Electronic Supplementary Information for

Copper(II)-mediated oxidative cyclization of enamides to oxazoles

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1. General Considerations

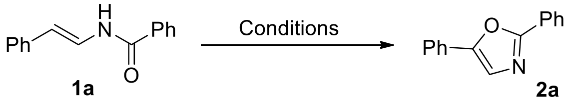
All commercially available compounds were purchased from Sigma-Aldrich, and used as received unless otherwise indicated. Solvents were dried over alumina columns prior to use; anhydrous 1,4-dioxane was used as received. ^{1}H and ^{13}C NMR spectra were recorded on Bruker AC-300 MHz or Varian Mercury-300 MHz spectrometers. Chemical shift values are given in parts per million relative to residual solvent peaks or TMS internal standard. Exact mass measurements were obtained by the mass spectrometry facility at the University of Wisconsin. Melting points were taken on a Mel-Temp II melting point apparatus. Gas Chromatography was done on a Shimadzu GC-17A using Shimadzu RTX-5MS (15m) column and referenced to an internal standard (trimethoxybenzene). Flash chromatography was performed using SilicaFlash® P60 (Silicycle, particle size 40-63 μm, 230-400 mesh) from Sigma Aldrich.

2. Procedure for Reaction Screening

Reaction screening was carried out as follows. Under ambient air, a 1.5dr vial containing a flea stirbar was loaded with 10mg (0.045mmol) of *N*-[(*E*)-2-phenylethenyl]benzamide, **1**, followed by the addition of 12.1mg (0.09mmol) of anhydrous $CuCl_2$. Anhydrous 1,4-dioxane was added (0.5mL), followed by 7.2uL of *N*-methylimidazole. The vial was sealed firmly with a Teflon cap, and a dark blue coloration was observed. (If N_2 or O_2 atmosphere was desired the vial was equipped at this point with a septum, and flushed for 5-7minutes with dry O_2 or N_2 before being sealed with a Teflon cap. The vial(s) were then clamped in an oil bath already stabilized at 140 °C, and heated with gentle stirring for 20 h (although timecourse studies indicate that reaction is 90% complete after around 6hrs). Within 5 minutes of heating, the reaction had turned from dark blue to green. By the end of the reaction vials contained a clear to pale yellow solution with a black residue at the bottom. Vials were removed from heat and allowed to cool. Samples were diluted with 3mL EtOAc, and 1mL of internal standard stock solution (1,3,5-trimethoxybenzene in EtOAc) was added. Approximately 0.5 to 1.0 mL of saturated Na_2S solution was then added and the vial was shaken vigorously to precipitate out CuS salts. An aliquot of the organic phase was then filtered through celite and analyzed by Gas Chromatography. Yields were determined by comparision with internal standard, with retention factor corrections previously ascertained though calibration curves.

3. Additional screening Table, S1

Table S1. Additional Screening Data[a]

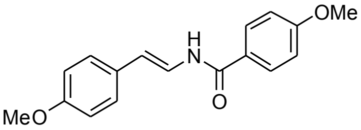


Entry	Cu Source	Solvent	Additive	Temp	% yield[b]
1.	15% $Cu(OAc)_2$	DMSO	5eq AcOH	100C	<1 %
2.	20% $Cu(OTf)_2$	o-xylene	------	140C	<1 %
3.	20% $Cu(OTf)_2$	toluene	------	140C	<1 %
4.	20% $Cu(OAc)_2$	toluene	------	140C	1.7%
5.	20% $Cu(OAc)_2$	toluene	2.0 eq pyridine	140C	<1 %
6.	20% $Cu(OAc)_2$	toluene	2.0 eq NaOAc	140C	<1 %
7.	20% $Cu(OAc)_2$	toluene	5.0 eq AcOH	140C	<1 %
8.	200% $Cu(OAc)_2$	toluene	------	140C	5.8 %
9.	200% $CuCl_2$	toluene	------	140C	7.9 %
10.	200% $CuCl_2$	toluene	3.0 eq $NaHCO_3$	140C	7.9%
11.	200% $CuCl_2$	toluene	3.0 eq Na_2CO_3	140C	4.1%
12.	200% $CuCl_2$	toluene	3.0 eq K_2CO_3	140C	5.1%
13.	200% $CuCl_2$	toluene	3.0 eq Cs_2CO_3	140C	2.5%
14.	200% $CuCl_2$	toluene	3.0 eq NaOAc	140C	9.4%
15.	200% $CuCl_2$	toluene	0.8 eq pyridine	140C	14.4%
16.	200% $CuCl_2$	toluene	0.8 eq imidazole	140C	19.2%
17.	200% $CuCl_2$	toluene	0.8 eq DBU[c]	140C	17.8%
18.	200% $CuCl_2$	toluene	0.8 eq DABCO[d]	140C	2.3%
19.	200% $CuCl_2$	toluene	0.8 eq pyrrolidine	140C	18.6%
20.	200% $CuCl_2$	toluene	0.8 eq bipy	140C	3.5%
21.	200% $CuCl_2$	toluene	0.8 eq phen	140C	1.9%
22.	200% $CuCl_2$	toluene	0.4 eq bipy	140C	3.9%
23.	200% $CuCl_2$	toluene	0.4 eq phen	140C	5.0%
24.	200% $CuCl_2$	toluene	0.3 eq DMAP	140C	16.3%
25.	200% $CuCl_2$	toluene	0.5 eq DMAP	140C	19.1%
26.	200% $CuCl_2$	toluene	0.8 eq DMAP	140C	15.4%
27.	200% $CuCl_2$	toluene	1.0 eq DMAP	140C	13.9%
28.	200% $CuCl_2$	toluene	2.0 eq DMAP	140C	6.4%
29.	200% $CuCl_2$	1,4-dioxane	0.5 eq DMAP	140C	23.7%
30.	200% $CuCl_2$	1,4-dioxane	0.5 eq imidazole	140C	31%
31.	200% $CuCl_2$	1,4-dioxane	2 eq imidazole	140C	57.4%
32.	100% $CuCl_2$	1,4-dioxane	2 eq imidazole	140C	1.7%
33.	100% $CuCl_2$	1,4-dioxane	1 eq imidazole	140C	53.8%
34.	50% $CuCl_2$	1,4-dioxane	2 eq imidazole	140C	2.3%
35.	50% $CuCl_2$	1,4-dioxane	0.5 eq imidazole	140C	39.4%

[a] Reaction Conditions: reactions were run on 0.05mmol scale, at 0.1M in a sealed vessel at 140 C under air unless otherwise specified. [b] GC Yield. [c] 1,8-Diazabicyclo[5.4.0]undec-7-ene. [d] DABCO.

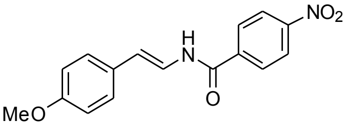
4. Substrate Synthesis

All enamides substrates were prepared using the procedure developed by Gooβen et al[1]. Characterization data for substrates not reported therein are included below. Though not noted in their initial report, we found that trace carboxylic acid impurities in the amide substrates poisoned the catalyst; an additional base wash (10 % Na_2CO_3) was utilized on commercial amides containing these impurities. Ru(mta)$_2$cod is commercially available, but was prepared from $RuCl_3$ according to the procedure of Genet et al.[2] An alternative, metal-free preparation of *N*-[(*E*)-2-phenylethenyl]benzamide*,* **1**, was adapted from Katritzky and coworkers.[3]



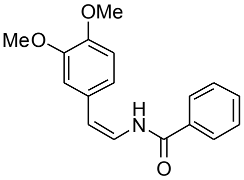
4-methoxy-N-[(E)-2-(4-methoxyphenyl)ethenyl]benzamide

Isolated as a cream-colored solid, mp = 200-203 °C. ^{1}H NMR (300MHz, DMSO-d^6): δ 10.37 (d, NH, 9.9Hz), 7.95 (d, 2H, J = 8.7Hz), 7.49 (dd, 1H, J = 14.4, 9.6 Hz), 7.30 (d, 2H, J= 8.7Hz), 7.05 (d, 2H, J = 8.7Hz), 6.88 (d, 2H, J = 8.8Hz), 6.37 (d, 1H, J =14.7Hz), 3.83 (s, 3H), 3.74 (s, 3H); ^{13}C NMR (300MHz, DMSO-d^6): δ 163.93, 162.73, 158.58, 130.18, 129.87, 127.01, 126.25, 123.22, 114.91, 114.37, 112.81, 56.11, 55.75; EMM (ESI) *m/z* calcd for $C_{17}H_{17}NO_3$ $[M+H]^+$: 284.1282, meas: 284.1288.



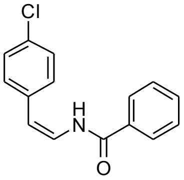
N-[(E)-2-(4-methoxyphenyl)ethenyl]-4-nitrobenzamide

Isolated as a yellow solid, decomposition to red oil at 217 °C. ^{1}H NMR (300MHz, DMSO-d^6): δ 10.83 (d, NH, 9.3Hz), 8.37 (dt, 2H**,** J=6.9, 2.1Hz), 8.20(dt, 2H, J = 9.0, 2.1Hz), 7.50 (dd, 1H, 14.4, 9.3 Hz), 7.36 (d, 2H, J = 6.6Hz), 6.90 (d, 2H, J = 6.9Hz), 6.47 (d, 1H, J = 14.7 Hz); ^{13}C NMR (300MHz, DMSO-d^6): δ 162.81, 158.89, 149.93, 139.74, 129.74, 129.35, 127.34, 124.31, 122.60, 114.94, 114.77, 55.77; EMM (ESI) *m/z* calcd for $C_{16}H_{14}N_2O_4$ $[M]^+$: 298.0949, meas: 298.0953.



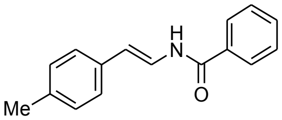
N-[(Z)-2-(3,4-dimethoxyphenyl)ethenyl]benzamide

Isolated as a white solid, mp 132-133 °C. ^{1}H NMR (300MHz, DMSO-d^6): δ 9.94 (d, NH, J = 9.3Hz), 7.95 (m, 2H), 7.58 (t, 1H, J = 7.2Hz), 7.50 (t, 2H, J = 7.5Hz), 7.09 (d, 1H, J = 1.5Hz), 7.03 (dd, 1H, J = 8.4, 1.5Hz), 6.97 (d, 1H, J = 8.4Hz), 6.85 (t, 1H, J = 9.6Hz), 5.81 (d, 1H, J = 9.9Hz), 3.79 (s, 3H), 3.77 (s, 3H); ^{13}C NMR (300MHz, DMSO-d^6): δ 165.81, 149.24, 148.38, 134.19, 132.44, 129.21, 129.04, 128.43, 122.05, 121.72, 113.72, 112.76, 112.62, 56.22, 55.99; EMM (ESI): *m/z* calcd for $C_{17}H_{17}NO_3$ $[M]^+$: 283.1203, meas 283.1212.



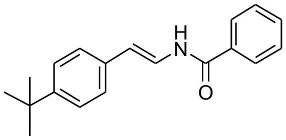
N-[(Z)-2-(4-chlorophenyl)ethenyl]benzamide

Isolated as a white solid, Mp = 131-133°C; ^{1}H NMR (300MHz, DMSO-d^6): δ 10.05 (d, NH, J = 9.3Hz), 7.91 (d, 2H, J = 6.9Hz), 7.38-7.59 (m, 6H), 6.94 (t, 1H, J = 9.6Hz), 5.75 (d, 1H, J = 9.6Hz); ^{13}C NMR (300MHz, DMSO-d^6): δ 166.15, 135.42, 134.06, 132.55, 131.48, 130.85, 129.12, 129.02, 128.61, 124.29, 112.06; EMM (ESI) m/z calcd for $C_{15}H_{12}ClNO$[M+Na]:280.0500, meas: 280.0504.



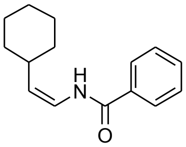
N-[(E)-2-(4-methylphenyl)ethenyl]benzamide

Isolated as a white solid, Mp = 178-179 °C. ^{1}H NMR (300MHz, DMSO-d^6): δ 10.55 (d, NH, J = 9.9Hz), 7.94 (d, 2H, J = 6.9Hz), 7.47-7.61 (m, 4H), 7.27 (d, 2H, J = 8.1Hz), 7.10 (d, 2H, J = 7.8Hz), 6.42 (d, 1H, J = 15 Hz), 2.25 (s, 3H); ^{13}C NMR (300MHz, DMSO-d^6): δ 164.63, 136.14, 134.38, 134.09, 132.51, 130.00, 129.14, 128.26, 125.86, 123.99, 113.64, 21.40. EMM (ESI) m/z calcd for $C_{16}H_{15}NO$ [M+Na]$^+$:260.1046, meas: 260.1053.



N-[(E)-2-(4-tert-butylphenyl)ethenyl]benzamide

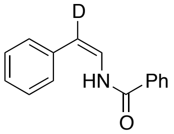
Isolated as a white solid, Mp = 196-199°C. ^{1}H NMR (300MHz, DMSO-d^6): δ 10.56 (d, NH, J = 9.9Hz), 7.95 (d, 2H, J = 6.6Hz), 7.47-7.63 (m, 4H), 7.30 (virtual s, 4H), 6.42 (d, 1H, J = 14.4Hz), 1.25, (s, 9H); ^{13}C NMR (300MHz, DMSO-d^6): δ 164.64, 149.43, 134.38, 134.08, 132.52, 129.15, 128.26, 126.16, 125.67, 124.12, 113.49, 34.87, 31.77. EMM (ESI) m/z calcd for $C_{19}H_{21}NO$ [M+H]$^+$:280.1696, meas: 280.1697.



N-[(*Z*)-2-cyclohexylethenyl]benzamide

Isolated as an oil which solidified over time, mp: 90-93 °C.^{1}H NMR (300MHz, $CDCl_3$): δ 7.79 (d, 2H, J = 6.9Hz), 7.67 (br d, 1H, J = 9.3Hz), 7.41-7.59 (m, 3H), 6.79 (t, 1H, J = 10.2 Hz), 4.75 (t, 1H, J = 9.3Hz), 2.20 (m, 1H), 1.69 (m, 5H), 1.14-1.34 (m, 5H); ^{13}C NMR (300MHz, $CDCl_3$): δ 164.58, 134.31, 132.08, 128.96, 127.25, 119.63, 118.52, 35.80, 33.26, 26.10, 26.01. EMM(ESI) *m/z* calcd for $C_{15}H_{19}NO$ [M+Na]$^+$: 252.1359, Meas (M+Na): 252.1353.

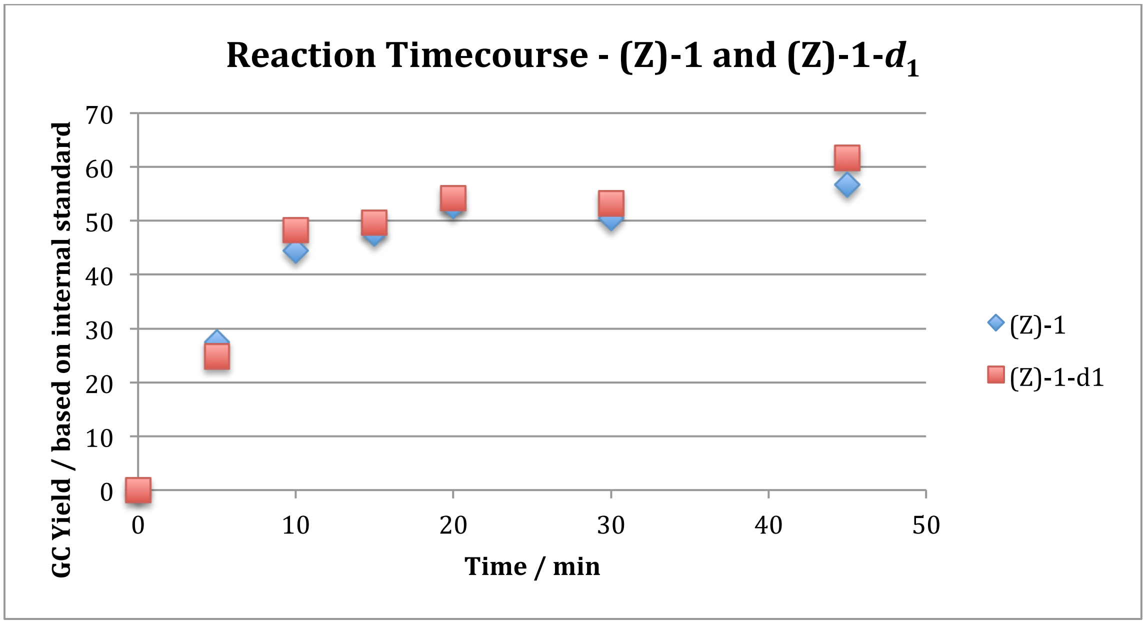
5. Kinetic Isotope Effect Determination



N-[2'-Deutero-(Z)-2-phenylethenyl]benzamide, ***1**-d_1*

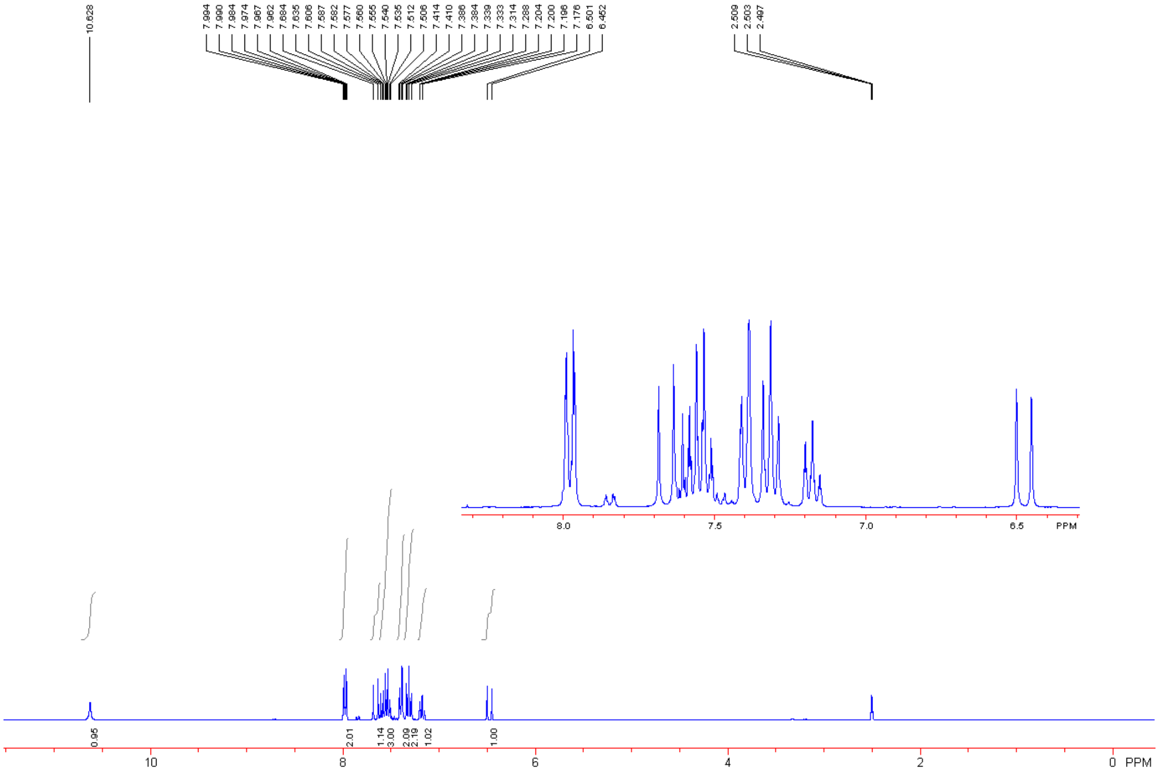
Deuterated enamide substrate **1**-d_1 was prepared from benzamide-*N*-d_2 according to the method of Goossen,[4] with slight modifications to the standard protocol. A Schlenk flask was washed three times with D_2O (2-3 mL) acidified with a few drops of aqueous DCl (35 wt %), flame dried under vacuum, and transferred into an inert-atmosphere glovebox. The solid reaction components, benzamide-d_2 (0.49 g, 4.0 mmol), 1,4-bis(dicyclohexylphosphino)butane (0.108 g, 0.32 mmol), $Ru(mta)_2(COD)$ (0.064 g, 0.20 mmol), and ytterbium triflate (0.099 g, 0.16 mmol) were then added to the flask, followed by the addition of dry, degassed DMF (12 mL). After the sealed flask was removed from the glovebox, phenylacetylene (0.88 mL, 8.0 mmol) and degassed D_2O (0.43 mL, 24 mmol) were added to the reaction flask. The reaction was subsequently carried out according to the literature procedures. Several flash column purifications were required to obtain pure product (column conditions: gradient 1:20-to-1:5 EtOAc:Hexanes, using a NEt_3-washed silica column). The title compound was obtained with 93% deuterium incorporation, based on ^1H NMR spectroscopic analysis (220 mg, 25% yield). ^1H NMR (300 MHz, $CDCl_3$): δ 8.36 (br s, 1H), 7.74 (d, 2H, J = 6.9 Hz), 7.1-7.5 (m, 9H); ^{13}C NMR (300 MHz, $CDCl_3$): δ 164.58, 135.95, 133.62, 132.38, 129.48, 129.07, 128.08, 127.30, 122.55, 110 .83 (t, J = 24.9Hz); EMM (ESI) m/z calcd for $C_{15}H_{12}DNO$ [M+H]: 225.1133, meas: 225.1138.

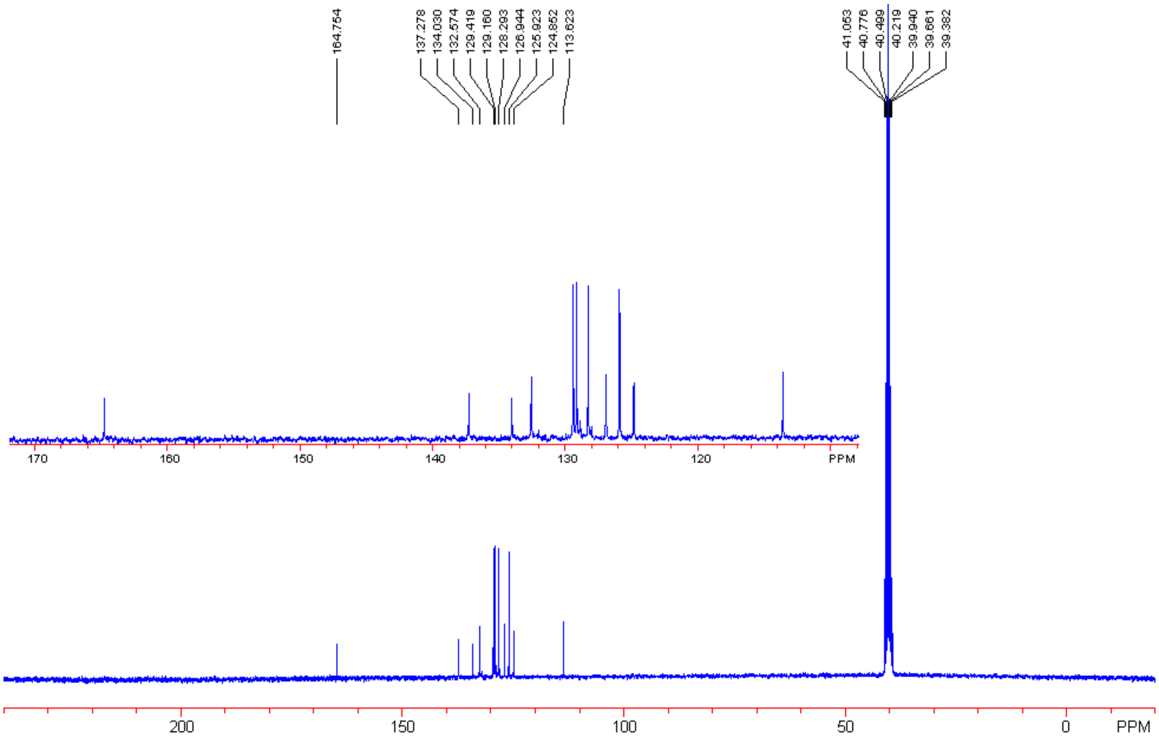
The kinetic isotope effect was determined by independent rate measurements of (*Z*)-**1** and (*Z*)-**1**-d_1. A comparison of the initial linear region of the reaction timecourse (t=0 to t=10 min) results in a measured k_H/k_D of 1.0 ± 0.2.

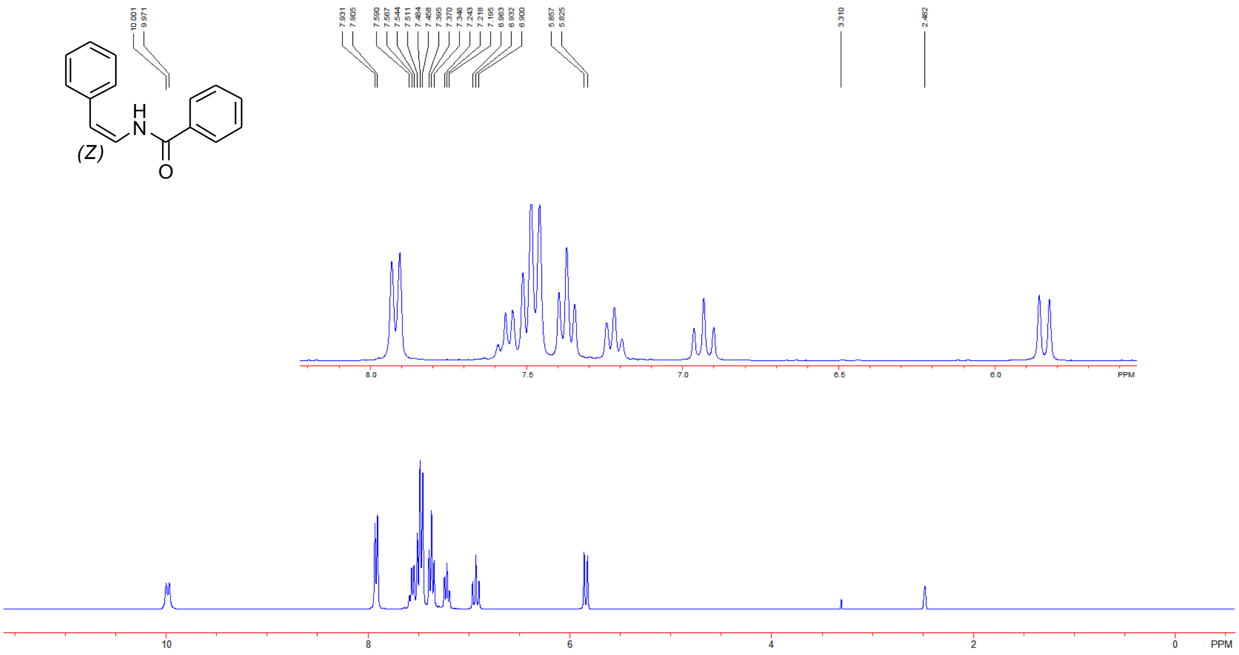


6. ^{1}H and ^{13}C NMR Spectra of Substrates

(E)-**1**:



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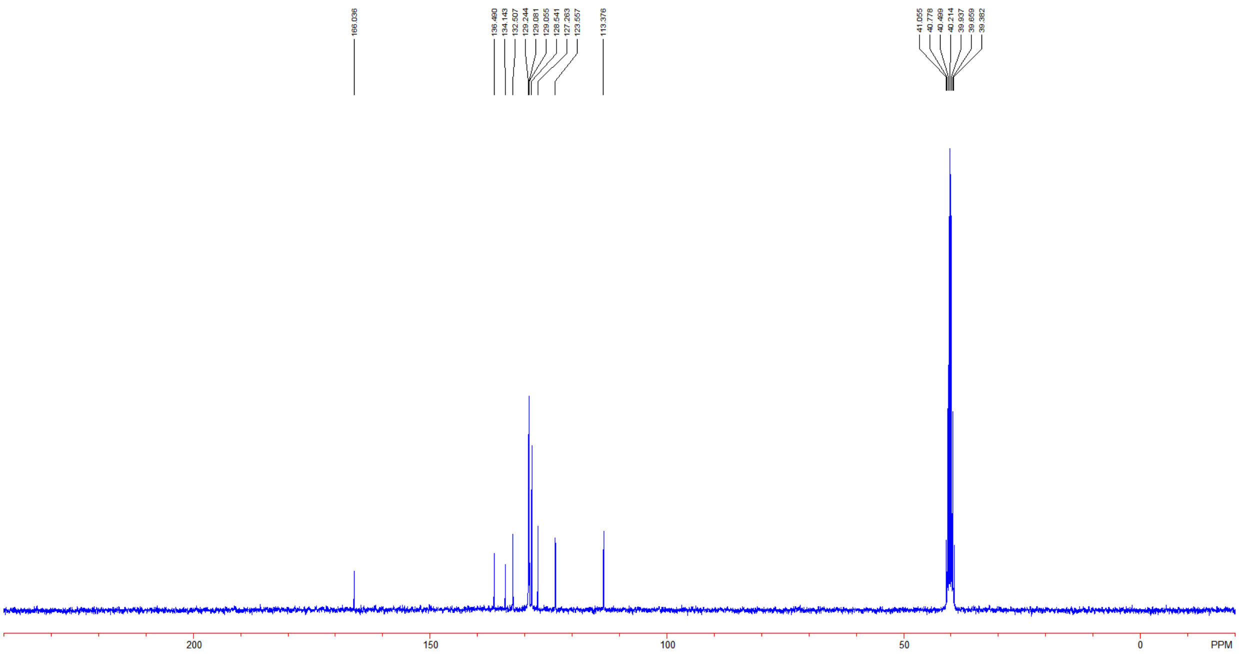
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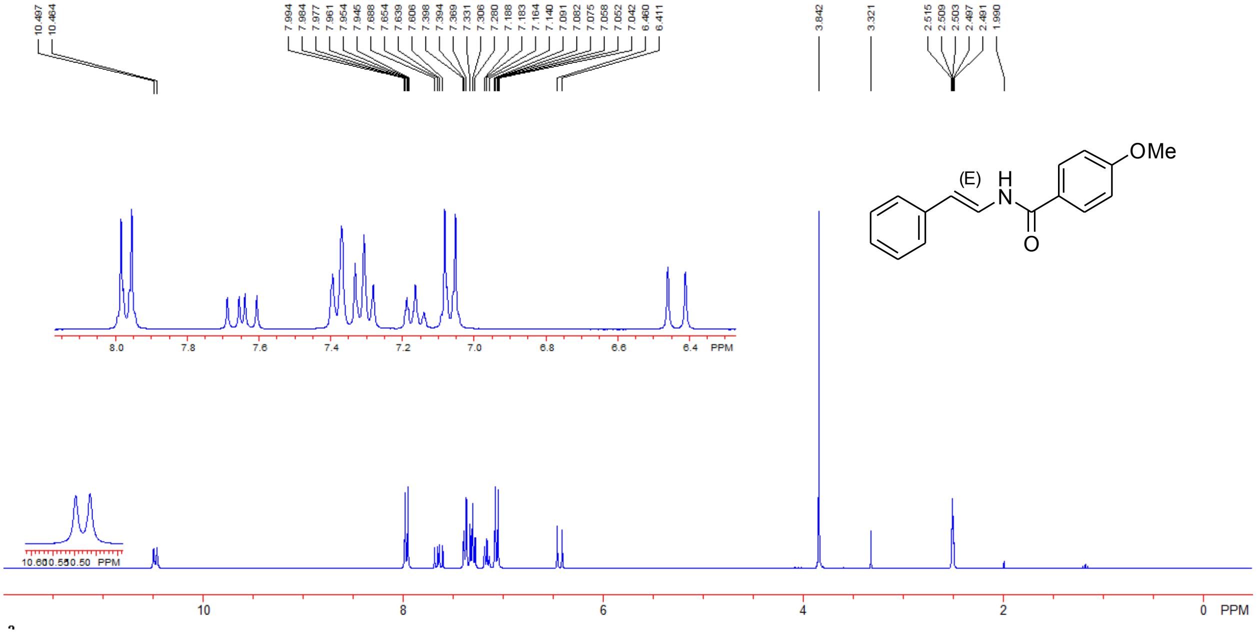
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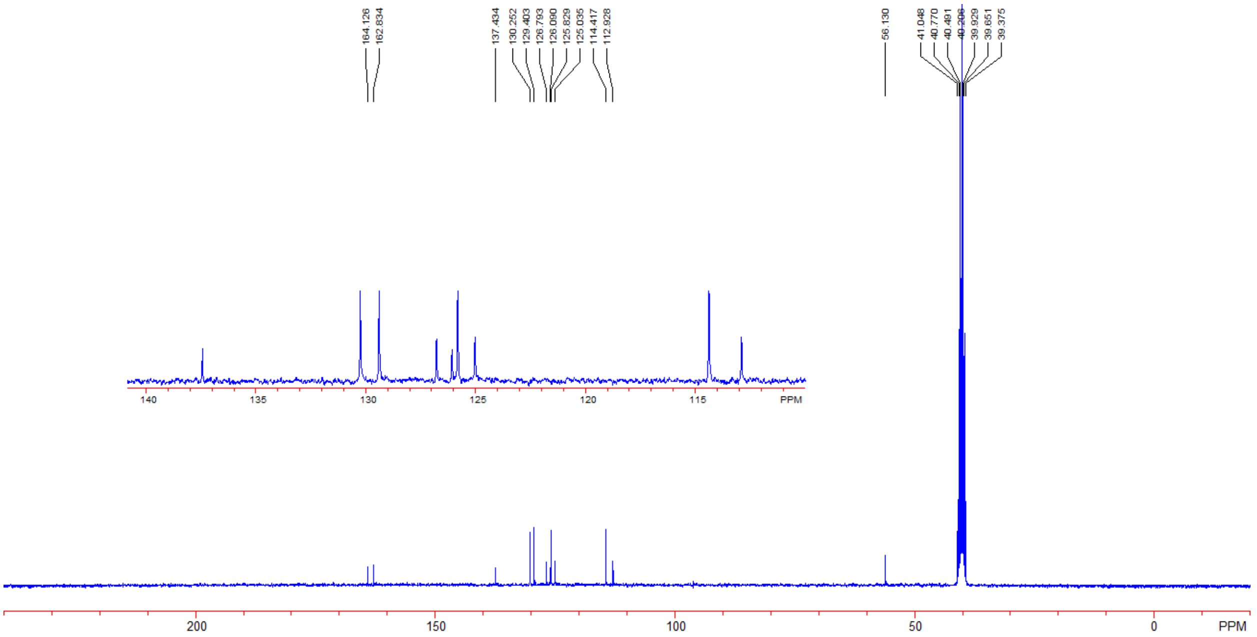
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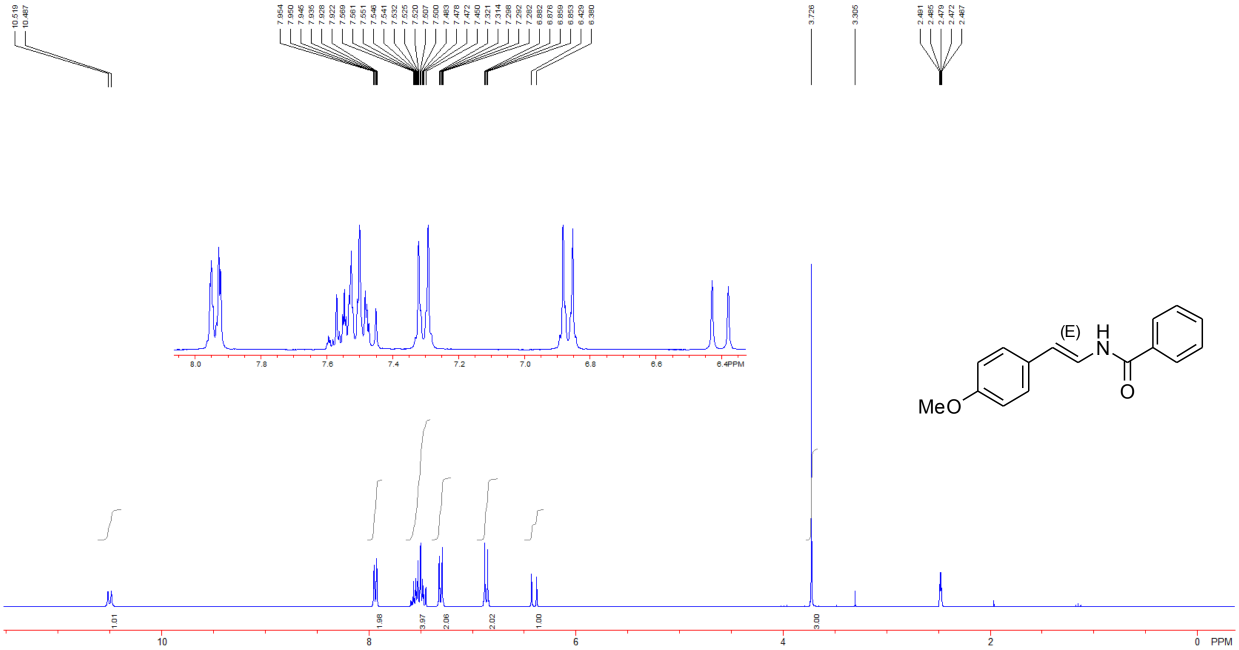
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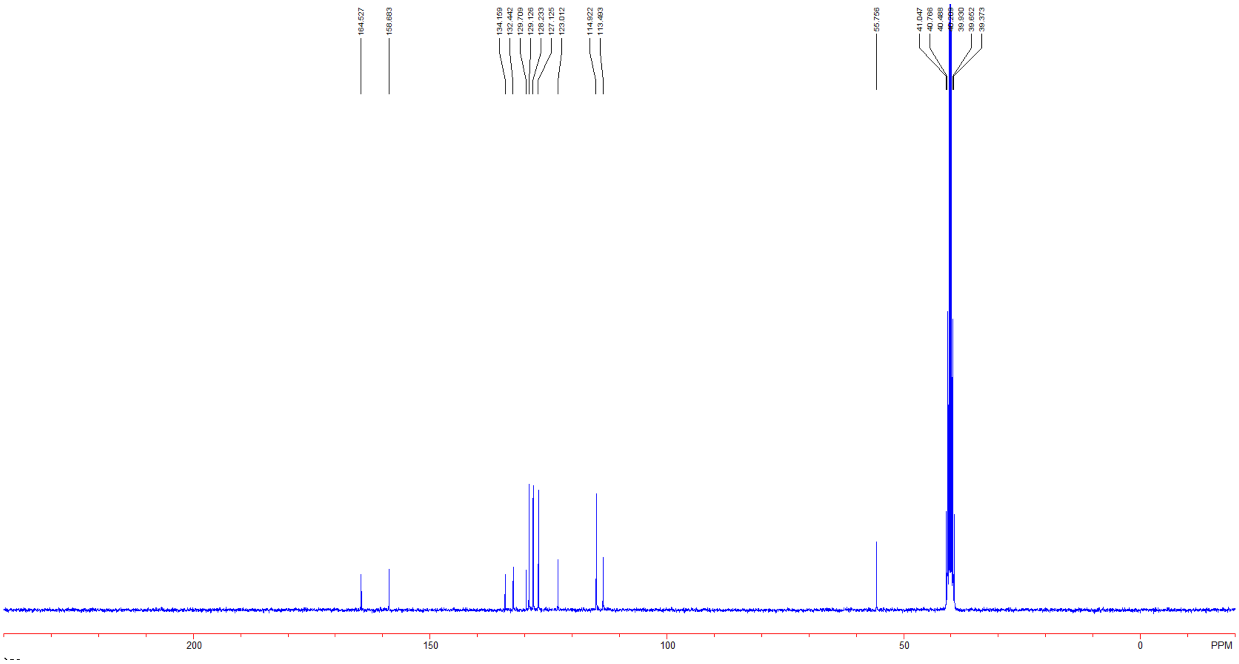
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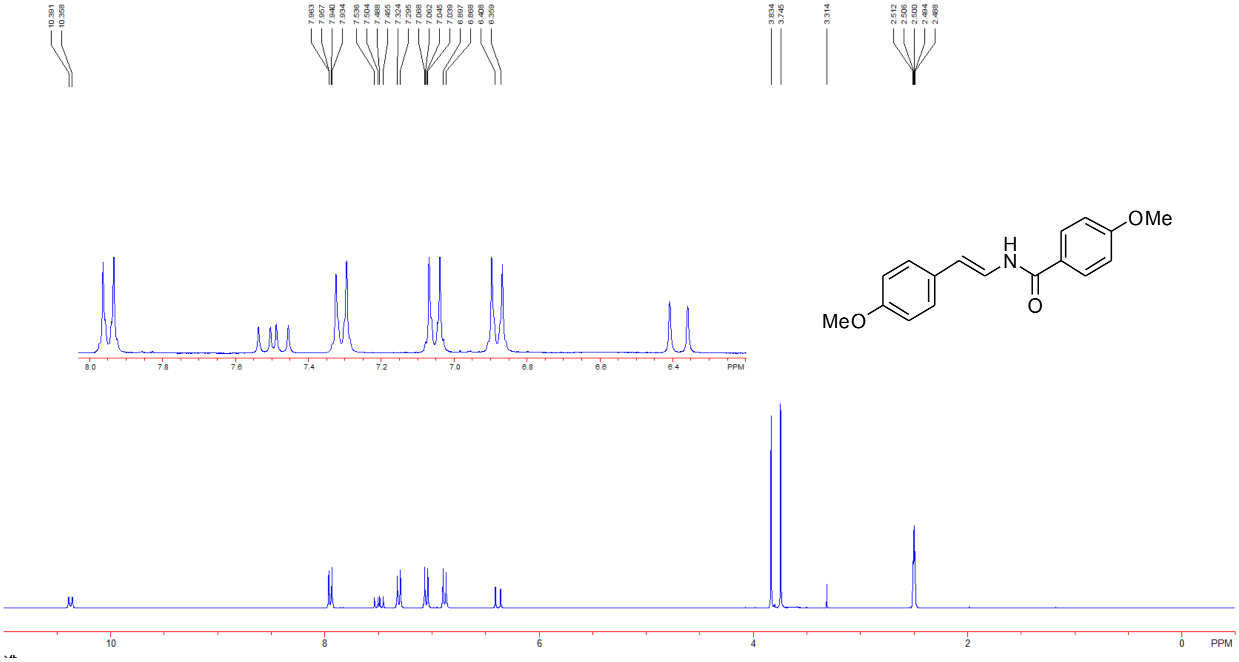
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2.512
2.506
2.500
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7.6
7.4
7.2
7.0
6.8
6.6
6.4
PPM
OMe
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N
O
MeO
10
8
6
4
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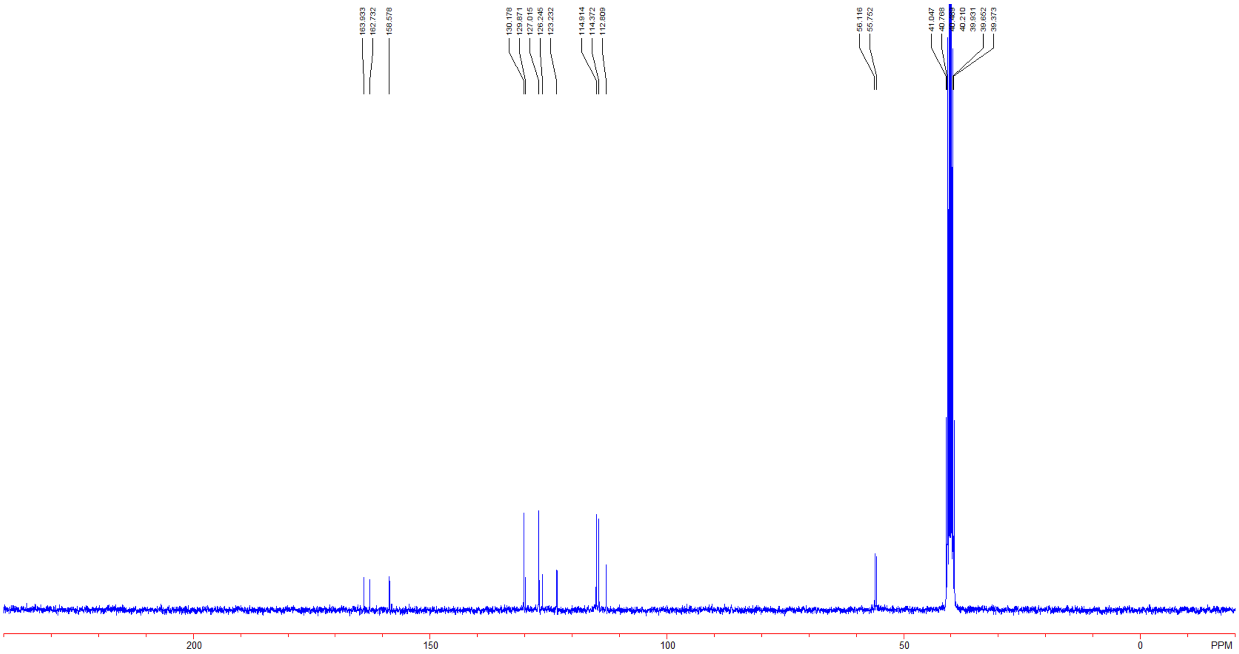
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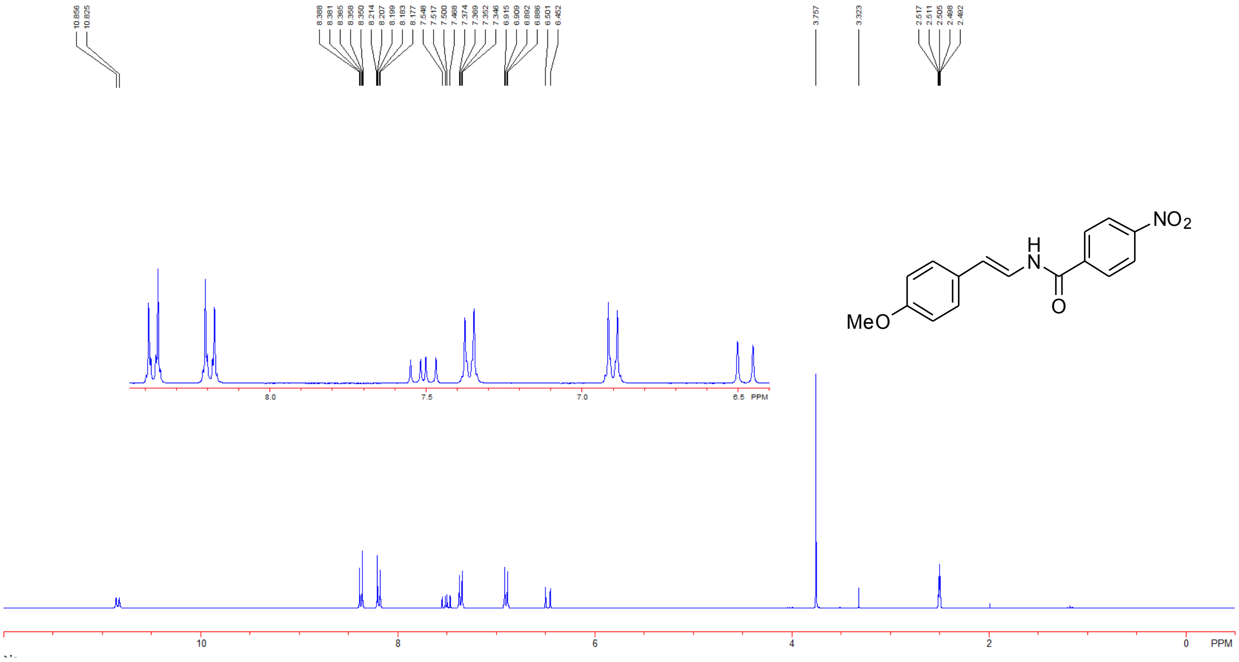
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6.909
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2.492
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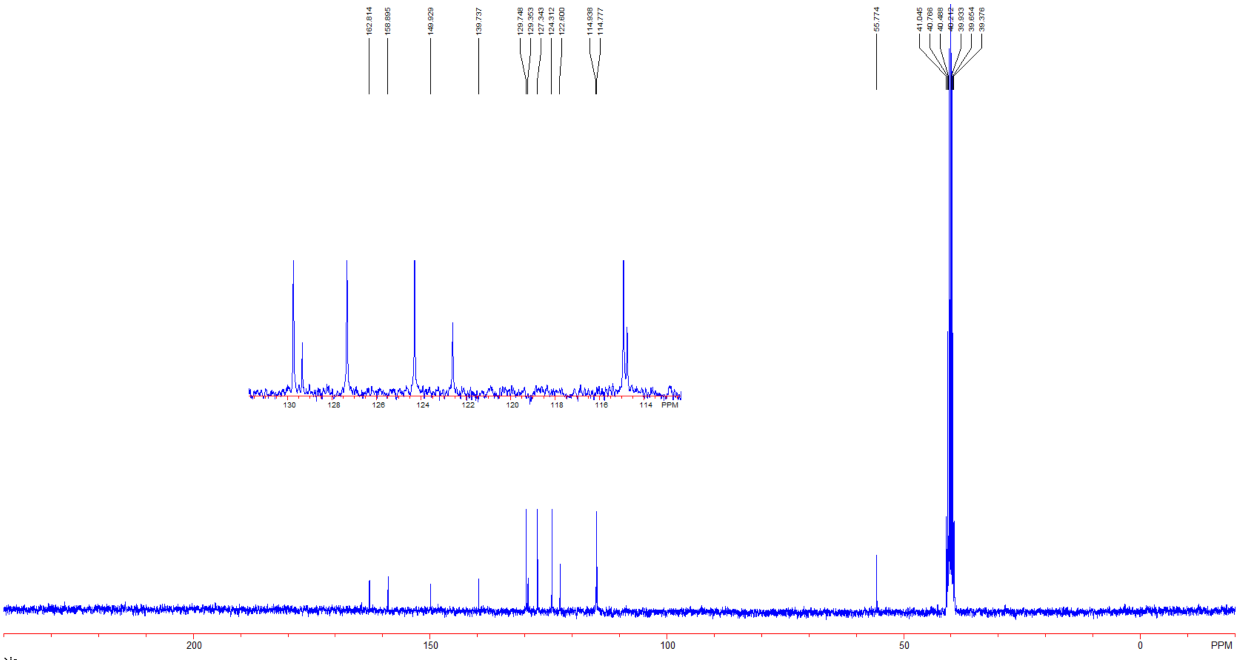
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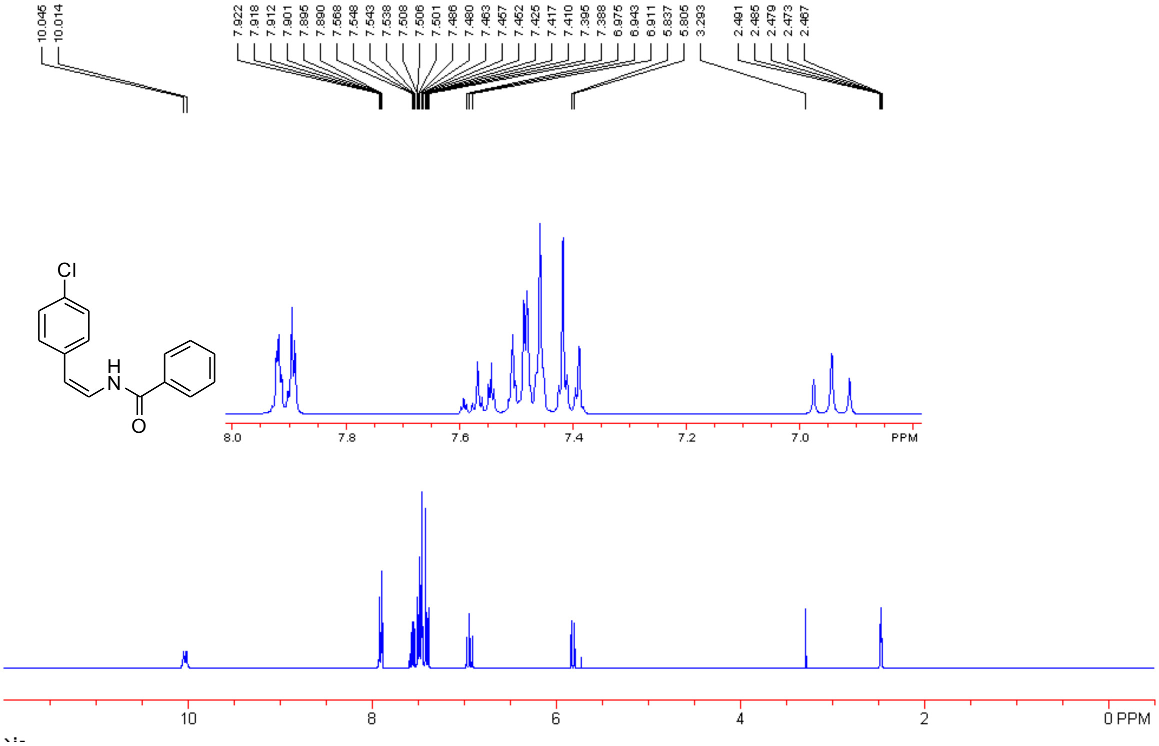
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7.501
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7.480
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7.425
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2.491
2.485
2.479
2.473
2.467
Cl
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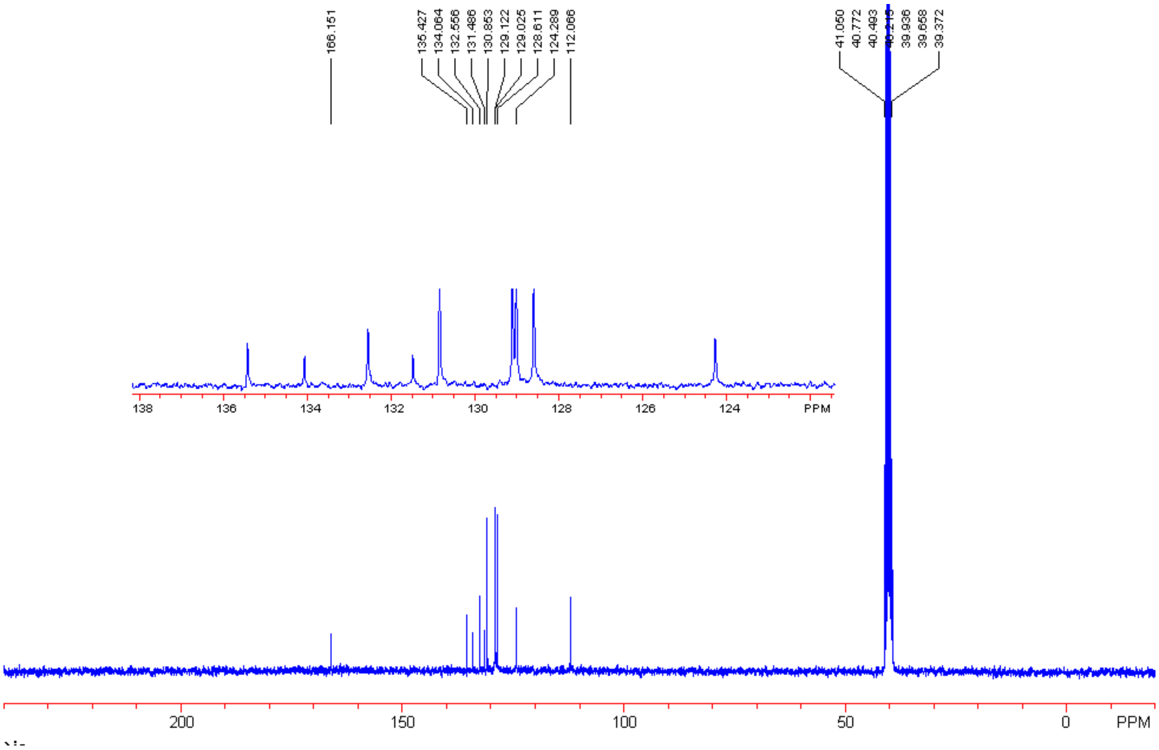
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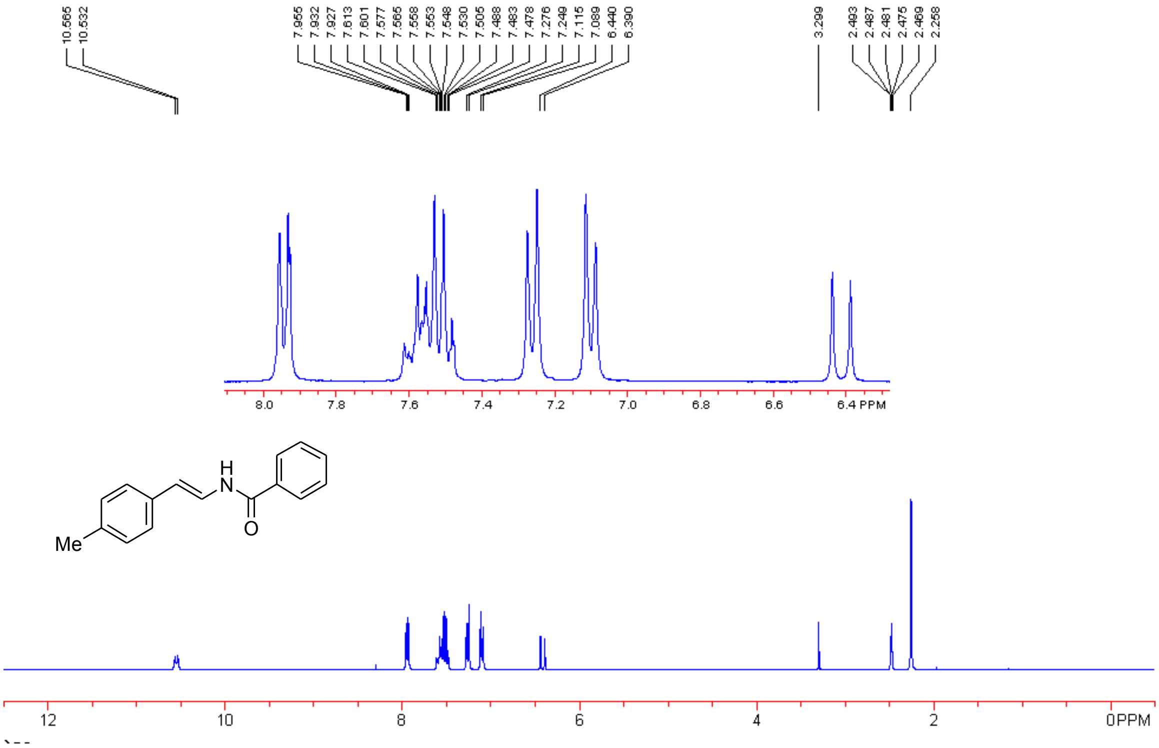
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7.478
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7.249
7.115
7.089
6.440
6.390
3.299
2.493
2.487
2.481
2.475
2.469
2.258
8.0
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7.6
7.4
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6.6
6.4 PPM
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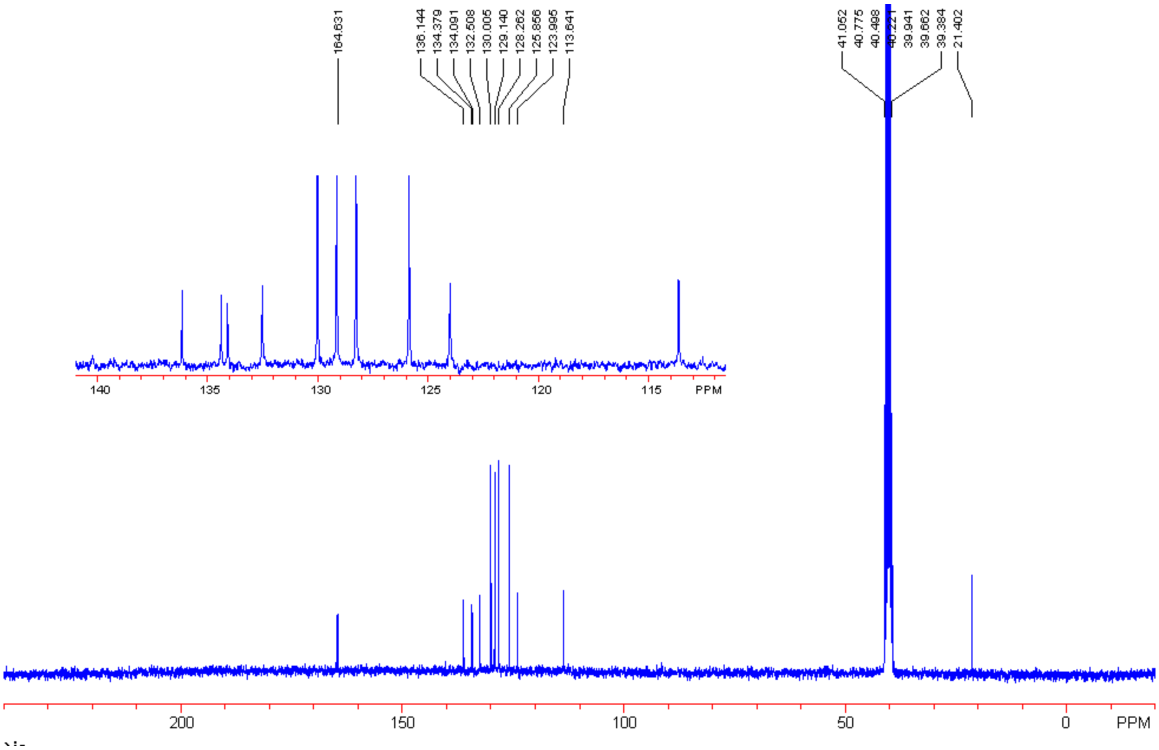
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40.221
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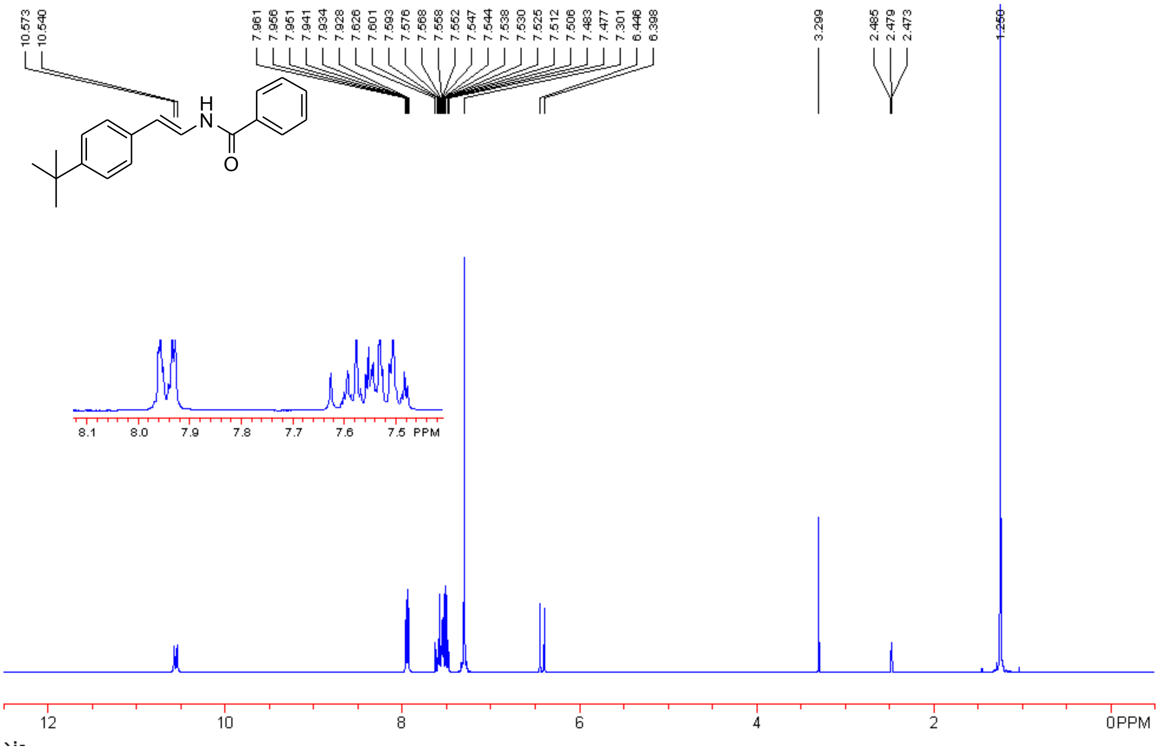
PPM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7.558
7.552
7.547
7.544
7.538
7.530
7.525
7.512
7.506
7.483
7.477
7.301
6.446
6.398
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2.479
2.473
1.250
H
N
O
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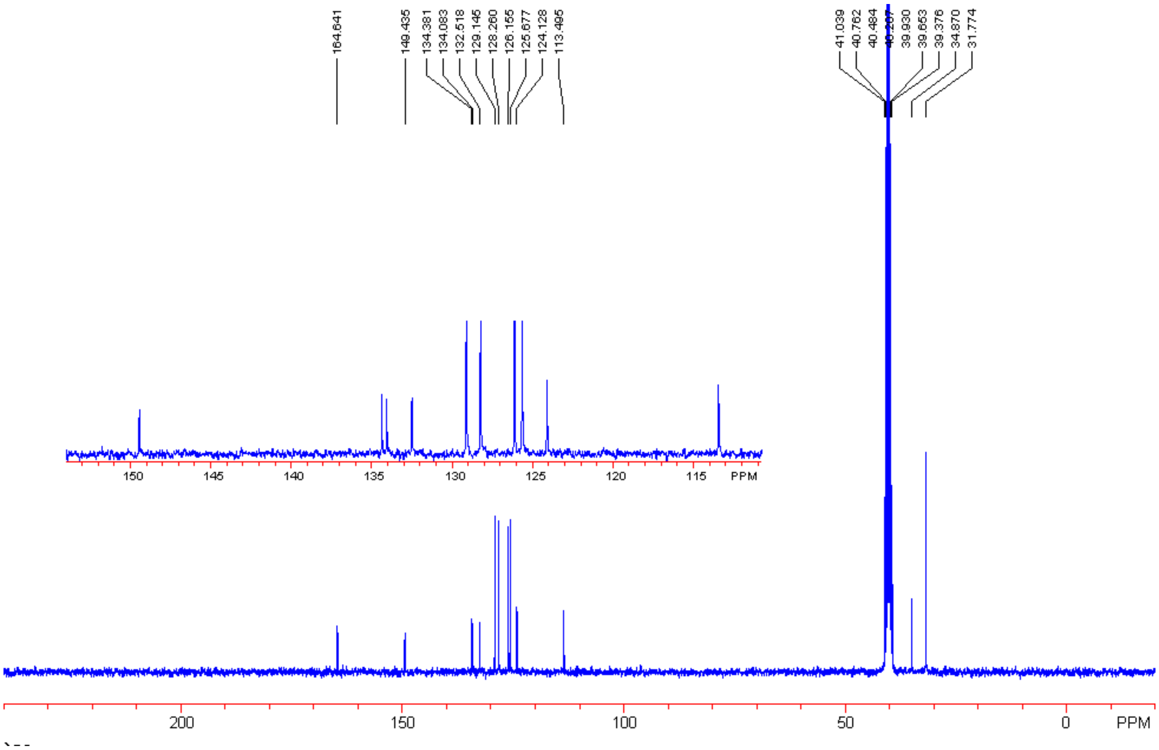
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39.653
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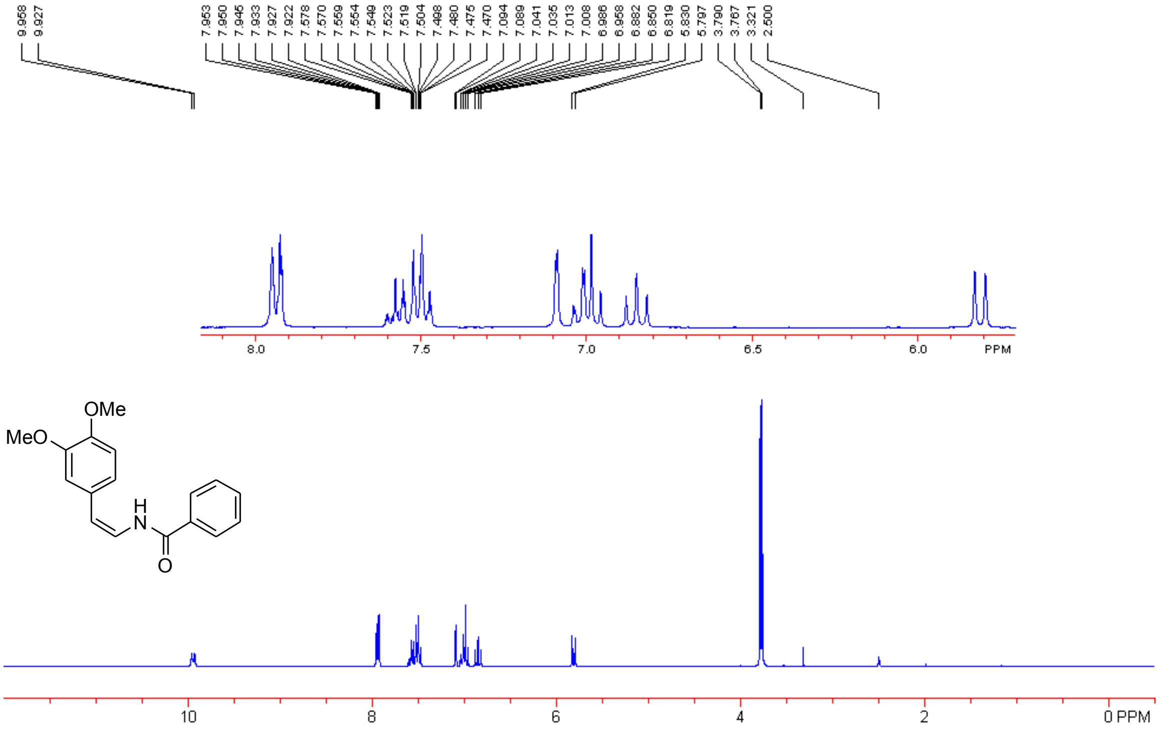
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7.470
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7.089
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7.035
7.013
7.008
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5.830
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3.321
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OMe
MeO
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O
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4
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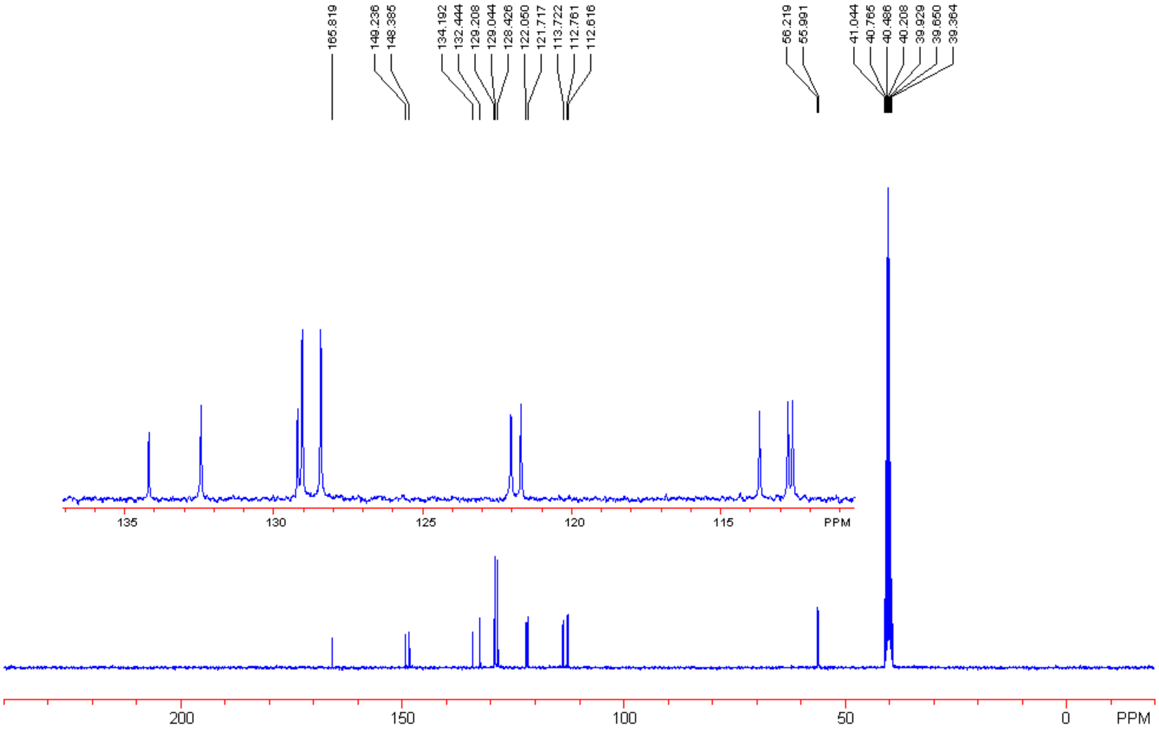
0 PPM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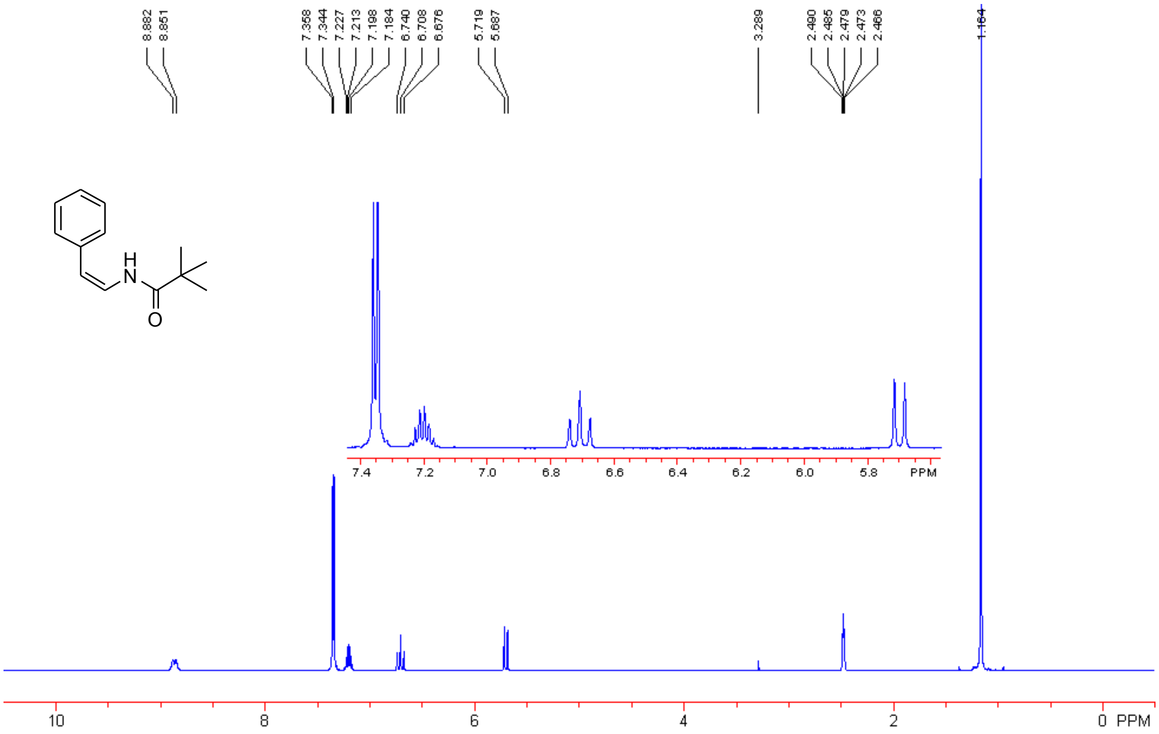
PPM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5.687
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2.485
2.479
2.473
2.466
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H
N
O
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7.2
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6.6
6.4
6.2
6.0
5.8
PPM
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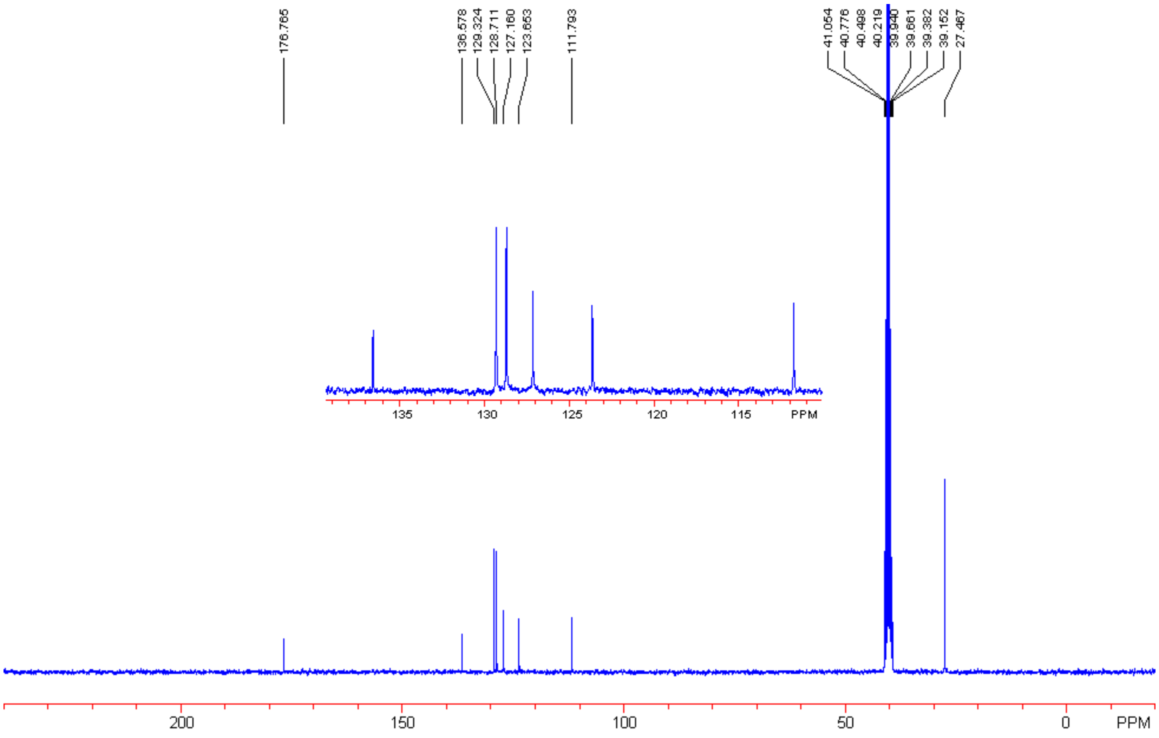
8
6
4
2
0 PPM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135
130
125
120
115
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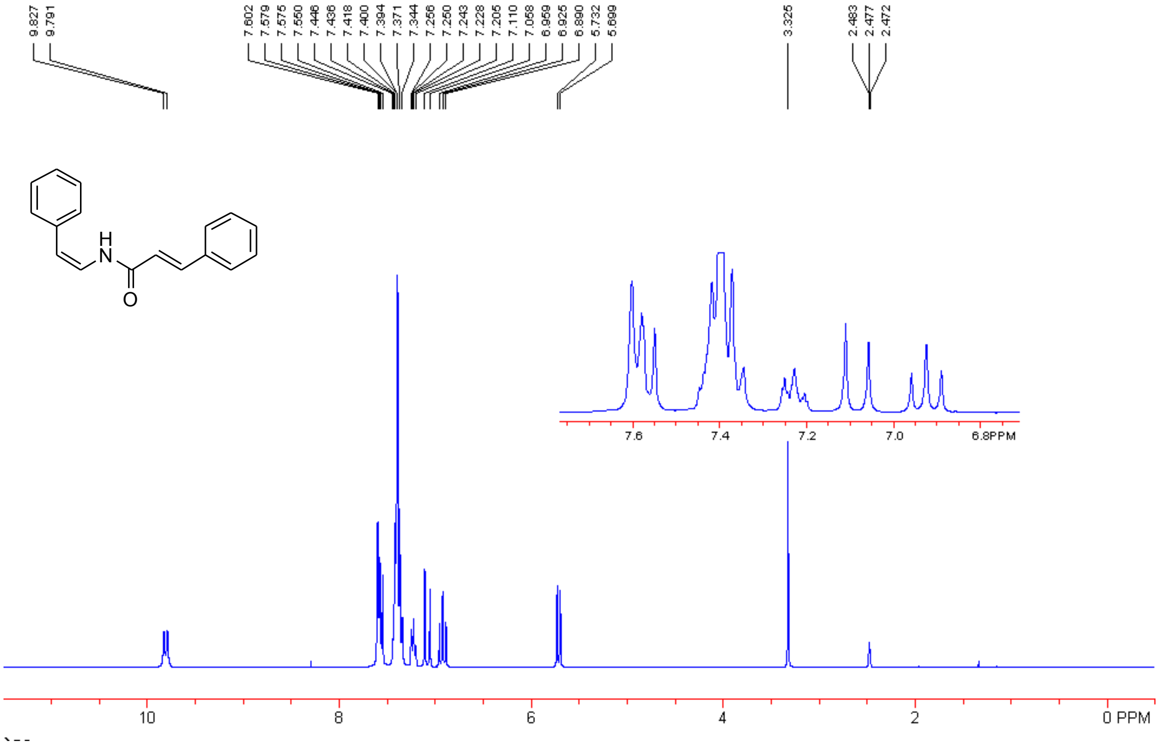
PPM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O
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4
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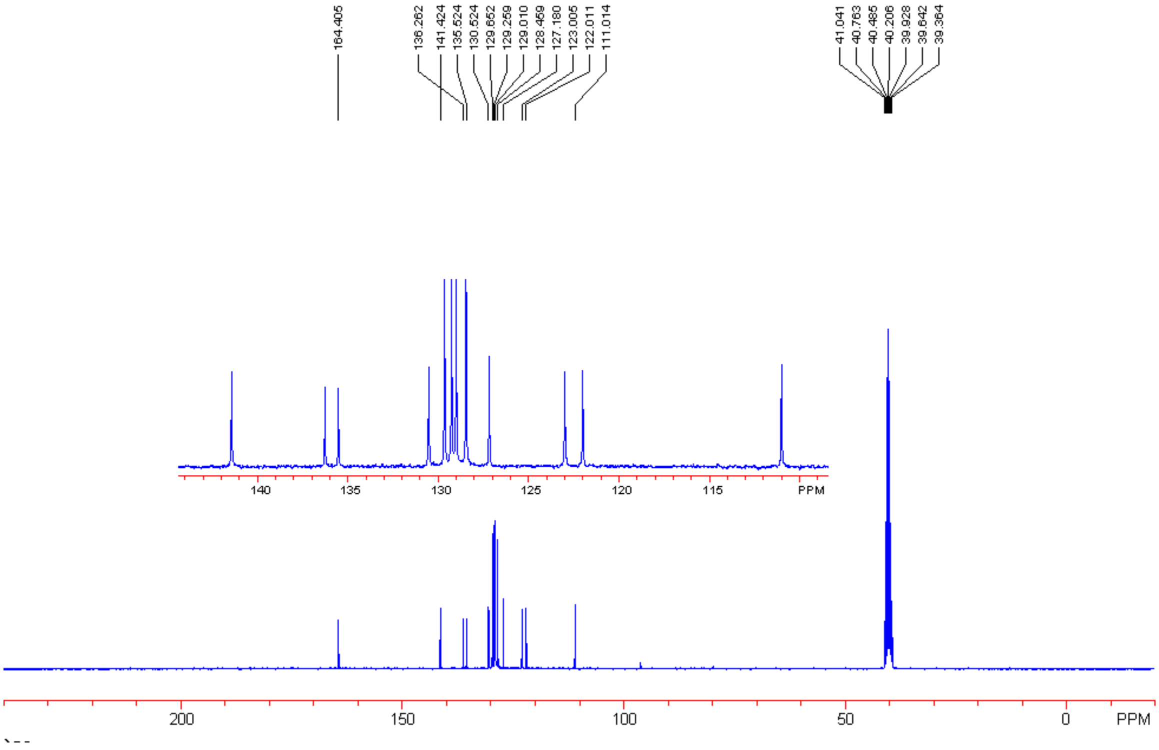
0 PPM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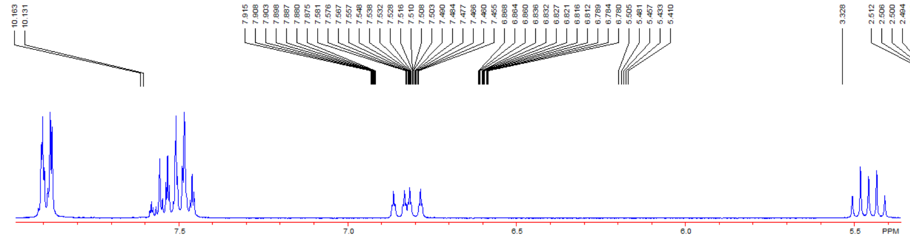
PPM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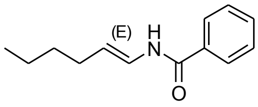
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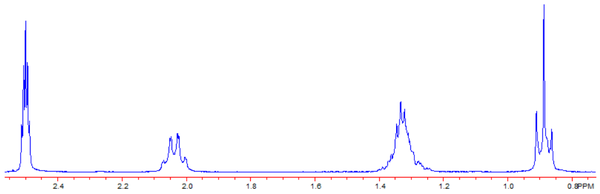
O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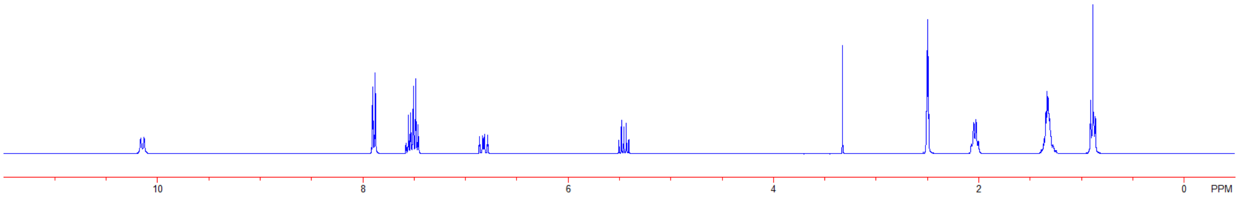
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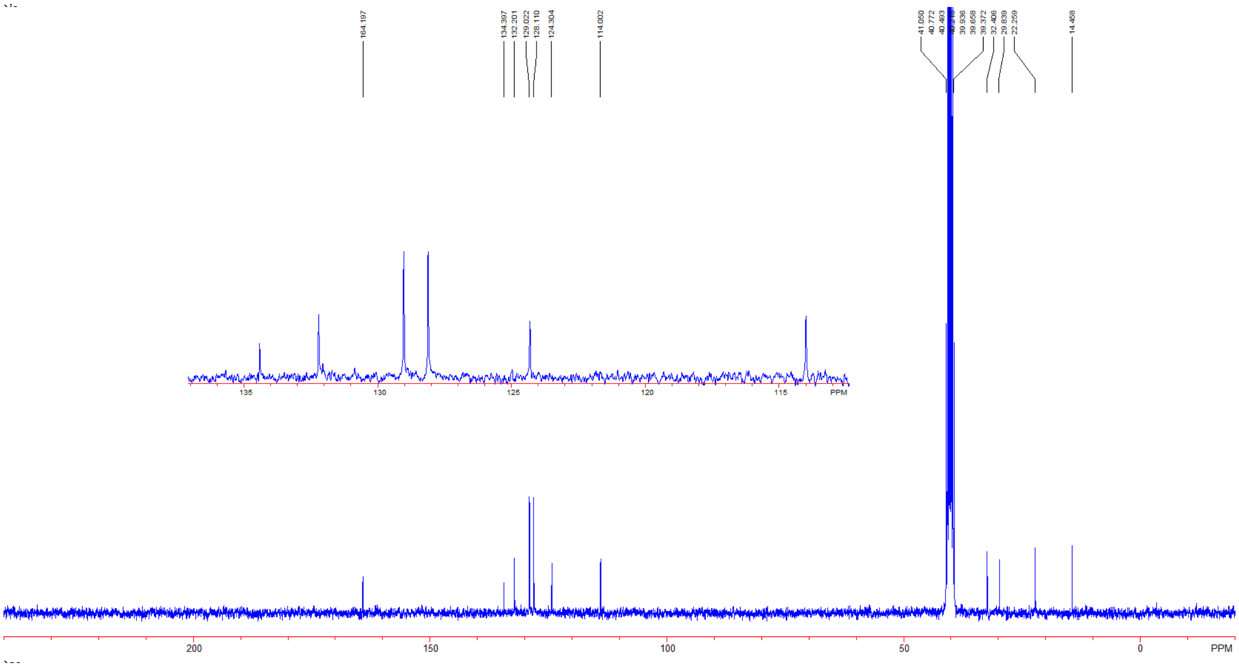
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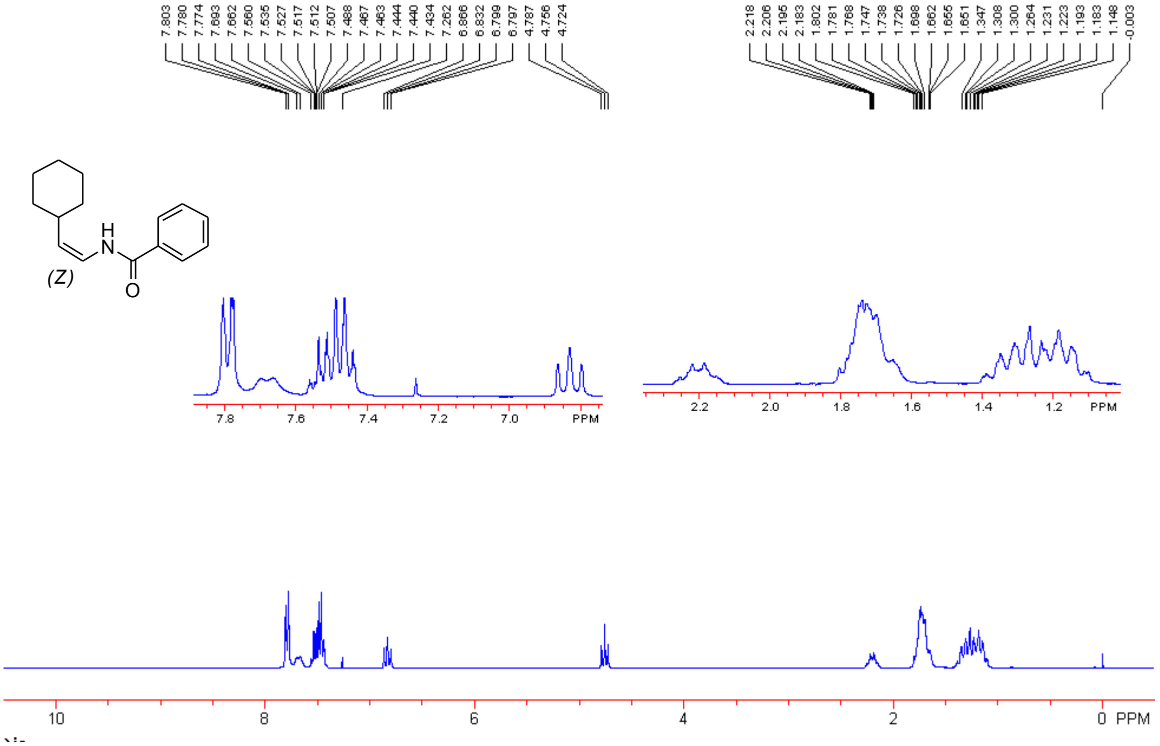
PPM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6.797
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4.756
4.724
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2.195
2.183
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1.223
1.193
1.183
1.148
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H
N
O
(Z)
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7.4
7.2
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PPM
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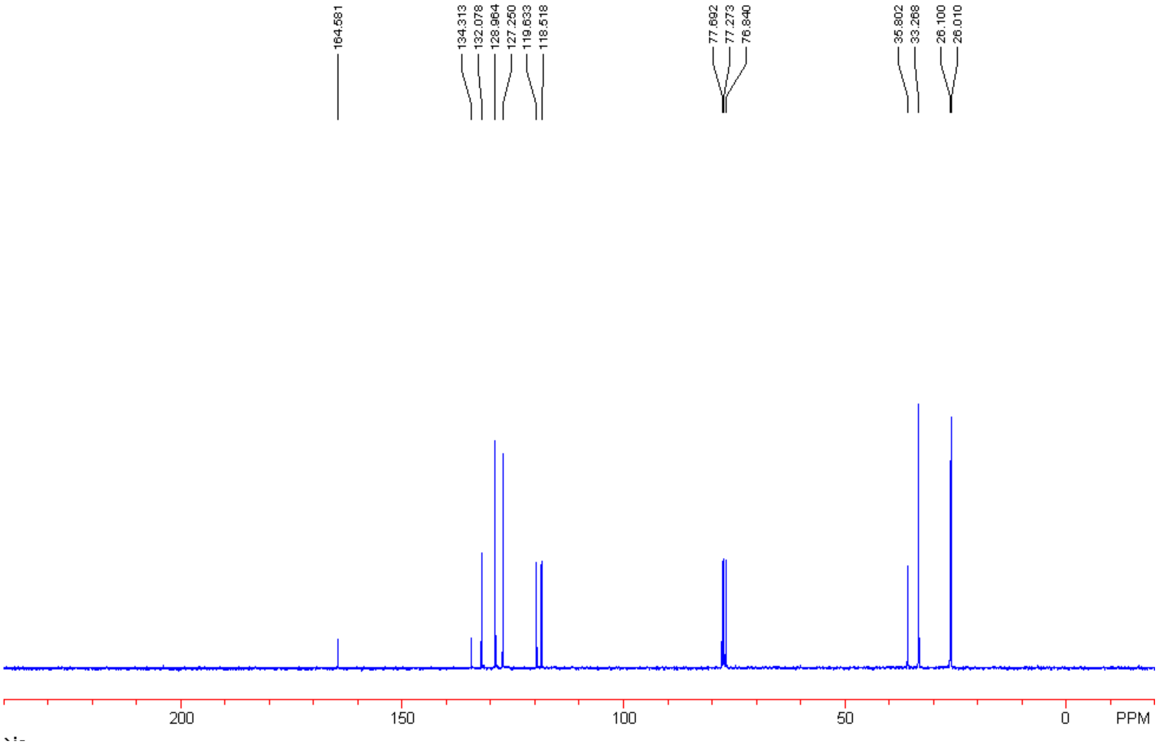
0 PPM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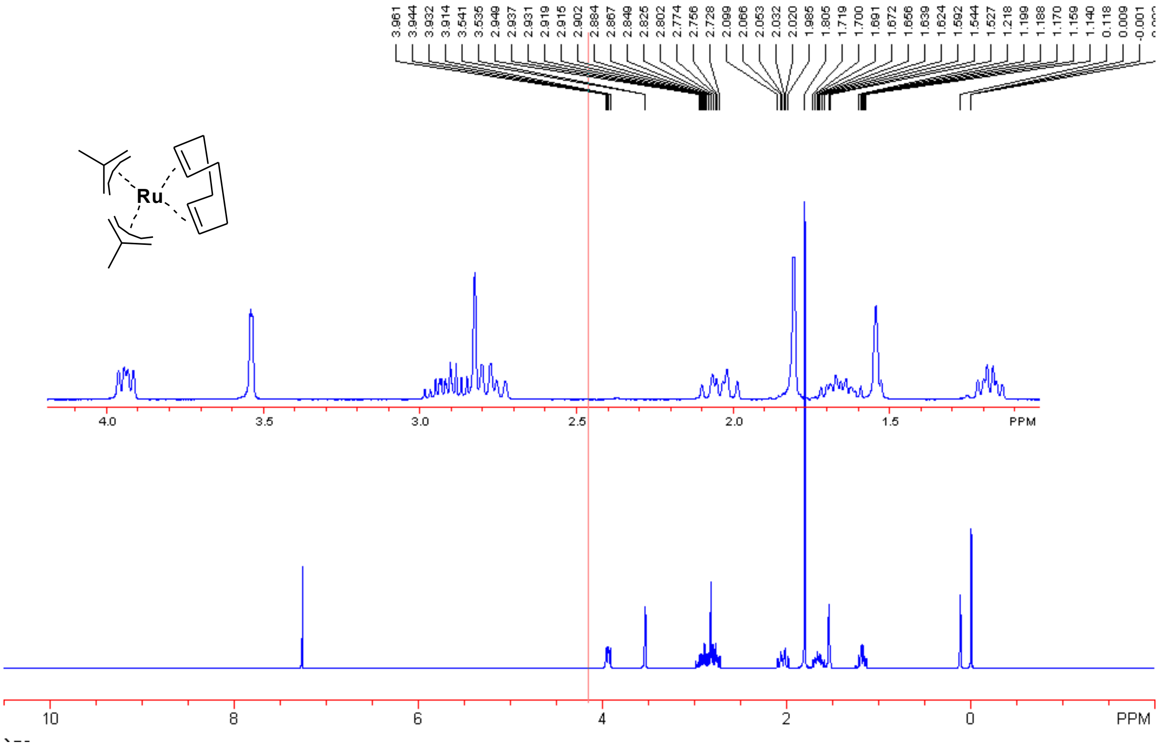
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-0.001
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3.5
3.0
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1.5
PPM
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8
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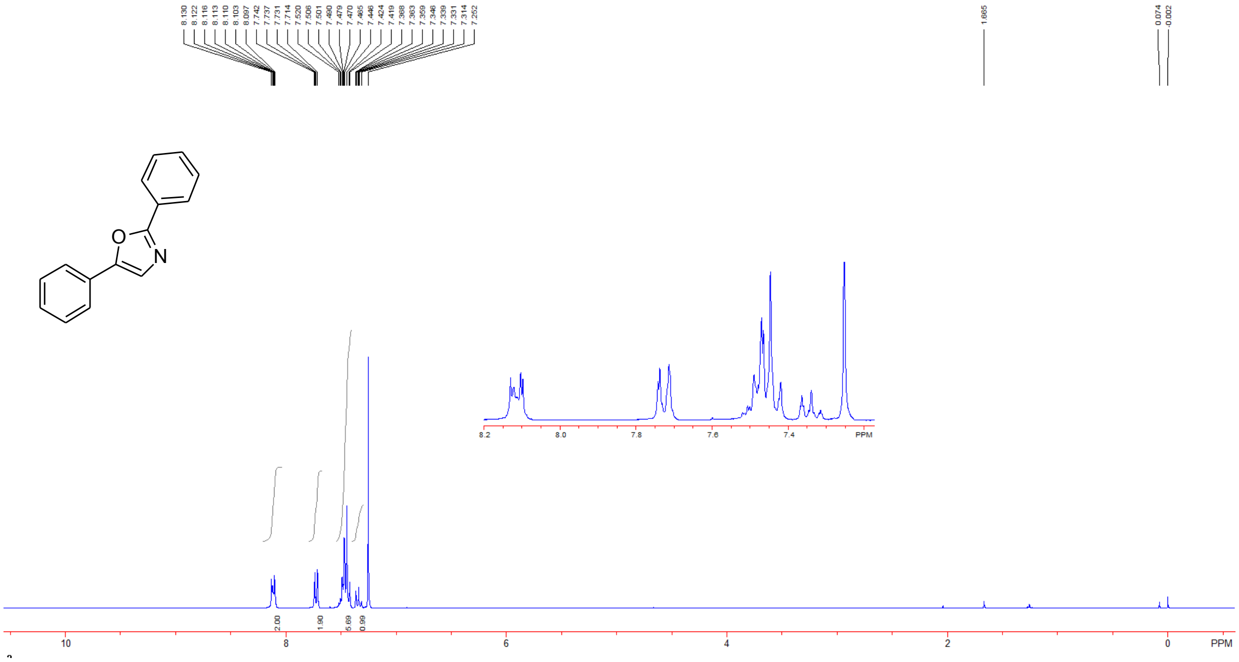
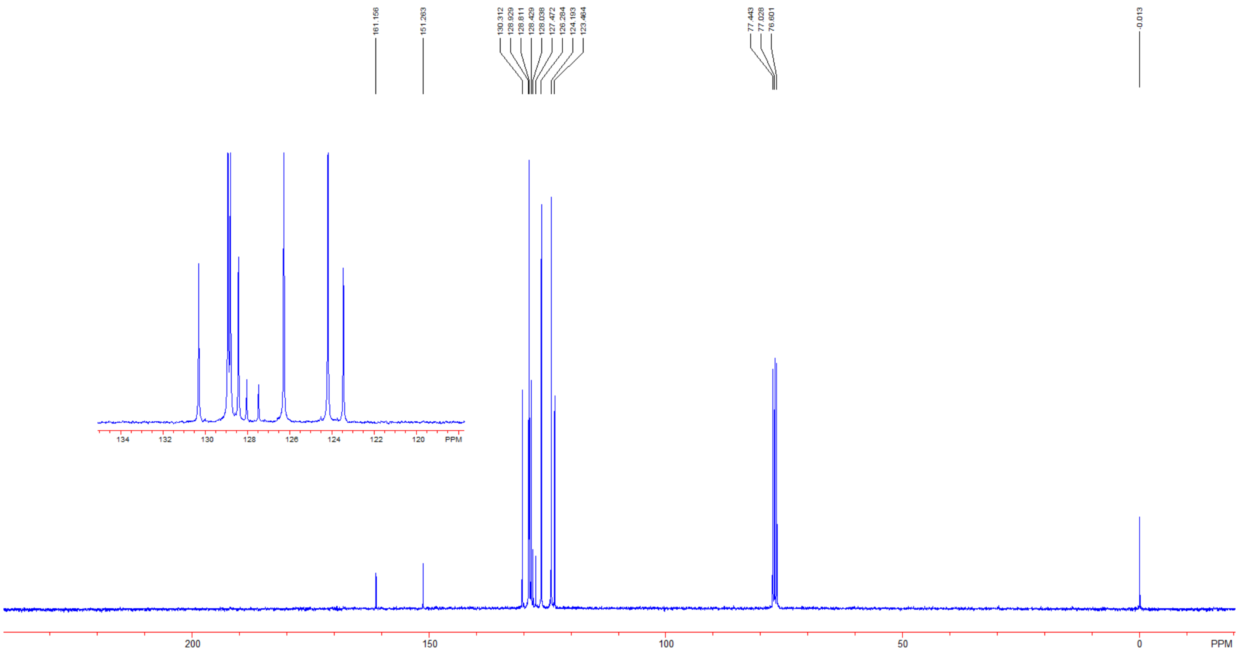
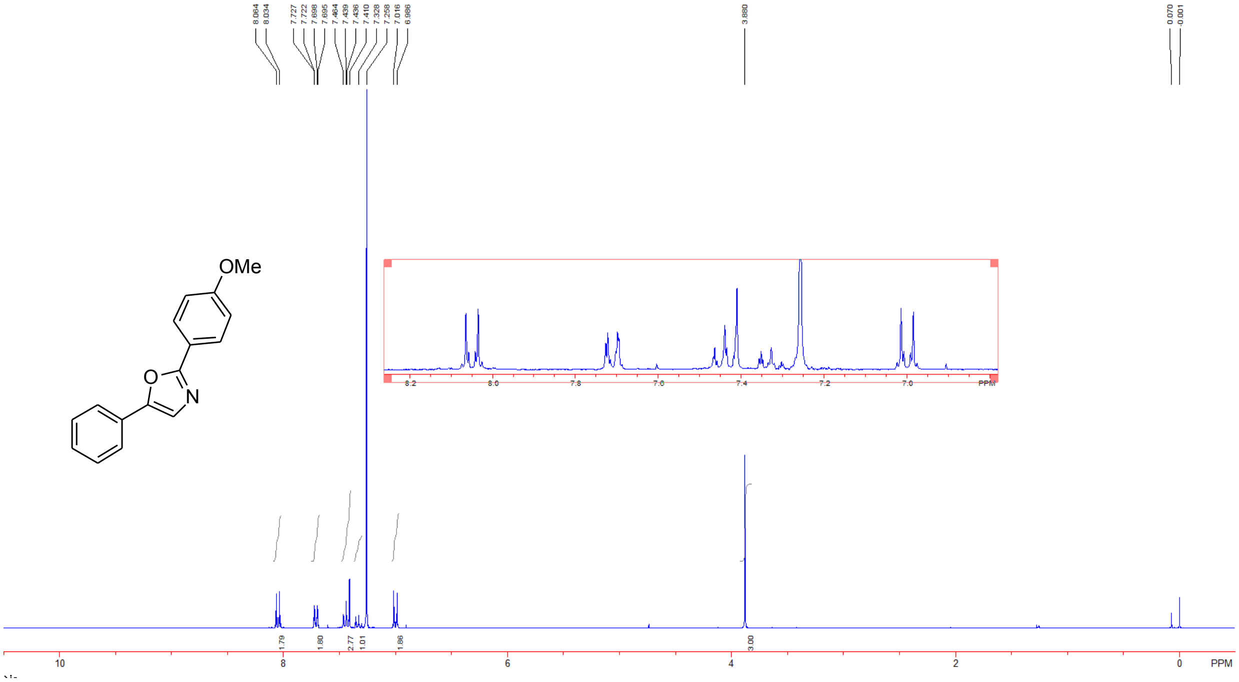
4
2
0
PPM

7. ^{1}H and ^{13}CNMR Spectra of Products



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7.722
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7.439
7.436
7.410
7.328
7.258
7.016
6.986
3.880
0.070
0.001
OMe
O
N
8.2
8.0
7.8
7.6
7.4
7.2
7.0
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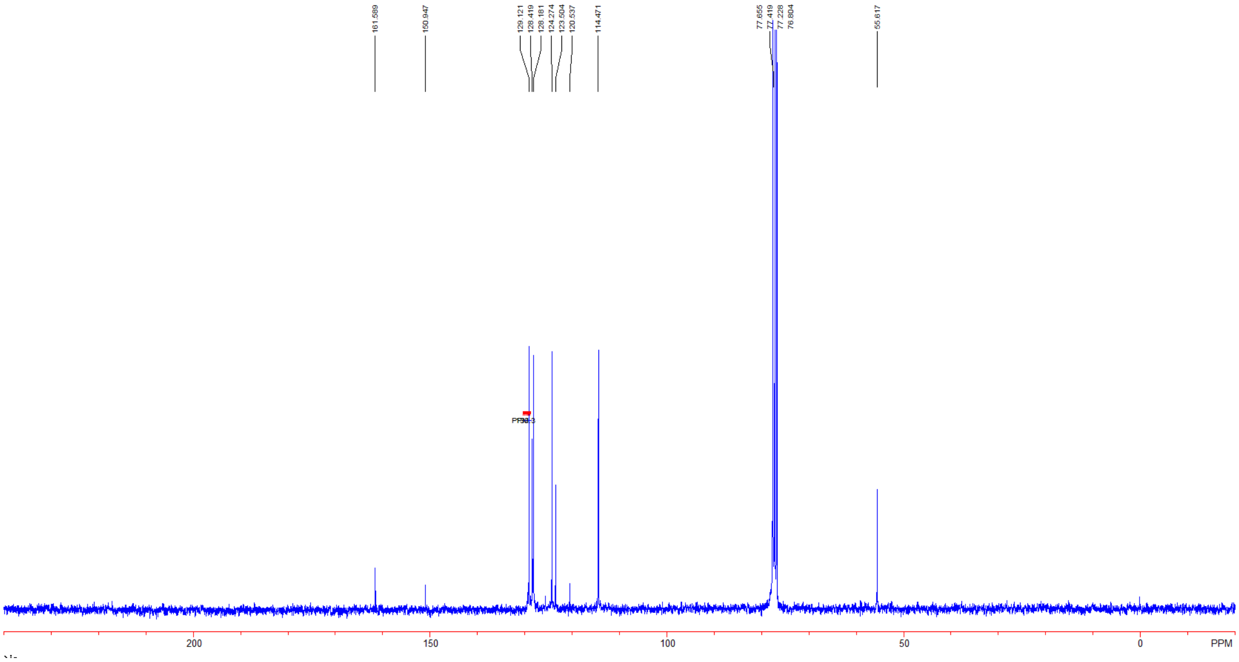
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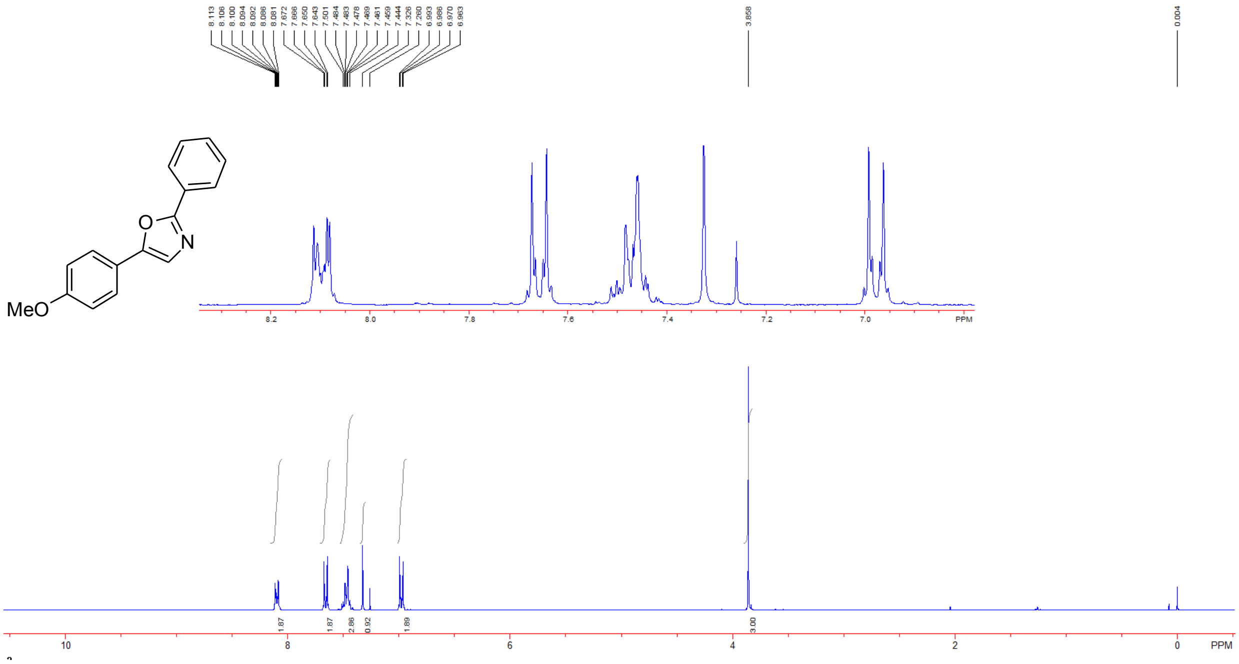
PPM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7.444
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7.260
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6.970
6.963
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O
N
MeO
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7.6
7.4
7.2
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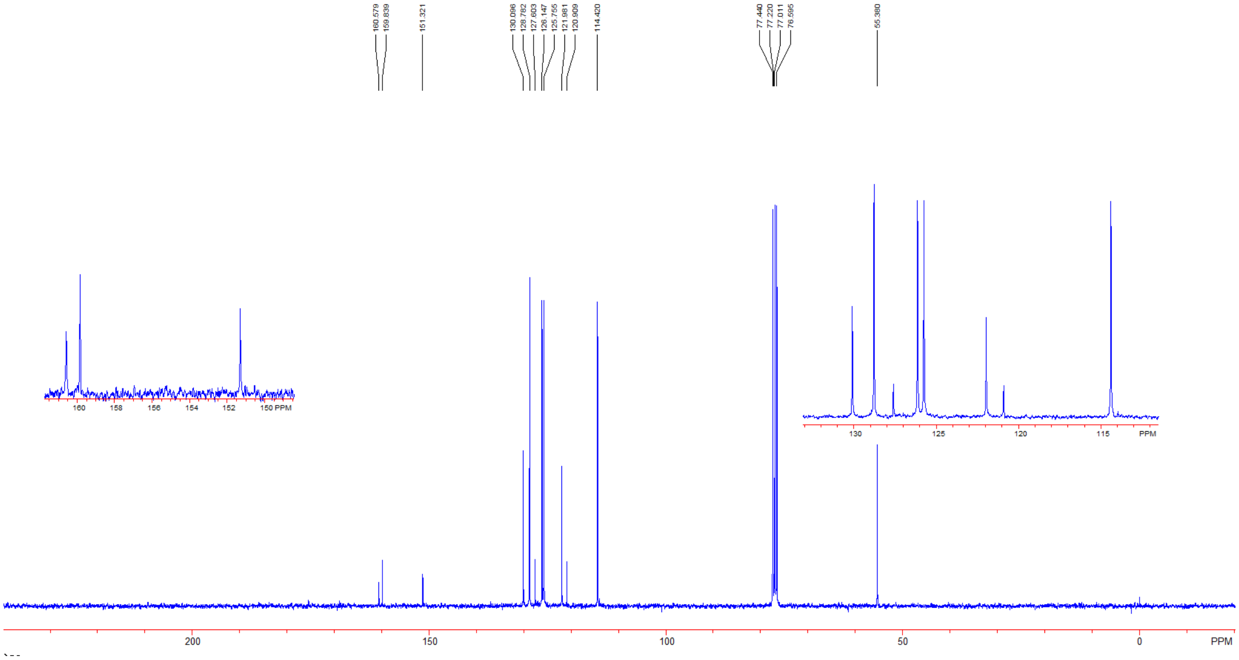
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PPM
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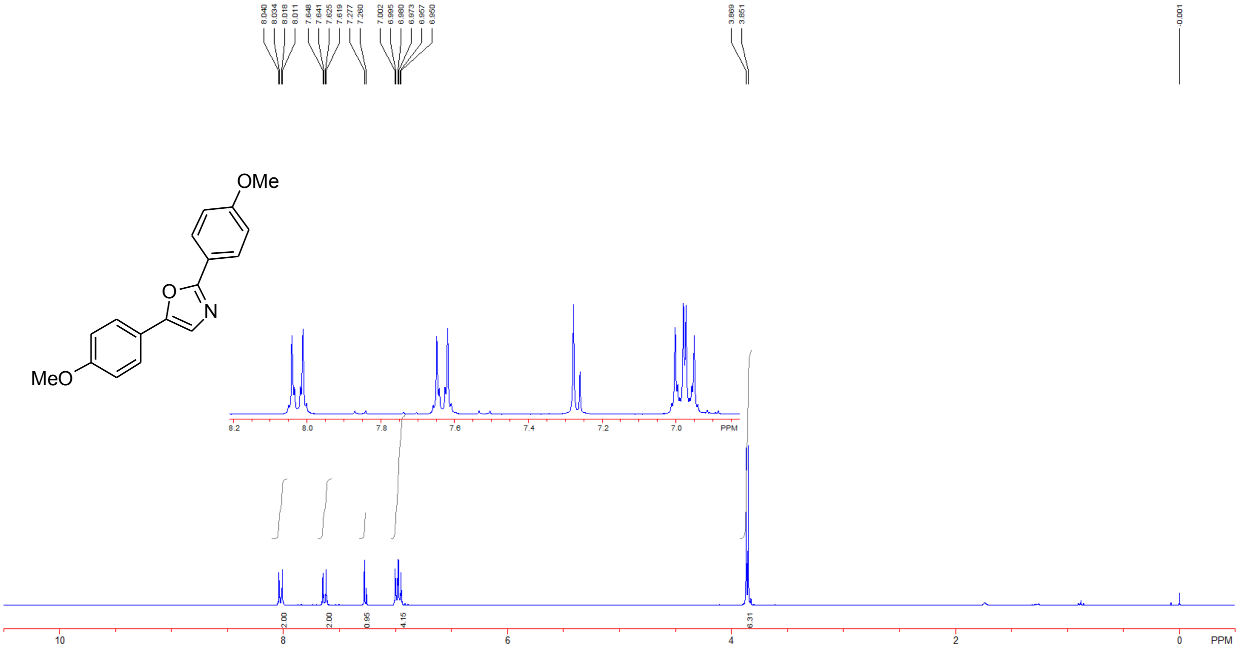
PPM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6.980
6.973
6.957
6.950
3.869
3.851
0.001
OMe
O
N
MeO
8.2
8.0
7.8
7.6
7.4
7.2
7.0
PPM
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2.00
0.95
4.15
6.31
10
8
6
4
2
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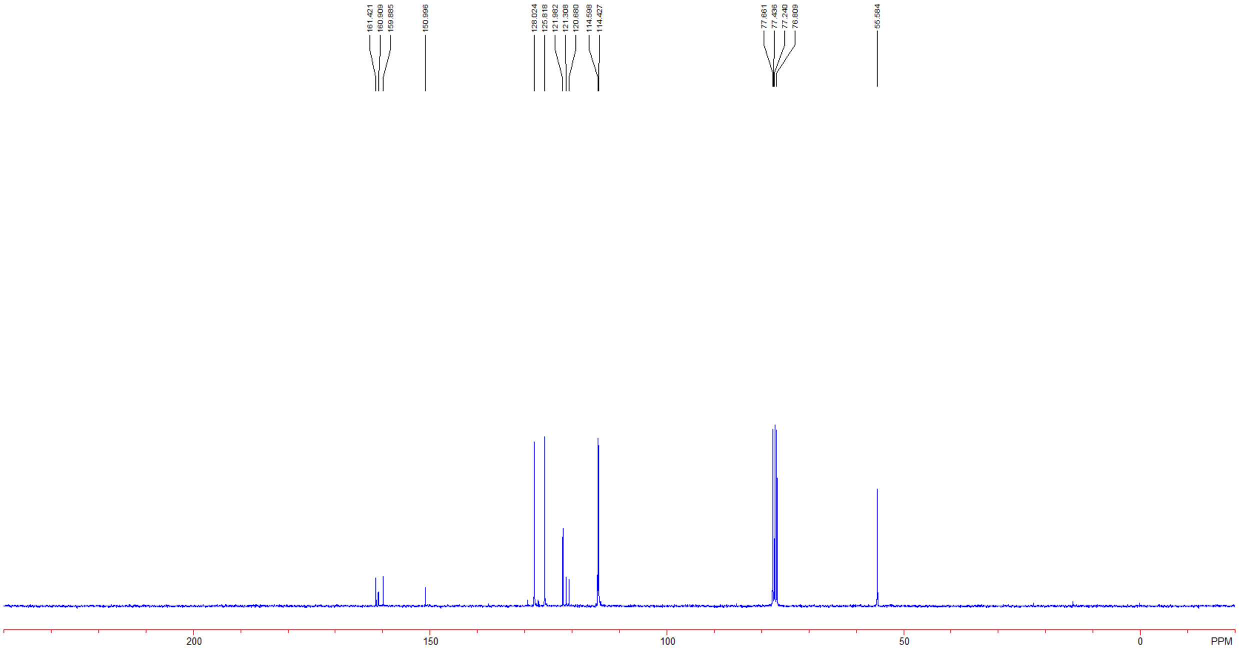
PPM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77.240
76.809
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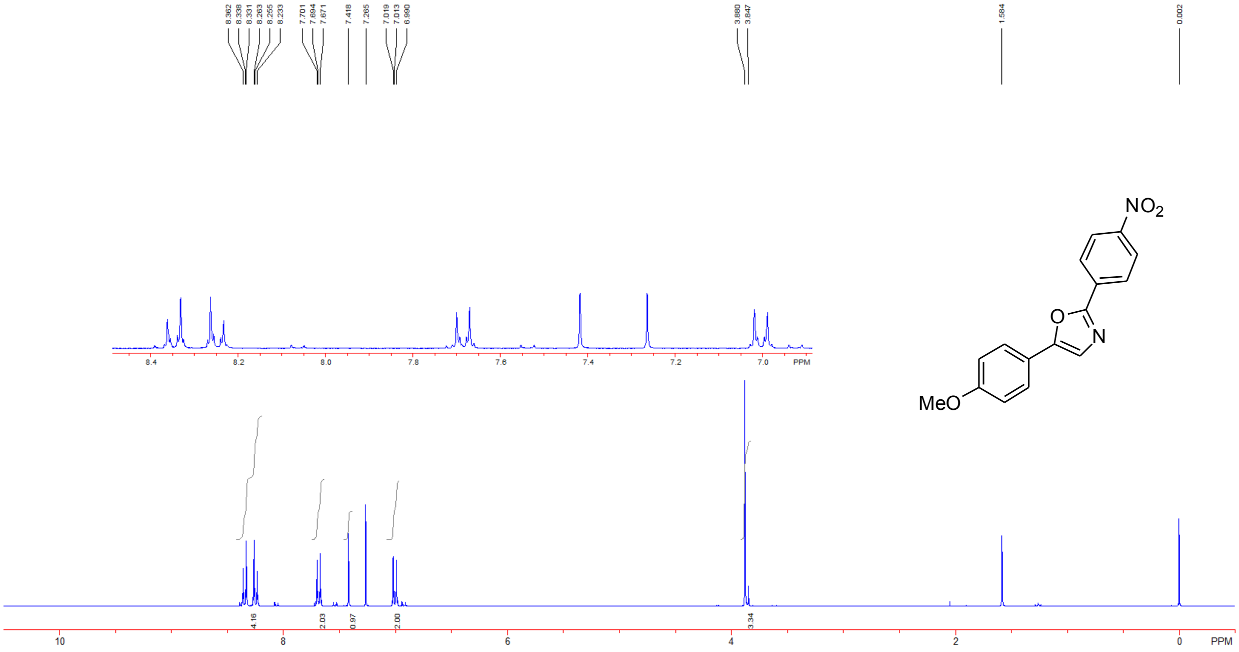
PPM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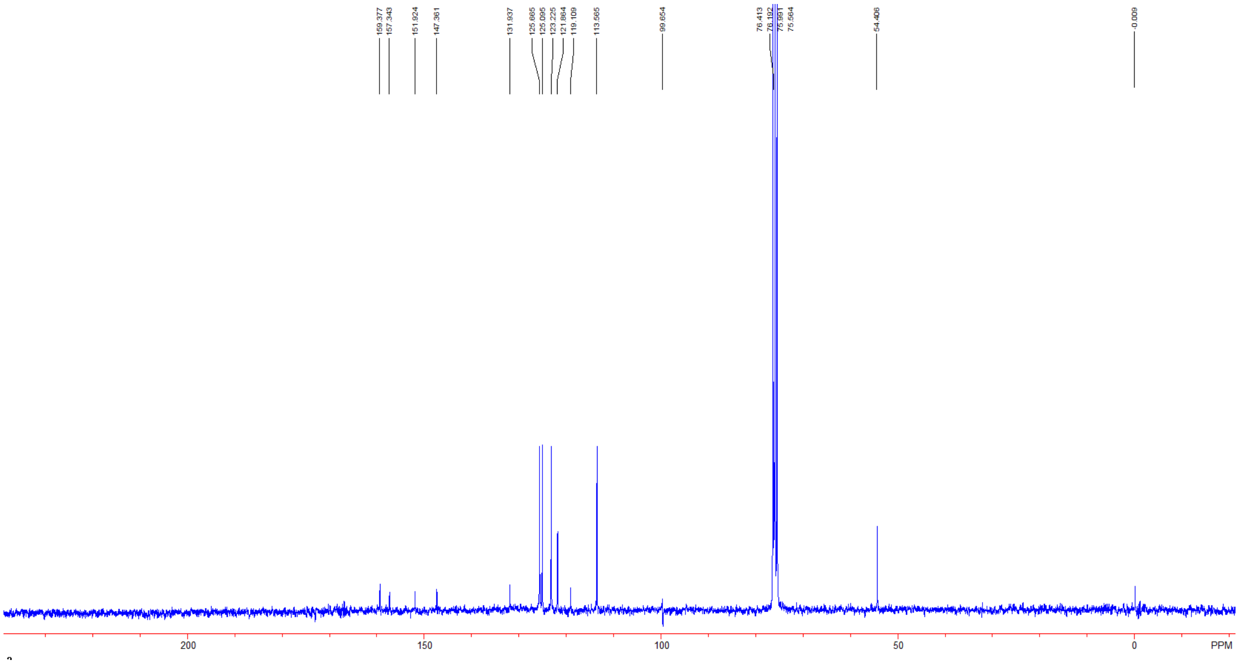
7.265
7.019
7.013
6.990
3.880
3.847
1.594
0.002
NO2
O
N
MeO
8.4
8.2
8.0
7.8
7.6
7.4
7.2
7.0
PPM
4.16
2.03
0.97
2.00
3.34
10
8
6
4
2
0
PPM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119.109
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76.192
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75.564
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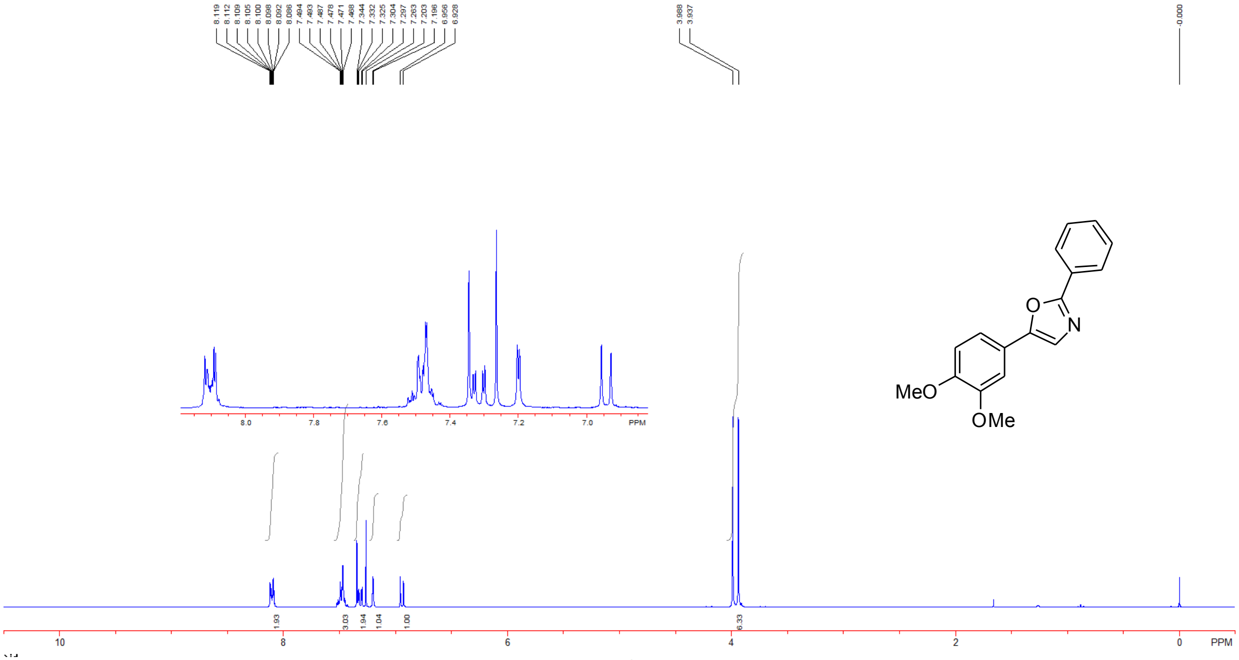
150
100
50
0
PPM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8.100
8.098
8.092
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7.493
7.487
7.478
7.471
7.468
7.344
7.332
7.325
7.304
7.297
7.263
7.203
7.198
6.956
6.928
3.988
3.937
0.000
8.0
7.8
7.6
7.4
7.2
7.0
PPM
O
N
MeO
OMe
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3.03
1.94
1.04
1.00
6.33
10
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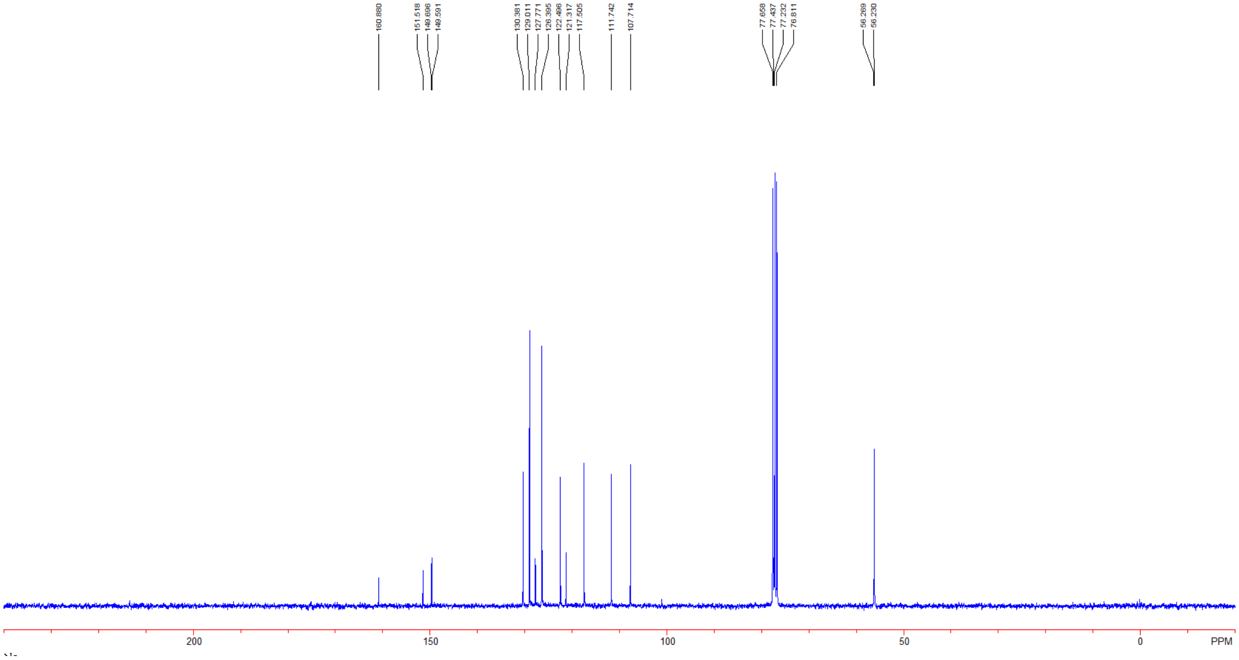
6
4
2
0
PPM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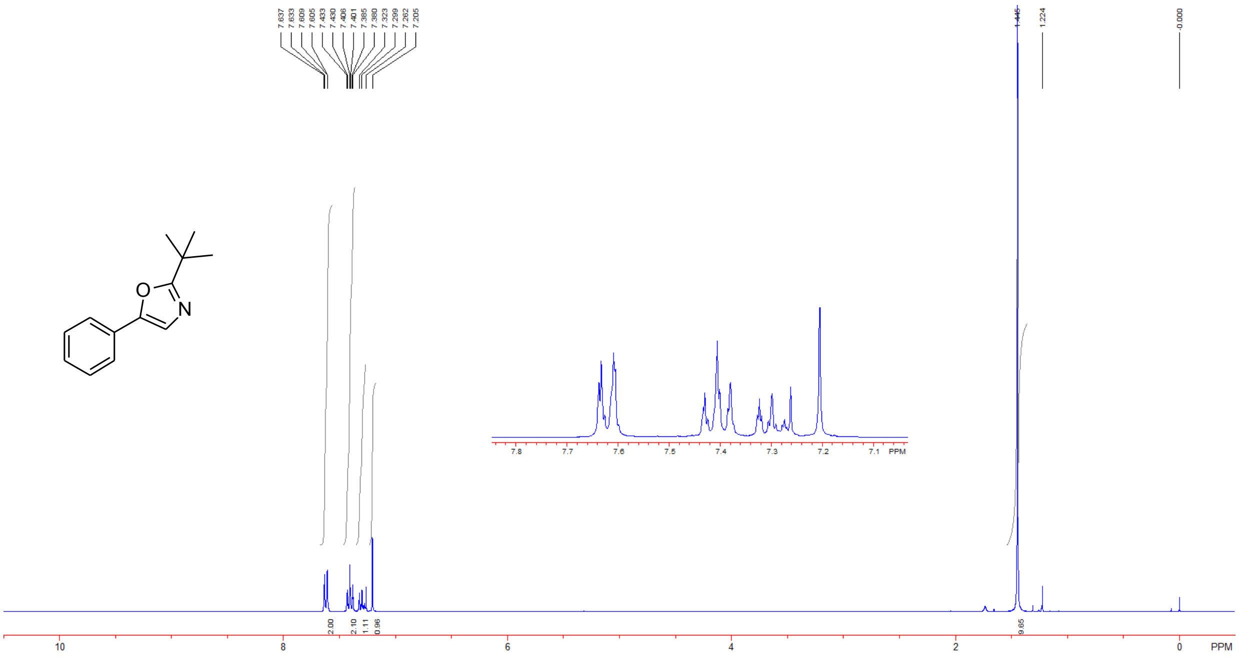
149.686
149.591
130.381
129.011
127.771
126.395
122.486
121.317
117.505
111.742
107.714
77.658
77.437
77.232
76.811
56.269
56.230
200
150
100
50
0
PPM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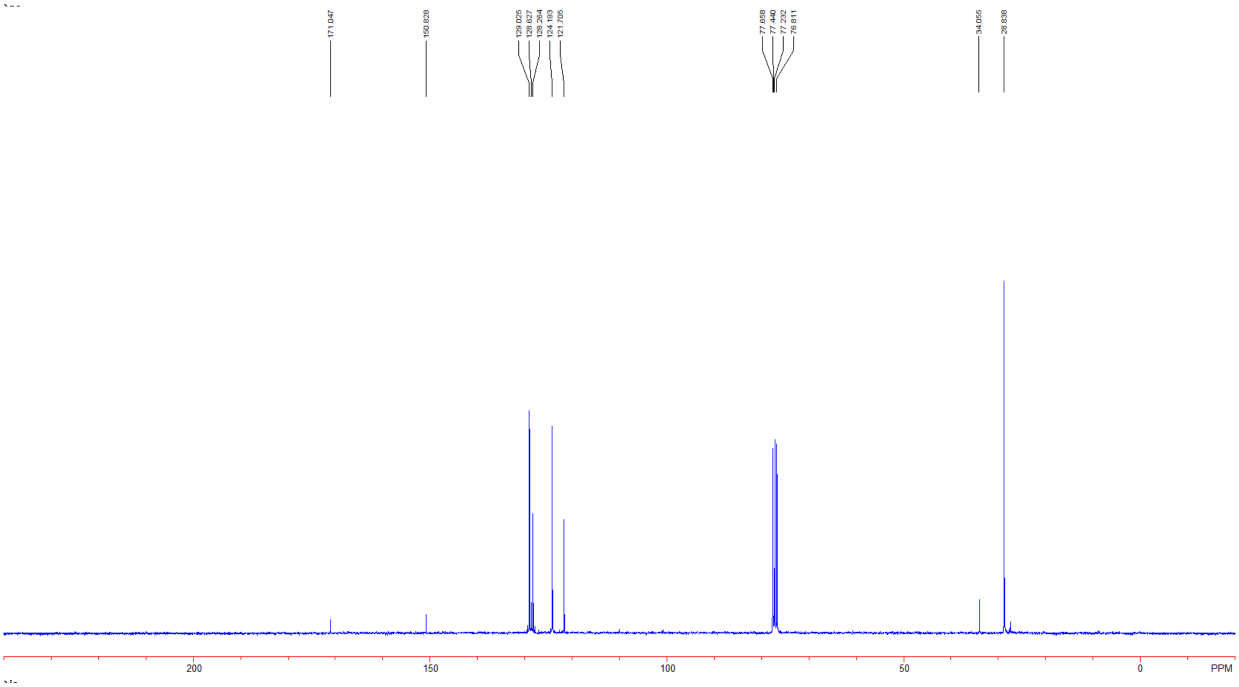
7.633
7.609
7.605
7.433
7.430
7.406
7.401
7.385
7.380
7.323
7.299
7.262
7.205
1.445
1.224
0.000
O
N
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
PPM
2.00
2.10
1.11
0.96
9.65
10
8
6
4
2
0
PPM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128.264
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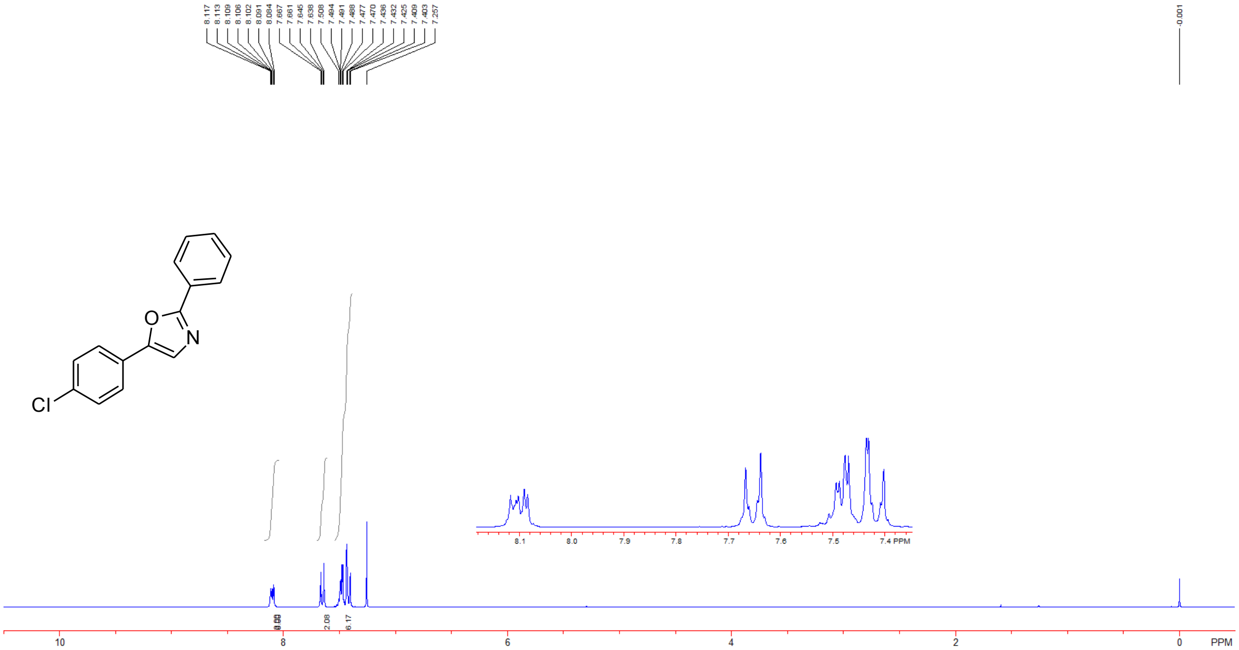
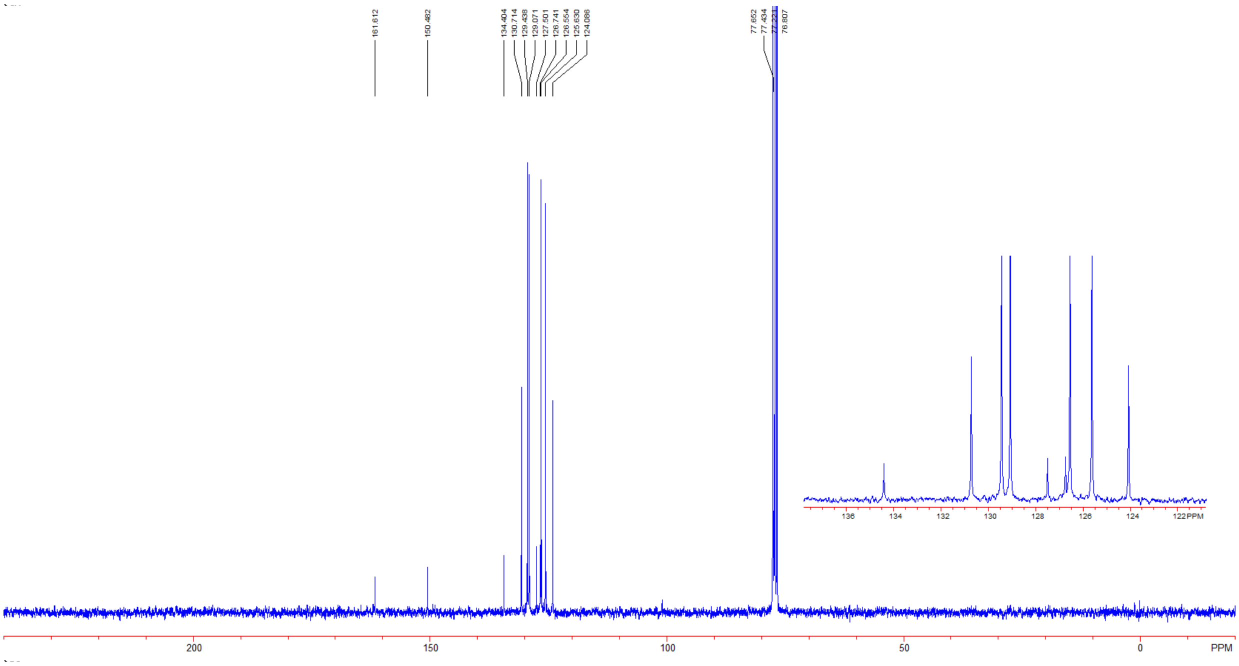
77.658
77.440
77.232
76.811
34.055
28.838
200
150
100
50
0
PPM


8.117
8.113
8.109
8.106
8.102
8.091
8.084
7.667
7.661
7.645
7.638
7.508
7.494
7.491
7.488
7.477
7.470
7.436
7.432
7.425
7.409
7.403
7.257
0.001
O
N
Cl
8.1
8.0
7.9
7.8
7.7
7.6
7.5
7.4 PPM
2.08
6.17
10
8
6
4
2
0
PPM


161.612
150.482
134.404
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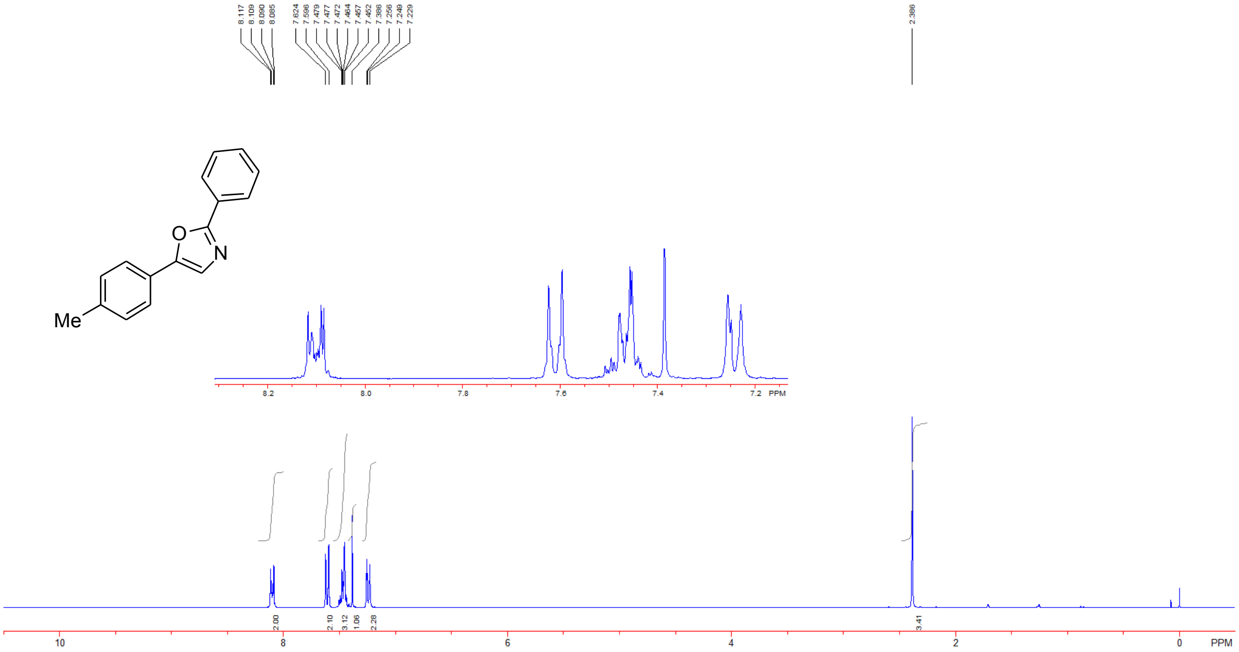
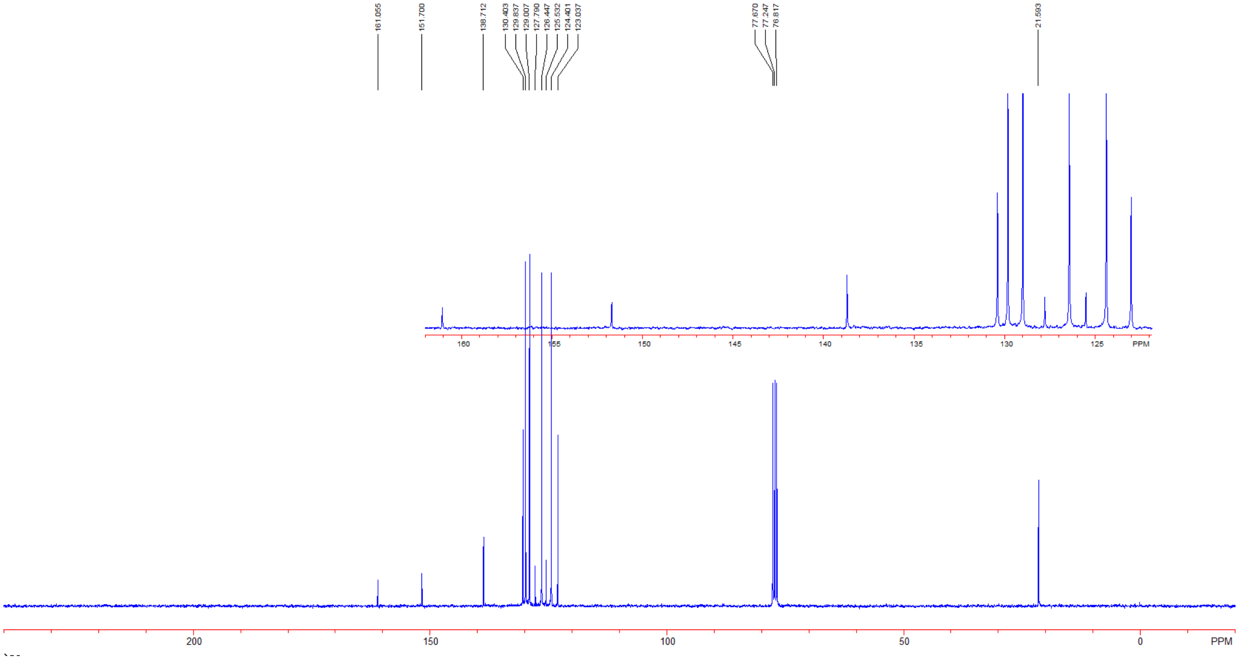
129.438
129.071
127.501
126.741
126.554
125.630
124.086
77.652
77.434
77.221
76.807
136
134
132
130
128
126
124
122 PPM
200
150
100
50
0
PPM


8.117
8.109
8.090
8.085
7.624
7.598
7.479
7.477
7.472
7.464
7.457
7.452
7.388
7.256
7.249
7.229
2.388
O
N
Me
8.2
8.0
7.8
7.6
7.4
7.2
PPM
2.00
2.10
3.12
1.06
2.28
3.41
10
8
6
4
2
0
PPM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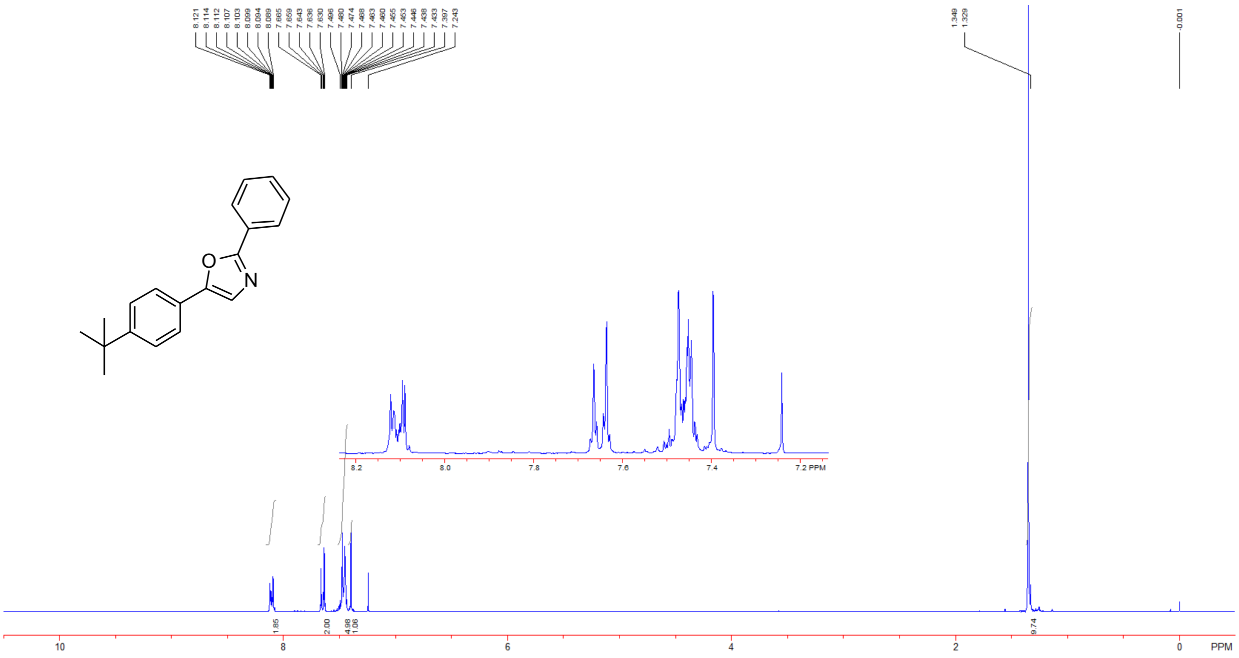
151.700
138.712
130.403
129.837
129.007
127.790
126.447
125.532
124.401
123.037
77.670
77.247
76.817
21.593
160
155
150
145
140
135
130
125
PPM
200
150
100
50
0
PPM


8.121
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8.112
8.107
8.103
8.099
8.094
8.089
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7.659
7.643
7.636
7.630
7.496
7.480
7.474
7.468
7.463
7.460
7.455
7.453
7.446
7.438
7.433
7.397
7.243
1.349
1.329
0.001
O
N
8.2
8.0
7.8
7.6
7.4
7.2 PPM
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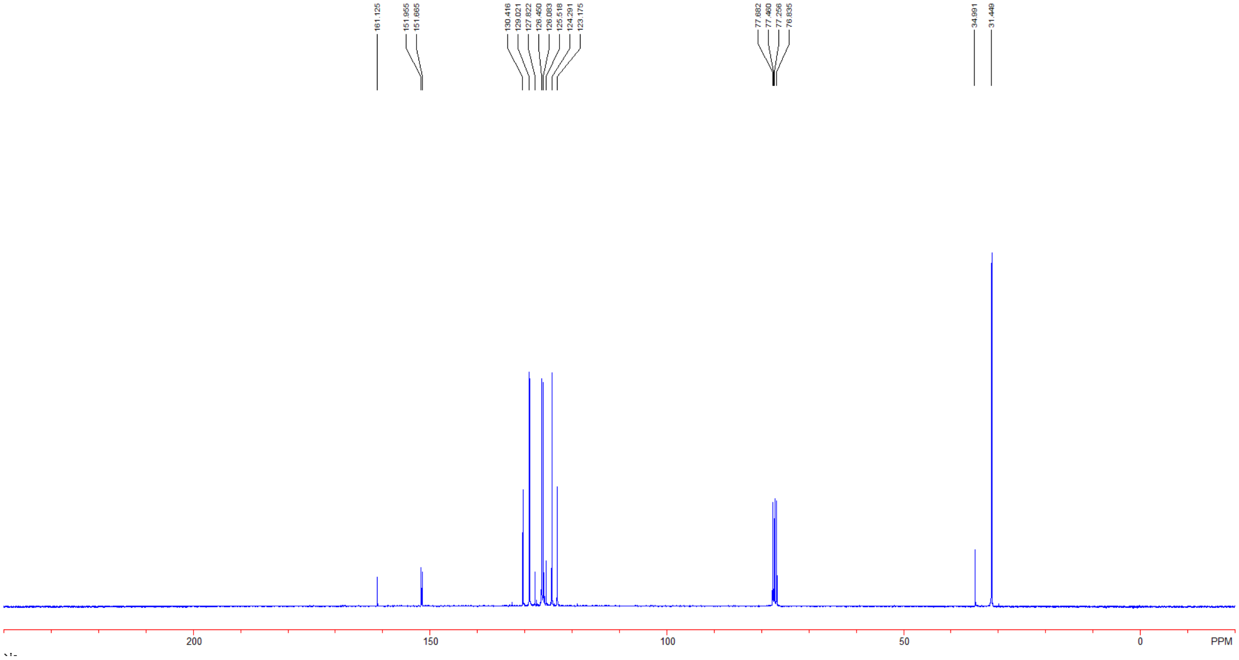
2.00
4.98
1.06
9.74
10
8
6
4
2
0
PPM


161.125
151.955
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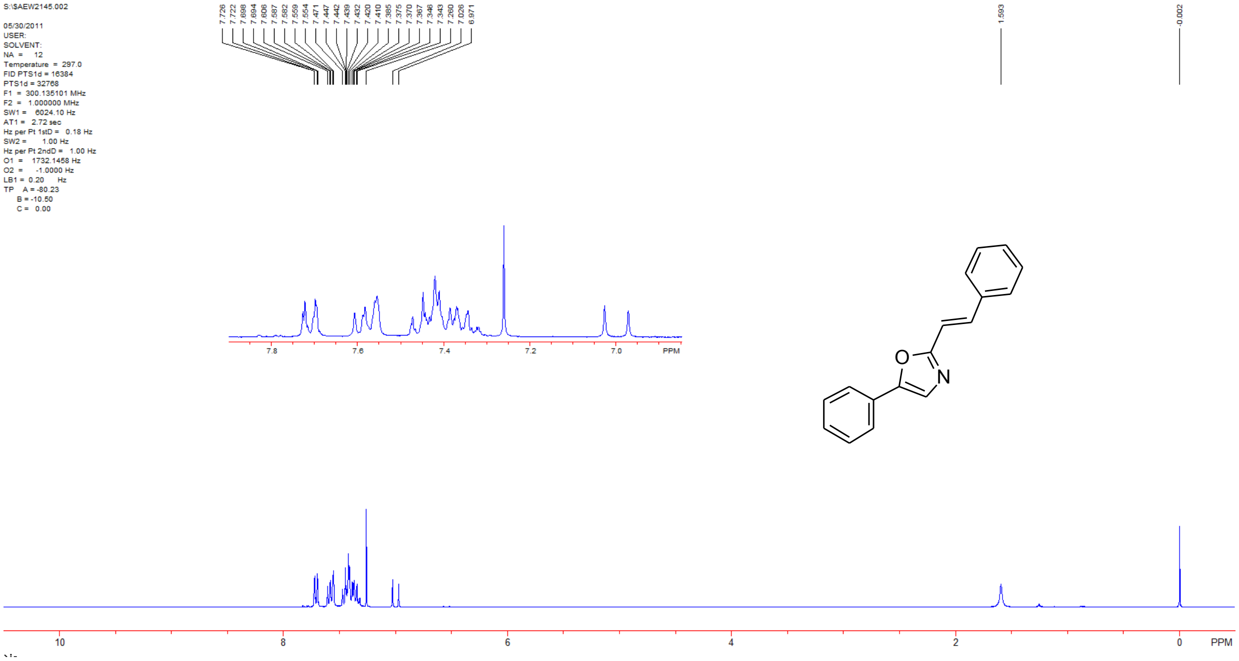
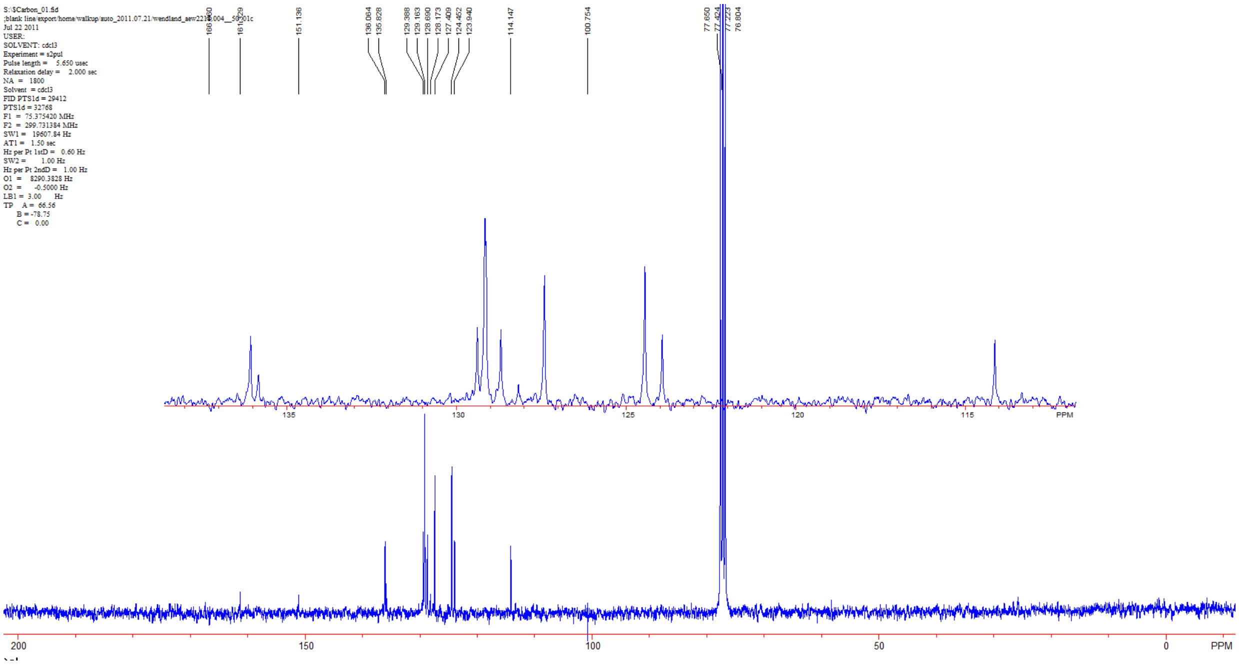
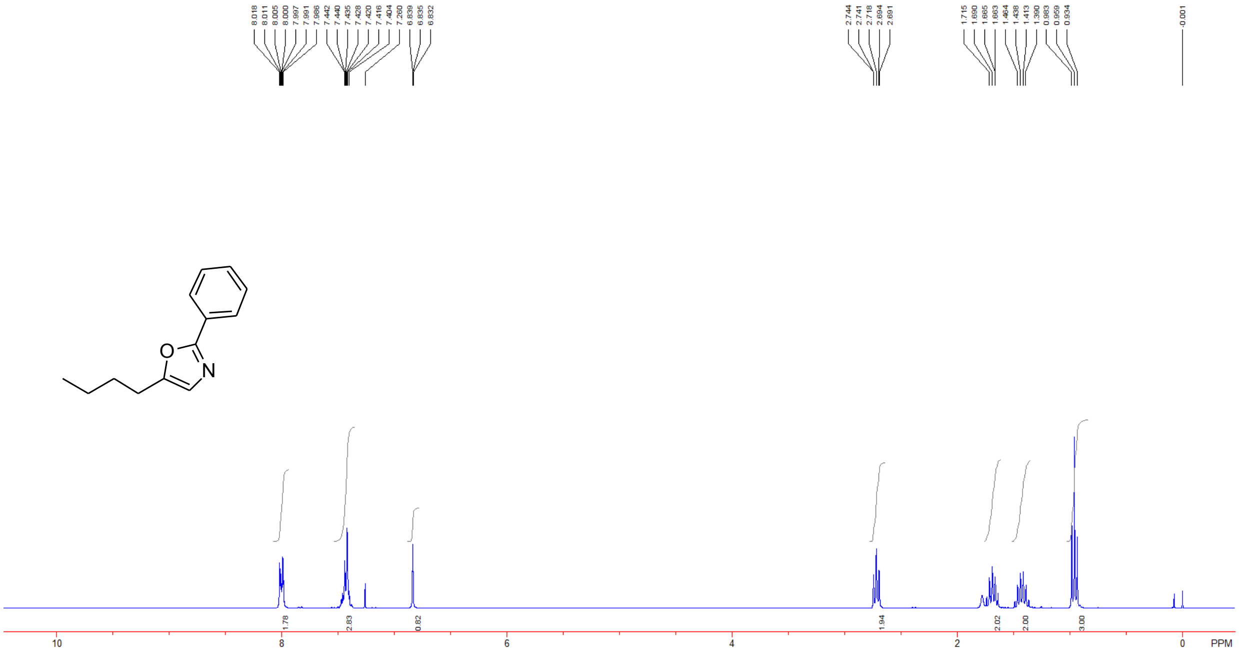
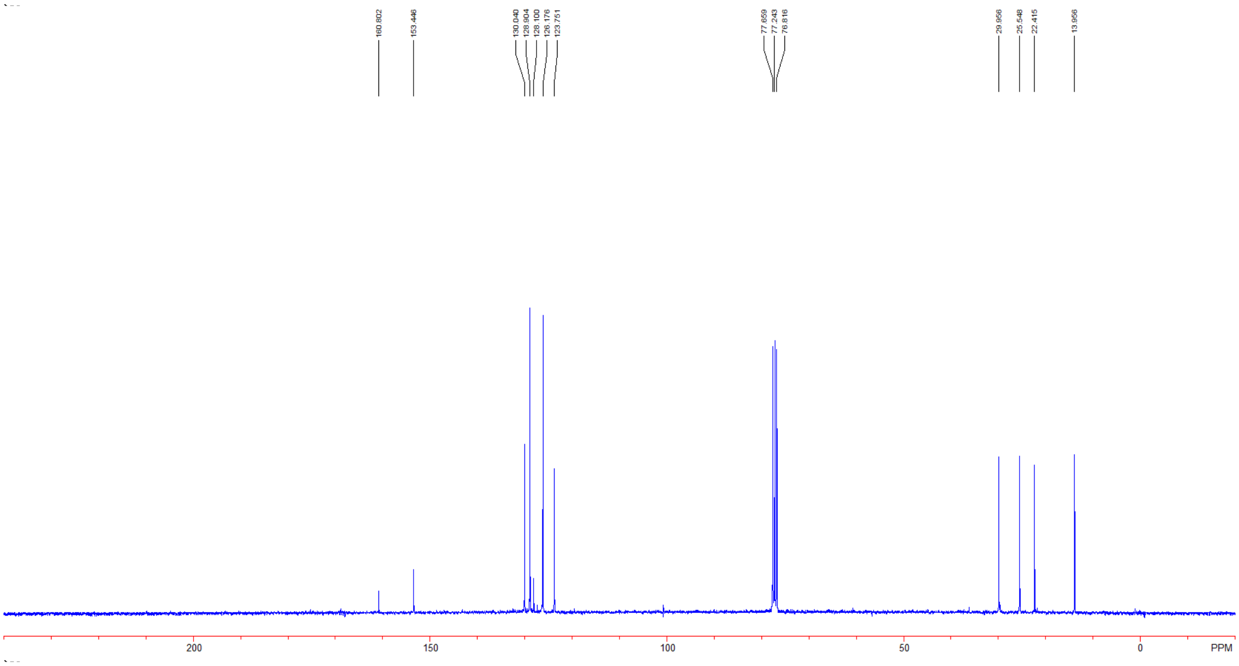
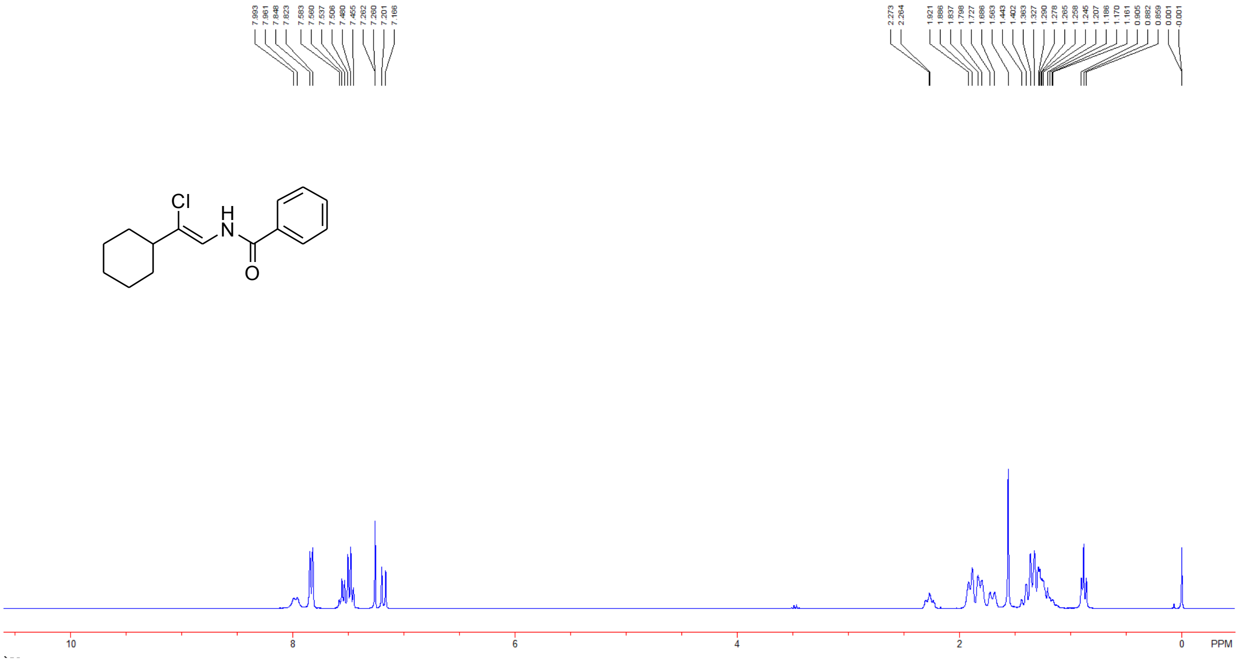
130.416
129.021
127.822
126.450
126.083
125.518
124.291
123.175
77.682
77.460
77.256
76.835
34.991
31.449
200
150
100
50
0
PPM

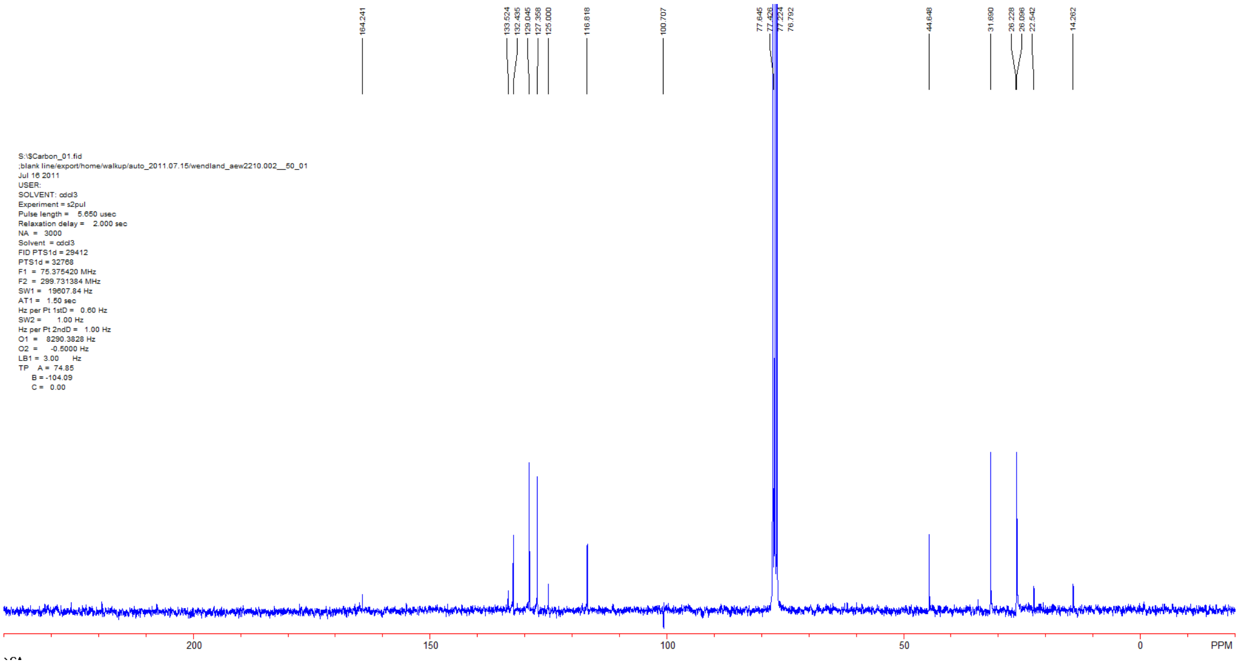

S:\$AEW2145.002
05/30/2011
USER:
SOLVENT:
NA = 12
Temperature = 297.0
FID PTS1d = 16384
PTS1d = 32768
F1 = 300.135101 MHz
F2 = 1.000000 MHz
SW1 = 6024.10 Hz
AT1 = 2.72 sec
Hz per Pt 1stD = 0.18 Hz
SW2 = 1.00 Hz
Hz per Pt 2ndD = 1.00 Hz
O1 = 1732.1458 Hz
O2 = -1.0000 Hz
LB1 = 0.20 Hz
TP A = -80.23
B = -10.50
C = 0.00
7.726
7.722
7.698
7.694
7.606
7.587
7.582
7.559
7.554
7.471
7.447
7.442
7.439
7.432
7.420
7.410
7.385
7.375
7.370
7.367
7.346
7.343
7.260
7.026
6.971
1.593
0.002
7.8
7.6
7.4
7.2
7.0
PPM
O
N
10
8
6
4
2
0
PPM


S:\$Carbon_01.fid
;blank line/export/home/walkup/auto_2011.07.21/wendland_aew221[illegible].004__50[illegible]01c
Jul 22 2011
USER:
SOLVENT: cdcl3
Experiment = s2pul
Pulse length = 5.650 usec
Relaxation delay = 2.000 sec
NA = 1800
Solvent = cdcl3
FID PTS1d = 29412
PTS1d = 32768
F1 = 75.375420 MHz
F2 = 299.731384 MHz
SW1 = 19607.84 Hz
AT1 = 1.50 sec
Hz per Pt 1stD = 0.60 Hz
SW2 = 1.00 Hz
Hz per Pt 2ndD = 1.00 Hz
O1 = 8290.3828 Hz
O2 = -0.5000 Hz
LB1 = 3.00 Hz
TP A = 66.56
B = -78.75
C = 0.00
166.[illegible]60
161.[illegible]29
151.136
136.064
135.828
129.388
129.163
128.690
128.173
127.409
124.452
123.940
114.147
100.754
77.650
77.424
77.223
76.804
135
130
125
120
115
PPM
200
150
100
50
0
PPM


8.018
8.011
8.005
8.000
7.997
7.991
7.986
7.442
7.440
7.435
7.428
7.420
7.416
7.404
7.260
6.839
6.835
6.832
2.744
2.741
2.718
2.694
2.691
1.715
1.690
1.665
1.663
1.464
1.438
1.413
1.390
0.983
0.959
0.934
-0.001
O
N
1.78
2.83
0.82
1.94
2.02
2.00
3.00
10
8
6
4
2
0
PPM


160.802
153.446
130.040
128.904
128.100
126.176
123.751
77.659
77.243
76.816
29.956
25.548
22.415
13.956
200
150
100
50
0
PPM





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S:\$Carbon_01.fid
;blank line/export/home/walkup/auto_2011.07.15/wendland_aew2210.002__50_01
Jul 16 2011
USER:
SOLVENT: cdcl3
Experiment = s2pul
Pulse length =    5.650 usec
Relaxation delay =    2.000 sec
NA  =   3000
Solvent  = cdcl3
FID PTS1d = 29412
PTS1d = 32768
F1  =  75.375420 MHz
F2  =  299.731384 MHz
SW1 =   19607.84 Hz
AT1 =   1.50 sec
Hz per Pt 1stD =   0.60 Hz
SW2 =       1.00 Hz
Hz per Pt 2ndD =   1.00 Hz
O1  =    8290.3828 Hz
O2  =     -0.5000 Hz
LB1 =  3.00      Hz
TP    A =  74.85
      B = -104.09
      C =   0.00
```

8. References

1. L. J. Goossen,; K. S. M. Salih, M. Blanchot, “Synthesis of Secondary Enamides by Ruthenium-Catalyzed Selective Addition of Amides to Terminal Alkynes.” *Angew. Chem. Int. Ed.* **2008**, *47*, 8492-8495.

2. J. P. Genêt, C. Pinel, V. Ratovelomanana-Vidal, S. Mallart, X. Pfister, M. C. C. De Andrade, J. A. Laffitte, “Novel, general synthesis of the chiral catalysts diphosphine-ruthenium (II) diallyl complexes and a new practical in situ preparation of chiral ruthenium (II) catalysts.” *Tetrahedron: Asymmetry* **1994**, **5**, 665-674.

3. A. R. Katritzky, A. V. Ignatchenko, H. Lang, “A Novel Route to N-Styrylamides.” *Synthetic Commun.* **1995**, *25*, 1197-1204.

4. M. Arndt, K. S. M. Salih, A. Fromm, L.J. Goossen, F. Menges, G. Niedner-Schatteburg, “Mechanistic Investigation of the Ru-Catalyzed Hydroamidation of Terminal alkynes” *J. Am. Chem. Soc.* **2011**, *133*, 7428-7449.