Supporting Information

A Diversity-Oriented Novel Regioselective Synthesis of Sulfonamide-Thiazolidinone Hybrids

Preeti,[a] and Krishna Nand Singh[a*]

[a]Department of Chemistry (Centre of Advanced Study), Institute of Science,
Banaras Hindu University,Varanasi-221005, India.
*e-mail: knsingh@bhu.ac.in; knsinghbhu@yahoo.co.in
Phone: +91-1332-284751

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1. Experimental Section:

General. ^{1}HNMR spectra were recorded on Jeol Resonance ECX-500II (500 MHz); Chemical shifts (δ in ppm) and coupling constant (*J* in Hz) are calibrated either relative to internal solvent tetramethylsilane TMS (δ_H = 0.00ppm) or $CDCl_3$ (δ_H = 7.256 ppm). In the ^{1}H NMR data, the following abbreviations were used throughout: s = singlet, d = doublet, t = triplet, dd = double doublets, dt = double triplets, and brs = broad singlet. ^{13}C NMR spectra were recorded on Jeol Resonance ECX-500II (125 MHz) in $CDCl_3$; chemical shifts are calibrated relative to $CDCl_3$ (δc = 77.0 ppm). IR spectra were recorded on Perkin Elmer FT-IR spectrometer -spectrum two. The reactions were monitored by Thin Layer Chromatography (TLC) using Merck silica gel plates (Merck® $60F_{254}$). Isothiocyanates and dialkylacetylene dicarboxylates were purchased from Alfa Aesar or Sigma Aldrich. The sulfonylhydrazides were prepared according to literature procedure.[1] Solvents were purified prior to its use.

General Procedure for the Synthesis of Products 4a-4t: Sulfonylhydrazide **1** (0.5 mmol), isothiocyanate **2** (0.5 mmol), dialkylacetylene dicarboxylate **3** (0.5 mmol) and ethanol (2 mL) were placed in a glass vessel, and then stirred at room temperature for 1 h. After completion of the reaction (TLC), a yellow solid product appeared, which was filtered and washed with cold ethanol to give the pure product **4**. The products were characterized based on FTIR, ^{1}H-NMR, ^{13}C-NMR and HRMS.

[1] F.–L. Yang, X.–T. Ma, S.–K. Tian, *Chem. Eur. J.* **2012**, *18*, 1582.

2. Crystal data of the Product 4a:

Data block: ups3310_kns_bhu_0m

Bond precision: C-C = 0.0035 A, **Wavelength** =0.71073

Cell: a=9.050(5) **b**=10.325(5) **c**=11.792(5)

Alpha=97.739(5) **beta**=103.231(5) **gamma**=109.788(5)

Temperature: 293 K

	Calculated	**Reported**
Volume	981.8(8)	981.8(8)
Space group	P -1	P-1
Hall group	- P 1 ?	
Moiety formula	C19 H17 N3 O5 S2	C19 H17 N3 O5 S2
Sum formula	C19 H17 N3 O5 S2	C19 H17 N3 O5 S2
Mr	431.48	431.48
Dx, g cm^{-3}	1.459	1.459
Z	2	2
Mu (mm^{-1})	0.308	0.308
F000	448.0	448.0
F000'	448.70	
h, k, l$_{max}$	12,13,15	12,13,15
N$_{ref}$	4889	4805
T$_{min}$, T$_{max}$	0.868, 0.879	0.965, 0.974
T$_{min}$'	0.868	

Data completeness= 0.983 **Theta(max)**= 28.340

R(reflections)=0.0448(3772) **wR2(reflections)**=0.1530(4805)

S = 1.085 **N$_{par}$** = 270

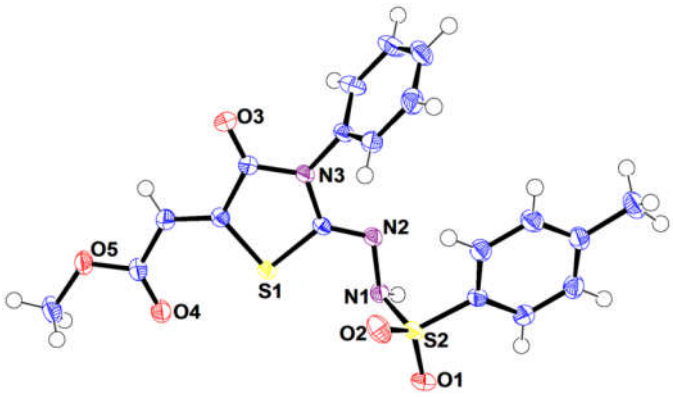
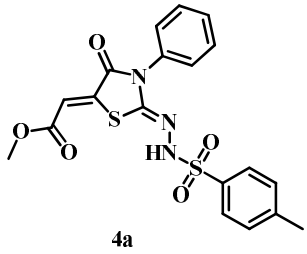


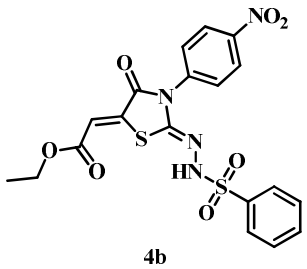
Figure. ORTEP diagram of a single crystal of product **4a** (CCDC 1843990).

3. Spectral Data of the Products:



4a

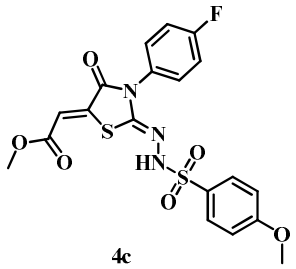
(*Z*)-Methyl 2-((*Z*)-4-oxo-3-phenyl-2-(2-tosylhydrazono)thiazolidin-5-ylidene)acetate (4a)[2]: Pale yellow solid (91 %), m.p. 220-221 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3424, 3181, 1714, 1699, 1639, 1610. ^{1}H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 7.62 (d, 2H, *J* = 8.5 Hz, ArH), 7.43- 7.50 (m, 3H, ArH), 7.193 (d, 2H, *J* = 8.0 Hz, ArH), 7.26-7.29 (m, 2H, ArH), 7.00 (s, 1H, CH), 6.56 (s, NH), 3.89 (s, 3H, OCH_3), 2.39 (s, 3H, CH_3). ^{13}C NMR ($CDCl_3$, 125 MHz): δc (ppm) 166.0, 164.1, 161.6, 144.6, 139.6, 134.1, 133.2, 129.4, 129.1, 128.5, 127.5, 117.9, 52.8, 21.6.



4b

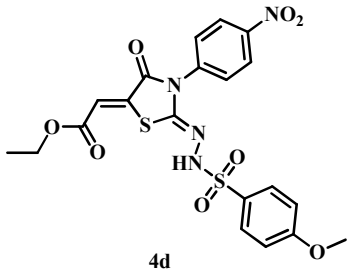
(Z)-Ethyl-2-((Z)-3-(4-nitrophenyl)-4-oxo-2-(2-(phenylsulfonyl)hydrazono)thiazolidin-5-ylidene)acetate (4b): Yellow solid (89 %), m.p. 217-218 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3553, 3308, 3244, 3056, 2986, 2863, 1711, 1638, 1610, 1520. ^{1}H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 8.30 (d, 2H, *J* = 9.0 Hz, ArH), 7.76 (d, 2H, *J* = 8.0 Hz, ArH), 7.61 (t, 1H, *J* = 7.0 Hz, ArH), 7.40-7.52 (m, 4H, ArH), 7.02 (s, 1H, CH), 6.77 (brs, NH), 4.35 (q, 2H, *J* = 7.0 Hz, CH_2), 1.36 (t, 3H, J = 7.0 Hz, CH_3). ^{13}C NMR ($CDCl_3$, 125 MHz): δc (ppm) 165.4 (CO), 163.4 (COO), 159.8 (C=N), 147.6 (Ar), 138.4 (CH), 138.4 (Ar), 137.0 (Ar), 133.9 (Ar), 128.9 (Ar), 128.6 (Ar), 128.4 (Ar), 124.3 (Ar), 119.3 (=C), 62.3 (CH_2), 14.2 (CH_3). HR-MS (ESI) for $C_{19}H_{16}N_4O_7S_2$ m/z $[M + H]^+$ calcd.: 477.0538, found: 477.0549; $[2M + H]^+$ calcd.: 953.0998, found: 953.1011.

[2] A. A. Hassan, A. A. Aly, T. I. M. Bedair, A. B. Brown and T. I. El-Emary, *J. Heterocyclic Chem.* **2014**, *51*, 44.



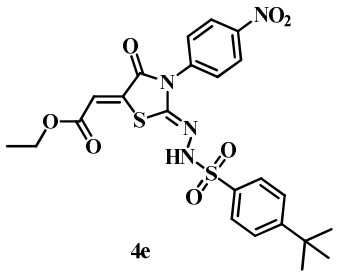
4c

(Z)-Methyl 2-((Z)-3-(4-fluorophenyl)-2-(2-((4-methoxyphenyl)sulfonyl)hydrazono)-4-oxothiazolidin-5-ylidene)acetate (4c): Yellow solid (81 %), m.p. 225-226 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3168, 3053, 1714, 1690, 1640, 1598, 1510. ^{1}H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 7.66 (d, 2H, *J* = 9.0 Hz, ArH), 7.15 (t, 2H, *J* = 8.0 Hz, ArH), 7.21-7.27 (m, 2H, merge with $CDCl_3$, ArH), 6.86 (d, 2H, *J* = 9.0 Hz, ArH), 6.97 (s, 1H, CH), 6.92 (brs, NH), 3.85 (s, 3H, CH_3), 4.33 (q, 2H, *J* = 7.5 Hz, CH_2), 1.35 (t, 3H, *J* = 7.0 Hz, CH_3). ^{13}C NMR ($CDCl_3$, 125 MHz): δc (ppm) 165.5 (CO), 163.9 (d, *J* = 40 Hz, Ar), 163.5 (COO), 161.6 (Ar), 160.2 (C=N), 139.2 (CH), 130.6 (Ar), 129.5 (d, *J* = 8.7 Hz, Ar), 129.1 (Ar), 128.6 (Ar), 118.4 (=C), 116.2 (d, *J* = 23.7 Hz, Ar), 113.9 (CH), 62.1 (OCH_2), 55.7 (OCH_3), 14.2 (CH_3). HR-MS (ESI) for $C_{20}H_{18}N_3O_6S_2F$ m/z $[M + H]^+$ calcd.: 480.0699, found: 480.0711; $[2M + H]^+$ calcd.: 959.132, found: 959.1345.



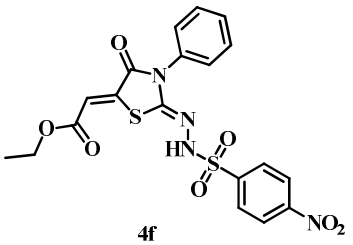
4d

(Z)-Ethyl 2-((Z)-2-(2-((4-methoxyphenyl)sulfonyl)hydrazono)-3-(4-nitrophenyl)-4-oxothiazolidin-5-ylidene)acetate (4d): Yellow solid (87 %), m.p. > 250 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3172, 1715, 1693, 1612, 1595, 1525. ^{1}H NMR (DMSO-d_6, 500 MHz): δ_H (ppm) 10.33 (brs, NH), 8.36 (d, 2H, *J* = 8.5 Hz, ArH), 7.65 (d, 2H, *J* = 9.0 Hz, ArH), 7.59 (d, 2H, *J* = 8.5 Hz, ArH), 7.01 (d, 2H, *J* = 9.0 Hz, ArH), 6.82 (s, 1H, CH), 4.30 (q, 2H, *J* = 7.0 Hz, OCH_2), 3.82 (s, 3H, CH_3), 1.29 (t, 3H, *J* = 7.0 Hz, CH_3). ^{13}C NMR (DMSO-d_6, 125 MHz): δc (ppm) 166.0 (CO), 163.7 (COO), 163.4 (Ar), 147.8 (C=N), 141.3 (Ar), 139.7 (CH), 130.7 (Ar), 130.0 (Ar), 129.7 (Ar), 124.6 (Ar), 116.5 (=C), 114.5 (Ar), 62.2 (OCH_2), 56.2 (OCH_3), 14.6 (CH_3). HR-MS (ESI) for $C_{20}H_{18}N_4O_8S_2$ m/z $[M + H]^+$ calcd.: 507.0644, found: 507.0658.



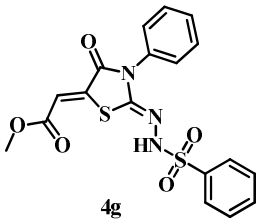
4e

(Z)-Ethyl 2-((Z)-2-(2-((4-(tert-butyl)phenyl)sulfonyl)hydrazono)-3-(4-nitrophenyl)-4-oxothiazolidin-5-ylidene)acetate (4e): Light yellow solid (86 %), m.p. > 250 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3423, 3155, 3063, 2965, 1719, 1694, 1644, 1615, 1595, 1530. ^{1}H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 8.29 (d, 2H, *J* = 8.5 Hz, ArH), 7.69 (d, 2H, *J* = 8.5 Hz, ArH), 7.50 (d, 2H, *J* = 9.0 Hz, ArH), 7.46 (d, 2H, *J* = 8.5 Hz, ArH), 7.02 (s, 1H, CH), 6.70 (brs, NH), 4.35 (q, 2H, *J* = 7.0 Hz, OCH_2), 1.37 (t, 3H, *J* = 7.5 Hz, CH_3), 1.32 (s, 9H, $(CH_3)_3$). ^{13}C NMR ($CDCl_3$, 125 MHz): δc (ppm) 165.5 (CO), 163.5 (COO), 160.0 (Ar), 158.1 (Ar), 147.7 (C=N), 138.5 (CH), 134.0 (Ar), 128.7 (Ar), 128.3 (Ar), 126.0 (Ar), 124.3 (Ar), 119.3 (=C), 62.4 (OCH_2), 35.4 ($C(CH_3)_3$), 31.1 (CH_3), 14.2 (CH_3). HR-MS (ESI) for $C_{23}H_{24}N_4O_7S_2$ m/z $[M + H]^+$ calcd.: 533.1164, found: 533. 1179.



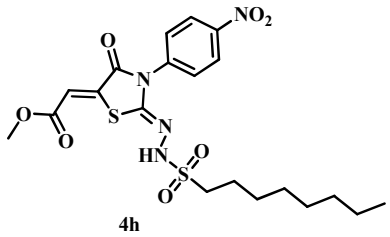
4f

(Z)-Ethyl 2-((Z)-2-(2-((4-nitrophenyl)sulfonyl)hydrazono)-4-oxo-3-phenylthiazolidin-5-ylidene)acetate (4f): Light yellow solid (89 %), m.p. 225-226 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3324, 3251, 3185, 3058, 2980, 1720, 1688, 1638, 1611. ^{1}H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 8.19 (d, 2H, *J* = 9.0 Hz, ArH), 7.88 (d, 2H, *J* = 8.5 Hz, ArH), 7.49-7.54 (m, 3H, ArH), 7.23-7.28 (m, 2H, merged with $CDCl_3$, ArH), 7.01 (s, 1H, CH), 6.70 (brs, NH), 4.35 (q, 2H, *J* = 7.0 Hz, CH_2), 1.36 (t, 3H, *J* = 7.5 Hz, CH_3). ^{13}C NMR (DMSO-d_6, 125 MHz): δc (ppm) 165.5 (CO), 163.5 (COO), 150.0 (Ar), 140.7 (C=N, CH), 133.6 (Ar), 129.8 (Ar), 129.5 (Ar), 129.0 (Ar), 128.9 (Ar), 127.9 (Ar), 124.4 (Ar), 123.9 (Ar), 115.9 (=C), 61.7 (OCH_2), 14.0 (CH_3). HR-MS (ESI) for $C_{19}H_{16}N_4O_7S_2$ m/z $[M + H]^+$ calcd.: 477.0538, found: 477.0552; $[2M + Na]^+$ calcd.: 975.0818, found: 975.0826.



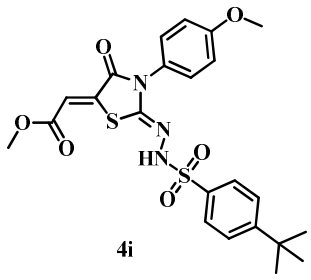
4g

(Z)-Methyl 2-((Z)-4-oxo-3-phenyl-2-(2-(phenylsulfonyl)hydrazono)thiazolidin-5-ylidene)acetate (4g): Yellow solid (85 %), m.p. 206-207 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3168, 3069, 2953, 1716, 1694, 1637, 1611. ^{1}H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 7.73 (d, 2H, *J* = 7.5 Hz, ArH), 7.55 (t, 1H, *J* = 7.5 Hz, ArH), 7.42-7.48 (m, 3H, ArH), 7.39 (t, 2H, *J* = 8.0 Hz, ArH), 7.20-7.27 (m, 2H, ArH), 7.00 (s, 1H, CH), 6.67 (brs, NH), 3.88 (s, 3H, CH_3). ^{13}C NMR ($CDCl_3$, 125 MHz): δ_c (ppm) 166.0 (CO), 164.0 (COO), 161.5 (C=N), 139.6 (CH), 137.0 (Ar), 133.6 (Ar), 133.2 (Ar), 129.4 (Ar), 129.2 (Ar), 128.7 (Ar), 128.5 (Ar), 127.5 (Ar), 118.0 (=C), 52.8 (OCH_3). HR-MS (ESI) for $C_{18}H_{15}N_3O_5S_2$ m/z $[M + H]^+$ calcd.: 418.0531, found: 418.0540.



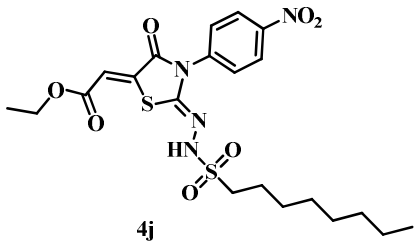
4h

(Z)-Methyl 2-((Z)-3-(4-nitrophenyl)-2-(2-(octylsulfonyl)hydrazono)-4-oxothiazolidin-5-ylidene)acetate (4h): Yellow solid (83 %), m.p. 185-186 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3166, 2924, 2858, 1715, 1697, 1635, 1608, 1524. ^1H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 8.38 (d, 2H, *J* = 9.0 Hz, ArH), 7.62 (d, 2H, *J* = 9.0 Hz, ArH), 7.048 (s, 1H, CH), 6.76 (brs, NH), 3.90 (s, 3H, OCH_3), 3.08 (t, 2H, *J* = 8.0 Hz, CH_2), 1.77 (p, 2H, *J* = 7.5 Hz, CH_2), 1.32-1.40 (m, 2H, CH_2), 1.15-1.30 (m, 8H, $(CH_2)_4$), 0.870 (t, 3H, *J* = 6.5 Hz, CH_3). ^{13}C NMR ($CDCl_3$, 125 MHz): δc (ppm) 165.8 (CO), 163.6 (COO), 161.6 (C=N), 147.7 (Ar), 138.7 (CH), 138.5 (Ar), 128.6 (Ar), 124.6 (Ar), 118.9 (=C), 53.0 (CH_2), 50.2 (OCH_3), 31.7 (CH_2), 28.9 (CH_2), 28.9 (CH_2), 28.2 (CH_2), 23.2 (CH_2), 22.6 (CH_2), 14.0 (CH_3). HR-MS (ESI) for $C_{20}H_{26}N_4O_7S_2$ m/z $[M + H]^+$ calcd.: 499.1321, found: 499.1338.



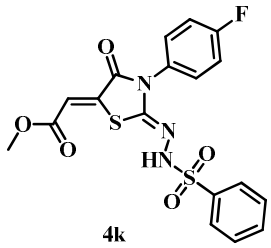
4i

(Z)-Methyl 2-((Z)-2-(2-((4-(tert-butyl)phenyl)sulfonyl)hydrazono)-3-(4-methoxyphenyl)-4-oxothiazolidin-5-ylidene)acetate (4i): Yellow solid (80 %), m.p. 188-189 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3417, 3154, 3077, 2962, 1713, 1695, 1641, 1608, 1513. ^1H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 7.67 (d, 2H, *J* = 8.5 Hz, ArH), 7.41 (d, 2H, *J* = 8.5 Hz, ArH), 7.16 (d, 2H, *J* = 8.5 Hz, ArH), 6.98 (s, 1H, CH), 6.95 (d, 2H, *J* = 9.0 Hz, ArH), 6.66 (brs, NH), 3.87 (s, 3H, OCH_3), 3.84 (s, 3H, OCH_3), 1.31 (s, 9H, $(CH_3)_3$). ^{13}C NMR ($CDCl_3$, 125 MHz): δc (ppm) 166.1 (CO), 164.4 (COO), 162.1 (Ar), 160.1 (C=N), 157.6 (Ar), 139.9 (CH), 134.1 (Ar), 128.8 (Ar), 128.5 (Ar), 125.8 (Ar), 117.9 (=C), 114.5 (Ar), 55.6 (OCH_3), 52.9 (OCH_3), 35.3 ($C(CH_3)_3$), 31.1 (CH_3). HR-MS (ESI) for $C_{23}H_{25}N_3O_6S_2$ m/z $[M + H]^+$ calcd.: 504.1263, found: 504.1277; $[2M + Na]^+$ calcd.: 1029.2268, found: 1029. 2284.



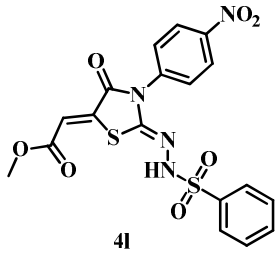
4j

(Z)-Ethyl 2-((Z)-3-(4-nitrophenyl)-2-(2-(octylsulfonyl)hydrazono)-4-oxothiazolidin-5-ylidene)acetate (4j): Light yellow solid (84 %), m.p. 171-172 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3436, 3138, 2925, 2856, 1731, 1686, 1632, 1612, 1525. ^{1}H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 8.37 (d, 2H, *J* = 8.5 Hz, ArH), 7.61 (d, 2H, *J* = 6.5 Hz, ArH), 7.04 (s, 1H, CH), 6.59 (m, NH), 4.35 (q, 2H, *J* = 6.5 Hz, OCH_2), 3.08 (t, 2H, *J* = 8.0 Hz, CH_2), 1.76 (p, 2H, *J* = 8.0 Hz, CH_2), 1.31-1.40 (m, 5H, CH_2 and CH_3), 1.17-1.30 (m, 8H, $(CH_2)_2$), 0.87 (t, 3H, *J* = 6.5 Hz, CH_3). ^{13}C NMR ($CDCl_3$, 125 MHz): δ_c (ppm) 165.4 (CO), 163.7 (COO), 147.8 (Ar), 138.5 (C=N), 138.4 (CH), 128.6 (Ar), 124.6 (Ar), 119.6 (Ar), 62.4 (OCH_2), 50.3 (CH_2), 31.7 (CH_2), 29.0 (CH_2), 28.9 (CH_2), 28.2 (CH_2), 23.3 (CH_2), 22.7 (CH_2), 14.2 (CH_3), 14.1 (CH_3). HR-MS (ESI) for $C_{21}H_{28}N_4O_7S_2$ m/z $[M + H]^+$ calcd.: 513.1477, found: 513.1493.



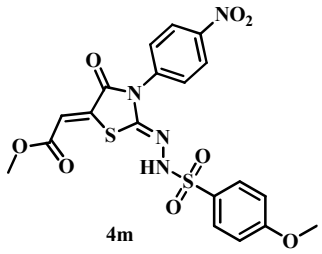
4k

(Z)-Methyl 2-((Z)-3-(4-fluorophenyl)-4-oxo-2-(2-(phenylsulfonyl)hydrazono)thiazolidin-5-ylidene)acetate (4k): Yellow solid (79 %), m.p. 242-243 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3418, 3181, 3075, 2924, 1720, 1694, 1635, 1607, 1511. ^{1}H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 7.76 (d, 2H, *J* = 7.5 Hz, ArH), 7.59 (t, 1H, *J* = 7.5 Hz, ArH), 7.43 (t, 2H, *J* = 8.0 Hz, ArH), 7.21-7.25 (m, 2H, ArH), 7.15 (t, 2H, *J* = 8.0 Hz, ArH), 7.00 (s, 1H, CH), 6.60 (s, NH), 3.89 (s, 3H, OCH_3). ^{13}C NMR ($CDCl_3$, 125 MHz): δc (ppm) 165.9 (CO), 164.0 (COO), 161.5 (d, *J* = 40.0 Hz, Ar), 139.2 (CH), 137.0 (Ar), 133.7 (Ar), 129.46 (d, *J* = 8.75 Hz, Ar), 128.8 (Ar), 128.4 (Ar), 118.2 (=C), 116.4 (d, *J* = 22.7 Hz, Ar), 52.9 (OCH_3). HR-MS (ESI) for $C_{18}H_{14}N_3O_5S_2F$ m/z $[M + H]^+$ calcd.: 436.0437, found: 436.0448; $[2M + H]^+$ calcd.: 871.0796, found: 871.0814.



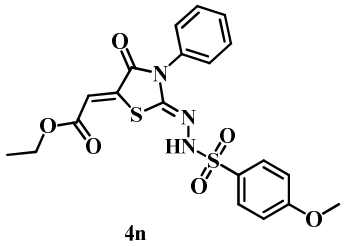
4l

(Z)-Methyl 2-((Z)-3-(4-nitrophenyl)-4-oxo-2-(2-(phenylsulfonyl)hydrazono)thiazolidin-5-ylidene)acetate (4l): Yellow solid (85 %), m.p. > 250 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3413, 1711, 1684, 1639, 1607, 1519, 1497. ^{1}H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 8.30 (d, 2H, *J* = 8.0 Hz, ArH), 7.78 (d, 2H, *J* = 8.0 Hz, ArH), 7.61 (t, 1H, *J* = 7.5 Hz, ArH), 7.49 (d, 2H, *J* = 8.5 Hz, ArH), 7.45 (t, 2H, *J* = 8.0 Hz, ArH), 7.03 (s, 1H, CH), 6.71 (brs, NH), 3.91 (s, 3H, OCH_3). ^{13}C NMR (DMSO-d_6, 125 MHz): δ_c (ppm) 166.0 (CO), 163.2 (COO), 156.7 (C=N), 147.2 (Ar), 140.8 (CH), 139.2 (Ar), 137.5 (Ar), 133.4 (Ar), 129.5 (Ar), 128.8 (Ar), 128.0 (Ar), 124.1 (Ar), 115.7 (=C), 52.8 (OCH_3). HR-MS (ESI) for $C_{18}H_{14}N_4O_7S_2$ m/z $[M + H]^+$ calcd.: 463.0382, found: 463.0393; $[2M + H]^+$ calcd.: 925.0686, found: 925.0698.



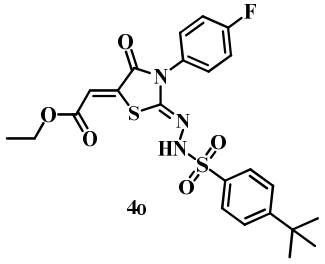
4m

(Z)-Methyl 2-((Z)-2-(2-((4-methoxyphenyl)sulfonyl)hydrazono)-3-(4-nitrophenyl)-4-oxothiazolidin-5-ylidene)acetate (4m): Yellow solid (86 %), m.p. > 250 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3167, 3053, 1712, 1698, 1641, 1613, 1595. ^{1}H NMR (DMSO-d_6, 500 MHz): δ_H (ppm) 10.33 (brs, NH), 8.37 (d, 2H, *J* = 8.5 Hz, ArH), 7.65 (d, 2H, *J* = 9.0 Hz, ArH), 7.59 (d, 2H, *J* = 8.5 Hz, ArH), 7.03 (d, 2H, *J* = 8.5 Hz, ArH), 6.86 (s, 1H, CH), 3.83 (s, 3H, OCH_3), 3.82 (s, 3H, OCH_3). ^{13}C NMR (DMSO-d_6, 125 MHz): δc (ppm) 166.5 (CO), 163.7 (COO), 163.4 (Ar), 147.7 (C=N), 141.4 (Ar), 139.7 (CH), 130.7 (Ar), 130.0 (Ar), 129.6 (Ar), 124.6 (Ar), 116.2 (Ar), 114.5 (=C), 56.2 (OCH_3), 53.3 (OCH_3). HR-MS (ESI) for $C_{19}H_{16}N_4O_8S_2$ m/z $[M + H]^+$ calcd.: 493.0488, found: 493.0503.



4n

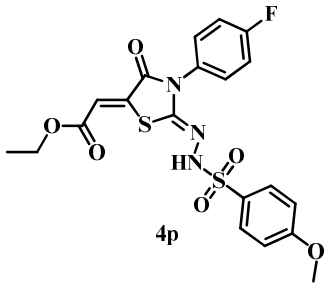
(Z)-Ethyl 2-((Z)-2-(2-((4-methoxyphenyl)sulfonyl)hydrazono)-4-oxo-3-phenylthiazolidin-5-ylidene)acetate (4n): Pale yellow solid (86 %), m.p. 209-210 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3212, 3067, 1731, 1697, 1598, 1499. ^{1}H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 7.67 (d, 2H, J = 9.0 Hz, ArH), 7.41-7.52 (m, 3H, ArH), 7.27 (d, 2H, *J* = 6.5 Hz, merge with $CDCl_3$, ArH), 7.00 (s, 1H, CH), 6.85 (d, 2H, *J* = 9.0 Hz, ArH), 6.70 (brs, NH), 4.33 (q, 2H, *J* = 7.0 Hz, OCH_2), 3.84 (s, 3H, OCH_3), 1.36 (t, 3H, *J* = 7.0 Hz, CH_3). ^{13}C NMR ($CDCl_3$, 125 MHz): δc (ppm) 165.4 (CO), 164.2 (COO), 163.7 (Ar), 161.3 (C=N), 139.5 (CH), 133.4 (Ar), 130.8 (Ar), 129.4 (Ar), 129.3 (Ar), 128.6 (Ar), 127.6 (Ar), 118.4 (Ar), 114.0 (=C), 62.1 (OCH_2), 55.7 (OCH_3), 14.3 (CH_3). HR-MS (ESI) for $C_{20}H_{19}N_3O_6S_2$ m/z $[M + H]^+$ calcd.: 462.0793, found: 462.0806.



4o

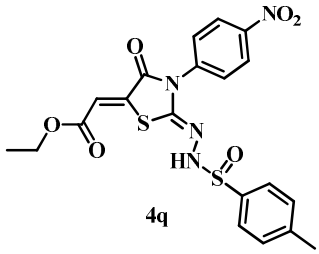
(*Z*)-Ethyl 2-((*Z*)-2-(2-((4-(tert-butyl)phenyl)sulfonyl)hydrazono)-3-(4-fluorophenyl)-4-oxothiazolidin-5-ylidene)acetate (4o): Pale yellow solid (88 %), m.p. 241-242 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3148, 2970, 1739,

1720, 1696, 1619, 1507. ^{1}H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 7.66 (d, 2H, *J* = 8.5 Hz, ArH), 7.42 (d, 2H, *J* = 8.5 Hz, ArH), 7.22-7.26 (m, 2H, ArH), 7.14 (t, 2H, *J* = 8.5 Hz, ArH), 6.99 (s, 1H, CH), 6.61 (brs, NH), 4.34 (q, 2H, *J* = 7.0 Hz, OCH_2), 1.36 (t, 3H, *J* = 7.5 Hz, CH_3). ^{13}C NMR ($CDCl_3$, 125 MHz): δc (ppm) 165.5 (CO), 164.0 (COO), 163.6 (Ar), 161.4 (*J* = 56.25 Hz, Ar), 157.7 (C=N), 139.1 (CH), 134.0 (Ar), 129.5 (*J* = 8.75 Hz, Ar), 129.1 (Ar), 128.3 (Ar), 125.8 (Ar), 118.6 (=C), 116.1 (*J* = 23.75 Hz, Ar), 62.1 (OCH_2), 35.2 ($C(CH_3)_3$), 31.0 (CH_3), 14.2 (CH_3). HR-MS (ESI) for $C_{23}H_{24}FN_3O_5S_2$ m/z $[M - H]^+$ calcd.: 504.1061, found: 504.1042.



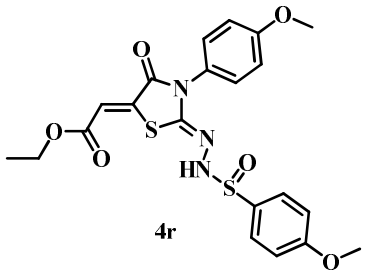
4p

(*Z*)-Ethyl 2-((*Z*)-3-(4-fluorophenyl)-2-(2-((4-methoxyphenyl)sulfonyl)hydrazono)-4-oxothiazolidin-5-ylidene)acetate (4p): Yellow solid (87 %), m.p. 220-221 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3159, 2922, 1739, 1687, 1634, 1628, 1603. ^{1}H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 7.67 (d, 2H, *J* = 8.5 Hz, ArH), 7.22-7.30 (m, 2H, ArH), 7.16 (t, 2H, *J* = 8.5 Hz, ArH), 6.99 (s, 1H, CH), 6.88 (d, 2H, *J* = 8.5 Hz, ArH), 6.24 (brs, NH), 4.34 (q, 2H, *J* = 7.0 Hz, OCH_2), 3.86 (s, 3H, OCH_3), 1.36 (t, 2H, *J* = 7.0 Hz, CH_3). ^{13}C NMR ($CDCl_3$, 125 MHz): δc (ppm) 165.5 (CO), 163.9 (*J* = 33.75 Hz, Ar), 163.6 (COO), 161.6 (C=N), 160.8 (Ar), 139.1 (CH), 130.6 (Ar), 129.5 (*J* = 8.75 Hz, Ar), 118.6 (Ar), 116.2 (*J* = 22.5 Hz, Ar), 116.1 (Ar), 114.0 (=C), 62.1 (OCH_2), 55.7 (OCH_3), 14.2 (CH_3). HR-MS (ESI) for $C_{20}H_{18}FN_3O_6S_2$ m/z $[M - H]^+$ calcd.: 478.0541, found: 478.0552.



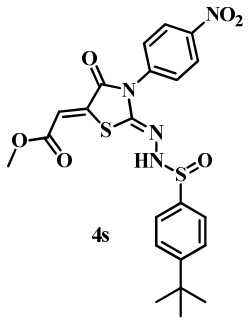
4q

(*Z*)-Ethyl 2-((Z)-3-(4-nitrophenyl)-4-oxo-2-(2-(p-tolylsulfinyl)hydrazono)thiazolidin-5-ylidene)acetate (4q): Pale yellow solid (86 %), m.p. 210-211˚C. IR (4000-600 cm^{-1}): ν_{max} = 3306, 3238, 3147, 1710, 1689, 1639, 1611, 1596, 1553. ^{1}H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 8.31 (d, 2H, *J* = 8.5 Hz, ArH), 7.65 (d, 2H, *J* = 8.0 Hz, ArH), 7.51 (d, 2H, *J* = 8.5 Hz, ArH), 7.22-7.29 (m, 2H, merge with $CDCl_3$, ArH), 7.01 (s, 1H, CH), 6.72 (brs, NH), 4.35 (q, 2H, *J* = 6.5 Hz, OCH_2), 2.42 (s, 3H, CH_3), 1.37 (t, 3H, *J* = 7.0 Hz, CH_3). ^{13}C NMR (DMSO-d_6, 125 MHz): δc (ppm) 165.5 (CO), 163.2 (COO), 145.3 (C=N), 144.1 (CH), 129.7 (Ar), 129.5 (Ar), 129.3 (Ar), 128.1 (Ar), 128.0 (Ar), 124.1 (Ar), 123.6 (Ar), 116.1 (=C), 61.8 (OCH_2), 21.1 (CH_3), 14.1 (CH_3). HR-MS (ESI) for $C_{20}H_{18}N_4O_7S_2$ m/z $[M + H]^+$ calcd.: 491.0695, found: 491.0695.



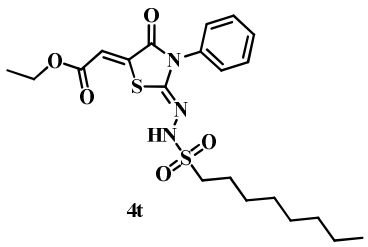
4r

(*Z*)-Ethyl 2-((*Z*)-3-(4-methoxyphenyl)-2-(2-((4-methoxyphenyl)sulfinyl)hydrazono)-4-oxothiazolidin-5-ylidene)acetate (4r): Pale yellow solid (88 %), m.p. 178-179 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3138, 3065, 2953, 1705, 1642, 1614, 1527, 1495. ^{1}H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 7.68 (d, 2H, *J* = 8.5 Hz, ArH), 7.17 (d, 2H, *J* = 8.5 Hz, ArH), 6.94-7.00 (m, 2H, ArH), 6.86 (d, 2H, *J* = 9.0 Hz, ArH), 6.56 (s, 1H, CH), 4.33 (q, 2H, *J* = 7.0 Hz, OCH_2), 3.82-3.87 (m, 6H, OCH_3, OCH_3), 1.36 (t, 3H, *J* = 7.0 Hz, CH_3). ^{13}C NMR ($CDCl_3$, 125 MHz): δc (ppm) 165.6 (CO), 164.3 (COO), 163.7 (Ar), 161.7 (Ar), 160.0 (C=N), 139.4 (CH), 130.7 (Ar), 128.7 (Ar), 125.8 (Ar), 118.3 (Ar), 114.4 (Ar), 113.9 (=C), 62.0 (OCH_2), 55.6 (OCH_3), 55.6 (OCH_3), 14.2 (CH_3). HR-MS (ESI) for $C_{21}H_{21}N_3O_7S_2$ m/z $[M + H]^+$ calcd.: 492.0899, found: 492.0891.



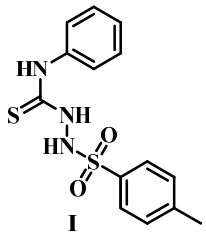
4s

(*Z*)-Methyl 2-((*Z*)-2-(2-((4-(tert-butyl)phenyl)sulfinyl)hydrazono)-3-(4-nitrophenyl)-4-oxothiazolidin-5-ylidene)acetate (4s): Cream color solid (86 %), m.p. 220-221 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3193, 1730, 1692, 1604, 1511, 1388. ^{1}H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 8.30 (d, 2H, *J* = 9.0 Hz, ArH), 7.68 (d, 2H, *J* = 8.5 Hz, ArH), 7.50 (d, 2H, *J* = 9.0 Hz, ArH), 7.45 (d, 2H, *J* = 8.5 Hz, ArH), 7.03 (s, 1H, CH), 6.66 (brs, NH), 3.90 (s, 3H, OCH_3), 1.32 (s, 9H, $C(CH_3)_3$). ^{13}C NMR ($CDCl_3$, 125 MHz): δc (ppm) 165.8 (CO), 163.4 (COO), 159.3 (Ar), 158.1 (Ar), 147.7 (C=N), 138.9 (CH), 138.6 (Ar), 134.2 (Ar), 128.6 (Ar), 128.3 (Ar), 125.9 (Ar), 124.2, 118.7 (=C), 52.9 (OCH_3), 35.3 ($C(CH_3)_3$), 31.0 (CH_3). HR-MS (ESI) for $C_{22}H_{22}N_4O_7S_2$ m/z $[M + H]^+$ calcd.: 519.1008, found: 519.0000.



4t

(*Z*)-Ethyl 2-((*Z*)-2-(2-(octylsulfonyl)hydrazono)-4-oxo-3-phenylthiazolidin-5-ylidene)acetate (4t): Pale yellow solid (87 %), m.p. 164-165 ˚C. IR (4000-600 cm^{-1}): ν_{max} = 3156, 2920, 2852, 1739, 1715, 1685, 1628, 1602. ^1H NMR ($CDCl_3$, 500 MHz): δ_H (ppm) 7.51 (t, 2H, *J* = 6.0 Hz, ArH), 7.46 (t, 1H, *J* = 6.5 Hz, ArH), 7.33 (d, 2H, *J* = 7.5 Hz, ArH), 7.00 (s, 1H, CH), 6.55 (brs, NH), 4.34 (q, 2H, *J* = 7.0 Hz, OCH_2), 3.04-3.09 (m, 2H, CH_2), 1.70-1.78 (m, 2H, CH_2), 1.36 (t, 3H, *J* = 8.0 Hz, CH_3), 1.20-1.30 (m, 10 H, $(CH_2)_5$), 0.87 (t, 3H, *J* = 6.5 Hz, CH_3). ^{13}C NMR ($CDCl_3$, 125 MHz): δc (ppm). 165.5 (CO), 164.3 (COO), 163.5 (C=N), 139.2 (=CH), 133.3 (Ar), 129.4 (Ar), 129.4 (Ar), 127.4 (Ar), 118.6 (=C), 62.1 (OCH_2), 50.1 (CH_2), 31.7 (CH_2), 30.9 (CH_2), 28.9 (CH_2), 28.8 (CH_2), 28.2 (CH_2), 23.1 (CH_2), 22.6 (CH_2), 14.2 (CH_3), 14.0 (CH_3). HR-MS (ESI) for $C_{21}H_{29}N_3O_5S_2$ m/z $[M - H]^+$ calcd.: 466.1497, found: 466.1469.

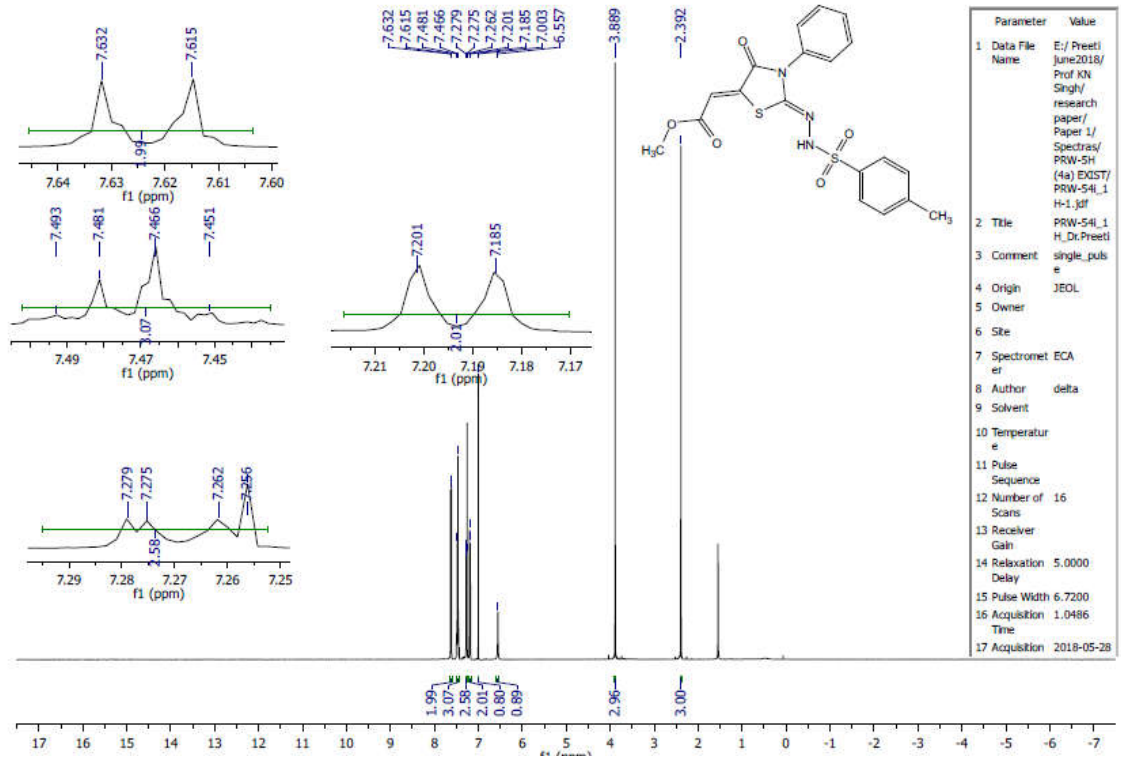


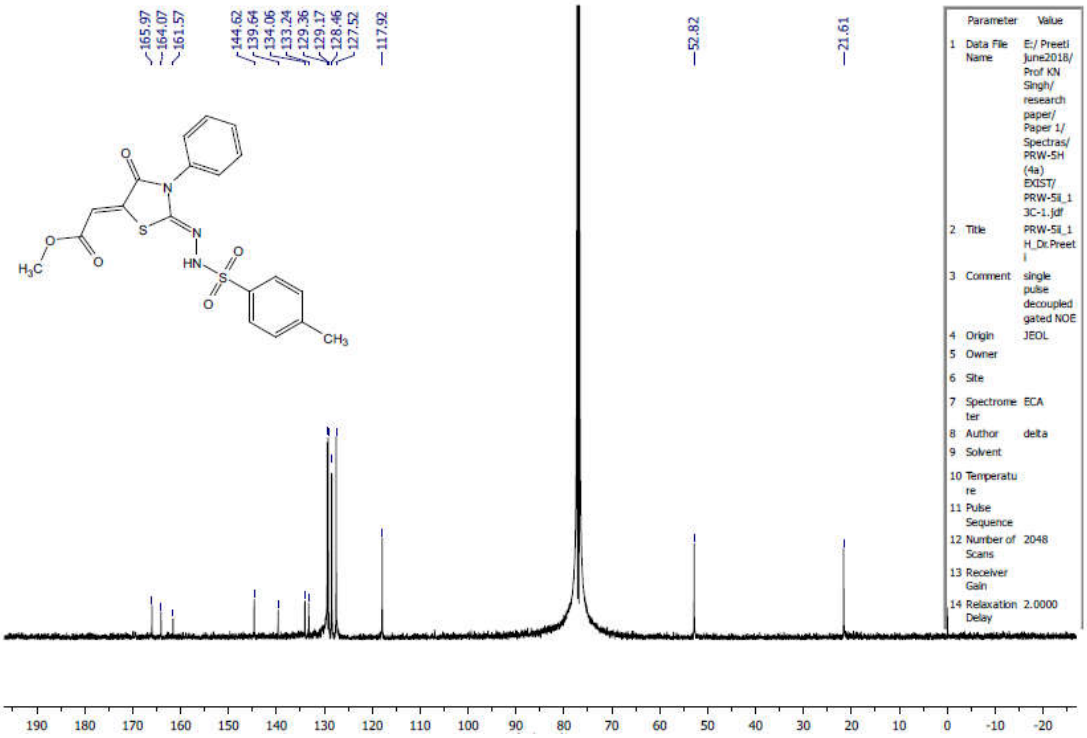
I

***N*-Phenyl-2-tosylhydrazinecarbothioamide (Intermediate I):** White solid, ^1H NMR (DMSO-d_6,500 MHz): δ_H (ppm) 10.03 (brs, NH), 9.81 (brs, NH), 9.68 (brs, NH), 7.82 (d, 2H, *J* = 8.5 Hz, ArH), 7.48 (d, 2H, *J* = 8.5 Hz, ArH), 7.32-7.40 (m, 4H, ArH), 7.20 (t, 1H, *J* = 7.5 Hz, ArH), 2.45 (s, 3H, CH_3).

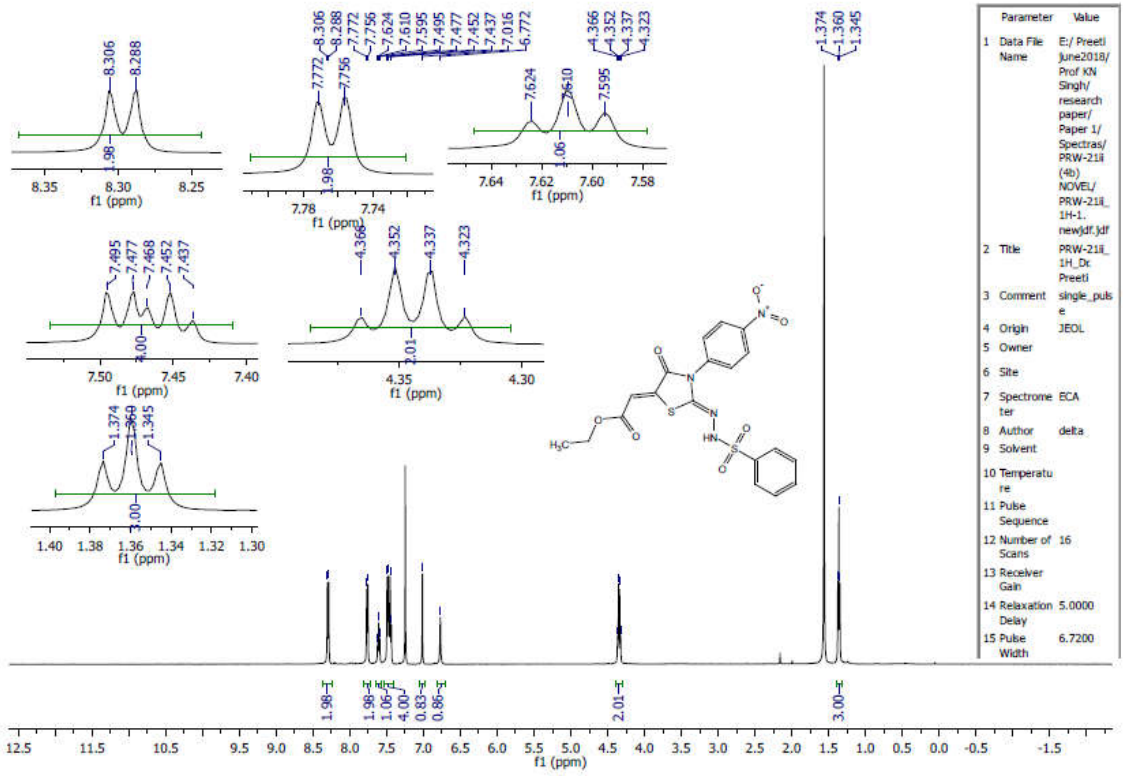
4. Copies of ^{1}H & ^{13}C NMR spectra of the Products:

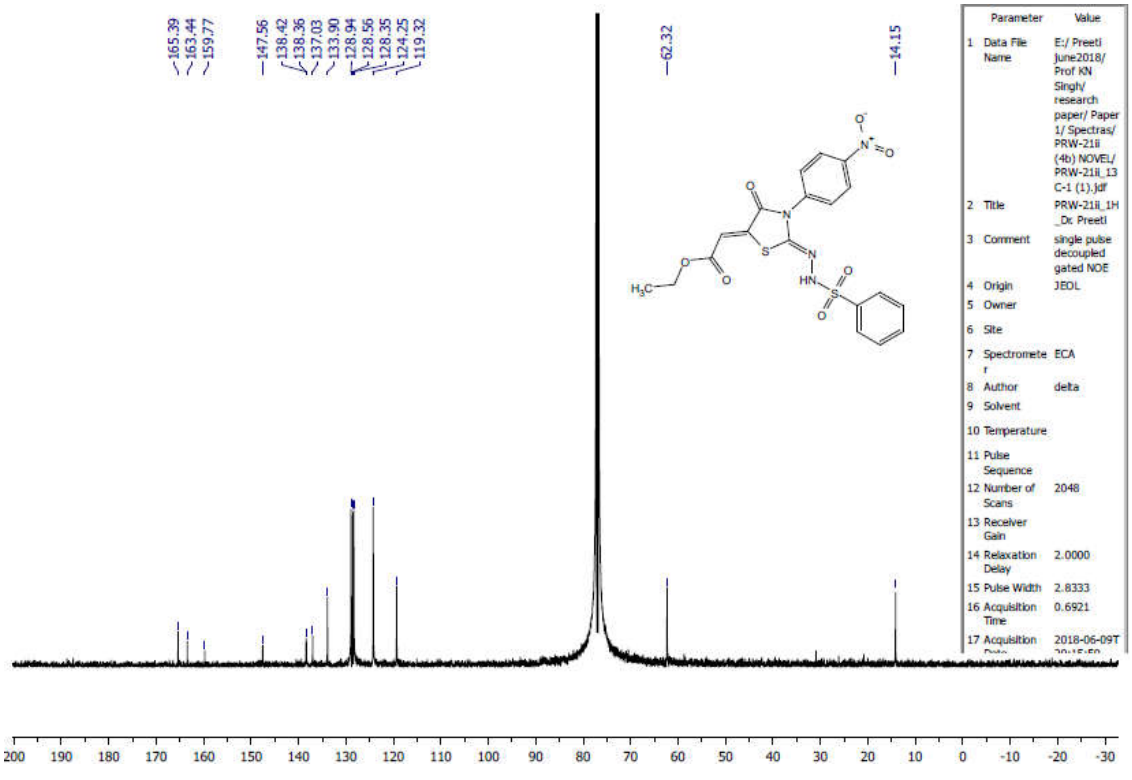
(*Z*)-Methyl 2-((*Z*)-4-oxo-3-phenyl-2-(2-tosylhydrazono)thiazolidin-5-ylidene)acetate (4a):



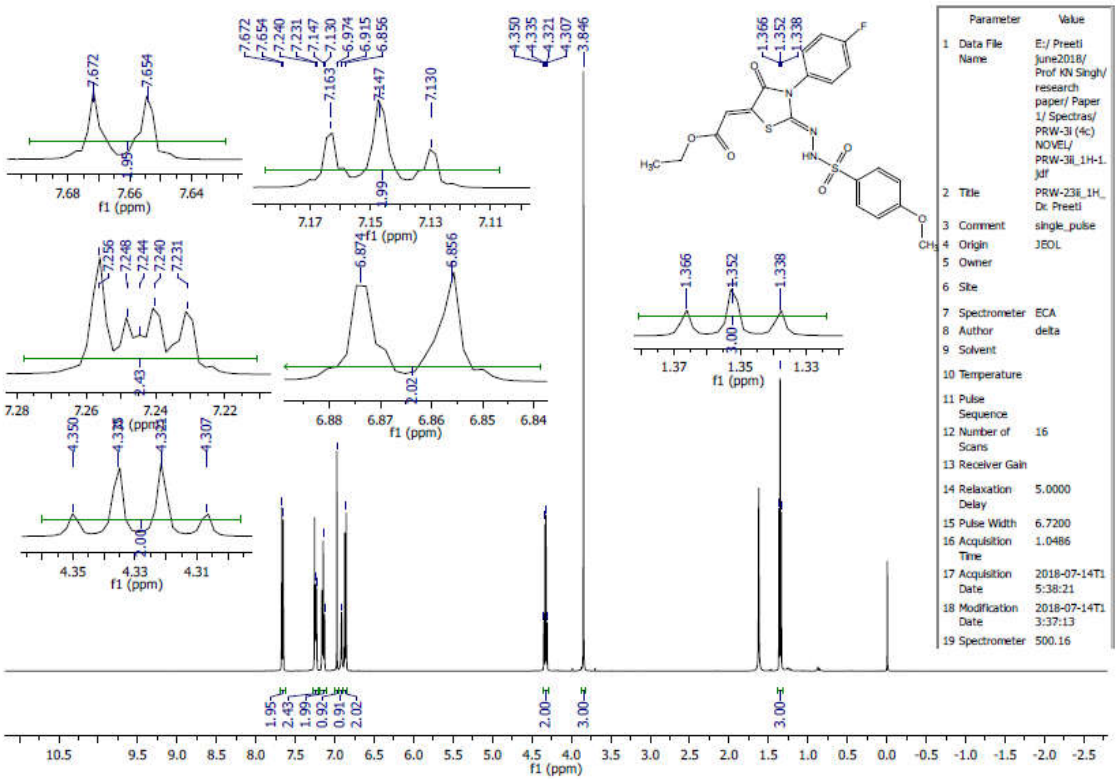


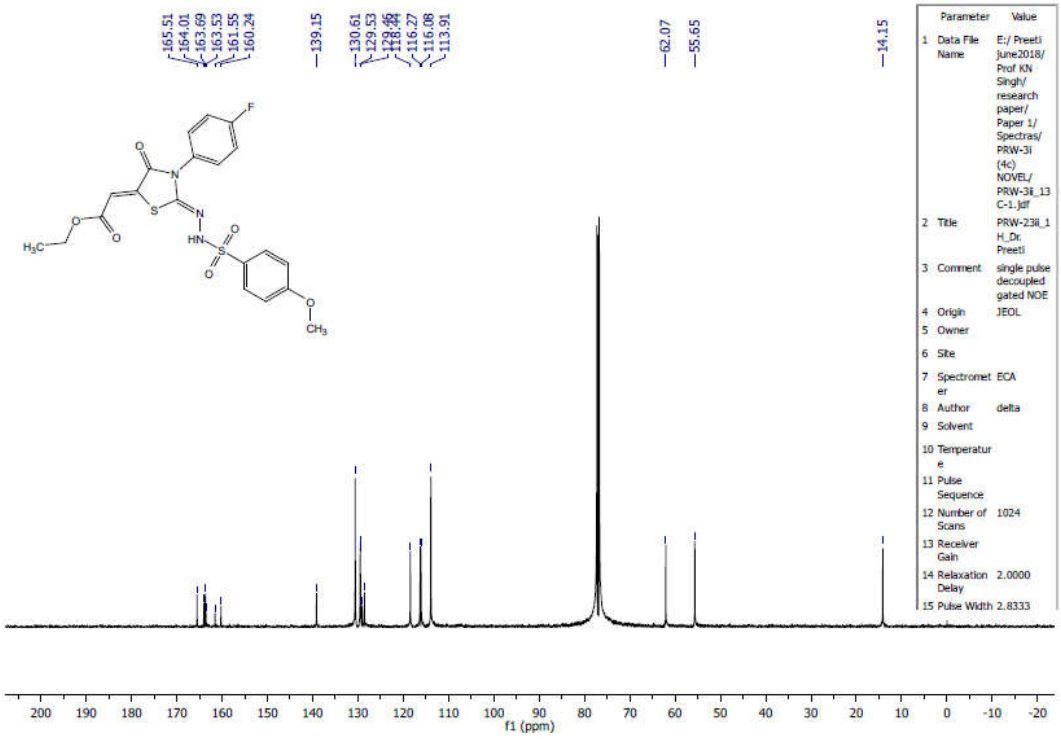
(*Z*)-Ethyl 2-((*Z*)-3-(4-nitrophenyl)-4-oxo-2-(2-(phenylsulfonyl)hydrazono)thiazolidin-5-ylidene)acetate (4b):



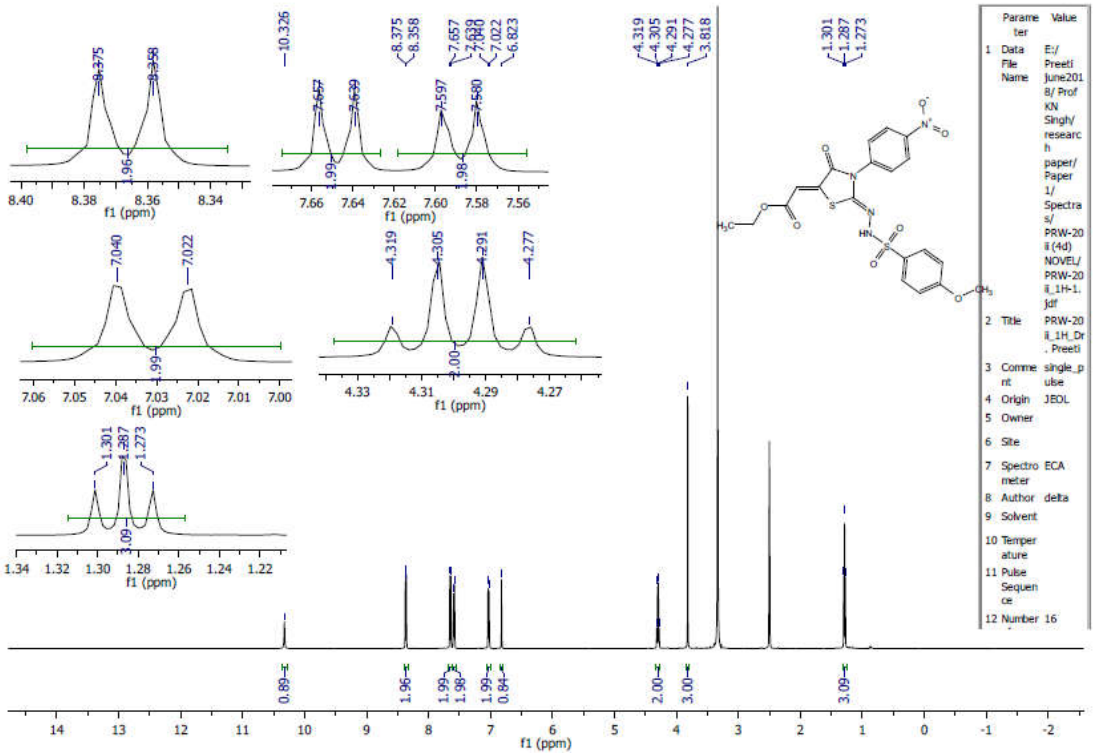


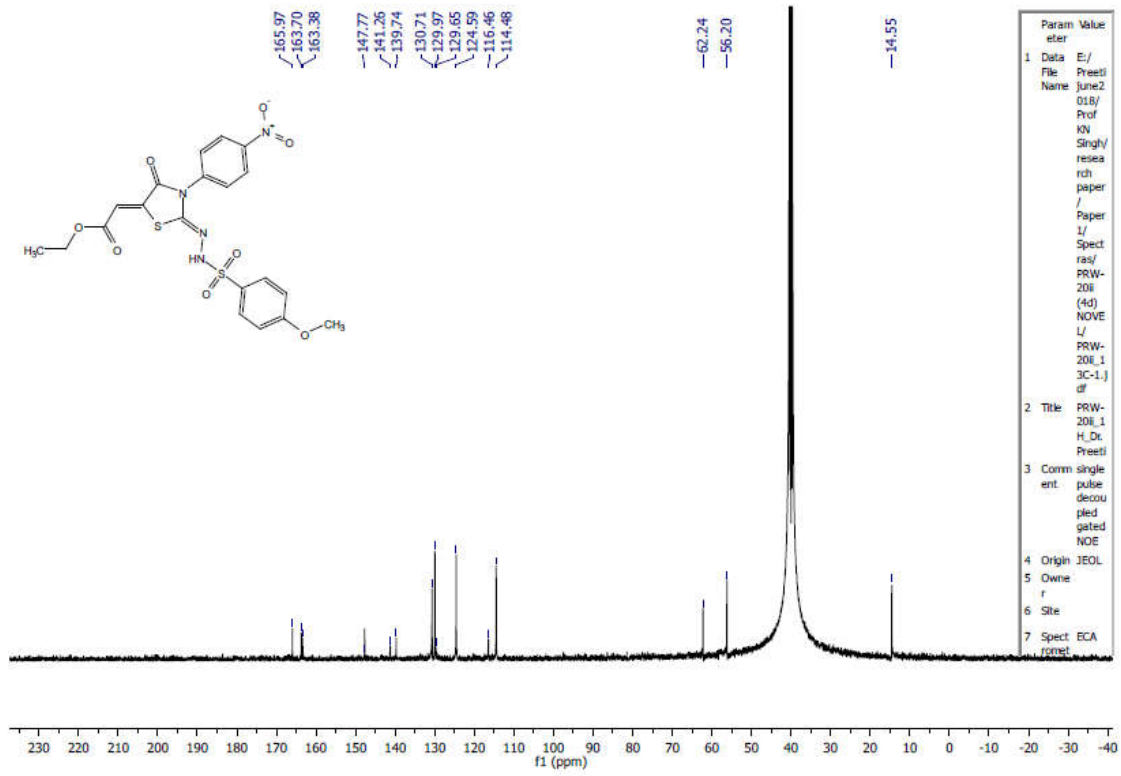
(*Z*)-Methyl 2-((*Z*)-3-(4-fluorophenyl)-2-(2-((4-methoxyphenyl)sulfonyl)hydrazono)-4-oxothiazolidin-5-ylidene)acetate (4c):



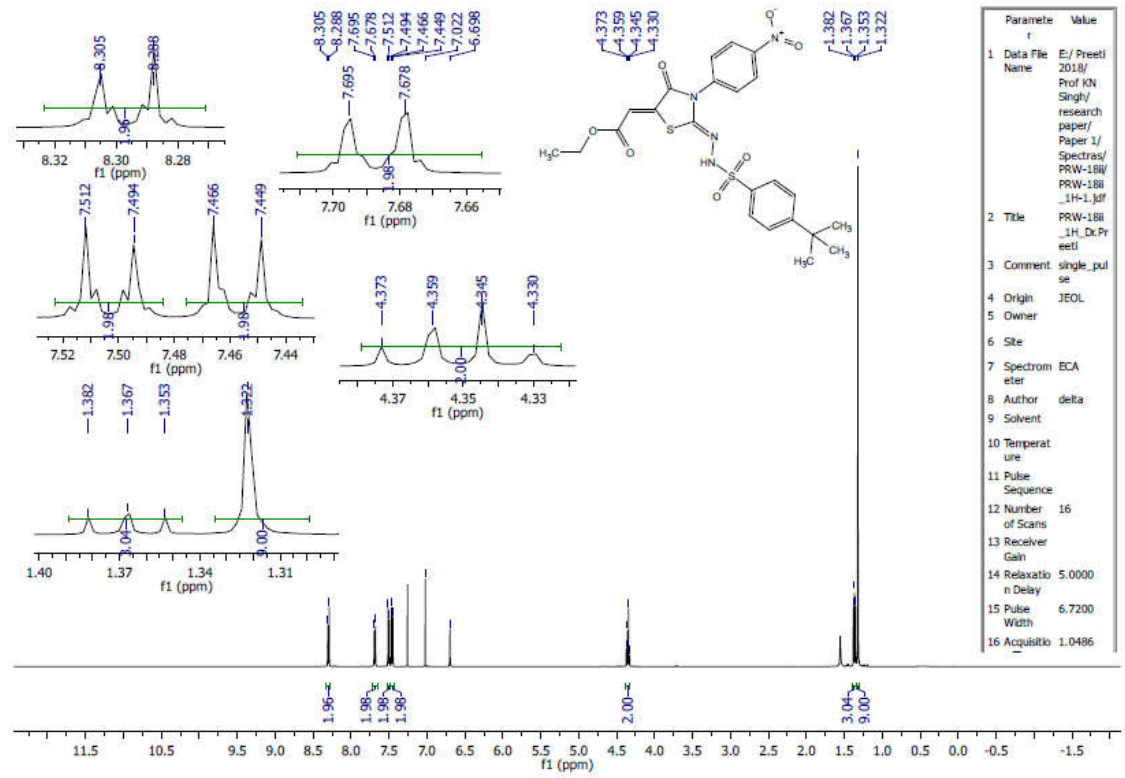


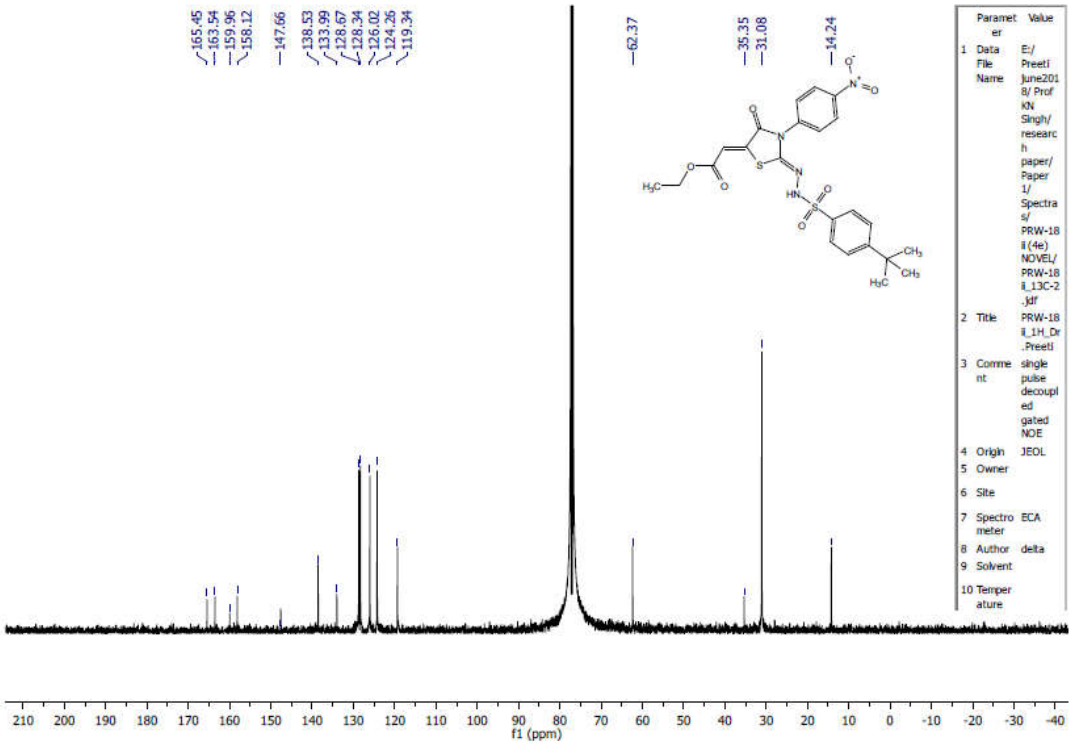
(*Z*)-Ethyl 2-((*Z*)-2-(2-((4-methoxyphenyl)sulfonyl)hydrazono)-3-(4-nitrophenyl)-4-oxothiazolidin-5-ylidene)acetate (4d):



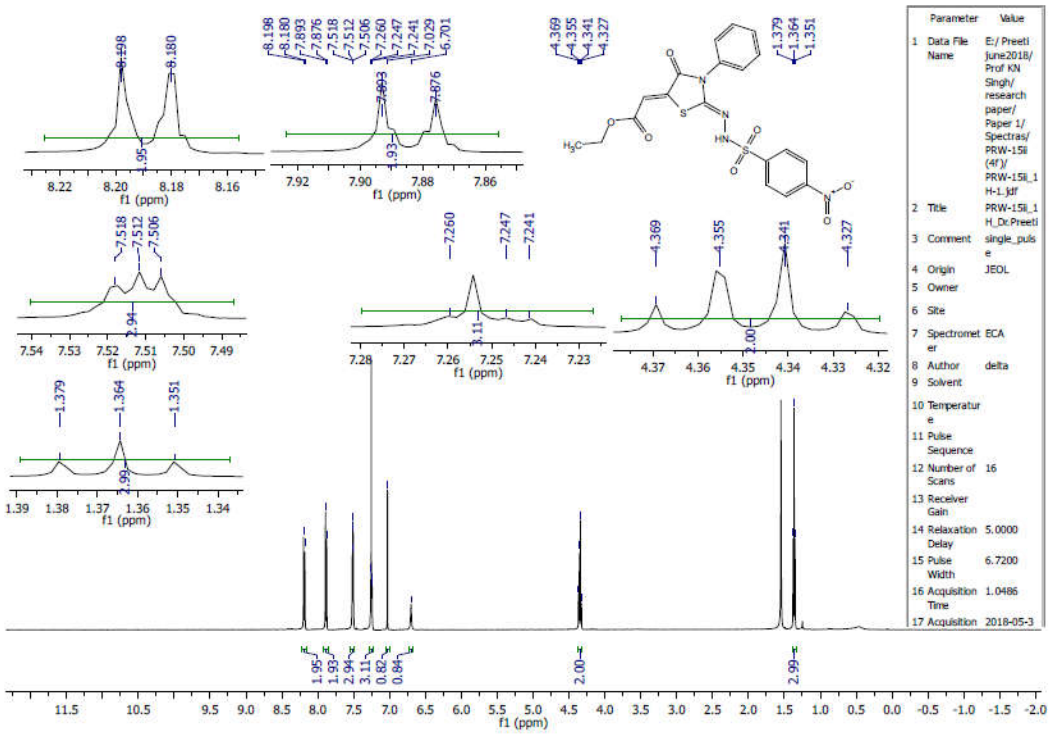


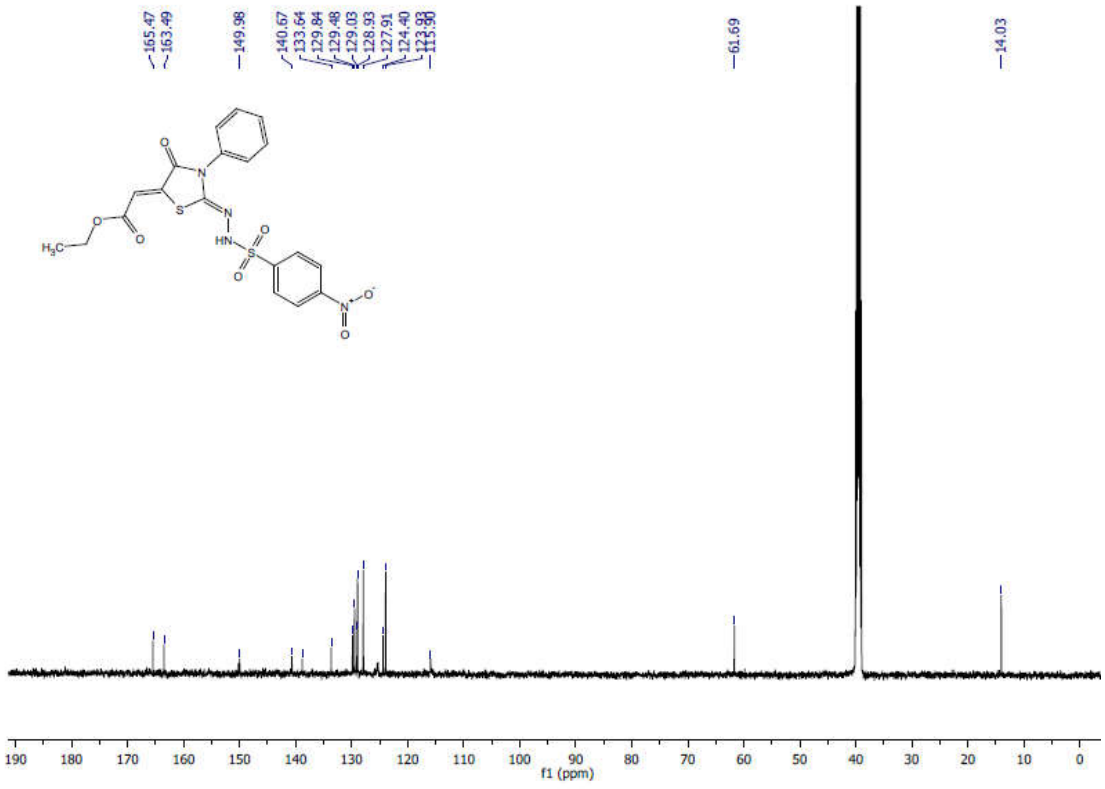
(*Z*)-Ethyl 2-((*Z*)-2-(2-((4-(tert-butyl)phenyl)sulfonyl)hydrazono)-3-(4-nitrophenyl)-4-oxothiazolidin-5-ylidene)acetate (4e):



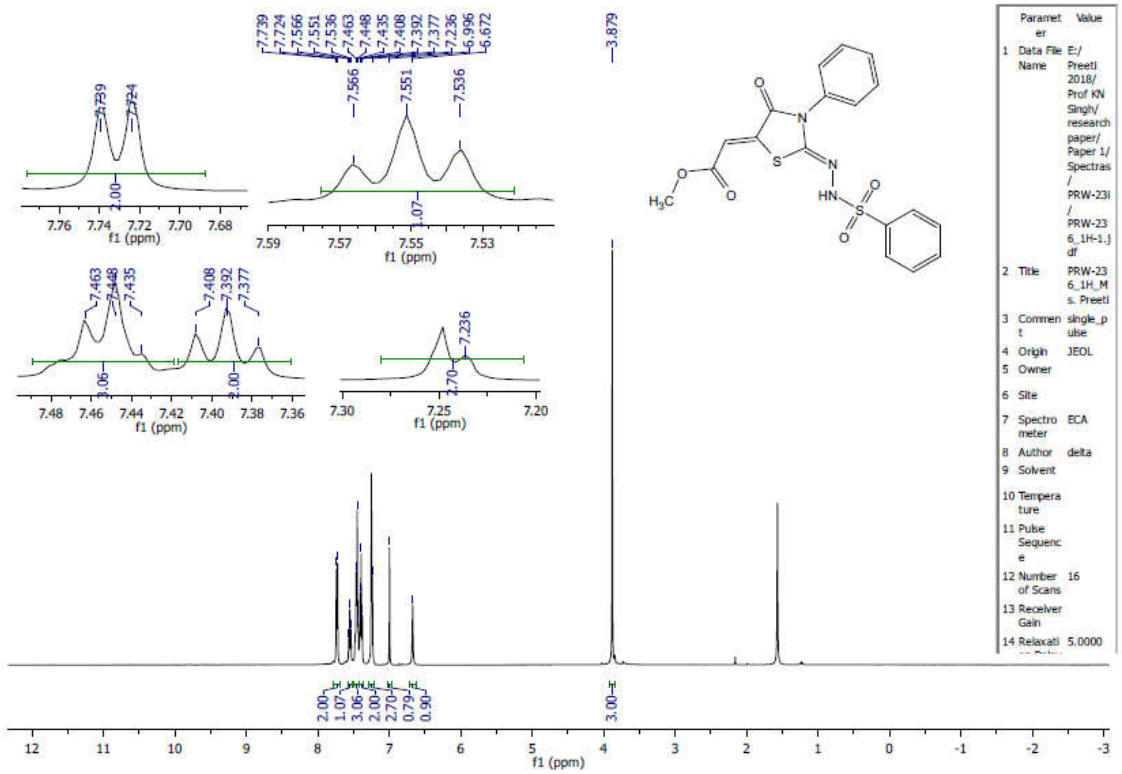


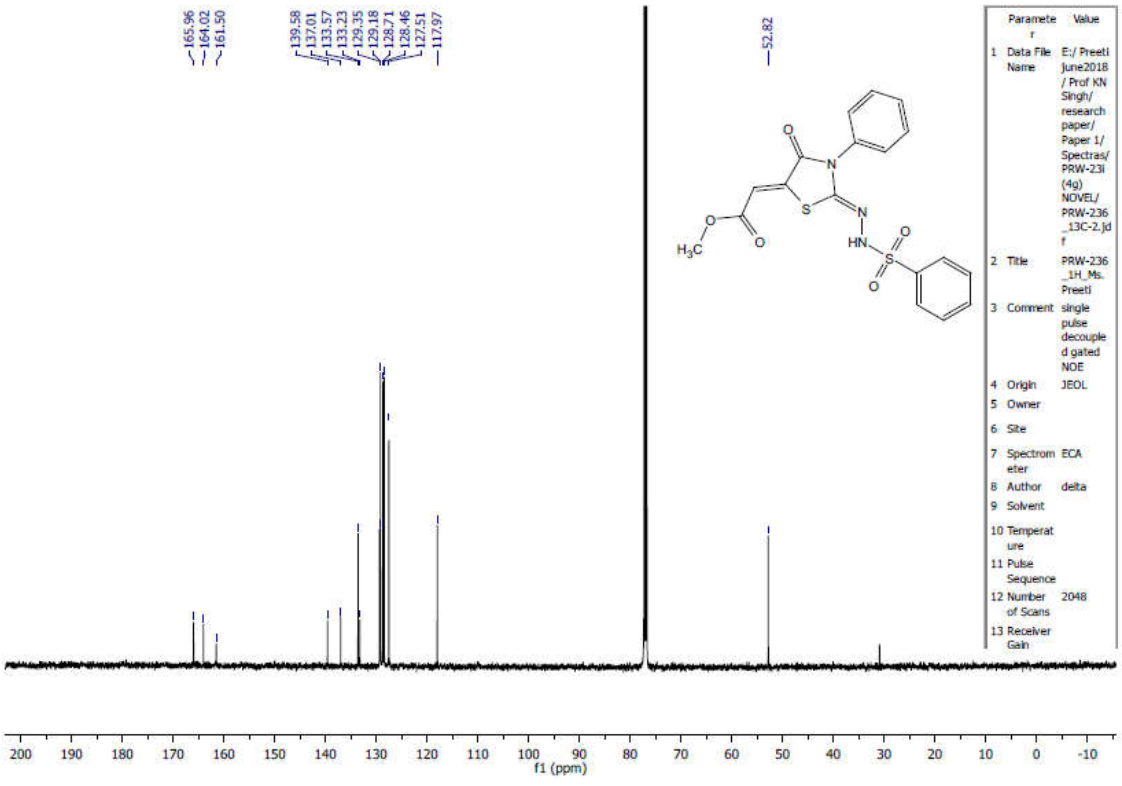
(*Z*)-Ethyl 2-((*Z*)-2-(2-((4-nitrophenyl)sulfonyl)hydrazono)-4-oxo-3-phenylthiazolidin-5-ylidene)acetate (4f):



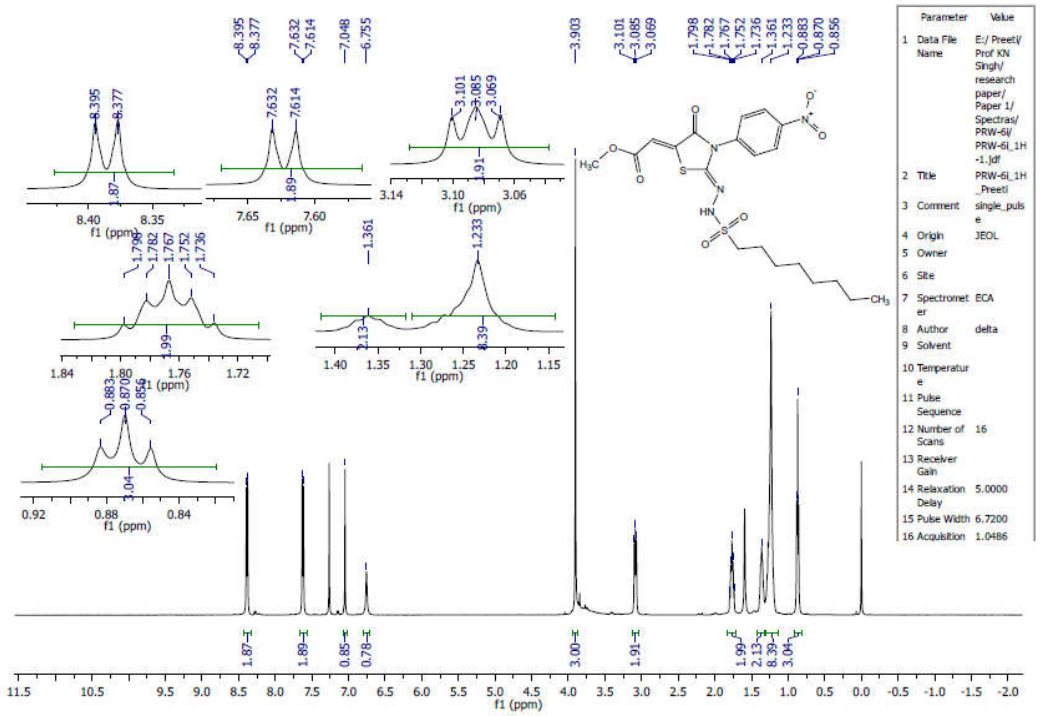


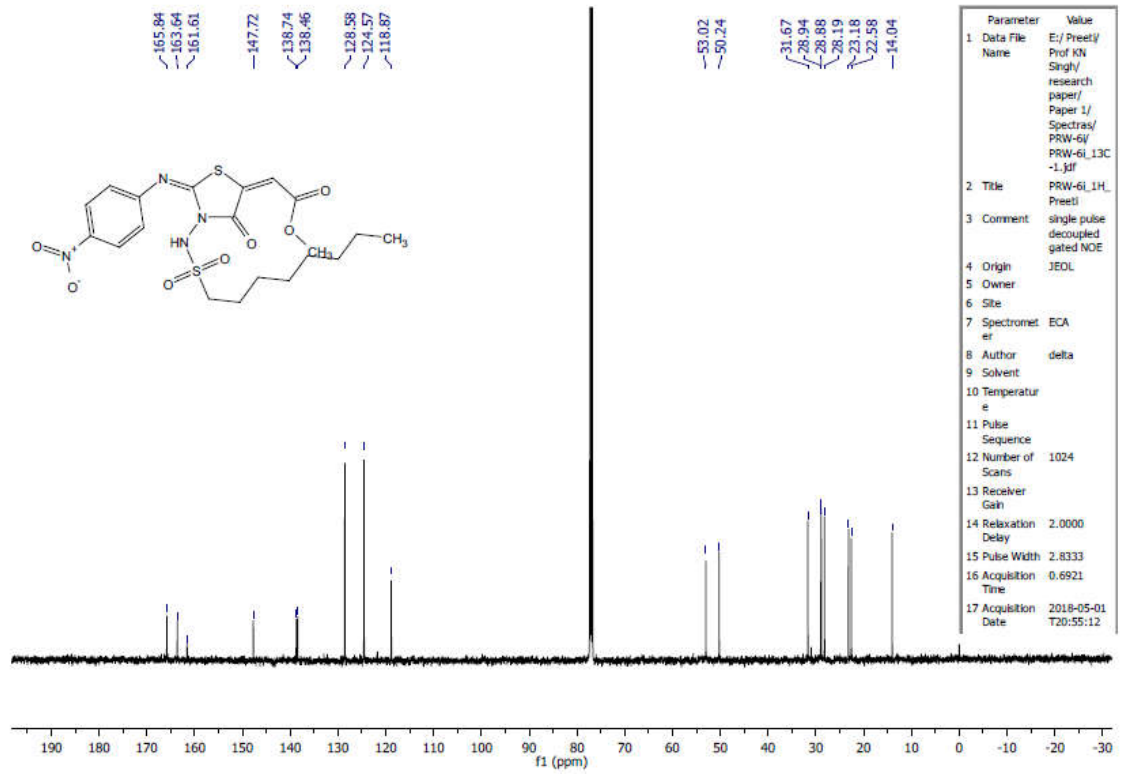
(*Z*)-Methyl 2-((*Z*)-4-oxo-3-phenyl-2-(2-(phenylsulfonyl)hydrazono)thiazolidin-5-ylidene)acetate (4g):



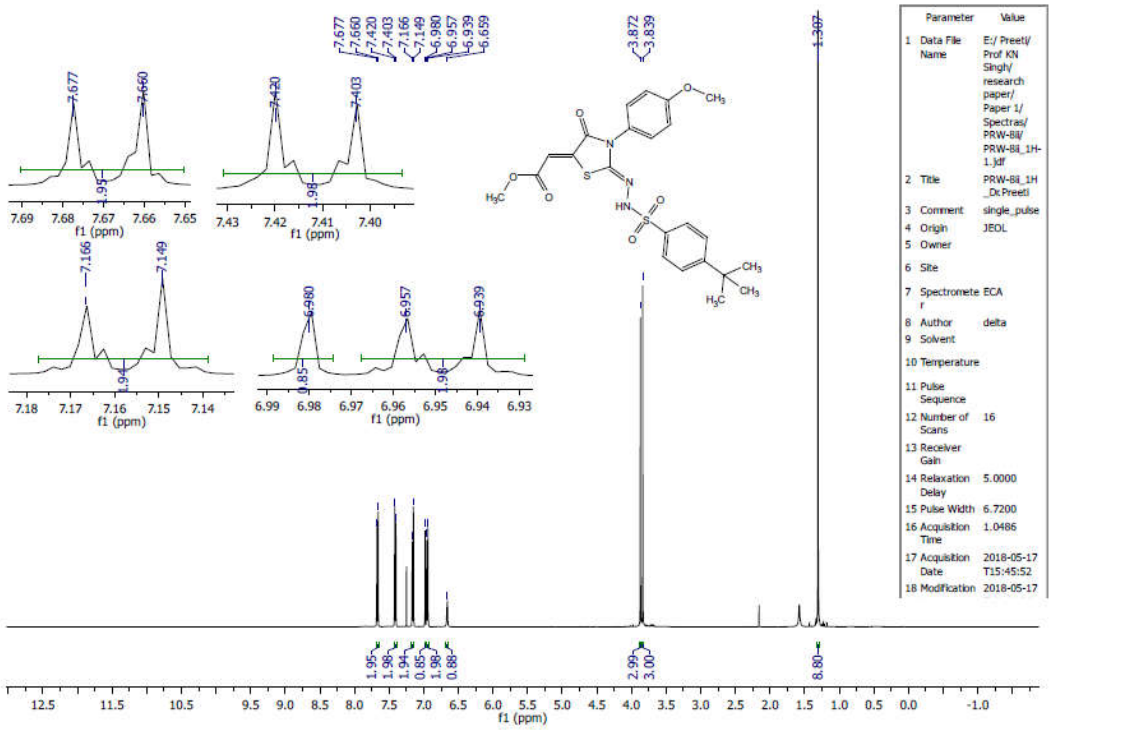


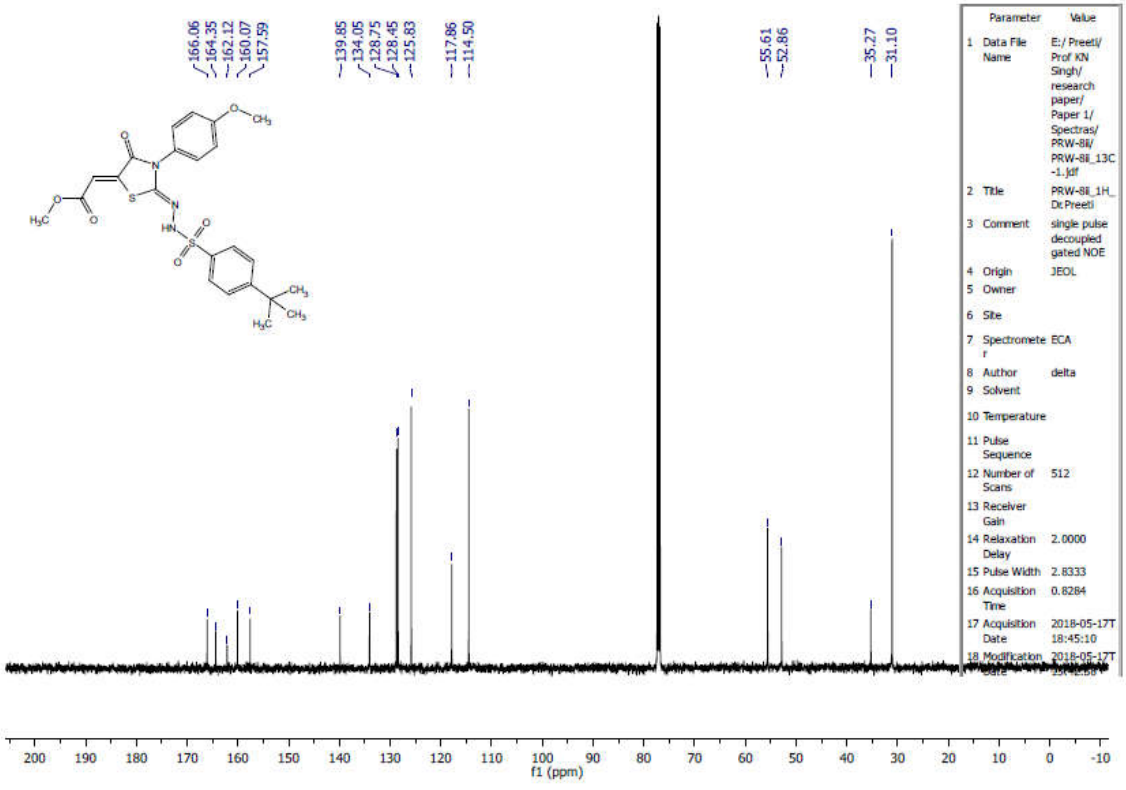
(*Z*)-Methyl 2-((*Z*)-3-(4-nitrophenyl)-2-(2-(octylsulfonyl)hydrazono)-4-oxothiazolidin-5-ylidene)acetate (4h):



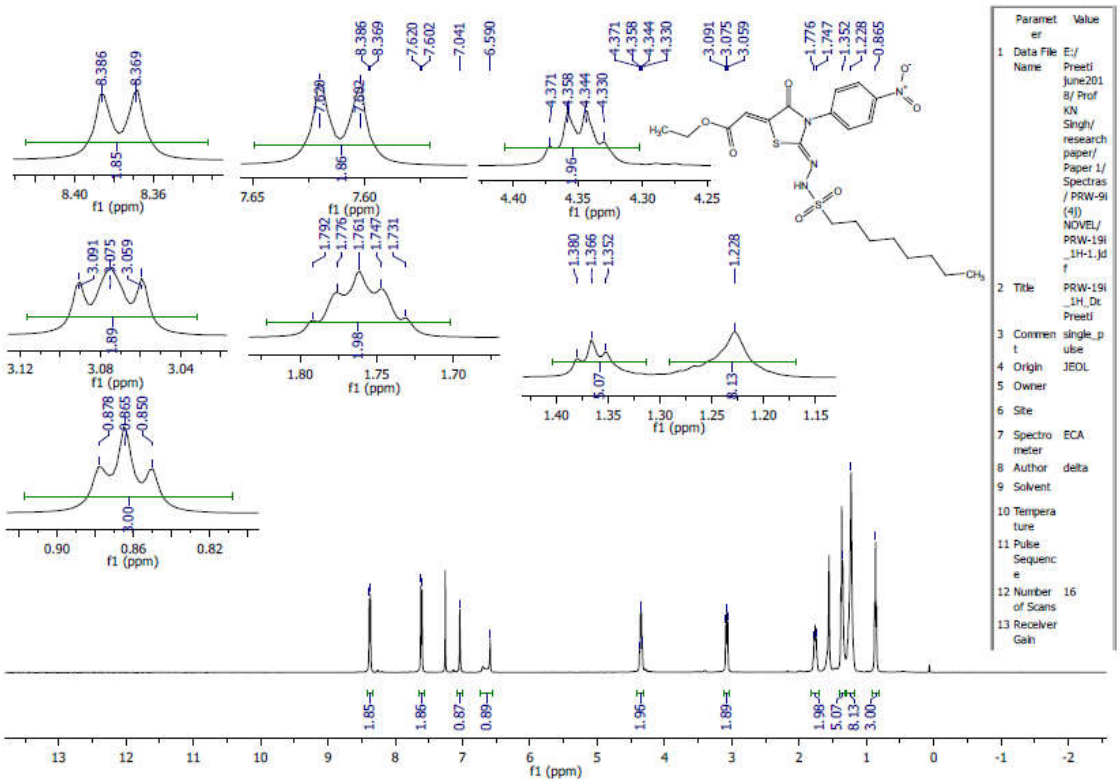


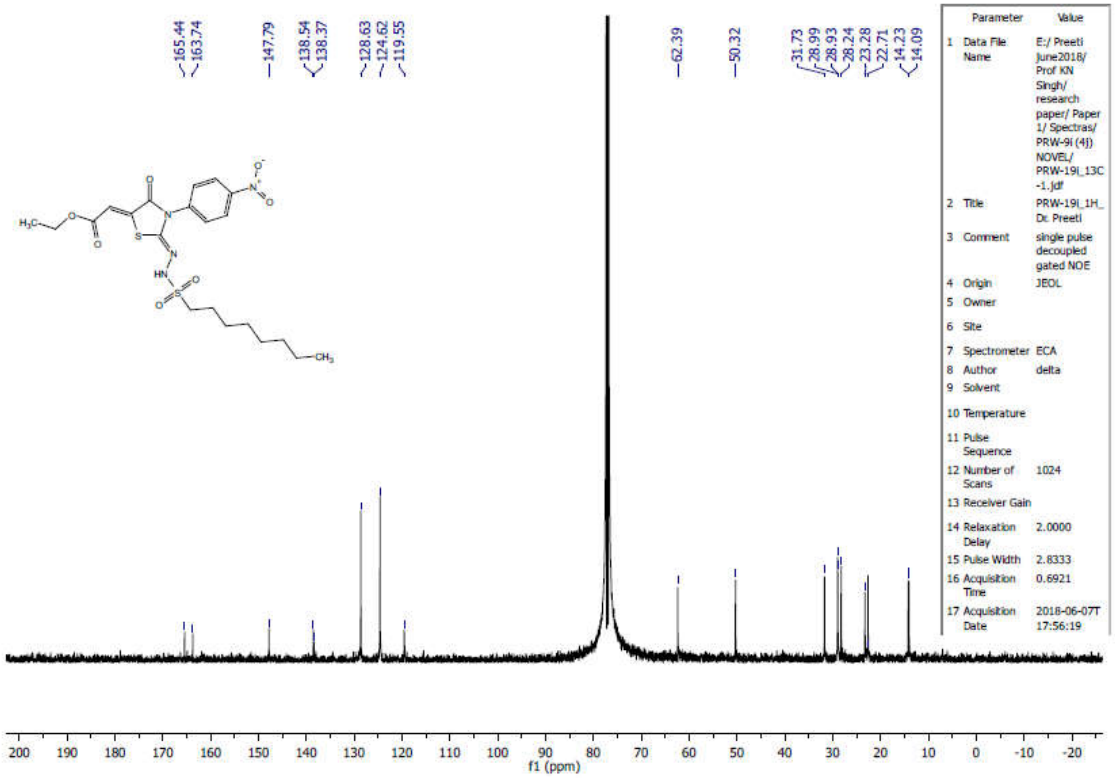
(*Z*)-Methyl 2-((*Z*)-2-(2-((4-(tert-butyl)phenyl)sulfonyl)hydrazono)-3-(4-methoxyphenyl)-4-oxothiazolidin-5-ylidene)acetate (4i):



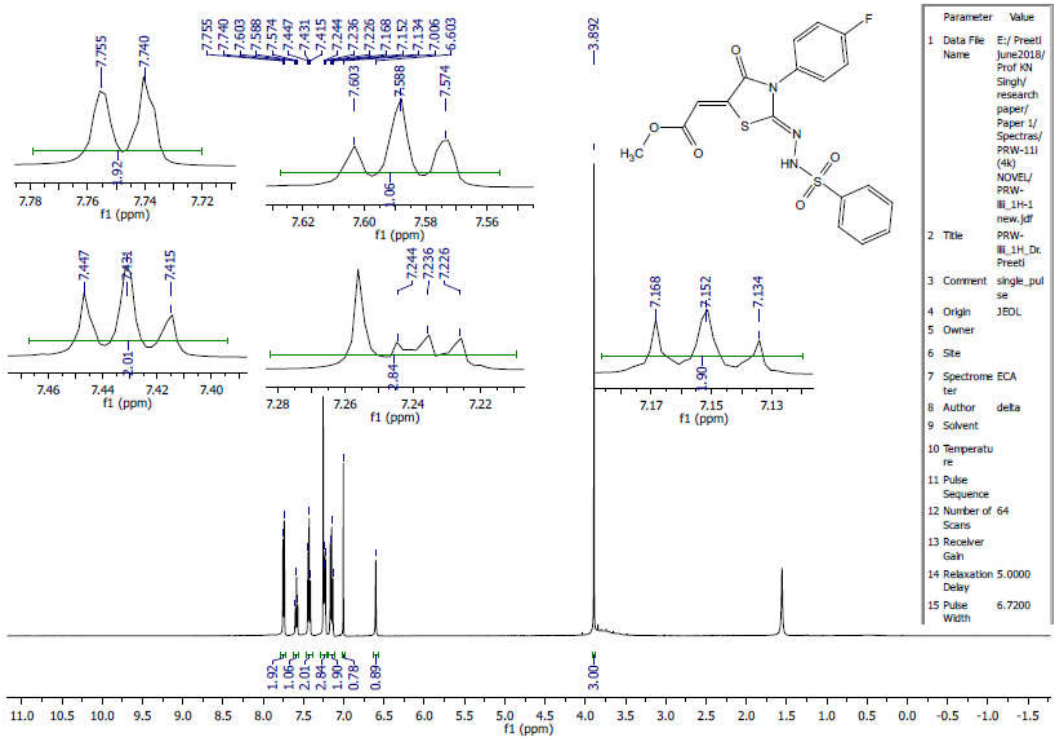


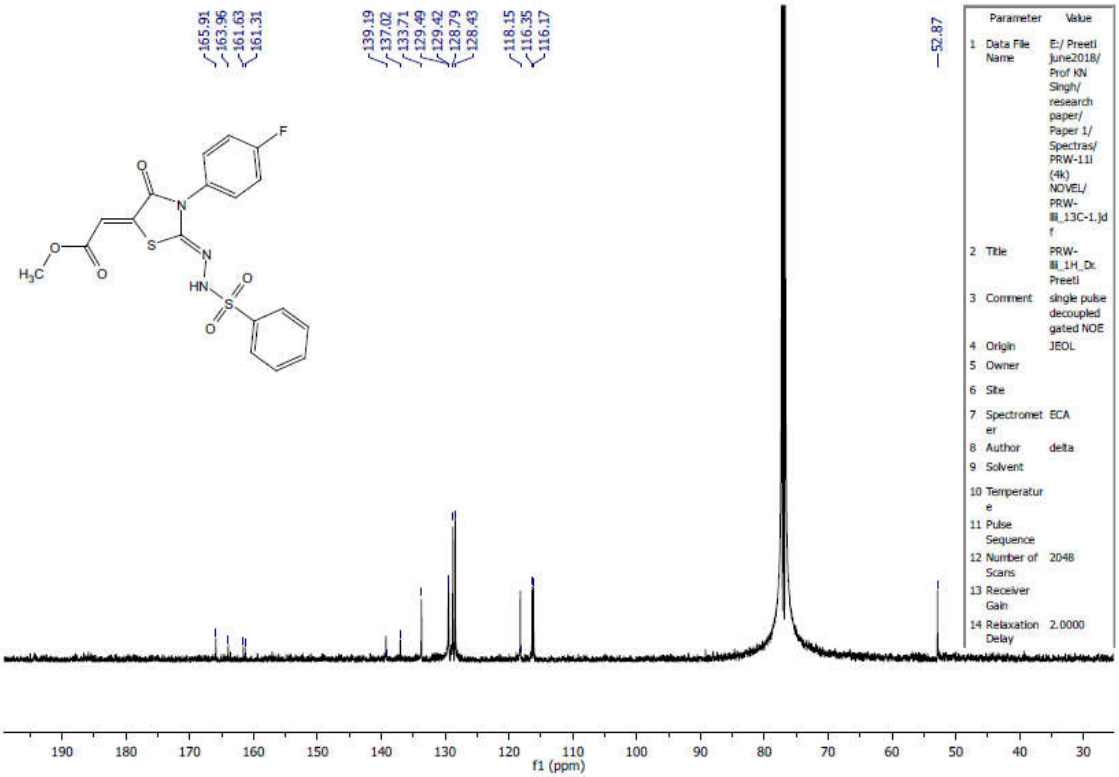
(*Z*)-Ethyl 2-((*Z*)-3-(4-nitrophenyl)-2-(2-(octylsulfonyl)hydrazono)-4-oxothiazolidin-5-ylidene)acetate (4j):



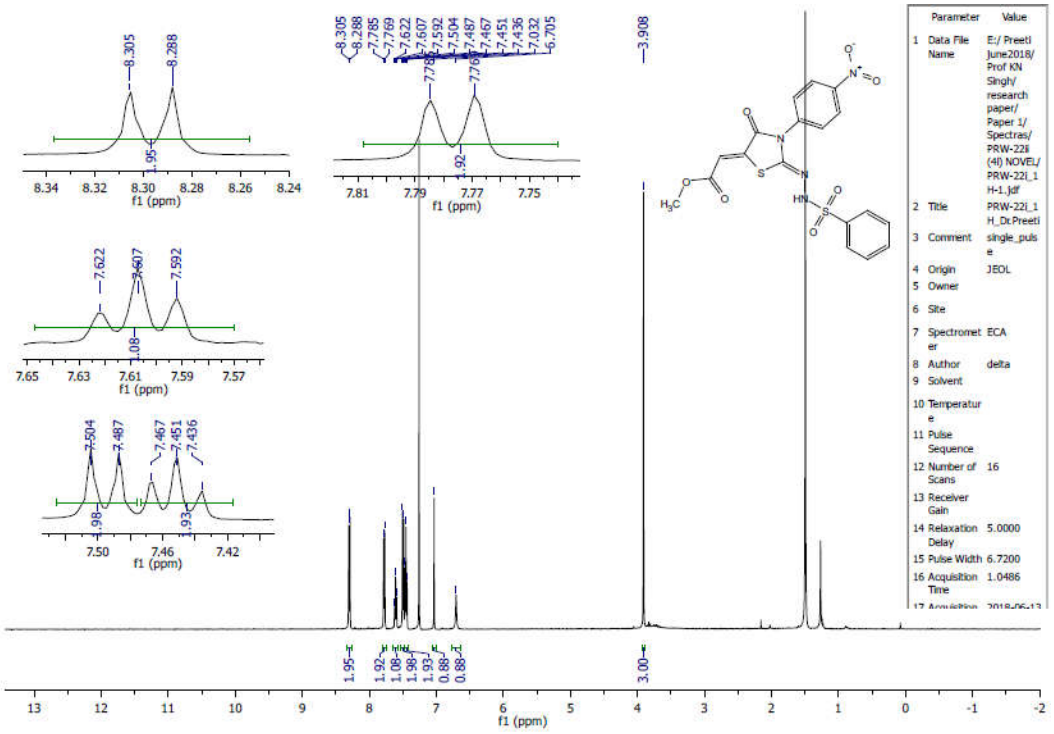


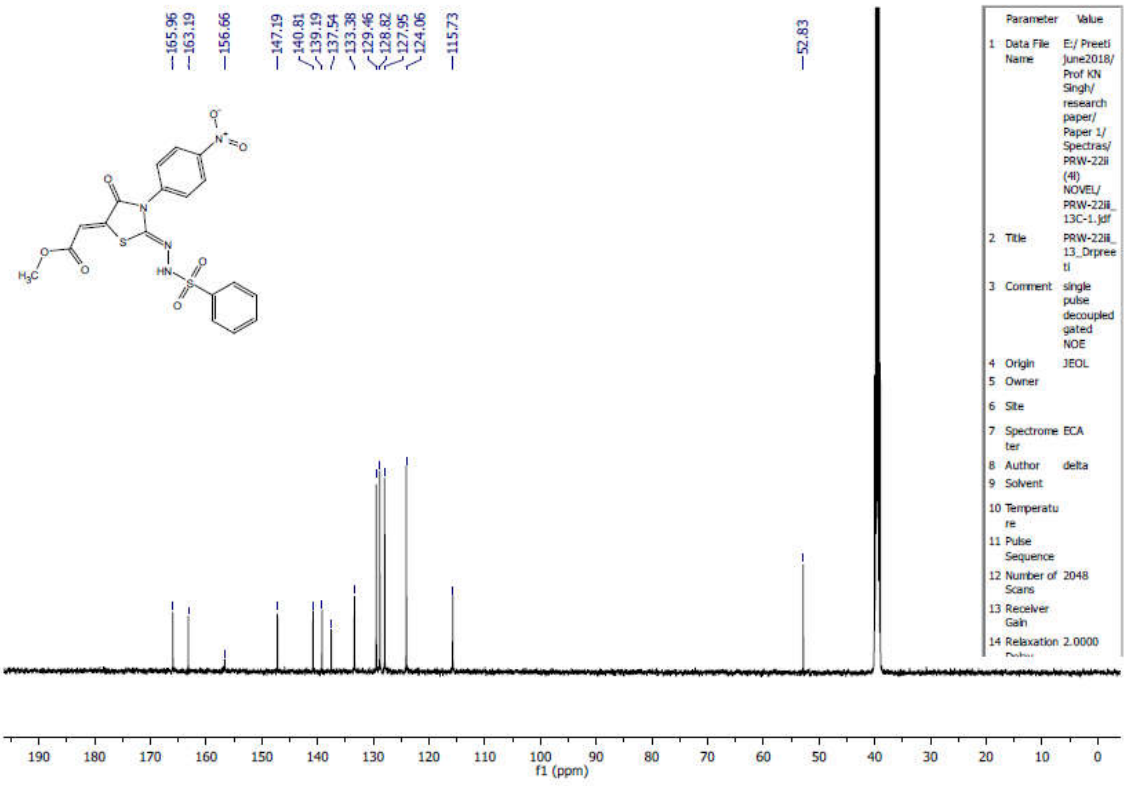
(*Z*)-Methyl 2-((*Z*)-3-(4-fluorophenyl)-4-oxo-2-(2-(phenylsulfonyl)hydrazono)thiazolidin-5-ylidene)acetate (4k):



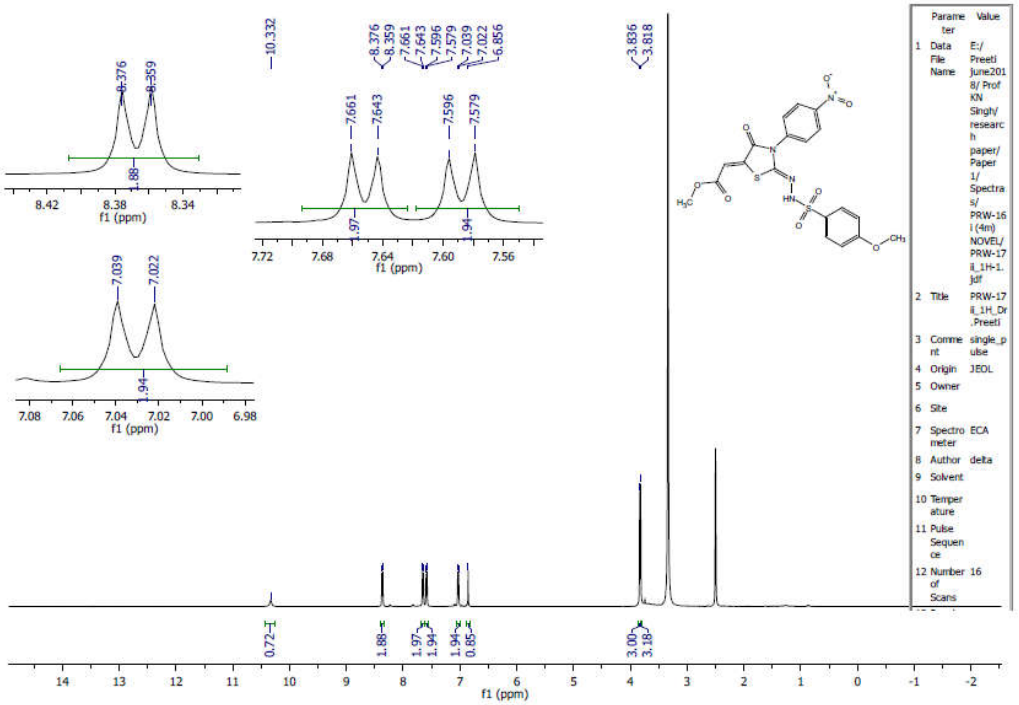


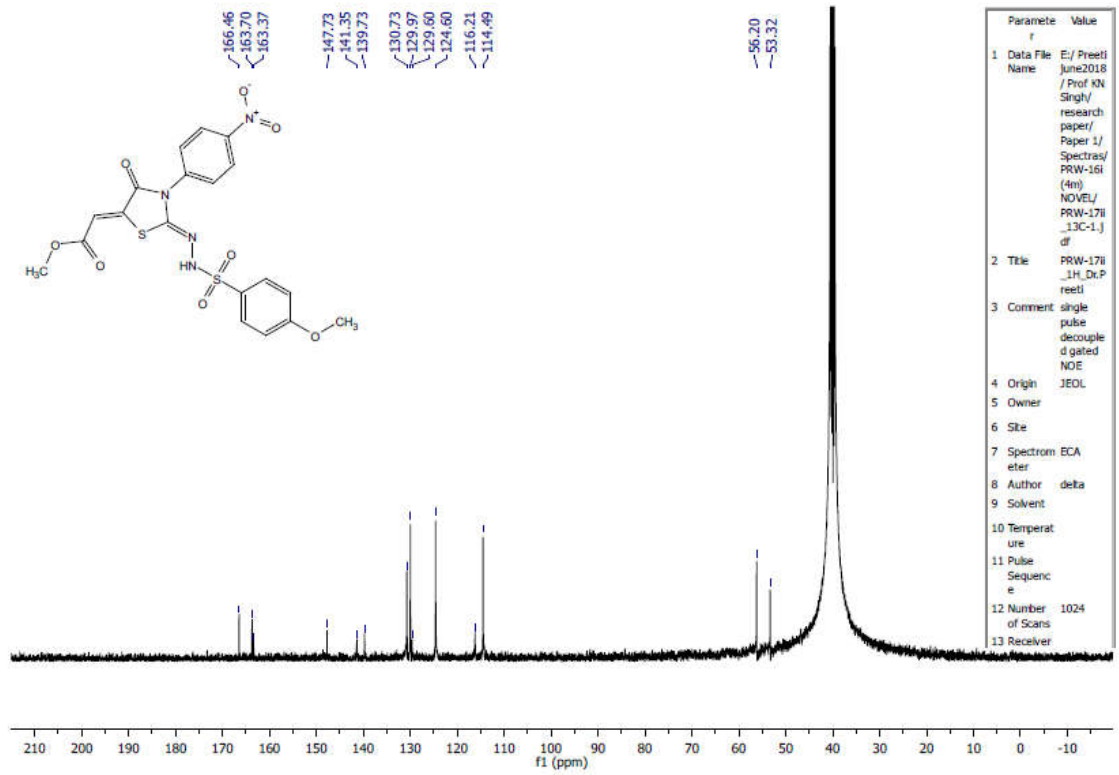
(*Z*)-Methyl 2-((*Z*)-3-(4-nitrophenyl)-4-oxo-2-(2-(phenylsulfonyl)hydrazono)thiazolidin-5-ylidene)acetate (4l):



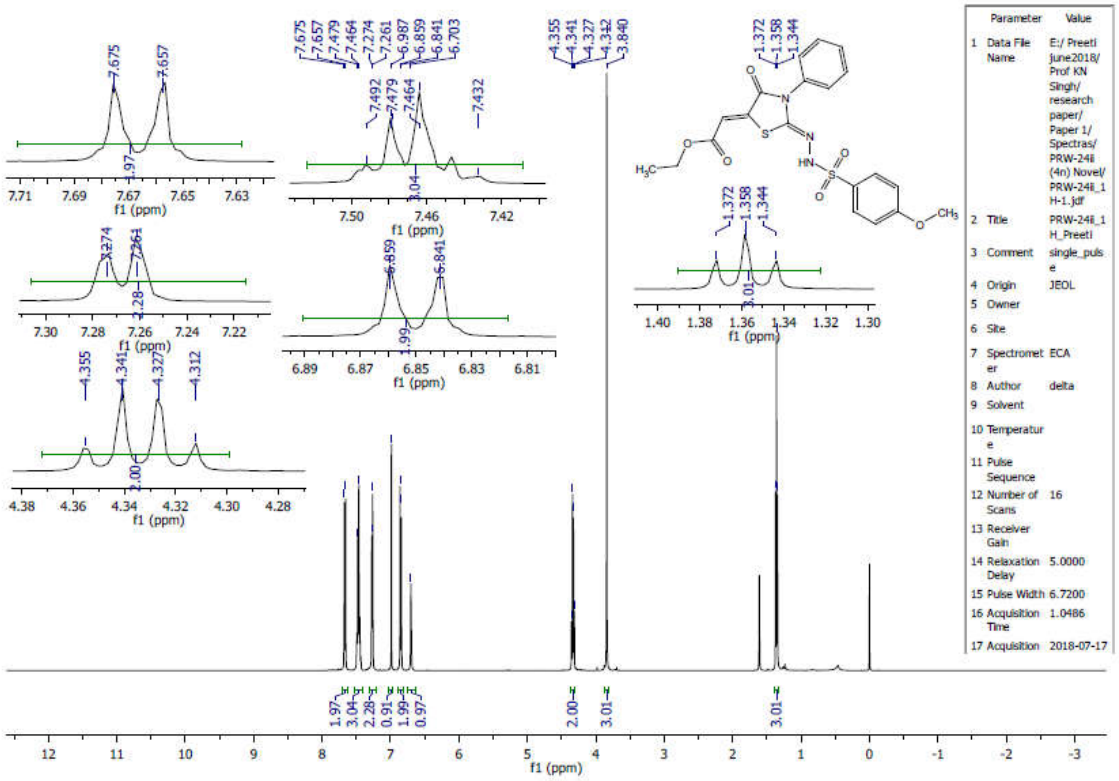


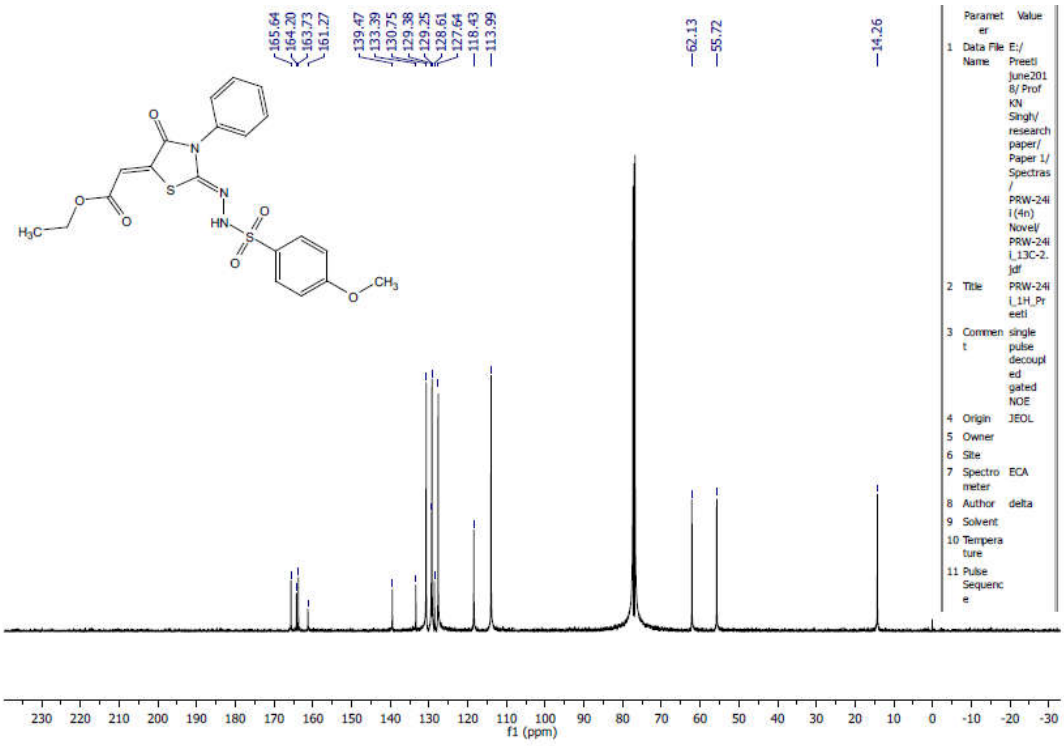
(*Z*)-Methyl 2-((*Z*)-2-(2-((4-methoxyphenyl)sulfonyl)hydrazono)-3-(4-nitrophenyl)-4-oxothiazolidin-5-ylidene)acetate (4m):



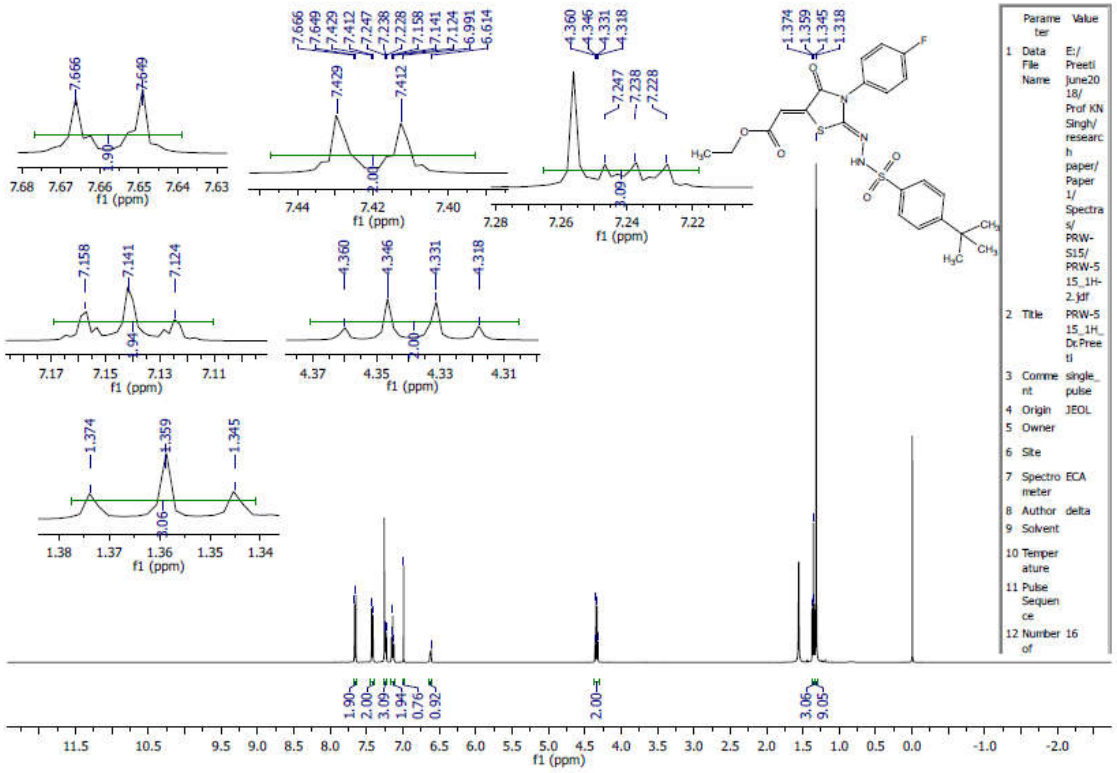


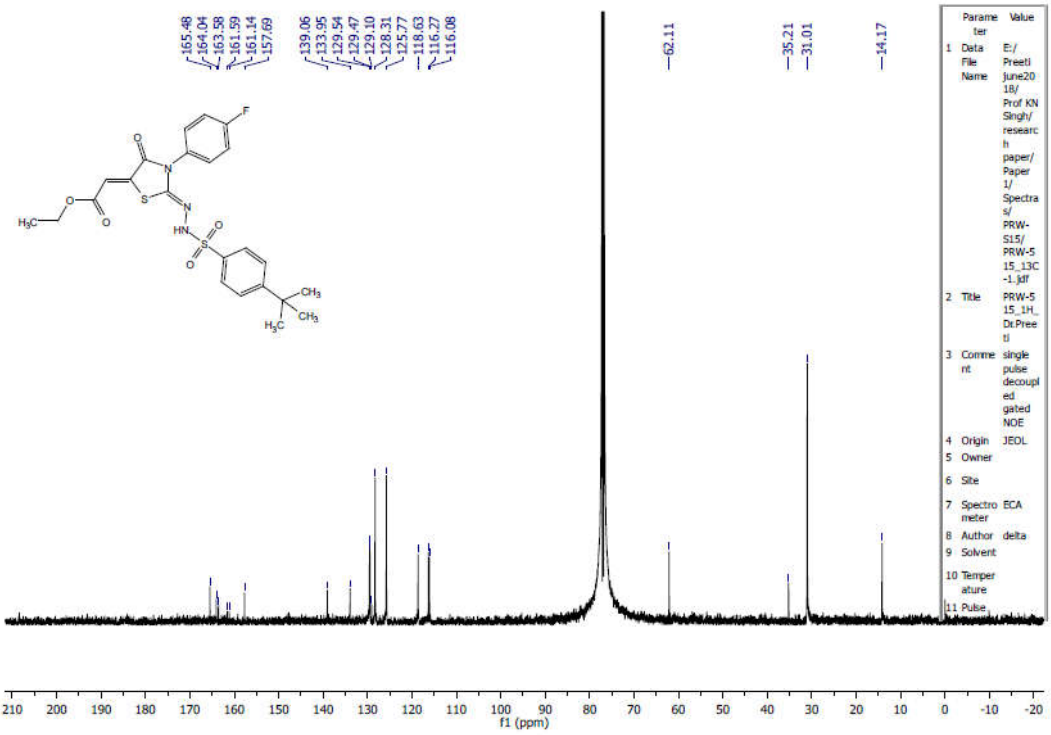
(*Z*)-Ethyl 2-((*Z*)-2-(2-((4-methoxyphenyl)sulfonyl)hydrazono)-4-oxo-3-phenylthiazolidin-5-ylidene)acetate (4n):



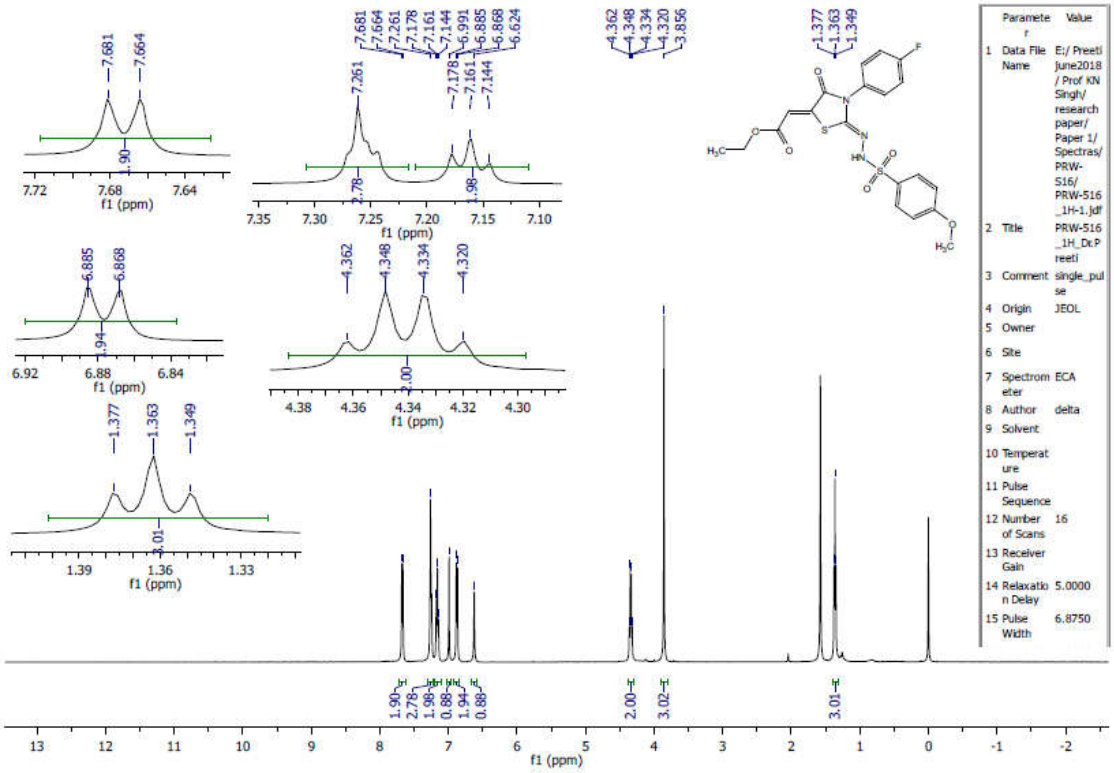


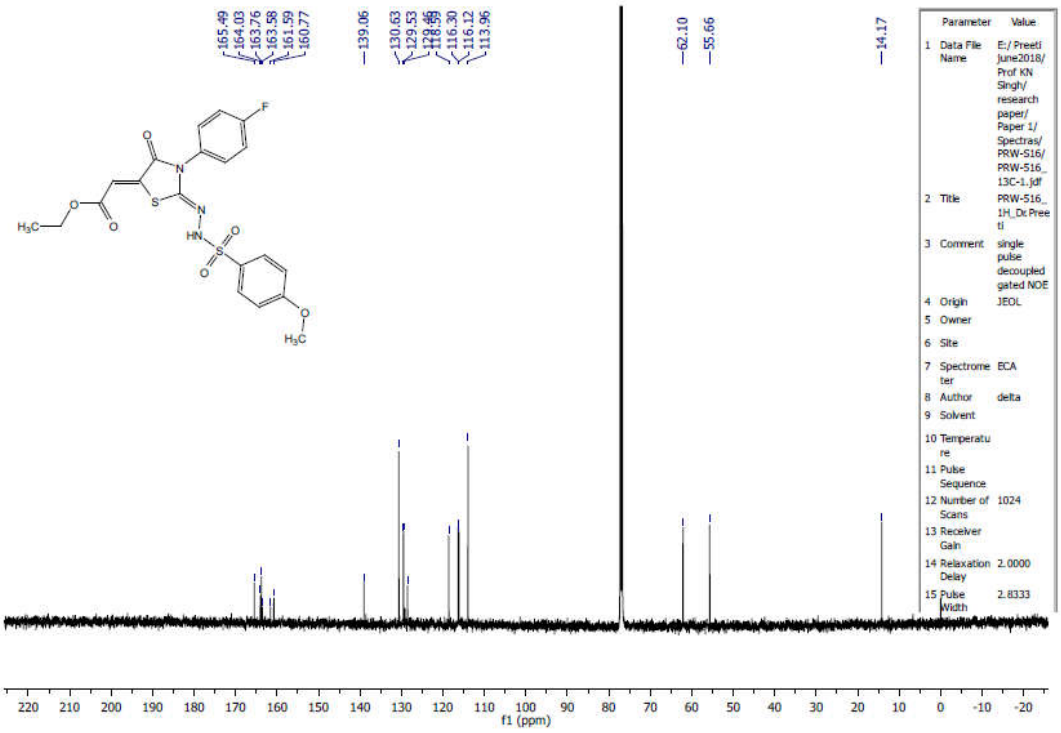
(*Z*)-Ethyl 2-((*Z*)-2-(2-((4-(tert-butyl)phenyl)sulfonyl)hydrazono)-3-(4-fluorophenyl)-4-oxothiazolidin-5-ylidene)acetate (4o):



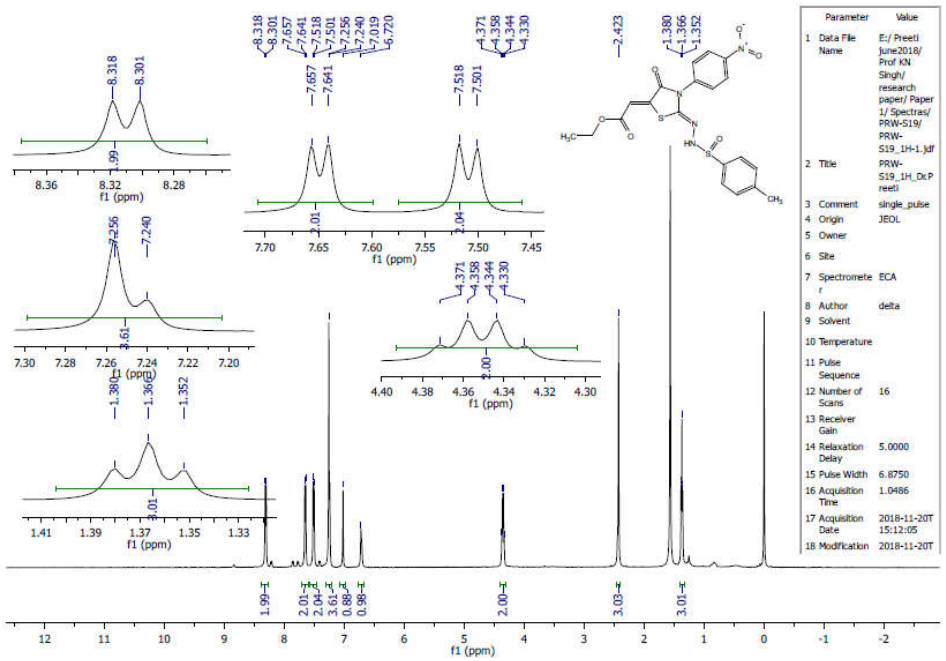


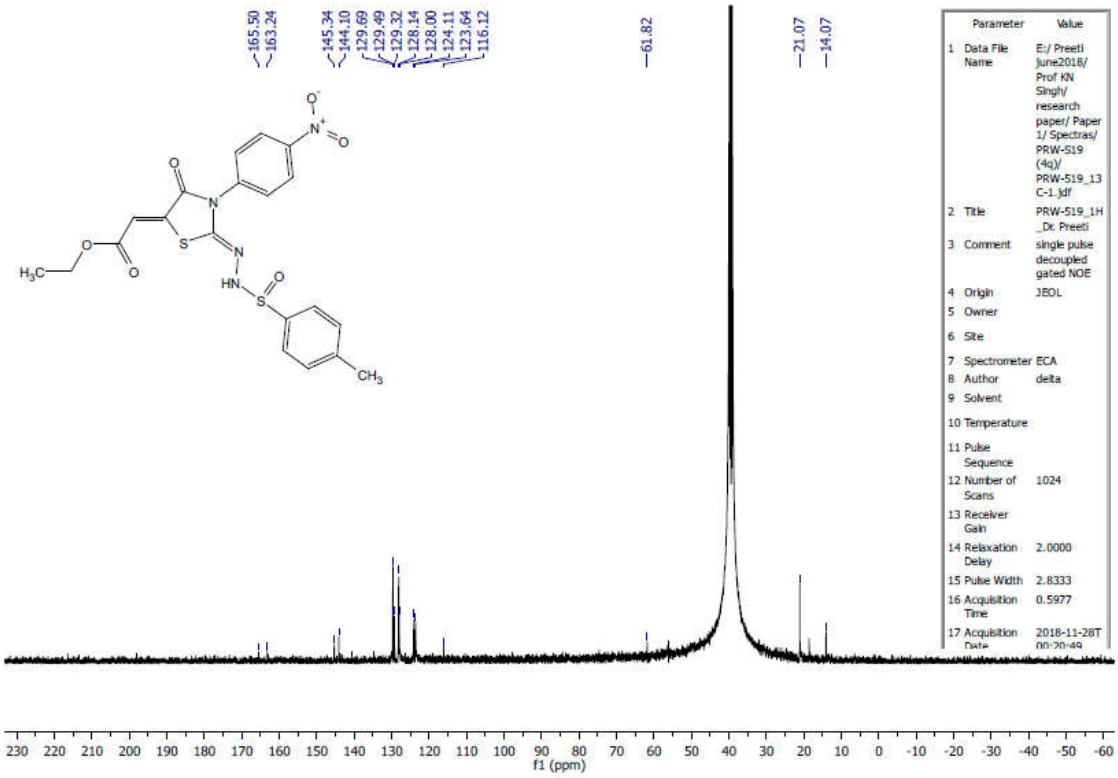
(Z)-Ethyl 2-((Z)-3-(4-fluorophenyl)-2-(2-((4-methoxyphenyl)sulfonyl)hydrazono)-4-oxothiazolidin-5-ylidene)acetate (4p):



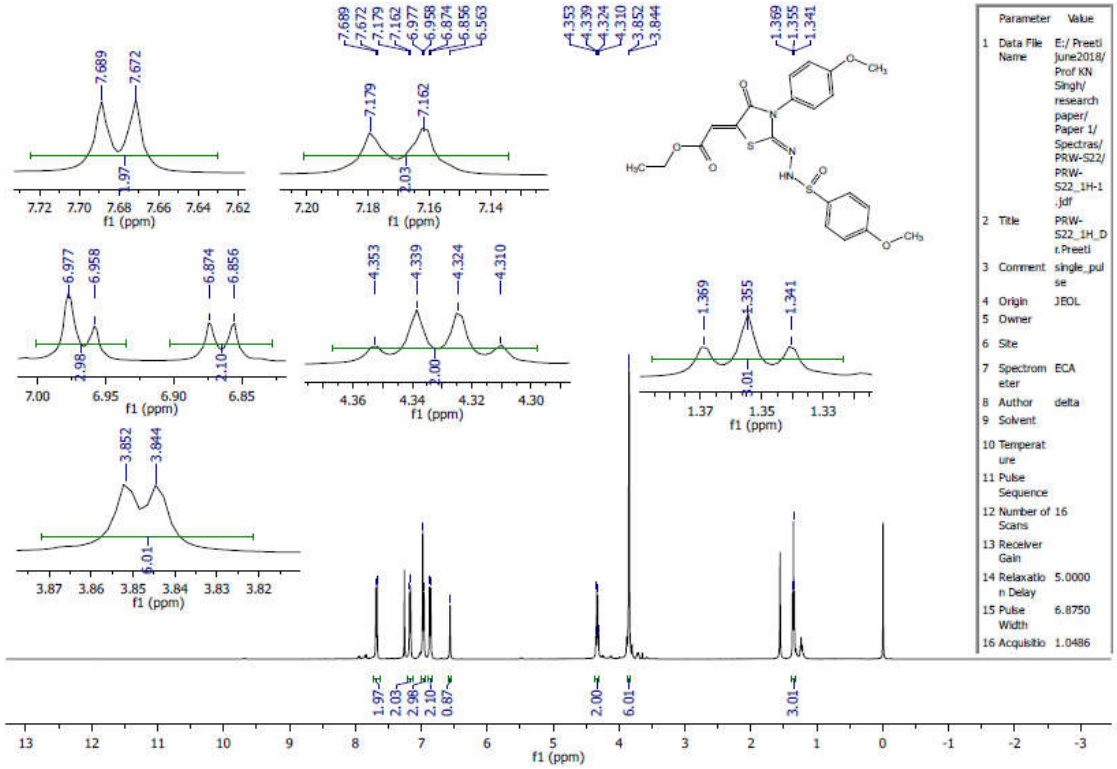


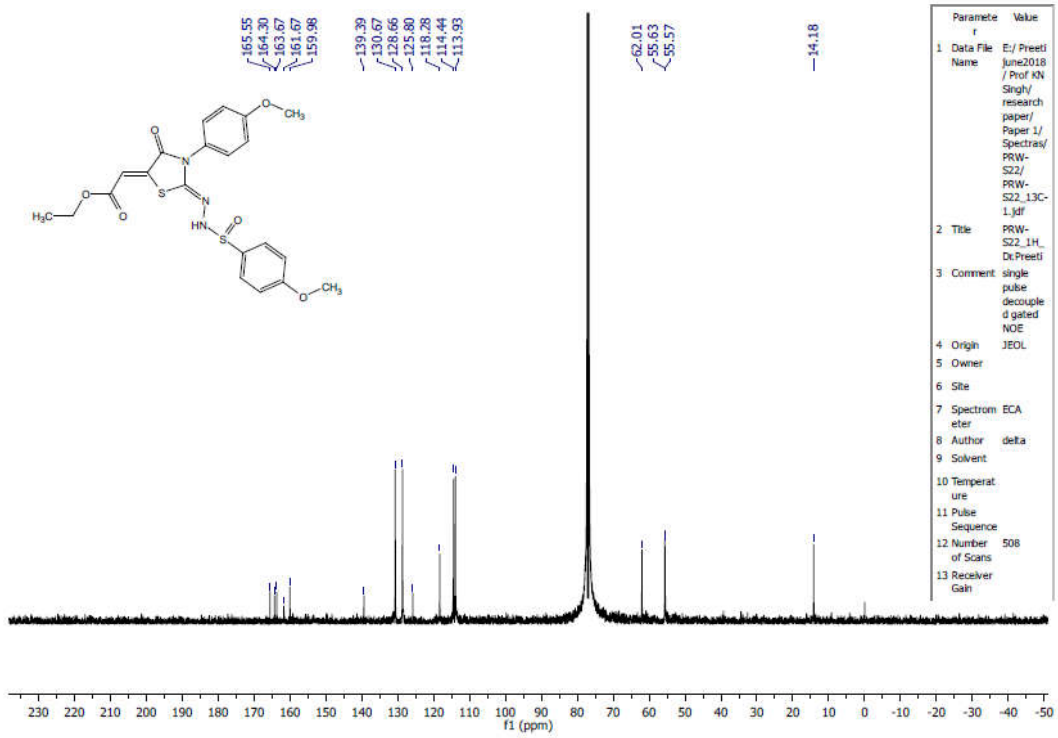
(Z)-Ethyl 2-((Z)-3-(4-nitrophenyl)-4-oxo-2-(2-(p-tolylsulfinyl)hydrazono)thiazolidin-5-ylidene)acetate (4q):



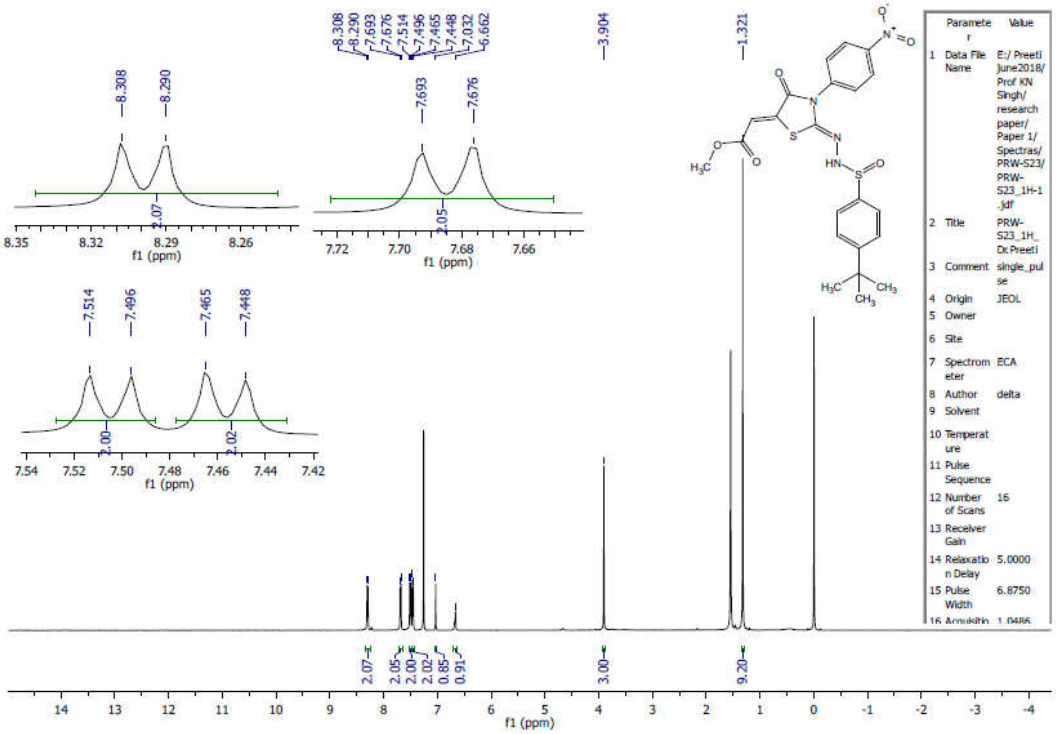


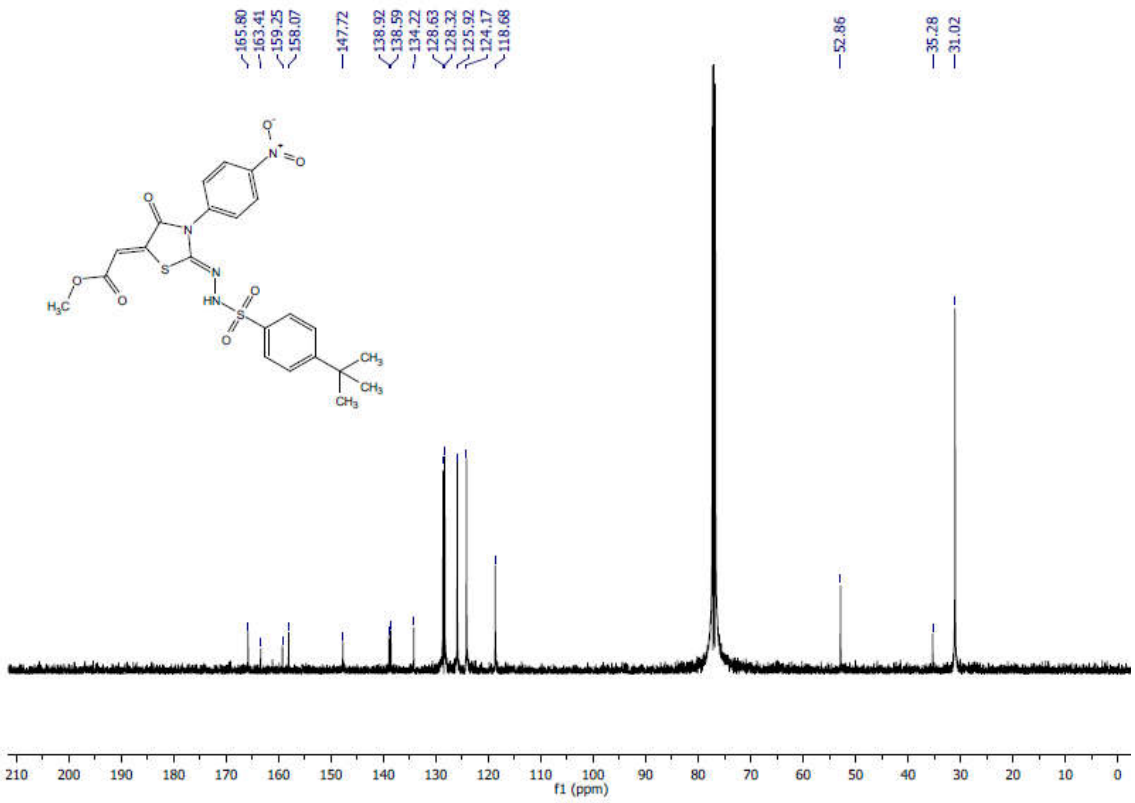
(*Z*)-Ethyl 2-((*Z*)-3-(4-methoxyphenyl)-2-(2-((4-methoxyphenyl)sulfinyl)hydrazono)-4-oxothiazolidin-5-ylidene)acetate (4r):



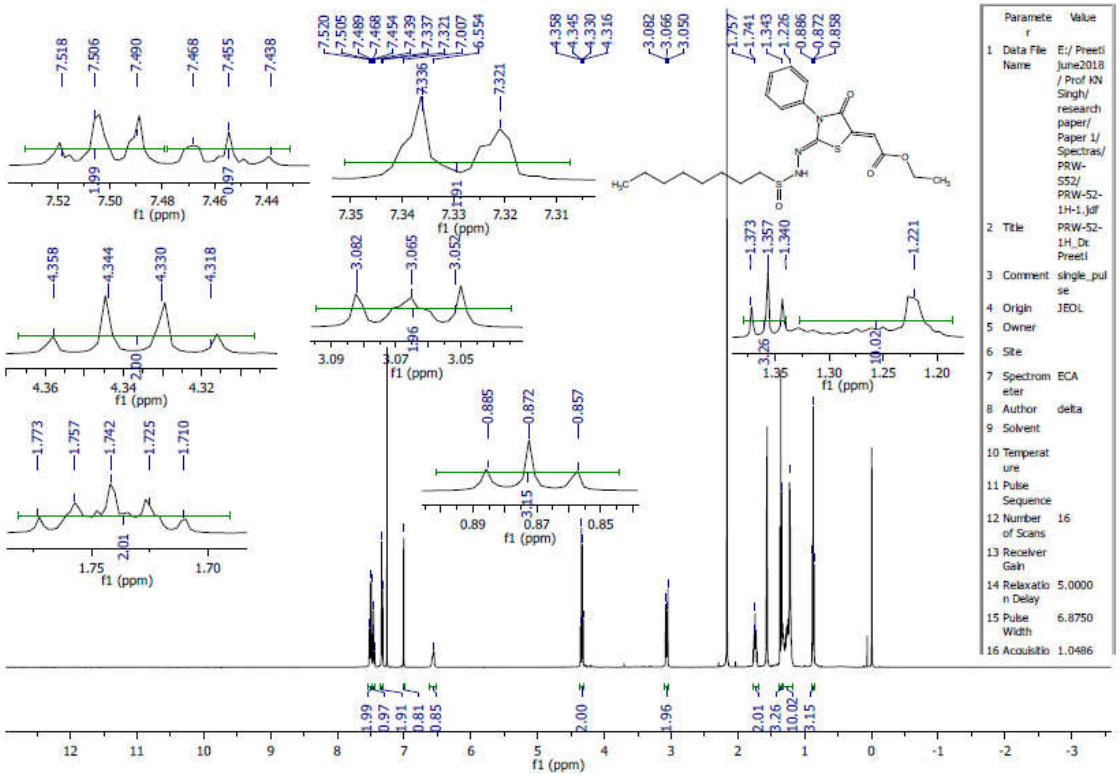


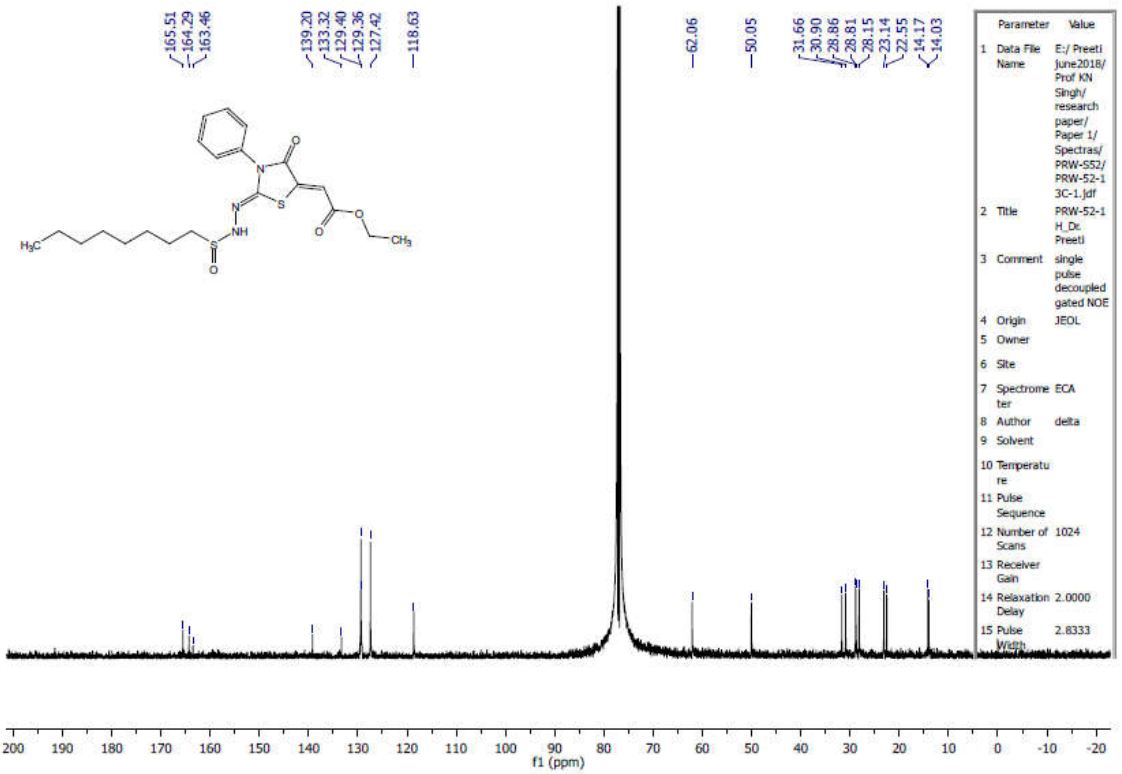
(*Z*)-Methyl 2-((*Z*)-2-(2-((4-(tert-butyl)phenyl)sulfinyl)hydrazono)-3-(4-nitrophenyl)-4-oxothiazolidin-5-ylidene)acetate (4s):





(*Z*)-Ethyl 2-((*Z*)-2-(2-(octylsulfonyl)hydrazono)-4-oxo-3-phenylthiazolidin-5-ylidene)acetate (4t):





***N*-Phenyl-2-tosylhydrazinecarbothioamide (intermediate I):**