Electronic Supplementary Information (ESI)

One-pot preparation of pyrazole "turn on" and "turn off" fluorescent sensors for Zn^{2+} and Cd^{2+} directly from chalcones via *in situ* aromatisation

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General Experimental

Chemicals, solvents and reagents were purchased from commercial sources and used without further purification. PE refers to petroleum ether, bp 40-60 °C. Spectroscopy was performed with CHROMASOLV® gradient grade acetonitrile for HPLC, ≥99.9%, from Sigma-Aldrich.

The metal complexes used in this study were: LiCl, NaCl, KCl, $CaCl_2$, $MgCl_2$, $CuCl_2$, $CuSO_4$, $Cu(OAC)_2$, $NiCl_2$, $ZnCl_2$, $CdCl_2$, $RuCl_3$, $CoCl_2$, $MnCl_2$, $PbCl_2$, $ZnCl_2$, $FeSO_4$ and $FeCl_3$.

TLCs were carried out on Merck Aluminium backed TLC plates Silica Gel 60 F254 and viewed using UV light of wavelength 254 nm. Merck Silica Gel (0.040-0.063 mm) was used for column chromatography. Compounds were loaded as an oil, CH_2Cl_2 solution or dry loaded by adsorption onto silica.

NMR spectra were obtained on a Bruker Avance III (400 MHz) spectrometer and processed via TopSpin® software. The chemical shifts are recorded in parts per million (ppm) with reference to tetramethylsilane. The coupling constants J are quoted to the nearest 0.5 Hz and are not corrected.

High resolution Mass spectroscopy was performed on Bruker Quadrupole Time-of-Flight (qToF) mass spectrometer.

UV/Vis spectroscopy was performed on an Agilent Cary5000 in quartz cuvettes with a 1 cm pathlength using HPLC grade MeCN, 250-500 nm range with 0.2 sec dwell time. Detector switchover occurred at 350 nm.

FTIR spectroscopy was performed on a Bruker VERTEX 70 spectrometer.

Fluorescence spectroscopy was performed on an Edinburgh Instruments FLS1000 with a xenon excitation source, 2 nm bandwidths for both excitation and emission monochromator, scan speed of 1 nm and dwell time of 0.2 sec. Fluorescence quartz cuvettes with a 1 cm pathlength were used throughout with HPLC grade MeCN.

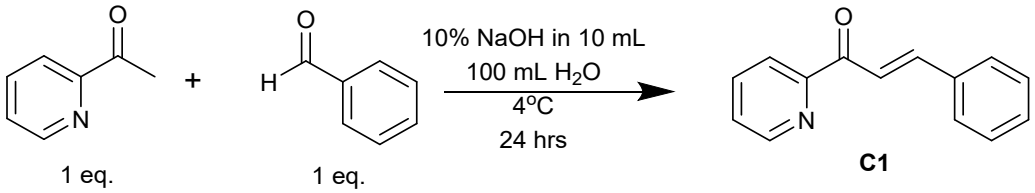
An Agilent LC-MS 1260 system with 40% MeOH, 60% H_2O (with 1% Formic acid) isocratic flow rate of 1mL/min on a 250 mm C_{18} ZORBAX column with detection at 254 nm. Mass spectrometer was in MM-APCI mode with a scan of 50 -400 m/z.

A 100 Watt 365 nm Analytikjena High intensity UV lamp or 254 nm 6 Watt Analytikjena TLC lamp was used for images of samples in cuvettes.

All figures were plotted using SigmaPlot® 14.5 software.

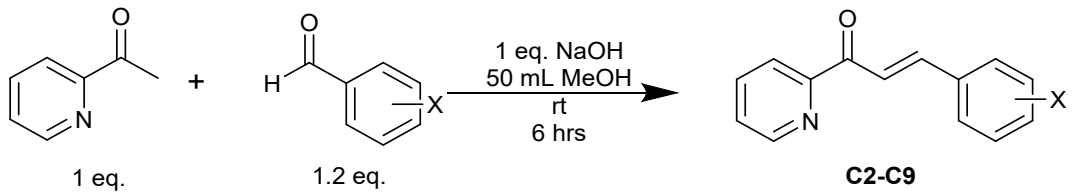
General Synthesis

Synthesis of (E)-3-phenyl-1-(pyridin-2-yl)prop-2-en-1-one (**C1**)



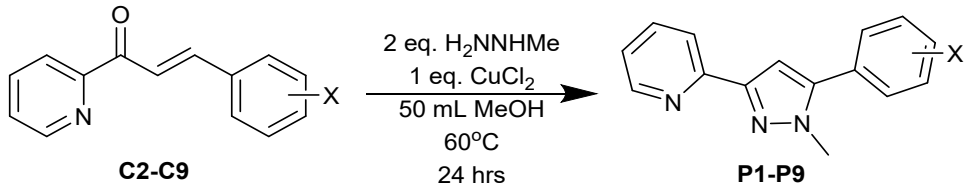
Using the methods previously reported (*Org. Biomol. Chem*., 2012, **10**, 8753) 2-acetylpyridine (20 mmol) was added to a solution of benzaldehyde (20 mmol) in 100 mL water. 10 mL of a 10% NaOH solution was added, the mixture shaken for several minutes and then left at 4°C for 24 hours. After 24 hours the solid precipitate was filtered, washed with cold water and dried to afford **C1** (3.31 g, 79%).

Synthesis of C2-C9



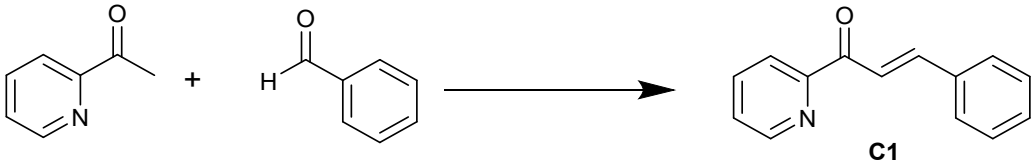
The following general method was adapted from the literature (*RSC Adv.*, 2015, **5**, 21445). 2-acetylpyridine (5 mmol) was added to a solution of the required substituted aldehyde (6 mmol) in 50 mL MeOH at room temperature. NaOH (5 mmol) was added and stirring continued at room temperature for 6 hrs after which the solution was removed under reduced pressure. The residue was resuspended in cold H_2O and filtered to afford the required chalcone which was further purified by recrystallization from diethyl ether.

Synthesis of P1-P9



Methylhydrazine (2 mmol) was added to a stirred solution of required chalcone (1 mmol) in 50 mL MeOH followed by the addition of $CuCl_2$ (1 mmol) and heated at 60°C for 24 hrs. After 24 hrs the solution was removed under reduced pressure, the residue resuspended in 100 mL of a saturated EDTA solution and extracted with ethyl acetate (3 x 50 mL). The ethyl acetate layers were combined, and solvent removed under reduced pressure. The residue was then purified by column chromatography using petroleum ether: ethyl acetate (80:20) to afford the required pyrazole.

Synthesis of (E)-3-phenyl-1-(pyridin-2-yl)prop-2-en-1-one (**C1**)



Yield 3.31g (79%);

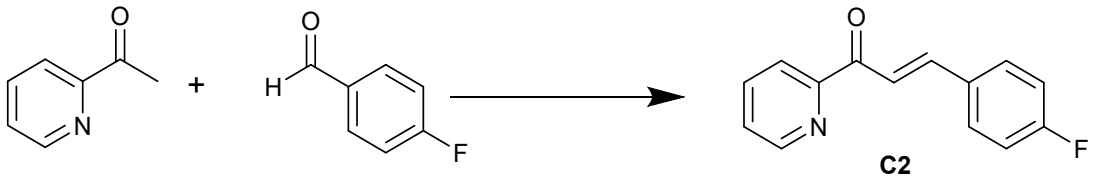
Vmax (Solid)/cm^{-1} 1677, 1316 and 753;

^{1}H NMR δ_H (400 MHz; $CDCl_3$) 7.43-7.49 (3 H, m, CH), 7.50-7.52 (1 H, m, CH), 7.74-7.76 (2 H, m, CH), 7.87-7.90 (1 H, m, CH), 7.90 (2 H, d, *J* = 16 Hz, CH), 8.20-8.22 (1 H, m, CH), 8.22 (1 H, d, J = 16 Hz, CH) and 8.76-8.77 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 120.9, 122.9, 127.0, 128.4, 128.9, 130.6, 135.2, 137.0, 144.8, 148.9, 154.2 and 189.5;

HRMS m/z (qToF) Found 210.2576 ($M+H^+$). $C_{14}H_{11}NO$ requires 210.2560.

Synthesis of (E)-3-(4-fluorophenyl)-1-(pyridin-2-yl)prop-2-en-1-one (**C2**)



Yield 0.780g (68%);

Vmax (Solid)/cm^{-1} 1697, 1597, 1215 and 762;

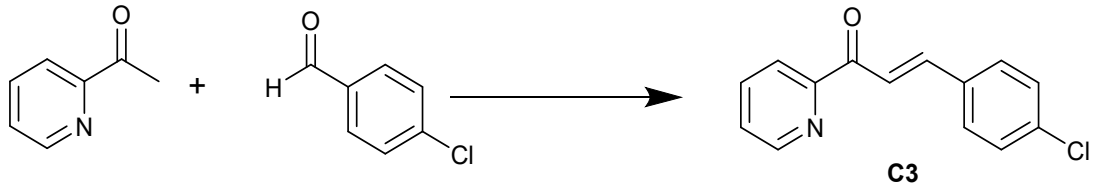
^{1}H NMR δ_H (400 MHz; $CDCl_3$) 7.11-7.15 (2 H, m, CH), 7.50-7.53 (1 H, m, CH), 7.73-7.76 (2 H, m, CH), 7.88-7.94 (2 H, m, CH), 8.20-8.28 (2 H, m, CH) and 8.75-8.77 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 115.9, 116.1, 120.6, 123.0, 127.0, 130.1, 131.4, 137.1, 143.4, 148.9, 154.1 and 189.3;

HRMS m/z (qToF) Found 228.2413 ($M+H^+$). $C_{14}H_{10}FNO$ requires 228.2464.

In agreement with H. M. Faidallah, M. M. Al-Mohammadi, K. A. Alamry and K. A. Khan, *J. Enzyme Inhib. Med. Chem.*, 2016, **31**, 157–163

Synthesis of (E)-3-(4-chlorophenyl)-1-(pyridin-2-yl)prop-2-en-1-one (**C3**)



C3

Yield 0.84g (69%);

Vmax (Solid)/cm^{-1} 1697, 1580, 1230 and 762;

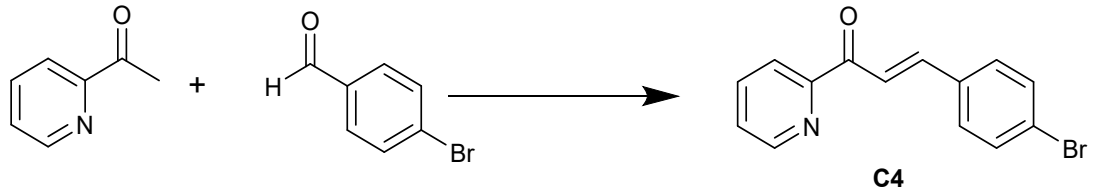
^{1}H NMR δ_H (400 MHz; $CDCl_3$) 7.40-7.50 (2 H, m, CH), 7.51-7.54 (1 H, m, CH), 7.67-7.70 (2 H, m, CH), 7.88-7.92 (2 H, m, CH), 8.20-8.22 (1 H, m, CH), 8.28-8.33 (1 H, d, *J* = 16.4 Hz, CH) and 8.76-8.77 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 121.3, 123.0, 127.0, 129.1, 130.0, 133.7, 136.4, 137.1, 143.2, 148.9, 154.1, 189.3;

HRMS m/z (qToF) Found 244.7029 ($M+H^+$). $C_{14}H_{10}ClNO$ requires 244.6980.

In agreement with J. Majeed, M. Shaharyar, *J. Enzyme Inhib. Med. Chem*. 2011, **26**, 819.

Synthesis of (E)-3-(4-bromophenyl)-1-(pyridin-2-yl)prop-2-en-1-one (**C4**)



C4

Yield 1.33g (92%);

Vmax (Solid)/cm^{-1} 1695, 1509 and 742;

^{1}H NMR δ_H (400 MHz; $CDCl_3$) 7.50-7.54 (1 H, m, CH), 7.58-7.63 (4 H, m, CH), 7.86-7.92 (2 H, m, CH), 8.20-8.22 (1 H, m, CH), 8.32 (1 H, d, *J* = 16 Hz, CH) and 8.76-8.77 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 121.5, 123.0, 124.9, 127.0, 130.2, 132.1, 134.1, 137.1, 143.2, 148.9, 154.1 and 189.3;

HRMS m/z (qToF) Found 289.1585 ($M+H^+$). $C_{14}H_{10}BrNO$ requires 289.1520.

In agreement with Y.J. Ren, Z.C. Wang, X. Zhang, H.Y. Qiu, P.F. Wang, H.B. Gong, A.Q. Jiang, H.L. Zhu, *RSC Adv*., 2015, **5**, 21445-21454.

Synthesis of (E)-3-(4-iodophenyl)-1-(pyridin-2-yl)prop-2-en-1-one (**C5**)

Yield 0.96g (57%);

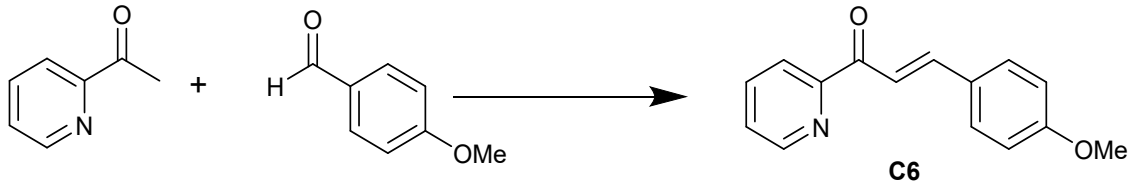
Vmax (Solid)/cm^{-1} 1672, 1642 and 714;

^{1}H NMR δ_H (400 MHz; $CDCl_3$) 7.46-7.51 (2 H, m, CH), 7.53-7.54 (1 H, m, CH), 7.78-7.79 (2 H, m, CH), 7.88-7.90 (2 H, m, CH), 8.20-8.22 (1 H, m, CH), 8.33 (1 H, d, *J* = 16 Hz, CH), 8.76-8.77 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 121.5, 123.0, 127.0, 130.0, 134.7, 137.1, 138.1, 143.4, 148.9, 154.0 and 191.4;

HRMS m/z (qToF) Found 336.1466 ($M+H^+$). $C_{14}H_{10}INO$ requires 336.1525.

Synthesis of (E)-3-(4-methoxyphenyl)-1-(pyridin-2-yl)prop-2-en-1-one (**C6**)



Yield 0.80g (67%);

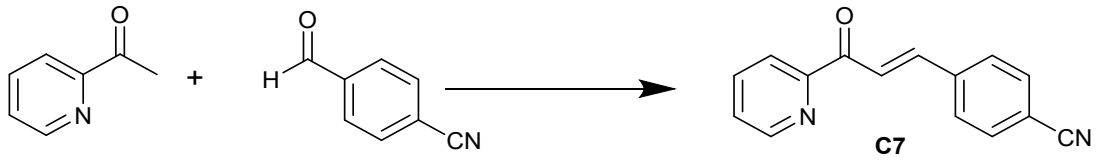
Vmax (Solid)/cm^{-1} 1642, 1511, 1215 and 1027;

^{1}H NMR δ_H (400 MHz; $CDCl_3$) 3.95 (3 H, s, CH_3), 7.47-7.51 (1 H, m, CH), 7.70-7.72 (2 H, m, CH), 7.87-7.96 (2 H, m, CH), 8.18-8.22 (2 H, m, CH) and 8.75-8.77 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 55.4, 114.3, 118.5, 122.9, 126.7, 128.0, 131.0, 132.0, 137.0, 144.7, 148.9, 154.5, 161.8 and 189.4;

HRMS m/z (qToF) Found 240.2812 ($M+H^+$). $C_{16}H_{14}NO_2$ requires 240.2820.

Synthesis of (E)-4-(3-oxo-3-(pyridin-2-yl)prop-1-en-1-yl)benzonitrile (**C7**)



C7

Yield 0.45g (38%);

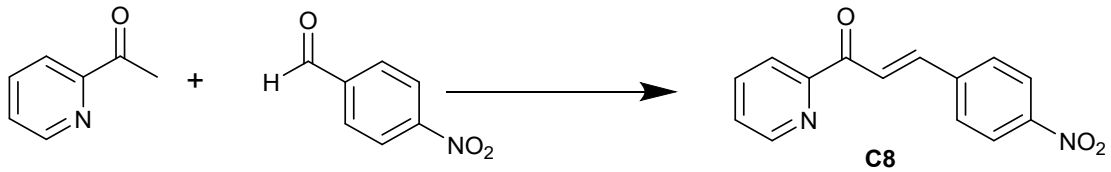
Vmax (Solid)/cm^{-1} 1642, 1521 and 1203;

^{1}H NMR δ_H (400 MHz; $CDCl_3$) 7.53-7.56 (1 H, m, CH), 7.72-7.74 (2 H, m, CH), 7.82-7.84 (2 H, m, CH), 7.88- 7.93 (2 H, m, CH), 8.21-8.23 (1 H, m, CH), 8.40 (1 H, d, *J* = 16 Hz, CH) and 8.77-8.78 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 113.4, 118.5, 123.1, 124.1, 127.3, 129.0, 132.6, 117.3, 139.5, 141.9, 149.0, 153.7 and 189.0;

HRMS m/z (qToF) Found 235.2704 ($M+H^+$). $C_{15}H_{10}N_2O$ requires 235.2660.

Synthesis of (E)-3-(4-nitrophenyl)-1-(pyridin-2-yl)prop-2-en-1-one (**C8**)



C8

Yield 0.87g (69%);

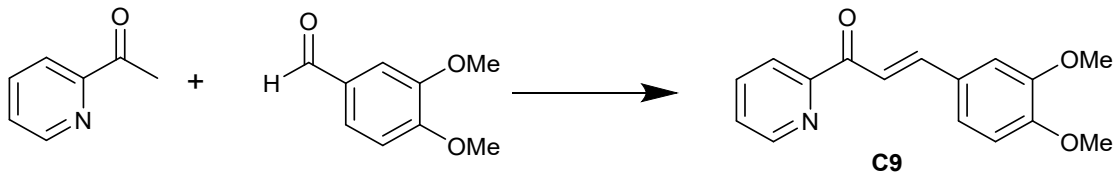
Vmax (Solid)/cm^{-1} 1596, 1511, 1217 and 748;

^{1}H NMR δ_H (400 MHz; $CDCl_3$) 7.54-7.52 (1 H, m, CH), 7.88-7.97 (4 H, m, CH), 8.22-8.24 (1 H, m, CH), 8.29-8.31 (2 H, m, CH), 8.45 (1 H, d, *J* = 16.4 Hz, CH), 8.77-8.79 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 123.1, 124.1, 124.9, 127.4, 129.3, 137.2, 141,2, 141.3, 148.6, 149.0, 153.6, 188.6;

HRMS m/z (qToF) Found 255.2456 ($M+H^+$). $C_{14}H_{10}N_2O_3$ requires 255.2530.

Synthesis of (E)-1-(pyridin-2-yl)-3-(3,4,5-trimethoxyphenyl)prop-2-en-1-one (**C9**)



C9

Yield 0.52g (38%);

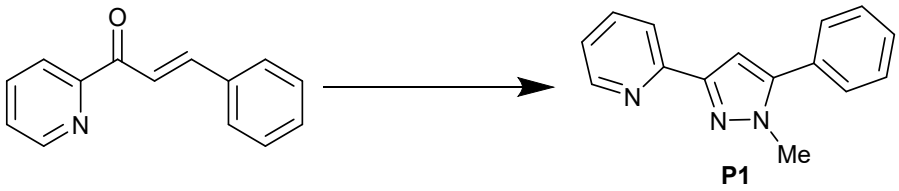
Vmax (Solid)/cm^{-1} 1581, 1448, 1026 and 791;

^{1}H NMR δ_H (400 MHz; $CDCl_3$) 3.96 (3 H, s, CH_3), 4.00 (3 H, s, CH_3), 6.91-6.94 (2 H, m, CH), 7.28-7.34 (2 H, m, CH), 7.50-7.53 (1 H, m, CH), 7.88-7.96 (2 H, m, CH), 8.15-8.23 (2 H, m, CH), 8.77-8.78 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 56.0, 56.1, 110.2, 111.0, 118.6, 123.0, 124.0, 126.8, 128.2, 137.1, 145.1, 148.8, 149.2, 151.6, 154.5 and 189.3;

HRMS m/z (qToF) Found 270.3051 ($M+H^+$). $C_{16}H_{14}NO_2$ requires 270.3080.

Synthesis of 2-(1-methyl-5-phenyl-1H-pyrazol-3-yl)pyridine (**P1**)



P1

Yield 0.137g (57%);

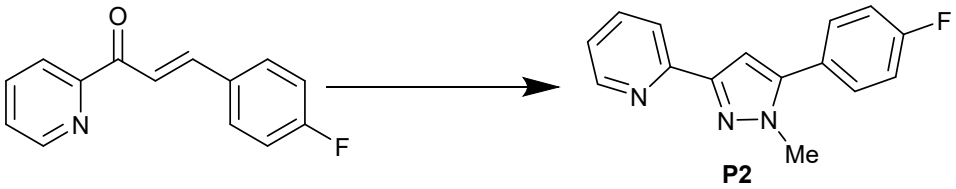
Vmax (Film)/cm^{-1} 1691, 1671, 1581, 1326 and 743;

^{1}H NMR δ_H (400 MHz; $CDCl_3$) 4.29 (3 H, s, CH_3), 6.90 (1 H, s, CH), 7.27-7.28 (1 H, m, CH), 7.30-7.32 (1 H, m, CH), 7.33-7.42 (2 H, m, CH), 7.44-7.45 (1 H, m, CH), 7.65-7.67 (1 H, m, CH), 7.77-7.88 (2 H, m, CH) and 8.71-8.73 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 39.5, 103.5, 122.5, 128.9, 125.6, 127.6, 128.6, 133.3, 136.8, 142.7, 149.3, 149.9, 150.0;

HRMS m/z (qToF) Found 236.2958 ($M+H^+$). $C_{15}H_{13}N_3$ requires 236.2980.

Synthesis of 2-(5-(4-fluorophenyl)-1-methyl-1H-pyrazol-3-yl)pyridine (**P2**)



P2

Yield 0.194g (77%);

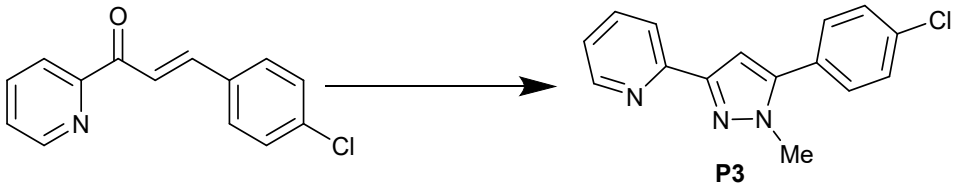
Vmax (Film)/cm^{-1} 1630, 1480, 1282 and 1042;

^{1}H NMR δ_H (400 MHz; $CDCl_3$) 4.29 (3 H, s, CH_3), 6.84 (1 H, s, CH), 7.08-7.14 (2 H, m, CH), 7.26-7.29 (1 H, m, CH), 7.43-7.47 (1 H, m, CH), 7.64-7.66 (1 H, m, CH), 7.80-7.84 (3 H, m, CH) and 8.71-8.73 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 39.4, 103.0, 115.4, 115.6, 122.5, 122.8, 127.1, 127.2, 129.0, 130.0, 136.8, 142.9, 149.3, 149.8, 161.3 and 163.8;

HRMS m/z (qToF) Found 254.2954 ($M+H^+$). $C_{15}H_2FN_3$ requires 254.2884.

Synthesis of 2-(5-(4-chlorophenyl)-1-methyl-1H-pyrazol-3-yl)pyridine (**P3**)



P3

Yield 0.149g (61%);

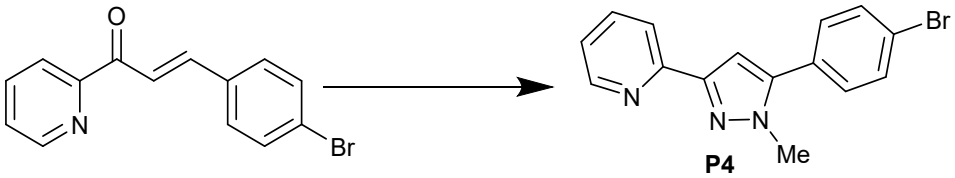
Vmax (Film)/cm^{-1} 1629, 1479, 1282 and 1010;

^{1}H NMR δ_H (400 MHz; $CDCl_3$) 4.28 (3 H, s, CH_3), 6.87 (1 H, s, CH), 7.28-7.31 (1 H, m, CH), 7.31-7.41 (2 H, m, CH), 7.64-7.66 (1 H, m, CH), 7.78-7.81 (3 H, m, CH) and 8.71-8.73 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 39.5, 103.5, 120.5, 122.6, 122.8, 126.8, 128.8, 131.8, 133.3, 136.8, 143.0, 149.0 and 149.7;

HRMS m/z (qToF) Found 270.7455 ($M+H^+$). $C_{15}H_{12}ClN_3$ requires 270.7400.

Synthesis of 2-(5-(4-bromophenyl)-1-methyl-1H-pyrazol-3-yl)pyridine (**P4**)



P4

Yield 0.125g (40%);

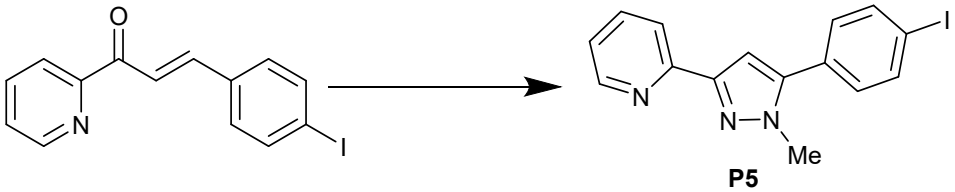
Vmax (Film)/cm^{-1} 1630, 1536, 1282 and 1020;

^{1}H NMR δ_H (400 MHz; $CDCl_3$) 4.27 (3 H, s, CH3), 6.87 (1 H, s, CH), 7.25-7.31 (2 H, m, CH), 7.49-7.51 (1 H, m, CH), 7.54-7.56 (2 H, m, CH), 7.62-7.63 (1 H, m, CH), 7.64-7.77 (2 H, m, CH), 7.79-7.81 (1 H, m, CH) and 8.71-8.72 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 39.5, 103.5, 121.5, 122.6, 122.9, 127.1, 128.6, 131.6, 131.2, 132.3, 136.8, 142.9 and 149.3;

HRMS m/z (qToF) Found 315.2010 ($M+H^+$). $C_{15}H_{12}BrN_3$ requires 315.1940.

Synthesis of 2-(5-(4-iodophenyl)-1-methyl-1H-pyrazol-3-yl)pyridine (**P5**)



P5

Yield 0.117g (32%);

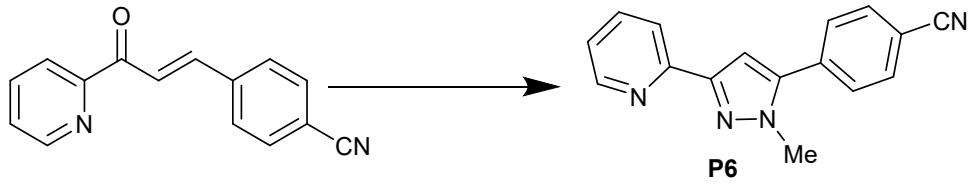
Vmax (Film)/cm^{-1} 1628, 1576, 1282 and 1007;

^{1}H NMR δ_H (400 MHz; $CDCl_3$) 4.28 (3 H, s, CH_3), 6.87 (1 H, s, CH), 7.60-7.65 (3 H, m, CH), 7.72-7.80 (4 H, m, CH) and 8.71-8.73 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 39.5, 103.5, 122.6, 122.9, 127.2, 129.4, 130.3, 132.9, 136.8, 137.6, 137.7, 137.8, 142.9 and 149.3;

HRMS m/z (qToF) Found 362.1996 ($M+H^+$). $C_{15}H_{12}IN_3$ requires 362.1945.

Synthesis of 4-(1-methyl-3-(pyridin-2-yl)-1H-pyrazol-5-yl)benzonitrile (**P6**)



P6

Yield 0.148g (57%);

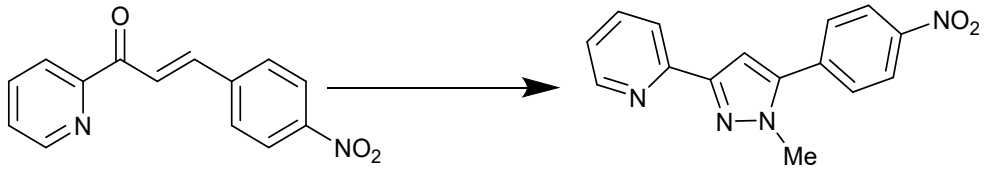
Vmax (Film)/cm^{-1} 1630, 1479, 1226 and 1001;

^{1}H NMR δ_H (400 MHz; $CDCl_3$) 4.30 (3 H, s, CH_3), 6.94 (1 H, s, CH), 7.30-7.33 (1 H, m, CH), 7.64-7.67 (1 H, m, CH), 7.69-7.72 (2 H, m, CH), 7.80-7.83 (1 H, m, CH), 7.94-7.97 (2 H, m, CH) and 8.71-8.73 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 39.8, 104.1, 110.8, 119.1, 122.8, 122.9, 125.8, 128.1, 129.2, 132.6, 136.9, 137.7, 143.3 and 148.0;

HRMS m/z (qToF) Found 261.3015 ($M+H^+$). $C_{16}H_{12}N_4$ requires 261.3080.

Synthesis of 2-(1-methyl-5-(4-nitrophenyl)-1H-pyrazol-3-yl)pyridine (**P7**)



P7

Yield 0.131g (47%);

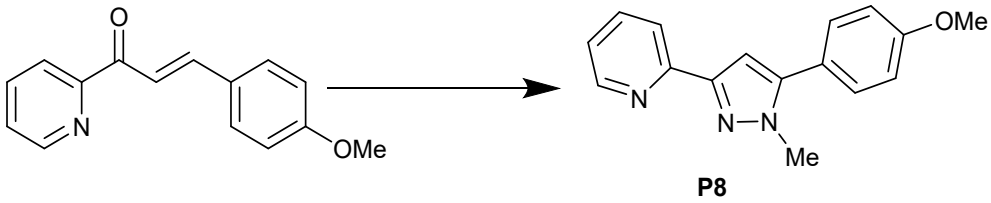
Vmax (Film)/cm^{-1} 1625, 1432, 1223 and 1012;

^{1}H NMR δ_H (400 MHz; $CDCl_3$) 3.98 (3 H, s, CH_3), 6.53-6.57 (1 H, m, CH), 6.63-6.67 (1 H, m, CH), 6.73 (1 H, s, CH), 7.42-7.50 (1 H, m, CH), 7.70-7.73 (2 H, m, CH) and 8.28-8.33 3 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 58.9, 101.5, 112.7, 113.0, 116.0, 117.6, 118.7, 121.1, 123.4, 124.7, 126.3, 138.7 and 140.3

HRMS m/z (qToF) Found 281.2916 ($M+H^+$). $C_{15}H_{12}N_4O_2$ requires 281.2950.

Synthesis of 2-(5-(4-methoxyphenyl)-1-methyl-1H-pyrazol-3-yl)pyridine (**P8**)



P8

Yield 0.128g (48%);

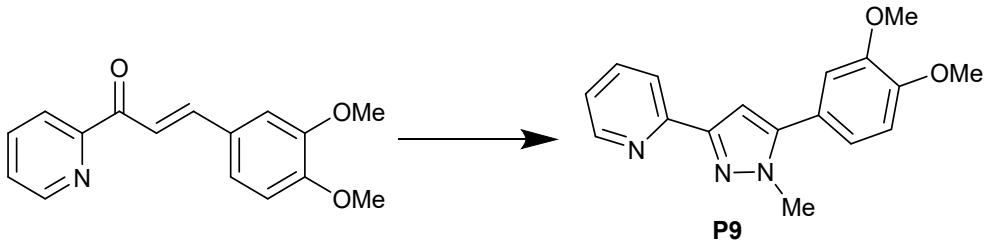
Vmax (Film)/cm^{-1} 1628, 1536, 1226 and 1053;

^{1}H NMR δ_H (400 MHz; $CDCl_3$) 3.87 (3 H, s, CH_3), 4.27 (3 H, s, CH_3), 6.82 (1 H, s, CH), 6.96-6.98 (2 H, m, CH2), 7.27-7.29 (1 H, m, CH), 7.64-7.77 (1 H, m, CH), 7.77-7.81 (3 H, m, CH) and 8.71-8.72 (1 H, m, CH);

^{13}C NMR δ_c (400 MHz; $CDCl_3$) 39.3, 55.3, 103.0, 114.0, 119.2, 122.4, 122.9, 125.5, 126.2, 126.7, 136.7, 149.3, 150.0 and 159.3;

HRMS m/z (qToF) Found 266.3191 ($M+H^+$). $C_{16}H_{14}NO_2$ requires 266.3240.

Synthesis of 2-(5-(3,4-dimethoxyphenyl)-1-methyl-1H-pyrazol-3-yl)pyridine (**P9**)



P9

Yield 0.119g (38%);

Vmax (Film)/cm^{-1} 1630, 1536, 1282 and 1001;

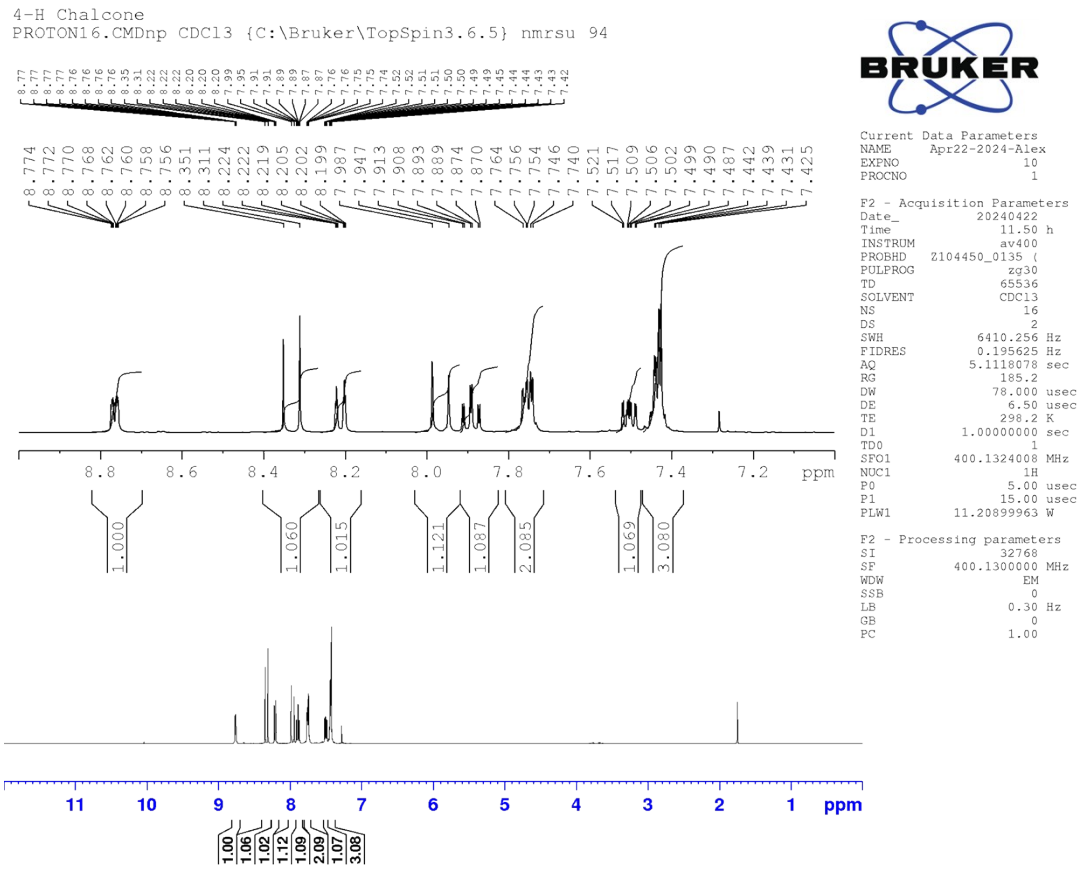
^{1}H NMR δ_H (400 MHz; $CDCl_3$) 3.94, (3 H, s, CH3), 4.01 (3 H, s, CH3), 4.28 (3 H, s, CH3), 6.84 (1 H, s, CH), 6.93-6.45 (1 H, m, CH), 7.27-7.30 (2 H, m, CH), 7.36-7.38 (1 H, m, CH), 7.46-7.46 (1 H, m, CH), 7.65-7.67 (1 H, m, CH), 7.77-7.82 (1 H, m, CH) and 8.71-8.73 (1 H, m, CH);

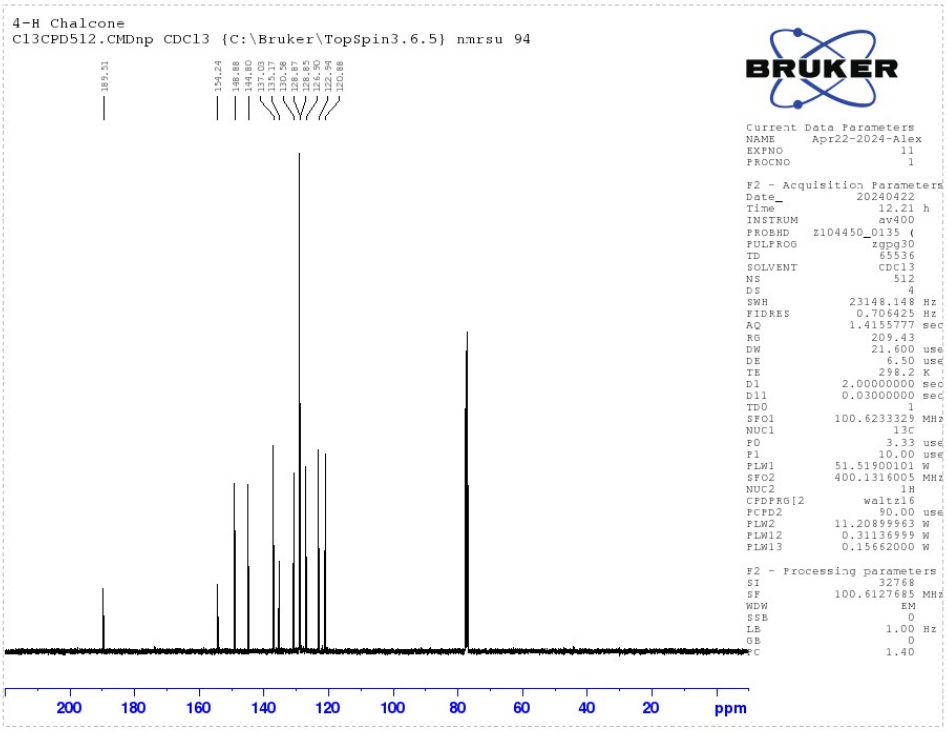
^{13}C NMR δ_c (400 MHz; $CDCl_3$) 39.4, 39.5, 103.2, 108.7, 111.2, 111.4, 118.1, 121.7, 122.4, 126.4, 126.8, 128.5, 129.2, 136.7, 148.8, 149.2 and 168.3;

HRMS m/z (qToF) Found 296.3423 ($M+H^+$). $C_{17}H_{17}N_3O_2$ requires 296.3500.

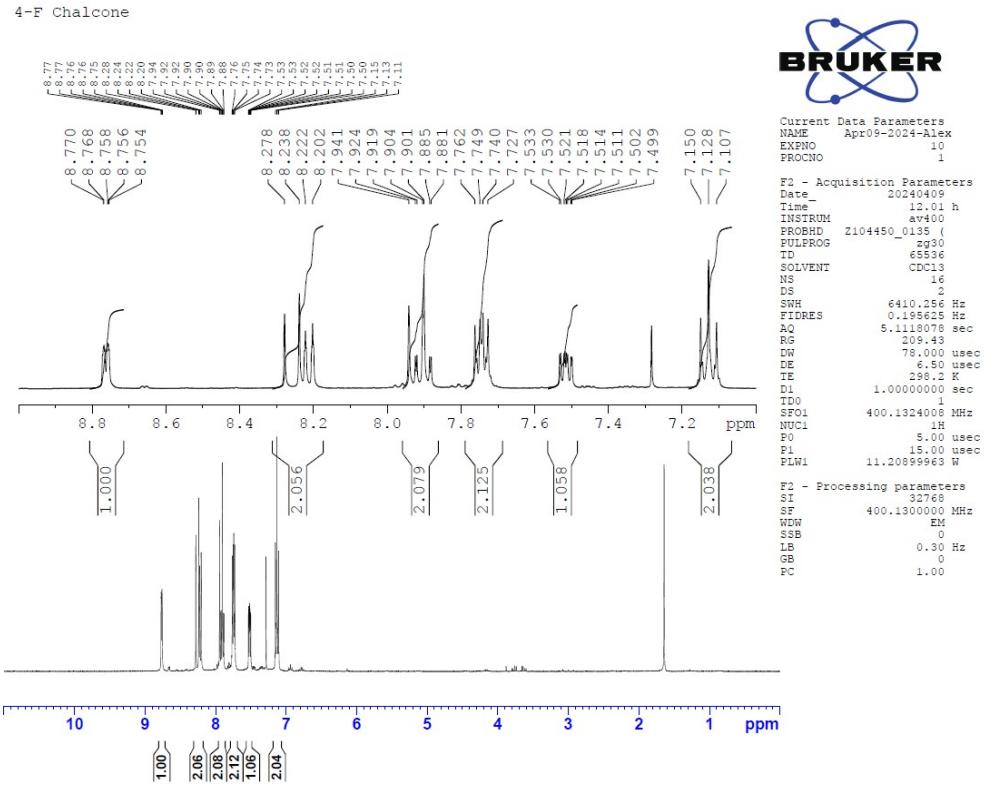
NMR Spectra

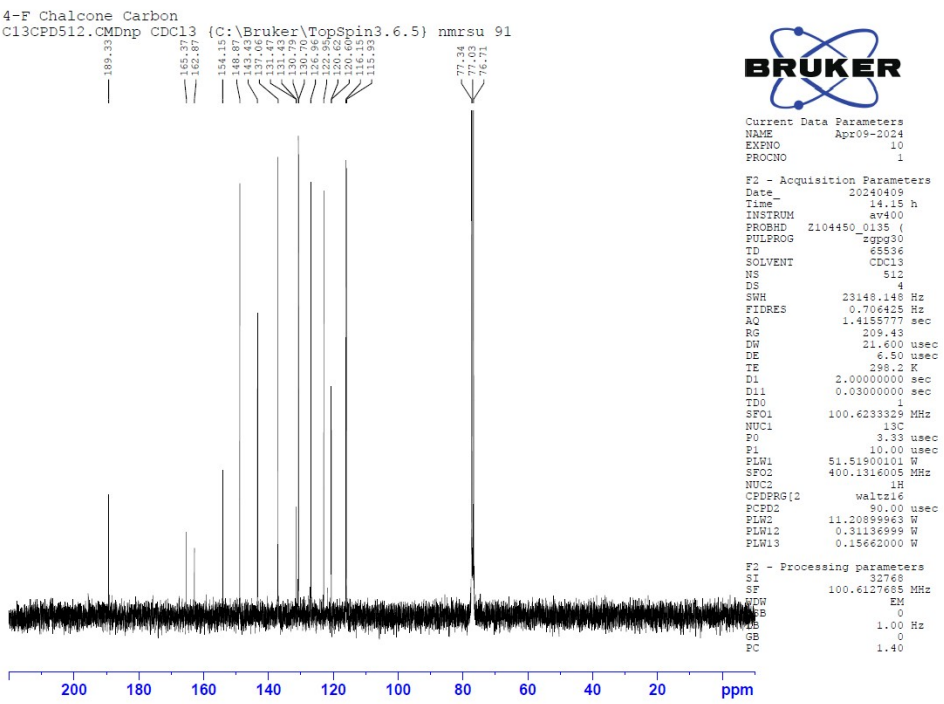
Synthesis of (E)-3-phenyl-1-(pyridin-2-yl)prop-2-en-1-one (**C1**)



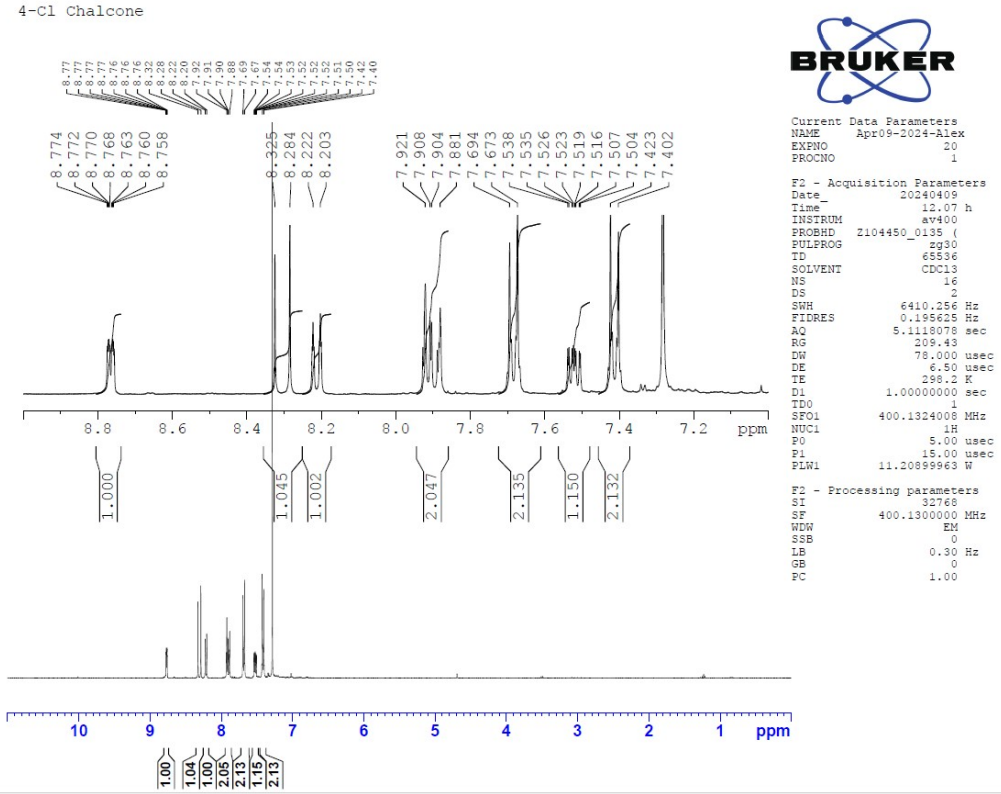


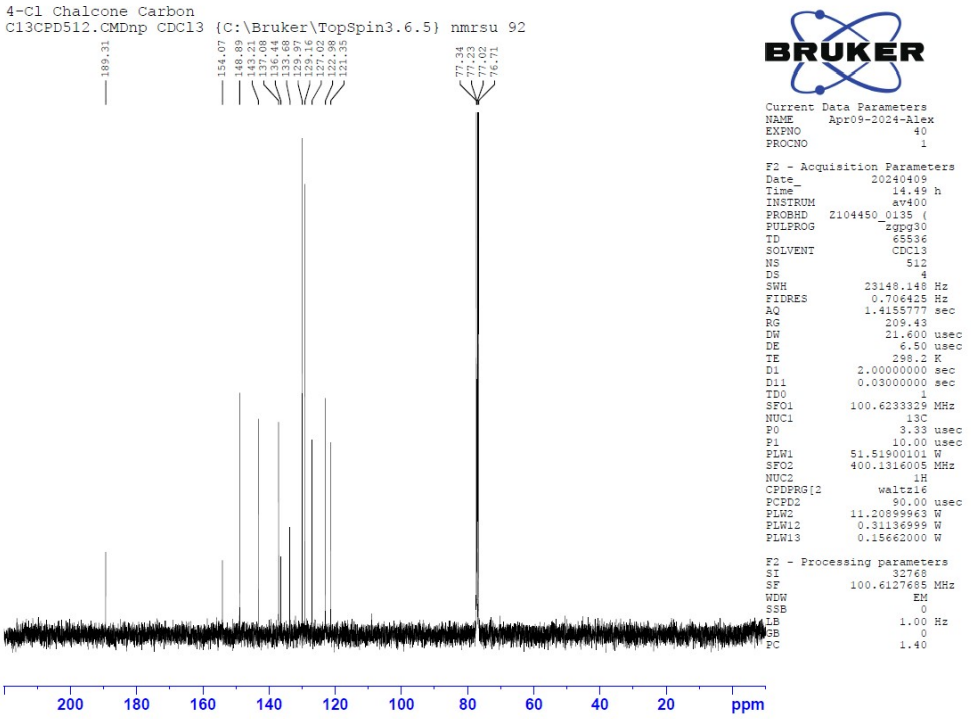
Synthesis of (E)-3-(4-fluorophenyl)-1-(pyridin-2-yl)prop-2-en-1-one (**C2**)



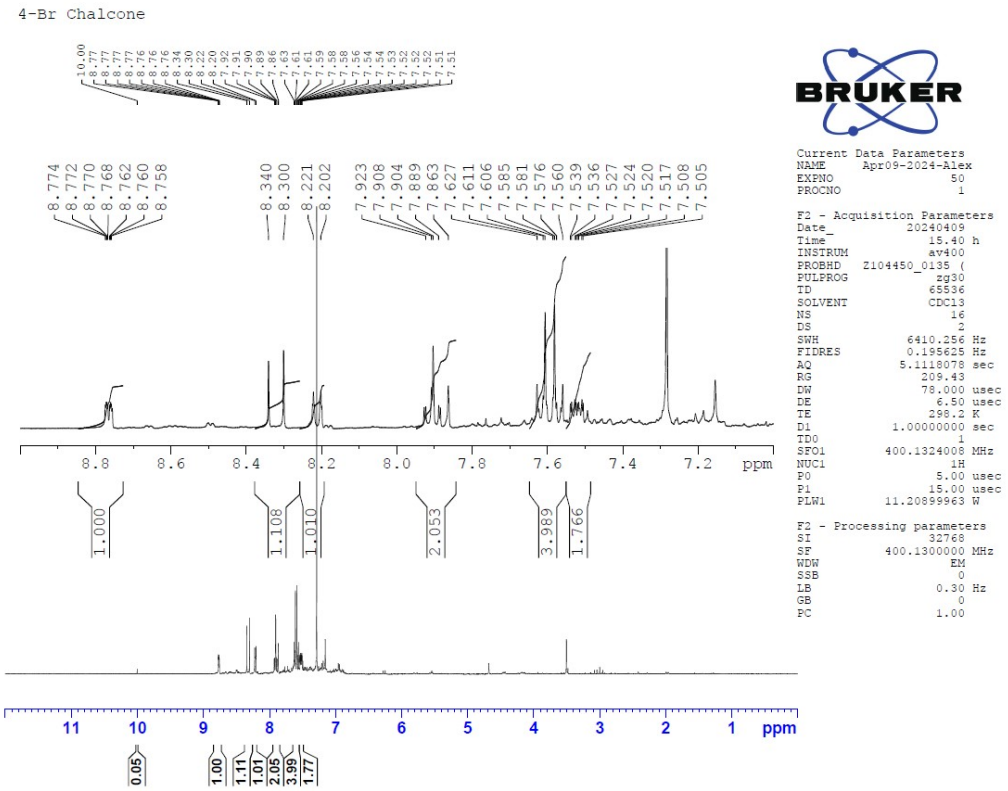


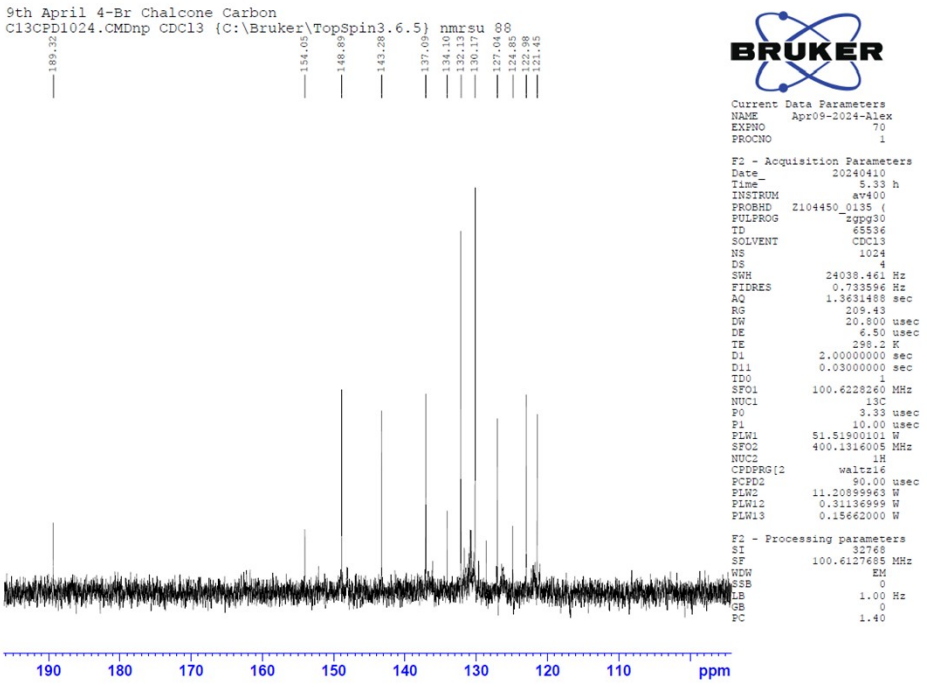
Synthesis of (E)-3-(4-chlorophenyl)-1-(pyridin-2-yl)prop-2-en-1-one (**C3**)



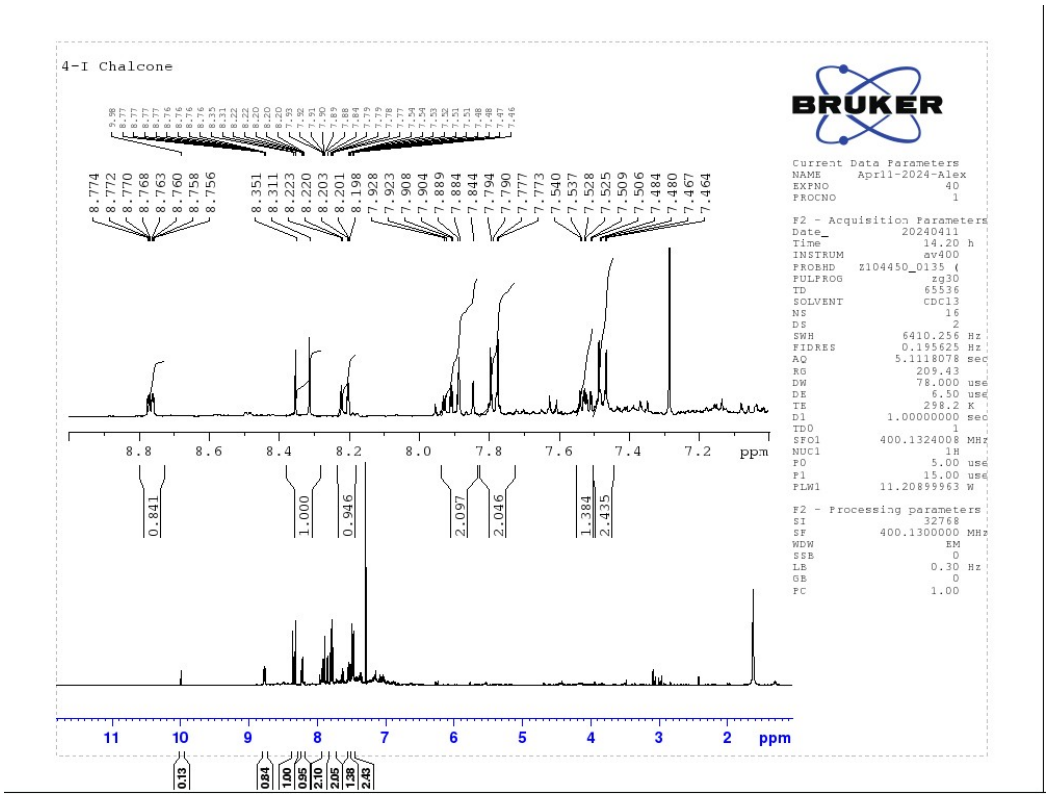


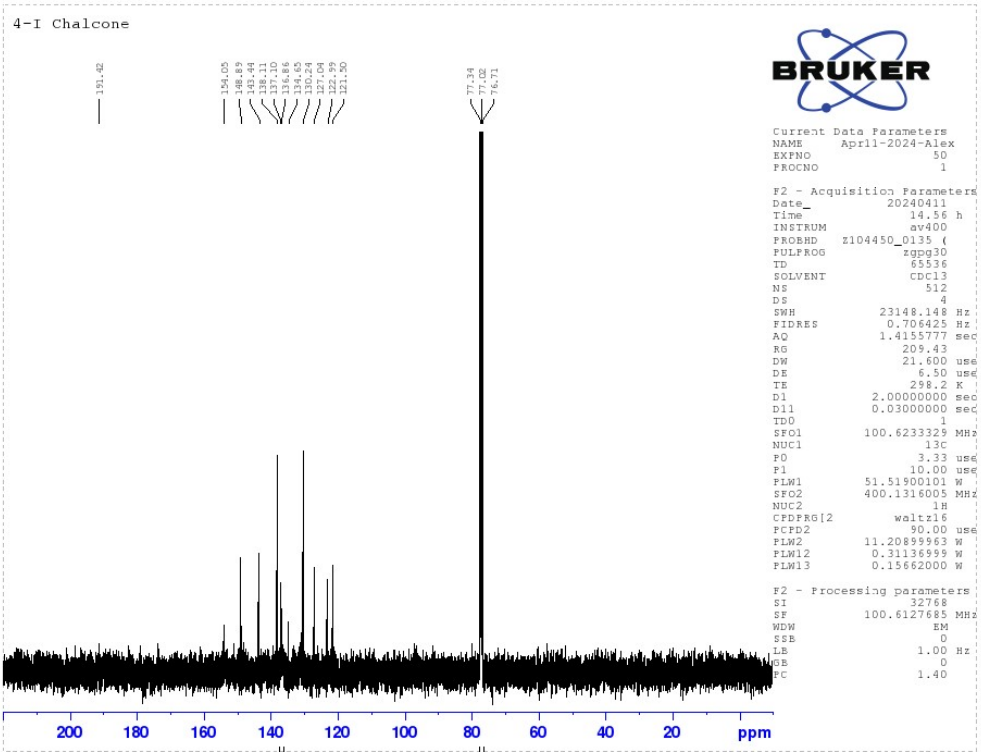
Synthesis of (E)-3-(4-bromophenyl)-1-(pyridin-2-yl)prop-2-en-1-one (**C4**)



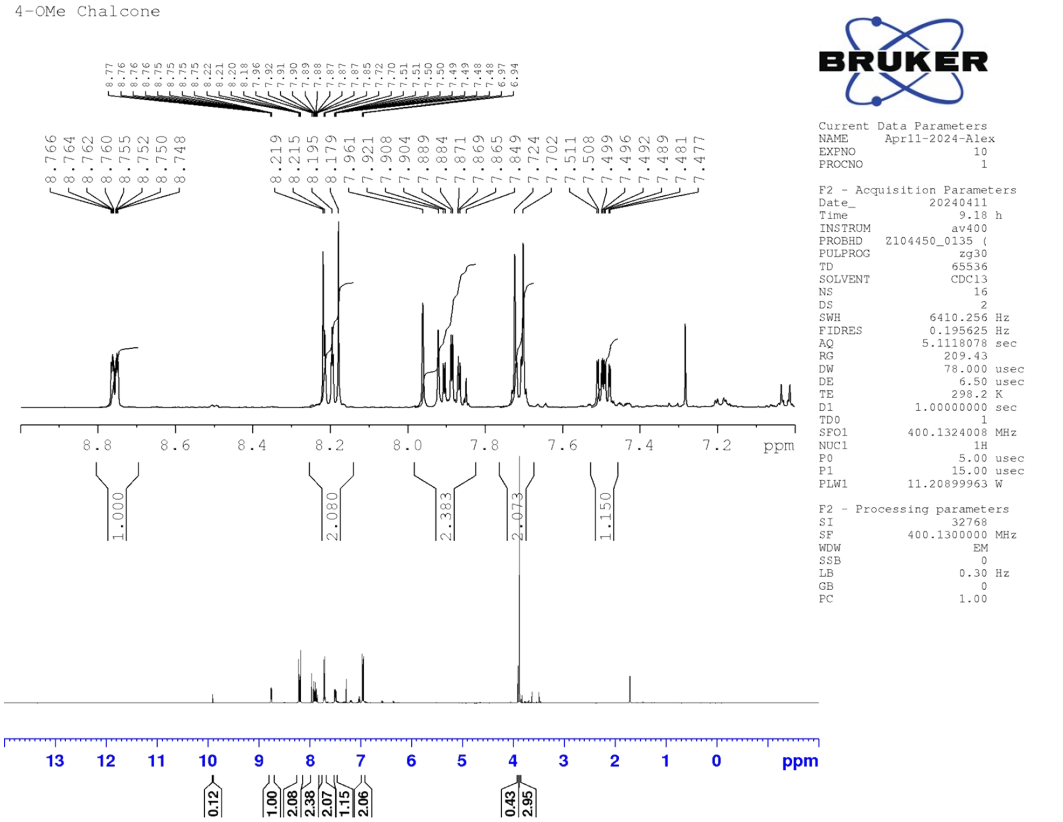


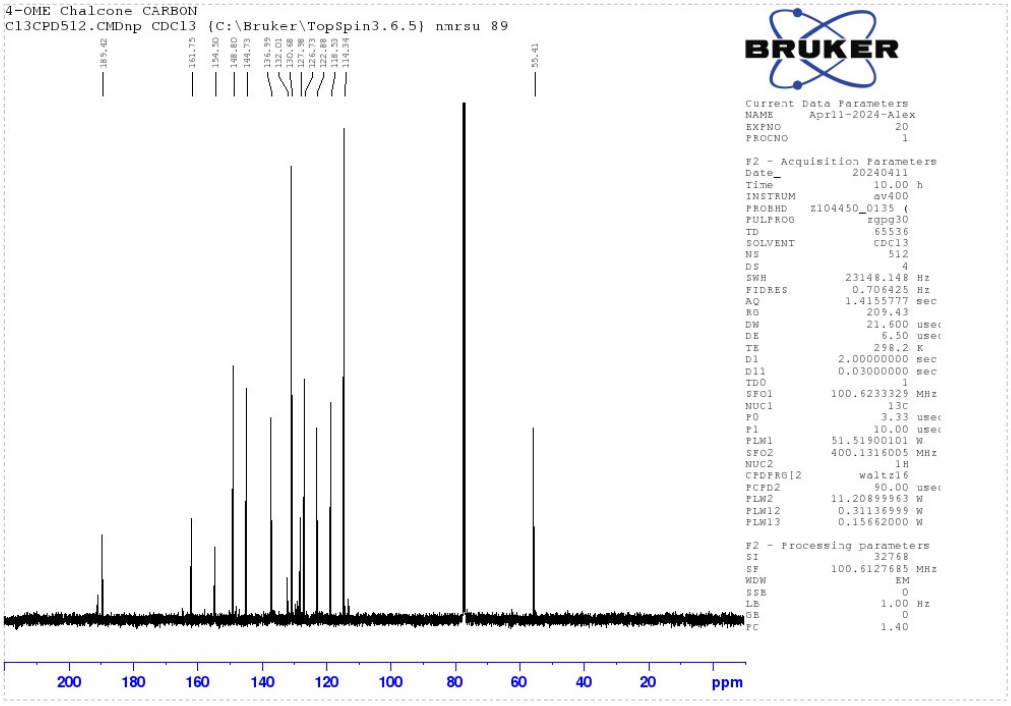
Synthesis of (E)-3-(4-iodophenyl)-1-(pyridin-2-yl)prop-2-en-1-one (**C5**)



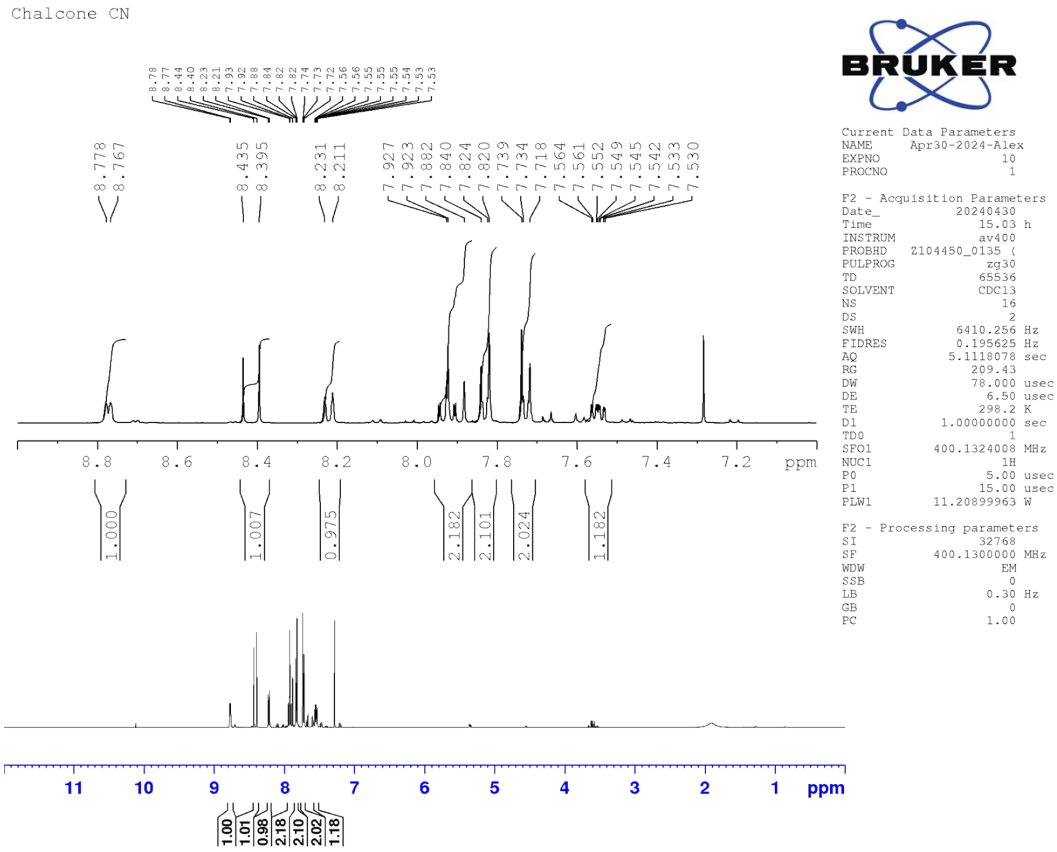


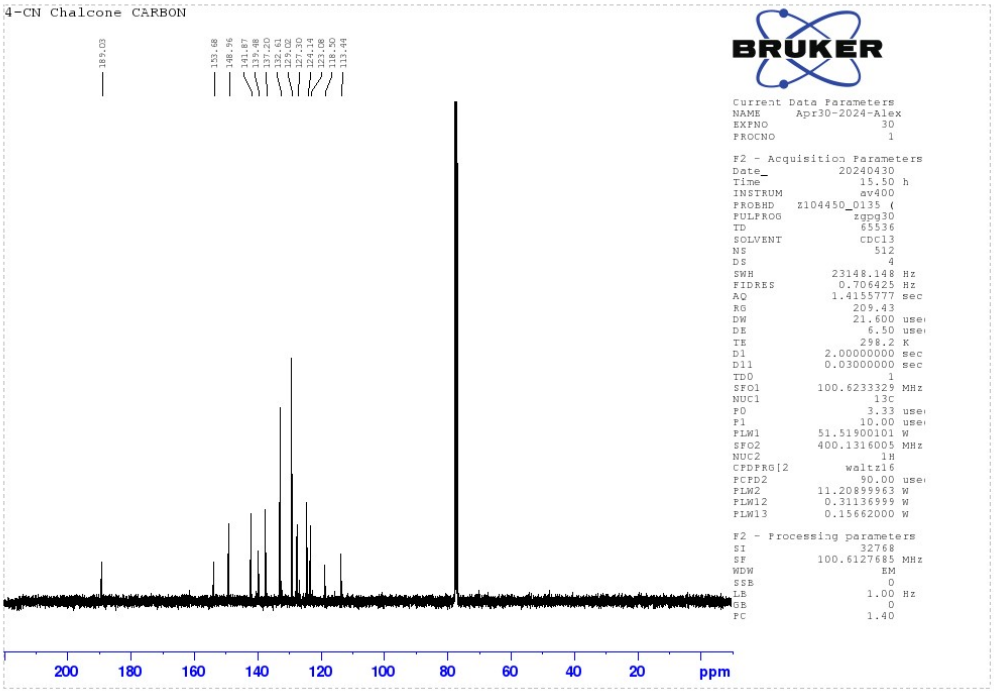
Synthesis of (E)-3-(4-methoxyphenyl)-1-(pyridin-2-yl)prop-2-en-1-one (**C6**)



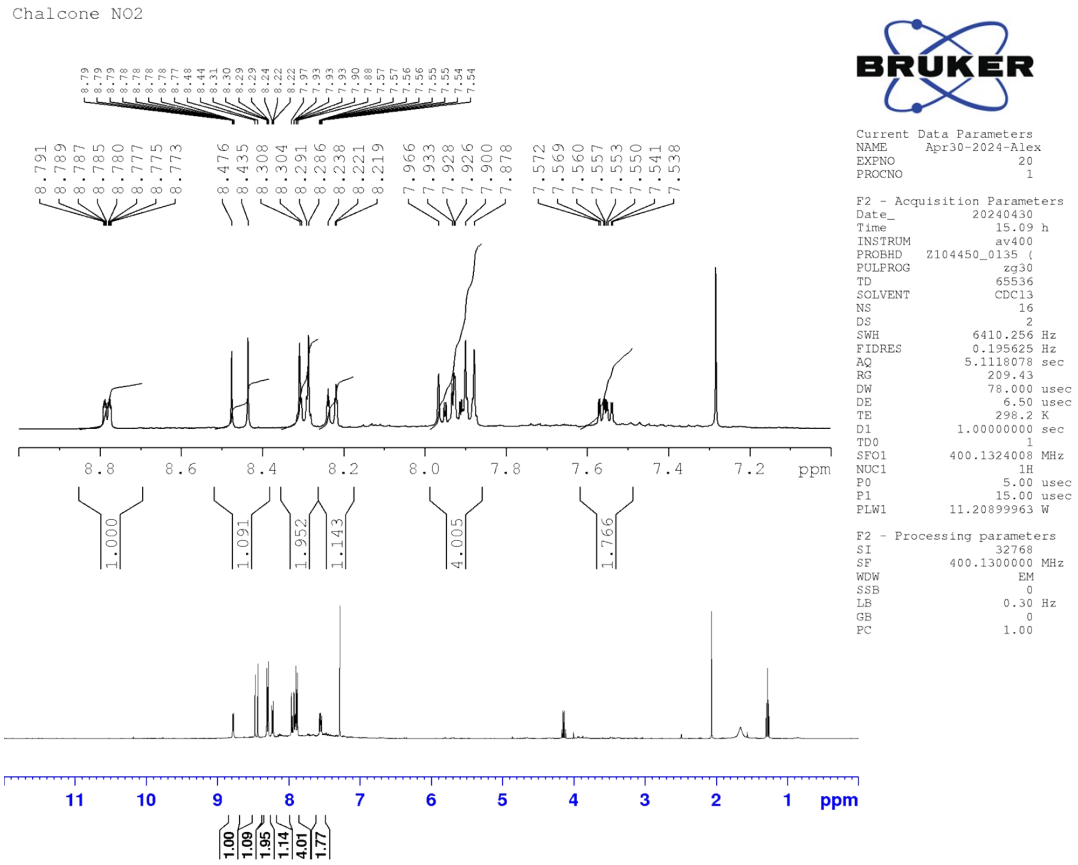


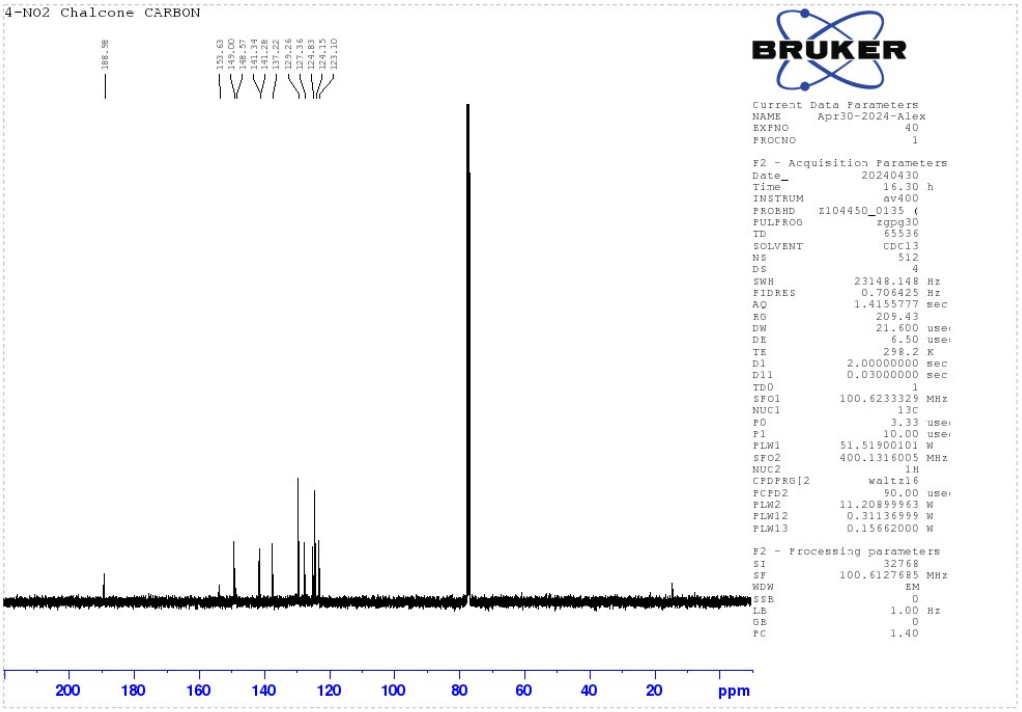
Synthesis of (E)-4-(3-oxo-3-(pyridin-2-yl)prop-1-en-1-yl)benzonitrile (**C7**)



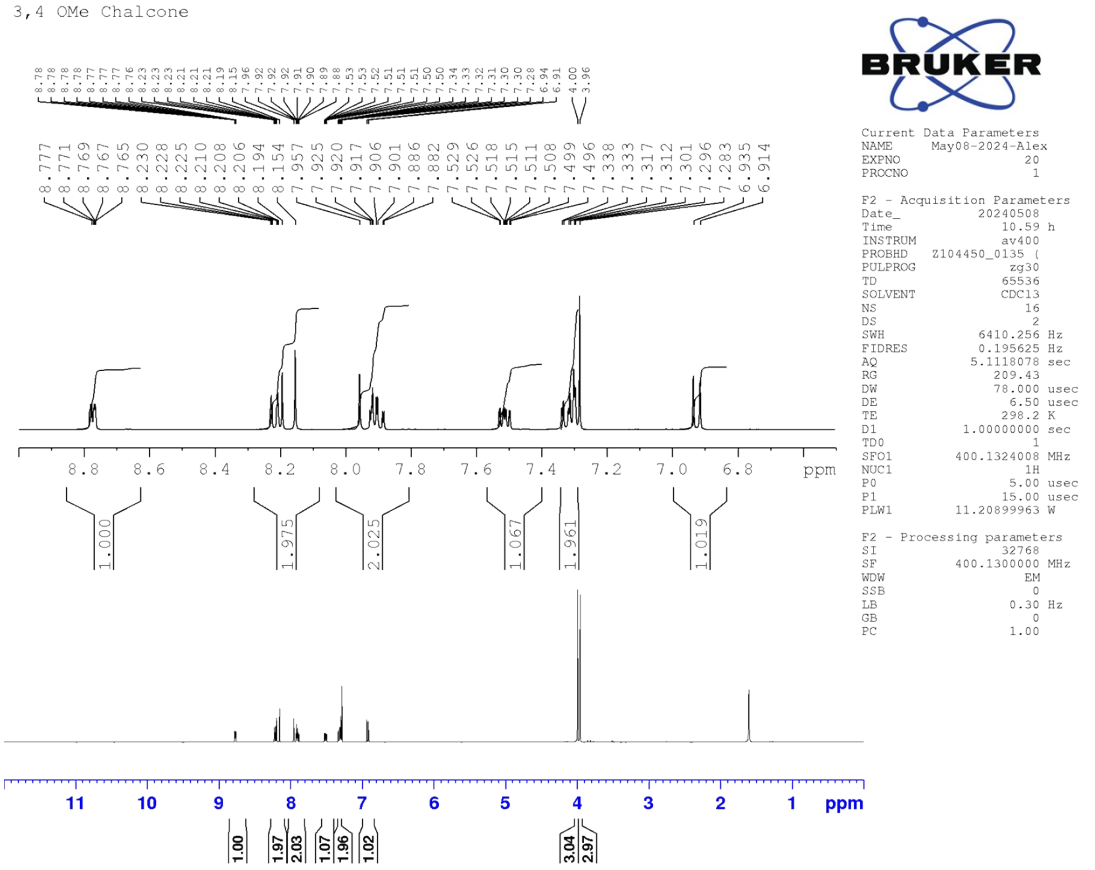


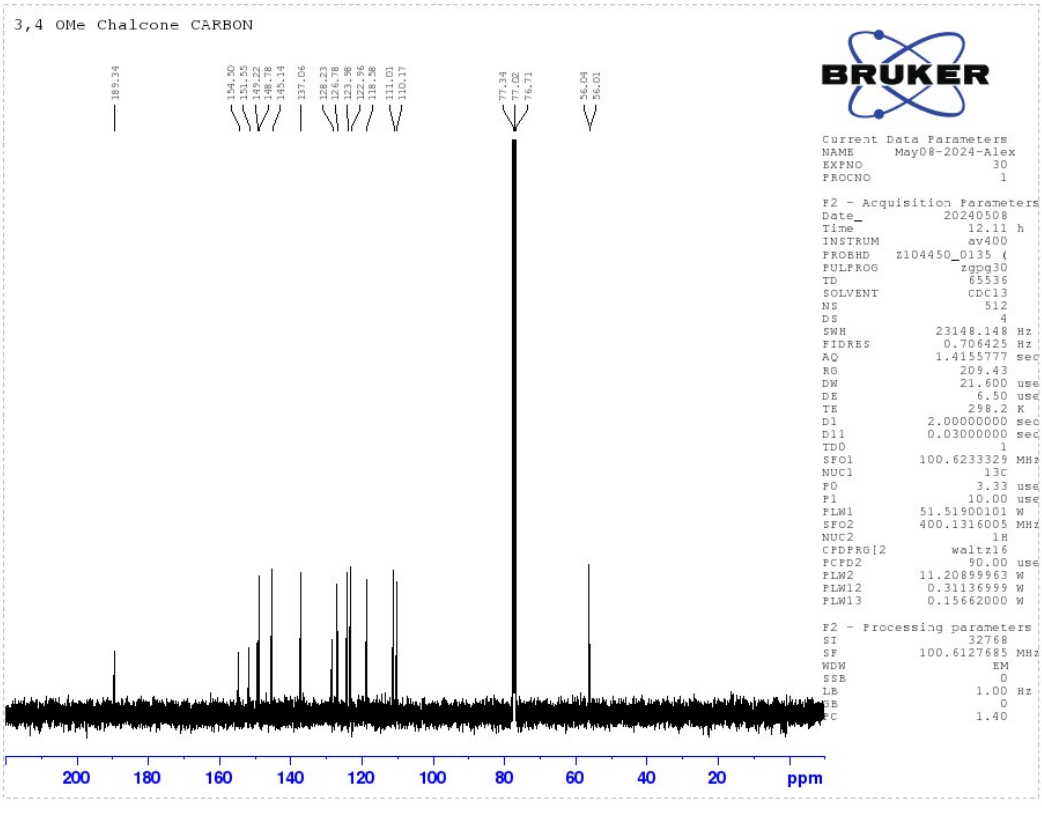
Synthesis of (E)-3-(4-nitrophenyl)-1-(pyridin-2-yl)prop-2-en-1-one (**C8**)



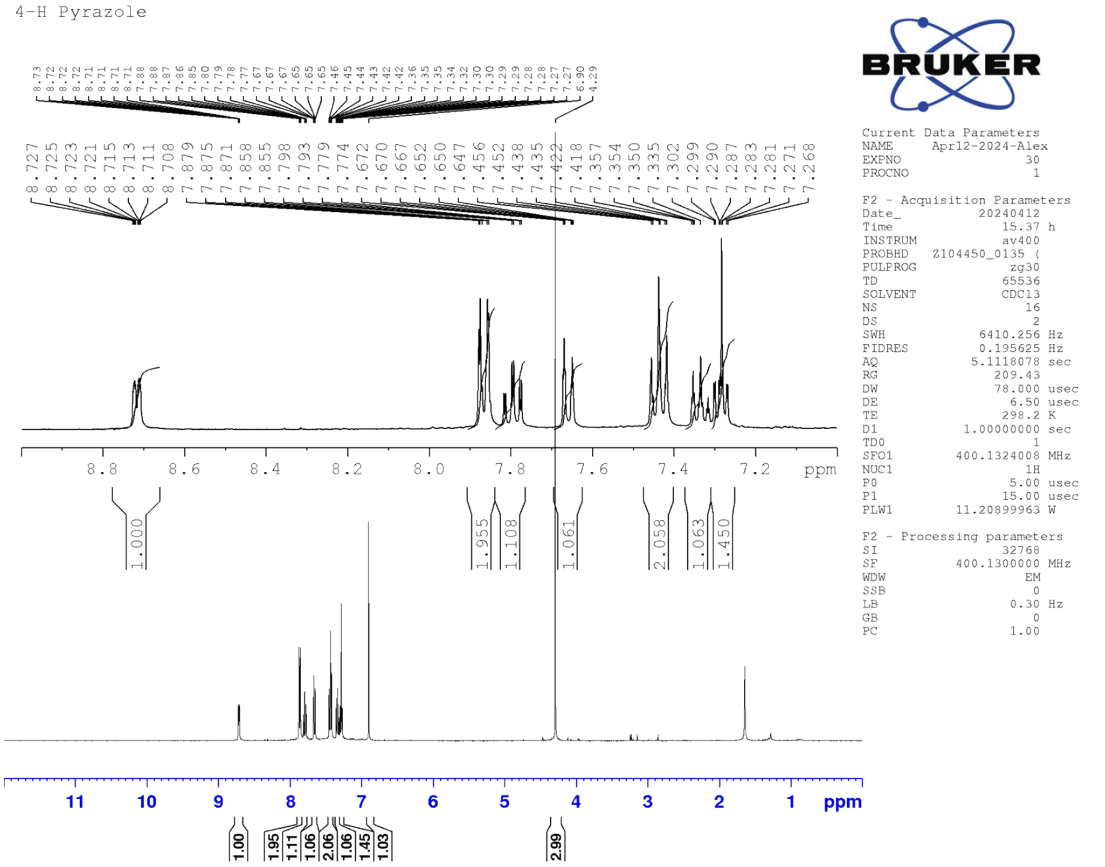


Synthesis of (E)-1-(pyridin-2-yl)-3-(3,4,5-trimethoxyphenyl)prop-2-en-1-one (**C9**)





Synthesis of 2-(1-methyl-5-phenyl-1H-pyrazol-3-yl)pyridine (**P1**)



BRUKER

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PROCNO                 1

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Time               15.37 h
INSTRUM            av400
PROBHD   Z104450_0135 (
PULPROG            zg30
TD                65536
SOLVENT           CDCl3
NS                   16
DS                    2
SWH            6410.256 Hz
FIDRES         0.195625 Hz
AQ             5.1118078 sec
RG                209.43
DW                78.000 usec
DE                 6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                   1
SFO1           400.1324008 MHz
NUC1                  1H
P0                 5.00 usec
P1                15.00 usec
PLW1          11.20899963 W

F2 - Processing parameters
SI                32768
SF           400.1300000 MHz
WDW                  EM
SSB                   0
LB                 0.30 Hz
GB                    0
PC                 1.00
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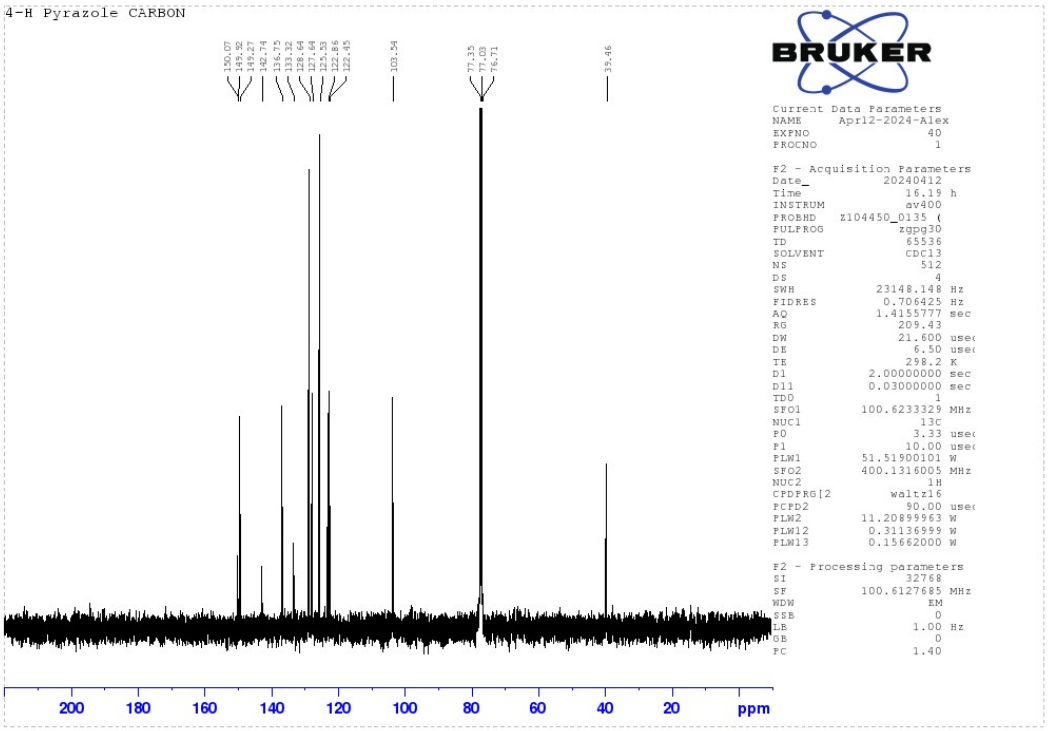

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Current Data Parameters
NAME      Apr12-2024-Alex
EXPNO                 40
PROCNO                 1

F2 - Acquisition Parameters
Date_           20240412
Time               16.19 h
INSTRUM            av400
PROBHD   Z104450_0135 (
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  512
DS                    4
SWH           23148.148 Hz
FIDRES         0.706425 Hz
AQ             1.4155777 sec
RG                209.43
DW                21.600 usec
DE                 6.50 usec
TE                298.2 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                   1
SFO1          100.6233329 MHz
NUC1                 13C
P0                 3.33 usec
P1                10.00 usec
PLW1          51.51900101 W
SFO2          400.1316005 MHz
NUC2                  1H
CPDPRG[2         waltz16
PCPD2             90.00 usec
PLW2          11.20899963 W
PLW12          0.31136999 W
PLW13          0.15662000 W

F2 - Processing parameters
SI                32768
SF           100.6127685 MHz
WDW                  EM
SSB                   0
LB                 1.00 Hz
GB                    0
PC                 1.40
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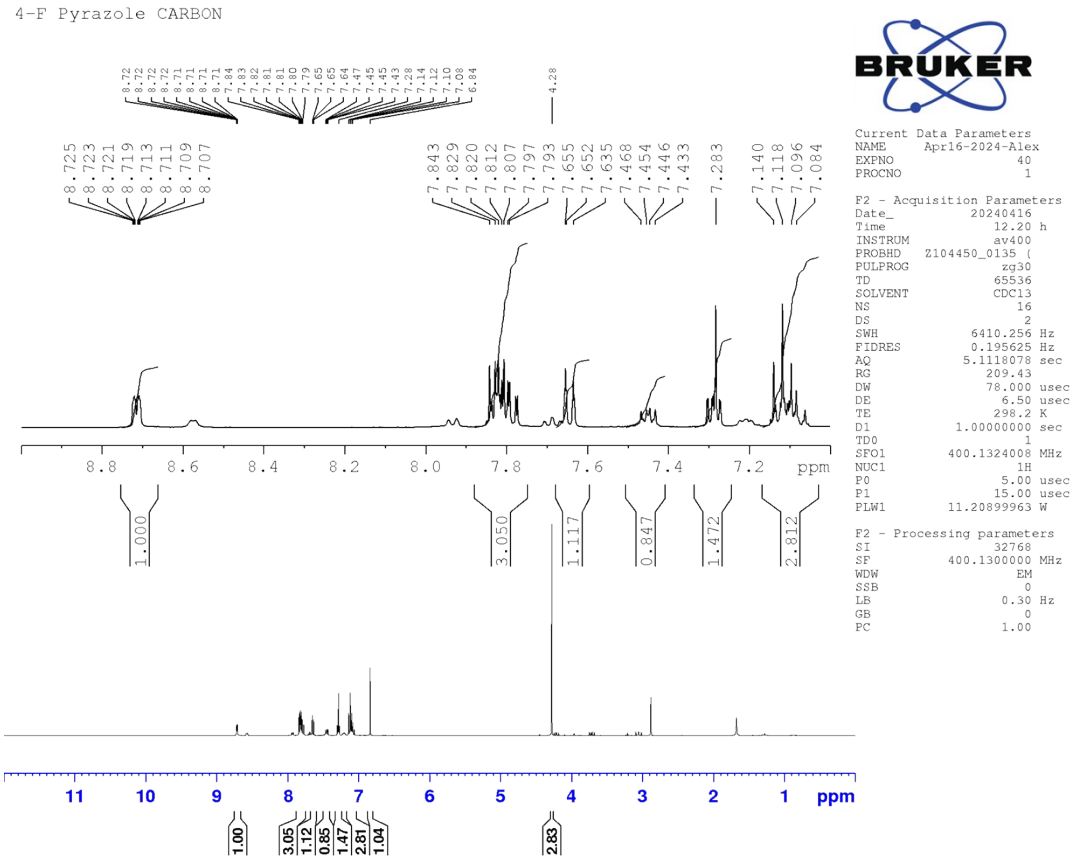
Synthesis of 2-(5-(4-fluorophenyl)-1-methyl-1H-pyrazol-3-yl)pyridine (**P2**)



Current Data Parameters
NAME Apr16-2024-Alex
EXPNO 40
PROCNO 1

F2 - Acquisition Parameters
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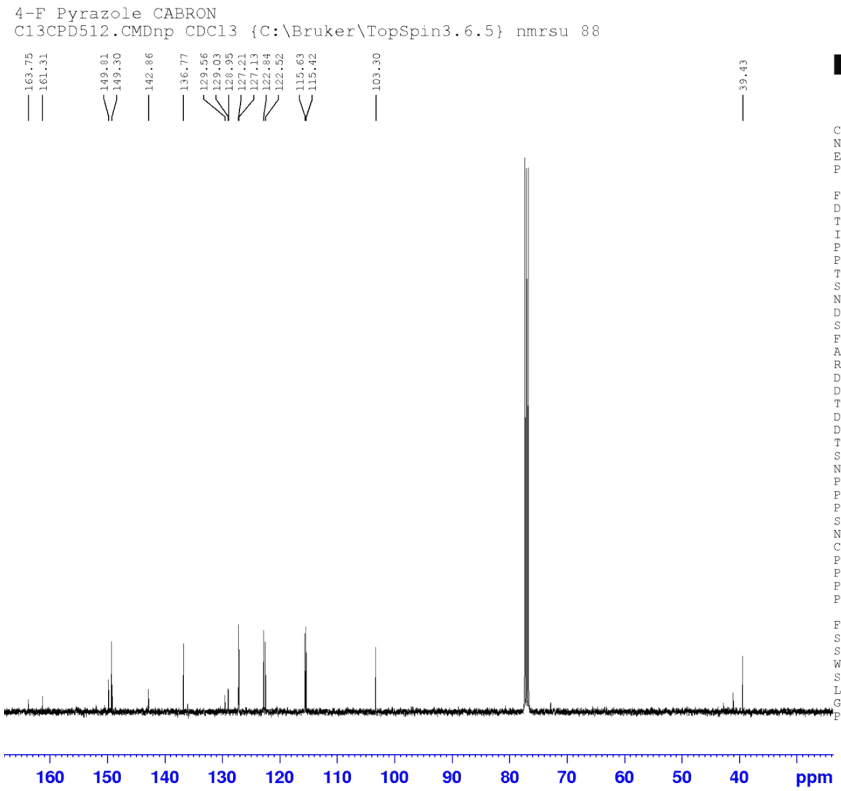
Time 12.20 h
INSTRUM av400
PROBHD Z104450_0135 (
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 6410.256 Hz
FIDRES 0.195625 Hz
AQ 5.1118078 sec
RG 209.43
DW 78.000 usec
DE 6.50 usec
TE 298.2 K
D1 1.00000000 sec
TD0 1
SFO1 400.1324008 MHz
NUC1 1H
P0 5.00 usec
P1 15.00 usec
PLW1 11.20899963 W

F2 - Processing parameters
SI 32768
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00



Current Data Parameters
NAME Apr16-2024-Alex
EXPNO 50
PROCNO 1

F2 - Acquisition Parameters
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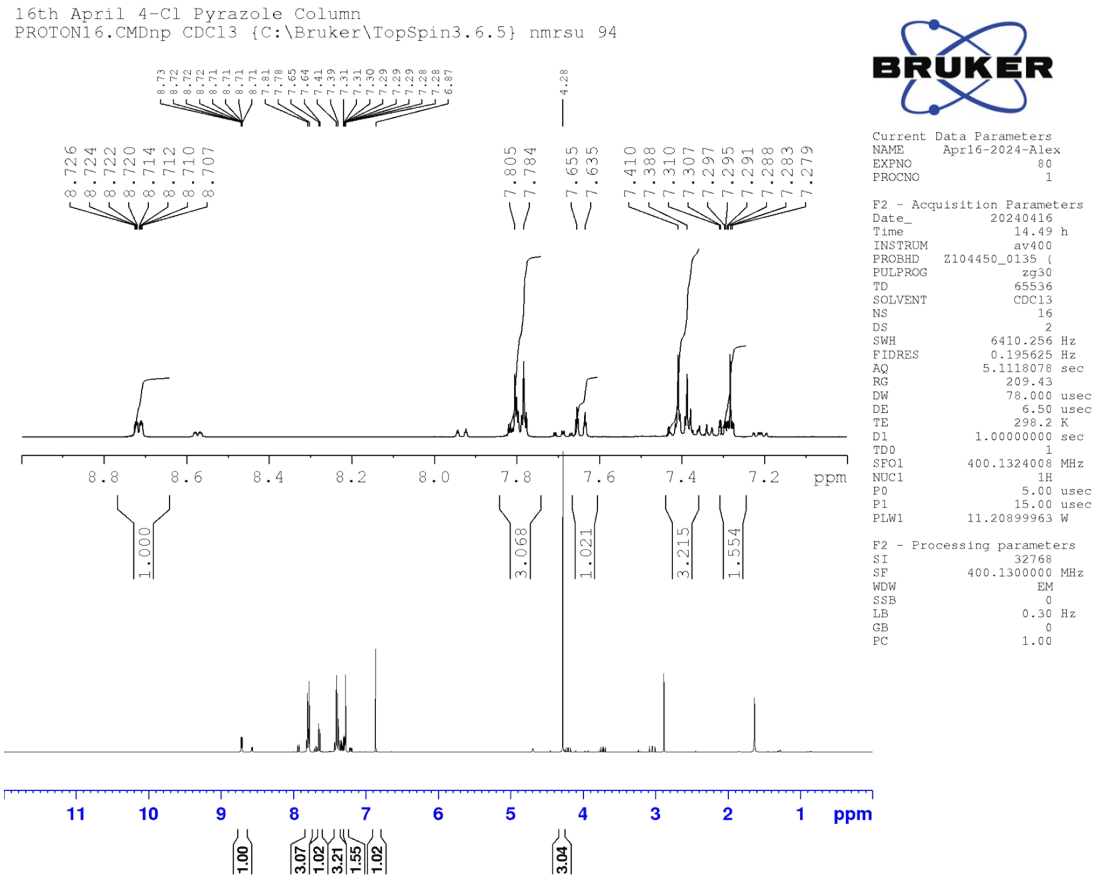
Time 13.11 h
INSTRUM av400
PROBHD Z104450_0135 (
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 512
DS 4
SWH 23148.148 Hz
FIDRES 0.706425 Hz
AQ 1.4155777 sec
RG 209.43
DW 21.600 usec
DE 6.50 usec
TE 298.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
SFO1 100.6233329 MHz
NUC1 13C
P0 3.33 usec
P1 10.00 usec
PLW1 51.51900101 W
SFO2 400.1316005 MHz
NUC2 1H
CPDPRG[2 waltz16
PCPD2 90.00 usec
PLW2 11.20899963 W
PLW12 0.31136999 W
PLW13 0.15662000 W

F2 - Processing parameters
SI 32768
SF 100.6127685 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

Synthesis of 2-(5-(4-chlorophenyl)-1-methyl-1H-pyrazol-3-yl)pyridine (**P3**)



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Current Data Parameters
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EXPNO                 80
PROCNO                 1

F2 - Acquisition Parameters
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Time              14.49 h
INSTRUM             av400
PROBHD    Z104450_0135 (
PULPROG             zg30
TD                 65536
SOLVENT             CDCl3
NS                    16
DS                     2
SWH             6410.256 Hz
FIDRES          0.195625 Hz
AQ              5.1118078 sec
RG                209.43
DW                78.000 usec
DE                 6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1          400.1324008 MHz
NUC1                  1H
P0                 5.00 usec
P1                15.00 usec
PLW1          11.20899963 W

F2 - Processing parameters
SI                 32768
SF            400.1300000 MHz
WDW                   EM
SSB                    0
LB                  0.30 Hz
GB                     0
PC                  1.00
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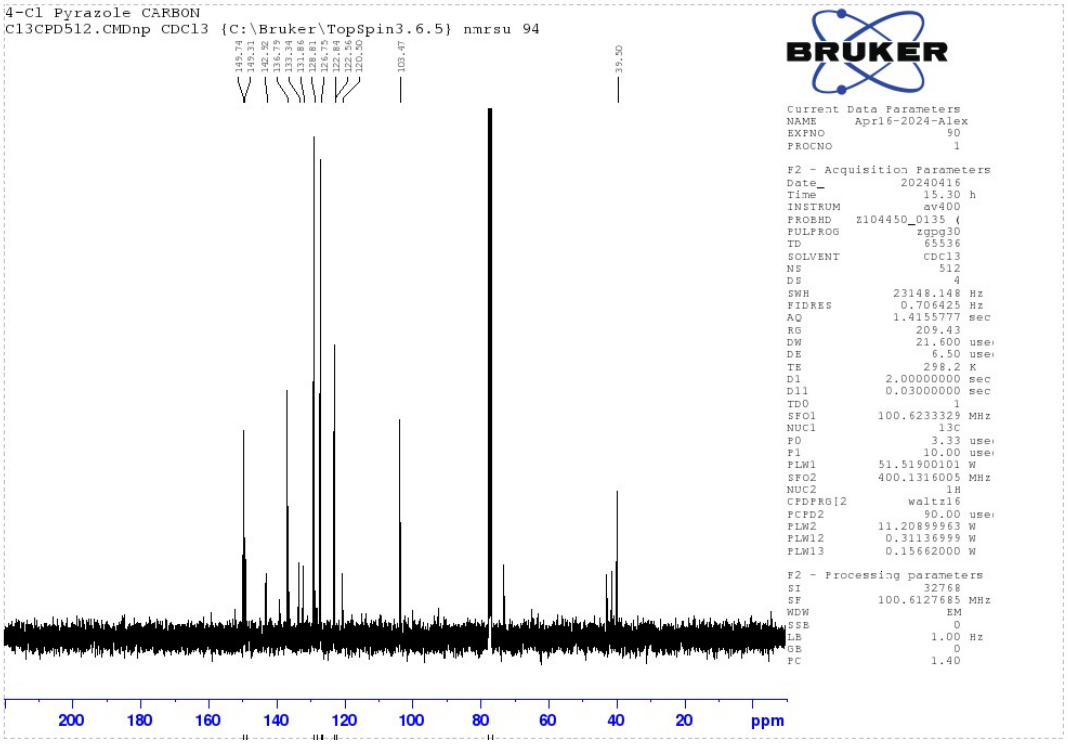

BRUKER

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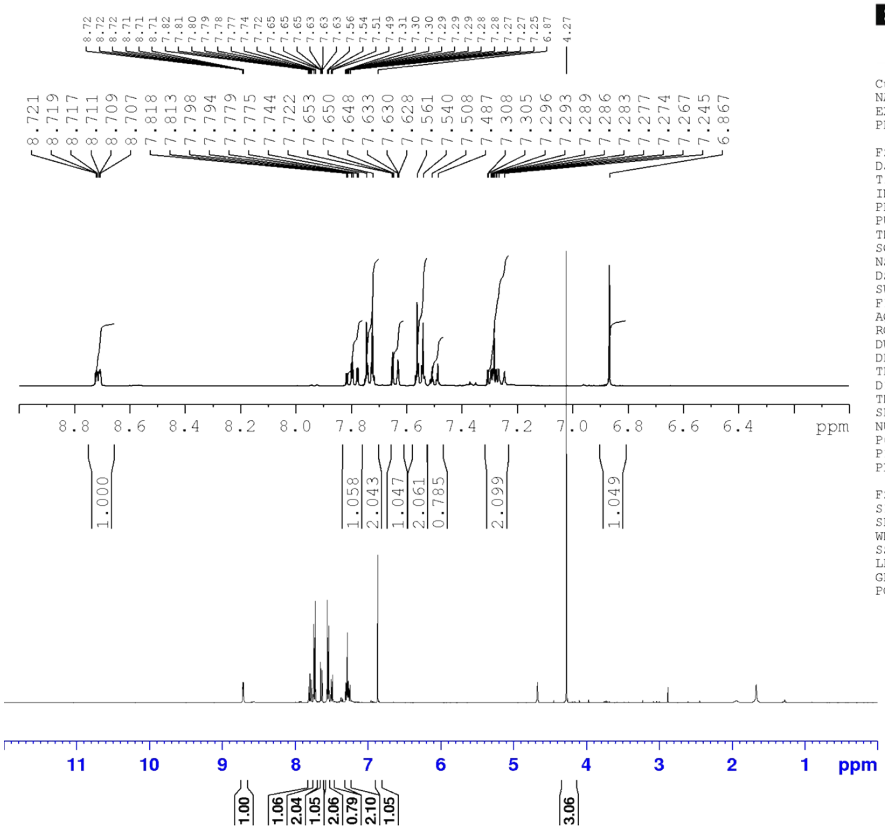
Current Data Parameters
NAME      Apr16-2024-Alex
EXPNO                 90
PROCNO                 1

F2 - Acquisition Parameters
Date_           20240416
Time              15.30 h
INSTRUM             av400
PROBHD    Z104450_0135 (
PULPROG          zgpg30
TD                 65536
SOLVENT             CDCl3
NS                   512
DS                     4
SWH            23148.148 Hz
FIDRES          0.706425 Hz
AQ              1.41557777 sec
RG                209.43
DW                21.600 use
DE                 6.50 use
TE                298.2 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1
SFO1          100.6233329 MHz
NUC1                  13C
P0                 3.33 use
P1                10.00 use
PLW1          51.51900101 W
SFO2          400.1316005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2             90.00 use
PLW2          11.20899963 W
PLW12          0.31136999 W
PLW13          0.15662000 W

F2 - Processing parameters
SI                 32768
SF            100.6127685 MHz
WDW                   EM
SSB                    0
LB                  1.00 Hz
GB                     0
PC                  1.40
```

Synthesis of 2-(5-(4-bromophenyl)-1-methyl-1H-pyrazol-3-yl)pyridine (**P4**)

4-Br Column



BRUKER

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Current Data Parameters
NAME      Apr23-2024-Alex
EXPNO                 30
PROCNO                 1

F2 - Acquisition Parameters
Date_           20240423
Time              14.58 h
INSTRUM           av400
PROBHD    Z104450_0135 (
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH            6410.256 Hz
FIDRES         0.195625 Hz
AQ             5.1118078 sec
RG                209.43
DW                78.000 usec
DE                 6.50 usec
TE                298.2 K
D1           1.00000000 sec
TD0                    1
SFO1         400.1324008 MHz
NUC1                  1H
P0                 5.00 usec
P1                15.00 usec
PLW1         11.20899963 W

F2 - Processing parameters
SI                 32768
SF           400.1300000 MHz
WDW                   EM
SSB                    0
LB                  0.30 Hz
GB                     0
PC                  1.00
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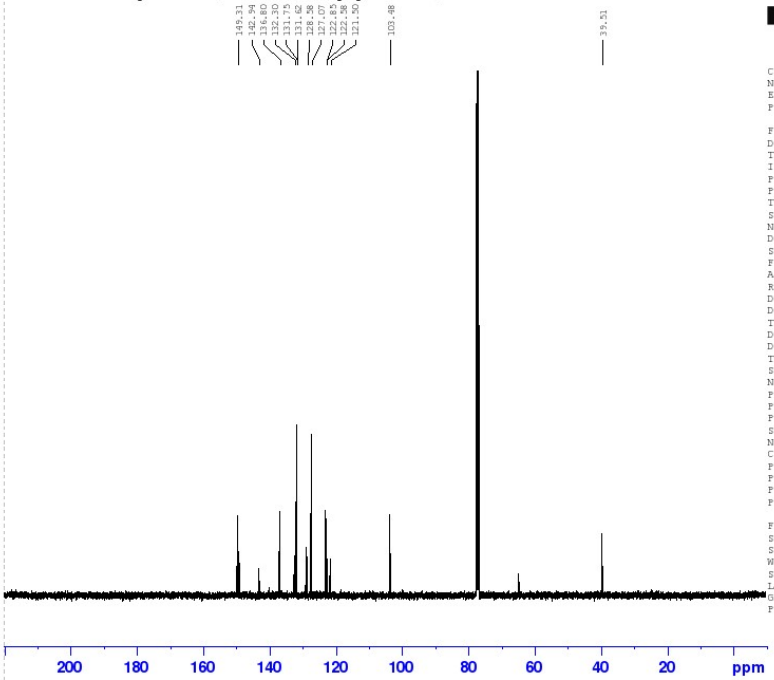
4-Br Pyrazole CARBON

C13CPD512.CMDnp CDCl3 {C:\Bruker\TopSpin3.6.5} nmrsu 94



BRUKER

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Current Data Parameters
NAME      Apr23-2024-Alex
EXPNO                 40
PROCNO                 1

F2 - Acquisition Parameters
Date_           20240423
Time              15.41 h
INSTRUM           av400
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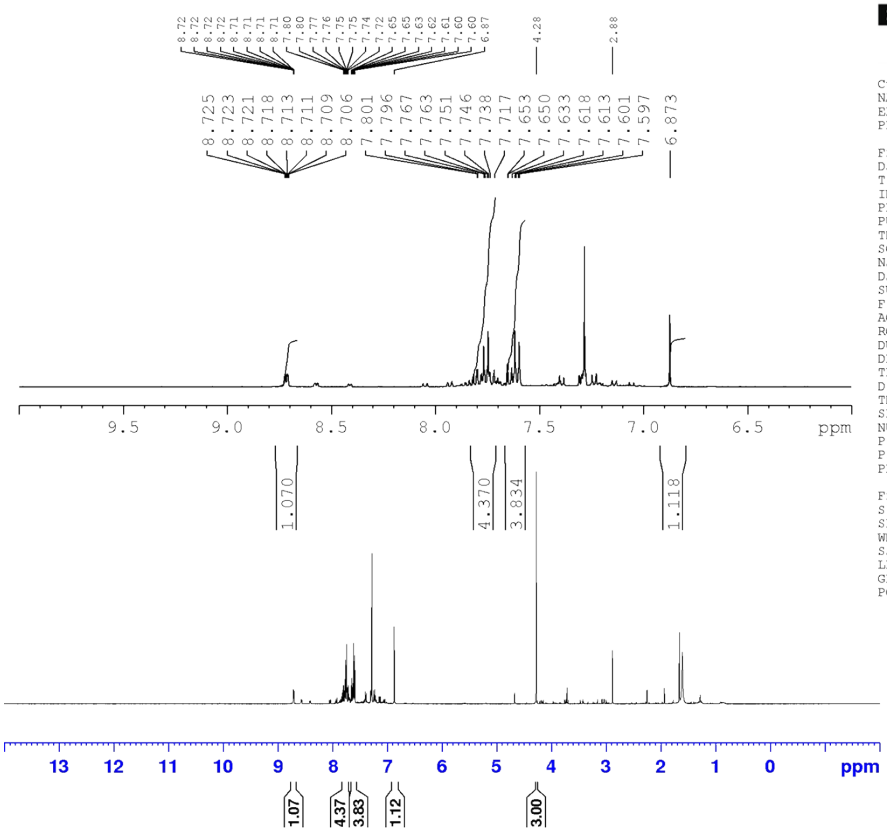
PULPROG         zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   512
DS                     4
SWH            23148.148 Hz
FIDRES         0.706425 Hz
AQ             1.4155777 sec
RG                209.43
DW                21.600 use
DE                 6.50 use
TE                298.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1
SFO1         100.6233329 MHz
NUC1                  13C
P0                 3.33 use
P1                10.00 use
PLW1         51.51900101 W
SFO2         400.1316005 MHz
NUC2                  1H
CPDPRG[2         waltz16
PCPD2             90.00 use
PLW2         11.20899963 W
PLW12         0.31136999 W
PLW13         0.15662000 W

F2 - Processing parameters
SI                 32768
SF           100.6127685 MHz
WDW                   EM
SSB                    0
LB                  1.00 Hz
GB                     0
PC                  1.40
```

Synthesis of 2-(5-(4-iodophenyl)-1-methyl-1H-pyrazol-3-yl)pyridine (**P5**)

4-I Pyrazole



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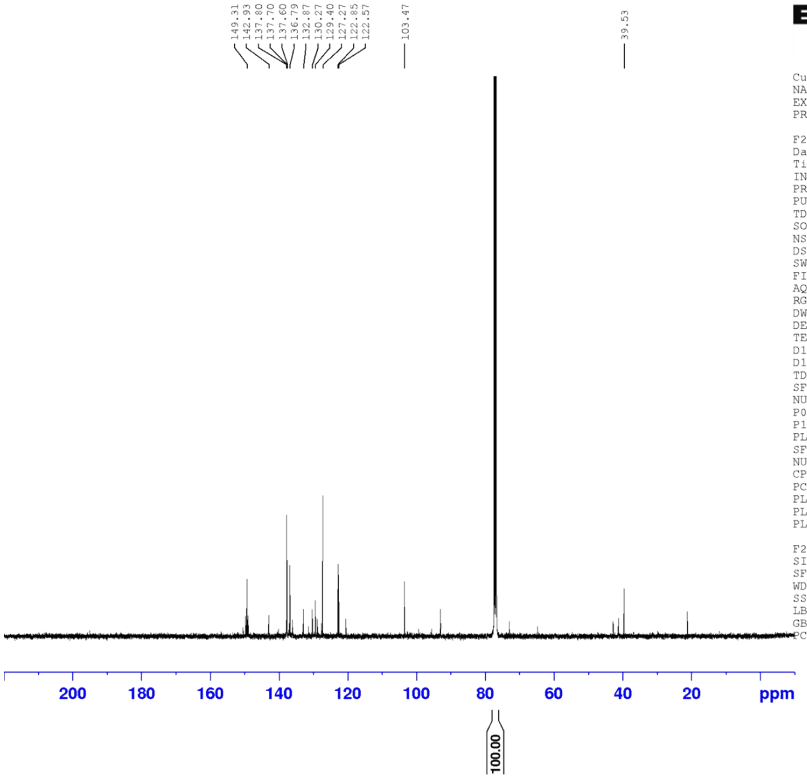
```
Current Data Parameters
NAME      Apr19-2024-Alex
EXPNO                 20
PROCNO                 1

F2 - Acquisition Parameters
Date_           20240419
Time              16.35 h
INSTRUM           av400
PROBHD    Z104450_0135 (
PULPROG           zg30
TD                65536
SOLVENT           CDCl3
NS                   16
DS                    2
SWH            6410.256 Hz
FIDRES         0.195625 Hz
AQ             5.1118078 sec
RG                209.43
DW                78.000 usec
DE                 6.50 usec
TE                298.2 K
D1           1.00000000 sec
TD0                   1
SFO1         400.1324008 MHz
NUC1                 1H
P0                 5.00 usec
P1                15.00 usec
PLW1         11.20899963 W

F2 - Processing parameters
SI                32768
SF           400.1300000 MHz
WDW                  EM
SSB                   0
LB                 0.30 Hz
GB                    0
PC                 1.00
```

19th April 4-I Pyrazole
C13CPD10K.CMDnp CDCl3 {C:\Bruker\TopSpin3.6.5} nmrsu 91



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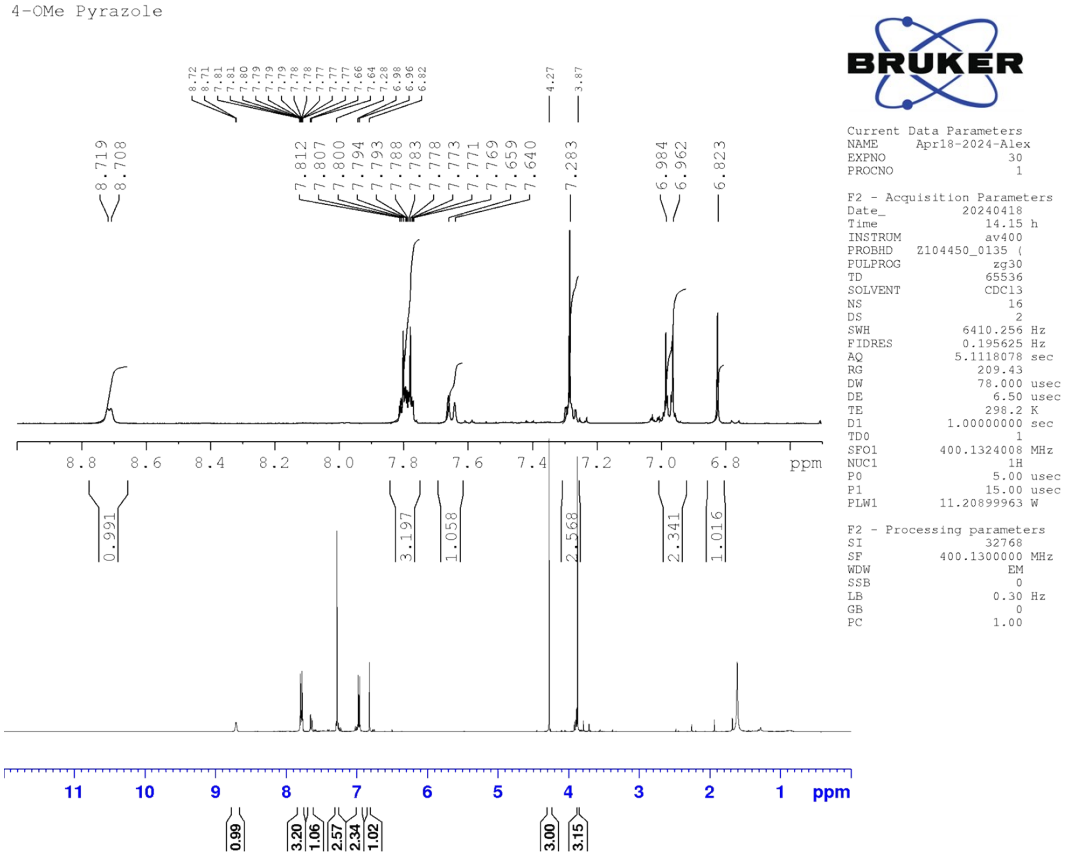
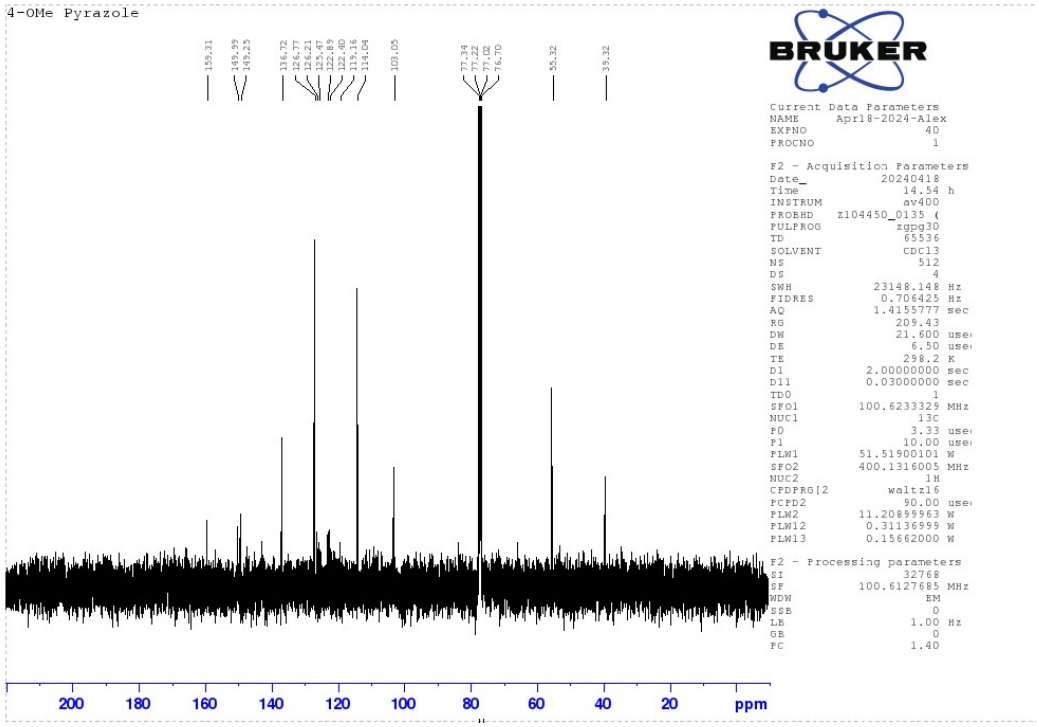
Current Data Parameters
NAME      Apr19-2024-Alex
EXPNO                 30
PROCNO                 1

F2 - Acquisition Parameters
Date_           20240420
Time              2.25 h
INSTRUM           av400
PROBHD    Z104450_0135 (
PULPROG         zgpg30
TD                65536
SOLVENT           CDCl3
NS                10000
DS                    4
SWH           23148.148 Hz
FIDRES         0.706425 Hz
AQ             1.4155777 sec
RG                209.43
DW                21.600 usec
DE                 6.50 usec
TE                298.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1
SFO1         100.6233329 MHz
NUC1                 13C
P0                 3.33 usec
P1                10.00 usec
PLW1         51.51900101 W
SFO2         400.1316005 MHz
NUC2                 1H
CPDPRG[2         waltz16
PCPD2             90.00 usec
PLW2         11.20899963 W
PLW12         0.31136999 W
PLW13         0.15662000 W

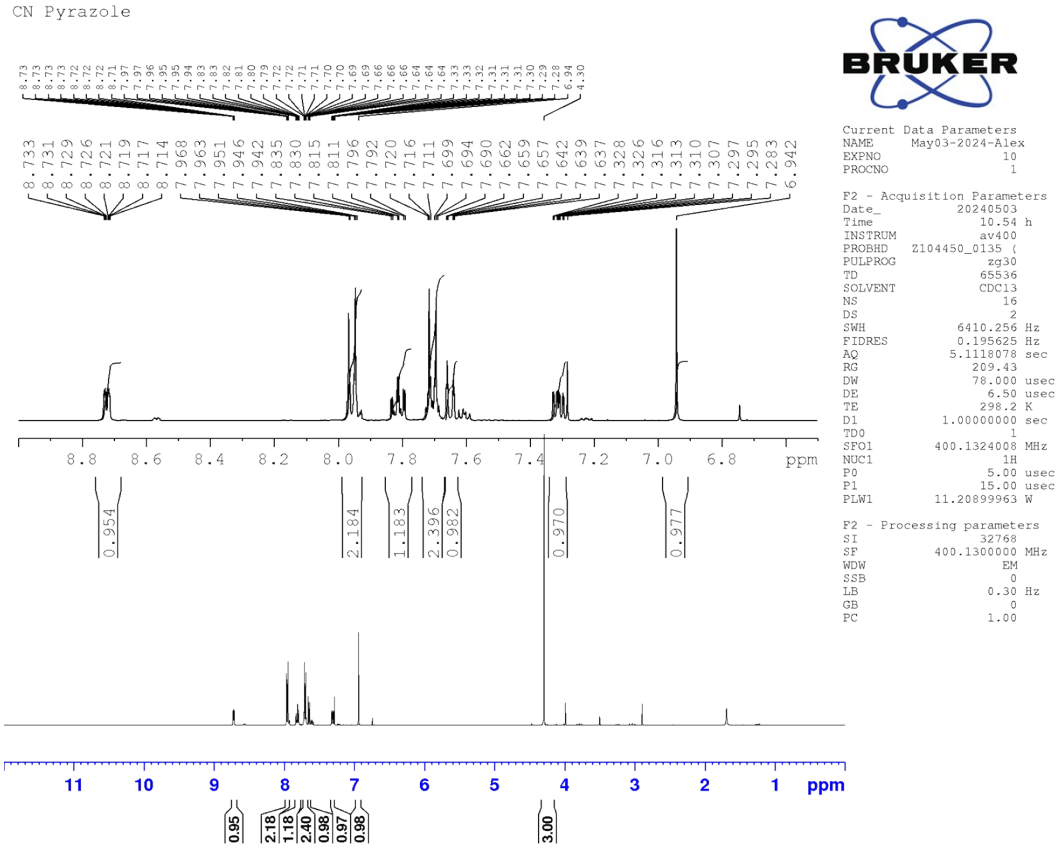
F2 - Processing parameters
SI                32768
SF           100.6127685 MHz
WDW                  EM
SSB                   0
LB                 1.00 Hz
GB                    0
PC                 1.40
```

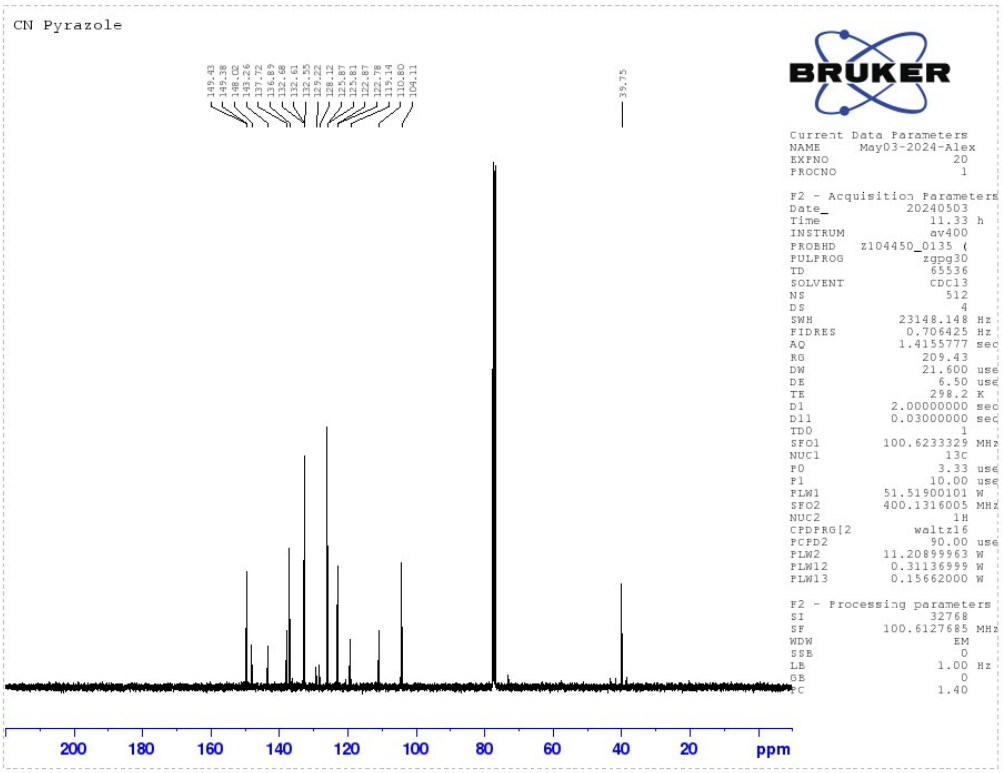
Synthesis of 2-(5-(4-methoxyphenyl)-1-methyl-1H-pyrazol-3-yl)pyridine (**P8**)



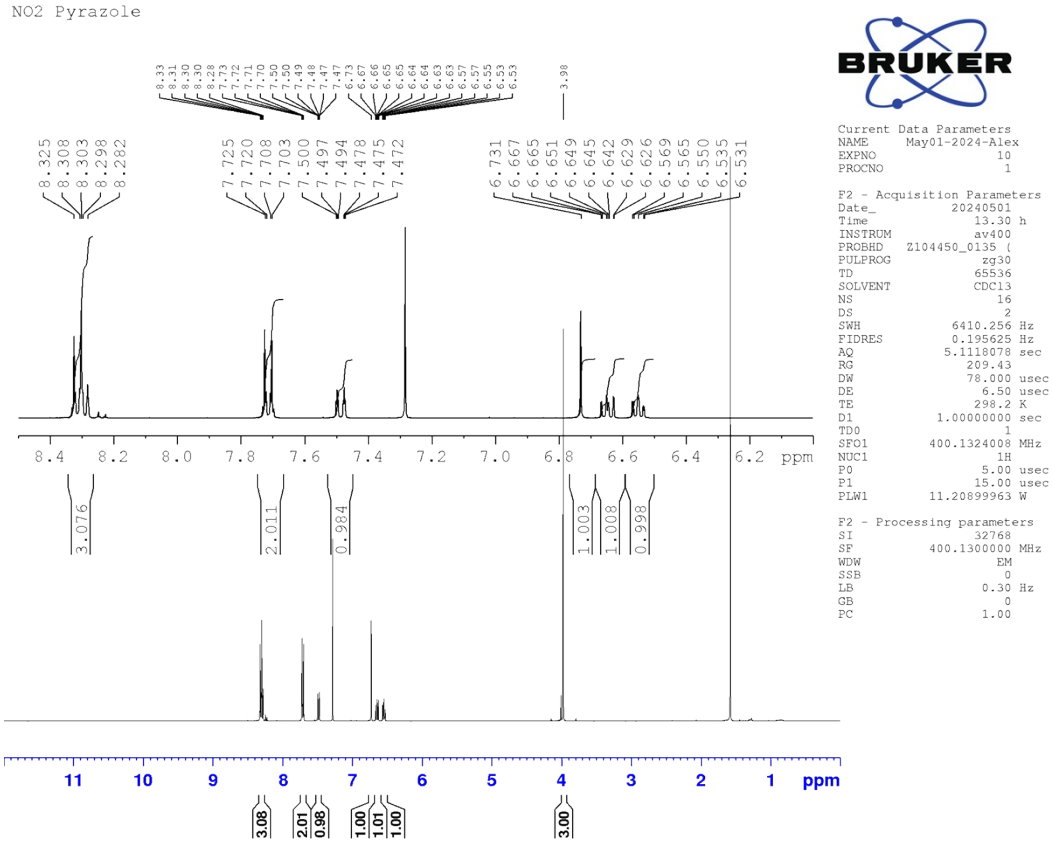


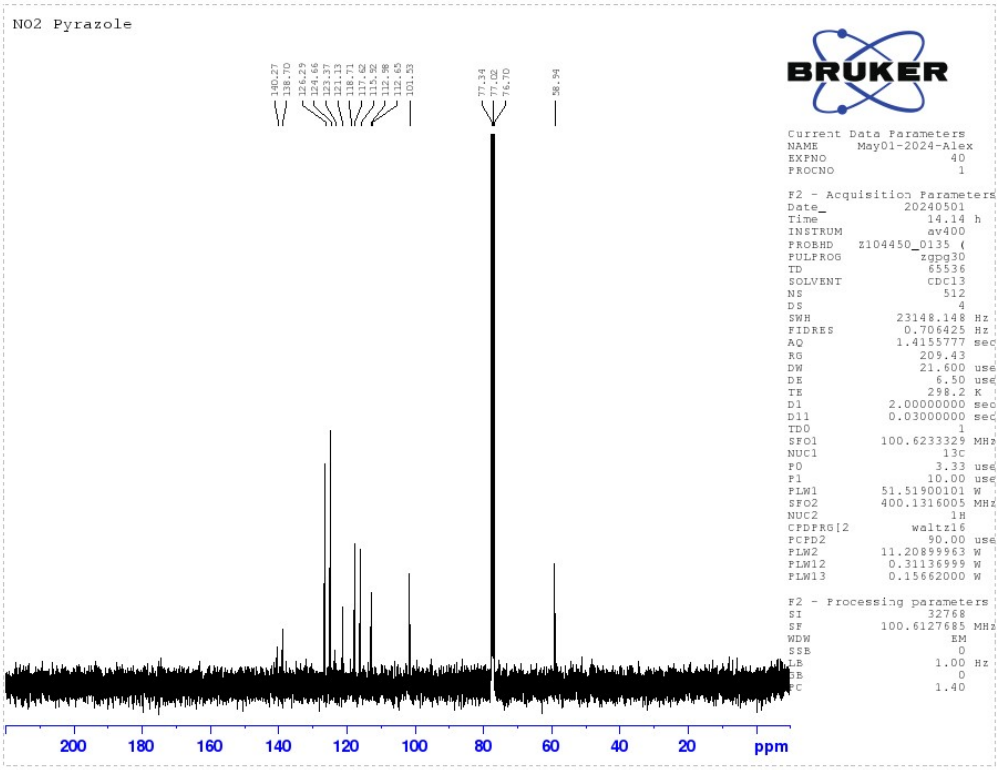
Synthesis of 4-(1-methyl-3-(pyridin-2-yl)-1H-pyrazol-5-yl)benzonitrile (**P6**)



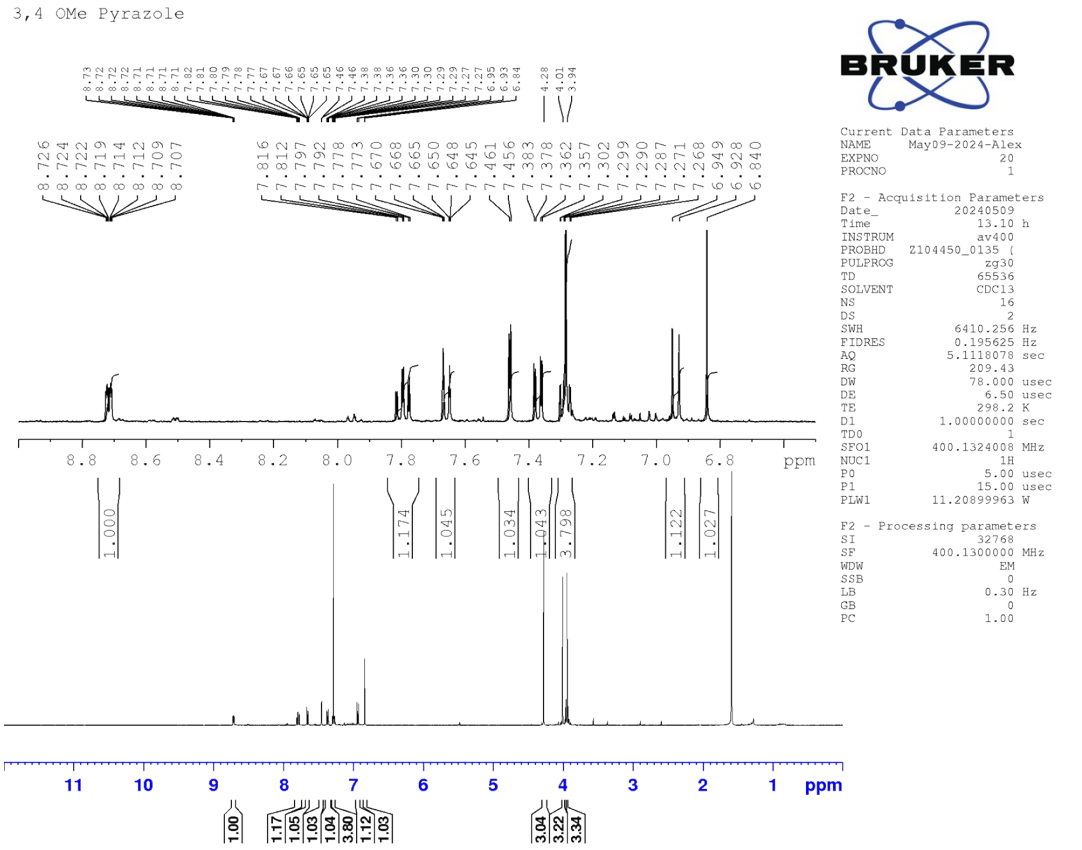


Synthesis of 2-(5-(4-methoxyphenyl)-1-methyl-1H-pyrazol-3-yl)pyridine (**P7**)





Synthesis of 2-(5-(3,4-dimethoxyphenyl)-1-methyl-1H-pyrazol-3-yl)pyridine (**P9**)



BRUKER

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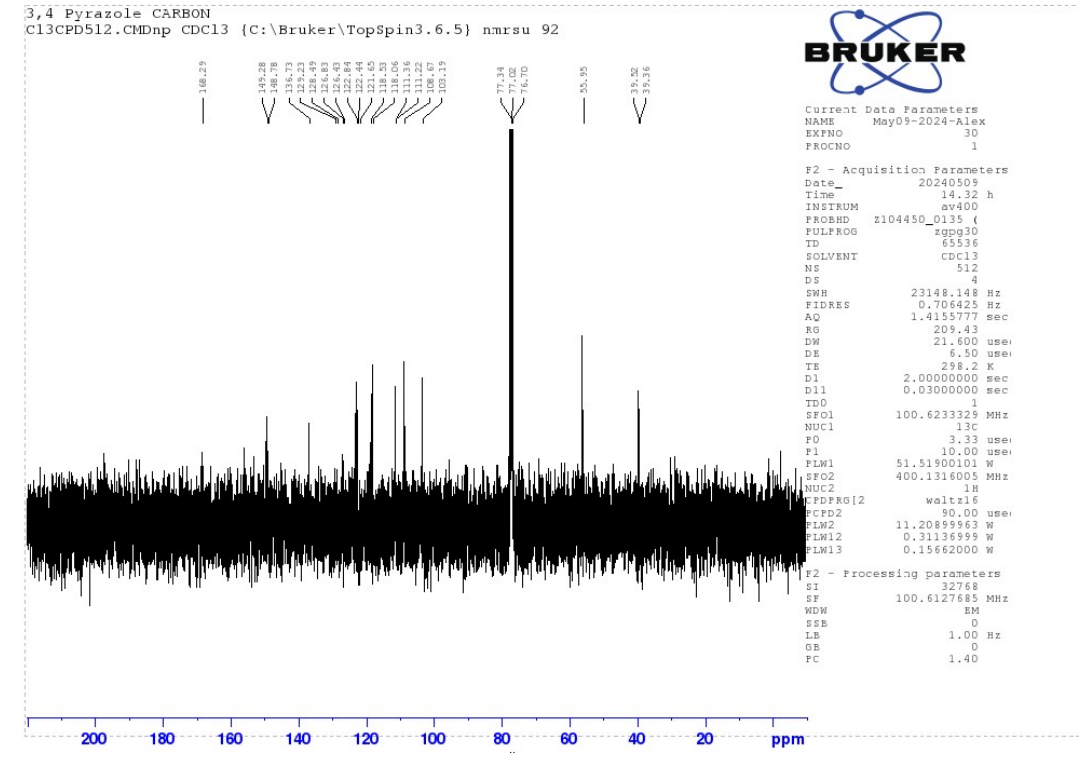
Current Data Parameters
NAME      May09-2024-Alex
EXPNO                 20
PROCNO                 1

F2 - Acquisition Parameters
Date_           20240509
Time              13.10 h
INSTRUM             av400
PROBHD    Z104450_0135 (
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH             6410.256 Hz
FIDRES          0.195625 Hz
AQ              5.1118078 sec
RG                 209.43
DW                 78.000 usec
DE                  6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1
SFO1           400.1324008 MHz
NUC1                  1H
P0                  5.00 usec
P1                 15.00 usec
PLW1           11.20899963 W

F2 - Processing parameters
SI                 32768
SF            400.1300000 MHz
WDW                   EM
SSB                    0
LB                  0.30 Hz
GB                     0
PC                  1.00
```



BRUKER

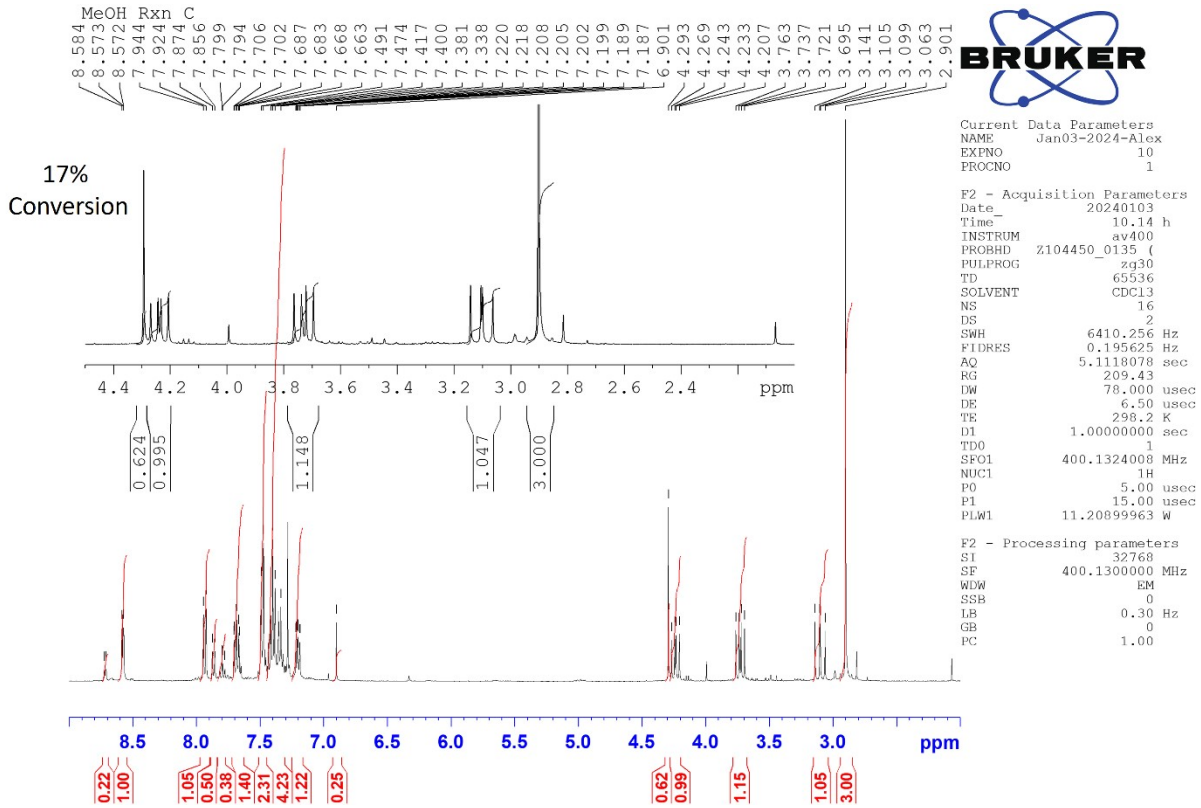
```
Current Data Parameters
NAME      May09-2024-Alex
EXPNO                 30
PROCNO                 1

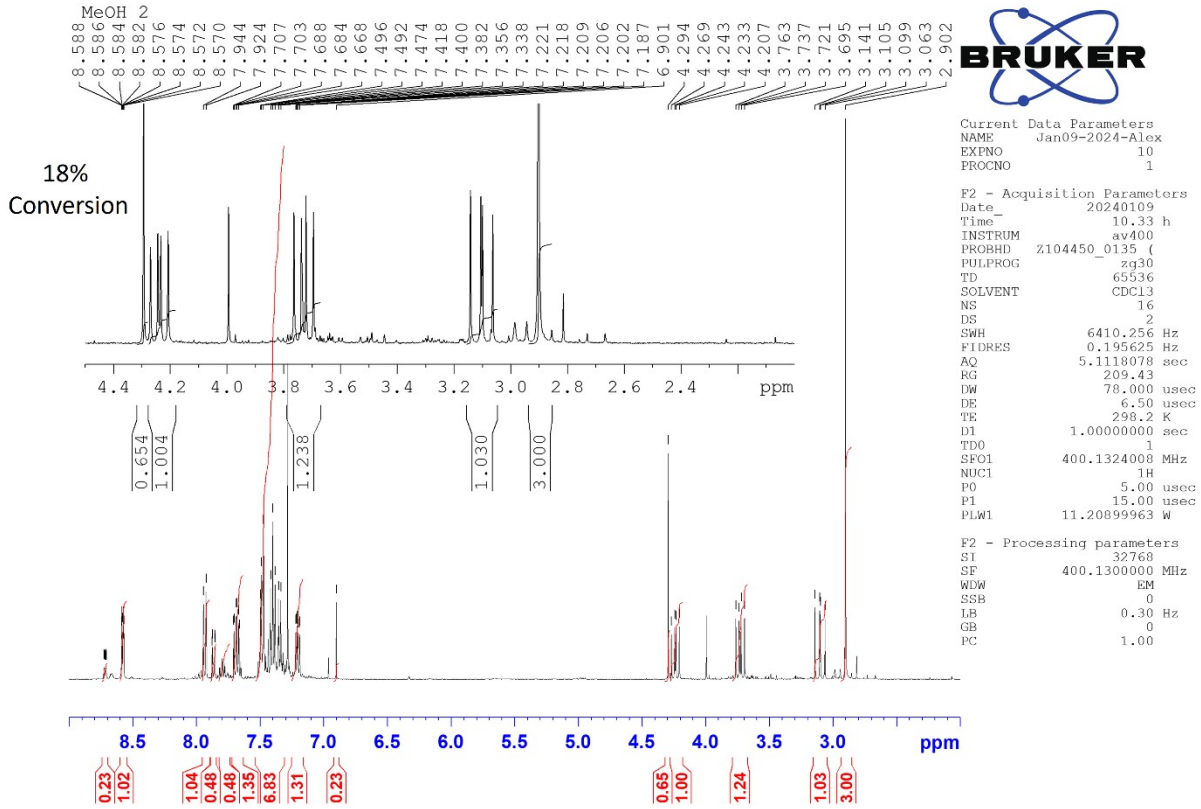
F2 - Acquisition Parameters
Date_           20240509
Time              14.32 h
INSTRUM             av400
PROBHD    Z104450_0135 (
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   512
DS                     4
SWH            23148.148 Hz
FIDRES          0.706425 Hz
AQ              1.4155777 sec
RG                 209.43
DW                 21.600 use
DE                  6.50 use
TE                298.2 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1
SFO1          100.6233329 MHz
NUC1                  13C
P0                  3.33 use
P1                 10.00 use
PLW1           51.51900101 W
SFO2          400.1316005 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2              90.00 use
PLW2           11.20899963 W
PLW12           0.31136999 W
PLW13           0.15662000 W

F2 - Processing parameters
SI                 32768
SF            100.6127685 MHz
WDW                   EM
SSB                    0
LB                  1.00 Hz
GB                     0
PC                  1.40
```

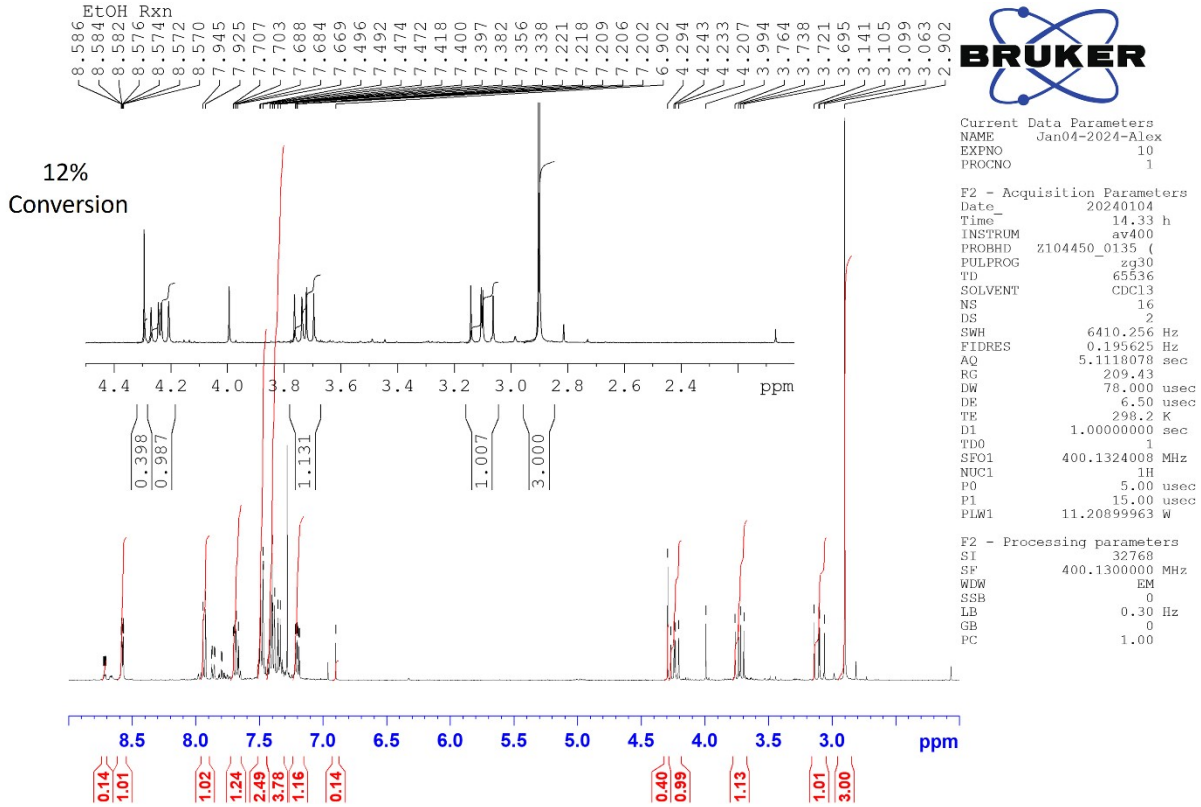
Reaction Screening ^{1}H NMR Studies

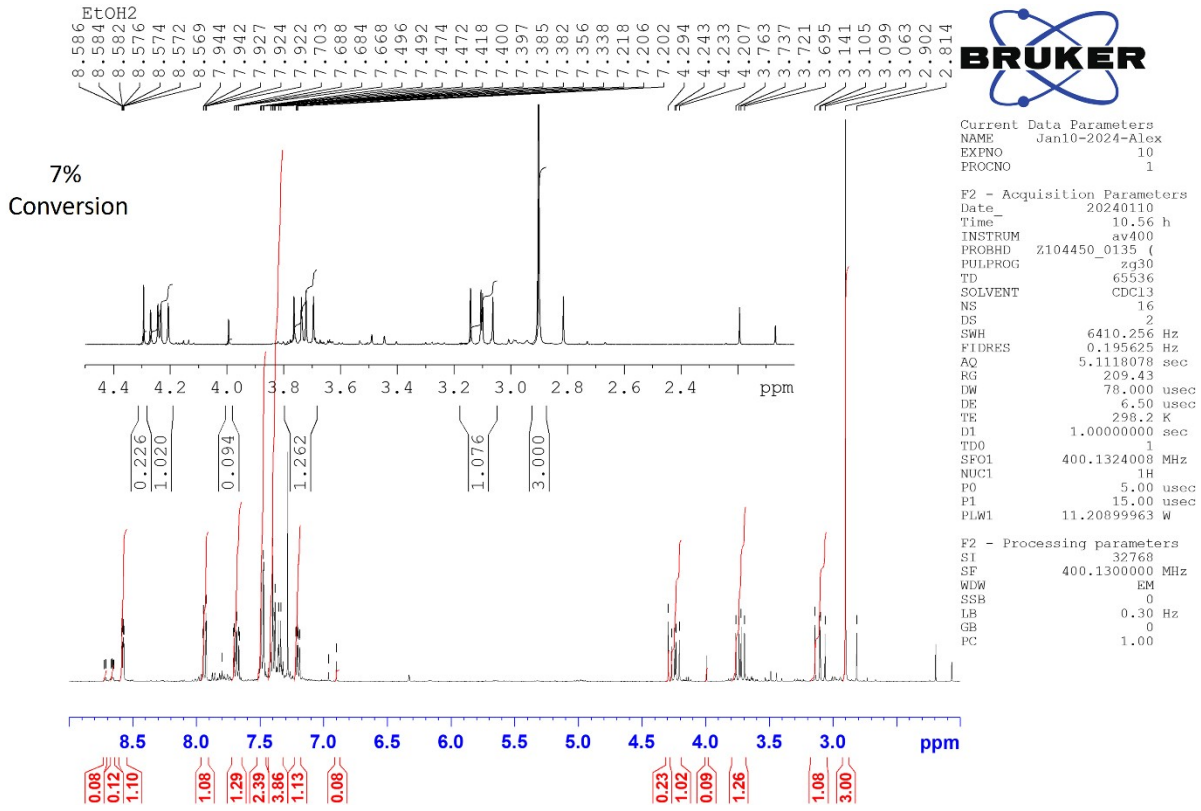
Solvent Screen: MeOH



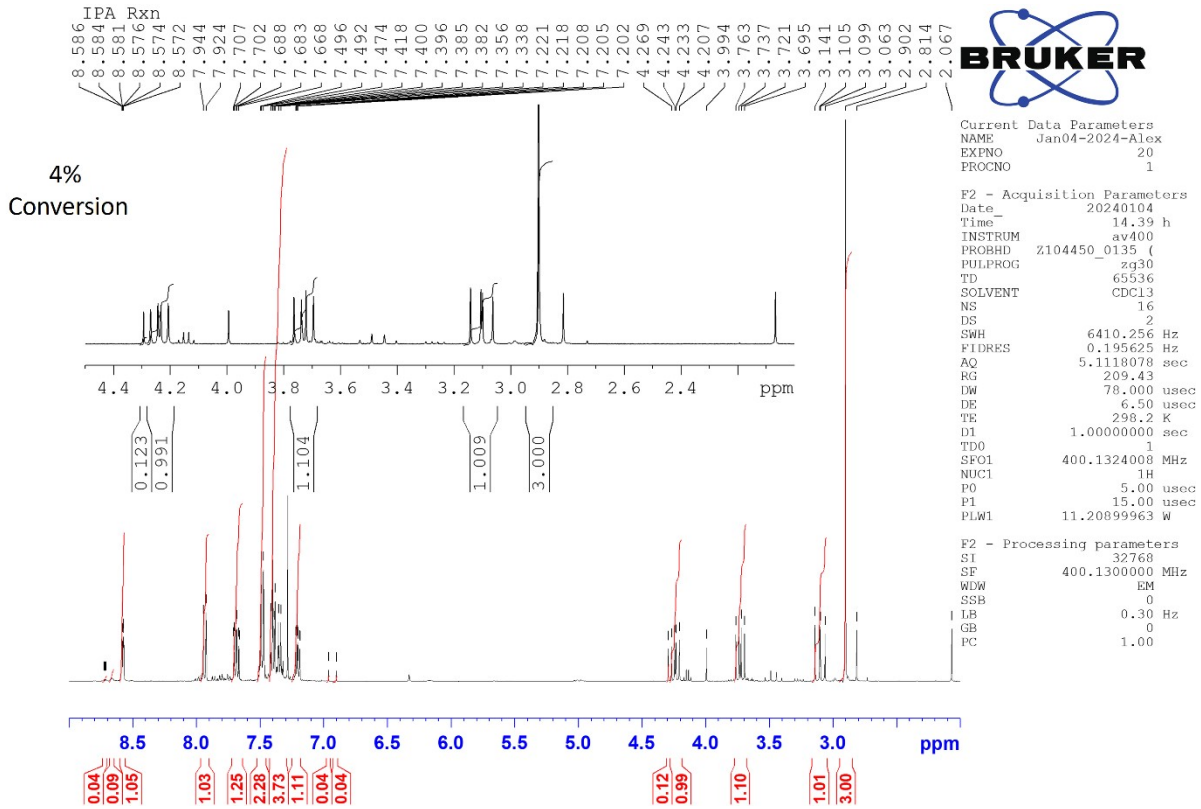


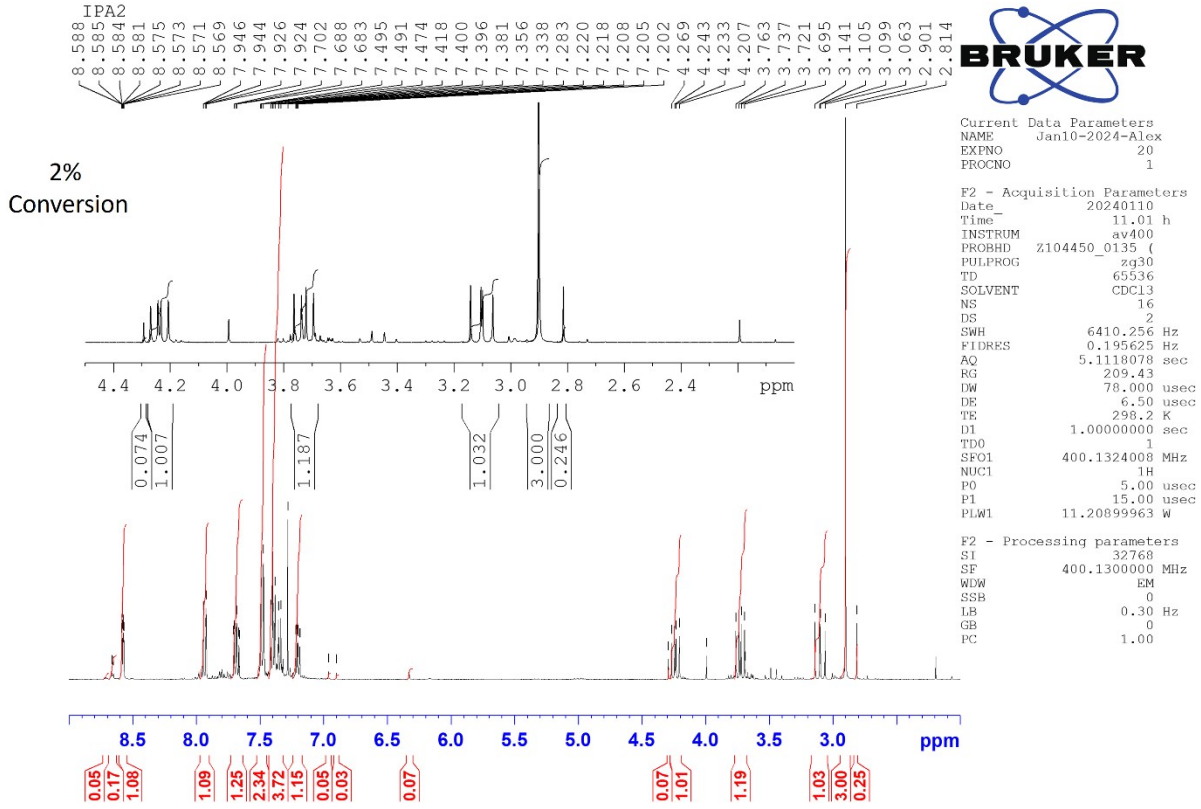
Solvent Screen: EtOH



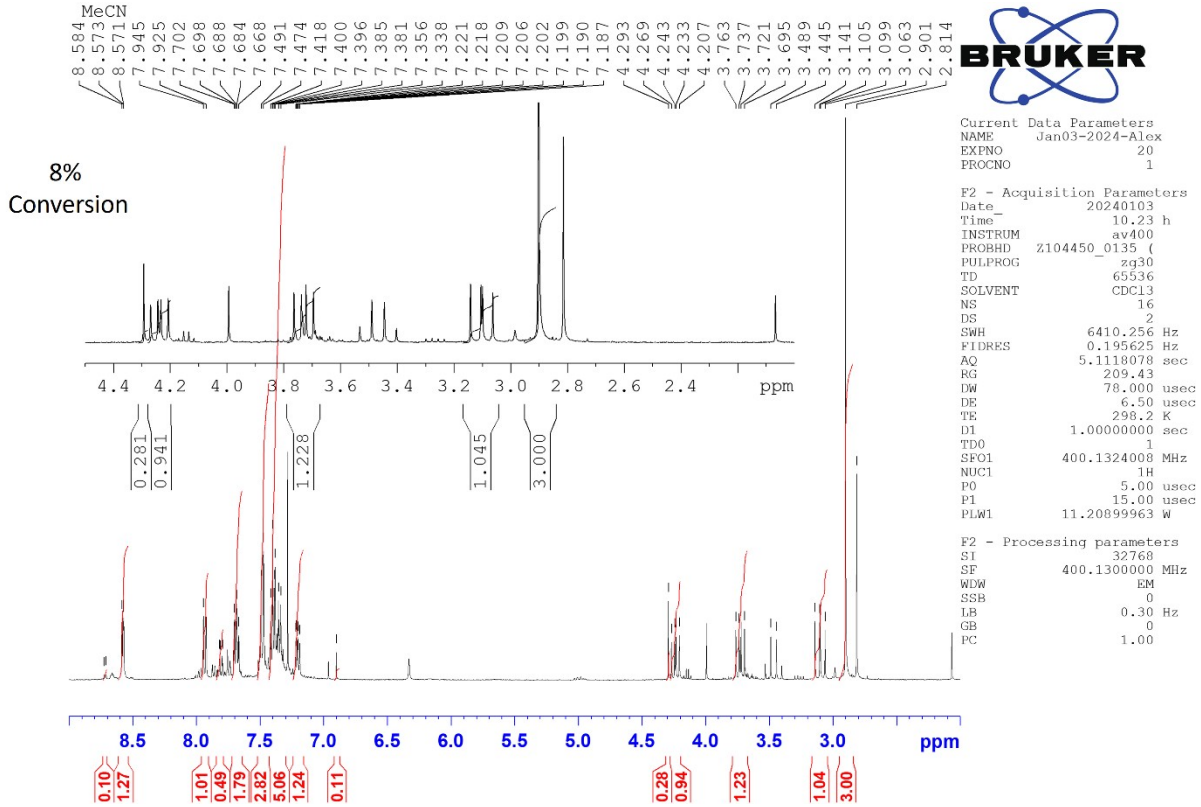


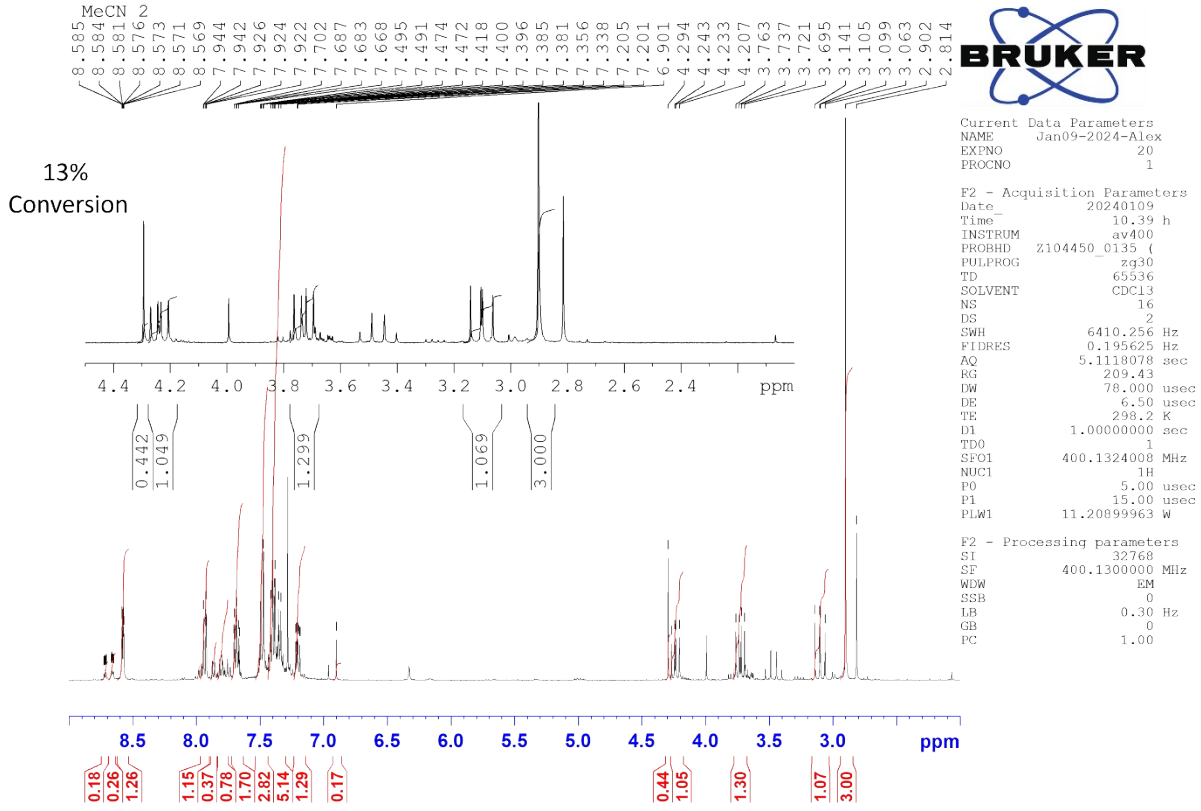
Solvent Screen: EtOH



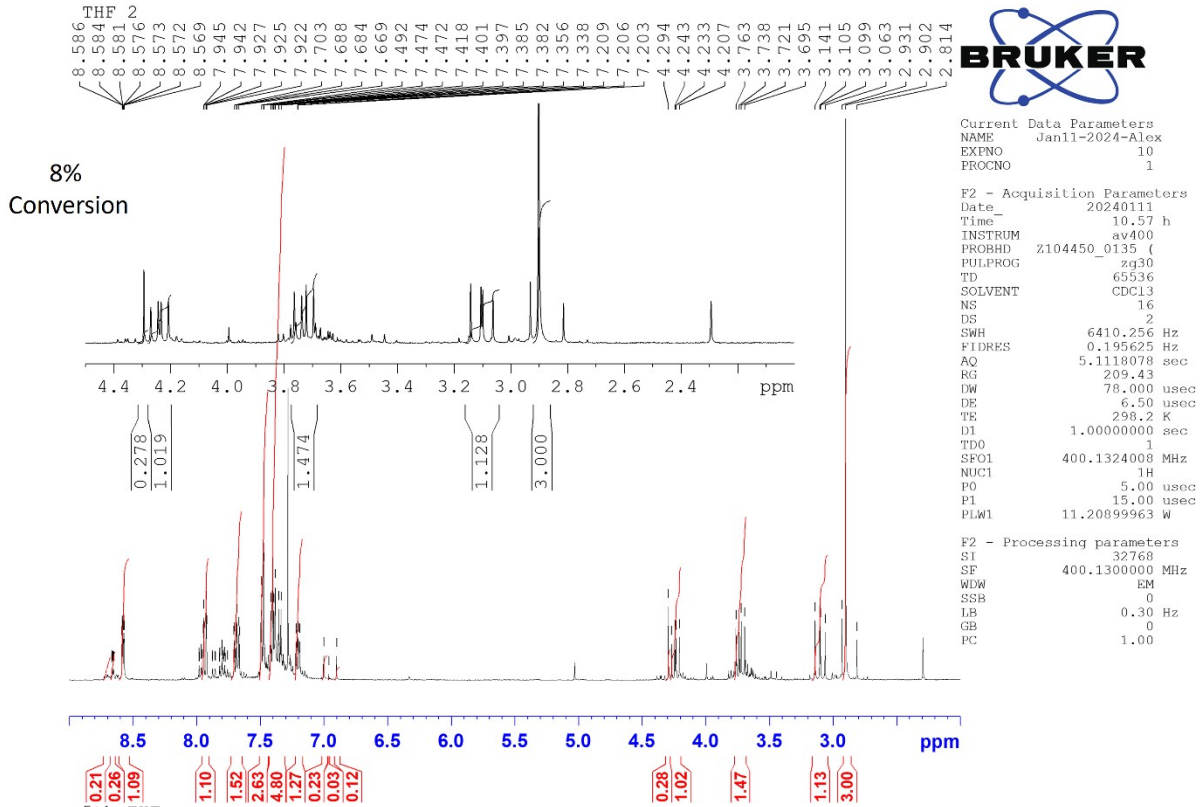


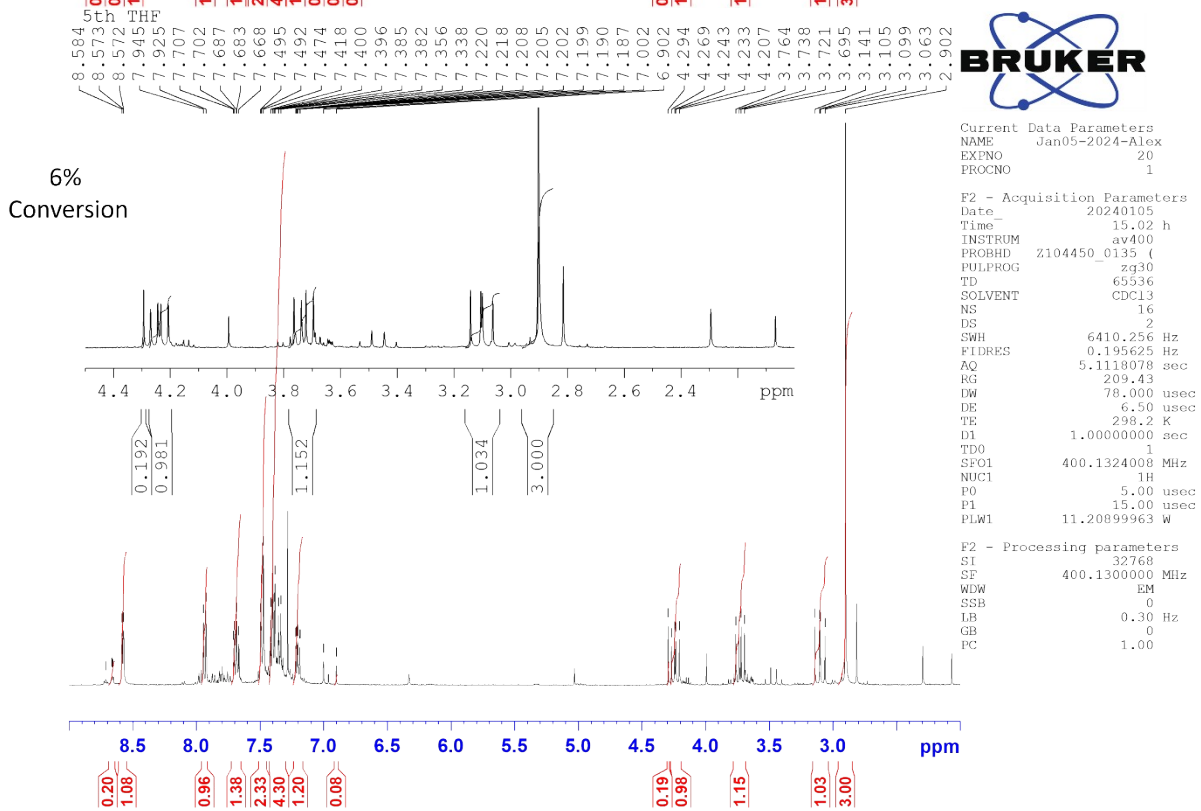
Solvent Screen: MeCN



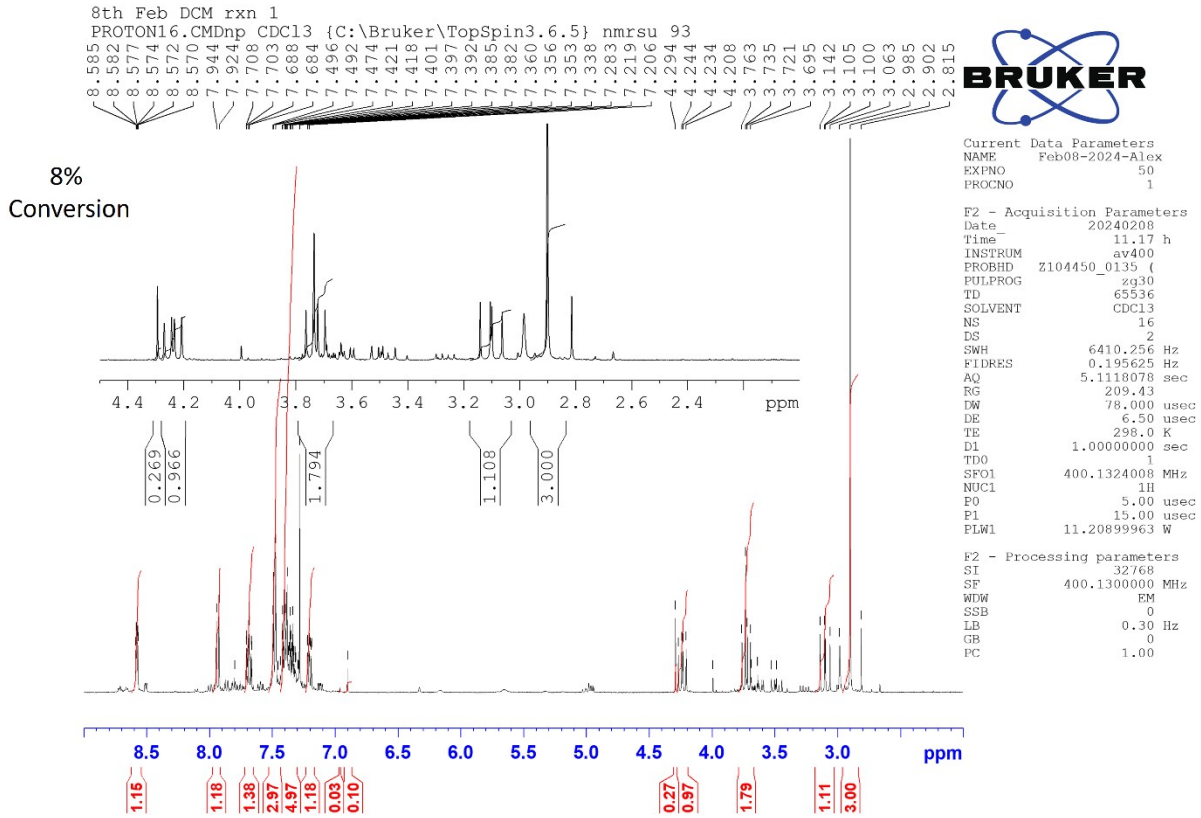


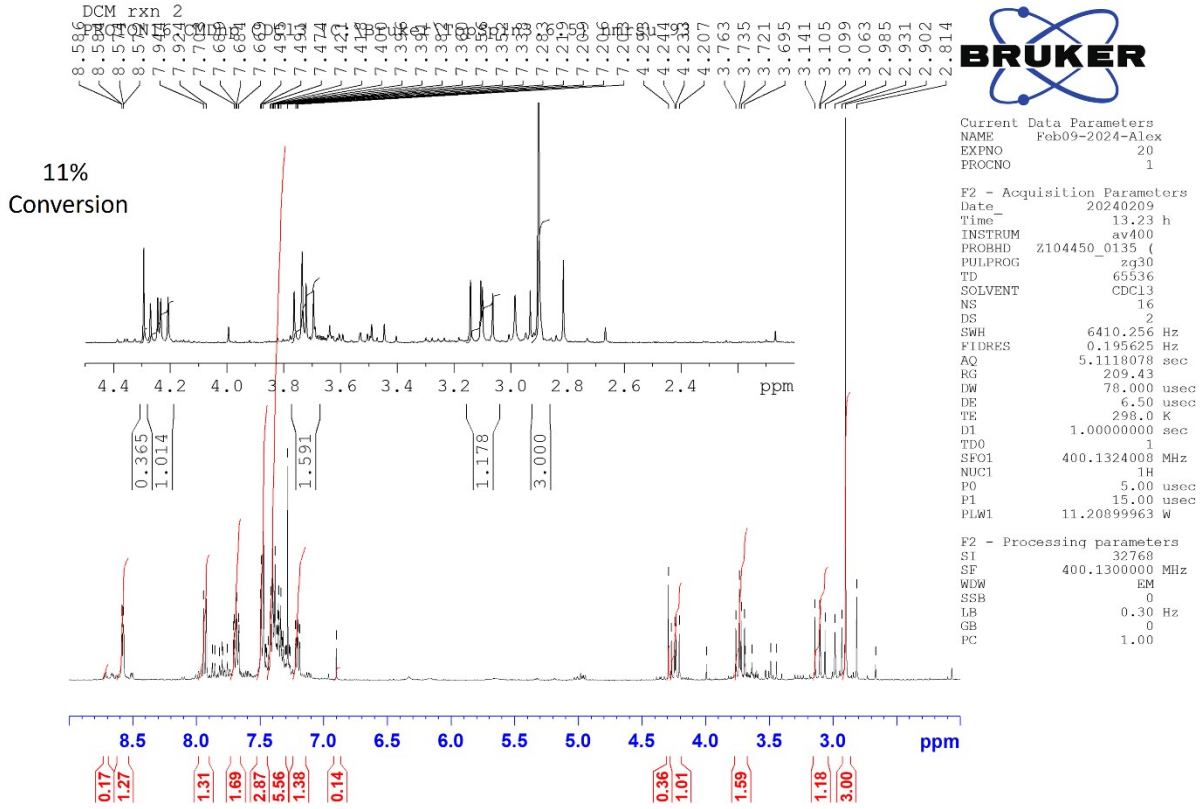
Solvent Screen: THF



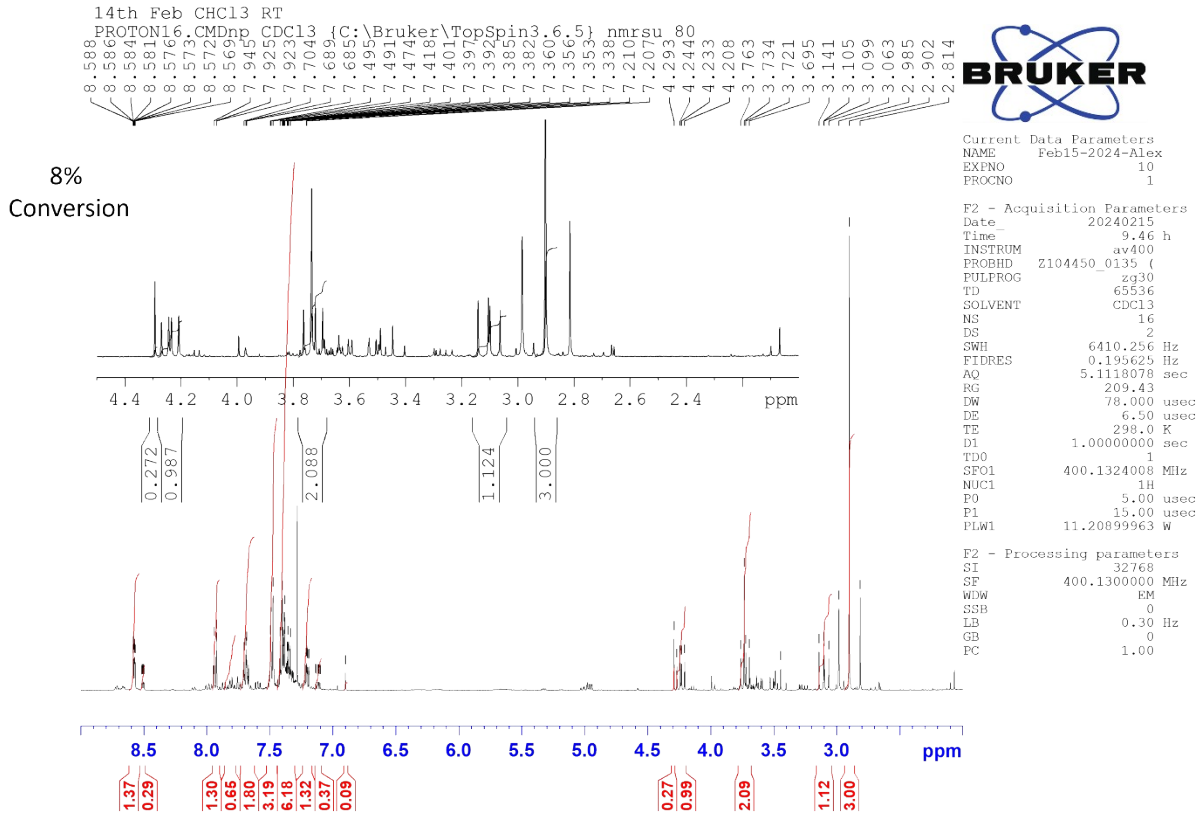


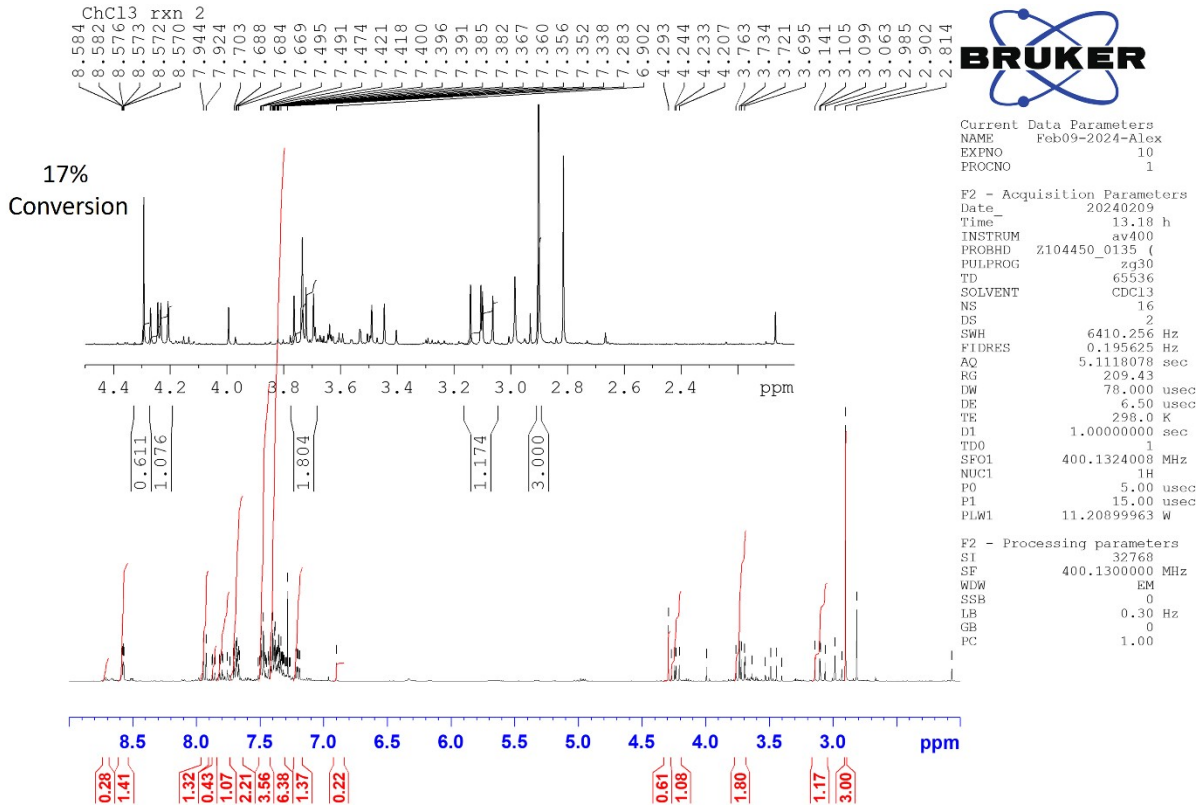
Solvent Screen: CH_2Cl_2



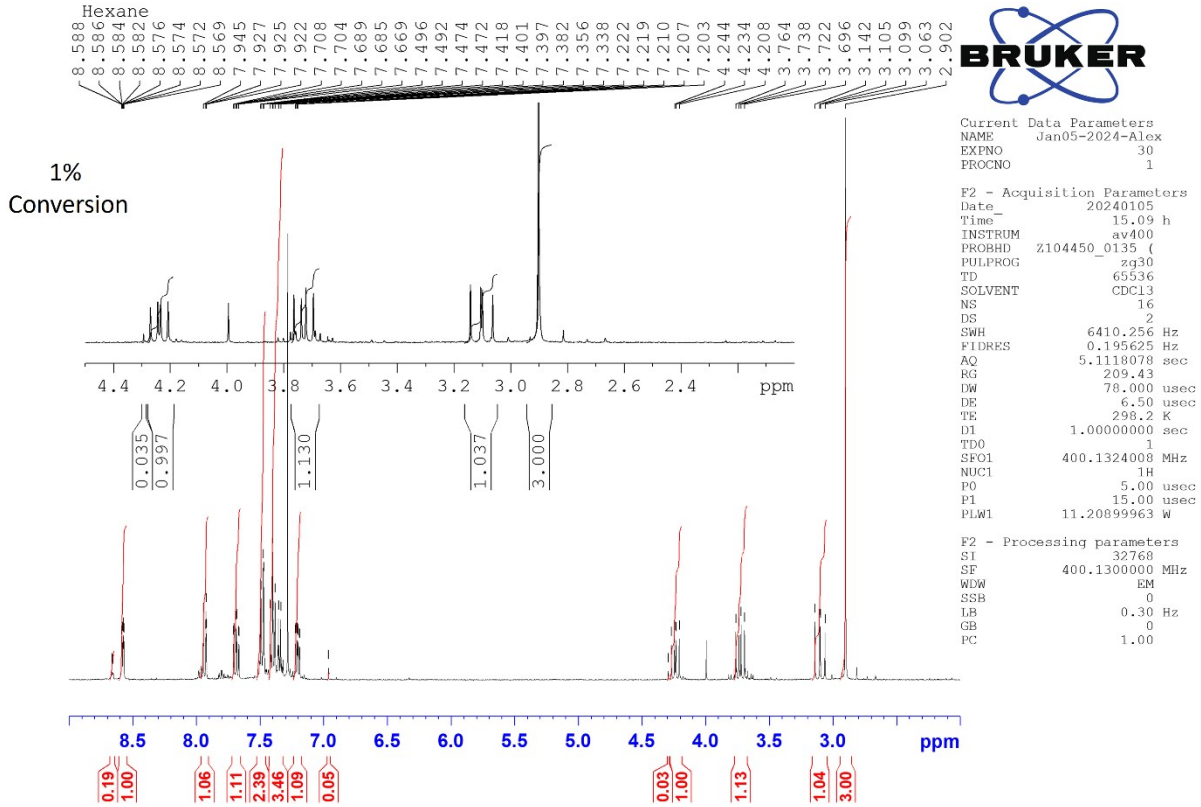


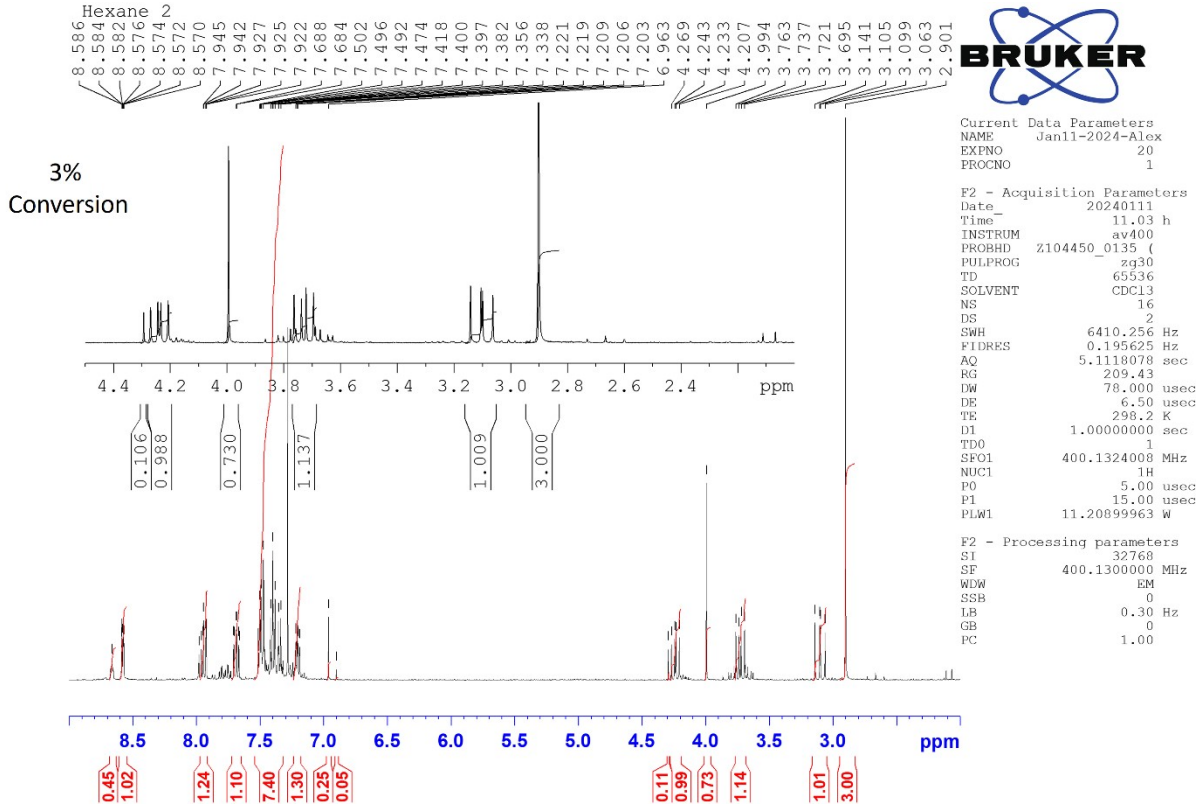
Solvent Screen: $CHCl_3$



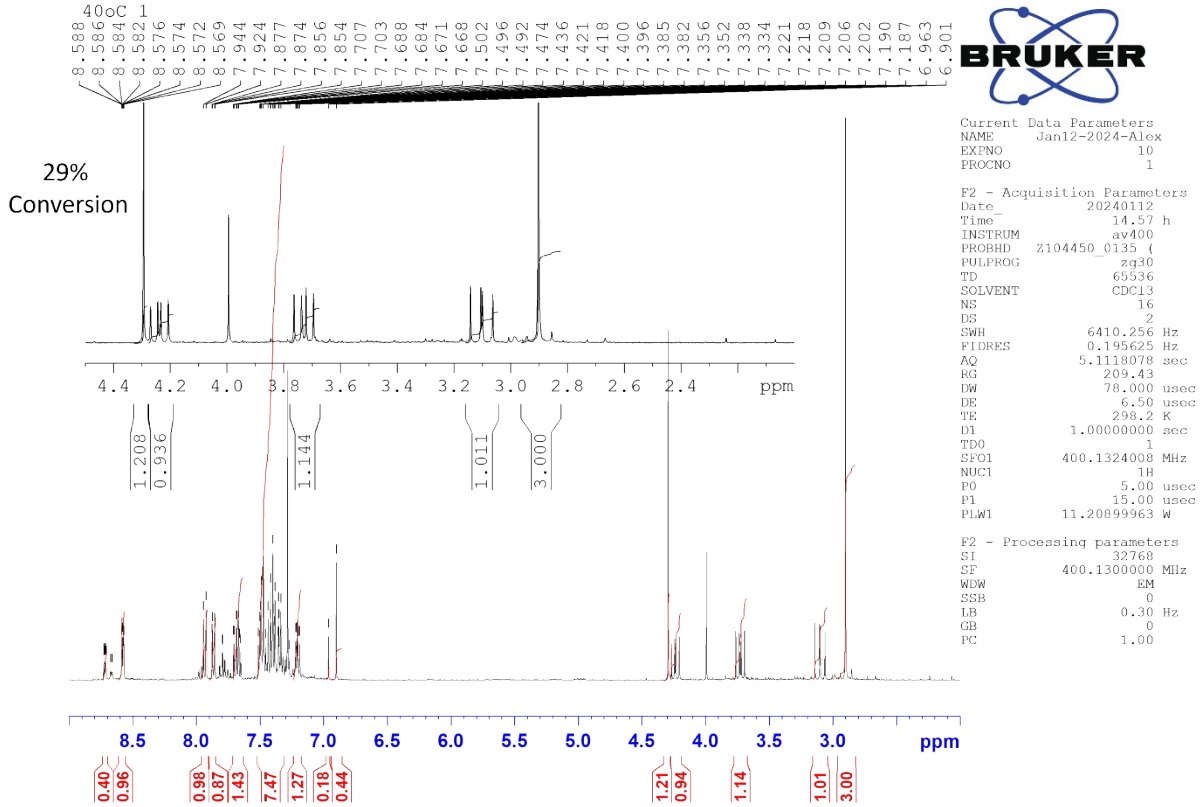


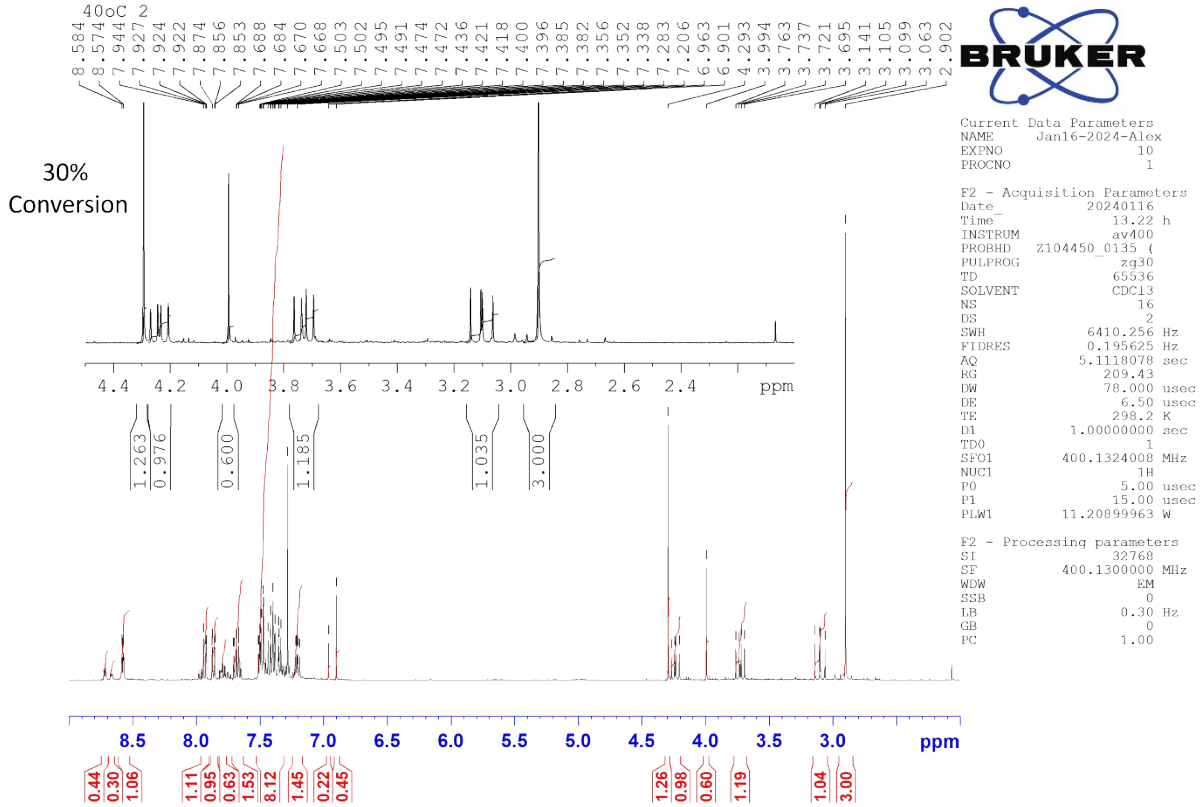
Solvent Screen: Hexane



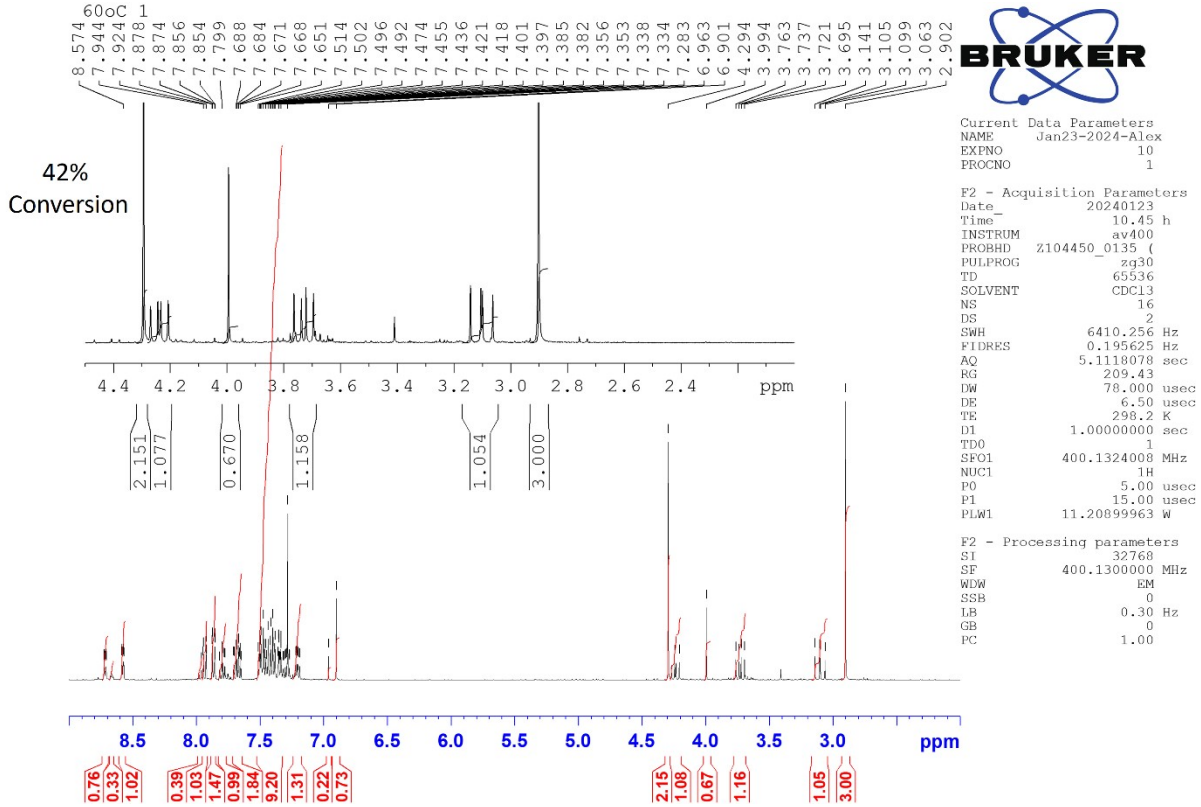


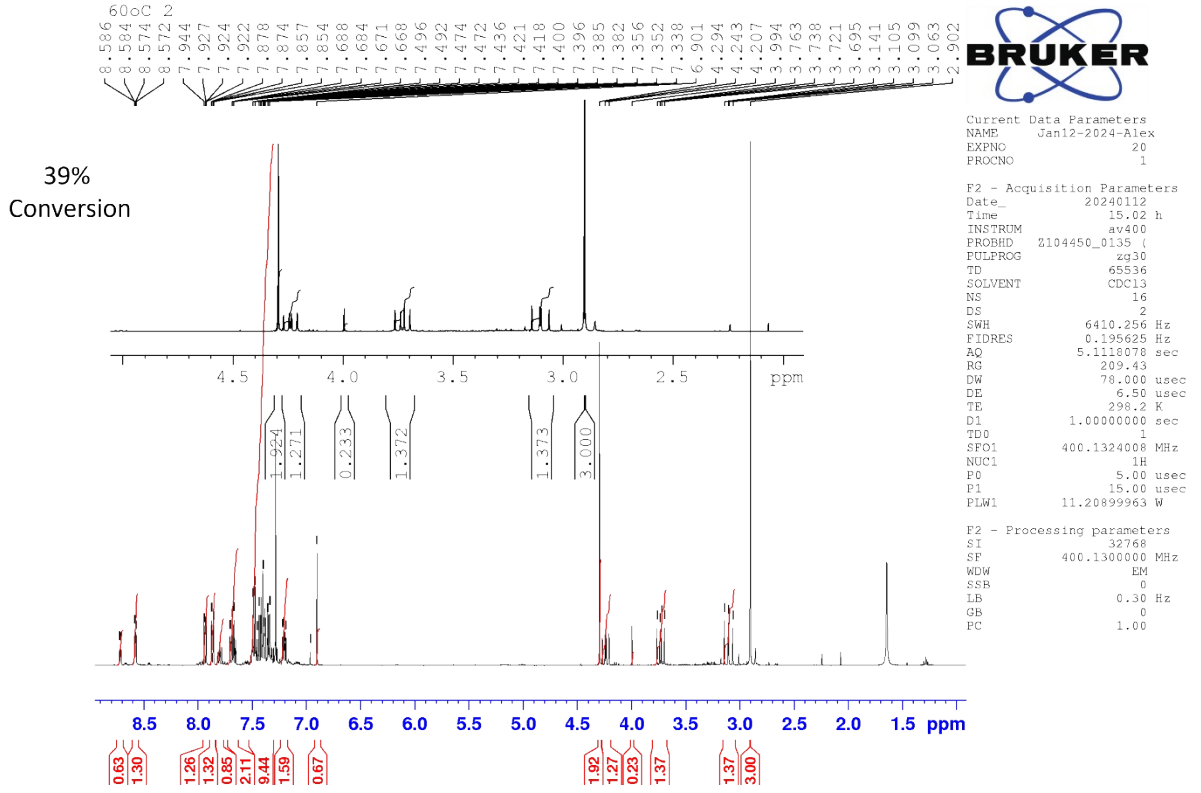
Solvent Screen: 40°C Temperature



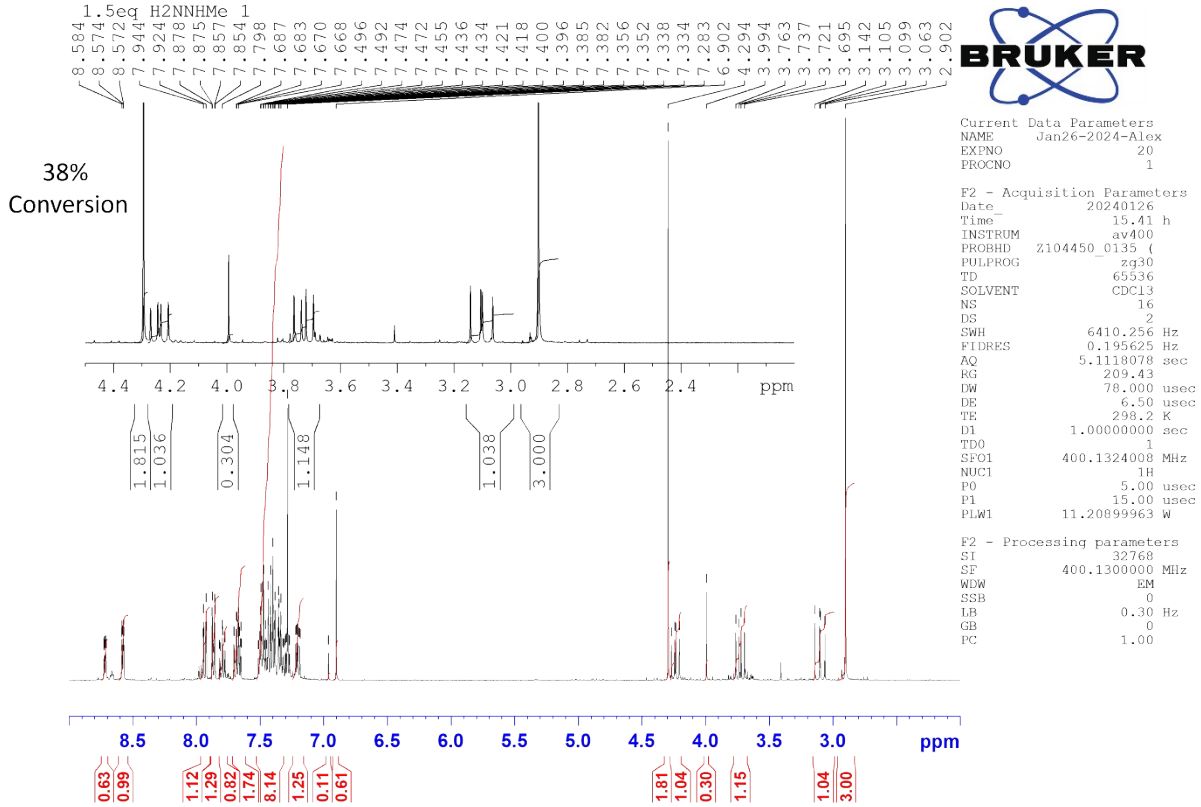


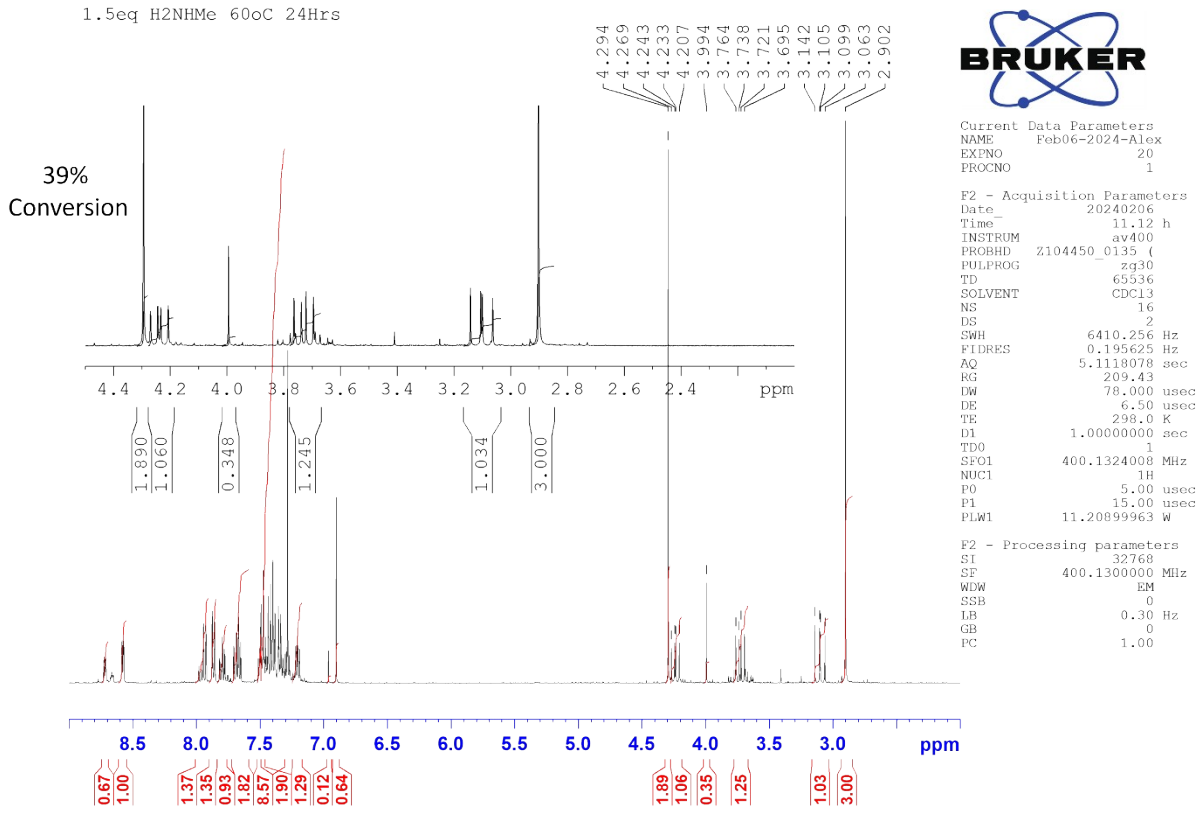
Solvent Screen: 60°C Temperature



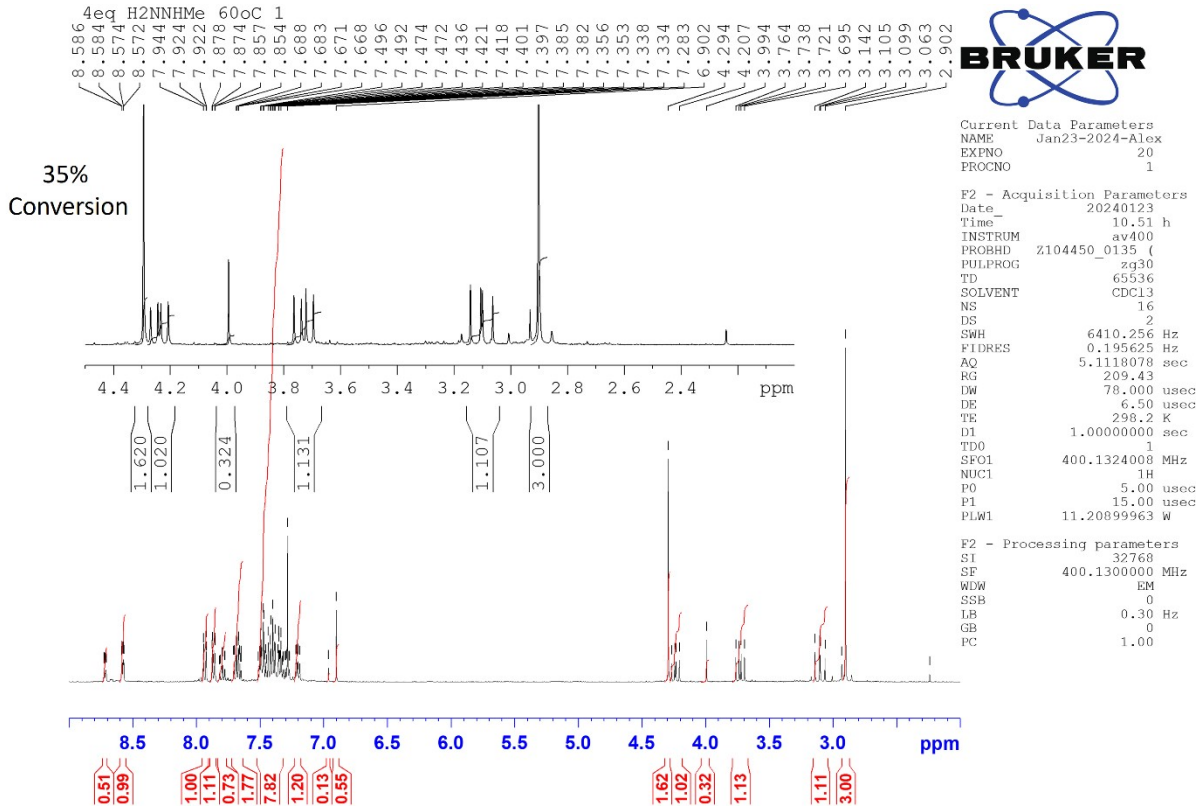


Eq. Screen: 1.5 eq. H_2NNHMe





Eq. Screen: 4.0 eq. H_2NNHMe

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Current Data Parameters
NAME      Jan23-2024-Alex
EXPNO                 20
PROCNO                 1

F2 - Acquisition Parameters
Date_           20240123
Time               10.51 h
INSTRUM            av400
PROBHD    Z104450_0135 (
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH             6410.256 Hz
FIDRES          0.195625 Hz
AQ              5.1118078 sec
RG                 209.43
DW                 78.000 usec
DE                   6.50 usec
TE                 298.2 K
D1              1.00000000 sec
TD0                    1
SFO1          400.1324008 MHz
NUC1                  1H
P0                   5.00 usec
P1                  15.00 usec
PLW1           11.20899963 W

F2 - Processing parameters
SI                 32768
SF            400.1300000 MHz
WDW                   EM
SSB                    0
LB                  0.30 Hz
GB                     0
PC                  1.00
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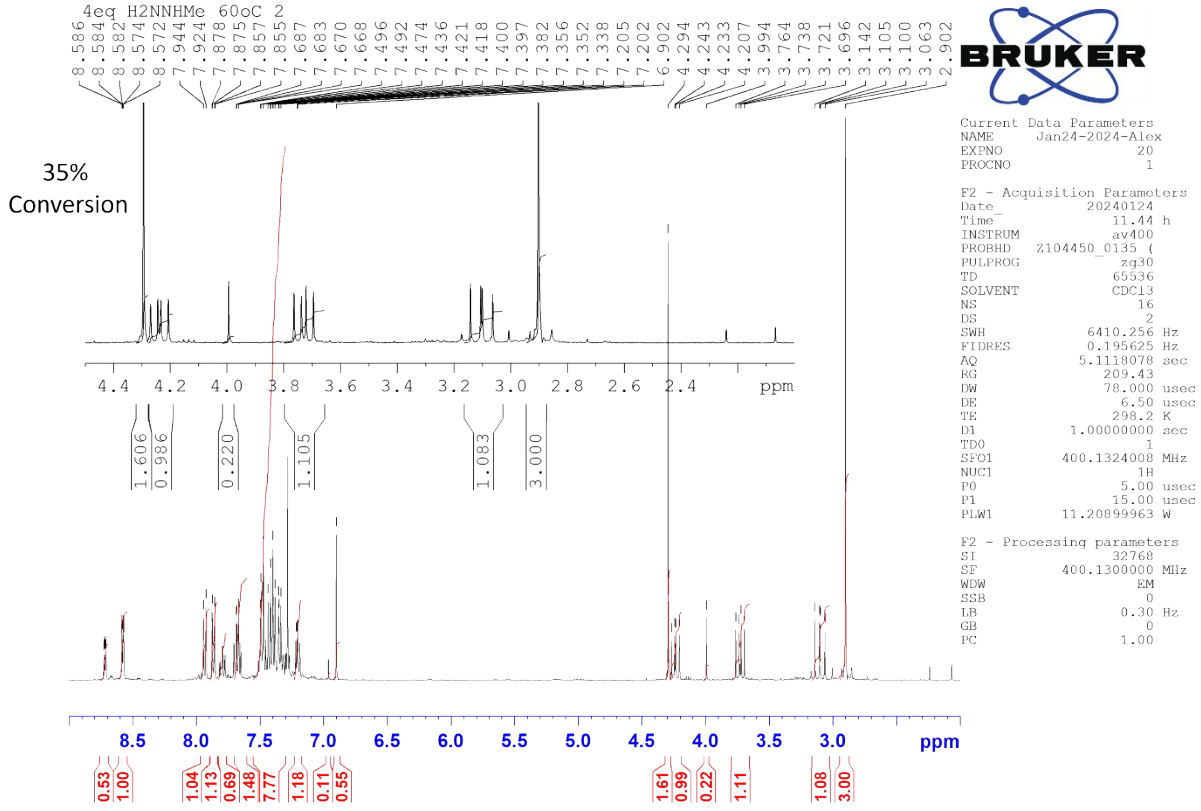


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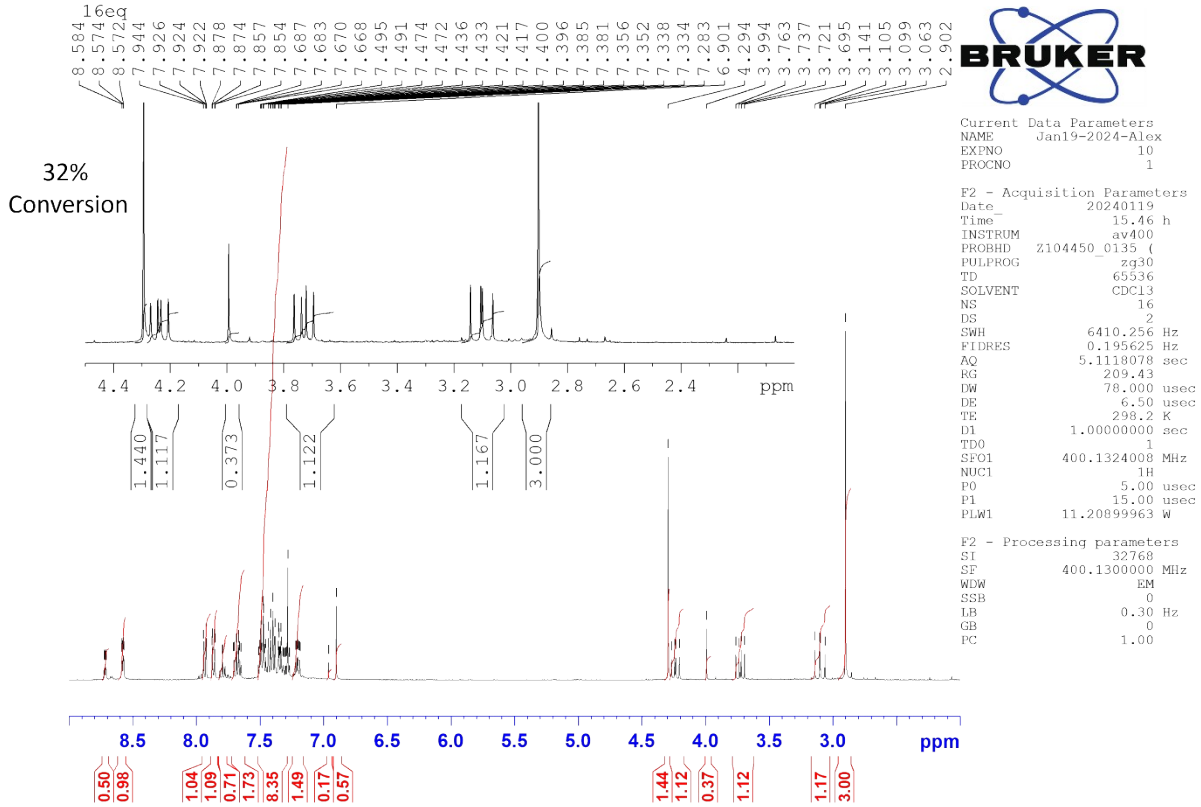
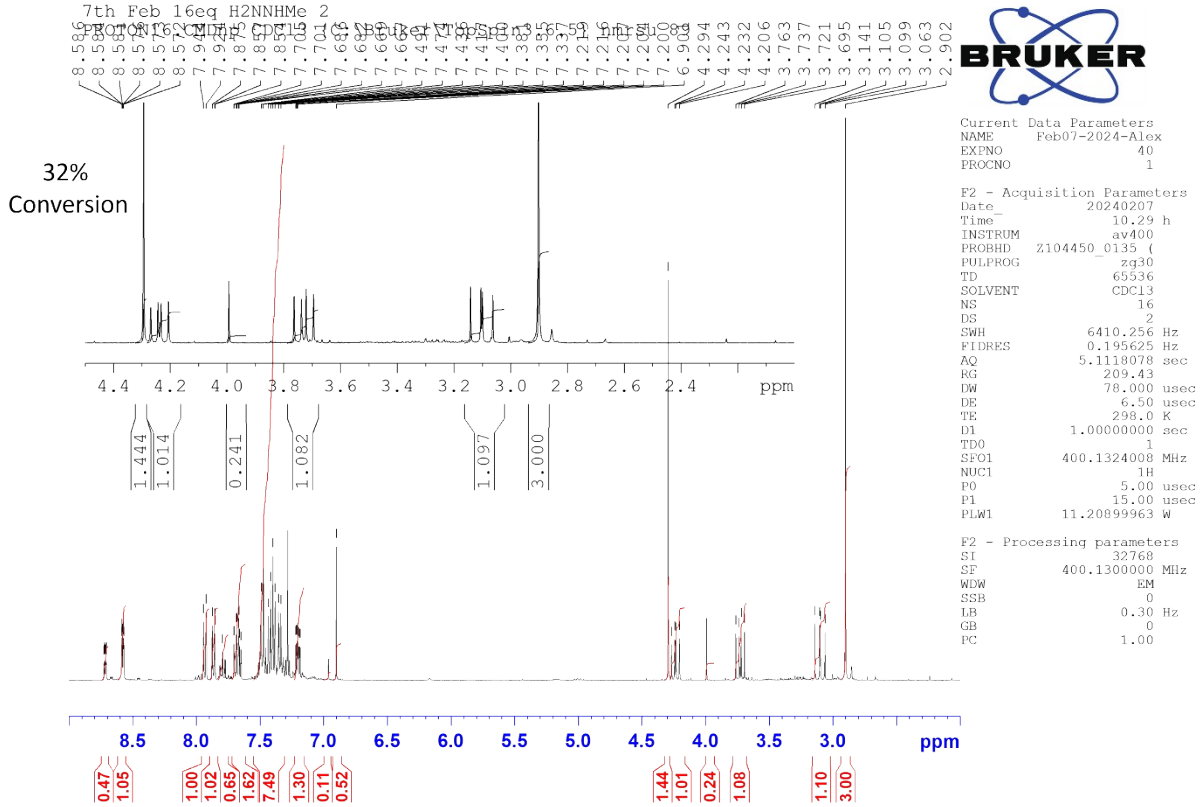
Current Data Parameters
NAME      Jan24-2024-Alex
EXPNO                 20
PROCNO                 1

F2 - Acquisition Parameters
Date_           20240124
Time               11.44 h
INSTRUM            av400
PROBHD    Z104450_0135 (
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH             6410.256 Hz
FIDRES          0.195625 Hz
AQ              5.1118078 sec
RG                 209.43
DW                 78.000 usec
DE                   6.50 usec
TE                 298.2 K
D1              1.00000000 sec
TD0                    1
SFO1          400.1324008 MHz
NUC1                  1H
P0                   5.00 usec
P1                  15.00 usec
PLW1           11.20899963 W

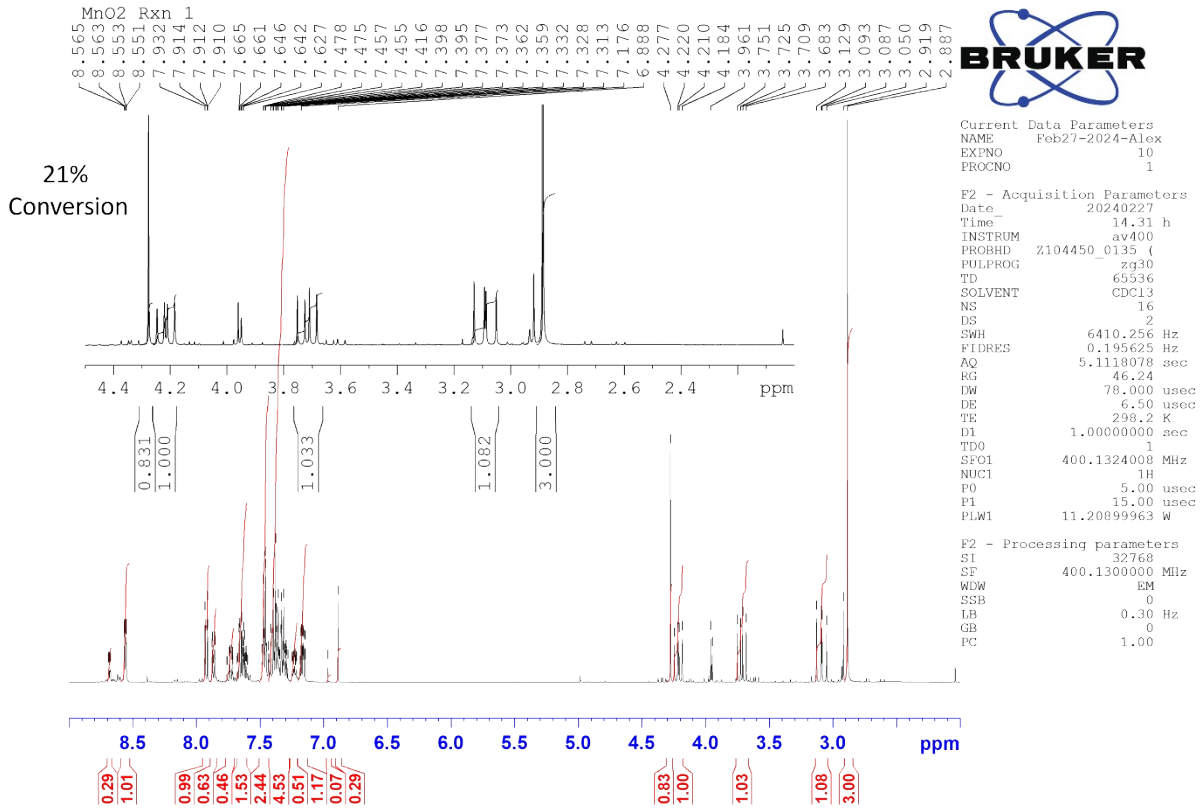
F2 - Processing parameters
SI                 32768
SF            400.1300000 MHz
WDW                   EM
SSB                    0
LB                  0.30 Hz
GB                     0
PC                  1.00
```

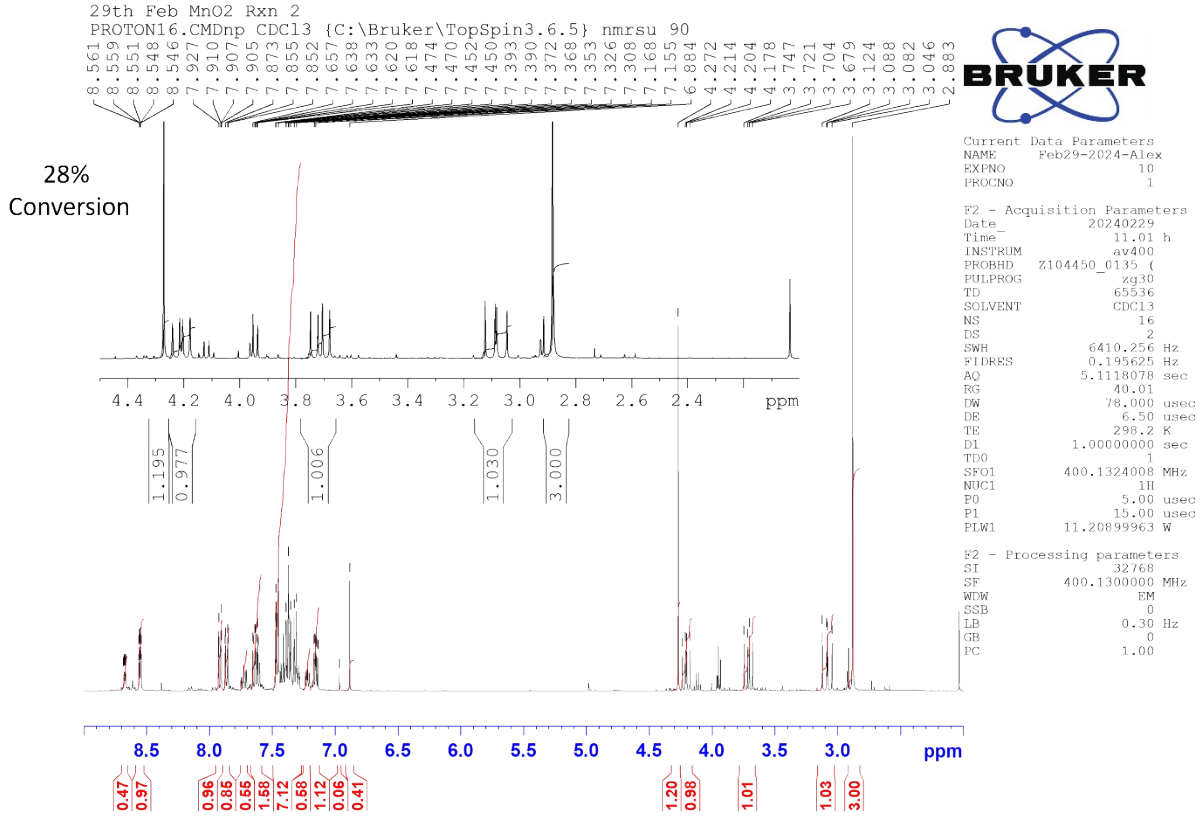
Eq. Screen: 16.0 eq. H_2NNHMe



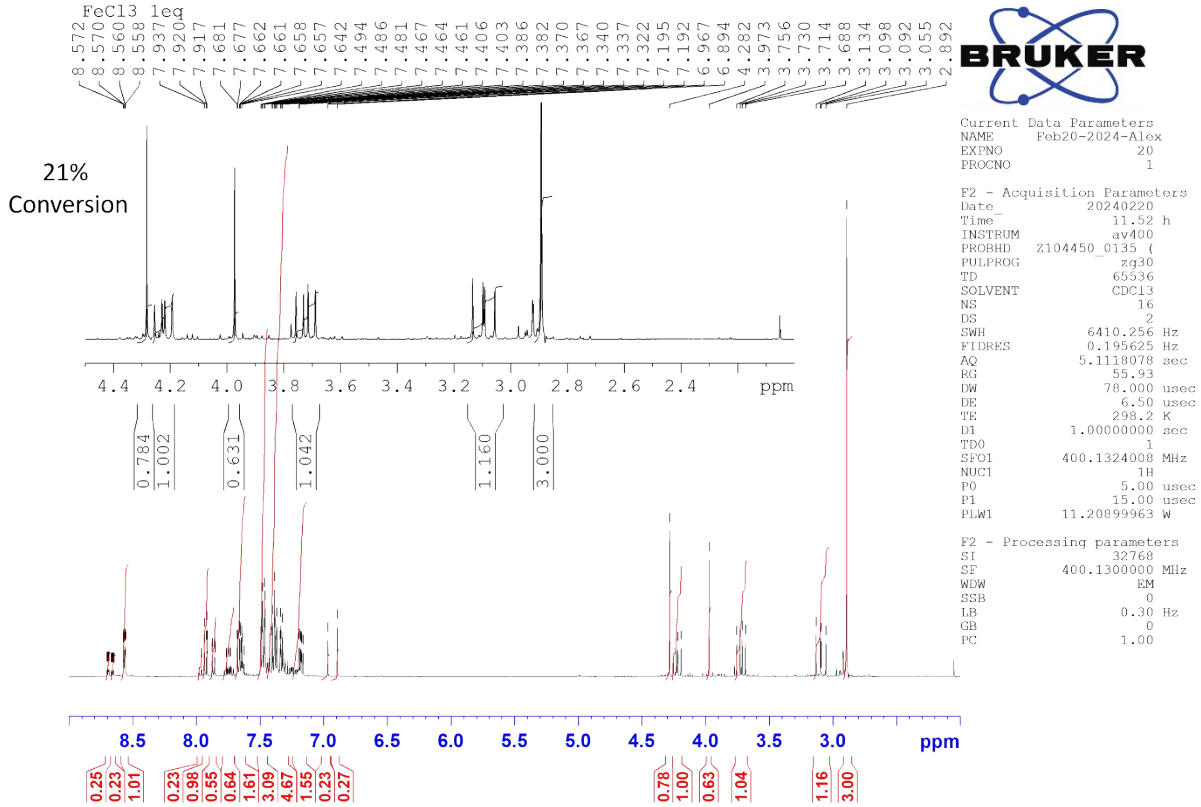


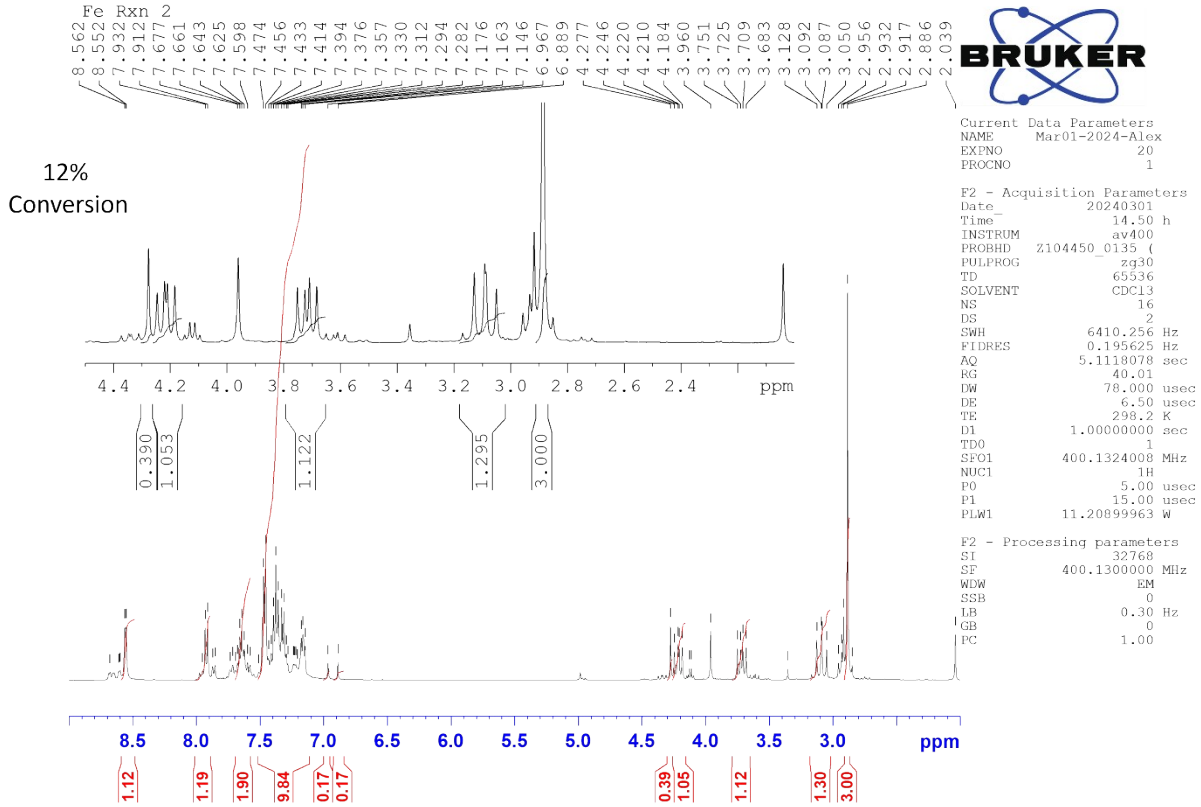
Oxidant Screen: MNO_2



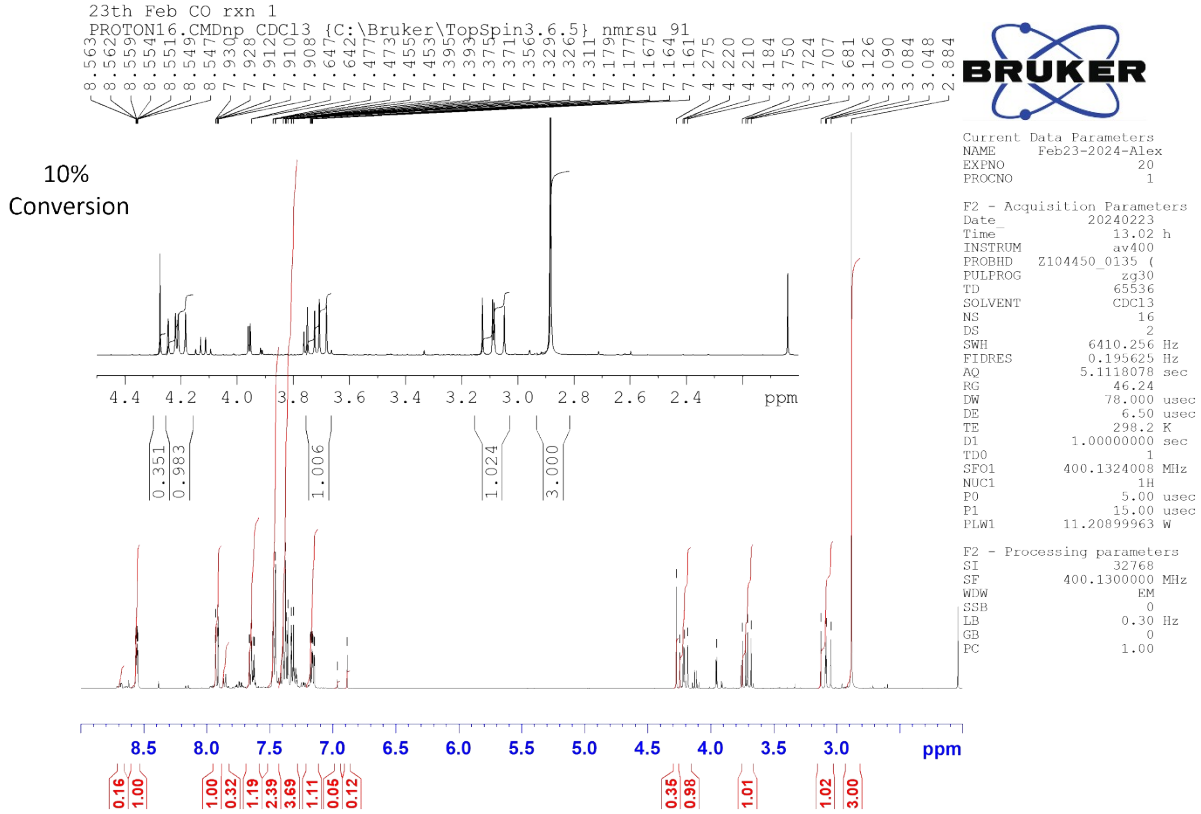


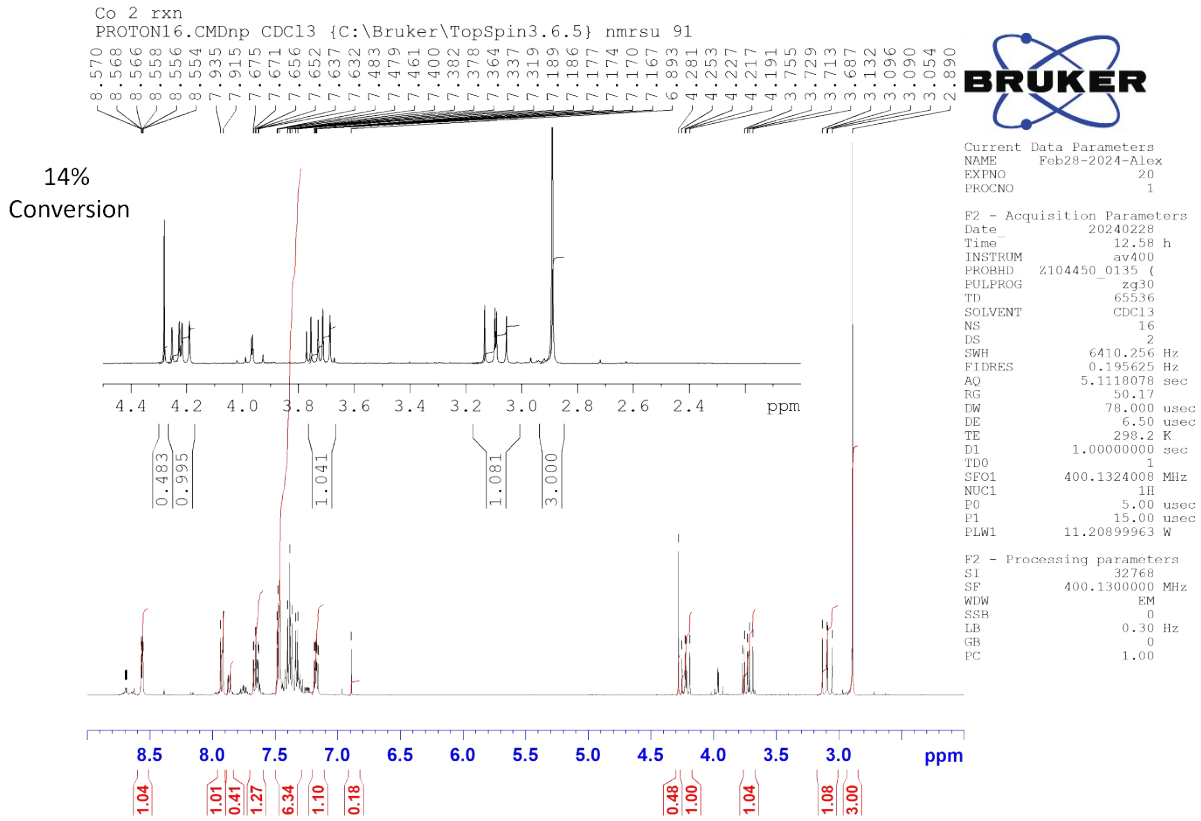
Oxidant Screen: $FeCl_3$



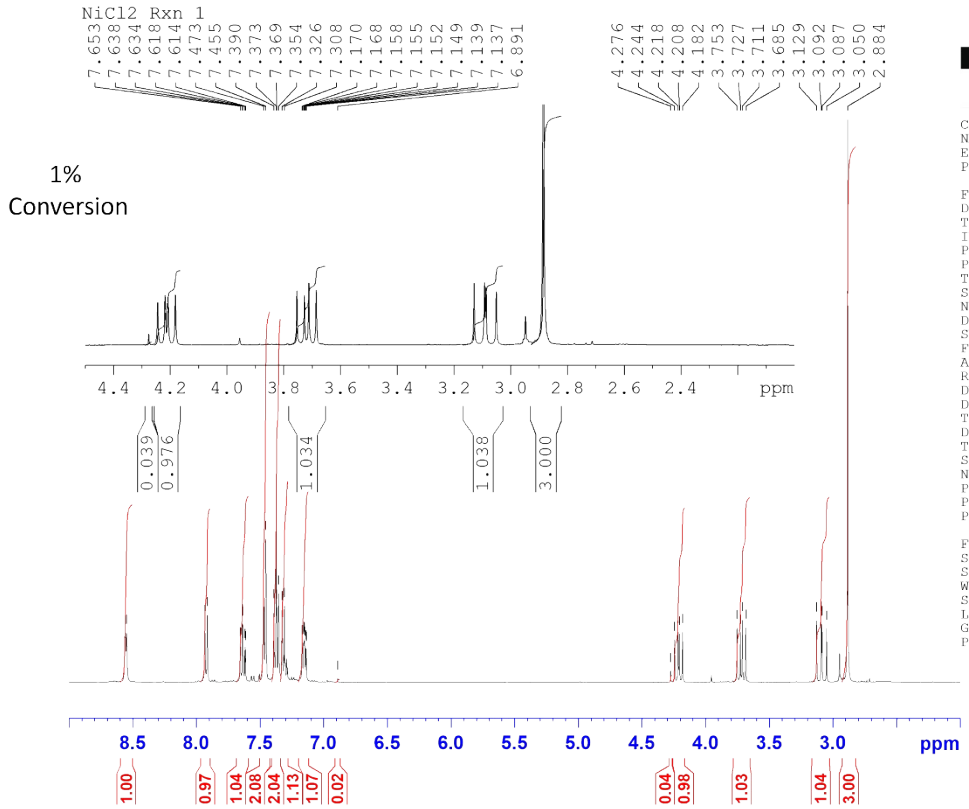


Oxidant Screen: $CoCl_2$





Oxidant Screen: $NiCl_2$

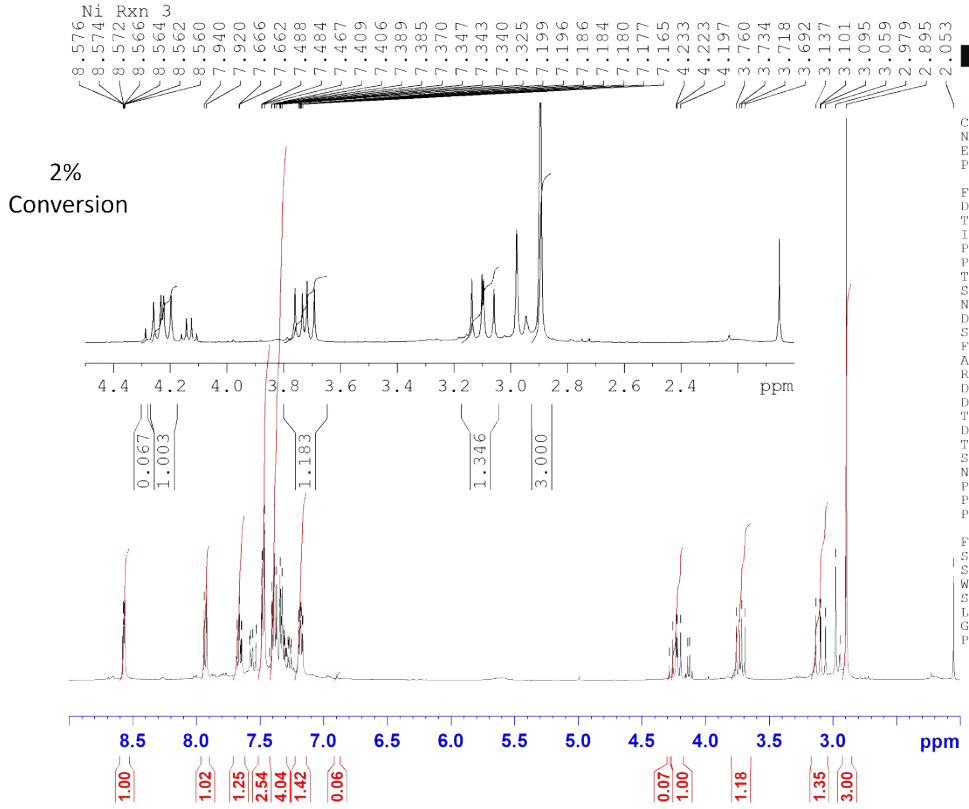


BRUKER

```
Current Data Parameters
NAME      Feb27-2024-Alex
EXPNO                 20
PROCNO                 1

F2 - Acquisition Parameters
Date_           20240227
Time_              14.37 h
INSTRUM            av400
PROBHD   Z104450_0135 (
PULPROG            zg30
TD                65536
SOLVENT           CDCl3
NS                   16
DS                    2
SWH             6410.256 Hz
FIDRES          0.195625 Hz
AQ              5.1118078 sec
RG                35.24
DW                78.000 usec
DE                 6.50 usec
TE                298.2 K
D1              1.00000000 sec
TD0                   1
SFO1          400.1324008 MHz
NUC1                  1H
P0                 5.00 usec
P1                15.00 usec
PLW1          11.20899963 W

F2 - Processing parameters
SI                32768
SF            400.1300000 MHz
WDW                  EM
SSB                   0
LB                 0.30 Hz
GB                    0
PC                 1.00
```



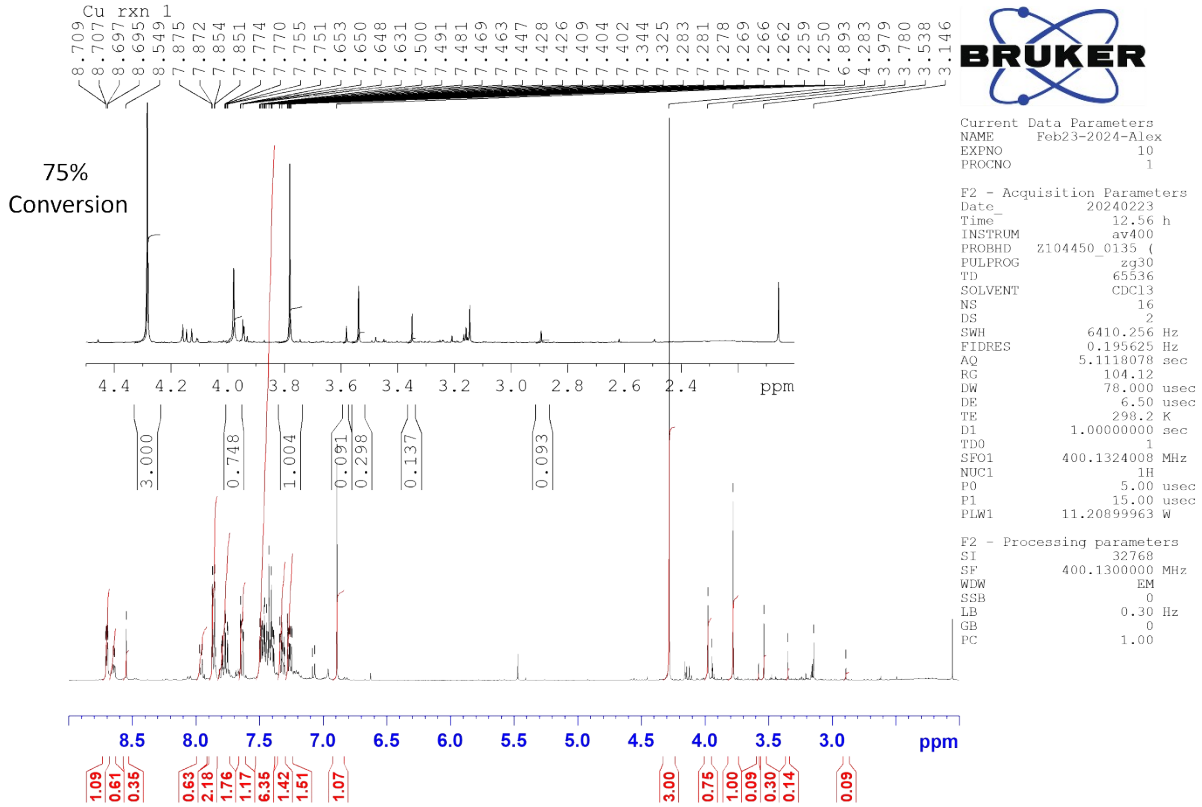
BRUKER

```
Current Data Parameters
NAME      Mar05-2024-Alex
EXPNO                 20
PROCNO                 1

F2 - Acquisition Parameters
Date_           20240305
Time_              13.29 h
INSTRUM            av400
PROBHD   Z104450_0135 (
PULPROG            zg30
TD                65536
SOLVENT           CDCl3
NS                   16
DS                    2
SWH             6410.256 Hz
FIDRES          0.195625 Hz
AQ              5.1118078 sec
RG                55.93
DW                78.000 usec
DE                 6.50 usec
TE                298.2 K
D1              1.00000000 sec
TD0                   1
SFO1          400.1324008 MHz
NUC1                  1H
P0                 5.00 usec
P1                15.00 usec
PLW1          11.20899963 W

F2 - Processing parameters
SI                32768
SF            400.1300000 MHz
WDW                  EM
SSB                   0
LB                 0.30 Hz
GB                    0
PC                 1.00
```

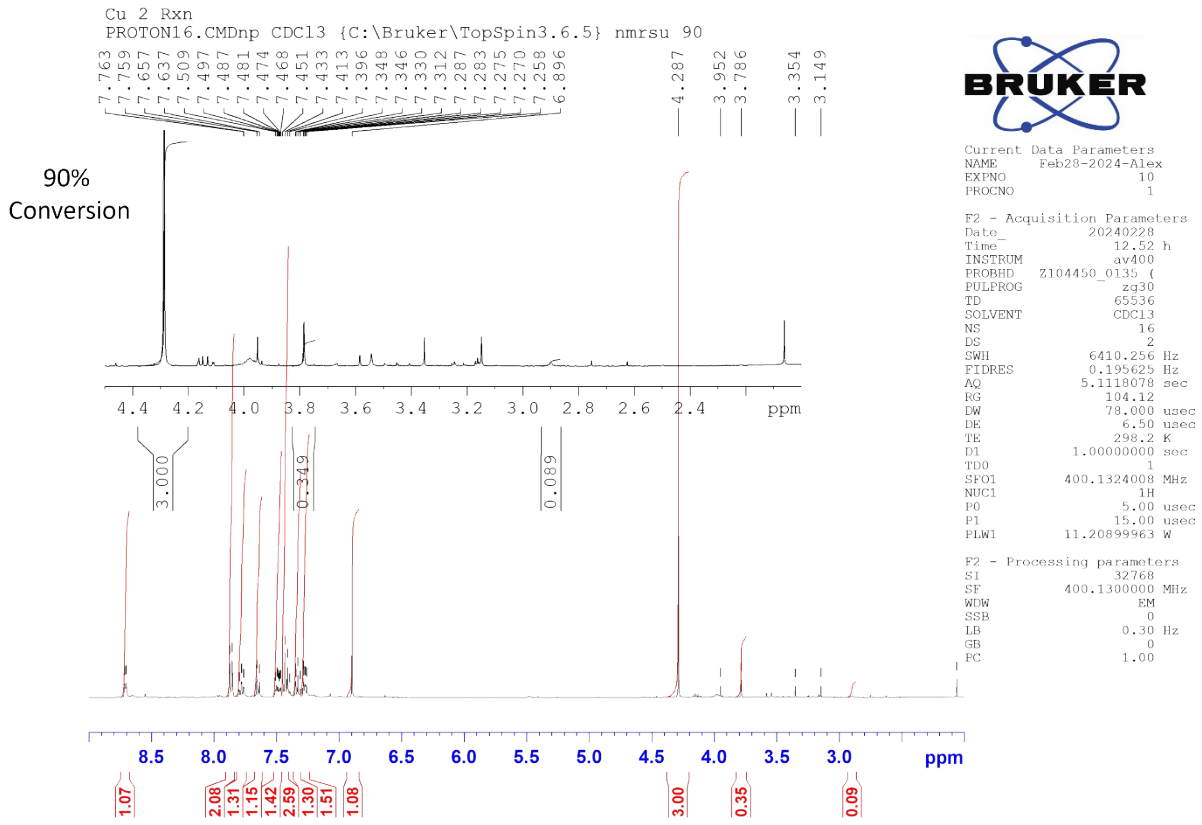
Oxidant Screen: $CuCl_2$



Current Data Parameters
NAME Feb23-2024-Alex
EXPNO 10
PROCNO 1

F2 - Acquisition Parameters
Date_ 20240223
Time 12.56 h
INSTRUM av400
PROBHD Z104450_0135 (
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 6410.256 Hz
FIDRES 0.195625 Hz
AQ 5.1118078 sec
RG 104.12
DW 78.000 usec
DE 6.50 usec
TE 298.2 K
D1 1.00000000 sec
TD0 1
SFO1 400.1324008 MHz
NUC1 1H
P0 5.00 usec
P1 15.00 usec
PLW1 11.20899963 W

F2 - Processing parameters
SI 32768
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

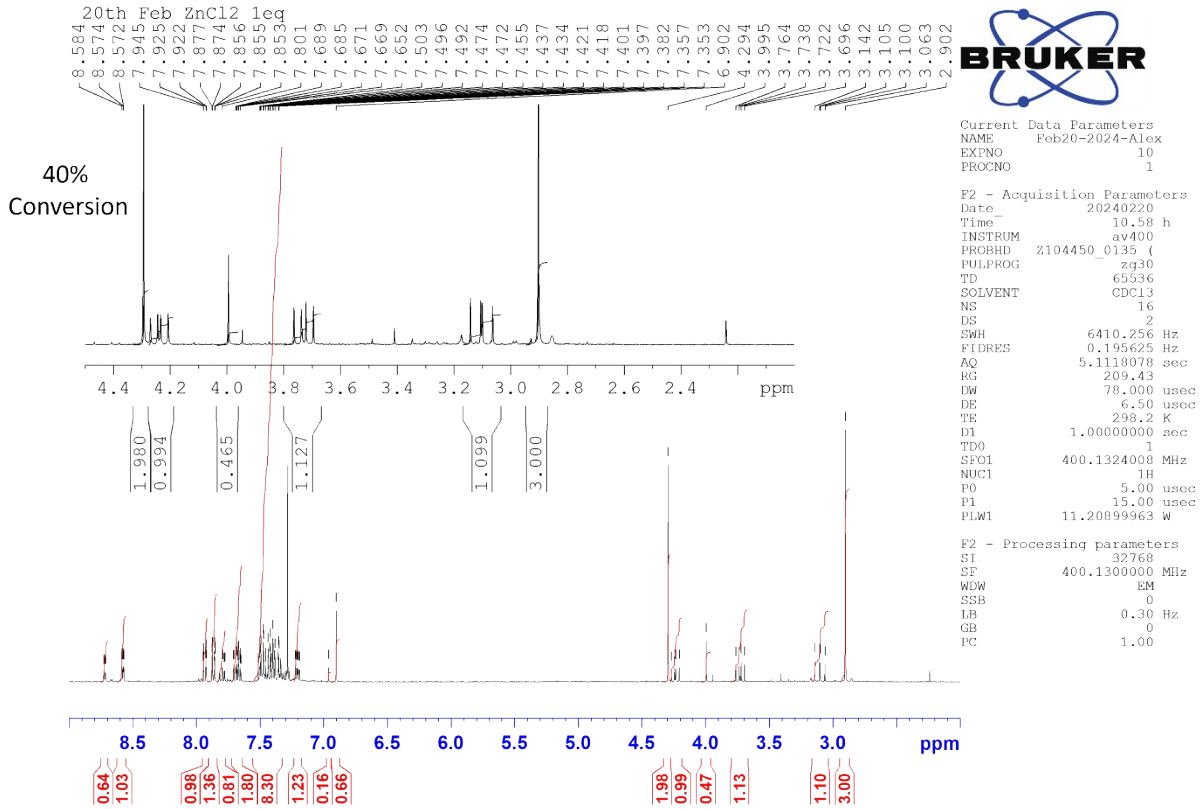


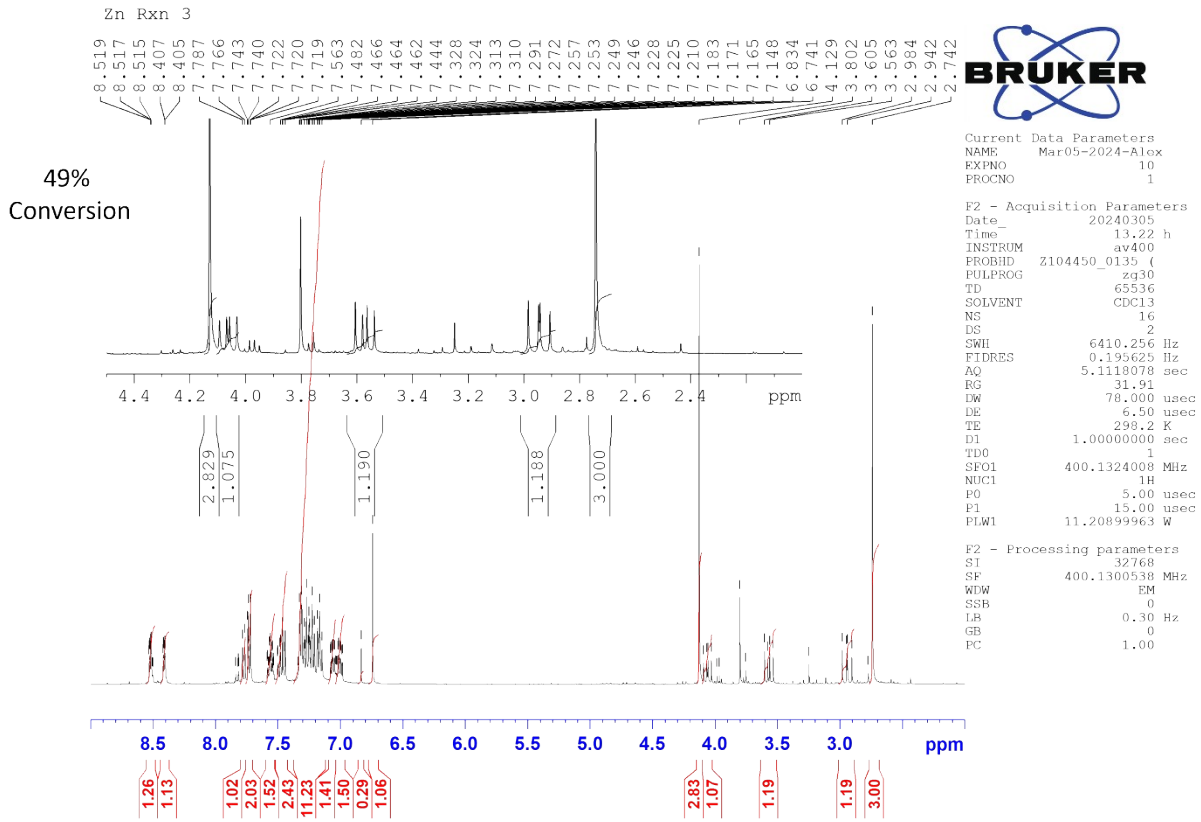
Current Data Parameters
NAME Feb28-2024-Alex
EXPNO 10
PROCNO 1

F2 - Acquisition Parameters
Date_ 20240228
Time 12.52 h
INSTRUM av400
PROBHD Z104450_0135 (
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 6410.256 Hz
FIDRES 0.195625 Hz
AQ 5.1118078 sec
RG 104.12
DW 78.000 usec
DE 6.50 usec
TE 298.2 K
D1 1.00000000 sec
TD0 1
SFO1 400.1324008 MHz
NUC1 1H
P0 5.00 usec
P1 15.00 usec
PLW1 11.20899963 W

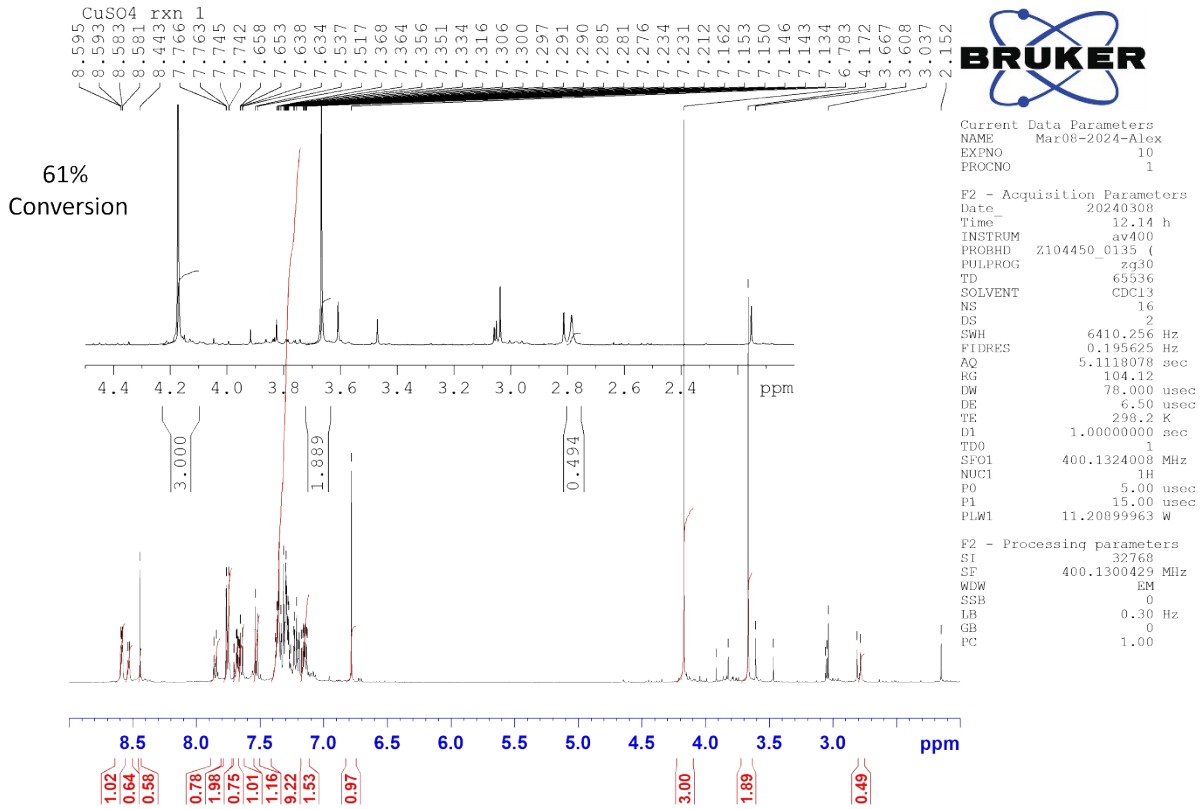
F2 - Processing parameters
SI 32768
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

Oxidant Screen: $ZnCl_2$





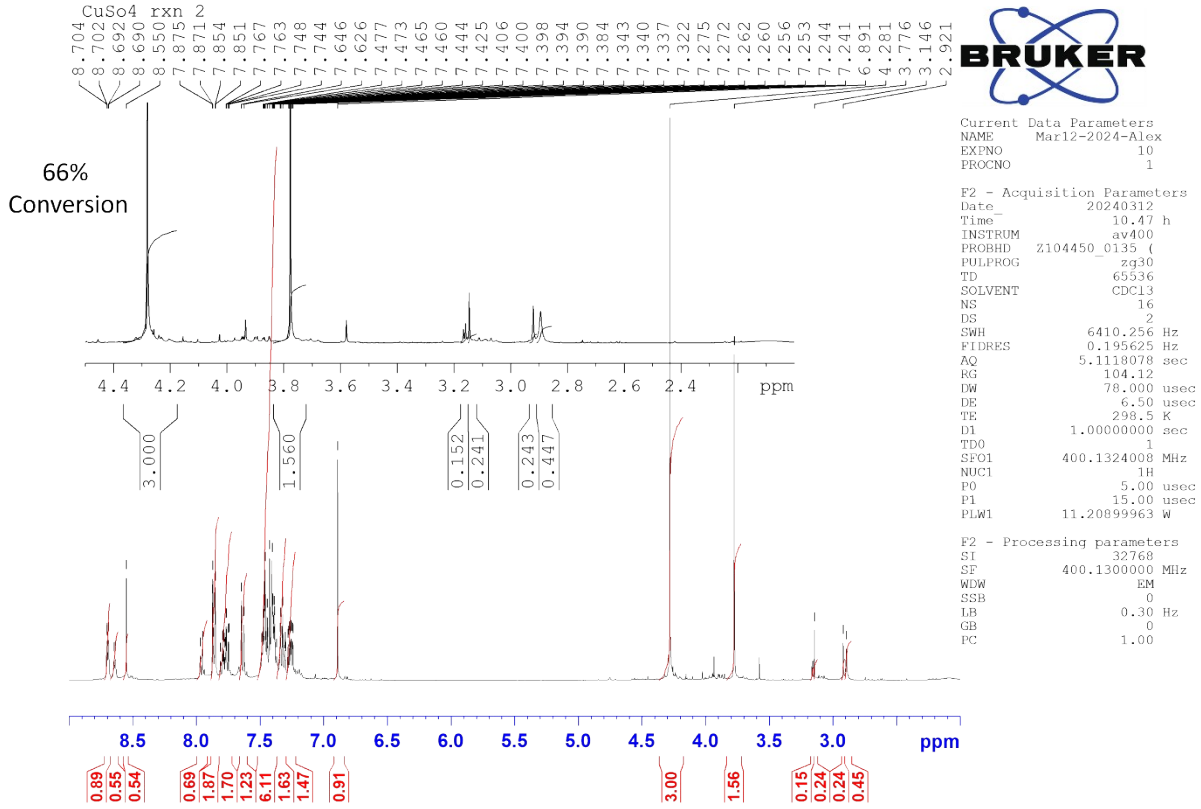
Copper Salts: $CuSO_4$



Current Data Parameters
NAME Mar08-2024-Alex
EXPNO 10
PROCNO 1

F2 - Acquisition Parameters
Date_ 20240308
Time 12.14 h
INSTRUM av400
PROBHD Z104450_0135 (
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 6410.256 Hz
FIDRES 0.195625 Hz
AQ 5.1118078 sec
RG 104.12
DW 78.000 usec
DE 6.50 usec
TE 298.2 K
D1 1.00000000 sec
TD0 1
SFO1 400.1324008 MHz
NUC1 1H
P0 5.00 usec
P1 15.00 usec
PLW1 11.20899963 W

F2 - Processing parameters
SI 32768
SF 400.1300429 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

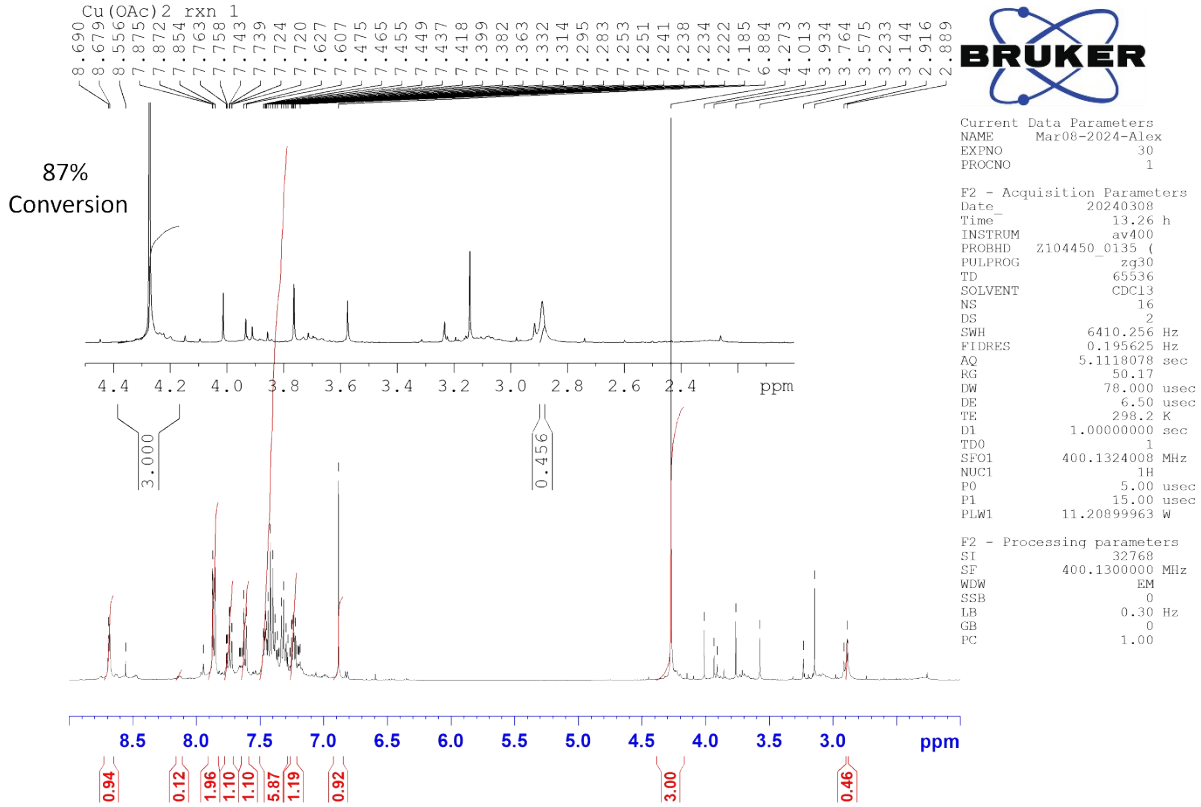


Current Data Parameters
NAME Mar12-2024-Alex
EXPNO 10
PROCNO 1

F2 - Acquisition Parameters
Date_ 20240312
Time 10.47 h
INSTRUM av400
PROBHD Z104450_0135 (
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 6410.256 Hz
FIDRES 0.195625 Hz
AQ 5.1118078 sec
RG 104.12
DW 78.000 usec
DE 6.50 usec
TE 298.5 K
D1 1.00000000 sec
TD0 1
SFO1 400.1324008 MHz
NUC1 1H
P0 5.00 usec
P1 15.00 usec
PLW1 11.20899963 W

F2 - Processing parameters
SI 32768
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

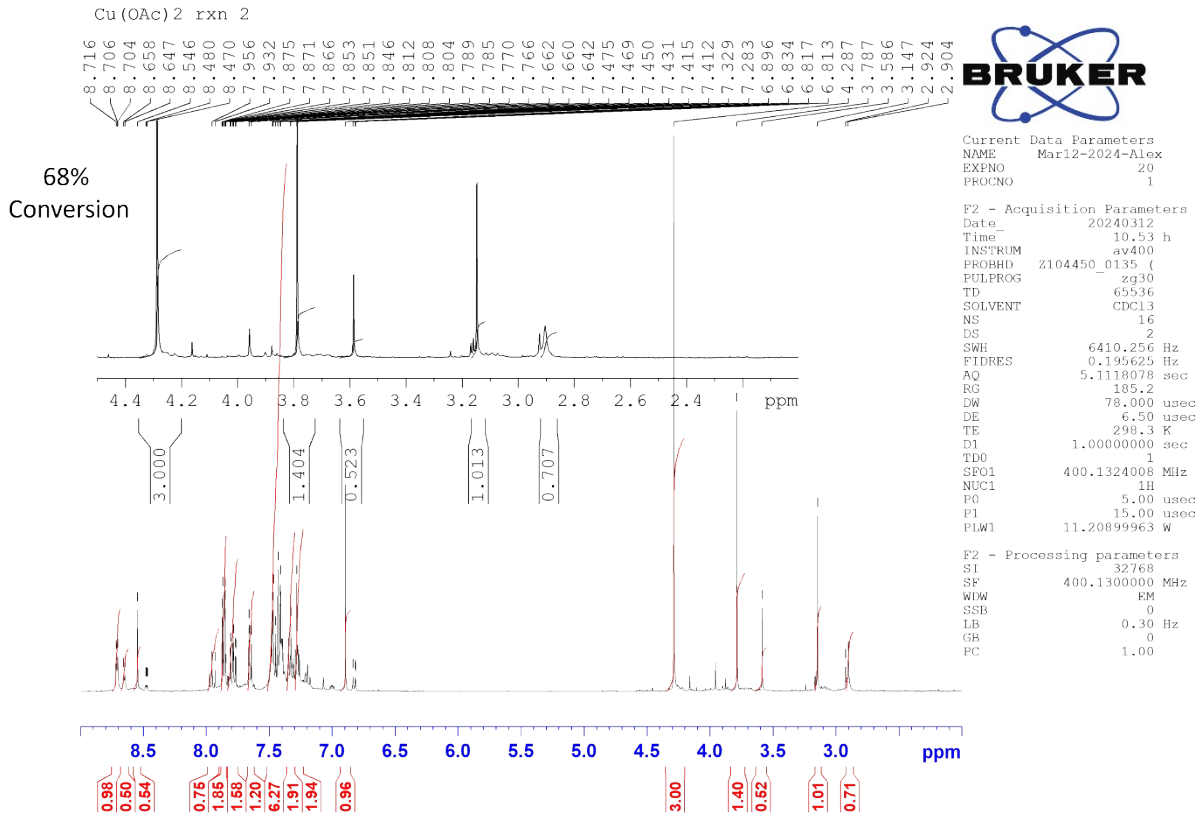
Copper Salts: $Cu(OAc)_2$



Current Data Parameters
NAME Mar08-2024-Alex
EXPNO 30
PROCNO 1

F2 - Acquisition Parameters
Date_ 20240308
Time 13.26 h
INSTRUM av400
PROBHD Z104450_0135 (
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 6410.256 Hz
FIDRES 0.195625 Hz
AQ 5.1118078 sec
RG 50.17
DW 78.000 usec
DE 6.50 usec
TE 298.2 K
D1 1.00000000 sec
TD0 1
SFO1 400.1324008 MHz
NUC1 1H
P0 5.00 usec
P1 15.00 usec
PLW1 11.20899963 W

F2 - Processing parameters
SI 32768
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

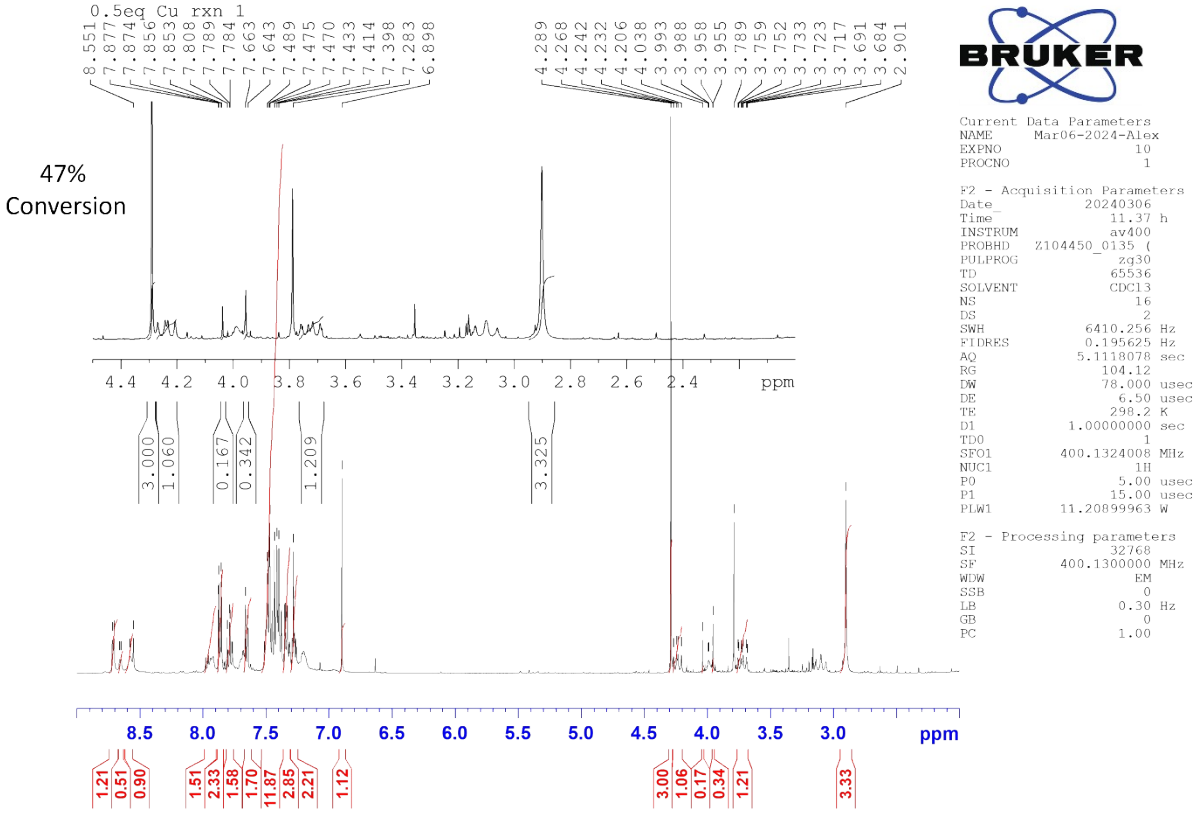


Current Data Parameters
NAME Mar12-2024-Alex
EXPNO 20
PROCNO 1

F2 - Acquisition Parameters
Date_ 20240312
Time 10.53 h
INSTRUM av400
PROBHD Z104450_0135 (
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 6410.256 Hz
FIDRES 0.195625 Hz
AQ 5.1118078 sec
RG 185.2
DW 78.000 usec
DE 6.50 usec
TE 298.3 K
D1 1.00000000 sec
TD0 1
SFO1 400.1324008 MHz
NUC1 1H
P0 5.00 usec
P1 15.00 usec
PLW1 11.20899963 W

F2 - Processing parameters
SI 32768
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

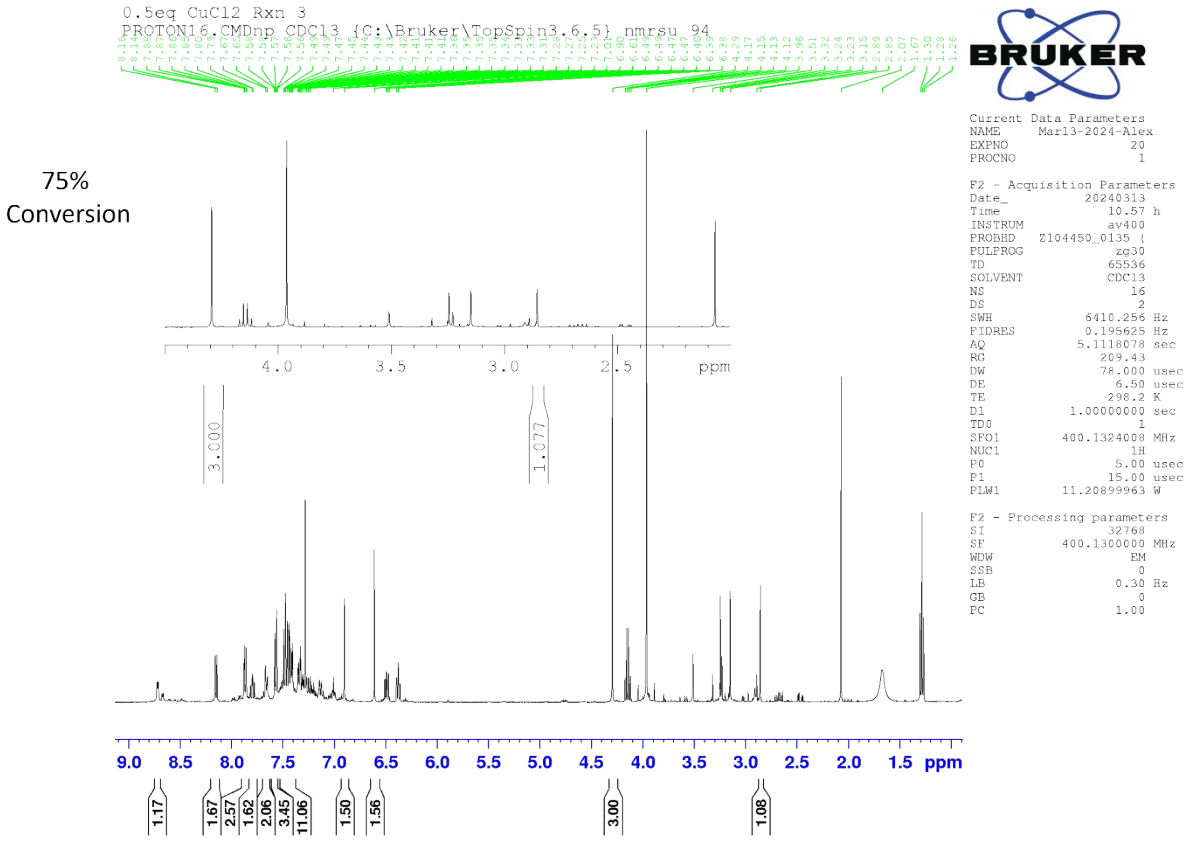
Copper Salts: 0.5 eq $CuCl_2$



Current Data Parameters
NAME Mar06-2024-Alex
EXPNO 10
PROCNO 1

F2 - Acquisition Parameters
Date_ 20240306
Time 11.37 h
INSTRUM av400
PROBHD Z104450_0135 (
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 6410.256 Hz
FIDRES 0.195625 Hz
AQ 5.1118078 sec
RG 104.12
DW 78.000 usec
DE 6.50 usec
TE 298.2 K
D1 1.00000000 sec
TD0 1
SFO1 400.1324008 MHz
NUC1 1H
P0 5.00 usec
P1 15.00 usec
PLW1 11.20899963 W

F2 - Processing parameters
SI 32768
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

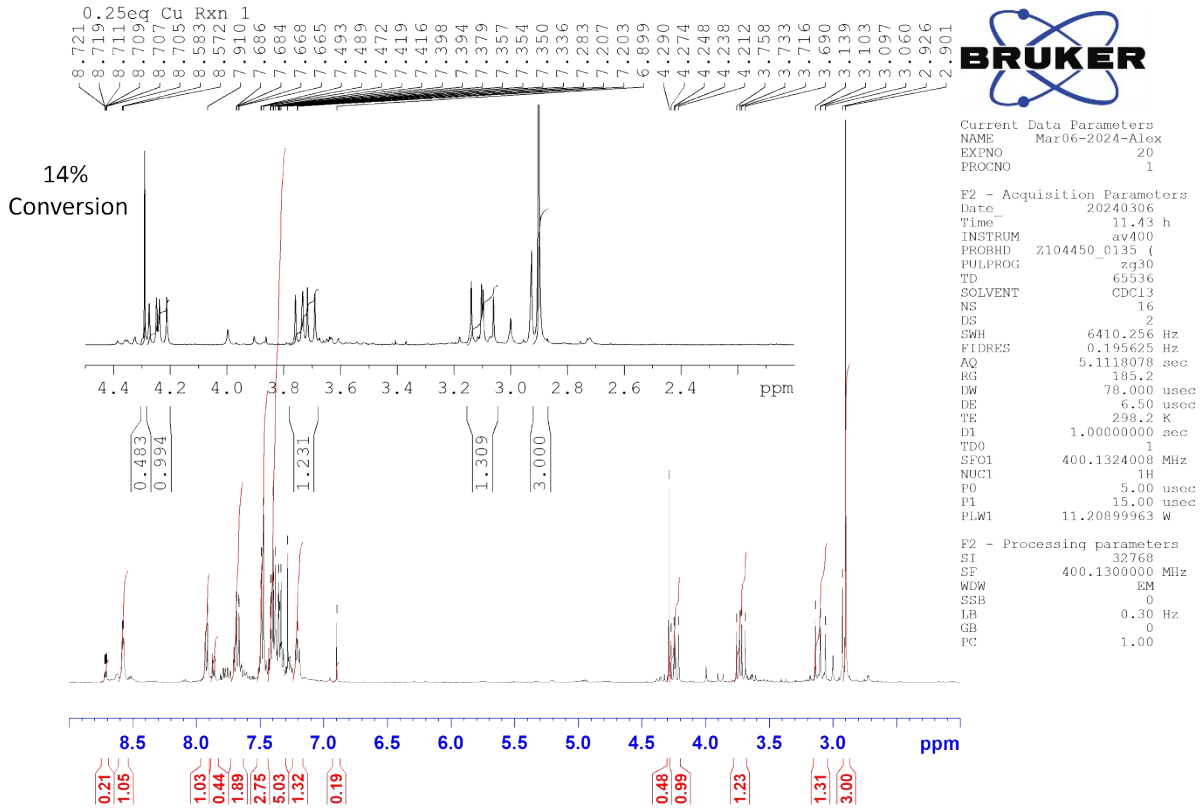


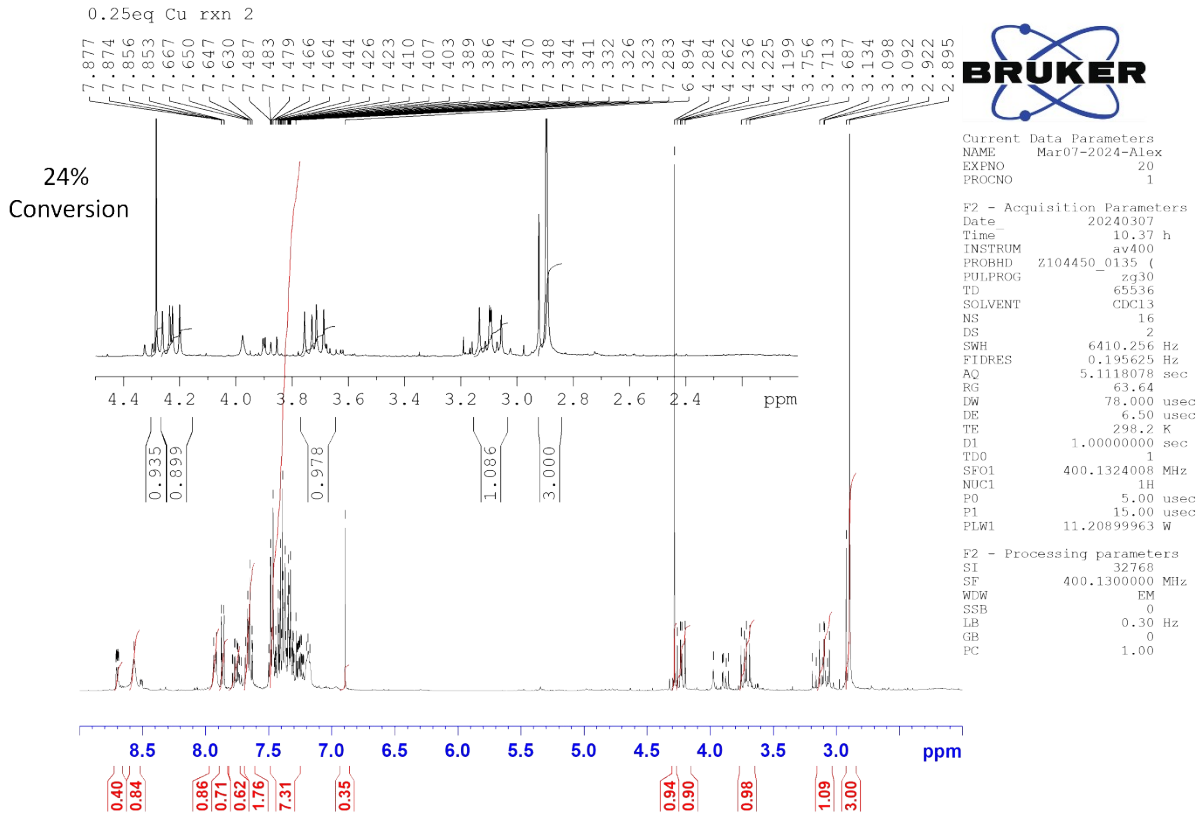
Current Data Parameters
NAME Mar13-2024-Alex
EXPNO 20
PROCNO 1

F2 - Acquisition Parameters
Date_ 20240313
Time 10.57 h
INSTRUM av400
PROBHD Z104450_0135 (
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 6410.256 Hz
FIDRES 0.195625 Hz
AQ 5.1118078 sec
RG 209.43
DW 78.000 usec
DE 6.50 usec
TE 298.2 K
D1 1.00000000 sec
TD0 1
SFO1 400.1324008 MHz
NUC1 1H
P0 5.00 usec
P1 15.00 usec
PLW1 11.20899963 W

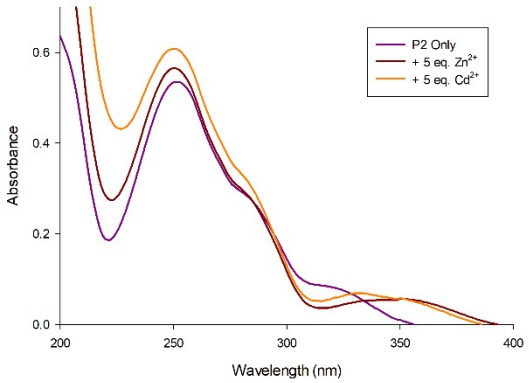
F2 - Processing parameters
SI 32768
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

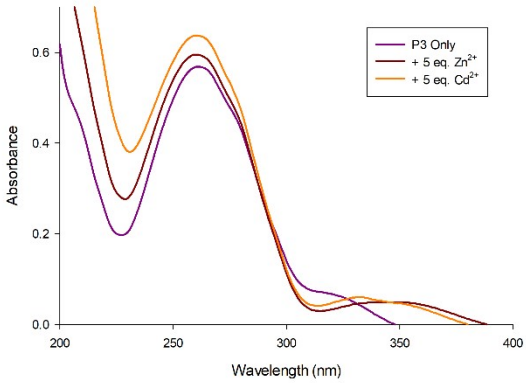
Copper Salts: 0.25eq. $CuCl_2$

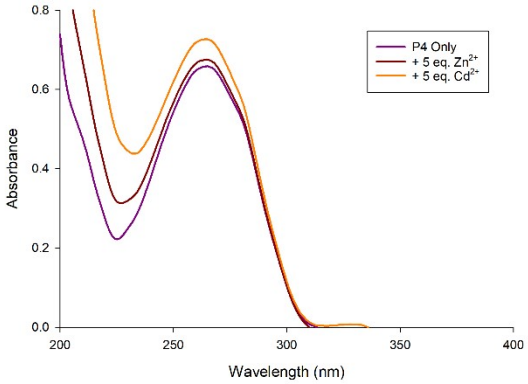


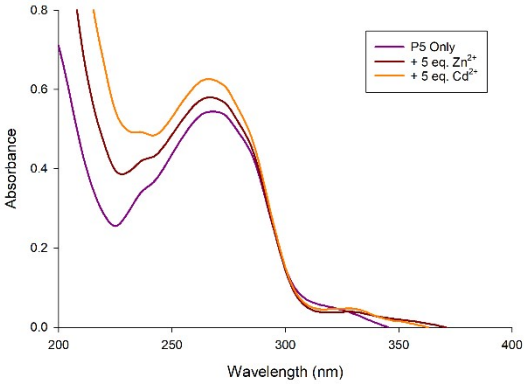


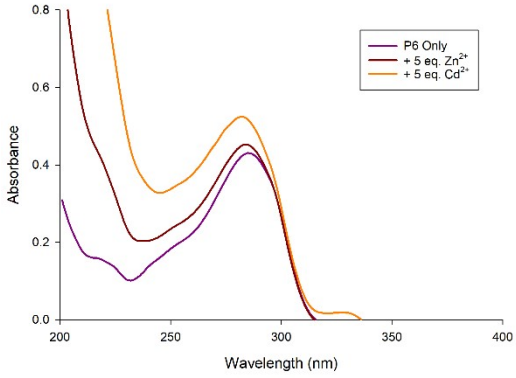
UV/Vis Assays

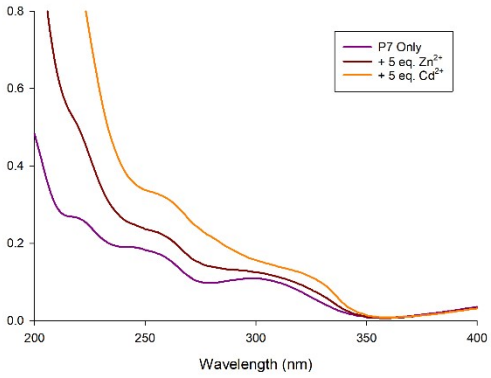


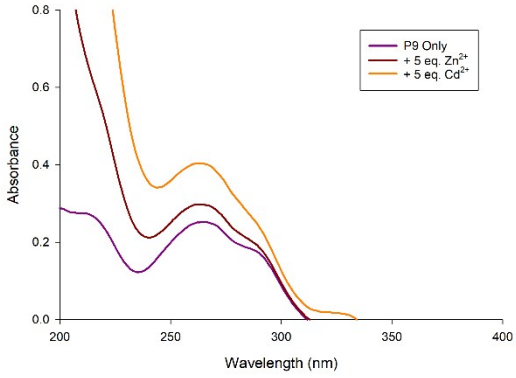




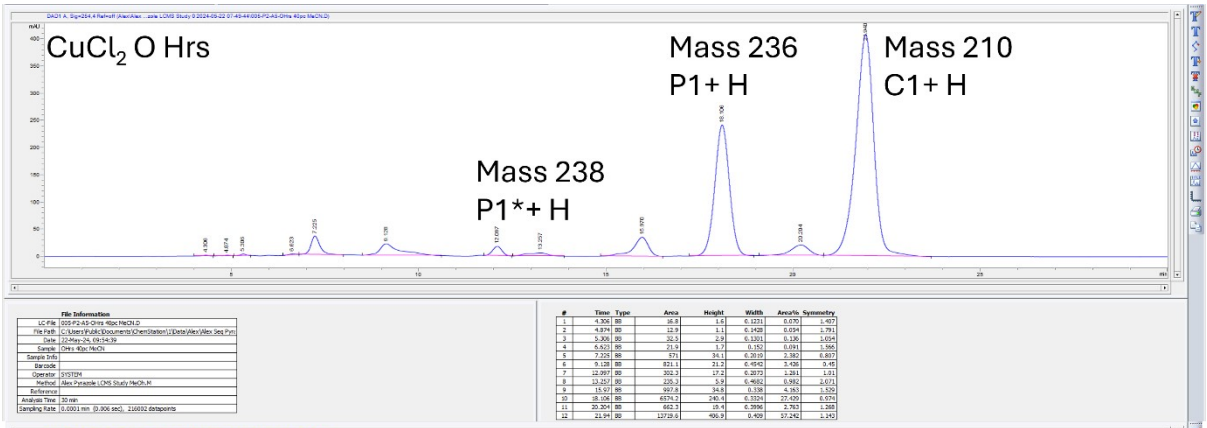






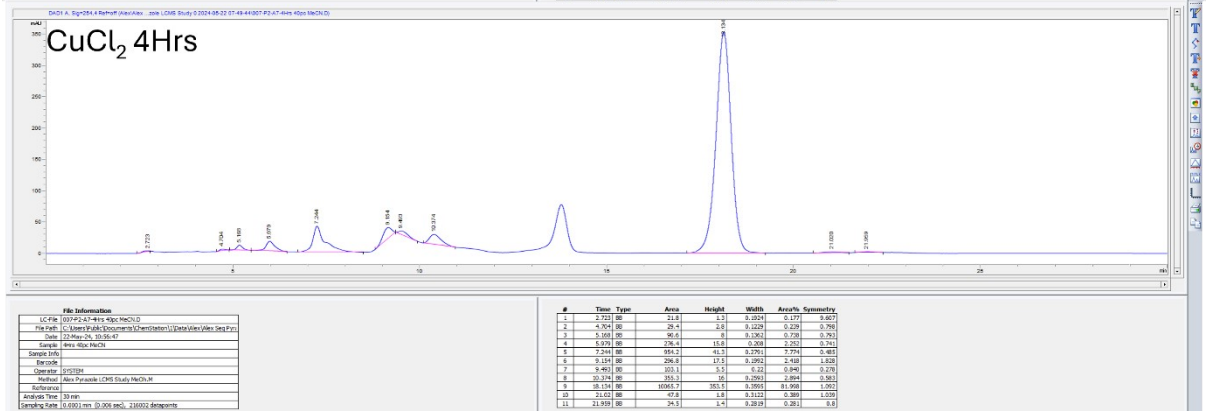


LC-MS Studies



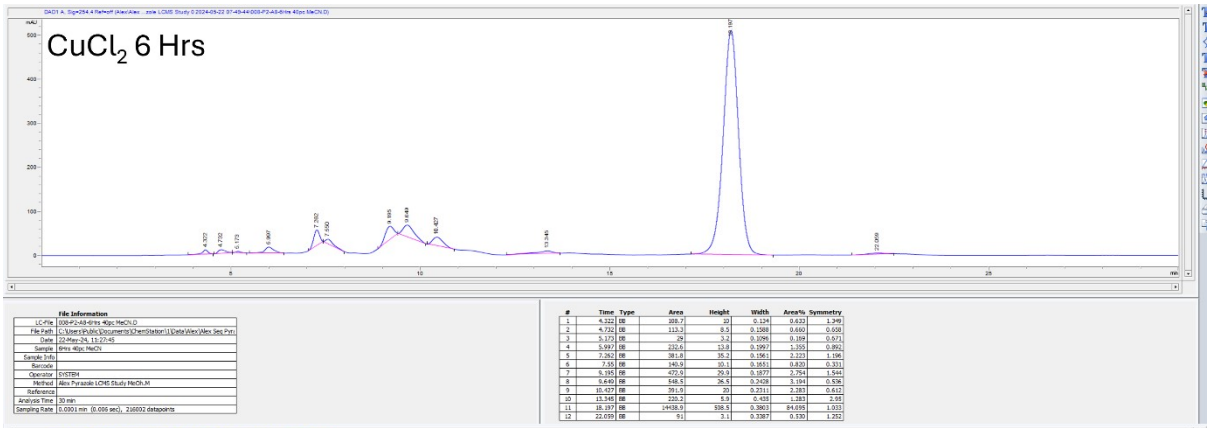
File Information	
LC File	009-P2-A3-0Hrs 40pc MeCN.D
File Path	C:\Users\Public\Documents\ChemStation\1\Data\Alex\Alex Seq Pyri
Date	22-May-24, 09:54:39
Sample	0Hrs 40pc MeCN
Sample Info	
Barcode	
Operator	SYSTEM
Method	Alex Pyrazole LCMS Study MeOH.M
Reference	
Analysis Time	30 min
Sampling Rate	0.0301 min (0.006 sec), 216092 datapoints

#	Time	Type	Area	Height	Width	Area%	Symmetry
1	4.306	BB	16.8	1.6	0.1231	0.070	1.407
2	4.874	BB	12.9	1.1	0.1428	0.054	1.791
3	5.309	BB	26.5	2.9	0.1301	0.106	1.059
4	5.623	BB	21.9	1.7	0.152	0.091	1.366
5	7.229	BB	571	34.1	0.2610	2.382	0.8837
6	9.128	BB	821.1	21.2	0.4542	3.426	0.48
7	12.997	BB	302.2	17.2	0.2072	1.261	1.01
8	13.257	BB	225.2	5.9	0.4052	0.952	2.071
9	15.97	BB	997.8	34.8	0.338	4.163	1.529
10	16.106	BB	6574.3	240.4	0.3324	27.429	0.674
11	20.304	BB	662.3	18.4	0.3996	2.763	1.268
12	21.94	BB	12719.6	406.9	0.409	37.242	1.249



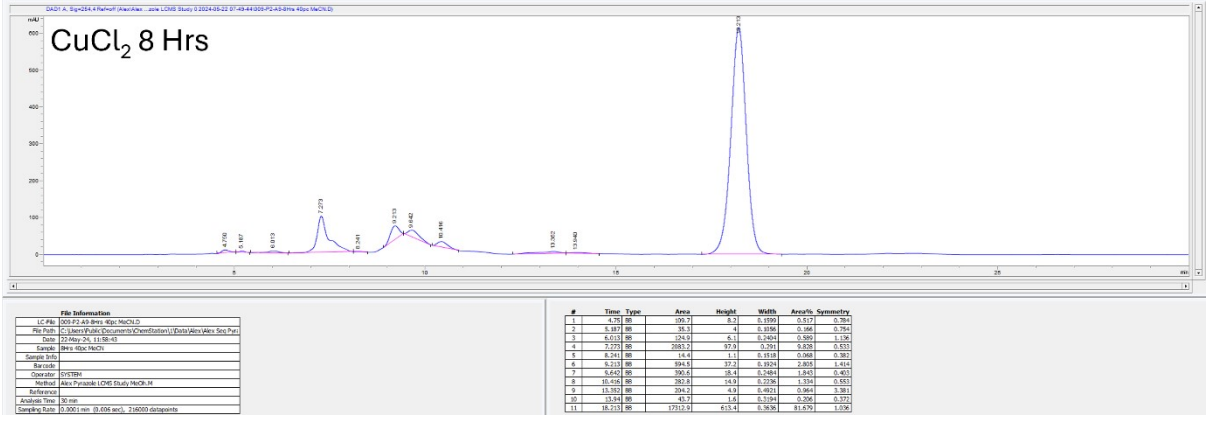
File Information	
LC File	037-P2-A7-4Hrs 40pc MeCN.D
File Path	C:\Users\Public\Documents\ChemStation\1\Data\Alex\Alex Seq Pyri
Date	22-May-24, 10:55:47
Sample	4Hrs 40pc MeCN
Sample Info	
Barcode	
Operator	SYSTEM
Method	Alex Pyrazole LCMS Study MeOH.M
Reference	
Analysis Time	30 min
Sampling Rate	0.0301 min (0.006 sec), 216092 datapoints

#	Time	Type	Area	Height	Width	Area%	Symmetry
1	2.723	BB	21.8	1.3	0.1924	0.177	9.667
2	4.904	BB	29.4	2.8	0.1229	0.239	0.798
3	5.168	BB	96.6	8	0.1352	0.78	0.793
4	5.979	BB	276.4	15.8	0.209	2.252	0.741
5	7.244	BB	954.3	41.3	0.3751	7.774	0.483
6	9.154	BB	296.8	17.5	0.2952	2.418	1.828
7	9.493	BB	103.1	5.5	0.22	0.840	0.278
8	10.374	BB	355.3	16	0.2593	2.894	0.583
9	18.134	BB	10065.7	355.5	0.3955	81.998	1.063
10	21.02	BB	47.8	1.8	0.3112	0.389	1.039
11	21.959	BB	34.5	1.4	0.2819	0.281	0.8



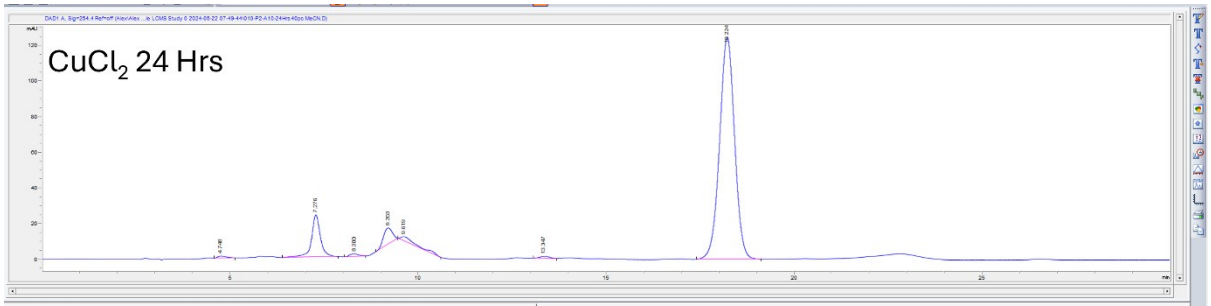
File Information	
LC File	038-P2-A8-6Hrs 40pc MeCN.D
File Path	C:\Users\Public\Documents\ChemStation\1\Data\Alex\Alex Seq Pyri
Date	22-May-24, 11:27:45
Sample	6Hrs 40pc MeCN
Sample Info	
Barcode	
Operator	SYSTEM
Method	Alex Pyrazole LCMS Study MeOH.M
Reference	
Analysis Time	30 min
Sampling Rate	0.0301 min (0.006 sec), 216092 datapoints

#	Time	Type	Area	Height	Width	Area%	Symmetry
1	4.322	BB	108.7	10	0.124	0.633	1.349
2	4.732	BB	113.3	8.5	0.1388	0.660	0.928
3	5.173	BB	29	3.2	0.1096	0.169	0.671
4	5.997	BB	232.6	13.8	0.1997	1.355	0.892
5	7.362	BB	381.8	35.2	0.1561	2.223	1.196
6	7.55	BB	140.9	10.1	0.1651	0.820	0.331
7	8.195	BB	472.6	20.9	0.1877	2.754	1.544
8	8.449	BB	548.5	36.5	0.2408	3.194	0.536
9	10.427	BB	391.0	20	0.2311	2.283	0.612
10	13.345	BB	220.2	8.8	0.403	1.283	2.93
11	18.197	BB	14438.9	538.5	0.3803	84.695	1.033
12	22.059	BB	91	3.1	0.3387	0.530	1.252



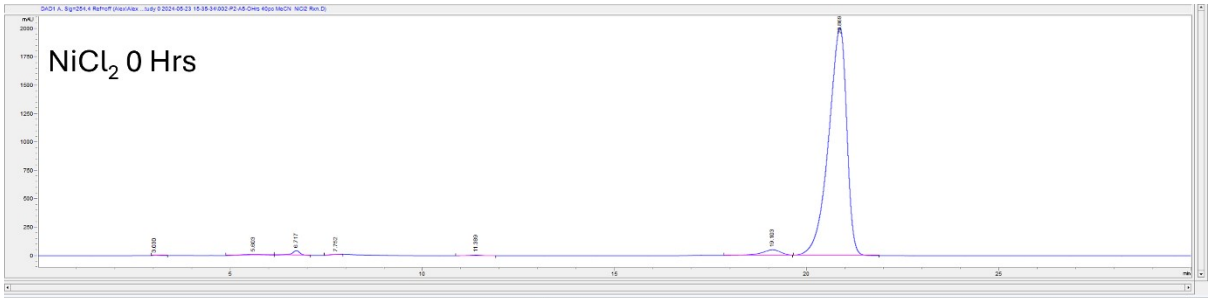
File Information	
LC File	009-P2-A9-8Hrs 40pc MeCN.D
File Path	C:\Users\Public\Documents\ChemStation\1\Data\Alex\Alex Seq Pyri
Date	22-May-24, 11:58:43
Sample	8Hrs 40pc MeCN
Sample Info	
Barcode	
Operator	SYSTEM
Method	Alex Pyrazole LCMS Study MeOH.M
Reference	
Analysis Time	30 min
Sampling Rate	0.0301 min (0.006 sec), 216092 datapoints

#	Time	Type	Area	Height	Width	Area%	Symmetry
1	4.75	BB	109.7	8.2	0.1595	0.517	0.784
2	5.187	BB	35.3	4	0.1056	0.166	0.754
3	6.013	BB	124.9	6.1	0.2404	0.589	1.136
4	7.273	BB	2883.2	97.9	0.291	9.828	0.533
5	8.241	BB	14.4	1.1	0.1518	0.068	0.382
6	9.213	BB	594.5	37.2	0.1924	2.805	1.414
7	9.642	BB	390.6	18.4	0.2484	1.843	0.403
8	10.416	BB	282.8	14.9	0.2236	1.334	0.553
9	13.382	BB	204.2	4.9	0.4921	0.964	3.381
10	13.94	BB	43.7	1.6	0.3194	0.206	0.372
11	18.213	BB	17312.9	613.4	0.3636	81.679	1.036



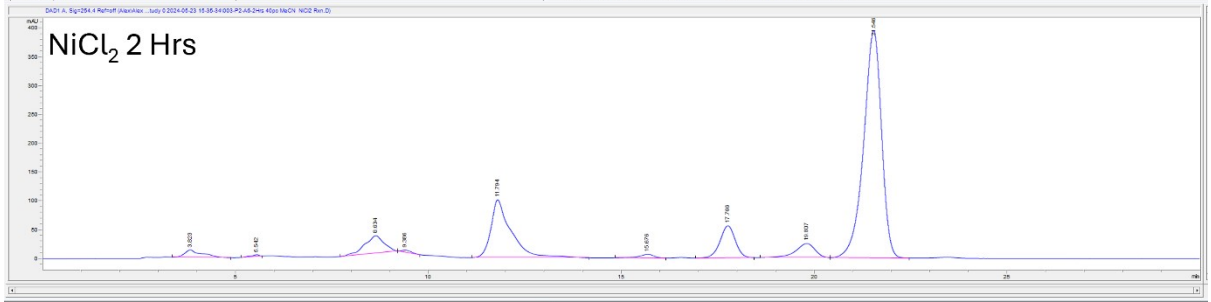
File Information	
LC-File	002-P2-A10-24Hrs 40pc MeCN.D
File Path	C:\Users\Public\Documents\ChemStation\1\Data\Alex\Alex Seq Pyr
Date	22-Mar-24, 12:26:41
Sample	24Hrs 40pc MeCN
Sample Info	
Barcode	
Operator	SYSTEM
Method	Alex Pyrazole LCMS Study MeOh.M
Reference	
Analysis Time	30 min
Sampling Rate	0.0001 min (0.006 sec), 215996 datapoints

#	Time	Type	Area	Height	Width	Area%	Symmetry
1	4.748	BB	19.1	1.2	0.1963	0.466	0.540
2	7.276	BB	397.5	23.6	0.1983	9.574	0.971
3	8.31	BB	24.3	1.3	0.1947	0.596	1.169
4	9.203	BB	153.7	9.2	0.1972	3.703	1.238
5	9.619	BB	75.4	2.4	0.3741	1.817	0.175
6	13.347	BB	20.5	1.1	0.2179	0.495	0.781
7	18.224	BB	3460.8	124.6	0.3343	83.365	1.028



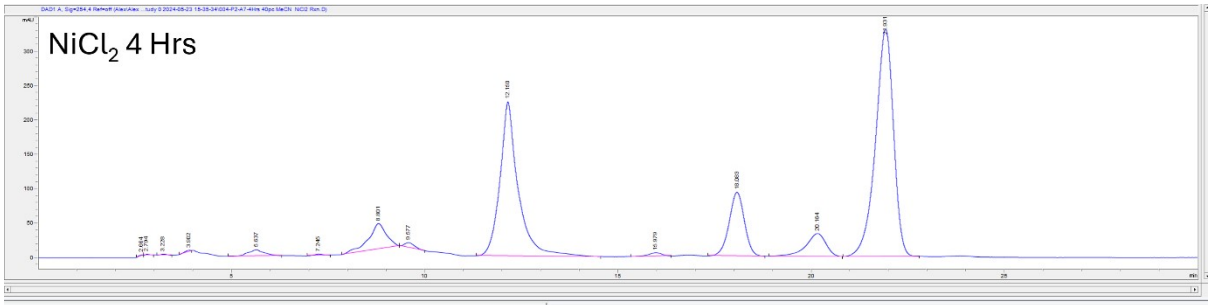
File Information	
LC-File	002-P2-A8-0Hrs 40pc MeCN NiCl2 Run.D
File Path	C:\Users\Public\Documents\ChemStation\1\Data\Alex\Alex Seq Pyr
Date	23-May-24, 16:07:25
Sample	0Hrs 40pc MeCN NiCl2 Run
Sample Info	
Barcode	
Operator	SYSTEM

#	Time	Type	Area	Height	Width	Area%	Symmetry
1	5.01	BB	40.5	4.1	0.1811	0.059	0.411
2	5.603	BB	274.6	6.7	0.4813	0.403	1.429
3	6.717	BB	591.6	40.7	0.2017	0.866	1.365
4	7.752	BB	60.6	3.5	0.2034	0.089	2.22
5	11.389	BB	120.3	5.5	0.2572	0.176	1.238
6	19.303	BB	1565.7	46.9	0.2694	2.307	1.359
7	20.869	BB	65599.7	2001.7	0.384	96.679	1.643



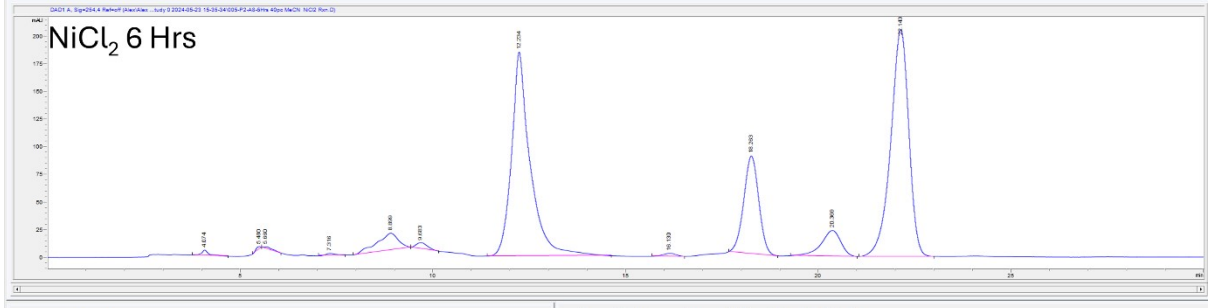
File Information	
LC-File	002-P2-A6-2Hrs 40pc MeCN NiCl2 Run.D
File Path	C:\Users\Public\Documents\ChemStation\1\Data\Alex\Alex Seq Pyr
Date	23-May-24, 16:39:22
Sample	2Hrs 40pc MeCN NiCl2 Run
Sample Info	
Barcode	
Operator	SYSTEM
Method	Alex Pyrazole LCMS Study MeOh.M
Reference	
Analysis Time	30 min
Sampling Rate	0.0001 min (0.006 sec), 215999 datapoints

#	Time	Type	Area	Height	Width	Area%	Symmetry
1	3.822	BB	412.7	13.2	0.2668	2.904	0.481
2	5.342	BB	45.6	2.8	0.1877	0.321	2.80
3	8.634	BB	1080.7	30.7	0.4127	5.235	1.346
4	9.386	BB	64.8	3.7	0.264	0.314	0.447
5	11.794	BB	3684.8	101	0.4438	17.895	0.481
6	15.676	BB	175.4	4.3	0.3262	0.849	1.382
7	17.766	BB	1536.5	55.8	0.3246	7.443	1.05
8	19.807	BB	865.3	24.7	0.4301	4.192	1.318
9	21.946	BB	12774.9	395.9	0.4231	61.883	1.255



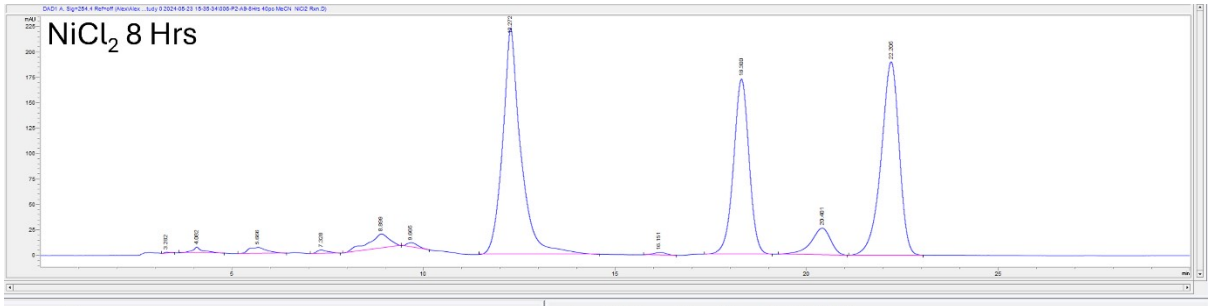
File Information	
LC-File	004-P2-A7-4Hrs 40pc MeCN NiCl2 Run.D
File Path	C:\Users\Public\Documents\ChemStation\1\Data\Alex\Alex Seq Pyr
Date	23-May-24, 17:09:21
Sample	4Hrs 40pc MeCN NiCl2 Run
Sample Info	
Barcode	
Operator	SYSTEM
Method	Alex Pyrazole LCMS Study MeOh.M
Reference	
Analysis Time	30 min
Sampling Rate	0.0001 min (0.006 sec), 216000 datapoints

#	Time	Type	Area	Height	Width	Area%	Symmetry
1	2.664	BB	16.5	1.5	0.6862	0.044	3.089
2	2.794	BB	8.6	1.4	0.6773	0.036	0.387
3	3.238	BB	16.7	1.5	0.1356	0.070	0.708
4	3.932	BB	16.8	1.7	0.1355	0.083	4.736
5	5.637	BB	366.2	9.3	0.1358	1.122	1.043
6	7.245	BB	33.9	2	0.1673	0.124	0.952
7	8.891	BB	1204.4	37.1	0.1801	5.076	1.294
8	9.577	BB	129.7	7.1	0.2139	0.547	0.593
9	12.19	BB	7274.4	224.7	0.4133	21.079	0.727
10	15.979	BB	121.3	5.1	0.2808	0.511	1.256
11	18.083	BB	2558	93	0.3273	10.781	1.066
12	20.164	BB	1198.8	33.5	0.4217	5.052	1.339
13	21.931	BB	10787.8	331.6	0.3975	45.464	1.285



File Information	
LC-File	005-P2-A8-6Hrs 40pc MeCN NiCl2 Run.D
File Path	C:\Users\Public\Documents\ChemStation\1\Data\Alex\Alex Seq Pyr
Date	23-May-24, 17:40:18
Sample	6Hrs 40pc MeCN NiCl2 Run
Sample Info	
Barcode	
Operator	SYSTEM
Method	Alex Pyrazole LCMS Study MeOh.M
Reference	
Analysis Time	30 min
Sampling Rate	0.0001 min (0.006 sec), 216902 datapoints

#	Time	Type	Area	Height	Width	Area%	Symmetry
1	4.074	BB	67.6	5	0.1627	0.396	0.742
2	5.48	BB	23.8	2.7	0.103	0.139	2.635
3	5.96	BB	26	1.5	0.1599	0.152	0.201
4	7.316	BB	35.4	1.9	0.2164	0.206	0.685
5	8.895	BB	594.8	15.2	0.4584	3.471	1.877
6	9.663	BB	111.4	5.5	0.2388	0.651	0.634
7	12.234	BB	6244.9	184.7	0.4224	36.464	0.647
8	16.13	BB	64.7	2.8	0.2708	0.378	1.019
9	18.263	BB	2454.1	86.5	0.3185	14.327	0.995
10	20.399	BB	825.8	23.3	0.4142	4.822	1.33
11	22.140	BB	6727.4	205.8	0.4088	39.282	1.188



File Information	
LC-File	006-P2-A9-8Hrs 40pc MeCN NiCl2 Run.D
File Path	C:\Users\Public\Documents\ChemStation\1\Data\Alex\Alex Seq Pyr
Date	23-May-24, 18:11:16
Sample	8Hrs 40pc MeCN NiCl2 Run
Sample Info	
Barcode	
Operator	SYSTEM
Method	Alex Pyrazole LCMS Study MeOh.M
Reference	
Analysis Time	30 min
Sampling Rate	0.0001 min (0.006 sec), 216902 datapoints

#	Time	Type	Area	Height	Width	Area%	Symmetry
1	3.282	BB	13.2	1.3	0.1217	0.064	0.511
2	4.082	BB	118.6	5.8	0.241	0.578	0.724
3	5.666	BB	195	5.9	0.3868	0.950	0.95
4	7.328	BB	67.4	3.4	0.2362	0.329	0.641
5	8.899	BB	558.6	14.1	0.4631	2.722	1.683
6	9.665	BB	91.1	4.5	0.2388	0.444	0.508
7	12.272	BB	7362.8	222.6	0.4006	35.872	0.751
8	16.151	BB	61.2	2.4	0.274	0.298	0.828
9	18.3	BB	4866.7	173.4	0.3387	23.711	1.046
10	20.401	BB	940.7	26.3	0.4187	4.583	1.275
11	22.305	BB	6249.6	160.3	0.3931	30.446	1.215

Limit of Detection (LoD) Assays

The method reported by Lee et al was used to calculate limit of detection (LoD) for **P2** in MeCN using the indicated cation with the average from three replicates used.

B. P. Joshi, J. Park, W. I. Lee and K.-H. Lee*, Talanta*, 2009, **78**, 90.