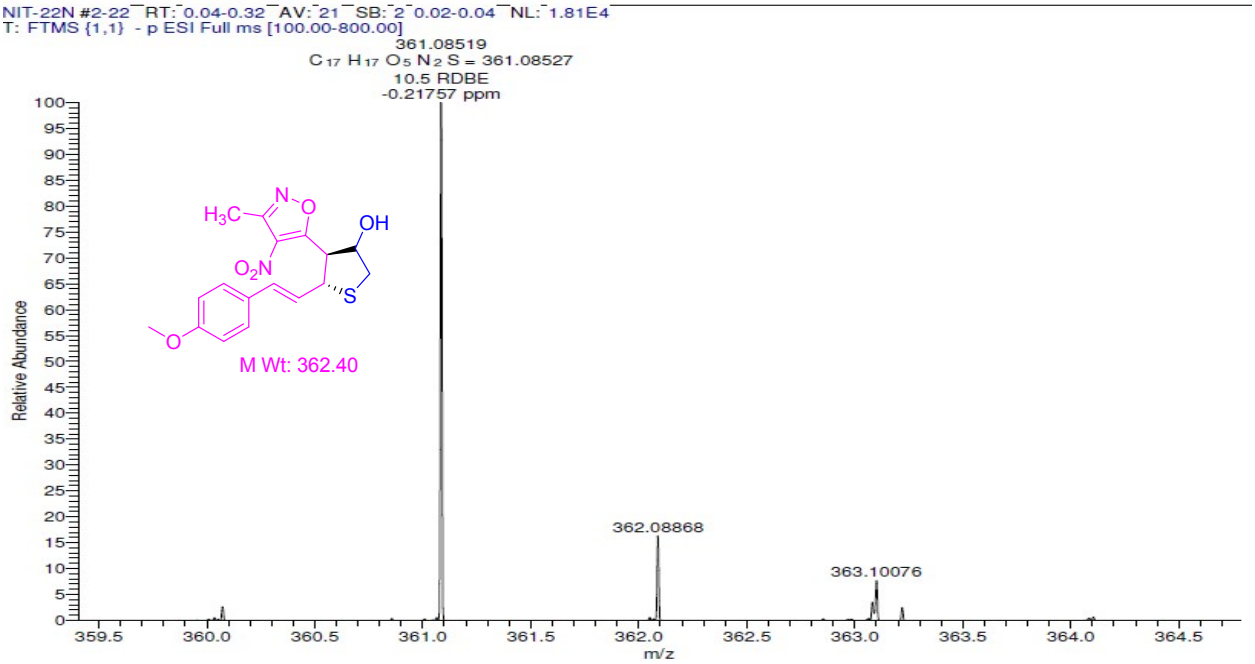

NIT-21N #1-15 RT: 0.02-0.18 AV: 15 NL: 2.39E5
T: FTMS {1,1} - p ESI Full ms [100.00-800.00]
331.07472
C16 H15 O4 N2 S = 331.07470
10.5 RDBE
0.03672 ppm
M Wt: 332.37
332.07802
Relative Abundance
m/z


%T
cm-1
c:\documents and settings\admin\my documents\research scholar\nagaraju\marcapto\simple butadiene.asc

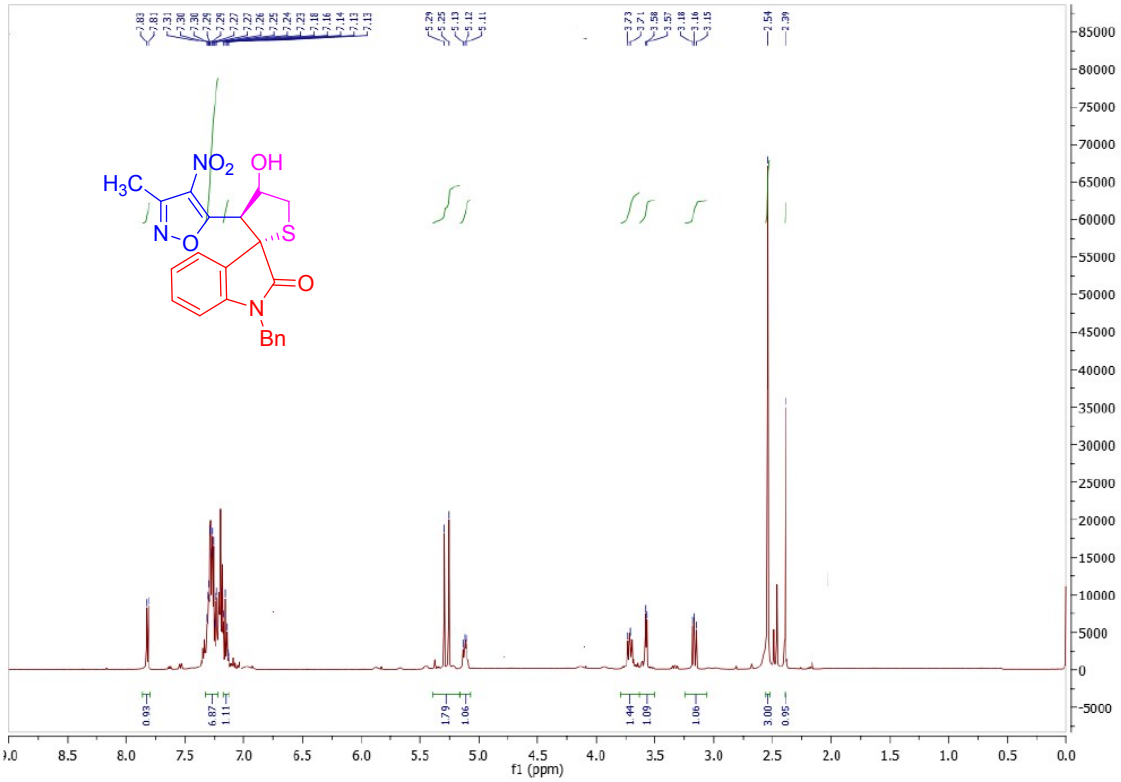
5-(4-methoxystyryl)-4-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophen-3-ol

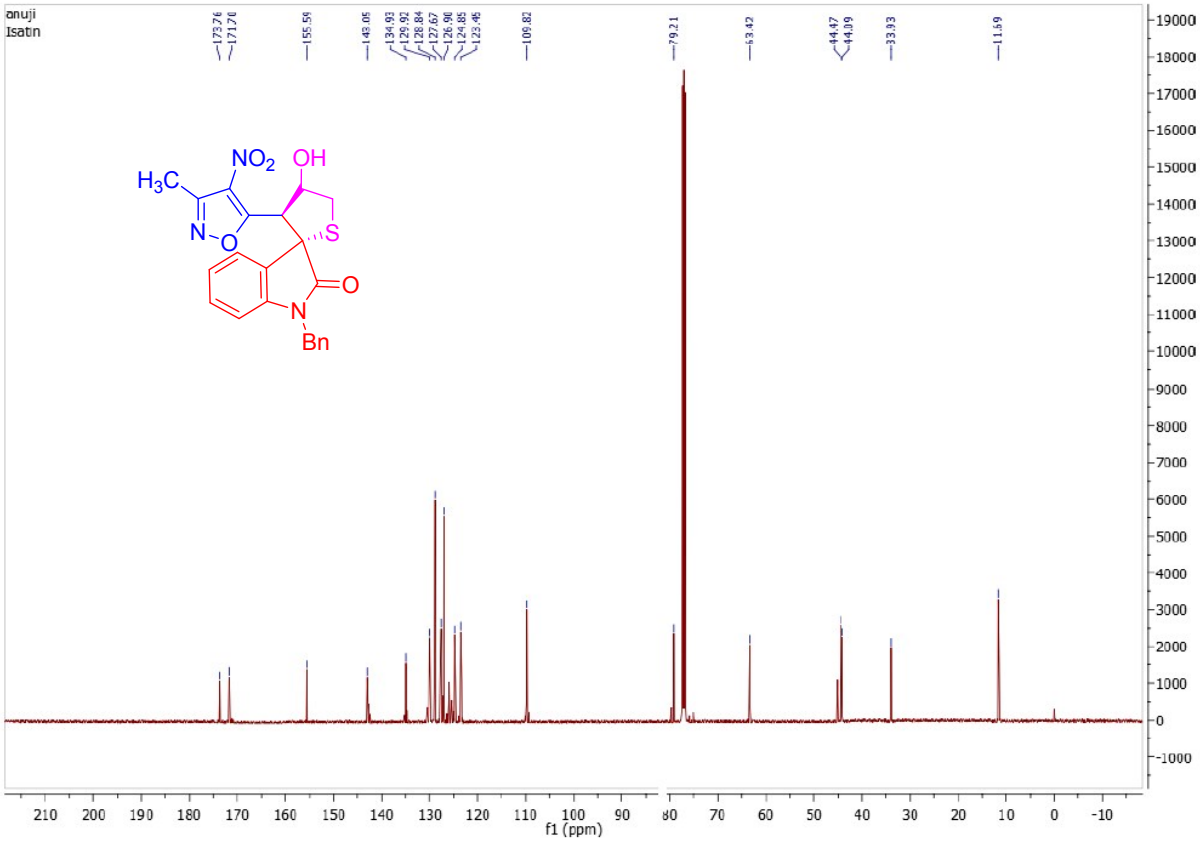


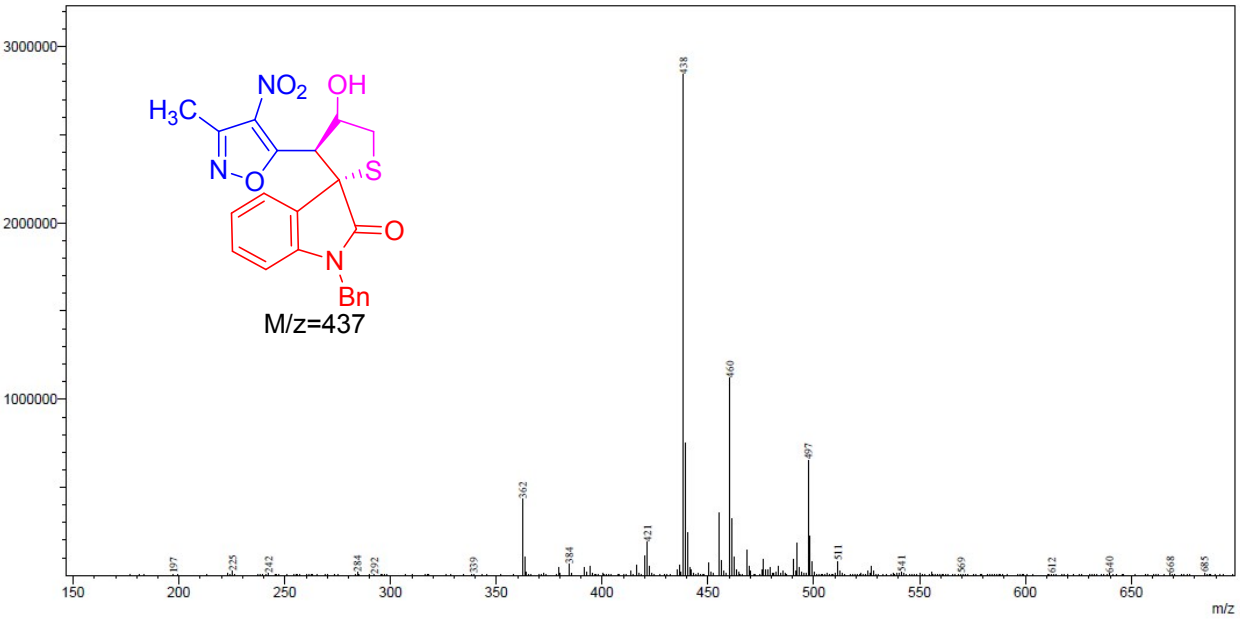




1-benzyl-4'-hydroxy-3'-(3-methyl-4-nitroisoxazol-5-yl)-4',5'-dihydro-3'H-spiro[indoline-3,2'-thiophen]-2-one




anuji
Isatin
NO2
OH
H3C
N
O
S
O
N
Bn
f1 (ppm)


NO2
OH
H3C
N
O
S
O
N
Bn
M/z=437
m/z

2-(4-bromophenyl)-4-hydroxy-3-(3-methyl-4-nitroisoxazol-5-yl)tetrahydrothiophene 1,1-dioxide