Palladium-Catalyzed Intramolecular Cp-H Bond Functionalization/Arylation: An Enantioselective Approach to Planar Chiral Quinilinoferrocenes

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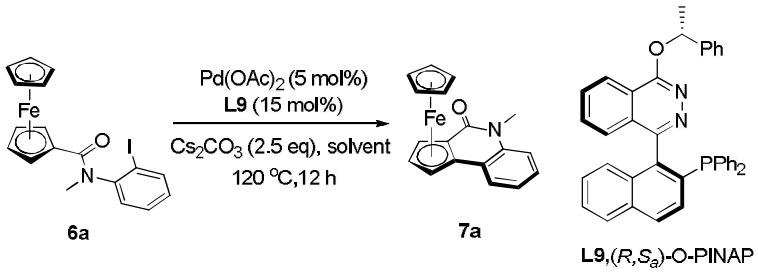
Supporting Information

General Information. Proton nuclear magnetic resonance were recorded on 400MHz instruments internally referenced to tetramethylsilane (0.0 ppm) or residue of $CDCl_3$ (7.26 ppm) signals. All reactions were performed under an inert atmosphere of nitrogen in flame-dried glassware, unless otherwise stated. Solvents were distilled using standard techniques. Tetrahydrofuran was distilled over sodium under an atmosphere of nitrogen. Toluene, dichloromethane were distilled calcium hydride under an atmosphere of nitrogen.

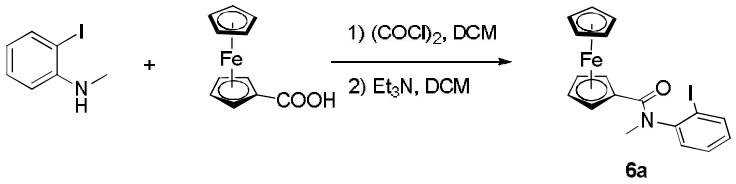
Table S1. Solvents Screening



solvent	yield	%ee
MeCN	NR	-
1,4-dioxane	30%	70
THF	NR	-
DMF	NR	-
toluene	98%	67
mesitylene[a]	43%	52
anisole	20%	50
benzene	98%	67
cyclohexane	20%	50

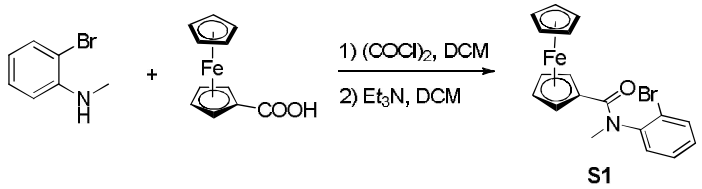
[a] At 80 °C

Typical Procedures for the preparation of 6: (Typical Procedure A)



Oxalyl chloride (0.85 ml, 10.0 mmol) was added dropwise to a solution of ferrocenecarboxylic acid (1.15 g, 5.0 mmol) in CH_2Cl_2 (75 ml) at 25 °C under argon. The resulting solution was stirred at room temperature for 0.5 h and concentrated under reduced pressure. 2-Iodo-*N*-methylaniline (1.165 g, 5.0 mmol) and Et_3N (1.4 ml, 10.0 mmol) in CH_2Cl_2 (75 ml) was added to a solution of the above acid chloride in CH_2Cl_2 (125 ml) and stirred for 15 h. The reaction mixture was extracted with CH_2Cl_2 and the organic layer was washed with $NaHCO_3$ aq. and brine. The organic layer was dried over $MgSO_4$, filtrated and concentrated under reduced pressure and the residue was purified by flash chromatography (hexanes/EtOAc = 5:1) on silica gel to afford **6a** as a yellow solid (1.50 g, 66%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.95 (dd, *J* = 8.0, 1.6 Hz, 1 H), 7.36 (td, *J* = 7.6, 1.2 Hz, 1 H), 7.18 (dd, *J* = 8.0, 1.6 Hz, 1 H), 7.07 (td, *J* = 7.6, 1.6 Hz, 1 H), 4.22 (bs, 1 H), 4.20 (s, 5 H), 4.16 (bs, 1 H), 4.08 (bs, 1 H), 3.80 (bs, 1 H), 3.30 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.4, 147.1, 140.1, 129.74,

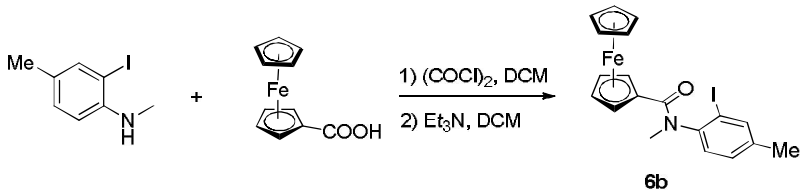
129.68, 129.5, 99.4, 75.4, 72.0, 70.3, 70.07, 70.03, 69.95, 37.7. HRMS (EI) calcd for $C_{18}H_{16}{}^{56}FeINO$ [M^+] 444.9626, found 444.9620.



S1

Compound **S1** was prepared following the Typical Procedure A.

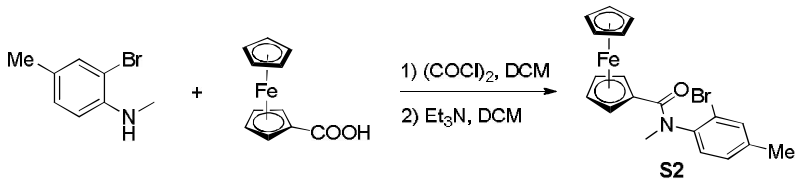
The reaction of ferrocenecarboxylic acid (0.138 g, 0.60 mmol) and 2-bromo-*N*-methylaniline (0.111 g, 0.60 mmol) afforded **S1** (0.154 g, 65%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.70 (dd, *J* = 8.0, 1.6 Hz, 1 H), 7.33 (td, *J* = 7.6, 1.6 Hz, 1 H), 7.26 (td, *J* = 7.6, 1.6 Hz, 1 H), 7.19 (dd, *J* = 8.0, 1.6 Hz, 1 H), 4.29 (bs, 1 H), 4.19 (s, 5 H), 4.17 (bs, 1 H), 4.08 (bs, 1 H), 3.75 (bs, 1 H), 3.32 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.4, 143.6, 133.7, 130.5, 129.5, 128.7, 123.1, 75.3, 71.8, 70.0, 69.9, 37.3. HRMS (EI) calcd for $C_{18}H_{16}{}^{79}Br^{56}FeNO$ [M^+] 396.9765, found 396.9760.



6b

Compound **6b** was prepared following the Typical Procedure A.

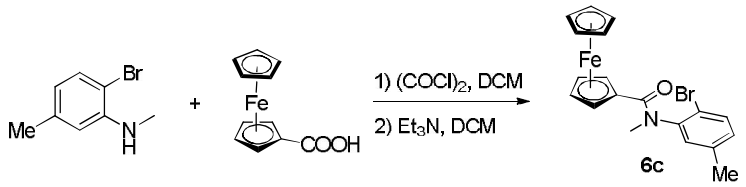
The reaction of ferrocenecarboxylic acid (0.552 g, 2.4 mmol) and 2-iodo-*N*,4-dimethylaniline (0.593 g, 2.4 mmol) afforded **6b** (0.881 g, 80%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.77 (d, *J* = 1.2 Hz, 1 H), 7.15 (dd, *J* = 8.0, 1.2 Hz, 1 H), 7.04 (d, *J* = 7.6 Hz, 1 H), 4.21 (bs, 1 H), 4.20 (s, 5 H), 4.16 (bs, 1 H), 4.09 (bs, 1 H), 3.84 (bs, 1 H), 3.27 (s, 3 H), 2.36 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.4, 144.5, 140.4, 139.9, 130.4, 129.1, 99.2, 75.5, 71.9, 70.4, 70.03, 69.99, 69.92, 37.8, 20.6. HRMS (EI) calcd for $C_{19}H_{18}{}^{56}FeINO$ [M^+] 458.9782, found 458.9789.



S2

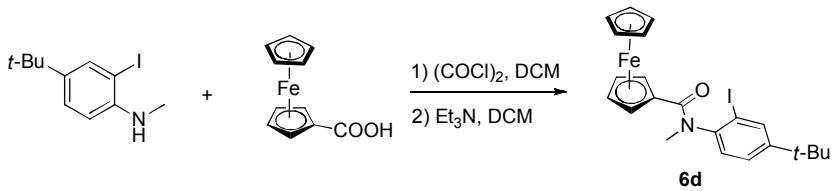
Compound **S2** was prepared following the Typical Procedure A.

The reaction of ferrocenecarboxylic acid (0.460 g, 2.0 mmol) and 2-bromo-*N*,4-dimethylaniline (0.494 g, 2.0 mmol) afforded **S2** (0.617 g, 75%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.52 (d, *J* = 1.2 Hz, 1 H), 7.11 (dd, *J* = 8.0, 1.2 Hz, 1 H), 7.06 (d, *J* = 8.0 Hz, 1 H), 4.28 (bs, 1 H), 4.18 (s, 5 H), 4.17 (bs, 1 H) 4.09 (bs, 1 H), 3.78 (bs, 1 H), 3.29 (s, 3 H), 2.38 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.4, 140.9, 139.9, 134.1, 129.9, 129.4, 122.7, 75.3, 71.8, 70.1, 70.0, 69.9, 37.4, 20.8. HRMS (EI) calcd for $C_{19}H_{18}{}^{79}Br^{56}FeNO$ [M^+] 410.9921, found 410.9914.



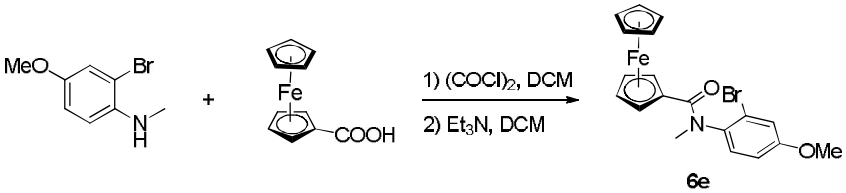
Compound **6c** was prepared following the Typical Procedure A.

The reaction of ferrocenecarboxylic acid (0.138 g, 0.60 mmol) and 2-bromo-*N*,5-dimethylaniline (0.119 g, 0.60 mmol) afforded **6c** (0.201 g, 82%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.56 (d, *J* = 8.0 Hz, 1 H), 7.06 (d, *J* = 8.4 Hz, 1 H), 7.01 (s, 1 H), 4.33-4.03 (m, 8 H), 3.80 (bs, 1 H), 3.29 (s, 3 H), 2.30 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.3, 143.3, 139.0, 133.3, 131.0, 130.4, 119.7, 75.4, 71.8, 70.2, 70.1, 69.9, 37.4, 20.8. HRMS (EI) calcd for $C_{19}H_{18}{}^{79}Br^{56}FeNO$ [M^+] 410.9921, found 410.9915.



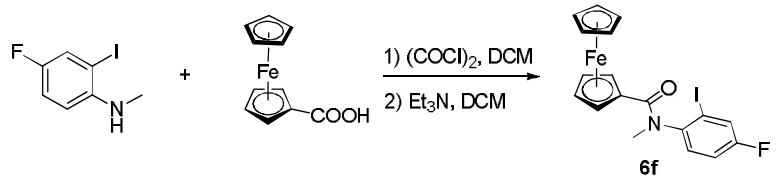
Compound **6d** was prepared following the Typical Procedure A.

The reaction of ferrocenecarboxylic acid (0.460 g, 2.0 mmol) and 4-(*tert*-butyl)-2-iodo-*N*-methylaniline (0.578 g, 2.0 mmol) afforded **6d** (0.731 g, 73%). **^{1}H NMR** (400 MHz, CDCl3) δ 7.91 (d, *J* = 2.0 Hz, 1 H), 7.35 (dd, *J* = 8.0, 2.0 Hz, 1 H), 7.07 (d, *J* = 8.0 Hz, 1 H), 4.29 (s, 1 H), 4.21 (s, 5 H), 4.17 (bs, 1 H), 4.08 (bs, 1 H), 3.75 (bs, 1 H), 3.28 (s, 3 H), 1.33 (s, 9 H); **^{13}C NMR** (100 MHz, CDCl3) δ 170.5, 153.2, 144.4, 137.0, 128.9, 126.8, 99.2, 75.5, 72.0, 70.2, 70.1, 69.9, 37.8, 34.6, 31.2. HRMS (EI) calcd for $C_{22}H_{24}{}^{56}FeINO$ [M^+] 501.0252, found 501.0250.



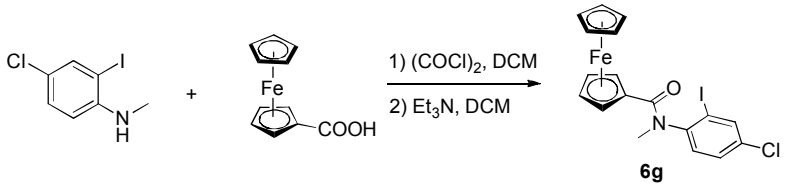
Compound **6e** was prepared following the Typical Procedure A.

The reaction of ferrocenecarboxylic acid (0.460 g, 2.0 mmol) and 2-bromo-4-methoxy-*N*-methylaniline (0.430 g, 2.0 mmol) afforded **6e** (0.599 g, 70%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.22 (d, *J* = 2.8 Hz, 1 H), 7.10 (d, *J* = 8.8 Hz, 1 H), 6.85 (dd, *J* = 8.8, 2.8 Hz, 1 H), 4.26 (bs, 1 H), 4.21-4.15 (m, 6 H) 4.10 (bs, 1 H), 3.84 (s, 3 H), 3.81 (bs, 1 H), 3.28 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.6, 159.5, 136.4, 130.7, 123.6, 118.5, 114.4, 75.4, 71.9, 70.2, 70.1, 70.0, 69.9, 55.8, 37.6. HRMS (EI) calcd for $C_{19}H_{18}{}^{79}Br^{56}FeNO_2$ [M^+] 426.9870, found 426.9868.



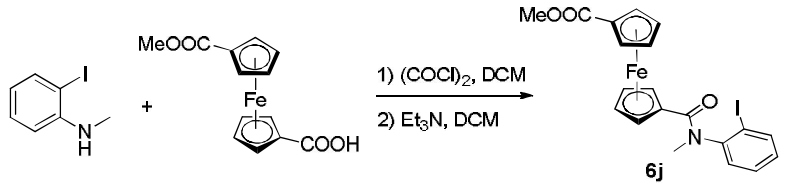
Compound **6f** was prepared following the Typical Procedure A.

The reaction of ferrocenecarboxylic acid (0.161 g, 0.70 mmol) and 4-fluoro-2-iodo-*N*-methylaniline (0.176 g, 0.70 mmol) afforded **6f** (0.253 g, 78%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.66 (dd, *J* = 7.6, 2.8 Hz, 1 H), 7.17-7.04 (m, 2 H), 4.33-4.16 (m, 7 H), 4.12 (bs, 1 H), 3.79 (bs, 1 H), 3.27 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.5, 162.3, 159.7, 143.6, 143.5, 130.3, 130.2, 126.9, 126.7, 116.8, 116.6, 99.3, 99.2, 75.3, 71.9, 70.2, 70.0, 37.8. HRMS (EI) calcd for $C_{18}H_{15}F^{56}FeINO$ [M^+] 462.9532, found 462.9524.



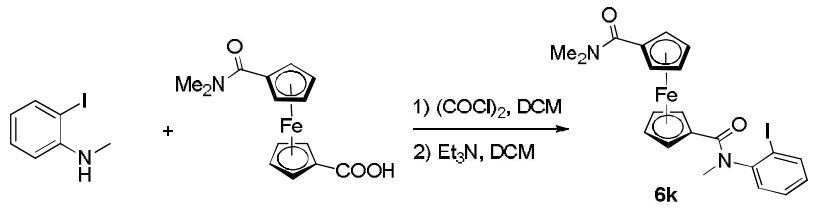
Compound **6g** was prepared following the Typical Procedure A.

The reaction of ferrocenecarboxylic acid (0.460 g, 2.0 mmol) and 2-iodo-4-chloro-*N*-methylaniline (0.534 g, 2.0 mmol) afforded **6g** (0.651 g, 68%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.94 (d, *J* = 2.4 Hz, 1 H), 7.33 (dd, *J* = 8.4, 2.4 Hz, 1 H), 7.09 (d, *J* = 8.4 Hz, 1 H), 4.29 (bs, 1 H), 4.21 (s, 6 H), 4.13 (bs, 1 H), 3.82 (bs, 1 H), 3.27 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.4, 145.9, 139.4, 134.2, 130.1, 129.8, 99.6, 75.2, 72.0, 70.2, 70.08, 70.05, 37.7. HRMS (EI) calcd for $C_{18}H_{15}{}^{35}Cl^{56}FeINO$ [M^+] 478.9236, found 478.9232.



Compound **6j** was prepared following the Typical Procedure A.

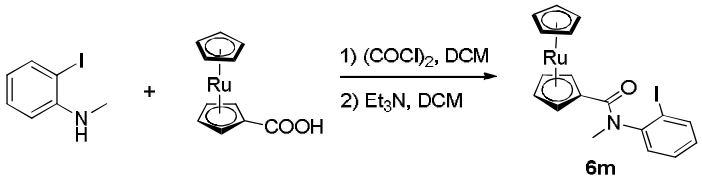
The reaction of 1'-methoxycarbonylferrocene-1-carboxylic acid (0.144 g, 0.50 mmol) and 2-iodo-*N*-methylaniline (0.117 g, 0.50 mmol) afforded **6j** (0.151 g, 60%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.92 (dd, *J* = 7.6, 1.2 Hz, 1 H), 7.39 (td, *J* = 7.6, 1.2 Hz, 1 H), 7.28 (dd, *J* = 7.6, 1.2 Hz, 1 H), 7.07 (td, *J* = 8.0, 1.6 Hz, 1 H), 4.89-4.73 (m, 2 H), 4.49-4.39 (m, 2 H), 4.23-4.07 (m, 3 H), 3.98 (bs, 1 H), 3.80 (s, 3 H), 3.29 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 171.3, 146.8, 140.1, 129.73, 129.68, 99.5, 73.61, 73.56, 72.44, 72.40, 72.0, 71.8, 71.7, 71.6, 71.2, 51.7, 37.6. HRMS (EI) calcd for $C_{20}H_{18}{}^{56}FeINO_3$ [M^+] 502.9681, found 502.9673.



6k

Compound **6k** was prepared following the Typical Procedure A.

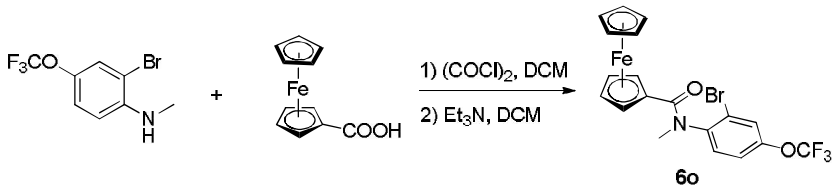
The reaction of 1-carboxy-1'-[(dimethylamino) carbonyl] ferrocene (60.0 mg, 0.20 mmol) and 2-iodo-*N*-methylaniline (47.0 mg, 0.20 mmol) afforded **6k** (45.0 mg, 44%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.91 (dd, *J* = 8.0, 1.2 Hz, 1 H), 7.37 (td, *J* = 7.2, 1.2 Hz, 3 H), 7.24 (dd, *J* = 8.0, 1.2 Hz, 1 H), 7.06 (td, *J* = 8.0, 1.6 Hz, 1 H), 4.66 (d, *J* = 12.4 Hz, 2 H), 4.38 (d, *J* = 10.8 Hz, 2 H), 4.28-4.08 (m, 3 H), 4.01 (bs, 1 H), 3.28 (s, 3 H), 3.23-2.91 (br, 6 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.1, 169.8, 146.7, 140.0, 129.7, 129.6, 99.2, 79.2, 76.7, 72.9, 72.4, 72.3, 72.2, 72.1, 72.0, 71.9, 71.7, 39.0, 37.7, 36.6. HRMS (EI) calcd for $C_{21}H_{21}{}^{56}FeIN_2O_2$ [M^+] 515.9997, found 515.9991.



6m

Compound **6m** was prepared following the **Typical Procedure A**.

The reaction of ruthenocenecarboxylic acid (0.275 g, 1.0 mmol) and 2-iodo-*N*-methylaniline (0.233 g, 1.0 mmol) afforded **6m** (0.368 g, 75%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.93 (d, *J* = 8.0 Hz, 1 H), 7.40 (td, *J* = 8.0, 1.6 Hz, 1 H), 7.24 (dd, *J* = 8.0, 1.2 Hz, 1 H), 7.09 (td, *J* = 8.0, 1.2 Hz, 1 H), 4.57 (s, 5 H), 4.47 (bs, 1 H), 4.43 (bs, 1 H), 4.32 (bs, 1 H), 4.28 (bs, 1 H) 3.24 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 168.8, 146.8, 140.1, 129.71, 129.65, 129.58, 99.5, 79.7, 72.9, 72.4, 72.0, 71.9, 71.7, 37.7. HRMS (EI) calcd for $C_{18}H_{16}{}^{102}RuINO$ [M^+] 490.9320, found 490.9315.

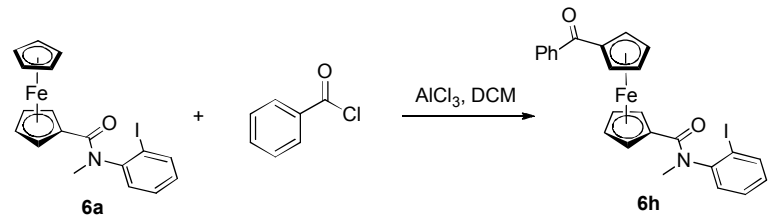


6o

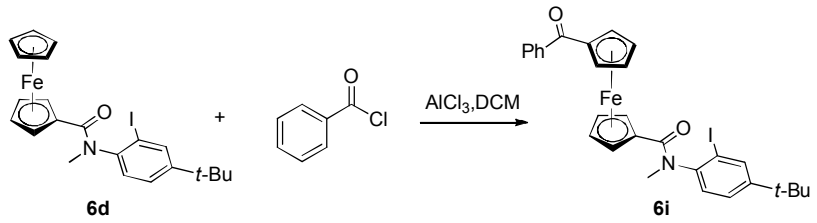
Compound **6o** was prepared following the **Typical Procedure A**.

The reaction of ferrocenecarboxylic acid (0.138 g, 0.60 mmol) and 2-bromo-*N*-methyl-4-(trifluoromethoxy)aniline (0.162 g, 0.60 mmol) afforded **6o** (87.0 mg, 30%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.58 (d, *J* = 1.6 Hz, 1 H), 7.24-7.15 (m, 2 H), 4.35 (bs, 1 H), 4.26-4.16 (m, 6 H), 4.12 (bs, 1 H), 3.74 (bs, 1 H), 3.30 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.5, 148.4, 142.5, 131.2, 126.1, 123.7, 121.5, 121.0, 118.9, 116.4, 75.2, 71.9, 70.3, 70.1, 69.9, 37.4. HRMS (EI) calcd for $C_{19}H_{15}{}^{79}BrF_3{}^{56}FeNO_2$ [M^+] 480.9588, found 480.9591.

Typical Procedures for the preparation of 6h, 6i, 6l: (Typical Procedure B)

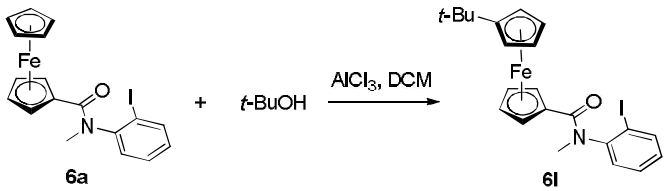


The benzoyl chloride (0.14 ml, 1.2 mmol, 1.2 equiv) was added to a mixture of **6a** (0.445 g, 1.0 mmol) and $AlCl_3$ (0.267 g, 2.0 mmol, 2.0 equiv) in CH_2Cl_2 (10 ml) at room temperature and stirred for additional 3 h. The reaction was quenched by the addition of crushed ice and extracted with CH_2Cl_2 twice. The combined organic phase was washed with water and dried over Na_2SO_4. After filtration the solvent was removed by evaporation, and the resulting mixture was purified by column chromatography on silica gel (hexanes/ethyl acetate = 1:1) to afford the desired product **6h** (0.480 g, 85%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.96-7.80 (m, 3 H), 7.56 (t, *J* = 7.2 Hz, 1 H), 7.46 (t, *J* = 8.0 Hz, 2 H), 7.33 (t, *J* = 7.2 Hz, 1 H), 7.17 (dd, *J* = 7.6, 1.2 Hz, 1 H), 7.06 (t, *J* = 7.6 Hz, 1 H), 4.93 (s, 2 H), 4.66 (s, 1 H), 4.65 (s, 1 H), 4.22-3.97 (m, 4 H), 3.27 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 198.5, 168.9, 146.6, 140.1, 139.3, 131.7, 129.75, 129.69, 128.2, 99.4, 79.0, 75.2, 73.2, 73.05, 72.98, 72.61, 72.56, 72.4, 72.0, 37.7. HRMS (EI) calcd for $C_{25}H_{20}{}^{56}FeINO_2$ [M^+] 548.9888, found 548.9895.



Compound **6i** was prepared following the **Typical Procedure B**.

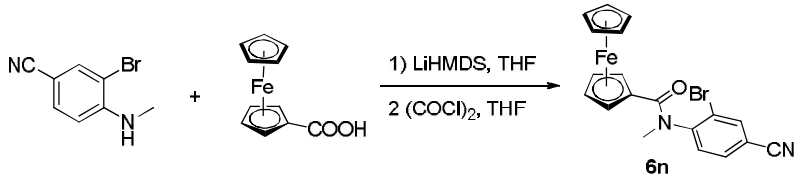
The reaction of benzoyl chloride (70 µl, 0.60 mmol, 1.2 equiv) and **6d** (0.251 g, 0.50 mmol) afforded **6i** (0.242 g, 80%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.04-7.74 (m, 3 H), 7.64-7.31 (m, 4 H), 7.06 (bs, 1 H), 4.92 (bs, 2 H), 4.66 (bs, 2 H), 4.25-3.85 (m, 4 H), 3.32 (br, 3 H), 1.30 (s, 9 H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 198.5, 169.1, 153.5, 143.8, 139.4, 136.9, 131.7, 128.9, 128.2, 126.9, 99.2, 78.9, 75.2, 73.2, 73.0, 72.7, 72.4, 72.1, 37.7, 34.6, 31.1. HRMS (EI) calcd for $C_{29}H_{28}{}^{56}FeINO_2$ [M^+] 605.0514, found 605.0511.



Compound **6l** was prepared following the **Typical Procedure B**.

The reaction of *t*-BuOH (16.3 mg, 0.22 mmol, 1.1 equiv) and **6a** (89.0 mg, 0.20

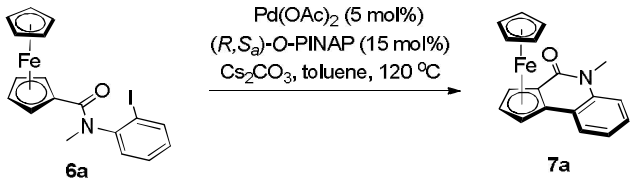
mmol) afforded **6l** (40.1 mg, 40%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.94 (d, *J* = 8.0 Hz, 1 H), 7.36 (t, *J* = 7.2 Hz, 1 H), 7.18 (d, *J* = 6.8 Hz, 1 H), 7.07 (t, *J* = 7.6 Hz, 1 H), 4.25-4.11 (m, 4 H), 4.10-4.02 (m, 3 H), 3.87 (bs, 1 H), 3.29 (s, 3 H), 1.17 (s, 9 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.6, 147.2, 140.1, 129.7, 129.6, 129.4, 103.2, 99.4, 75.5, 71.8, 70.6, 70.5, 70.04, 69.98, 66.9, 66.4, 37.7, 31.4, 30.2. HRMS (EI) calcd for $C_{22}H_{24}{}^{56}FeINO_2$ [M^+] 501.0252, found 501.0250.



6n

The LiHMDS (1.0 M in THF) (10.0 ml, 10.0 mmol) was added to 3-bromo-4-(methylamino)benzonitrile (0.422 g, 2.0 mmol) in THF (20 ml) at -10 °C. After stirring for 20 min at -10 °C the reaction mixture was allowed to warm to room temperature and stirred for additional 2 h.

Oxalyl chloride (0.43 ml, 5.0 mmol) was added dropwise to a solution of ferrocenecarboxylic acid (0.576 g, 2.5 mmol) in CH_2Cl_2 (20 ml) at 25 °C under argon. The resulting solution was stirred at room temperature for 0.5 h and concentrated under reduced pressure. The residue was diluted with THF (12 ml). This solution was added to the above amide solution at 0 °C in 25 min then the reaction mixture was allowed to warm to room temperature and stirred for another 20 min. After quenched with water, the residue was extracted with ethyl acetate twice. The combined organic layer was washed with brine, dried over Na_2SO_4, filtrated and concentrated, and purified by column chromatography (hexanes/EtOAc = 4:1) on silica gel to afford **6n** (0.558 g, 66%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.99 (d, *J* = 1.6 Hz, 1 H), 7.59 (dd, *J* = 8.0, 1.6 Hz, 1H), 7.26 (d, *J* = 8.0 Hz, 1H), 4.41 (bs, 1 H), 4.32-3.95 (m, 7 H), 3.73 (bs, 1 H), 3.31 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.4, 148.3, 137.3, 132.3, 131.3, 123.7, 116.6, 113.1, 75.1, 71.9, 70.3, 70.2, 69.8, 37.2. HRMS (EI) calcd for $C_{19}H_{15}{}^{79}Br^{56}FeN_2O$ [M^+] 421.9717, found 421.9709.

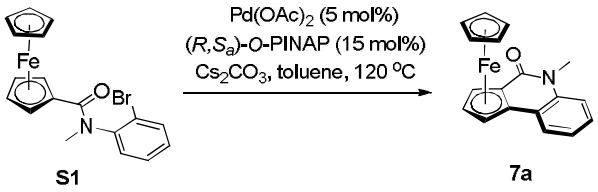


6a **7a**

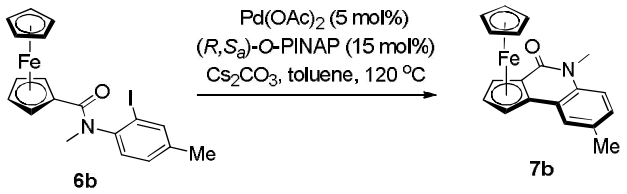
Typical procedure for the palladium-catalyzed asymmetric C-H functionalization/cyclization reaction: (**Typical Procedure C**).

A mixture of **6a** (44.5 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (*R,S$_a$*)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) was stirred at 120 °C for 12 h (the reaction was monitored by TLC). After cooling to room temperature the solvent was removed by evaporation and the residue was purified by column chromatography on silica gel (hexanes/ethyl acetate = 5:1) to afford **7a** (31.0 mg, 98%, 67% ee). $[\alpha]^{23}_D$

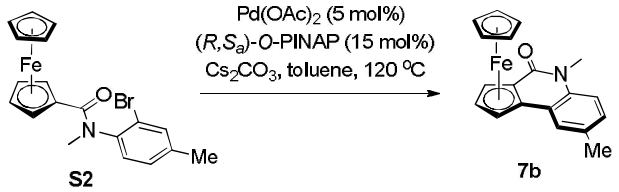
+19.6 (c 1.0, $CHCl_3$). HPLC conditions: Chiralcel AD-H, isopropanol/hexane = 8:92, flow: 1.0 ml/min, λ = 254 nm. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.72 (d, *J* = 7.6 Hz, 1 H), 7.39 (t, *J* = 7.6 Hz, 1 H), 7.27 (d, *J* = 7.6 Hz, 1 H), 7.18 (t, *J* = 7.6 Hz, 1 H), 5.22 (s, 1 H), 5.15 (s, 1 H), 4.49 (s, 1 H), 3.94 (s, 5 H), 3.70 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 167.8, 138.2, 127.2, 123.5, 123.0, 122.3, 114.9, 83.4, 71.5, 71.3, 70.4, 67.2, 63.6, 29.3. HRMS (EI) calcd for $C_{18}H_{15}{}^{56}FeNO$ [M^+] 317.0503, found 317.0497.



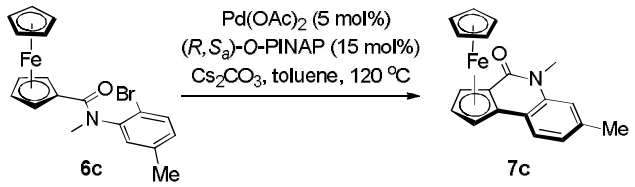
The reaction of **S1** (39.8 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (*R,S*$_a$)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7a** (29.8 mg, 94%, 49% ee).



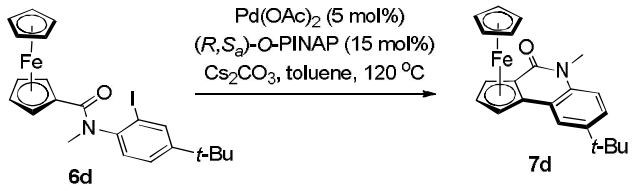
The reaction of **6b** (45.9 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (*R,S*$_a$)-O-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7b** (Rf = 0.30, PE:EA = 5:1) (29.8 mg, 90%, 67% ee). $[\alpha]^{23}{}_D$ +185.0 (c 1.0, $CHCl_3$). HPLC conditions: Chiralcel AD-H, isopropanol/hexane = 6:94, flow: 1.0 ml/min, λ = 254 nm. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.51 (s, 1 H), 7.23-7.11 (m, 2 H), 5.20 (s, 1 H), 5.12 (s, 1 H), 4.47 (s, 1 H), 3.94 (s, 5 H), 3.67 (s, 3 H), 2.44 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 167.7, 136.1, 131.7, 128.1, 123.7, 122.8, 114.9, 83.5, 71.6, 71.2, 70.4, 67.1, 63.5, 29.3, 20.7. HRMS (EI) calcd for $C_{19}H_{17}{}^{56}FeNO$ [M^+] 331.0660, found 331.0656.



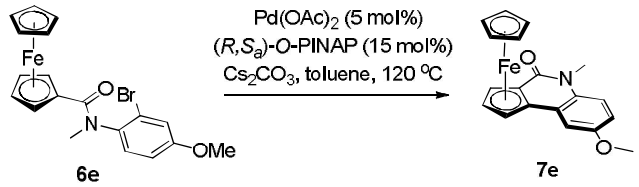
The reaction of **S2** (41.1 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (*R,S*$_a$)-O-PINAP (8.4 mg, 0.015 mmol, 15 mol %) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7b** (31.4 mg, 95%, 57% ee).



The reaction of **6c** (41.1 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (*R,S*$_a$)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7c** (Rf = 0.20, PE:EA = 5:1) (32.1 mg, 97%, 51% ee). $[\alpha]^{23}_D$ +6.4 (c 1.0, $CHCl_3$). HPLC conditions: Chiralcel AD-H, isopropanol/hexane = 6:94, flow: 1.0 ml/min, λ = 254 nm. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.60 (d, *J* = 7.6 Hz, 1 H), 7.08 (s, 1 H), 7.00 (d, *J* = 7.6 Hz, 1 H), 5.19 (dd, *J* = 2.4, 1.2 Hz, 1 H), 5.11 (dd, *J* = 2.4, 1.2 Hz, 1 H), 4.46 (t, *J* = 2.4 Hz, 1 H), 3.93 (s, 5 H), 3.68 (s, 3 H), 2.46 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 168.1, 138.2, 137.2, 123.3, 123.2, 120.0, 115.6, 83.8, 71.15, 71.06, 70.3, 66.9, 63.3, 29.3, 22.0. HRMS (EI) calcd for $C_{19}H_{17}{}^{56}FeNO$ [M^+] 331.0660, found 331.0655.

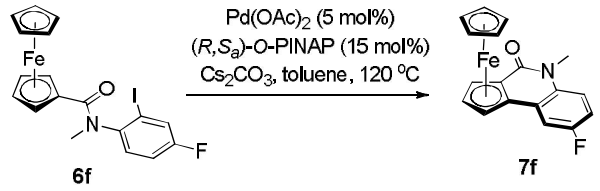


The reaction of **6d** (50.1 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (*R,S*$_a$)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7d** (Rf = 0.30, PE:EA = 5:1) (32.1 mg, 86%, 60% ee). $[\alpha]^{23}_D$ +293.8 (c 1.0, $CHCl_3$). HPLC conditions: Chiralcel AD-H, isopropanol/hexane = 0.5:99.5, flow: 1.0 ml/min, λ = 254 nm. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.70 (d, *J* = 2.4 Hz, 1 H), 7.42 (dd, *J* = 8.8, 2.4 Hz, 1 H), 7.21 (d, *J* = 8.8 Hz, 1 H), 5.24-5.18 (m, 1 H), 5.18-5.13 (m, 1 H), 4.48 (t, *J* = 2.8 Hz, 1 H), 3.94 (s, 5 H), 3.68 (s, 3 H), 1.41 (s, 9 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 167.8, 145.2, 136.0, 124.5, 122.4, 119.9, 114.7, 83.8, 71.6, 71.1, 70.4, 67.1, 63.4, 34.3, 31.5, 29.2. HRMS (EI) calcd for $C_{22}H_{23}{}^{56}FeNO$ [M^+] 373.1129, found 373.1126.

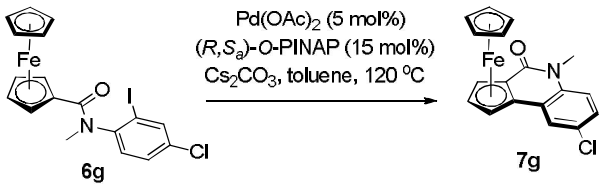


The reaction of **6e** (42.8 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (*R,S*$_a$)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7e** (Rf = 0.30, PE:EA = 3:1) (31.2 mg, 90%, 64% ee). $[\alpha]^{23}_D$ +198.9 (c 1.0, $CHCl_3$). HPLC conditions: Chiralcel AD-H, isopropanol/hexane = 6:94, flow: 1.0 ml/min, λ = 254 nm. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.22 (d, *J* = 2.8 Hz, 1 H), 7.20 (d, *J* = 9.2 Hz, 1 H),

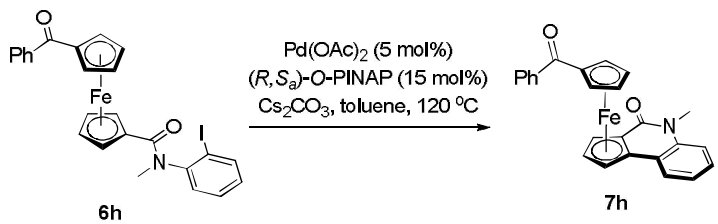
6.96 (dd, *J* = 9.2, 2.8 Hz, 1 H), 5.21 (dd, *J* = 2.4, 1.2 Hz, 1 H), 5.10 (dd, *J* = 2.4, 1.2 Hz, 1 H), 4.48 (t, *J* = 2.4 Hz, 1 H), 3.95 (s, 5 H), 3.91 (s, 3 H), 3.67 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 167.3, 154.9, 132.3, 124.2, 116.0, 112.8, 108.2, 83.0, 71.8, 71.3, 70.4, 67.3, 63.7, 55.6, 29.4. HRMS (EI) calcd for $C_{19}H_{17}{}^{56}FeNO_2$ [M^+] 347.0609, found 347.0610.



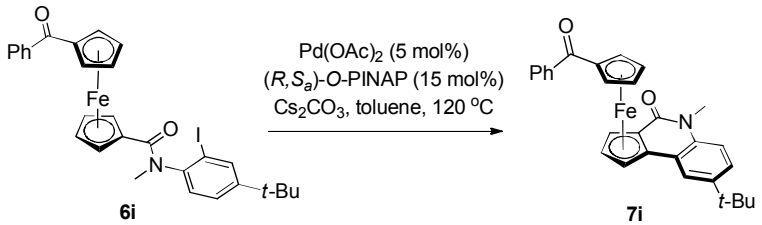
The reaction of **6f** (46.3 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (*R,S*$_a$)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7f** (Rf = 0.30, PE:EA = 5:1) (28.5 mg, 85%, 45% ee). $[\alpha]^{23}_D$ -67.0 (c 1.0, $CHCl_3$). HPLC conditions: Chiralcel AD-H, isopropanol/hexane = 8:92, flow: 1.0 ml/min, λ = 254 nm. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.39 (dd, *J* = 8.8, 3.2 Hz, 1 H), 7.21 (dd, *J* = 8.8, 4.8 Hz, 1 H), 7.09 (td, *J* = 8.8, 2.8 Hz, 1 H), 5.23 (d, *J* = 1.2 Hz, 1 H), 5.10 (d, *J* = 1.6 Hz, 1 H), 4.52 (t, *J* = 2.8 Hz, 1 H), 3.97 (s, 5 H), 3.68 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 167.4, 159.6, 157.2, 134.5, 124.94, 124.86, 116.3, 116.2, 114.0, 113.8, 109.7, 109.5, 82.2, 71.65, 71.62, 70.5, 67.6, 64.0, 29.5. HRMS (EI) calcd for $C_{18}H_{14}F^{56}FeNO$ [M^+] 335.0409, found 335.0402.



The reaction of **6g** (49.4 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol %), (*R,S*$_a$)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7g** (Rf = 0.30, PE:EA = 3:1) (33.0 mg, 94%, 28% ee). $[\alpha]^{23}_D$ +93.0 (c 1.0, $CHCl_3$). HPLC conditions: Chiralcel AD-H, isopropanol/hexane = 6:94, flow: 1.0 ml/min, λ = 254 nm. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.66 (d, *J* = 2.4 Hz, 1 H), 7.33 (dd, *J* = 8.8, 2.4 Hz, 1 H), 7.18 (d, *J* = 8.8 Hz, 1 H), 5.23 (s, 1 H), 5.11 (s, 1 H), 4.52 (s, 1 H), 3.97 (s, 5 H), 3.67 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 167.5, 136.8, 127.7, 126.9, 124.9, 122.9, 116.2, 82.0, 71.7, 71.5, 70.6, 67.6, 63.9, 29.4. HRMS (EI) calcd for $C_{18}H_{14}{}^{35}Cl^{56}FeNO$ [M^+] 351.0113, found 351.0109.

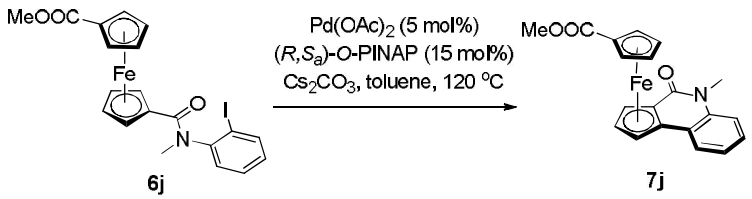


The reaction of **6h** (54.9 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (R,S_a)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7 h** (Rf = 0.20, PE:EA = 1:1) (21.1 mg, 50%, 61% ee). $[\alpha]^{23}_{D}$ -465.0 (c 1.0, $CHCl_3$). HPLC conditions: Chiralcel AD-H, isopropanol/hexane = 8:92, flow: 1.0 ml/min, λ = 254 nm. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.62-7.48 (m, 4 H), 7.46-7.33 (m, 3 H), 7.22 (d, *J* = 8.4 Hz, 1 H), 7.15 (t, *J* = 7.6 Hz, 1 H), 5.23 (s, 1 H), 5.12 (s, 1 H), 4.85 (s, 1 H), 4.55 (s, 1 H), 4.47 (s, 1 H), 4.45 (s, 1 H), 4.31 (s, 1 H), 3.58 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 196.7, 166.5, 138.9, 138.4, 131.7, 128.3, 128.00, 127.96, 124.3, 122.4, 120.5, 115.2, 85.7, 79.4, 74.6, 74.0, 73.6, 72.9, 72.5, 72.2, 68.0, 65.5, 29.3. HRMS (EI) calcd for $C_{25}H_{19}{}^{56}FeNO_2$ [M^+] 421.0765, found 421.0767.



6i **7i**

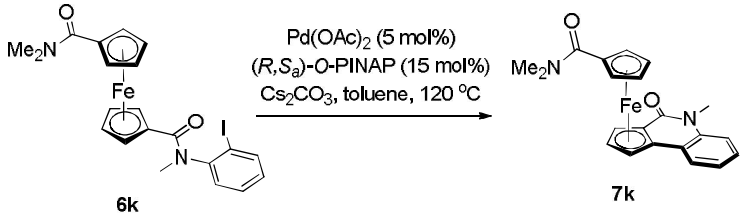
The reaction of **6i** (60.5 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (R,S_a)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7i** (Rf = 0.20, PE:EA = 2:1) (35.8 mg, 75%, 63% ee). $[\alpha]^{23}_{D}$ -242.1 (c 1.0, $CHCl_3$). HPLC conditions: Chiralcel AD-H, isopropanol/hexane = 6:94, flow: 1.0 ml/min, λ = 254 nm. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.61-7.52 (m, 3 H), 7.52-7.42 (m, 2 H), 7.37 (t, *J* = 7.2 Hz, 2 H), 7.16 (d, *J* = 8.4 Hz, 1 H), 5.22 (s, 1 H), 5.16 (s, 1 H) 4.86 (s, 1 H), 4.56 (s, 1 H), 4.46 (s, 1 H), 4.43 (s, 1 H), 4.30 (s, 1 H), 3.57 (s, 3 H), 1.37 (s, 9 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 196.7, 166.5, 145.3, 139.0, 136.2, 131.7, 128.3, 128.0, 125.4, 120.7, 119.9, 115.0, 86.3, 79.5, 74.5, 73.9, 73.6, 72.8, 72.6, 72.3, 68.0, 65.2, 34.2, 31.4, 29.2. HRMS (EI) calcd for $C_{29}H_{27}{}^{56}FeNO_2$ [M^+] 477.1391, found 477.1389.



6j **7j**

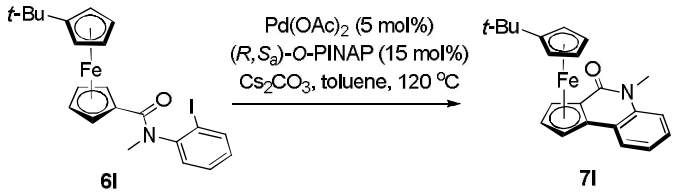
The reaction of **6j** (50.3 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (R,S_a)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7j** (Rf = 0.40, PE:EA = 2:1) (30.0 mg, 80%, 55% ee). $[\alpha]^{23}_{D}$ -284.5 (c 1.0, $CHCl_3$). HPLC conditions: Chiralcel AD-H, isopropanol/hexane = 6:94, flow: 1.0 ml/min, λ = 254 nm. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.65 (dd, *J* = 7.6, 1.6 Hz, 1 H), 7.45 (td, *J* = 7.6, 1.6 Hz, 1 H), 7.29 (d, *J* = 8.4 Hz, 1 H), 7.20 (td, *J* = 7.6, 1.2 Hz, 1 H), 5.24 (dd, *J* = 2.4, 1.2 Hz, 1 H), 5.14 (dd, *J* = 2.4, 1.2 Hz, 1 H), 4.65 (dt, *J* = 2.4, 1.2 Hz, 1 H), 4.49 (t, *J* = 2.4 Hz, 1 H), 4.44-4.35 (m, 2 H), 4.31 (td, *J* = 2.4, 1.2 Hz, 1 H), 3.68 (s, 3 H), 3.34

(s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 168.8, 166.6, 138.6, 127.9, 124.2, 122.2, 120.2, 115.1, 85.4, 74.1, 72.9, 72.8, 72.2, 71.9, 71.2, 67.8, 64.5, 51.6, 29.4. HRMS (EI) calcd for $C_{20}H_{17}{}^{56}FeNO_3$ [M^+] 375.0558, found 375.0550.



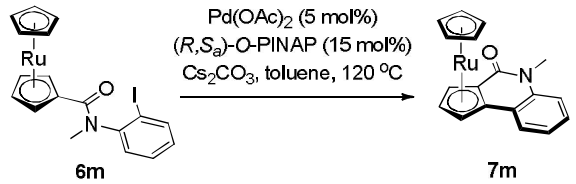
6k **7k**

The reaction of **6k** (51.6 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (*R,S*$_a$)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7k** (Rf = 0.20, ethyl acetate) (29.1 mg, 75%, 53% ee). $[\alpha]^{23}_D$ +31.3 (c 1.0, $CHCl_3$). HPLC conditions: Chiralcel AD-H, isopropanol/hexane = 6:94, flow: 1.0 ml/min, λ = 254 nm. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.73 (dd, *J* = 7.6, 1.6 Hz, 1 H), 7.42 (td, *J* = 7.2, 1.6 Hz, 1 H), 7.27 (d, *J* = 7.6 Hz, 1 H), 7.19 (td, *J* = 7.6, 0.8 Hz, 1 H), 5.23 (dd, *J* = 2.4, 1.2 Hz, 1 H), 5.21 (dd, *J* = 2.8, 1.2 Hz, 1 H), 4.61 (dt, *J* = 2.4, 1.2 Hz, 1 H), 4.58 (t, *J* = 2.4 Hz, 1 H), 4.23 (dt, *J* = 2.4, 1.2 Hz, 1 H), 4.16 (td, *J* = 2.4, 1.2 Hz, 1 H), 4.02 (td, *J* = 2.4, 1.2 Hz, 1 H), 3.69 (s, 3 H), 2.88 (br, 6 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 168.3, 167.2, 138.4, 127.6, 124.2, 122.2, 121.5, 114.9, 84.7, 79.8, 73.5, 73.1, 72.3, 72.0, 71.9, 71.3, 67.9, 66.5, 38.8, 36.6, 29.4. HRMS (EI) calcd for $C_{21}H_{20}{}^{56}FeN_2O_2$ [M^+] 388.0874, found 388.0871.



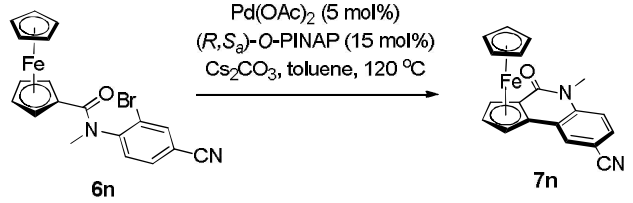
6l **7l**

The reaction of **6l** (50.1 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (*R,S*$_a$)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7l** (Rf = 0.30, PE:EA = 2:1) (19.4 mg, 52%, 60% ee). $[\alpha]^{23}_D$ -26.0 (c 1.0, $CHCl_3$). HPLC conditions: Chiralcel AD-H, isopropanol/hexane = 8:92, flow: 1.0 ml/min, λ = 254 nm. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.71 (dd, *J* = 7.6, 1.2 Hz, 1 H), 7.38 (t, *J* = 7.6, 1 H), 7.26(d, *J* = 7.6 Hz, 1 H), 7.17 (t, *J* = 7.2 Hz, 1 H), 5.20 (d, *J* = 1.2 Hz, 1 H), 5.12 (s, 1 H), 4.48 (t, *J* = 2.4 Hz, 1 H), 3.98 (s, 1 H), 3.77 (s, 1 H), 3.74 (s, 1 H), 3.69 (s, 3 H), 3.61 (s, 1 H), 1.18 (s, 9 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 167.9, 138.2, 127.1, 123.6, 123.0, 122.2, 114.9, 103.3, 83.3, 71.9, 71.3, 70.8, 70.5, 67.5, 67.1, 66.5, 64.1, 31.3, 30.2, 29.3. HRMS (EI) calcd for $C_{22}H_{23}{}^{56}FeNO$ [M^+] 373.1129, found 373.1126.

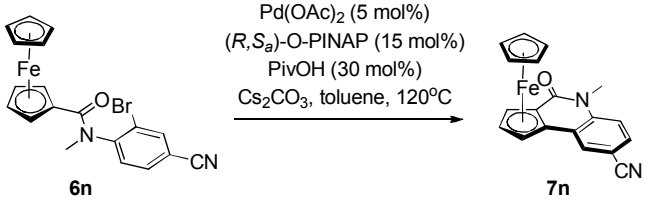


The reaction of **6m** (49.0 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (*R,S*$_a$)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7m** (Rf = 0.20, PE:EA = 5:1) (35.5 mg, 98%, 65% ee). $[\alpha]^{23}_D$ -22.9 (c 1.0, $CHCl_3$). HPLC conditions: Chiralcel AD-H, isopropanol/hexane = 1:99, flow: 1.0 ml/min, λ = 254 nm. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.64 (dd, *J* = 7.6, 1.6 Hz, 1 H), 7.34 (td, *J* = 7.6, 1.6 Hz, 1 H), 7.22 (d, *J* = 8.0 Hz, 1 H), 7.12 (td, *J* = 7.6, 0.8 Hz, 1 H), 5.51 (dd, *J* = 2.4, 0.8 Hz, 2 H), 4.84 (t, *J* = 2.4 Hz, 1 H), 4.38 (s, 5 H), 3.62 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 166.4, 137.8, 127.1, 123.2, 122.1, 121.8, 114.8, 86.6, 76.2, 72.8, 72.1, 69.3, 66.3, 29.3. HRMS (EI) calcd for $C_{18}H_{15}{}^{102}RuNO$ [M^+] 363.0197, found 363.0195.

Scheme 3. The effects by the addition of PivOH

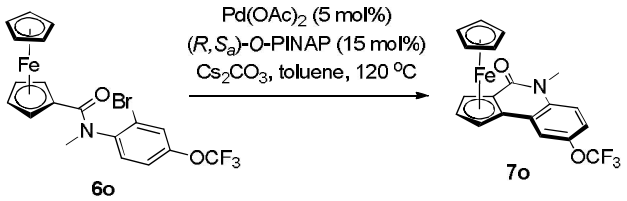


The reaction of **6n** (42.3 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (*R,S*$_a$)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7n** (Rf = 0.20, PE:EA = 2:1) (14.4 mg, 42%, 88% ee). $[\alpha]^{23}_D$ +197.8 (c 1.0, $CHCl_3$). HPLC conditions: Chiralcel OJ-H, isopropanol/hexane = 15:85, flow: 1.0 ml/min, λ = 254 nm. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 2.0 Hz, 1 H), 7.65 (dd, *J* = 8.8, 1.6 Hz, 1 H), 7.31 (d, *J* = 8.8 Hz, 1 H), 5.26 (d, *J* = 1.6 Hz, 1 H), 5.18 (d, *J* = 1.6 Hz, 1 H), 4.59 (t, *J* = 2.4 Hz, 1 H), 3.99 (s, 5 H), 3.70 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 167.7, 141.3, 130.6, 127.1, 124.4, 118.9, 115.4, 105.5, 81.2, 72.3, 71.1, 70.7, 67.9, 64.2, 29.5. HRMS (EI) calcd for $C_{19}H_{14}{}^{56}FeN_2O$ [M^+] 342.0456, found 342.0453.



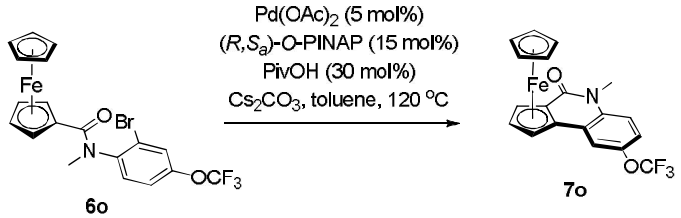
The reaction of **6n** (42.3 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005

mmol, 5 mol%), (*R,S*$_a$)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%), PivOH (3.1 mg, 0.030 mmol, 30 mol %) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7n** (Rf = 0.20, PE:EA = 2:1) (33.5 mg, 98%, 4% ee).



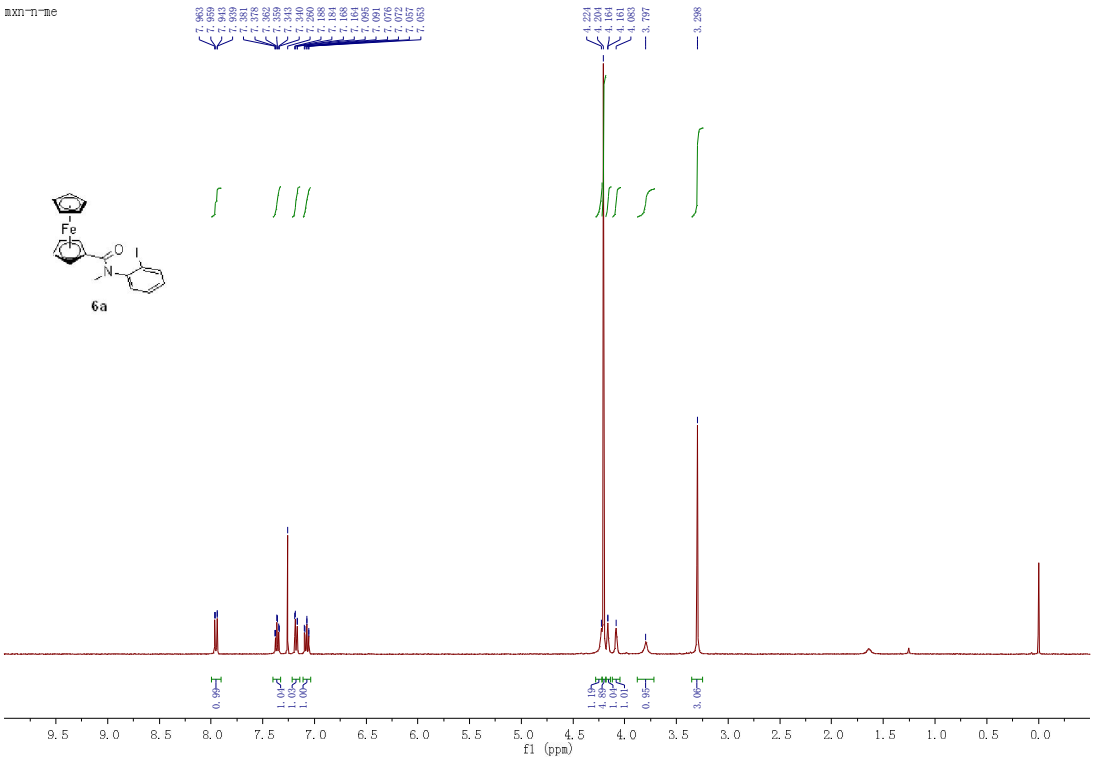
6o **7o**

The reaction of **6o** (48.1 mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (*R,S*$_a$)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7o** (Rf = 0.30, PE:EA = 3:1) (13.2 mg, 33%, 48% ee). $[\alpha]^{23}_D$ -11.0 (c 1.0, $CHCl_3$). HPLC conditions: Chiralcel AD-H, isopropanol/hexane = 6:94, flow: 1.0 ml/min, λ = 254 nm. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.54 (s, 1 H), 7.26-7.22 (m, 2 H), 5.24 (dd, *J* = 2.4, 1.2 Hz, 1 H), 5.13 (dd, *J* = 2.4, 1.2 Hz, 1 H), 4.54 (t, *J* = 2.4 Hz, 1 H), 3.97 (s, 5 H), 3.69 (s, 3 H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 167.5, 144.1, 136.8, 124.8, 124.4, 121.9, 119.6, 119.3, 116.0, 115.8, 81.9, 71.8, 71.5, 70.6, 67.7, 64.0, 29.5. HRMS (EI) calcd for $C_{19}H_{14}F_3{}^{56}FeNO_2$ [M^+] 401.0326, found 401.0319.



6o **7o**

The reaction of **6o** (48.1mg, 0.10 mmol, 1.0 equiv), $Pd(OAc)_2$ (1.1 mg, 0.005 mmol, 5 mol%), (*R,S*$_a$)-*O*-PINAP (8.4 mg, 0.015 mmol, 15 mol%), PivOH (3.1 mg, 0.030 mmol, 30 mol %) and Cs_2CO_3 (81.5 mg, 0.25 mmol, 2.5 equiv) in toluene (2.0 ml) at 120 °C for 12 h afforded **7o** (Rf = 0.30, PE:EA = 3:1) (16.8 mg, 42%, 16% ee).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7.959
7.943
7.939
7.381
7.378
7.362
7.359
7.343
7.340
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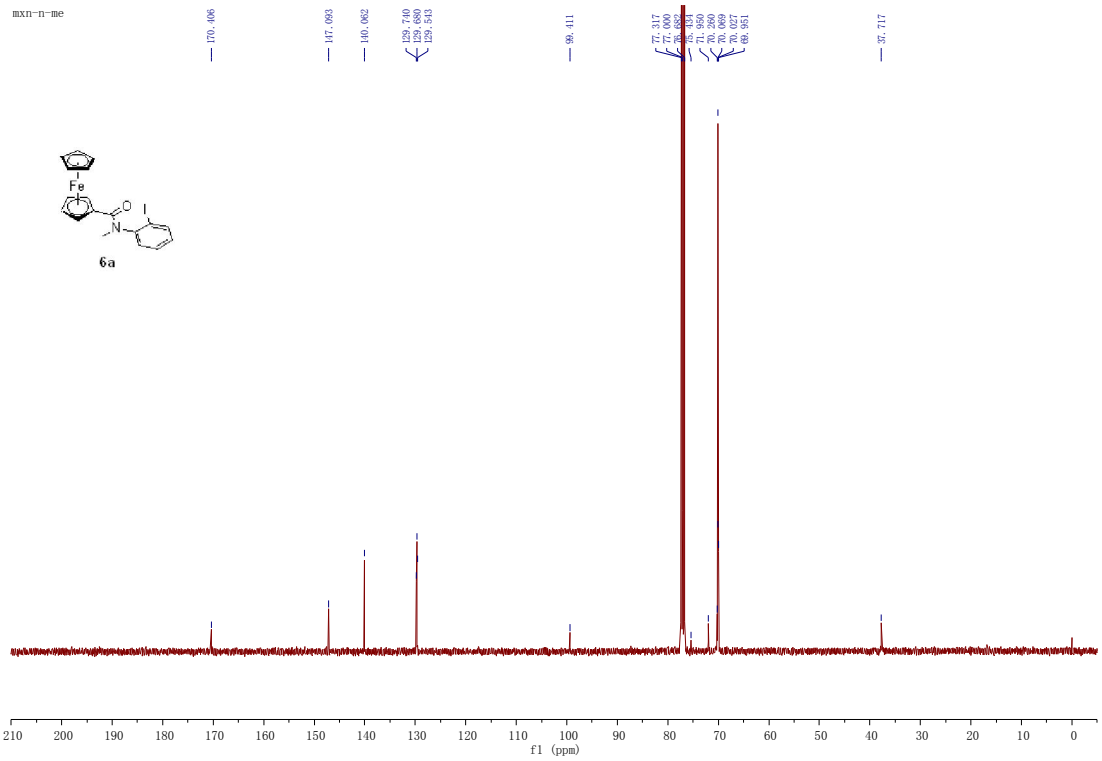
7.188
7.184
7.168
7.164
7.095
7.091
7.076
7.072
7.057
7.053
4.224
4.204
4.164
4.151
4.083
3.797
3.298
Fe
O
N
I
6a
0.99
1.04
1.03
1.00
1.19
4.89
4.04
1.01
0.95
3.06
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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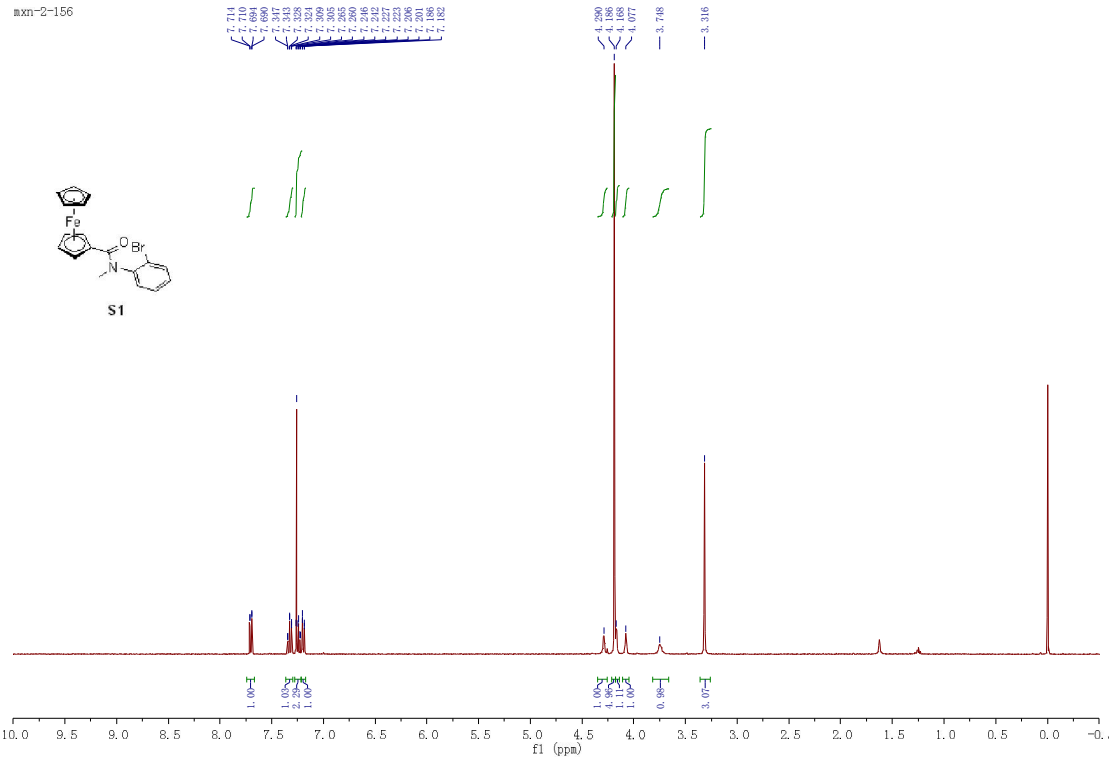
140.062
129.740
129.660
129.543
98.411
77.317
77.000
76.682
76.434
71.950
70.098
70.069
70.027
69.961
37.717
Fe
O
N
I
6a
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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7.710
7.694
7.690
7.347
7.343
7.328
7.324
7.309
7.305
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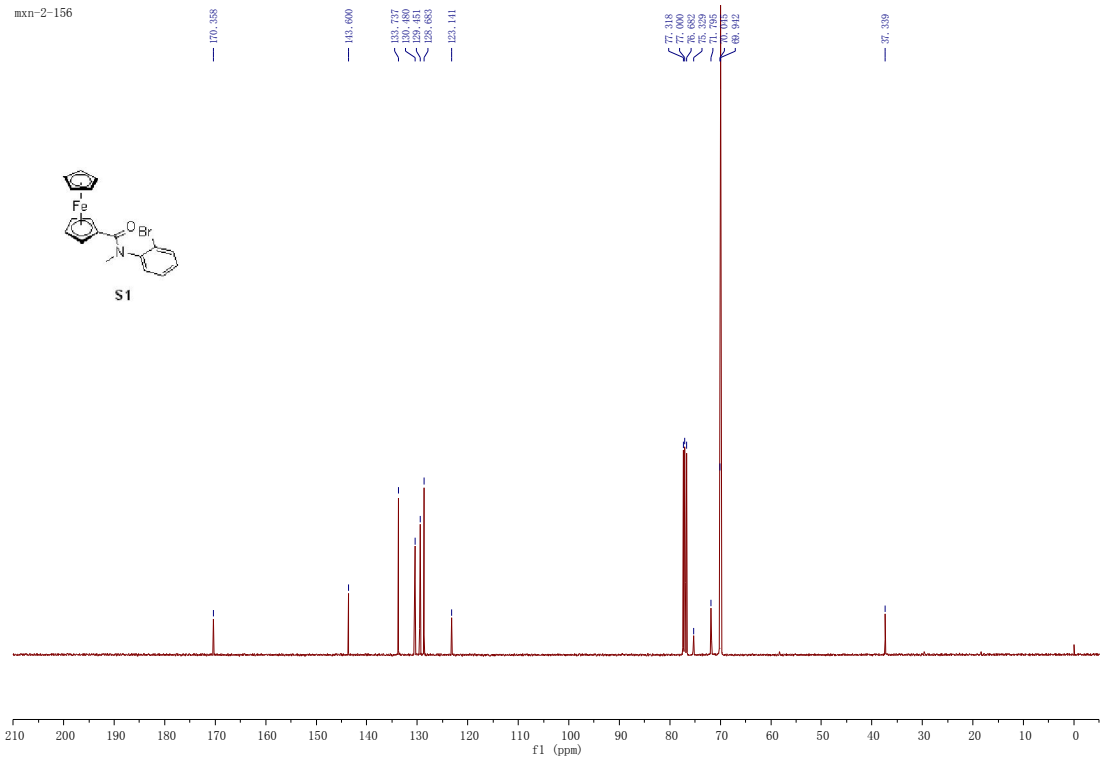
7.260
7.246
7.242
7.227
7.223
7.206
7.201
7.186
7.182
4.290
4.186
4.168
4.077
3.748
3.316
Fe
O
Br
N
S1
1.00
1.03
2.29
1.00
1.00
4.96
1.11
1.00
0.98
3.07
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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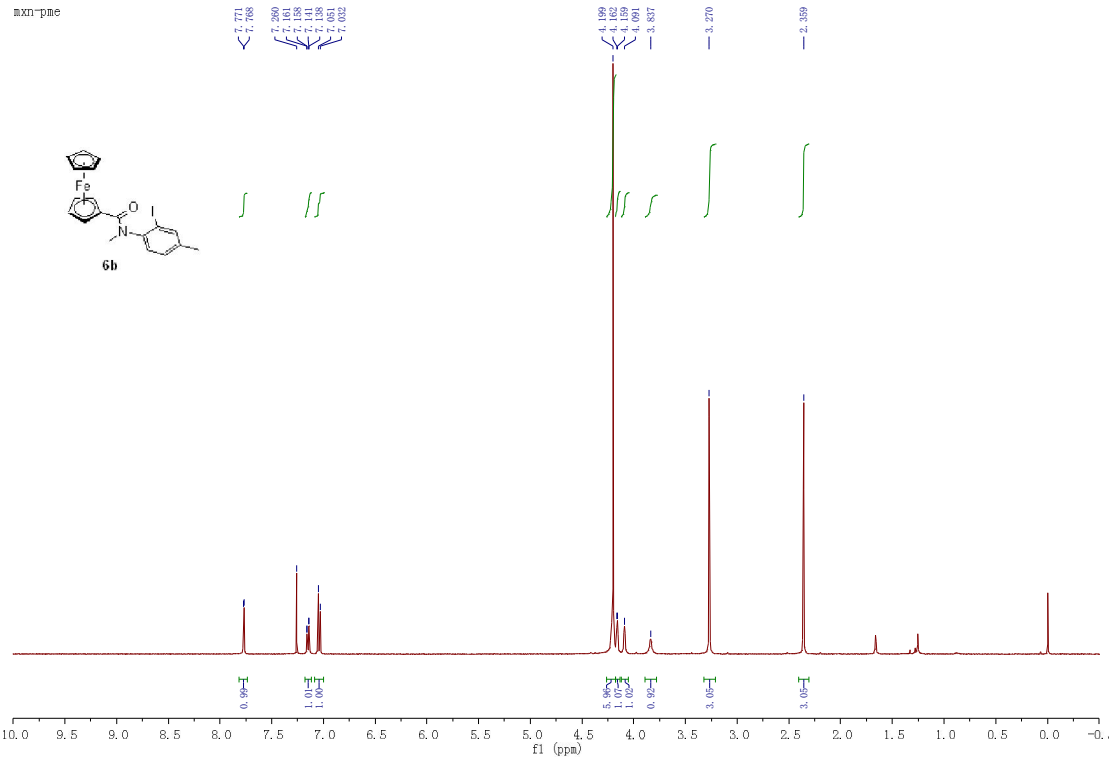
133.737
130.960
129.451
128.683
123.141
77.318
77.000
76.682
75.329
71.755
70.045
69.942
37.339
Fe
O
Br
N
S1
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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7.161
7.158
7.141
7.138
7.051
7.032
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4.162
4.159
4.091
3.837
3.270
2.359
6b
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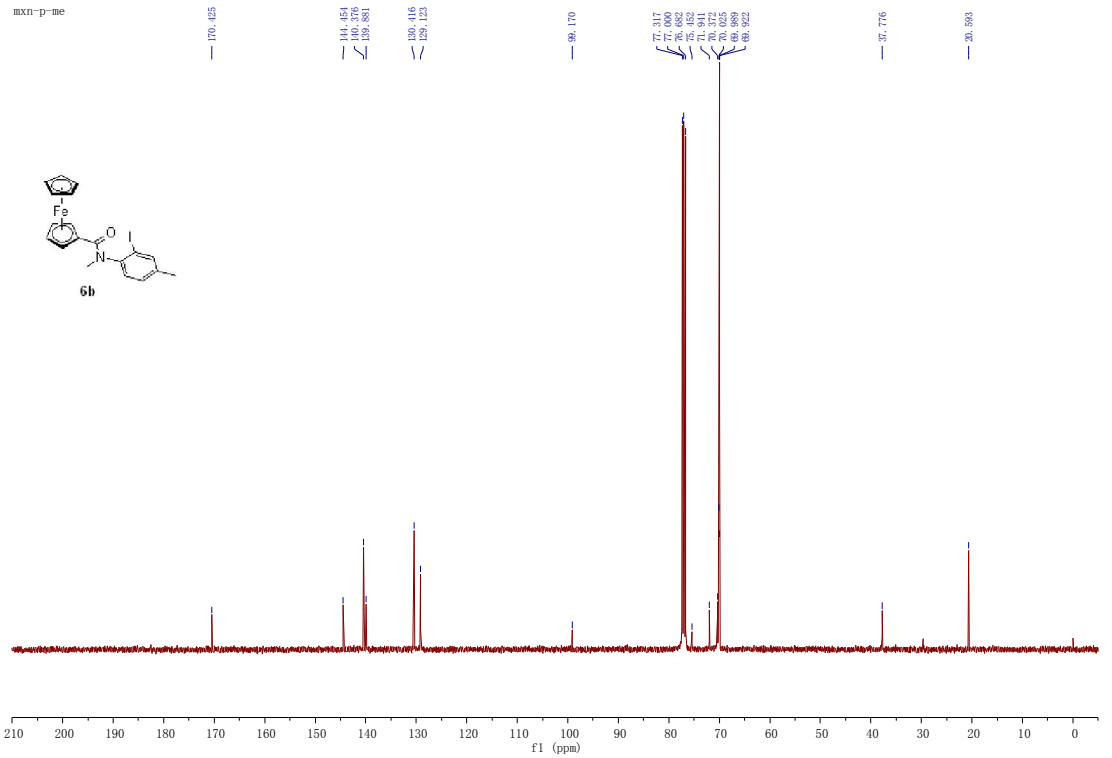
1.01
1.00
5.96
1.07
1.02
0.92
3.05
3.05
f1 (ppm)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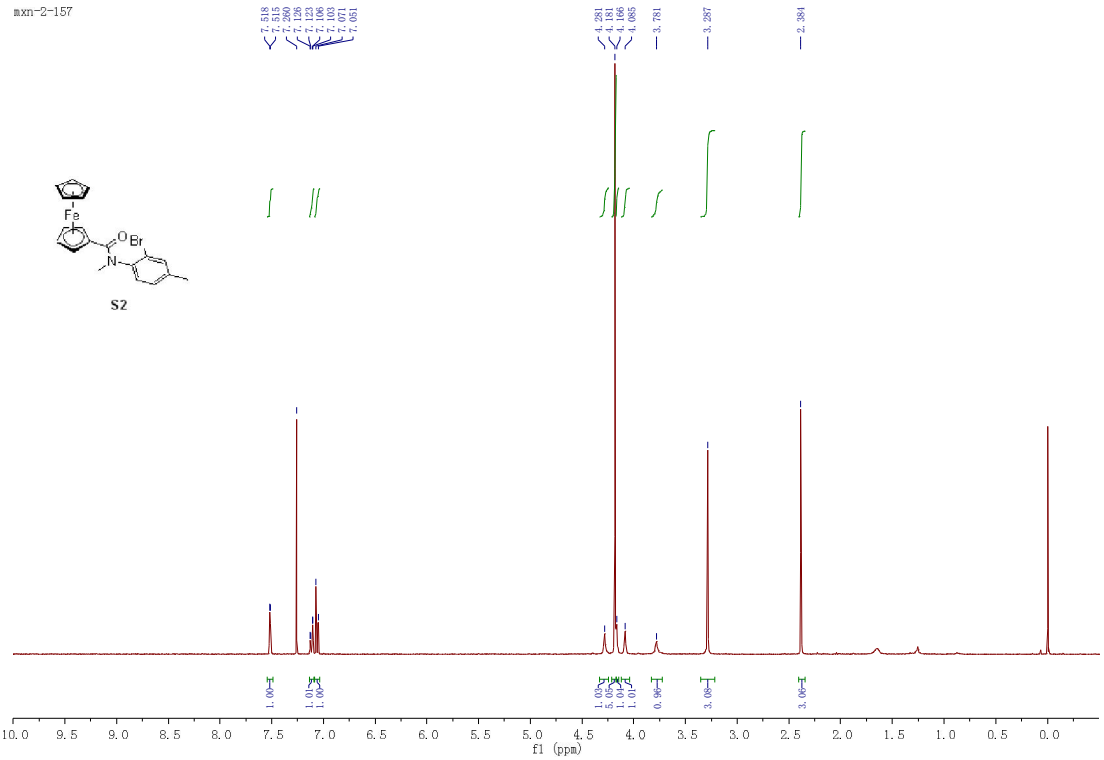
139.881
130.416
129.123
98.170
77.317
77.000
76.682
75.462
71.941
71.372
70.025
69.989
69.922
37.776
20.593
6b
f1 (ppm)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7.515
7.260
7.126
7.123
7.106
7.103
7.071
7.061
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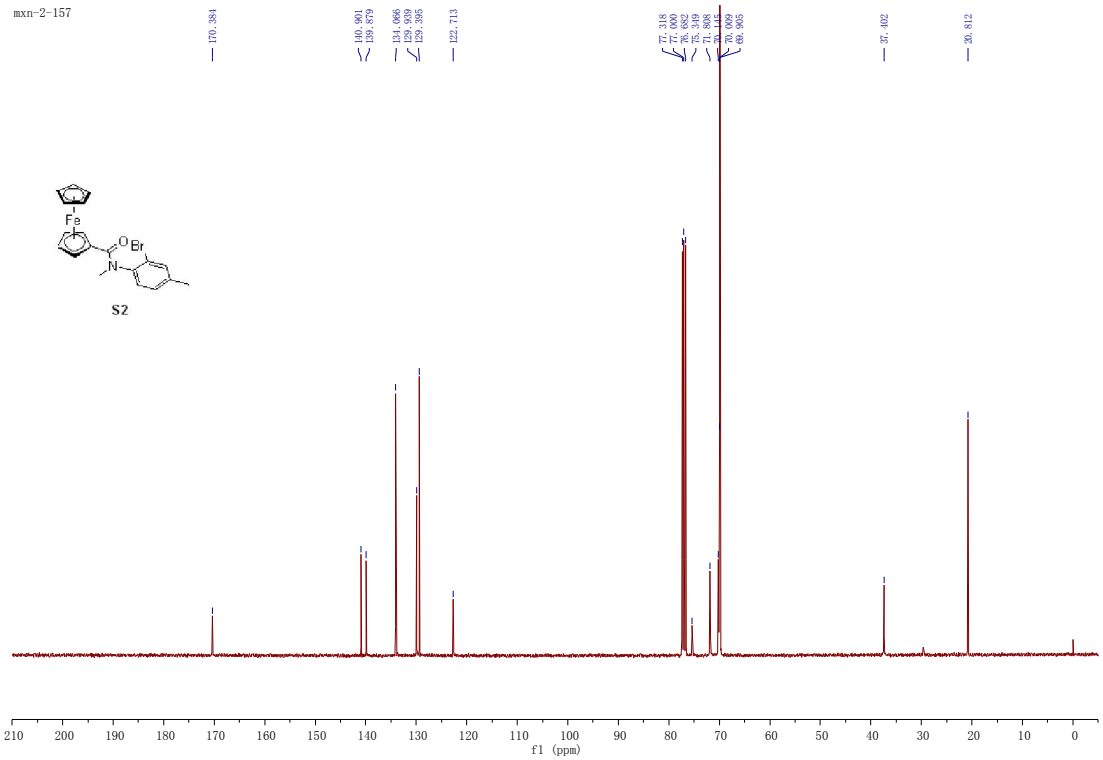
4.181
4.166
4.085
3.781
3.287
2.384
Fe
O
Br
N
S2
1.00
1.01
1.06
1.03
5.05
1.04
1.01
0.96
3.08
3.06
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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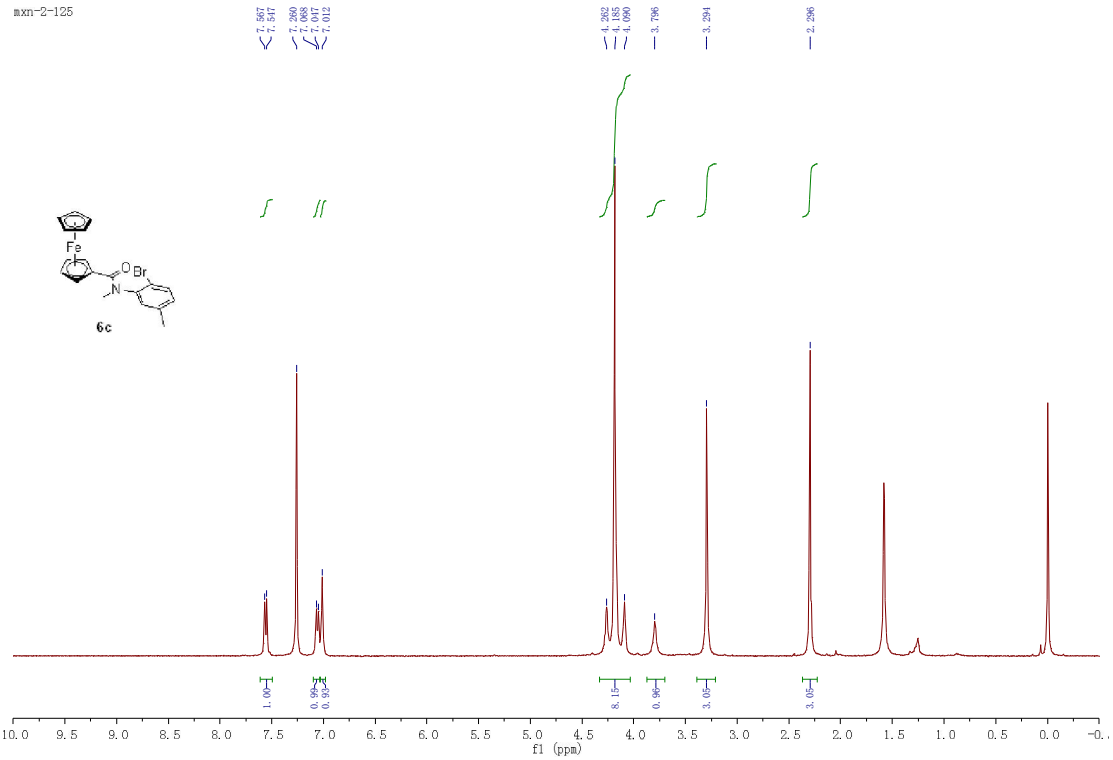
122.713
77.318
77.000
76.682
75.349
71.808
70.145
70.009
68.905
37.402
20.812
Fe
O
Br
N
S2
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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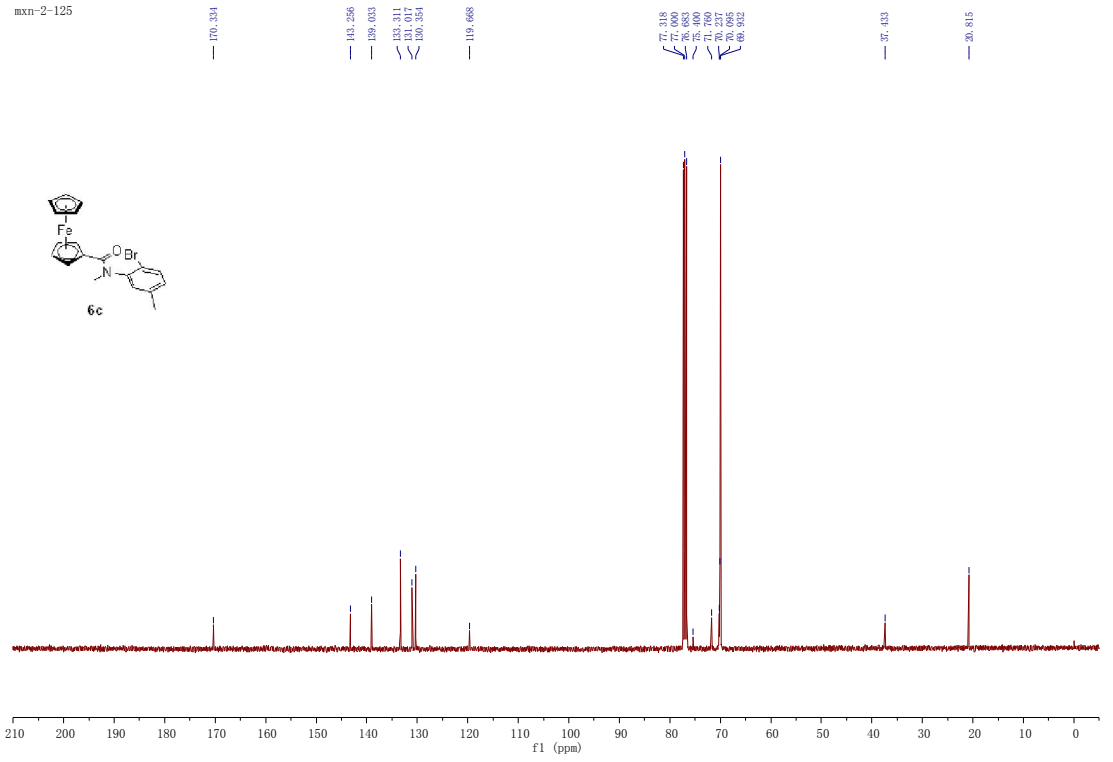
7.260
7.068
7.047
7.012
4.262
4.155
4.090
3.796
3.294
2.296
Fe
O
Br
N
6c
1.00
0.99
0.93
8.15
0.96
3.05
3.05
f1 (ppm)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133.311
131.017
130.354
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77.000
76.683
75.400
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70.237
70.095
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37.433
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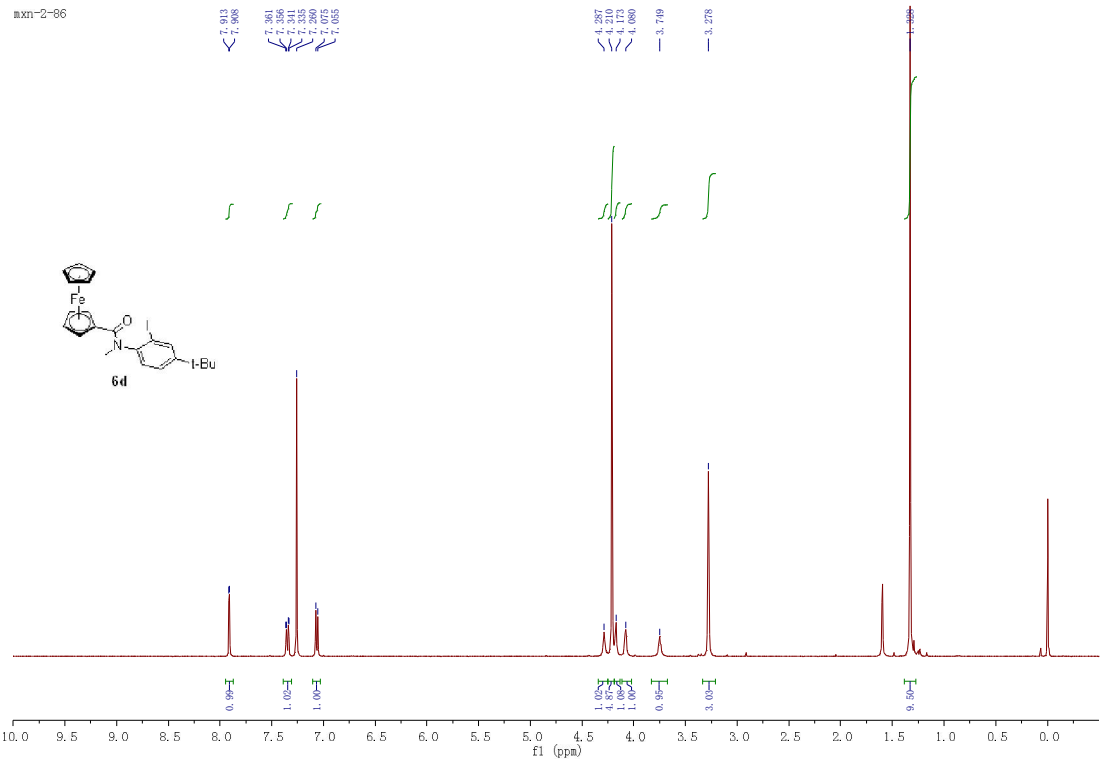
Fe
O
Br
N
6c
f1 (ppm)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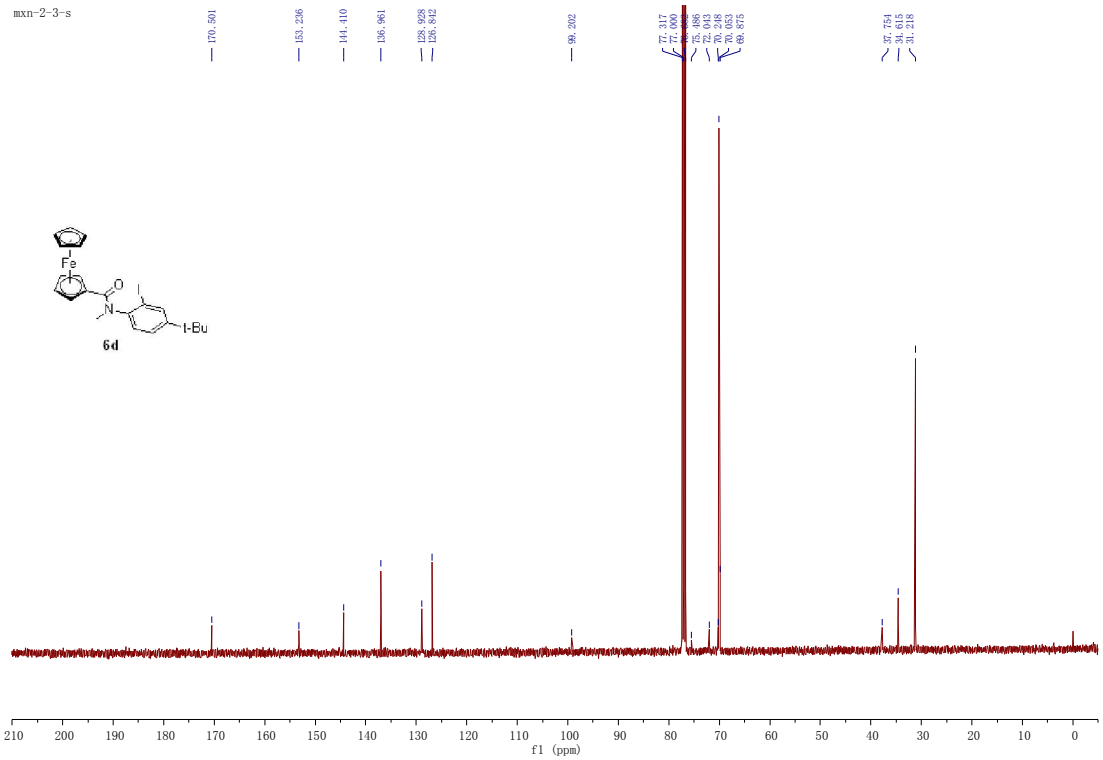
7.345
7.341
7.335
7.260
7.075
7.055
4.287
4.210
4.173
4.080
3.749
3.278
1.588
Fe
O
N
I
I-Bu
6d
0.99
1.02
1.00
1.02
4.87
1.08
1.00
0.95
3.03
9.50
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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128.928
128.512
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77.000
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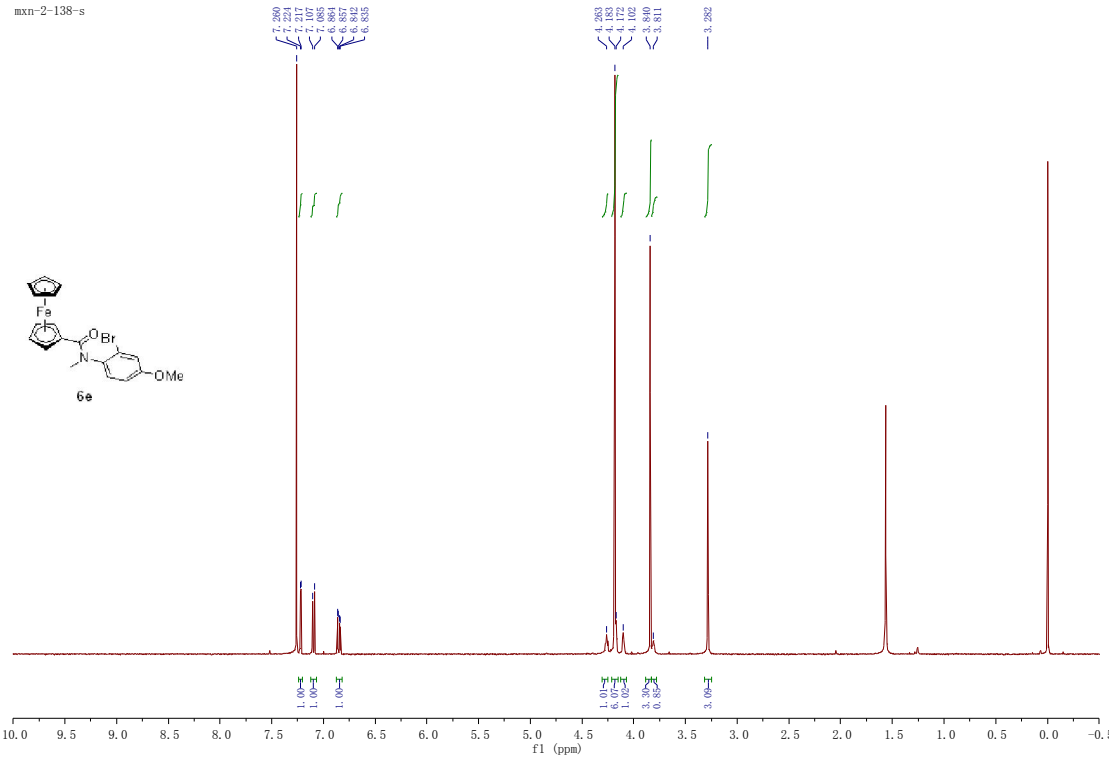
70.248
70.053
68.875
37.754
34.615
31.218
Fe
O
N
I
I-Bu
6d
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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7.095
6.864
6.857
6.842
6.835
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4.183
4.172
4.102
3.840
3.811
3.282
Fe
O
Br
N
OMe
6e
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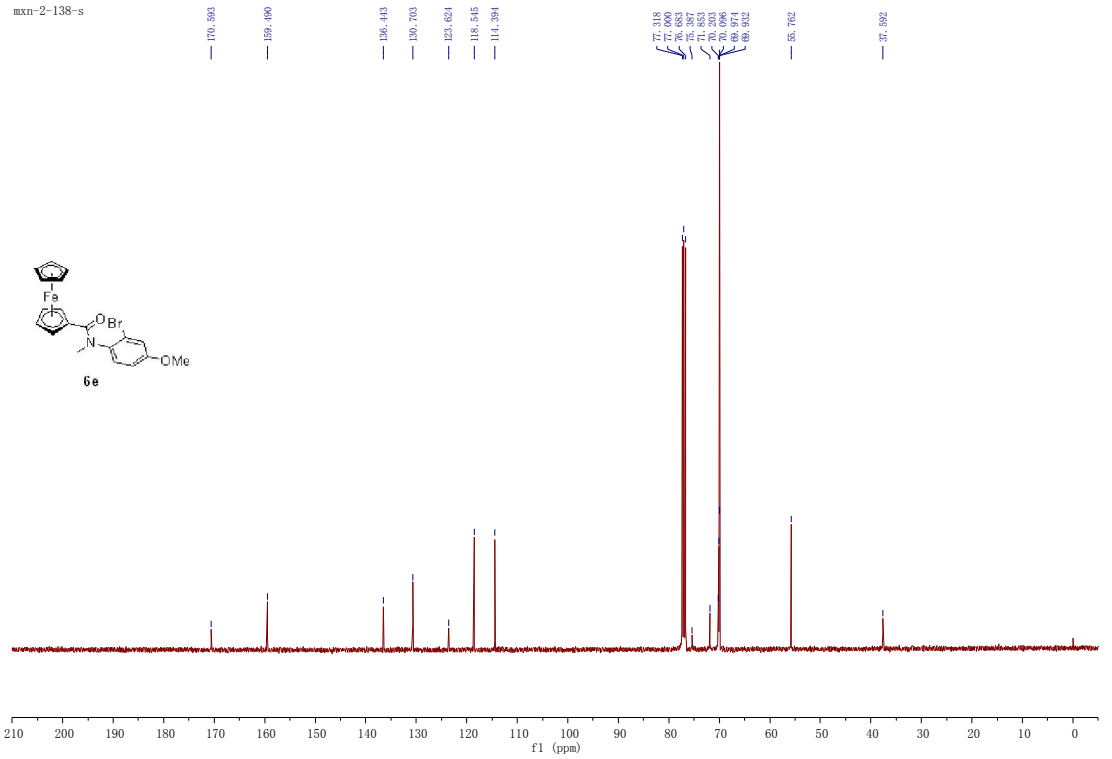
1.00
1.00
1.01
6.07
1.02
3.30
6.58
3.09
f1 (ppm)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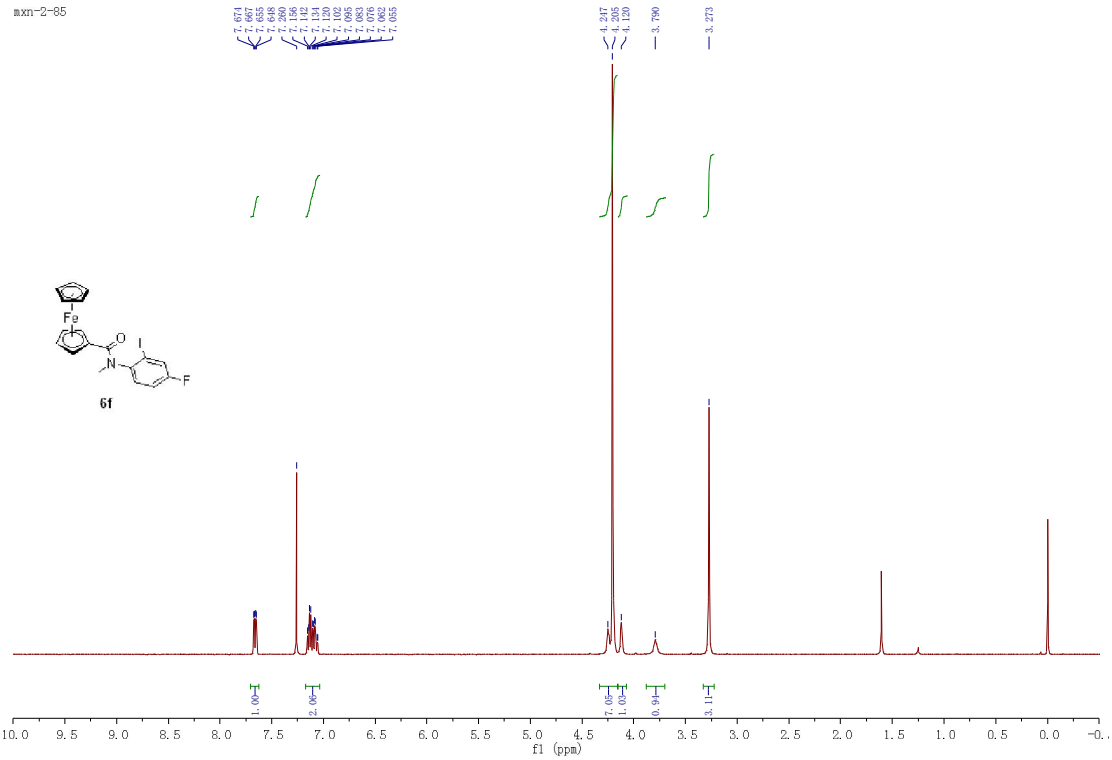
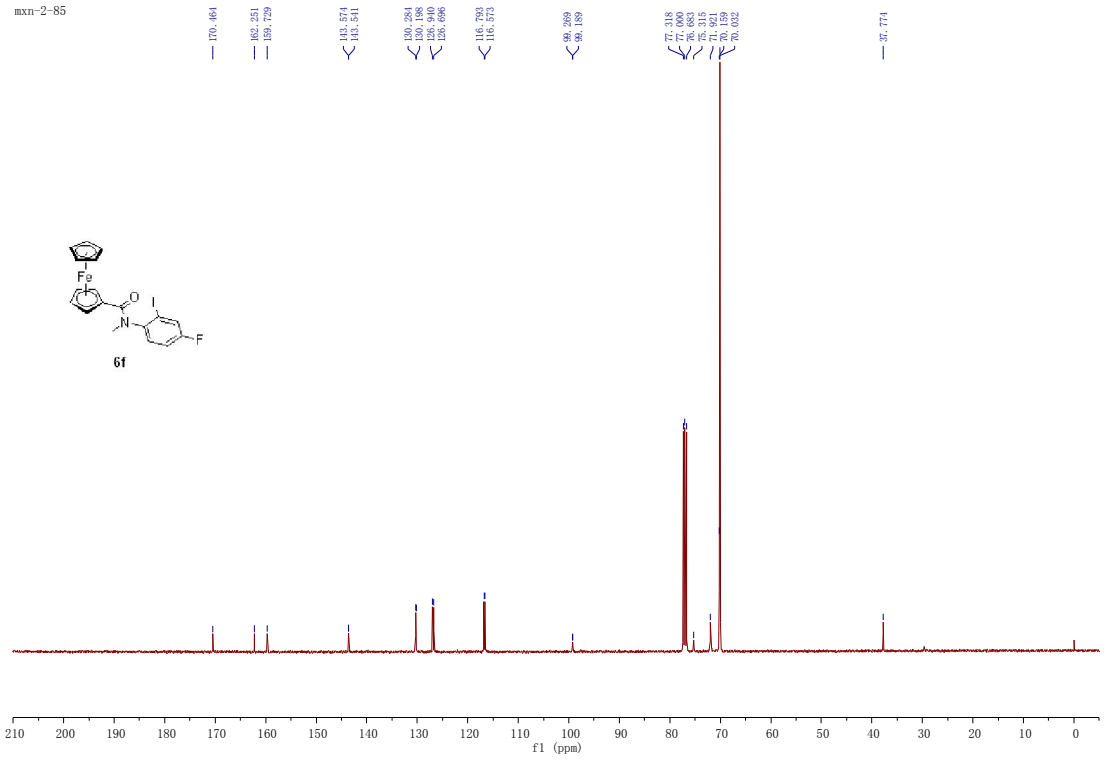
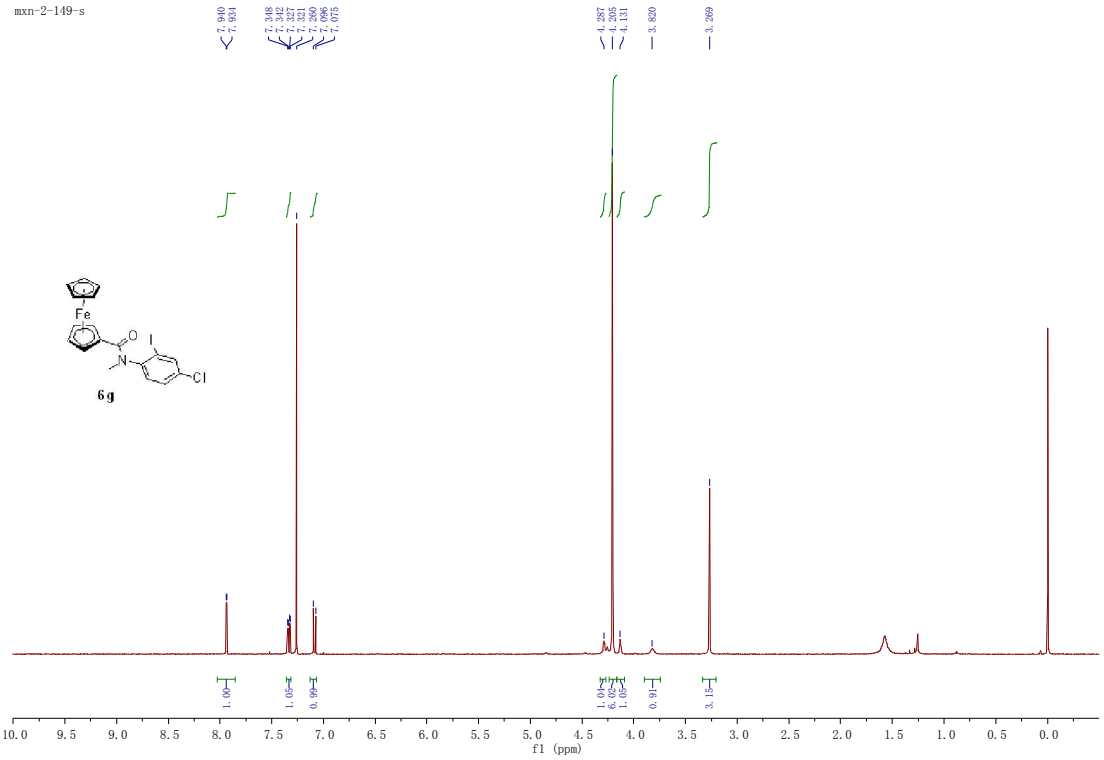
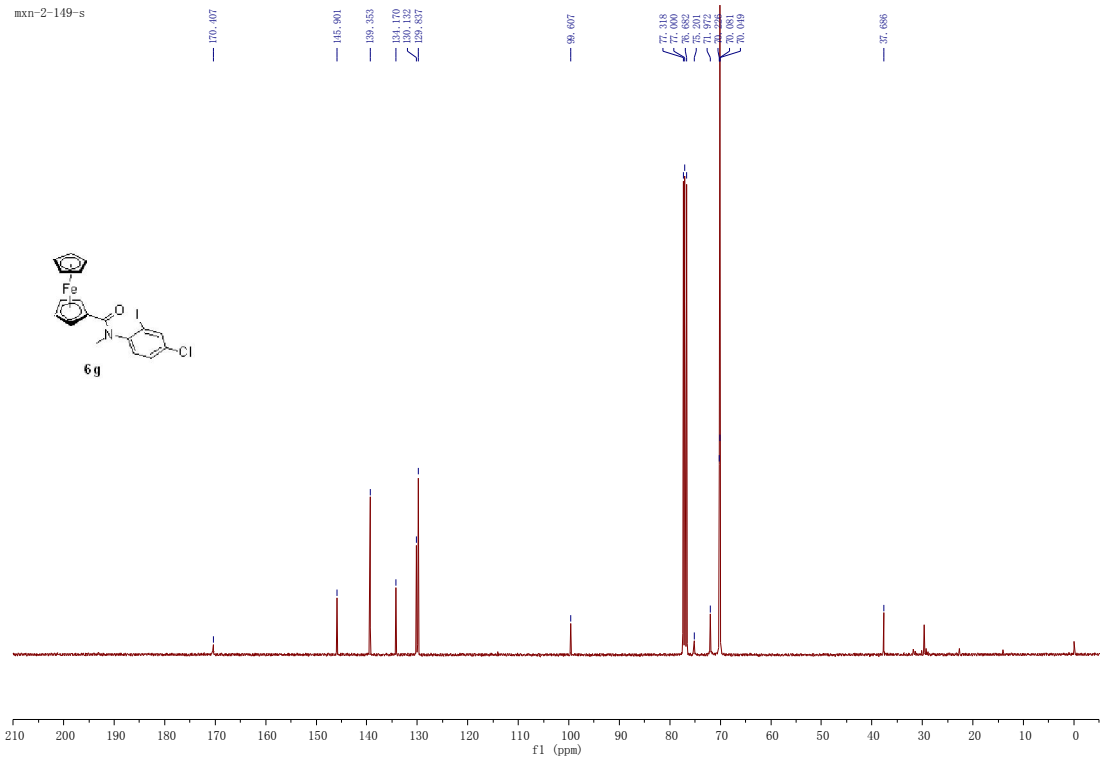
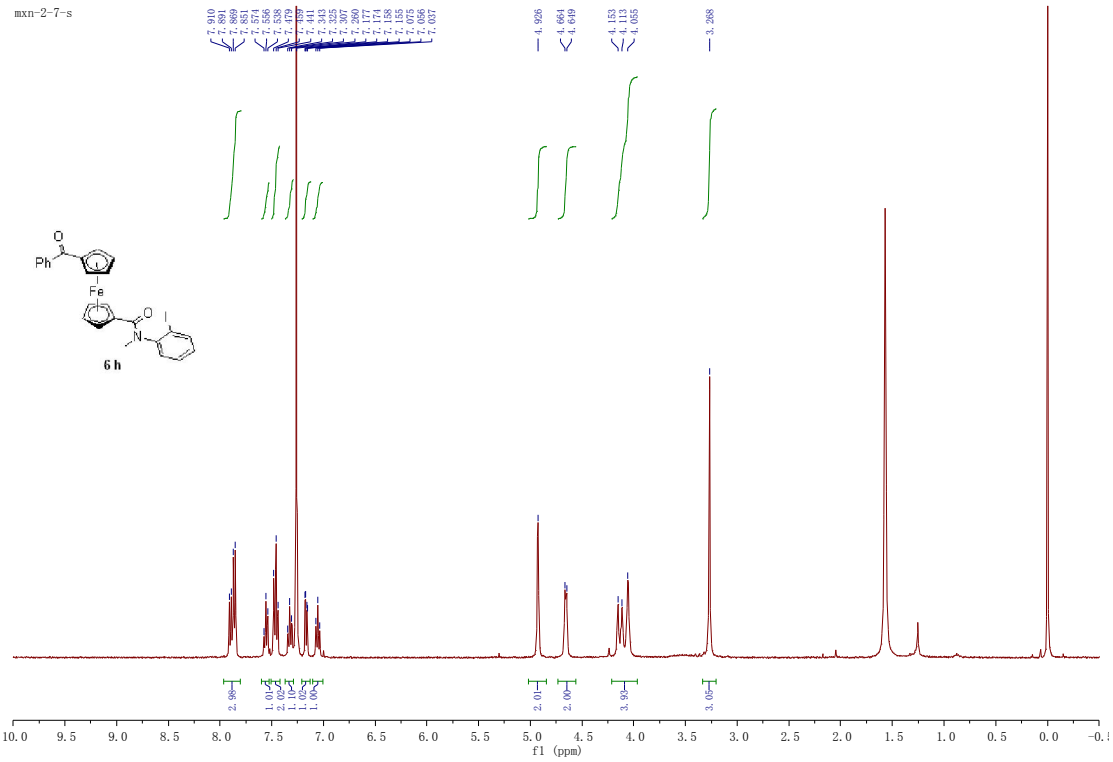
130.703
123.624
118.545
114.394
77.318
77.000
76.683
75.387
71.853
70.303
70.096
69.974
69.932
55.762
37.592
Fe
O
Br
N
OMe
6e
f1 (ppm)

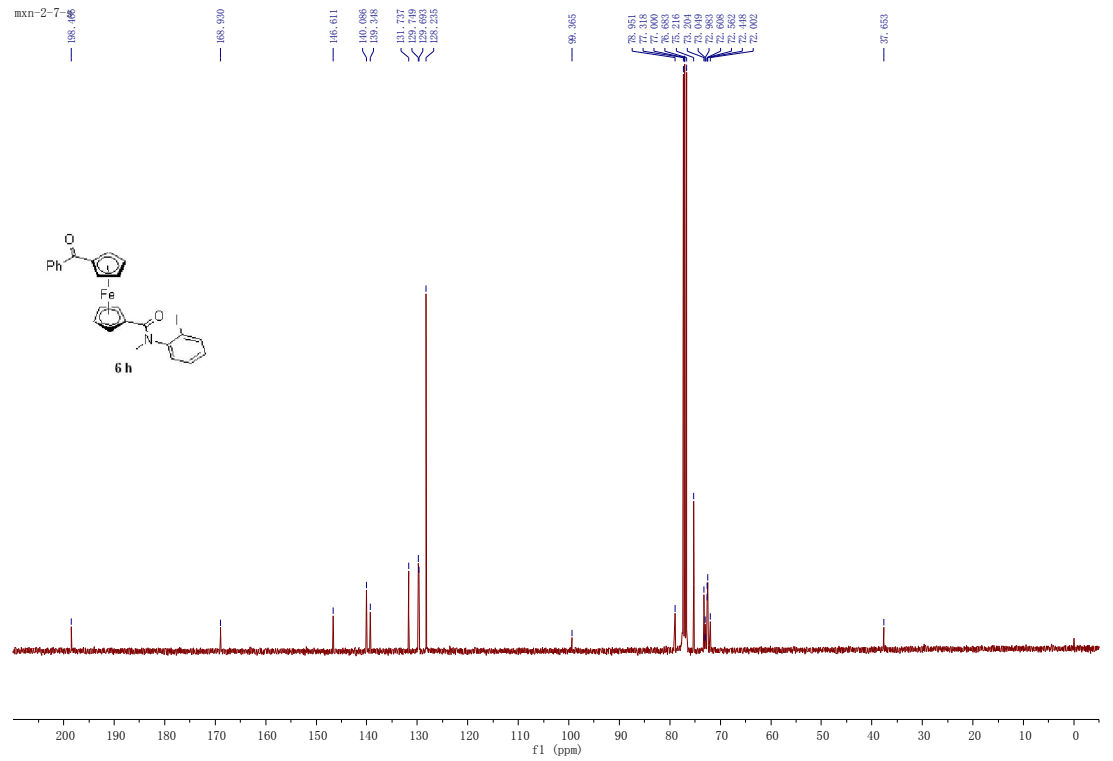

mxn-2-85
7.674
7.667
7.655
7.648
7.260
7.156
7.142
7.134
7.120
7.102
7.095
7.083
7.076
7.062
7.055
4.247
4.205
4.120
3.790
3.273
Fe
O
N
I
F
6f
1.00
2.00
7.05
1.00
0.94
3.11
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

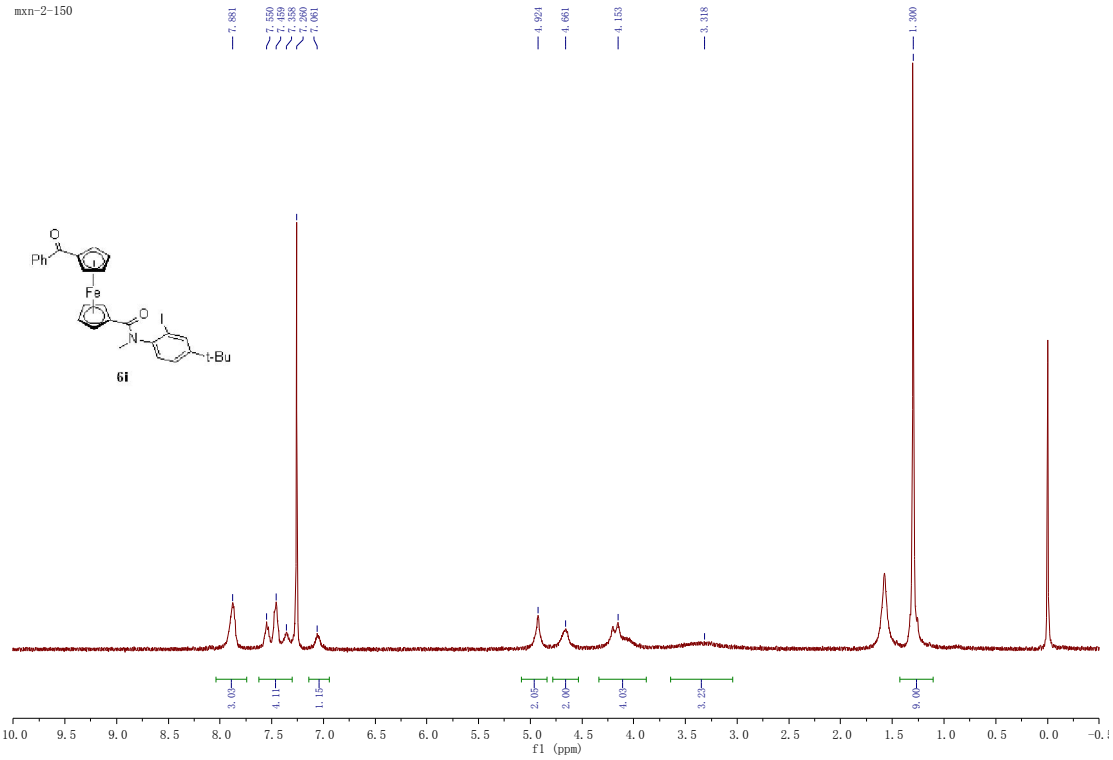

mxn-2-85
170.464
162.251
159.729
143.574
143.541
130.284
130.198
126.940
126.696
116.793
116.573
99.269
99.189
77.318
77.000
76.683
75.315
73.971
73.921
70.159
70.032
37.774
Fe
O
N
I
F
6f
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

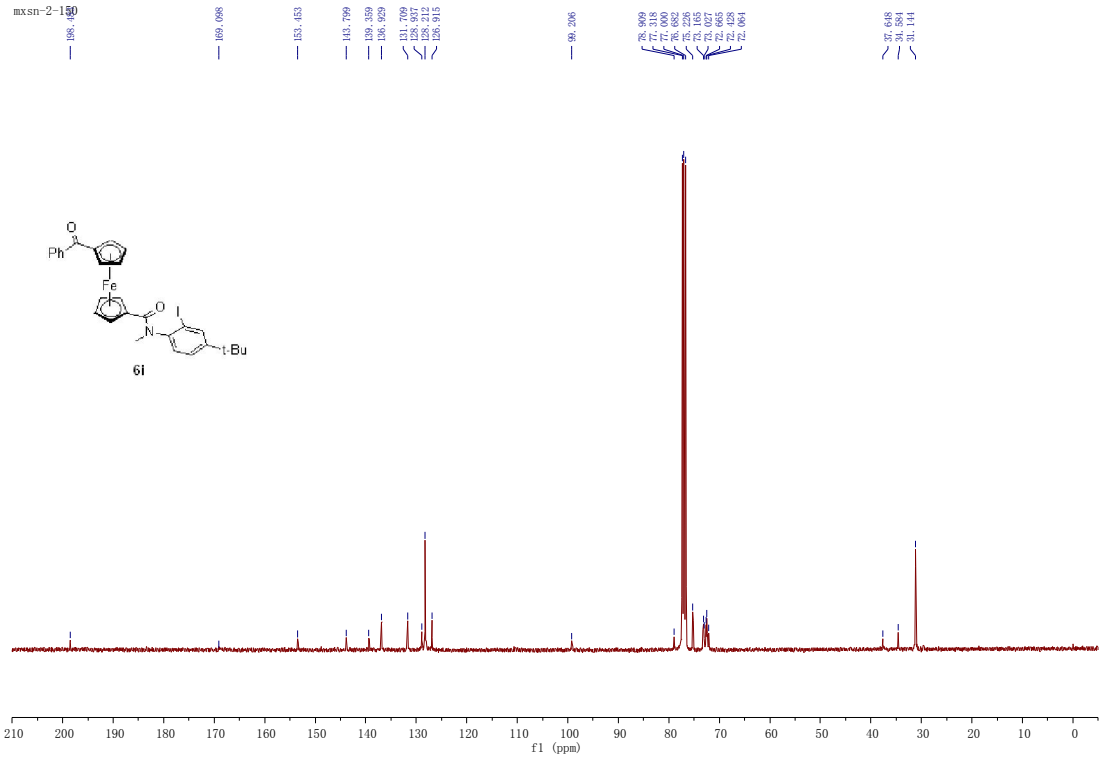

mxn-2-149-s
7.940
7.934
7.348
7.342
7.327
7.321
7.260
7.096
7.075
4.287
4.205
4.131
3.820
3.269
Fe
O
I
N
Cl
6g
1.00
1.05
0.99
1.04
6.02
1.05
0.91
3.15
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

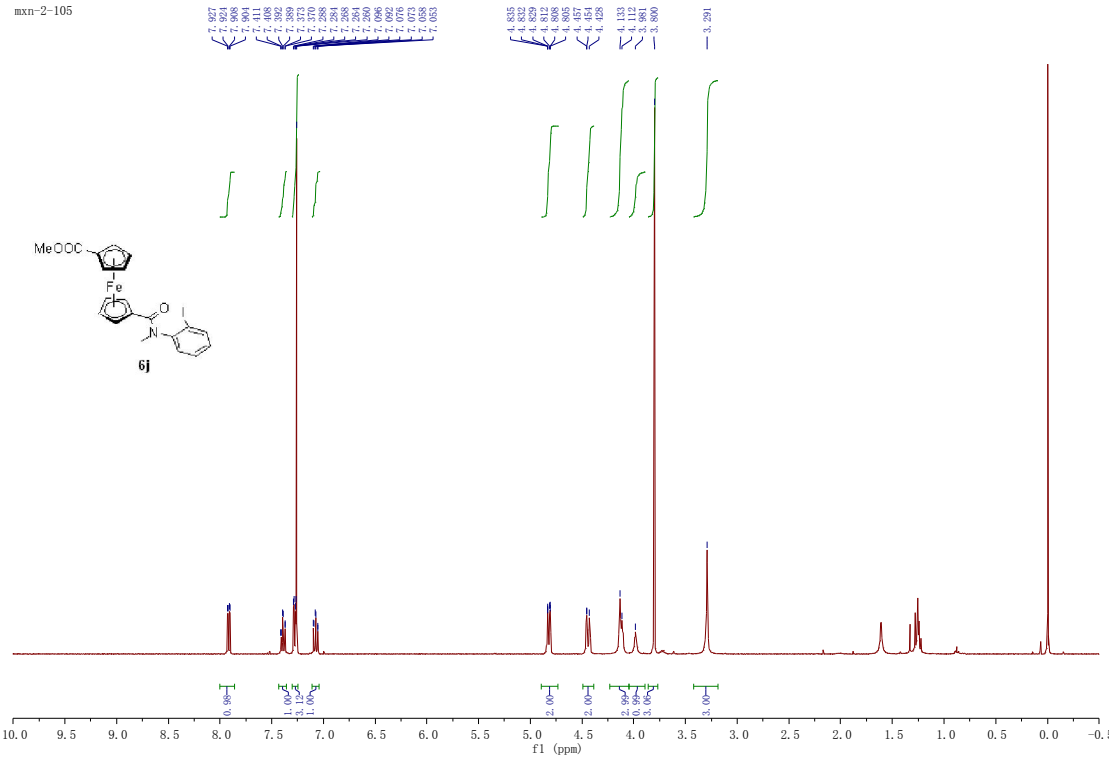

mxn-2-149-s
170.407
145.901
139.353
134.170
130.332
129.857
99.607
77.318
77.000
76.682
75.201
71.972
70.298
70.081
70.049
37.686
Fe
O
I
N
Cl
6g
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

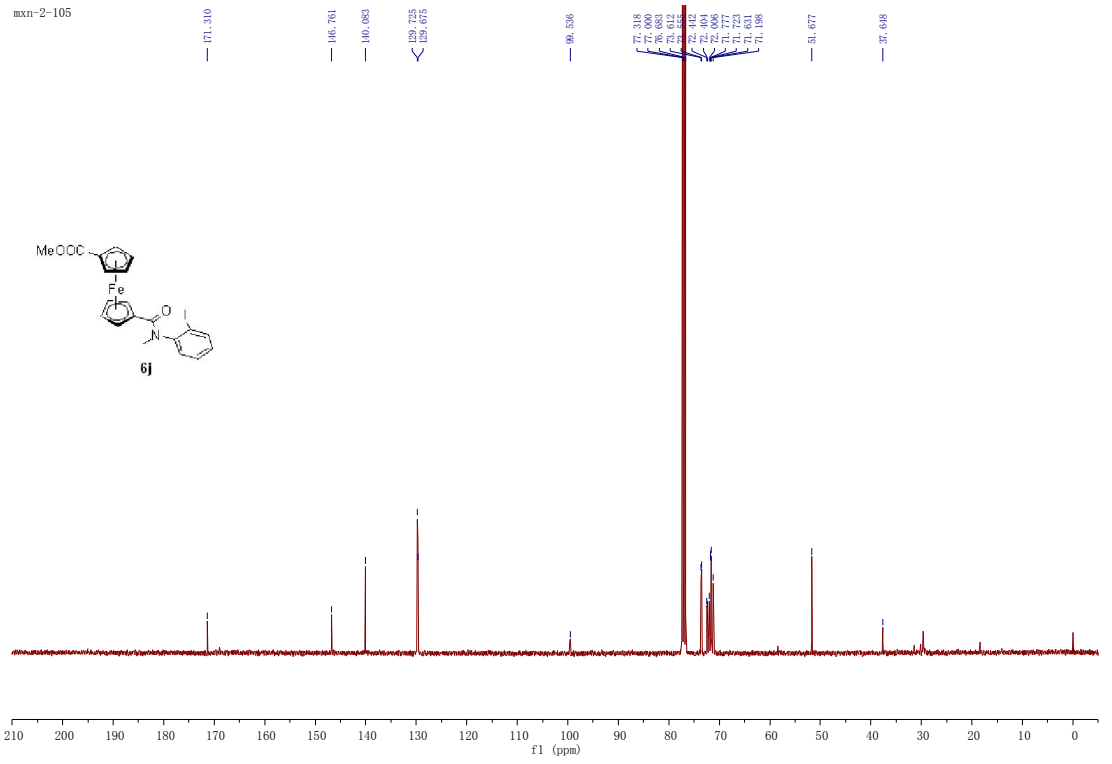

mxn-2-7-s
7.910
7.891
7.869
7.851
7.574
7.556
7.538
7.479
7.459
7.441
7.343
7.325
7.307
7.260
7.177
7.174
7.158
7.155
7.075
7.056
7.037
4.926
4.664
4.649
4.153
4.113
4.055
3.268
Ph
Fe
O
N
I
6 h
2.98
1.01
2.05
1.02
1.00
2.01
2.00
3.93
3.05
f1 (ppm)

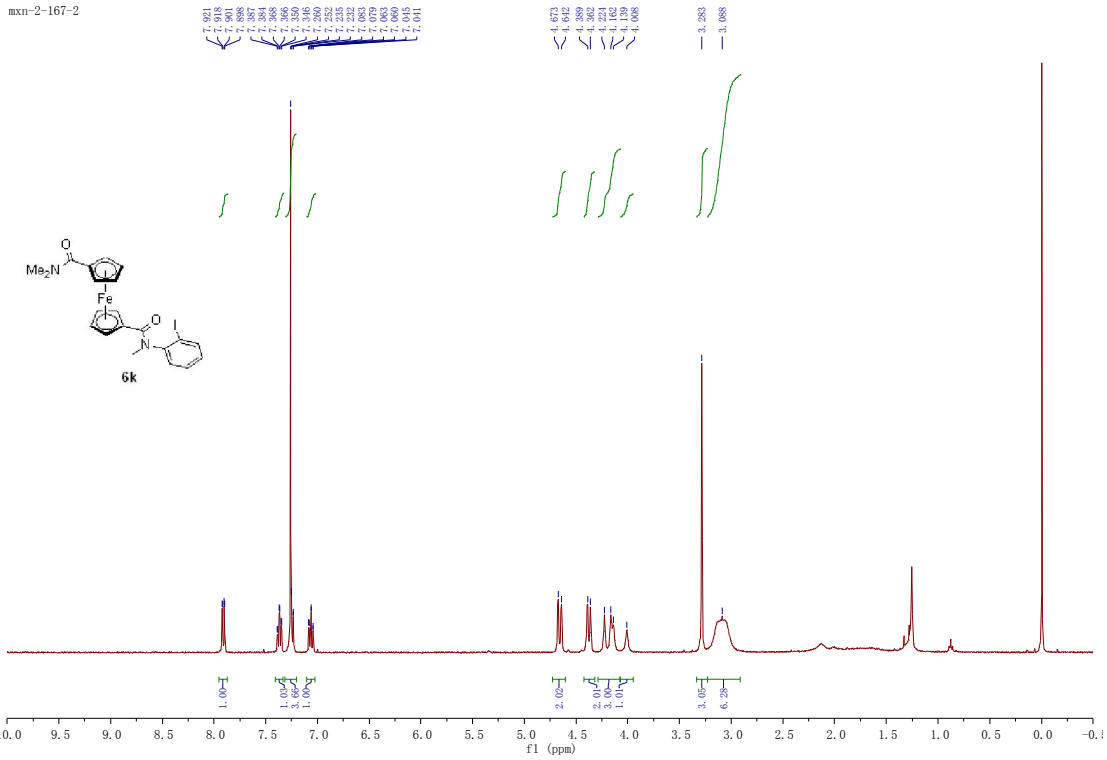

mxn-2-7-
198.486
168.930
146.611
140.086
139.348
131.737
129.749
129.693
128.235
98.365
78.951
78.318
77.000
76.683
75.216
73.304
73.049
72.983
72.608
72.562
72.448
72.402
37.653
Ph
Fe
O
N
I
6 h
f1 (ppm)

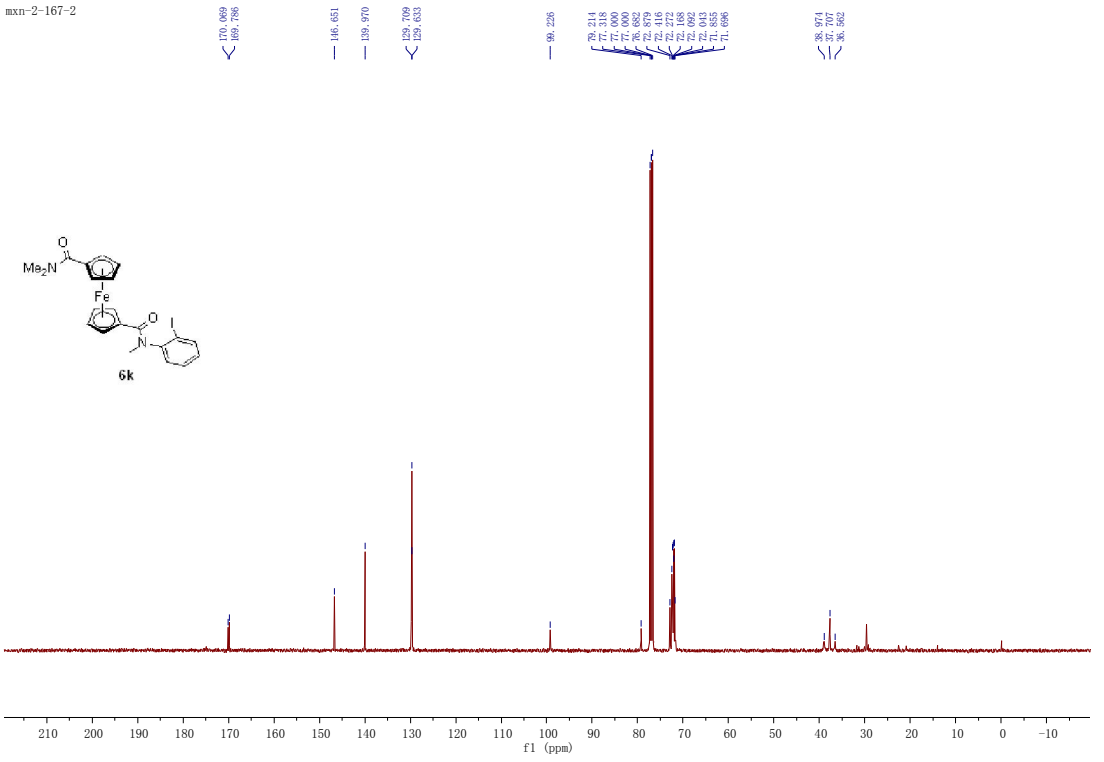

mxn-2-150
7.881
7.559
7.459
7.358
7.260
7.061
4.924
4.661
4.153
3.318
1.300
Ph
Fe
I
t-Bu
6i
3.03
4.11
1.15
2.05
2.00
4.03
3.23
9.00
f1 (ppm)

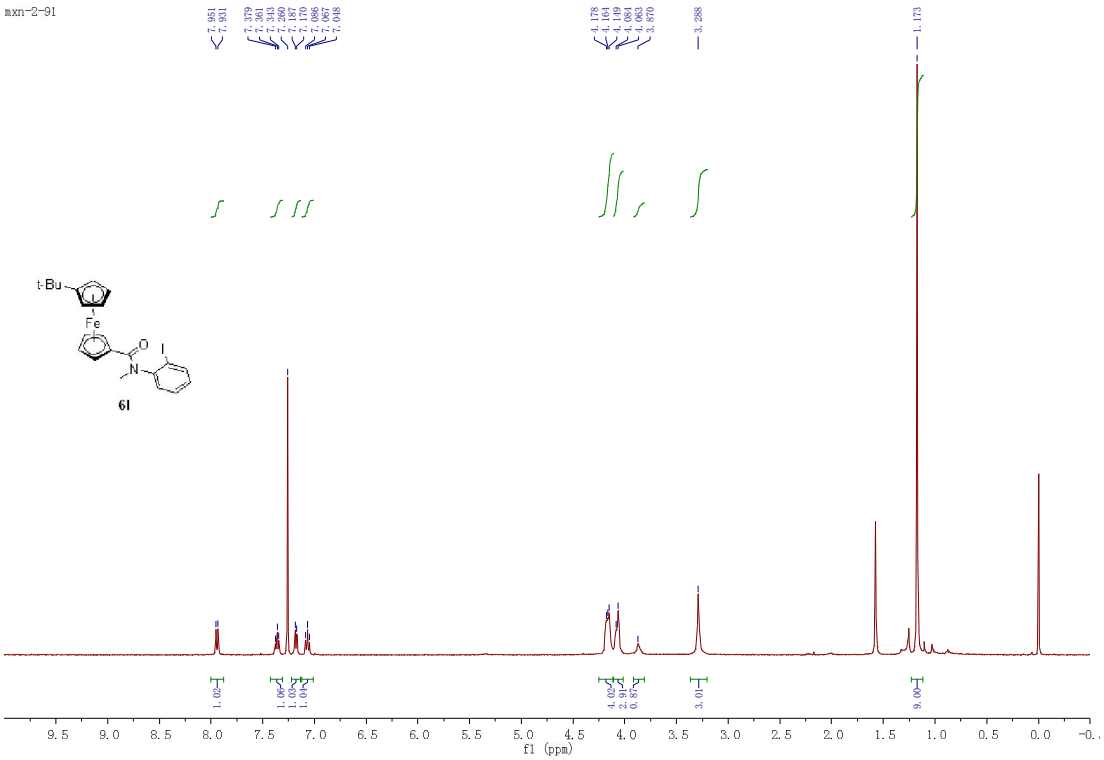

mxsn-2-150
198.470
169.098
153.453
143.799
139.359
136.929
131.709
128.937
128.212
126.915
98.206
78.909
77.318
77.000
76.682
75.226
73.145
72.027
72.665
72.428
72.064
37.648
34.884
31.144
Ph
Fe
I
t-Bu
6i
f1 (ppm)

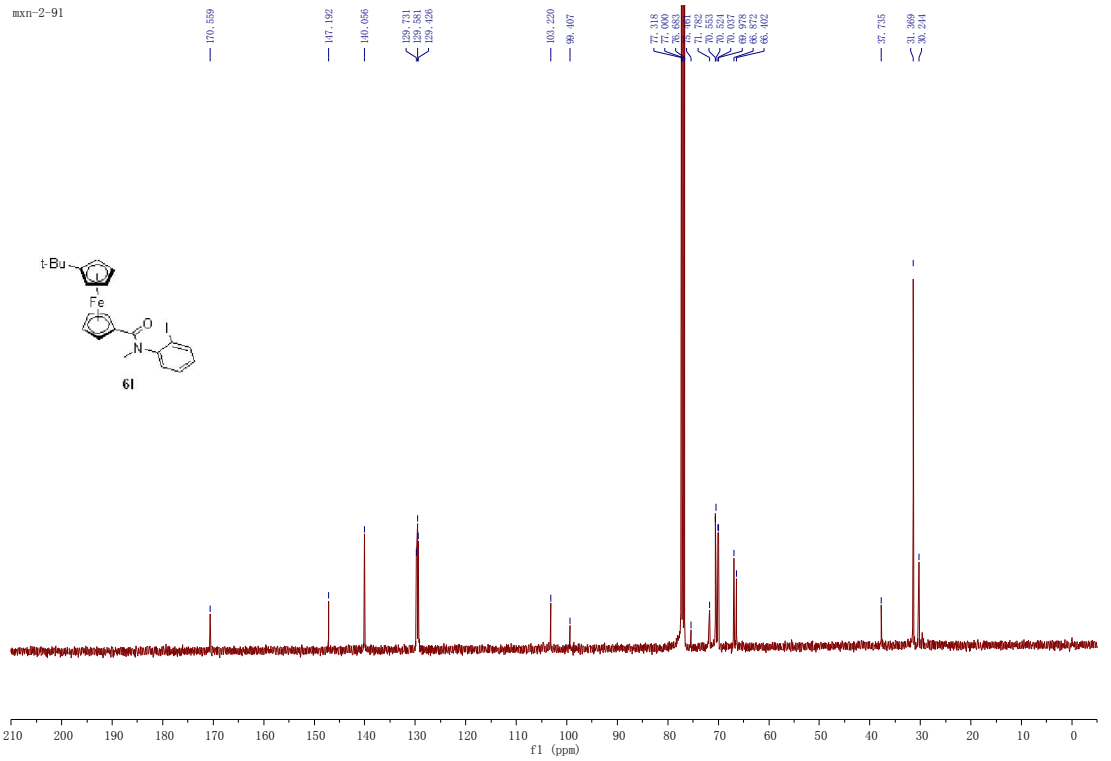

mxn-2-105
MeOOC
Fe
O
N
I
6j
f1 (ppm)

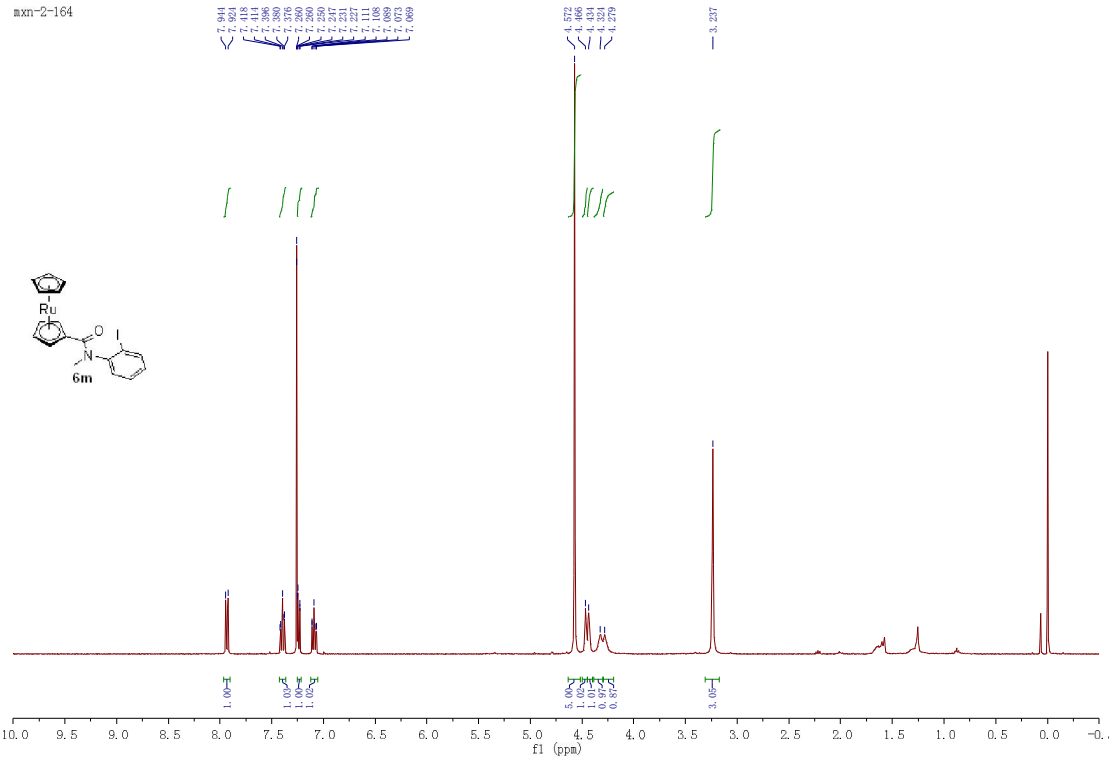

mxn-2-105
MeOOC
Fe
O
N
I
6j
f1 (ppm)

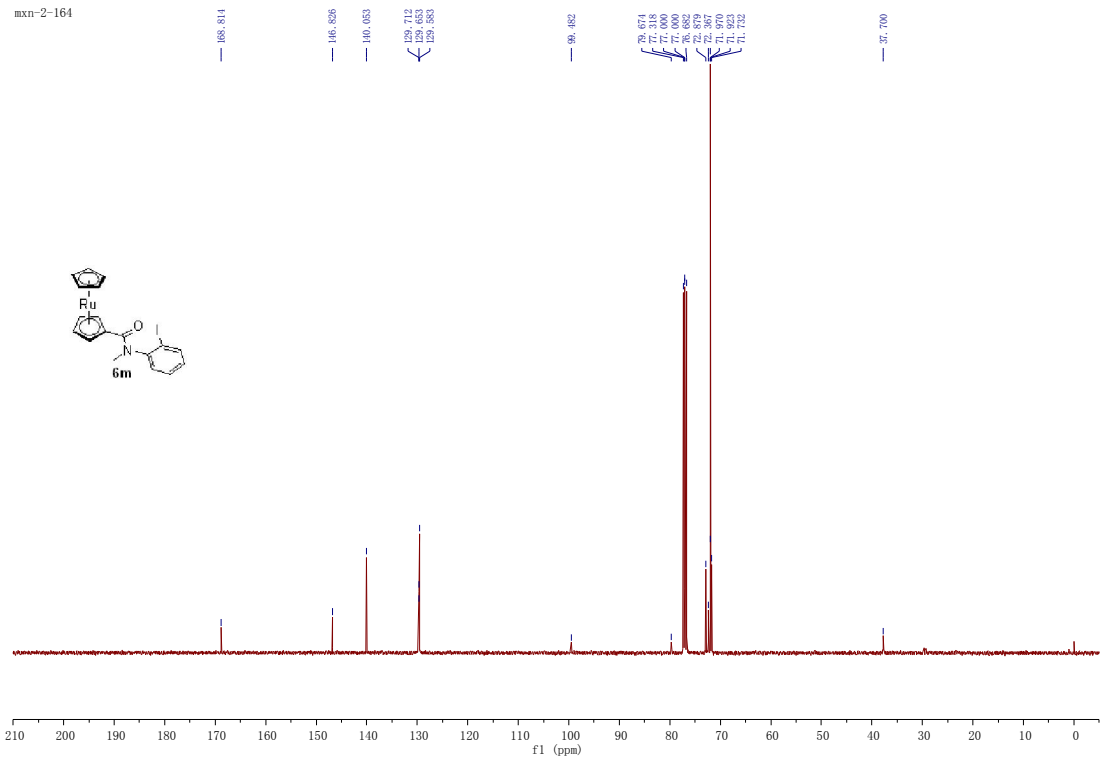

mxn-2-167-2
7.921
7.918
7.901
7.898
7.387
7.384
7.368
7.366
7.350
7.346
7.269
7.252
7.235
7.232
7.083
7.079
7.065
7.060
7.045
7.041
4.673
4.642
4.389
4.362
4.224
4.162
4.139
4.008
3.283
3.088
Me2N
Fe
O
N
I
6k
1.00
1.03
3.66
1.00
2.02
2.01
3.04
1.01
3.05
6.28
f1 (ppm)

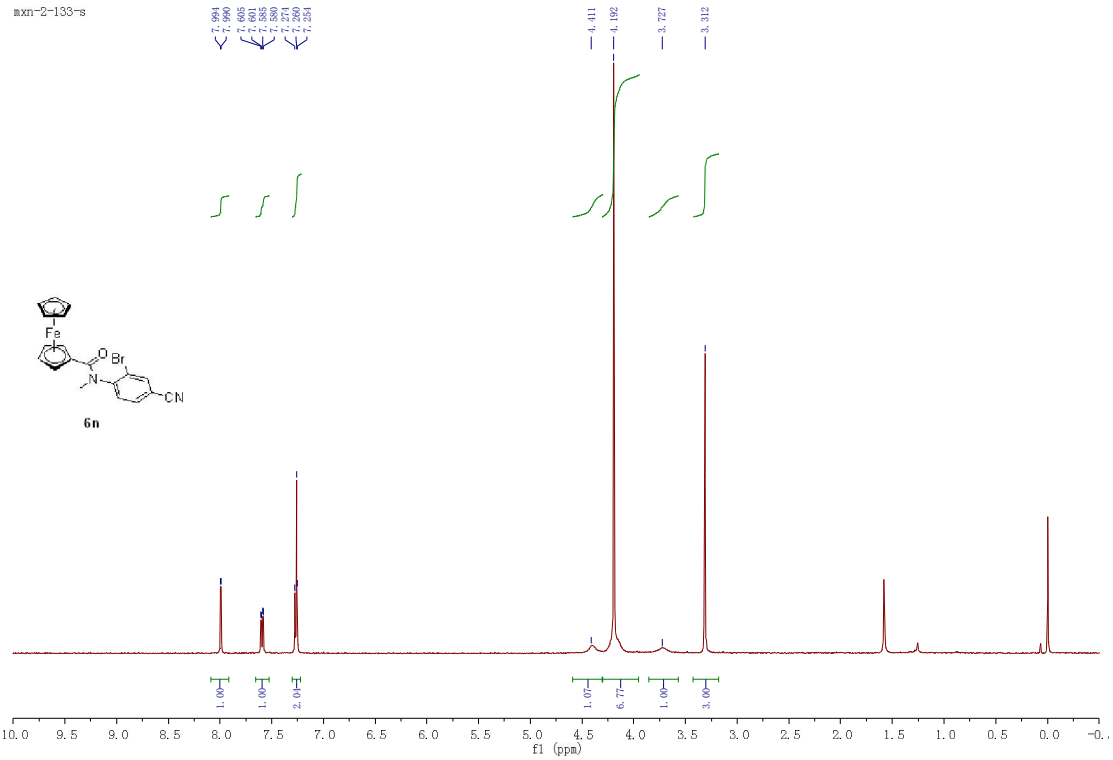

mxn-2-167-2
170.069
169.786
146.651
139.970
129.709
129.633
98.226
79.214
77.318
77.000
76.682
72.579
72.416
72.272
72.168
72.092
72.043
71.855
71.696
38.974
37.777
36.582
Me2N
Fe
O
N
I
6k
f1 (ppm)

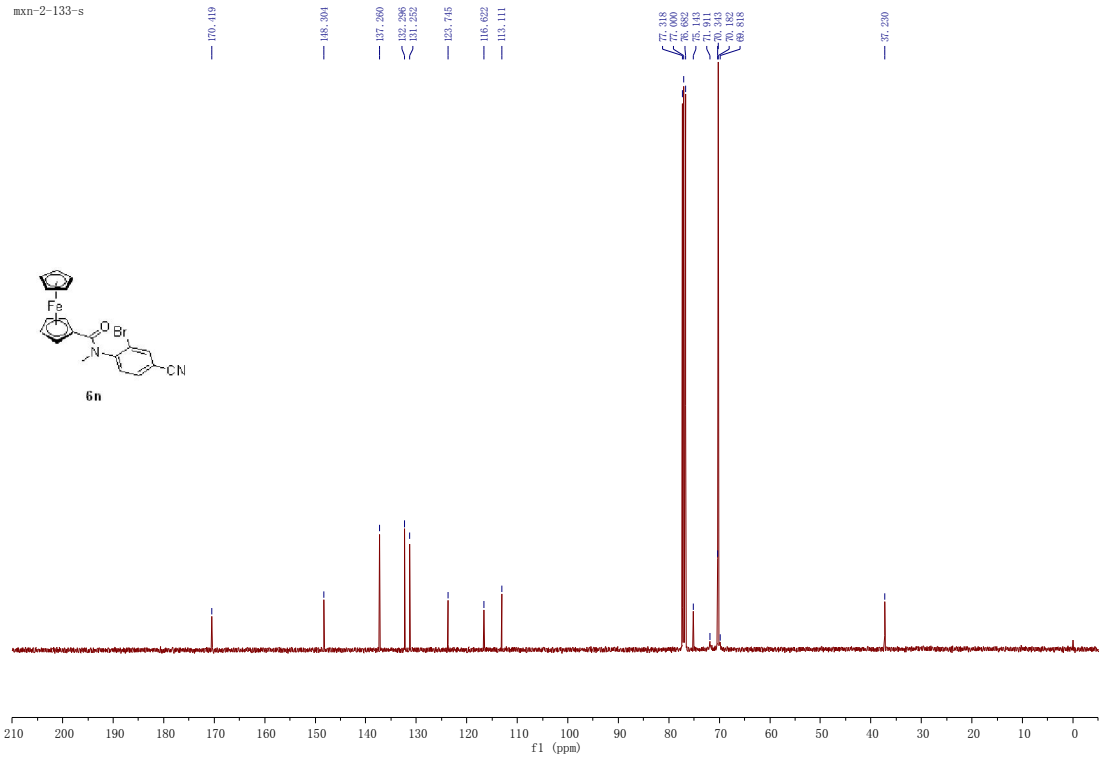

mxn-2-91
7.951
7.931
7.379
7.361
7.343
7.260
7.187
7.170
7.088
7.067
7.048
4.178
4.164
4.149
4.084
4.063
3.870
3.288
1.173
t-Bu
Fe
O
N
I
6l
1.02
1.06
1.03
1.04
4.02
2.91
0.87
3.01
9.00
f1 (ppm)

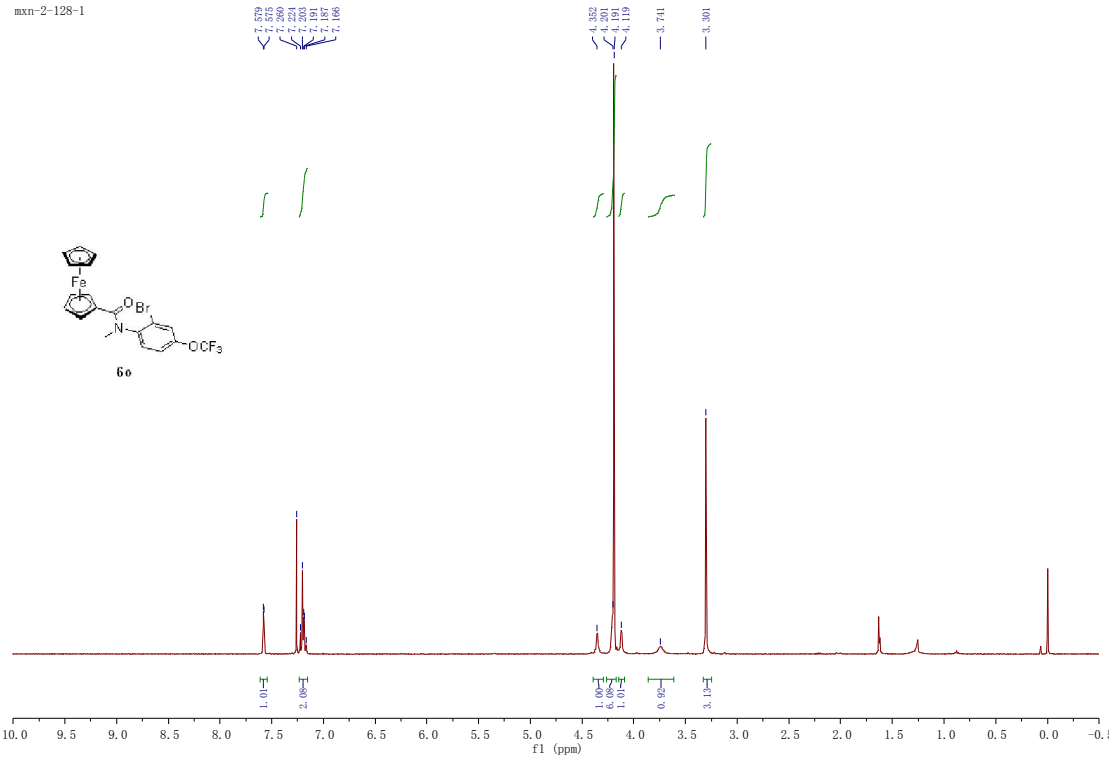

mxn-2-91
170.559
147.192
140.056
129.731
129.581
129.426
103.220
98.407
77.318
77.000
76.683
73.461
73.292
70.555
70.524
70.037
69.978
69.872
68.402
37.735
31.369
30.244
t-Bu
Fe
O
N
I
6l
f1 (ppm)

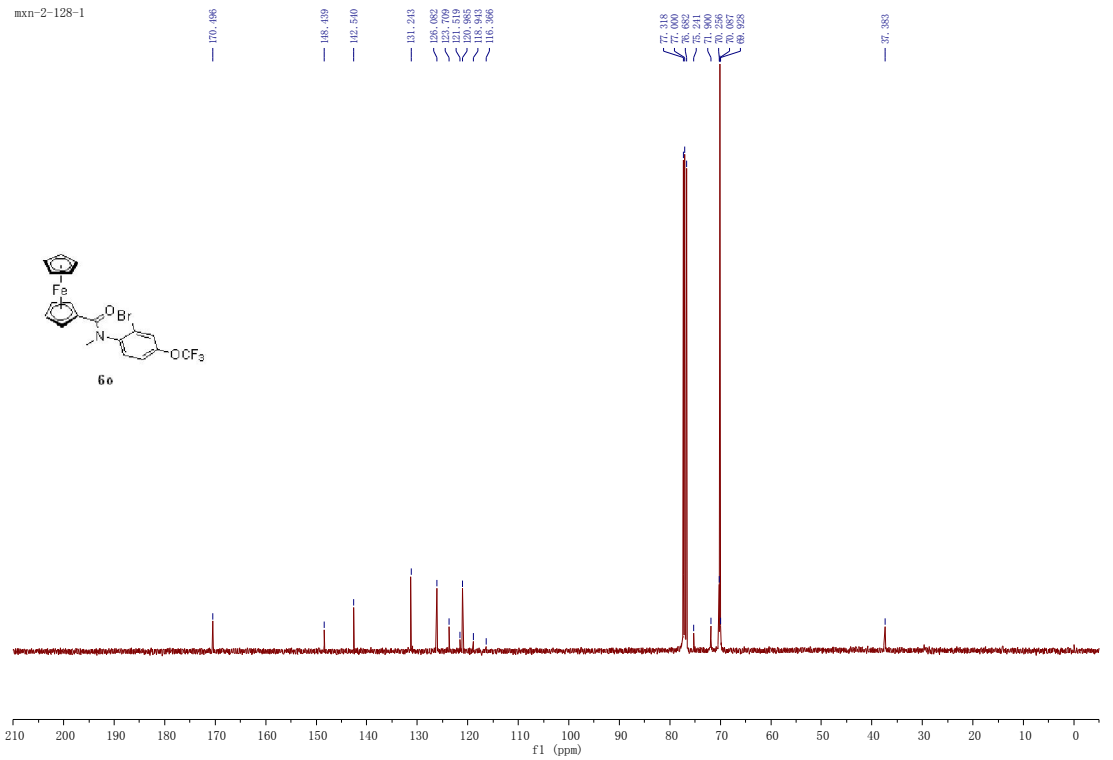

mxn-2-164
7.944
7.924
7.418
7.414
7.396
7.380
7.376
7.260
7.259
7.249
7.247
7.231
7.227
7.111
7.108
7.089
7.073
7.069
4.572
4.466
4.434
4.334
4.279
3.237
Ru
O
I
N
6m
1.00
1.03
1.00
1.02
5.06
1.02
1.01
0.85
0.87
3.05
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

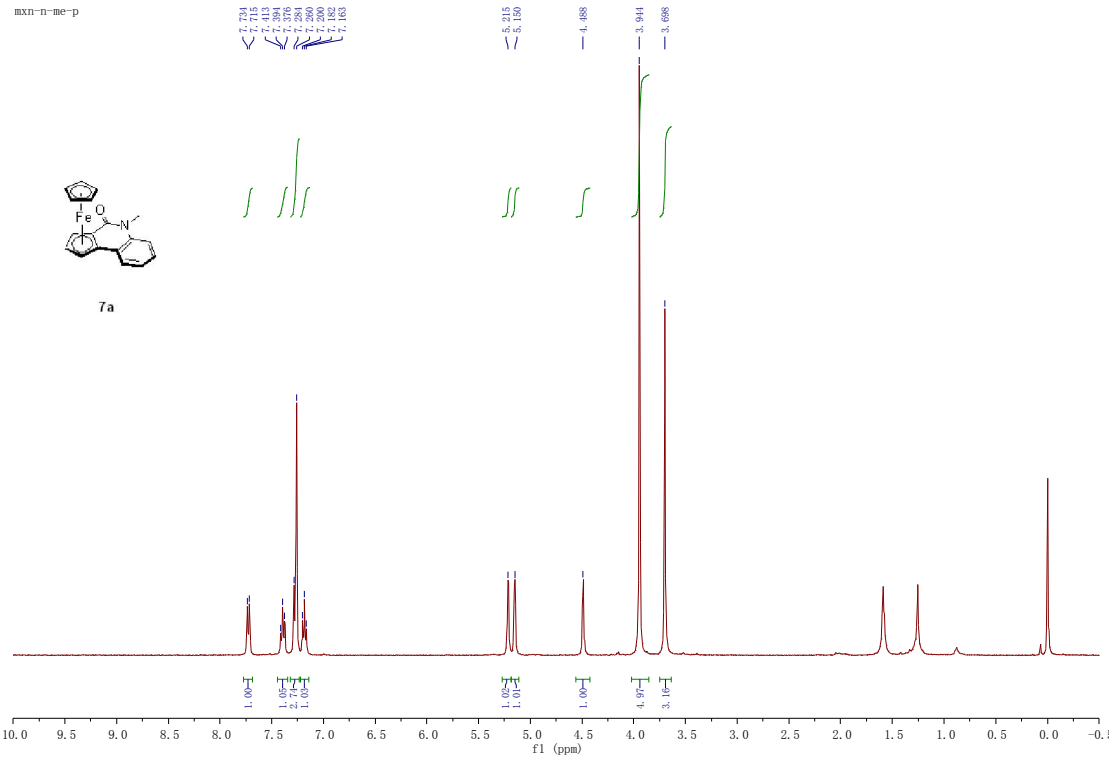

mxn-2-164
168.814
146.826
140.053
129.712
129.653
129.583
90.482
79.674
77.318
77.000
76.682
72.879
72.367
71.970
71.923
71.732
37.700
Ru
O
I
N
6m
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

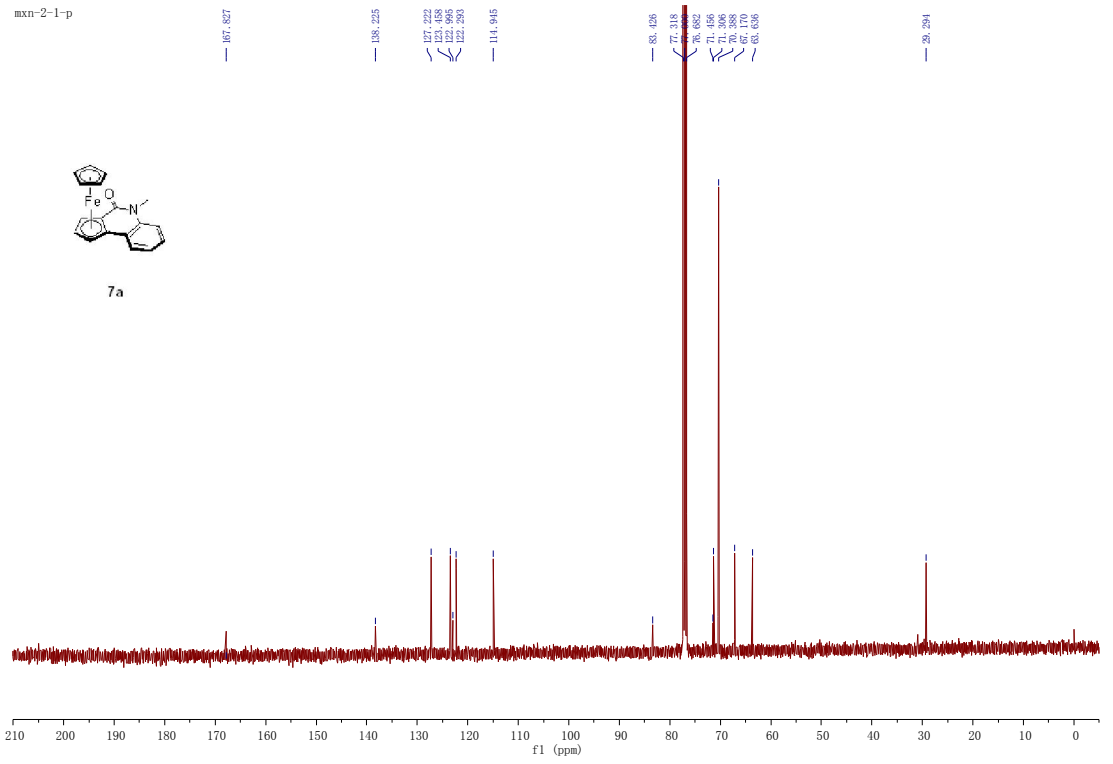

mxn-2-133-s
7.994
7.990
7.605
7.601
7.585
7.580
7.271
7.269
7.254
4.411
4.192
3.727
3.312
Fe
O
Br
N
CN
6n
1.00
1.00
2.04
1.07
6.77
1.00
3.00
f1 (ppm)

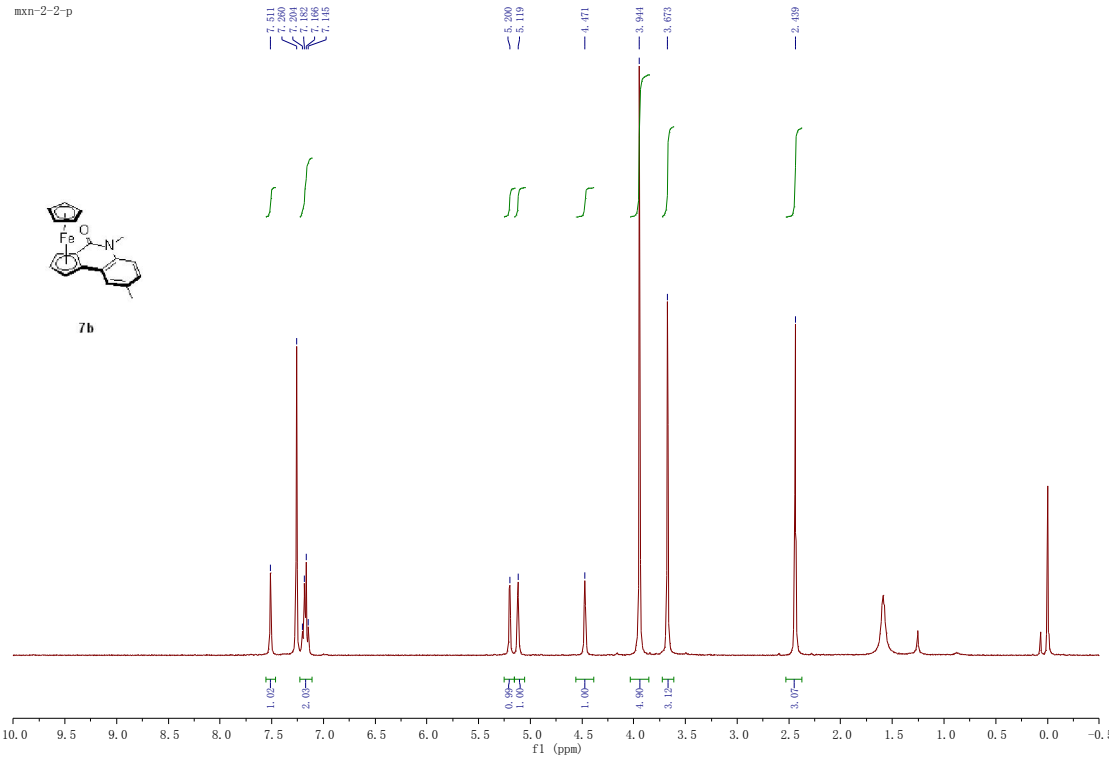

mxn-2-133-s
170.419
148.304
137.260
132.296
131.252
123.745
116.622
113.111
77.318
77.000
76.682
75.143
71.911
70.343
70.182
68.818
37.230
Fe
O
Br
N
CN
6n
f1 (ppm)


mxn-2-128-1
7.579
7.575
7.299
7.295
7.203
7.191
7.187
7.166
4.352
4.201
4.193
4.119
3.741
3.301
Fe
O
Br
N
OCF3
6o
1.01
2.08
1.00
6.08
1.01
0.92
3.13
f1 (ppm)

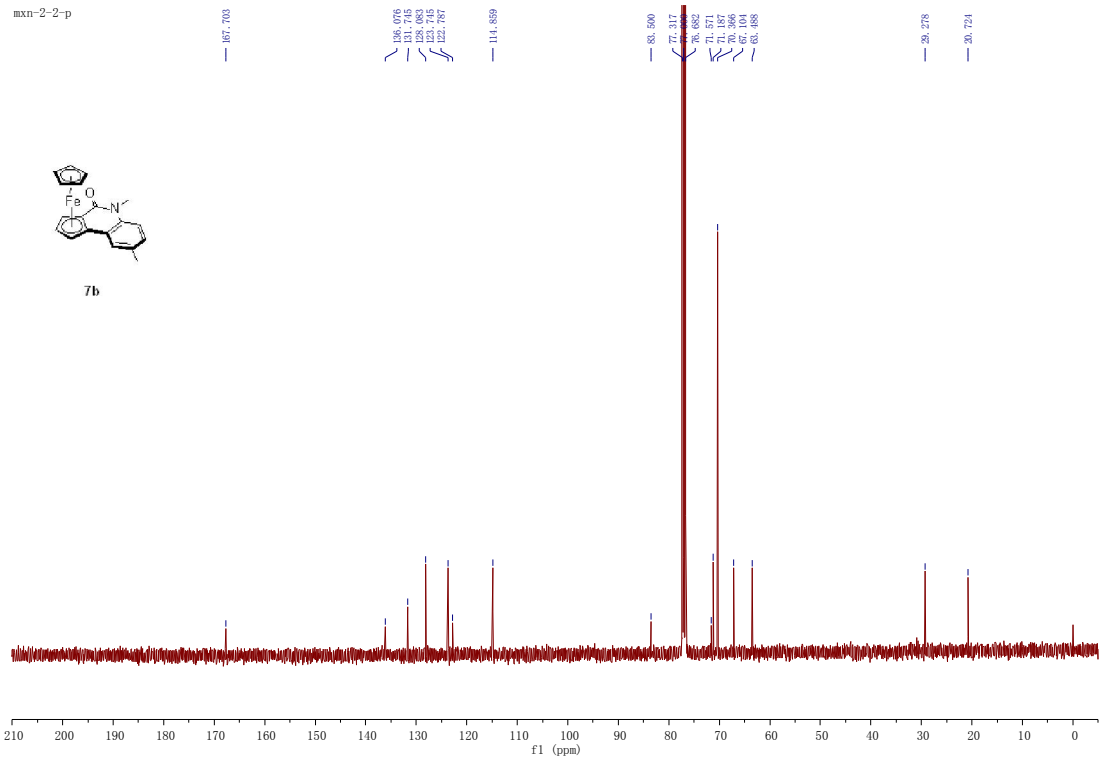

mxn-2-128-1
170.496
148.439
142.540
131.243
126.082
123.709
121.519
120.985
118.943
116.366
77.318
77.000
76.682
75.241
71.900
70.256
70.057
68.928
37.383
Fe
O
Br
N
OCF3
6o
f1 (ppm)


mxn-n-me-p
7.734
7.715
7.413
7.394
7.376
7.284
7.269
7.200
7.182
7.163
5.215
5.190
4.488
3.944
3.698
7a
1.00
1.05
2.74
2.03
1.02
1.01
1.00
4.97
3.16
f1 (ppm)

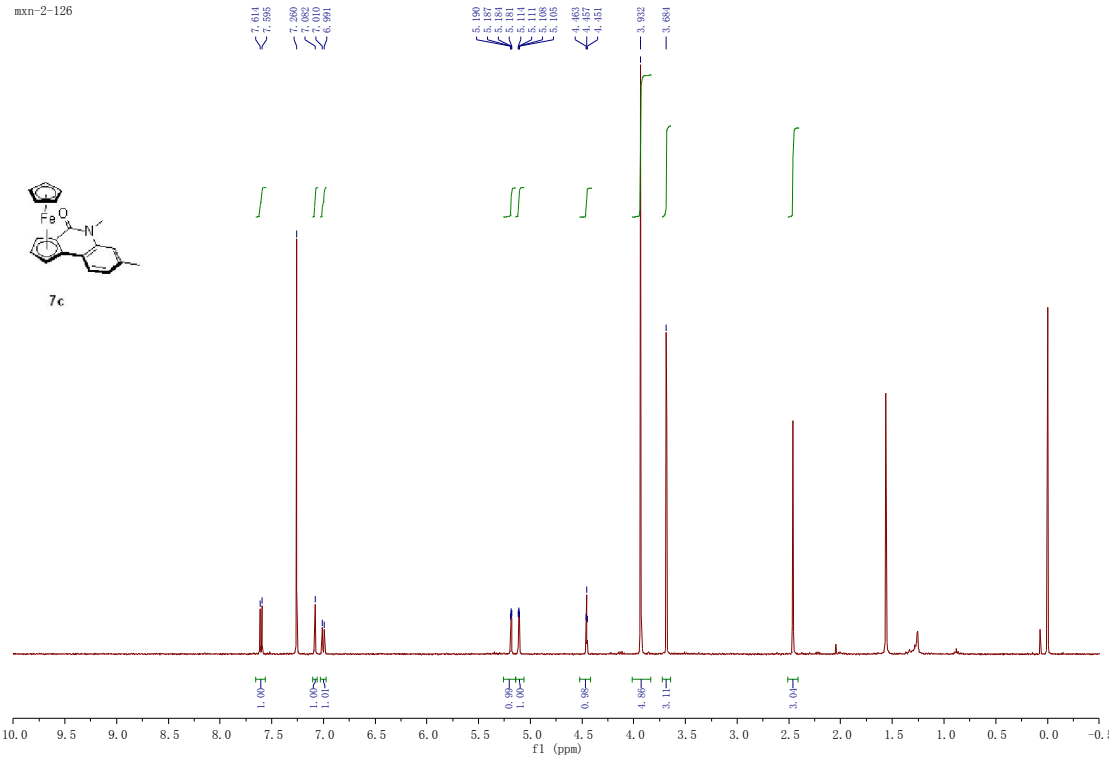

mxn-2-1-p
167.827
138.225
127.222
123.458
122.995
122.393
114.945
83.126
77.318
76.682
71.456
71.306
70.388
67.170
65.636
26.294
7a
f1 (ppm)

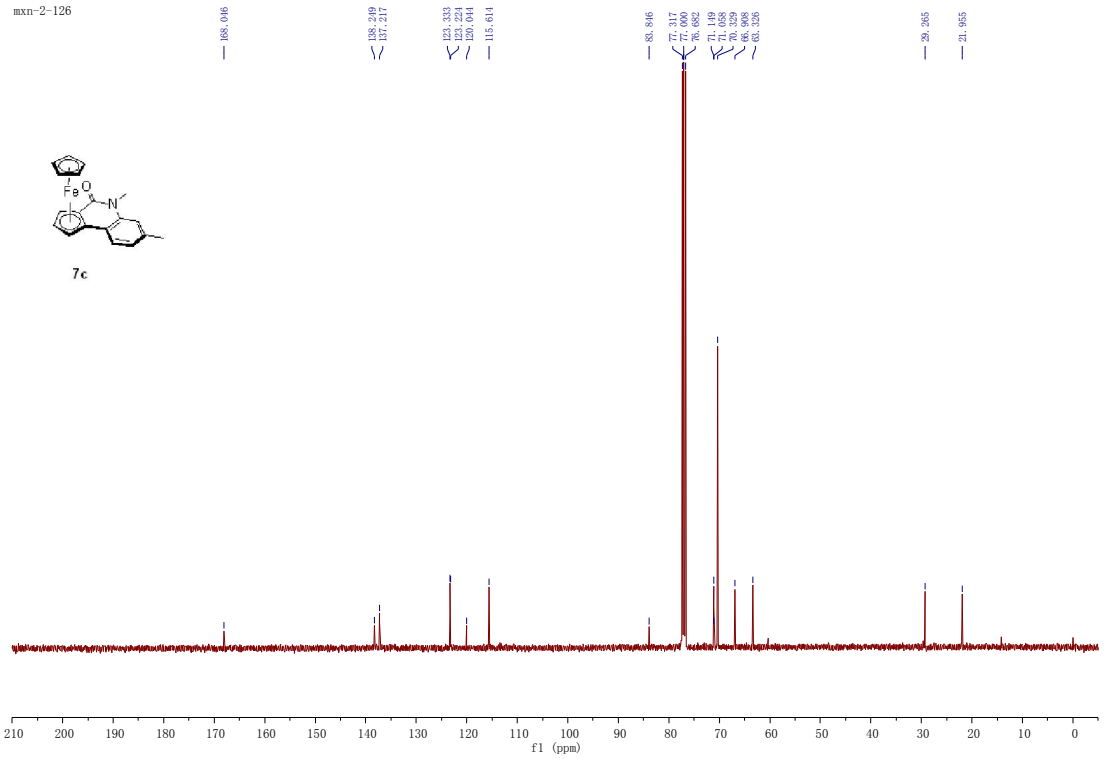

mxn-2-2-p
7.511
7.260
7.204
7.182
7.166
7.145
5.200
5.119
4.471
3.944
3.673
2.439
1.02
2.03
0.99
1.00
1.00
4.90
3.12
3.07
f1 (ppm)

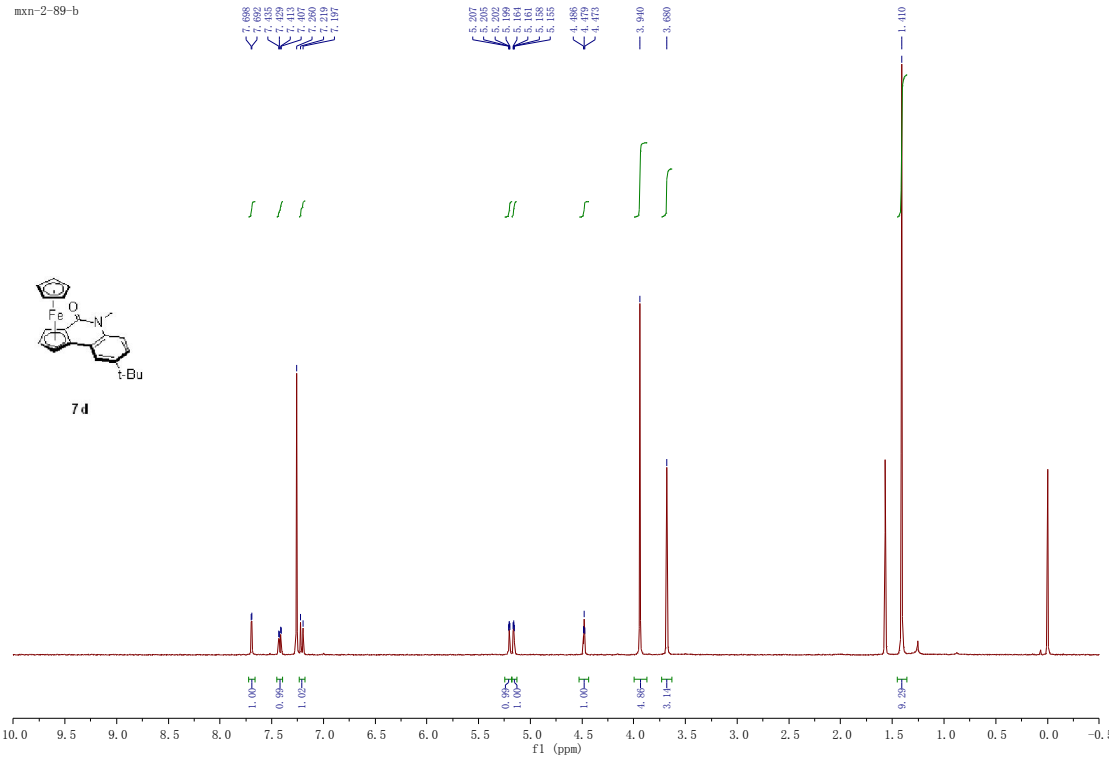
7b

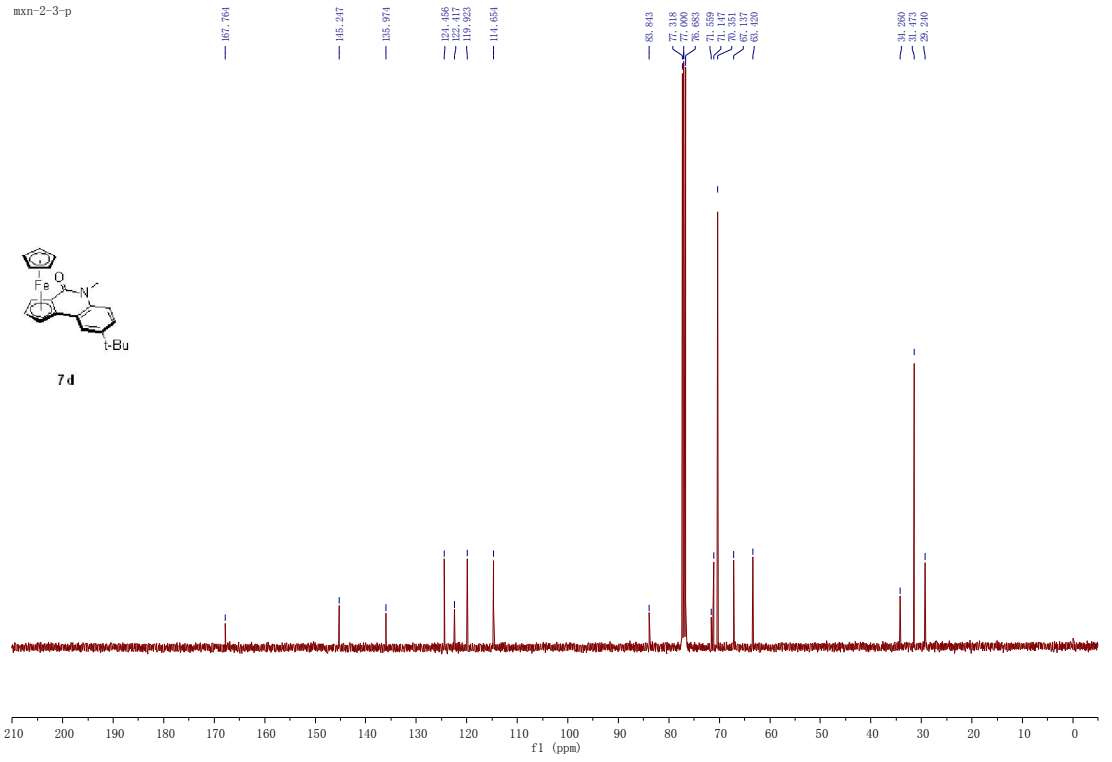

mxn-2-2-p
167.703
136.076
131.745
128.993
125.745
122.787
114.859
83.500
77.317
76.682
71.571
71.187
70.366
67.104
63.488
29.278
20.724
f1 (ppm)

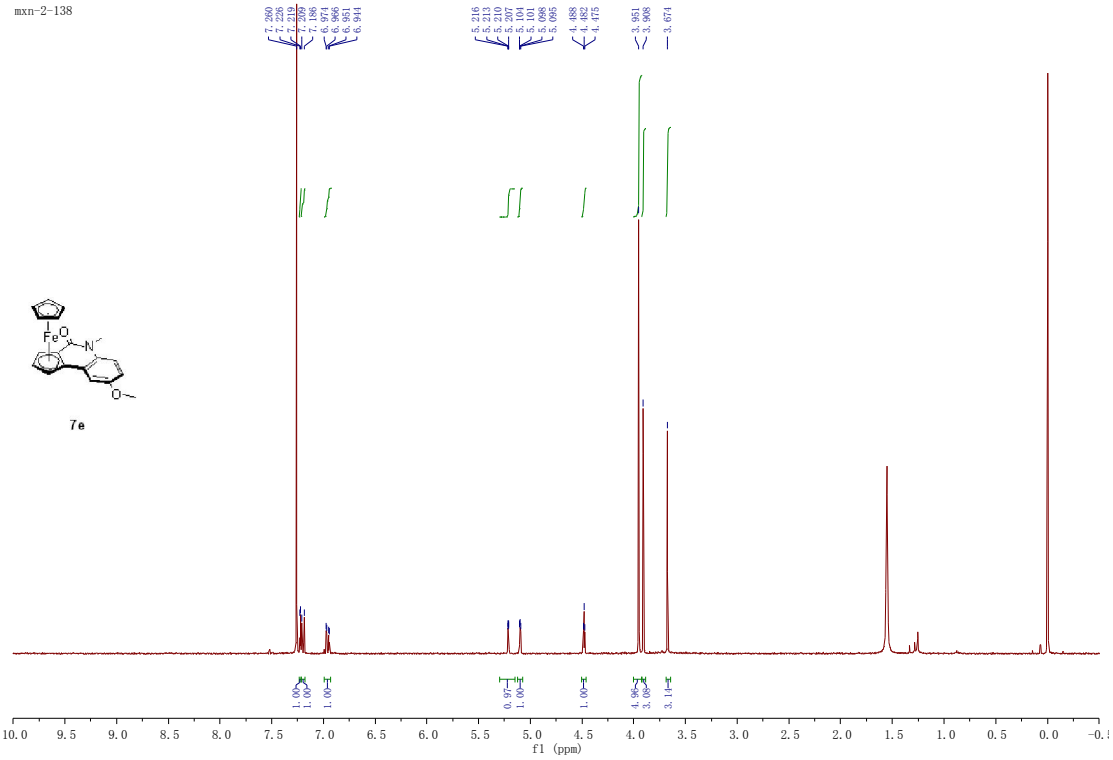
7b

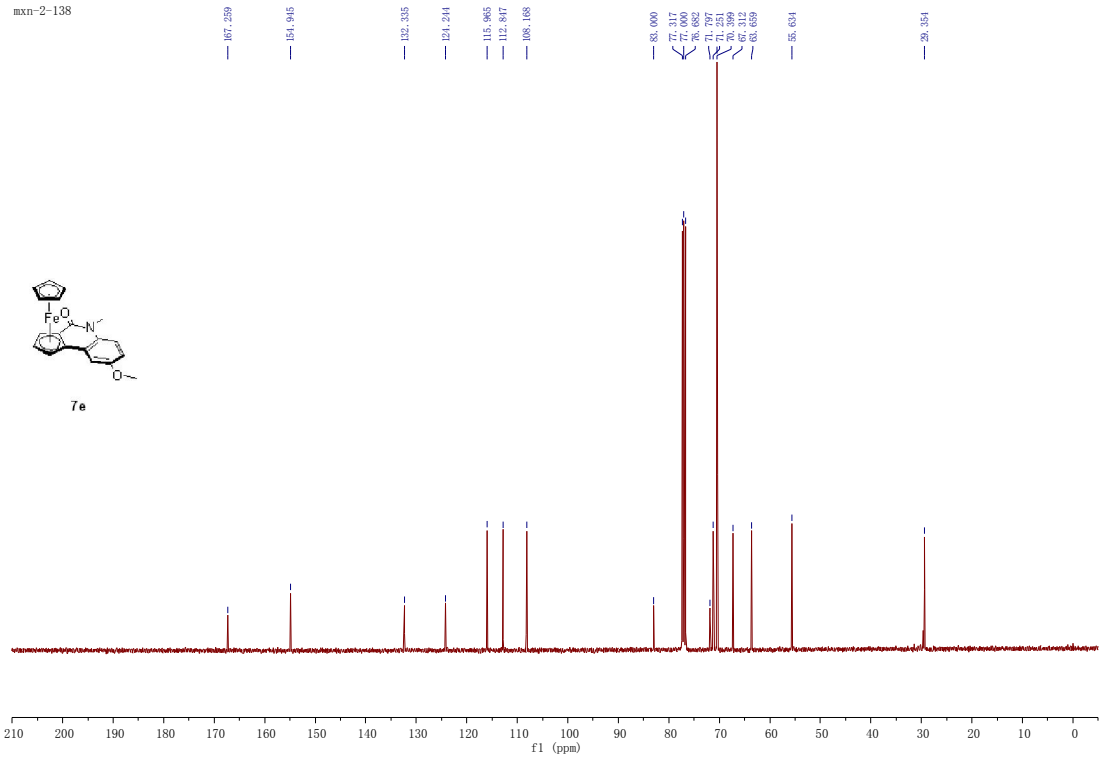

mxn-2-126
7.614
7.595
7.260
7.082
7.010
6.991
5.190
5.187
5.184
5.181
5.114
5.111
5.108
5.105
4.463
4.457
4.451
3.932
3.684
7c
1.00
1.00
1.01
0.99
1.00
0.98
4.86
3.11
3.04
f1 (ppm)

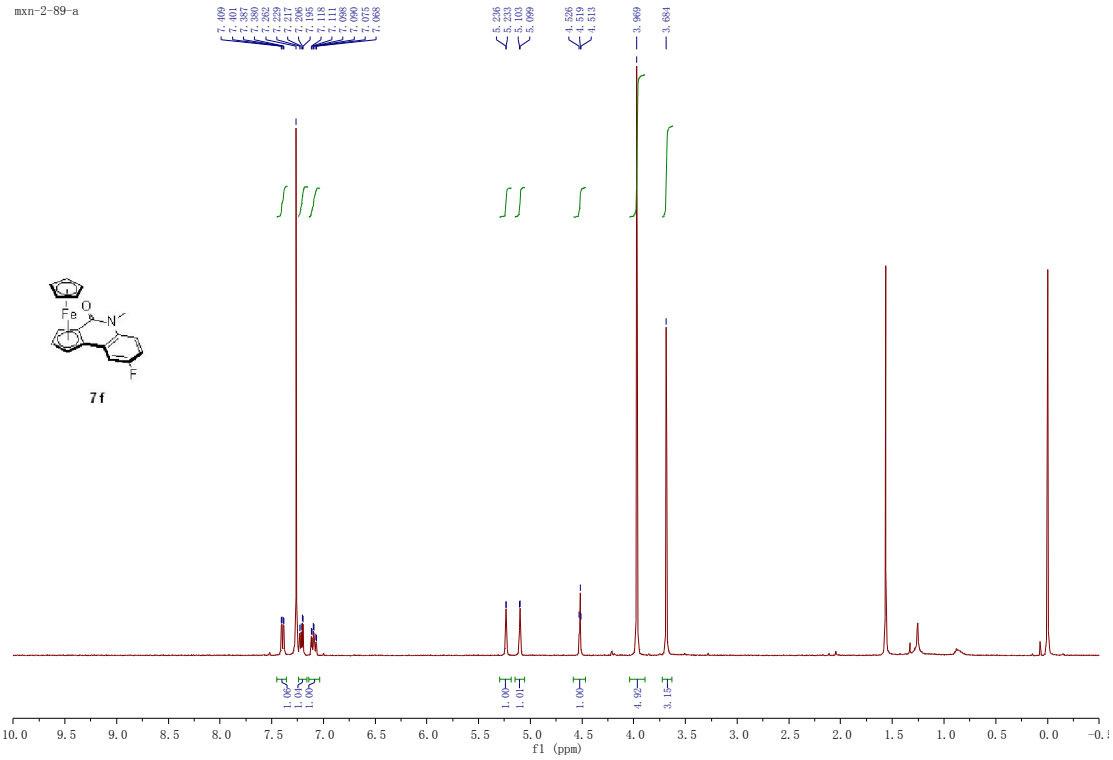

mxn-2-126
168.046
138.249
137.217
123.333
123.224
120.044
115.614
80.846
77.317
77.000
76.682
71.149
71.058
70.329
66.908
65.326
29.265
21.955
7c
f1 (ppm)

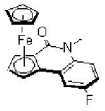

mxn-2-89-b
7.698
7.692
7.435
7.429
7.413
7.407
7.260
7.219
7.197
5.207
5.205
5.202
5.199
5.164
5.161
5.158
5.155
4.486
4.479
4.473
3.940
3.680
1.410
1.00
0.99
1.02
0.99
1.00
1.00
4.86
3.14
9.29
f1 (ppm)
Fe
O
N
t-Bu
7d


mxn-2-3-p
167.764
145.247
135.974
124.456
122.417
119.923
114.654
83.843
77.318
77.000
76.683
71.559
71.147
70.351
67.137
65.430
34.260
31.473
29.240
f1 (ppm)
Fe
O
N
t-Bu
7d


mxn-2-138
7.289
7.285
7.219
7.209
7.186
6.974
6.966
6.951
6.944
5.216
5.213
5.210
5.207
5.101
5.101
5.098
5.095
4.488
4.482
4.475
3.951
3.908
3.674
1.00
1.00
1.00
0.97
1.00
1.00
4.96
3.08
3.14
f1 (ppm)
7e


mxn-2-138
167.259
154.945
132.335
124.244
115.965
112.847
108.168
83.000
77.317
77.000
76.682
71.797
71.251
70.399
67.312
65.689
55.634
29.354
f1 (ppm)
7e

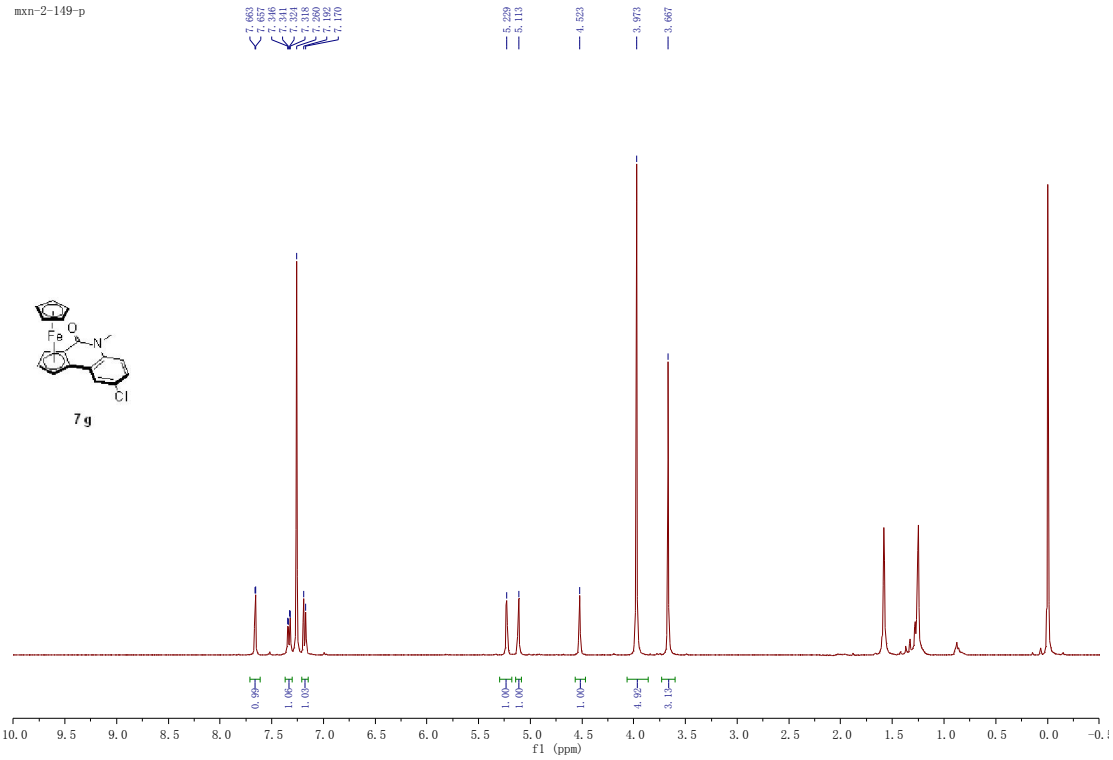

mxn-2-89-a
7.409
7.401
7.387
7.380
7.252
7.229
7.217
7.206
7.195
7.115
7.111
7.098
7.090
7.075
7.068
5.236
5.233
5.103
5.099
4.526
4.519
4.513
3.969
3.684
1.06
1.04
1.00
1.00
1.01
1.00
4.92
3.15
f1 (ppm)



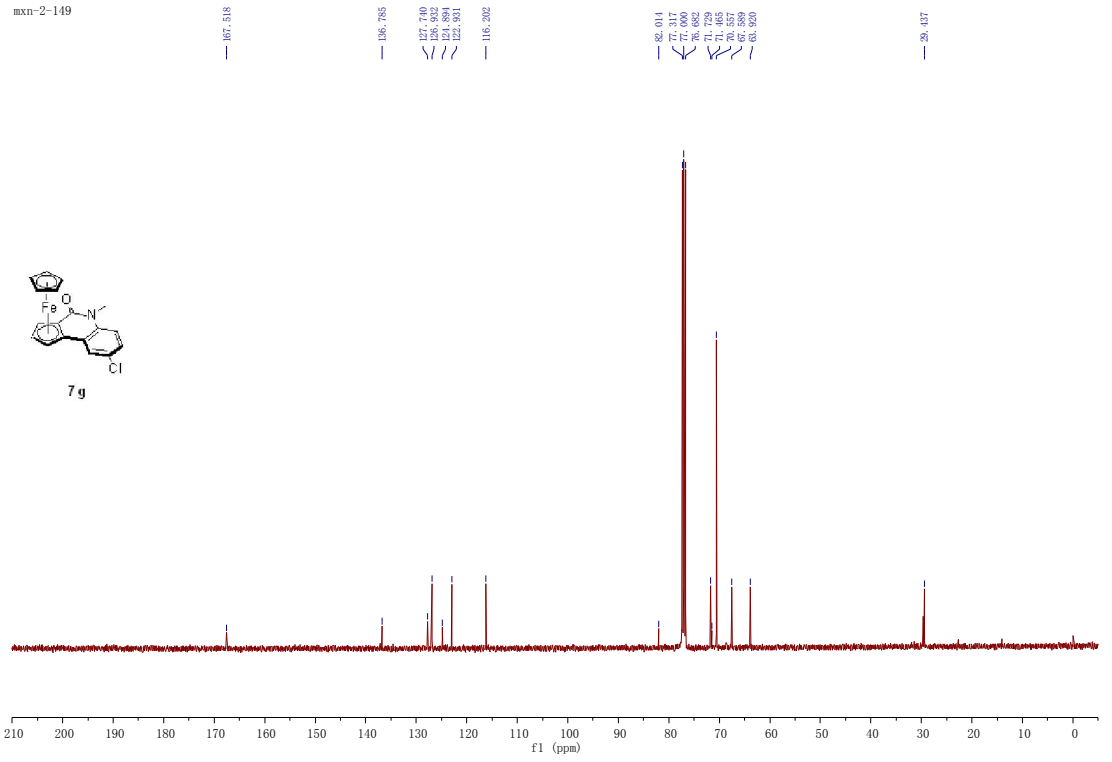
7f

mxn-2-89-a
167.384
159.557
157.154
134.549
124.938
124.855
116.299
116.186
113.986
113.758
109.685
109.452
82.235
77.317
77.000
76.682
71.649
71.622
70.516
67.604
63.982
29.535
f1 (ppm)

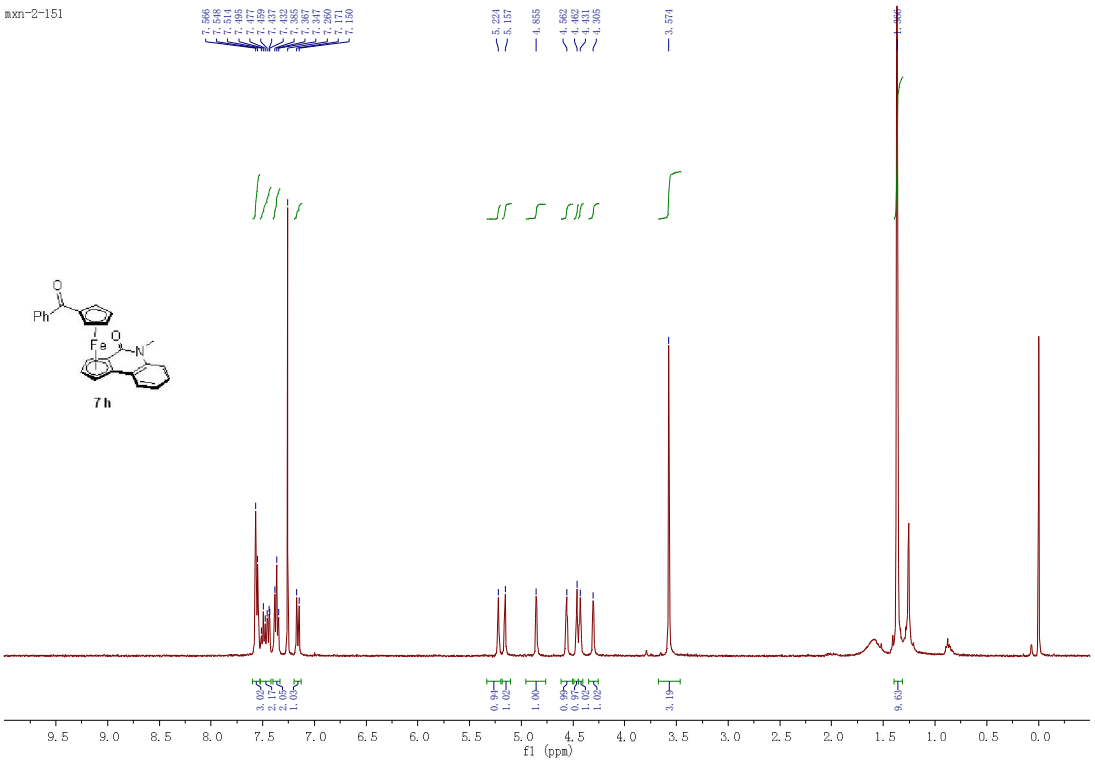
7f

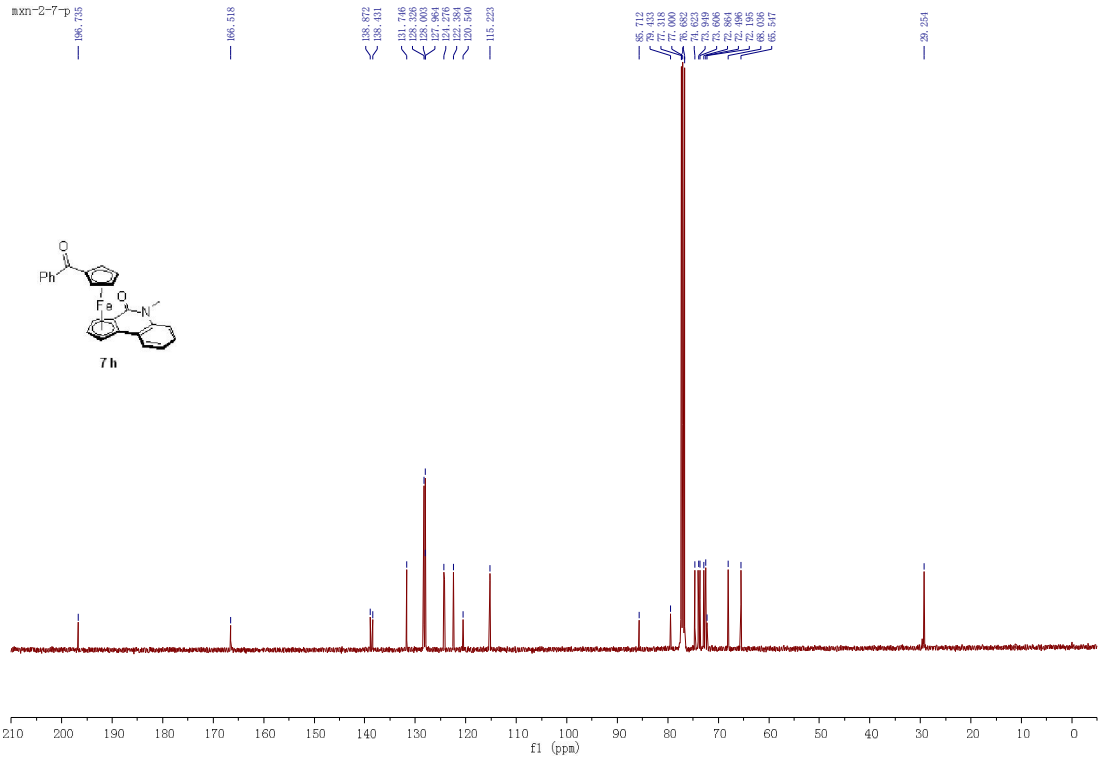

mxn-2-149-p
7.663
7.657
7.346
7.341
7.334
7.318
7.280
7.192
7.170
5.229
5.113
4.523
3.973
3.667
0.99
1.06
1.03
1.06
1.00
1.00
4.92
3.13
f1 (ppm)

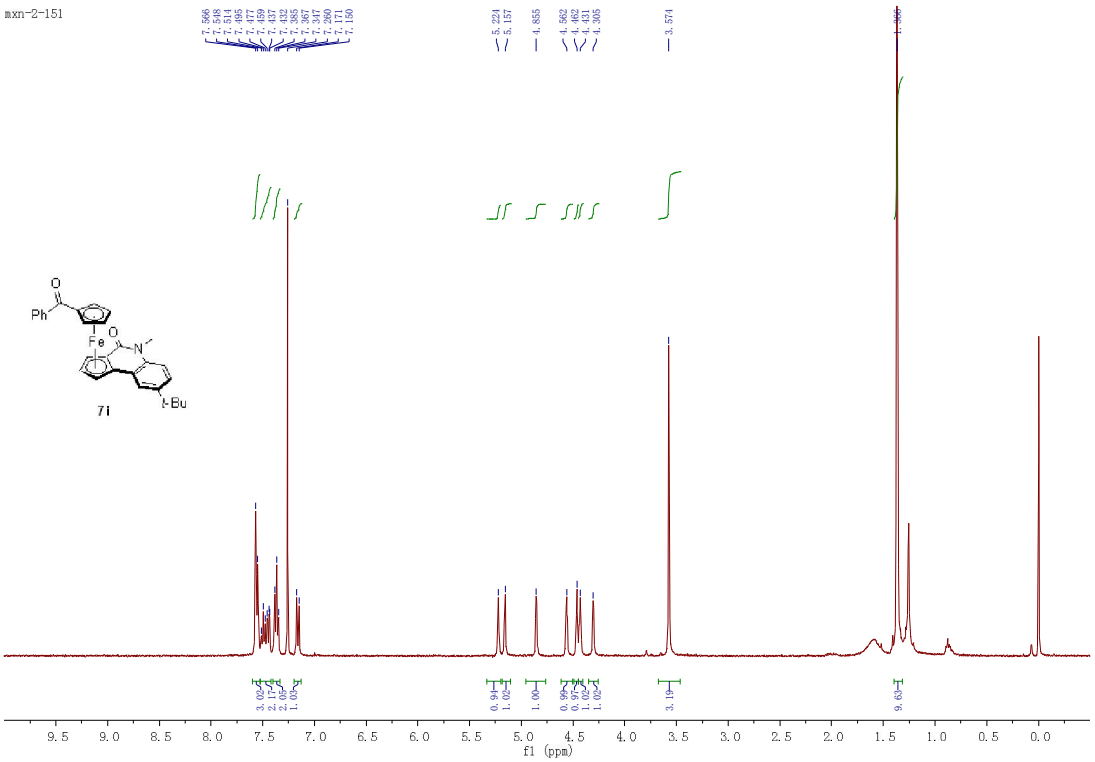
7g

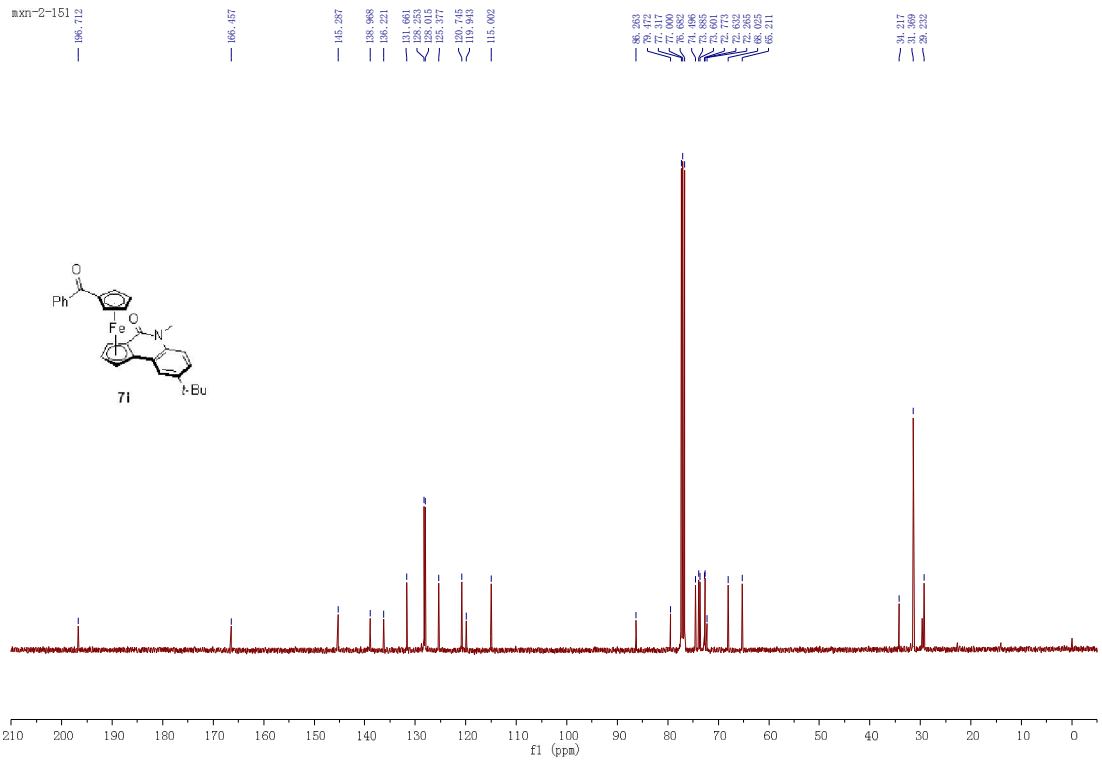

mxn-2-149
167.518
136.785
127.740
126.952
124.984
122.931
116.202
82.014
77.317
77.000
76.682
71.729
71.465
70.557
67.599
66.920
29.437
f1 (ppm)

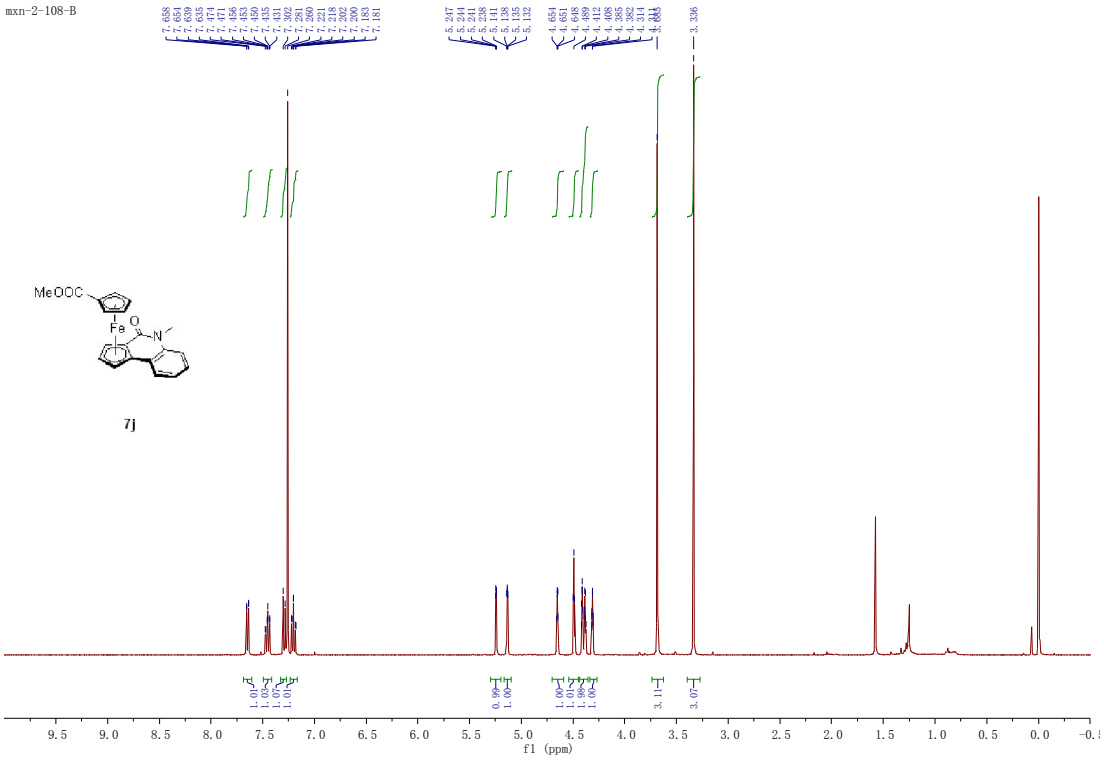
7g


mxn-2-151
7.566
7.548
7.514
7.495
7.477
7.459
7.437
7.432
7.385
7.367
7.347
7.269
7.171
7.150
5.224
5.157
4.855
4.562
4.462
4.431
4.305
3.574
1.565
Ph
Fe
O
N
7h
3.02
2.15
2.05
1.03
0.94
1.02
1.00
0.99
0.97
1.02
1.02
3.19
9.63
f1 (ppm)

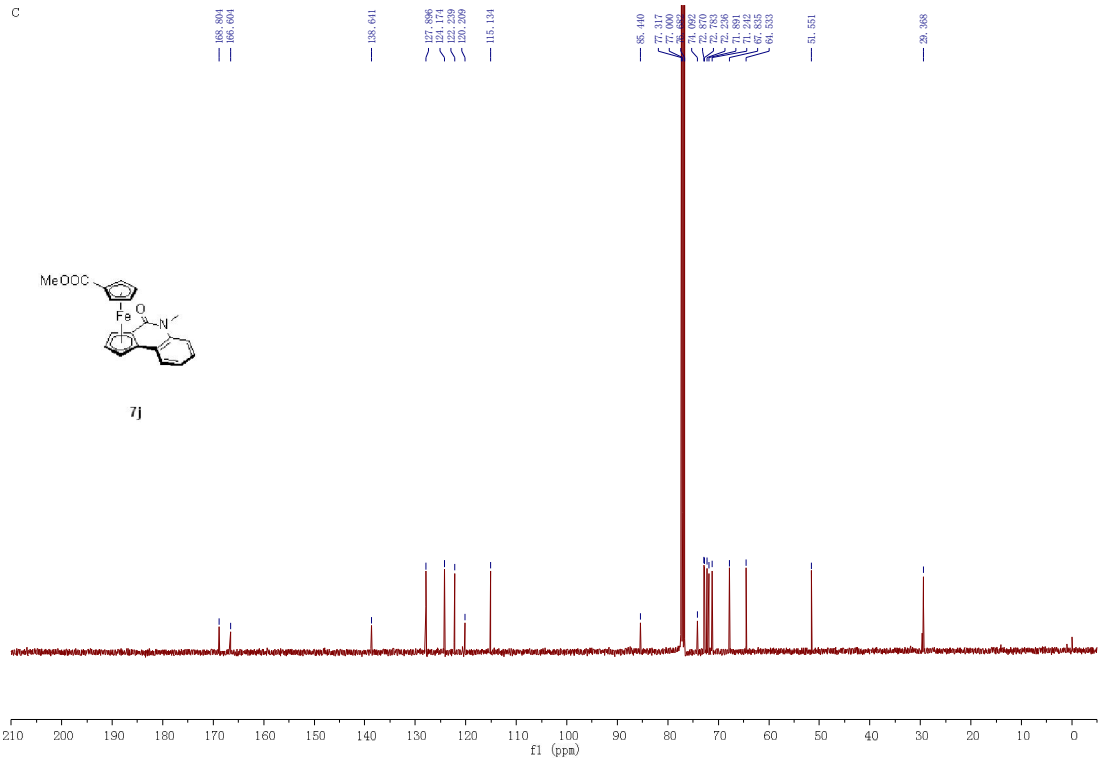

mxn-2-7-p
196.735
166.518
138.872
138.431
131.746
128.326
128.003
127.964
124.775
122.384
120.540
115.223
85.712
79.433
77.318
77.000
76.682
74.623
73.949
73.606
72.864
72.496
72.195
68.036
65.547
29.254
Ph
Fe
O
N
7h
f1 (ppm)


mxn-2-151
7.566
7.548
7.514
7.495
7.477
7.459
7.437
7.432
7.385
7.367
7.347
7.269
7.171
7.150
5.224
5.157
4.855
4.562
4.462
4.431
4.305
3.574
1.365
O
Ph
Fe
O
N
t-Bu
7i
3.02
2.15
2.05
1.03
0.94
1.02
1.00
0.99
0.97
1.02
1.02
3.19
9.63
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

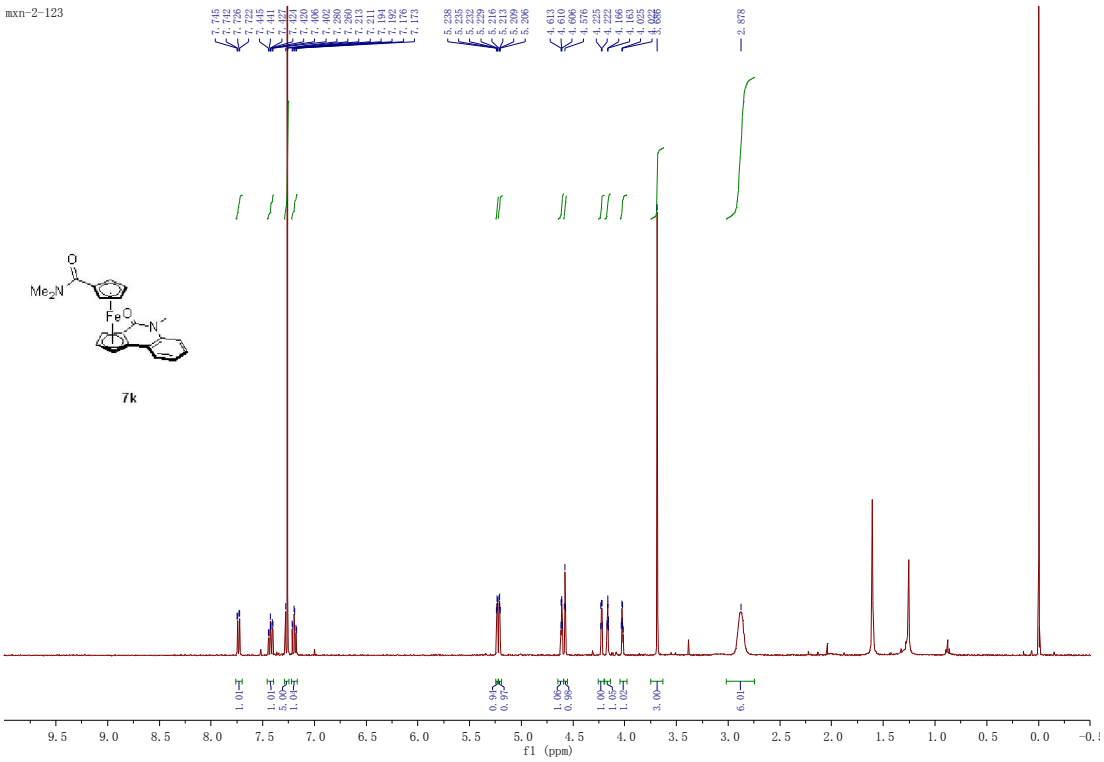

mxn-2-151
196.712
166.457
145.287
138.968
136.221
131.661
128.553
128.015
125.377
120.745
119.943
115.002
86.263
79.472
77.317
77.000
76.682
74.496
73.885
73.691
72.773
72.632
72.265
68.025
65.211
34.217
31.369
29.232
O
Ph
Fe
O
N
t-Bu
7i
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

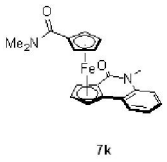


7j



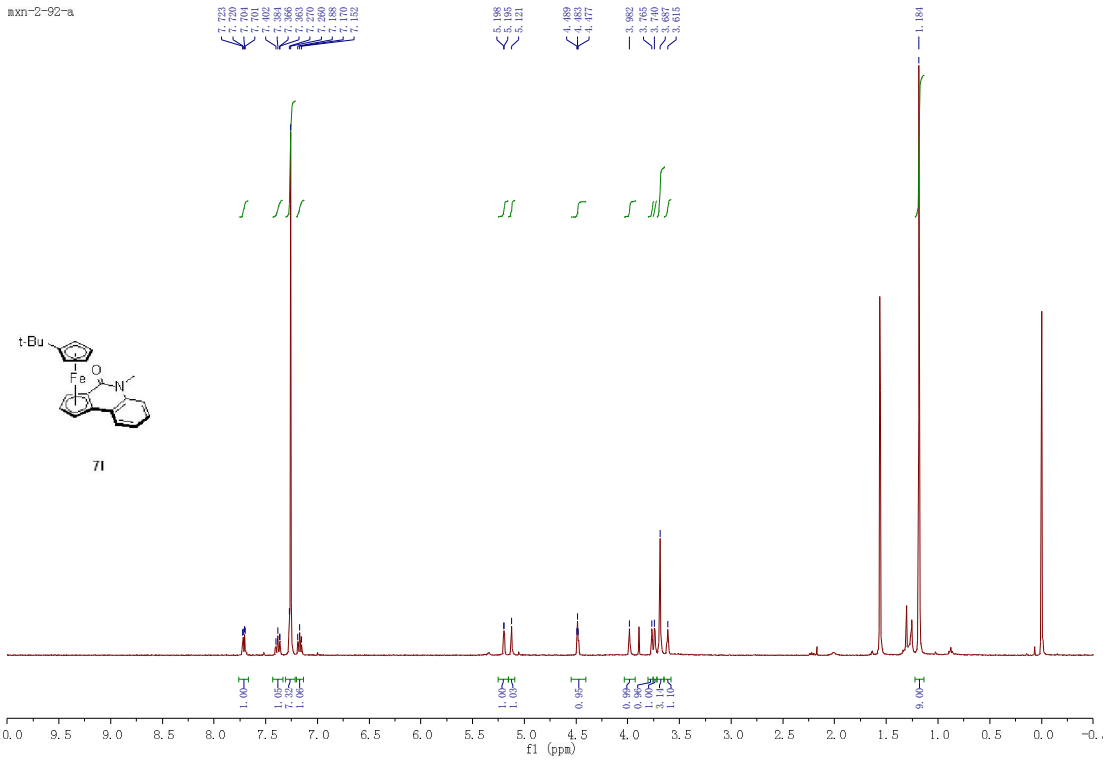
7j

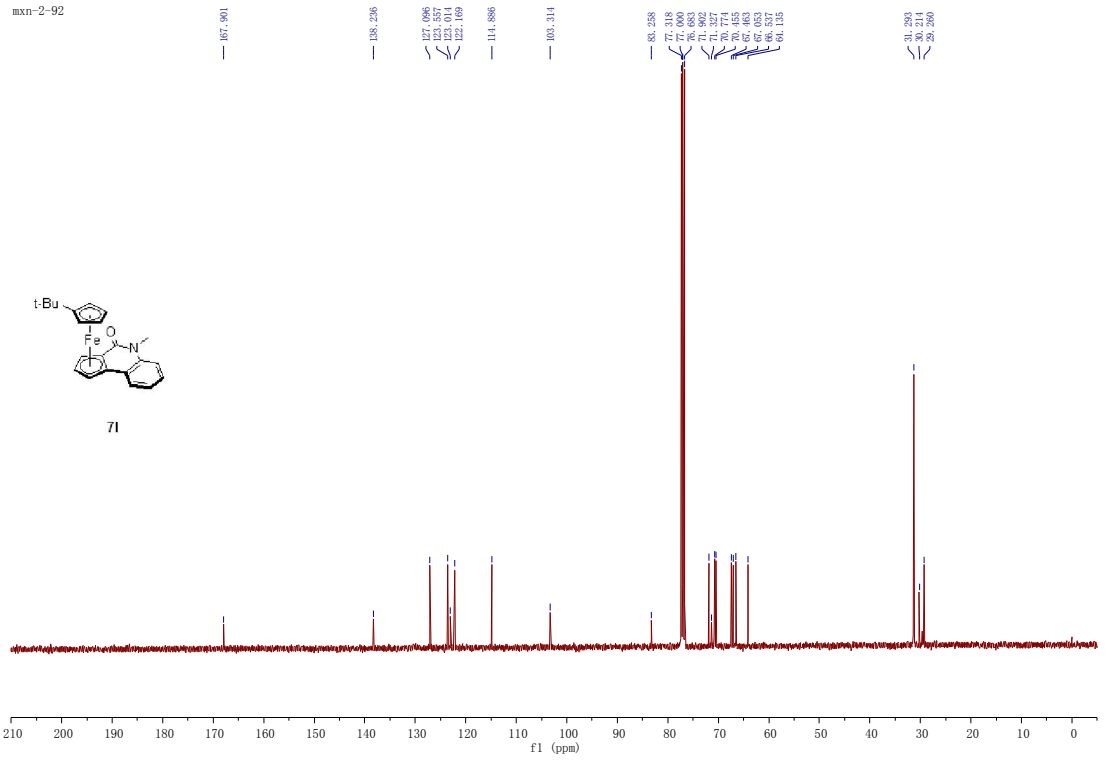


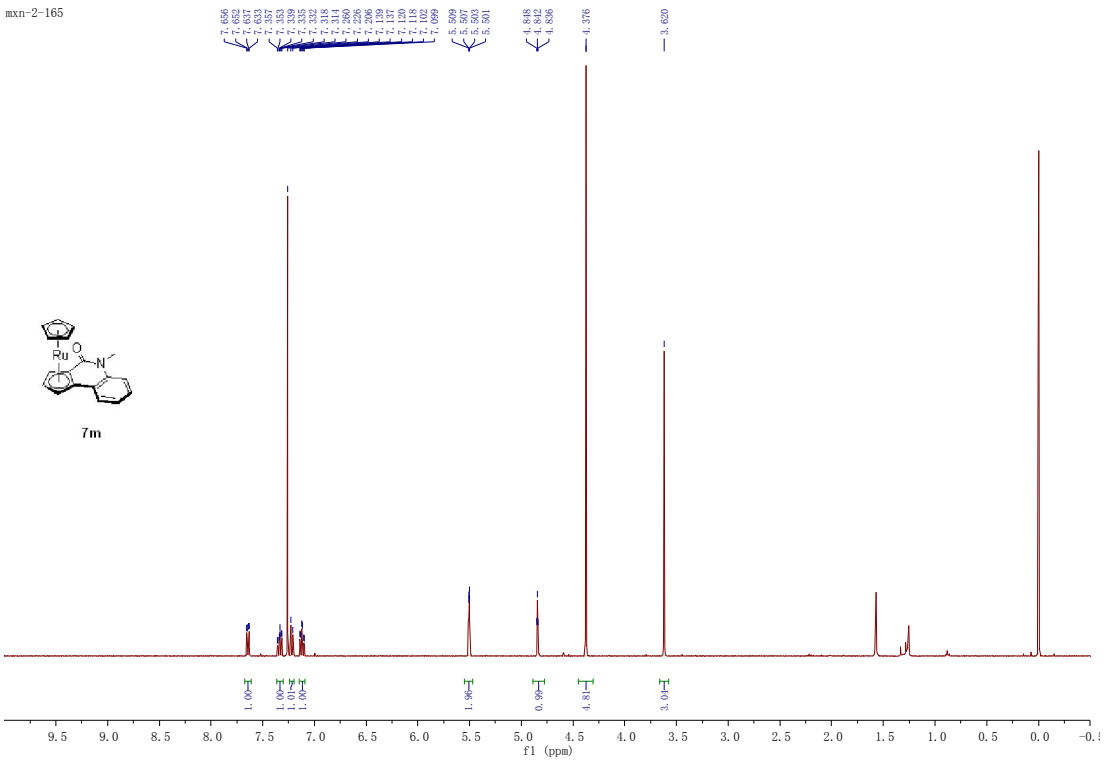


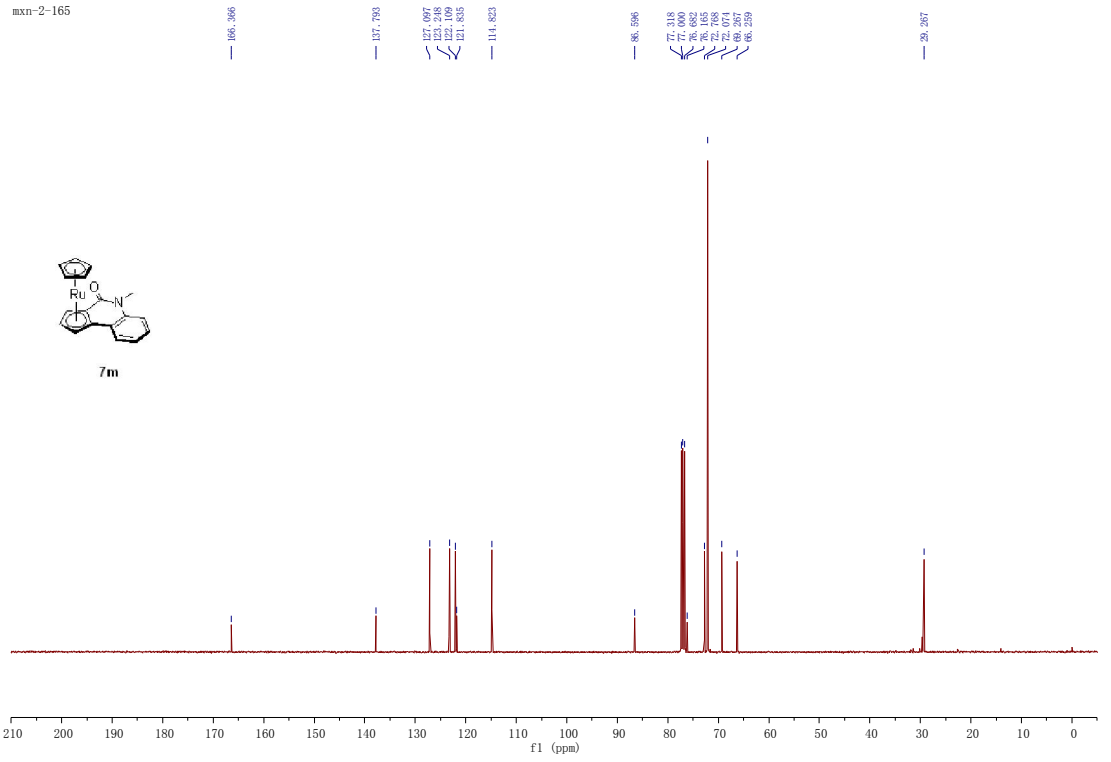
7k

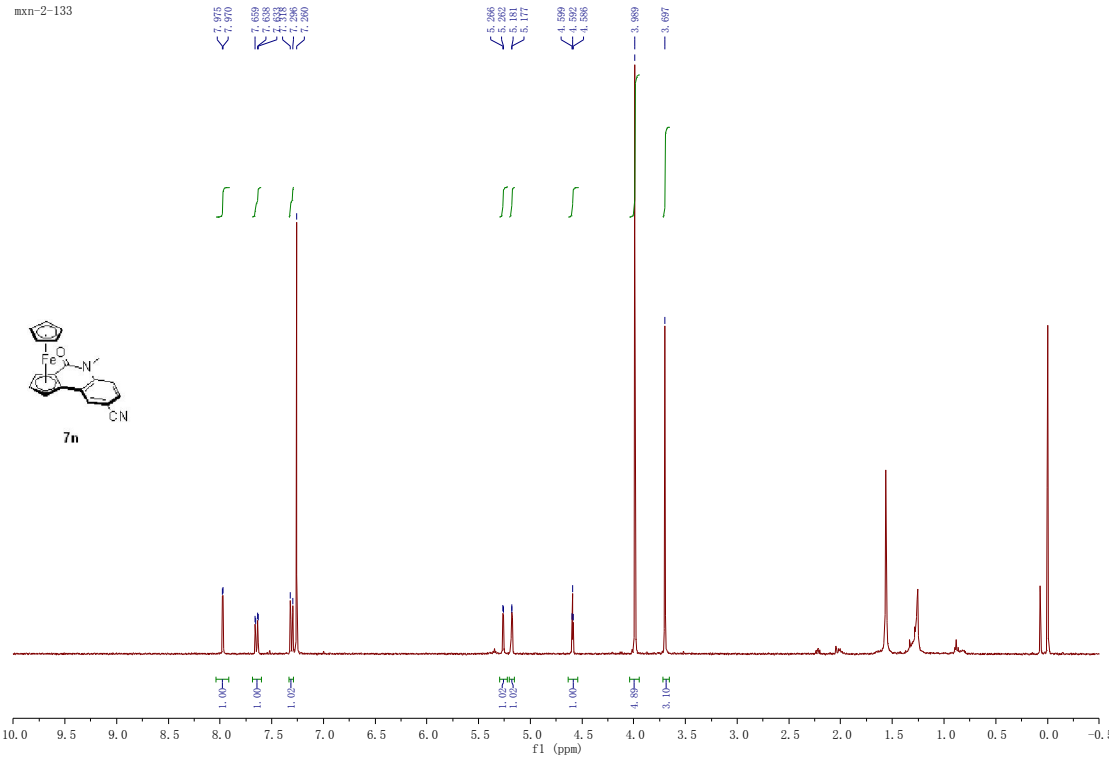
7k

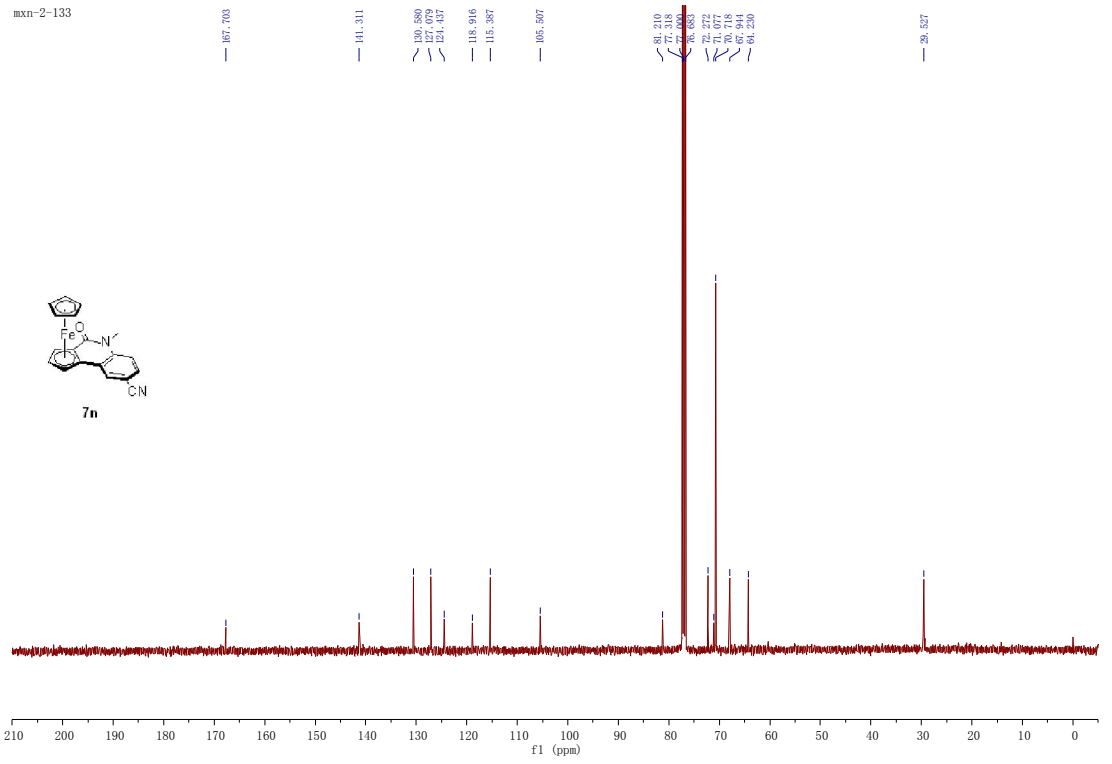

mxn-2-92-a
7.723
7.720
7.704
7.701
7.402
7.384
7.365
7.270
7.260
7.188
7.170
7.152
5.198
5.195
5.121
4.489
4.483
4.477
3.982
3.765
3.740
3.657
3.615
1.184
t-Bu
Fe
O
N
7l
f1 (ppm)

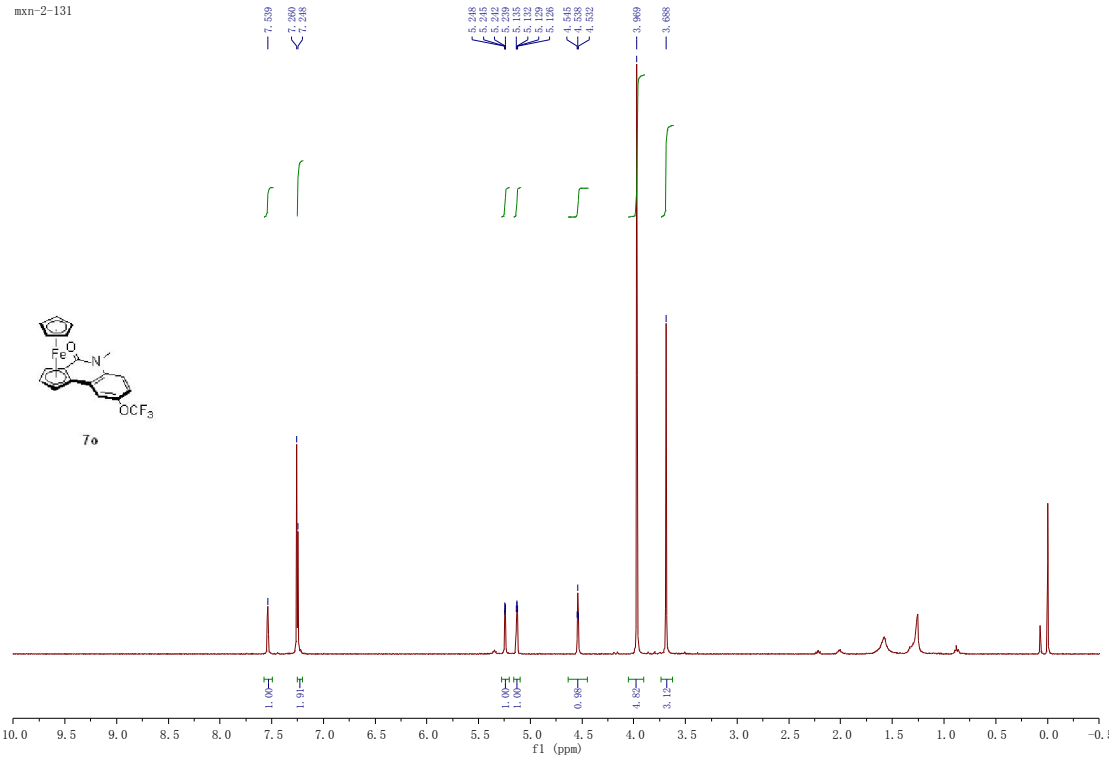

mxn-2-92
167.901
138.236
127.096
123.557
123.014
122.169
114.886
103.314
82.258
77.318
77.000
76.683
71.902
71.527
71.274
70.455
67.463
67.053
66.557
66.135
31.293
30.214
29.260
t-Bu
Fe
O
N
7l
f1 (ppm)


mxn-2-165
7.656
7.652
7.637
7.633
7.357
7.353
7.339
7.335
7.323
7.318
7.314
7.260
7.226
7.206
7.139
7.137
7.120
7.118
7.102
7.099
5.509
5.507
5.503
5.501
4.848
4.842
4.836
4.376
3.620
Ru
O
N
7m
1.00
1.00
1.01
1.00
1.96
0.99
4.81
3.04
f1 (ppm)

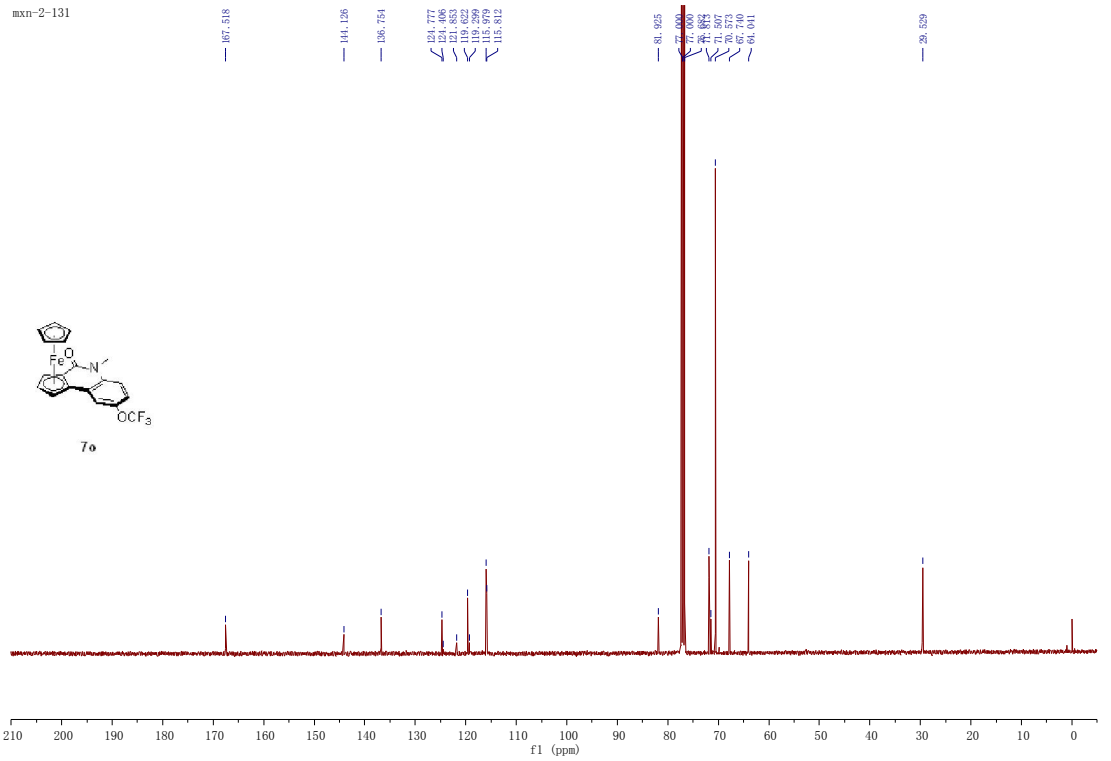

mxn-2-165
166.366
137.793
127.097
123.248
122.109
121.835
114.823
86.596
77.318
77.000
76.682
76.165
72.768
72.071
69.267
68.259
29.267
Ru
O
N
7m
f1 (ppm)


mxn-2-133
7.975
7.970
7.659
7.638
7.318
7.296
7.280
5.266
5.262
5.181
5.177
4.599
4.592
4.586
3.989
3.697
1.06
1.00
1.02
1.02
1.02
1.00
4.89
3.10
f1 (ppm)
7n


mxn-2-133
167.703
141.311
130.580
127.079
124.437
118.916
115.387
105.507
81.210
77.318
77.000
76.683
72.272
71.077
70.718
69.944
64.230
29.527
f1 (ppm)
7n


mxn-2-131
7.539
7.260
7.248
5.248
5.245
5.242
5.239
5.135
5.132
5.129
5.126
4.545
4.538
4.532
3.969
3.688
1.00
1.91
1.00
1.06
0.98
4.82
3.12
f1 (ppm)

7o


mxn-2-131
167.518
144.126
136.754
124.777
124.406
121.853
119.622
119.399
115.956
115.812
81.925
77.000
76.682
76.365
71.507
70.573
67.740
60.041
29.529
f1 (ppm)

7o

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-01-22 17:36 Reported Date and Time: 2014-06-02 20:38

Processed Date and Time: 2014-06-02 20:38

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0038\

Processing Method: isopropanol

System (acquisition): LCE Series: 0038

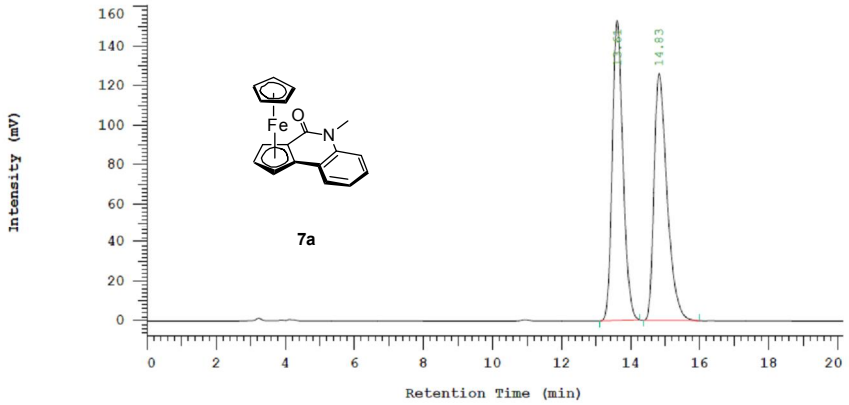
Application(data): maxinna Vial Number: 1

Sample Name: mxn-2-1-p-rac Vial Type: UNK

Injection from this vial: 1 of 1 Volume: 10.0 ul

Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol

Column Type: Column Method Developer:

Method Description:

Chrom Type: HPLC Channel : 1

Peak Quantitation: AREA

Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	13.61	3316666	50.051	BB
2	14.83	3309967	49.949	BB
		6626633	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000: maxinna Series: 0039 Report Name: modified System: LCE

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-01-22 18:05 Reported Date and Time: 2014-06-02 20:36

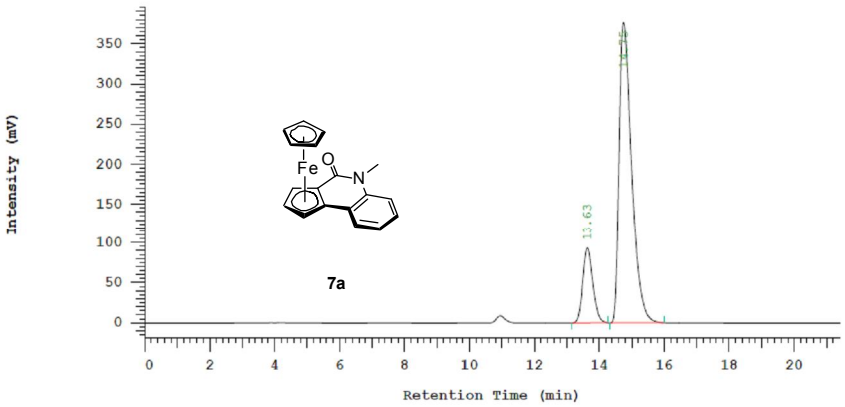
Processed Date and Time: 2014-06-02 20:35

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0039\

Processing Method: isopropanol

System (acquisition): LCE Series: 0039
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-1-p-rac Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	13.63	2014185	16.770	BB
2	14.75	9996677	83.230	BB
		12010862	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-04-14 22:16 Reported Date and Time: 2014-06-02 20:43

Processed Date and Time: 2014-06-02 20:43

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0055\

Processing Method: isopropanol

System (acquisition): LCE Series: 0055

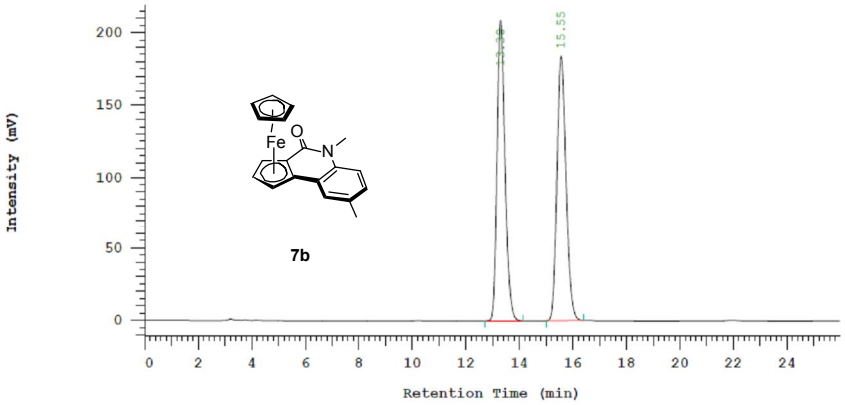
Application(data): maxinna Vial Number: 1

Sample Name: mxn-2-2-rac Vial Type: UNK

Injection from this vial: 1 of 1 Volume: 10.0 ul

Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol

Column Type: Column Method Developer:

Method Description:

Chrom Type: HPLC Channel : 1

Peak Quantitation: AREA

Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	13.30	4321282	50.047	BB
2	15.55	4313176	49.953	BB
		8634458	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-04-14 22:44 Reported Date and Time: 2014-06-02 20:41

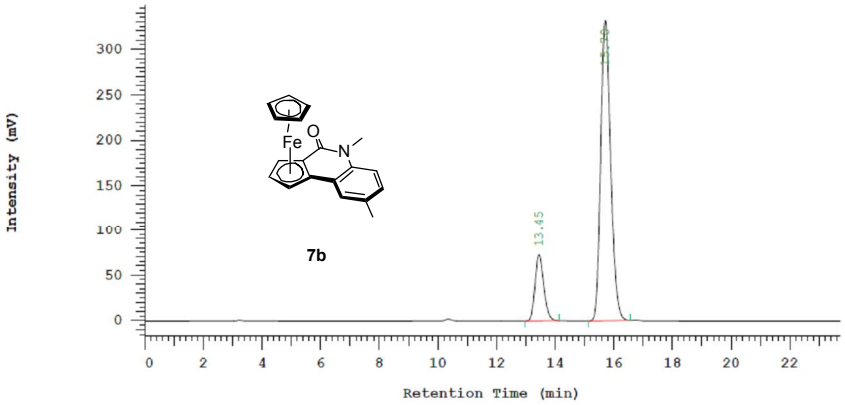
Processed Date and Time: 2014-06-02 20:40

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0056\

Processing Method: isopropanol

System (acquisition): LCE Series: 0056
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-2-rac Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



7b

Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	13.45	1485346	16.038	BB
2	15.70	7776032	83.962	BB
		9261378	100.000	

Peak rejection level: 0

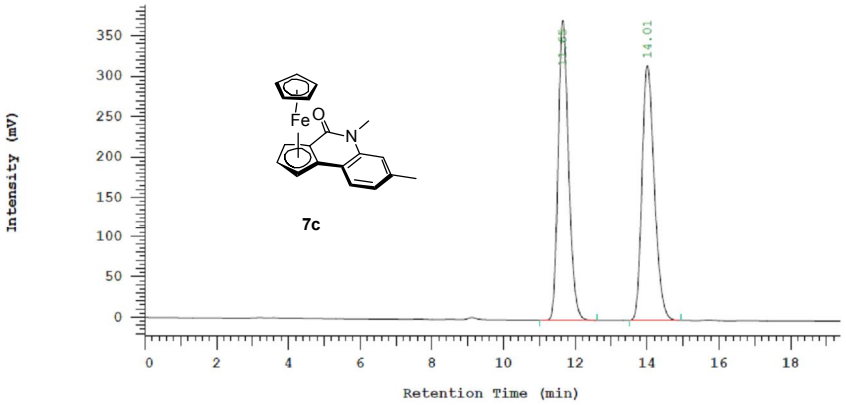
Page Indicator: 1 / 4

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-03-26 11:04 Reported Date and Time: 2014-06-02 21:17
Processed Date and Time: 2014-06-02 21:17
Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0048\
Processing Method: isopropanol

System (acquisition): LCE Series: 0048
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-126-rac-1 Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	11.65	7568147	50.015	BB
2	14.01	7563459	49.985	BB
		15131606	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-03-26 11:27 Reported Date and Time: 2014-06-02 21:15

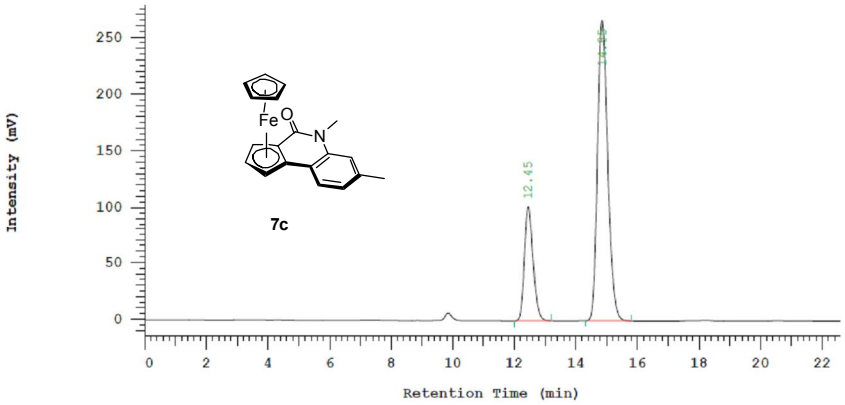
Processed Date and Time: 2014-06-02 21:15

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0049\

Processing Method: isopropanol

System (acquisition): LCE Series: 0049
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-126-rac-1 Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	12.45	1978784	24.540	BB
2	14.85	6084881	75.460	BB
		8063665	100.000	

Peak rejection level: 0

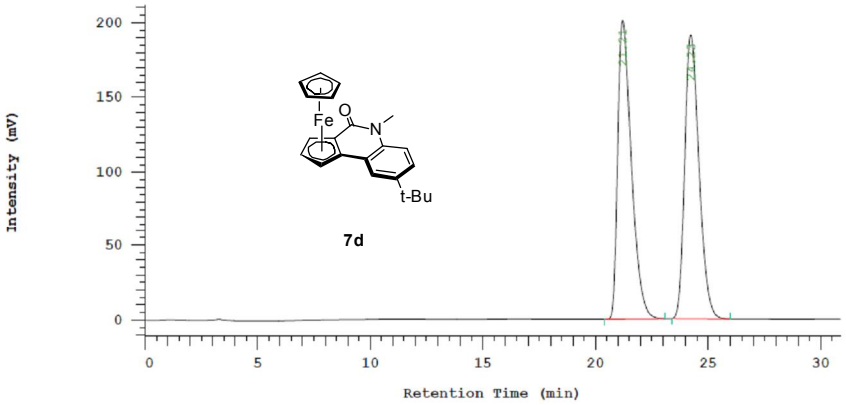
Page Indicator: 1 / 4

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2013-12-30 21:50 Reported Date and Time: 2014-06-02 20:45
Processed Date and Time: 2014-06-02 20:45
Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0036\
Processing Method: isopropanol

System (acquisition): LCE Series: 0036
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-89-b-rac Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	21.21	8383408	50.039	BB
2	24.23	8370294	49.961	BB
		16753702	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2013-12-30 22:24 Reported Date and Time: 2014-06-02 20:48

Processed Date and Time: 2014-06-02 20:47

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0037\

Processing Method: isopropanol

System (acquisition): LCE Series: 0037

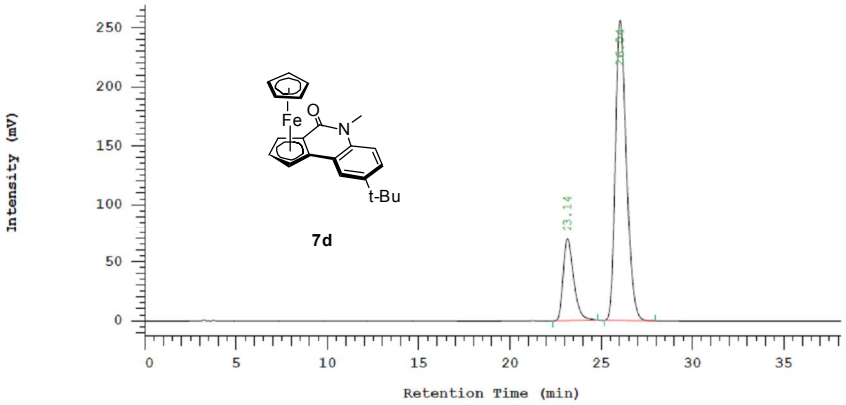
Application(data): maxinna Vial Number: 1

Sample Name: mxn-2-89-b-rac Vial Type: UNK

Injection from this vial: 1 of 1 Volume: 10.0 ul

Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol

Column Type: Column Method Developer:

Method Description:

Chrom Type: HPLC Channel : 1

Peak Quantitation: AREA

Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	23.14	2760809	20.526	BB
2	26.04	10689787	79.474	BB
		13450596	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000: maxinna Series: 0065 Report Name: modified System: LCE

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-04-15 22:53 Reported Date and Time: 2014-06-02 21:28

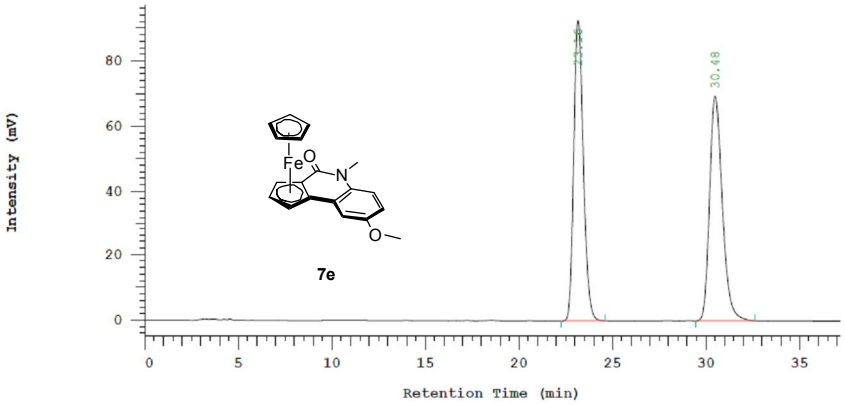
Processed Date and Time: 2014-06-02 21:28

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0065\

Processing Method: isopropanol

System (acquisition): LCE Series: 0065
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-138 Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	23.16	3207038	49.772	BB
2	30.48	3236478	50.228	BB
		6443516	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-04-15 23:33 Reported Date and Time: 2014-06-02 21:28

Processed Date and Time: 2014-06-02 21:27

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0066\

Processing Method: isopropanol

System (acquisition): LCE Series: 0066

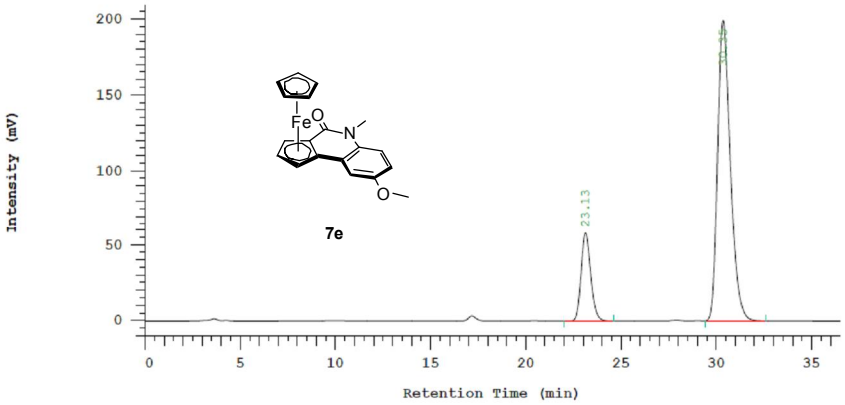
Application(data): maxinna Vial Number: 1

Sample Name: mxn-2-138 Vial Type: UNK

Injection from this vial: 1 of 1 Volume: 10.0 ul

Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol

Column Type: Column Method Developer:

Method Description:

Chrom Type: HPLC Channel : 1

Peak Quantitation: AREA

Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	23.13	2020216	17.921	BB
2	30.35	9252836	82.079	BB
		11273052	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000: maxinna Series: 0032 Report Name: modified System: LCE

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2013-12-30 17:09 Reported Date and Time: 2014-06-02 20:54

Processed Date and Time: 2014-06-02 20:53

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0032\

Processing Method: isopropanol

System (acquisition): LCE Series: 0032

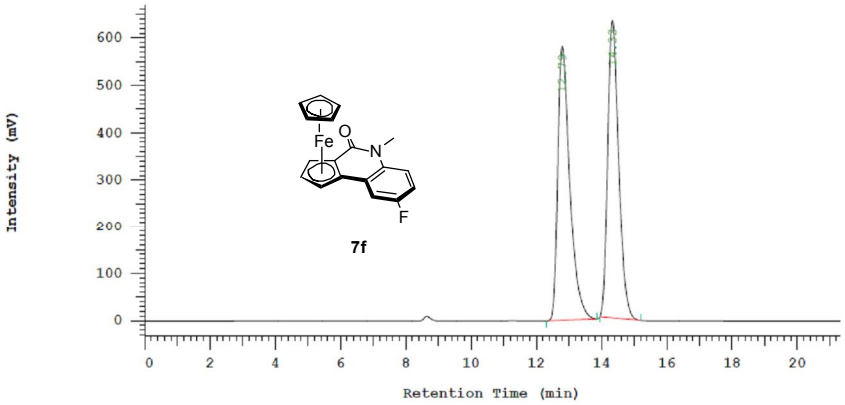
Application(data): maxinna Vial Number: 1

Sample Name: mxn-2-89-a-rac Vial Type: UNK

Injection from this vial: 1 of 1 Volume: 10.0 ul

Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol

Column Type: Column Method Developer:

Method Description:

Chrom Type: HPLC Channel : 1

Peak Quantitation: AREA

Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	12.79	14945224	50.167	BB
2	14.33	14845587	49.833	BB
		29790811	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000: maxinna Series: 0033 001 Report Name: modified System: LCE

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2013-12-30 17:36 Reported Date and Time: 2014-06-02 20:53

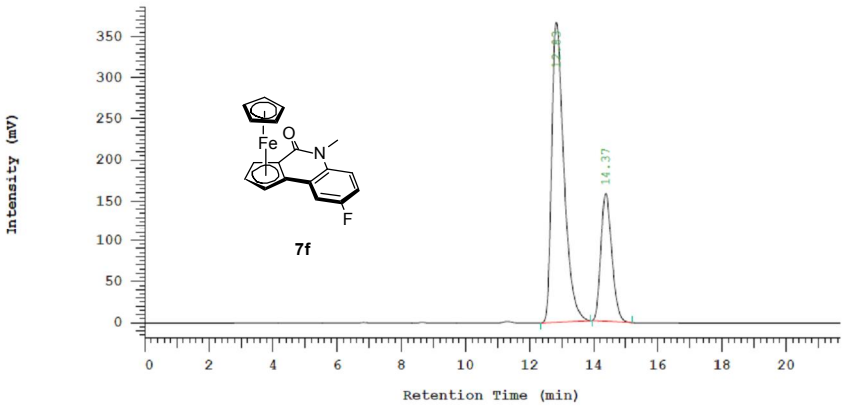
Processed Date and Time: 2014-06-02 20:51

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0033_001\

Processing Method: isopropanol

System (acquisition): LCE Series: 0033_001
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-89-a-rac Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	12.83	9650331	72.328	BB
2	14.37	3692179	27.672	BB
		13342510	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-04-14 23:47 Reported Date and Time: 2014-06-02 20:58

Processed Date and Time: 2014-06-02 20:57

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0058\

Processing Method: isopropanol

System (acquisition): LCE Series: 0058

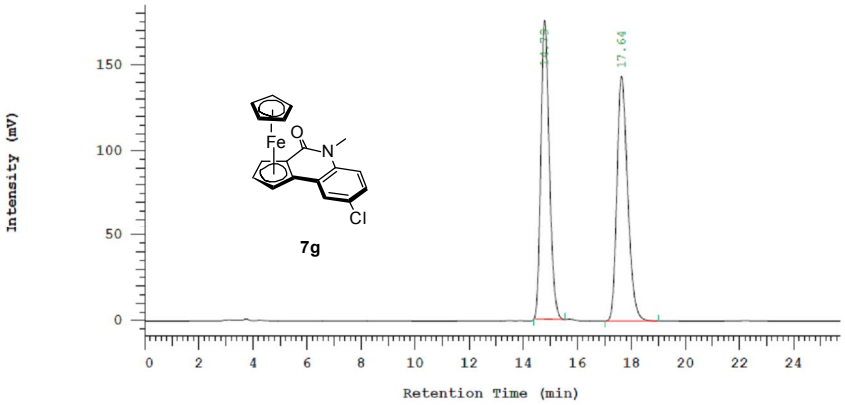
Application(data): maxinna Vial Number: 1

Sample Name: mxn-2-5 Vial Type: UNK

Injection from this vial: 1 of 1 Volume: 10.0 ul

Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol

Column Type: Column Method Developer:

Method Description:

Chrom Type: HPLC Channel : 1

Peak Quantitation: AREA

Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	14.79	3838877	49.469	BB
2	17.64	3921306	50.531	BB
		7760183	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000: maxinna Series: 0061 Report Name: modified System: LCE

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-04-15 11:35 Reported Date and Time: 2014-06-02 20:56

Processed Date and Time: 2014-06-02 20:55

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0061\

Processing Method: isopropanol

System (acquisition): LCE Series: 0061

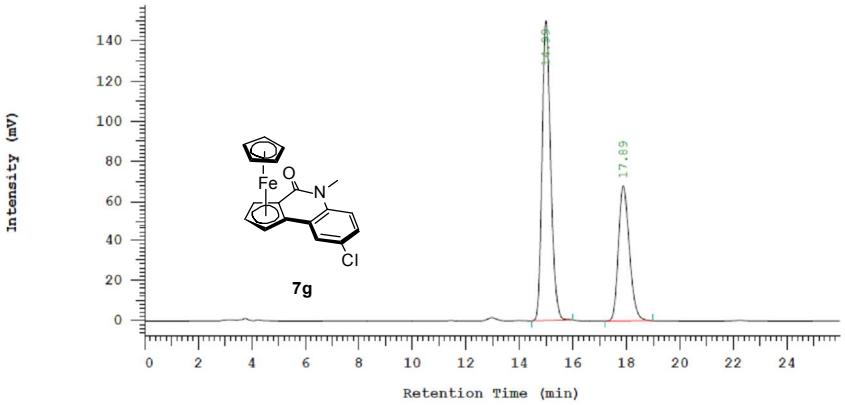
Application(data): maxinna Vial Number: 1

Sample Name: mxn-2-5 Vial Type: UNK

Injection from this vial: 1 of 1 Volume: 10.0 ul

Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol

Column Type: Column Method Developer:

Method Description:

Chrom Type: HPLC Channel : 1

Peak Quantitation: AREA

Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	14.99	3359905	63.928	BB
2	17.89	1895860	36.072	BB
		5255765	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-04-17 12:18 Reported Date and Time: 2014-06-02 21:07

Processed Date and Time: 2014-06-02 21:07

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0071\

Processing Method: isopropanol

System (acquisition): LCE Series: 0071

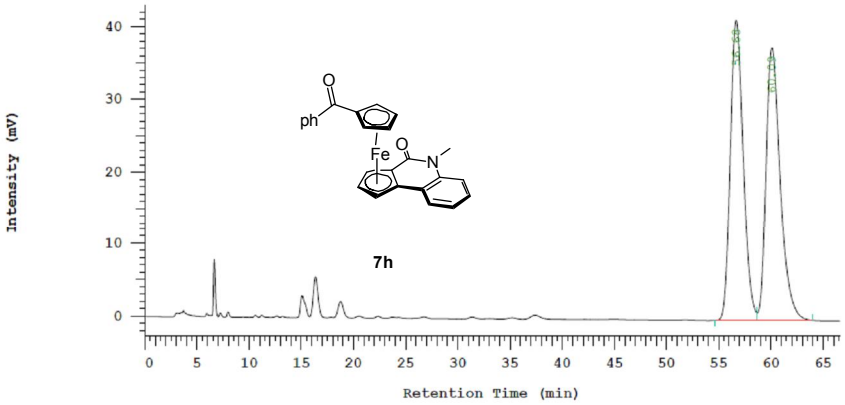
Application(data): maxinna Vial Number: 1

Sample Name: mxn-2-7 Vial Type: UNK

Injection from this vial: 1 of 1 Volume: 10.0 ul

Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol

Column Type: Column Method Developer:

Method Description:

Chrom Type: HPLC Channel : 1

Peak Quantitation: AREA

Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	56.68	3523887	49.839	BV
2	60.09	3546699	50.161	VB
		7070586	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000: maxinna Series: 0072 Report Name: modified System: LCE

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-04-17 13:38 Reported Date and Time: 2014-06-02 21:05

Processed Date and Time: 2014-06-02 21:04

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0072\

Processing Method: isopropanol

System (acquisition): LCE Series: 0072

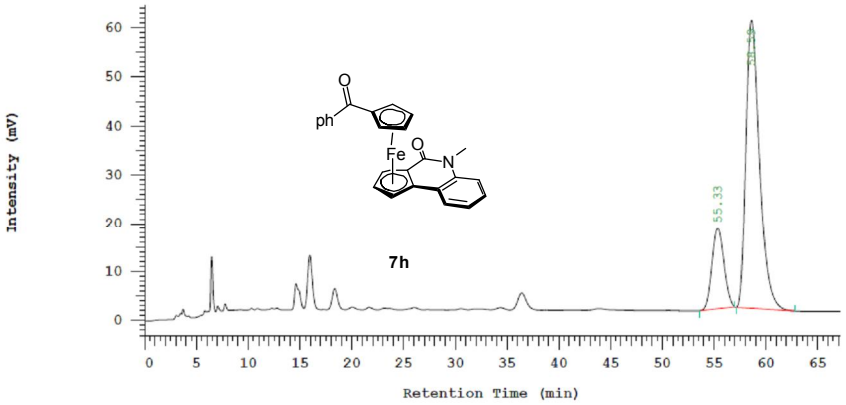
Application(data): maxinna Vial Number: 1

Sample Name: mxn-2-7 Vial Type: UNK

Injection from this vial: 1 of 1 Volume: 10.0 ul

Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol

Column Type: Column Method Developer:

Method Description:

Chrom Type: HPLC Channel : 1

Peak Quantitation: AREA

Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	55.33	1301946	19.479	BB
2	58.59	5381908	80.521	BB
		6683854	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-05-06 16:46 Reported Date and Time: 2014-06-02 21:47

Processed Date and Time: 2014-06-02 21:46

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0115\

Processing Method: isopropanol

System (acquisition): LCE Series: 0115

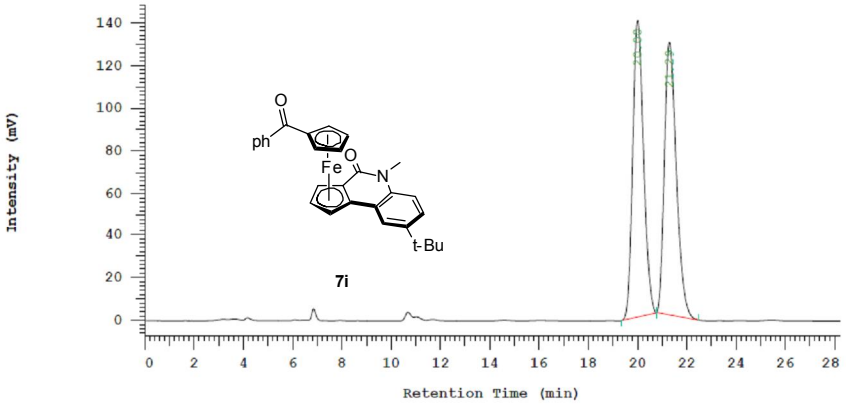
Application(data): maxinna Vial Number: 1

Sample Name: mxn-2-151 Vial Type: UNK

Injection from this vial: 1 of 1 Volume: 10.0 ul

Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



7i

Processing Method: isopropanol

Column Type: Column Method Developer:

Method Description:

Chrom Type: HPLC Channel : 1

Peak Quantitation: AREA

Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	20.00	4264319	50.055	BB
2	21.29	4254999	49.945	BB
		8519318	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-05-06 17:15 Reported Date and Time: 2014-06-02 21:45

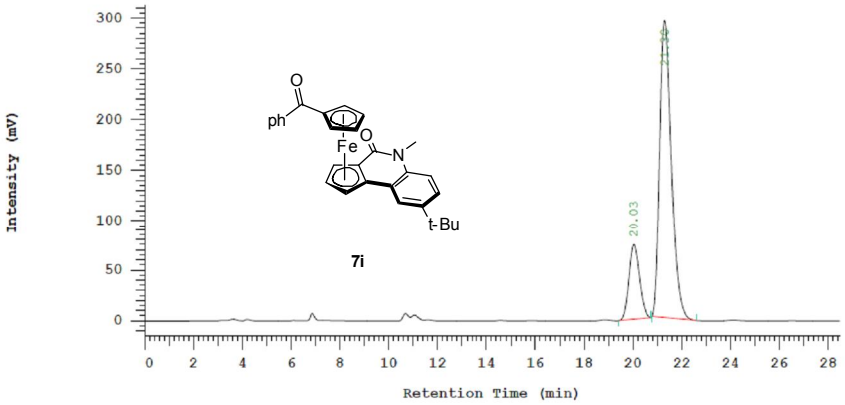
Processed Date and Time: 2014-06-02 21:44

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0116\

Processing Method: isopropanol

System (acquisition): LCE Series: 0116
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-151 Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



7i

Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	20.03	2216919	18.501	BB
2	21.30	9765971	81.499	BB
		11982890	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-04-15 16:52 Reported Date and Time: 2014-06-02 21:10

Processed Date and Time: 2014-06-02 21:10

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0062\

Processing Method: isopropanol

System (acquisition): LCE Series: 0062

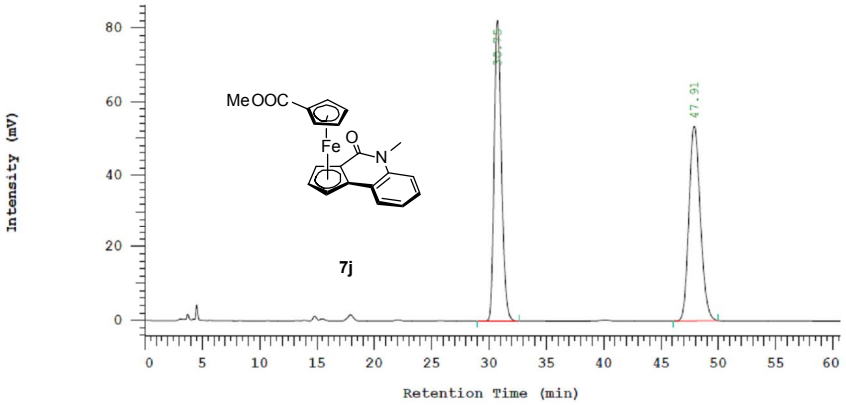
Application(data): maxinna Vial Number: 1

Sample Name: mxn-2-108-b Vial Type: UNK

Injection from this vial: 1 of 1 Volume: 10.0 ul

Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



7j

Processing Method: isopropanol

Column Type: Column Method Developer:

Method Description:

Chrom Type: HPLC Channel : 1

Peak Quantitation: AREA

Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	30.75	3616373	50.061	BB
2	47.91	3607591	49.939	BB
		7223964	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000: maxinna Series: 0064 Report Name: modified System: LCE

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-04-15 18:48 Reported Date and Time: 2014-06-02 21:09

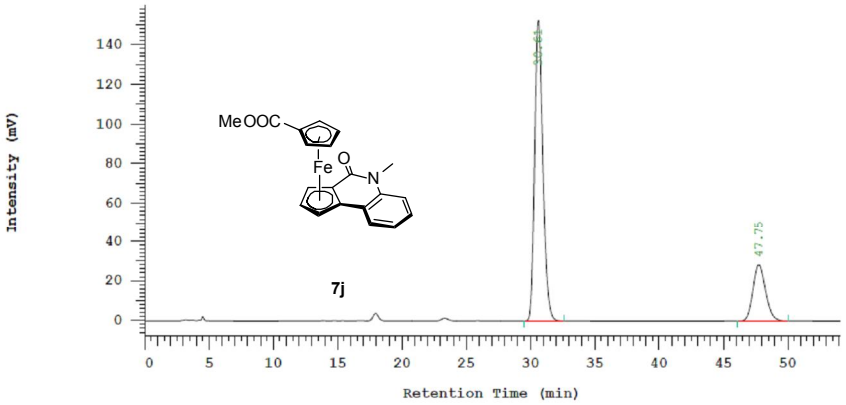
Processed Date and Time: 2014-06-02 21:09

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0064\

Processing Method: isopropanol

System (acquisition): LCE Series: 0064
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-108-b Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



7j

Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	30.61	6656194	77.689	BB
2	47.75	1911501	22.311	BB
		8567695	100.000	

Peak rejection level: 0

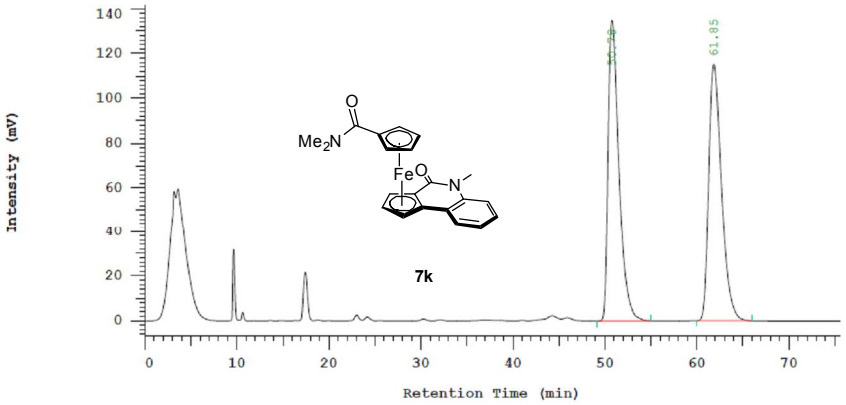
Page Indicator: 1 / 4

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-03-15 17:46 Reported Date and Time: 2014-06-02 21:14
Processed Date and Time: 2014-06-02 21:13
Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0046\
Processing Method: isopropanol

System (acquisition): LCE Series: 0046
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-122-rac-4 Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	50.78	11020169	50.187	BB
2	61.85	10937936	49.813	BB
		21958105	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000: maxinna Series: 0047 Report Name: modified System: LCE

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-03-15 19:09 Reported Date and Time: 2014-06-02 21:12

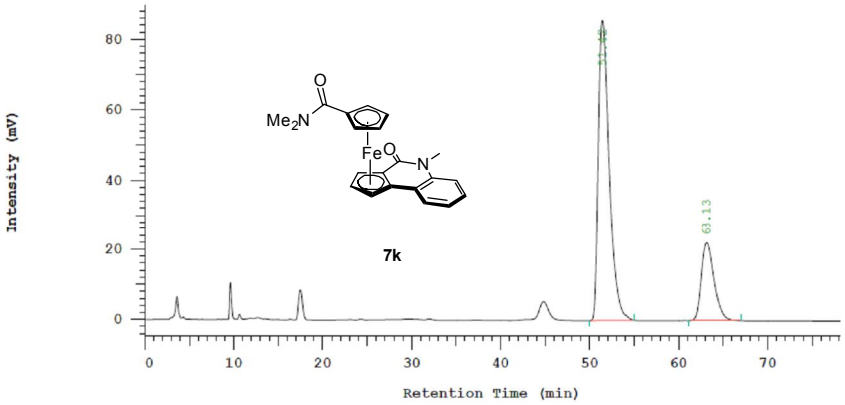
Processed Date and Time: 2014-06-02 21:12

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0047\

Processing Method: isopropanol

System (acquisition): LCE Series: 0047
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-122-rac-4 Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	51.42	7151881	76.639	BB
2	63.13	2180042	23.361	BB
		9331923	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000: maxinna Series: 0040 Report Name: modified System: LCE

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-01-22 18:37 Reported Date and Time: 2014-06-02 21:02

Processed Date and Time: 2014-06-02 21:02

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0040\

Processing Method: isopropanol

System (acquisition): LCE Series: 0040

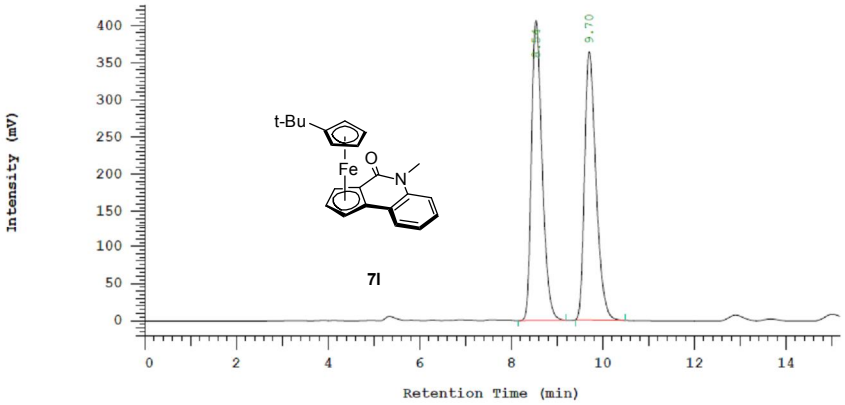
Application(data): maxinna Vial Number: 1

Sample Name: mxn-2-1-p-rac Vial Type: UNK

Injection from this vial: 1 of 1 Volume: 10.0 ul

Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



7l

Processing Method: isopropanol

Column Type: Column Method Developer:

Method Description:

Chrom Type: HPLC Channel : 1

Peak Quantitation: AREA

Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	8.54	6511258	50.611	BB
2	9.70	6353925	49.389	BB
		12865183	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000: maxinna Series: 0041 Report Name: modified System: LCE

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-01-22 18:58 Reported Date and Time: 2014-06-02 21:01

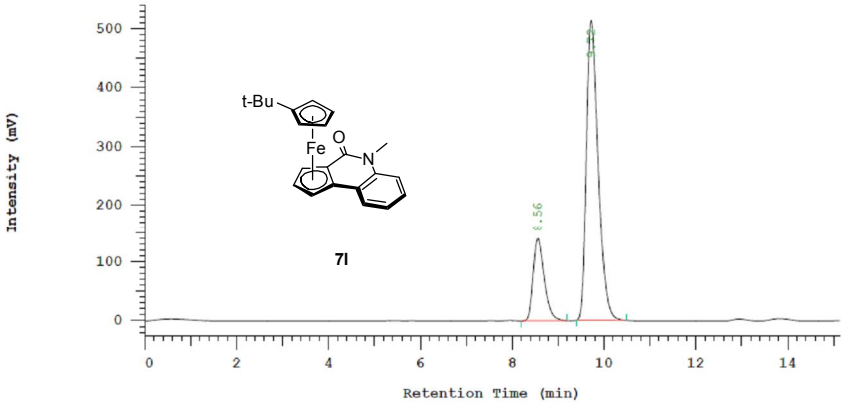
Processed Date and Time: 2014-06-02 21:00

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0041\

Processing Method: isopropanol

System (acquisition): LCE Series: 0041
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-1-p-rac Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



7l

Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	8.56	2337420	20.238	BB
2	9.72	9212408	79.762	BB
		11549828	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000: maxinna Series: 0121 Report Name: modified System: LCE

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-05-07 18:19 Reported Date and Time: 2014-06-02 21:54

Processed Date and Time: 2014-06-02 21:53

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0121\

Processing Method: isopropanol

System (acquisition): LCE Series: 0121

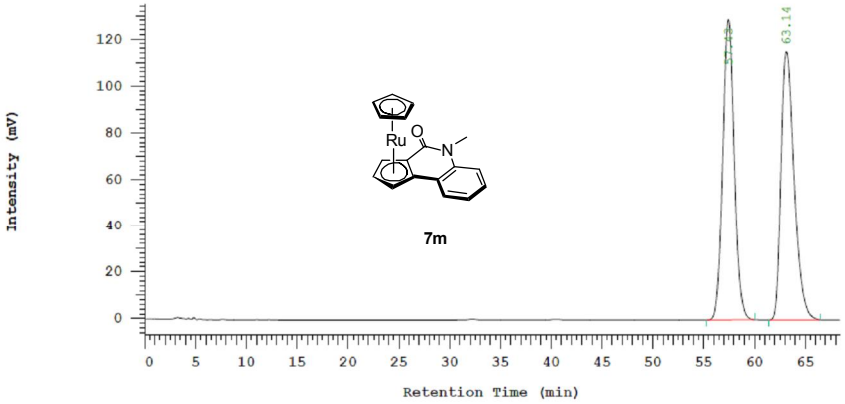
Application(data): maxinna Vial Number: 1

Sample Name: mxn-2-165 Vial Type: UNK

Injection from this vial: 1 of 1 Volume: 10.0 ul

Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol

Column Type: Column Method Developer:

Method Description:

Chrom Type: HPLC Channel : 1

Peak Quantitation: AREA

Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	57.43	10158084	50.001	BB
2	63.14	10157879	49.999	BB
		20315963	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000: maxinna Series: 0122 Report Name: modified System: LCE

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-05-07 20:08 Reported Date and Time: 2014-06-02 21:53

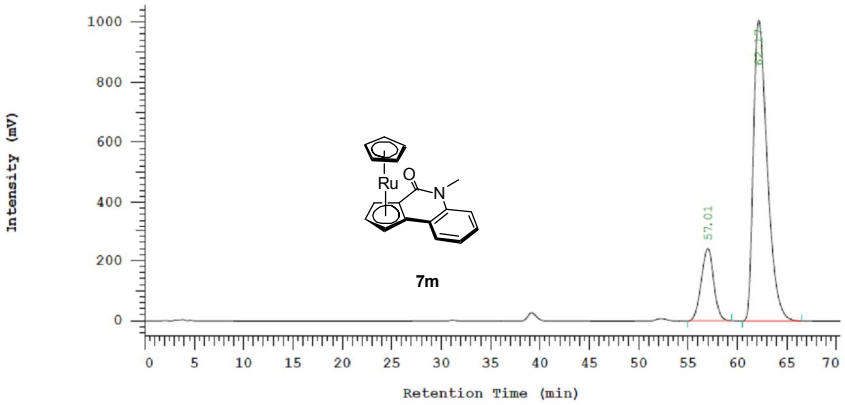
Processed Date and Time: 2014-06-02 21:52

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0122\

Processing Method: isopropanol

System (acquisition): LCE Series: 0122
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-165 Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	57.01	20874481	17.654	BB
2	62.17	97364953	82.346	BB
		1.182E+08	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-05-21 11:04 Reported Date and Time: 2014-06-02 21:26

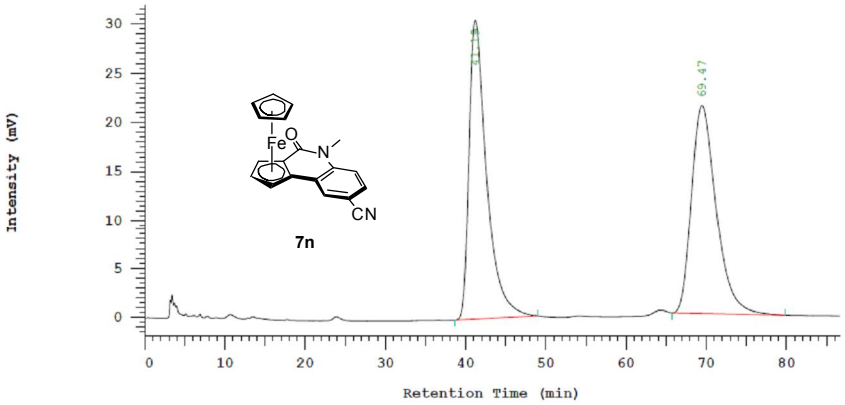
Processed Date and Time: 2014-06-02 21:25

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0135\

Processing Method: isopropanol

System (acquisition): LCE Series: 0135
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-133 Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	41.19	4619472	50.509	BB
2	69.47	4526402	49.491	BB
		9145874	100.000	

Peak rejection level: 0

Page Indicator: 1 / 5

D-2000: maxinna Series: 0136 Report Name: modified System: LCE

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-05-21 12:32 Reported Date and Time: 2014-06-02 21:24

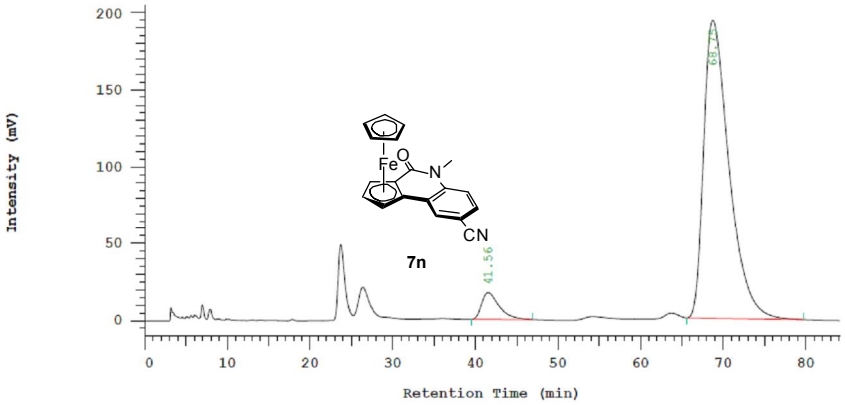
Processed Date and Time: 2014-06-02 21:24

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0136\

Processing Method: isopropanol

System (acquisition): LCE Series: 0136
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-133 Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	41.56	2526523	5.785	BB
2	68.75	41146339	94.215	BB
		43672862	100.000	

Peak rejection level: 0

Page Indicator: 1 / 5

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-03-26 11:55 Reported Date and Time: 2014-06-02 21:22

Processed Date and Time: 2014-06-02 21:21

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0050\

Processing Method: isopropanol

System (acquisition): LCE Series: 0050

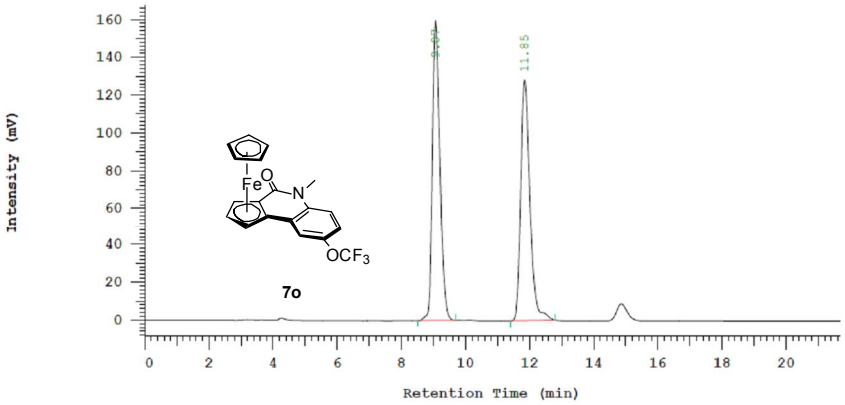
Application(data): maxinna Vial Number: 1

Sample Name: mxn-2-131 Vial Type: UNK

Injection from this vial: 1 of 1 Volume: 10.0 ul

Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol

Column Type: Column Method Developer:

Method Description:

Chrom Type: HPLC Channel : 1

Peak Quantitation: AREA

Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	9.07	2595461	50.108	BB
2	11.85	2584226	49.892	BB
		5179687	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014-03-26 12:22 Reported Date and Time: 2014-06-02 21:20

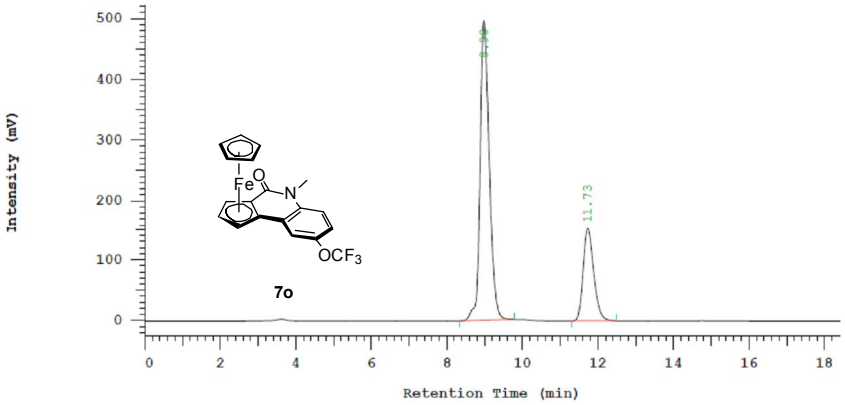
Processed Date and Time: 2014-06-02 21:19

Data Path: C:\WIN32APP\D2000HSM\maxinna\DATA\0051\

Processing Method: isopropanol

System (acquisition): LCE Series: 0051
Application(data): maxinna Vial Number: 1
Sample Name: mxn-2-131 Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 10.0 ul
Sample Description: xleiliu04-113-OJ-12

Chrom Type: HPLC Channel : 1



Processing Method: isopropanol
Column Type: Column Method Developer:
Method Description:

Chrom Type: HPLC Channel : 1
Peak Quantitation: AREA
Calculation Method: AREA%

No.	RT	Area	Conc 1	BC
1	8.98	8323963	73.771	BB
2	11.73	2959532	26.229	BB
		11283495	100.000	

Peak rejection level: 0

Page Indicator: 1 / 4