Supporting Information

Synthesis, Computational Study, and In Vitro α-Glucosidase Inhibitory Action of Thiourea Derivatives Based on 3-Aminopyridin-2(1H)-Ones

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Experimental Procedures

1. Materials and Methods

^{1}H and ^{13}C NMR spectra were recorded on a Bruker DRX400 (400 and 100 MHz, respectively), Bruker AVANCE 500 (500 and 125 MHz, respectively) and Magritek spinsolve 80 carbon ultra (81 and 20 MHz, respectively) instruments using DMSO-d6 the internal standard was TMS or residual solvent signals (2.49 and 39.9 ppm ^{1}H and for ^{13}C nuclei in DMSO-d6).

Sample were analyzed by HPLC-MS on an Agilent 1260 Infinity II chromatograph coupled to an Agilent 6545 LC/Q-TOF high-resolution mass spectrometer with a Dual AJS ESI ionization source operating in positive ion mode using the following parameters: capillary voltage: 4000 V; spray pressure: 20 (psi); drying gas: 10 *l*/min; gas temperature: 325ºC; sheathed gas flow: 12 *l*/min; shielding gas temperature: 400°C; nozzle voltage: 0 V, fragmentation voltage: 180 V; skimmer voltage: 45 V; octopole RF: 750 V. Mass spectra with LC/MS accuracy were recorded in the range 100-1000 m/z, scan rate 1.5 spectrum/s.

Chromatographic separation was carried out on columns: ZORBAX RRHD Eclipse Plus C18 (2.1 x 50 mm, particle size 1.8 μm). The column temperature during the analysis was maintained at 35°C. The mobile phase was formed by eluents A and B. In the positive ionization mode, 0.1% formic acid solution in deionized water was used as eluent A, and 0.1% formic acid solution in acetonitrile was used as eluent B. Chromatographic separation was performed with elution according to the following scheme: 0-10 min 95% A, 10-13 min 100% B, 13-15 min 95% A. The flow of the mobile phase was maintained at 400 μL/min throughout the analysis. In all experiments, the sample injection volume was 1 μL. The sample was prepared by dissolving the entire sample (in 1000 μL) in methanol (for HPLC). Sample dilution was carried out immediately before analysis.

The recorded data were processed using Agilent MassHunter 10.0 software.

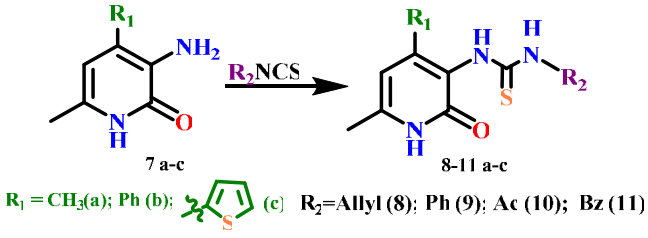
Melting points were determined using a Stuart SMP10 hot bench. Monitoring of the reaction course and the purity of the products was carried out by TLC on Sorbfil plates and visualized using iodine vapor or UV light.

The general procedure for obtaining thiourea derivatives is as follows:

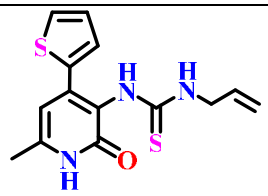
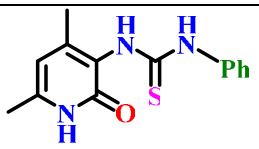
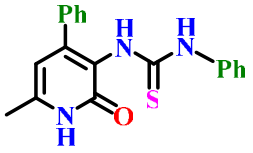
Metod A. To the solution of the corresponding 3-amino-4,6-dimethylpyridin-2(1*H*)-one **7a-c** (1.0 mmol) in a mixture of DMF: methylene chloride (2:1), 1.2 mmol phenyl isothiocyanate (for compounds **9a-c**) is added dropwise. The reaction mixture is stirred for 10-15 hours at room temperature. The resulting precipitate is cooled, filtered, washed with cold acetone, dried, and recrystallized from a mixture of solvents 2-propanol-hexane (2:1) or DMF:2-propanol (for **9c**).

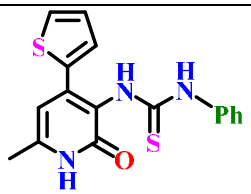
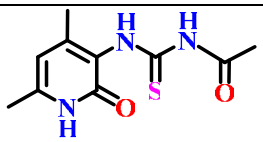
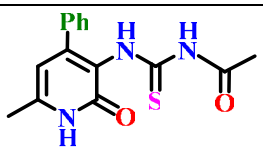
Metod B. A mixture of ammonium thiocyanate (1.2 mmol), acetyl chloride (for compounds **10a-c**) or benzoyl chloride (for compounds **11a-c**) in 20 mL of acetone is heated with reflux and stirring for 2 hours. The resulting precipitate of KCl is filtered off and immediately added to a solution of 1 mmol of the corresponding 3-aminopyridin-2(1*H*)-one (**7a-c**) in 10 mL of acetone and stirred for an additional 3 hours. The reaction mixture with the precipitated solid is cooled, filtered, washed with acetone, and dried. After recrystallization from a mixture of 2-propanol-DMF (2:1), compounds **10-11a-c** are obtained.

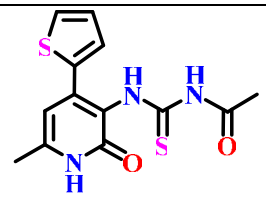
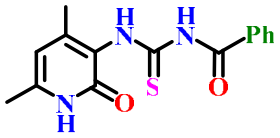
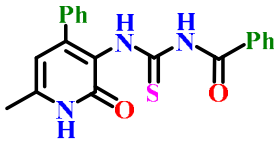
The physicochemical constants and spectral characteristics of thioureas 1-allyl-3-(4,6-dimethyl-2-oxo-1,2-dihydropyridin-3-yl)thiourea (**8a**), 1-allyl-3-(6-methyl-2-oxo-4-phenyl-1,2-dihydropyridin-3-yl)thiourea (**8b**), N-((4,6-dimethyl-2-oxo-1,2-dihydropyridin-3-yl)carbamothioyl)benzamide (**11a**), and N-((6-methyl-2-oxo-4-phenyl-1,2-dihydropyridin-3-yl)carbamothioyl)benzamide (**11b**) were described by us in [31].

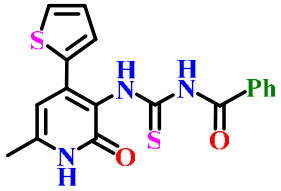


Characterization data of products

 Chemica Formula: $C_{14}H_{15}N_3OS_2$ Molecular Weight: 305,41	**1-Allyl-3-(6-methyl-2-oxo-4-(thiophen-2-yl)-1,2-dihydropyridin-3-yl)thiourea (8c)** Yield 360 mg (59%), M.p.: = 289-292 °C. ^{1}H NMR (400 MHz, DMSO-d6) δ ppm (*J*, Hz): 2.20 (s, 3H, 6-CH_3); 4.05 (br. s, 2H, CH_2); 4.98 (br. s., 1H, C=H_a); 5.11 (br. d, *J*=15.1 Hz, 1H, C=H_b); 5.76 (br. s., 1H, -C<u>H</u>=CH_aH_b); 6.45 (s, 1H, H-5); 7.14 (d, *J*=4.1 Hz, 1H, H-4 thiophene); 7.61 (br. s. 1H, N<u>H</u>-CH_2); 7.66 (d, *J*=3.7 Hz, 1H, H-3 thiophene); 7.71 (d, *J*=4.6 Hz, 1H, H-5 tiophene); 8.52 (br. s., 1H, NHCS); 11.64 (br. s., 1H, NHCO). ^{13}C NMR (101 MHz, DMSO-d6) δ ppm 18.5 (CH_3); 46.3 (NH-<u>C</u>H_2); 102.6; 114.9 (=<u>C</u>H_2),; 120.5; 126.9 (C-3 thiophene); 128.7 (C-4 thiophene); 130.3 (C-5 thiophene); 135.1 (CH_2<u>C</u>=); 137.3; 141.0; 143.3; 161.0; 189.0 (C=S).
 Chemical Formula: $C_{14}H_{15}N_3OS$ Molecular Weight: 273,35	**1-(4,6-dimethyl-2-oxo-1,2-dihydropyridin-3-yl)-3-phenylthiourea (9a)** Yield: 0.180 g (66%), white powder, M.p.: 140-143°C. ^{1}H NMR (500 MHz, DMSO-d6) δ ppm (*J*, Hz): 2.05 (s, 1H, CH_3); 2.13 (s, 1H, CH_3); 5.90 (s, 1H, H-5); 7.09 (t, 1H, *J*=7.2 Hz, H-4 Ph); 7.30 (t, 2H, *J*=7.6 Hz, H-3,5 Ph); 7.50 (d, 2H, *J*=7.3 Hz, H-3,5 Ph); 8.68 (br. s., 1H, NHPh); 9.57 (br. s., 1H, NHCS); 11.63 (br. s., 1H, NHCO). ^{13}C NMR (125 MHz, DMSO-d6) δ ppm 18.2 (CH_3); 18.2 (CH_3); 106.6 (C-5); 124.1 (2C Ph); 125.9 (C Ph); 128.3 (2C Ph); 129.9; 139.7; 142.3; 147.9; 160.4; 180.7. HRMS m/z: calcd for $C_{14}H_{16}N_3OS^+$ [M + H]+: 274.1009; found: 274.0099.
 Chemical Formula: $C_{19}H_{17}N_3OS$ Molecular Weight: 335,43	**1-(6-methyl-2-oxo-4-phenyl-1,2-dihydropyridin-3-yl)-3-phenylthiourea (9b)** Yield: 0.232 g (69%), white powder, M.p.: 141-144°C. ^{1}H NMR (81 MHz, DMSO-d6) δ ppm (*J*, Hz): 2.22 (s, 1H, CH_3); 6.03 (s, 1H, H-5); 7.14-7.43 (m, 10H, H-2,3,4,5,6 Ph, H-2,3,4,5,6 Ar); 8.67 (br. s., 1H, NHPh); 9.51 (br. s, 1H, NHCS); 11.83 (br. s., 1H, NHCO). ^{13}C NMR (20 MHz, DMSO-d6) δ ppm 18.4 (CH_3); 105.8 (C-5); 123.6 (2C Ph); 128.2 (8C Ph); 137.6; 139.6; 143.3; 149.0; 160.8; 162.3; 181.2. HRMS m/z: calcd for $C_{19}H_{18}N_3OS^+$ $[M + H]^+$: 336.1165; found: 336.1175.

 Chemica Formula: $C_{17}H_{15}N_3OS_2$ Molecular Weight: 341,45	**1-(6-methyl-2-oxo-4-(thiophen-2-yl)-1,2-dihydropyridin-3-yl)-3-phenylthiourea (9c)** Yield: 0.260 g (76%), white powder, M.p.: 145-147°C. ^{1}H NMR (81 MHz, DMSO-d6) δ ppm (*J*, Hz): 2.22 (s, 1H, CH_3); 6.47 (s, 1H, H-5); 7.09-7.76 (m, 8H, H-2,3,4,5,6 Ph, H-3,4,5 thiophene); 8.76 (s, 1H, NHPh); 9.73 (br.s, 1H, NHCS); 11.69 (br. s., 1H, NHCO). ^{13}C NMR (20 MHz, DMSO-d6) δ ppm 18.5 (CH_3); 102.8 (C-5); 124.3 (2C Ph); 126.9 (1C thiophene); 128.2 (5C Ph); 128.7 (1C thiophene); 130.2 (1C thiophene); 137.4; 139.6; 141.4; 143.0; 160.9; 162.3; 181.6. HRMS m/z: calcd for $C_{17}H_{16}N_3OS_2^+$ [M + H]+: 342.0729; found: 342.0735.
 Chemica Formula: $C_{10}H_{13}N_3O_2S$ Molecular Weight: 239,29	**N-((4,6-dimethyl-2-oxo-1,2-dihydropyridin-3-yl)carbamothioyl)acetamide (10a)** Yield: 0.127 g (53%), light beige powder, M.p.: 273-275°C. ^{1}H NMR (500 MHz, DMSO-d6) δ ppm (*J*, Hz): 1.99 (s, 3H, CH_3); 2.12 (s, 6H, $2CH_3$); 5.90 (s, 1H, H-5); 11.42 (br. s., 1H, NHCS); 11.44 (br. s., 1H, NHCO); 11.69 (br. s., 1H, NHCO). ^{13}C NMR (125 MHz, DMSO-d6) δ ppm 18.18 (CH_3); 18.21 (CH_3); 23.7 (CH_3); 106.6 (C-5); 123.1; 143.0; 147.6; 159.5; 172.4; 180.7. HRMS m/z: calcd for $C_{10}H_{14}N_3O_2S^+$ [M + H]+: 240.0801; found: 240.0810.
 Chemica Formula: $C_{15}H_{15}N_3O_2S$ Molecular Weight: 301,36	**N-((6-methyl-2-oxo-4-phenyl-1,2-dihydropyridin-3-yl)carbamothioyl)acetamide (10b)** Yield: 0.168 g (56%), light beige powder, M.p.: 249-251°C. ^{1}H NMR (500 MHz, DMSO-d6) δ ppm (*J*, Hz): 2.05 (s, 3H, CH_3); 2.21 (s, 3H, CH_3); 6.02 (s, 1H, H-5); 7.35-7.39 (m, 3H, H-3,4,5 Ph); 7.42-7.45 (m, 2H, H-2,6 Ph); 11.29 (br. s., 1H, NHCS); 11.34 (br. s., 1H, NHCO); 11.91 (br. s, 1H, NHCO). ^{13}C NMR (125 MHz, DMSO-d6) δ ppm 18.4 (CH_3); 23.6 (CH_3); 105.5 (C-5); 122.1; 127.6 (2C Ph); 128.2 (2C Ph); 128.5; 137.1; 144.0; 148.9; 159.5; 172.2; 181.4. HRMS m/z: calcd for $C_{15}H_{16}N_3O_2S^+$ $[M + H]^+$: 302.0958; found: 302.0963.

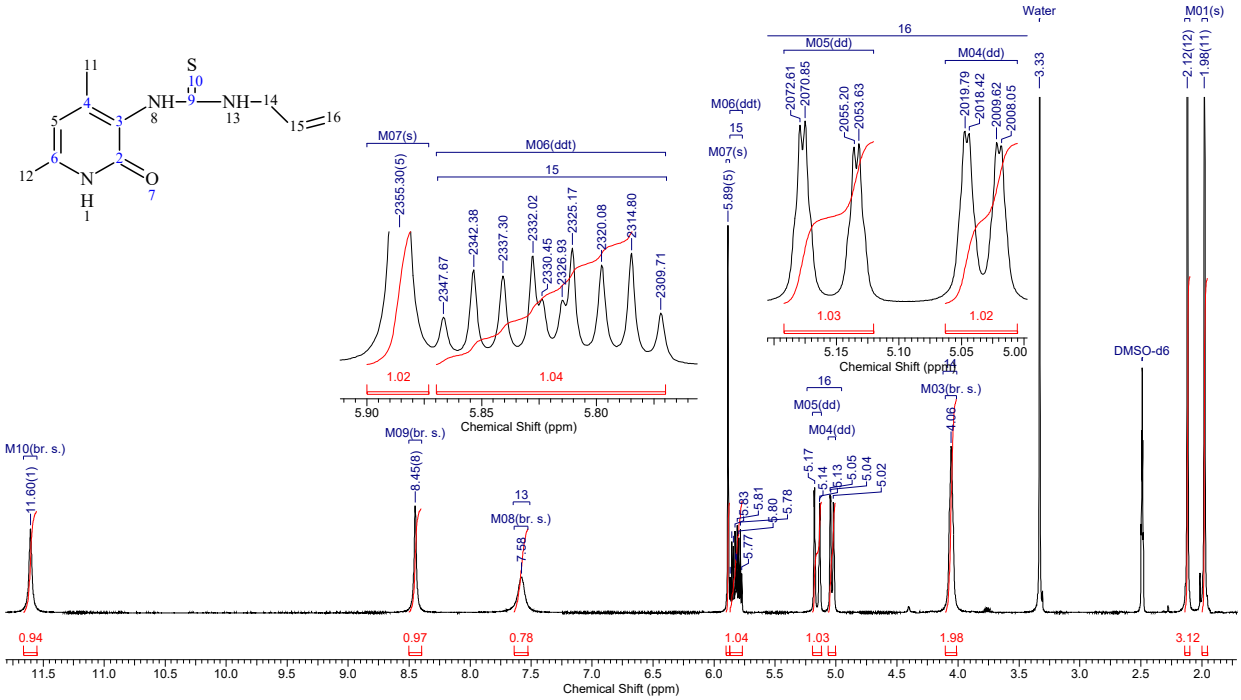
 Chemical Formula: $C_{13}H_{13}N_3O_2S_2$ Molecular Weight 307,39	**N-((6-methyl-2-oxo-4-(thiophen-2-yl)-1,2-dihydropyridin-3-yl)carbamothioyl)acetamide (10c)** Yield: 0.169 g (55%), light beige powder, M.p.: 252-254°C. ^{1}H NMR (500 MHz, DMSO-d6) δ ppm (*J*, Hz): 2.16 (s 3H, CH_3'); 2.20 (s, 3H, CH_3); 6.46 (s, 1H, H-5); 7.14 (dd, 1H, *J*=5.0 Hz, *J*=3.7 Hz, H-4 thiophene); 7.64 (dd, 1H, *J*=3.8 Hz, *J*=1.1 Hz, H-3 thiophene); 7.72 (dd, 1H, *J*=5.1 Hz, *J*=1.0 Hz, H-5 tiophene); 11.47 (br. s, 1H, NHCS); 11.56 (br. s, 1H, NHCO); 11.77 (br. s, 1H, NHCO). ^{13}C NMR (125 MHz, DMSO-d6) δ ppm 18.5 (CH_3); 23.7 (CH_3); 102.6 (C-5); 120.2; 127.2 (C-3 thiophene); 129.00 (C-4 thiophene); 130.3 (C-5 thiophene); 136.8; 140.6; 143.6; 159.7; 172.5; 182.2. HRMS m/z: calcd for $C_{13}H_{14}N_3O_2S_2^+$ $[M+H]^+$: 308.0522; found: 308.0530.
 Chemical Formula $C_{15}H_{15}N_3O_2S$ Molecular Weight: 301,3640	**N-[(4,6-Dimethyl-2-oxo-1,2-dihydropyridin-3-yl)carbamothioyl]benzamide (11a)** Yield: 0.682 g (76%), light-yellow, finely crystalline powder, M.p.: 230-232°C. ^{1}H NMR (400 MHz, DMSO-d6) δ ppm (*J*, Hz): 2.07 (s, 3H, 4-CH_3); 2.16 (s, 3H, 6-CH_3); 5.92 (s, 1H, H-5); 7.53 (t, *J*=7.6 Hz, 2H, H-3,5 Ph); 7.65 (t, *J*=7.6 Hz, 1H, H-4 Ph); 7.98 (d, *J*=7.8 Hz, 2H, H-2,6 Ph); 11.42 (br. s, 1H, NHCS); 11.62 (br. s, 1H, NHCO); 11.64 (br. s, 1H, NHCO). ^{13}C NMR (100 MHz, DMSO-d6) δ ppm 18.2 (4,6-CH_3); 106.6 (C-5); 123.4 (C-4); 128.4 (C-2,6 Ph); 128.6 (C-3,5 Ph); 132.1 (C-1 Ph); 133.1 (C-4 Ph); 143.1 (C-3); 147.6 (C-6); 159.5 (C-2); 168.3 (CO); 180.9 (CS). HRMS m/z: calcd for $C_{15}H_{16}N_3O_2S^+$ $[M + H]^+$: 302.0958; found: 302.0963.
 Chemical Formula $C_{20}H_{17}N_3O_2S$ Molecular Weight: 363,4350	**N-[(6-Methyl-2-oxo-4-phenyl-1,2-dihydropyridin-3-yl)carbamothioyl]benzamide (11b)** Yield: 0.244 g (67%), light-yellow, finely crystalline powder, M.p.: 218-220°C. ^{1}H NMR (400 MHz, DMSO-d6) δ ppm (*J*, Hz): 2.24 (s, 3H, 6-CH_3); 6.05 (s, 1H, H-5); 7.34-7.41 (m, 3H, H-2,4,6 Ph); 7.47-7.51 (m, 4H, H-3,5 Ph, H-3,5 Ph'); 7.62 (t, *J*=7.4 Hz, 1H, H-4 Ph'); 7.91 (d, *J*=7.2 Hz, 2H, H-2,6 Ph'); 11.41 (br. s, 1H, NHCS); 11.63 (br. s, 1H, NHCO); 11.92 (br. s, 1H, NHCO). ^{13}C NMR (100 MHz, DMSO-d6) δ ppm 18.9 (6-CH_3); 106.0 (C-5); 122.8 (C-1 Ph); 128.1 (C-2,6 Ph); 128.7

	(C-3,5 Ph); 128.9 (C-4 Ph, C-2,6 Bz); 129.0 (C-3,5 Bz); 132.4 (C-1 Bz); 133.6 (C-4 Bz); 137.6 (C-4); 144.5 (C-3); 149.4 (C-6); 160.0 (C-2); 168.4 (CO); 182.0 (CS). HRMS m/z: calcd for $C_{20}H_{18}N_3O_2S^+$ $[M + H]^+$: 364.1114; found: 364.1113.
 Chemical Formula: $C_{18}H_{15}N_3O_2S_2$ Molecular Weight 369,46	**N-((6-methyl-2-oxo-4-(thiophen-2-yl)-1,2-dihydropyridin-3-yl)carbamothioyl)benzamide (11c)** Yield: 0.314 g (85%), light beige powder, M.p.: 245-249°C. ^{1}H NMR (500 MHz, DMSO-d6) δ ppm (*J*, Hz): 2.23 (s, 3H, CH_3); 6.50 (s, 1H, H-5); 7.15 (dd, 1H, *J*=4.9 Hz, *J*=4.1 Hz, H-4 thiophene); 7.55 (t, 2H, H-3,5 Ph); 7.66 (m, 1H, H-4 Ph); 7.69 (d, 1H, H-3 thiophene); 7.72 (d, 1H, H-5 thiophene); 8.01 (d, 2H, H-2,6 Ph); 11.76 (br. s, 2H, NHCS, NHCO); 11.81 (br. s, 1H, NHCO). ^{13}C NMR (125 MHz, DMSO-d6) δ ppm 18.5 (CH_3); 102.7 (C-5); 120.4; 127.2; 128.5 (2C Ph); 128.7 (2C Ph); 129.0; 130.2; 132.0; 133.2; 136.8; 140.6; 143.6; 159.7; 168.2; 182.4. HRMS m/z: calcd for $C_{18}H_{15}N_3O_2S_2^+$ $[M + H]^+$: 370.0678; found: 370.0670.

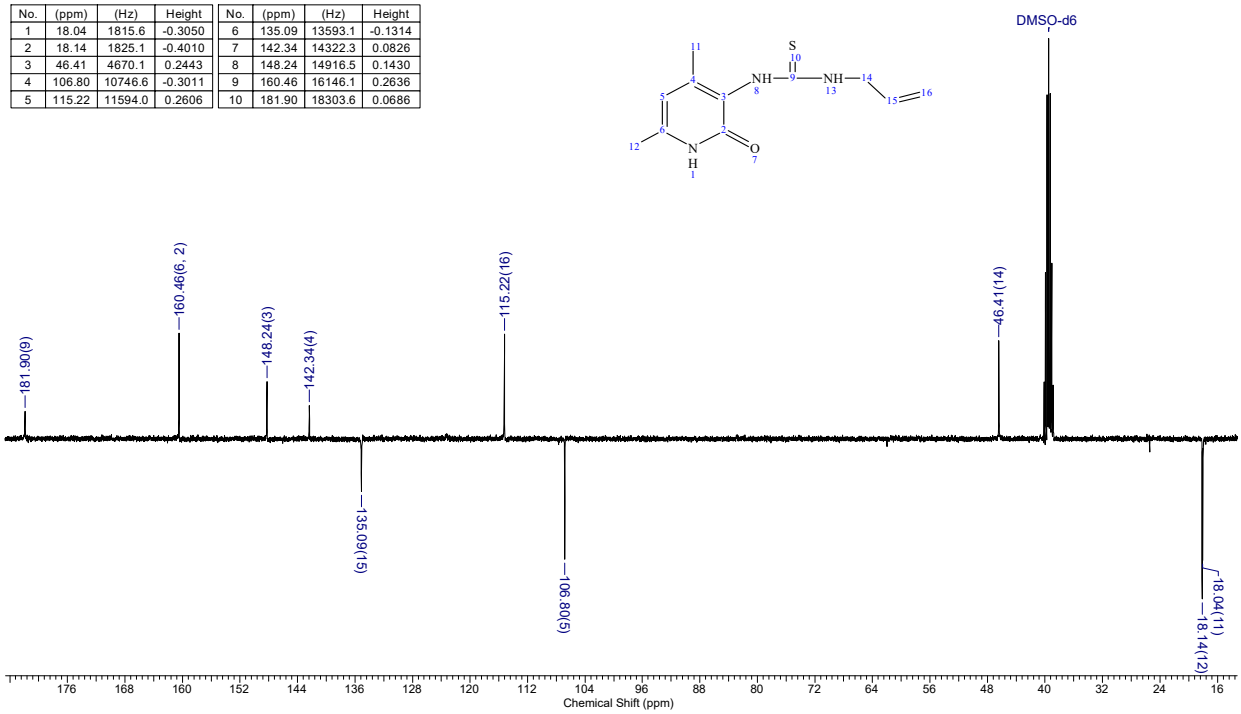
Author Contributions

Spectrophotometric studies were performed on the basis of the Research Resource Center “Natural Resource Management and Physico-Chemical Research” Institute of Chemistry, Tyumen State University.

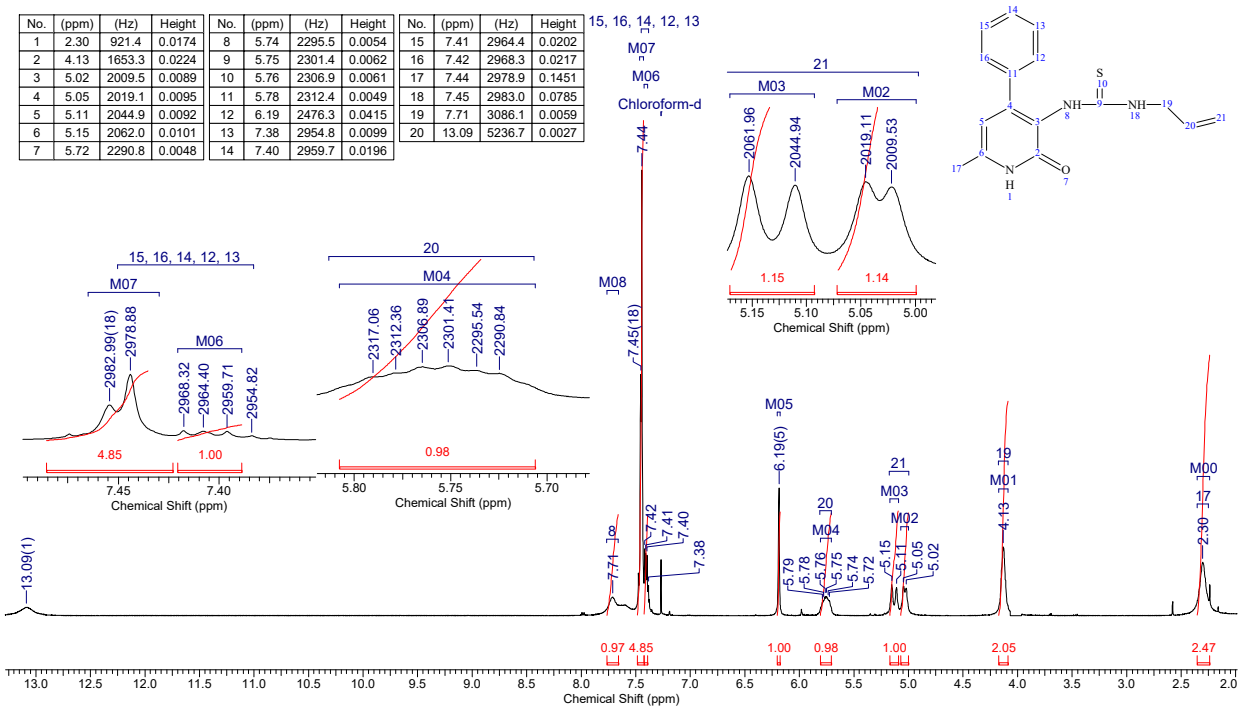
Copies of NMR Spectra of Products



No.	(ppm)	(Hz)	Height	No.	(ppm)	(Hz)	Height
1	18.04	1815.6	-0.3050	6	135.09	13593.1	-0.1314
2	18.14	1825.1	-0.4010	7	142.34	14322.3	0.0826
3	46.41	4670.1	0.2443	8	148.24	14916.5	0.1430
4	106.80	10746.6	-0.3011	9	160.46	16146.1	0.2636
5	115.22	11594.0	0.2606	10	181.90	18303.6	0.0686



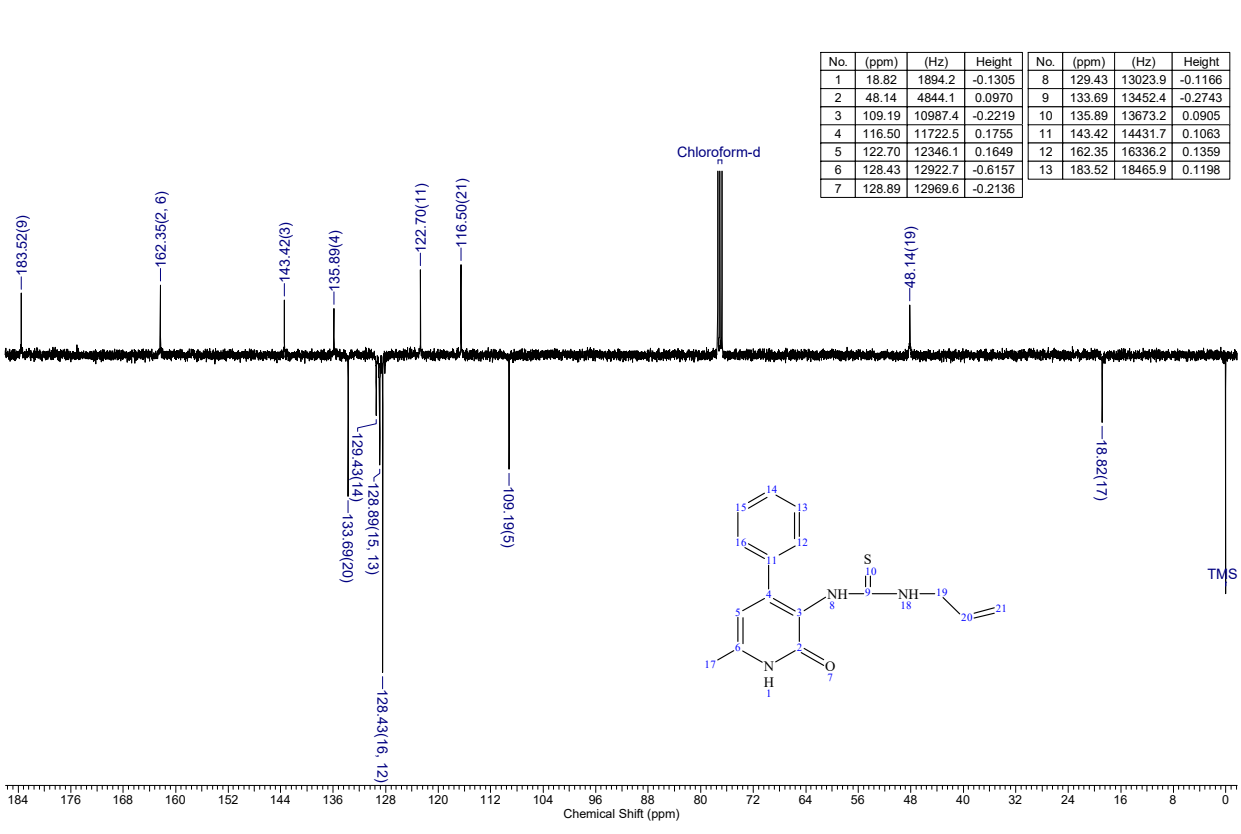
^{1}H (400 MHz, DMSO-d6) and ^{13}C (100 MHz, DMSO-d6) NMR Spectra of **8a**



No.	(ppm)	(Hz)	Height
1	2.30	921.4	0.0174
2	4.13	1653.3	0.0224
3	5.02	2009.5	0.0089
4	5.05	2019.1	0.0095
5	5.11	2044.9	0.0092
6	5.15	2062.0	0.0101
7	5.72	2290.8	0.0048

No.	(ppm)	(Hz)	Height
8	5.74	2295.5	0.0054
9	5.75	2301.4	0.0062
10	5.76	2306.9	0.0061
11	5.78	2312.4	0.0049
12	6.19	2476.3	0.0415
13	7.38	2954.8	0.0099
14	7.40	2959.7	0.0196

No.	(ppm)	(Hz)	Height
15	7.41	2964.4	0.0202
16	7.42	2968.3	0.0217
17	7.44	2978.9	0.1451
18	7.45	2983.0	0.0785
19	7.71	3086.1	0.0059
20	13.09	5236.7	0.0027



No.	(ppm)	(Hz)	Height
1	18.82	1894.2	-0.1305
2	48.14	4844.1	0.0970
3	109.19	10987.4	-0.2219
4	116.50	11722.5	0.1755
5	122.70	12346.1	0.1649
6	128.43	12922.7	-0.6157
7	128.89	12969.6	-0.2136

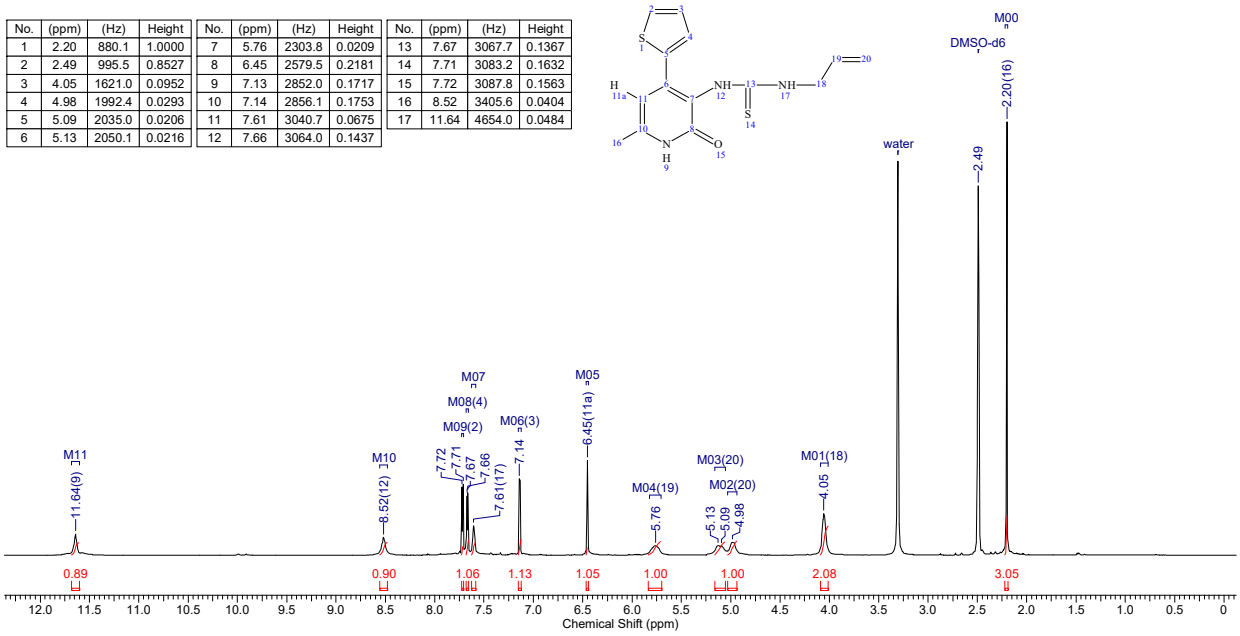
No.	(ppm)	(Hz)	Height
8	129.43	13023.9	-0.1166
9	133.69	13452.4	-0.2743
10	135.89	13673.2	0.0905
11	143.42	14431.7	0.1063
12	162.35	16336.2	0.1359
13	183.52	18465.9	0.1198

^{1}H (400 MHz,$CDCl_3$) and ^{13}C (100 MHz, $CDCl_3$) NMR Spectra of **8b**

No.	(ppm)	(Hz)	Height
1	2.20	880.1	1.0000
2	2.49	995.5	0.8527
3	4.05	1621.0	0.0952
4	4.98	1992.4	0.0293
5	5.09	2035.0	0.0206
6	5.13	2050.1	0.0216

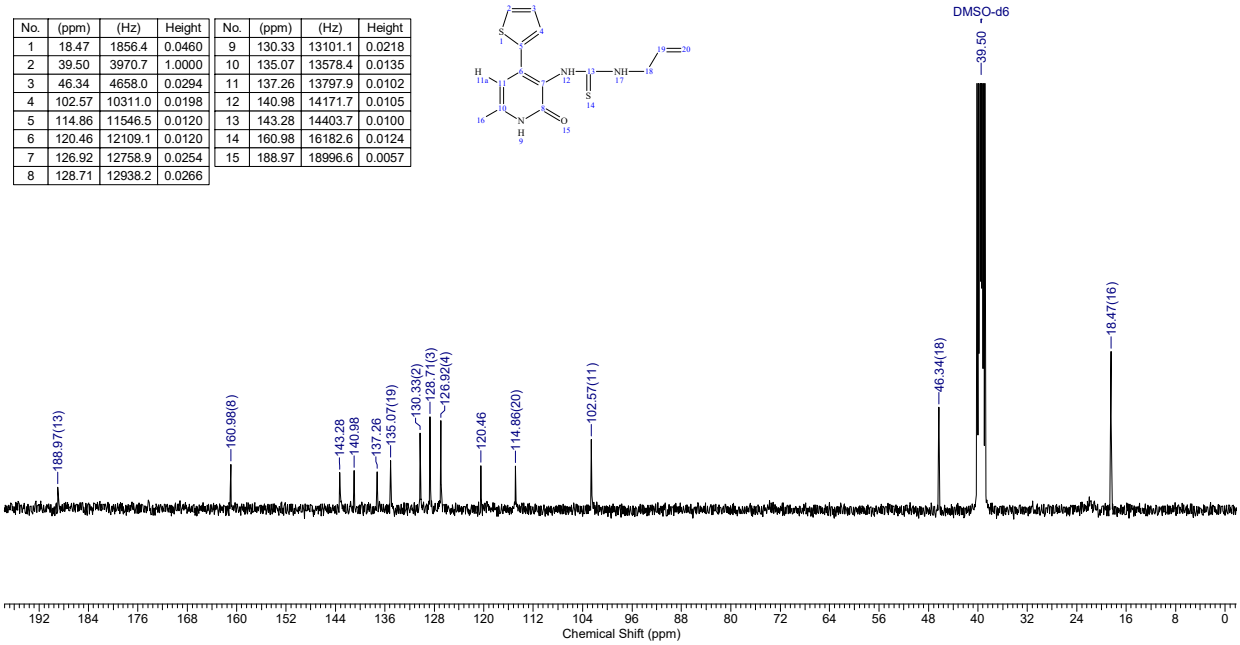
No.	(ppm)	(Hz)	Height
7	5.76	2303.8	0.0209
8	6.45	2579.5	0.2181
9	7.13	2852.0	0.1717
10	7.14	2856.1	0.1753
11	7.61	3040.7	0.0675
12	7.66	3064.0	0.1437

No.	(ppm)	(Hz)	Height
13	7.67	3067.7	0.1367
14	7.71	3083.2	0.1632
15	7.72	3087.8	0.1563
16	8.52	3405.6	0.0404
17	11.64	4654.0	0.0484



No.	(ppm)	(Hz)	Height
1	18.47	1856.4	0.0460
2	39.50	3970.7	1.0000
3	46.34	4658.0	0.0294
4	102.57	10311.0	0.0198
5	114.86	11546.5	0.0120
6	120.46	12109.1	0.0120
7	126.92	12758.9	0.0254
8	128.71	12938.2	0.0266

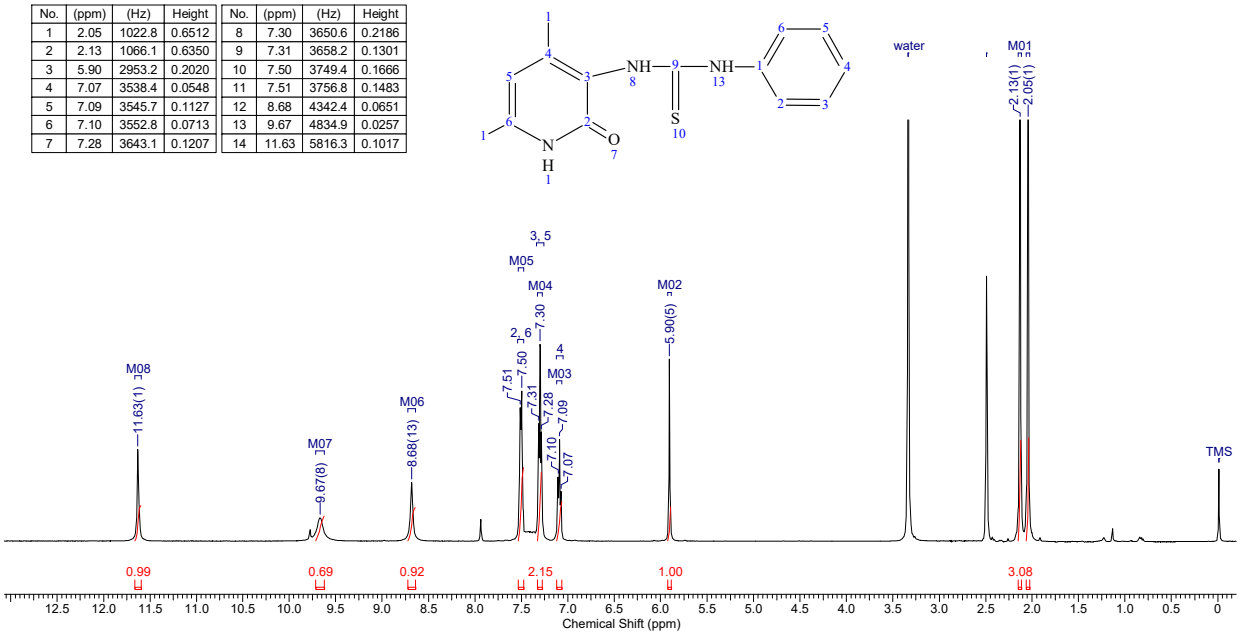
No.	(ppm)	(Hz)	Height
9	130.33	13101.1	0.0218
10	135.07	13578.4	0.0135
11	137.26	13797.9	0.0102
12	140.98	14171.7	0.0105
13	143.28	14403.7	0.0100
14	160.98	16182.6	0.0124
15	188.97	18996.6	0.0057



^{1}H (400 MHz,$CDCl_3$) and ^{13}C (100 MHz, $CDCl_3$) NMR Spectra of **8c**

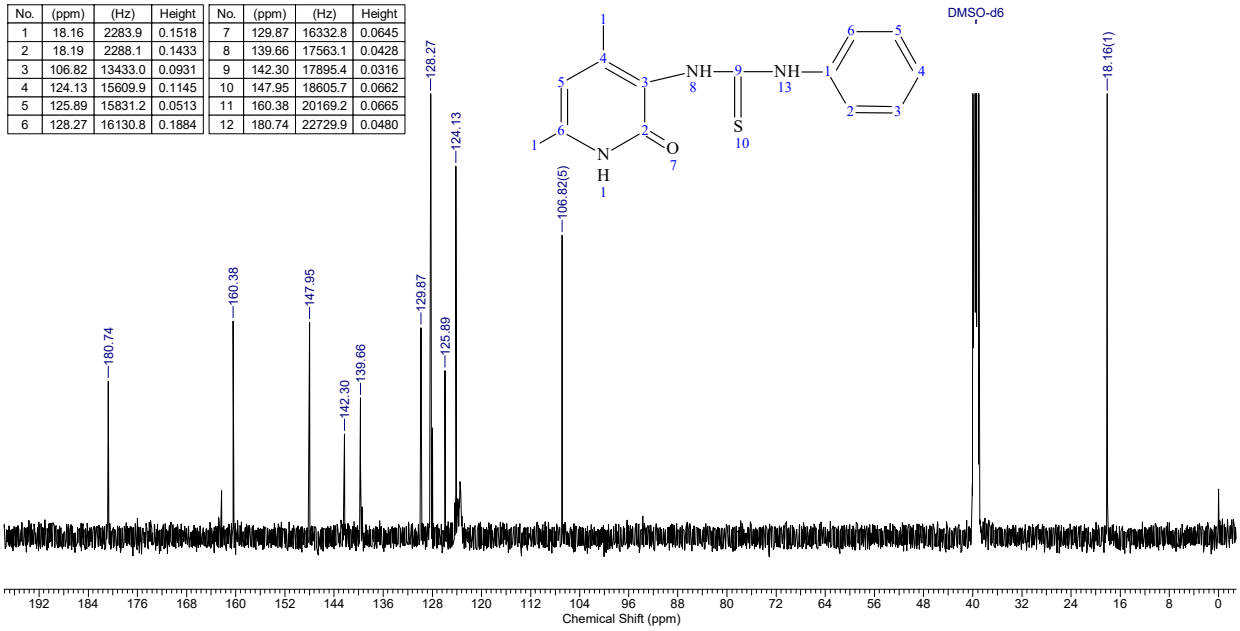
No.	(ppm)	(Hz)	Height
1	2.05	1022.8	0.6512
2	2.13	1066.1	0.6350
3	5.90	2953.2	0.2020
4	7.07	3538.4	0.0548
5	7.09	3545.7	0.1127
6	7.10	3552.8	0.0713
7	7.28	3643.1	0.1207

No.	(ppm)	(Hz)	Height
8	7.30	3650.6	0.2186
9	7.31	3658.2	0.1301
10	7.50	3749.4	0.1666
11	7.51	3756.8	0.1483
12	8.68	4342.4	0.0651
13	9.67	4834.9	0.0257
14	11.63	5816.3	0.1017



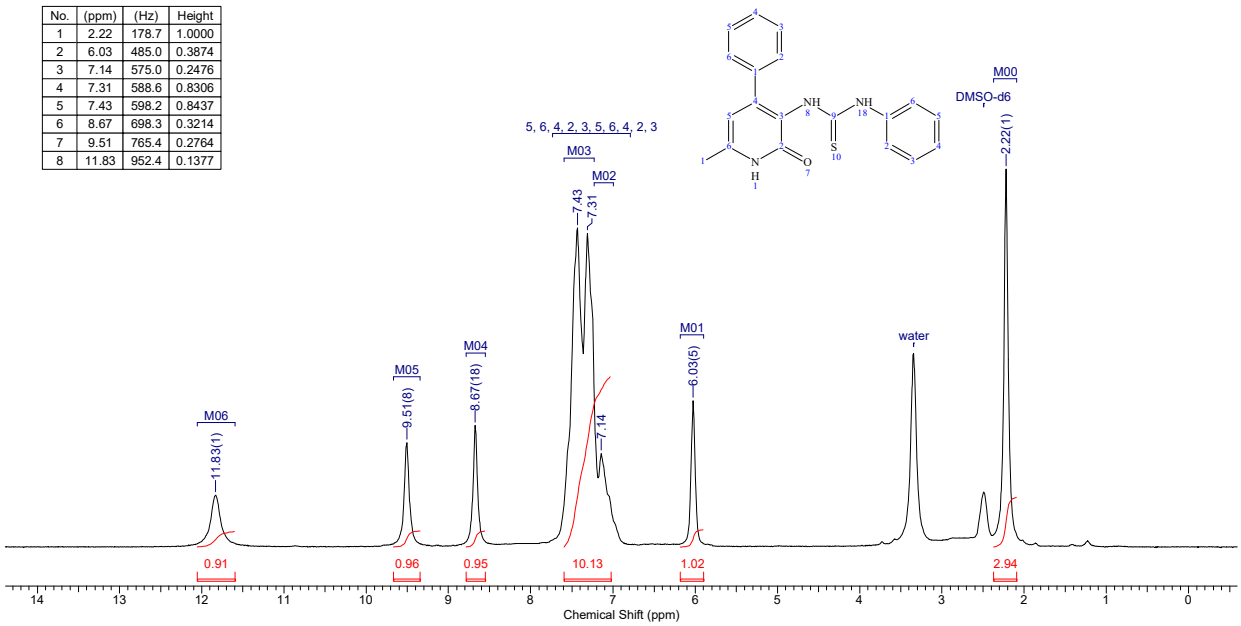
No.	(ppm)	(Hz)	Height
1	18.16	2283.9	0.1518
2	18.19	2288.1	0.1433
3	106.82	13433.0	0.0931
4	124.13	15609.9	0.1145
5	125.89	15831.2	0.0513
6	128.27	16130.8	0.1884

No.	(ppm)	(Hz)	Height
7	129.87	16332.8	0.0645
8	139.66	17563.1	0.0428
9	142.30	17895.4	0.0316
10	147.95	18605.7	0.0662
11	160.38	20169.2	0.0665
12	180.74	22729.9	0.0480



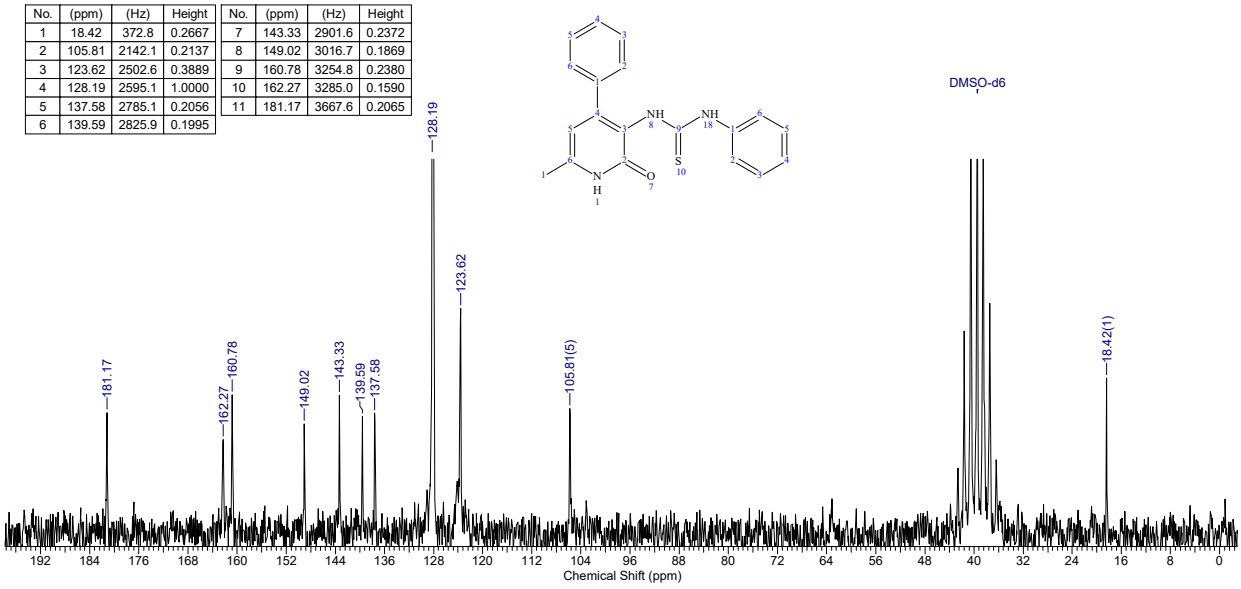
^{1}H (500 MHz, DMSO-d6) and ^{13}C (125 MHz, DMSO-d6) NMR Spectra of **9a**

No.	(ppm)	(Hz)	Height
1	2.22	178.7	1.0000
2	6.03	485.0	0.3874
3	7.14	575.0	0.2476
4	7.31	588.6	0.8306
5	7.43	598.2	0.8437
6	8.67	698.3	0.3214
7	9.51	765.4	0.2764
8	11.83	952.4	0.1377



No.	(ppm)	(Hz)	Height
1	18.42	372.8	0.2667
2	105.81	2142.1	0.2137
3	123.62	2502.6	0.3889
4	128.19	2595.1	1.0000
5	137.58	2785.1	0.2056
6	139.59	2825.9	0.1995

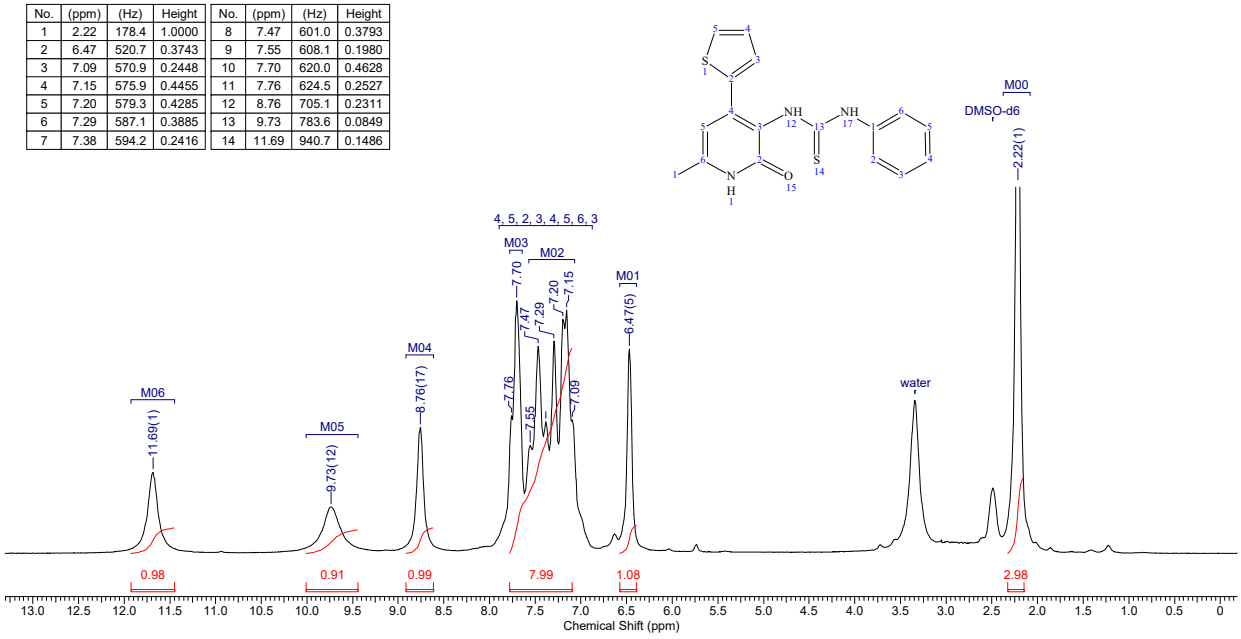
No.	(ppm)	(Hz)	Height
7	143.33	2901.6	0.2372
8	149.02	3016.7	0.1869
9	160.78	3254.8	0.2380
10	162.27	3285.0	0.1590
11	181.17	3667.6	0.2065



^{1}H (81 MHz, DMSO-d6) and ^{13}C (20 MHz, DMSO-d6) NMR Spectra of **9b**

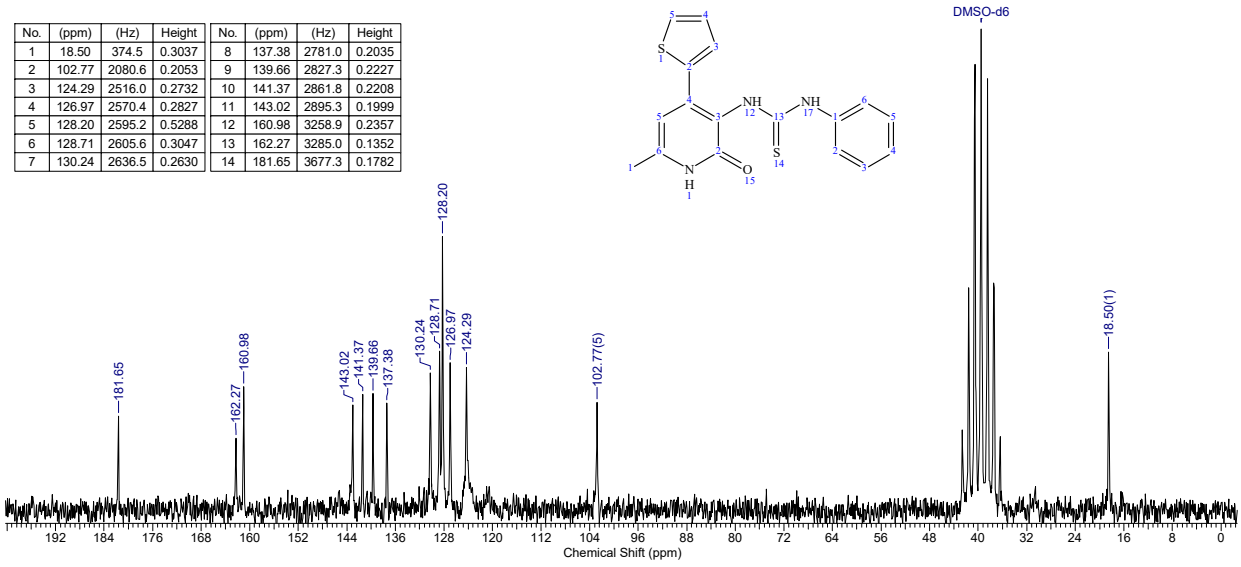
No.	(ppm)	(Hz)	Height
1	2.22	178.4	1.0000
2	6.47	520.7	0.3743
3	7.09	570.9	0.2448
4	7.15	575.9	0.4455
5	7.20	579.3	0.4285
6	7.29	587.1	0.3885
7	7.38	594.2	0.2416

No.	(ppm)	(Hz)	Height
8	7.47	601.0	0.3793
9	7.55	608.1	0.1980
10	7.70	620.0	0.4628
11	7.76	624.5	0.2527
12	8.76	705.1	0.2311
13	9.73	783.6	0.0849
14	11.69	940.7	0.1486



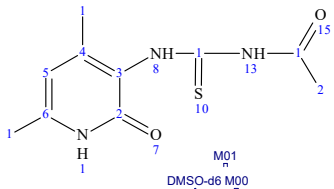
No.	(ppm)	(Hz)	Height
1	18.50	374.5	0.3037
2	102.77	2080.6	0.2053
3	124.29	2516.0	0.2732
4	126.97	2570.4	0.2827
5	128.20	2595.2	0.5288
6	128.71	2605.6	0.3047
7	130.24	2636.5	0.2630

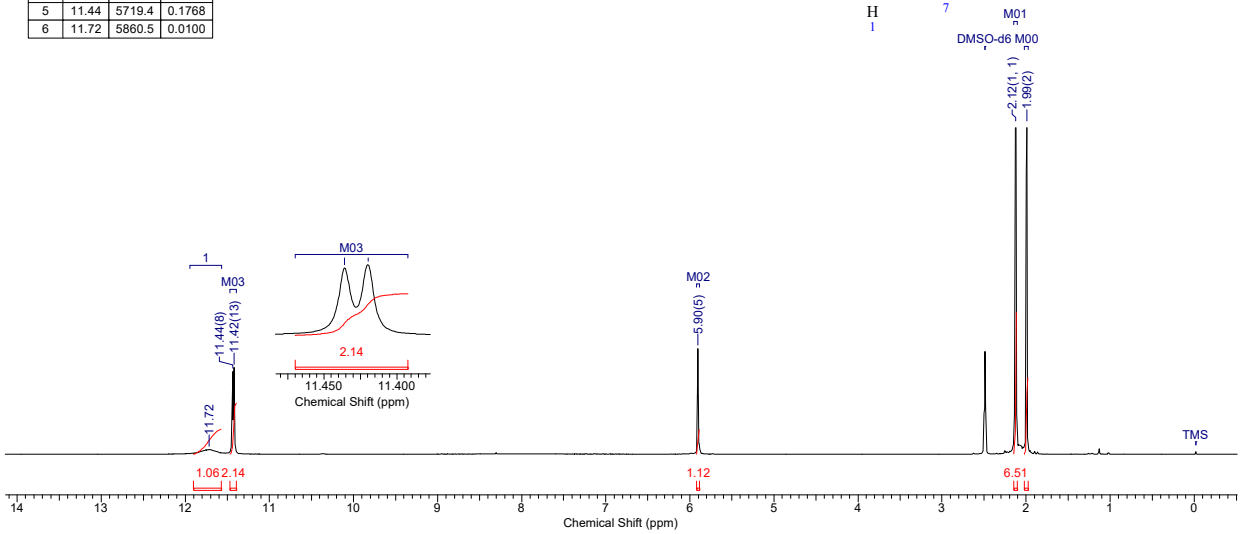
No.	(ppm)	(Hz)	Height
8	137.38	2781.0	0.2035
9	139.66	2827.3	0.2227
10	141.37	2861.8	0.2208
11	143.02	2895.3	0.1999
12	160.98	3258.9	0.2357
13	162.27	3285.0	0.1352
14	181.65	3677.3	0.1782



^{1}H (81 MHz, DMSO-d6) and ^{13}C (20 MHz, DMSO-d6) NMR Spectra of **9c**

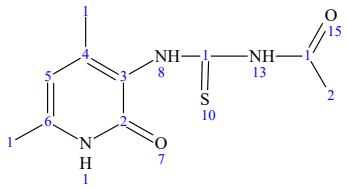
No.	(ppm)	(Hz)	Height
1	1.99	997.5	0.7231
2	2.12	1062.1	1.0000
3	5.90	2952.9	0.2254
4	11.42	5711.4	0.1852
5	11.44	5719.4	0.1768
6	11.72	5860.5	0.0100





No.	(ppm)	(Hz)	Height
1	18.18	2286.3	0.1841
2	18.21	2290.1	0.1630
3	23.70	2980.6	0.1576
4	106.59	13404.7	0.1244
5	123.14	15485.5	0.0810

No.	(ppm)	(Hz)	Height
6	143.02	17986.4	0.0875
7	147.58	18559.0	0.0812
8	159.46	20053.3	0.0869
9	172.43	21684.8	0.1140
10	180.68	22721.3	0.0905

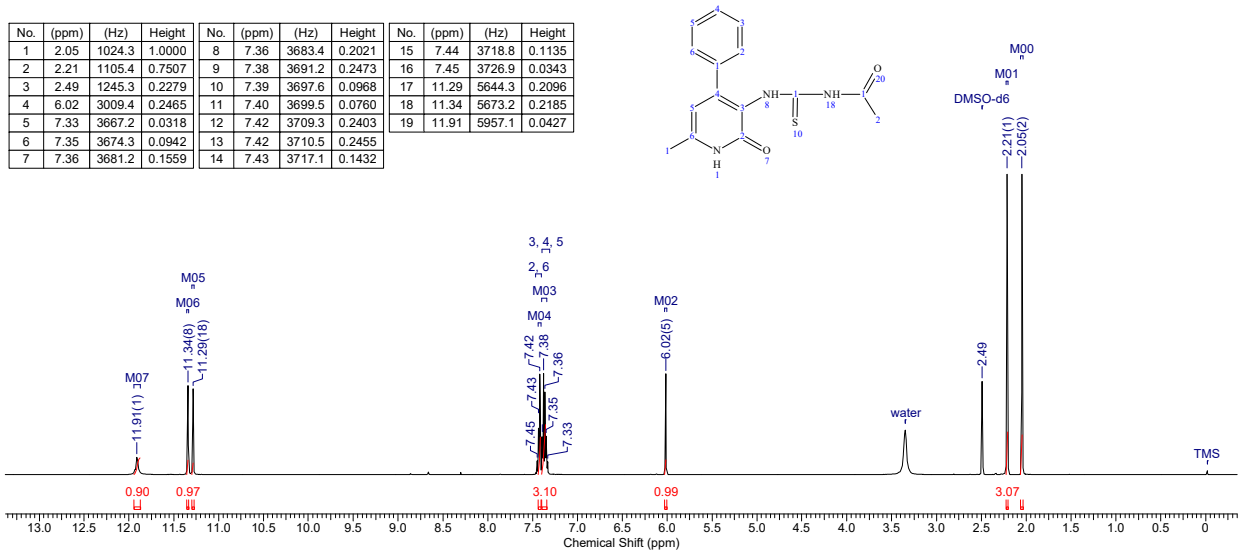


^{1}H (500 MHz, DMSO-d6) and ^{13}C (125 MHz, DMSO-d6) NMR Spectra of **10a**

No.	(ppm)	(Hz)	Height
1	2.05	1024.3	1.0000
2	2.21	1105.4	0.7507
3	2.49	1245.3	0.2279
4	6.02	3009.4	0.2465
5	7.33	3667.2	0.0318
6	7.35	3674.3	0.0942
7	7.36	3681.2	0.1559

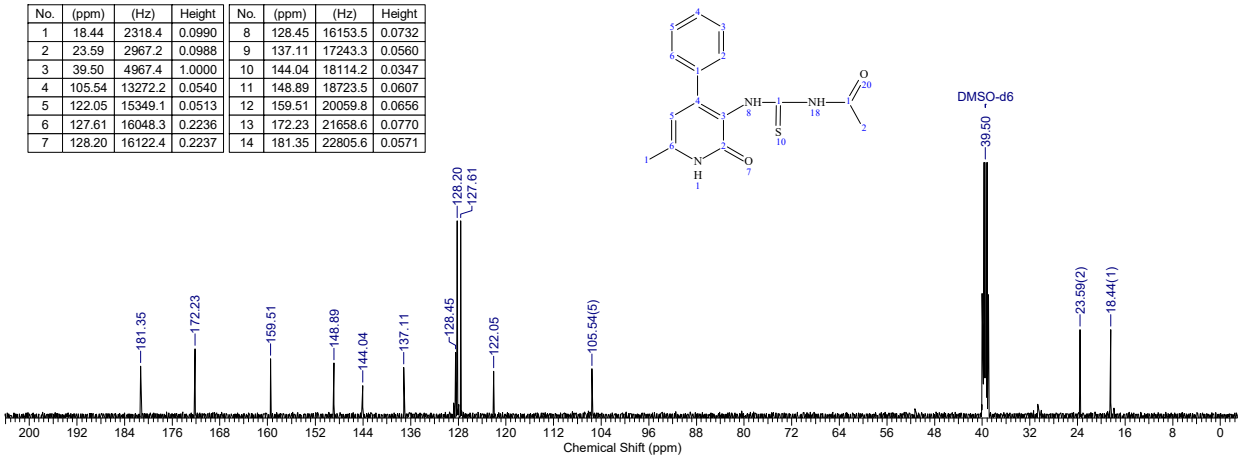
No.	(ppm)	(Hz)	Height
8	7.36	3683.4	0.2021
9	7.38	3691.2	0.2473
10	7.39	3697.6	0.0968
11	7.40	3699.5	0.0760
12	7.42	3709.3	0.2403
13	7.42	3710.5	0.2455
14	7.43	3717.1	0.1432

No.	(ppm)	(Hz)	Height
15	7.44	3718.8	0.1135
16	7.45	3726.9	0.0343
17	11.29	5644.3	0.2096
18	11.34	5673.2	0.2185
19	11.91	5957.1	0.0427



No.	(ppm)	(Hz)	Height
1	18.44	2318.4	0.0990
2	23.59	2967.2	0.0988
3	39.50	4967.4	1.0000
4	105.54	13272.2	0.0540
5	122.05	15349.1	0.0513
6	127.61	16048.3	0.2236
7	128.20	16122.4	0.2237

No.	(ppm)	(Hz)	Height
8	128.45	16153.5	0.0732
9	137.11	17243.3	0.0560
10	144.04	18114.2	0.0347
11	148.89	18723.5	0.0607
12	159.51	20059.8	0.0656
13	172.23	21658.6	0.0770
14	181.35	22805.6	0.0571

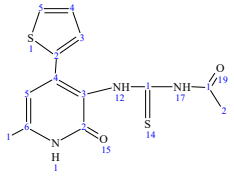


^{1}H (500 MHz, DMSO-d6) and ^{13}C (125 MHz, DMSO-d6) NMR Spectra of **10b**

No.	(ppm)	(Hz)	Height
1	2.18	1092.1	1.0000
2	2.22	1112.6	0.7328
3	6.48	3242.1	0.2368
4	7.16	3578.5	0.1182
5	7.16	3582.3	0.1321
6	7.17	3583.6	0.1274

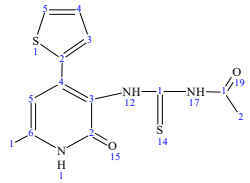
No.	(ppm)	(Hz)	Height
7	7.17	3587.2	0.1214
8	7.66	3830.6	0.1313
9	7.66	3831.7	0.1381
10	7.67	3834.5	0.1349
11	7.67	3835.6	0.1277
12	7.73	3868.3	0.1377

No.	(ppm)	(Hz)	Height
13	7.74	3869.1	0.1294
14	7.74	3873.2	0.1364
15	7.75	3874.2	0.1243
16	11.49	5744.7	0.2178
17	11.58	5790.2	0.2051
18	11.79	5894.7	0.0871



No.	(ppm)	(Hz)	Height
1	18.51	2327.6	0.1136
2	23.73	2984.9	0.1401
3	102.63	12906.2	0.0714
4	120.17	15112.6	0.0661
5	127.24	16001.2	0.1205
6	129.00	16223.4	0.1231
7	130.30	16385.8	0.0990

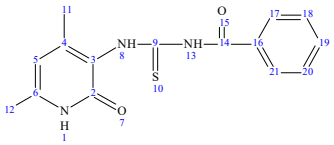
No.	(ppm)	(Hz)	Height
8	136.79	17202.9	0.0749
9	140.62	17684.2	0.0746
10	143.58	18056.2	0.0531
11	159.71	20084.2	0.0835
12	172.51	21694.8	0.0944
13	182.20	22913.3	0.0790



^{1}H (500 MHz, DMSO-d6) and ^{13}C (125 MHz, DMSO-d6) NMR Spectra of **10c**

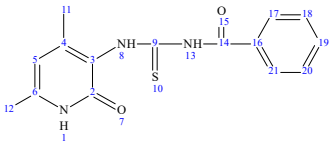
No.	(ppm)	(Hz)	Height
1	2.07	827.8	1.0000
2	2.16	865.0	0.9273
3	2.49	996.4	0.2054
4	5.92	2369.6	0.3112
5	7.51	3005.0	0.1331
6	7.53	3012.6	0.3015
7	7.55	3020.3	0.2003

No.	(ppm)	(Hz)	Height
8	7.63	3052.7	0.0999
9	7.65	3060.4	0.1452
10	7.97	3190.1	0.2861
11	7.99	3197.9	0.2687
12	11.42	4569.7	0.1495
13	11.62	4648.1	0.0813
14	11.64	4658.3	0.1955



No.	(ppm)	(Hz)	Height
1	18.24	1835.4	-0.5162
2	106.63	10729.0	-0.1450
3	123.41	12417.8	0.0937
4	128.45	12925.5	-0.4680
5	128.65	12945.3	-0.4777
6	132.15	13297.4	0.0986

No.	(ppm)	(Hz)	Height
7	133.10	13392.8	-0.1404
8	143.07	14395.6	0.0747
9	147.60	14852.0	0.1034
10	159.48	16047.0	0.1050
11	168.28	16932.5	0.1004
12	180.93	18205.3	0.0952



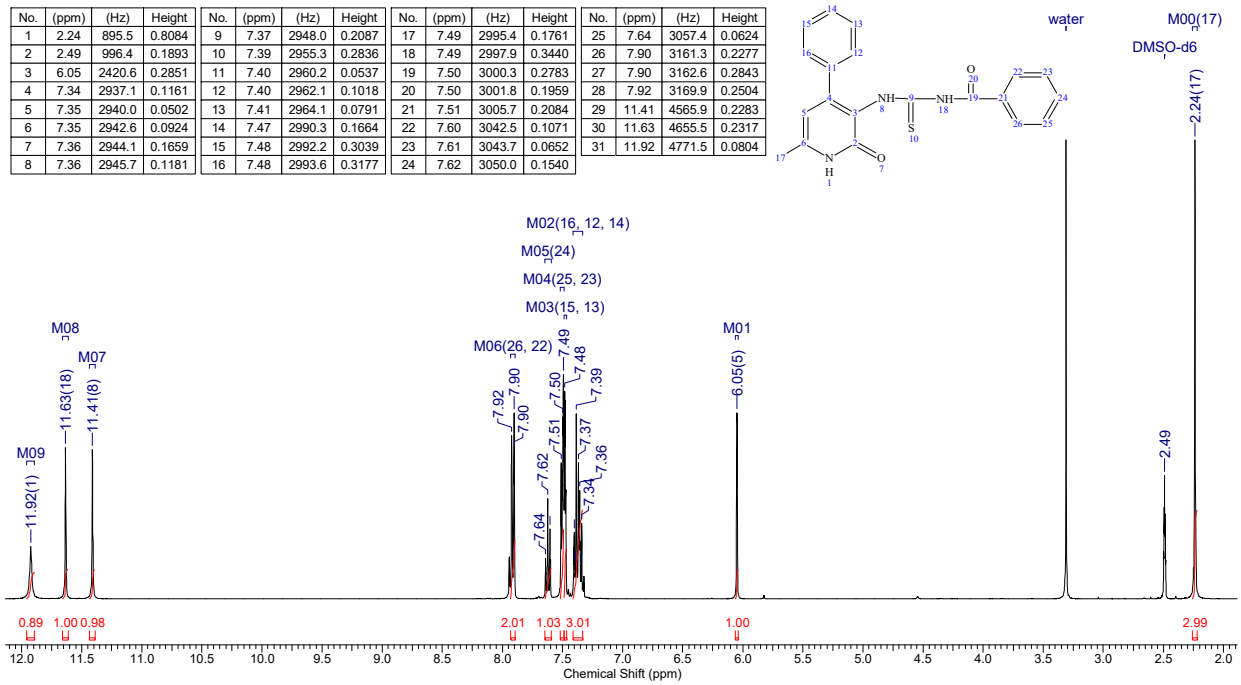
^{1}H (400 MHz, DMSO-d6) and ^{13}C (100 MHz, DMSO-d6) NMR Spectra of **11a**

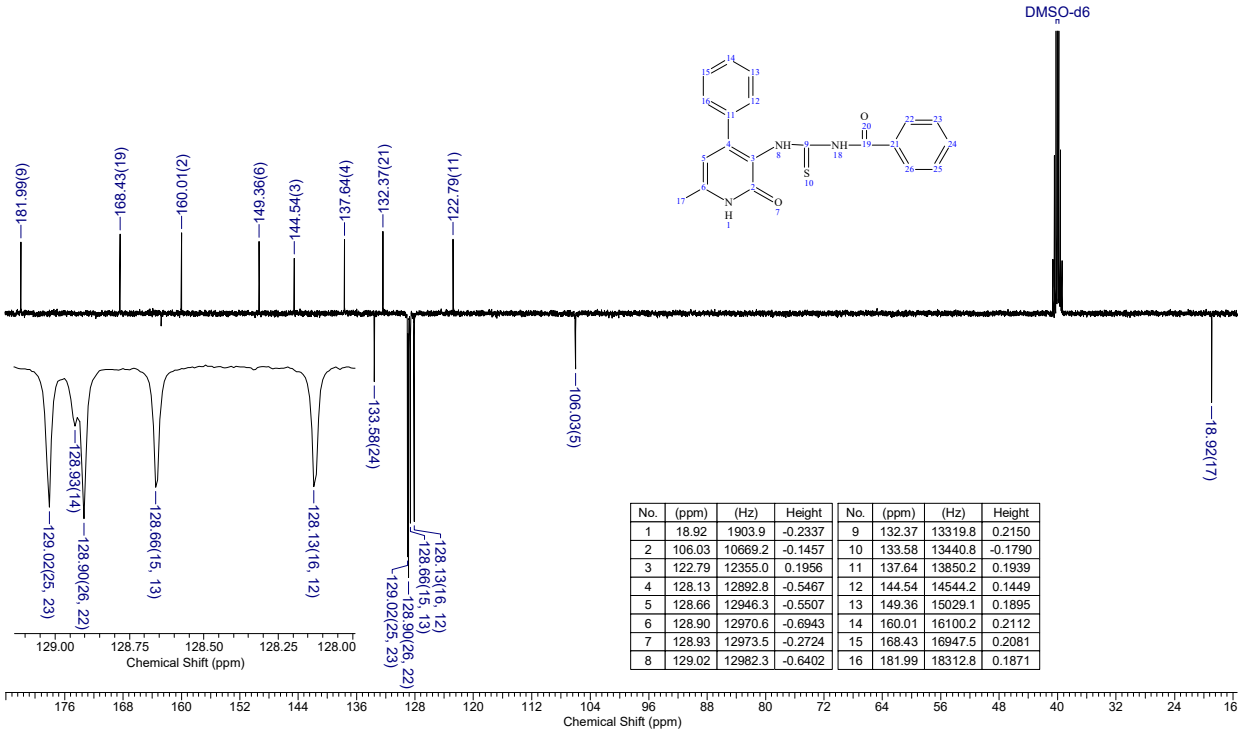
No.	(ppm)	(Hz)	Height
1	2.24	895.5	0.8084
2	2.49	996.4	0.1893
3	6.05	2420.6	0.2851
4	7.34	2937.1	0.1161
5	7.35	2940.0	0.0502
6	7.35	2942.6	0.0924
7	7.36	2944.1	0.1659
8	7.36	2945.7	0.1181

No.	(ppm)	(Hz)	Height
9	7.37	2948.0	0.2087
10	7.39	2955.3	0.2836
11	7.40	2960.2	0.0537
12	7.40	2962.1	0.1018
13	7.41	2964.1	0.0791
14	7.47	2990.3	0.1664
15	7.48	2992.2	0.3039
16	7.48	2993.6	0.3177

No.	(ppm)	(Hz)	Height
17	7.49	2995.4	0.1761
18	7.49	2997.9	0.3440
19	7.50	3000.3	0.2783
20	7.50	3001.8	0.1959
21	7.51	3005.7	0.2084
22	7.60	3042.5	0.1071
23	7.61	3043.7	0.0652
24	7.62	3050.0	0.1540

No.	(ppm)	(Hz)	Height
25	7.64	3057.4	0.0624
26	7.90	3161.3	0.2277
27	7.90	3162.6	0.2843
28	7.92	3169.9	0.2504
29	11.41	4565.9	0.2283
30	11.63	4655.5	0.2317
31	11.92	4771.5	0.0804





No.	(ppm)	(Hz)	Height
1	18.92	1903.9	-0.2337
2	106.03	10669.2	-0.1457
3	122.79	12355.0	0.1956
4	128.13	12892.8	-0.5467
5	128.66	12946.3	-0.5507
6	128.90	12970.6	-0.6943
7	128.93	12973.5	-0.2724
8	129.02	12982.3	-0.6402

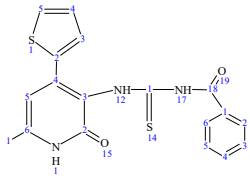
No.	(ppm)	(Hz)	Height
9	132.37	13319.8	0.2150
10	133.58	13440.8	-0.1790
11	137.64	13850.2	0.1939
12	144.54	14544.2	0.1449
13	149.36	15029.1	0.1895
14	160.01	16100.2	0.2112
15	168.43	16947.5	0.2081
16	181.99	18312.8	0.1871

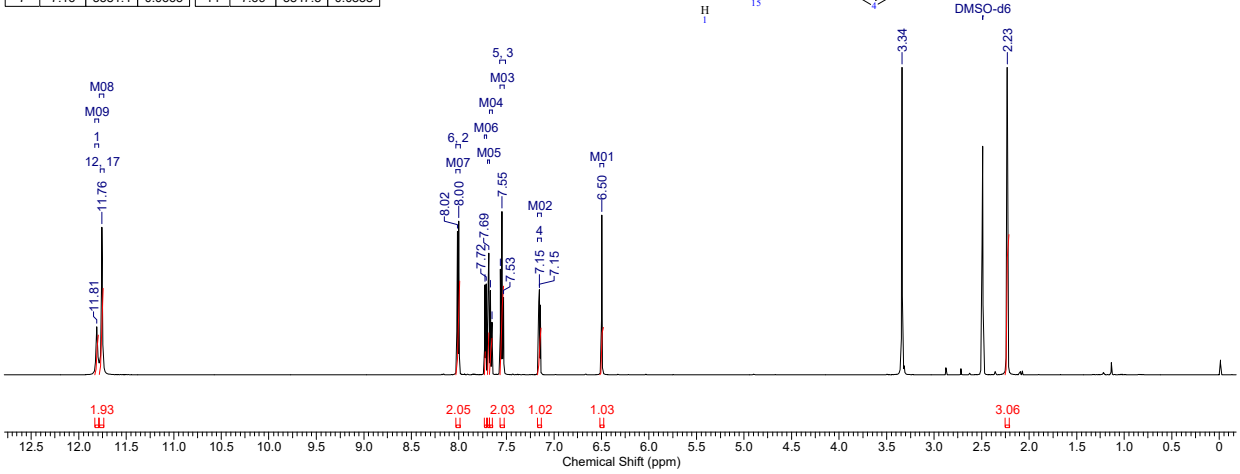
^{1}H (400 MHz, DMSO-d6) and ^{13}C (100 MHz, DMSO-d6) NMR Spectra of **11b**

No.	(ppm)	(Hz)	Height
1	2.23	1115.6	0.4505
2	3.34	1668.7	1.0000
3	6.50	3249.1	0.1447
4	7.14	3572.5	0.0632
5	7.15	3576.5	0.0759
6	7.15	3577.4	0.0774
7	7.16	3581.4	0.0663

No.	(ppm)	(Hz)	Height
8	7.53	3766.3	0.0703
9	7.55	3774.0	0.1480
10	7.56	3781.9	0.0959
11	7.65	3828.1	0.0478
12	7.67	3835.6	0.0762
13	7.69	3843.7	0.1102
14	7.69	3847.5	0.0838

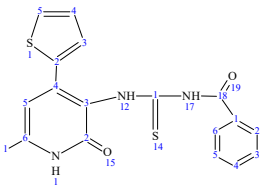
No.	(ppm)	(Hz)	Height
15	7.72	3858.6	0.0825
16	7.73	3863.8	0.0813
17	8.00	4002.0	0.1392
18	8.02	4009.3	0.1297
19	11.76	5879.9	0.1338
20	11.81	5906.7	0.0435





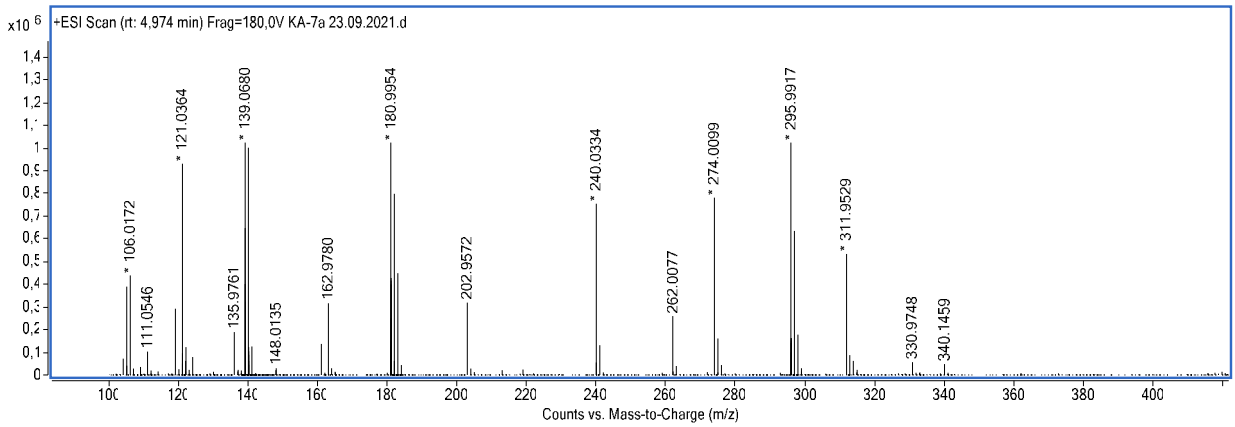
No.	(ppm)	(Hz)	Height
1	18.48	2324.3	0.0566
2	102.69	12913.7	0.0302
3	120.43	15144.6	0.0302
4	127.19	15995.3	0.0678
5	128.47	16156.1	0.1520
6	128.67	16181.3	0.1499
7	128.98	16220.9	0.0573
8	130.22	16375.7	0.0479

No.	(ppm)	(Hz)	Height
9	131.94	16592.0	0.0414
10	133.20	16751.0	0.0404
11	136.81	17205.4	0.0432
12	140.61	17683.4	0.0340
13	143.57	18055.3	0.0214
14	159.68	20080.8	0.0423
15	168.24	21158.0	0.0428
16	182.39	22936.9	0.0319

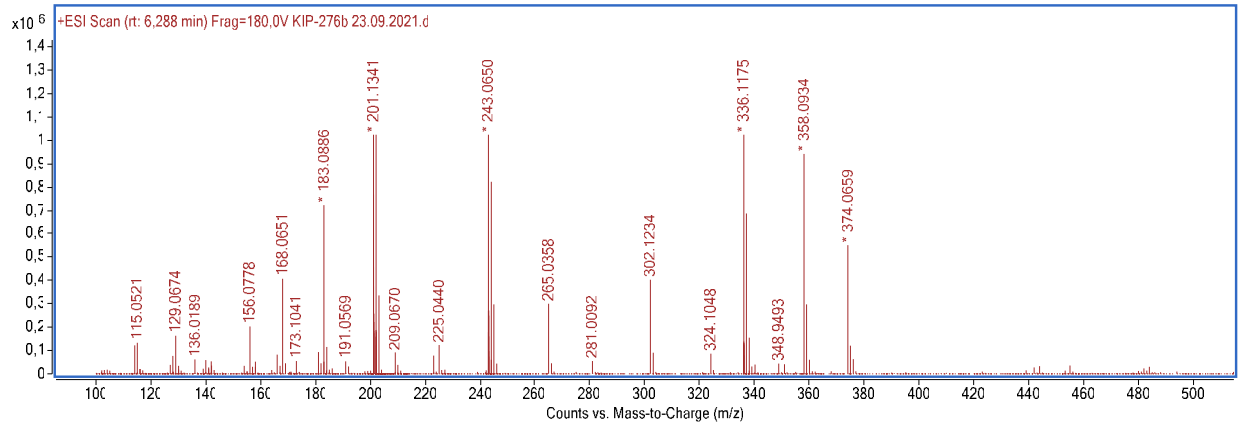


^{1}H (500 MHz, DMSO-d6) and ^{13}C (125 MHz, DMSO-d6) NMR Spectra of **11c**

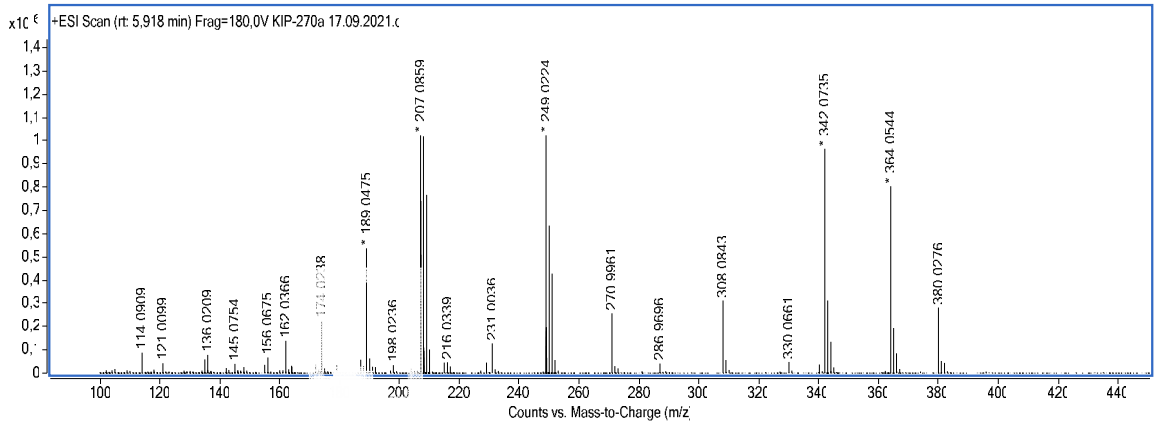
Copies of MS Spectra of Products



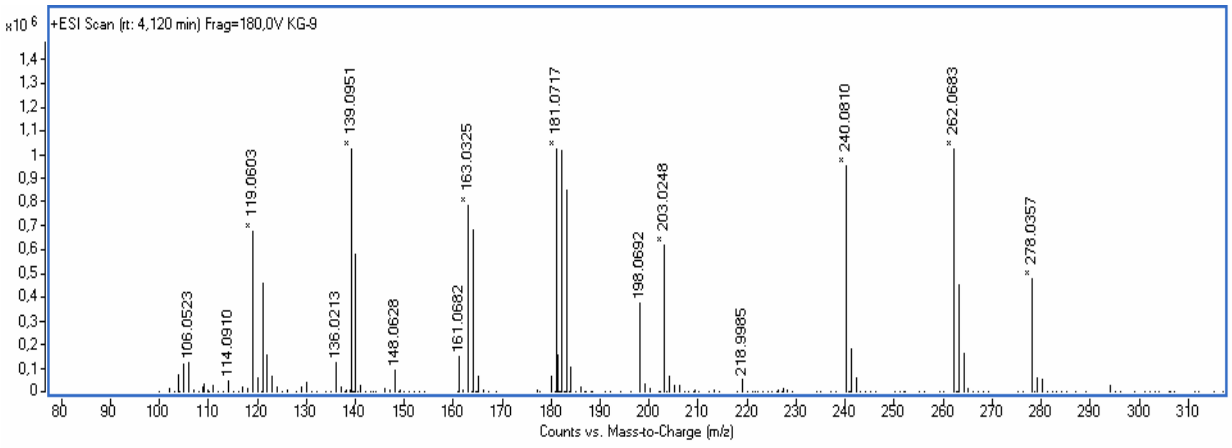
Mass spectrum (LC/Q-TOF) of (**9a**)



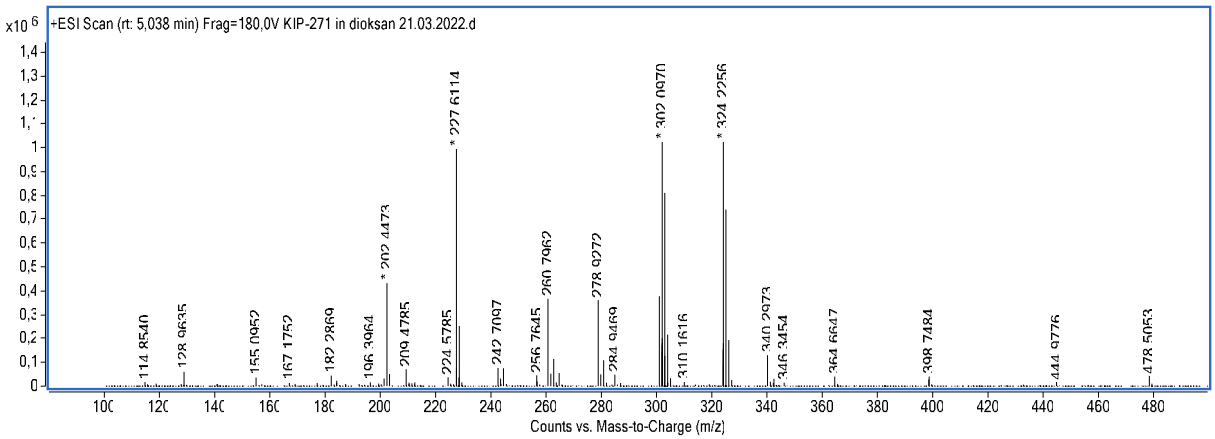
Mass spectrum (LC/Q-TOF) of (**9b**)



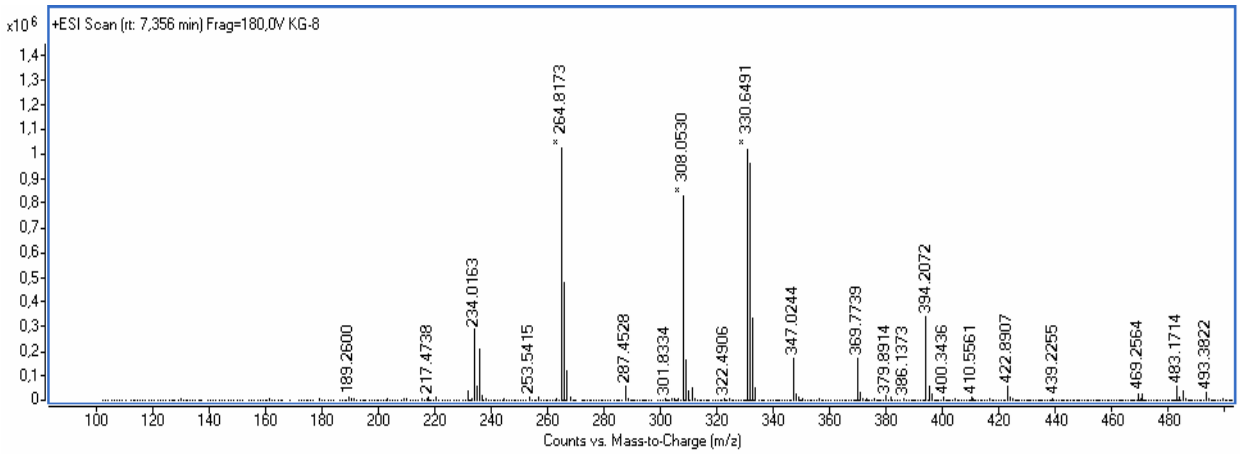
Mass spectrum (LC/Q-TOF) of (**9c**)



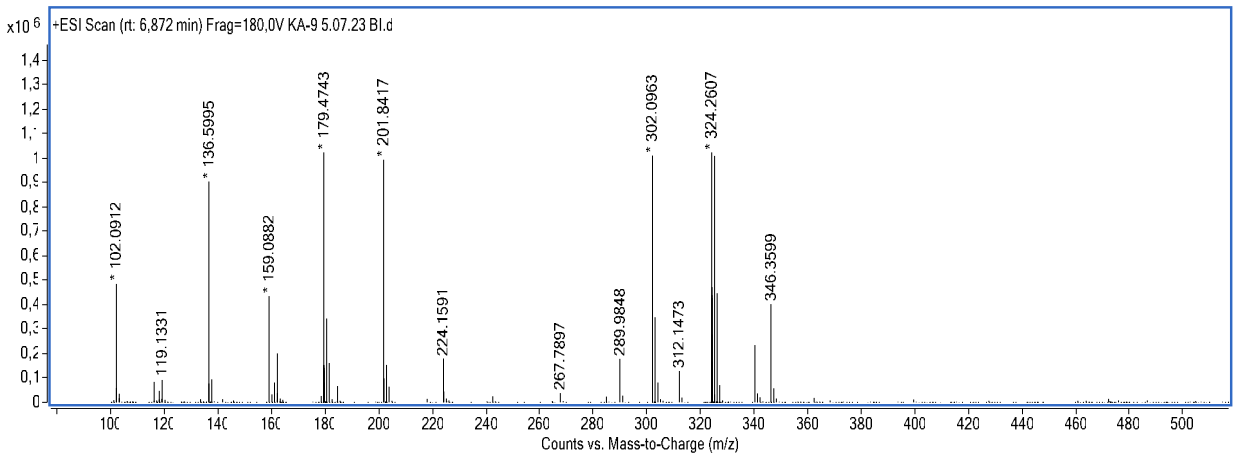
Mass spectrum (LC/Q-TOF) of (**10a**)



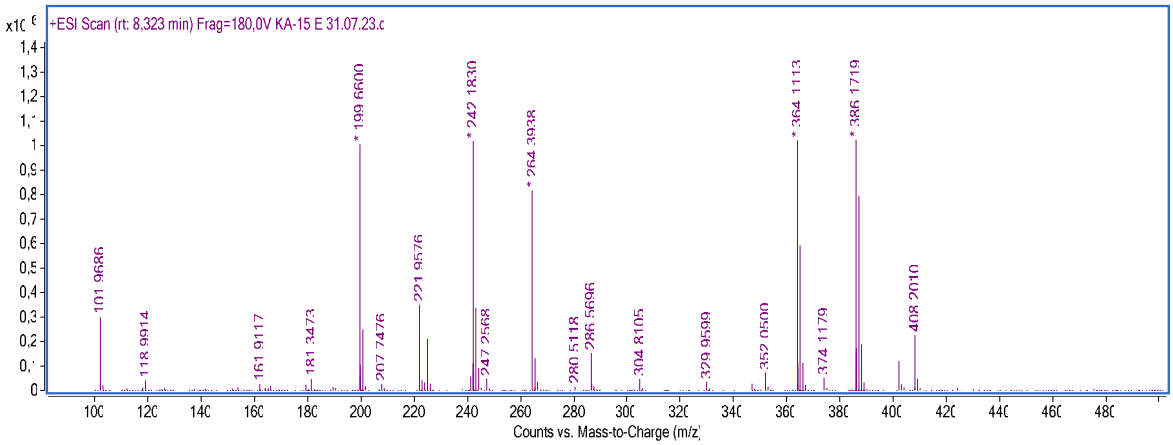
Mass spectrum (LC/Q-TOF) of (**10b**)



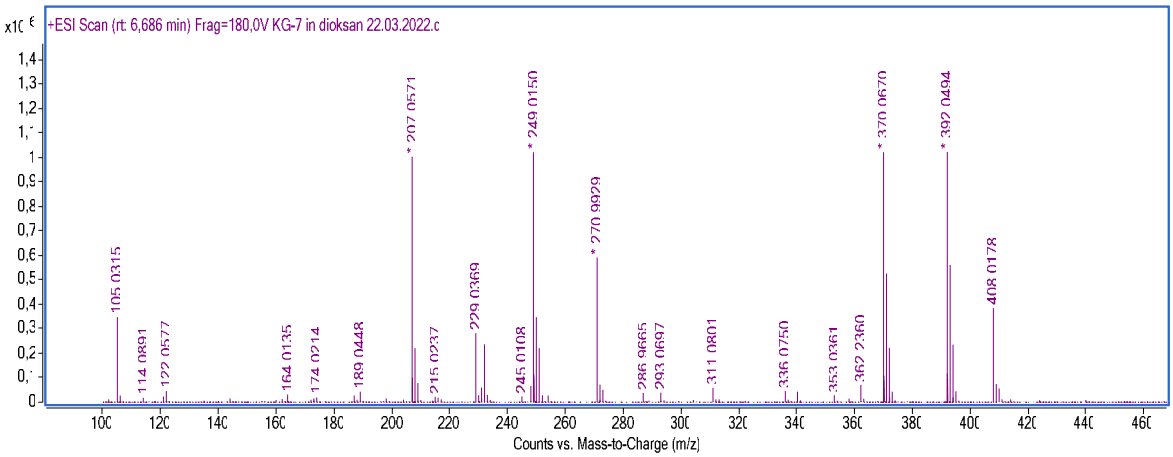
Mass spectrum (LC/Q-TOF) of (**10c**)



Mass spectrum (LC/Q-TOF) of (**11a**)

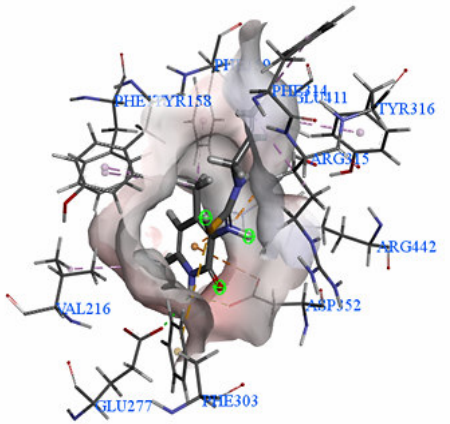
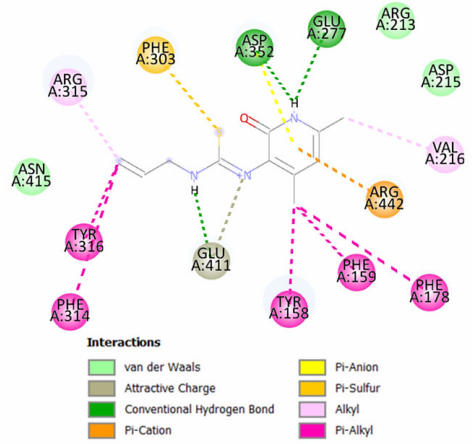
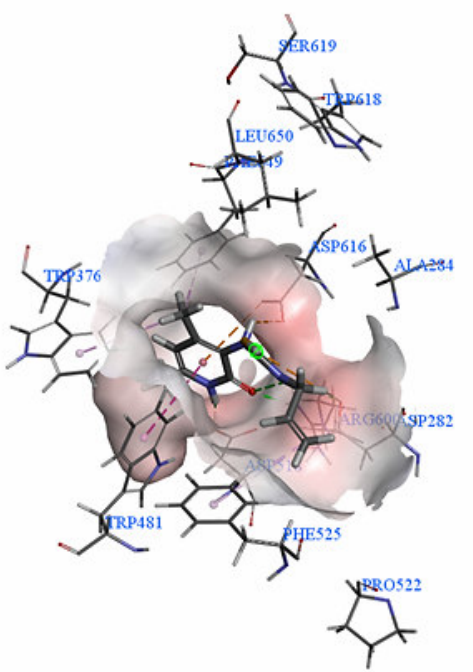
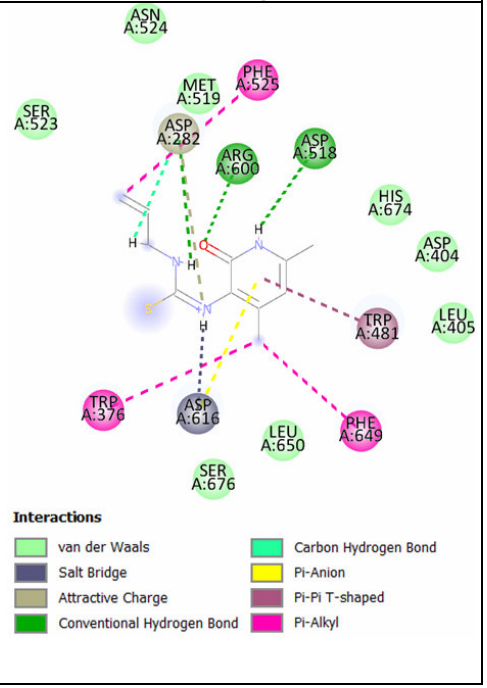


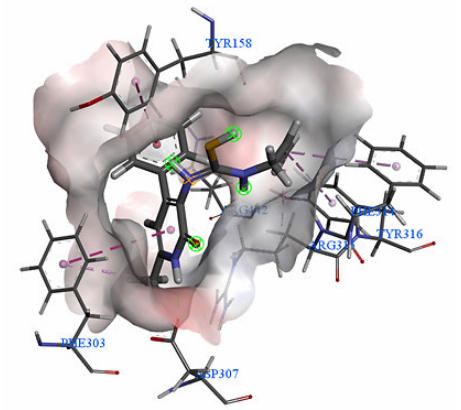
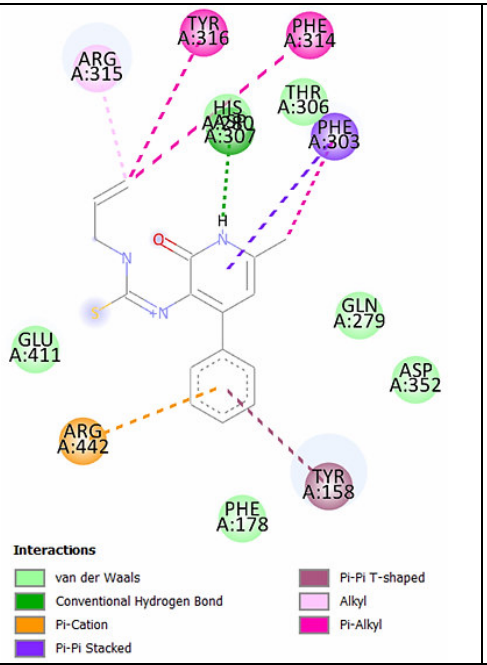
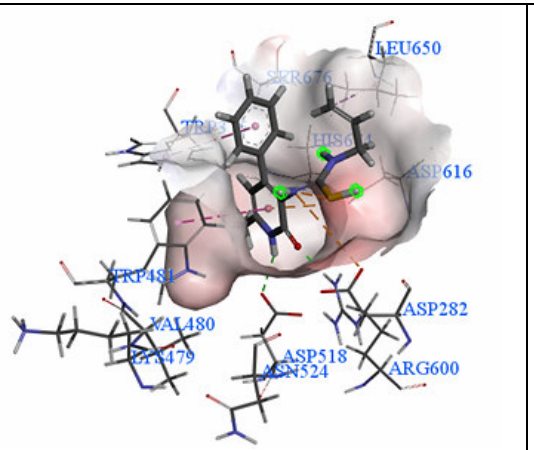
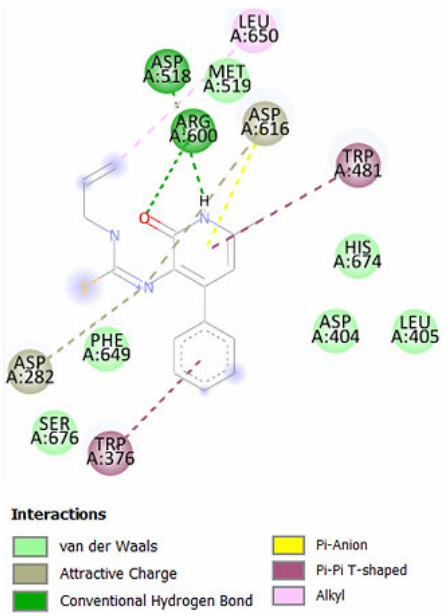
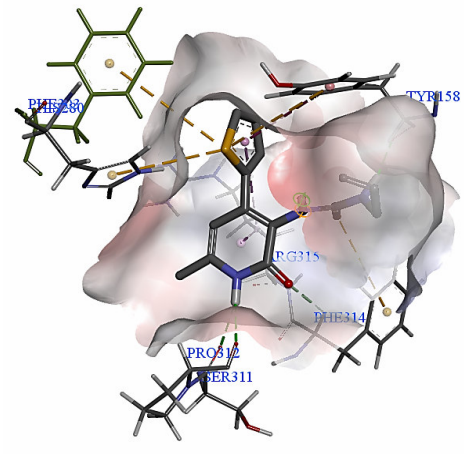
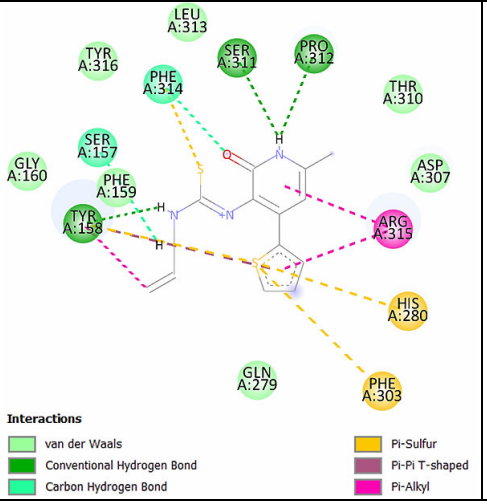
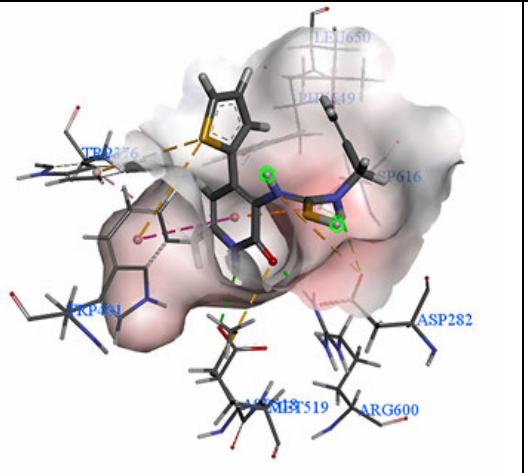
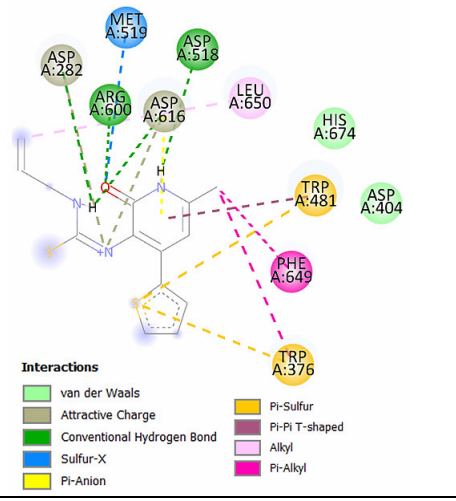
Mass spectrum (LC/Q-TOF) of (**11b**)

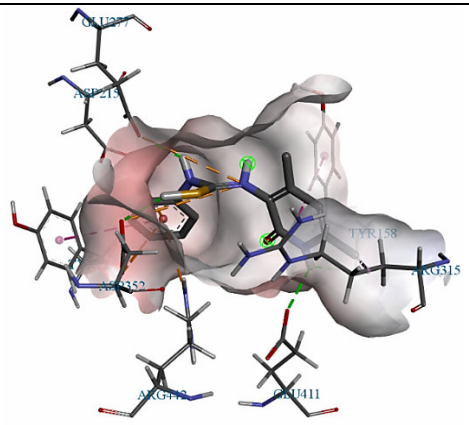
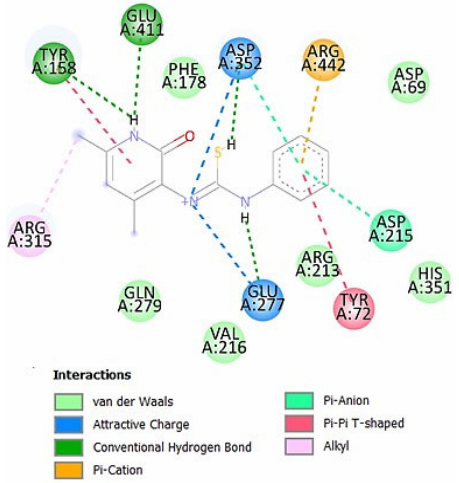
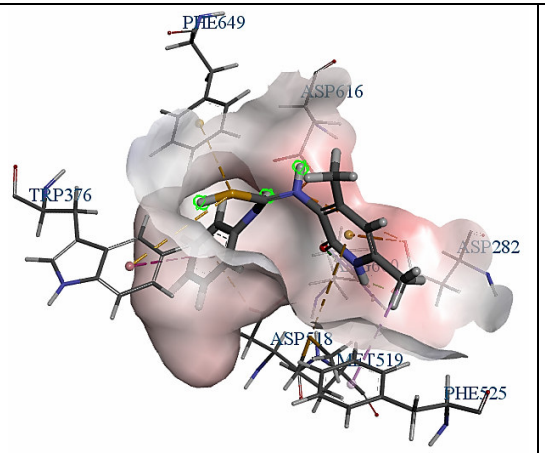
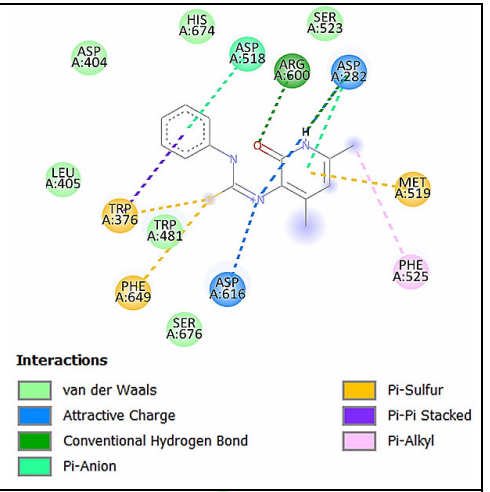
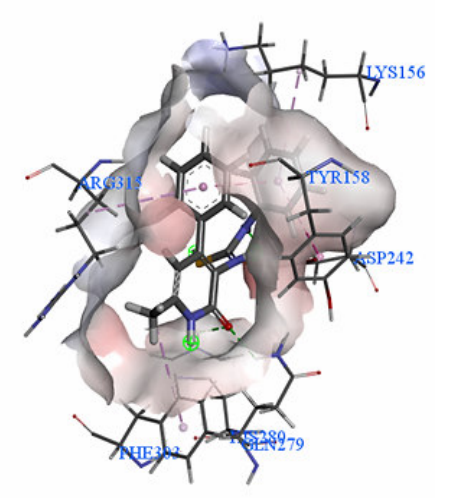
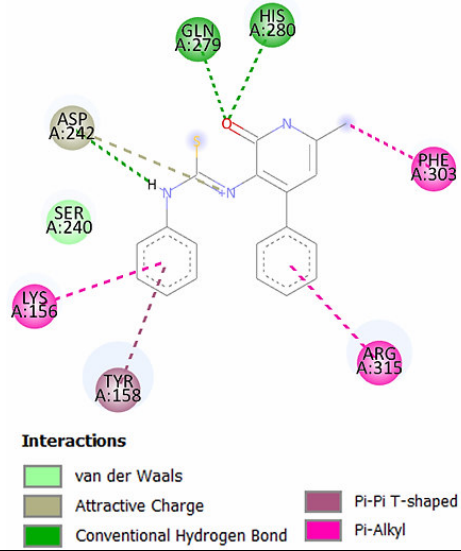
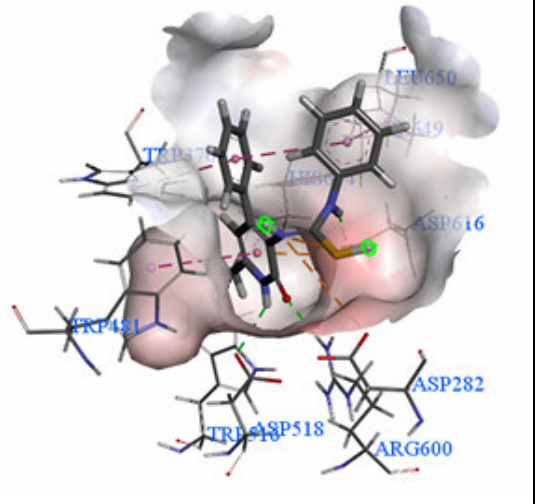
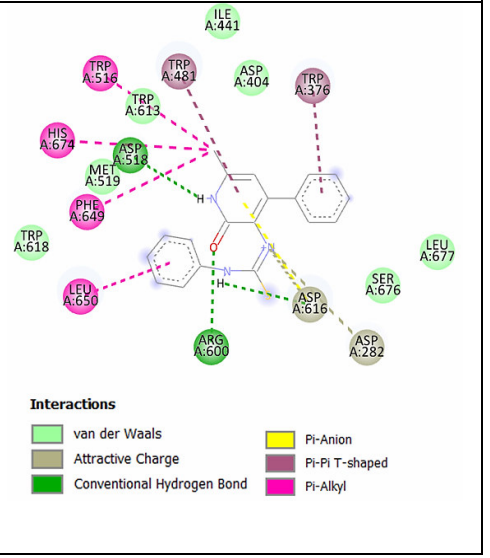


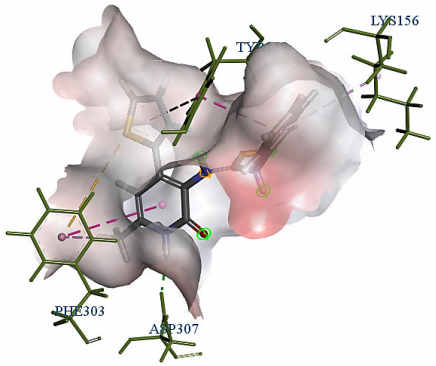
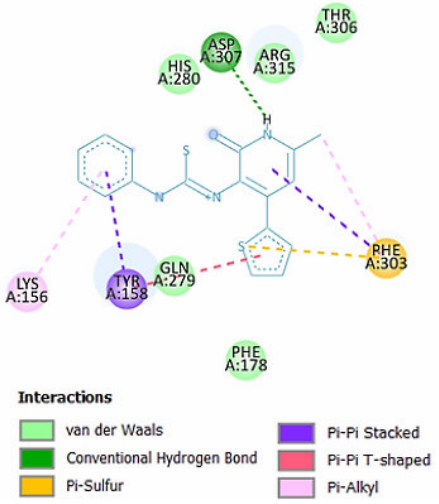
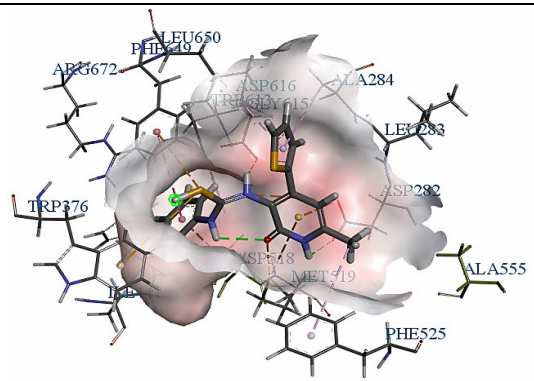
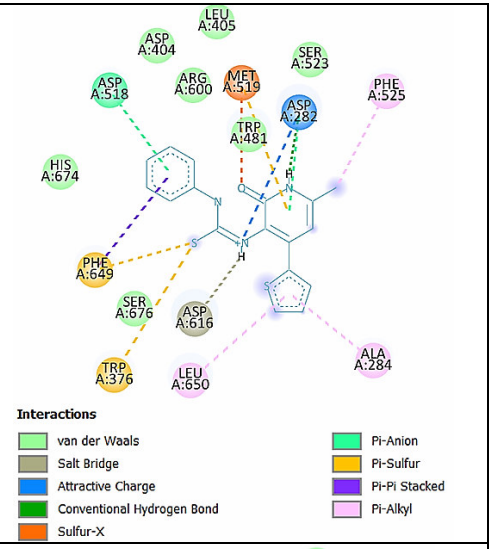
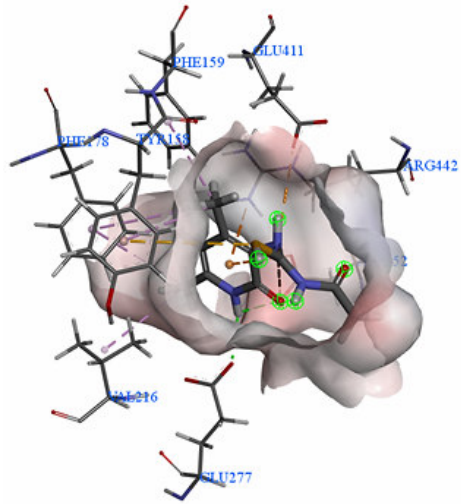
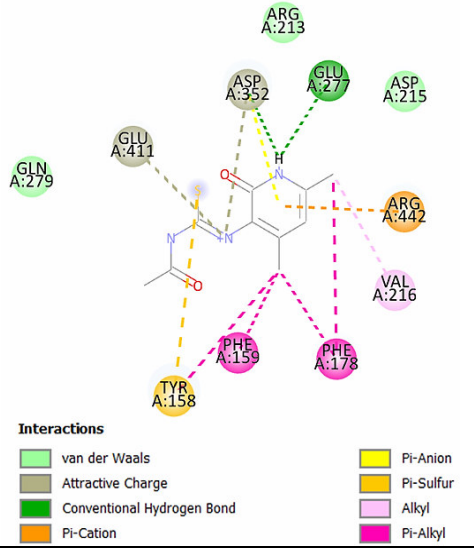
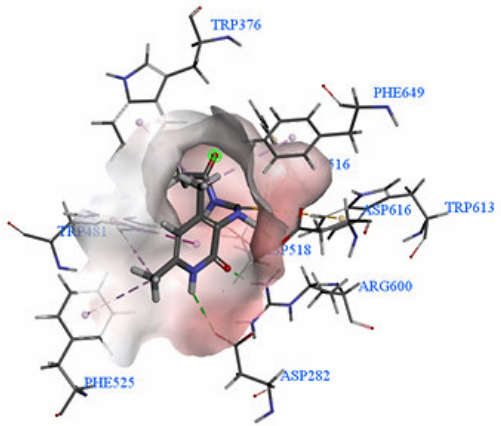
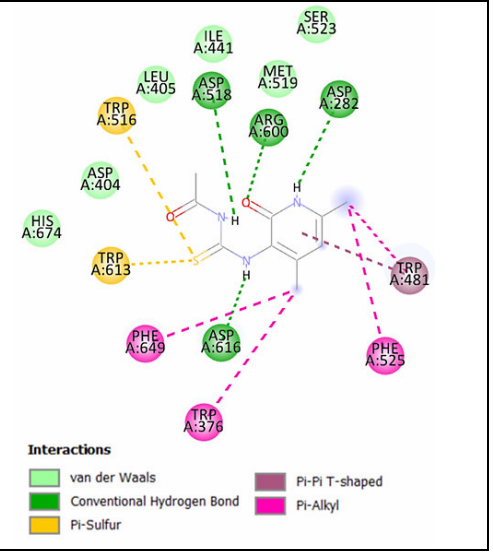
Mass spectrum (LC/Q-TOF) of (**11c**)

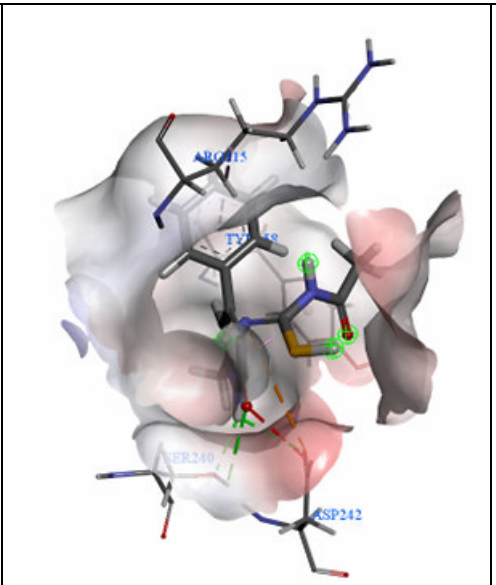
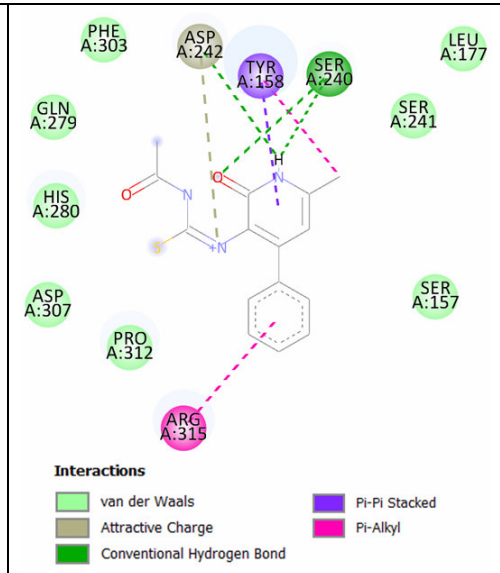
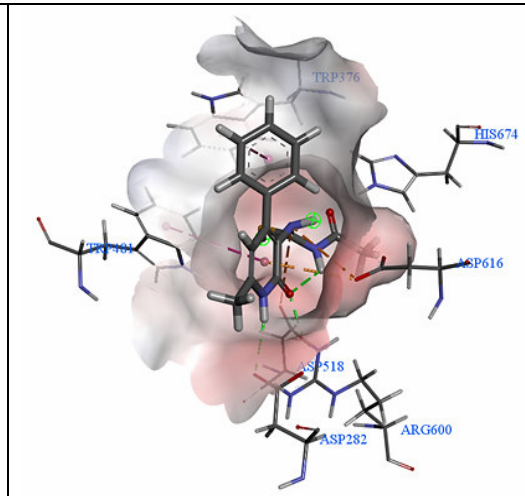
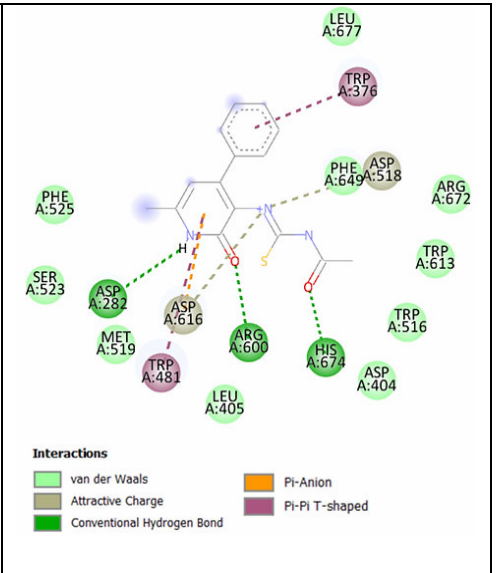
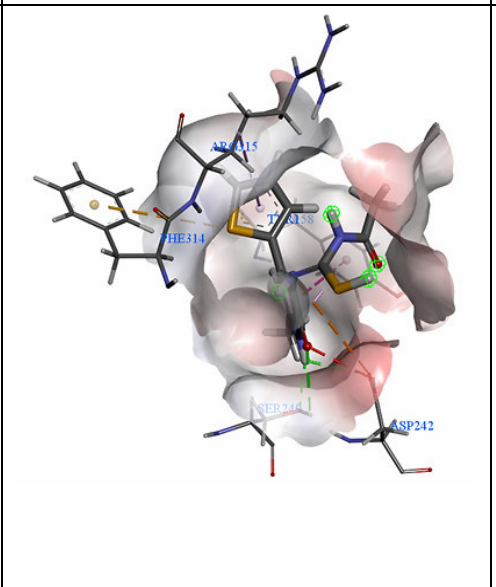
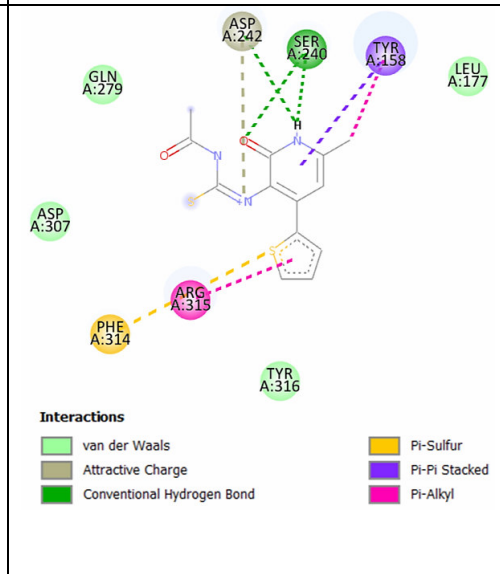
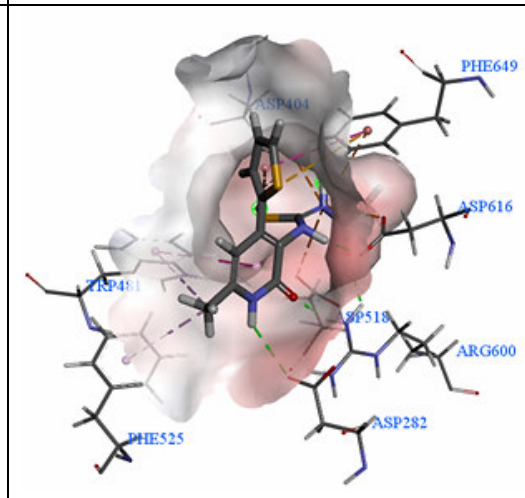
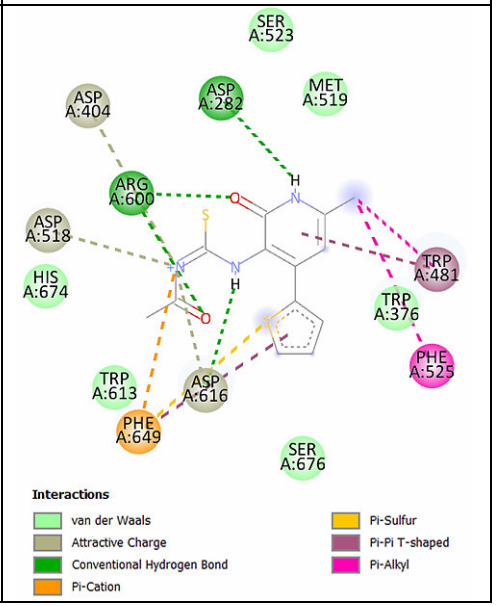
Table S1. Complexes between synthesized derivatives 8-11(a-c) and active sites of proteins (PDB: 3A4A, 5NN8)

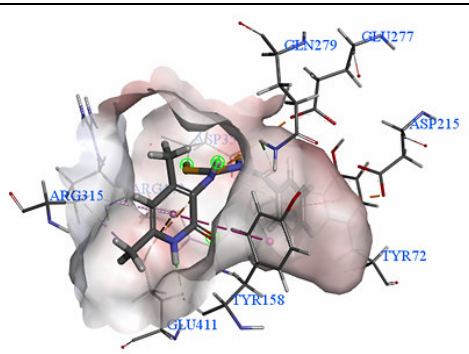
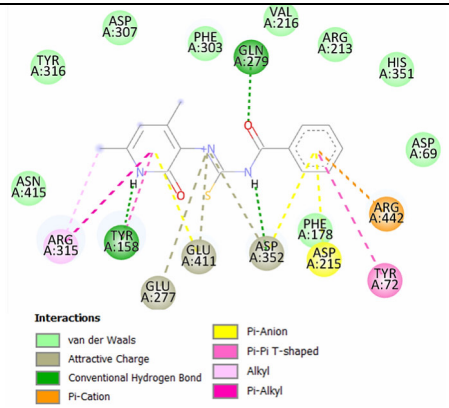
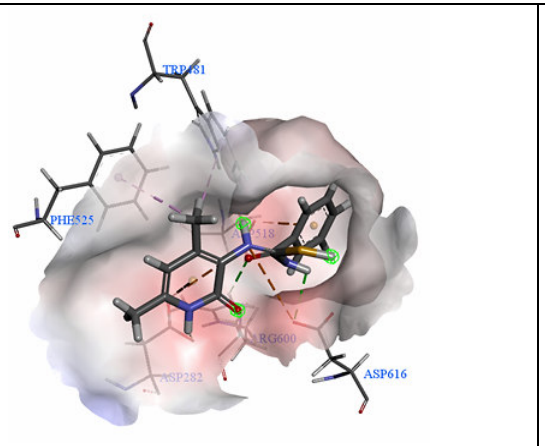
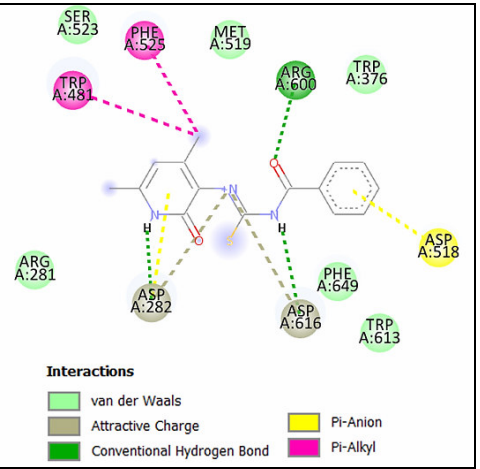
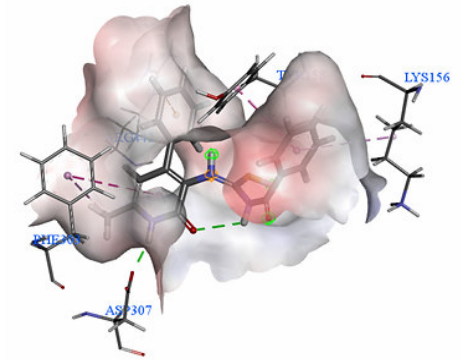
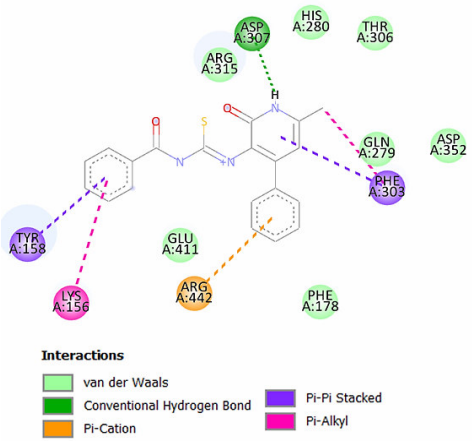
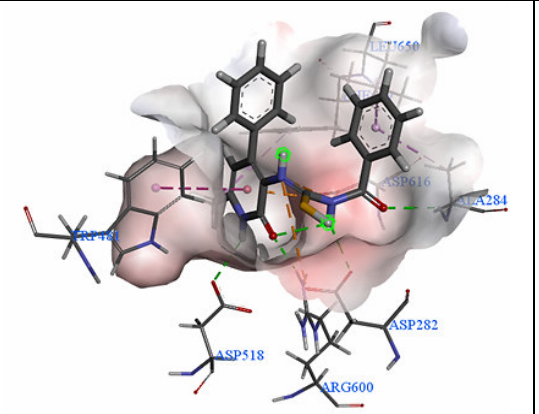
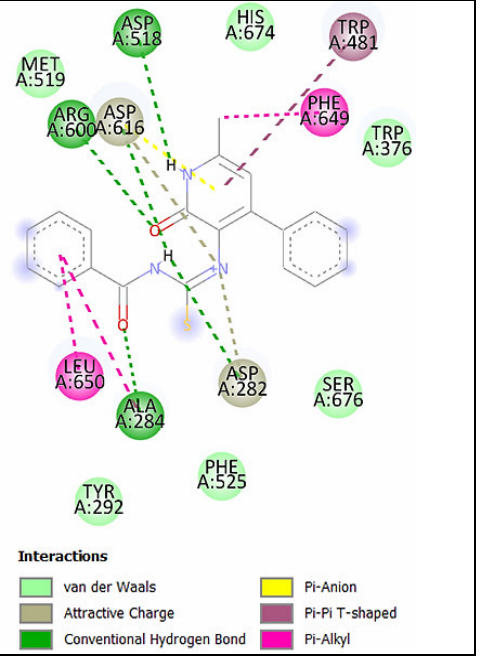
	3A4A		5NN8	
	3D docking model	2D docking model	3D docking model	2D docking model
8a				

8b		 TYR A:316 PHE A:314 ARG A:315 THR A:306 HIS A:280 PHE A:303 GLN A:279 GLU A:411 ASP A:352 ARG A:442 TYR A:158 PHE A:178 Interactions van der Waals Conventional Hydrogen Bond Pi-Cation Pi-Pi Stacked Pi-Pi T-shaped Alkyl Pi-Alkyl	 LEU650 ASP616 TRP481 VAL480 ASP282 ASP518 ARG600	 LEU A:650 ASP A:518 MET A:519 ARG A:600 ASP A:616 TRP A:481 HIS A:674 ASP A:404 LEU A:405 PHE A:649 ASP A:282 SER A:676 TRP A:376 Interactions van der Waals Attractive Charge Conventional Hydrogen Bond Pi-Anion Pi-Pi T-shaped Alkyl
8c		 LEU A:313 TYR A:316 SER A:311 PRO A:312 PHE A:314 THR A:310 SER A:157 GLY A:160 ASP A:307 PHE A:159 TYR A:158 ARG A:315 HIS A:280 GLN A:279 PHE A:303 Interactions van der Waals Conventional Hydrogen Bond Carbon Hydrogen Bond Pi-Sulfur Pi-Pi T-shaped Pi-Alkyl	 ASP282 ARG600	 MET A:519 ASP A:518 ASP A:282 ARG A:600 ASP A:616 LEU A:650 HIS A:674 TRP A:481 ASP A:404 PHE A:649 TRP A:376 Interactions van der Waals Attractive Charge Conventional Hydrogen Bond Sulfur-X Pi-Anion Pi-Sulfur Pi-Pi T-shaped Alkyl Pi-Alkyl

9a		GLU A:411 TYR A:158 PHE A:178 ASP A:352 ARG A:442 ASP A:69 ARG A:315 ASP A:215 ARG A:213 HIS A:351 GLN A:279 GLU A:277 TYR A:72 VAL A:216 Interactions van der Waals Attractive Charge Conventional Hydrogen Bond Pi-Cation Pi-Anion Pi-Pi T-shaped Alkyl	PHE649 ASP616 TRP376 ASP282 ASP518 MET519 PHE525	HIS A:674 SER A:523 ASP A:404 ASP A:518 ARG A:600 ASP A:282 LEU A:405 MET A:519 TRP A:376 TRP A:481 PHE A:525 PHE A:649 ASP A:616 SER A:676 Interactions van der Waals Attractive Charge Conventional Hydrogen Bond Pi-Anion Pi-Sulfur Pi-Pi Stacked Pi-Alkyl
9b	LYS156 ARG315 TYR158 ASP242 PHE303 HIS280 GLN279	GLN A:279 HIS A:280 ASP A:242 PHE A:303 SER A:240 LYS A:156 TYR A:158 ARG A:315 Interactions van der Waals Attractive Charge Conventional Hydrogen Bond Pi-Pi T-shaped Pi-Alkyl	LEU650 ASP616 TRP481 ASP282 ASP518 ARG600	ILE A:441 TRP A:516 TRP A:481 ASP A:404 TRP A:376 TRP A:613 HIS A:674 ASP A:518 MET A:519 PHE A:649 TRP A:618 LEU A:677 LEU A:650 SER A:676 ASP A:616 ARG A:600 ASP A:282 Interactions van der Waals Attractive Charge Conventional Hydrogen Bond Pi-Anion Pi-Pi T-shaped Pi-Alkyl

9c	LYS156 PHE303 ASP307	THR A:306 ASP A:307 ARG A:315 HIS A:280 PHE A:303 GLN A:279 LYS A:156 TYR A:158 PHE A:178 Interactions van der Waals Conventional Hydrogen Bond Pi-Sulfur Pi-Pi Stacked Pi-Pi T-shaped Pi-Alkyl	LEU650 ARG672 ALA284 TRP376 ALA555 PHE525	LEU A:405 ASP A:404 SER A:523 ASP A:518 ARG A:600 MET A:519 PHE A:525 ASP A:282 TRP A:481 HIS A:674 PHE A:649 SER A:676 ASP A:616 TRP A:376 LEU A:650 ALA A:284 Interactions van der Waals Salt Bridge Attractive Charge Conventional Hydrogen Bond Sulfur-X Pi-Anion Pi-Sulfur Pi-Pi Stacked Pi-Alkyl
10a	PHE159 GLU411 ARG442 GLU277	ARG A:213 ASP A:352 GLU A:277 ASP A:215 GLU A:411 GLN A:279 ARG A:442 VAL A:216 PHE A:159 PHE A:178 TYR A:158 Interactions van der Waals Attractive Charge Conventional Hydrogen Bond Pi-Cation Pi-Anion Pi-Sulfur Alkyl Pi-Alkyl	TRP376 PHE649 ASP616 TRP613 ARG600 PHE525 ASP282	SER A:523 ILE A:441 LEU A:405 ASP A:518 MET A:519 TRP A:516 ASP A:282 ARG A:600 ASP A:404 HIS A:674 TRP A:613 TRP A:481 PHE A:649 ASP A:616 PHE A:525 TRP A:376 Interactions van der Waals Conventional Hydrogen Bond Pi-Sulfur Pi-Pi T-shaped Pi-Alkyl

10b		PHE A:303 ASP A:242 TYR A:158 SER A:240 LEU A:177 GLN A:279 SER A:241 HIS A:280 ASP A:307 SER A:157 PRO A:312 ARG A:315 Interactions van der Waals Attractive Charge Conventional Hydrogen Bond Pi-Pi Stacked Pi-Alkyl	TRP376 HIS674 ASP616 ASP518 ASP282 ARG600	LEU A:677 TRP A:376 PHE A:649 ASP A:518 ARG A:672 PHE A:525 TRP A:613 SER A:523 ASP A:282 ASP A:616 TRP A:516 MET A:519 ARG A:600 HIS A:674 TRP A:481 ASP A:404 LEU A:405 Interactions van der Waals Attractive Charge Conventional Hydrogen Bond Pi-Anion Pi-Pi T-shaped
10c		ASP A:242 SER A:240 TYR A:158 GLN A:279 LEU A:177 ASP A:307 ARG A:315 PHE A:314 TYR A:316 Interactions van der Waals Attractive Charge Conventional Hydrogen Bond Pi-Sulfur Pi-Pi Stacked Pi-Alkyl	PHE649 ASP404 ASP616 TRP481 ASP518 ARG600 PHE525 ASP282	SER A:523 ASP A:404 ASP A:282 MET A:519 ARG A:600 ASP A:518 TRP A:481 HIS A:674 TRP A:376 PHE A:525 TRP A:613 ASP A:616 PHE A:649 SER A:676 Interactions van der Waals Attractive Charge Conventional Hydrogen Bond Pi-Cation Pi-Sulfur Pi-Pi T-shaped Pi-Alkyl

11 a	GLN279 GLU277 ASP215 ARG315 TYR72 TYR158 GLU411	ASP A:307 VAL A:216 PHE A:303 GLN A:279 ARG A:213 TYR A:316 HIS A:351 ASP A:69 ASN A:415 ARG A:442 ARG A:315 TYR A:158 GLU A:411 ASP A:352 PHE A:178 ASP A:215 GLU A:277 TYR A:72 Interactions van der Waals Attractive Charge Conventional Hydrogen Bond Pi-Cation Pi-Anion Pi-Pi T-shaped Alkyl Pi-Alkyl	TRP481 PHE525 ASP282 ASP616	SER A:523 PHE A:525 MET A:519 TRP A:481 ARG A:600 TRP A:376 ASP A:518 ARG A:281 ASP A:282 PHE A:649 ASP A:616 TRP A:613 Interactions van der Waals Attractive Charge Conventional Hydrogen Bond Pi-Anion Pi-Alkyl
11b	LYS156 PHE178 ASP307	ASP A:307 HIS A:280 THR A:306 ARG A:315 GLN A:279 ASP A:352 PHE A:303 TYR A:158 GLU A:411 LYS A:156 ARG A:442 PHE A:178 Interactions van der Waals Conventional Hydrogen Bond Pi-Cation Pi-Pi Stacked Pi-Alkyl	LEU650 ASP616 ALA284 TRP481 ASP518 ASP282 ARG600	ASP A:518 HIS A:674 TRP A:481 MET A:519 ARG A:600 ASP A:616 PHE A:649 TRP A:376 LEU A:650 ASP A:282 SER A:676 ALA A:284 PHE A:525 TYR A:292 Interactions van der Waals Attractive Charge Conventional Hydrogen Bond Pi-Anion Pi-Pi T-shaped Pi-Alkyl

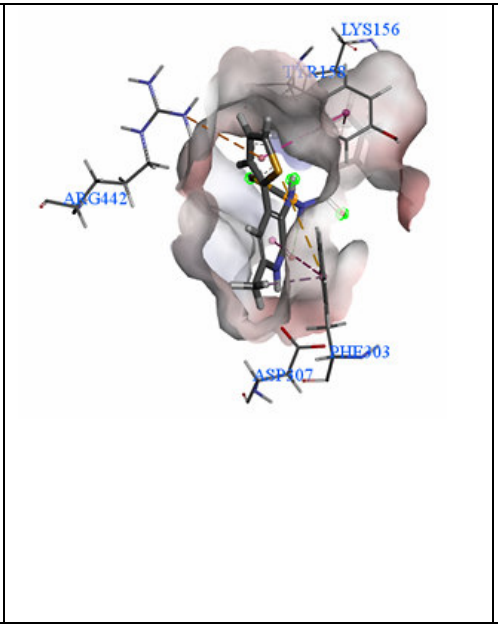
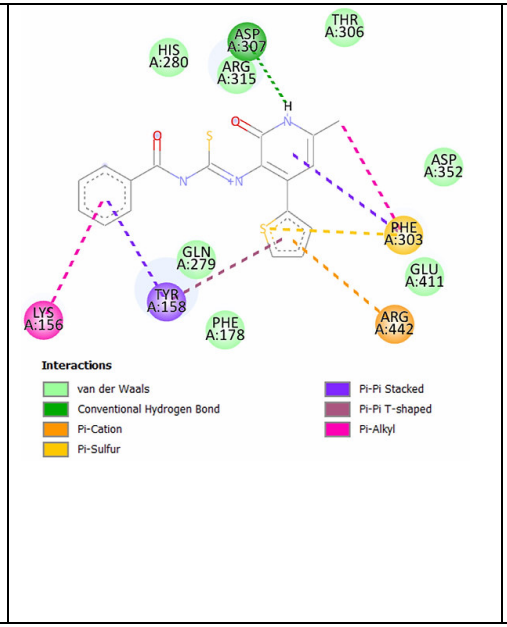
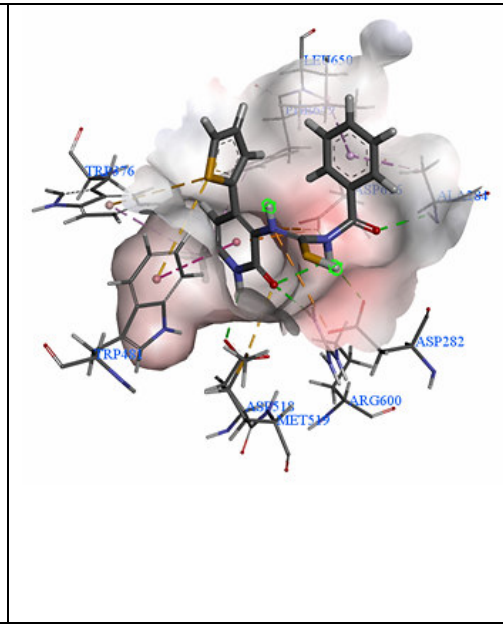
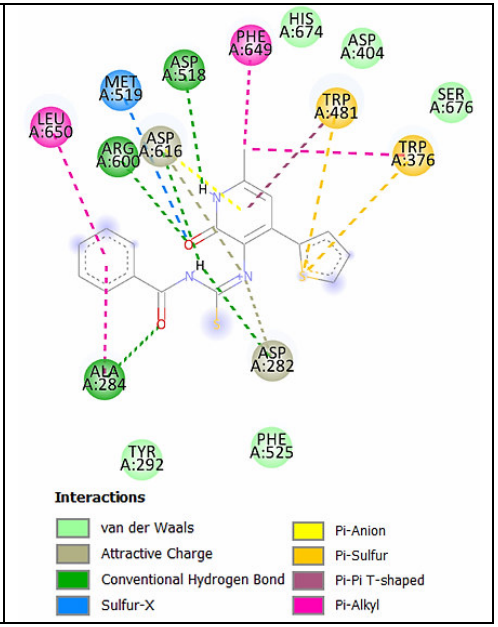
11c	LYS156 ARG442 PHE303 ASP307	THR A:306 HIS A:280 ASP A:307 ARG A:315 ASP A:352 PHE A:303 GLN A:279 GLU A:411 TYR A:158 LYS A:156 PHE A:178 ARG A:442 Interactions van der Waals Conventional Hydrogen Bond Pi-Cation Pi-Sulfur Pi-Pi Stacked Pi-Pi T-shaped Pi-Alkyl	TRP376 ASP282 ARG600	HIS A:674 PHE A:649 ASP A:404 ASP A:518 MET A:519 TRP A:481 SER A:676 LEU A:650 ASP A:616 ARG A:600 TRP A:376 ASP A:282 ALA A:284 TYR A:292 PHE A:525 Interactions van der Waals Attractive Charge Conventional Hydrogen Bond Sulfur-X Pi-Anion Pi-Sulfur Pi-Pi T-shaped Pi-Alkyl

Table S2. Basic amino acid interactions and H-bonds

Compound	Receptor	H-bond	Residual Amino acid Interactions	
			Pi-Sulfur/ Pi-Anion/Pi-Pi Stacked/ Pi-Pi T-shaped/Pi-Alkyl/Amide-Pi Stacked/Pis interactions	Van-der Walls interactions
8a	3a4a	ASP352, GLU277, GLU411	TYR316, PHE314, GLU411, TYR158, PHE159, PHE178, ARG442, VAL216, ASP352, PHE303, ARG315	ASN415, ARG213, ASP215
8b		ASP307	ARG442, TYR158, ARG315, TYR316, PHE314, PHE303	GLU411, PHE178, ASP352, GLN279, HIS280, THR306
8c		SER157, PHE314, SER311, PRO312, TYR158	TYR158, PHE314, ARG315, HIS280, PHE303	GLY160, PHE159, GLN279, THR310, ASP307, TYR316, LEU313
9a		TYR158, GLU411, ASP352, GLU277	ARG315, GLU277, TYR72, ASP215, ARG442, ASP352, TYR158	PHE178, GLN279, VAL216, HIS351, ARG213, ASP69
9b		GLN279, HIS280, ASP242	ASP242, PHE303, ARG315, TYR158, LYS156	SER240

9c		ASP307	LYS156, TYR158, PHE303	HIS280, GLN279, PHE178, ARG315, THR306
10a		ASP352, GLU277	GLU411, ASP352, ARG442, VAL216, PHE178, PHE159, TYR158	GLN279, ARG213, ASP215
10b		ASP242, SER240	ASP242, TYR158, SER240, ARG315	PRO312, ASP307, HIS280, GLN279, PHE303, LEU177, SER241, SER157
10c		ASP242, SER240	ASP242, TYR158, ARG315, PHE314	ASP307, GLN279, LEU177, TYR316
11a		TYR158, GLN279, ASP352	ARG315, TYR158, GLU277, GLU411, ASP352, ASP215, TYR72, ARG442	ASN415, TYR316, ASP307, PHE303, VAL216, ARG213, HIS351, ASP69, PHE178
11b		ASP307	TYR158, LYS156, ARG442, PHE303	GLU411, PHE178, GLN279, ARG315, HIS280, THR306
11c		ASP307	LYS156, TYR158, ARG442, PHE303	GLN279, PHE178, GLU411, ASP352, THR306, ARG315, HIS280
8a	5NN8	ASP282, ARG600, ASP518	PHE525, ASP282, ASP616, TRP376, PHE649, TRP481	SER523, ASN524, MET519, HIS674, ASP404, LEU405, LEU650, SER676
8b		ASP518, ARG600	LEU650, ASP616, TRP481,	PHE649, SER676, MET519,

			TRP376, ASP282	HIS674, ASP404, LEU405
8c		ASP282, ARG600, ASP518	MET519, ASP282, ASP616, LEU650, TRP481, PHE649, TRP376	HIS674, ASP404
9a		ARG600, ASP282	TRP376, PHE649, ASP616, MET519, PHE525, ASP282, ASP518	ASP404, LEU405, TRP481, SER676, SER523, HIS674
9b		ASP518, ARG600, ASP616	TRP481, TRP516, HIS674, PHE649, LEU650, ASP616, ASP282, TRP376	ILE441, ASP404, TRP613, MET519, TRP618, SER676, LEU677
9c		ASP282	ASP518, PHE649, TRP376, ASP616, LEU650, ALA284, PHE525, ASP282, MET519	HIS674, SER676, TRP481, SER523, LEU405, ARG600, ASP404
10a		ASP616, ASP282, ARG600, ASP518	TRP516, TRP613, PHE649, TRP376, PHE525, TRP481	HIS674, ASP404, LEU405, ILE441, MET519, SER523
10b		ASP282, ARG600, HIS674	ASP616, TRP481, ASP518, TRP376	PHE525, SER523, MET519, LEU405, ASP404, TRP516, TRP613, ARG672, PHE649, LEU677
10c		ARG600, ASP282	ASP404, ASP518, PHE649, ASP616, PHE525, TRP481	HIS674, TRP613, SER676, TRP376, MET519, SER523
11a		ARG600, ASP282,	ASP282, ASP616, PHE525,	ARG281, SER523, MET519,

		ASP616	TRP481, ASP518	TRP376, PHE649, TRP613
11b		ALA284, ASP282, ARG600, ASP518, ASP616	ASP518, ASP616, LEU650, ALA284, PHE649, TRP481	MET519, TRP292, PHE525, SER676, TRP376, HIS674
11c		ALA284, ARG600, ASP518, ASP616, ASP282	ASP616, ASP282, MET519, LEU650, ALA284, PHE649, TRP481, TRP376	TYR292, PHE525, HIS674, ASP404, SER676