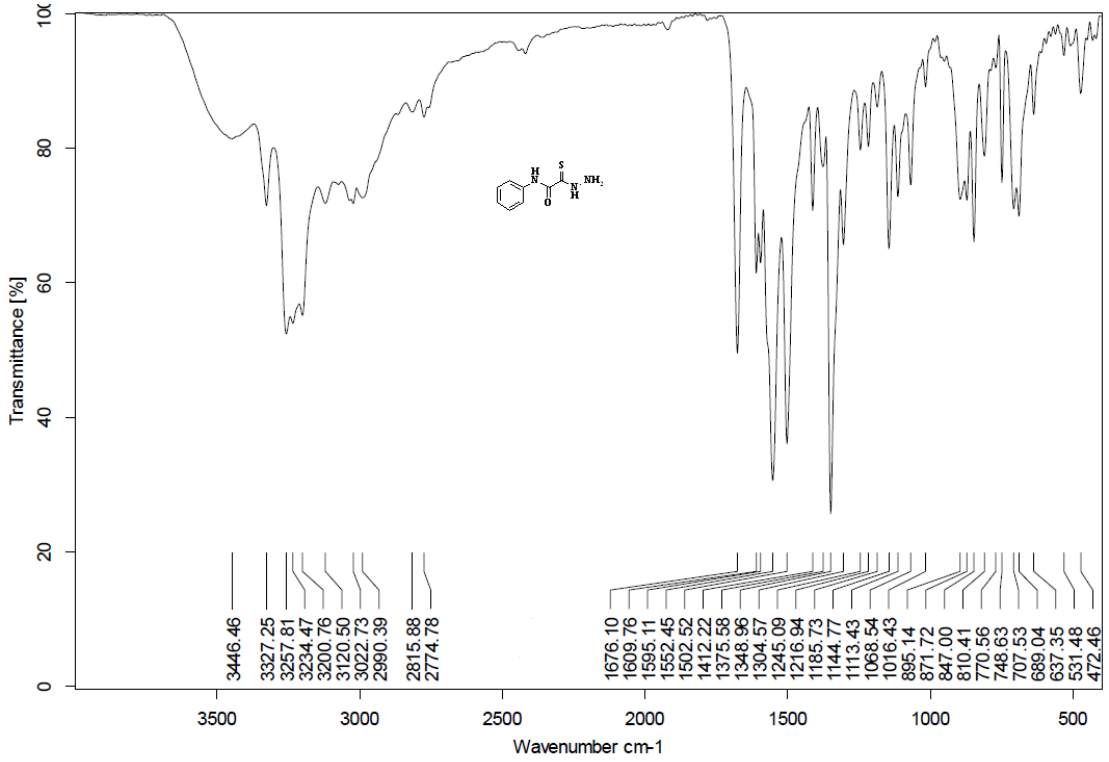
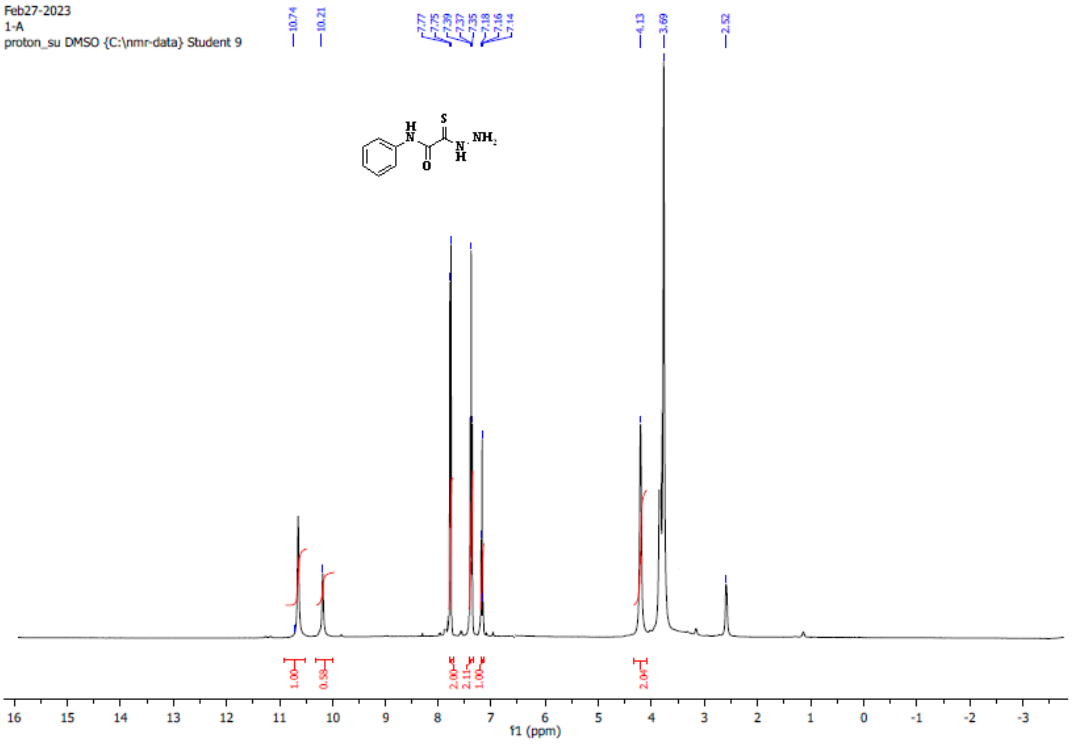
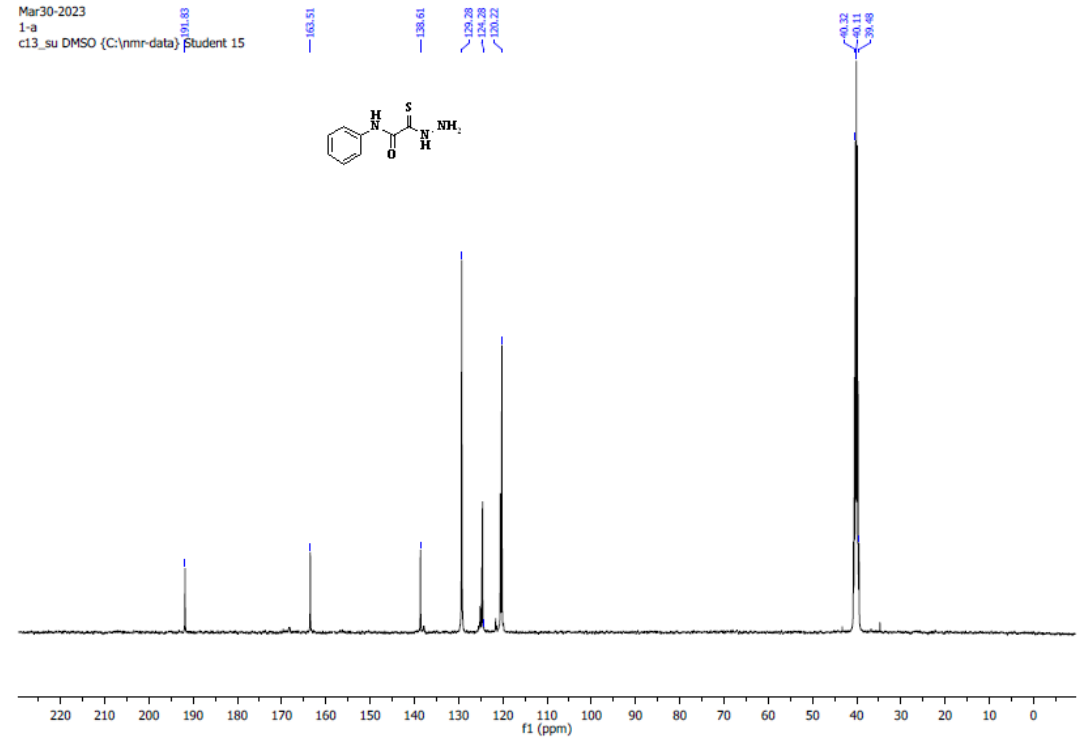
Synthesis of Some New Thiadiazole/Thiadiazine derivatives as potent Biologically Active Compounds

Ahmed M. El-Saghier*, Asmaa Abdul-Baset, Omer M. El-Hady, and Asmaa M. Kadry*
Chemistry Department, Faculty of Science, Sohag University, Sohag 82524, Egypt
**Email: (A.M.E: el.saghier@science.sohag.edu.eg, A.M.K: asmaa.kadry@science.sohag.edu.eg)*

2-Hydrazinyl-N-phenyl-2-thioxoacetamide (1)





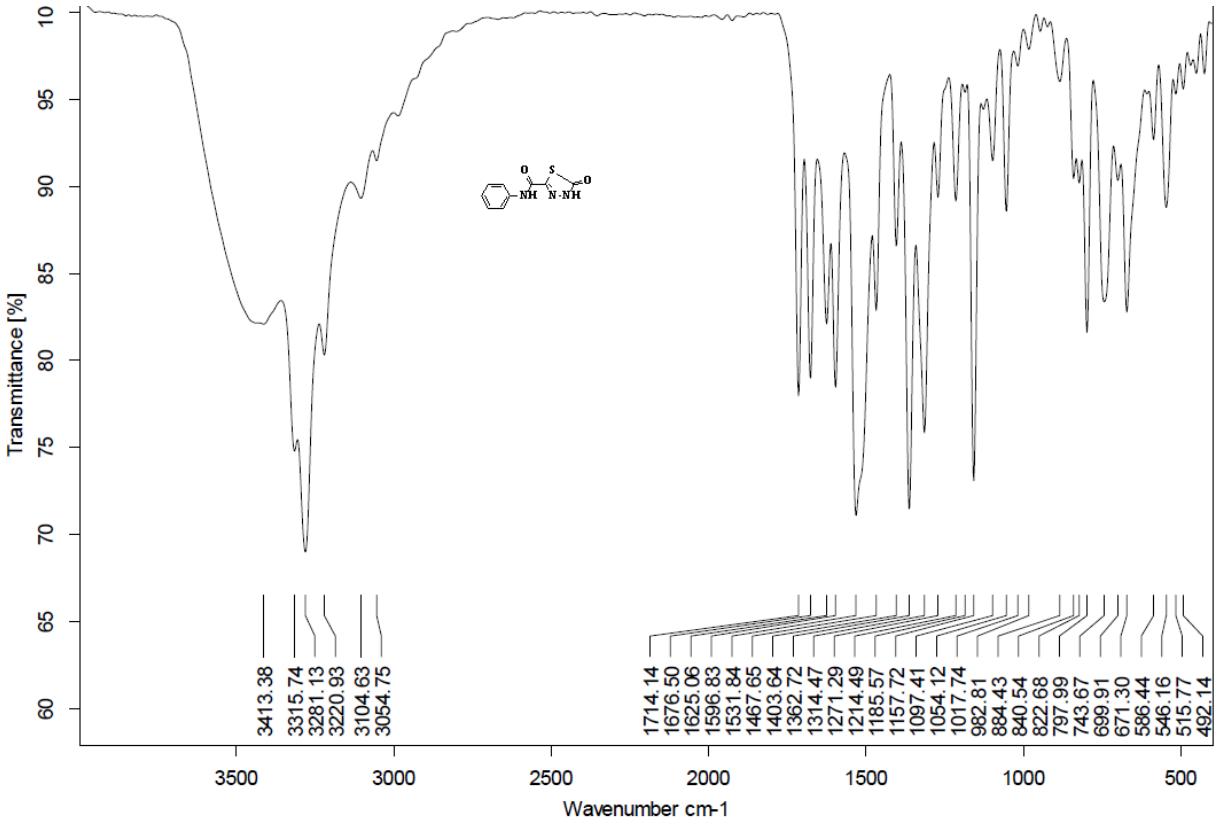


2-Hydrazinyl-N-phenyl-2-thioxoacetamide (1):

White crystals, yield 89% (0.18g), mp. 144-146 ºC FT-IR (ATR) λ max: 3325, 3259, 3239, 3207 (NH_2, 2NH), 1676.10 ($C=O_{amidic}$), 1185 (C=S); ^1H NMR: δ 10.74 (s, H, NH_{amidic}, exchangeable by D_2O), 10.21 (s, H, $NH_{hydrazide}$, exchangeable by D_2O), 7.77-7.14 (m, 5H, ArH), 4.13 ppm (s, 2H, NH_2, exchangeable by D_2O) ; ^{13}C NMR: δ

191.83 (C=S), 163.51 (C=O), 138.61, 129.28, 124.28, 120.22 ppm Arom. Anal. Calcd. for $C_8H_9N_3OS$ (195.24): C, 49.21; H, 4.65; N, 21.52; S,16.42% Found: C, 49.19; H, 4.67; N, 21.50; S, 16.41%.

5-Oxo-N-phenyl-4,5-dihydro-1,3,4-thiadiazole-2-carboxamide (2):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1625.06
1596.83
1531.84
1467.65
1403.64
1362.72
1314.47
1271.29
1214.49
1185.57
1157.72
1097.41
1054.12
1017.74
982.81
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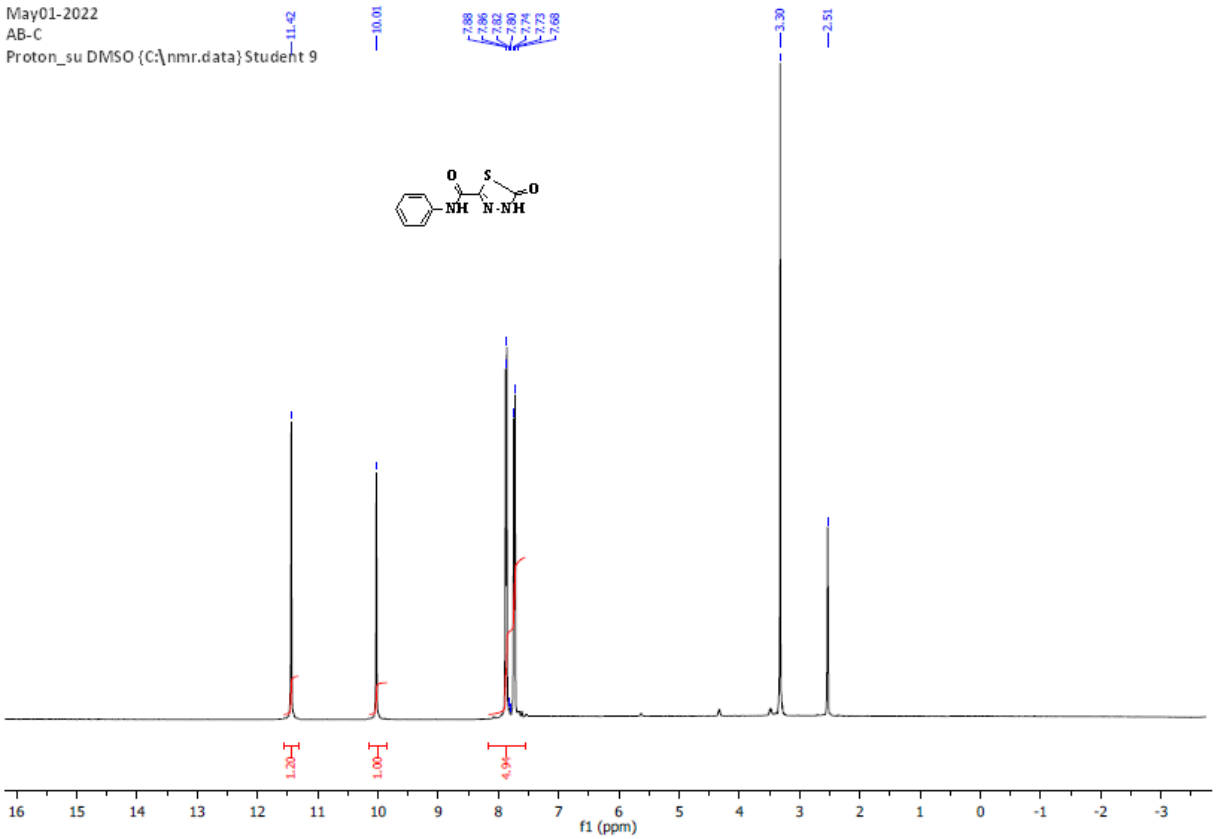
822.68
797.99
743.67
699.91
671.30
586.44
546.16
515.77
492.14


May01-2022
AB-C
Proton_su DMSO {C:\nmr.data} Student 9
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10.01
7.88
7.86
7.82
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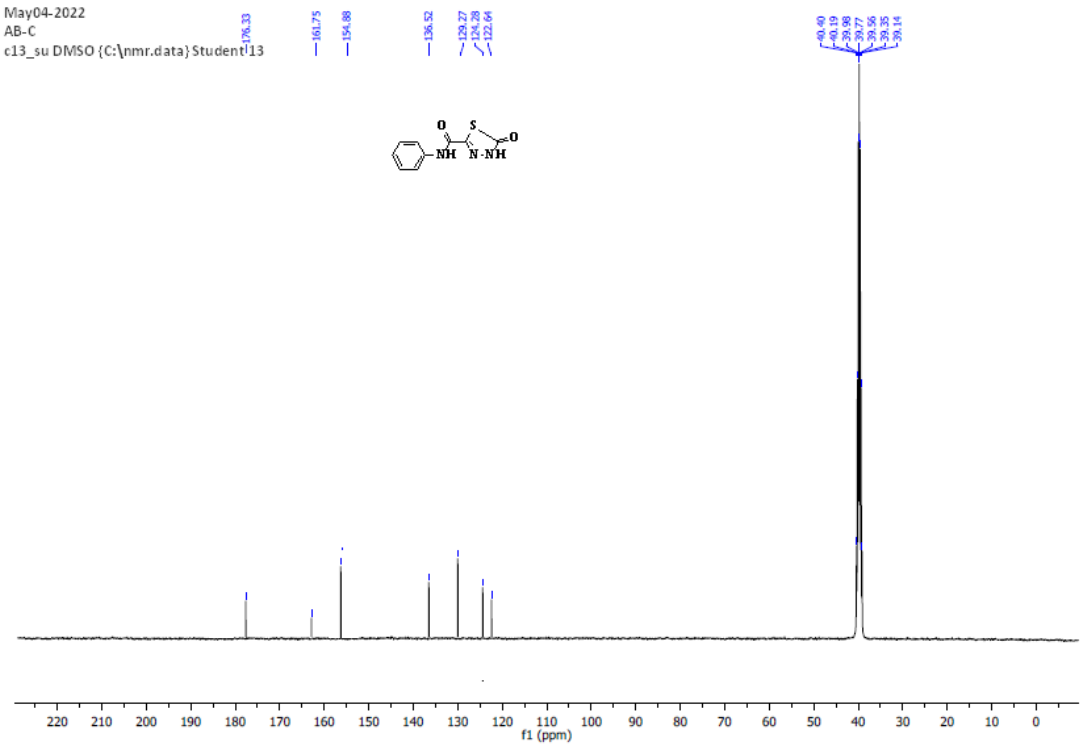
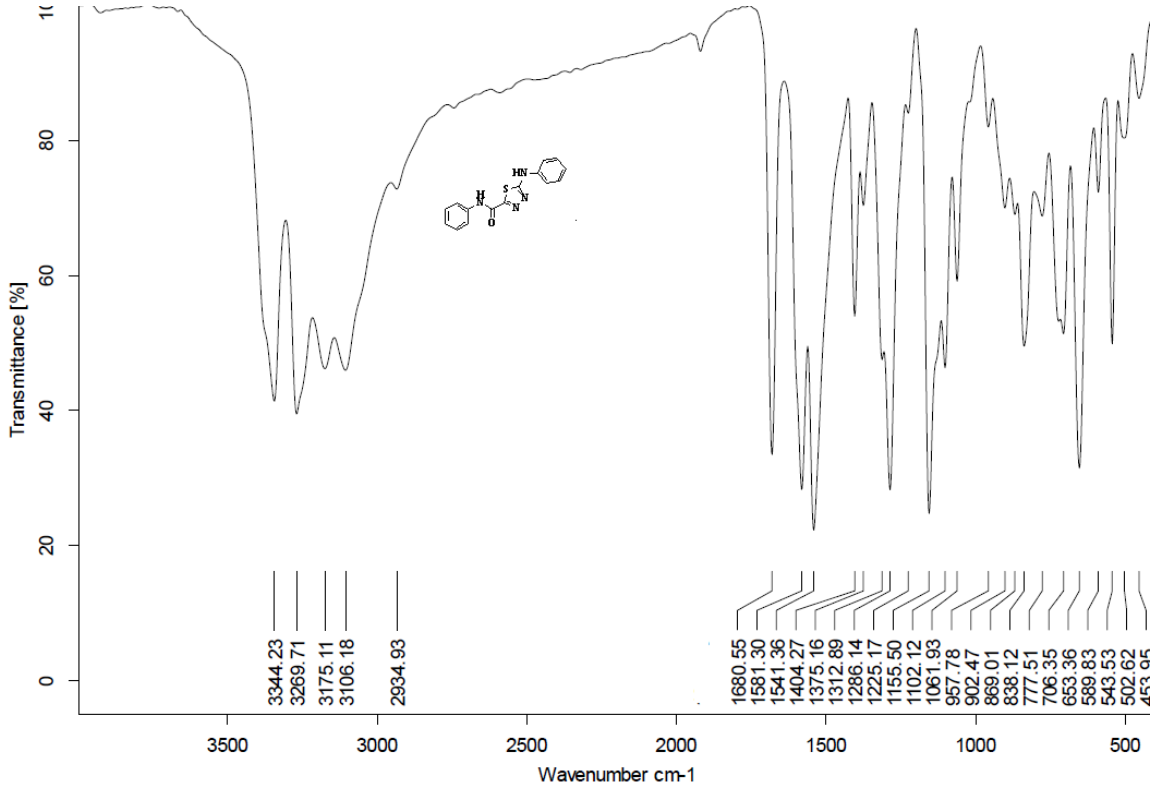
7.74
7.73
7.68
3.30
2.51
1.20
1.00
4.94
f1 (ppm)



5-Oxo-N-phenyl-4,5-dihydro-1,3,4-thiadiazole-2-carboxamide(2):

Pale white crystals, yield 87% (0.20g), mp. 180-182 ºC FT-IR (ATR) λ max: 3413, 3315 (2NH), 1714 (-C=O_{cyclic}), 1676 (C=O_{amidic}); ^{1}H NMR: δ 11.42 (s, H, NH_{cyclic}, exchangeable by D_2O), 10.01 (s, 2H, NH_2, exchangeable by D_2O) 7.88- 7.68 ppm (m, 5H, ArH) ; ^{13}C NMR: δ 176.33 (C=O_{cyclic}), 161.75 (C=O_{amidic}), 154.88(C=N), 136.52, 129.27, 124.28, 122.64 ppm Arom. Anal. Calcd. For $C_9H_7N_3O_2S$ (221.24): C, 48.86; H, 3.13; N, 18.99; S, 14.49% Found: C, 48.82; H, 3.19; N, 18.95; S, 14.51%.

N-phenyl-5-(phenylamino)-1,3,4-thiadiazole-2-carboxamide (3):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60
80
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3000
2500
2000
1500
1000
500
Wavenumber cm-1
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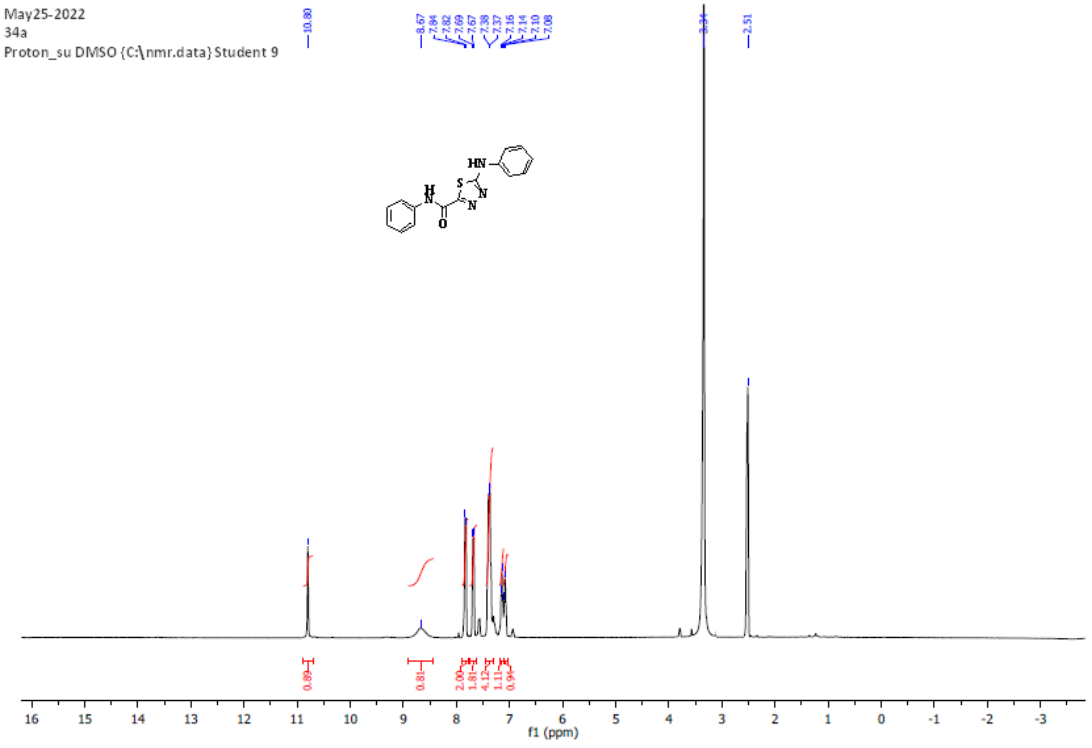
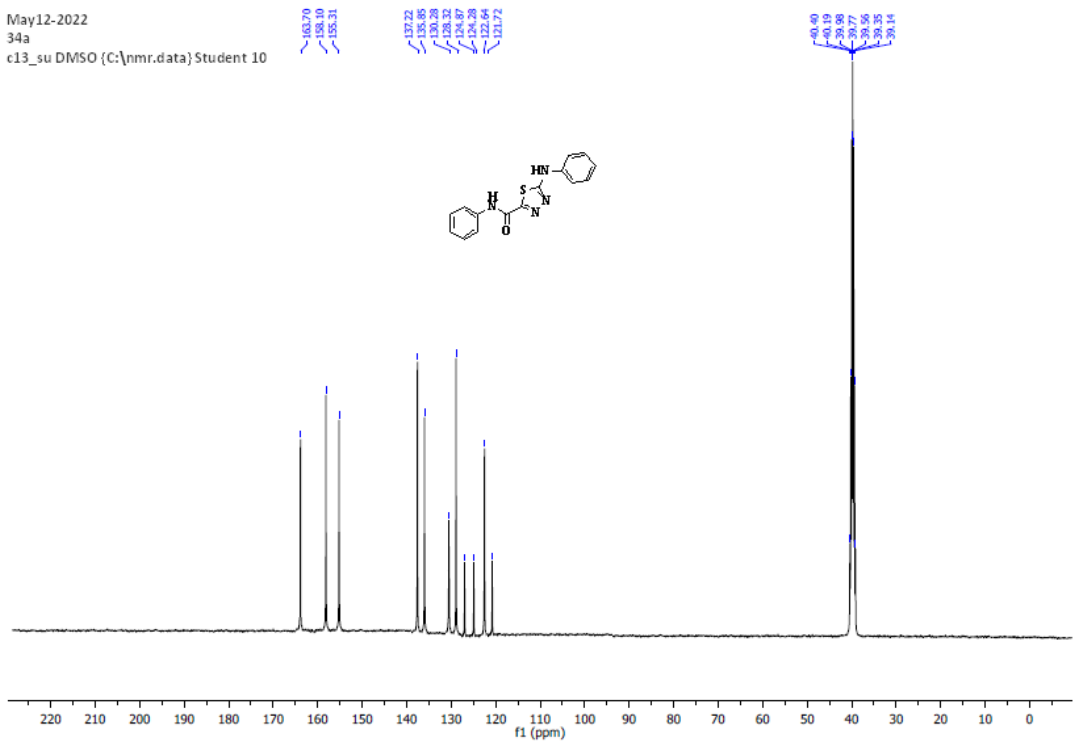
3269.71
3175.11
3106.18
2934.93
1680.55
1581.30
1541.36
1404.27
1375.16
1312.89
1286.14
1225.17
1155.50
1102.12
1061.93
957.78
902.47
869.01
838.12
777.51
706.35
653.36
589.83
543.53
502.62

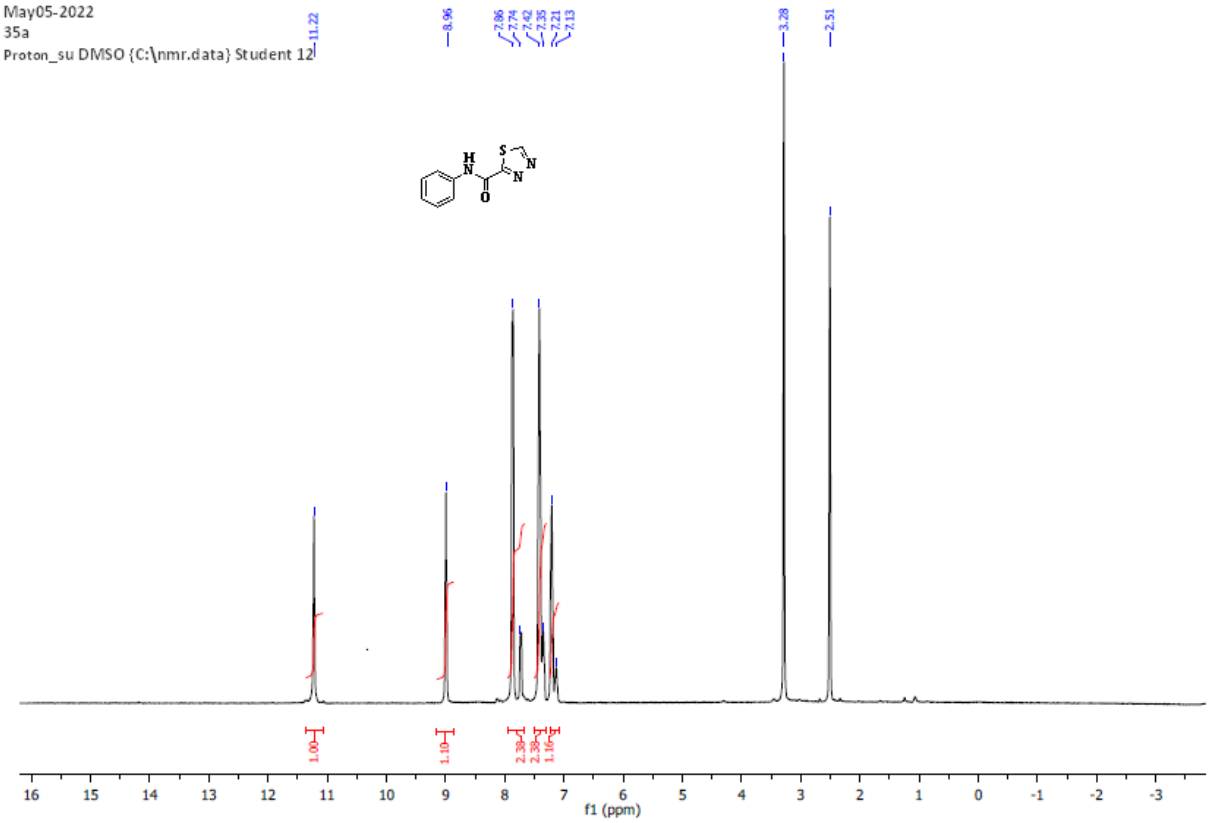

May25-2022
34a
Proton_su DMSO {C:\nmr.data} Student 9
10.80
8.67
7.94
7.82
7.69
7.67
7.38
7.37
7.16
7.14
7.10
7.08
3.34
2.51
0.89
0.81
2.00
1.81
4.12
1.11
0.94
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
f1 (ppm)

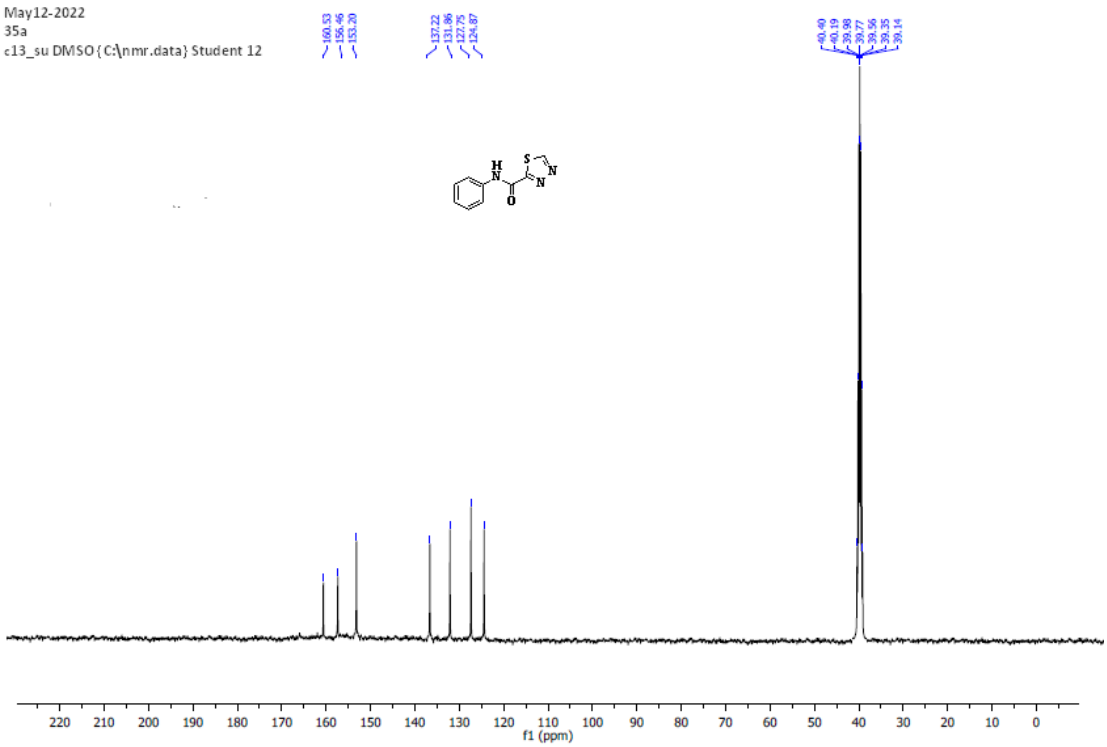


N-phenyl-5-(phenylamino)-1,3,4-thiadiazole-2-carboxamide(3):

White crystals, yield 88% (0.26g), mp. 172-174 ºC FT-IR (ATR) λ max: 3344, 3269 (2NH), 1680 ($C{=}O_{amidic}$); ^{1}H NMR: δ 10.80 (s, H, NH_{amidic}, exchangeable by D_2O), 8.67 (s, H, $NH_{phenylamino}$, exchangeable by D_2O), 7.84- 7.08 (m, 10H, ArH); ^{13}C NMR: δ 163.70 (C=O), 158.10 (C=N), 155.31(C=N), 137.22, 135.85, 130.28, 128.32, 124.87, 124.28, 122.64, 121.72 ppm Arom. Anal. Calcd . For $C_{15}H_{12}N_4OS$ (296.35): C, 60.79; H, 4.08; N, 18.91; S, 10.82% Found: C, 60.83; H, 4.02; N, 18.95; S, 10.81%.

N-phenyl-1,3,4-thiadiazole-2-carboxamide(4):



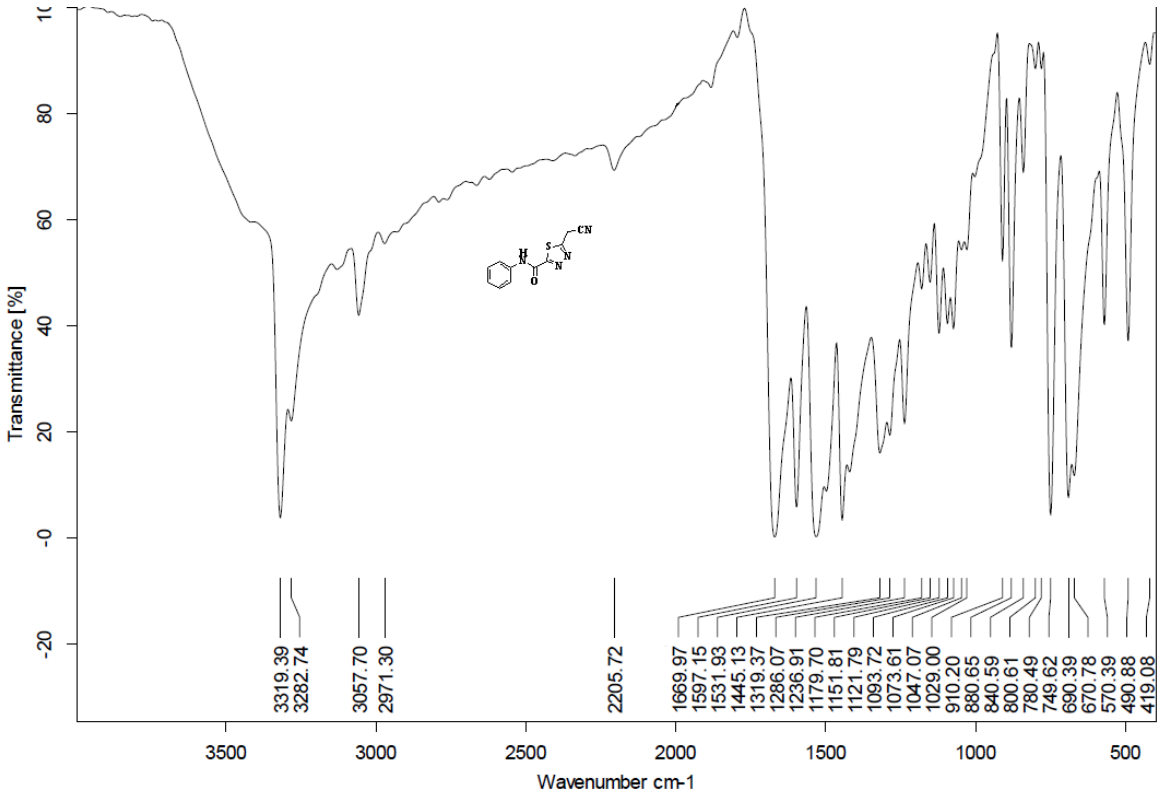


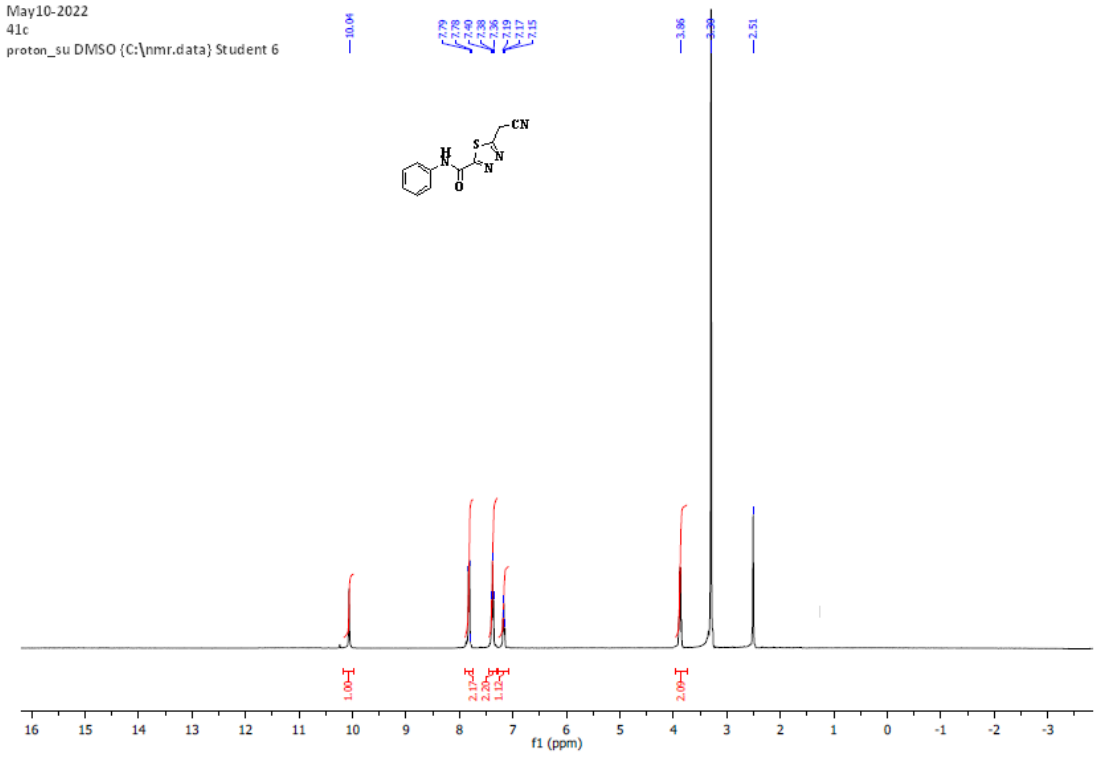
N-phenyl-1,3,4-thiadiazole-2-carboxamide(4):

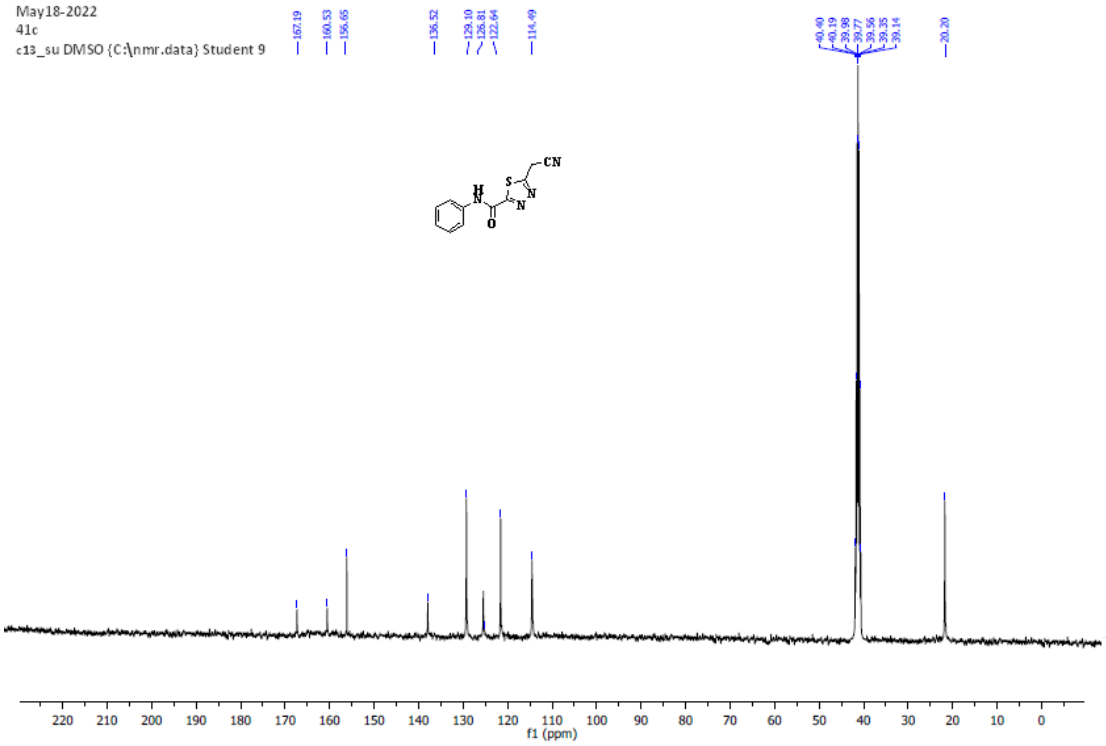
White crystals, yield 75% (0.16g), mp. 175-177 ºC FT-IR (ATR) λ max: 3230 (NH), 1680 ($C{=}O_{amidic}$); ^1H NMR: δ 10.74 (s, H, NH_{amidic}, exchangeable by D_2O), 10.22 (s, H, NH, exchangeable by D_2O), 8.96 (s, 1H, -CH=N) 7.86- 7.13 (m, 5H, ArH) ppm;

^{13}C NMR: δ 160.153 (C=O), 156.46 (C=N), 153.20 (CH=N), 137.22, 131.86, 127.75, 124.87 ppm Arom. Anal. Calcd. for $C_9H_7N_3OS$ (205.03): C, 52.67; H, 3.44; N, 20.47; S, 15.62% Found: C, 52.69; H, 3.42; N, 20.44; S, 15.61%.

5-(Cyanomethyl)-N-phenyl-1,3,4-thiadiazole-2-carboxamide(5):



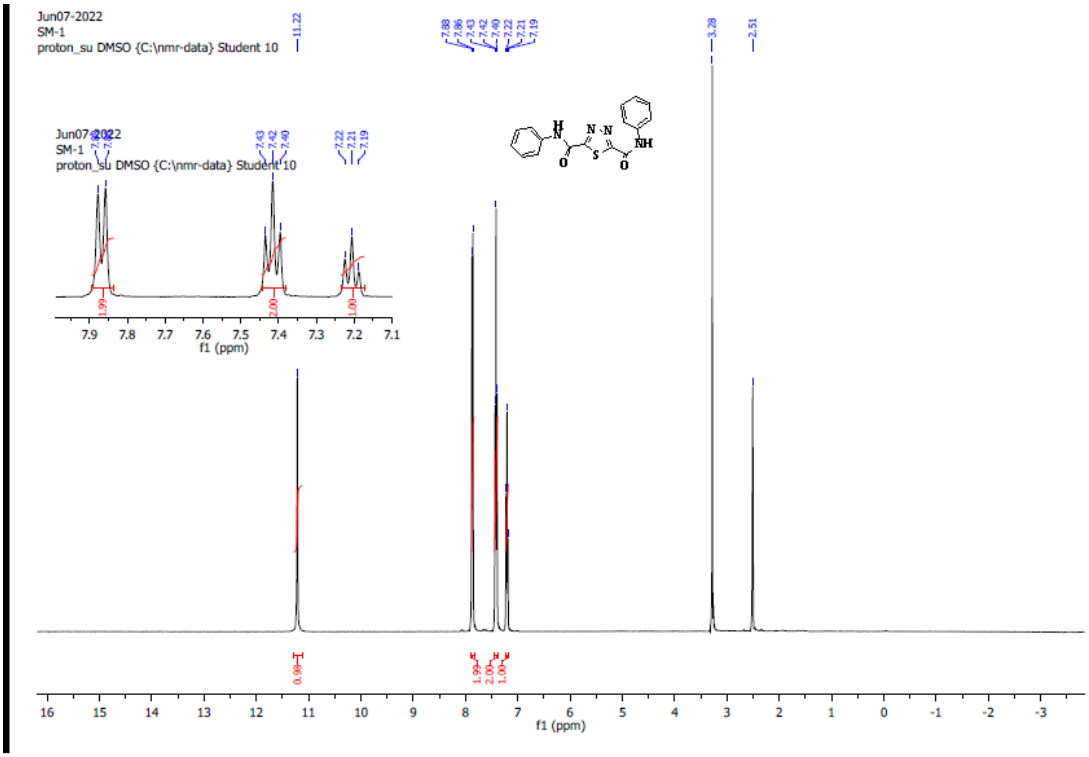




5-(Cyanomethyl)-N-phenyl-1,3,4-thiadiazole-2-carboxamide(5):

White crystals, yield 84% (0.21g), mp. 207-209 ºC FT-IR (ATR) λ max: (3319) (NH), 2205 (CN) 1669 ($C{=}O_{amidic}$); ^{1}H NMR: δ 10.04 (s, H, NH_{amidic}, exchangeable by D_2O), 7.79- 7.15 (m, 5H, ArH), 3.86 ppm (s, 2H, CH_2); ^{13}C NMR: δ 167.19 (C=O), 160.53 (C=N), 156.65 (C=N), 136.52, 129.10, 126.81, 122.64 ppm Arom, 114.49 (CN), 20.20 (CH_2). Anal. Calcd. for $C_{11}H_8N_4OS$ (244.27): C, 54.09; H, 3.30; N, 22.94; S,13.13% Found: C, 54.11; H, 3.29; N, 22.93; S, 13.10%.

N_2,N_5-diphenyl-1,3,4-thiadiazole-2,5-dicarboxamide(6):


Jun07-2022
SM-1
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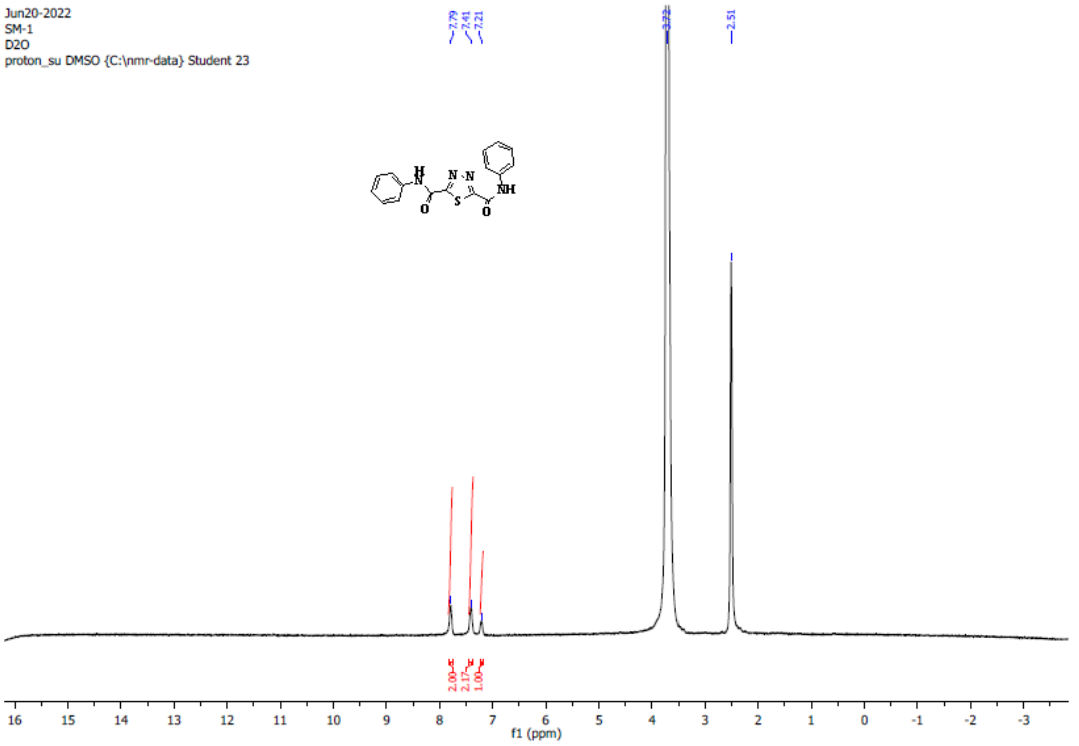
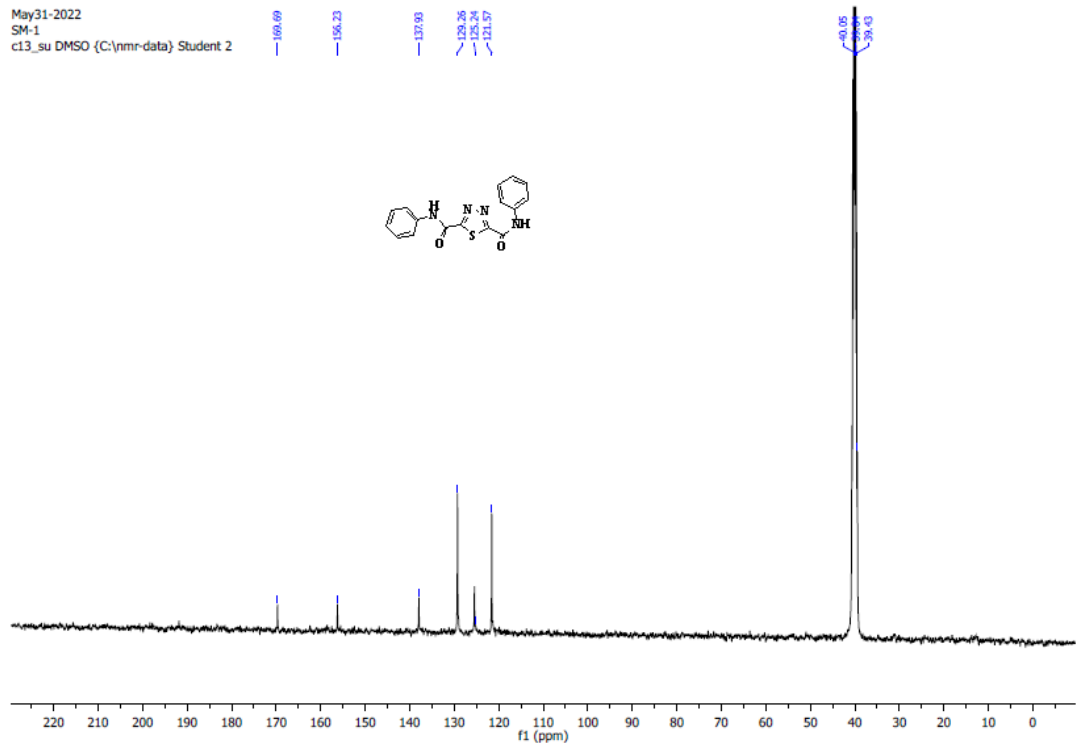
11.22
7.88
7.86
7.43
7.42
7.40
7.22
7.21
7.19
3.28
2.51
f1 (ppm)



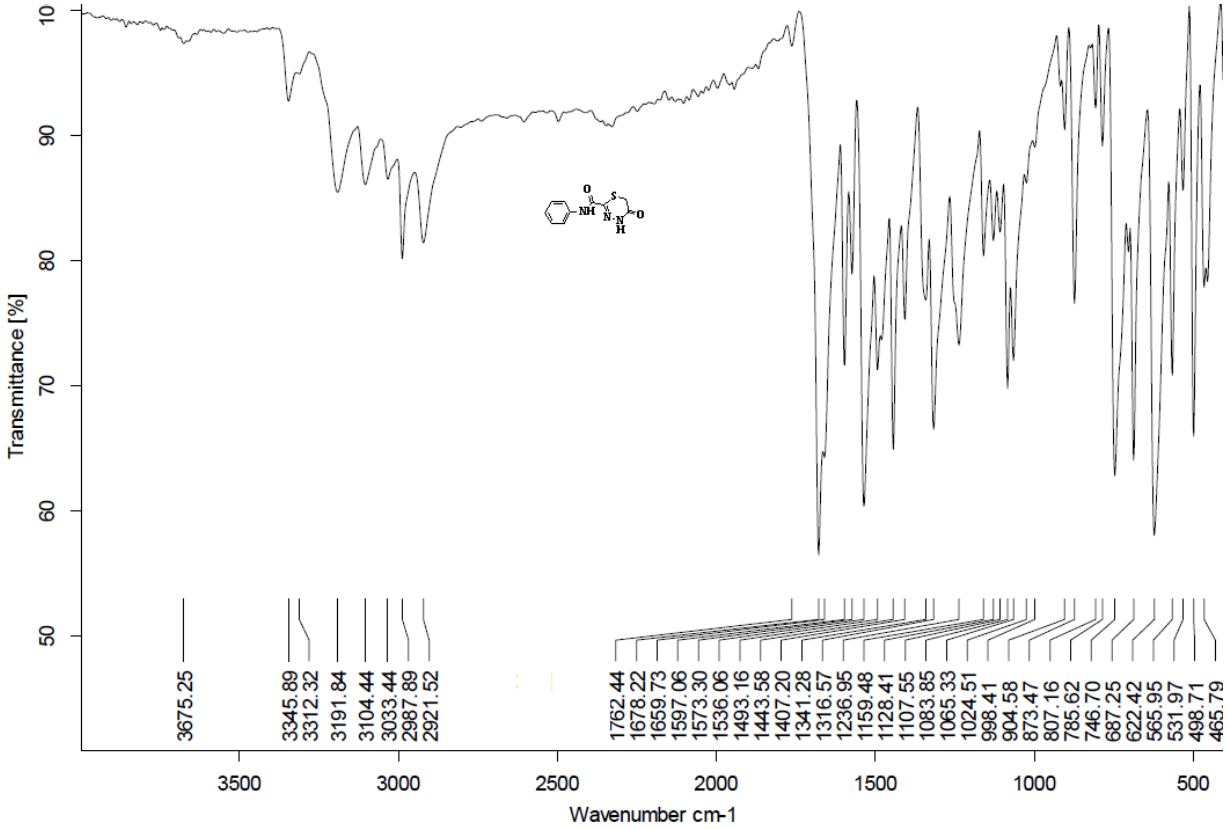


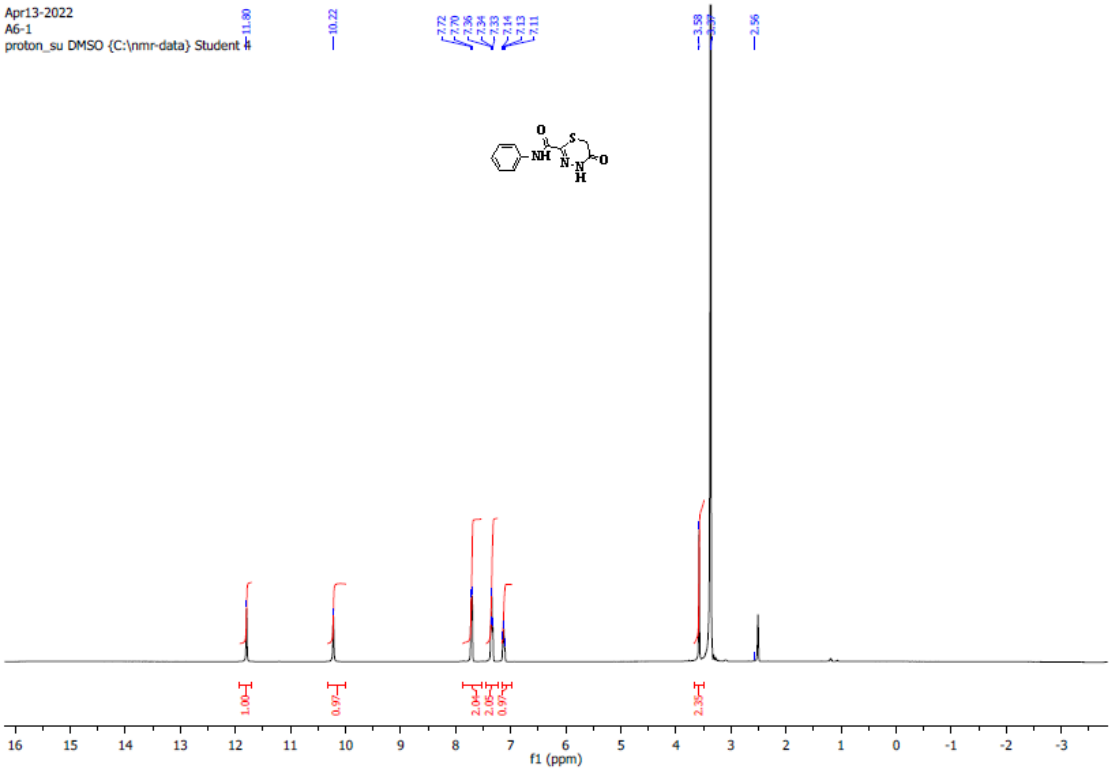
<u>N_2,N_5-diphenyl-1,3,4-thiadiazole-2,5-dicarboxamide(6):</u>

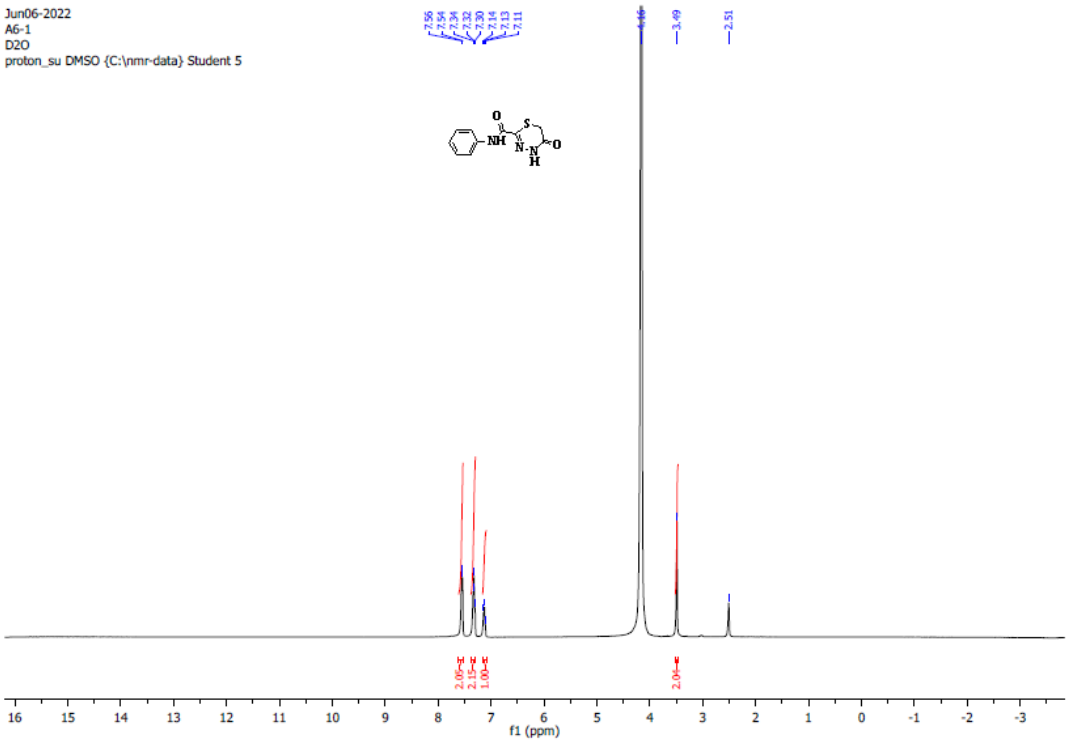
White crystals, yield 89% (0.29g), mp. 156-158 ºC FT-IR (ATR) λ max: 3237 (NH), 1679 ($C=O_{amidic}$); ^{1}H NMR: δ 11.22 (s, H, NH, exchangeable by D_2O), 7.88- 7.19 (m, 5H, ArH) ppm; ^{13}C NMR: δ 169.69 (-C=O), 156.23 (C=N), 137.93, 129.26, 125.24,

121.57 ppm Arom. Anal. Calcd. for $C_{16}H_{12}N_4O_2S$ (324.36): C, 59.25; H, 3.73; N, 17.27; S, 9.89% Found: 59.29; H, 3.75; N, 17.24; S, 9.75%.

***5-Oxo-N-phenyl-5,6-dihydro-4H-1,3,4-thiadiazine-2-carboxamide*(8):**






Jun06-2022
A6-1
D2O
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7.55
7.54
7.34
7.32
7.30
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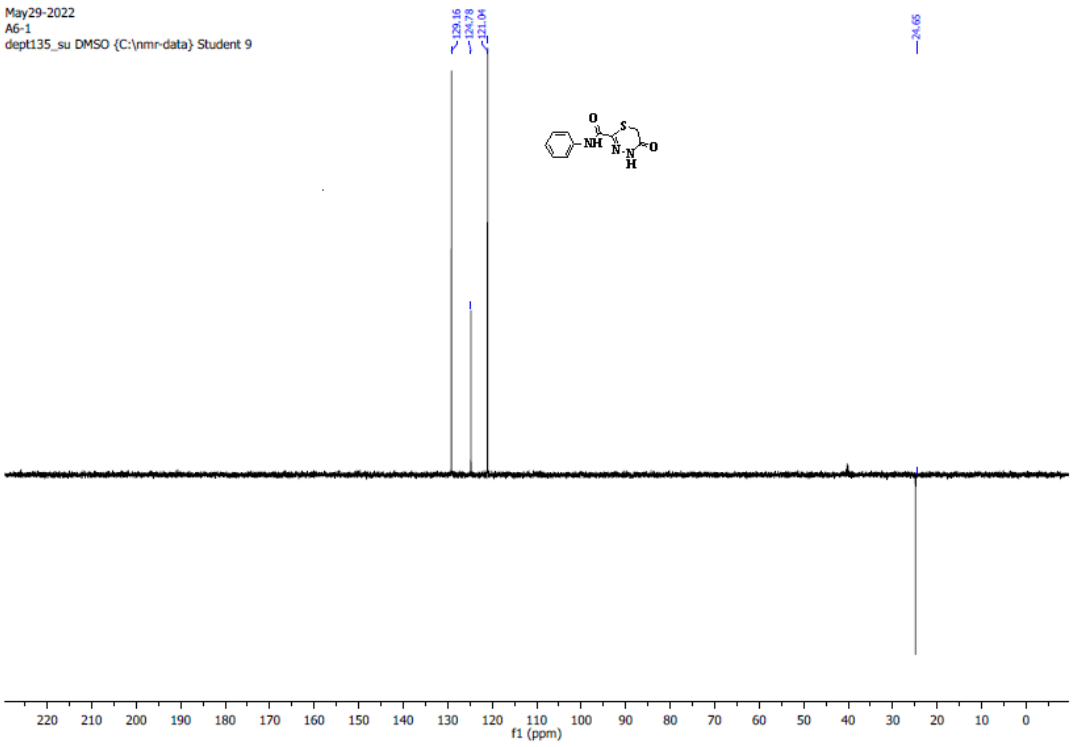
2.51
2.05
2.15
1.00
2.04
f1 (ppm)


May29-2022
A6-1
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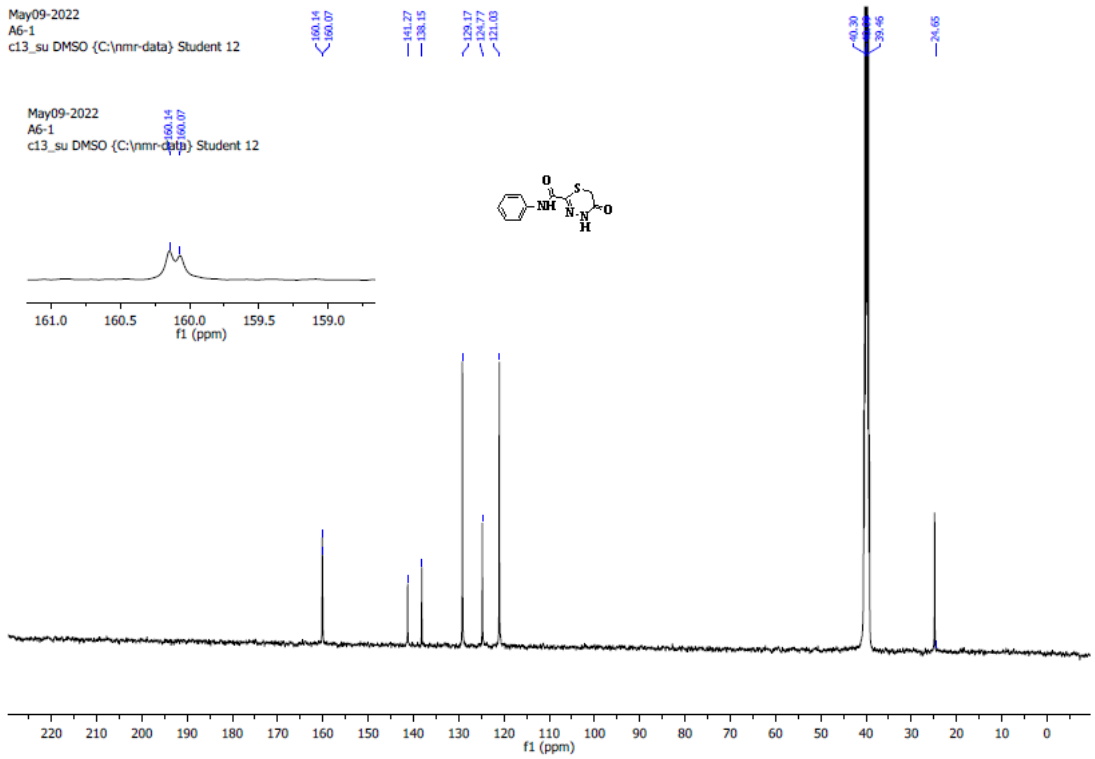
134.78
121.04
24.65
f1 (ppm)



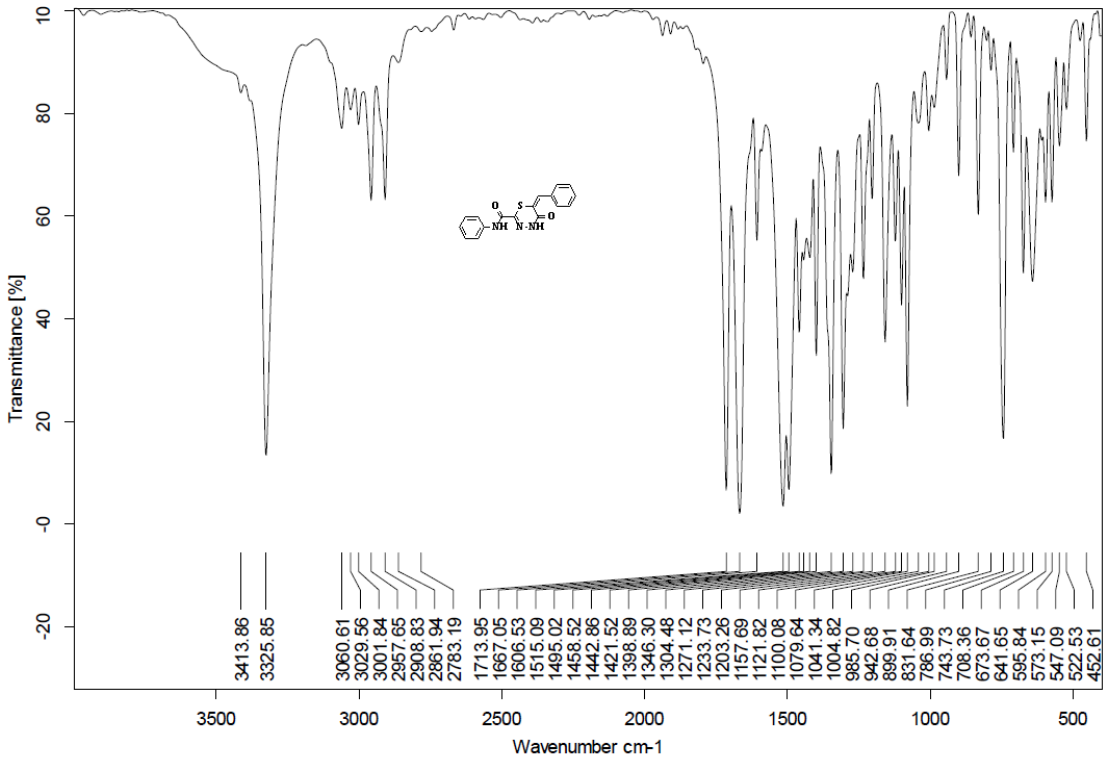
5-Oxo-N-phenyl-5,6-dihydro-4H-1,3,4-thiadiazine-2-carboxamide(8):

White crystals, yield 77% (0.18g), mp. 193-195 ºC FT-IR (ATR) λ max: (3345, 3312) (2NH), 1678 (-C=O_{cyclic}), 1659 (-C=O_{amidic}); 1H NMR: δ 11.80 (s, H, NH_{cyclic}, exchangeable by D_2O), 10.22 (s, 2H, NH_2, exchangeable by D_2O) 7.72- 7.11 (m, 5H, 5CH ArH), 3.58 (s, 2H, CH_2) ppm; ^{13}C NMR: δ 160.14 (C=O), 160.07 (-C=O), 141.27 (-C=N), 138.15, 129.17, 124.77, 121.03 Arom, 24.65 ppm (CH_2). Dept-135: δ 129.16,124.78,121.04 Arom, 29.36, 14.57 ppm. Anal. Calcd. For $C_{10}H_9N_3O_2S$ (235.26): C, 51.05; H, 3.86; N, 17.86; S, 13.63% Found: C, 51.11; H, 3.82; N, 17.82; S, 13.60%.

6-(4-Chlorobenzylidene)-5-oxo-N-phenyl-5,6-dihydro-4H-1,3,4-thiadiazine-2-carboxamides (9a-c):

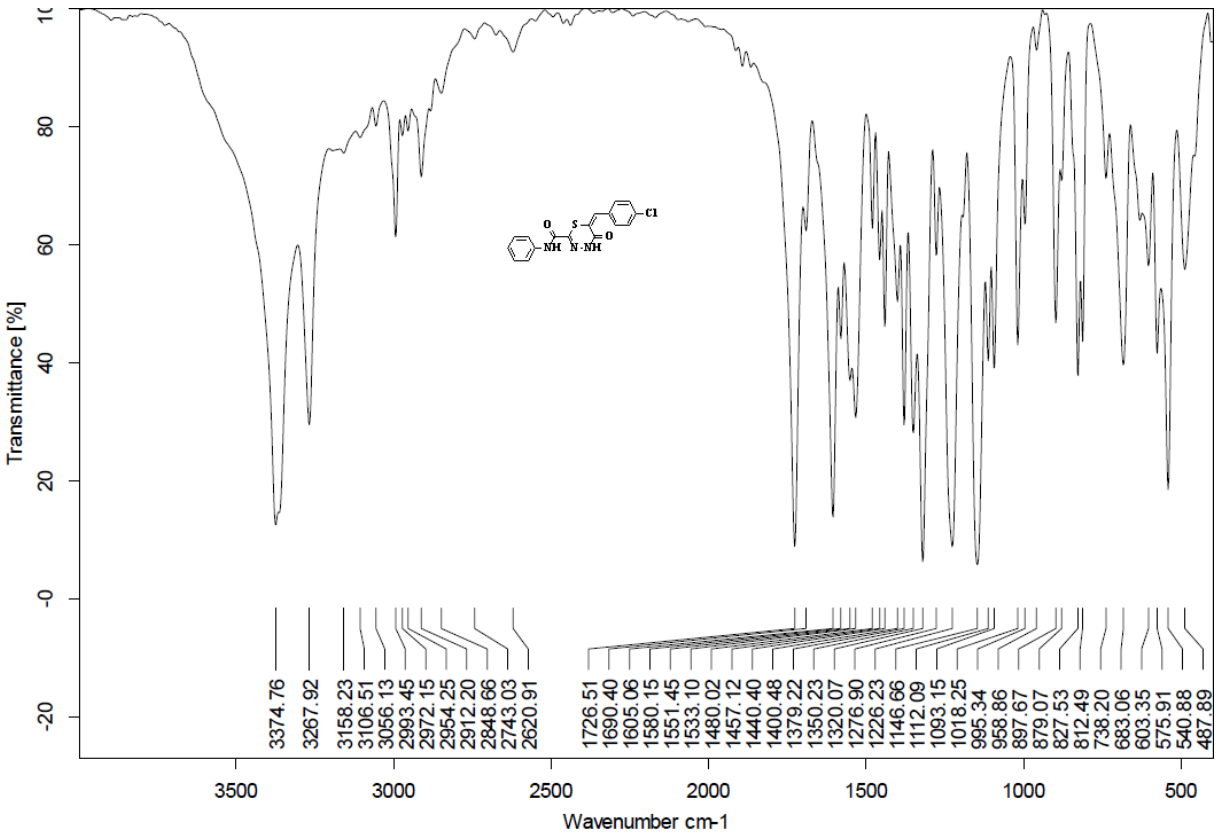
6-Benzylidene-5-oxo-N-phenyl-5,6-dihydro-4H-1,3,4-thiadiazine-2-carboxamide (9a):

White crystals, yield 78% (0.26g), mp. 228-220 ºC FT-IR (ATR) λ max: 3413, 3325 (2NH), 1713 (C=O_{cyclic}), 1667 (-C=O_{amidic}); ^{1}H NMR: δ 11.66 (s, H, NH_{amidic}, exchangeable by D_2O), 10.17 (s, H, $NH_{hydrazide}$, exchangeable by D_2O), 7.82- 7.10 (m, 9H, ArH); ^{13}C NMR: δ 161.04 (C=O), 158.33 (-C=O), 152.76 (-C=N), 141.29, 137.24, 133.77, 128.30, 126.13, 123.88, 123.55, 120.27, 120.04, 116.79 ppm Arom. Anal. Calcd. For $C_{17}H_{13}N_3O_2S$ (323.37): C, 63.14; H, 4.05; N, 12.99; S, 9.92% Found: C, 63.19; H, 4.02; N, 12.96; S, 9.90%.



6-(4-Chlorobenzylidene)-5-oxo-N-phenyl-5,6-dihydro-4H-1,3,4-thiadiazine-2-carboxamide (9b):

White crystals, yield 90% (0.32g), mp. 237-239 ºC FT-IR (ATR) λ max: 3374, 3267 (2NH), 1726 ($C=O_{cyclic}$), 1690 ($C=O_{amidic}$); ^{1}H NMR: δ 11.71 (s, H, NH_{amidic}, exchangeable by D_2O), 10.15 (s, H, $NH_{hydrazide}$, exchangeable by D_2O), 7.80- 7.12 ppm (m, 10H, ArH); ^{13}C NMR: δ 160.07 (C=O), 159.28 (C=O), 153.79 (-C=N), 141.24, 138.21, 131.89, 129.38, 129.12, 124.94, 124.71, 121.21, 121.06, 117.53 ppm Arom. Anal. Calcd. for $C_{17}H_{12}ClN_3O_2S$ (357.03): C, 57.06; H, 3.38; Cl, 9.91; N, 11.74; S, 8.96% Found: C, 57.08; H, 3.42; Cl, 9.89; N, 11.73; S, 8.91.


Transmittance [%]
Wavenumber cm-1
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3056.13
2993.45
2972.15
2954.25
2912.20
2848.66
2743.03
2620.91
1726.51
1690.40
1605.06
1580.15
1551.45
1533.10
1480.02
1457.12
1440.40
1400.48
1379.22
1350.23
1320.07
1276.90
1226.23
1146.66
1112.09
1093.15
1018.25
995.34
958.86
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879.07
827.53
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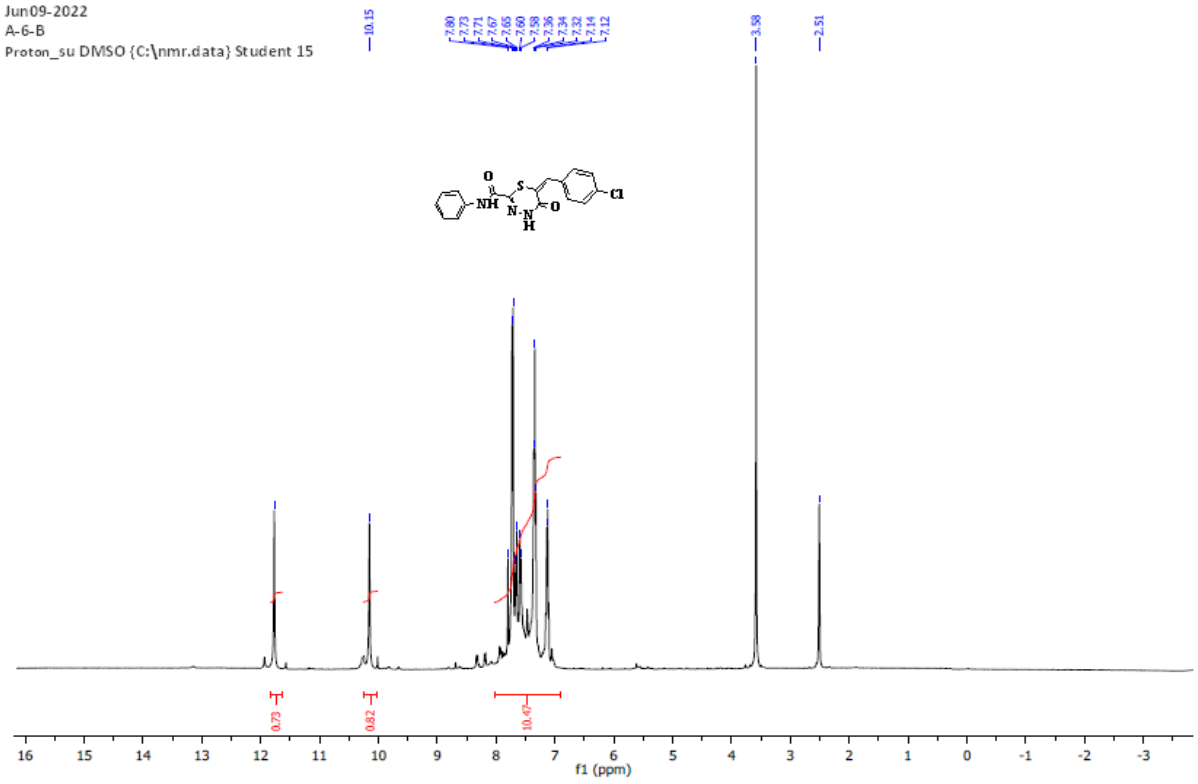
738.20
683.06
603.35
575.91
540.88
487.89


Jun09-2022
A-6-B
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7.60
7.58
7.36
7.34
7.32
7.14
7.12
3.58
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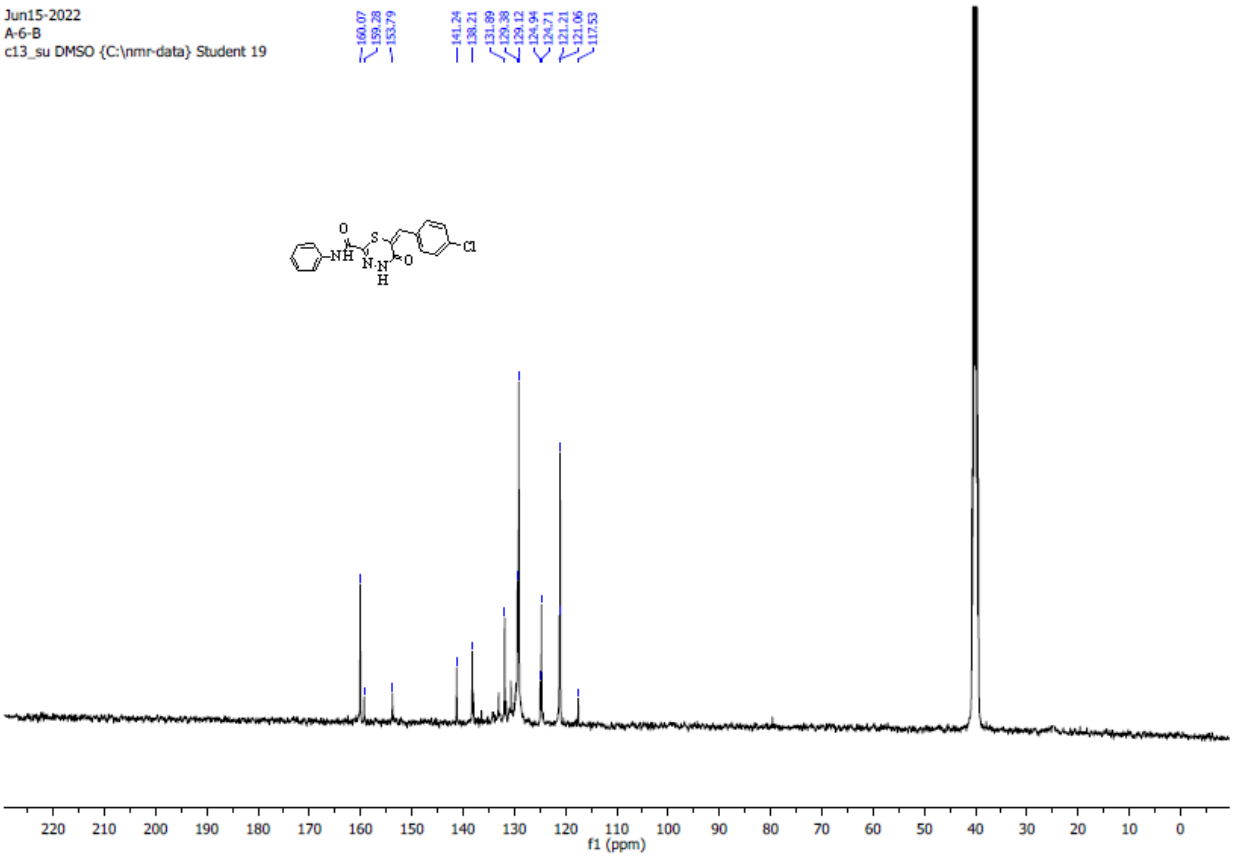
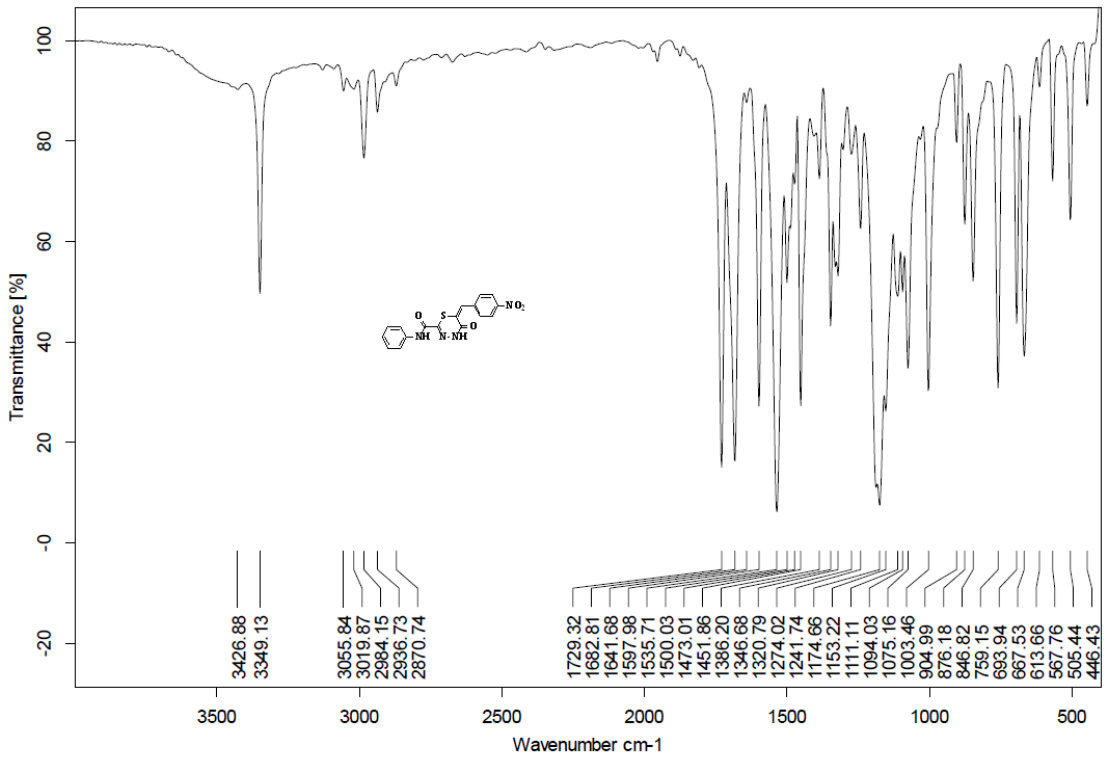
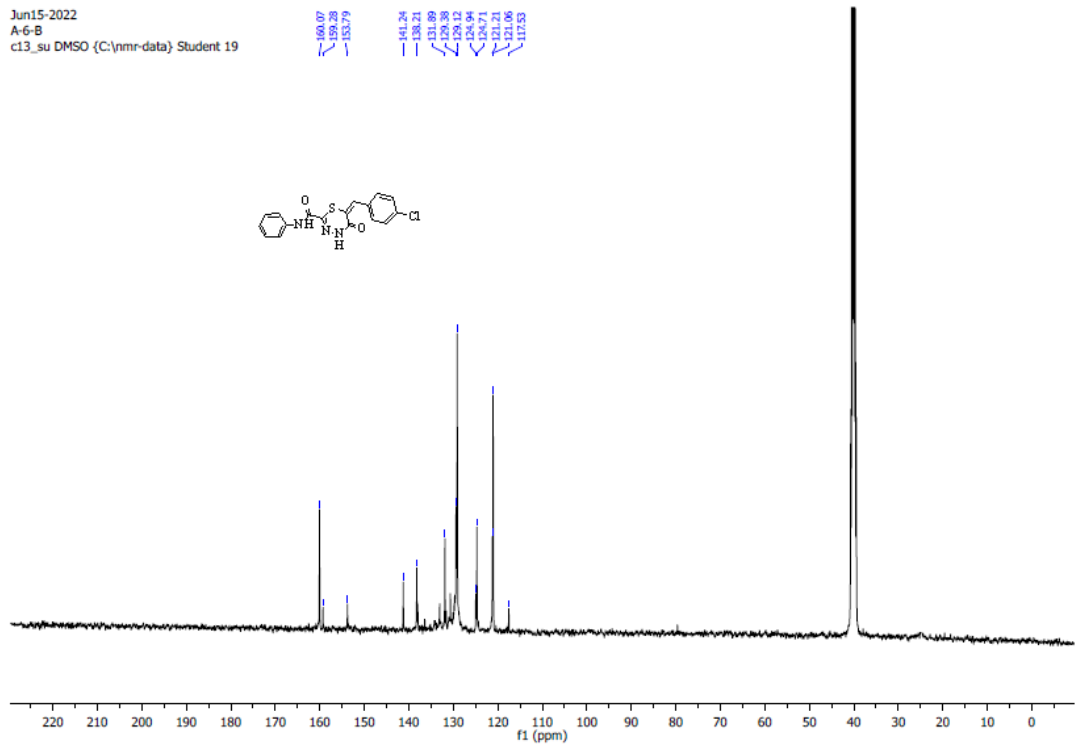
10.67
f1 (ppm)



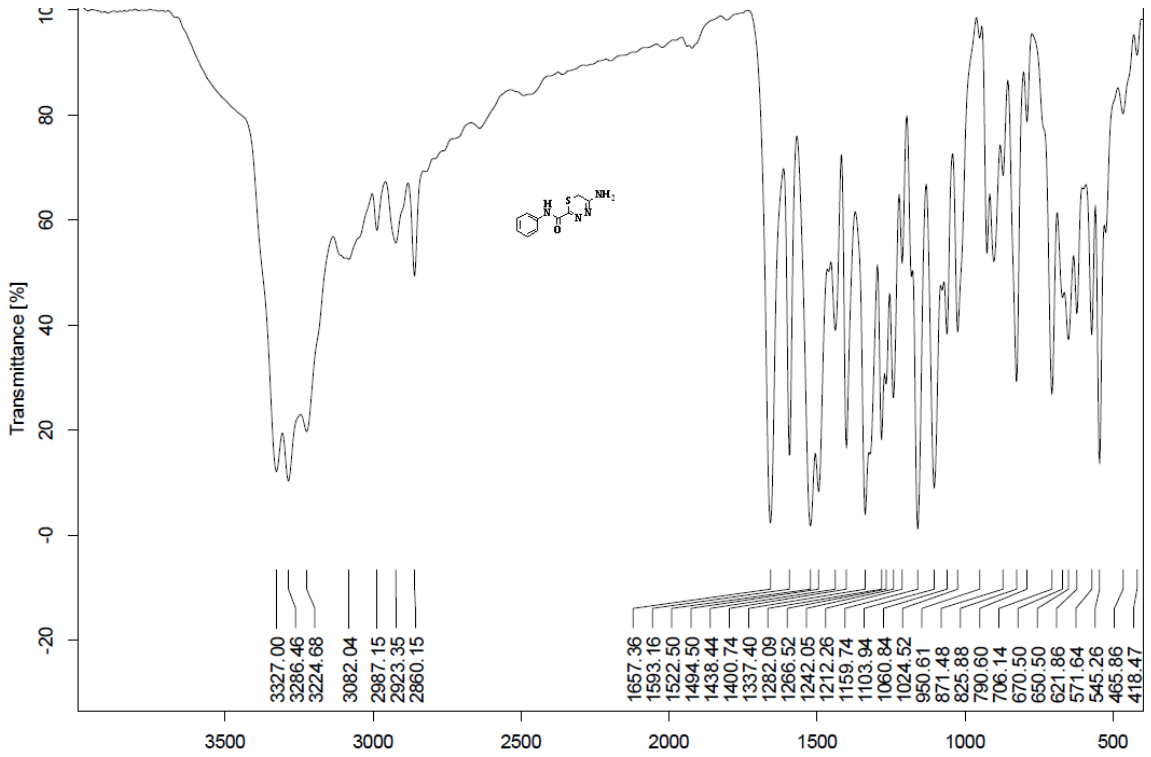
6-(4-Nitrobenzylidene)-5-oxo-N-phenyl-5,6-dihydro-4H-1,3,4-thiadiazine-2-carboxamide (9c):

White crystals, yield 72% (0.27g), mp. 237-239 ºC FT-IR (ATR) λ max: 3426, 3349 (2NH), 1729 (-C=O_{cyclic}), 1682 (C=O_{amidic}), 1346,1535 (NO_2); ^{1}H NMR: δ 11.71 (s, H, NH_{amidic}, exchangeable by D_2O), 10.15 (s, H, $NH_{hydrazide}$, exchangeable by D_2O), 7.80- 7.12 ppm (m, 10H, ArH); ^{13}C NMR: δ 160.07 (C=O), 159.28 (C=O), 153.79 (C=N), 141.24, 138.21, 131.89, 129.38, 129.12, 124.94, 124.71, 121.21, 121.06, 117.53 ppm Arom. Anal. Calcd. For $C_{17}H_{12}N_4O_4S$ (368.37): C, 55.43; H, 3.28; Cl, 9.91; N, 15.21; S, 8.70% Found: C, 55.48; H, 3.30; Cl, 9.90; N, 15.17; S, 8.68%.





5-Amino-N-phenyl-6H-1,3,4-thiadiazine-2-carboxamide(10):


Transmittance [%]
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80
60
40
20
0
-20
3500
3000
2500
2000
1500
1000
500
3327.00
3286.46
3224.68
3082.04
2987.15
2923.35
2860.15
1657.36
1593.16
1522.50
1494.50
1438.44
1400.74
1337.40
1282.09
1266.52
1242.05
1212.26
1159.74
1103.94
1060.84
1024.52
950.61
871.48
825.88
790.60
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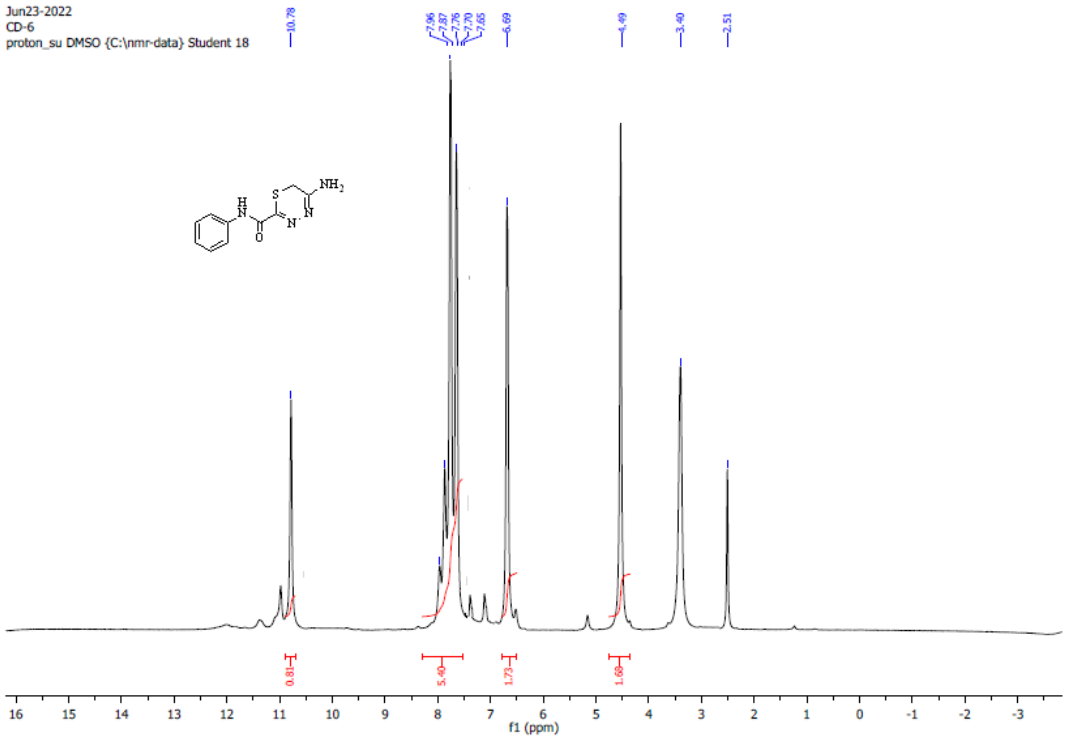
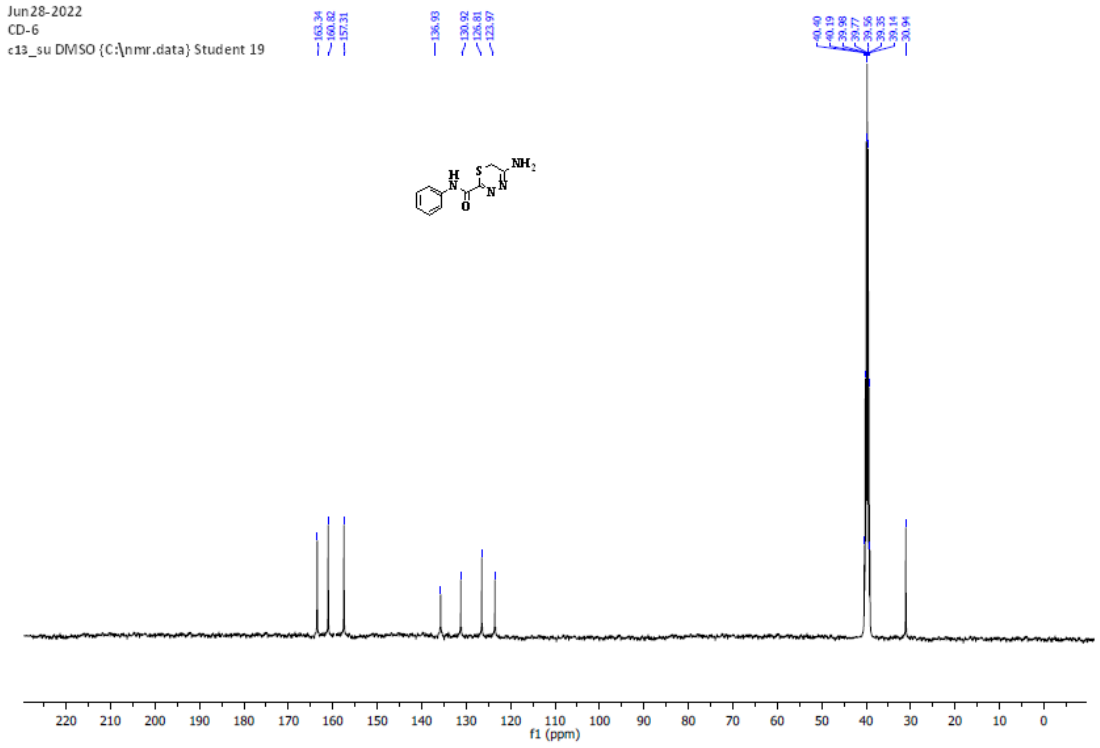
621.86
571.64
545.26
465.86
418.47


Jun23-2022
CD-6
proton_su DMSO {C:\nmr-data} Student 18
10.78
7.96
7.87
7.76
7.70
7.65
6.69
5.49
3.40
2.51
0.81
5.40
1.73
1.68
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
f1 (ppm)



White crystals, yield 80% (0.19g), mp. 256-258 ºC FT-IR (ATR) λ max: 3327, 3286, 3224 (NH_2, 2NH), 1657 ($C{=}O_{amidic}$); ^1H NMR: δ 10.78 (s, H, NH_{amidic}, exchangeable by D_2O), 7.96- 7.65 (m, 5H, ArH), 6.99 (s, 2H, NH_2, exchangeable by D_2O), 4.49 ppm (s, 2H, CH_2); ^{13}C NMR: δ 163.34 (C=S), 160.82 (C=O), 157.31, 136.93, 130.92, 126.81, 123.97, 30.94 ppm Arom. Anal. Calcd. for $C_{10}H_{10}N_4OS$ (234.28): C, 51.27; H, 4.30; N, 23.91; S, 13.69% Found: C, 51.23; H, 4.33; N, 23.91; S, 13.66%.