

Supporting Information for

HOTf-Catalyzed Intermolecular Hydroamination of Alkenes and Alkynes with Anilines

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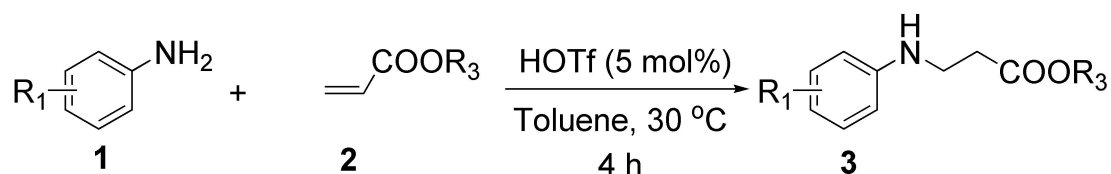
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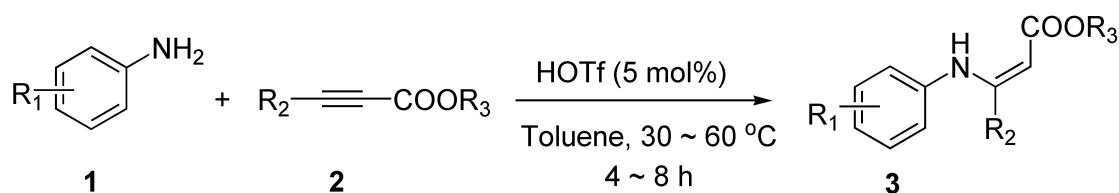
General Methods:

^1H and ^{13}C NMR spectra were recorded in CDCl_3 solutions on a Bruker AVANCE 400 MHz or 500 MHz spectrometer. High resolution mass spectra were obtained on a waters Micromass G C T machine. All the other reagents and solvents were used as from commercial sources. Unless noted below, all the other compounds have been reported in the literature or are commercially available.

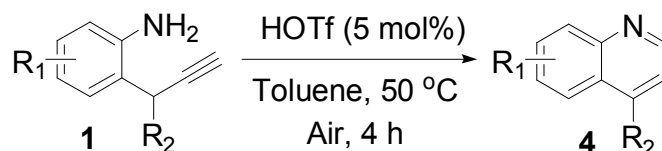
General catalytic procedure:



Aniline (0.093g, 1 mmol) was added to the round bottom flask, charged with HOTf (0.05 mmol) and 1.0 mmol alkene. The mixture was stirred at 30 °C for 4 hours, then cooled down to room temperature, diluted with 10 ml dichloromethane and washed with 10 ml H₂O. The aqueous layer was extracted twice with dichloromethane (10 ml) and the combined organic phase was dried over anhydrous Na₂SO₄. After evaporation of the solvents, the residue was purified by silica gel chromatography (dichloromethane/pet. ether).



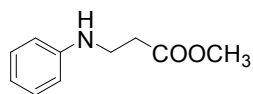
Aniline (0.093g, 1 mmol) was added to the round bottom flask, charged with HOTf (0.05 mmol) and 2.0 mmol alkene. The mixture was stirred at 30~60 °C for 4 hours, then cooled down to room temperature, diluted with 10 ml dichloromethane and washed with 10 ml H₂O. The aqueous layer was extracted twice with dichloromethane (10 ml) and the combined organic phase was dried over anhydrous Na₂SO₄. After evaporation of the solvents, the residue was purified by silica gel chromatography (dichloromethane/pet. ether).



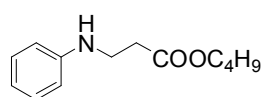
A test tube (25 mL) was charged with substrate **1** (1 mmol), HOTf (0.05 mmol) and 2.0 ml toluene. The mixture was stirred at 50 °C for 4 hours, then the reaction was cooled down to room temperature, the mixture was quenched by sat. aq. NaHCO₃,

and diluted with 10 ml dichloromethane and washed with 10 ml H₂O. The aqueous layer was extracted twice with dichloromethane (10 ml) and the combined organic phase was dried over Na₂SO₄. After evaporation of the solvents, the residue was purified by silica gel chromatography (hexane/AcOEt = 20:1).

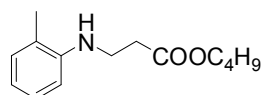
Characterization data for products



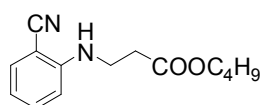
¹H NMR (400 MHz, CDCl₃) δ ppm: 7.16 - 7.20 (m, 2H), 6.70 - 6.74 (m, 1H), 6.61 - 6.63 (t, 2H), 4.01 (s, 1H), 3.70 (s, 3H), 3.44 - 3.47 (t, 2H), 2.61 - 2.64 (t, 2H); ¹³C NMR (100 MHz, CDCl₃) δ ppm: 172.9, 147.8, 129.3, 117.8, 113.1, 51.8, 39.4, 33.7; HRMS (EI) Calcd. for C₁₀H₁₃NO₂: [M⁺], 179.0946. Found: m/z 179.0942.



¹H NMR (400 MHz, CDCl₃) δ ppm: 7.16 - 7.20 (m, 2H), 6.70 - 6.73 (m, 1H), 6.61 - 6.63 (t, 2H), 4.08 - 4.11 (t, 2H), 4.02 (s, 1H), 3.42 - 3.46 (t, 2H), 2.59 - 2.62 (t, 2H), 1.57 - 1.63 (m, 2H), 1.34 - 1.40 (m, 2H), 0.91 - 0.95 (t, 3H); ¹³C NMR (100 MHz, CDCl₃) δ ppm: 172.5, 147.6, 129.3, 117.7, 113.1, 64.5, 39.5, 34.0, 30.6, 19.2, 13.7; HRMS (EI) Calcd. for C₁₃H₁₉NO₂: [M⁺], 221.1416. Found: m/z 221.1417.

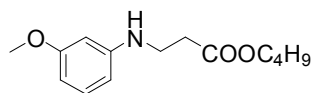


¹H NMR (400 MHz, CDCl₃) δ ppm: 7.10 - 7.23 (m, 1H), 7.04 - 7.06 (m, 1H), 6.61 - 6.68 (m, 2H), 4.08 - 4.12 (t, 2H), 3.96 (s, 1H), 3.47 - 3.50 (t, 2H), 2.63 - 2.66 (t, 2H), 2.12 (s, 3H), 1.59 - 1.63 (m, 2H), 1.34 - 1.40 (m, 2H), 0.91 - 0.94 (t, 3H); ¹³C NMR (100 MHz, CDCl₃) δ ppm: 172.6, 145.6, 130.3, 127.1, 122.5, 117.3, 109.7, 64.6, 39.5, 34.0, 30.7, 19.2, 17.4, 13.7; HRMS (EI) Calcd. for C₁₄H₂₁NO₂: [M⁺], 235.1572. Found: m/z 235.11577.

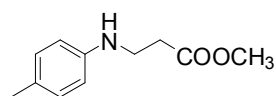


¹H NMR (400 MHz, CDCl₃) δ ppm: 7.38 - 7.41 (m, 2H), 6.67 - 6.71 (m, 2H), 4.89 (s,

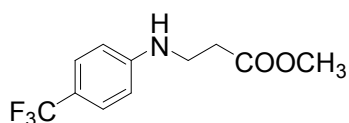
1H), 4.11 - 4.15 (t, 2H), 3.53 - 3.56 (t, 2H), 2.64 - 2.67 (t, 2H), 1.61 - 1.65 (m, 2H), 1.35 - 1.38 (m, 2H), 0.91 - 0.95 (t, 3H); ¹³C NMR (100 MHz, CDCl₃) δ ppm: 171.7, 150.0, 134.3, 123.0, 117.7, 116.9, 110.5, 96.3, 64.9, 38.9, 33.9, 30.6, 19.1, 13.7; HRMS (EI) Calcd. For C₁₄H₁₈N₂O₂: [M⁺], 246.1468. Found: m/z 246.1467.



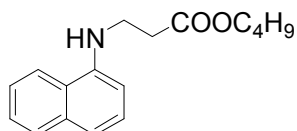
¹H NMR (400 MHz, CDCl₃) δ ppm: 7.05 - 7.09 (m, 1H), 6.26 - 6.29 (m, 1H), 6.17 - 6.24 (m, 1H), 6.16 (s, 1H), 4.07 - 4.10 (t, 2H), 3.75 (s, 3H), 3.40 - 3.43 (t, 2H), 2.58 - 2.61 (t, 2H), 1.58 - 1.62 (m, 2H), 1.36 - 1.39 (m, 2H), 0.91 - 0.94 (t, 3H); ¹³C NMR (100 MHz, CDCl₃) δ ppm: 172.5, 147.6, 129.3, 113.1, 117.7, 117.3, 109.7, 64.5, 39.5, 34.0, 30.6, 19.2, 13.7; HRMS (EI) Calcd. for C₁₄H₂₁NO₃: [M⁺], 251.1521. Found: m/z 251.1527.



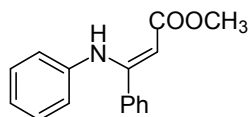
¹H NMR (400 MHz, CDCl₃) δ ppm: 7.00 (d, j = 8Hz, 2H), 6.55 (d, j = 8Hz, 2H), 3.69 (s, 3H), 3.41 - 3.44 (t, 2H), 2.59 - 2.62 (t, 2H), 2.23 (s, 3H); ¹³C NMR (100 MHz, CDCl₃) δ ppm: 172.9, 145.3, 129.8, 127.1, 113.3, 51.7, 39.8, 33.8, 20.4; HRMS (EI) Calcd. for C₁₁H₁₅NO₂: [M⁺], 193.1101. Found: m/z 193.1102.



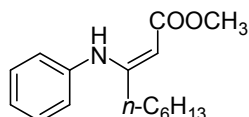
¹H NMR (400 MHz, CDCl₃) δ ppm: 7.39 (d, j = 8Hz, 2H), 6.59 (d, j = 8Hz, 2H), 4.38 (s, 1H), 3.69 (s, 3H), 3.45 - 3.48 (t, 2H), 2.60 - 2.63 (t, 2H); ¹³C NMR (100 MHz, CDCl₃) δ ppm: 172.6, 150.2, 126.7, 126.6, 120.0, 51.8, 38.8, 33.4; HRMS (EI) Calcd. for C₁₁H₁₂F₃NO₂: [M⁺], 247.0820. Found: m/z 247.0822.



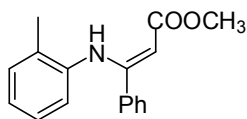
^1H NMR (400 MHz, CDCl_3) δ ppm: 7.59 - 7.67 (m, 3H), 7.32 - 7.59 (m, 1H), 7.17 - 7.20 (m, 1H), 6.80 - 6.85 (m, 2H), 4.08 - 4.11 (t, 2H), 3.50 - 3.53 (t, 2H), 2.63 - 2.66 (t, 2H), 1.57 - 1.61 (m, 2H), 1.32 - 1.36 (m, 2H), 0.89 - 0.93 (m, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ ppm: 172.6, 145.4, 135.2, 129.1, 127.7, 126.4, 126.0, 122.2, 118.2, 104.7, 64.7, 39.5, 33.8, 30.7, 19.2, 13.8; HRMS (EI) Calcd. for $\text{C}_{17}\text{H}_{21}\text{NO}_2$: $[\text{M}^+]$, 271.1572. Found: m/z 271.1573.



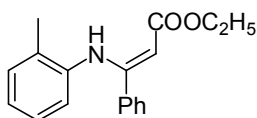
^1H NMR (500 MHz, CDCl_3) δ ppm: 10.28 (s, 1H), 7.26 - 7.35 (m, 5H), 7.06 - 7.09 (t, 2H), 6.90 - 6.93 (t, 1H), 6.66 - 6.67 (d, $J = 7.0$ Hz, 2H), 5.00 (s, 1H), 3.74 (s, 3H); ^{13}C NMR (500 MHz, CDCl_3) δ ppm: 170.5, 159.2, 140.4, 136.0, 129.5, 128.7, 128.5, 128.3, 123.2, 122.4, 90.8, 50.8; HRMS (EI) Calcd. for $\text{C}_{16}\text{H}_{15}\text{NO}_2$: $[\text{M}^+]$, 253.1103. Found: m/z 253.1104.



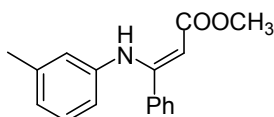
^1H NMR (500 MHz, CDCl_3) δ ppm: 10.30 (s, 1H), 7.31 - 7.34 (t, 2H), 7.16 - 7.19 (t, 1H), 7.08 - 7.10 (d, $J = 10.0$ Hz, 2H), 4.73 (s, 1H), 3.69 (s, 3H), 2.27 - 2.30 (t, 3H), 1.40 - 1.46 (m, 2H), 1.17 - 1.35 (m, 6H), 0.81 - 0.84 (t, 3H); ^{13}C NMR (500 MHz, CDCl_3) δ ppm: 171.0, 163.7, 139.3, 129.1, 125.2, 125.1, 84.6, 50.2, 32.2, 31.3, 28.8, 28.0, 22.4, 14.0; HRMS (EI) Calcd. for $\text{C}_{16}\text{H}_{23}\text{NO}_2$: $[\text{M}^+]$, 261.1729. Found: m/z 261.1724.



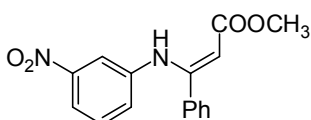
^1H NMR (500 MHz, CDCl_3) δ ppm: 10.13 (s, 1H), 7.25 - 7.32 (m, 5H), 7.12 - 7.14 (d, $J = 7.5$, 1H), 6.84 - 6.87 (t, 1H), 6.77 - 6.80 (t, 1H), 6.32 - 6.34 (d, $J = 8.0$ Hz, 1H), 5.03 (s, 1H), 3.75 (s, 3H), 2.42 (s, 3H); ^{13}C NMR (500 MHz, CDCl_3) δ ppm: 170.7, 160.0, 139.0, 136.2, 130.5, 130.3, 129.5, 128.4, 128.2, 125.9, 124.0, 123.7, 90.5, 50.7, 18.2; HRMS (EI) Calcd. for $\text{C}_{17}\text{H}_{17}\text{NO}_2$: $[\text{M}^+]$, 267.1259. Found: m/z 267.1263.



^1H NMR (500 MHz, CDCl_3) δ ppm: 10.14 (s, 1H), 7.25 - 7.32 (m, 5H), 7.12 - 7.14 (d, $J = 7.5$ Hz, 1H), 6.84 - 6.87 (t, 1H), 6.76 - 6.79 (t, 1H), 6.32 - 6.33 (d, $J = 8.0$ Hz, 1H), 5.03 (s, 1H), 4.19 - 4.23 (q, 3H), 2.42 (s, 3H), 1.30 - 1.33 (t, 2H); ^{13}C NMR (500 MHz, CDCl_3) δ ppm: 170.3, 159.9, 139.1, 136.3, 130.5, 129.4, 128.4, 128.1, 125.9, 123.9, 123.6, 110.0, 91.0, 59.3, 18.2, 14.6; HRMS (EI) Calcd. for $\text{C}_{18}\text{H}_{19}\text{NO}_2$: $[\text{M}^+]$, 281.1416. Found: m/z 281.1419.

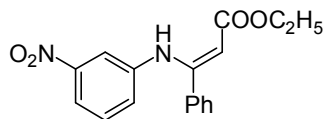


^1H NMR (500 MHz, CDCl_3) δ ppm: 10.24 (s, 1H), 7.27 - 7.35 (m, 5H), 6.91 - 6.94 (t, 1H), 6.71 - 6.73 (d, $J = 7.5$ Hz, 1H), 6.54 (s, 1H), 6.38 - 6.39 (d, $J = 7.0$ Hz, 1H), 4.98 (s, 1H), 3.74 (s, 3H), 2.16 (s, 3H); ^{13}C NMR (500 MHz, CDCl_3) δ ppm: 170.7, 160.0, 139.0, 136.2, 130.5, 130.3, 129.5, 128.4, 128.2, 125.9, 124.0, 123.7, 90.5, 50.7, 15.2; HRMS (EI) Calcd. for $\text{C}_{17}\text{H}_{17}\text{NO}_2$: $[\text{M}^+]$, 267.1259. Found: m/z 267.1262.

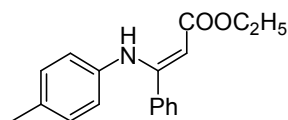


^1H NMR (500 MHz, CDCl_3) δ ppm: 10.43 (s, 1H), 7.75 - 7.77 (q, 1H), 7.49 - 7.50 (t, 1H), 7.37 - 7.41 (m, 4H), 7.19 - 7.26 (m, 2H), 6.94 - 6.90 (q, 1H), 5.18 (s, 1H), 3.79 (s, 3H); ^{13}C NMR (500 MHz, CDCl_3) δ ppm: 170.2, 157.8, 141.8, 134.9, 130.2, 129.3,

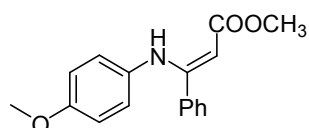
128.9, 128.0, 127.1, 117.2, 116.0, 100.0, 93.6, 51.0; HRMS (EI) Calcd. for $C_{16}H_{14}N_2O_4$: $[M^+]$, 298.0954. Found: m/z 298.0953.



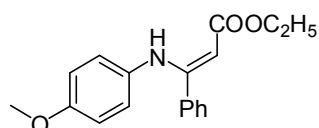
1H NMR (500 MHz, $CDCl_3$) δ ppm: 10.44 (s, 1H), 7.72 - 7.74 (t, 1H), 7.46 - 7.47 (t, 1H), 7.32 - 7.40 (m, 5H), 7.20 - 7.23 (t, 1H), 6.91 - 6.93 (q, 1H), 5.15 (s, 1H), 4.21 - 4.25 (q, 2H), 1.32 - 1.34 (t, 3H); ^{13}C NMR (500 MHz, $CDCl_3$) δ ppm: 169.8, 157.6, 148.5, 141.9, 135.0, 130.1, 129.3, 128.9, 128.0, 127.0, 117.1, 115.9, 94.2, 59.7, 14.4; HRMS (EI) Calcd. for $C_{17}H_{16}N_2O_4$: $[M^+]$, 312.1110. Found: m/z 312.1111.



1H NMR (500 MHz, $CDCl_3$) δ ppm: 10.25 (s, 1H), 7.26 - 7.34 (m, 5H), 6.87 - 6.88 (d, $J = 8.0$ Hz, 2H), 6.55 - 6.57 (d, $J = 8.0$ Hz, 2H), 4.95 (s, 1H), 4.18 - 4.22 (q, 2H), 2.20 (s, 3H), 1.30 - 1.33 (t, 3H); ^{13}C NMR (500 MHz, $CDCl_3$) δ ppm: 170.2, 159.4, 137.8, 136.2, 132.6, 129.3, 129.2, 128.4, 128.3, 122.4, 90.4, 59.2, 20.7, 14.6; HRMS (EI) Calcd. for $C_{18}H_{19}NO_2$: $[M^+]$, 281.1416. Found: m/z 281.1411.

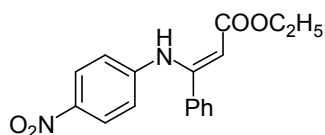


1H NMR (500 MHz, $CDCl_3$) δ ppm: 10.20 (s, 1H), 7.24 - 7.31 (m, 5H), 6.63 (t, 4H), 4.94 (s, 1H), 3.73 (s, 3H), 3.69 (s, 3H); ^{13}C NMR (500 MHz, $CDCl_3$) δ ppm: 170.6, 160.0, 155.9, 136.0, 133.4, 129.3, 128.4, 128.3, 124.3, 113.9, 89.2, 55.2, 50.5; HRMS (EI) Calcd. for $C_{17}H_{17}NO_3$: $[M^+]$, 283.1208. Found: m/z 283.1206.

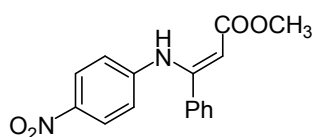


1H NMR (500 MHz, $CDCl_3$) δ ppm: 10.22 (s, 1H), 7.24 - 7.32 (m, 5H), 6.63 (t, 4H), 4.93 (s, 1H), 4.18 - 4.22 (q, 2H), 3.70 (s, 3H), 1.30 - 1.33 (t, 3H); ^{13}C NMR (500 MHz,

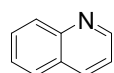
CDCl₃) δ ppm: 170.3, 159.9, 155.9, 136.1, 133.5, 129.2, 128.4, 128.3, 124.3, 113.9, 89.7, 59.1, 55.2, 14.6; HRMS (EI) Calcd. for C₁₈H₁₉NO₃: [M⁺], 297.1365. Found: m/z 297.1361.



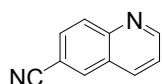
¹H NMR (500 MHz, CDCl₃) δ ppm: 10.44 (s, 1H), 7.72 - 7.74 (d, 1H), 7.34 - 7.46 (m, 1H), 7.20 - 7.26 (m, 6H), 6.91 - 6.93 (d, J = 9.0 Hz, 1H), 5.15 (s, 1H), 4.21 - 4.25 (q, 2H), 1.32-1.34 (t, 3H); ¹³C NMR (500 MHz, CDCl₃) δ ppm: 169.5, 156.5, 146.7, 141.9, 135.0, 130.3, 129.0, 127.8, 124.8, 119.7, 96.2, 59.9, 14.4; HRMS (EI) Calcd. for C₁₇H₁₆N₂O₄: [M⁺], 312.1110. Found: m/z 312.1109.



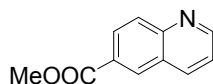
¹H NMR (500 MHz, CDCl₃) ppm: 10.52 (s, 1H), 7.97 - 7.99 (d, J = 7.5 Hz, 2H), 7.34 - 7.47 (m, 5H), 6.64 - 6.66 (d, J = 7.5 Hz, 1H), 5.23 (s, 1H), 3.80 (s, 3H); ¹³C NMR (500 MHz, CDCl₃) δ ppm: 169.9, 156.8, 146.6, 142.1, 135.0, 130.3, 129.1, 127.9, 124.8, 119.9, 95.6, 51.1; HRMS (EI) Calcd. for C₁₇H₁₆N₂O₄: [M⁺], 312.1110. Found: m/z 312.1109.



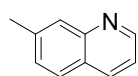
¹H NMR (400 MHz, CDCl₃) δ ppm: 8.93 (q, 1H), 8.16 (d, J = 8.3 Hz, 1H), 8.12 (d, J = 8.6 Hz, 1H), 7.82 (d, J = 8.1 Hz, 1H), 7.72 (m, 1H), 7.58 - 7.52 (m, 1H), 7.40 (q, 1H); ¹³C NMR (100 MHz, CDCl₃) δ ppm: 150.42, 148.28, 136.02, 129.46, 129.44, 128.26, 127.79, 126.52, 121.06; HRMS (EI) Calcd. for C₁₃H₉NO₂: [M⁺], 129.0578. Found: m/z 129.0579.



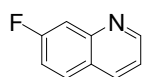
^1H NMR (400 MHz, CDCl_3) δ ppm: δ 9.05 (q, 1H), 8.24-8.21 (m, 2H), 8.19 (d, J = 8.8 Hz, 1H), 7.86 (q, 1H), 7.54 (q, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ ppm: 153.4, 149.3, 136.5, 134.2, 131.2, 130.3, 127.7, 122.9, 118.6, 110.5; HRMS (EI) Calcd. for $\text{C}_{10}\text{H}_6\text{N}_2$: $[\text{M}^+]$, 154.0531. Found: m/z 154.0529.



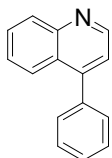
^1H NMR (400 MHz, CDCl_3) δ ppm: δ 8.98 (q, 1H), 8.57 (d, J = 1.8 Hz, 1H), 8.27 (q, 1H), 8.24 (d, J = 8.3 Hz, 1H), 8.12 (d, J = 8.8 Hz, 1H), 7.45 (q, 1H), 3.97 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ ppm: 170.2, 152.6, 148.3, 136.2, 133.4, 131.6, 130.4, 126.7, 121.6, 119.4, 51.3; HRMS (EI) Calcd. for $\text{C}_{11}\text{H}_9\text{NO}_2$: $[\text{M}^+]$, 187.0633. Found: m/z 187.00635.



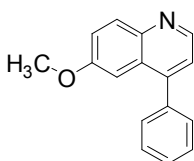
^1H NMR (400 MHz, CDCl_3) δ ppm: δ 8.82 (q, 1H), 8.00 (t, 2H), 7.57 - 7.45 (m, 2H), 7.30 (q, 1H), 2.49 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ ppm: 149.53, 146.90, 136.34, 135.32, 131.71, 129.11, 128.29, 126.58, 121.04, 21.57; HRMS (EI) Calcd. for $\text{C}_{10}\text{H}_9\text{N}$: $[\text{M}^+]$, 144.0808. Found: m/z 144.0809.



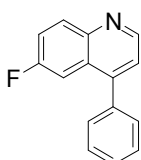
^1H NMR (400 MHz, CDCl_3) δ ppm: 8.89 (q, 1H), 8.13 (q, 1H), 7.79 (q, 1H), 7.71 (q, 1H), 7.37-7.29 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3) δ ppm: 162.9, 151.3, 149.1, 136.0, 129.8, 125.3, 120.4, 117.2, 113.0; HRMS (EI) Calcd. for $\text{C}_9\text{H}_6\text{NF}$: $[\text{M}^+]$, 147.00484. Found: m/z 147.0489.



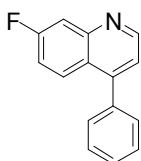
^1H NMR (400 MHz, CDCl_3) δ ppm: 8.78 (d, $J = 4.4$ Hz, 1H), 8.11 (d, $J = 8.5$ Hz, 1H), 8.00 (q, 1H), 7.71 (m, 1H), 7.57 (m, 1H), 7.23 (m, 1H), 2.71 (s, 3H); ^{13}C NMR (400 MHz, CDCl_3) δ ppm: 150.20, 147.99, 144.31, 130.03, 129.12, 128.29, 126.29, 123.82, 121.87, 18.69; HRMS (EI) Calcd. for $\text{C}_{10}\text{H}_9\text{N}$: $[\text{M}^+]$, 144.0808. Found: m/z 144.0812.



^1H NMR (400 MHz, CDCl_3) δ ppm: 8.06 - 8.14 (t, 4H), 7.83 (d, $J = 8.4$ Hz, 1H), 7.50 - 7.53 (t, 2H), 7.43 - 7.46 (m, 1H), 7.37 - 7.40 (m, 1H), 7.09 (d, $J = 2.8$ Hz, 1H), 3.94 (s, 3H); ^{13}C NMR (400 MHz, CDCl_3) δ ppm: 157.7, 155.1, 144.4, 139.8, 135.6, 131.2, 129.0, 128.8, 127.3, 122.4, 119.3, 114.1, 105.0, 55.6; HRMS (EI) Calcd. for $\text{C}_{26}\text{H}_{13}\text{NO}$: $[\text{M}^+]$, 235.0997. Found: m/z 235.0995.



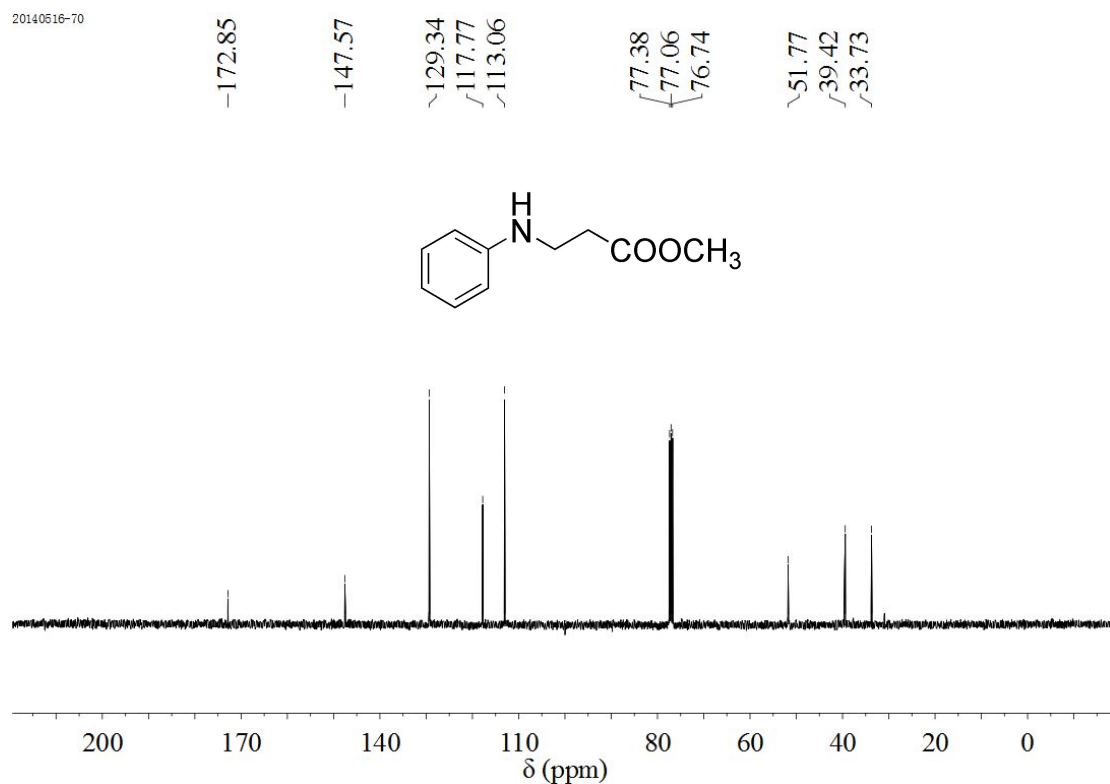
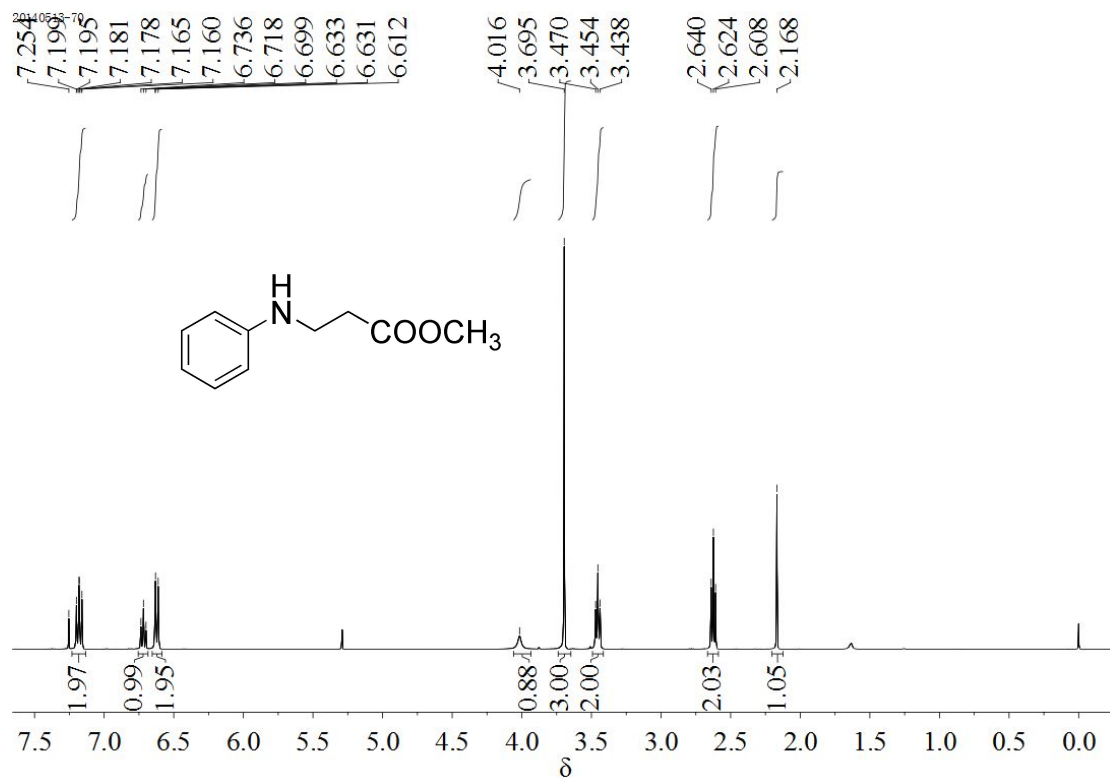
^1H NMR (400 MHz, CDCl_3) δ ppm: 8.13 - 8.18 (m, 4H), 7.87 (d, $J = 8.8$ Hz, 1H), 7.41 - 7.54 (m, 5H); ^{13}C NMR (400 MHz, CDCl_3) δ ppm: 161.6, 159.1, 156.7, 145.4, 139.4, 136.2, 132.2, 129.4, 128.9, 127.5, 120.0, 119.7, 110.4; HRMS (EI) Calcd. for $\text{C}_{15}\text{H}_{10}\text{NF}$: $[\text{M}^+]$, 223.0797. Found: m/z 223.0792.

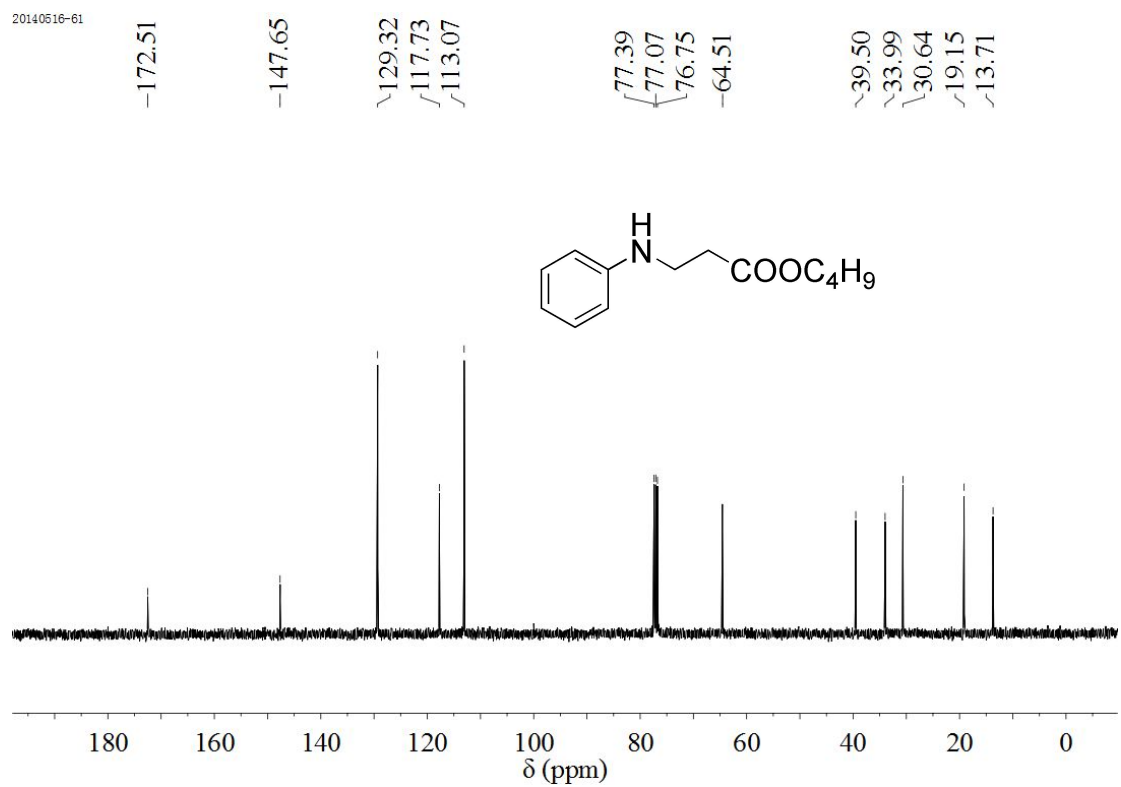
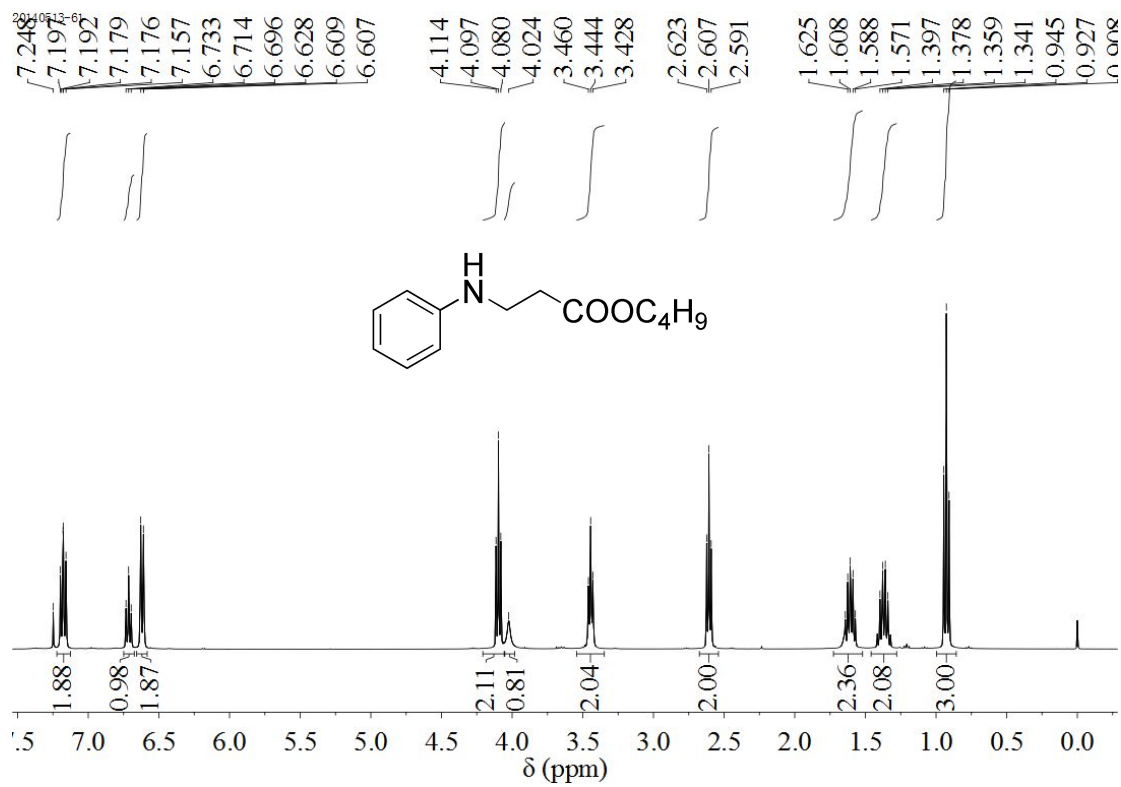


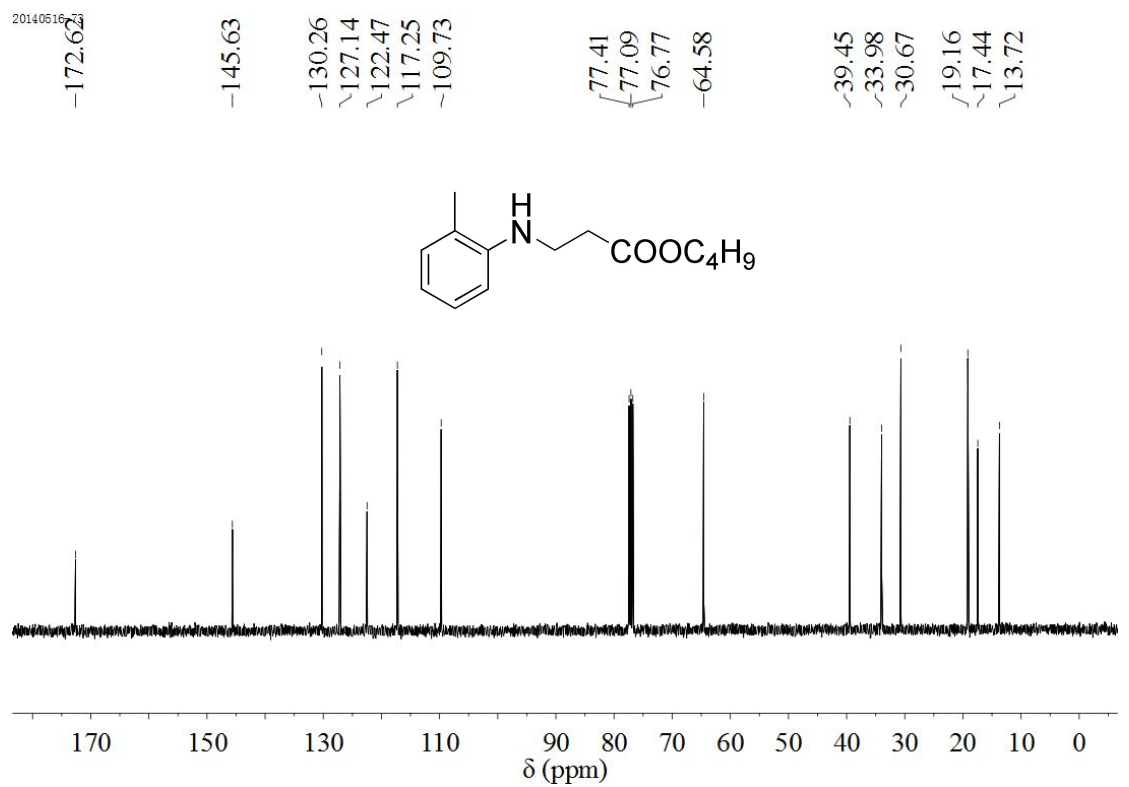
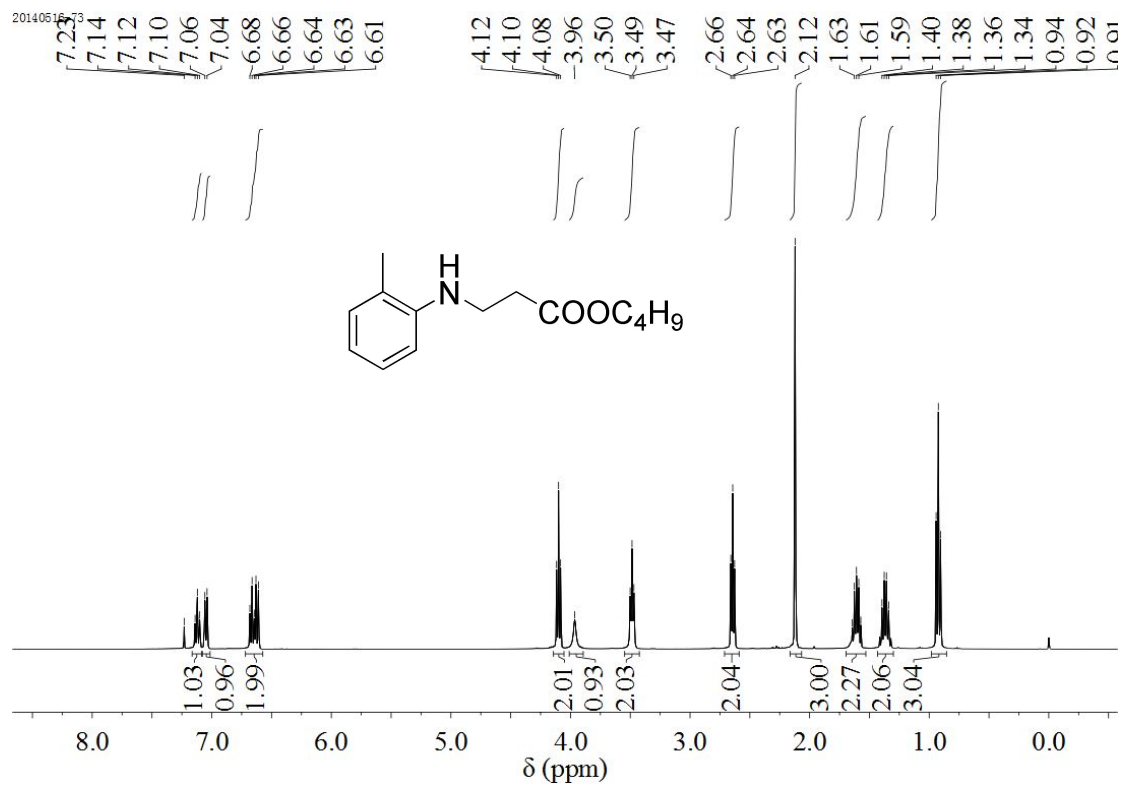
^1H NMR (400 MHz, CDCl_3) δ ppm: 8.13 - 8.18 (m, 3H), 7.77-7.83 (m, 3H), 7.47 -

7.54 (m, 3H), 7.24 - 7.32 (m, 1H); ^{13}C NMR (400 MHz, CDCl_3) δ ppm: 164.5, 162.1, 158.3, 149.2, 139.3, 136.7, 129.6, 129.5, 129.4, 128.9, 127.6, 124.2, 118.3, 116.9, 116.6, 113.4, 113.2; HRMS (EI) Calcd. for $\text{C}_{15}\text{H}_{10}\text{NF}$: $[\text{M}^+]$, 223.0797. Found: m/z 223.0794.

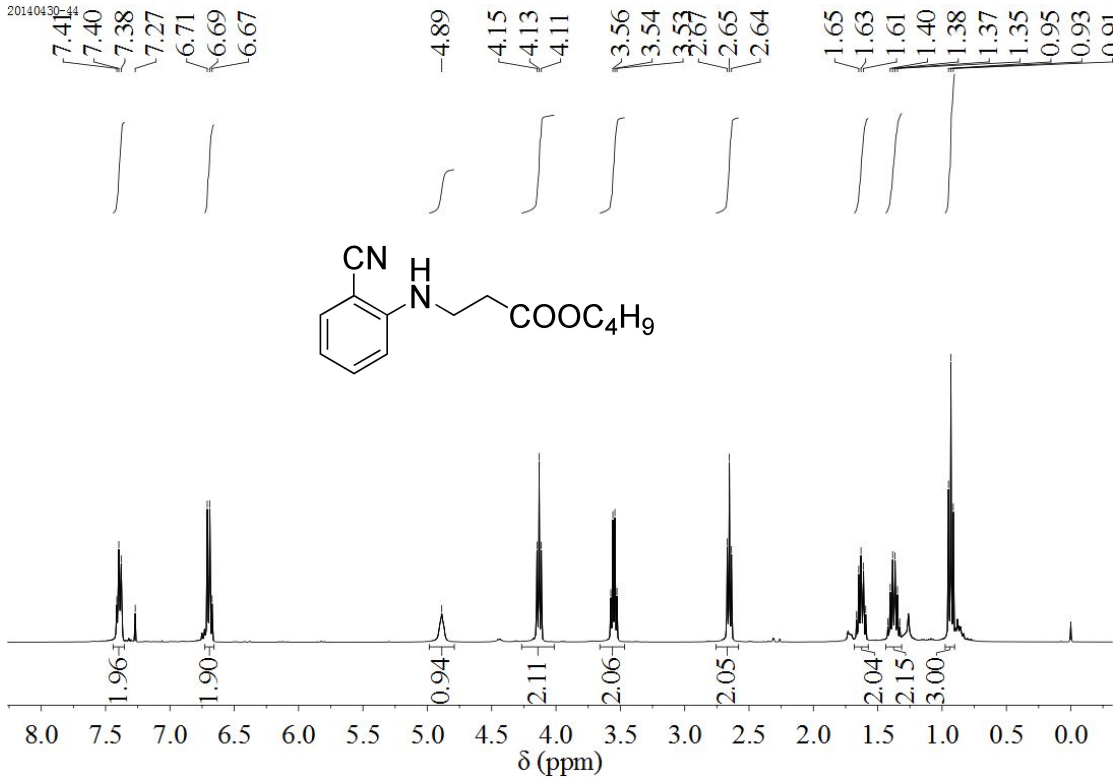
^1H and ^{13}C spectra of spectra



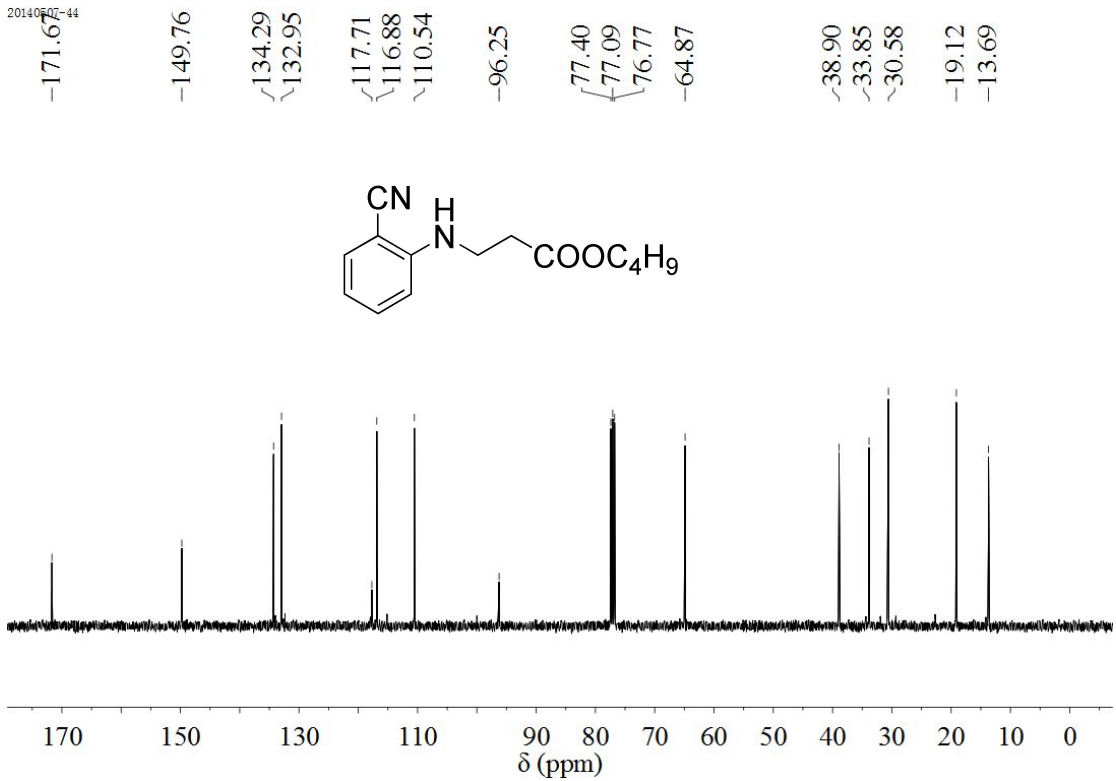




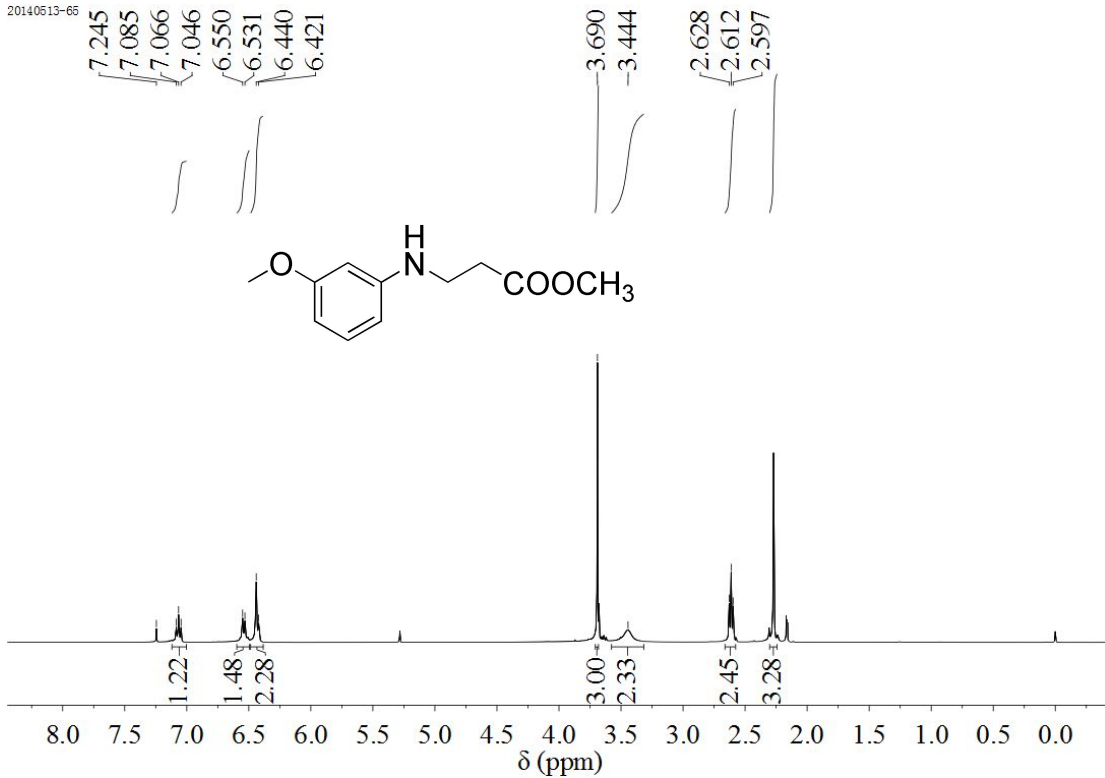
20140430-44



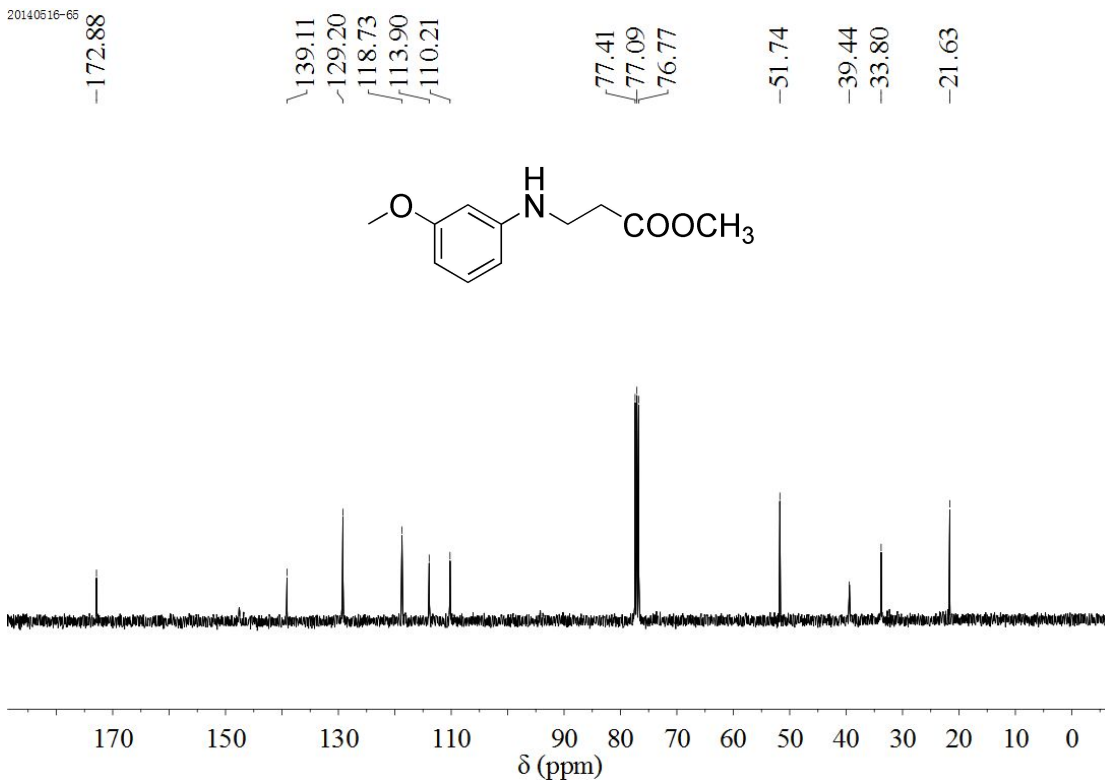
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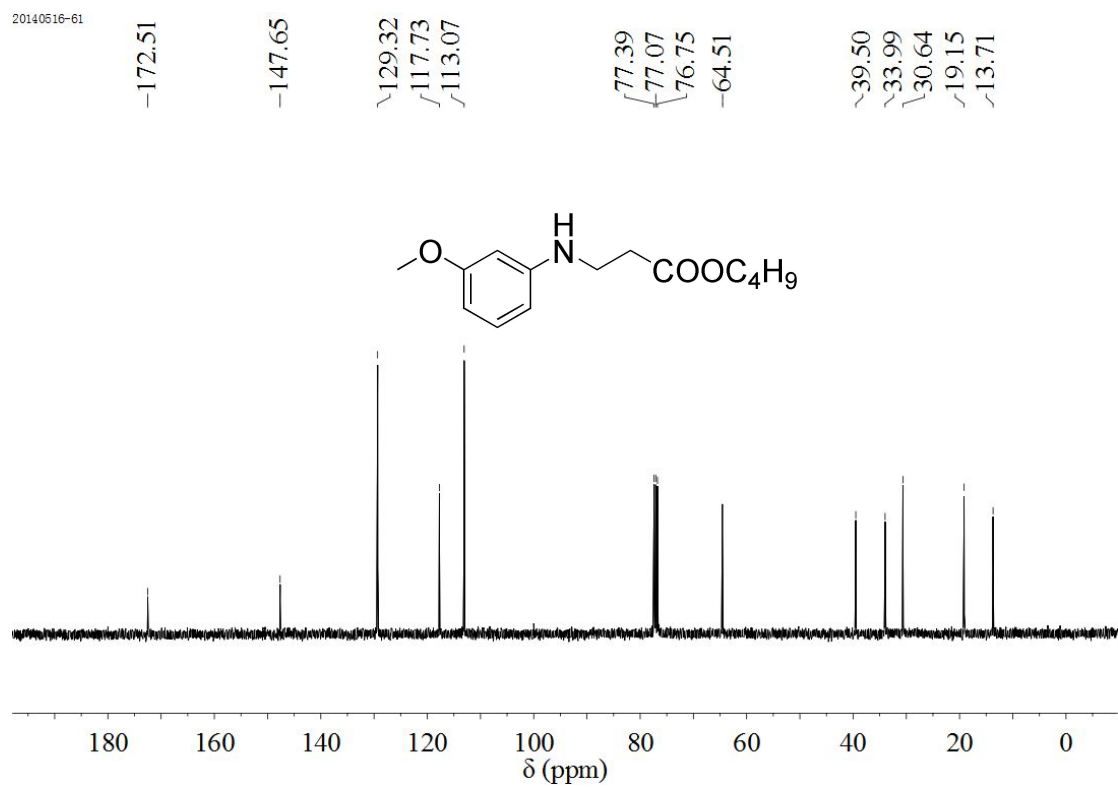
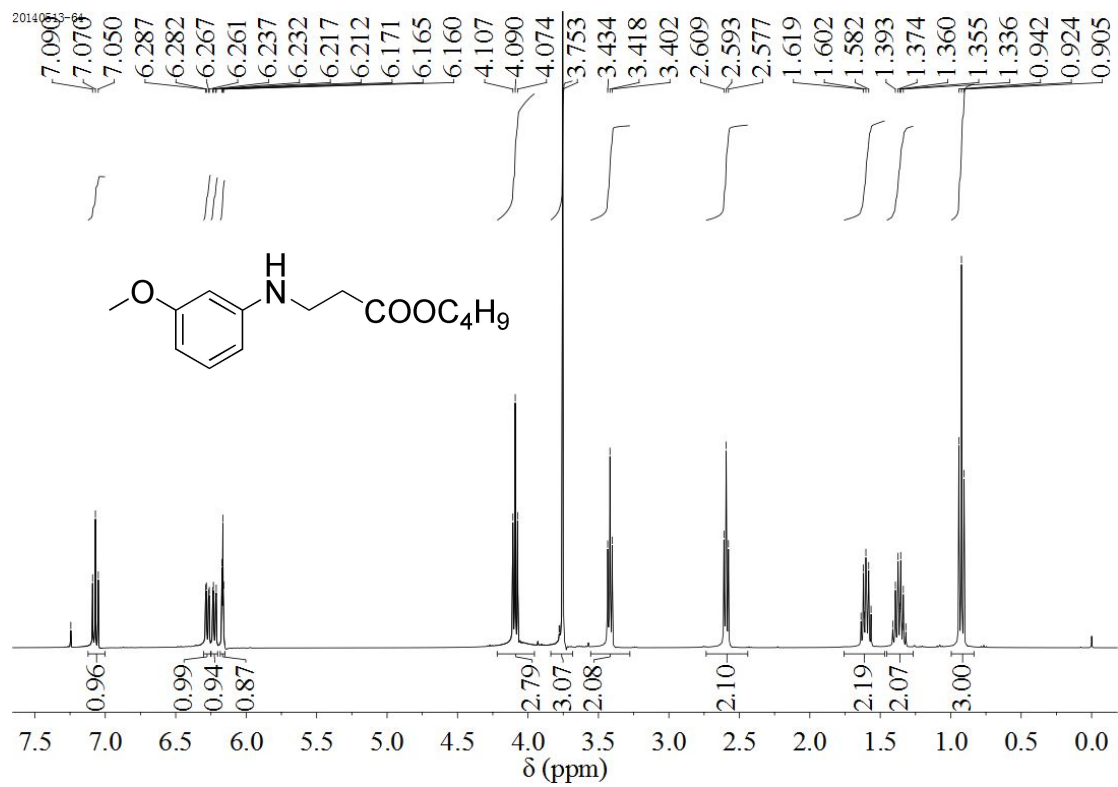


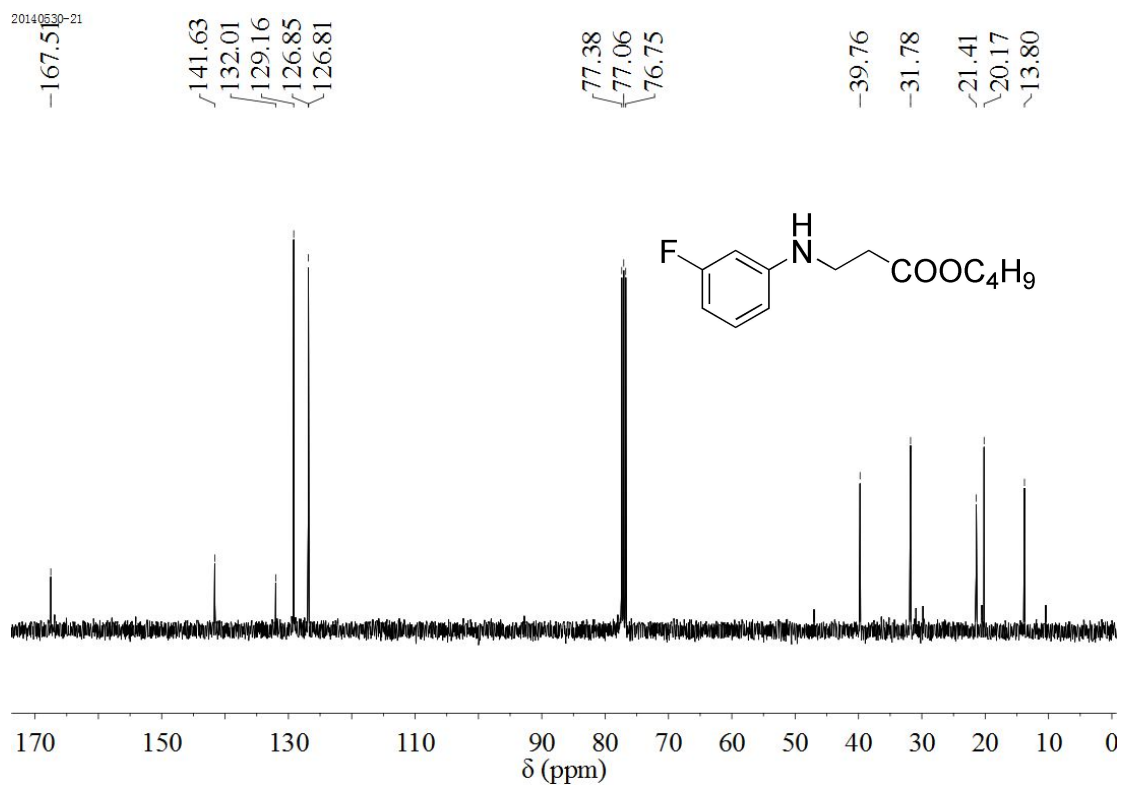
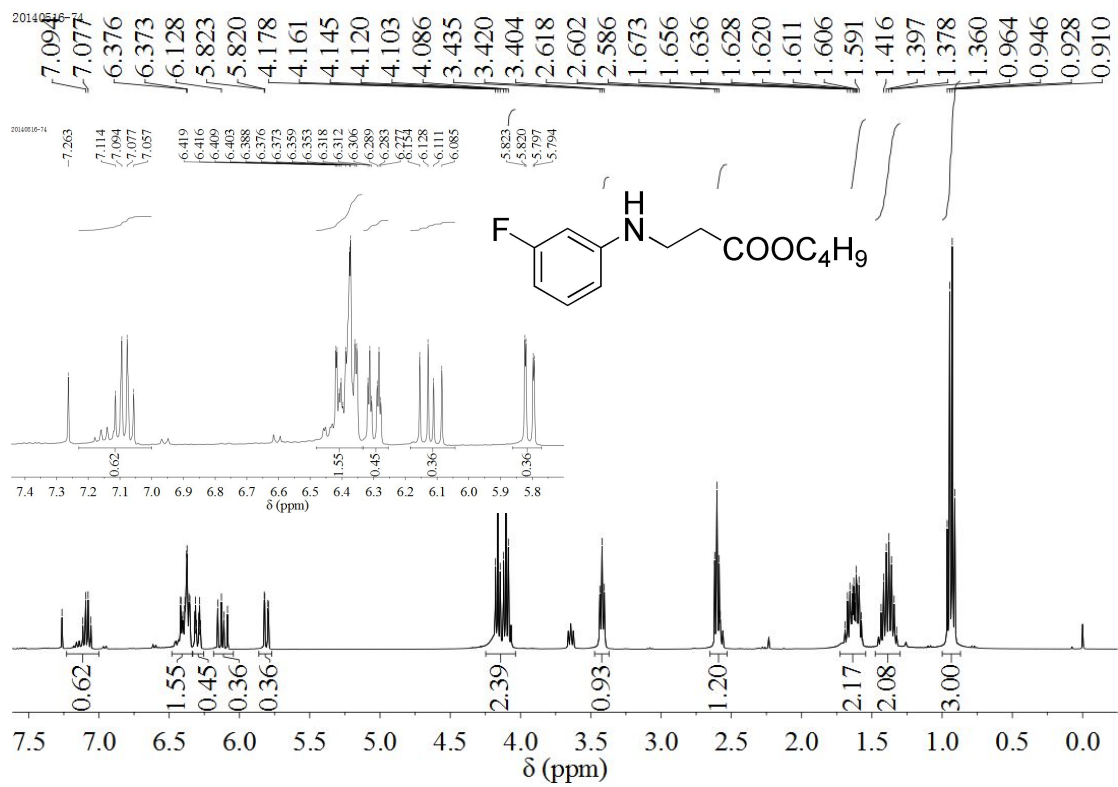
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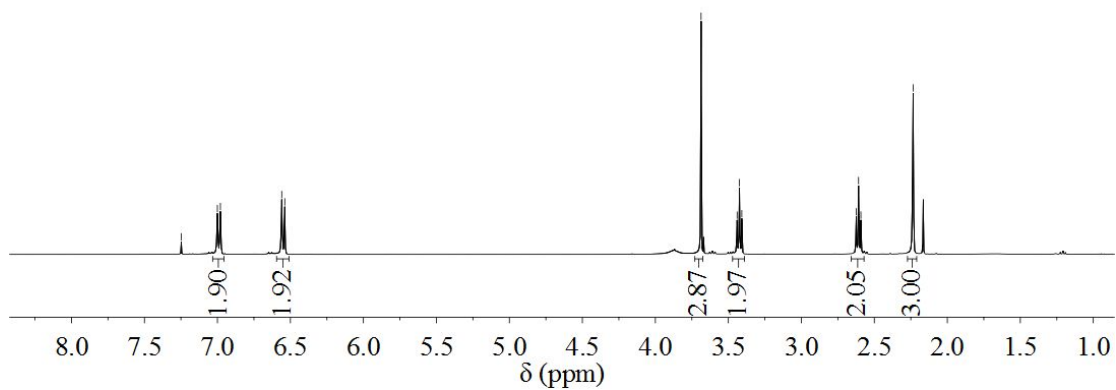
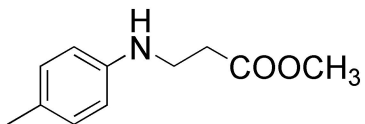
20140516-65



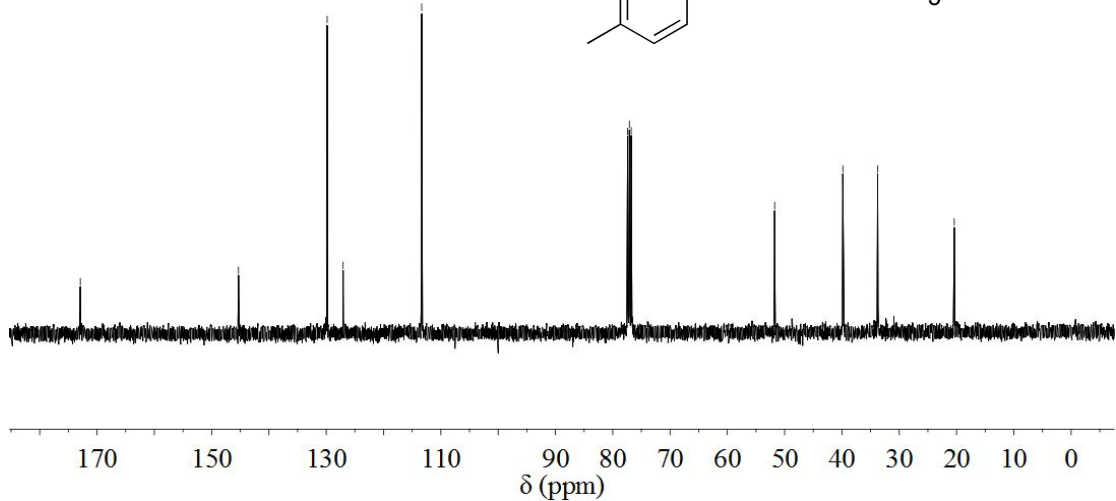
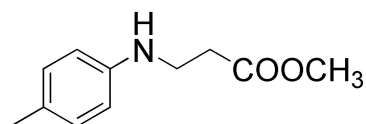


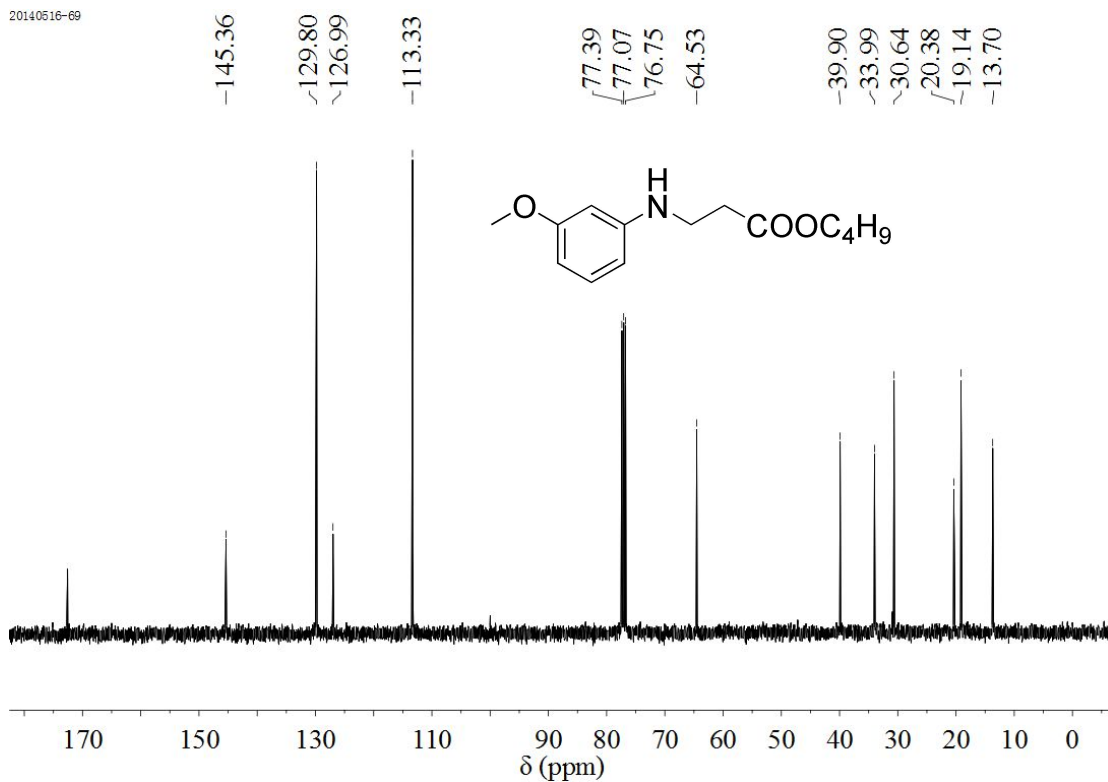
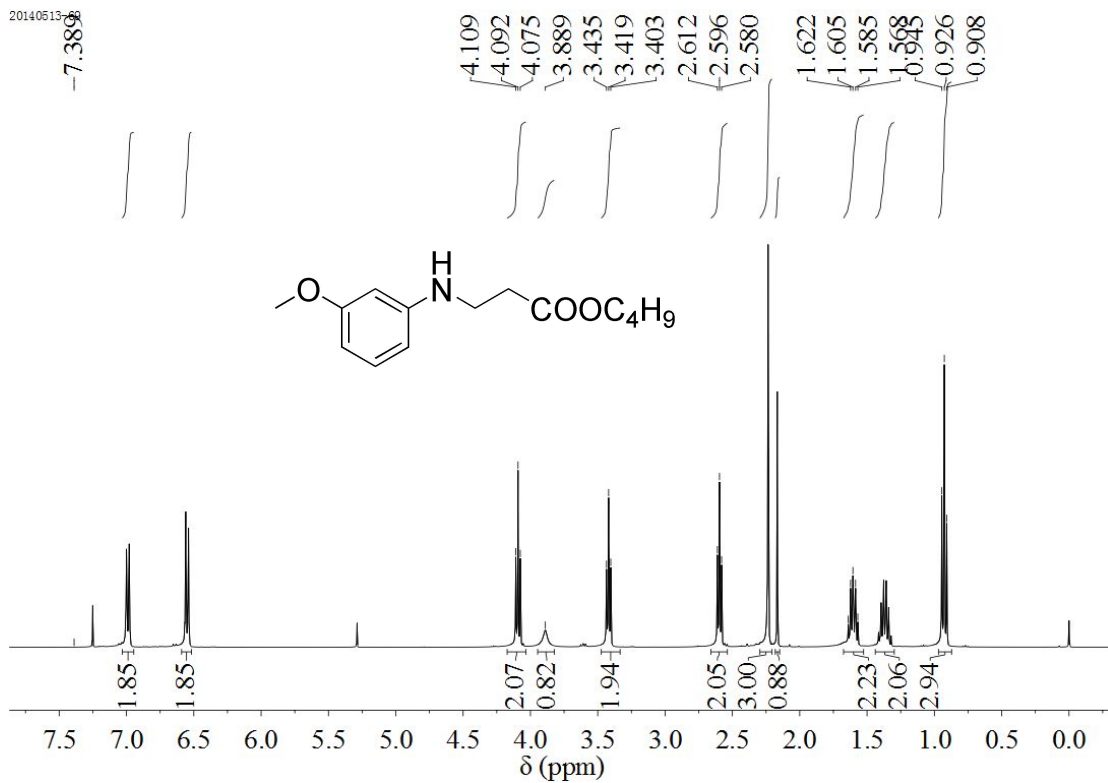


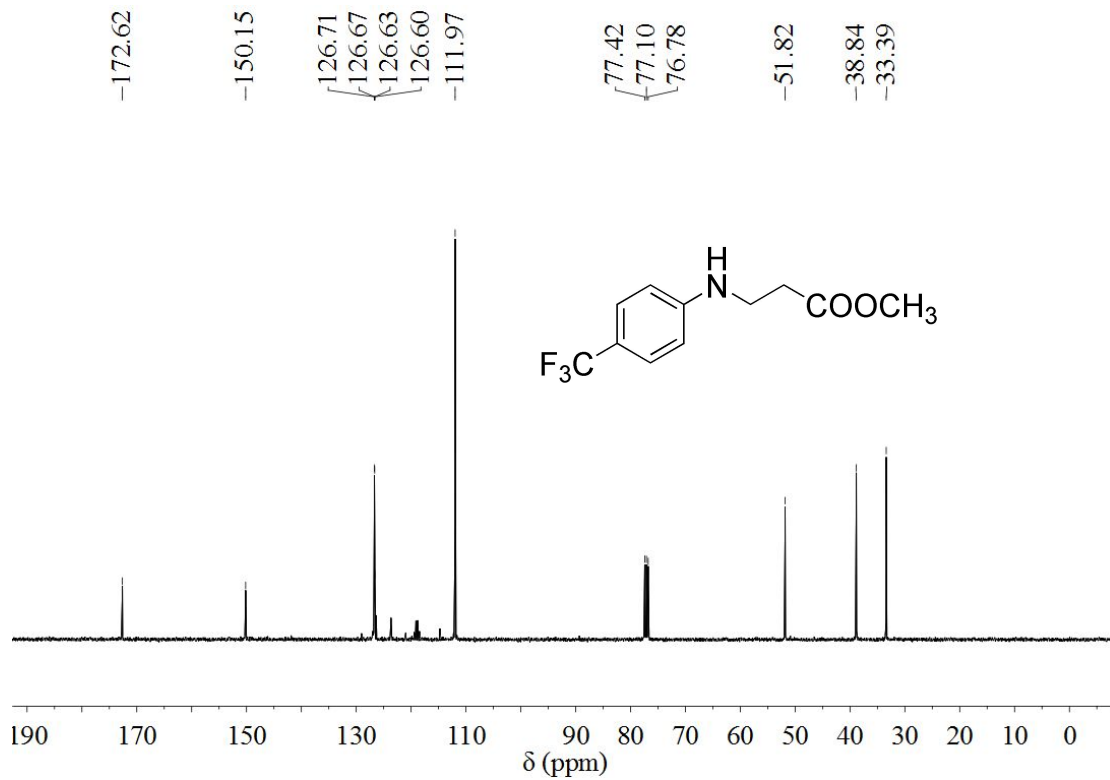
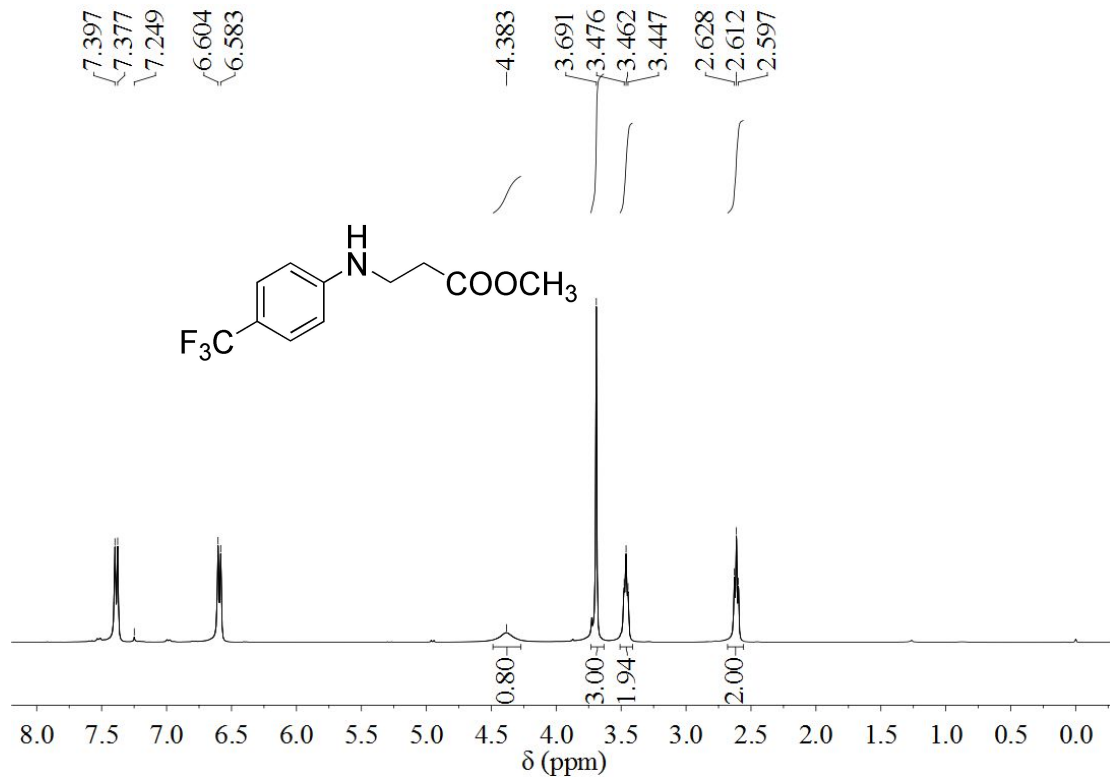
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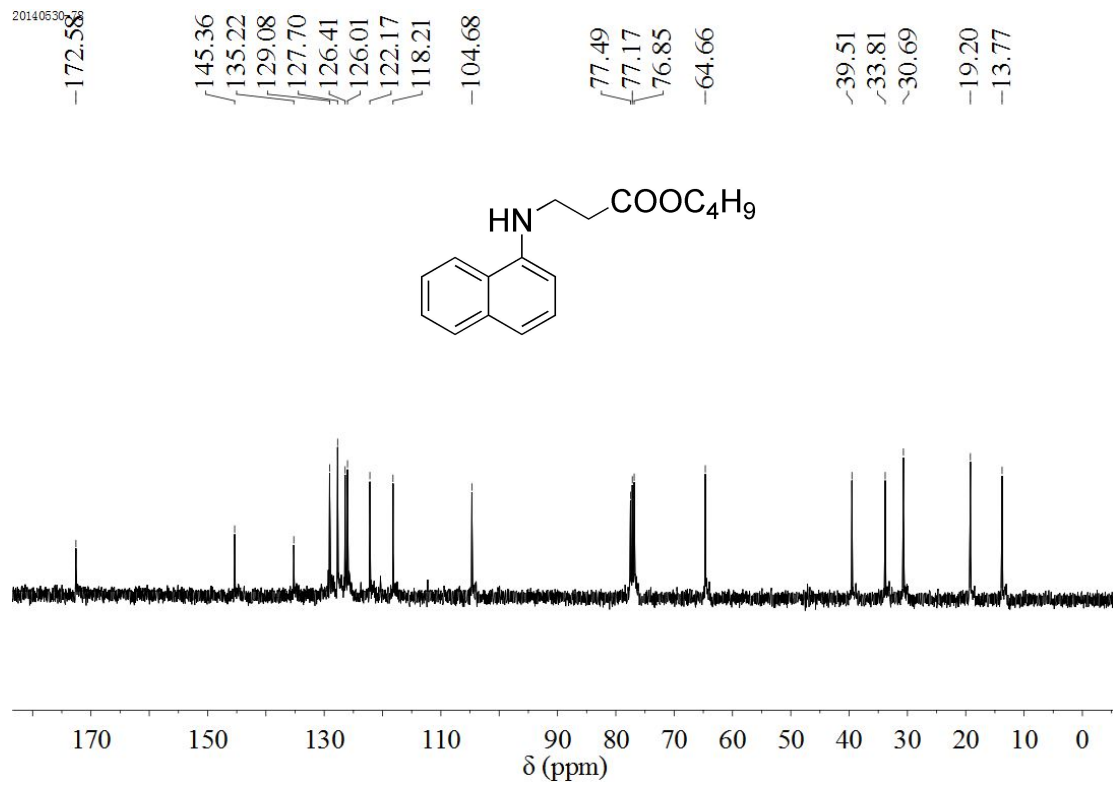
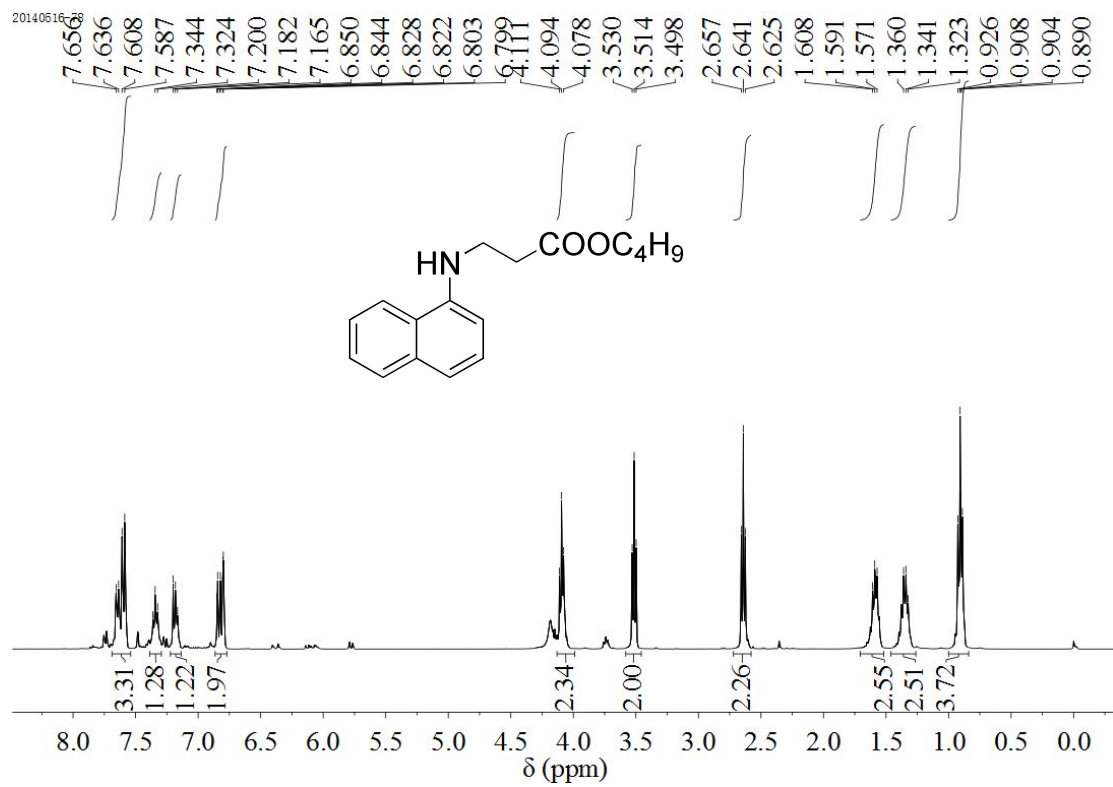


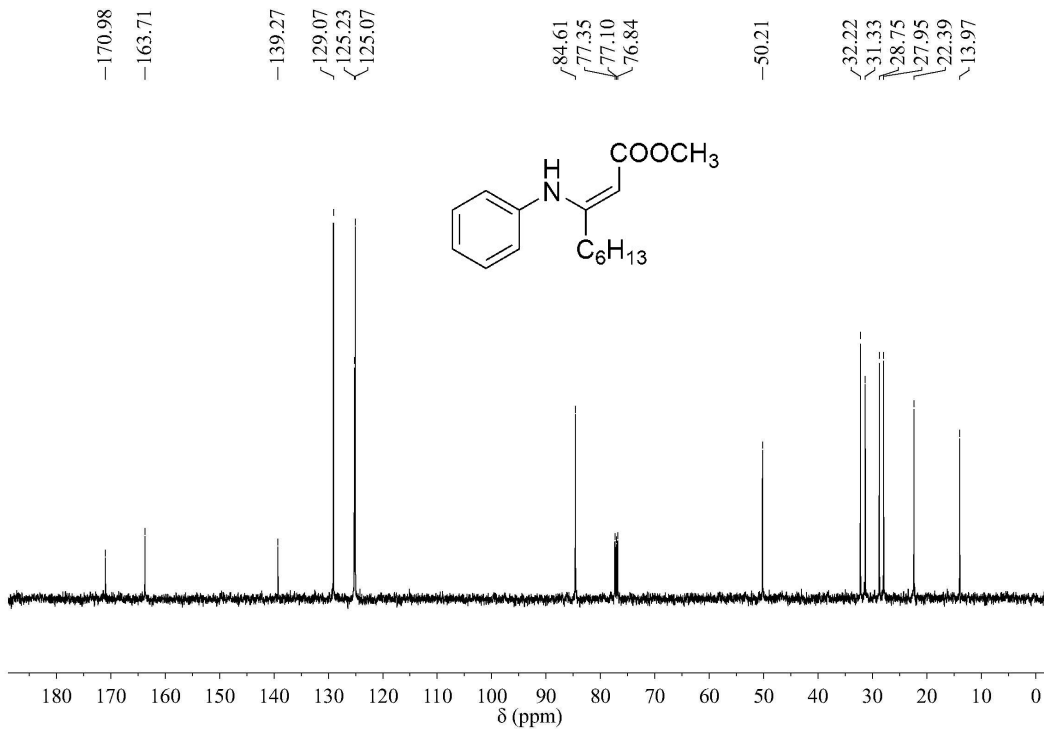
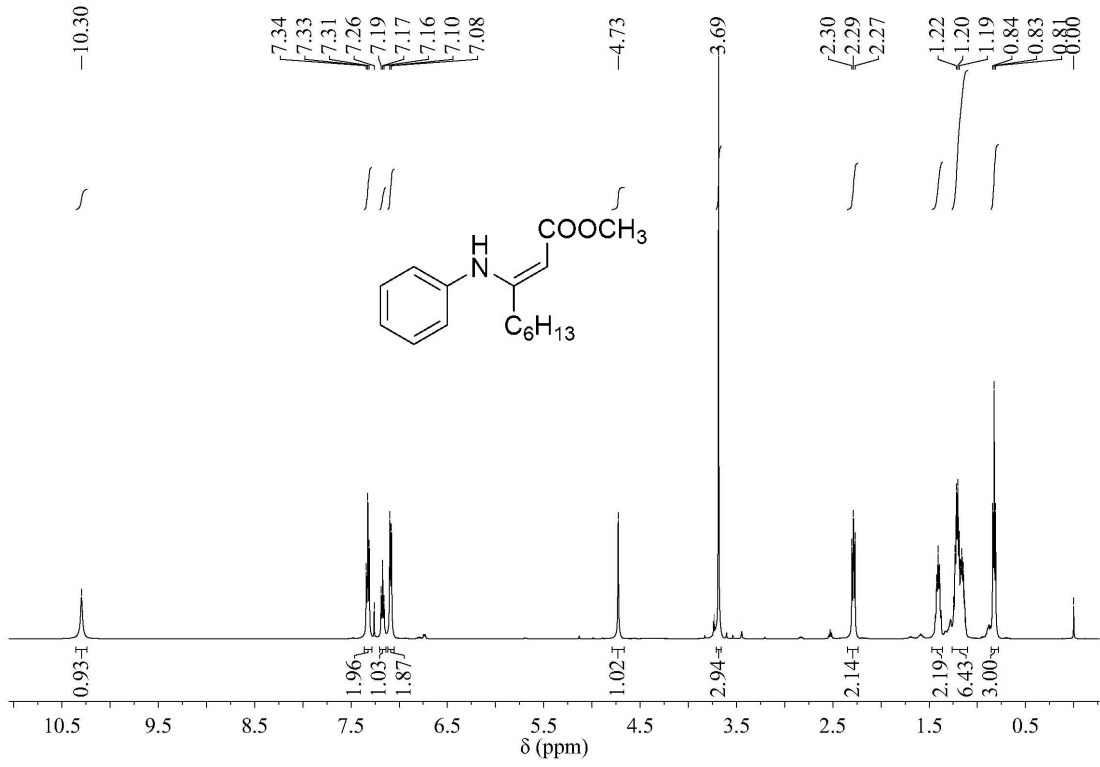
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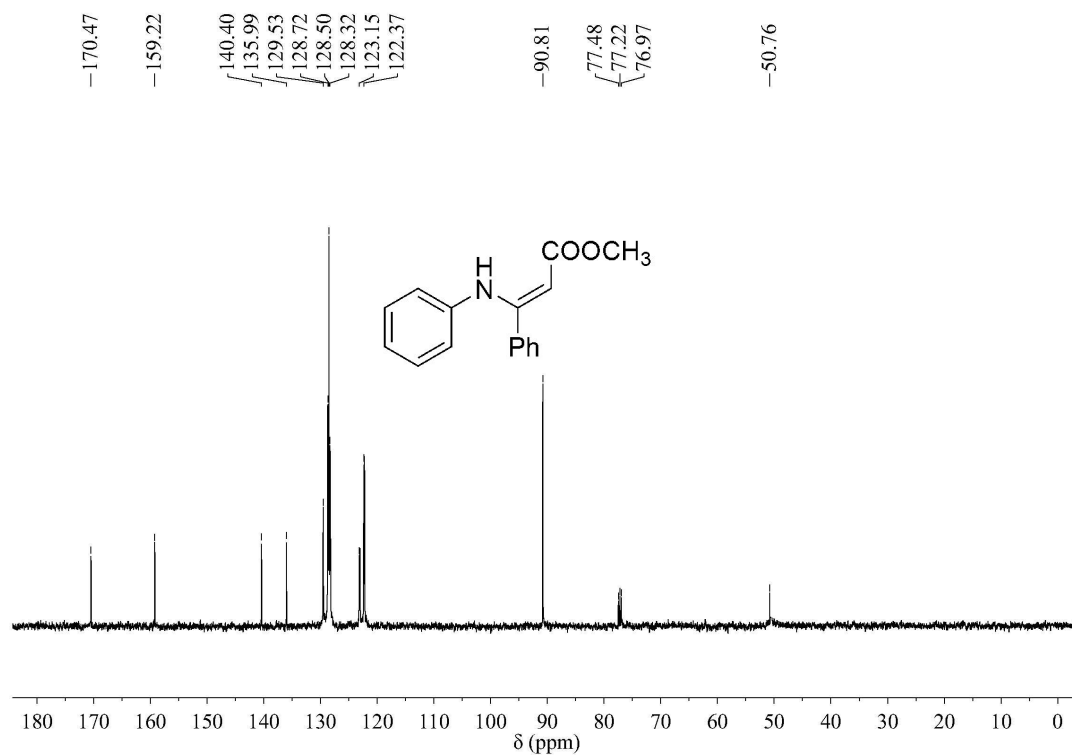
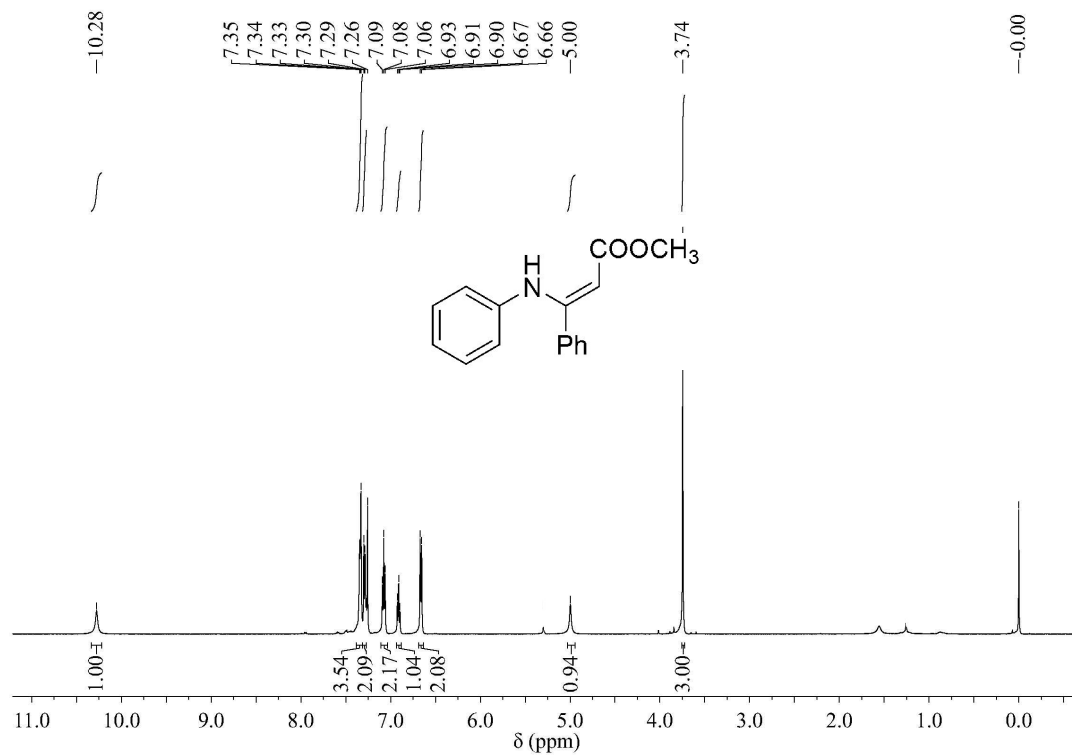


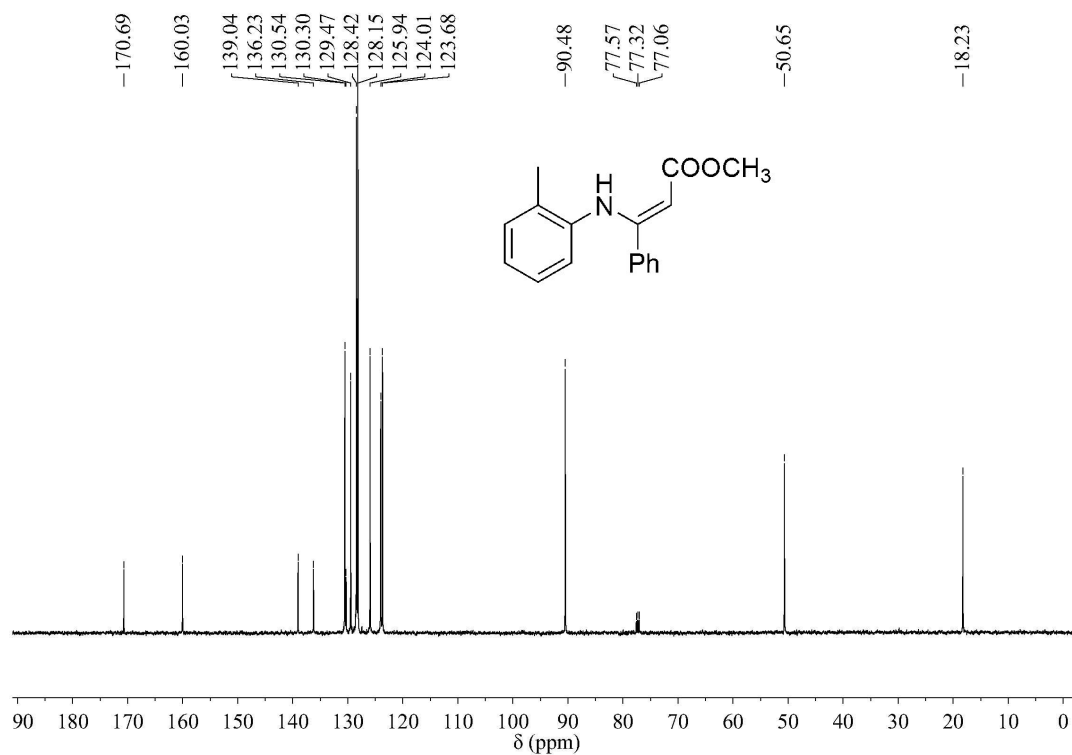
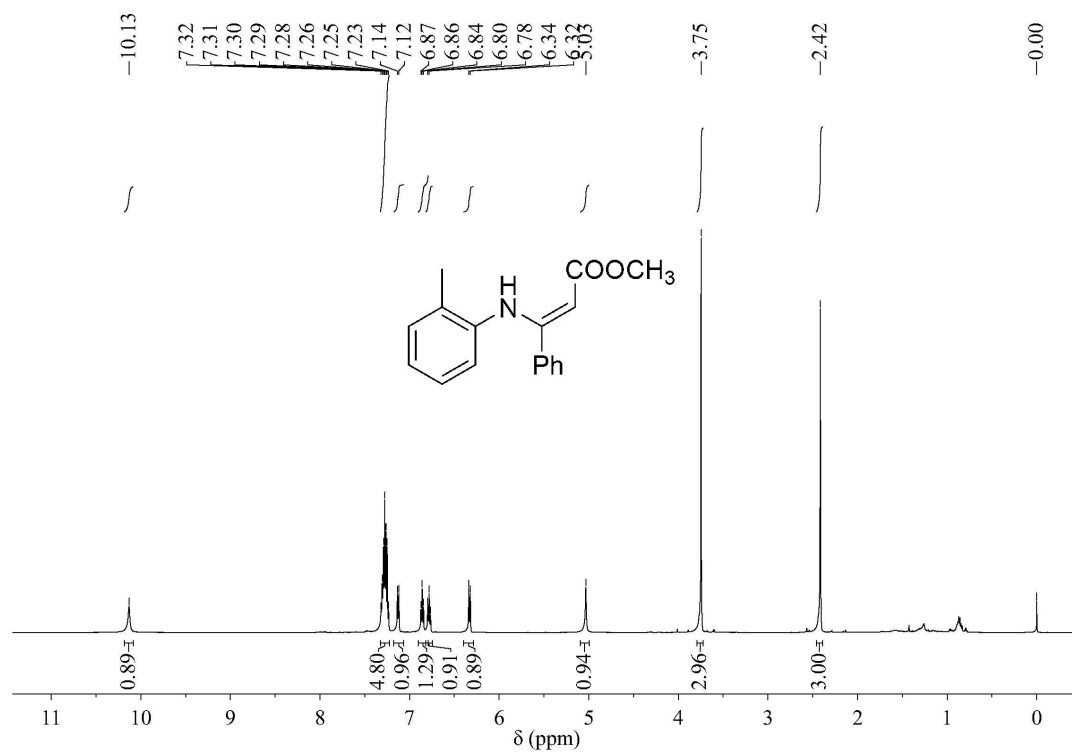


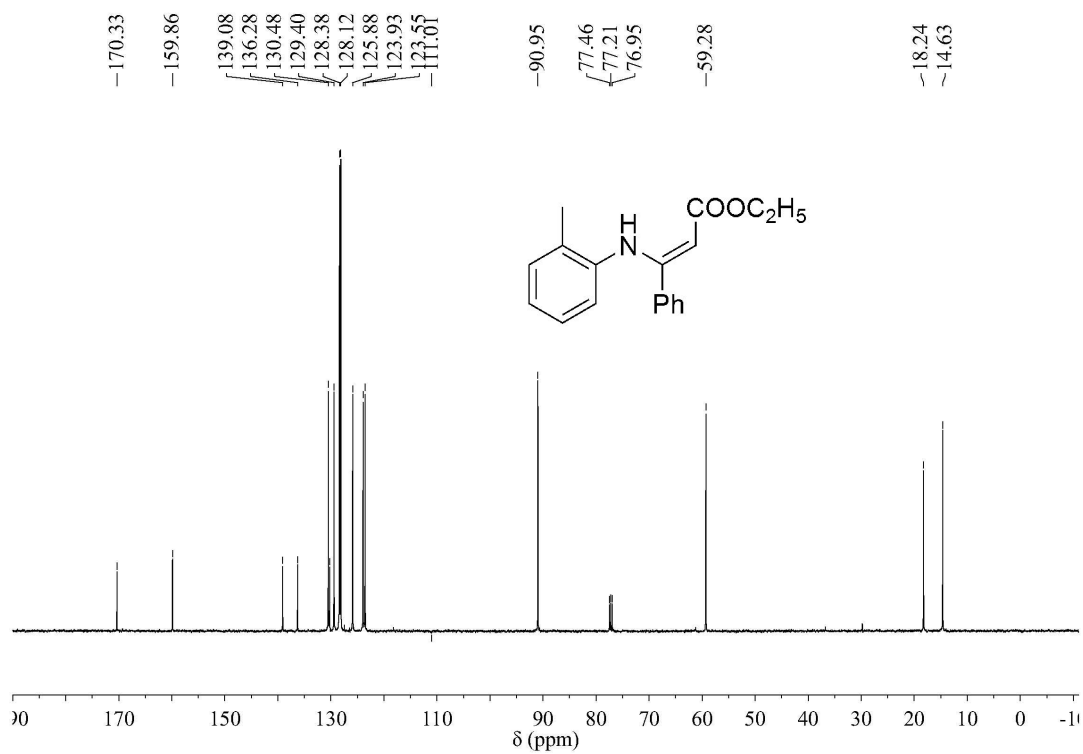
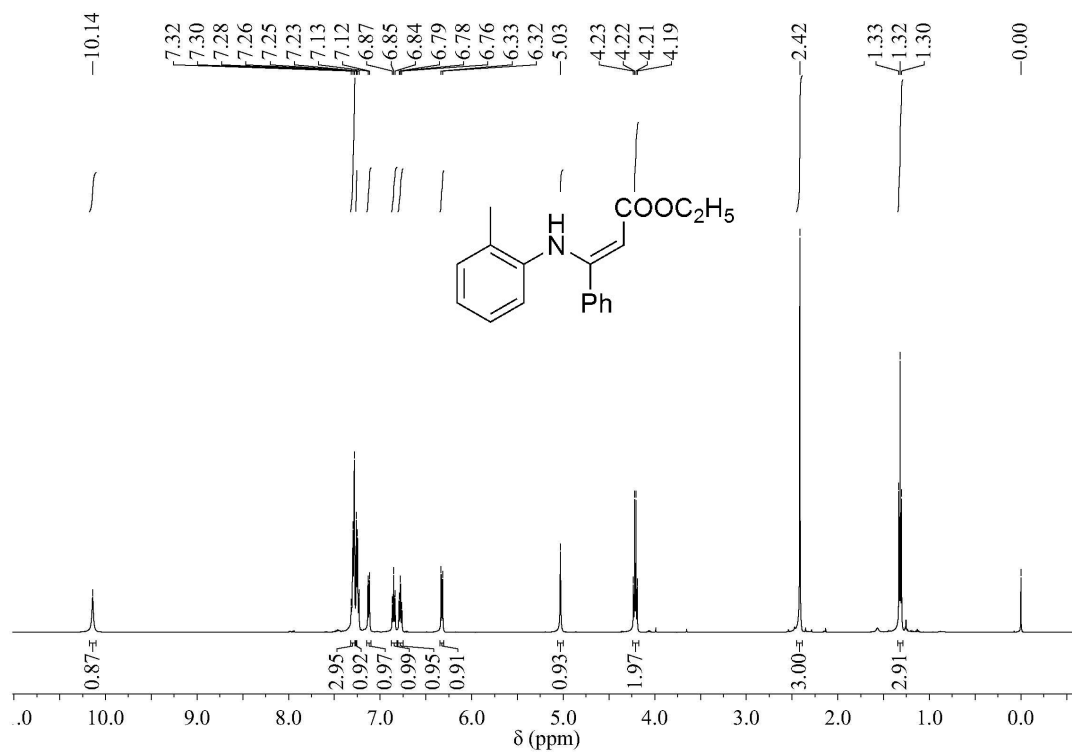


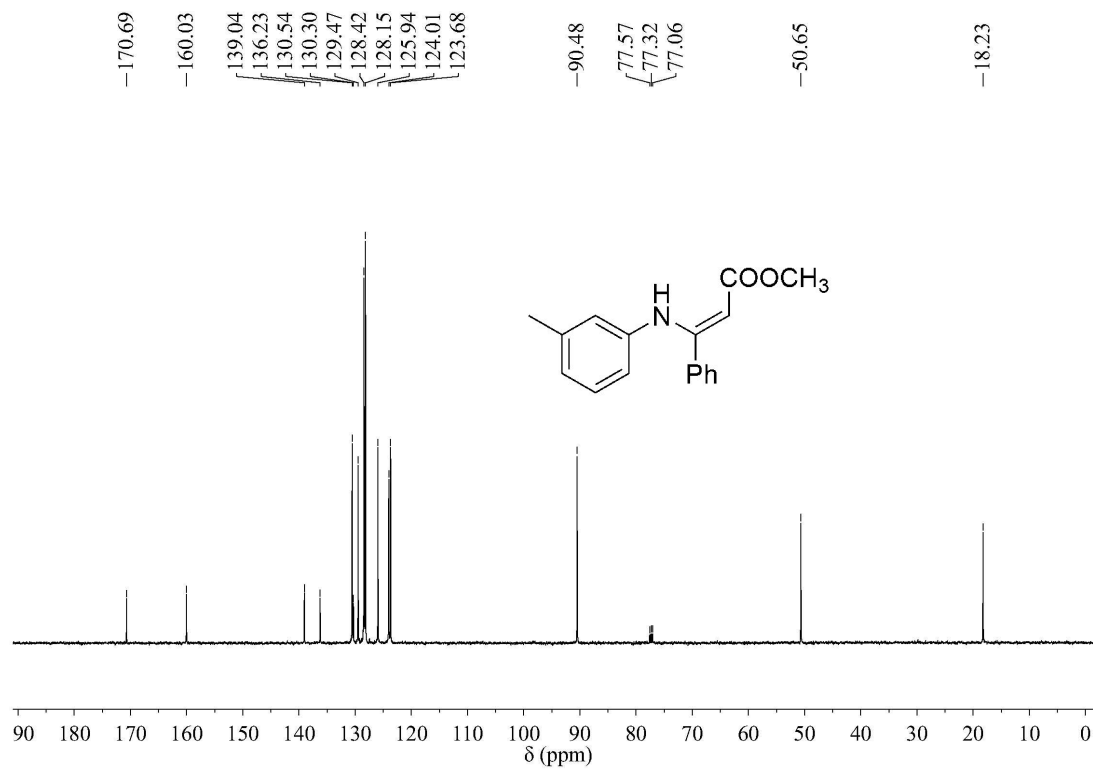
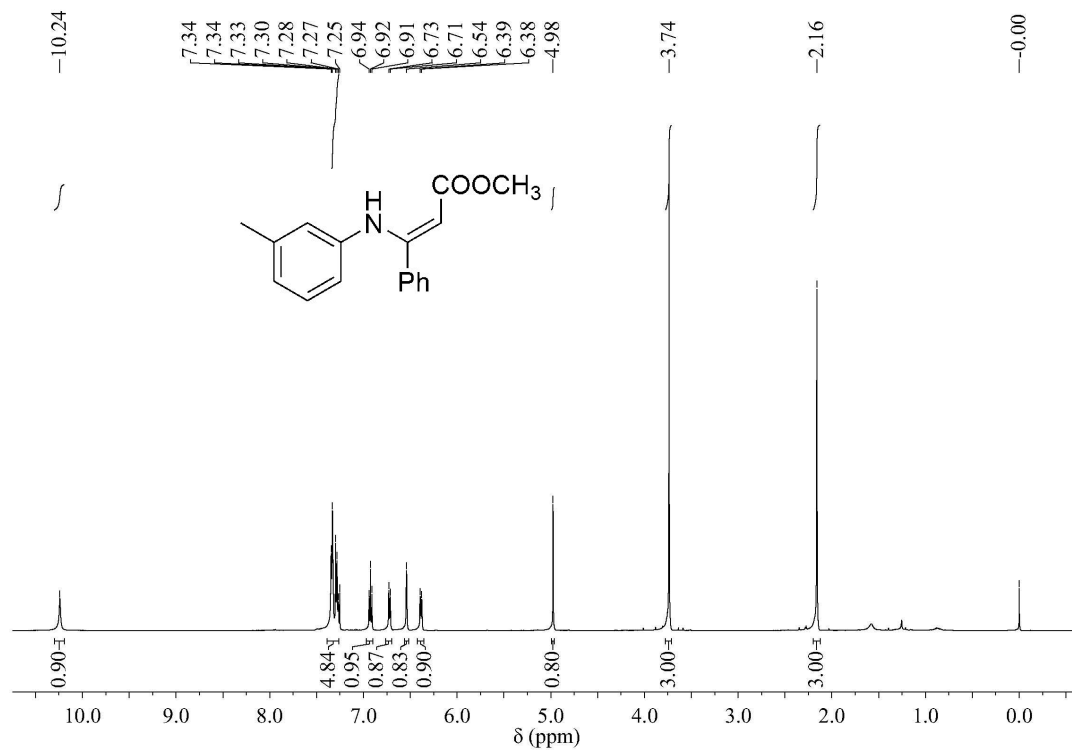


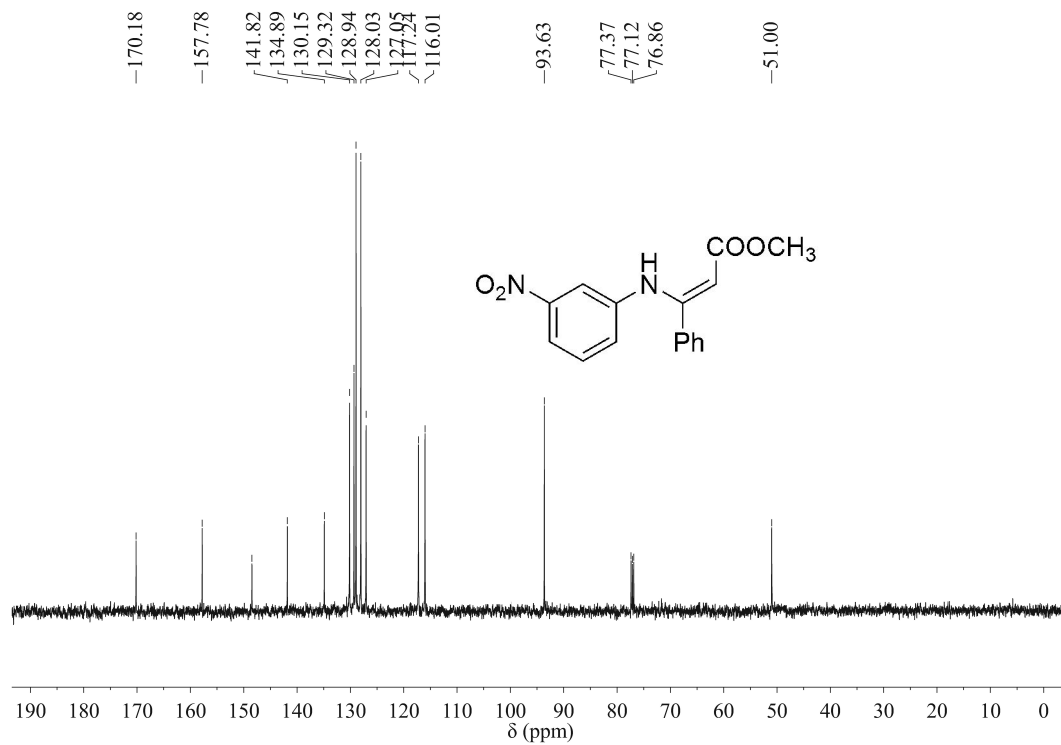
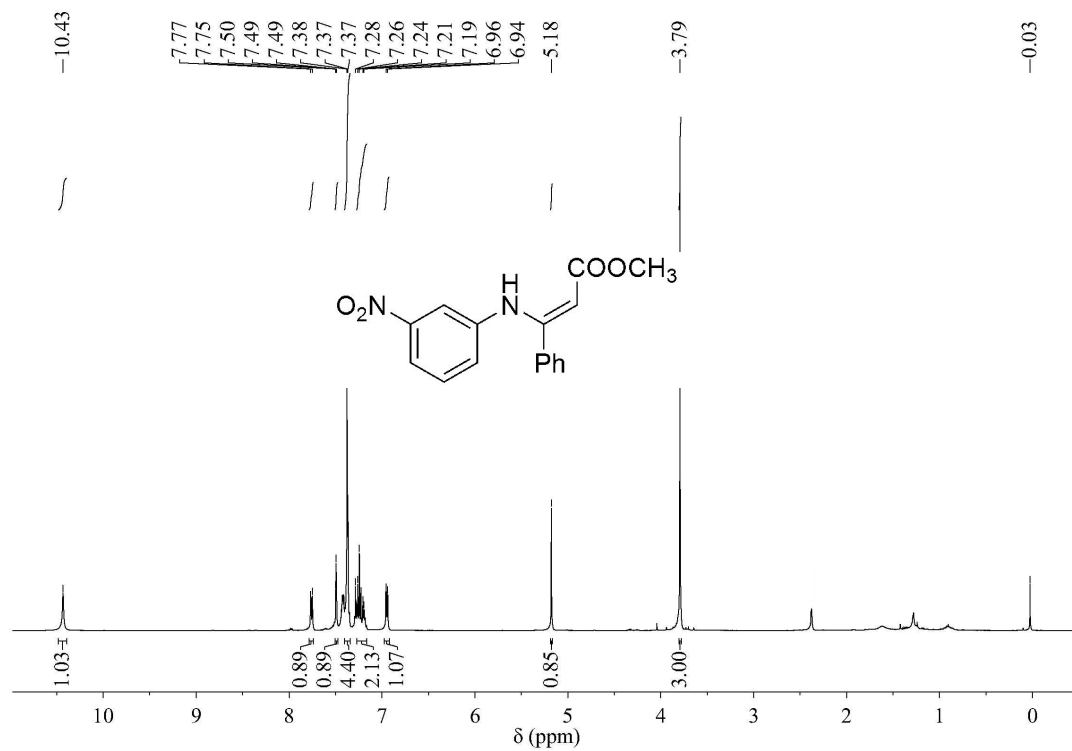


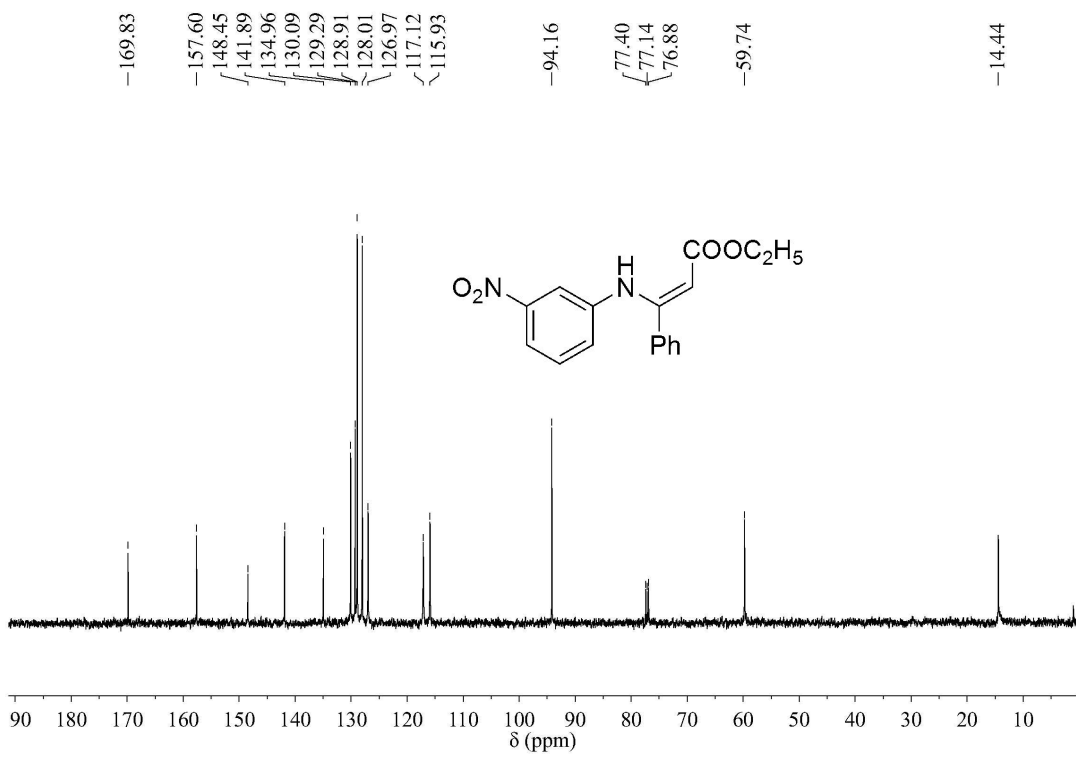
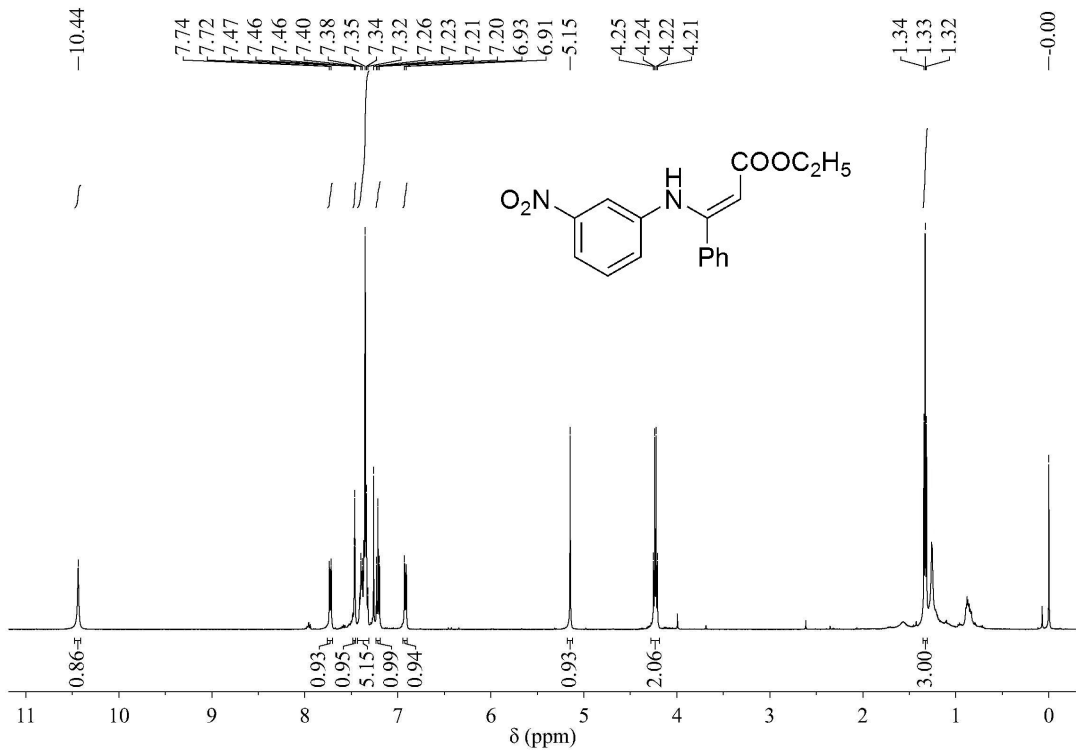


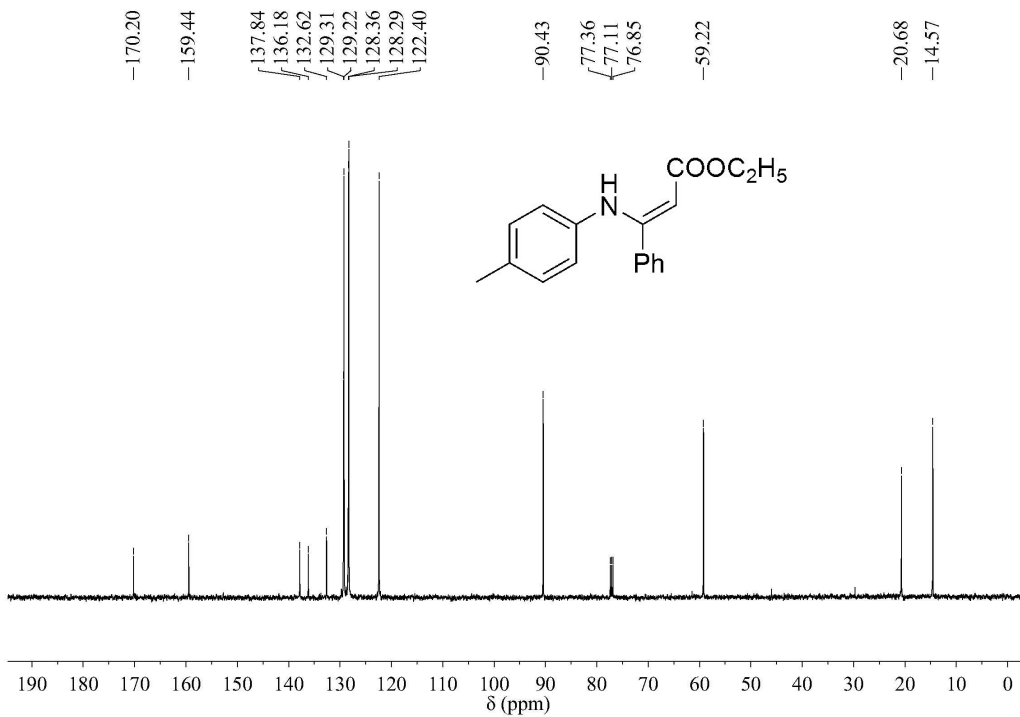
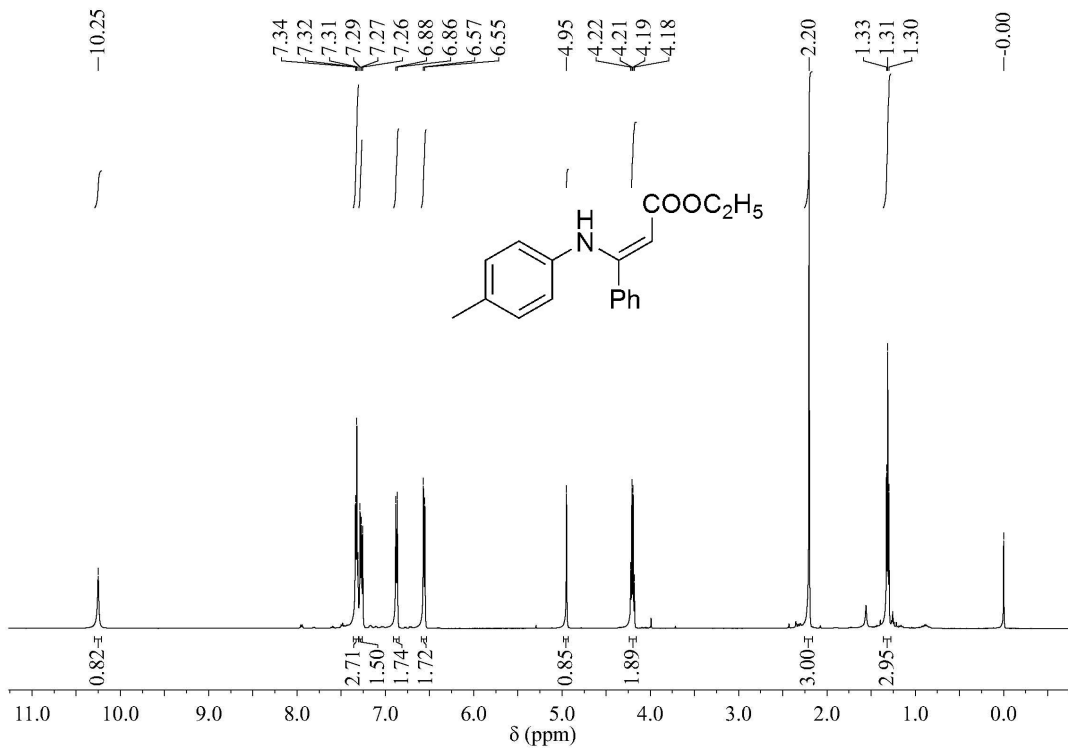


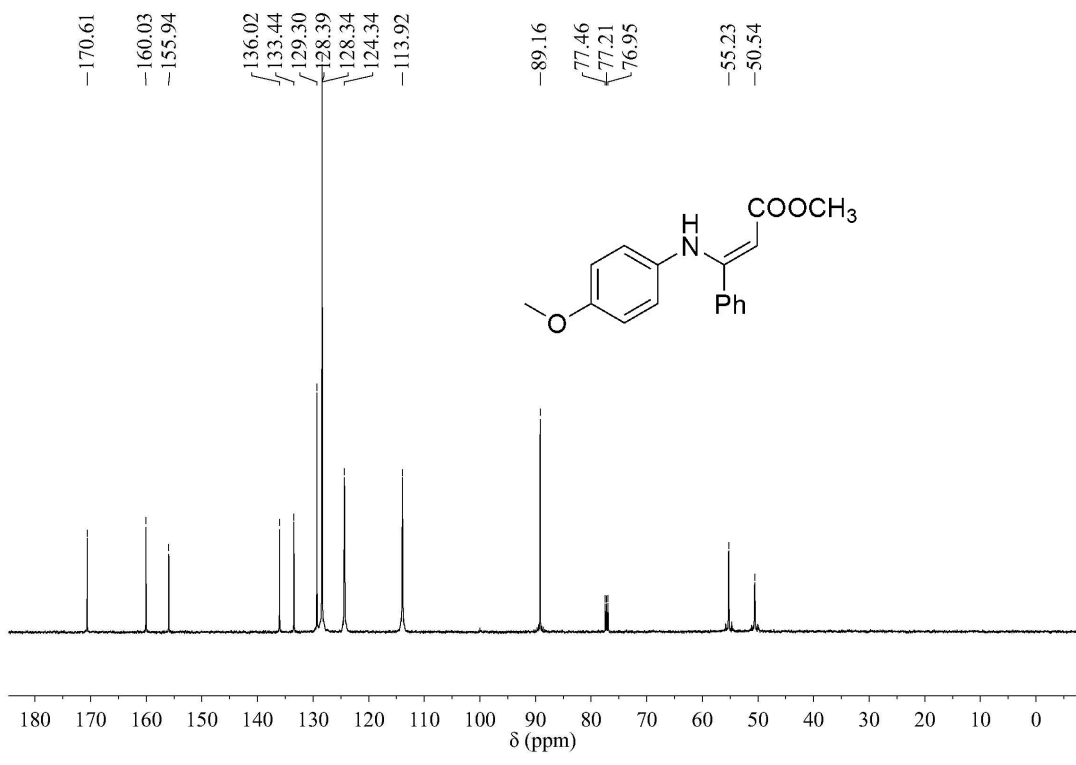
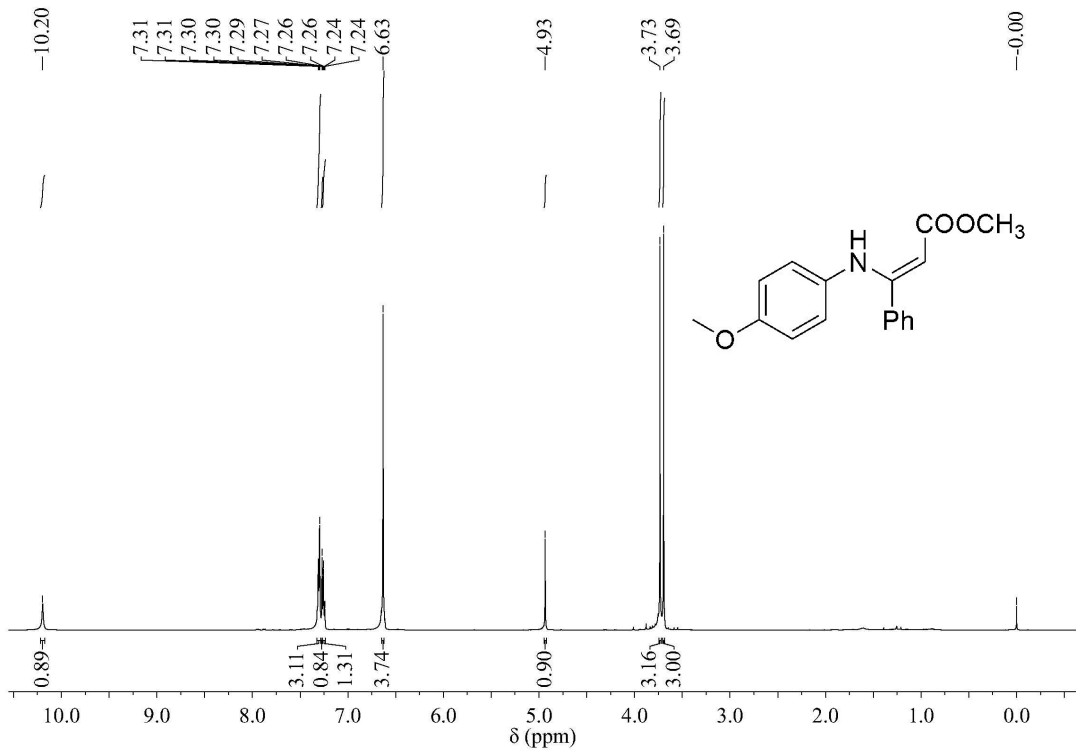


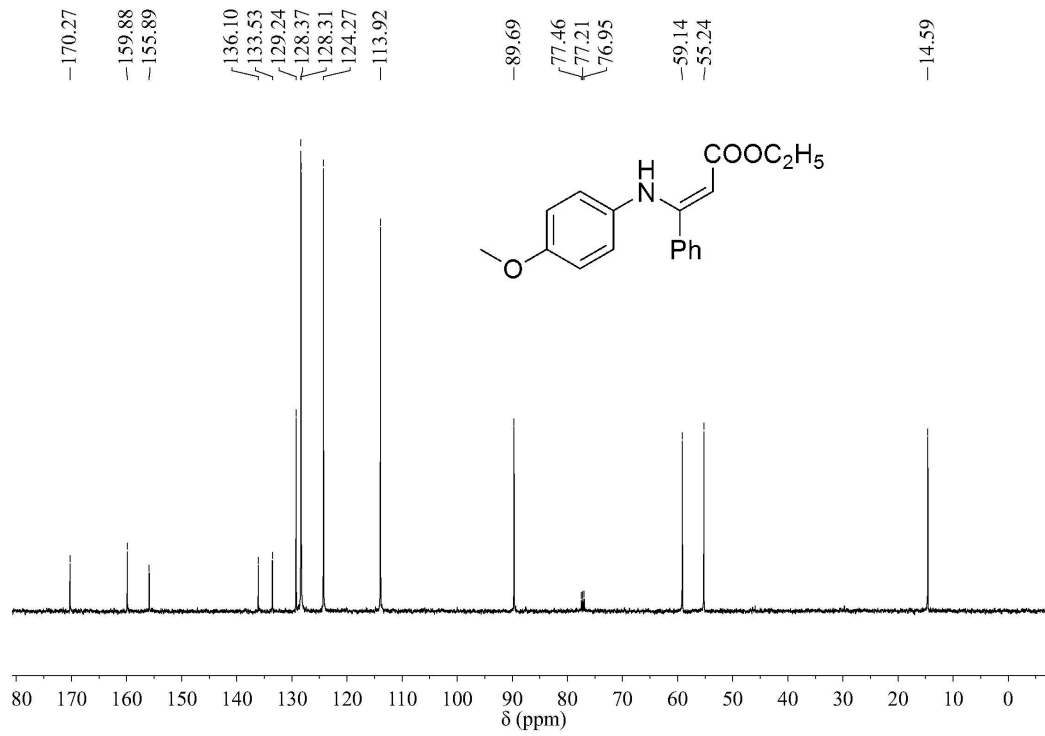
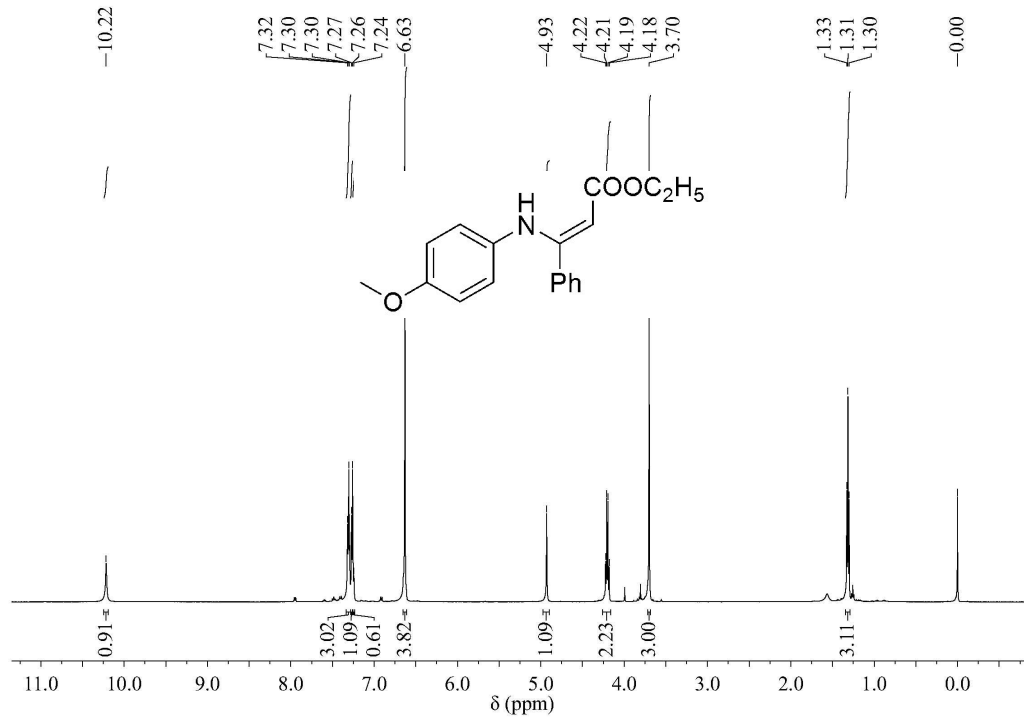


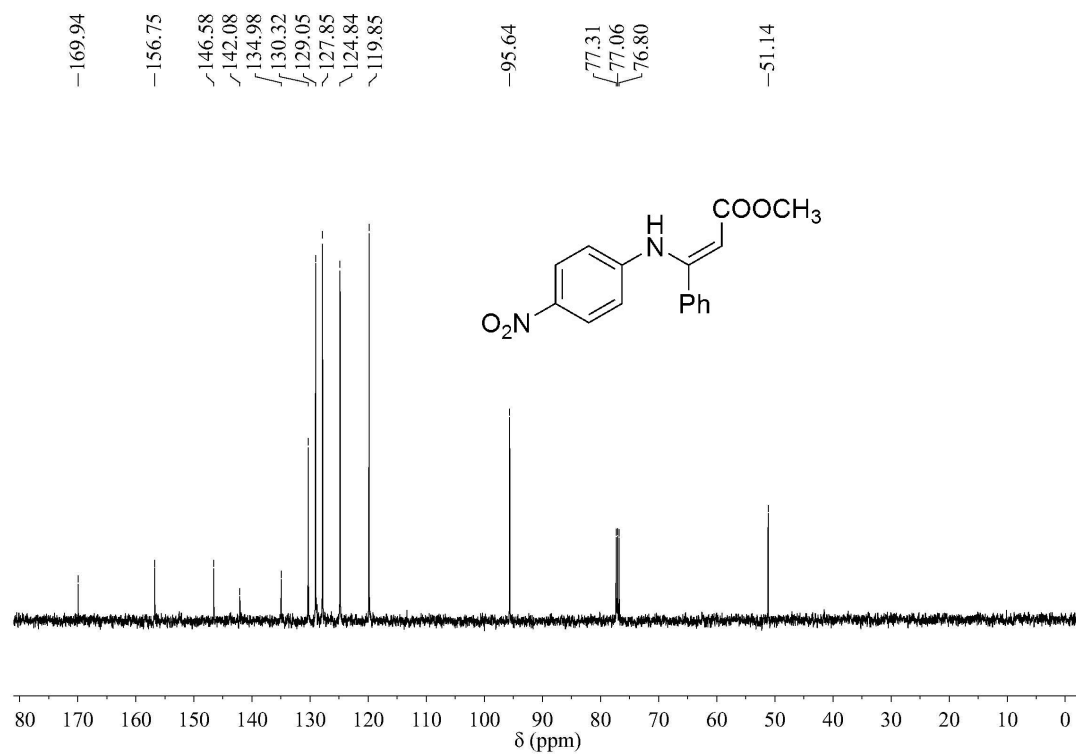
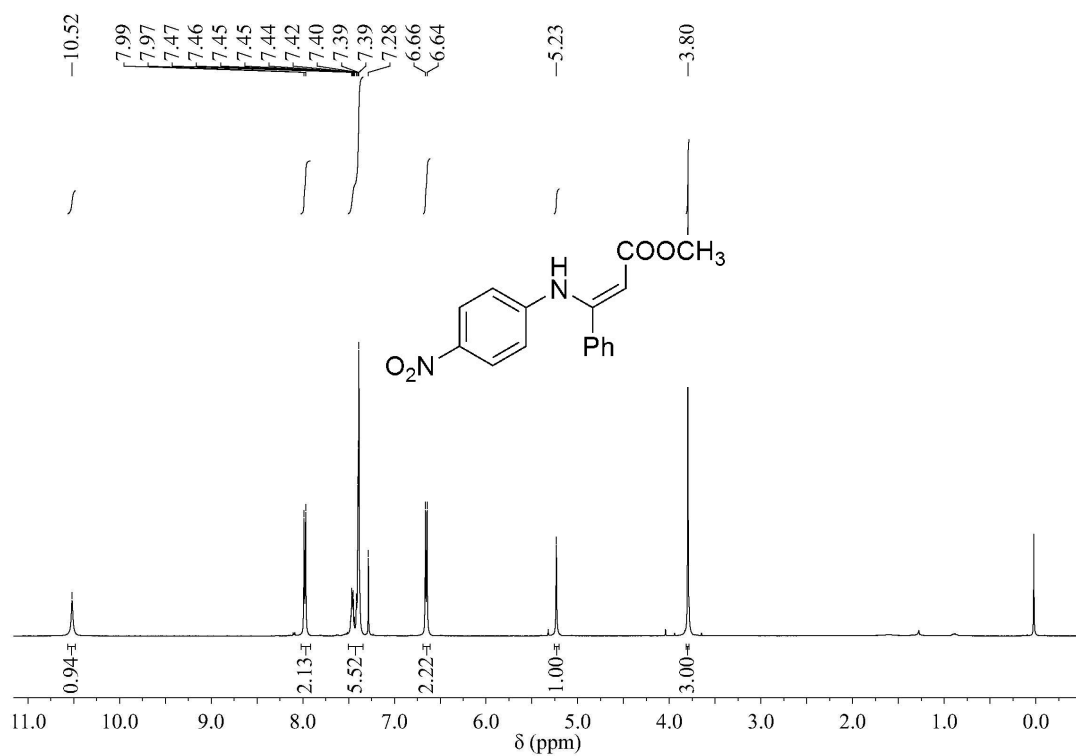


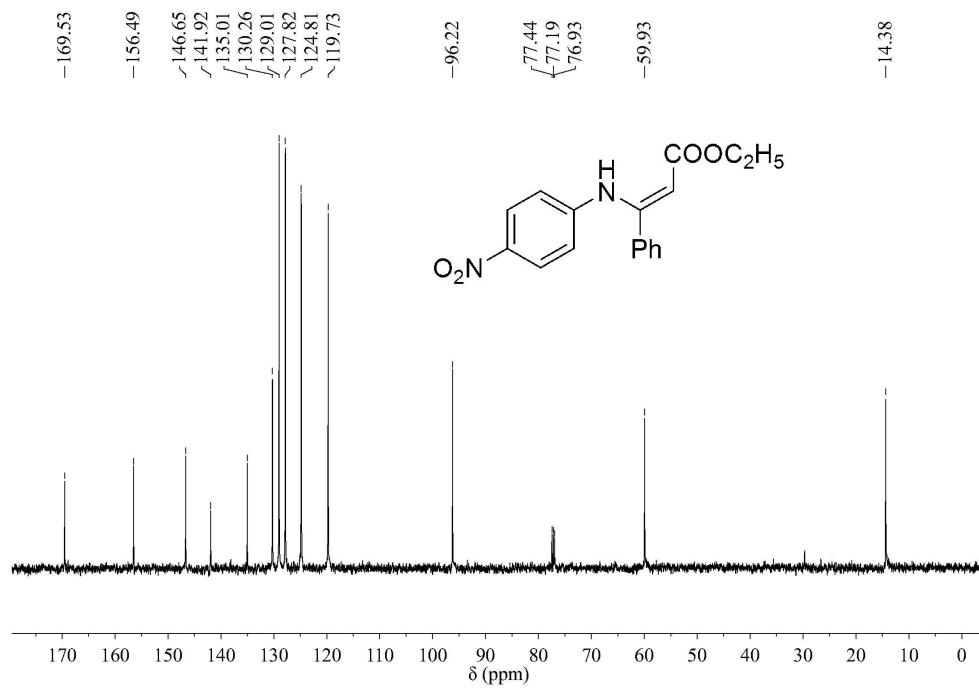
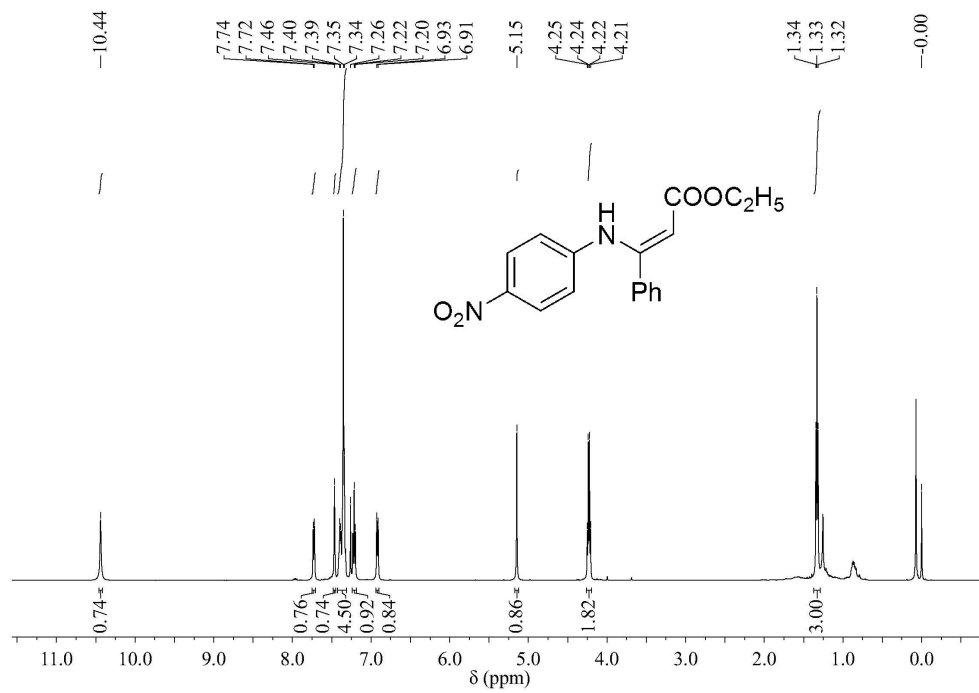


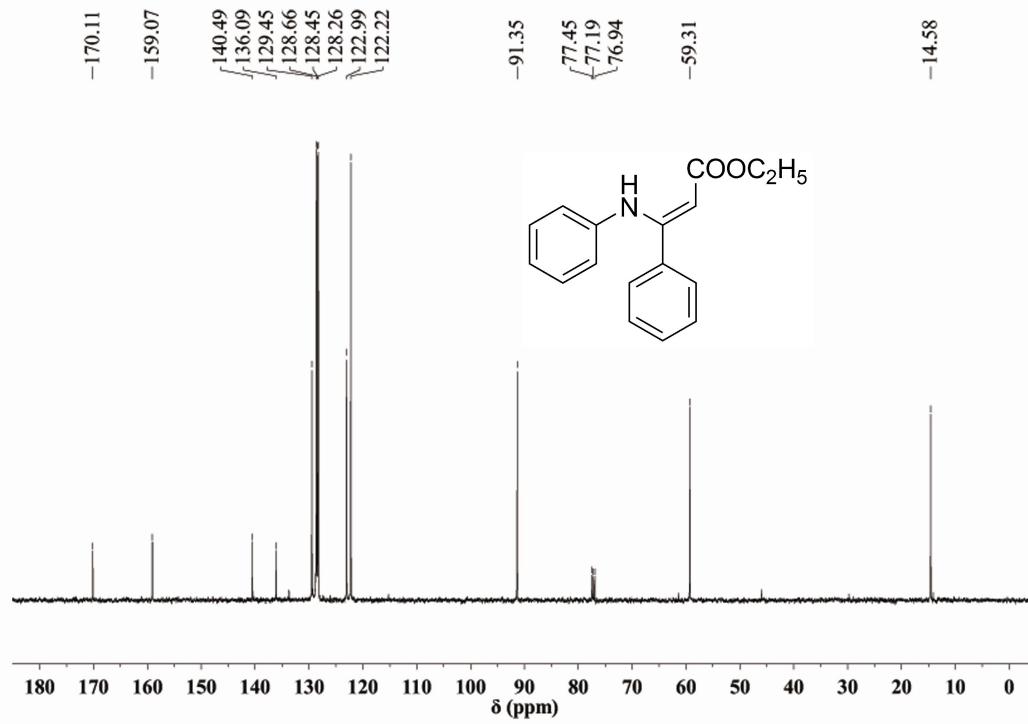
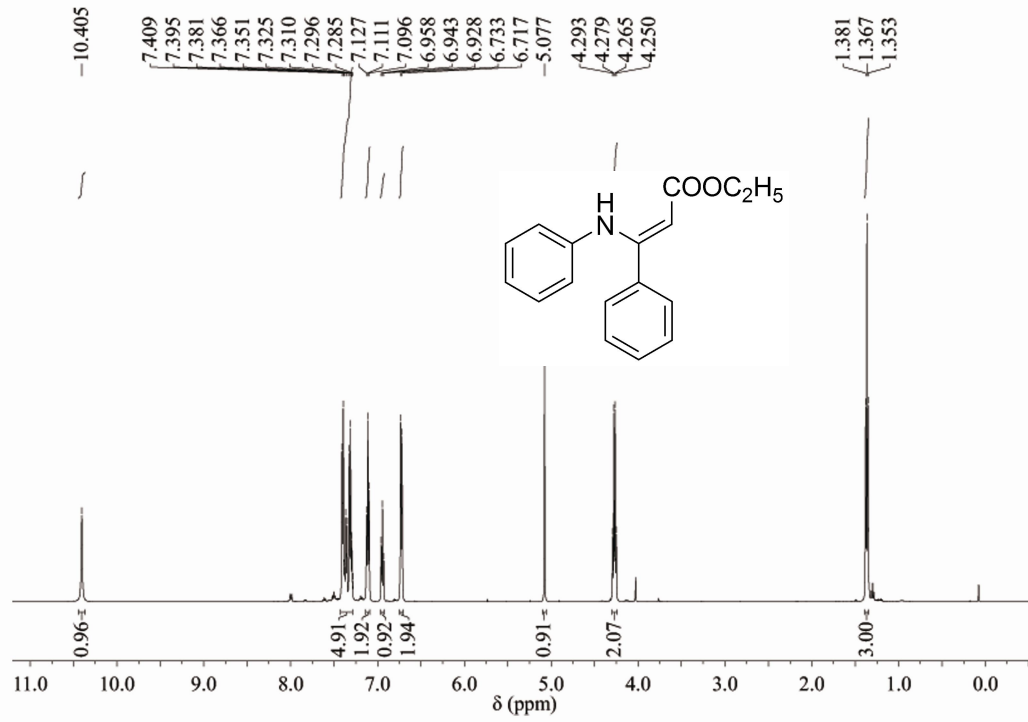


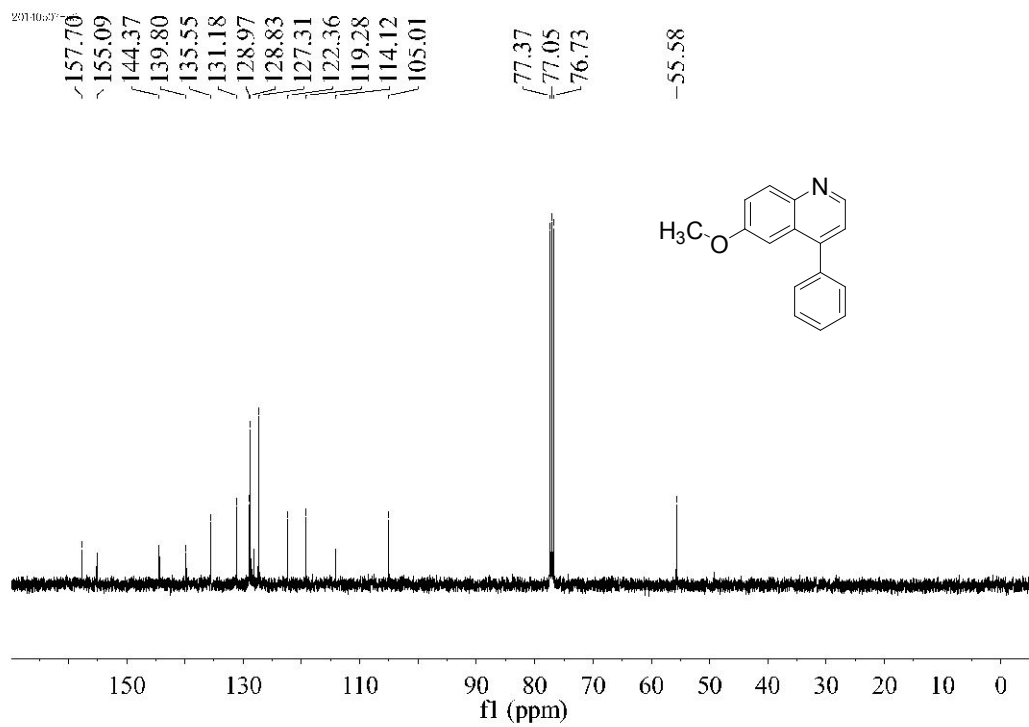
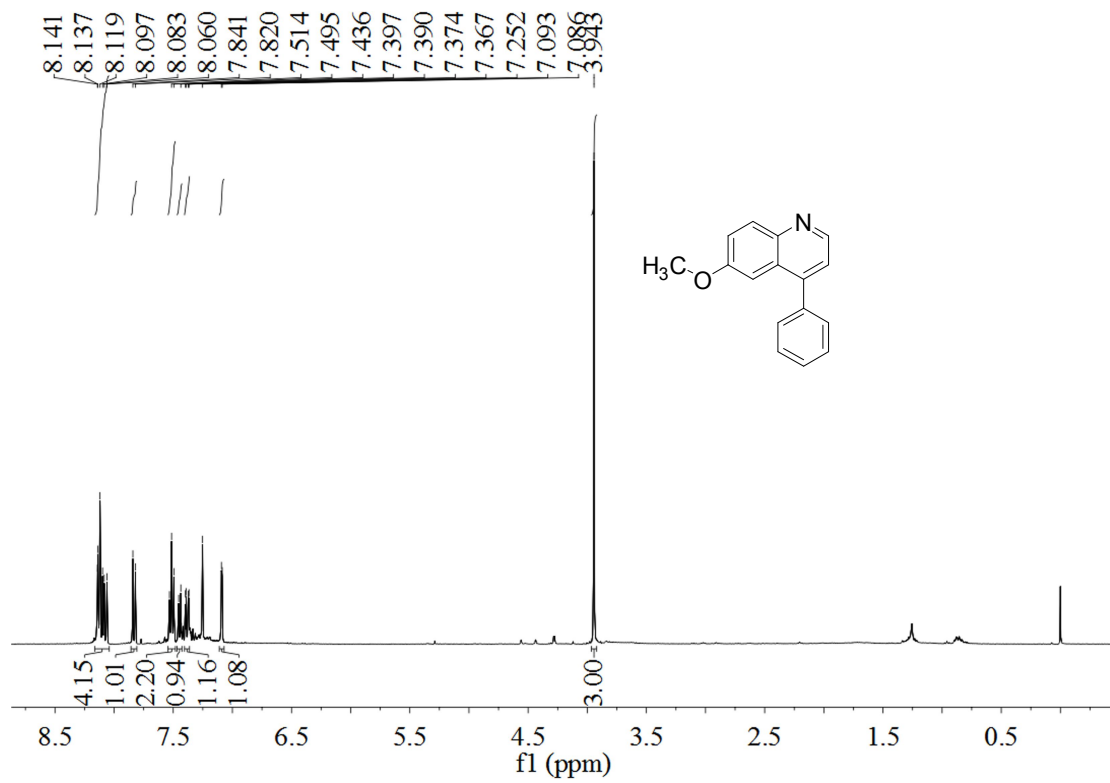


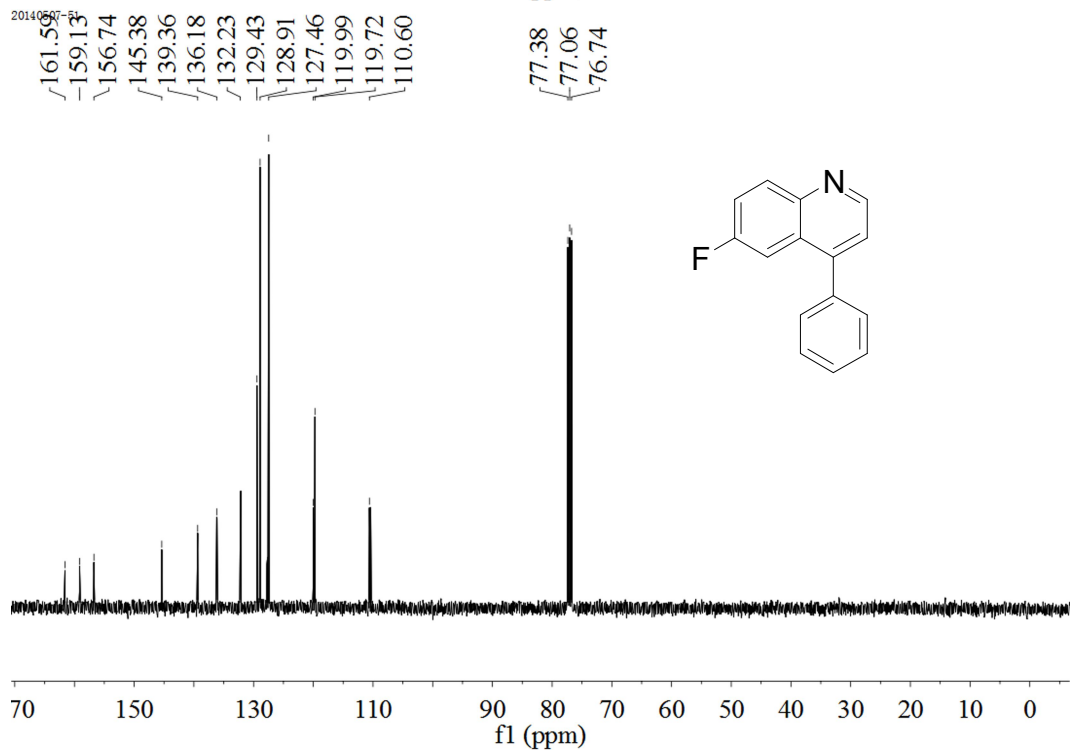
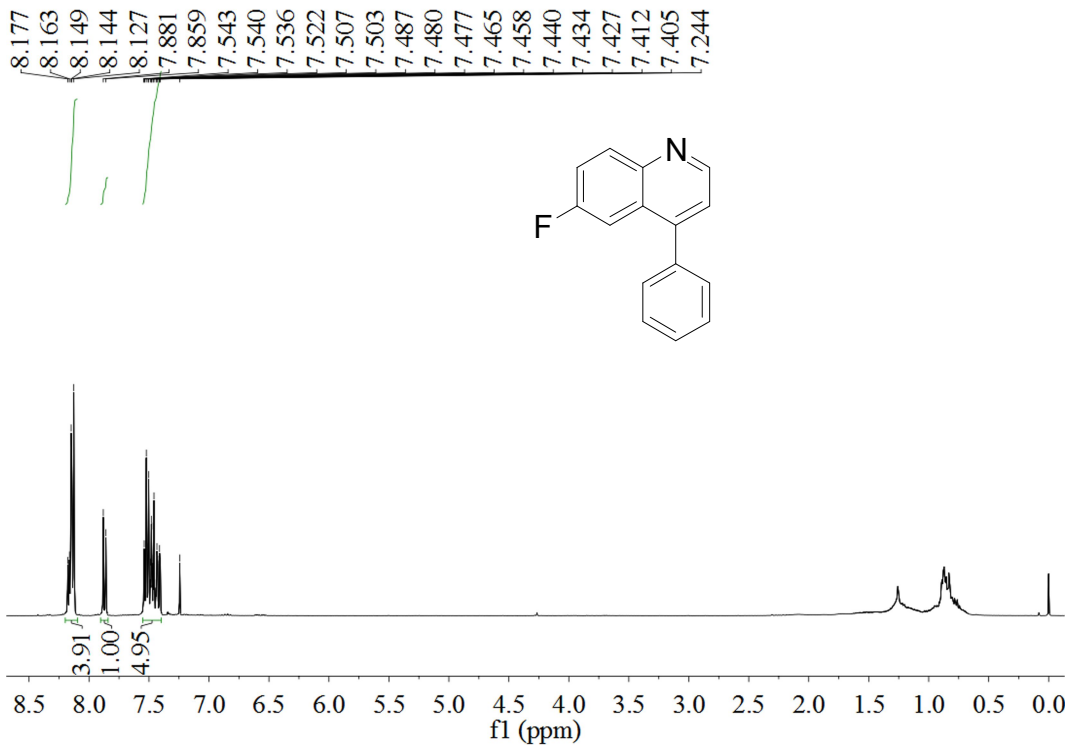


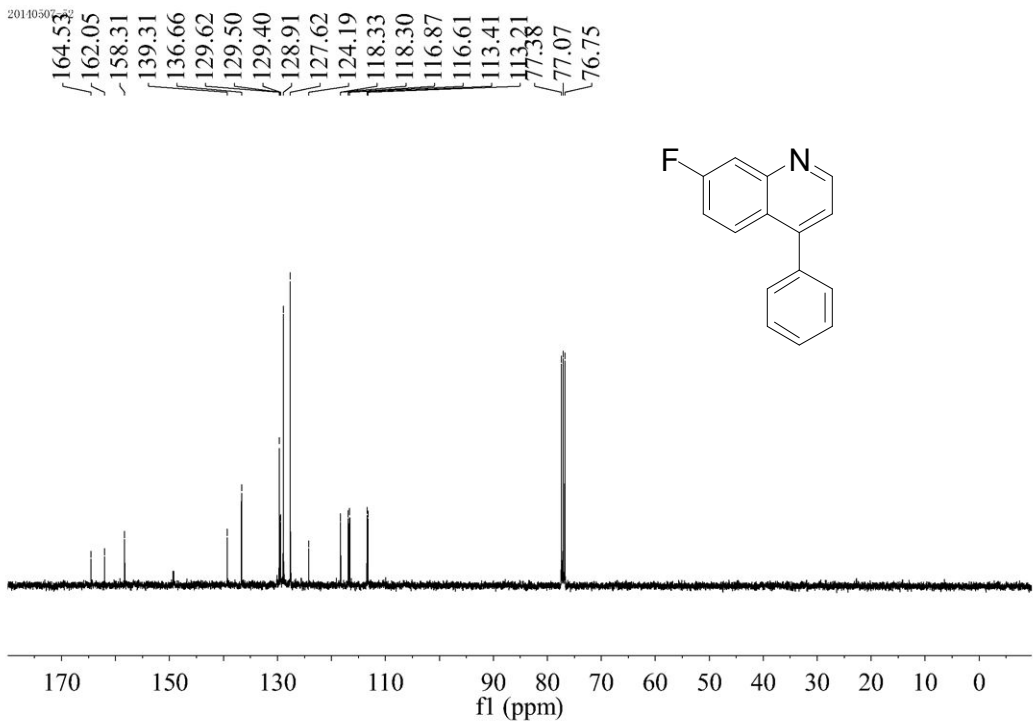
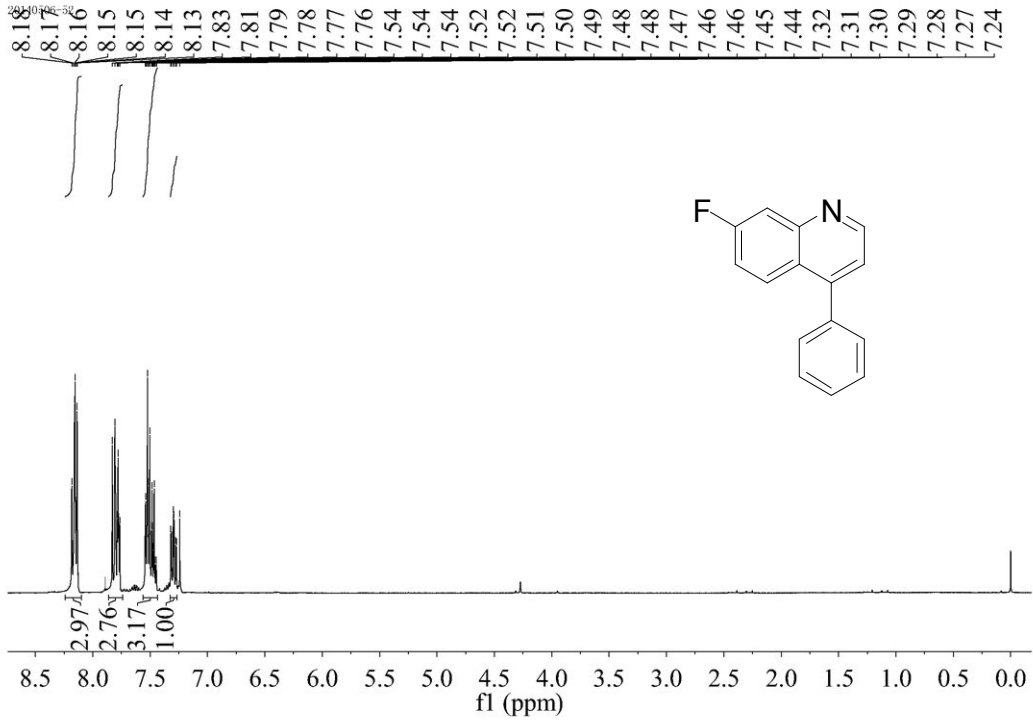


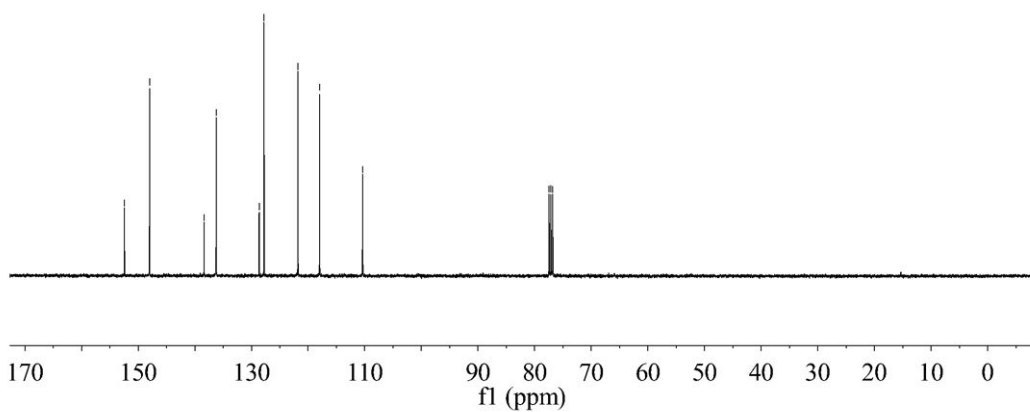
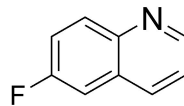
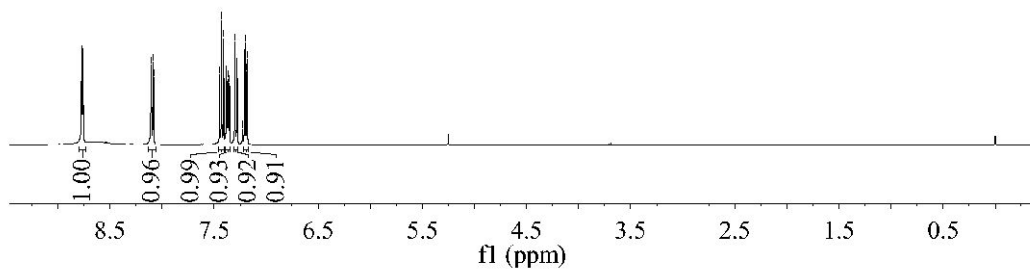
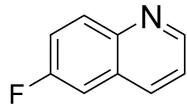
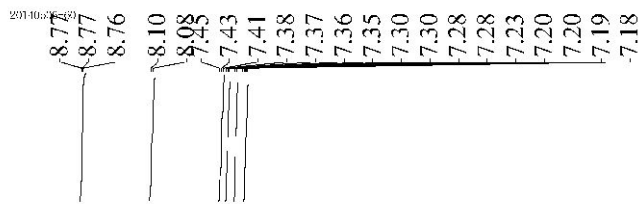




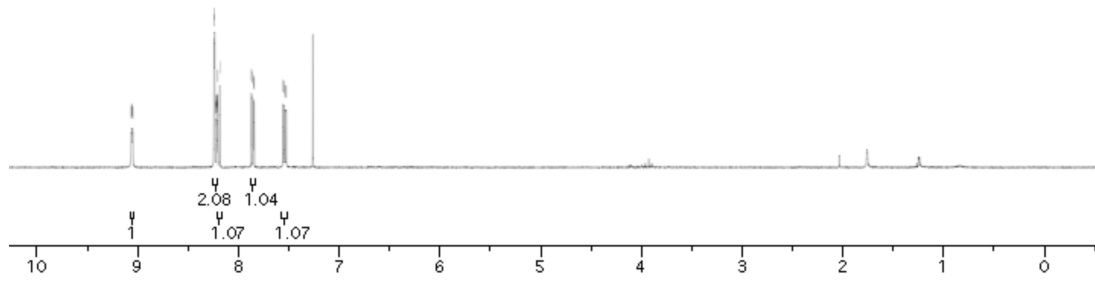
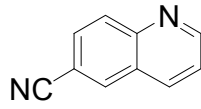








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110.5

