Electronic Supplementary Material (ESI) for RSC Advances.

Five and six membered heterocyclic rings endowed with azobenzene as dual EGFR^{T790M} and VEGFR-2 inhibitors: Design, synthesis, *in silico* ADMET profile, molecular docking, dynamic simulation and anticancer evaluations

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Docking studies

In the present work, all the target compounds were subjected to docking study to explore their binding mode towards VEGFR-2 and $EGFR^{T790M}$ receptors. All modeling experiments were performed using molsoft program, which provides a unique set of tools for the modeling of protein/ligand interactions. It predicts how small flexible molecule such as substrates or drug candidates bind to a protein of known 3D structure represented by grid interaction potentials (http://www.molsoft.com/icm_pro.html). The experimental work used the biological target VEGFR-2 downloaded from the Brookhaven Protein Databank (https://www.rcsb.org/structure/4ASD). Also experiments used EGFR downloaded from the Brookhaven Protein Databank (https://www.rcsb.org/structure/3W2O). In order to qualify the docking results in terms of accuracy of the predicted binding conformations in comparison with the experimental procedure, the reported VEGFR-2 and EGFR inhibitors sorafenib and erlotinib were used as reference ligands respectively.

Molecular dynamics simulation

The highly active derivatives **5**, **6**, **10** and **14** in the proteins VEGFR-2 and $EGFR^{T790M}$ were processed to a molecular dynamics study to address their binding affinity to the specific enzyme. Ligand force fields were generated using GAFF2 [50,51] and the force field AMBERff14SB for the protein [52]. The complex was solvated expanding 15.0 Å in each direction with TIP3P water box of octahedral truncated box neutralized to a salt concentration of 150 mM of NaCl. The system was prepared *via* multiple energy minimization and equilibration steps under gradual decline position restraints on the ligand and protein achieving 310 K of temperature and 1.0 bar of pressure followed by a restraint-free production run of 100 ns. The coordinates saved every 2 ns. The binding energy between the ligand and the receptor was determined by applying MM/GBSA approach on the trajectory using MM/PBSA.py script of Amber, the calculations were for the last 50 ns using snapshots of 1 ns intervals from the simulation trajectory.

Biological testing

In vitro anti-cancer activity

Cancer cells from different cancer cell lines hepatocellular carcinoma (HepG2), breast cancer (MCF-7), colorectal carcinoma (HCT-116) and lung cancer (A549) were purchased from American type Cell Culture collection (ATCC, Manassas, USA) and grown on the appropriate growth medium Roswell Park Memorial Institute medium (RPMI 1640) supplemented with 100 mg/ mL of streptomycin, 100 units/ mL of penicillin and 10% of heat-inactivated fetal bovine serum in a humidified, 5% (v/v) CO_2 atmosphere at 37 ºC Cytotoxicity assay by 3-[4,5-dimethylthiazole-2-yl]-2,5-diphenyltetrazolium bromide (MTT).

Exponentially growing cells from different cancer cell lines were trypsinized, counted and seeded at the appropriate densities (2000-1000 cells/0.33 cm2 well) into 96-well microtiter plates. Cells then were incubated in a humidified atmosphere at 37˚C for 24 hours. Then, cells were exposed to different concentrations of compounds (0.1, 10, 100 and 1000 µM) for 72 hours. Then the viability of treated cells was determined using MTT technique as follow. Cells were incubated with 200 µl of 5% MTT solution/well (Sigma Aldrich, MO) and were allowed to metabolize the dye into colored-insoluble formazan crystals for 2 hours. The remaining MTT solution were discarded from the wells and the formazan crystals were dissolved in 200 µl/well acidified isopropanol for 30 min, covered with aluminum foil and with continuous shaking using a MaxQ 2000 plate shaker (Thermo Fisher Scientific Inc, MI) at room temperature. The colorimetric assay was measured and recorded at absorbance of 570 nm using a Stat FaxR 4200 plate reader (Awareness Technology, Inc., FL). The cell viability were expressed as percentage of control and the concentration that induces 50% of maximum inhibition of cell proliferation (IC_{50}) were determined using Graph Pad Prism version 5 software (Graph Pad software Inc, CA) [53-55].

VEGFR-2 kinase inhibitory assay

The kinase activity of VEGFR-2 was measured by use of an anti-phosphotyrosine antibody with the Alpha Screen system (PerkinElmer, USA) according to manufacturer's instructions [56]. Enzyme reactions were performed in 50 mM Tris–HCl pH 7.5, 5 mM $MnCl_2$, 5 mM $MgCl_2$, 0.01% Tween-20 and 2 mM DTT, containing 10 μM ATP, 0.1 μg/mL biotinylated poly-GluTyr (4:1) and 0.1 nM of VEGFR-2 (Millipore, UK). Prior to catalytic initiation with ATP, the tested compounds at final concentrations ranging from 0-300 μg/mL and enzyme were incubated for 5 min at room temperature. The reactions were quenched by the addition of 25 μL of 100 mM EDTA, 10 μg/mL Alpha Screen streptavidine donor beads and 10 μg/mL acceptor beads in 62.5 mM HEPES pH 7.4, 250 mM NaCl, and 0.1% BSA. Plate was incubated in the dark overnight and then read by ELISA Reader (PerkinElmer, USA). Wells containing the substrate and the enzyme without compounds were used as reaction control. Wells containing biotinylated poly-GluTyr (4:1) and enzyme without ATP were used as basal control. Percent inhibition was calculated by the comparison of compounds treated to control incubations. The concentration of the test compound causing 50% inhibition (IC_{50}) was calculated from the concentration–inhibition response curve (triplicate determinations) and the data were compared with Sorafenib (Sigma-Aldrich, USA) as standard VEGFR-2 inhibitor.

$EGFR^{T790M}$ kinase inhibitory assay

Homogeneous time resolved fluorescence (HTRF) assay was applied in this test [57]. $EGFR^{T790M}$ and ATP were purchased from Sigma. Firstly $EGFR^{T790M}$ and its substrates were incubated with the tested compounds in enzymatic buffer for 5 min. ATP (1.65 μM) was added into the reaction mixture to allow starting the enzymatic reaction. The assay was conducted for 30 min at room temperature. The reaction was stopped by addition of detection reagents which contain EDTA. The detection step continued for 1 h, and then the IC50 values were determined by GraphPad Prism 5.0. Three independent experiments were performed for each concentration.

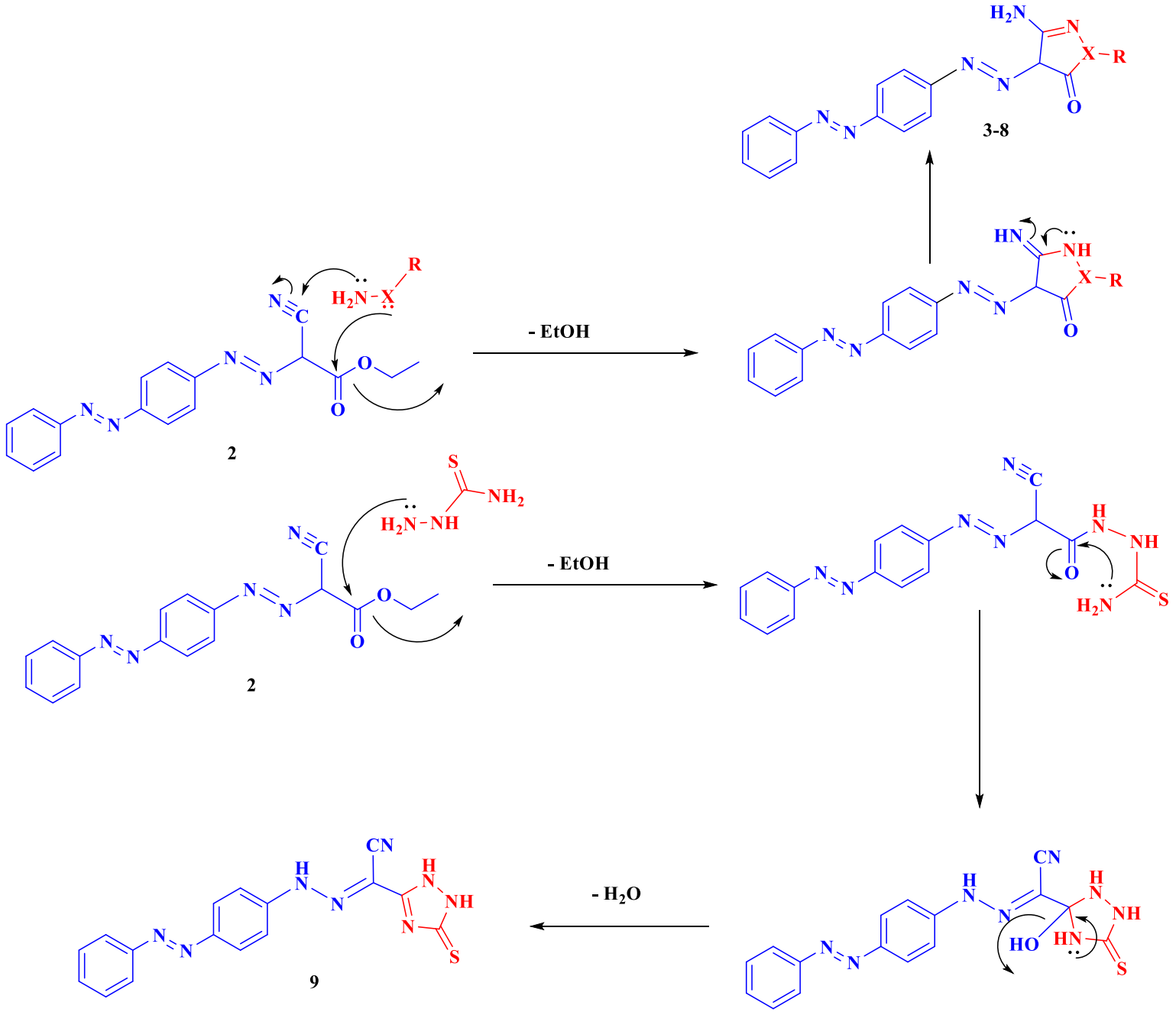


Fig. 1: The suggested pathway for formation of (**6-9**) derivatives.

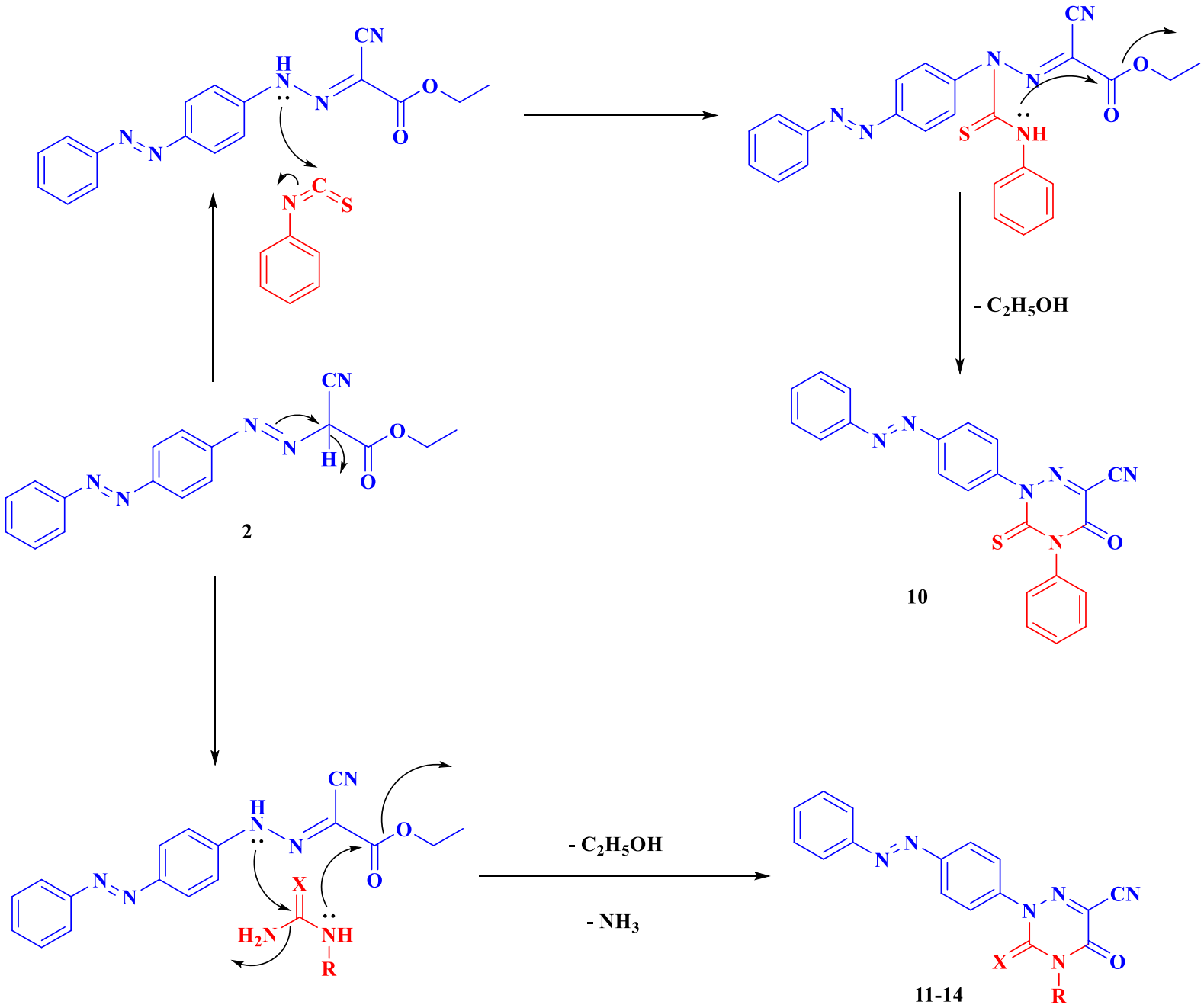


Fig. 2: The suggested pathway for syntheses of (**10-14**) derivatives.

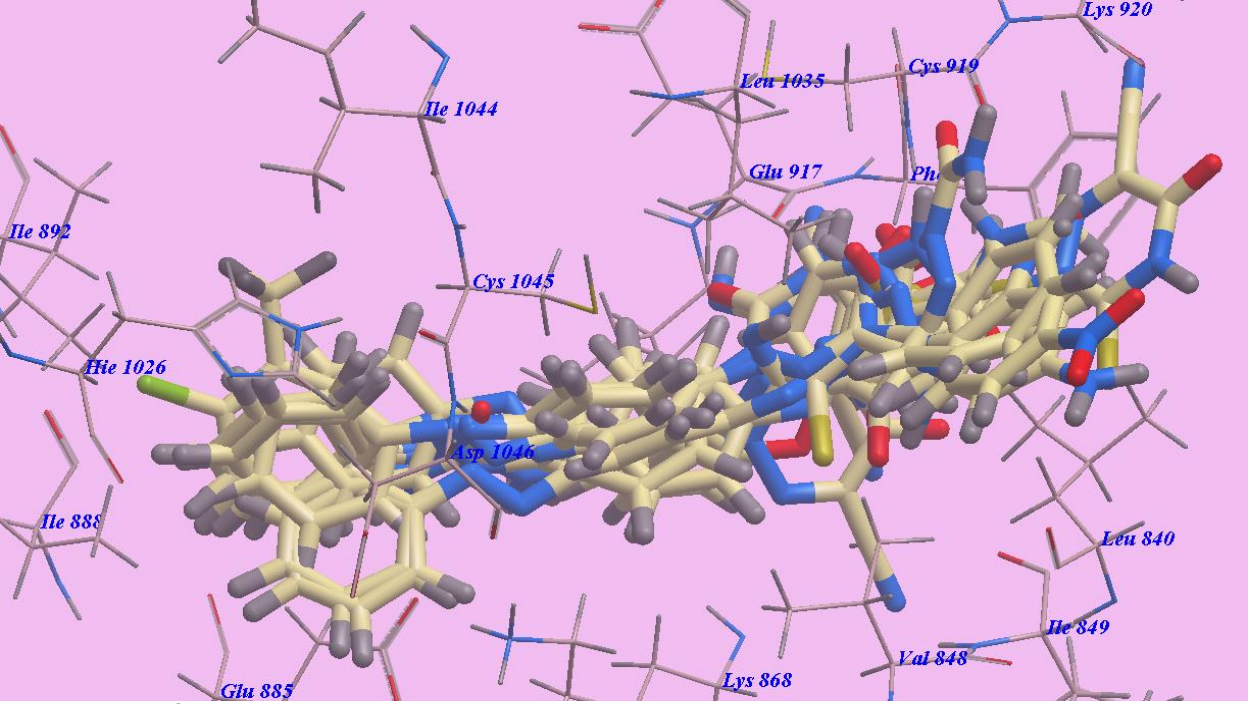


Fig. 3: A few docked compounds superimposed inside the 4ASD's binding space.

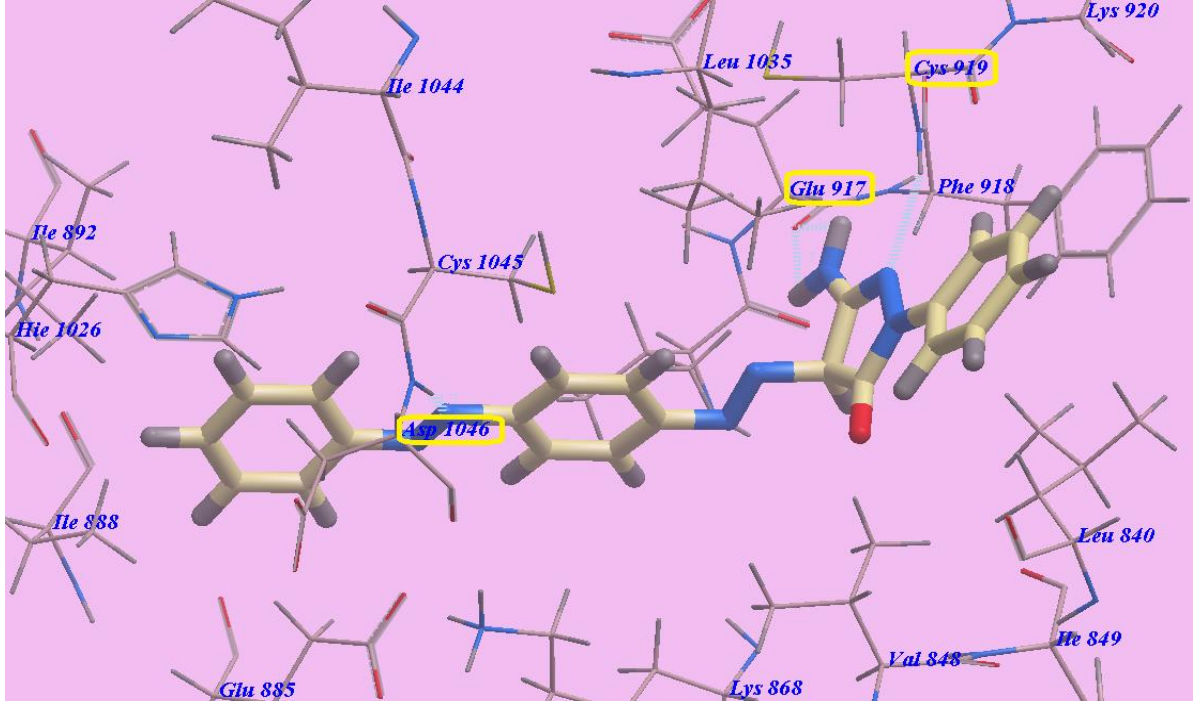


Fig. 4: Anticipated mode of binding for **5** with 4ASD.

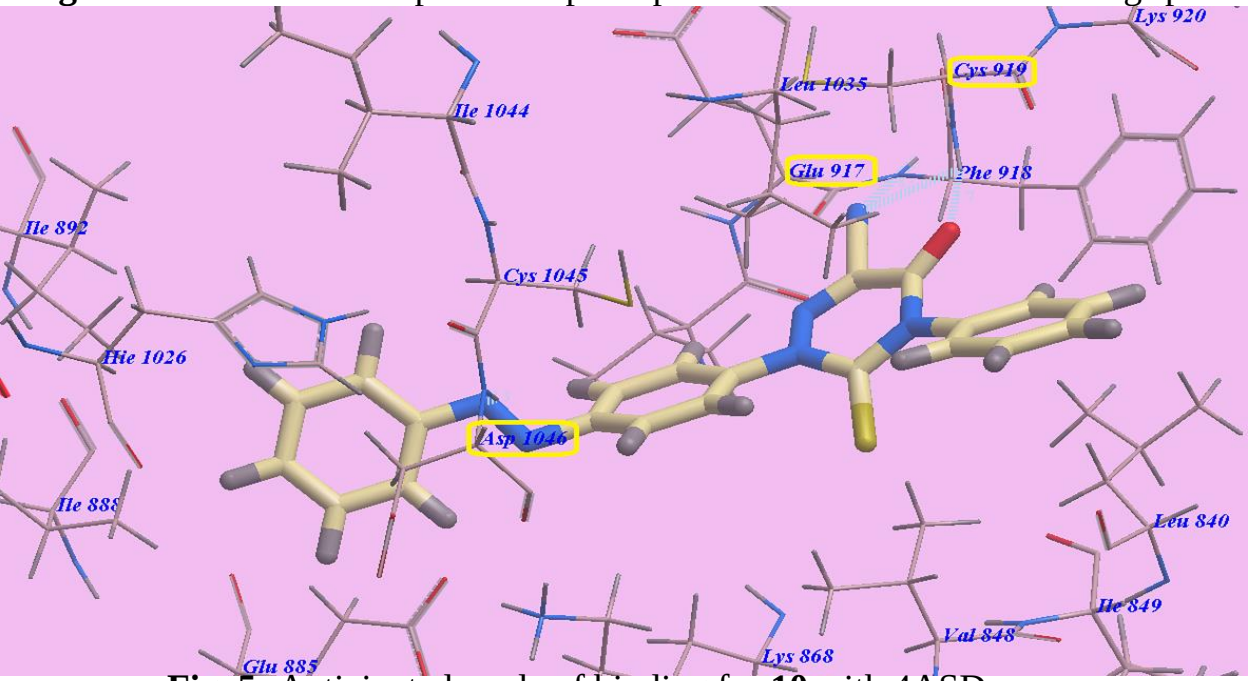


Fig. 5: Anticipated mode of binding for **10** with 4ASD.

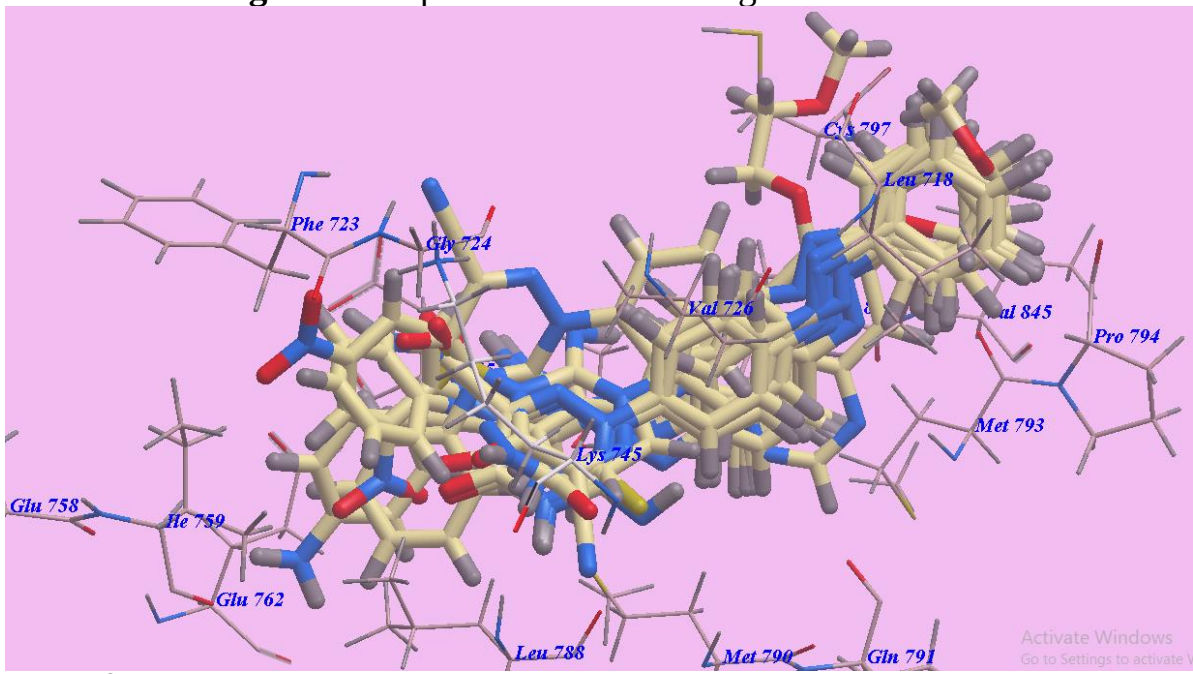


Fig. 6: A few docked compounds superimposed inside the 3W2O's binding space.

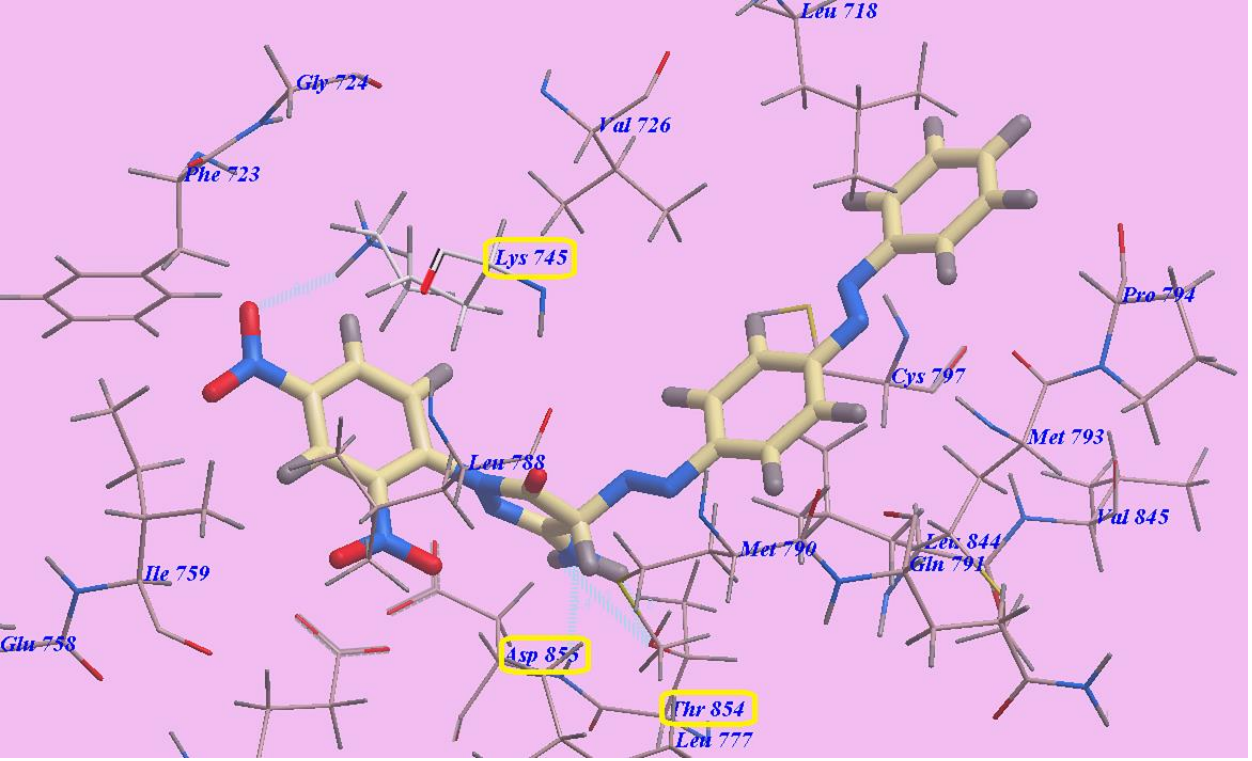


Fig. 7: Anticipated binding style for **6** with 3W2O.

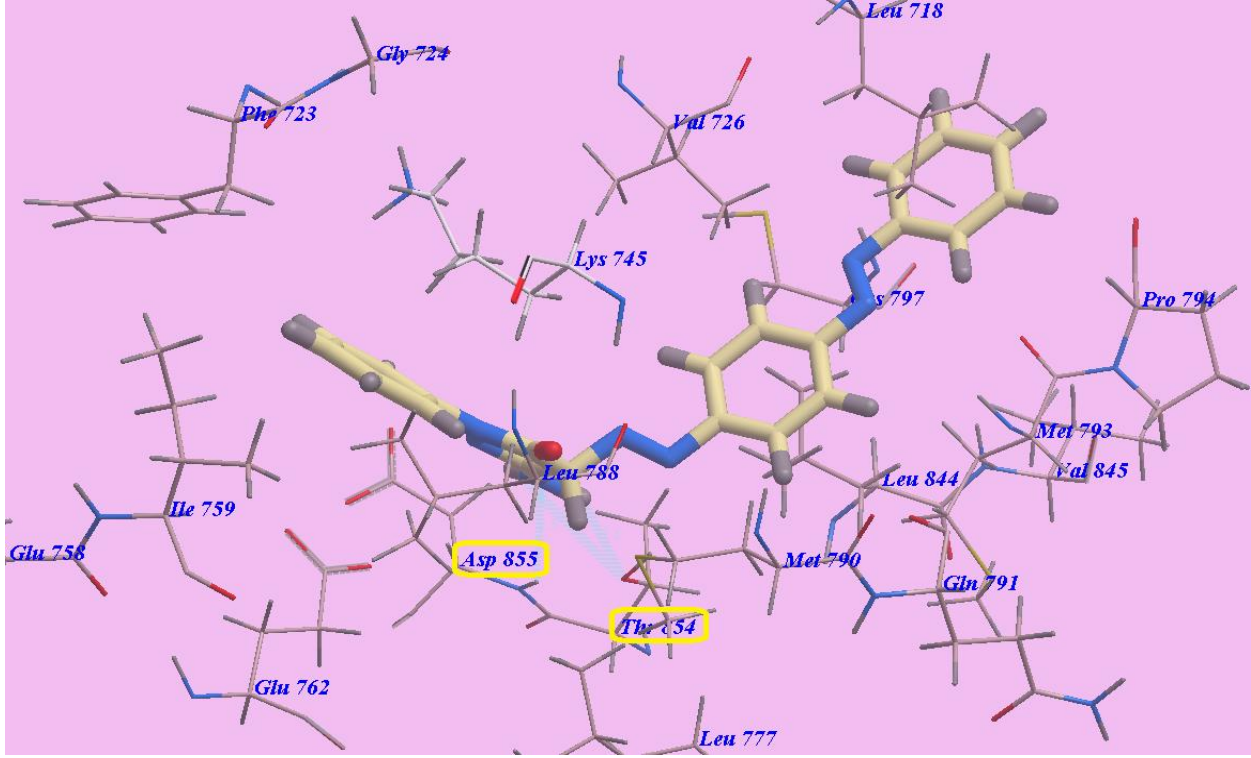


Fig. 8: Anticipated binding style for **5** with 3W2O.

1.Conventional and microwave methods comparison.

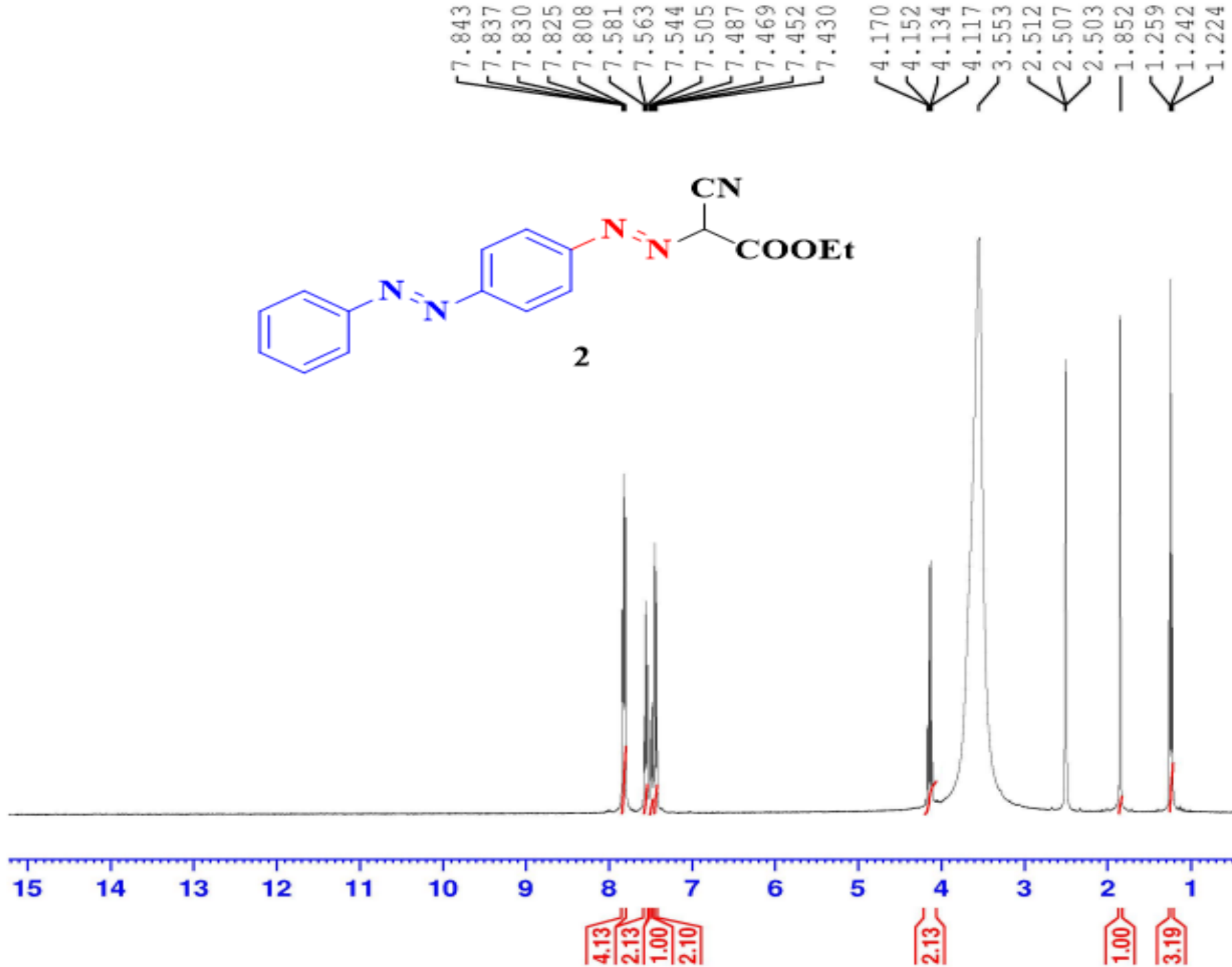
On the other hand, comparison between conventional and microwave methods by using different physical tools as YE (yield economy), AE (atomic economy), RME (reaction mass efficiency) and OE (optimum efficiency). The yields and times of compounds produced utilising microwave technology and conventional methods were compared and published [46-50]. However, in order to compare the differing efficiency of the same reaction in the microwave and traditional synthetic processes, we utilised the yield economy (YE) as an expression.

Calculation of YE was occurred through: = *yield%Reaction time "min"* . In this report, the YE was used to provide the obtained yields conclusively improved using the microwave and conventional conditions.

RME equation is: RME =*Wt of isolated product Wt of reactants* . OE was utilised to compare the three reaction types directly, and it may be calculated through. Therefore, we may use the yield economy (YE) as a metric to improve the conversion efficiencies of these three various synthetic processes for the same reaction. While RME provides the actual mass efficiency, atomic economy (AE) indicated the reaction's theoretical maximum efficiency. Due to applying two distinct reaction conditions to produce the same target molecules, as presented in **(Table 1)**, the AE of conventional and microwave processes have the same values.

Table 1: Comparing microwave and conventional techniques used in syntheses of our compounds 3-14

Cpd. no.	Time "min"		Yield %		YE		OE		RME		AE
	M.W.	Con.	M.W.	Con.	M.W.	Con.	M.W.	Con.	M.W.	Con.	
3	1	180	90	56	90	0.3111	82.79	51.52	48.29	30.05	58.33
4	0.5	120	95	52	190	0.4333	87.13	47.69	52.55	28.76	60.31
5	1.5	240	92	55	61.33	0.2292	85.09	50.87	57.48	34.36	67.55
6	3	360	91	54	30.33	0.1500	83.39	49.48	60.03	35.62	71.99
7	2	360	94	57	47	0.1583	86.99	52.75	53.41	32.39	61.40
9	4	360	94	53	23.50	0.1472	86.76	48.92	54.89	30.95	63.27
10	3	300	91	51	30.33	0.1700	76.28	42.75	68.58	38.44	89.91
11	3.5	480	90	50	25.71	0.1042	73.67	40.92	61.98	34.43	84.13
12	3.5	540	93	52	26.57	0.0963	75.56	42.25	63.06	35.26	83.46
13	4	540	93	54	23.25	0.1000	76.76	44.57	58.49	33.96	76.20
14	5	720	90	51	18	0.0708	77.30	43.80	68.19	38.64	88.22



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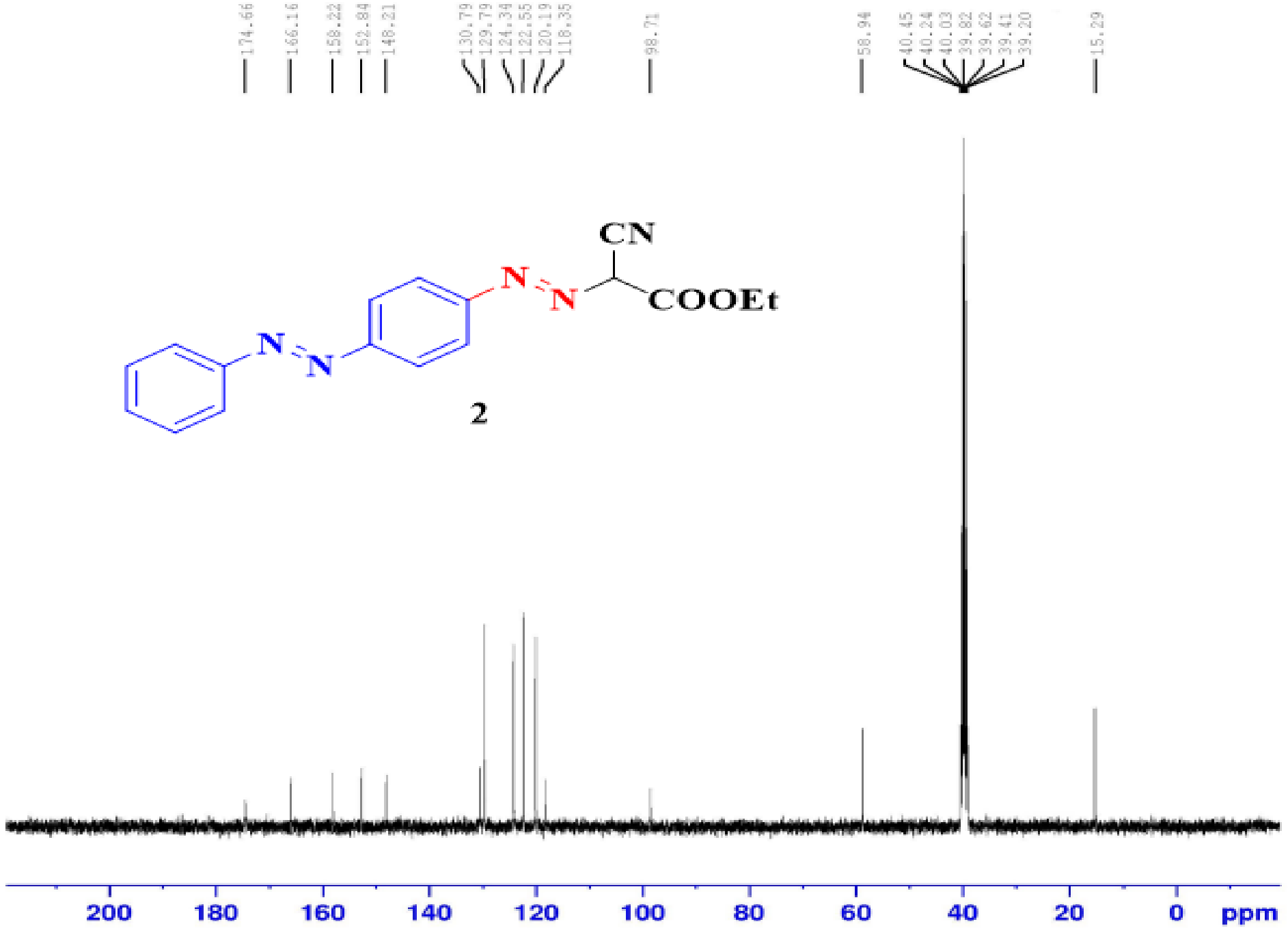

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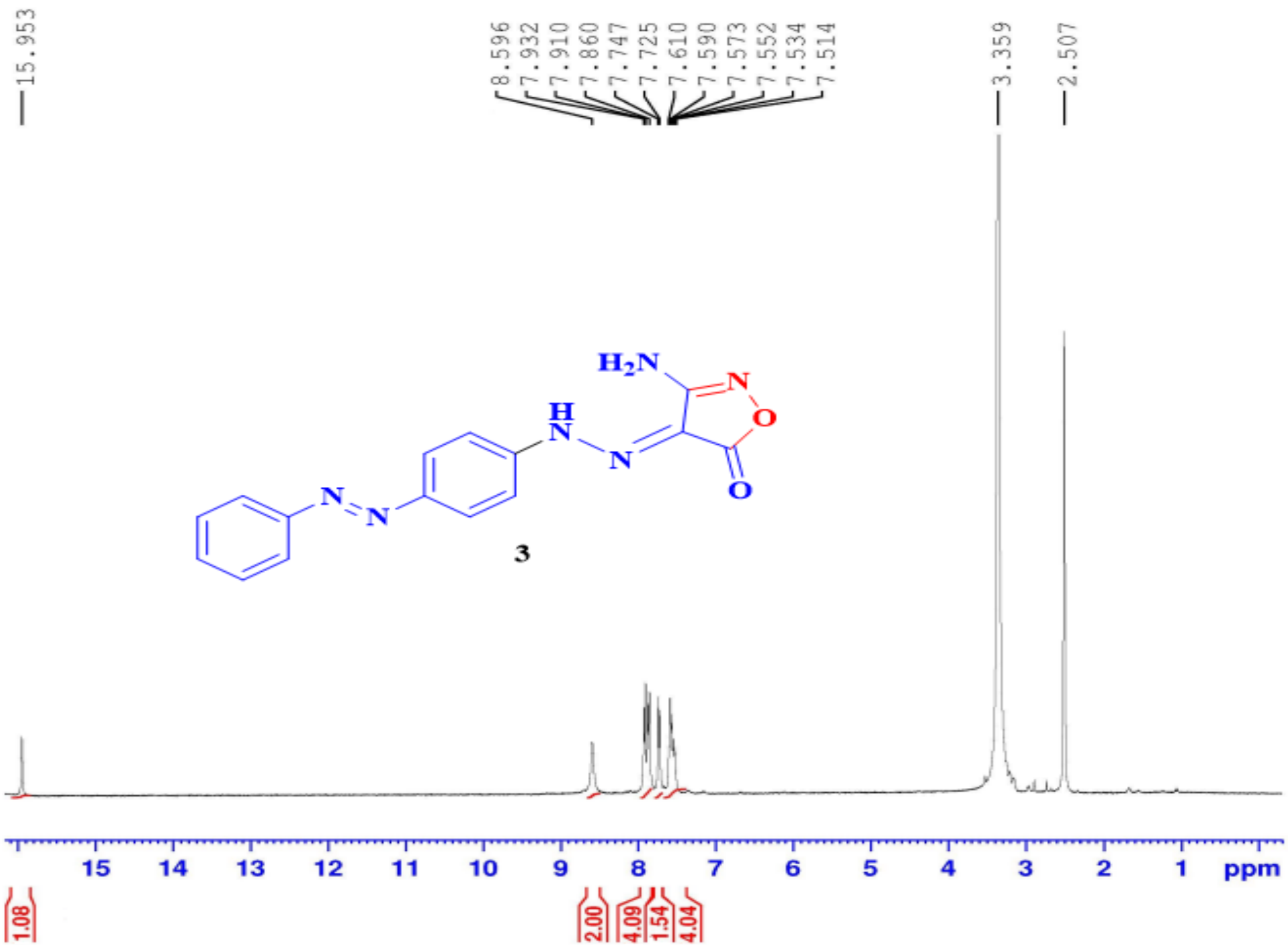

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RG                  205.37
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TE                  300.0 K
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P1                  12.00 usec
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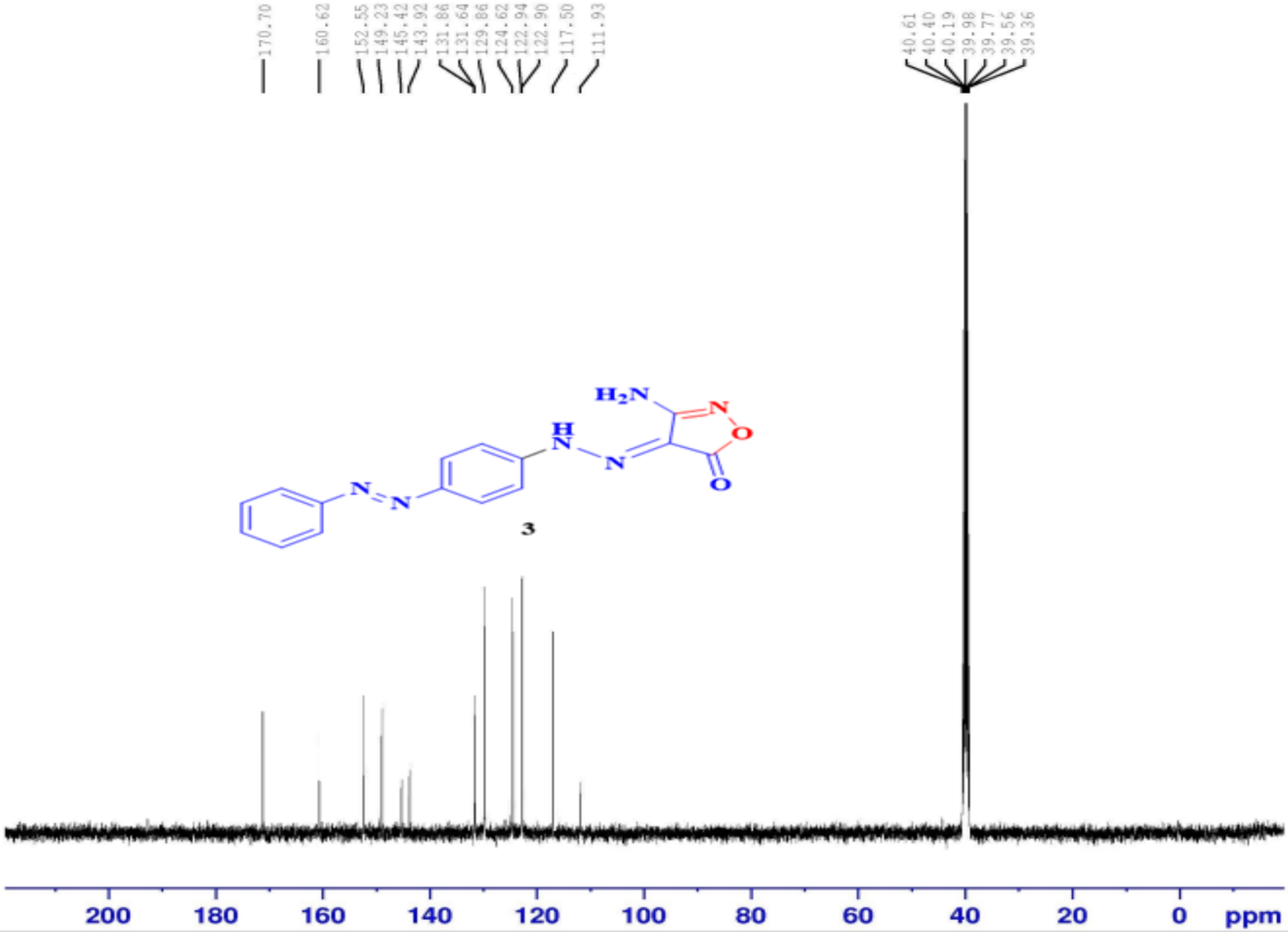

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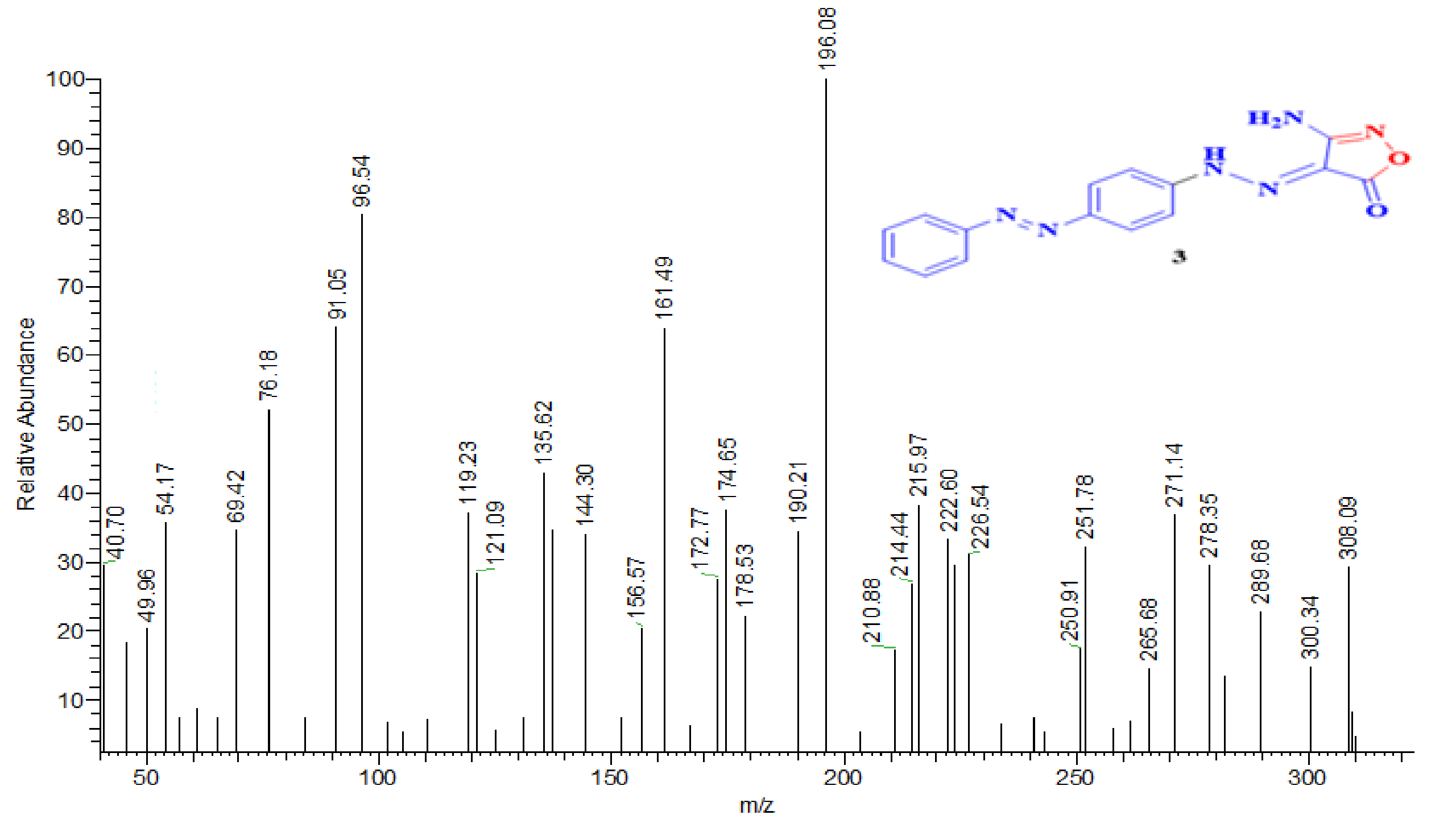
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54.17
69.42
76.18
91.05
96.54
119.23
121.09
135.62
144.30
156.57
161.49
172.77
174.65
178.53
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196.08
210.88
214.44
215.97
222.60
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251.78
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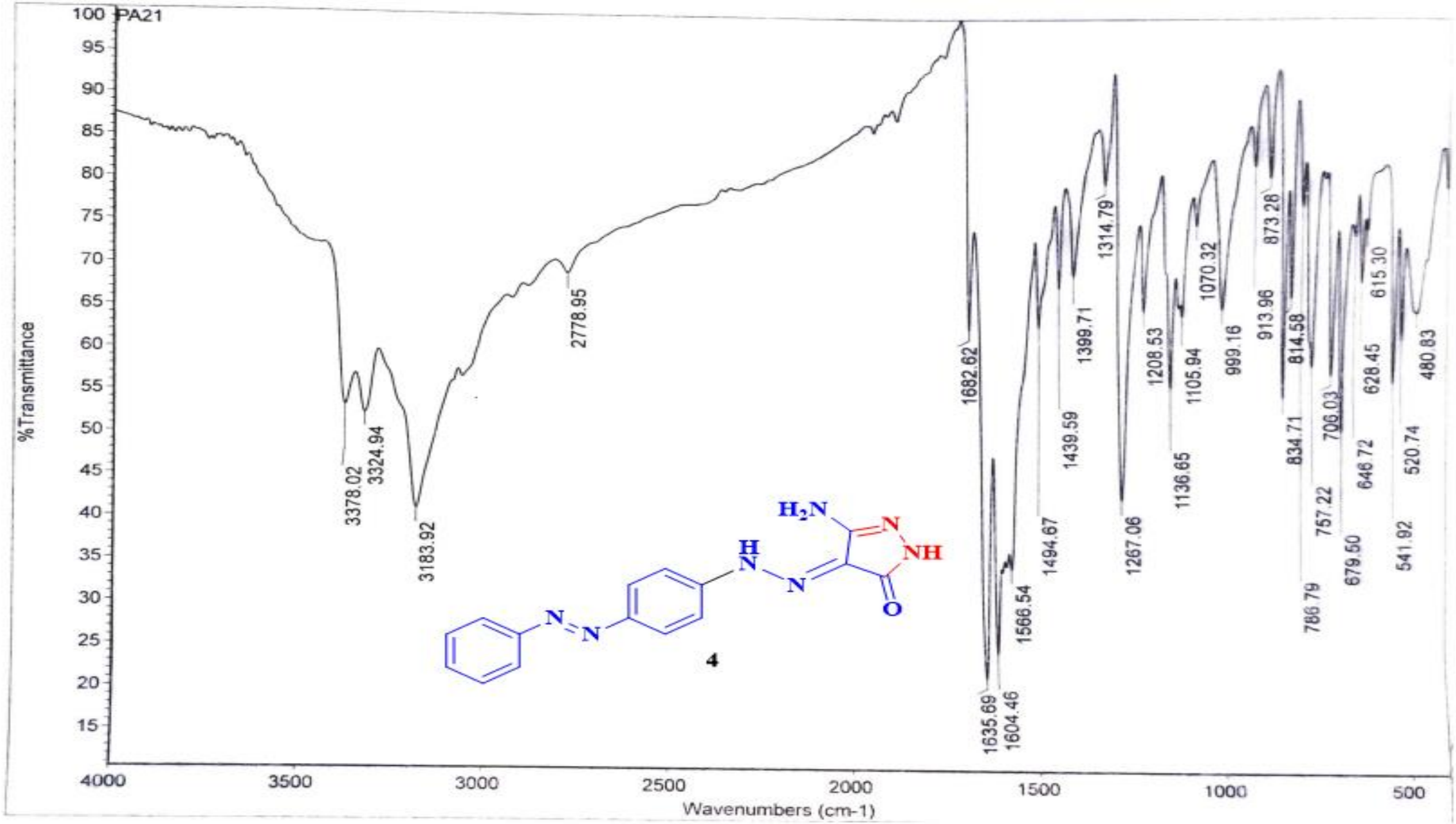
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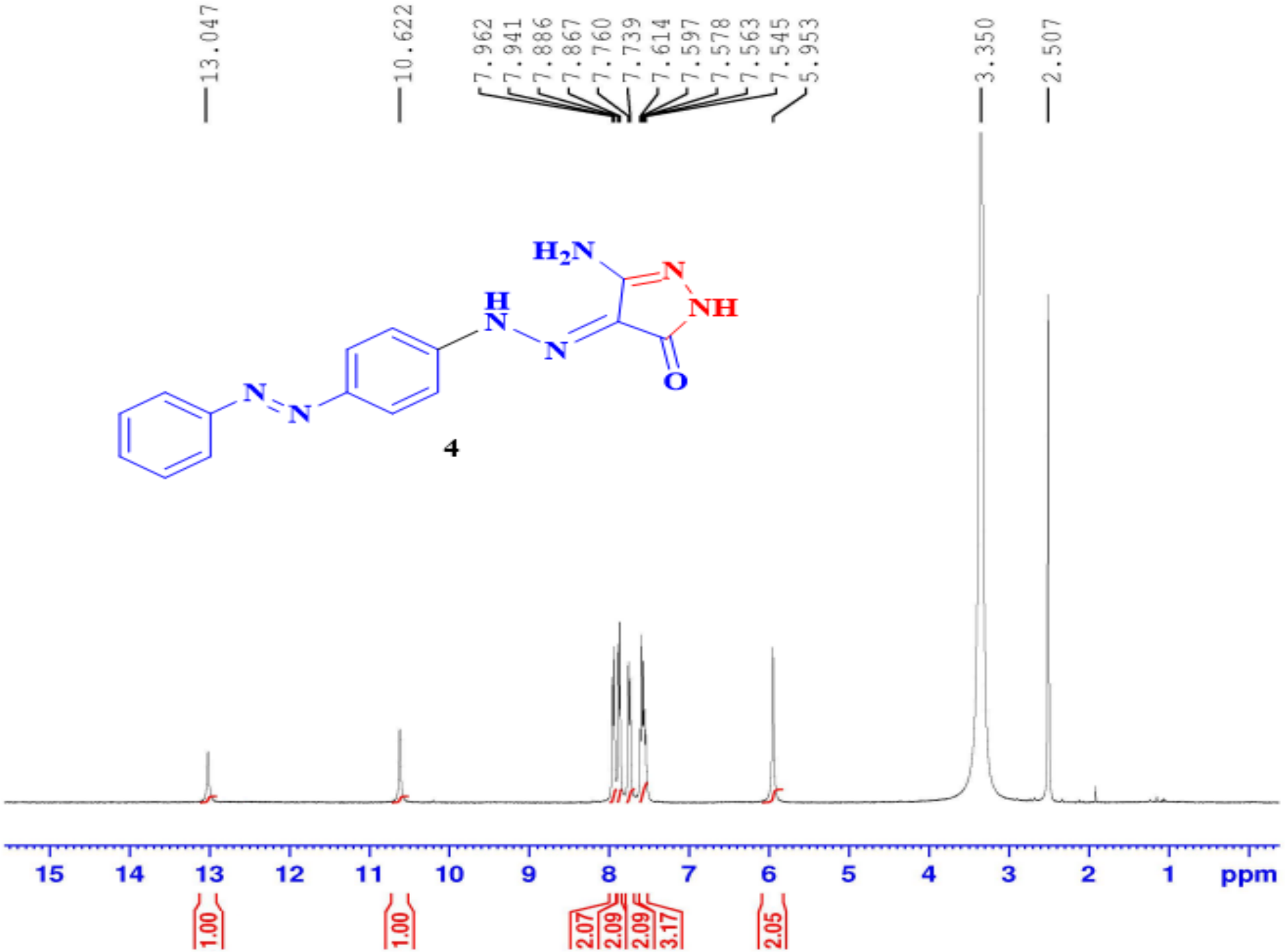

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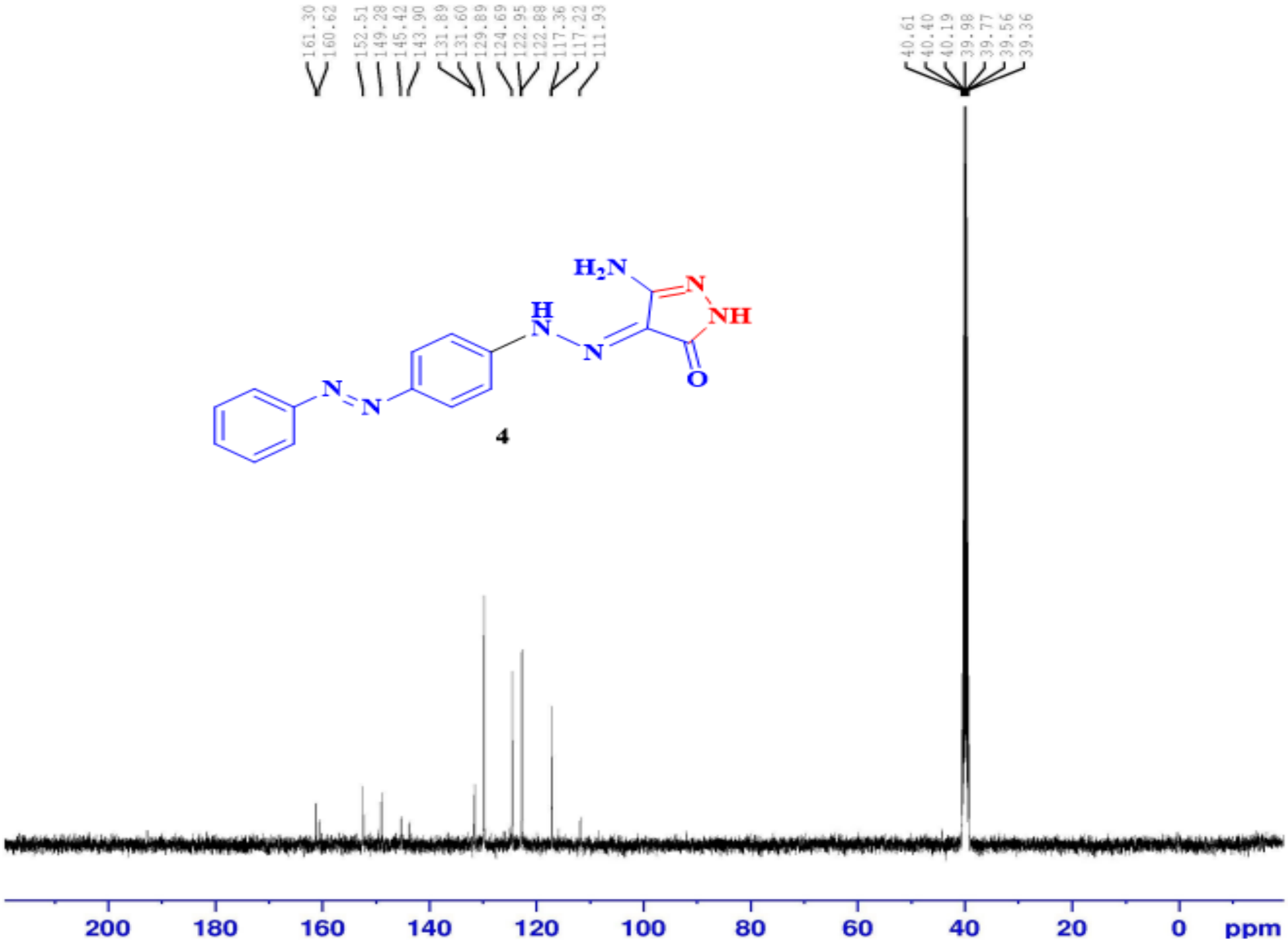

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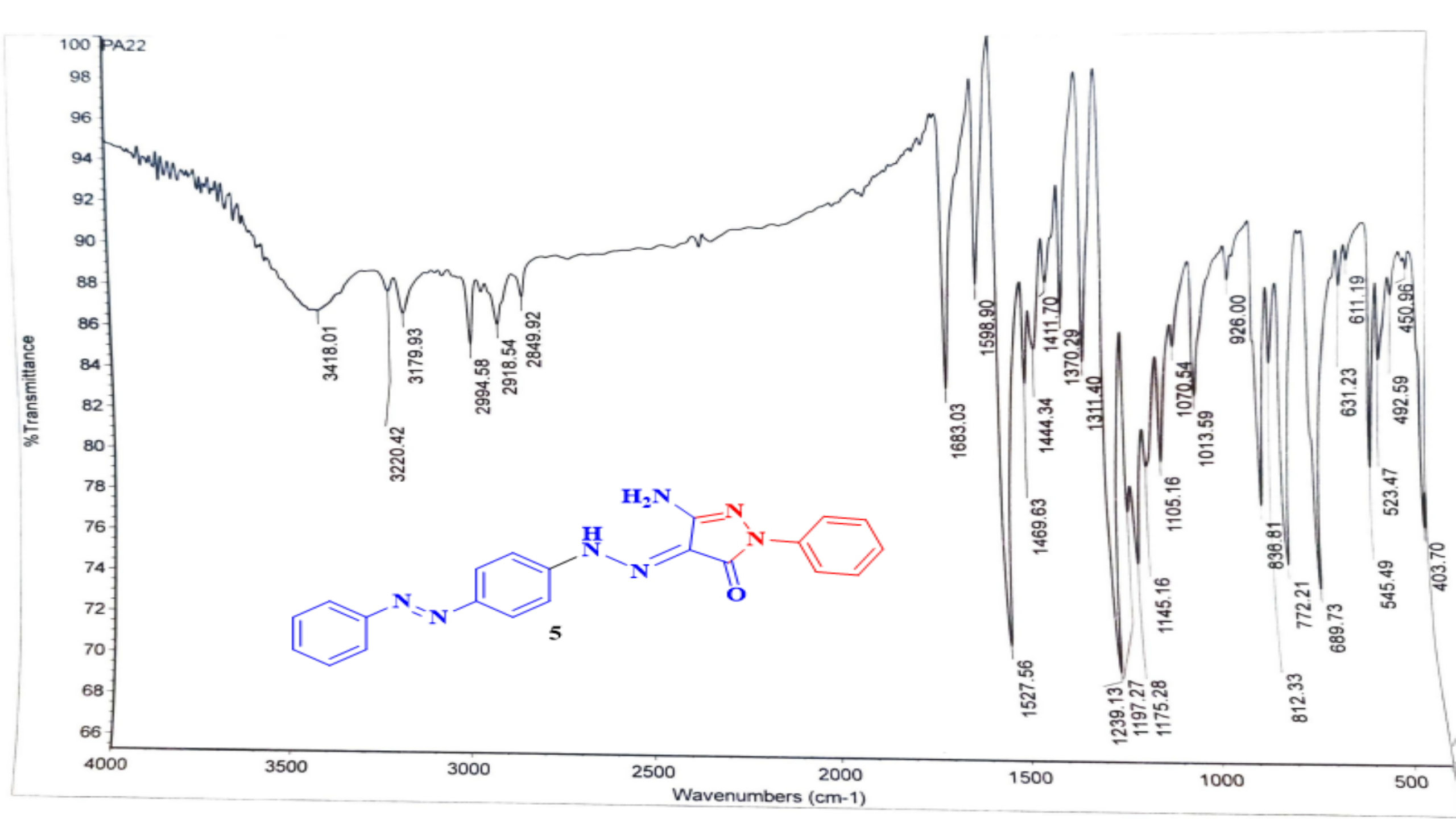
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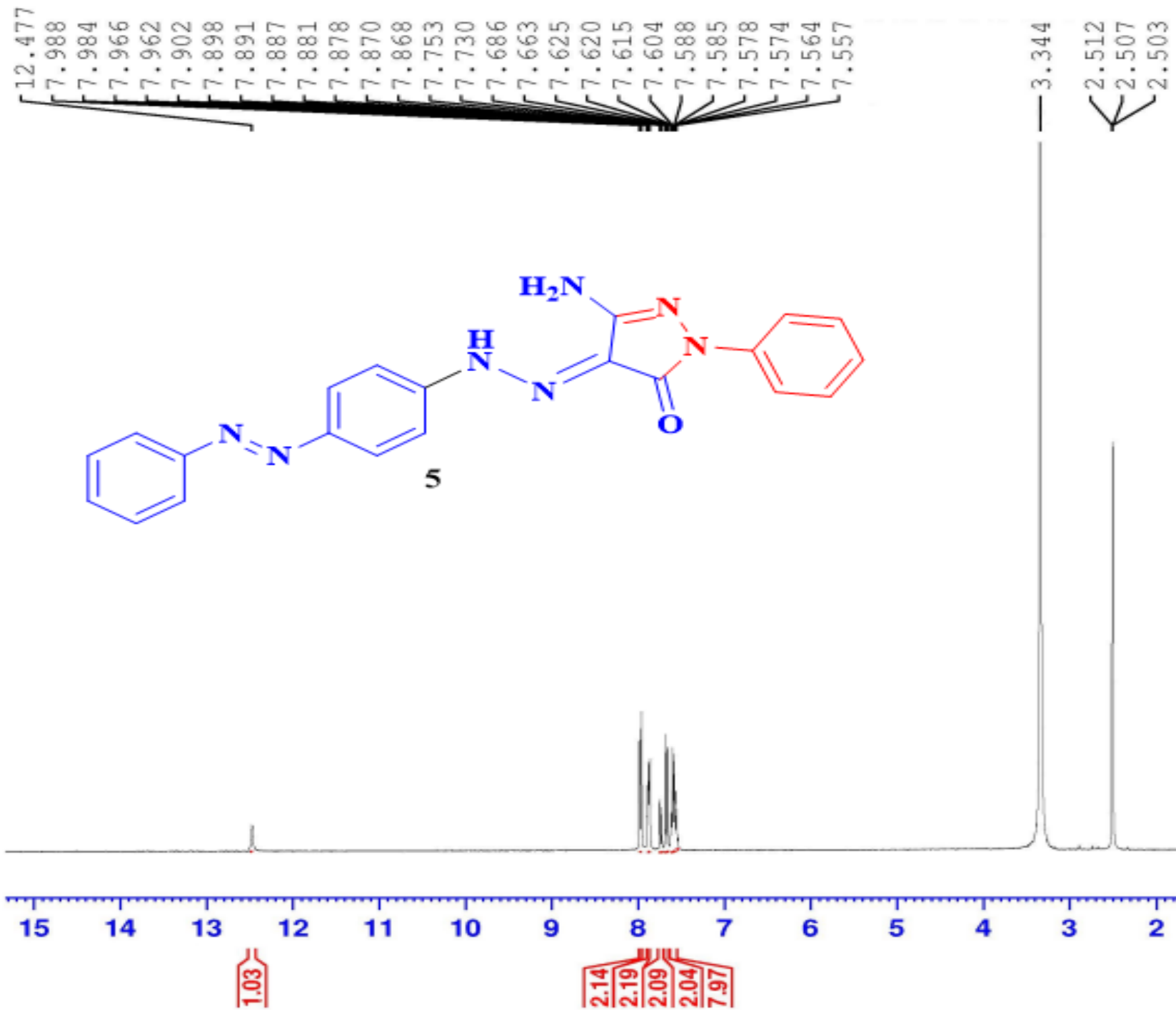
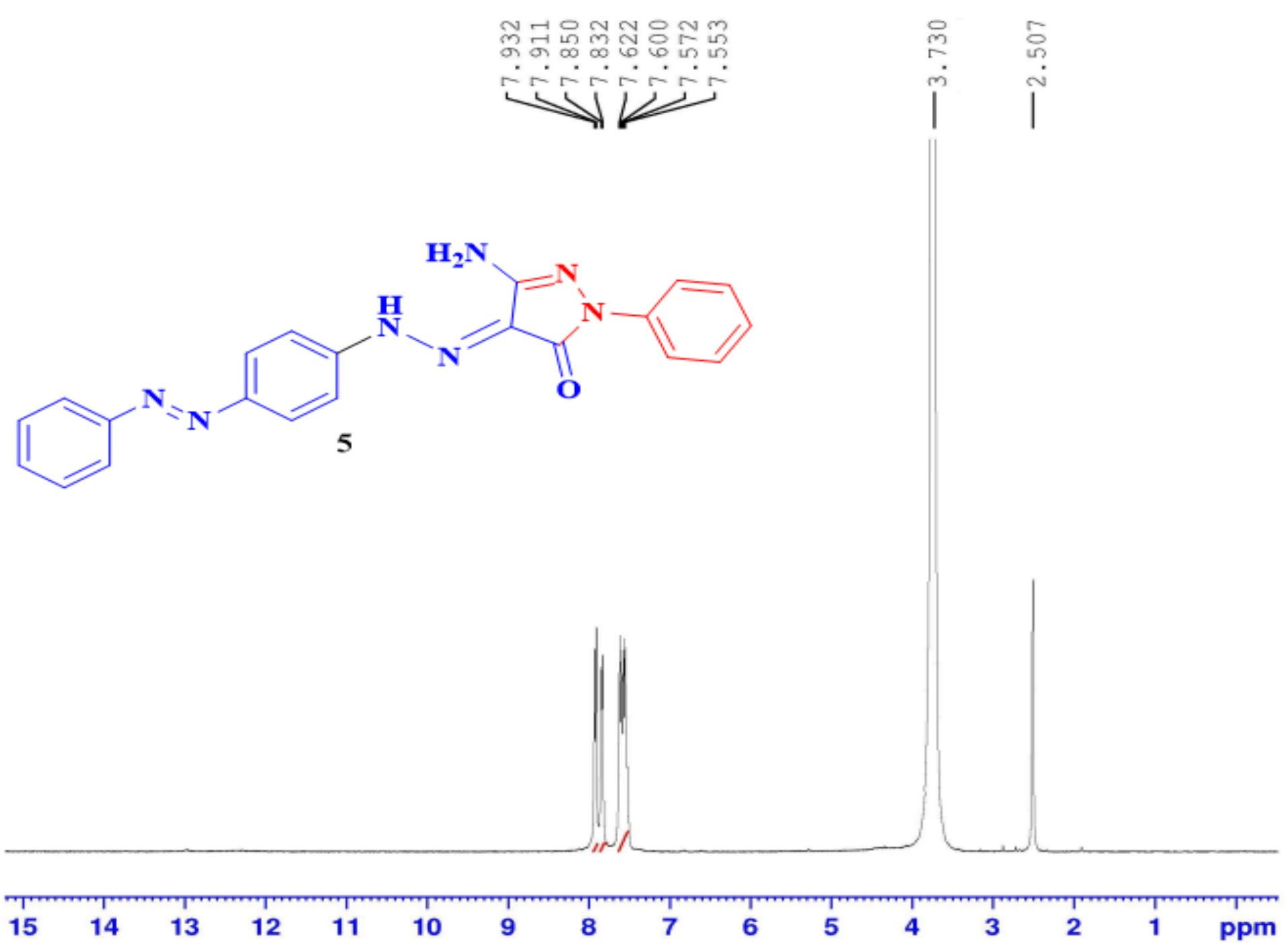
5



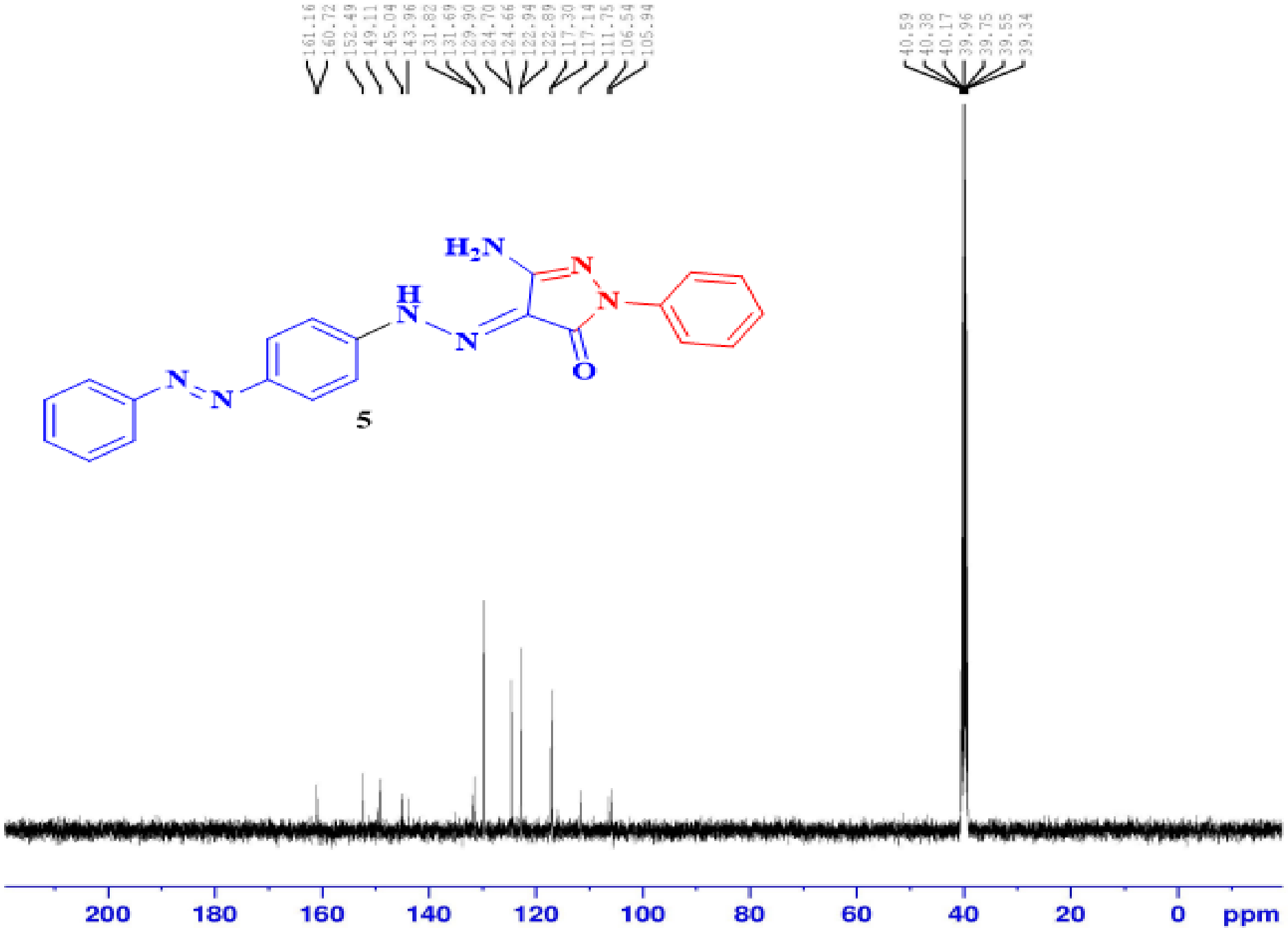
BRUKER

```
Current Data Parameters
NAME      nour eldin-PA22
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20230313
Time              17.03
INSTRUM           spect
PROBHD    5 mm PABBO BB/
PULPROG            zg30
TD                65536
SOLVENT            DMSO
NS                   128
DS                     2
SWH            8012.820 Hz
FIDRES         0.122266 Hz
AQ             4.0894465 sec
RG                205.37
DW                62.400 usec
DE                 6.50 usec
TE                300.0 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         400.1524711 MHz
NUC1                   1H
P1                 12.00 usec
PLW1        18.00000000 W

F2 - Processing parameters
SI                 65536
SF           400.1500000 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



BRUKER

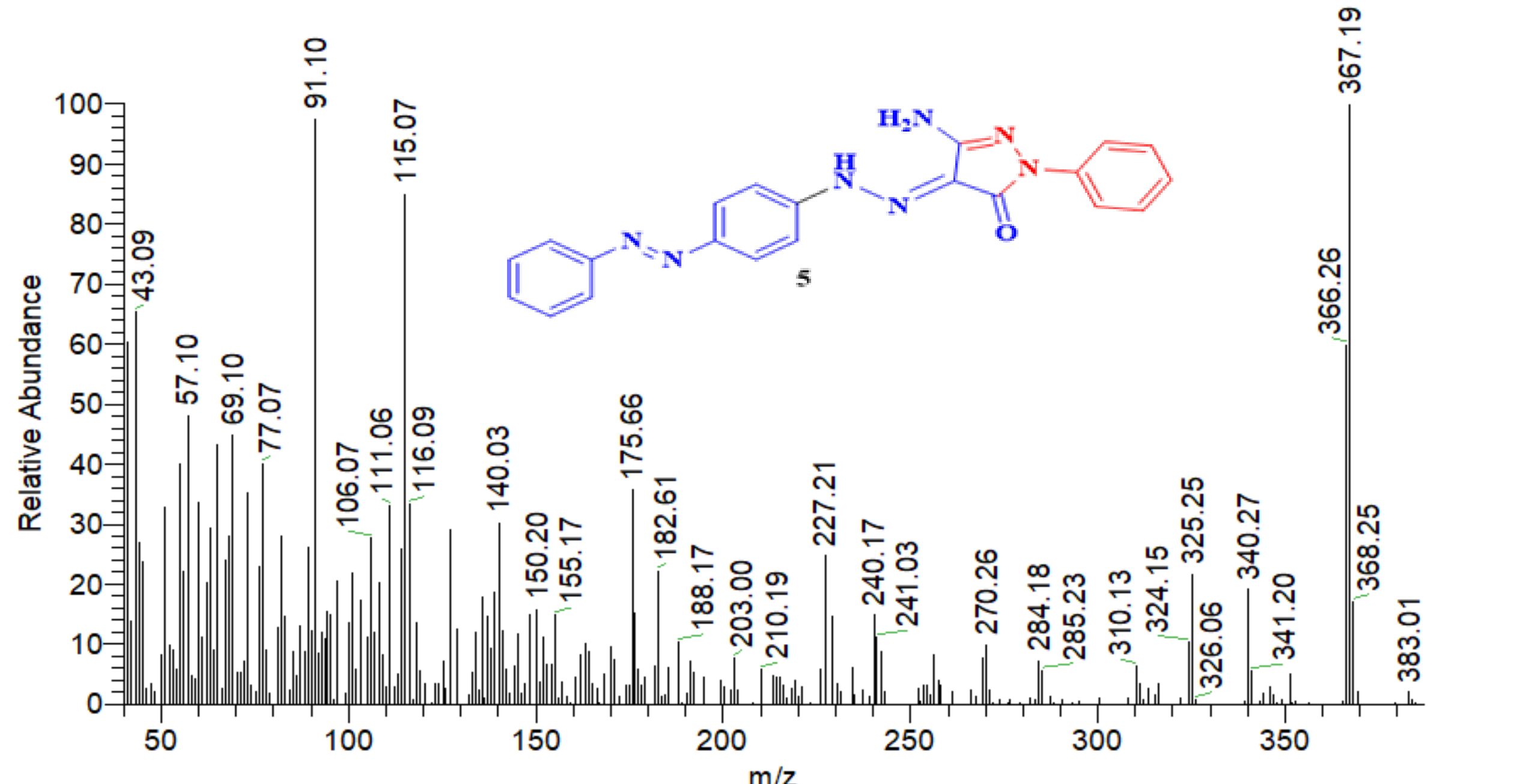
```
Current Data Parameters
NAME      nour eldin-PA22-d2o
EXPNO                       2
PROCNO                      1

F2 - Acquisition Parameters
Date_              20230322
Time                  10.37
INSTRUM               spect
PROBHD    5 mm PABBO BB/
PULPROG                zg30
TD                    65536
SOLVENT                DMSO
NS                       77
DS                        2
SWH                8012.820 Hz
FIDRES             0.122266 Hz
AQ                 4.0894465 sec
RG                    205.37
DW                    62.400 usec
DE                     6.50 usec
TE                    300.0 K
D1              1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
SFO1           400.1524711 MHz
NUC1                     1H
P1                    12.00 usec
PLW1          18.00000000 W

F2 - Processing parameters
SI                    65536
SF             400.1500000 MHz
WDW                      EM
SSB          0
LB                     0.30 Hz
GB           0
PC                     1.00
```

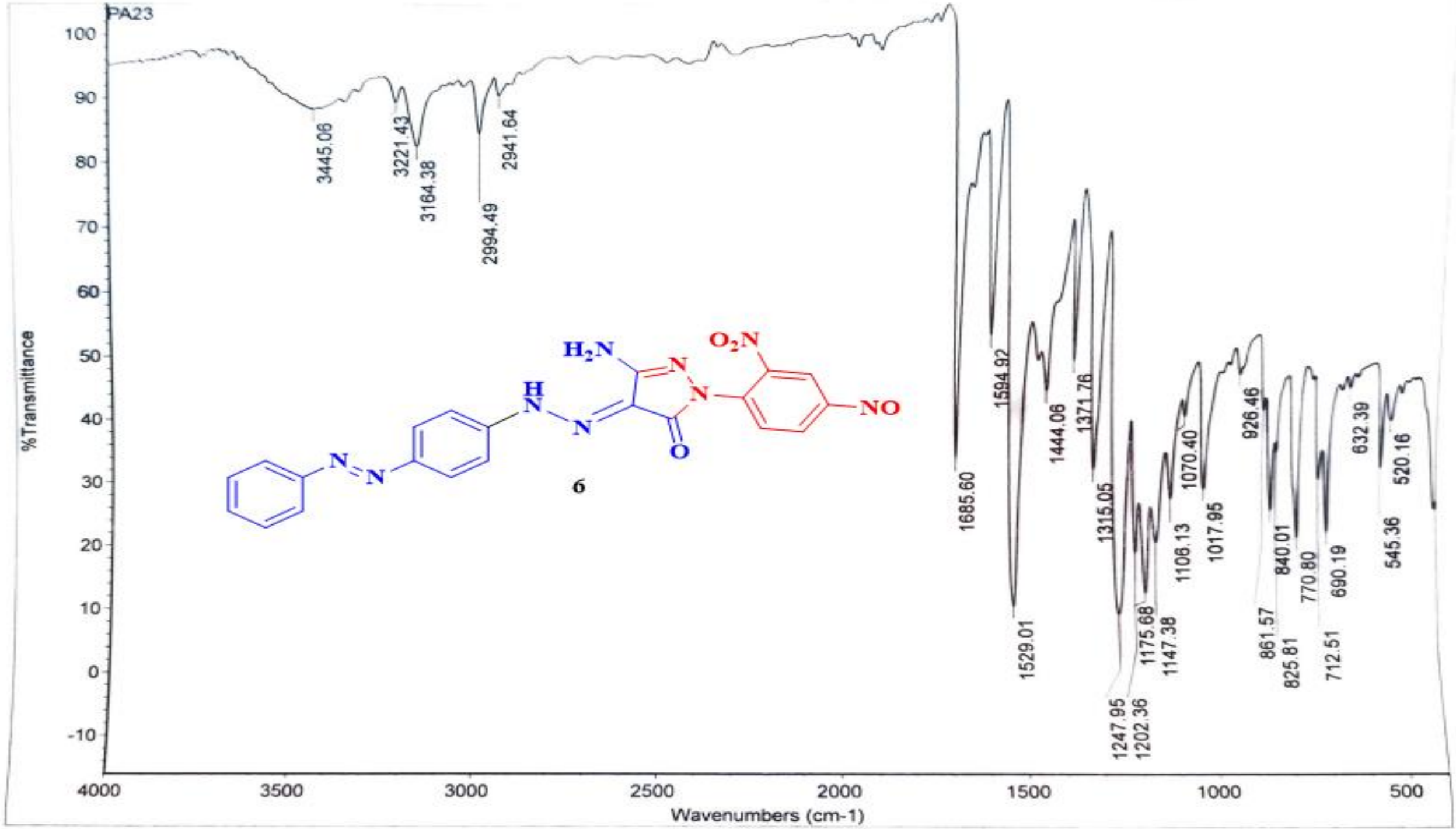


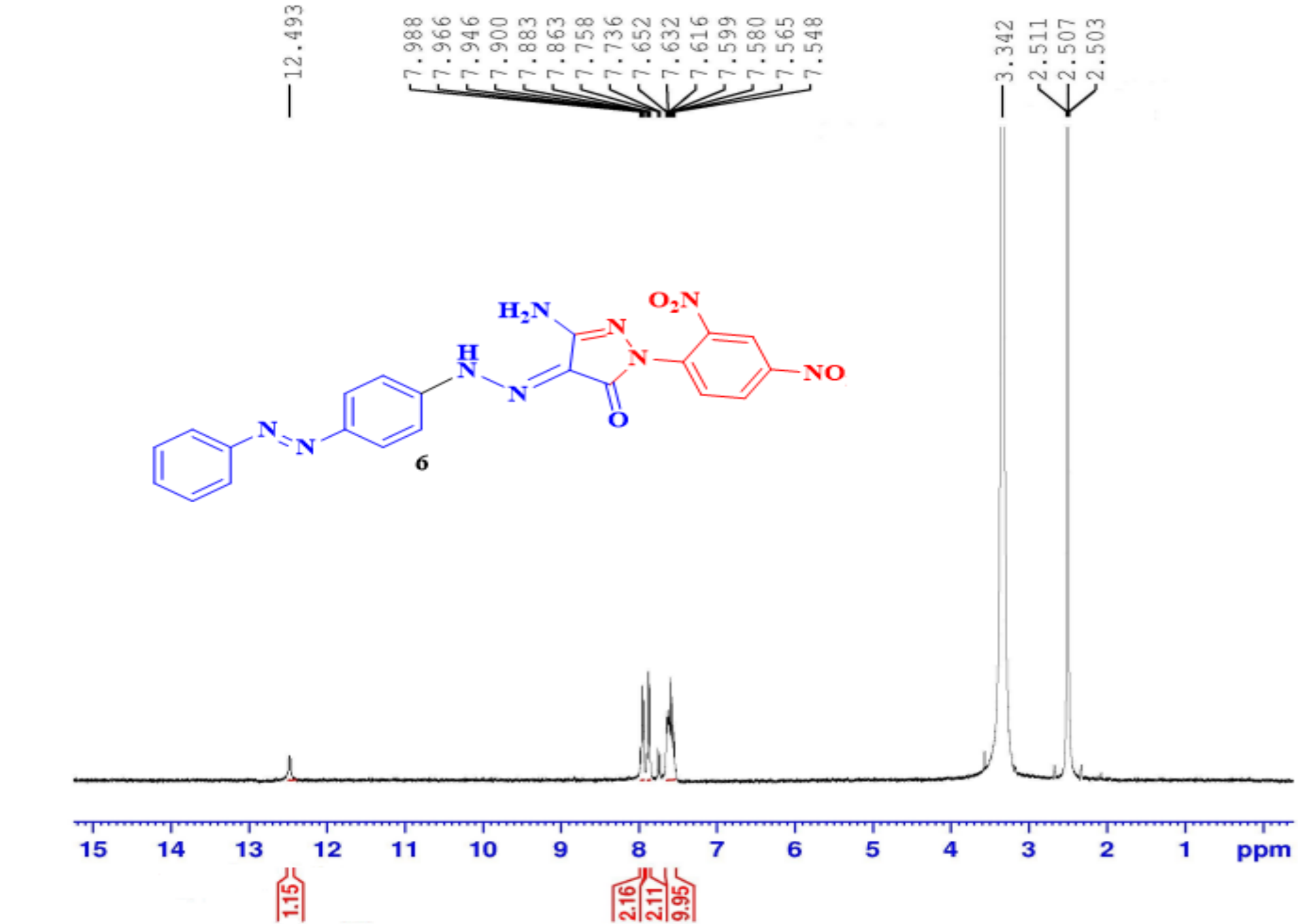
BRUKER

```
Current Data Parameters
NAME      nour eldin-PA22
EXPNO                  2
PROCNO                 1

F2 - Acquisition Parameters
Date_           20230315
Time               12.50
INSTRUM            spect
PROBHD    5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT             DMSO
NS                   900
DS                     4
SWH            24038.461 Hz
FIDRES          0.366799 Hz
AQ              1.3631488 sec
RG                205.37
DW                20.800 usec
DE                 6.50 usec
TE                300.0 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         100.6278588 MHz
NUC1                  13C
P1                  10.00 usec
PLW1         47.00000000 W

======== CHANNEL f2 ========
SFO2         400.1516006 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2               90.00 usec
PLW2         18.00000000 W
PLW12         0.34722000 W
PLW13         0.28125000 W

F2 - Processing parameters
SI                 32769
SF           100.6177975 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```

kerles-PA22 #101 RT: 1.71 AV: 1 SB: 26 1.21-1.34 , 0.87-1.14 NL: 2.55E4
T: {0,0} + c EI Full ms [40.00-1000.00]

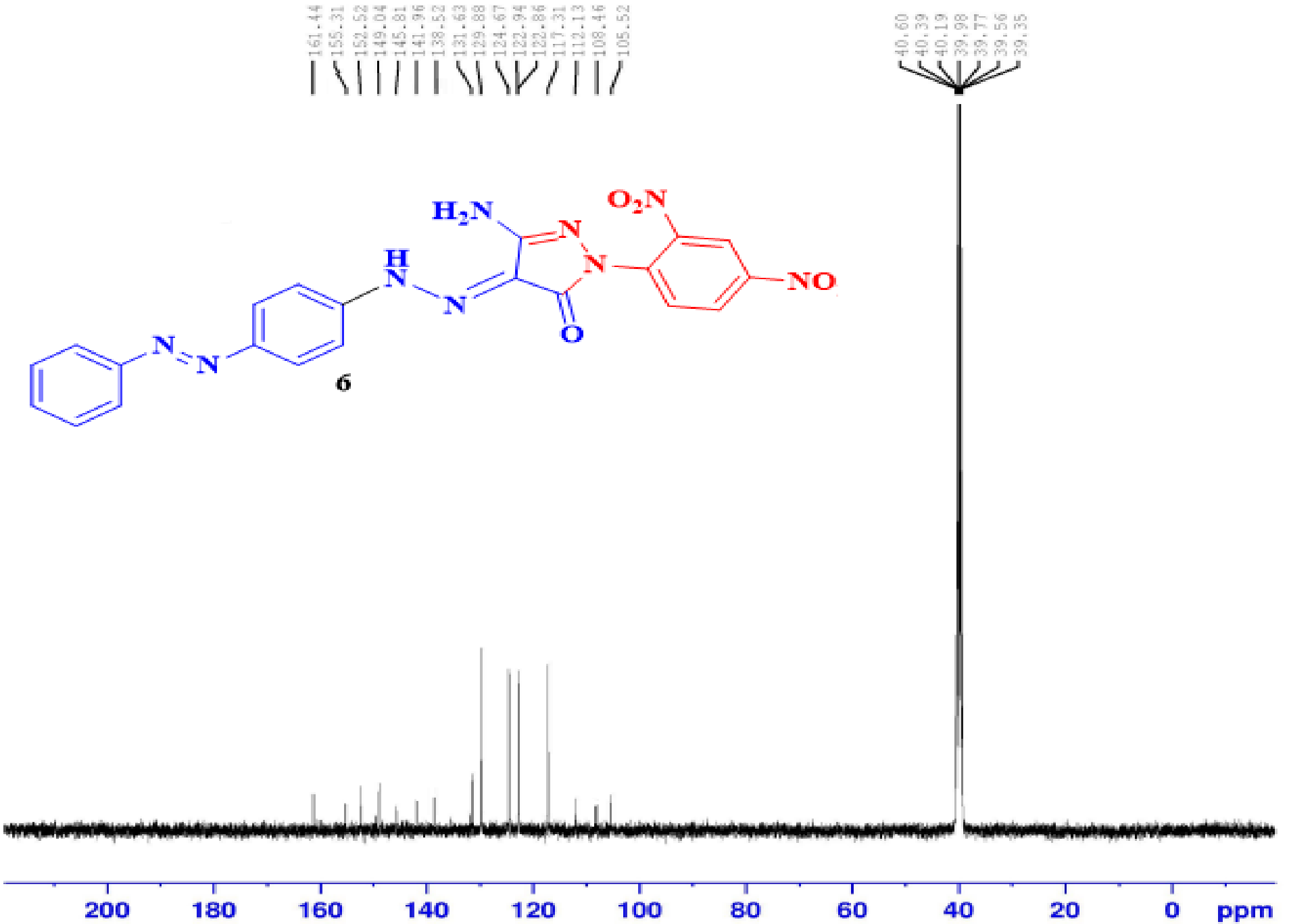



PA23
%Transmittance
Wavenumbers (cm-1)
3445.06
3221.43
3164.38
2994.49
2941.64
1685.60
1594.92
1529.01
1444.06
1371.76
1315.05
1247.95
1202.36
1175.68
1147.38
1106.13
1070.40
1017.95
926.46
861.57
840.01
825.81
770.80
712.51
690.19
632.39
545.36
520.16
H_2N
O_2N
NO
N
H
O
6



BRUKER

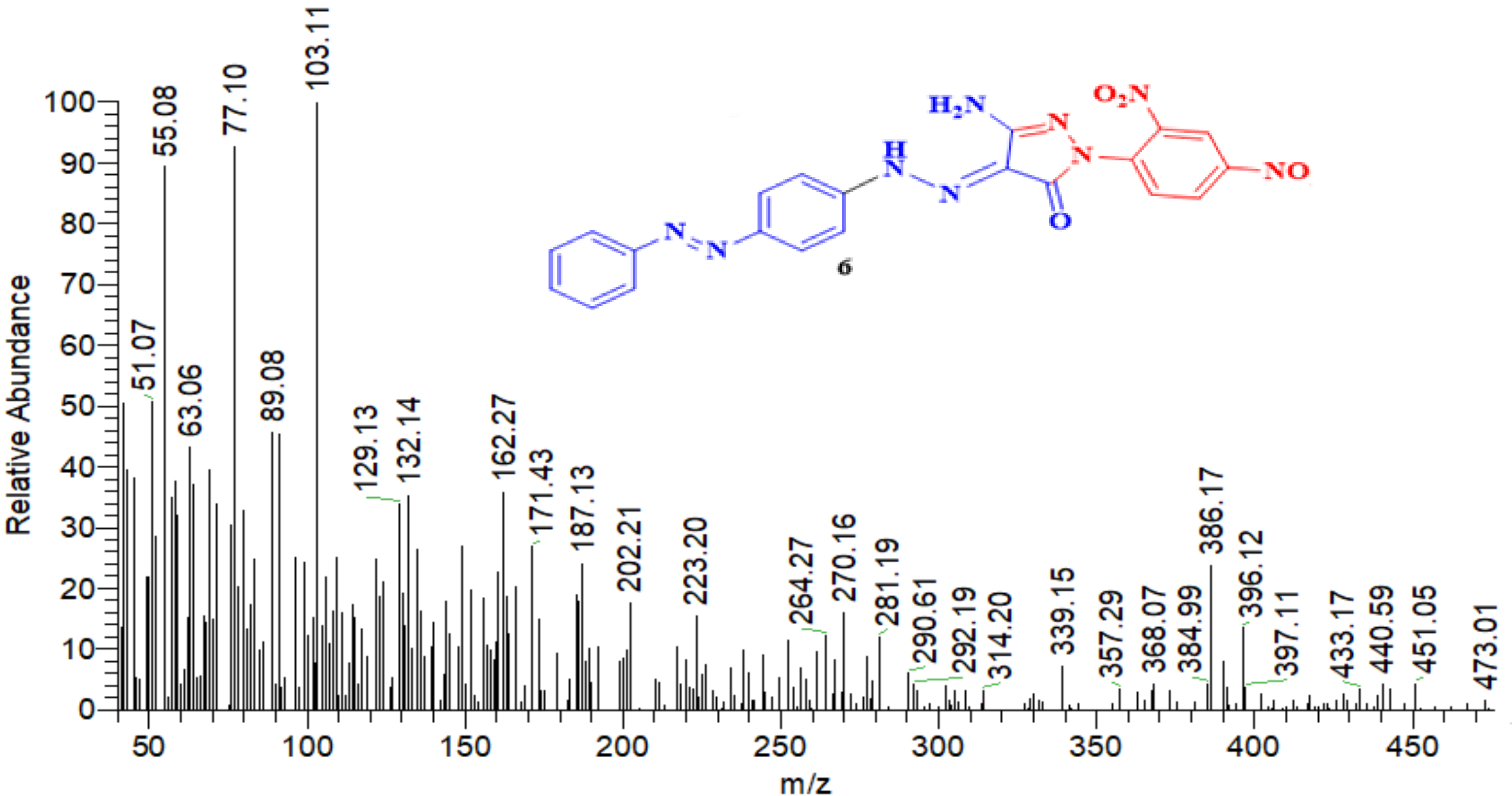
```
Current Data Parameters
NAME      nour eldin-PA23
EXPNO                   1
PROCNO                  1

F2 - Acquisition Parameters
Date_            20230313
Time                15.53
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG              zg30
TD                  65536
SOLVENT              DMSO
NS                     128
DS                       2
SWH              8012.820 Hz
FIDRES           0.122266 Hz
AQ               4.0894465 sec
RG                  205.37
DW                  62.400 usec
DE                   6.50 usec
TE                  300.0 K
D1             1.00000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1          400.1524711 MHz
NUC1                    1H
P1                  12.00 usec
PLW1          18.00000000 W

F2 - Processing parameters
SI                   65536
SF            400.1500000 MHz
WDW                     EM
SSB       0
LB                   0.30 Hz
GB        0
PC                   1.00
```

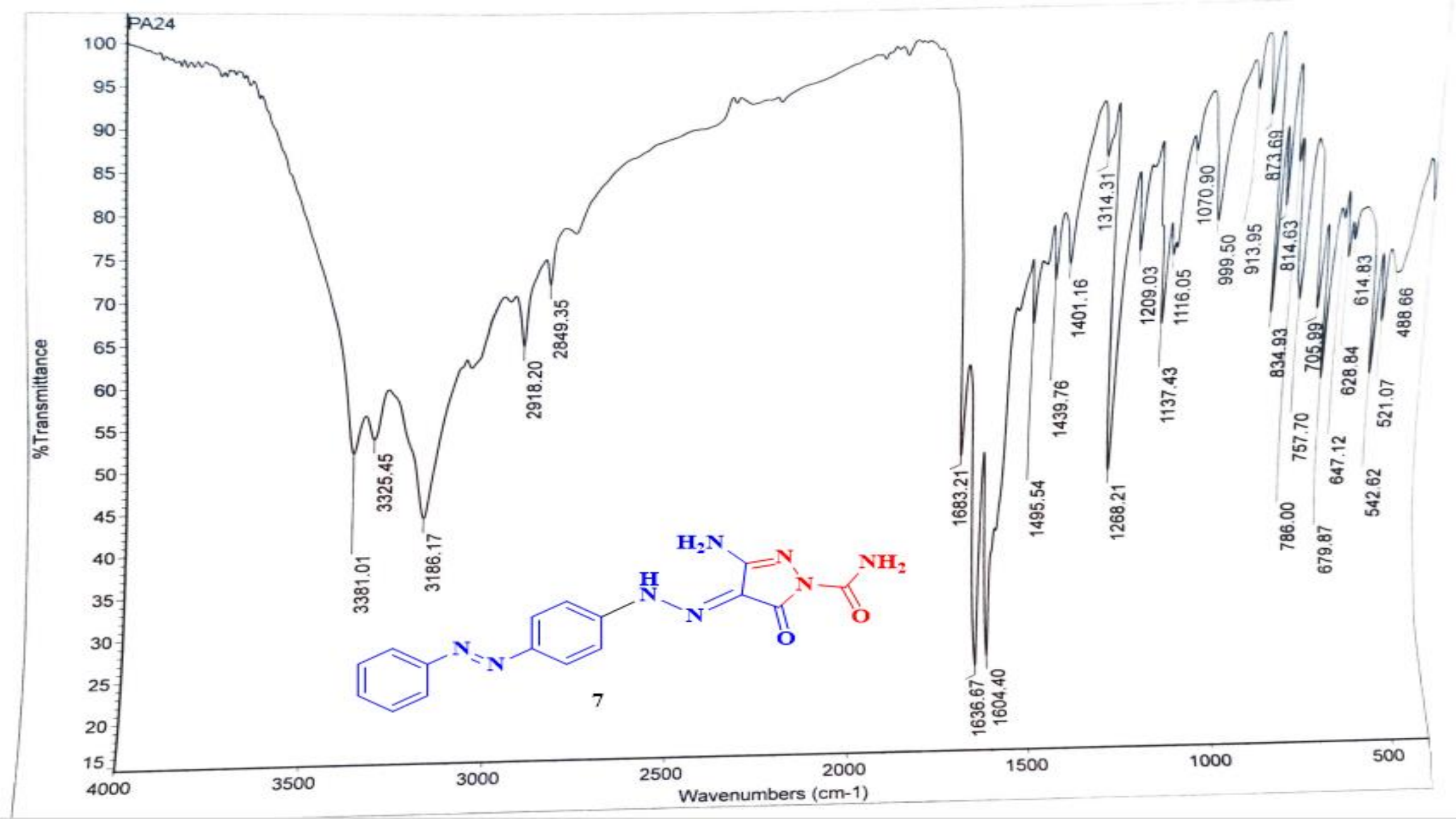


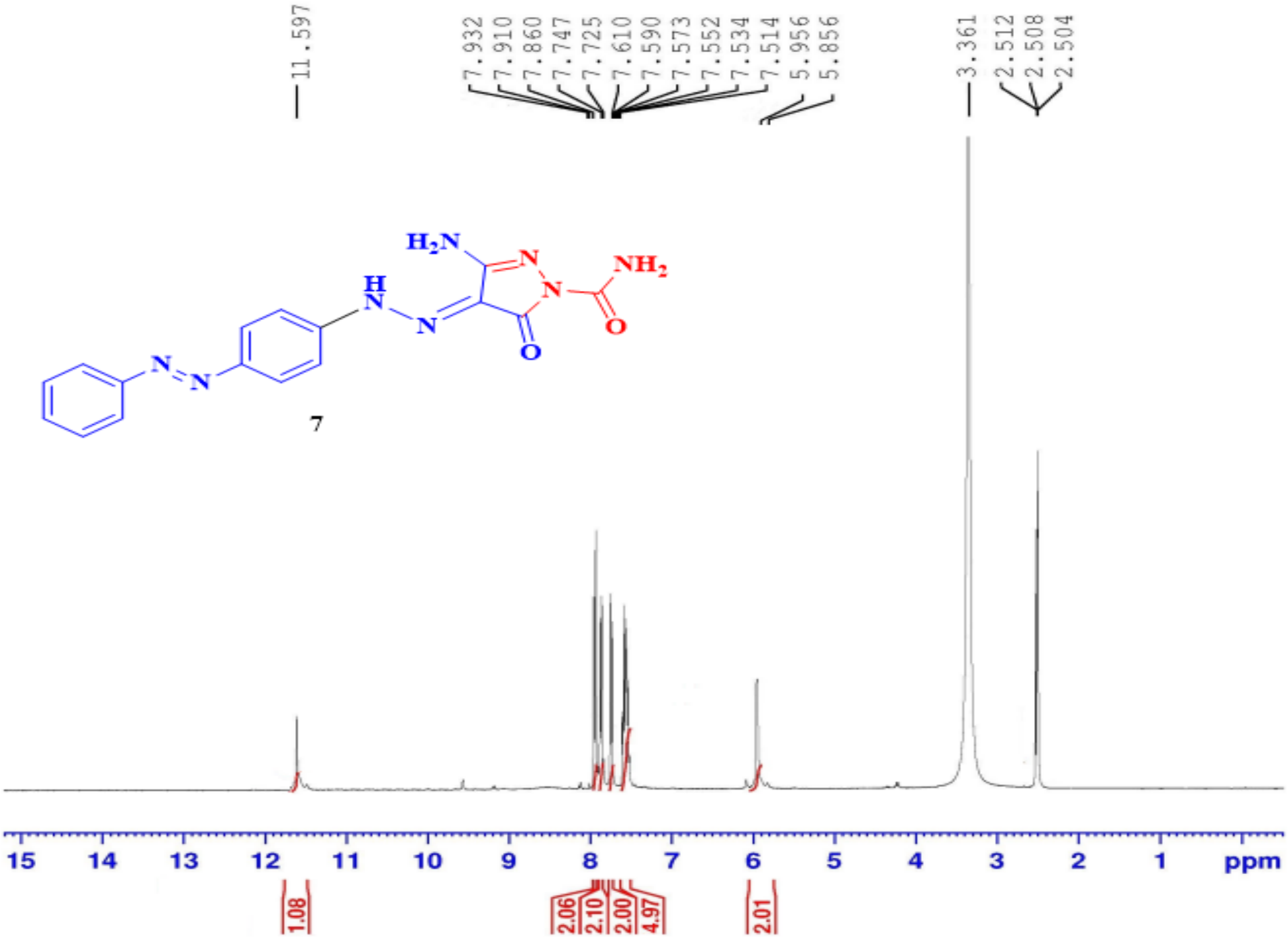
BRUKER

```
Current Data Parameters
NAME      nour eldin-PA23
EXPNO                   2
PROCNO                  1

F2 - Acquisition Parameters
Date_            20230316
Time                10.53
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
ID                65536
SOLVENT            DMSO
NS                 1534
DS                    4
SWH          24038.461 Hz
FIDRES        0.366798 Hz
AQ            1.3631488 sec
RG               205.37
DW               20.800 usec
DE                6.50 usec
TE               300.0 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1       100.6276588 MHz
NUC1               13C
P1               10.00 usec
PLW1       47.00000000 W

======== CHANNEL f2 ========
SFO2       400.1516006 MHz
NUC2               1H
CPDPRG[2        waltz16
PCPD2            90.00 usec
PLW2       19.00000000 W
PLW12       0.34722000 W
PLW13       0.28125000 W

F2 - Processing parameters
SI                32768
SF         100.6177975 MHz
WDW                EM
SSB       0
LB               1.00 Hz
GB        0
PC               1.40
```

kerles-PA23 #36-40 RT: 0.62-0.69 AV: 5 SB: 26 1.21-1.34 , 0.87-1.14 NL: 4.01E3
T: {0,0} + c EI Full ms [40.00-1000.00]

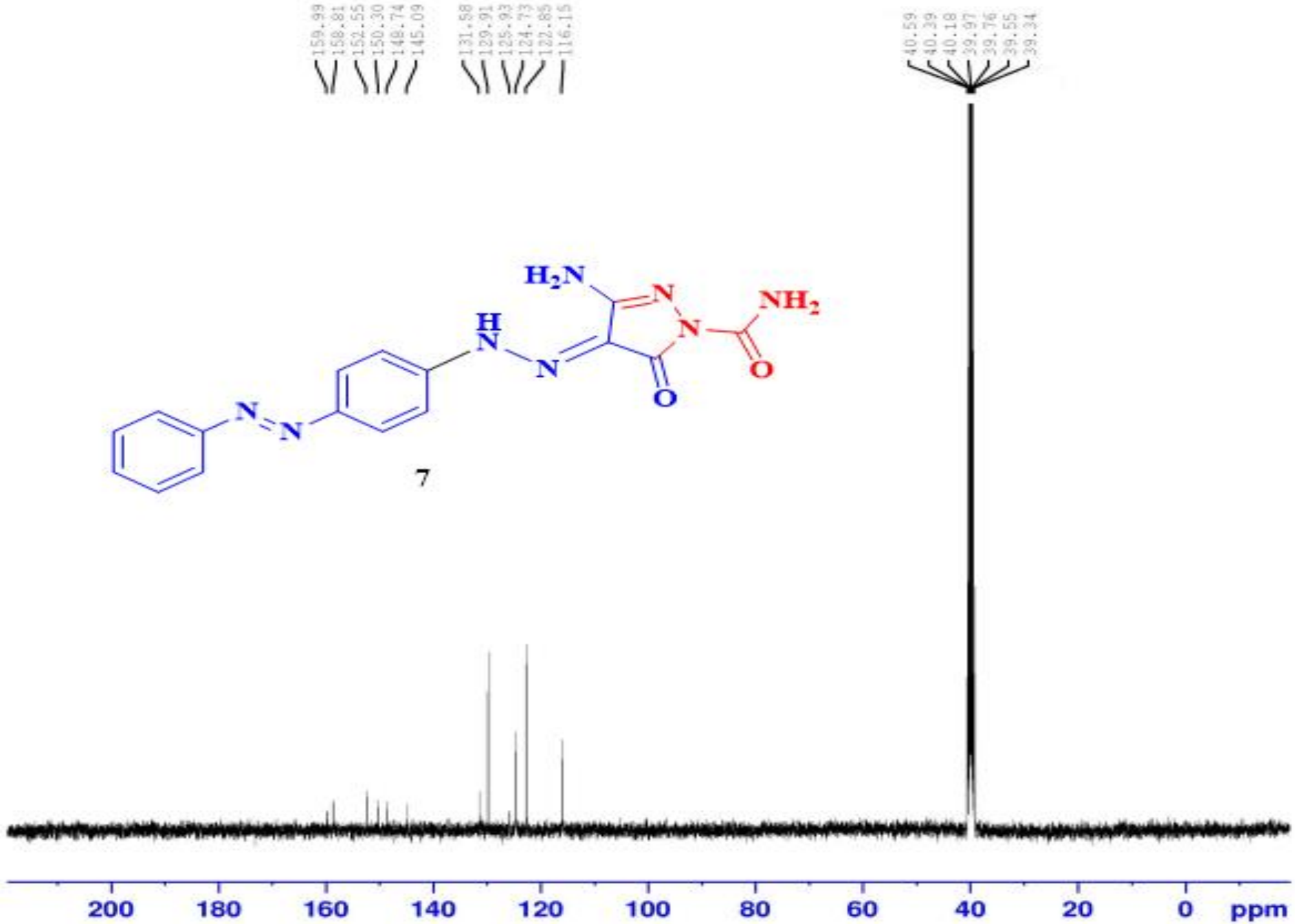



PA24
%Transmittance
Wavenumbers (cm-1)
3381.01
3325.45
3186.17
2918.20
2849.35
1683.21
1636.67
1604.40
1495.54
1439.76
1401.16
1314.31
1268.21
1209.03
1137.43
1116.05
1070.90
999.50
913.95
873.69
834.93
814.63
786.00
757.70
705.99
679.87
647.12
628.84
614.83
542.62
521.07
488.66
H2N
NH2
N
H
O
7



BRUKER

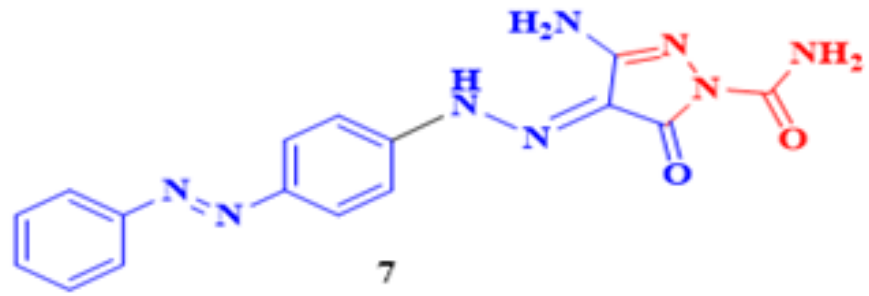
```
Current Data Parameters
NAME      nour eldin-PA24
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20230313
Time               13.28
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT             DMSO
NS                    83
DS                     2
SWH             8012.820 Hz
FIDRES          0.122266 Hz
AQ              4.0894465 sec
RG                205.37
DW                62.400 usec
DE                 6.50 usec
TE                300.0 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         400.1524711 MHz
NUC1                   1H
P1                 12.00 usec
PLW1         18.00000000 W

F2 - Processing parameters
SI                 65536
SF            400.1500000 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



BRUKER

```
Current Data Parameters
NAME      nour eldin-PA24
EXPNO                  2
PROCNO                 1

F2 - Acquisition Parameters
Date_           20230313
Time               15.27
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT             DMSO
NS                  2000
DS                     4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ             1.3631488 sec
RG                205.37
DW                20.800 usec
DE                 6.50 usec
TE                300.0 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1        100.6278568 MHz
NUC1               13C
P1               10.00 usec
PLW1        47.00000000 W

======== CHANNEL f2 ========
SFO2        400.1516006 MHz
NUC2               1H
CPDPRG[2        waltz16
PCPD2            90.00 usec
PLW2        18.00000000 W
PLW12        0.34722000 W
PLW13        0.28125000 W

F2 - Processing parameters
SI                 32768
SF          100.6177975 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```

kerles-PA24 #296 RT: 4.97 AV: 1 SB: 26 1.21-1.34 , 0.87-1.14 NL: 7.20E2
T: {0,0} + c EI Full ms [40.00-1000.00]



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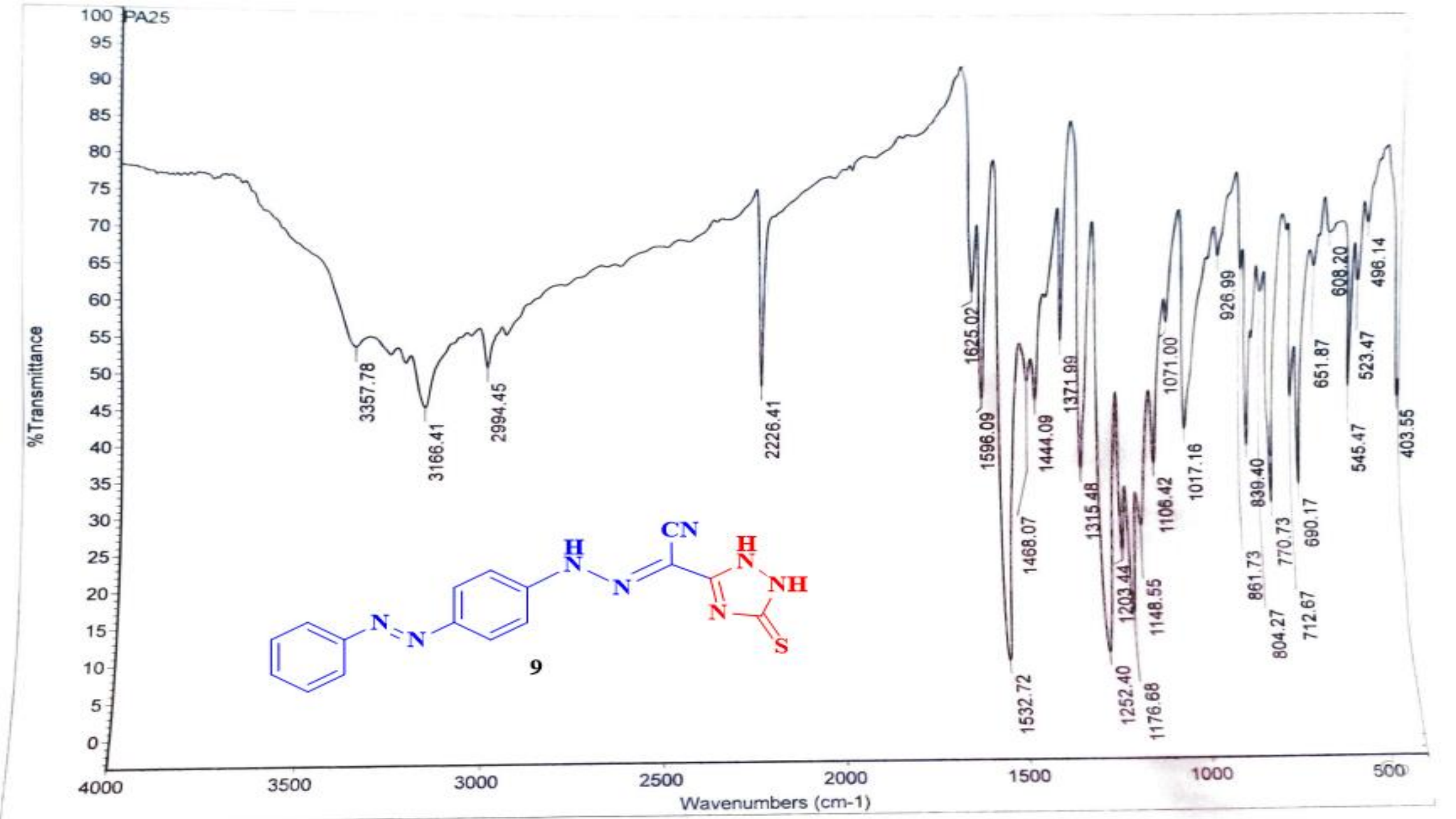
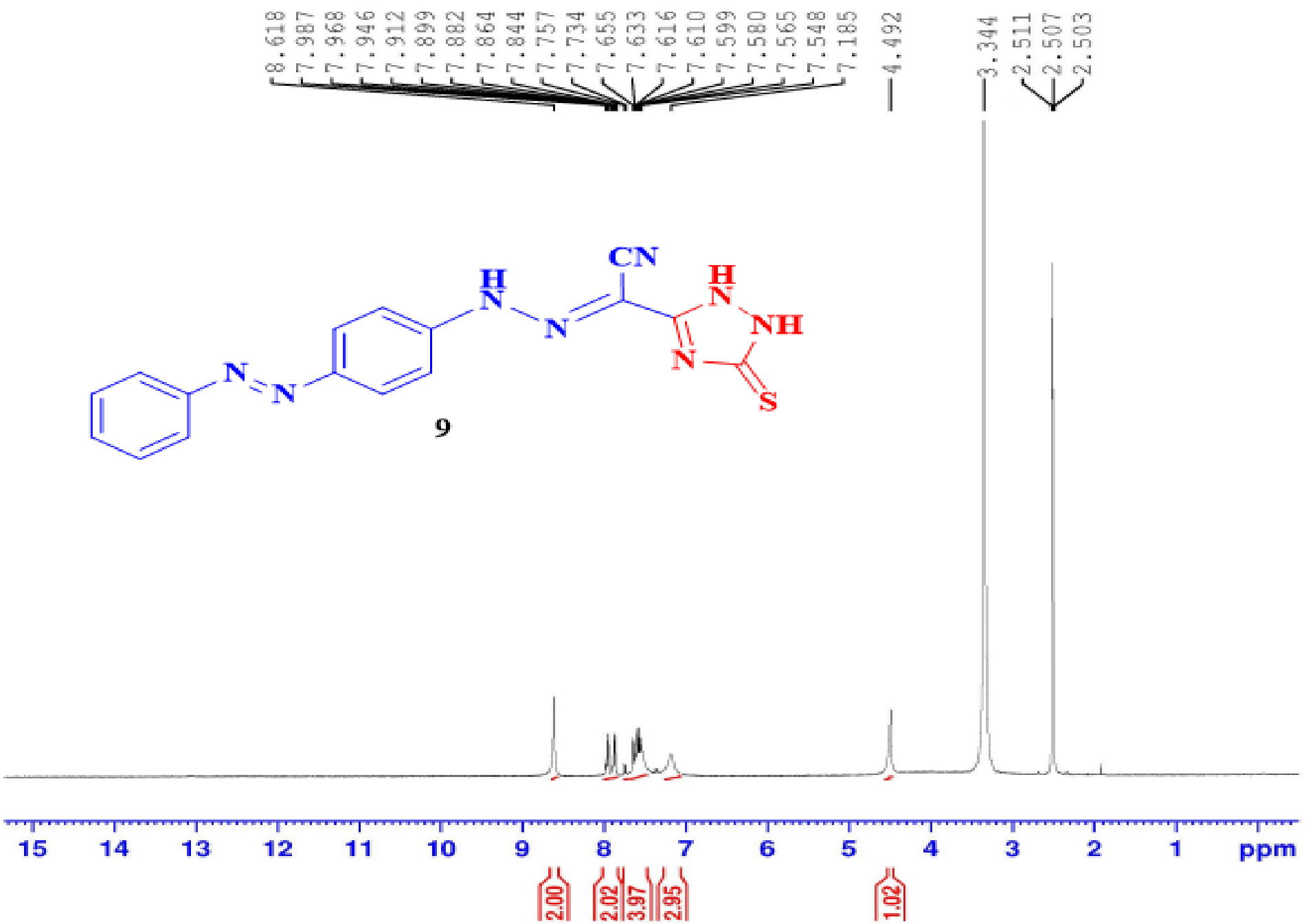
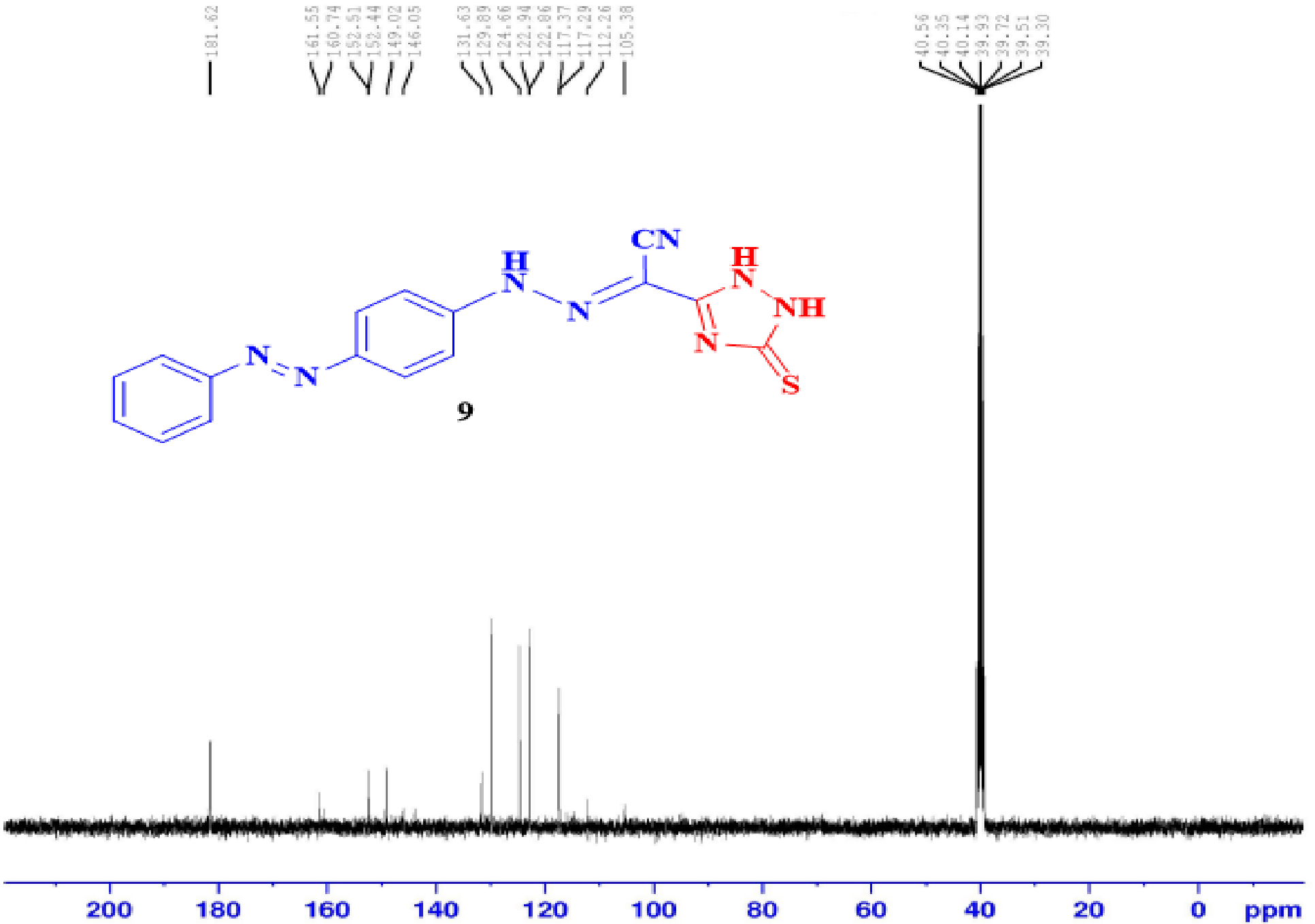

PA25
%Transmittance
Wavenumbers (cm-1)
3357.78
3166.41
2994.45
2226.41
1625.02
1596.09
1532.72
1468.07
1444.09
1371.99
1315.48
1252.40
1203.44
1176.68
1148.55
1106.42
1071.00
1017.16
926.99
861.73
839.40
804.27
770.73
712.67
690.17
651.87
608.20
545.47
523.47
496.14
403.55
CN
H
N
N
N
H
N
NH
N
S
N
N
9



BRUKER

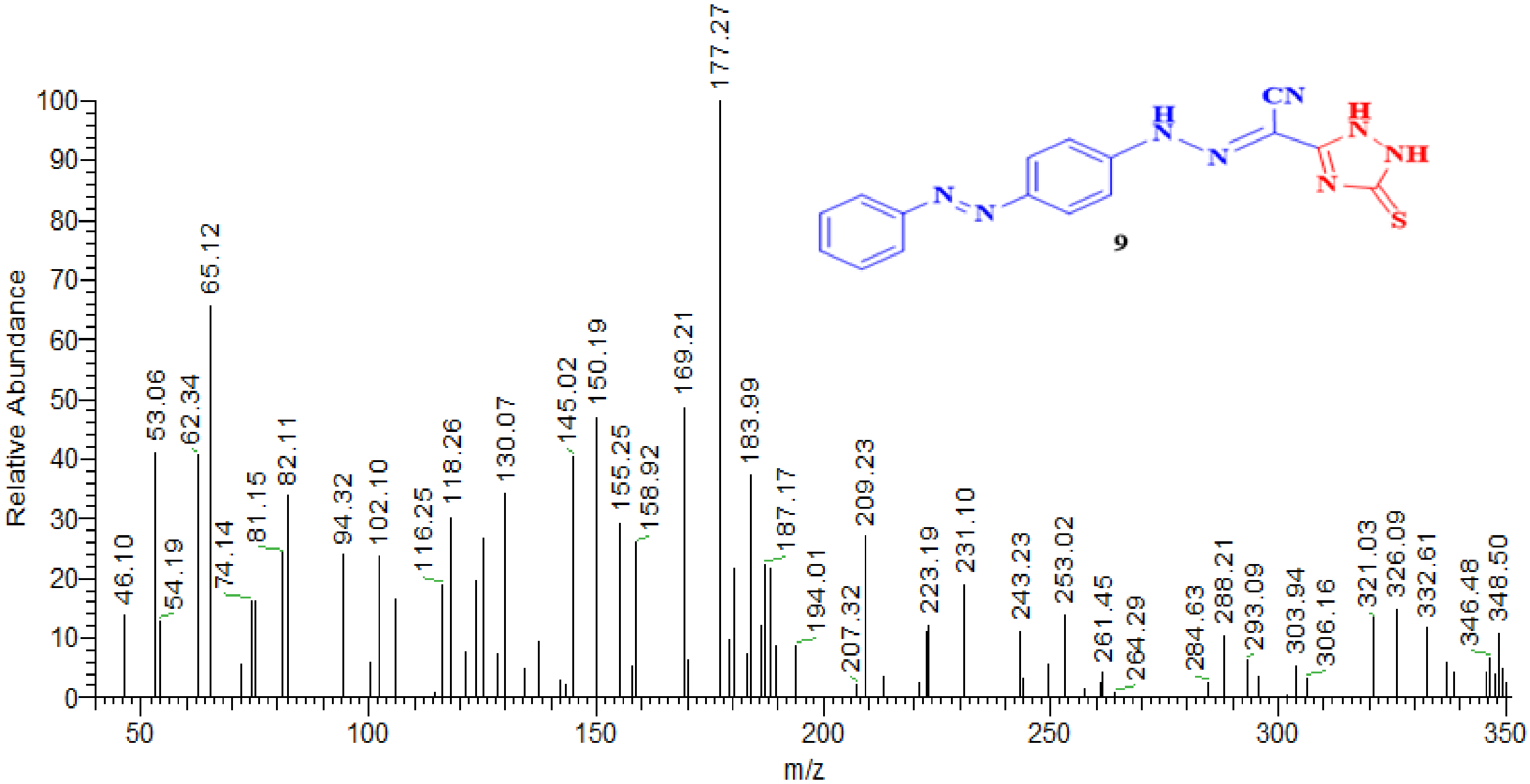
```
Current Data Parameters
NAME      nour eldin-PA25
EXPNO                   1
PROCNO                  1

F2 - Acquisition Parameters
Date_           20230313
Time               17.29
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT             DMSO
NS                   128
DS                     2
SWH             8012.820 Hz
FIDRES          0.122266 Hz
AQ              4.0894465 sec
RG                 205.37
DW                 62.400 usec
DE                  6.50 usec
TE                 300.0 K
D1              1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         400.1524711 MHz
NUC1                   1H
P1                  12.00 usec
PLW1        18.00000000 W

F2 - Processing parameters
SI                 65536
SF          400.1500000 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



BRUKER

```
Current Data Parameters
NAME       nour eldin-PA25
EXPNO                   2
PROCNO                  1

F2 - Acquisition Parameters
Date_           20230316
Time               9.22
INSTRUM           spect
PROBHD    5 mm PABBO BB/
PULPROG         zgpg30
TD              65536
SOLVENT           DMSO
NS                  954
DS                    4
SWH         24038.461 Hz
FIDRES       0.366798 Hz
AQ           1.3631488 sec
RG              205.37
DW              20.800 usec
DE               6.50 usec
TE              300.0 K
D1          2.00000000 sec
D11         0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1      100.6278589 MHz
NUC1              13C
P1              10.00 usec
PLW1     47.00000000 W

======== CHANNEL f2 ========
SFO2      400.1516006 MHz
NUC2              1H
CPDPRG[2       waltz16
PCPD2           90.00 usec
PLW2     18.00000000 W
PLW12     0.34722000 W
PLW13     0.28125000 W

F2 - Processing parameters
SI                32768
SF        100.6177975 MHz
WDW                 EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```

kerles-PA25 #53 RT: 0.90 AV: 1 SB: 26 1.21-1.34 , 0.87-1.14 NL: 1.74E3
T: {0,0} + c EI Full ms [40.00-1000.00]



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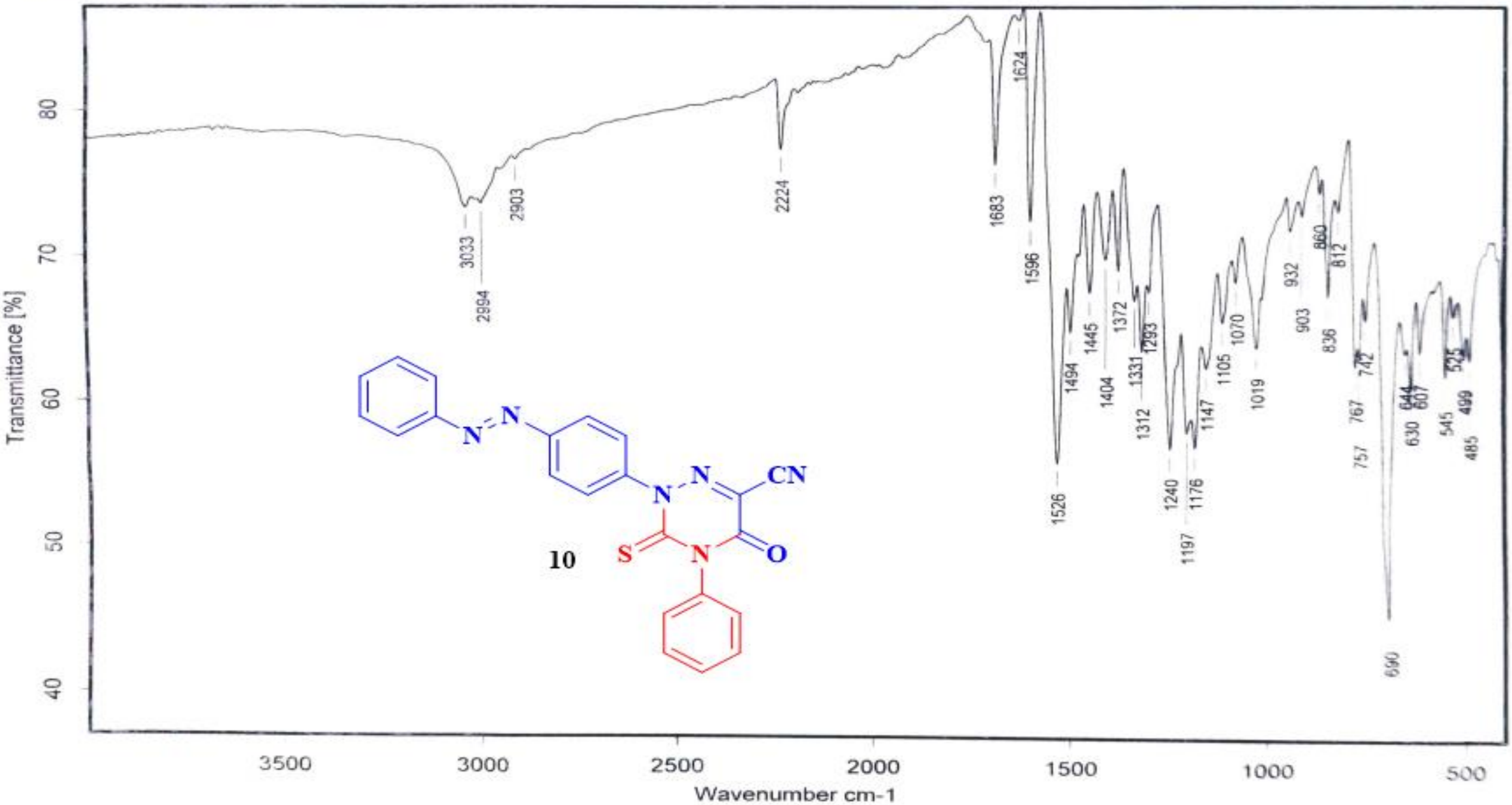
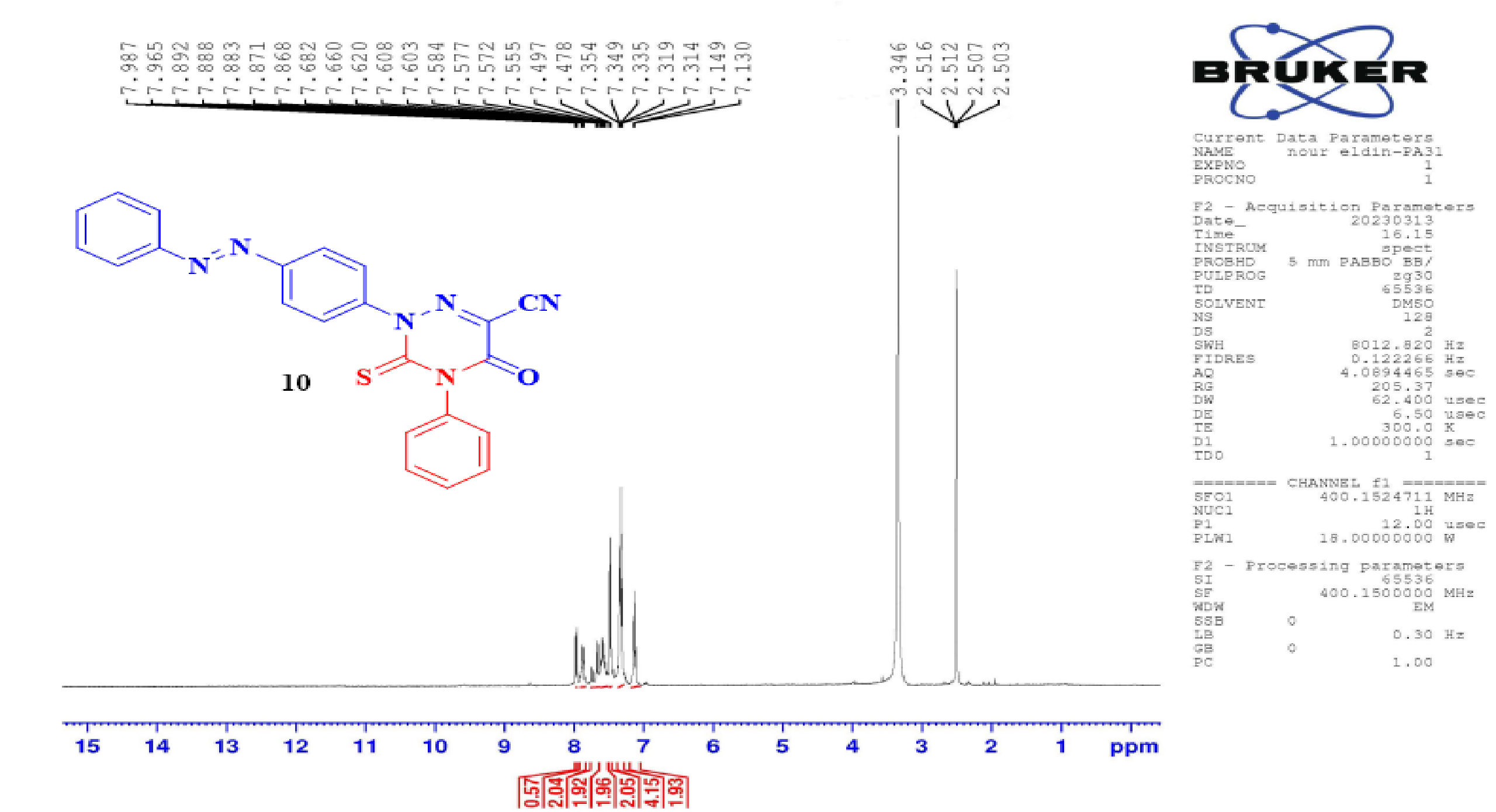
PA31.0


Transmittance [%]
80
70
60
50
40
3033
2994
2903
2224
1683
1624
1596
1526
1494
1445
1404
1372
1331
1312
1293
1240
1197
1176
1147
1105
1070
1019
932
903
860
836
812
767
757
742
690
644
630
607
545
525
499
485
3500
3000
2500
2000
1500
1000
500
Wavenumber cm-1

N
N
N
N
N
CN
S
N
O

10



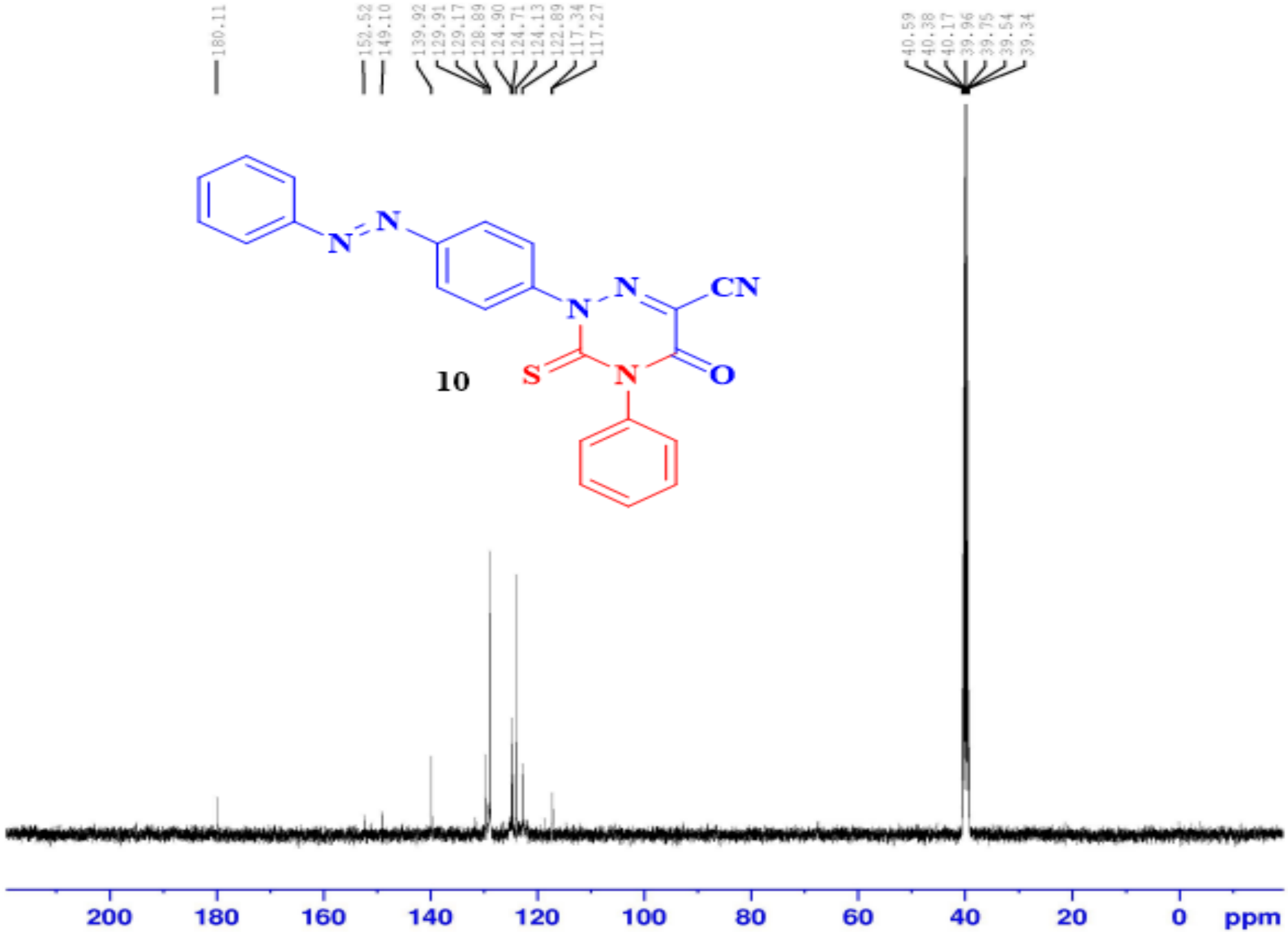
BRUKER

```
Current Data Parameters
NAME      nour eldin-PA31
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20230313
Time              16.15
INSTRUM           spect
PROBHD    5 mm PABBO BB/
PULPROG           zg30
TD               65536
SOLVENT           DMSO
NS                 128
DS                   2
SWH           8012.820 Hz
FIDRES        0.122266 Hz
AQ            4.0894465 sec
RG               205.37
DW               62.400 usec
DE                6.50 usec
TE               300.0 K
D1            1.00000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1        400.1524711 MHz
NUC1              1H
P1               12.00 usec
PLW1        18.00000000 W

F2 - Processing parameters
SI               65536
SF          400.1500000 MHz
WDW                EM
SSB       0
LB                0.30 Hz
GB        0
PC                1.00
```



BRUKER

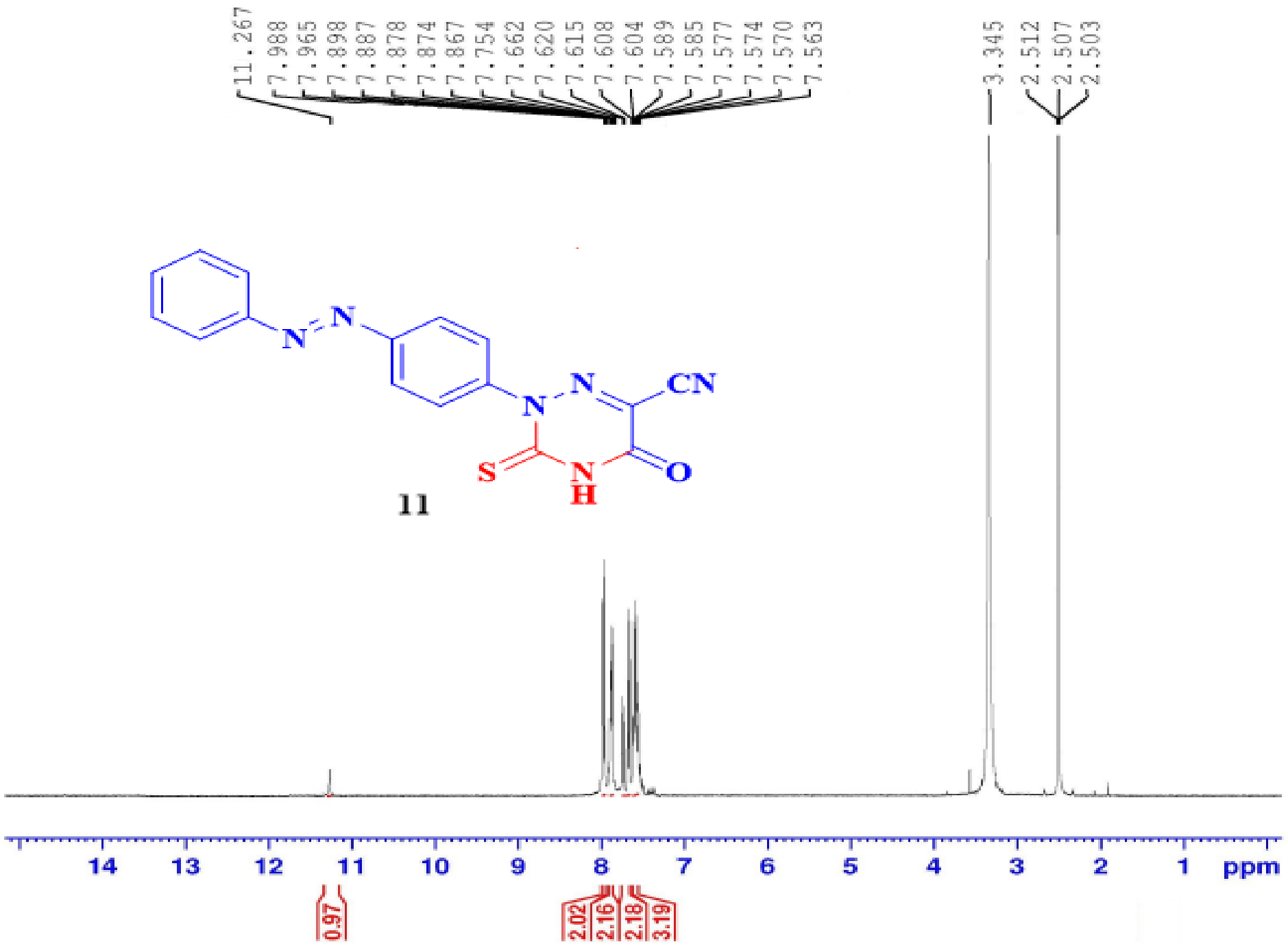
```
Current Data Parameters
NAME      nour eldin-PA31
EXPNO                   2
PROCNO                  1

F2 - Acquisition Parameters
Date_            20230315
Time                11.45
INSTRUM             spect
PROBHD    5 mm PABBO BB/
PULPROG          zgpg30
TD                 65536
SOLVENT             DMSO
NS                  1431
DS                     4
SWH            24038.461 Hz
FIDRES          0.366798 Hz
AQ              1.3631488 sec
RG                205.37
DW                20.800 usec
DE                 6.50 usec
TE                300.0 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1          100.6278588 MHz
NUC1                   13C
P1                   10.00 usec
PLW1          47.00000000 W

======== CHANNEL f2 ========
SFO2          400.1516006 MHz
NUC2                   1H
CPDPRG[2           waltz16
PCPD2                90.00 usec
PLW2          18.00000000 W
PLW12          0.34722000 W
PLW13          0.28125000 W

F2 - Processing parameters
SI                  32768
SF            100.6177975 MHz
WDW                    EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.40
```



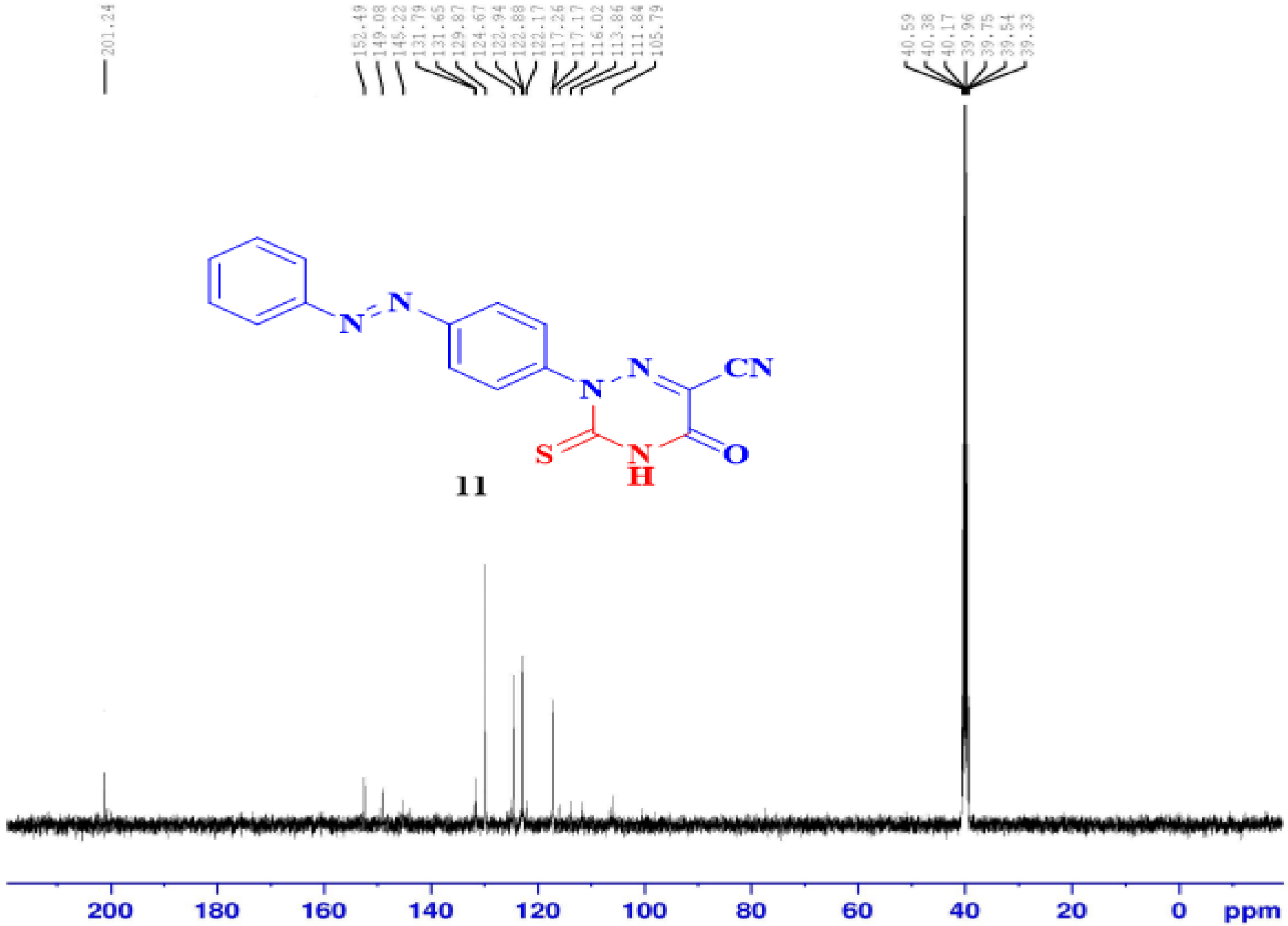
BRUKER

```
Current Data Parameters
NAME      nour eldin-PA28
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20230313
Time               17.42
INSTRUM            spect
PROBHD    5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT             DMSO
NS                   128
DS                     2
SWH           8012.820 Hz
FIDRES        0.122266 Hz
AQ            4.0894465 sec
RG               205.37
DW               62.400 usec
DE                6.50 usec
TE               300.0 K
D1            1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1        400.1524711 MHz
NUC1                   1H
P1                12.00 usec
PLW1        18.00000000 W

F2 - Processing parameters
SI                 65536
SF          400.1500000 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



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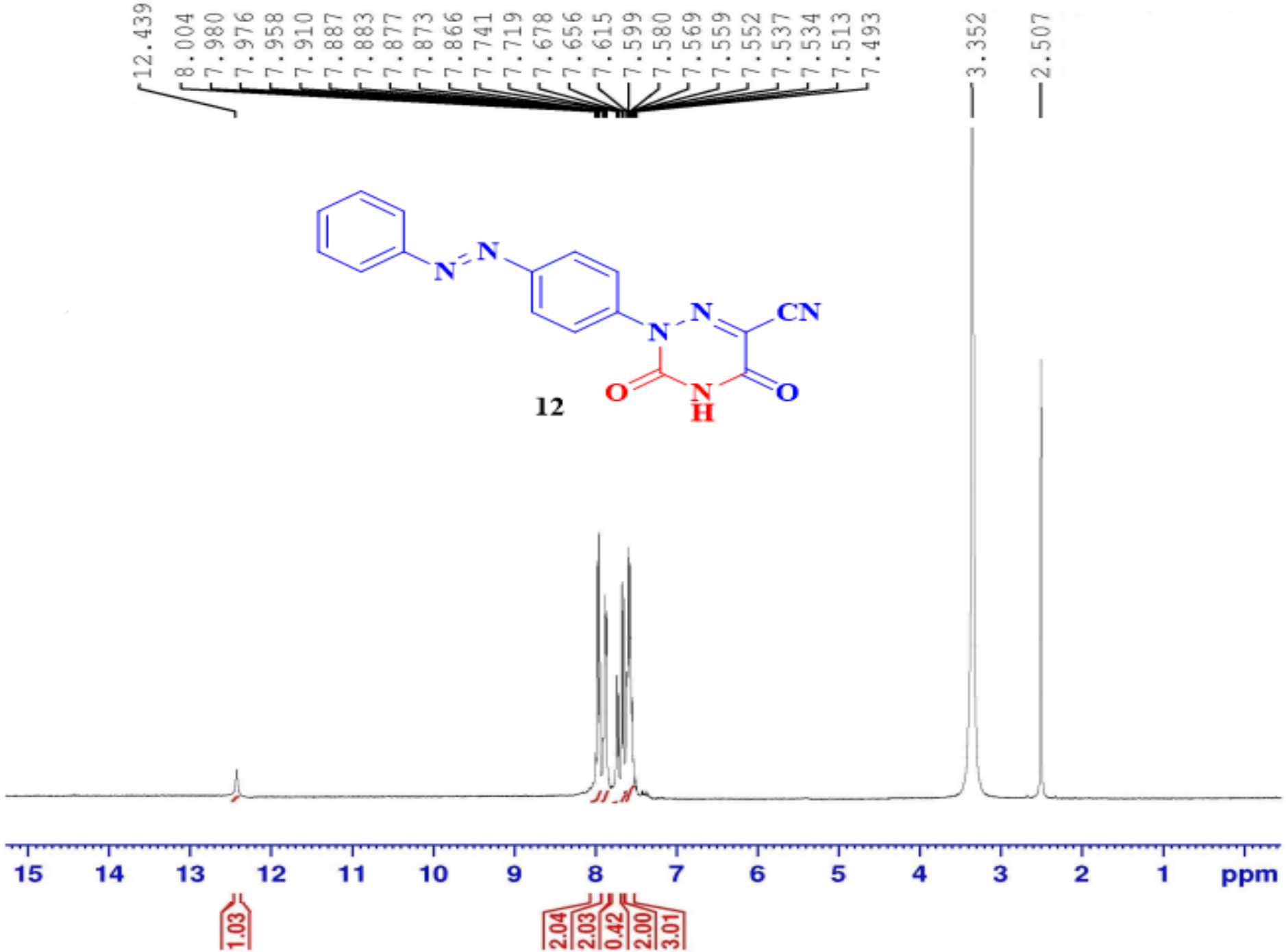
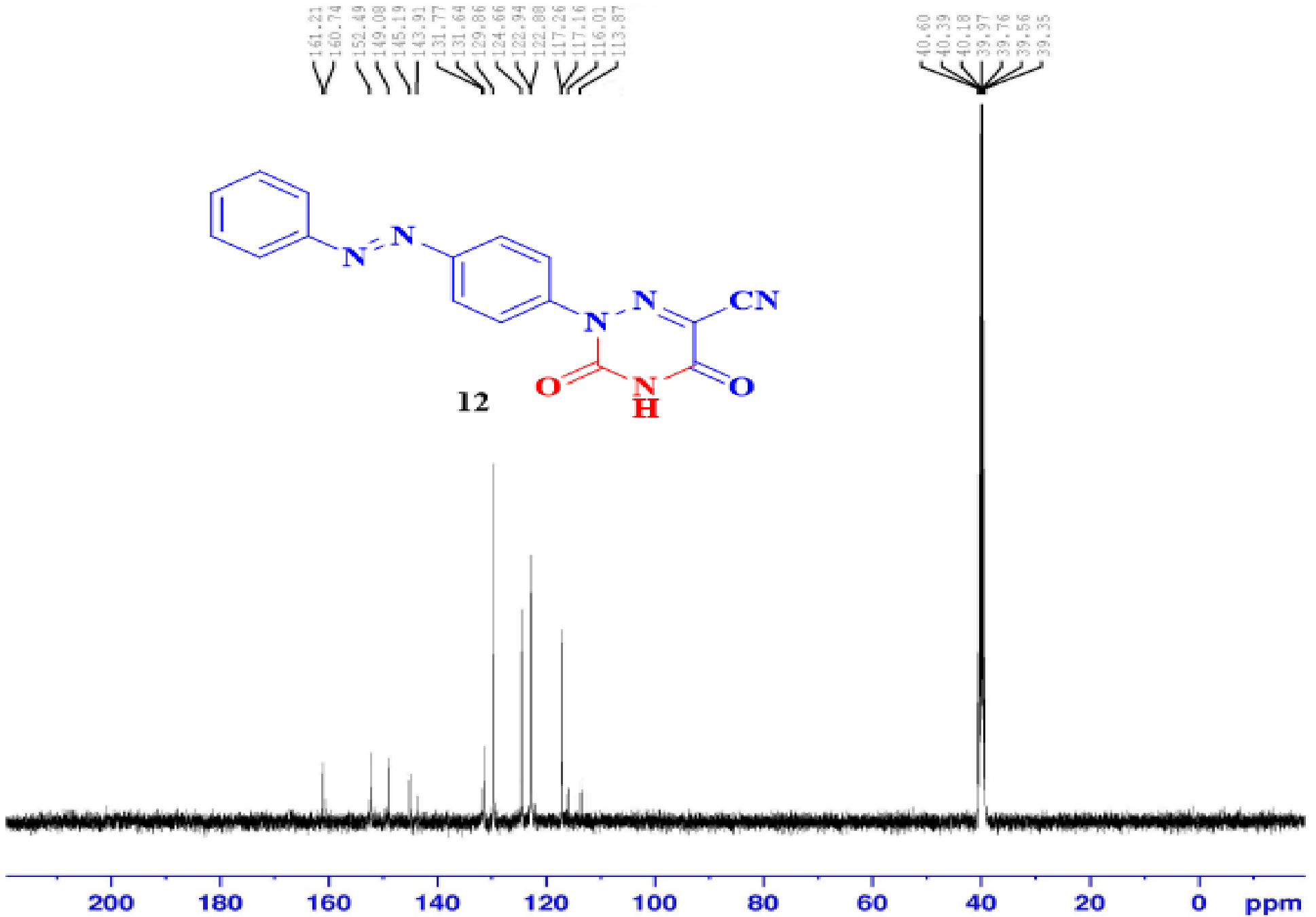
BRUKER

```
Current Data Parameters
NAME      nour eldin-PA28
EXPNO                  2
PROCNO                 1

F2 - Acquisition Parameters
Date_           20230315
Time               13.49
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
ID                65536
SOLVENT            DMSO
NS                 1000
DS                    4
SWH          24038.461 Hz
FIDRES        0.366798 Hz
AQ            1.3631488 sec
RG               205.37
DW               20.800 usec
DE                6.50 usec
TE               300.0 K
D1           2.00000000 sec
D11          0.03000000 sec
ID0                   1

======== CHANNEL f1 ========
SFO1       100.6276588 MHz
NUC1               13C
P1               10.00 usec
PLW1       47.00000000 W

======== CHANNEL f2 ========
SFO2       400.1516006 MHz
NUC2               1H
CPDPRG[2        waltz16
PCPD2            90.00 usec
PLW2       18.00000000 W
PLW12       0.34722000 W
PLW13       0.28125000 W

F2 - Processing parameters
SI                32768
SF         100.6177975 MHz
WDW                EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```



BRUKER

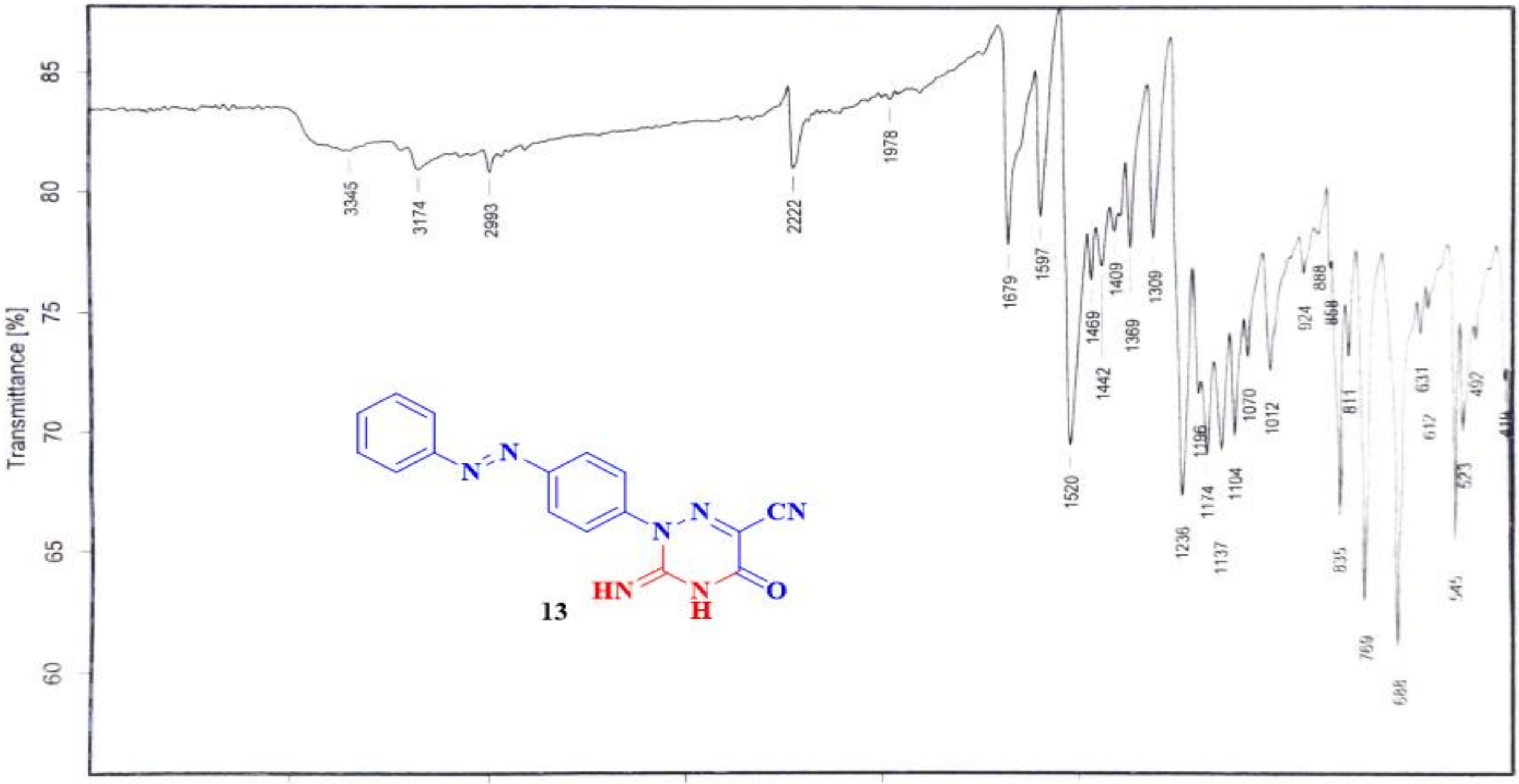
```
Current Data Parameters
NAME      nour eldin-PA27
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20230313
Time               16.37
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT             DMSO
NS                    84
DS                     2
SWH             8012.820 Hz
FIDRES          0.122266 Hz
AQ              4.0894465 sec
RG                205.37
DW                62.400 usec
DE                 6.50 usec
TE                300.0 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         400.1524711 MHz
NUC1                   1H
P1                 12.00 usec
PLW1        18.00000000 W

F2 - Processing parameters
SI                 65536
SF           400.1500000 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



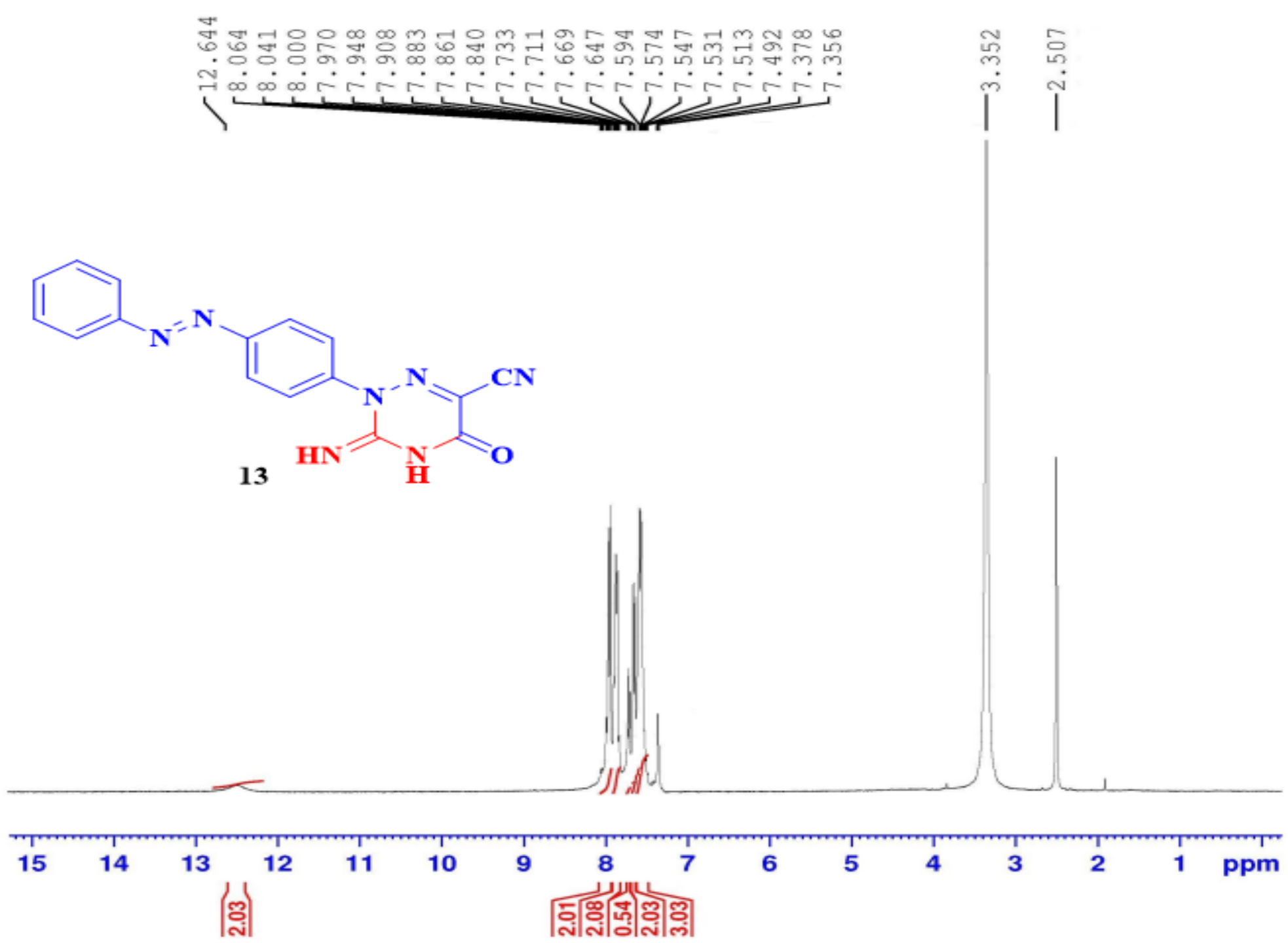
BRUKER

```
Current Data Parameters
NAME      nour eldin-PA27
EXPNO                  2
PROCNO                 1

F2 - Acquisition Parameters
Date_           20230314
Time              12.30
INSTRUM           spect
PROBHD    5 mm PABBO BB/
PULPROG         zgpg30
TD               65536
SOLVENT           DMSO
NS                1376
DS                   4
SWH          24038.461 Hz
FIDRES        0.366799 Hz
AQ            1.3631488 sec
RG              205.37
DW              20.800 usec
DE               6.50 usec
TE              300.0 K
D1          2.00000000 sec
D11         0.03000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1       100.6278589 MHz
NUC1              13C
P1              10.00 usec
PLW1       47.00000000 W

======== CHANNEL f2 ========
SFO2       400.1516006 MHz
NUC2              1H
CPDPRG[2       waltz16
PCPD2            90.00 usec
PLW2       18.00000000 W
PLW12       0.34722000 W
PLW13       0.28125000 W

F2 - Processing parameters
SI               32768
SF         100.6177975 MHz
WDW                EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```

PA29.0

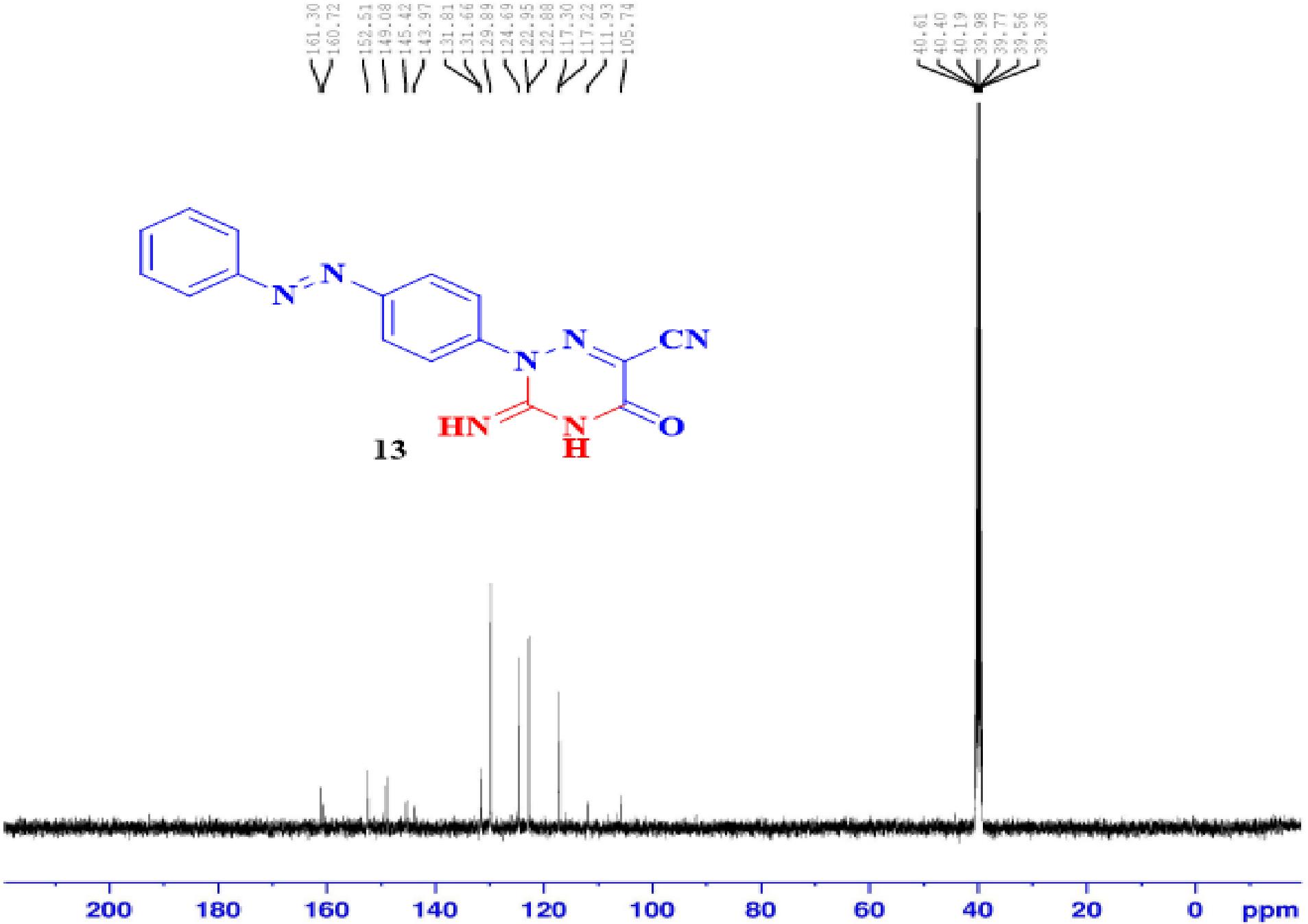

Transmittance [%]
85
80
75
70
65
60
3500
3000
2500
2000
1500
1000
500
3345
3174
2993
2222
1978
1679
1597
1520
1469
1442
1409
1369
1309
1236
1196
1174
1137
1104
1070
1012
924
888
868
835
811
769
688
631
612
523
497
HN
N
H
N
N
CN
O

13



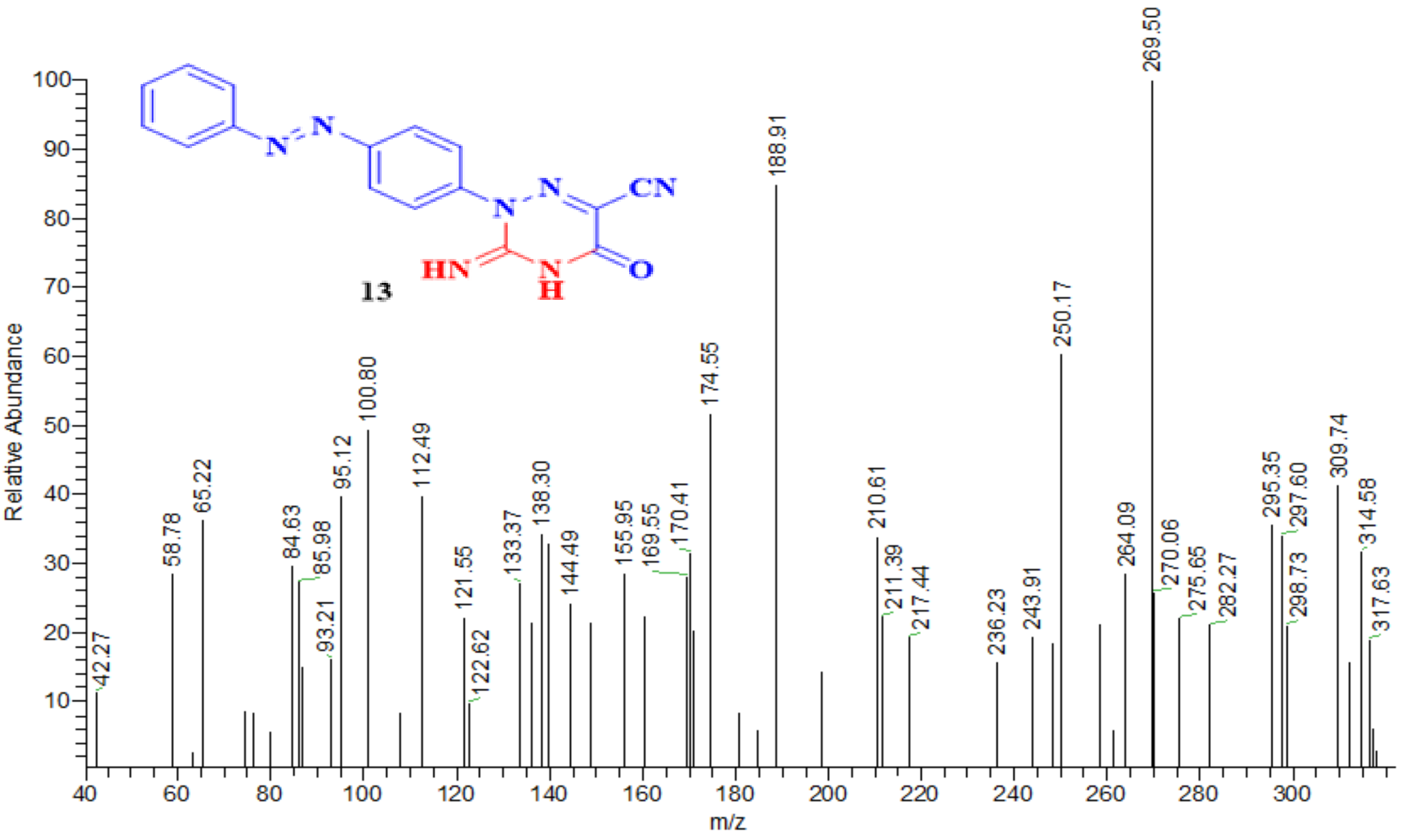
BRUKER

```
Current Data Parameters
NAME      nour eldin-PA29
EXPNO                  1
PROCNO                 1

F2 - Acquisition Parameters
Date_           20230313
Time               15.39
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT             DMSO
NS                   112
DS                     2
SWH             8012.820 Hz
FIDRES          0.122266 Hz
AQ              4.0894465 sec
RG                 31.47
DW                62.400 usec
DE                 6.50 usec
TE                300.0 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         400.1524711 MHz
NUC1                   1H
P1                 12.00 usec
PLW1        18.00000000 W

F2 - Processing parameters
SI                 65536
SF          400.1500000 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```

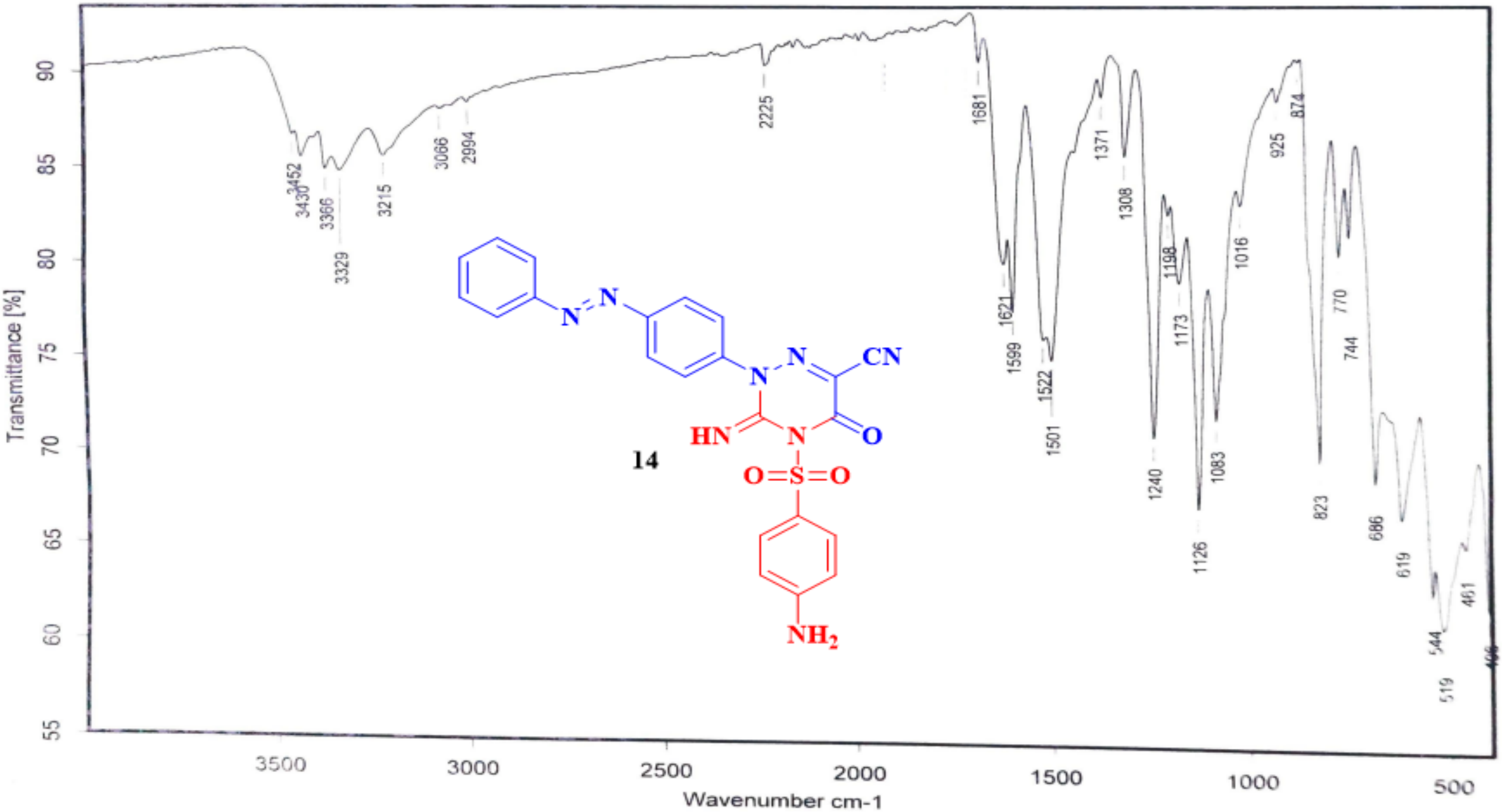


BRUKER

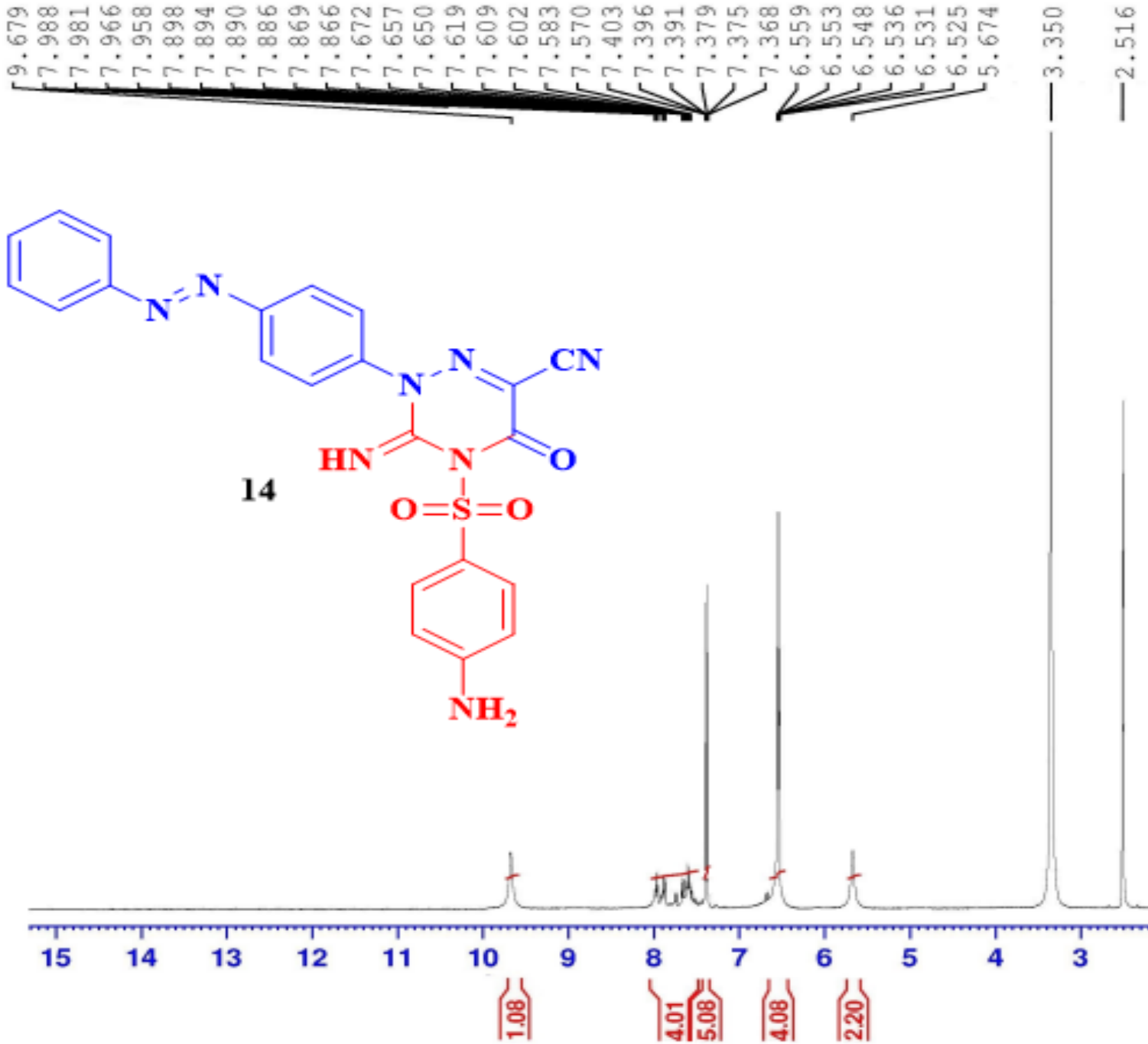
```
Current Data Parameters
NAME      nour eldin-PA29
EXPNO                   2
PROCNO                  1

F2 - Acquisition Parameters
Date_            20230314
Time                10.13
INSTRUM             spect
PROBHD    5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT            DMSO
NS                 1500
DS                    4
SWH          24038.461 Hz
FIDRES        0.366798 Hz
AQ            1.3631488 sec
RG               205.37
DW               20.800 usec
DE                6.50 usec
TE               300.0 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1       100.6278589 MHz
NUC1               13C
P1               10.00 usec
PLW1       47.00000000 W

======== CHANNEL f2 ========
SFO2       400.1516006 MHz
NUC2               1H
CPDPRG[2        waltz16
PCPD2            90.00 usec
PLW2       18.00000000 W
PLW12       0.34722000 W
PLW13       0.28125000 W

F2 - Processing parameters
SI                32768
SF         100.6177975 MHz
WDW                EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```


13
Relative Abundance
m/z
42.27
58.78
65.22
84.63
85.98
93.21
95.12
100.80
112.49
121.55
122.62
133.37
138.30
144.49
155.95
169.55
170.41
174.55
188.91
210.61
211.39
217.44
236.23
243.91
250.17
264.09
269.50
270.06
275.65
282.27
295.35
297.60
298.73
309.74
314.58
317.63

PA30.0

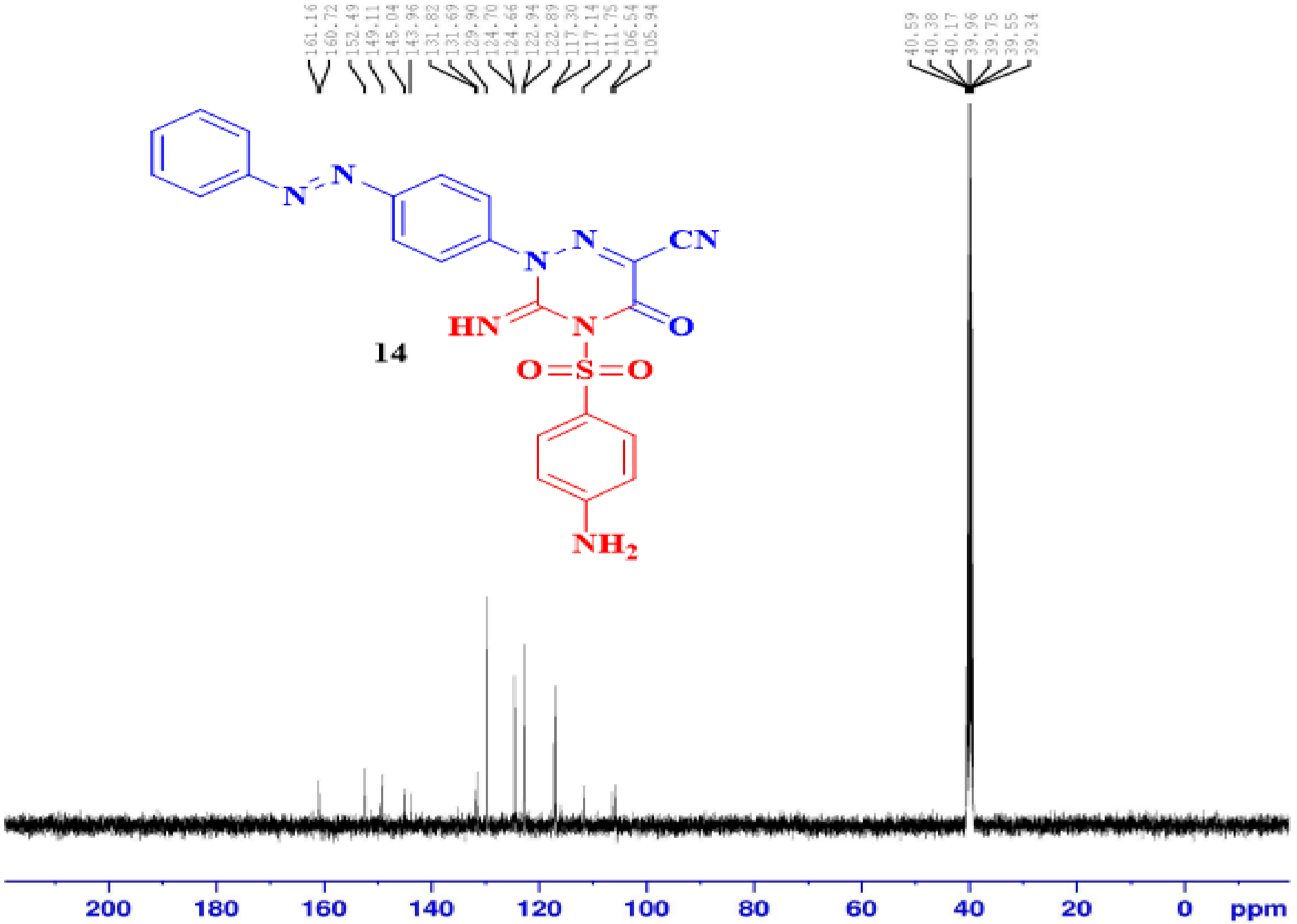

Transmittance [%]
90
85
80
75
70
65
60
55
3500
3000
2500
2000
1500
1000
500
Wavenumber cm-1
3452
3430
3366
3329
3215
3066
2994
2225
1681
1621
1599
1522
1501
1371
1308
1240
1198
1173
1126
1083
1016
925
874
823
770
744
686
619
544
519
461
HN
O
CN
O=S=O
NH2

14



BRUKER

```
Current Data Parameters
NAME      nour eldin-PA30
EXPNO                  2
PROCNO                 1

F2 - Acquisition Parameters
Date_           20230313
Time               17.16
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT             DMSO
NS                   106
DS                     2
SWH             8012.820 Hz
FIDRES          0.122266 Hz
AQ              4.0894465 sec
RG                205.37
DW                62.400 usec
DE                 6.50 usec
TE                300.0 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         400.1524711 MHz
NUC1                   1H
P1                 12.00 usec
PLW1        18.00000000 W

F2 - Processing parameters
SI                 65536
SF           400.1500000 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



BRUKER

```
Current Data Parameters
NAME      nour eldin-PA30
EXPNO                  3
PROCNO                 1

F2 - Acquisition Parameters
Date_           20230314
Time               12.49
INSTRUM            spect
PROBHD    5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT            DMSO
NS                   285
DS                     4
SWH          24038.461 Hz
FIDRES        0.366798 Hz
AQ            1.3631488 sec
RG               205.37
DW               20.800 usec
DE                6.50 usec
TE               299.9 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1        100.6278589 MHz
NUC1                13C
P1                10.00 usec
PLW1         47.00000000 W

======== CHANNEL f2 ========
SFO2        400.1516006 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2             90.00 usec
PLW2         18.00000000 W
PLW12         0.34722000 W
PLW13         0.28125000 W

F2 - Processing parameters
SI                 32768
SF          100.6177975 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```

kerles-PA30 #204 RT: 3.43 AV: 1 SB: 26 1.21-1.34 , 0.87-1.14 NL: 5.41E3
T: {0,0} + c EI Full ms [40.00-1000.00]