Supporting information

Facile Synthesis of (*E*)-*β*-Nitroolefinic Alkoxyamines *via* Silver-Catalyzed Decarboxylative Nitroaminoxylation of Phenylpropiolic Acids

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Contents

1. General Information

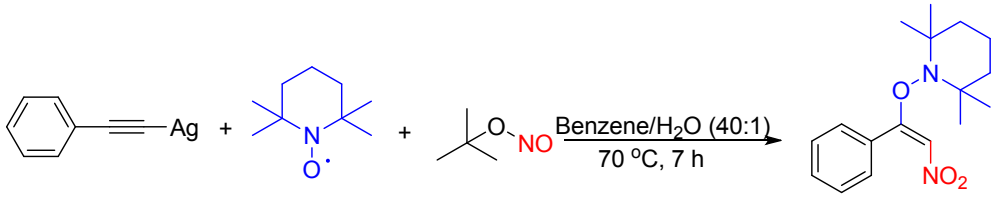
All the reactions were carried out under the air atmosphere condition. Solvents were dried and degassed by standard methods and all alkynes, 4-Acetamido-TEMPO and 4-Hydroxy-2,2,6,6-tetramethyl-piperidinooxy were commercial available. 4-Acetoxyl TEMPO[1] and silver phenylacetylide[2] were synthesized as the literature reported. Flash column chromatography was performed using silica gel (300-400 mesh). Analytical thin-layer chromatography was performed using glass plates pre-coated with 200-400 mesh silica gel impregnated with a fluorescent indicator (254 nm). NMR spectra were measured in $CDCl_3$ on 400 MHz or 300 MHz NMR spectrometer with TMS as an internal reference. Products were characterized by comparison of ^1H NMR, ^{13}C NMR, LC-MS.

2. General Procedure for Silver-catalyzed Decarboxylative Nitroaminoxylation of Phenylpropiolic Acid

Phenylpropiolic acid (0.0439 g), TEMPO (0.3mmol, 0.0469 g) and silver oxide (5 mol %, 0.0035 g) were added to a test tube. Then benzene (2 mL) and *tert*-butylnitrite (2 equiv, 72 μL) was added to the tube in order. The resulting reaction mixture was kept stirring at 70 °C for 24 h. At the end of the reaction, the reaction mixture was cooled to room temperature. After removal of the solvent, the residue was subjected to column chromatography on silica gel using ethyl acetate and petroleum ether mixtures to afford the desired product in high purity.

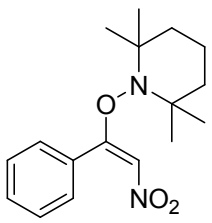
3. Mechanic study

Silver phenylacetylide (0.3mmol, 0.0627 g), TEMPO (0.3mmol, 0.0469 g) and were added to a test tube. Then benzene (2 mL), distilled water (50 μL) and *tert*-butylnitrite (2 equiv, 72 μL) was added to the tube in order. The resulting reaction mixture was kept stirring at 70 °C for 7 h. At the end of the reaction, the reaction mixture was cooled to room temperature. After removal of the solvent, the residue was subjected to column chromatography on silica gel using ethyl acetate and petroleum ether mixtures to afford **4a** in 49% yield.



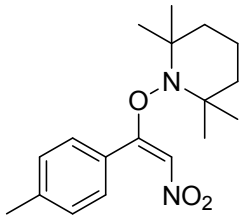
49 %

4. Characterization Data of All Products



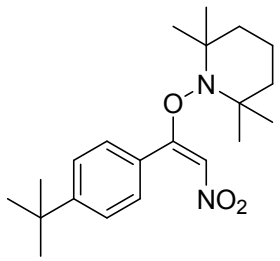
(*E*)-2,2,6,6-tetramethyl-1-((2-nitro-1-phenylvinyl)oxy)piperidine (4a)

The product was purified on silica gel column chromatography (petroleum ether/ethyl acetate, 36:1, R_f = 0.4); yellow solid, 69.4 mg; m.p. 108-110 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (s, 1H), 7.53-7.47 (m, 5H), 1.68-1.64 (m, 5H), 1.50-1.46 (m, 1H), 1.25 (s, 6H), 1.22 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.8, 131.8, 130.6, 128.3, 128.2, 123.4, 61.6, 39.6, 32.0, 20.7, 16.7. HRMS (TOF MS ESI+) $[M+Na]^+$ calculated for $C_{17}H_{24}N_2NaO_3$ 327.1685, found 327.1681.



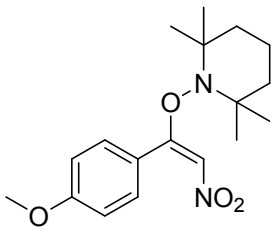
(*E*)-2,2,6,6-tetramethyl-1-((2-nitro-1-(p-tolyl)vinyl)oxy)piperidine (4b)

The product was purified on silica gel column chromatography (petroleum ether/ethyl acetate, 36:1, R_f = 0.4); yellow solid, 67.6 mg; m.p. 100-102 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (s, 1H), 7.38 (d, *J* = 8.0 Hz, 2H), 7.28 (d, *J* = 8.0 Hz, 2H), 2.45 (s, 3H), 1.68-1.63 (m, 5H), 1.50-1.45 (m, 1H), 1.24 (s, 6H), 1.22 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.9, 141.0, 129.0, 128.8, 128.2, 123.2, 61.5, 39.6, 32.0, 21.6, 20.7, 16.7. HRMS (TOF MS ESI+) $[M+Na]^+$ calculated for $C_{18}H_{26}N_2NaO_3$ 341.1841, found 341.1800.



(*E*)-1-((1-(4-(tert-butyl)phenyl)-2-nitrovinyl)oxy)-2,2,6,6-tetramethylpiperidine (4c)

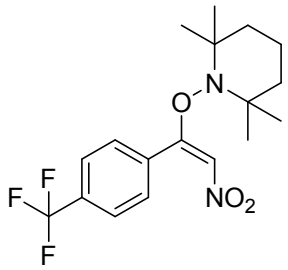
The product was purified on silica gel column chromatography (petroleum ether/ethyl acetate, 36:1, R_f = 0.3); yellow solid, 80.6 mg; m.p. 125-127 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (s, 1H), 7.50-7.42 (m, 4H), 1.68-1.63 (m, 5H), 1.50-1.45 (m, 1H), 1.38 (s, 9H), 1.23 (s, 12H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.8, 154.0, 128.6, 128.2, 125.2, 123.2, 61.5, 39.6, 35.0, 32.0, 31.2, 20.8, 16.7. HRMS (TOF MS ESI+) $[M+Na]^+$ calculated for $C_{21}H_{32}N_2NaO_3$ 383.2311, found 383.2285.



(*E*)-1-((1-(4-methoxyphenyl)-2-nitrovinyl)oxy)-2,2,6,6-tetramethylpiperidine (4d)

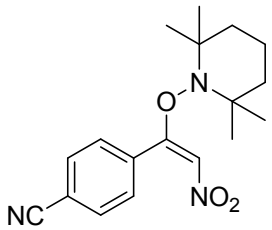
The product was purified on silica gel column chromatography (petroleum ether/ethyl acetate, 36:1, R_f = 0.1); yellow oil, 65.2 mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 (s, 1H), 7.36 (d, *J* = 8.8 Hz, 2H), 6.88

(d, *J* = 8.8 Hz, 2H), 3.78 (s, 3H), 1.58-1.53 (m, 5H), 1.39-1.35 (m, 1H), 1.12 (d, *J* = 3.6 Hz, 12H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.5, 161.6, 130.2, 123.5, 122.9, 113.7, 61.5, 55.4, 39.6, 32.0, 20.7, 16.7. HRMS (TOF MS ESI+) $[M+Na]^+$ calculated for $C_{18}H_{26}N_2NaO_4$ 357.1790, found 357.1774.



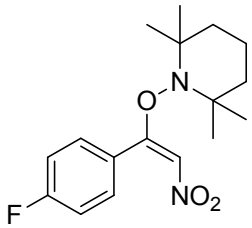
(*E*)-2,2,6,6-tetramethyl-1-((2-nitro-1-(4-(trifluoromethyl)phenyl)vinyl)oxy)piperidine (4e)

The product was purified on silica gel column chromatography (petroleum ether/ethyl acetate, 36:1, R_f = 0.4); yellow solid, 48.3 mg; m.p. 88-90 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 (s, 1H), 7.74 (d, *J* = 8.0 Hz, 2H), 7.57 (d, *J* = 8.0 Hz, 2H), 1.68-1.65 (m, 5H), 1.51-1.46 (m, 1H), 1.25 (s, 6H), 1.21 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.2, 135.5 (d, *J* = 1.1 Hz), 132.32 (d, *J* = 32.9 Hz), 128.6, 125.4 (q, *J* = 3.8 Hz), 124.0, 123.7 (d, *J* = 273.6 Hz), 61.7, 39.6, 32.1, 20.7, 16.6. HRMS (TOF MS ESI+) $[M+Na]^+$ calculated for $C_{18}H_{23}F_3N_2NaO_3$ 395.1558, found 395.1561.



(*E*)-4-(2-nitro-1-((2,2,6,6-tetramethylpiperidin-1-yl)oxy)vinyl)benzonitrile (4f)

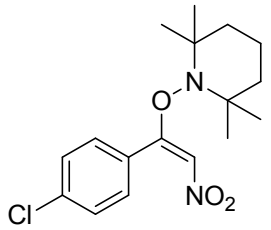
The product was purified on silica gel column chromatography (petroleum ether/ethyl acetate, 12:1, R_f = 0.5); yellow solid, 60.7 mg; m.p. 168-170 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (s, 1H), 7.78 (d, *J* = 8.4 Hz, 2H), 7.55 (d, *J* = 8.4 Hz, 2H), 1.68-1.65 (m, 5H), 1.50-1.47 (m, 1H), 1.24 (s, 6H), 1.21 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 169.5, 136.4, 132.2, 128.9, 124.2, 118.1, 114.3, 61.8, 39.6, 32.1, 20.7, 16.6. HRMS (TOF MS ESI+) $[M+Na]^+$ calculated for $C_{18}H_{23}N_3NaO_3$ 352.1637, found 352.1623.



(*E*)-1-((1-(4-fluorophenyl)-2-nitrovinyl)oxy)-2,2,6,6-tetramethylpiperidine (4g)

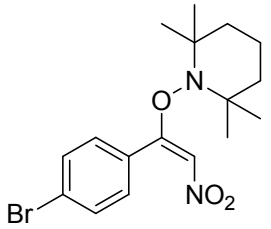
The product was purified on silica gel column chromatography (petroleum ether/ethyl acetate, 36:1, R_f = 0.4); yellow solid, 73.1 mg; m.p. 113-115 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (s, 1H), 7.49-7.45 (m, 2H), 7.19- 7.13 (m, 2H), 1.68-1.63 (m, 5H), 1.50-1.45 (m, 1H), 1.22 (d, *J* = 3.2 Hz, 12H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.6, 164.0 (d, *J* = 252.3 Hz), 130.5 (d, *J* = 8.8 Hz), 127.7 (d, *J* = 3.6 Hz),

123.55, 115.6 (d, J = 22.2 Hz), 61.6, 39.6, 32.0, 20.7, 16.7. HRMS (TOF MS ESI+) $[M+Na]^+$ calculated for $C_{17}H_{23}FN_2NaO_3$ 345.1590, found 345.1574.



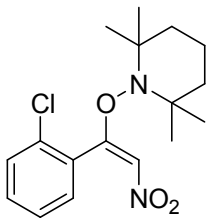
(*E*)-1-((1-(4-chlorophenyl)-2-nitrovinyl)oxy)-2,2,6,6-tetramethylpiperidine (4h)

The product was purified on silica gel column chromatography (petroleum ether/ethyl acetate, 36:1, R_f = 0.4); yellow solid, 53.5 mg; m.p. 100-102 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (s, 1H), 7.46-7.39 (m, 4H), 1.68-1.63 (m, 5H), 1.50-1.45 (m, 1H), 1.22 (d, J = 5.2 Hz, 12H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.5, 136.8, 130.2, 129.6, 128.7, 123.7, 61.6, 39.6, 32.0, 20.7, 16.7. HRMS (TOF MS ESI+) $[M+Na]^+$ calculated for $C_{17}H_{23}ClN_2NaO_3$ 361.1295, found 361.1294.



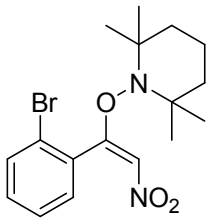
(*E*)-1-((1-(4-bromophenyl)-2-nitrovinyl)oxy)-2,2,6,6-tetramethylpiperidine (4i)

The product was purified on silica gel column chromatography (petroleum ether/ethyl acetate, 36:1, R_f = 0.4); yellow solid, 56.9 mg; m.p. 78-80 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 (s, 1H), 7.52 (d, J = 8.4 Hz, 2H), 7.24 (d, J = 8.4 Hz, 2H), 1.58-1.54 (m, 5H), 1.40-1.36 (m, 1H), 1.12 (d, J = 5.6 Hz, 12H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.5, 131.7, 130.7, 129.8, 125.2, 123.7, 61.6, 39.6, 32.0, 20.7, 16.7. HRMS (TOF MS ESI+) $[M+Na]^+$ calculated for $C_{17}H_{23}BrN_2NaO_3$ 405.0790, found 405.0781.



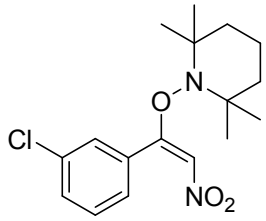
(*E*)-1-((1-(2-chlorophenyl)-2-nitrovinyl)oxy)-2,2,6,6-tetramethylpiperidine (4j)

The product was purified on silica gel column chromatography (petroleum ether/ethyl acetate, 36:1, R_f = 0.4); yellow solid, 78.2 mg; m.p. 135-137 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (s, 1H), 7.52-7.50 (m, 1H), 7.46-7.42 (m, 1H), 7.40-7.34 (m, 2H), 1.68-1.61 (m, 5H), 1.48-1.45 (m, 1H), 1.32 (d, J = 21.6 Hz, 6H), 1.20 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 168.9, 132.7, 132.1, 131.1, 129.8, 129.2, 126.9, 125.0, 61.9, 40.0, 32.2, 20.6, 16.7. HRMS (TOF MS ESI+) $[M+Na]^+$ calculated for $C_{17}H_{23}ClN_2NaO_3$ 361.1295, found 361.1277.



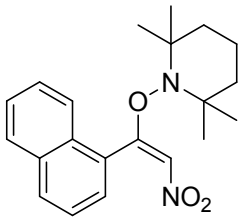
(*E*)-1-((1-(2-bromophenyl)-2-nitrovinyl)oxy)-2,2,6,6-tetramethylpiperidine (4k)

The product was purified on silica gel column chromatography (petroleum ether/ethyl acetate, 36:1, R_f = 0.3); yellow solid, 94.5 mg; m.p. 144-146 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90 (s, 1H), 7.69-7.67 (m, 1H), 7.45-7.41 (m, 1H), 7.37-7.33 (m, 2H), 1.65 (s, 5H), 1.47-1.44 (m, 1H), 1.40 (s, 3H), 1.28 (s, 3H), 1.21 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.0, 134.2, 133.0, 131.2, 129.4, 127.5, 124.8, 121.8, 62.1, 61.8, 40.2, 39.8, 32.2, 20.6, 16.7. HRMS (TOF MS ESI+) $[M+Na]^+$ calculated for $C_{17}H_{23}BrN_2NaO_3$ 405.0790, found 405.0780.



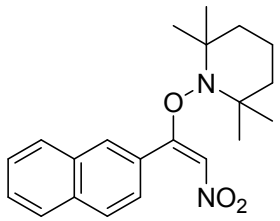
(*E*)-1-((1-(3-chlorophenyl)-2-nitrovinyl)oxy)-2,2,6,6-tetramethylpiperidine (4l)

The product was purified on silica gel column chromatography (petroleum ether/ethyl acetate, 36:1, R_f = 0.4); yellow solid, 65.6 mg; m.p. 72-74 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.82 (s, 1H), 7.51-7.48 (m, 1H), 7.43-7.39 (m, 2H), 7.34-7.32 (m, 1H), 1.68-1.64 (m, 5H), 1.51-1.46 (m, 1H), 1.23 (s, 6H), 1.22 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.1, 134.3, 133.5, 130.7, 129.7, 128.1, 126.4, 123.8, 61.7, 39.6, 32.1, 20.7, 16.7. HRMS (TOF MS ESI+) $[M+Na]^+$ calculated for $C_{17}H_{23}ClN_2NaO_3$ 361.1295, found 361.1270.



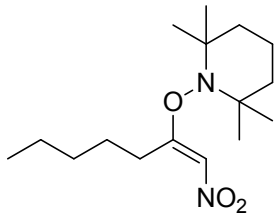
(*E*)-2,2,6,6-tetramethyl-1-((1-(naphthalen-1-yl)-2-nitrovinyl)oxy)piperidine (4m)

The product was purified on silica gel column chromatography (petroleum ether/ethyl acetate, 36:1, R_f = 0.3); yellow solid, 32.3 mg; m.p. 178-180 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.14 (s, 1H), 8.02-7.99 (m, 1H), 7.96-7.93 (m, 1H), 7.91-7.89 (m, 1H), 7.60-7.53 (m, 4H), 1.74-1.66 (m, 5H), 1.50-1.48 (m, 1H), 1.40 (s, 6H), 1.26 (s, 3H), 1.13 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.5, 133.2, 130.6, 130.6, 130.4, 128.8, 127.3, 126.4, 126.0, 125.3, 125.0, 123.9, 62.1, 61.4, 39.8, 32.4, 20.7, 16.8. HRMS (TOF MS ESI+) $[M+Na]^+$ calculated for $C_{21}H_{26}N_2NaO_3$ 377.1841, found 377.1833.



(*E*)-2,2,6,6-tetramethyl-1-((1-(naphthalen-2-yl)-2-nitrovinyl)oxy)piperidine (4n)

The product was purified on silica gel column chromatography (petroleum ether/ethyl acetate, 36:1, R_f = 0.3); yellow solid, 75.5 mg; m.p. 106-108 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (s, 1H), 7.95-7.91 (m, 4H), 7.62-7.52 (m, 3H), 1.70-1.64 (m, 5H), 1.52-1.47 (m, 1H), 1.31 (s, 6H), 1.25 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.9, 134.2, 132.7, 129.3, 128.7, 128.2, 128.1, 127.9, 127.6, 126.7, 125.2, 123.7, 61.6, 39.6, 32.1, 20.8, 16.7. HRMS (TOF MS ESI+) $[M+Na]^+$ calculated for $C_{21}H_{26}N_2NaO_3$ 377.1841, found 377.1823.



(*E*)-2,2,6,6-tetramethyl-1-((1-nitrohept-1-en-2-yl)oxy)piperidine (4o)

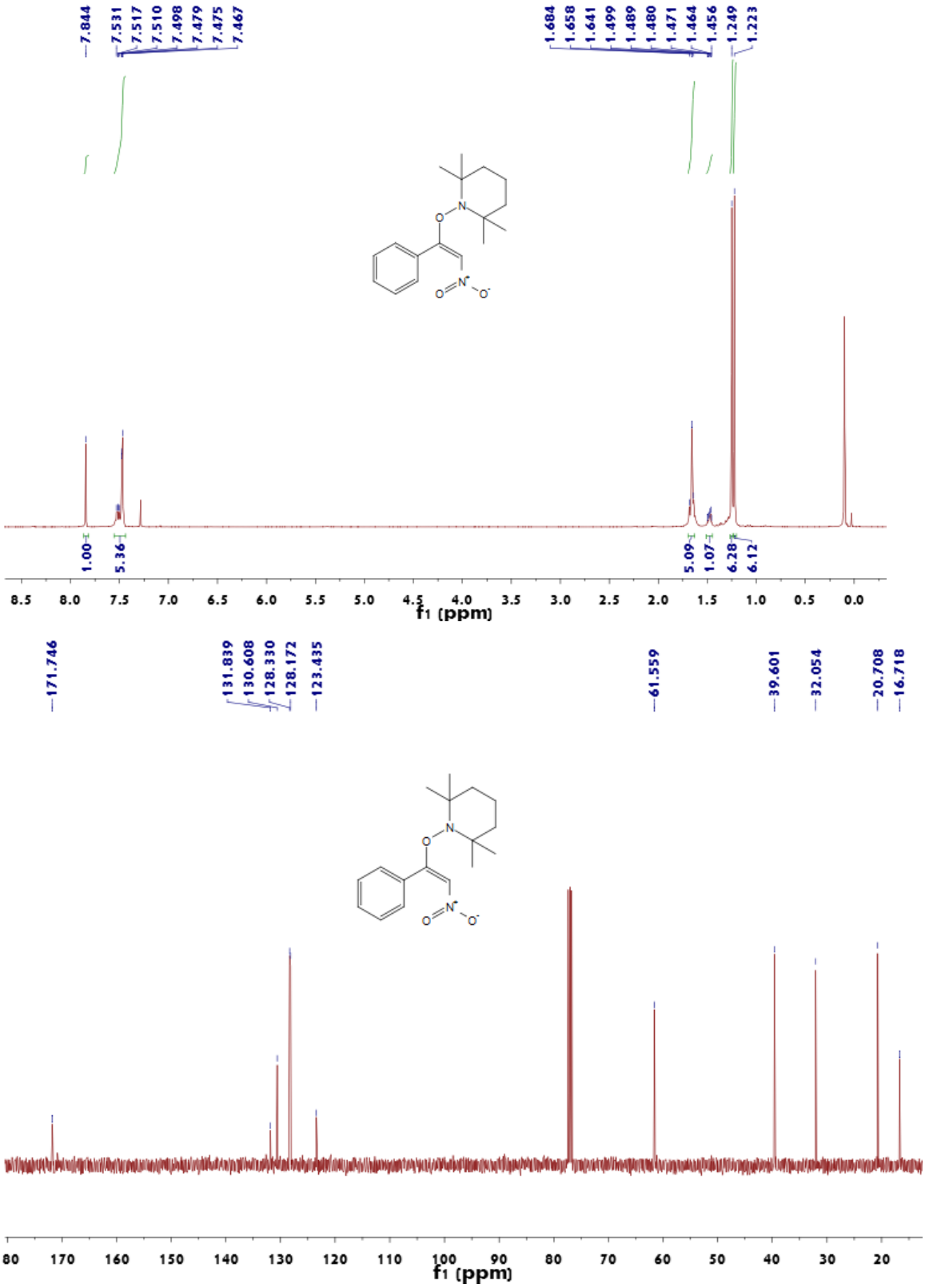
The product was purified on silica gel column chromatography (petroleum ether/ethyl acetate, 36:1, R_f = 0.5); yellow oil, 40.0 mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.61 (s, 1H), 2.81-2.77 (m, 2H), 1.65-1.58 (m, 2H), 1.53-1.48 (m, 6H), 1.38-1.32 (m, 4H), 1.12 (s, 6H), 0.98 (s, 6H), 0.85 (t, J = 7 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.4, 123.0, 61.2, 39.5, 31.9, 31.9, 31.2, 26.9, 22.3, 20.6, 16.7, 13.9. HRMS (TOF MS CI+) $[M]^+$ calculated for $C_{16}H_{30}N_2O_3$ 298.2256, found 298.2254.

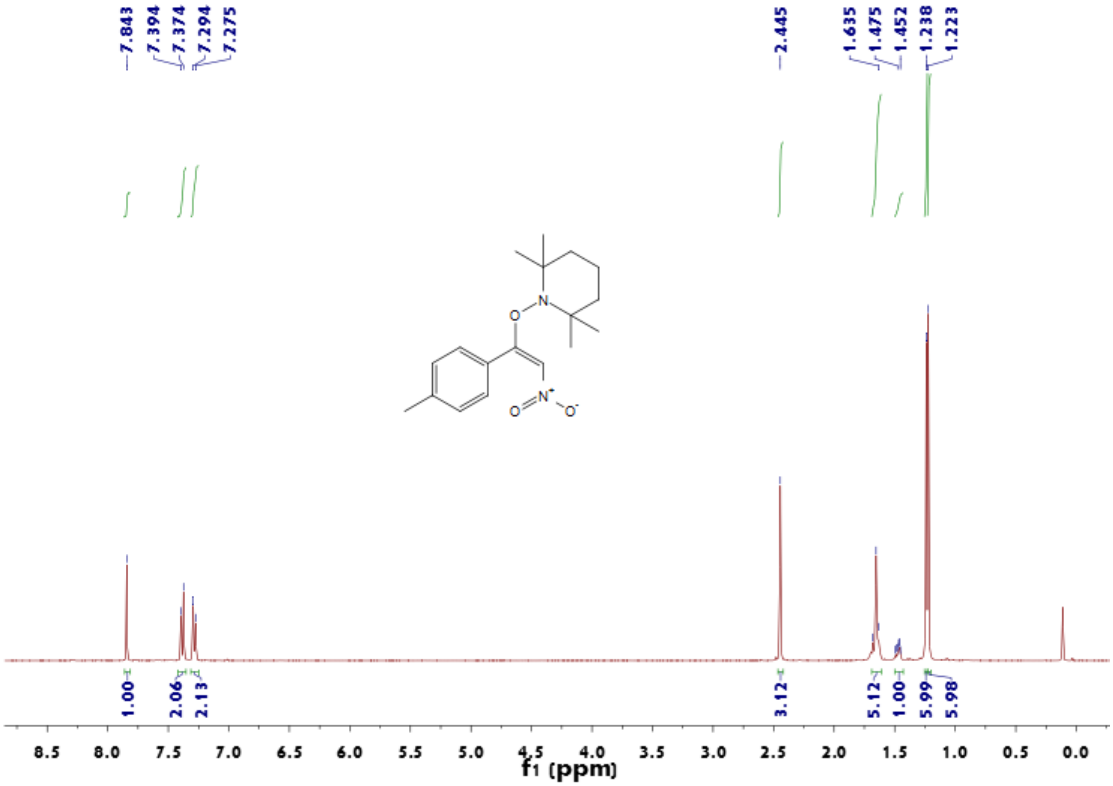
5. Reference:

[1] J. Zakrzewski, *Beilstein J. Org. Chem.* 2012, **8**, 1515–1522.

[2] B. K. Teo, Y. H. Xu, B. Y. Zhong, Y. K. He, H. Y. Chen, W. Qian, Y. J. Deng and Y. H. Zou, *Inorg. Chem.* 2001, **40**, 6794-6801.

6. Spectral Copies of ^{1}H and ^{13}C NMR of All Products

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1.238
1.223
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2.13
3.12
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5.99
5.98
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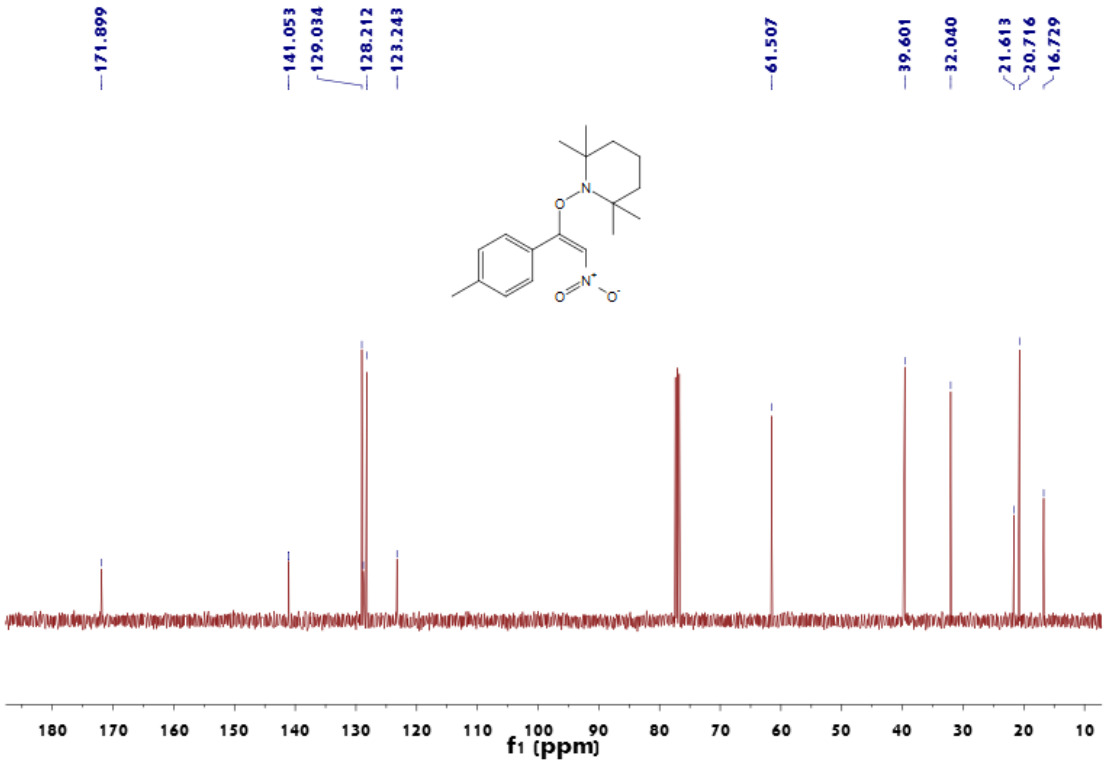
f1 (ppm)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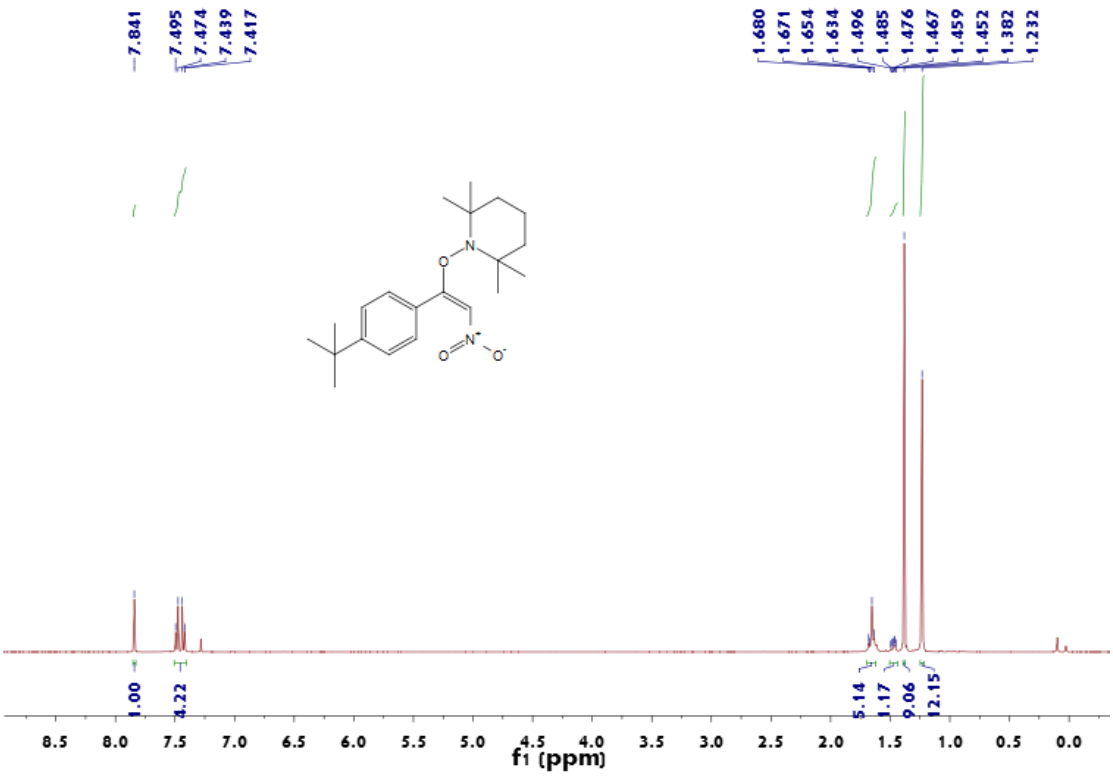
129.034
128.212
123.243
61.507
39.601
32.040
21.613
20.716
16.729
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)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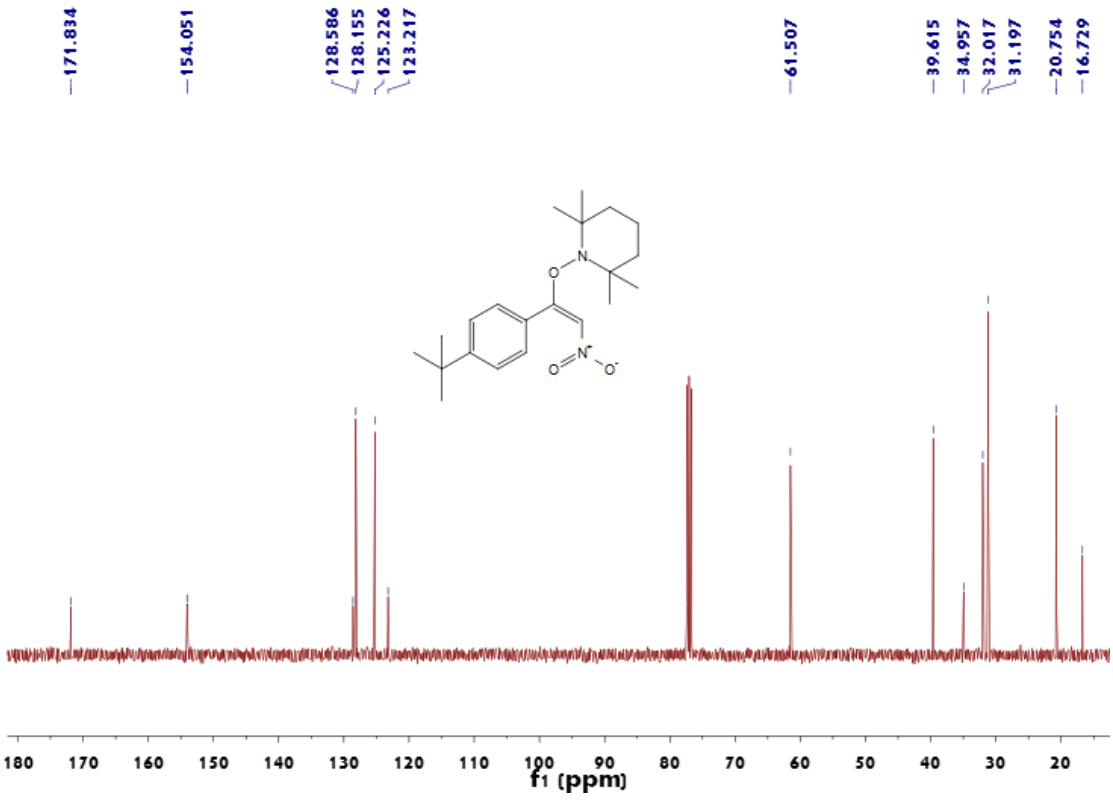
7.495
7.474
7.439
7.417
1.680
1.671
1.654
1.634
1.496
1.485
1.476
1.467
1.459
1.452
1.382
1.232
1.00
4.22
5.14
1.17
9.06
12.15
f1 (ppm)


171.834
154.051
128.586
128.155
125.226
123.217
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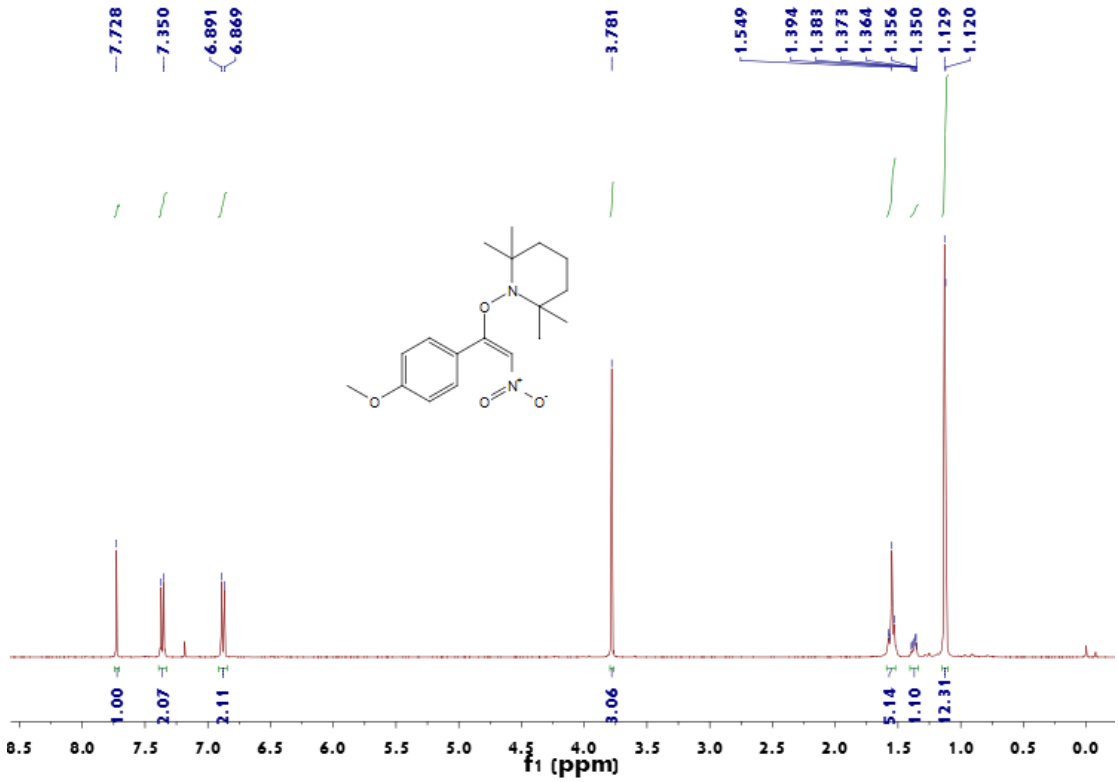
39.615
34.957
32.017
31.197
20.754
16.729
f1 (ppm)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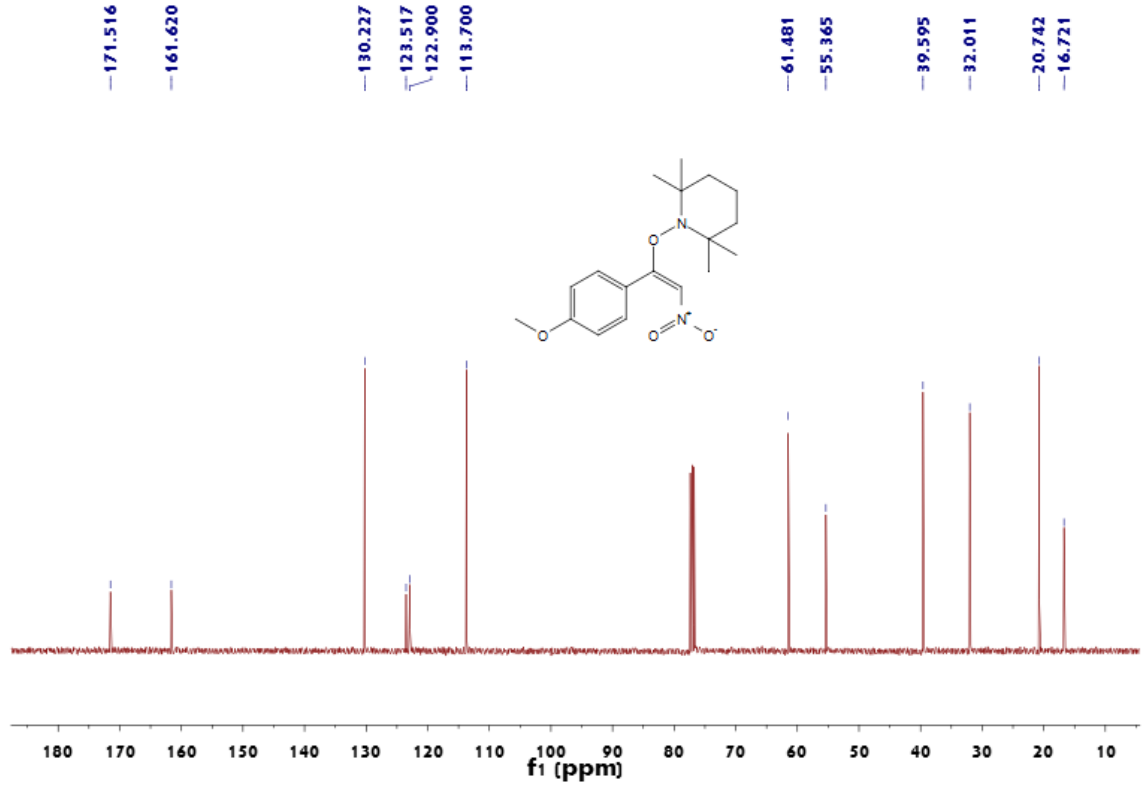
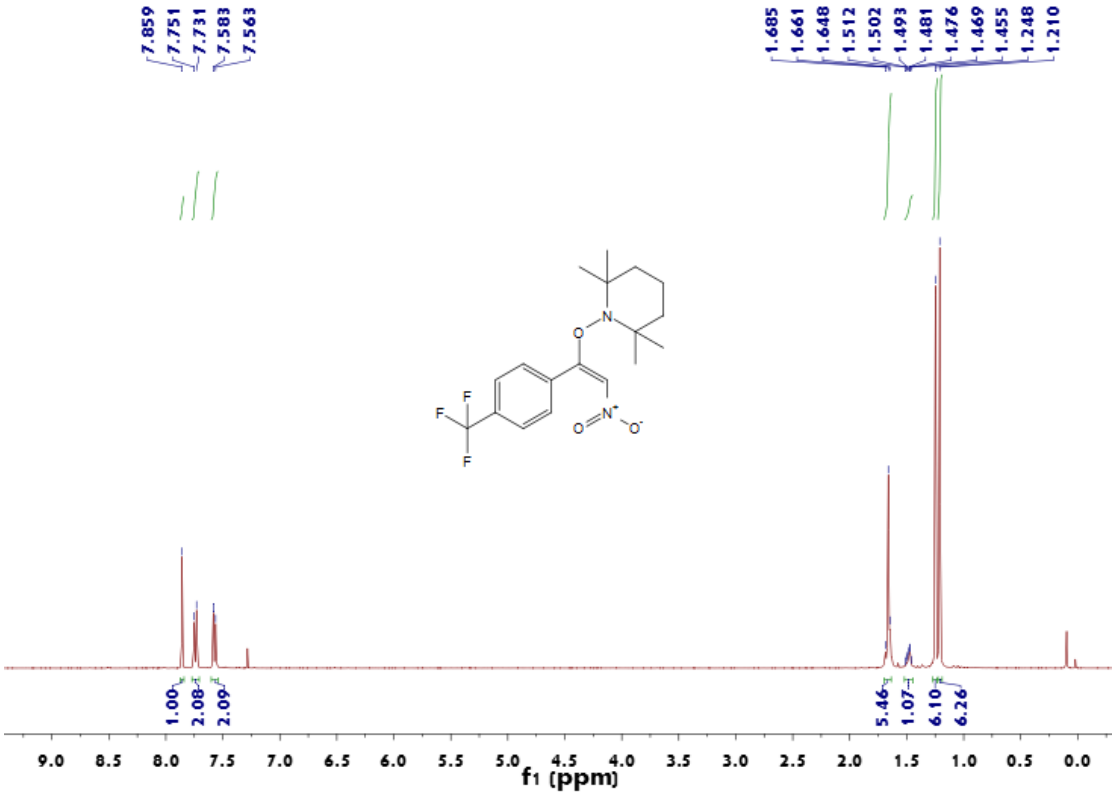
7.350
6.891
6.869
3.781
1.549
1.394
1.383
1.373
1.364
1.356
1.350
1.129
1.120
1.00
2.07
2.11
3.06
5.14
1.10
12.31
f1 (ppm)


171.516
161.620
130.227
123.517
122.900
113.700
61.481
55.365
39.595
32.011
20.742
16.721
f1 (ppm)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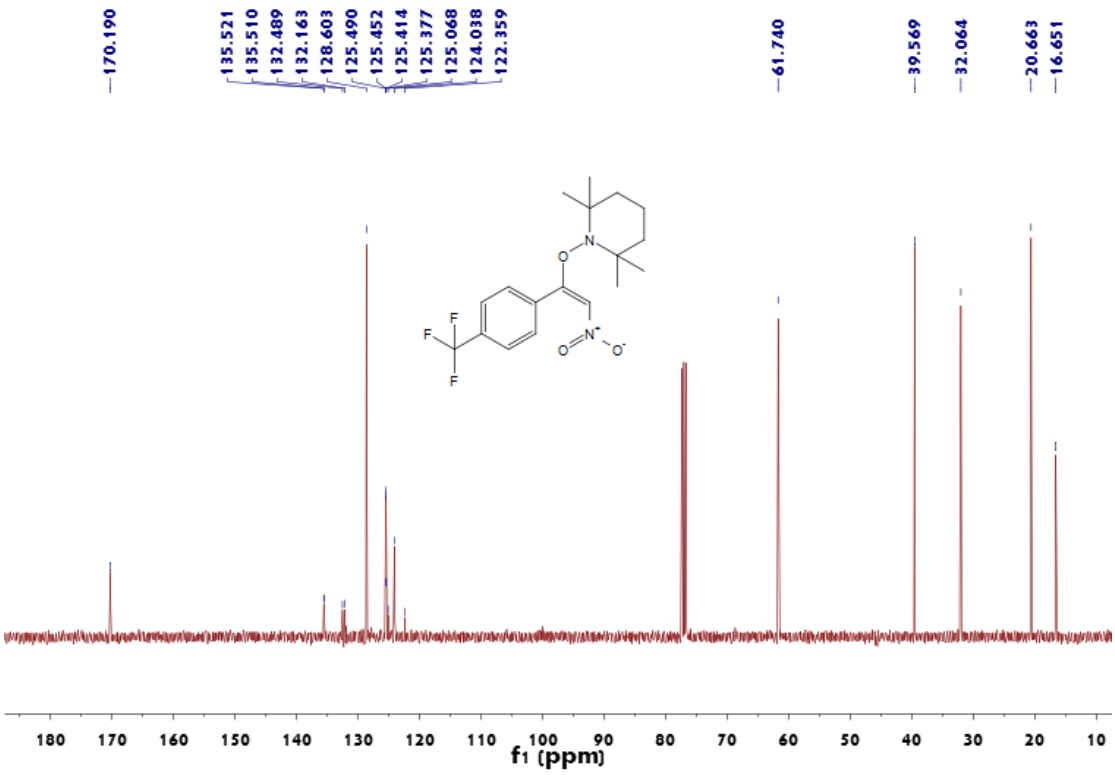
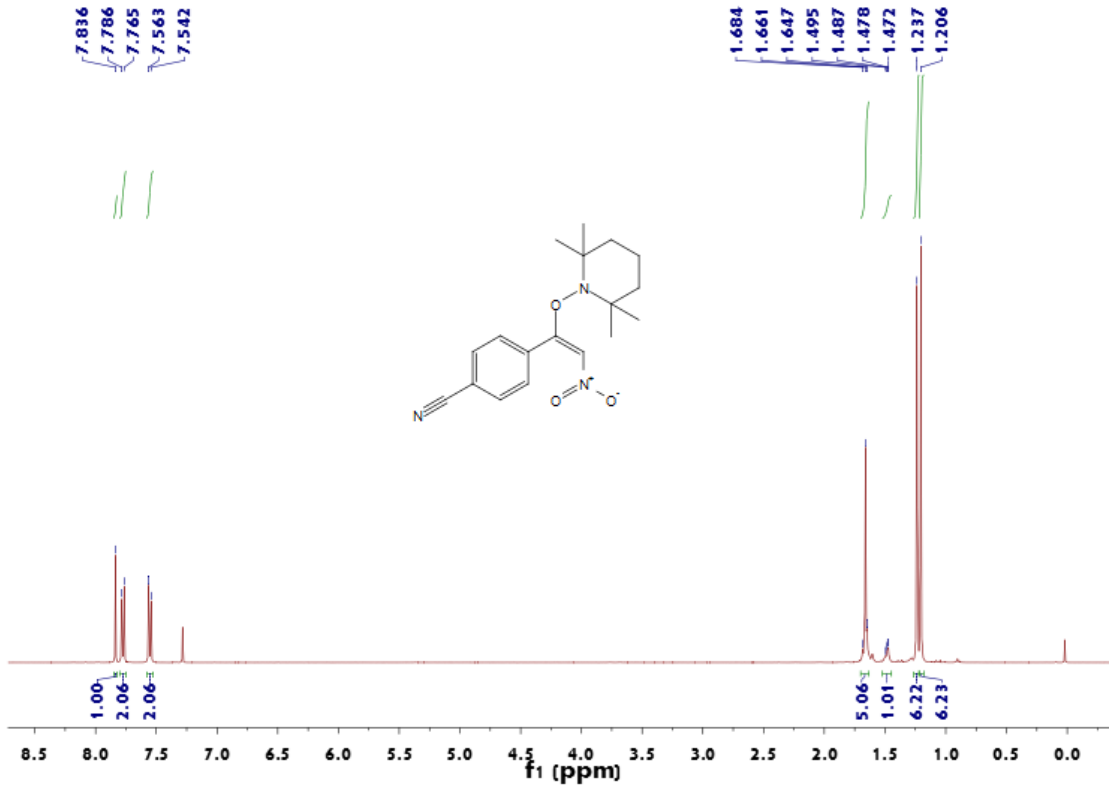
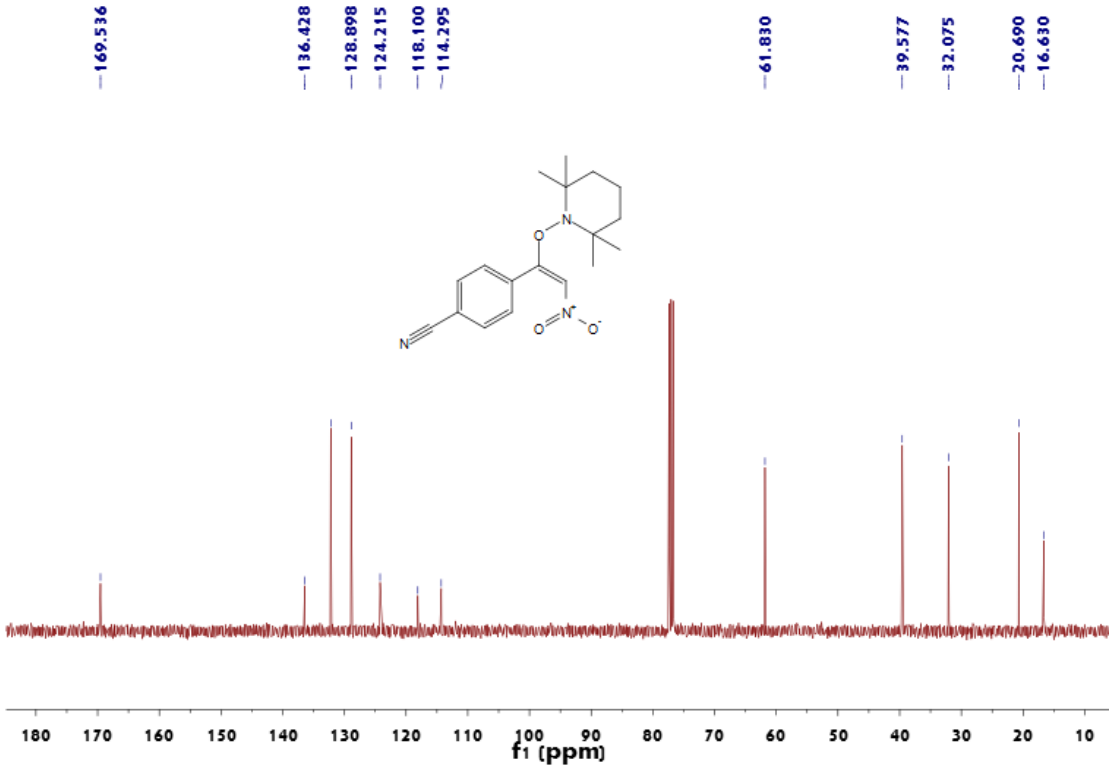
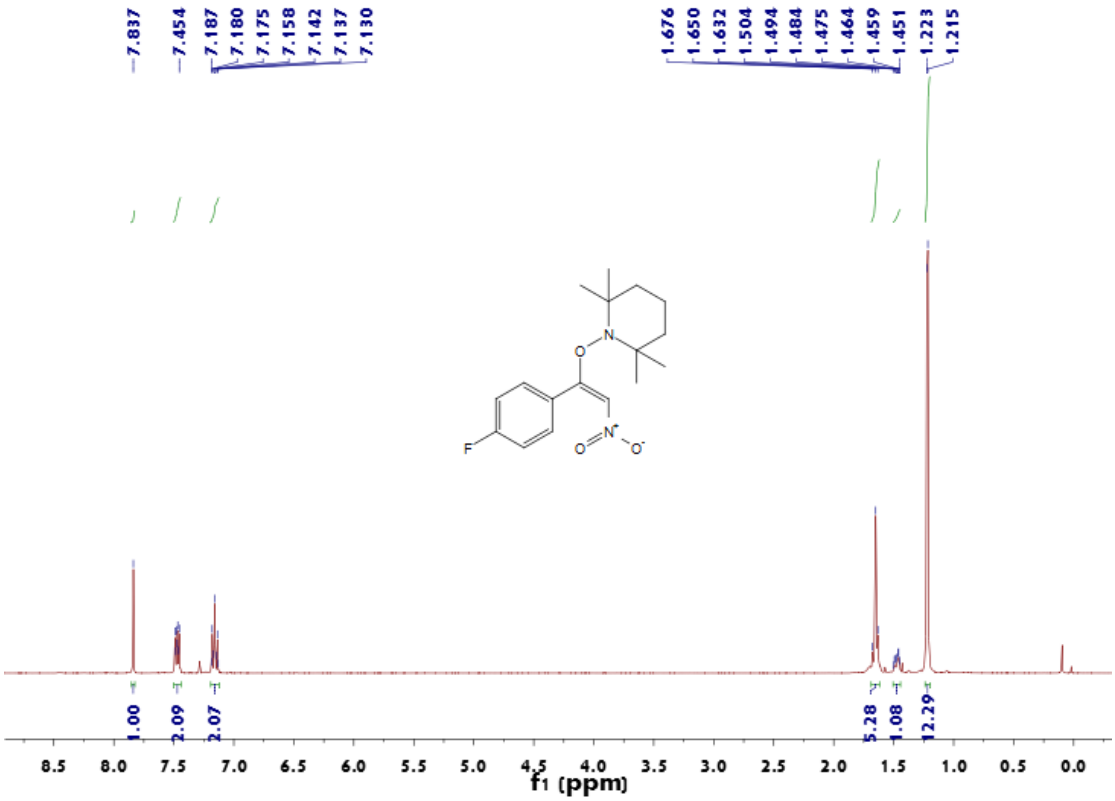
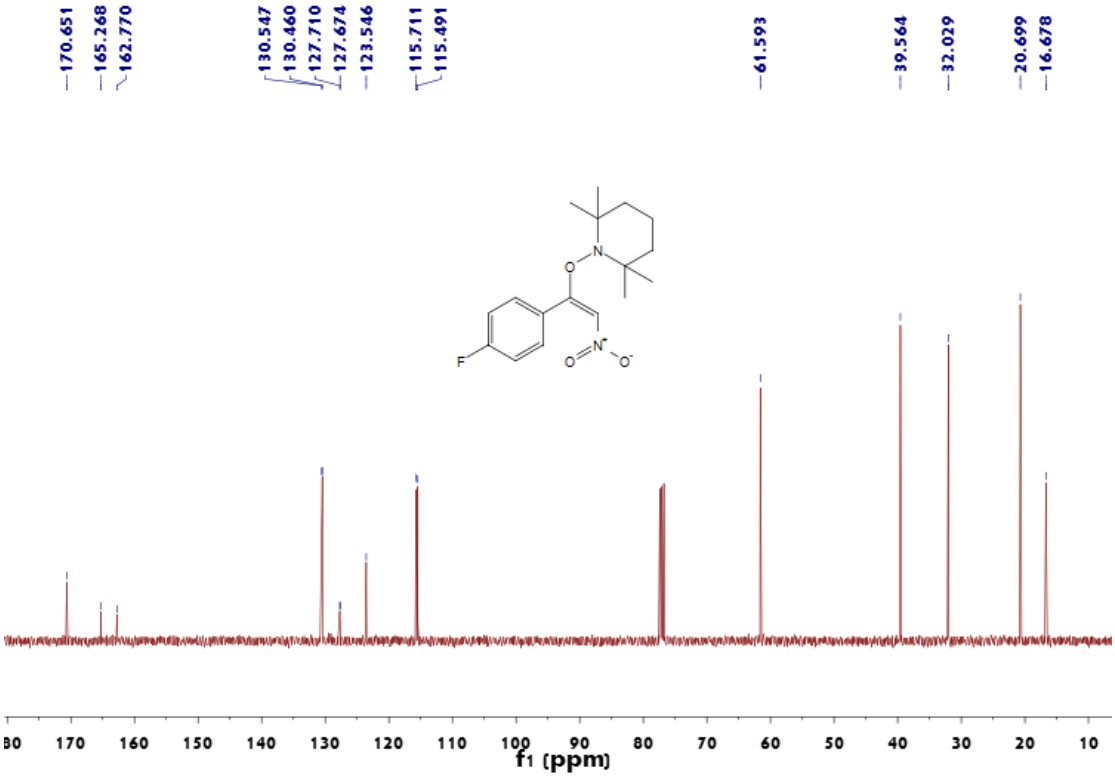
7.751
7.731
7.583
7.563
1.685
1.661
1.648
1.512
1.502
1.493
1.481
1.476
1.469
1.455
1.248
1.210
1.00
2.08
2.09
5.46
1.07
6.10
6.26
f1 (ppm)

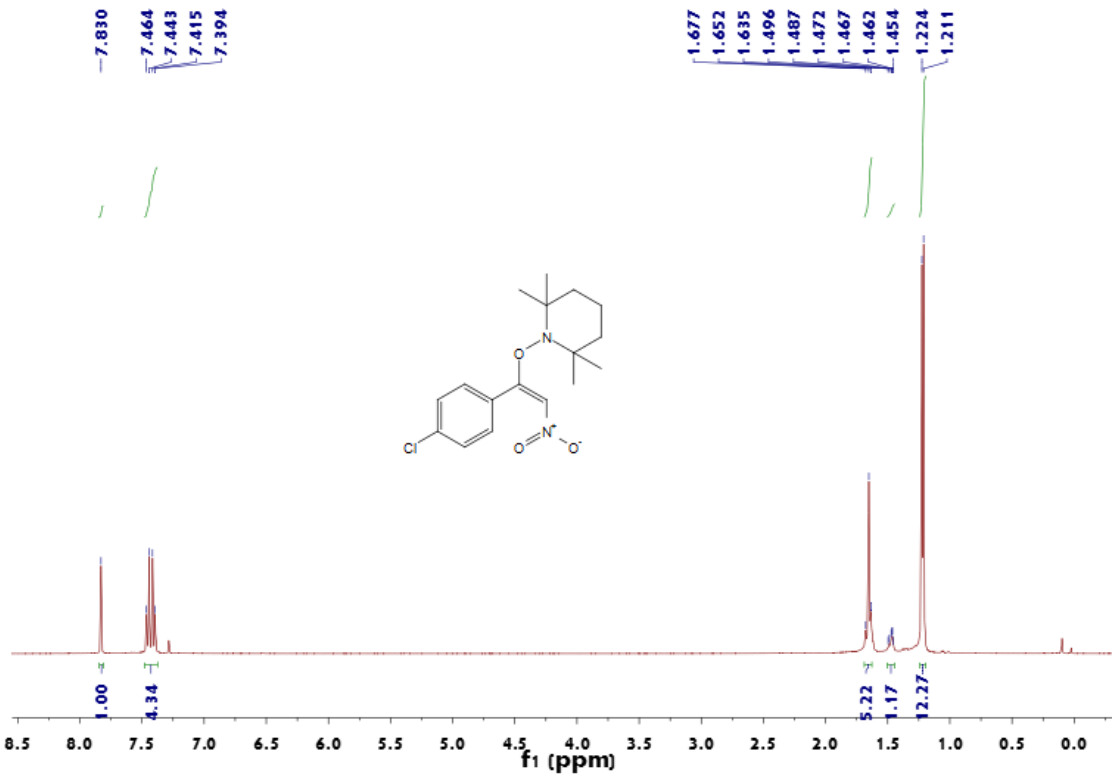

170.190
135.521
135.510
132.489
132.163
128.603
125.490
125.452
125.414
125.377
125.068
124.038
122.359
61.740
39.569
32.064
20.663
16.651
f1 (ppm)

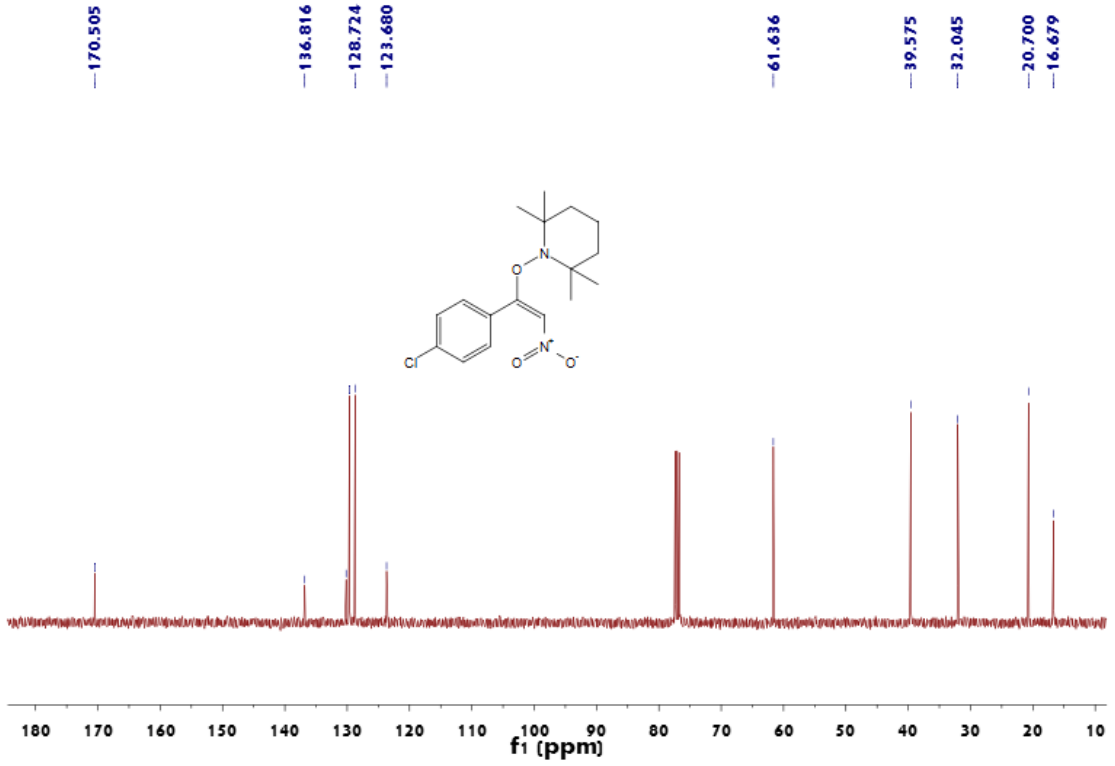

7.836
7.786
7.765
7.563
7.542
1.684
1.661
1.647
1.495
1.487
1.478
1.472
1.237
1.206
1.00
2.06
2.06
5.06
1.01
6.22
6.23
f1 (ppm)


169.536
136.428
128.898
124.215
118.100
114.295
61.830
39.577
32.075
20.690
16.630
f1 (ppm)


7.837
7.454
7.187
7.180
7.175
7.158
7.142
7.137
7.130
1.676
1.650
1.632
1.504
1.494
1.484
1.475
1.464
1.459
1.451
1.223
1.215
1.00
2.09
2.07
5.28
1.08
12.29
f1 (ppm)


170.651
165.268
162.770
130.547
130.460
127.710
127.674
123.546
115.711
115.491
61.593
39.564
32.029
20.699
16.678
f1 (ppm)


7.830
7.464
7.443
7.415
7.394
1.677
1.652
1.635
1.496
1.487
1.472
1.467
1.462
1.454
1.224
1.211
1.00
4.34
5.22
1.17
12.27
f1 (ppm)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39.575
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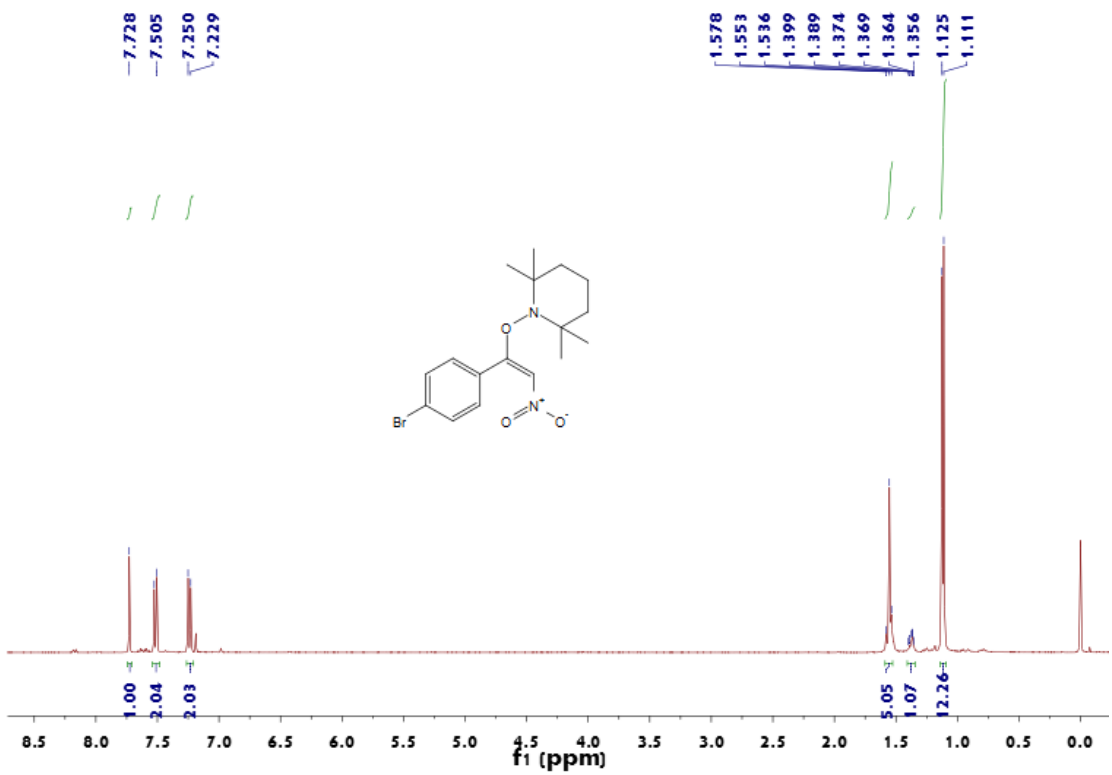
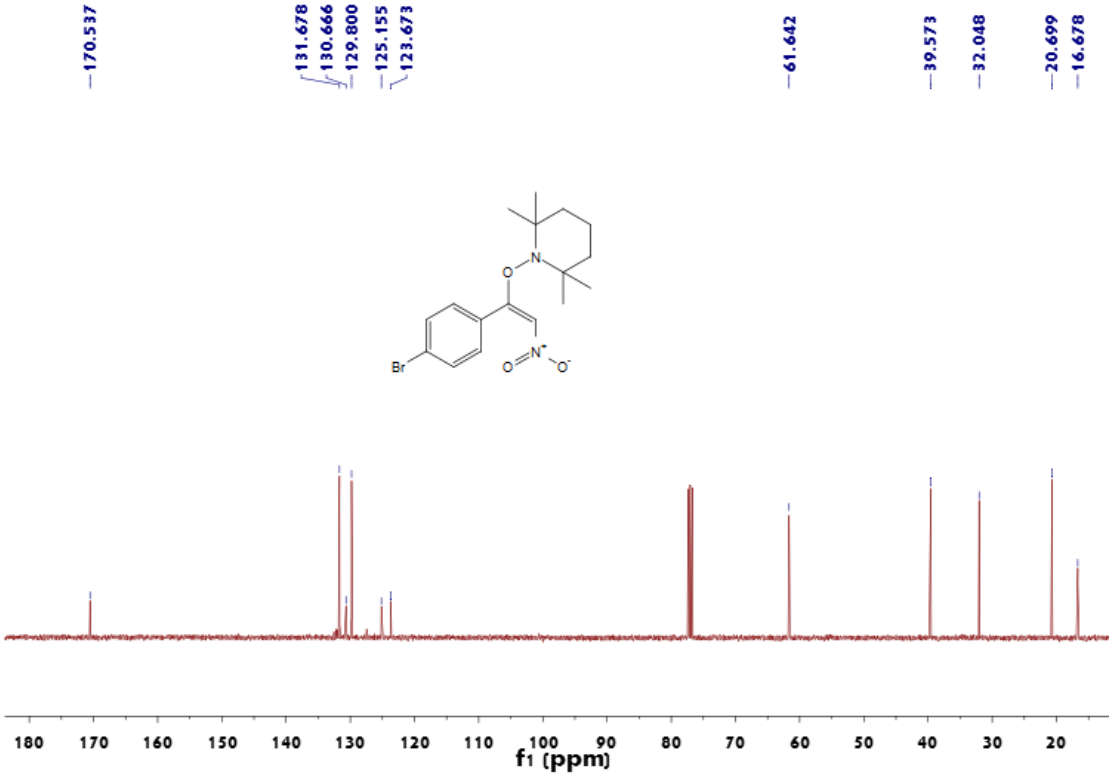
16.679
f1 (ppm)


7.728
7.505
7.250
7.229
1.578
1.553
1.536
1.399
1.389
1.374
1.369
1.364
1.356
1.125
1.111
Br
1.00
2.04
2.03
5.05
1.07
12.26
f1 (ppm)


170.537
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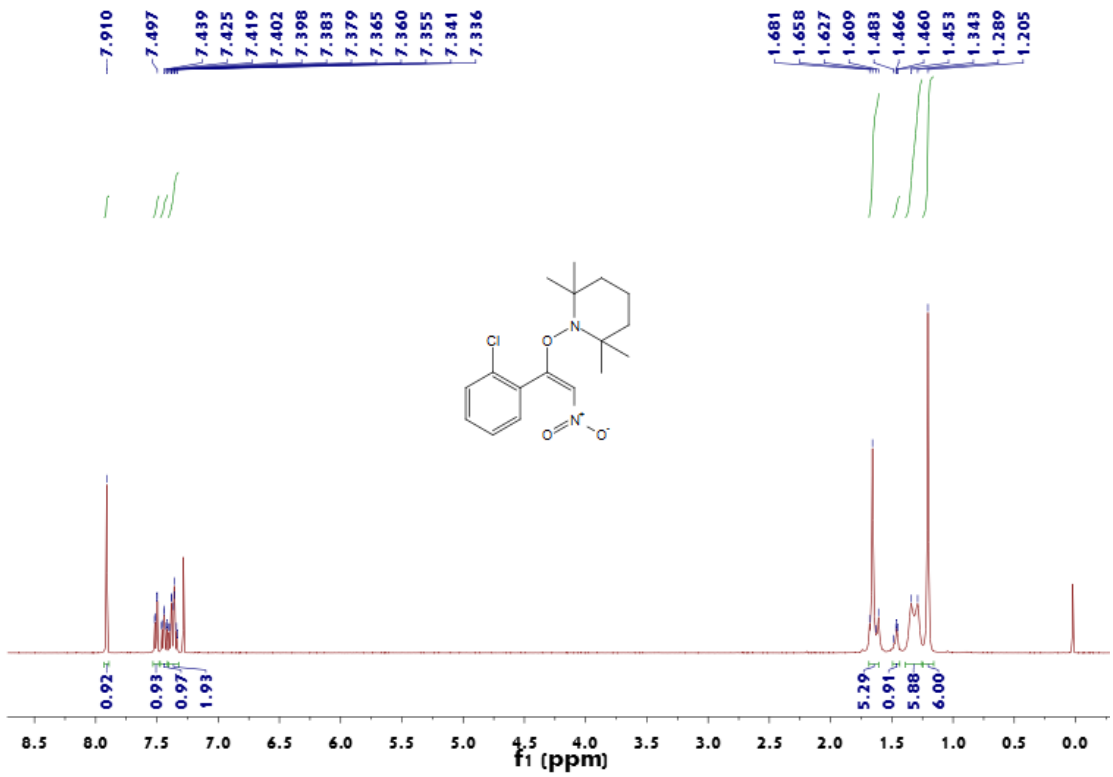
130.666
129.800
125.155
123.673
61.642
39.573
32.048
20.699
16.678
Br
f1 (ppm)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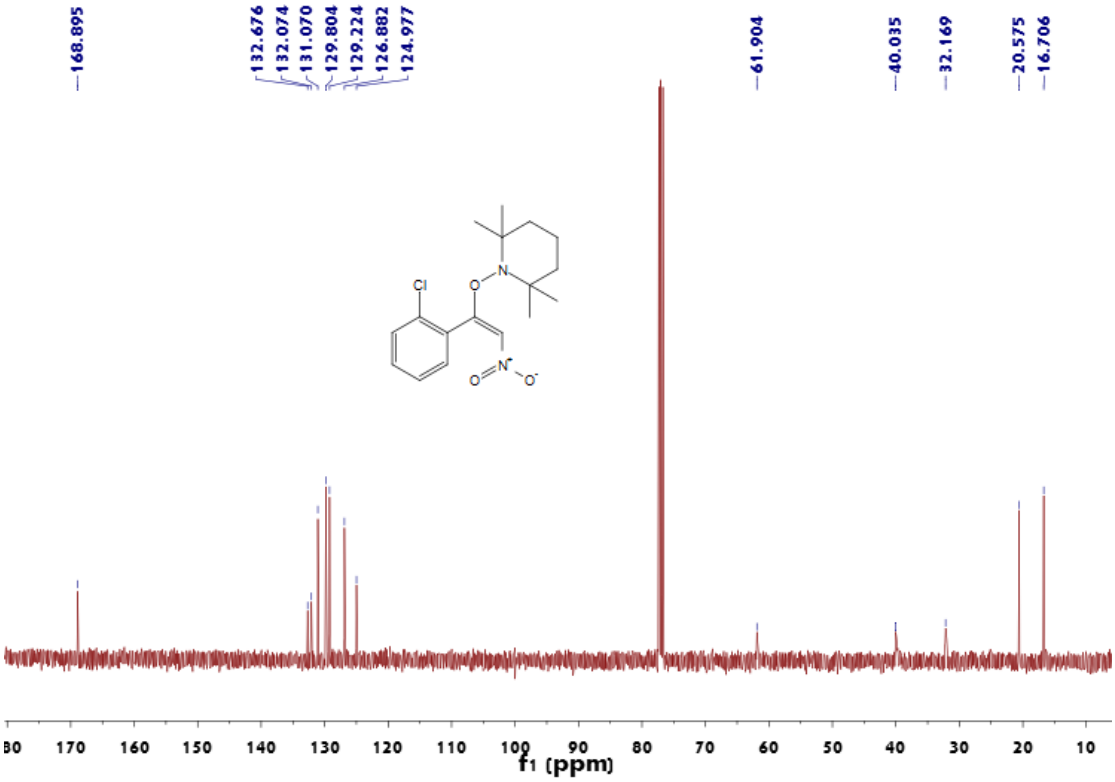
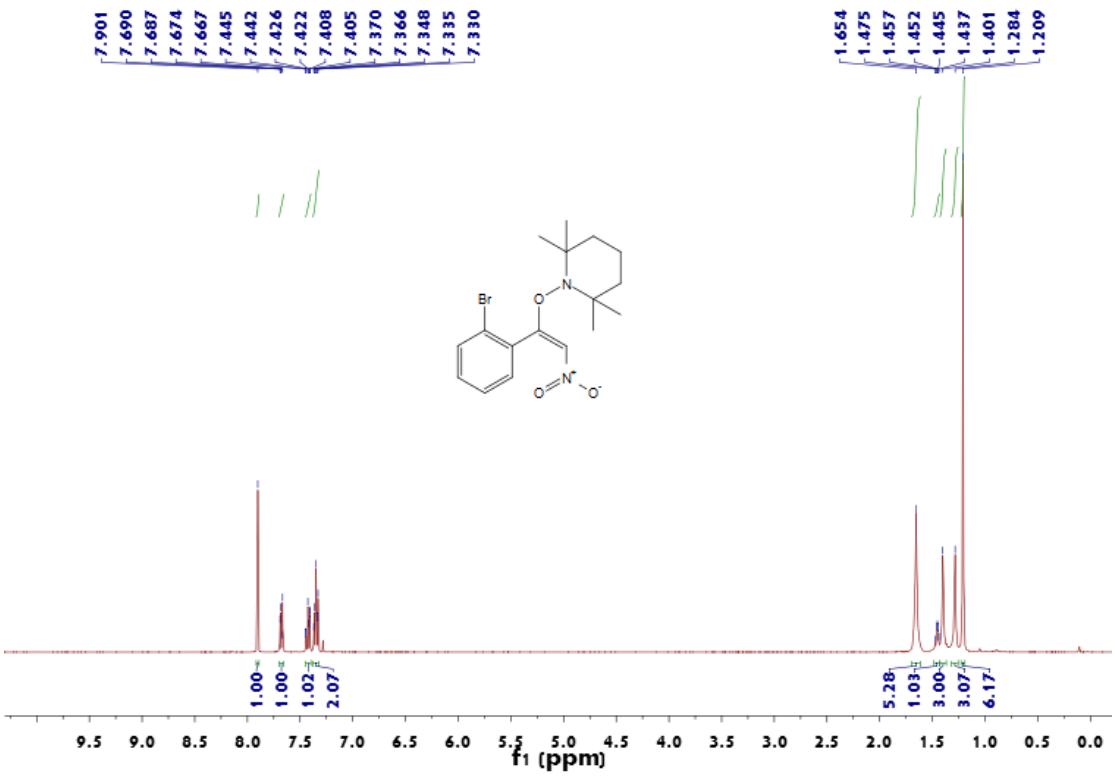
7.439
7.425
7.419
7.402
7.398
7.383
7.379
7.365
7.360
7.355
7.341
7.336
1.681
1.658
1.627
1.609
1.483
1.466
1.460
1.453
1.343
1.289
1.205
Cl
O
N
O
N
O
0.92
0.93
0.97
1.93
5.29
0.91
5.88
6.00
f1 (ppm)


168.895
132.676
132.074
131.070
129.804
129.224
126.882
124.977
61.904
40.035
32.169
20.575
16.706
Cl
O
N
O
N
O
f1 (ppm)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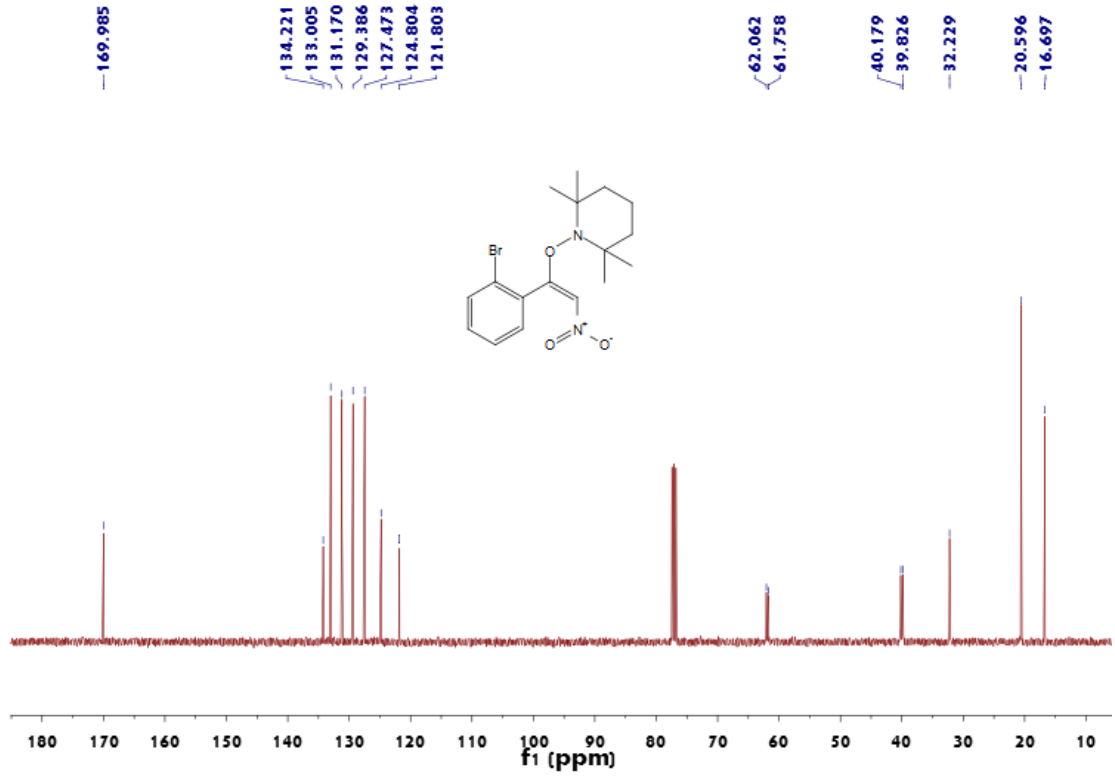
7.674
7.667
7.445
7.442
7.426
7.422
7.408
7.405
7.370
7.366
7.348
7.335
7.330
1.654
1.475
1.457
1.452
1.445
1.437
1.401
1.284
1.209
Br
O
N
O
N
O
1.00
1.00
1.02
2.07
5.28
1.03
3.00
3.07
6.17
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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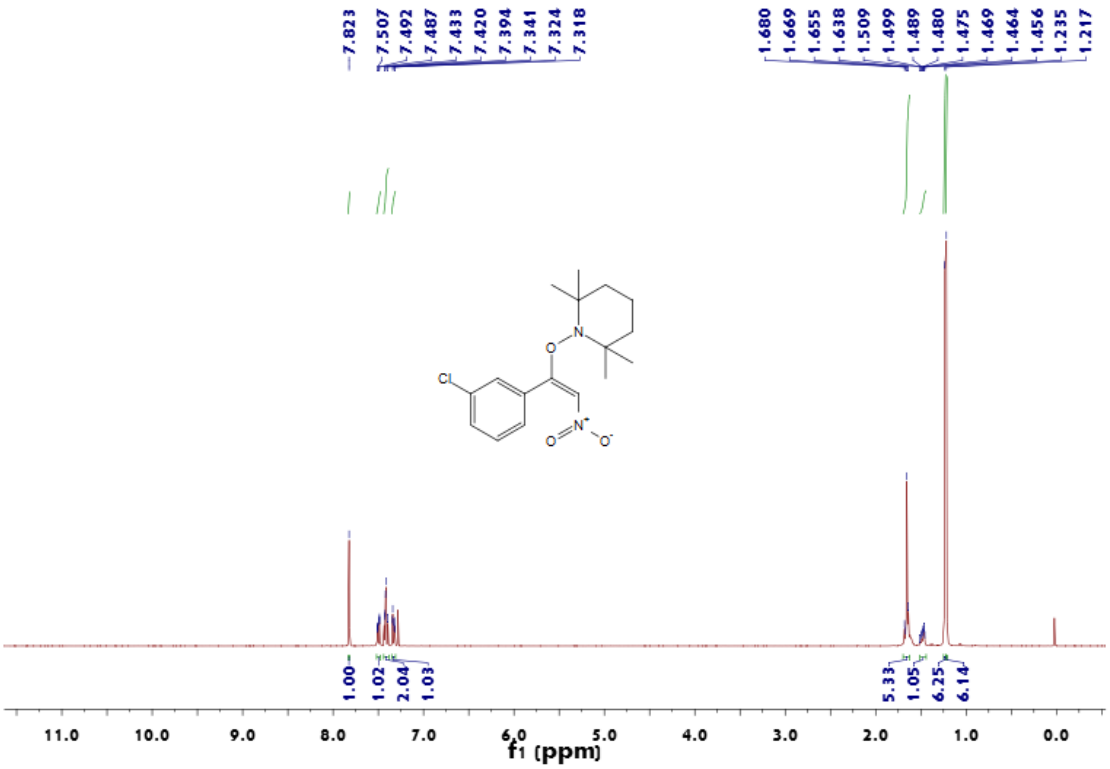
131.170
129.386
127.473
124.804
121.803
62.062
61.758
40.179
39.826
32.229
20.596
16.697
Br
O
N
O
N
O
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)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7.492
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7.433
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7.394
7.341
7.324
7.318
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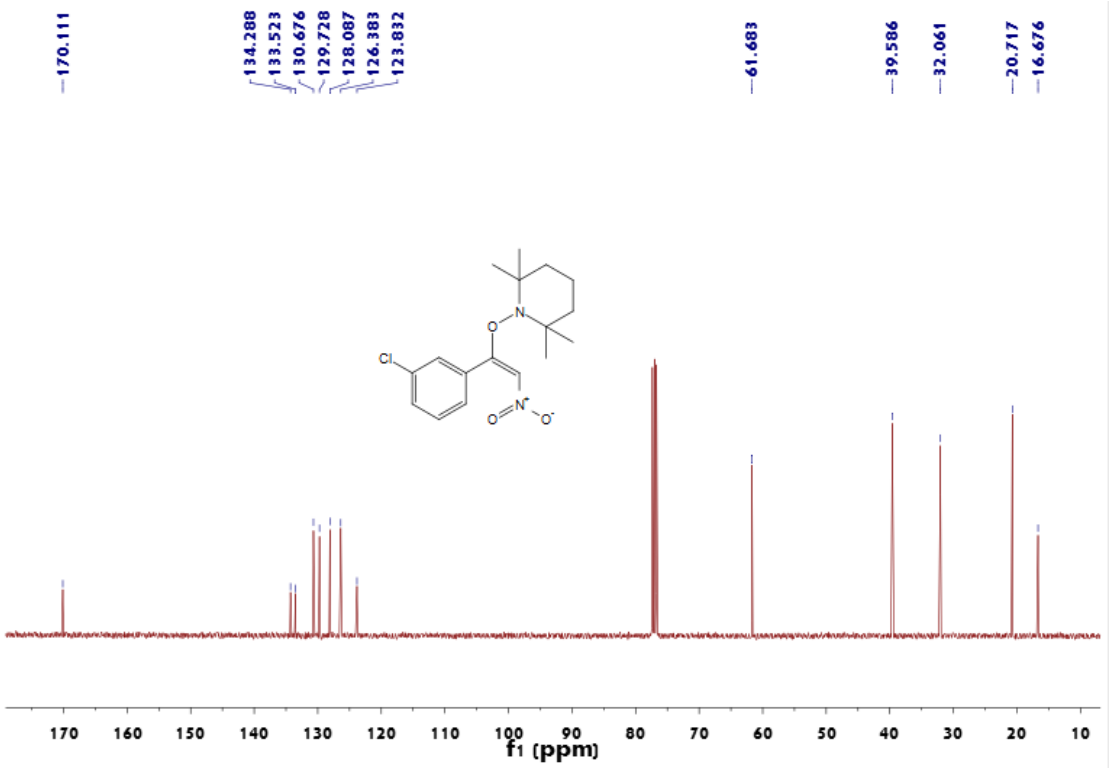
1.669
1.655
1.638
1.509
1.499
1.489
1.480
1.475
1.469
1.464
1.456
1.235
1.217
1.00
1.02
2.04
1.03
5.33
1.05
6.25
6.14
f1 (ppm)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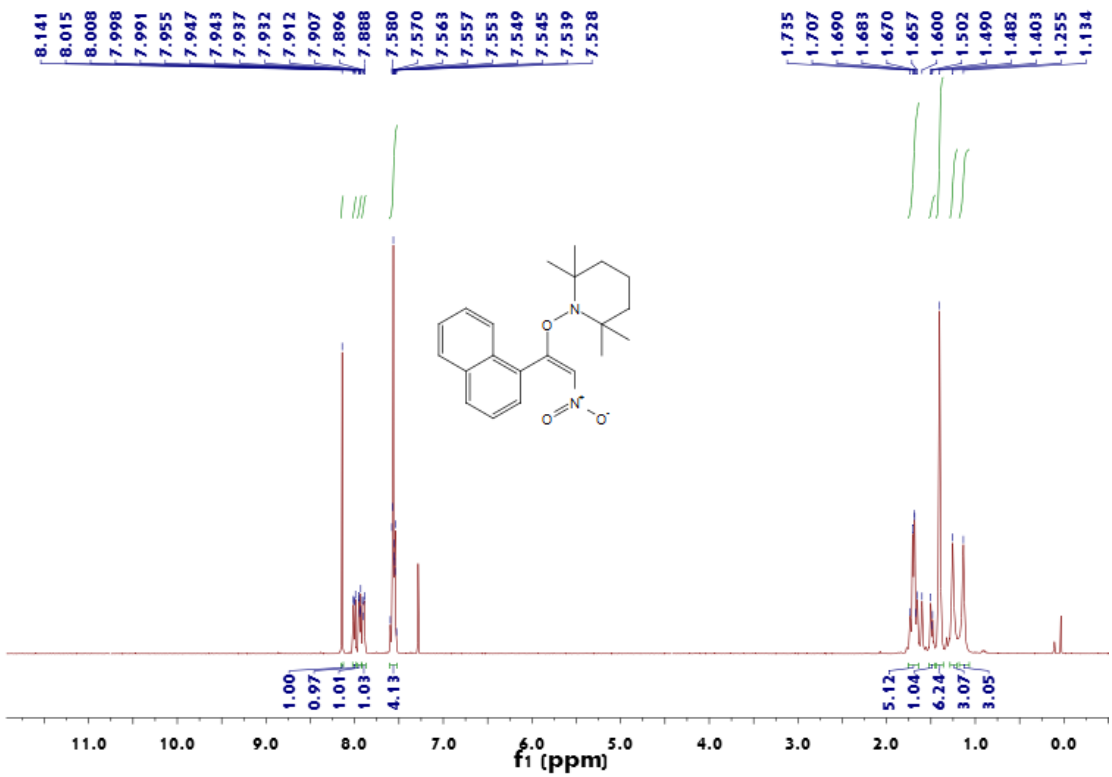
123.832
61.683
39.586
32.061
20.717
16.676
f1 (ppm)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8.008
7.998
7.991
7.955
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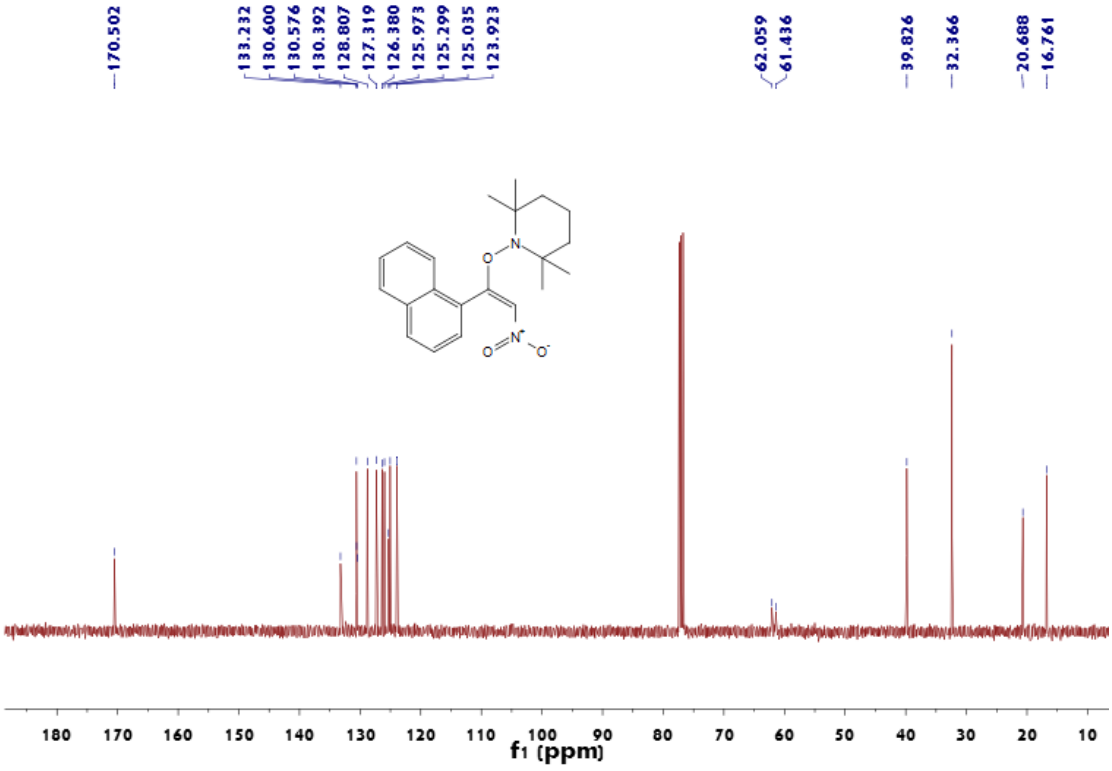
7.943
7.937
7.932
7.912
7.907
7.896
7.888
7.580
7.570
7.563
7.557
7.553
7.549
7.545
7.539
7.528
1.735
1.707
1.690
1.683
1.670
1.657
1.600
1.502
1.490
1.482
1.403
1.255
1.134
1.00
0.97
1.01
1.03
4.13
5.12
1.04
6.24
3.07
3.05
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)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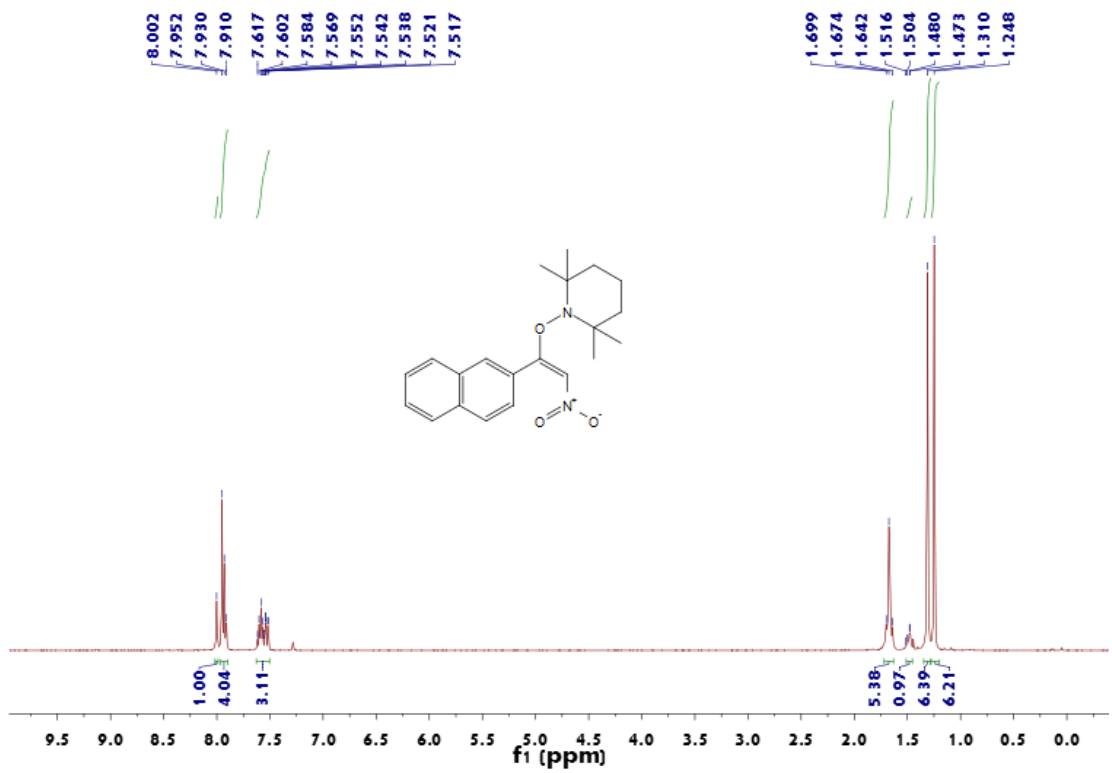
133.232
130.600
130.576
130.392
128.807
127.319
126.380
125.973
125.299
125.035
123.923
62.059
61.436
39.826
32.366
20.688
16.761
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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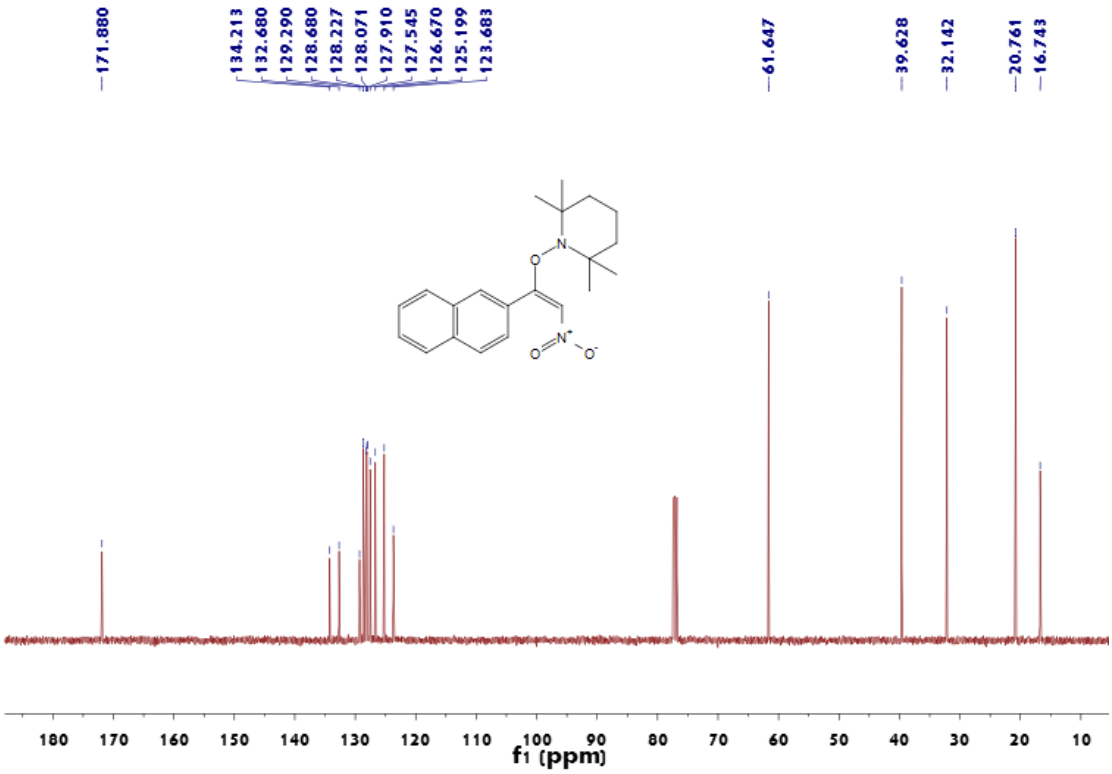
7.930
7.910
7.617
7.602
7.584
7.569
7.552
7.542
7.538
7.521
7.517
1.699
1.674
1.642
1.516
1.504
1.480
1.473
1.310
1.248
1.00
4.04
3.11
5.38
0.97
6.39
6.21
f1 (ppm)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129.290
128.680
128.227
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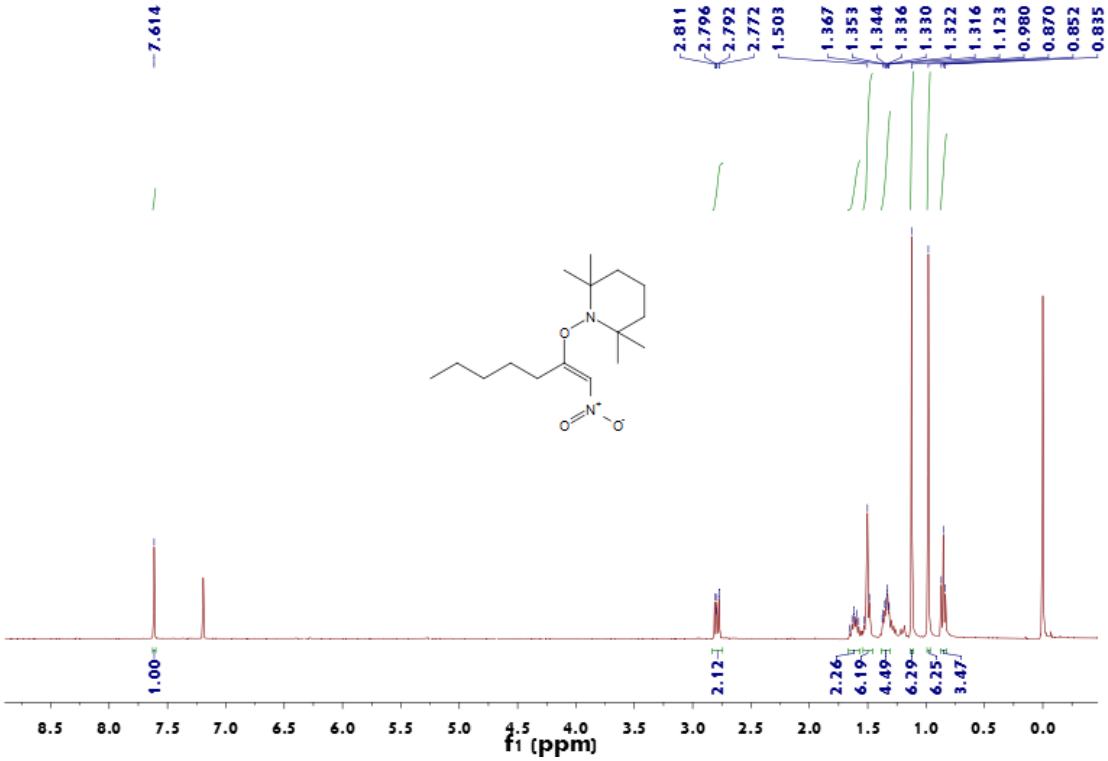
127.910
127.545
126.670
125.199
123.683
61.647
39.628
32.142
20.761
16.743
f1 (ppm)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2.772
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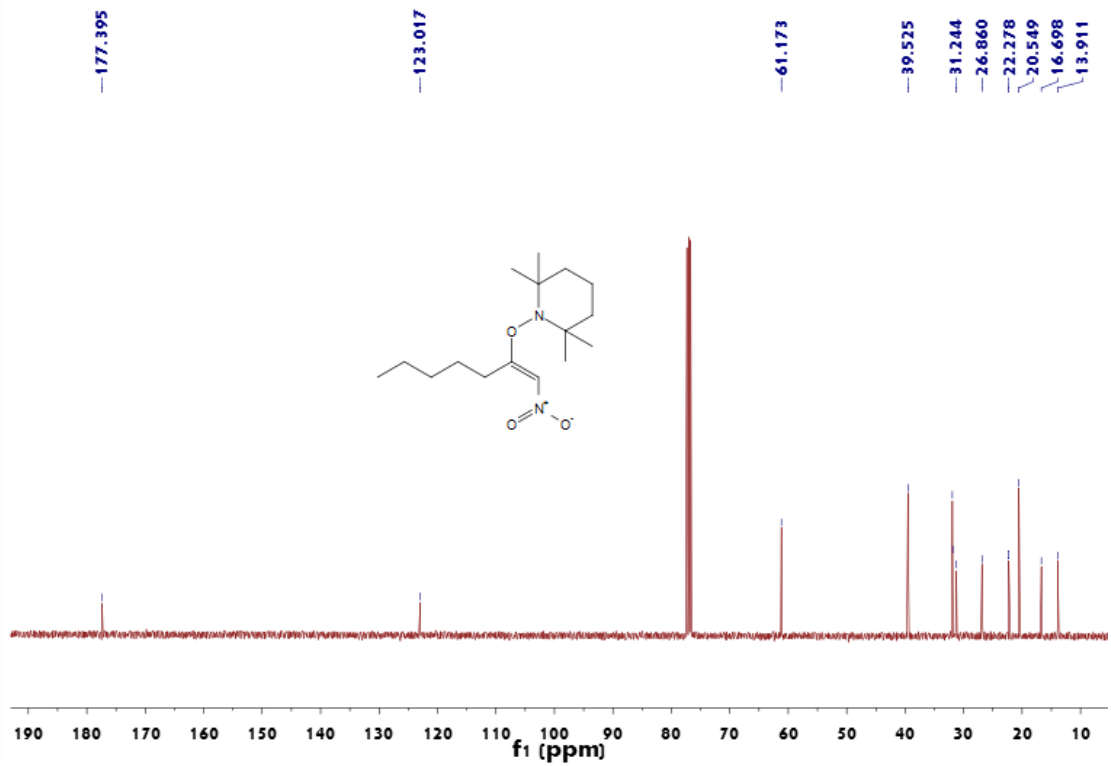
1.367
1.353
1.344
1.336
1.330
1.322
1.316
1.123
0.980
0.870
0.852
0.835
1.00
2.12
2.26
6.19
4.49
6.29
6.25
3.47
f1 (ppm)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123.017
61.173
39.525
31.244
26.860
22.278
20.549
16.698
13.911
f1 (ppm)