

Supporting Information

(*o*-CF₃PhO)₃P as a simple coupling reagent for direct amidation *via* activation of amines

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1. General information

Unless otherwise noted, reagents were obtained from commercial sources and used without further purification. All work-up and purification procedures were carried out with reagent-grade solvents in air. ^1H , ^{13}C NMR, ^{31}P NMR and ^{19}F NMR spectra were recorded with Bruker AV-600 or AV-400 spectrometers in $\text{DMSO-}d_6$ or CDCl_3 with tetramethylsilane (TMS) as an internal reference. Abbreviations are as follows: s (singlet), d (doublet), m (multiplet). HRMS was performed on a Waters Xevo G2-S Qtof instrument using electrospray ionization (ESI) techniques. Melting points of products in solid states were taken on a Yice wx-4 melting point apparatus without calibration.

2. Experimental Section

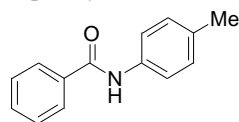
2.1 Synthesis of (*o*- CF_3PhO) $_3\text{P}$

To a solution of 2-(trifluoromethyl)phenol (10 g, 61.7 mmol, 3.3 equiv.) and triethylamine (10.4 mL, 74.8 mmol, 4.0 equiv.) in dry THF (120 mL) in two necked round bottomed flask, was slowly added a solution of PCl_3 (1.6 mL, 18.7 mmol, 1.0 equiv.) in dry THF (20 mL) at 0 °C. Then, the mixture was warmed to room temperature and stirred for 24 h. The solvent was concentrated under reduced pressure and the crude product was further purified by column chromatography on silica gel (Petroleum ether / EtOAc = 200/1) to give the pure (*o*- CF_3PhO) $_3\text{P}$ as colorless oil (7.7 g, 80% yield). ^1H NMR (600 MHz, $\text{DMSO-}d_6$): δ 7.79 (d, J = 6.0 Hz, 3H), 7.71-7.74 (m, 3H), 7.50 (d, J = 6.0 Hz, 3H), 7.39-7.42 (m, 3H). ^{13}C NMR (150 MHz, $\text{DMSO-}d_6$): δ 148.9, 134.9 128.0 (d, $J_{\text{C-F}}$ = 4.5 Hz), 125.3, 123.4 (dd, $J_{\text{C-F}}$ = 541.5 Hz, $J_{\text{C-F}}$ = 270.0 Hz), 121.1 (d, $J_{\text{C-F}}$ = 12 Hz), 120.8 (d, $J_{\text{C-F}}$ = 30 Hz). ^{19}F NMR (564 MHz, $\text{DMSO-}d_6$): δ -60.46. ^{31}P NMR (243 MHz, $\text{DMSO-}d_6$): δ 127.47. HRMS: $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{21}\text{H}_{21}\text{O}_3\text{F}_9\text{PNa}$ 537.0273, found 537.0276.

2.2 General Procedure for Synthesis of amides (**P1-P54**)

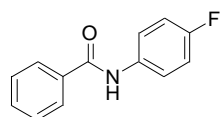
To a 10 mL tube were added amine (0.5 mmol, 1.0 equiv.), carboxylic acid (0.5 mmol, 1.0 equiv.), (*o*- CF_3PhO) $_3\text{P}$ (257 mg, 0.5 mmol, 1.0 equiv.) and CH_3CN (0.5 mL). The mixture was warmed to 80 °C in an oil bath and stirred for the indicated reaction time using magnetic stirring. Then, the solvent was concentrated under reduced pressure and the crude product was further purified by column chromatography on silica gel to give the pure product (**P1-P54**).

N-*p*-Tolyl-benzamide (P1)



Known compound,^[1] white solid, mp: 170-172 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 5:1), 96% yield, 102 mg. ^1H NMR (600 MHz, $\text{DMSO-}d_6$): δ 10.18 (s, 1H), 7.95 (d, J = 6.0 Hz, 2H), 7.67 (d, J = 3.0 Hz, 2H), 7.57-7.60 (m, 1H), 7.51-7.54 (m, 2H), 7.16 (d, J = 3.0 Hz, 2H), 2.28 (s, 3H). ^{13}C NMR (150 MHz, $\text{DMSO-}d_6$): δ 165.8, 137.1, 135.5, 133.1, 131.9, 129.5, 128.8, 128.1, 120.8, 21.0.

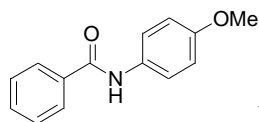
N-(4-Fluoro-phenyl)-benzamide (P2)



Known compound,^[1] white solid, mp: 197-198 °C, purified by silica gel

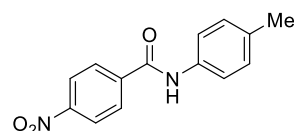
chromatography (petroleum ether/ethyl acetate = 3:1), 99% yield, 107 mg. ^1H NMR (600 MHz, DMSO- d_6): δ 10.33 (s, 1H), 7.96 (d, J = 3.0 Hz, 2H), 7.80-7.82 (m, 2H), 7.59-7.61 (m, 1H), 7.53-7.55 (m, 2H), 7.19-7.22 (m, 2H). ^{13}C NMR (150 MHz, DMSO- d_6): δ 165.9, 158.7 (d, $J_{\text{C-F}}$ = 238.5 Hz), 136.0 (d, $J_{\text{C-F}}$ = 1.5 Hz), 135.3, 132.08, 128.9, 128.1, 122.6 (d, $J_{\text{C-F}}$ = 7.5 Hz), 115.7 (d, $J_{\text{C-F}}$ = 22.5 Hz).

***N*-(4-Methoxy-phenyl)-benzamide (P3)**



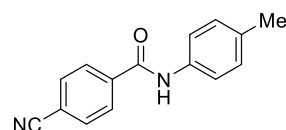
Known compound,^[1] light purple solid, mp: 173-175 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 8:1), 93% yield, 106 mg. ^1H NMR (600 MHz, DMSO- d_6): δ 10.14 (s, 1H), 7.95 (d, J = 3.0 Hz, 2H), 7.67 (d, J = 6.0 Hz, 2H), 7.57-7.59 (m, 1H), 7.51-7.54 (m, 1H), 6.94 (d, J = 3.0 Hz, 2H), 3.75 (s, 3H). ^{13}C NMR (150 MHz, DMSO- d_6): δ 165.6, 156.0, 135.5, 132.69, 131.9, 128.8, 128.0, 122.4, 114.2, 55.6.

4-Nitro-*N*-(*p*-tolyl)benzamide (P4)



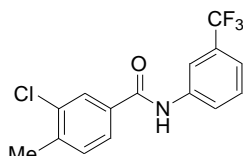
Known compound,^[2] light yellow solid, mp: 199-201 °C, purified by silica gel chromatography (petroleum ether / ethyl acetate = 8:1). 91% yield, 117 mg. ^1H NMR (400 MHz, DMSO- d_6): δ 10.49 (s, 1H), 8.37 (d, J = 6.0 Hz, 2H), 8.18 (d, J = 4.0 Hz, 2H), 7.67 (d, J = 6.0 Hz, 2H), 7.18 (d, J = 4.0 Hz, 2H), 2.29 (s, 3H). ^{13}C NMR (100 MHz, DMSO- d_6): δ 164.1, 149.6, 141.2, 136.7, 133.7, 129.6, 129.5, 124.0, 121.0, 21.0.

4-Cyano-*N*-(*p*-tolyl)benzamide(P5)



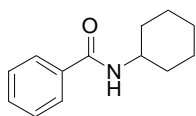
White solid, mp: 179-181 °C, purified by silica gel chromatography (petroleum ether / ethyl acetate = 5:1). 93% yield, 110 mg. ^1H NMR (400 MHz, DMSO- d_6): δ 10.40 (s, 1H), 8.10 (d, J = 4.0 Hz, 2H), 8.02 (d, J = 4.0 Hz, 2H), 7.65 (d, J = 4.0 Hz, 2H), 7.18 (d, J = 6.0 Hz, 2H), 2.29 (s, 3H). ^{13}C NMR (100 MHz, DMSO- d_6): δ 164.4, 139.5, 136.7, 133.6, 132.9, 129.6, 129.0, 120.9, 118.8, 114.2, 21.0. HRMS: $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{15}\text{H}_{13}\text{N}_2\text{O}$ 237.1022, found 237.1016.

3-Chloro-4-methyl-*N*-(3-trifluoromethyl-phenyl)-benzamide (P6)



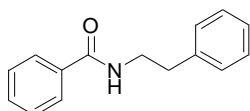
White solid, mp: 164-166 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 5:1), 99% yield, 156 mg. ^1H NMR (600 MHz, DMSO- d_6): δ 10.55 (s, 1H), 8.23 (s, 1H), 8.06 (d, J = 3.0 Hz, 2H), 7.88 (d, J = 3.0 Hz, 1H), 7.59-7.62 (m, 1H), 7.54 (d, J = 6.0 Hz, 1H), 7.47 (d, J = 3.0 Hz, 1H), 2.42 (s, 3H). ^{13}C NMR (150 MHz, DMSO- d_6): δ 164.8, 140.2 (d, $J_{\text{C-F}}$ = 10.5 Hz), 134.2, 133.9, 131.8, 130.4, 129.9 (q, $J_{\text{C-F}}$ = 63 Hz), 128.4, 127.0, 125.5, 124.3, 123.7, 120.6 (d, $J_{\text{C-F}}$ = 3.0 Hz), 116.9 (d, $J_{\text{C-F}}$ = 4.5 Hz), 20.1. HRMS: $[\text{M}-\text{H}]^-$ calcd for $\text{C}_{15}\text{H}_{10}\text{ClF}_3\text{NO}$ 312.0409, found 312.0409.

N-Cyclohexyl-benzamide (P7)



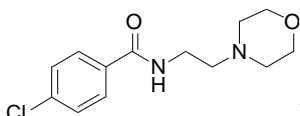
Known compound,^[1] white solid, mp: 154-156 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 5:1), 90% yield, 92 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 8.21 (d, *J* = 3.0 Hz, 1H), 7.84 (d, *J* = 3.0 Hz, 2H), 7.49-7.52 (m, 1H), 7.43-7.45 (m, 2H), 3.75-3.76 (m, 1H), 1.73-1.82 (m, 4H), 1.61 (d, *J* = 6.0 Hz, 1H), 1.26-1.34 (m, 4H), 1.11-1.17 (m, 1H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 165.8, 135.3, 131.4, 128.6, 127.7, 48.8, 32.9, 25.7, 25.4.

N-Phenethyl-benzamide (P8)



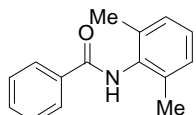
Known compound,^[1] white solid, mp: 123-125 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 8:1), 82% yield, 92 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 8.57-8.59 (m, 1H), 7.83 (d, *J* = 3.0 Hz, 2H), 7.50-7.53 (m, 1H), 7.44-7.47 (m, 2H), 7.29-7.31 (m, 2H), 7.25 (d, *J* = 3.0 Hz, 2H), 7.19-7.22 (m, 1H), 3.47-3.50 (m, 2H), 2.84-2.86 (m, 2H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 166.6, 140.0, 135.1, 131.5, 129.1, 128.8, 128.7, 127.6, 126.6, 41.4, 35.6.

4-Chloro-N-(2-morpholin-4-yl-ethyl)-benzamide (P9)



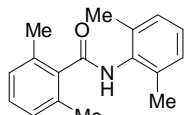
Known compound,^[1] white solid, mp: 146-148 °C, purified by silica gel chromatography (dichloromethane/methanol = 20:1), 95% yield, 127 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 8.51 (s, 1H), 7.85 (d, *J* = 6.0 Hz, 2H), 7.54 (d, *J* = 6.0 Hz, 2H), 3.56 (s, 4H), 3.36-3.39 (m, 4H), 2.44-2.46 (m, 2H), 2.40 (s, 2H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 165.5, 136.4, 133.7, 129.5, 128.8, 66.7, 57.8, 53.8, 37.1.

N-(2,6-Dimethyl-phenyl)-benzamide (P10)



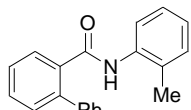
Known compound,^[3] white solid, mp: 162-163 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 5:1), 84% yield, 95 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 9.78 (s, 1H), 8.01 (d, *J* = 3.0 Hz, 2H), 7.58-7.61 (m, 1H), 7.52-7.54 (m, 2H), 7.13 (s, 3H), 2.18 (s, 6H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 165.4, 136.1, 135.8, 134.8, 132.0, 128.9, 128.2, 128.0, 127.2, 18.5.

N-(2,6-Dimethyl-phenyl)-2,6-dimethyl-benzamide (P11)



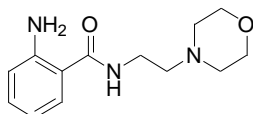
White solid, mp: 263-265 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 5:1), 83% yield, 105 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 9.78 (s, 1H), 7.21-7.23 (m, 1H), 7.12 (d, *J* = 3.0 Hz, 5H), 2.41 (s, 6H), 2.31 (s, 6H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 167.9, 139.1, 135.7, 135.3, 134.3, 128.7, 128.5, 127.9, 127.0, 20.2, 19.7. HRMS: [M+H]⁺ calcd for C₁₇H₂₀NO 254.1539, found 254.1549.

Biphenyl-2-carboxylic acid *o*-tolylamide (P12)



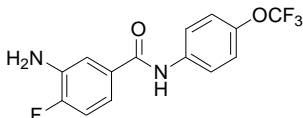
Known compound,^[4] white solid, mp: 135-137 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 10:1), 80% yield, 115 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 9.57 (s, 1H), 7.62 (d, *J* = 3.0 Hz, 1H), 7.55-7.58 (m, 1H), 7.46-7.51 (m, 4H), 7.41-7.44 (m, 2H), 7.35-7.37 (m, 1H), 7.29 (d, *J* = 6.0 Hz, 1H), 7.12-7.15 (m, 2H), 7.05-7.07 (m, 1H), 1.94 (m, 3H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 168.4, 140.7, 139.6, 137.8, 136.5, 132.8, 130.7, 130.4, 130.0, 129.0, 128.8, 128.4, 127.9, 127.7, 126.3, 125.9, 125.8, 17.8.

2-Amino-N-(2-morpholin-4-yl-ethyl)-benzamide (P13)



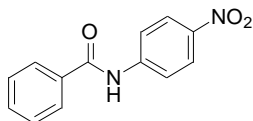
Known compound,^[5] light yellow solid, mp: 122-124 °C, purified by silica gel chromatography (dichloromethane/methanol = 40:1), 81% yield, 101 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 8.11-8.12 (m, 1H), 7.43 (d, *J* = 3.0 Hz, 1H), 7.11-7.13 (m, 1H), 7.68 (d, *J* = 3.0 Hz, 1H), 6.49-6.52 (m, 1H), 6.35 (s, 2H), 3.57-3.58 (m, 4H), 3.32-3.35 (m, 2H), 2.43-2.47 (m, 6H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 169.2, 149.9, 132.0, 128.4, 116.7, 115.6, 115.0, 66.6, 57.8, 53.7, 36.4.

3-Amino-4-fluoro-N-(4-trifluoromethoxy-phenyl)-benzamide (P14)



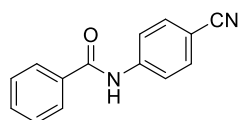
White solid, mp: 150-152 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 5:1), 84% yield, 132 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 10.30 (s, 1H), 7.86-7.88 (m, 2H), 7.36 (d, *J* = 3.0 Hz, 3H), 7.14 (d, *J* = 3.0 Hz, 2H), 5.43 (s, 2H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 166.0, 153.7, 152.1, 144.2, 139.0, 137.0 (d, *J*_{C-F} = 13.5 Hz), 131.8, 122.0 (d, *J*_{C-F} = 15 Hz), 120.6 (d, *J*_{C-F} = 238.5 Hz), 116.4 (d, *J*_{C-F} = 6.0 Hz), 115.9 (d, *J*_{C-F} = 7.5 Hz), 115.1 (d, *J*_{C-F} = 19.5 Hz). HRMS: [M+H]⁺ calcd for C₁₄H₁₁N₂O₂F₄ 315.0751, found 315.0754.

N-(4-Nitro-phenyl)-benzamide (P15)



Known compound,^[6] yellow solid, mp: 194-196 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 8:1), 58% yield, 71 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 10.82 (s, 1H), 8.27 (d, *J* = 6.0 Hz, 2H), 8.07 (d, *J* = 6.0 Hz, 2H), 7.99 (d, *J* = 3.0 Hz, 2H), 7.63-7.65 (m, 1H), 7.55-7.58 (m, 2H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 166.8, 146.0, 142.9, 134.7, 132.7, 129.0, 128.4, 125.27, 120.3.

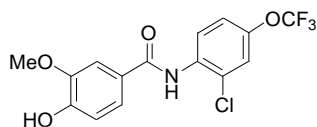
N-(4-cyanophenyl)benzamide (P16)



Known compound,^[7] white solid, mp: 168-170 °C, purified by silica gel chromatography (petroleum ether / ethyl acetate = 5:1). 80% yield, 90 mg. ¹H NMR (400 MHz, DMSO-*d*₆): δ 10.65 (s, 1H), 8.00 (d, *J* = 6.0 Hz, 2H), 7.97 (d, *J* = 4.0 Hz, 2H), 7.81 (d, *J* = 4.0 Hz,

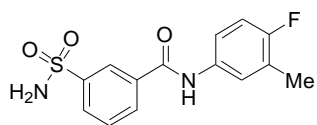
2H), 7.62-7.65 (m, 1H), 7.54-7.58 (m, 2H). ¹³C NMR (100 MHz, DMSO-*d*₆): δ 166.6, 143.9, 134.8, 133.6, 132.5, 128.9, 128.3, 120.6, 119.5, 105.8.

N-(2-Chloro-4-trifluoromethoxy-phenyl)-4-hydroxy-3-methoxy-benzamide (P17)



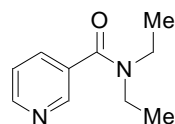
White solid, mp: 149-150 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 10:1), 71% yield, 128 mg. ¹H NMR (400 MHz, DMSO-*d*₆): δ 9.92 (s, 1H), 9.80 (s, 1H), 7.71 (d, *J* = 2.0 Hz, 2H), 7.56 (s, 1H), 7.52 (d, *J* = 4.0 Hz, 1H), 7.44 (d, *J* = 4.0 Hz, 1H), 6.89 (d, *J* = 4.0 Hz, 1H), 3.85 (s, 3H). ¹³C NMR (100 MHz, DMSO-*d*₆): δ 165.5, 150.8, 147.8, 146.1, 135.5, 130.8, 129.9, 124.8, 123.0, 121.7, 120.8, 115.4, 112.2, 56.2. HRMS: [M+Na]⁺ calcd for C₁₅H₁₁NO₄F₃ClNa 384.0221, found 384.0224.

N-(4-Fluoro-3-methyl-phenyl)-3-sulfamoyl-benzamide (P18)



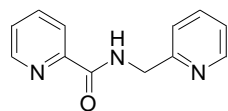
White solid, mp: 191-193 °C, purified by silica gel chromatography (dichloromethane/methanol = 15:1), 99% yield, 154 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 10.49 (s, 1H), 8.38 (s, 1H), 8.17 (d, *J* = 3.0 Hz, 1H), 8.03 (d, *J* = 3.0 Hz, 1H), 7.73-7.76 (m, 1H), 7.69 (d, *J* = 3.0 Hz, 1H), 7.60 (s, 1H), 7.51 (s, 2H), 7.13-7.16 (m, 1H), 2.25 (s, 3H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 164.7, 158.4, 156.8, 145.0, 136.0, 135.3 (d, *J*_{C-F} = 3.0 Hz), 130.4 (d, *J*_{C-F} = 210.0 Hz), 128.9, 125.5, 124.6 (d, *J*_{C-F} = 18.0 Hz), 124.1 (d, *J*_{C-F} = 4.5 Hz), 120.3 (d, *J*_{C-F} = 7.5 Hz), 115.4 (d, *J*_{C-F} = 24.0 Hz), 14.8 (d, *J*_{C-F} = 3.0 Hz). HRMS: [M+Na]⁺ calcd for C₁₄H₁₃FN₂O₃SNa 331.0523, found 331.0522.

N,N-Diethyl-nicotinamide (P19)



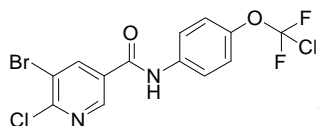
Known compound,^[8] light yellow oil, purified by silica gel chromatography (dichloromethane/methanol = 40:1), 65% yield, 59 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 8.64 (d, *J* = 3.0 Hz, 1H), 8.57 (s, 1H), 7.80 (d, *J* = 3.0 Hz, 1H), 7.46-7.48 (m, 1H), 3.46 (d, *J* = 3.0 Hz, 2H), 3.19 (d, *J* = 3.0 Hz, 2H), 1.16 (s, 3H), 1.06 (s, 3H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 168.1, 150.48, 147.2, 134.4, 133.5, 124.0, 43.4, 39.3, 14.5, 13.3.

Pyridine-2-carboxylic acid (pyridin-2-ylmethyl)-amide (P20)



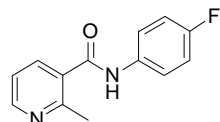
Known compound,^[9] light yellow oil, purified by silica gel chromatography (dichloromethane/methanol = 40:1), 61% yield, 65 mg. ¹H NMR (400 MHz, DMSO-*d*₆): δ 9.39-9.41 (m, 1H), 8.70 (d, *J* = 2.0 Hz, 1H), 8.54 (d, *J* = 2.0 Hz, 1H), 8.08 (d, *J* = 4.0 Hz, 1H), 8.00-8.05 (m, 1H), 7.74-7.78 (m, 1H), 7.62-7.66 (m, 1H), 7.33 (d, *J* = 4.0 Hz, 1H), 7.26-7.29 (m, 1H), 4.64 (d, *J* = 2.0 Hz, 2H). ¹³C NMR (100 MHz, DMSO-*d*₆): δ 164.5, 158.4, 150.2, 149.3, 149.0, 138.3, 137.20, 127.1, 122.6, 122.4, 121.45, 44.6.

5-Bromo-6-chloro-N-[4-(chloro-difluoro-methoxy)-phenyl]-nicotinamide (P21)



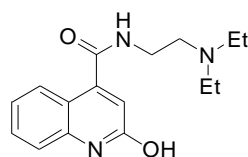
White solid, mp: 185-187 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 5:1), 75% yield, 155 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 10.68 (s, 1H), 8.93 (s, 1H), 8.73 (s, 1H), 7.87 (d, *J* = 6.0 Hz, 2H), 7.39 (d, *J* = 6.0 Hz, 2H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 162.3, 152.4, 148.3, 145.9, 142.2, 138.2, 131.4, 125.4 (t, *J*_{C-F} = 285 Hz), 122.4, 122.2, 119.7. HRMS: [M-H]⁻ calcd for C₁₃H₆N₂O₂F₂Cl₂Br 408.8963, found 408.8959.

N-(4-Fluoro-phenyl)-2-methyl-nicotinamide (P22)



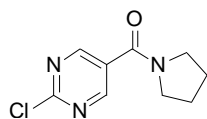
White solid, mp: 162-164 °C, purified by silica gel chromatography (dichloromethane/methanol = 10:1), 92% yield, 107 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 10.52 (s, 1H), 8.57 (d, *J* = 6.0 Hz, 1H), 7.88 (d, *J* = 3.0 Hz, 1H), 7.75-7.77 (m, 2H), 7.34-7.37 (m, 1H), 7.19-7.22 (m, 2H), 2.57 (s, 3H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 166.97, 158.82 (d, *J*_{C-F} = 238.5), 155.5, 150.3, 135.9 (d, *J*_{C-F} = 3.0 Hz), 135.6, 132.6, 123.0 (d, *J*_{C-F} = 7.5 Hz), 121.4, 115.8 (d, *J*_{C-F} = 22.5 Hz), 23.0. HRMS: [M+H]⁺ calcd for C₁₃H₁₂FN₂O 231.0928, found 231.0930.

2-Hydroxy-quinoline-4-carboxylic acid (2-diethylamino-ethyl)-amide (P23)



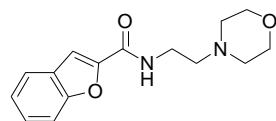
White solid, mp: 270-272 °C, precipitated by ethyl acetate, 99% yield, 143 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 11.94 (s, 1H), 8.64-8.65 (m, 1H), 7.79 (d, *J* = 3.0 Hz, 1H), 7.52-7.54 (m, 1H), 7.35 (d, *J* = 3.0 Hz, 1H), 7.17-7.20 (m, 1H), 6.47 (s, 1H), 3.34-3.36 (m, 4H), 2.53-2.58 (m, 4H), 0.97-0.99 (m, 6H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 166.1, 161.8, 147.1, 139.7, 131.2, 126.6, 122.4, 119.9, 116.7, 116.1, 51.9, 47.0, 37.7, 12.4. HRMS: [M+H]⁺ calcd for C₁₆H₂₂N₃O₂ 288.1707, found 288.1703.

(2-Chloro-pyrimidin-5-yl)-pyrrolidin-1-yl-methanone (P24)



White solid, mp: 113-115 °C, purified by silica gel chromatography (dichloromethane/methanol = 50:1), 73% yield, 77 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 8.96 (s, 2H), 3.47-3.50 (m, 4H), 1.83-1.89 (m, 4H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ = 163.1, 160.9, 159.3, 130.3, 48.9, 46.7, 26.4, 24.4. HRMS: [M+H]⁺ calcd for C₉H₁₁ClN₃O 212.0585, found 212.0584.

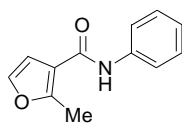
Benzofuran-2-carboxylic acid (2-morpholin-4-yl-ethyl)-amide (P25)



Known compound,^[10] white solid, mp: 82-84 °C, purified by silica gel chromatography (dichloromethane/methanol = 40:1), 98% yield, 135 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 8.63-8.65 (m, 1H), 7.78 (d, *J* = 3.0 Hz, 1H), 7.67 (d, *J* = 3.0 Hz, 1H), 7.53 (s, 1H), 7.46-7.48 (m, 1H), 7.33-7.35 (m, 1H), 3.57-3.58 (m, 4H), 3.40-3.43 (m, 2H), 2.48-2.49 (m, 2H),

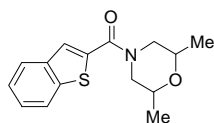
2.42 (s, 4H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 158.5, 154.6, 149.7, 127.7, 127.2, 124.2, 123.2, 112.2, 109.8, 66.7, 57.7, 53.7, 36.4.

2-Methyl-furan-3-carboxylic acid phenylamide (P26)



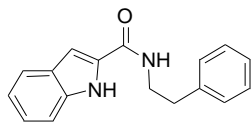
Known compound,^[1] white solid, mp: 108-110 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 15:1), 91% yield, 96 mg. ¹H NMR (400 MHz, DMSO-*d*₆): δ 9.70 (s, 1H), 7.72 (d, *J* = 2.0 Hz, 2H), 7.60 (s, 1H), 7.32-7.34 (m, 2H), 7.09 (d, *J* = 2.0 Hz, 2H), 2.56 (s, 3H). ¹³C NMR (100 MHz, DMSO-*d*₆): δ 162.2, 157.3, 141.2, 139.4, 129.0, 124.0, 120.9, 116.5, 109.9, 13.8.

Benzo[b]thiophen-2-yl-(2,6-dimethyl-morpholin-4-yl)-methanone (P27)



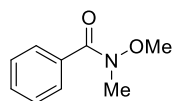
White solid, mp: 128-130 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 10:1), 91% yield, 125 mg. ¹H NMR (600 MHz, CDCl₃): δ 7.84-7.87 (m, 1H), 7.81-7.83 (m, 1H), 7.47 (s, 1H), 7.39-7.43 (m, 2H), 3.99-4.65 (m, 2H), 3.64 (s, 2H), 2.53-3.01 (m, 2H), 1.21 (s, 6H). ¹³C NMR (150 MHz, CDCl₃): δ 163.7, 140.2, 138.6, 136.4, 125.9, 125.4, 124.9, 124.6, 122.4, 72.0, 18.7. HRMS: [M+Na]⁺ calcd for C₁₅H₁₇NO₂SNa 298.0872, found 298.0874.

1H-Indole-2-carboxylic acid phenethyl-amide (P28)



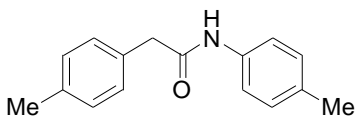
Light yellow solid, mp: 218-220 °C, purified by silica gel chromatography (dichloromethane/methanol = 20:1), 80% yield, 106 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 11.57 (s, 1H), 8.58-8.60 (m, 1H), 7.61 (d, *J* = 3.0 Hz, 1H), 7.43 (d, *J* = 3.0 Hz, 1H), 7.29-7.31 (m, 2H), 7.27 (d, *J* = 3.0 Hz, 2H), 7.16-7.21 (m, 2H), 7.10 (s, 1H), 7.02-7.04 (m, 1H), 3.51-3.54 (m, 2H), 2.86-2.89 (m, 2H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 161.5, 140.0, 136.8, 132.3, 129.2, 128.8, 127.6, 126.6, 123.7, 121.9, 120.1, 112.8, 102.7, 40.9, 35.7. HRMS: [M-H]⁻ calcd for C₁₇H₁₅N₂O 263.1190, found 263.1191.

N-methoxy-N-methylbenzamide (P29)



Known compound, ^[1] colorless oil, purified by silica gel chromatography (petroleum ether / ethyl acetate = 15:1). 91% yield, 75 mg. ¹H NMR (400 MHz, DMSO-*d*₆): δ 7.56-7.59 (m, 2H), 7.42-7.52 (m, 3H), 3.54 (s, 3H), 3.25 (s, 3H). ¹³C NMR (100 MHz, DMSO-*d*₆): δ 169.6, 134.9, 130.8, 128.5, 128.0, 61.1, 33.7.

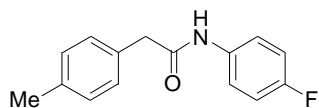
2,N-Di-p-tolyl-acetamide (P30)



Known compound,^[12] white solid, mp: 184-186 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 5:1), 99% yield, 119 mg. ¹H NMR (400 MHz, DMSO-*d*₆): δ 10.03 (s, 1H), 7.47 (d, *J* = 4.0 Hz, 2H), 7.21 (d, *J* = 2.0 Hz, 2H), 7.12 (d, *J* = 4.0 Hz, 2H), 7.09 (d, *J* = 2.0 Hz, 2H), 3.55 (s, 2H), 2.27 (s, 3H), 2.23 (s, 3H). ¹³C NMR (100 MHz,

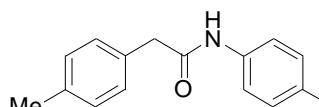
DMSO-*d*₆): δ 169.5, 137.2, 136.0, 133.5, 132.5, 129.5, 129.4, 129.3, 119.6, 43.4, 21.1, 20.9.

N-(4-Fluoro-phenyl)-2-p-tolyl-acetamide (P31)



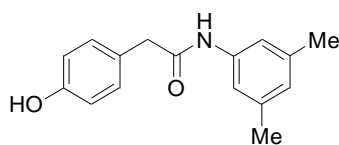
White solid, mp: 155-157 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 3:1), 99% yield, 121 mg. ¹H NMR (400 MHz, DMSO-*d*₆): δ 10.19 (s, 1H), 7.60-7.62 (m, 2H), 7.22 (d, *J* = 2.0 Hz, 2H), 7.12-7.15 (m, 4H), 3.57 (s, 2H), 2.27 (s, 3H). ¹³C NMR (100 MHz, DMSO-*d*₆): δ 169.6, 158.4 (d, *J*_{C-F} = 238.0 Hz), 136.1 (d, *J*_{C-F} = 2.0 Hz), 136.0, 133.3, 129.4 (d, *J*_{C-F} = 7.0 Hz), 121.3 (d, *J*_{C-F} = 8 Hz), 115.8, 115.6, 43.3, 21.1. HRMS: [M+Na]⁺ calcd for C₁₅H₁₄FNONa 266.0952, found 266.0949.

N-(4-Methoxy-phenyl)-2-p-tolyl-acetamide (P32)



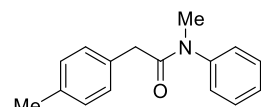
Light purple solid, mp: 171-173 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 8:1), 99% yield, 127 mg. ¹H NMR (400 MHz, DMSO-*d*₆): δ 9.89 (s, 1H), 7.49 (d, *J* = 4.0 Hz, 2H), 7.21 (d, *J* = 2.0 Hz, 2H), 7.12 (d, *J* = 4.0 Hz, 2H), 6.86 (d, *J* = 4.0 Hz, 2H), 3.70 (s, 3H), 3.54 (s, 2H), 2.27 (s, 3H). ¹³C NMR (100 MHz, DMSO-*d*₆): δ 169.2, 155.6, 135.9, 133.5, 132.9, 129.4, 129.3, 121.1, 114.3, 55.6, 43.3, 21.1. HRMS: [M-H]⁻ calcd for C₁₆H₁₆NO₂ 254.1187, found 254.1184.

N-(3,5-Dimethyl-phenyl)-2-(4-hydroxy-phenyl)-acetamide (P33)



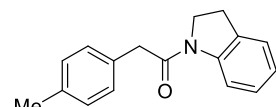
White solid, mp: 189-191 °C, purified by silica gel chromatography (dichloromethane/methanol = 50:1), 83% yield, 106 mg. ¹H NMR (400 MHz, DMSO-*d*₆): δ 9.89 (s, 1H), 9.25 (s, 1H), 7.21 (s, 2H), 7.11 (d, *J* = 4.0 Hz, 2H), 6.67-6.71 (m, 3H), 3.46 (s, 2H), 2.21 (s, 6H). ¹³C NMR (100 MHz, DMSO-*d*₆): δ 170.0, 156.5, 139.6, 138.1, 130.4, 126.7, 125.1, 117.3, 115.5, 43.1, 21.5. HRMS: [M-H]⁻ calcd for C₁₆H₁₆NO₂ 254.1187, found 254.1185.

N-methyl-N-phenyl-2-(p-tolyl)acetamide (P34)



Light yellow oil, purified by silica gel chromatography (petroleum ether/ethyl acetate = 8:1), 90% yield, 108 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 7.35 (d, *J* = 6.0 Hz, 2H), 7.38 (s, 1H), 7.04 (d, *J* = 3.0 Hz, 2H), 6.90 (s, 2H), 3.34 (s, 3H), 3.17 (s, 2H), 2.25 (s, 3H). ¹³C NMR (151 MHz, DMSO): δ 170.3, 144.4, 135.7, 133.2, 130.1, 129.4, 129.1, 128.0, 117.4, 40.5, 37.5, 21.1. HRMS: [M+H]⁺ calcd for C₁₆H₁₈NO 240.1383, found 240.1373.

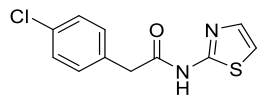
1-(Indolin-1-yl)-2-(p-tolyl)ethan-1-one (P35)



White solid, mp: 115-117 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 8:1), 93% yield, 117 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 8.06 (d, *J* = 3.0 Hz, 1H), 7.22 (d, *J* = 3.0 Hz, 1H), 7.17 (d, *J* = 3.0 Hz, 2H), 7.13 (d, *J* = 6.0 Hz, 3H), 6.97-

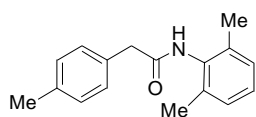
6.99 (m, 1H), 4.11-4.14 (m, 2H), 3.78 (s, 2H), 3.11-3.14 (m, 2H), 2.28 (s, 3H). ^{13}C NMR (150 MHz, DMSO- d_6): δ 169.7, 143.5, 136.0, 132.5, 132.2, 129.8, 129.3, 127.4, 125.3, 123.7, 116.4, 48.1, 42.3, 27.9, 21.1. HRMS: $[\text{M}+\text{Na}]^+$ $\text{C}_{17}\text{H}_{17}\text{NONa}$ calcd for 274.1202, found 274.1200.

2-(4-chlorophenyl)-N-(thiazol-2-yl)acetamide (P36)



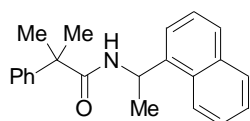
White solid, mp: 189-191 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 2:1), 51% yield, 65 mg. ^1H NMR (600 MHz, DMSO- d_6): δ 12.39 (s, 1H), 7.48 (d, J = 1.5 Hz, 1H), 7.40 (d, J = 6.0 Hz, 2H), 7.36 (d, J = 3.0 Hz, 2H), 7.22 (d, J = 3.0 Hz, 1H), 3.78 (s, 2H). ^{13}C NMR (150 MHz, DMSO- d_6): δ 169.3, 158.4, 138.1, 134.4, 132.0, 131.6, 128.8, 114.0, 41.3. HRMS: $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{11}\text{H}_9\text{ClN}_2\text{OSNa}$ 275.0016, found 275.0015.

N-(2,6-Dimethyl-phenyl)-2-p-tolyl-acetamide (P37)



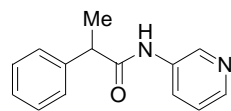
White solid, mp: 184-186 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 5:1), 61% yield, 78 mg. ^1H NMR (400 MHz, DMSO- d_6): δ 9.41 (s, 1H), 7.26 (d, J = 2.0 Hz, 2H), 7.14 (d, J = 4.0 Hz, 2H), 7.03-7.05 (m, 3H), 3.58 (s, 2H), 2.28 (s, 3H), 2.07 (s, 6H). ^{13}C NMR (100 MHz, DMSO- d_6): δ 169.3, 135.9, 135.6, 135.6, 133.8, 129.4, 129.3, 128.1, 126.8, 42.6, 21.1, 18.5. HRMS: $[\text{M}-\text{H}]^-$ calcd for $\text{C}_{17}\text{H}_{18}\text{NO}$ 252.1394, found 252.1394.

N-(1-Naphthalen-1-yl-ethyl)-2-phenyl-isobutyramide (P38)



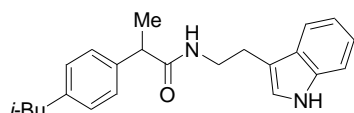
White solid, mp: 108-110 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 3:1), 96% yield, 152 mg. ^1H NMR (600 MHz, DMSO- d_6): δ 8.09 (d, J = 3.0 Hz, 1H), 7.91 (d, J = 6.0 Hz, 1H), 7.83 (d, J = 6.0 Hz, 1H), 7.79 (d, J = 3.0 Hz, 1H), 7.50-7.56 (m, 2H), 7.38-7.41 (m, 1H), 7.35 (d, J = 3.0 Hz, 1H), 7.26-7.29 (m, 4H), 7.18-7.21 (m, 1H), 5.72-5.77 (m, 1H), 1.49 (s, 3H), 1.44 (d, J = 6.0 Hz, 6H). ^{13}C NMR (150 MHz, DMSO- d_6): δ 175.1, 146.7, 140.8, 133.7, 130.9, 129.0, 128.5, 127.6, 126.6, 126.5, 126.3, 126.0, 125.7, 123.7, 122.9, 46.5, 44.82, 27.6, 27.1, 21.5. HRMS: $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{22}\text{H}_{23}\text{NONa}$ 340.1672, found 340.1671.

2-Phenyl-N-pyridin-3-yl-propionamide (P39)



White solid, mp: 100-102 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 1:1), 48% yield, 54 mg. ^1H NMR (400 MHz, DMSO- d_6): δ 10.30 (s, 1H), 8.75 (d, J = 2.0 Hz, 1H), 8.25 (d, J = 2.0 Hz, 1H), 8.05 (d, J = 2.0 Hz, 1H), 7.40 (d, J = 2.0 Hz, 2H), 7.31-7.35 (m, 3H), 7.24-7.26 (m, 1H), 3.84-3.88 (m, 1H), 1.44 (d, J = 2.0 Hz, 3H). ^{13}C NMR (100 MHz, DMSO- d_6): δ 173.2, 144.6, 142.0, 141.2, 136.3, 128.9, 127.7, 127.3, 126.5, 124.1, 46.4, 19.1. HRMS: $[\text{M}-\text{H}]^-$ calcd for $\text{C}_{14}\text{H}_{13}\text{N}_2\text{O}$ 225.1033, found 225.1032.

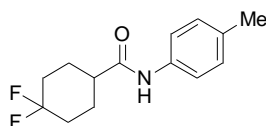
N-[2-(1H-Indol-3-yl)-ethyl]-2-(4-isobutyl-phenyl)-propionamide (P40)



Light brown solid, mp: 99-101 °C, purified by silica gel

chromatography (petroleum ether/ethyl acetate = 10:1), 80% yield, 140 mg. ^1H NMR (400 MHz, DMSO- d_6): δ 10.78 (s, 1H), 8.01-8.04 (m, 1H), 7.50 (d, $J = 4.0$ Hz, 1H), 7.32 (d, $J = 4.0$ Hz, 1H), 7.21 (d, $J = 4.0$ Hz, 2H), 7.04-7.08 (m, 4H), 6.94-6.97 (m, 1H), 3.51-3.57 (m, 1H), 3.29-3.32 (m, 2H), 2.76-2.79 (m, 2H), 2.40 (d, $J = 4.0$ Hz, 2H), 1.77-1.84 (m, 1H), 1.31 (d, $J = 2.0$ Hz, 3H), 0.85 (d, $J = 4.0$ Hz, 6H). ^{13}C NMR (100 MHz, DMSO- d_6): δ 173.7, 140.1, 139.6, 136.7, 129.2, 127.7, 127.4, 123.1, 121.3, 118.7, 118.6, 112.2, 111.8, 45.2, 44.7, 30.1, 25.6, 22.7, 19.1. HRMS: $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{23}\text{H}_{28}\text{N}_2\text{ONa}$ 371.2094, found 371.2094.

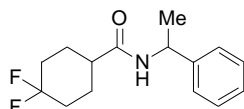
4,4-Difluoro-cyclohexanecarboxylic acid p-tolylamide (P41)



White solid, mp: 164-166 °C, purified by silica gel chromatography

(petroleum ether/ethyl acetate = 5:1), 99% yield, 126 mg. ^1H NMR (400 MHz, DMSO- d_6): δ 9.85 (s, 1H), 7.48 (d, $J = 2.0$ Hz, 2H), 7.09 (d, $J = 2.0$ Hz, 2H), 2.43-2.47 (m, 1H), 2.24 (s, 3H), 2.07-2.12 (m, 3H), 1.81-1.90 (m, 4H), 1.67-1.71 (m, 2H). ^{13}C NMR (100 MHz, DMSO- d_6): δ 173.0 (d, $J_{\text{C-F}} = 2.0$ Hz), 137.2, 132.4, 129.5, 124.1 (dd, $J_{\text{C-F}} = 238.0, 240.0$ Hz), 119.6, 42.4, 33.0, 32.7 (dd, $J_{\text{C-F}} = 23.0, 25.0$ Hz), 26.1 (d, $J_{\text{C-F}} = 9.0$ Hz), 20.9. HRMS: $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{14}\text{H}_{17}\text{F}_2\text{NONa}$ 276.1170, found 276.1175.

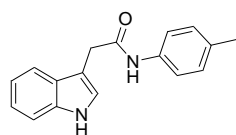
4,4-Difluoro-cyclohexanecarboxylic acid (1-phenyl-ethyl)-amide (P42)



White solid, mp: 137-139 °C, purified by silica gel chromatography

(petroleum ether/ethyl acetate = 3:1), 78% yield, 105 mg. ^1H NMR (600 MHz, DMSO- d_6): δ 8.30 (d, $J = 6.0$ Hz, 1H), 7.28-7.31 (m, 4H), 7.20-7.22 (m, 1H), 4.87-4.92 (m, 1H), 2.30-2.34 (m, 1H), 2.02-2.06 (m, 2H), 1.76-1.81 (m, 4H), 1.54-1.63 (m, 2H), 1.33 (d, $J = 3.0$ Hz, 3H). ^{13}C NMR (150 MHz, DMSO- d_6): δ 173.3, 145.4, 128.7, 127.0, 126.3, 124.2 (t, $J_{\text{C-F}} = 159.0$ Hz), 48.0, 41.4, 32.8 (t, $J_{\text{C-F}} = 24$ Hz), 32.7 (t, $J_{\text{C-F}} = 22.5$ Hz), 26.0 (dd, $J_{\text{C-F}} = 9.0$ Hz, 34.5 Hz), 23.0. HRMS: $[\text{M}-\text{H}]^-$ $\text{C}_{15}\text{H}_{18}\text{F}_2\text{NO}$ 266.1362, found 266.1363.

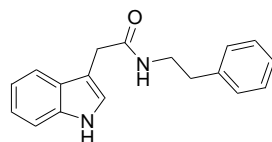
2-(1H-Indol-3-yl)-N-p-tolyl-acetamide (P43)



Known compound,^[13] yellow solid, mp: 193-195 °C, purified by silica gel

chromatography (petroleum ether/ethyl acetate = 5:1), 97% yield, 131 mg. ^1H NMR (400 MHz, DMSO- d_6): δ 10.91 (s, 1H), 10.00 (s, 1H), 7.61 (d, $J = 2.0$ Hz, 1H), 7.49 (d, $J = 2.0$ Hz, 2H), 7.35 (d, $J = 4.0$ Hz, 1H), 7.25 (s, 1H), 7.06-7.09 (m, 3H), 6.97-6.99 (m, 3H), 3.70 (s, 2H), 2.23 (s, 3H). ^{13}C NMR (100 MHz, DMSO): δ 169.9, 137.4, 136.6, 132.4, 129.5, 127.7, 124.3, 121.4, 119.6, 119.2, 118.8, 111.8, 109.12, 34.2, 20.9.

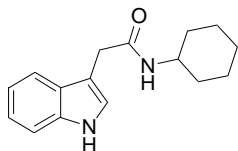
2-(1H-Indol-3-yl)-N-phenethyl-acetamide (P44)



Light yellow oil, purified by silica gel chromatography

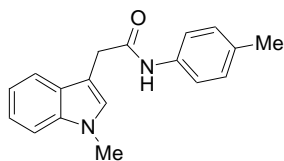
(dichloromethane/methanol = 100:1), 96% yield, 134 mg. ^1H NMR (600 MHz, $\text{DMSO-}d_6$): δ 10.86 (s, 1H), 7.90 (d, $J = 3.0$ Hz, 1H), 7.51 (d, $J = 3.0$ Hz, 1H), 7.34 (d, $J = 6.0$ Hz, 1H), 7.23-7.26 (m, 2H), 7.17-7.19 (m, 1H), 7.14 (d, $J = 6.0$ Hz, 3H), 7.05-7.08 (m, 1H), 6.95-6.98 (m, 1H), 3.48 (s, 2H), 3.25-3.29 (m, 2H), 2.67-2.70 (m, 2H). ^{13}C NMR (150 MHz, $\text{DMSO-}d_6$): δ 171.1, 140.0, 136.6, 129.1, 128.7, 127.7, 126.5, 124.3, 121.4, 119.2, 118.7, 111.7, 109.3, 40.8, 35.6, 33.2. HRMS: $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{18}\text{H}_{19}\text{N}_2\text{O}$ 279.1492, found 279.1498.

N-Cyclohexyl-2-(1H-indol-3-yl)-acetamide (P45)



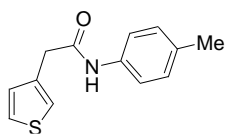
Light pink solid, mp: 159-161 °C, purified by silica gel chromatography (dichloromethane/methanol = 100:1), 83% yield, 107 mg. ^1H NMR (600 MHz, $\text{DMSO-}d_6$): δ 10.81 (s, 1H), 7.78 (d, $J = 3.0$ Hz, 1H), 7.56 (d, $J = 3.0$ Hz, 1H), 7.34 (d, $J = 3.0$ Hz, 1H), 7.16 (s, 1H), 7.05-7.07 (m, 1H), 6.95-6.98 (m, 1H), 3.52-3.55 (m, 1H), 3.47 (s, 2H), 1.72 (d, $J = 6.0$ Hz, 2H), 1.66 (d, $J = 6.0$ Hz, 2H), 1.54 (d, $J = 6.0$ Hz, 1H), 1.21-1.27 (m, 2H), 1.11-1.18 (m, 3H). ^{13}C NMR (150 MHz, $\text{DMSO-}d_6$): δ 170.1, 136.6, 127.7, 124.0, 121.3, 119.2, 118.7, 111.7, 109.7, 48.0, 33.3, 33.0, 25.7, 25.0. HRMS: $[\text{M}-\text{H}]^-$ calcd for $\text{C}_{16}\text{H}_{19}\text{N}_2\text{O}$ 255.1503, found 255.1506.

2-(1-Methyl-1H-indol-3-yl)-N-p-tolyl-acetamide (P46)



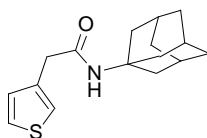
White solid, mp: 145-147 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 5:1), 95% yield, 132 mg. ^1H NMR (400 MHz, $\text{DMSO-}d_6$): δ 10.02 (s, 1H), 7.62 (d, $J = 2.0$ Hz, 1H), 7.49 (d, $J = 2.0$ Hz, 2H), 7.39 (d, $J = 2.0$ Hz, 1H), 7.23 (s, 1H), 7.12-7.15 (m, 1H), 7.08 (d, $J = 4.0$ Hz, 2H), 7.01-7.03 (m, 1H), 3.75 (s, 3H), 3.70 (s, 2H), 2.23 (s, 3H). ^{13}C NMR (100 MHz, $\text{DMSO-}d_6$): δ 169.8, 137.3, 137.0, 132.4, 129.5, 128.6, 128.0, 121.6, 119.6, 119.4, 118.9, 110.0, 108.4, 34.0, 32.7, 20.9. HRMS: $[\text{M}-\text{H}]^-$ calcd for $\text{C}_{18}\text{H}_{17}\text{N}_2\text{O}$ 277.1346, found 277.1345.

2-Thiophen-3-yl-N-p-tolyl-acetamide (P47)



Gray solid, mp: 136-138 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 10:1), 99% yield, 115 mg. ^1H NMR (600 MHz, $\text{DMSO-}d_6$): δ 10.04 (s, 1H), 7.48 (d, $J = 3.0$ Hz, 3H), 7.31 (s, 1H), 7.10 (d, $J = 3.0$ Hz, 3H), 3.63 (s, 2H), 2.24 (s, 3H). ^{13}C NMR (150 MHz, $\text{DMSO-}d_6$): δ 168.9, 137.2, 136.2, 132.6, 129.5, 129.2, 126.2, 122.9, 119.6, 38.5, 20.9. HRMS: $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{13}\text{H}_{13}\text{NOS}$ 254.0610, found 254.0614.

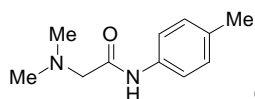
N-(adamantan-1-yl)-2-(thiophen-3-yl)acetamide (P48)



Light yellow solid, mp: 147-149 °C, purified by silica gel chromatography

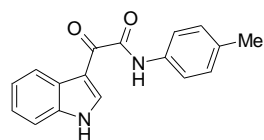
(petroleum ether/ethyl acetate = 8:1), 62% yield, 86 mg. $^1\text{H NMR}$ (600 MHz, $\text{DMSO-}d_6$): δ 7.59 (s, 1H), 7.33 (d, $J = 3.0$ Hz, 1H), 6.92-6.94 (m, 1H), 6.86 (d, $J = 1.5$ Hz, 1H), 3.56 (s, 2H), 2.00 (s, 3H), 1.91 (s, 6H), 1.61 (s, 6H). $^{13}\text{C NMR}$ (150 MHz, $\text{DMSO-}d_6$): δ 168.7, 138.9, 126.9, 126.1, 125.1, 51.2, 41.4, 37.9, 36.5, 29.2. HRMS: $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{16}\text{H}_{22}\text{NOS}$ 276.1417, found 276.1413.

2-Dimethylamino-N-p-tolyl-acetamide (P49)



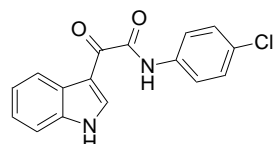
Colorless oil, purified by silica gel chromatography (petroleum ether/ethyl acetate = 2:1), 96% yield, 92 mg. $^1\text{H NMR}$ (600 MHz, $\text{DMSO-}d_6$): δ 9.60 (s, 1H), 7.53 (d, $J = 3.0$ Hz, 2H), 7.10 (d, $J = 3.0$ Hz, 2H), 3.03 (s, 2H), 2.26 (s, 6H), 2.24 (s, 3H). $^{13}\text{C NMR}$ (150 MHz, $\text{DMSO-}d_6$): δ 168.8, 136.6, 132.7, 129.5, 119.9, 63.7, 45.8, 20.9. HRMS: $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{11}\text{H}_{16}\text{N}_2\text{ONa}$ 215.1155, found 215.1156.

2-(1H-Indol-3-yl)-2-oxo-N-p-tolyl-acetamide (P50)



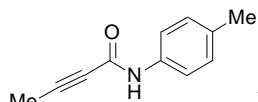
Known compound,^[14] light brown solid, mp: 254-256 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 8:1), 75% yield, 105 mg. $^1\text{H NMR}$ (400 MHz, $\text{DMSO-}d_6$): δ 12.34 (s, 1H), 10.59 (s, 1H), 8.77 (s, 1H), 8.28-8.30 (m, 1H), 7.75 (d, $J = 4.0$ Hz, 2H), 7.55-7.58 (m, 1H), 7.29-7.31 (m, 2H), 7.18 (d, $J = 4.0$ Hz, 2H), 2.29 (s, 3H). $^{13}\text{C NMR}$ (100 MHz, $\text{DMSO-}d_6$): δ 182.5, 162.6, 139.0, 136.8, 136.0, 133.7, 129.6, 126.6, 124.0, 123.2, 121.7, 120.7, 113.1, 112.4, 21.0.

N-(4-Chloro-phenyl)-2-(1H-indol-3-yl)-2-oxo-acetamide (P51)



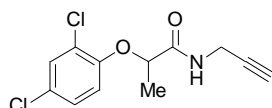
Known compound,^[15] light green solid, mp: 268-270 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 5:1), 50% yield, 76 mg. $^1\text{H NMR}$ (400 MHz, $\text{DMSO-}d_6$): δ 12.36 (s, 1H), 10.85 (s, 1H), 8.76 (s, 1H), 8.28-8.30 (m, 1H), 7.91 (d, $J = 4.0$ Hz, 2H), 7.56-7.59 (m, 1H), 7.45 (d, $J = 4.0$ Hz, 2H), 7.28-7.32 (m, 2H). $^{13}\text{C NMR}$ (100 MHz, $\text{DMSO-}d_6$): δ 182.1, 162.8, 139.1, 137.5, 136.9, 129.1, 128.4, 126.6, 124.1, 123.2, 122.3, 121.7, 113.2, 112.4.

But-2-ynoic acid p-tolylamide (P52)



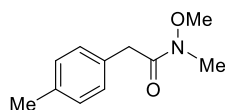
Light yellow solid, mp: 129-131 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 8:1), 86% yield, 75 mg. $^1\text{H NMR}$ (600 MHz, $\text{DMSO-}d_6$): δ 10.51 (s, 1H), 7.48 (d, $J = 3.0$ Hz, 2H), 7.11 (d, $J = 3.0$ Hz, 2H), 2.24 (s, 3H), 2.03 (s, 3H). $^{13}\text{C NMR}$ (150 MHz, $\text{DMSO-}d_6$): δ 150.8, 136.6, 133.3, 129.6, 119.9, 84.3, 76.5, 20.9, 3.7. HRMS: $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{11}\text{H}_{12}\text{NO}$ 174.0913, found 174.0915.

2-(2,4-Dichloro-phenoxy)-N-prop-2-ynyl-propionamide (P53)



White solid, mp: 106-107 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 10:1), 86% yield, 117 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 8.53-8.54 (m, 1H), 7.59 (d, *J* = 1.5 Hz, 1H), 7.34 (d, *J* = 6.0 Hz, 1H), 6.96 (d, *J* = 6.0 Hz, 1H), 4.76-4.79 (m, 1H), 3.87-3.89 (m, 2H), 3.10-3.11 (m, 1H), 1.45 (d, *J* = 3.0 Hz, 3H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 170.5, 152.4, 130.0, 128.5, 125.8, 123.7, 116.7, 81.2, 75.4, 73.5, 28.5, 18.9. HRMS: [M-H]⁻ calcd for C₁₂H₁₀Cl₂NO₂ 270.0094, found 270.0094.

N-methoxy-N-methyl-2-(p-tolyl)acetamide (P54)

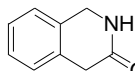


Known compound, ^[11] colorless oil, purified by silica gel chromatography (petroleum ether / ethyl acetate = 15:1). 87% yield, 84 mg. ¹H NMR (400 MHz, DMSO-*d*₆): δ 7.08-7.13 (m, 4H), 3.66 (s, 2H), 3.65 (s, 3H), 3.09 (s, 3H), 2.27 (s, 3H). ¹³C NMR (100 MHz, DMSO-*d*₆): δ 172.0, 135.9, 132.7, 129.7, 129.2, 61.6, 38.4, 32.3, 21.1.

2.3 General Procedure for Synthesis of lactams (P55-P57)

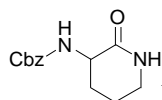
To a 10 mL tube were added substrate (0.5 mmol, 1.0 equiv.), (*o*-CF₃PhO)₃P (257 mg, 0.5 mmol, 1.0 equiv.) and CH₃CN (0.5 mL). The mixture was warmed to 80 °C in an oil bath and stirred for the indicated reaction time using magnetic stirring. Then, the solvent was concentrated under reduced pressure and the crude product was further purified by column chromatography on silica gel to give the pure product (P55-P57).

1,4-Dihydro-2H-isoquinolin-3-one (P55)



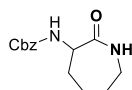
Light yellow solid, mp: 132-134 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 1:2), 82% yield, 60 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 7.99 (s, 1H), 7.19-7.26 (m, 4H), 4.32 (s, 2H), 3.43 (s, 2H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 170.9, 133.4, 133.2, 127.7, 127.4, 126.6, 125.8, 44.6, 37.3. HRMS: [M+H]⁺ C₉H₁₀NO calcd for 148.0757, found 148.0745.

(2-Oxo-piperidin-3-yl)-carbamic acid benzyl ester (P56)



White solid, mp: 88-90 °C, purified by silica gel chromatography (ethyl acetate), 99% yield, 123 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 7.53 (s, 1H), 7.36 (s, 5H), 7.31 (s, 1H), 5.02 (s, 2H), 3.89 (s, 1H), 3.10 (s, 2H), 1.95 (s, 1H), 1.66-1.77 (m, 3H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 170.3, 156.5, 137.6, 128.8, 128.2, 65.7, 51.2, 41.5, 28.3, 21.7. HRMS: [M+Na]⁺ calcd for C₁₃H₁₆N₂O₃Na 271.1053, found 271.1053.

(2-Oxo-azepan-3-yl)-carbamic acid benzyl ester (P57)



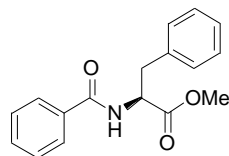
White solid, mp: 118-120 °C, purified by silica gel chromatography (petroleum

ether/ethyl acetate = 2:1), 73% yield, 96 mg. ¹H NMR (600 MHz, DMSO-*d*₆): δ 7.75-7.76 (m, 1H), 7.36 (d, *J* = 3.0 Hz, 4H), 7.30-7.32 (m, 1H), 7.00 (d, *J* = 3.0 Hz, 1H), 5.02 (s, 2H), 4.16-4.19 (m, 1H), 3.13-3.19 (m, 1H), 3.03-3.06 (m, 1H), 1.86-1.88 (m, 1H), 1.78 (d, *J* = 6.0 Hz, 1H), 1.71-1.74 (m, 1H), 1.59-1.66 (m, 1H), 1.39-1.46 (m, 1H), 1.16-1.22 (m, 1H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 174.6, 155.7, 137.6, 128.8, 128.2, 128.1, 65.7, 53.6, 41.0, 31.3, 29.3, 28.0. HRMS: [M+Na]⁺ calcd for C₁₄H₁₈N₂O₃Na 285.1210, found 285.1210.

2.4 General Procedure for Synthesis of amides containing chiral center (**P58-P62**)

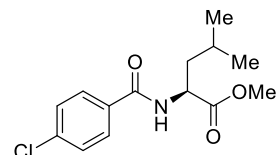
To a 10 mL tube were added amine (0.5 mmol, 1.0 equiv.), carboxylic acid (0.5 mmol, 1.0 equiv.), (*o*-CF₃PhO)₃P (257 mg, 0.5 mmol, 1.0 equiv.) and CH₃CN (0.5 mL). The mixture was warmed to 80 °C in an oil bath and stirred for the indicated reaction time using magnetic stirring. Then, the solvent was concentrated under reduced pressure and the crude product was further purified by column chromatography on silica gel to give the pure product (**P58-P62**). The er values of all compounds were determined by HPLC with a chiral column with Chirasil OD-H column (25 cm × 4.6 mm), Chirasil IC column (25 cm × 4.6 mm).

(*S*)-2-Benzoylamino-3-phenyl-propionic acid methyl ester (**P58**)



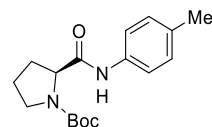
Known compound,^[17] white solid, mp: 79-81 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 8:1), 87% yield, 123 mg, > 99% er. ¹H NMR (400 MHz, DMSO-*d*₆): δ 8.88 (d, *J* = 2.0 Hz, 1H), 7.80 (d, *J* = 2.0 Hz, 2H), 7.52-7.55 (m, 1H), 7.45-7.47 (m, 2H), 7.31 (d, *J* = 4.0 Hz, 2H), 7.27-7.29 (m, 2H), 7.18-7.21 (m, 1H), 4.65-4.68 (m, 1H), 3.64 (s, 3H), 3.08-3.19 (m, 2H). ¹³C NMR (100 MHz, DMSO-*d*₆): δ 172.7, 166.9, 138.2, 134.1, 132.0, 129.5, 128.7, 128.7, 127.8, 126.9, 54.75, 52.4, 36.7.

Methyl-(4-chlorobenzoyl)-L-leucinate (**P59**)



White solid, mp: 85-87 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 10:1), 99% yield, 141 mg, > 99% er. ¹H NMR (600 MHz, DMSO-*d*₆): δ 8.83 (d, *J* = 3.0 Hz, 1H), 7.92 (d, *J* = 3.0 Hz, 2H), 7.57 (d, *J* = 3.0 Hz, 2H), 4.48-4.52 (m, 1H), 3.65 (s, 3H), 1.76-1.81 (m, 1H), 1.66-1.72 (m, 1H), 1.56-1.60 (m, 1H), 0.93 (d, *J* = 3.0 Hz, 3H), 0.88 (d, *J* = 6.0 Hz, 3H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 173.5, 166.0, 136.8, 132.9, 129.9, 128.9, 52.4, 51.5, 24.9, 23.3, 21.6. HRMS: [M+Na]⁺ calcd for C₁₄H₁₈ClNO₃Na 306.0867, found 306.0863.

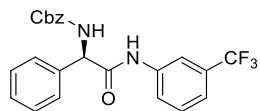
(*R*)-2-p-Tolylcarbamoyl-pyrrolidine-1-carboxylic acid tert-butyl ester (**P60**)



Known compound,^[18] white solid, mp: 166-168 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 8:1), 87% yield, 133 mg, > 99% er. ¹H NMR (600 MHz, DMSO-*d*₆): δ 9.87 (s, 1H), 7.49 (d, *J* = 3.0 Hz, 2H), 7.10 (d, *J* = 6.0 Hz, 2H), 4.17-4.24 (m,

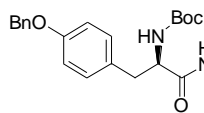
1H), 3.31-3.43 (m, 2H), 2.24 (s, 3H), 2.11-2.20 (m, 1H), 1.84-1.92 (m, 2H), 1.76-1.82 (m, 1H), 1.40 (s, 3H), 1.27 (s, 6H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 171.7, 153.6, 137.0, 132.5, 129.5, 119.7, 78.9, 60.8, 47.0, 31.5, 28.4, 23.9, 20.9.

(R)-[Phenyl-(3-trifluoromethyl-phenylcarbamoyl)-methyl]-carbamic acid benzyl ester (P61)



White solid, mp: 148-150 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 5:1), 90% yield, 193 mg, > 99% er. ¹H NMR (600 MHz, DMSO-*d*₆): δ 10.68 (s, 1H), 8.23 (d, *J* = 3.0 Hz, 1H), 8.10 (s, 1H), 7.80 (d, *J* = 3.0 Hz, 1H), 7.53-7.57 (m, 3H), 7.18-7.42 (m, 9H), 5.44 (d, *J* = 6.0 Hz, 1H), 5.09 (s, 2H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 170.0, 156.4, 140.0, 137.8, 137.3, 130.6, 130.0 (q, *J*_{C-F} = 63.0 Hz), 129.0, 128.8, 128.5, 128.3, 128.2, 128.0, 125.5 (d, *J*_{C-F} = 271.5 Hz), 123.2, 120.4, 115.7, 66.2, 59.6. HRMS: [M+Na]⁺ calcd for C₂₃H₁₉N₂O₃F₃Na 451.1240, found 451.1246.

(R)-[2-(4-Benzyloxy-phenyl)-1-(4-methoxy-phenylcarbamoyl)-ethyl]-carbamic acid tert-butyl ester (P62)

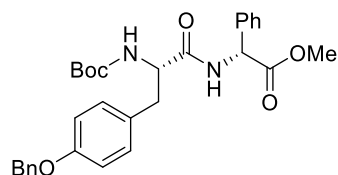


White solid, mp: 158-160 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 5:1), 70% yield, 167 mg, > 99% er. ¹H NMR (600 MHz, DMSO-*d*₆): δ 9.86 (s, 1H), 7.49 (d, *J* = 3.0 Hz, 2H), 7.43 (d, *J* = 6.0 Hz, 2H), 7.37-7.39 (m, 2H), 7.31-7.33 (m, 1H), 7.22 (d, *J* = 6.0 Hz, 2H), 7.02 (d, *J* = 3.0 Hz, 1H), 6.92 (d, *J* = 6.0 Hz, 2H), 6.89 (d, *J* = 3.0 Hz, 2H), 5.05 (s, 2H), 4.24 (s, 1H), 3.72 (s, 3H), 2.90-2.93 (m, 1H), 2.75-2.79 (m, 1H), 1.32 (s, 9H). ¹³C NMR (150 MHz, DMSO-*d*₆): δ 170.8, 157.4, 155.8, 155.7, 137.7, 132.5, 130.7, 130.6, 128.9, 128.2, 128.1, 121.3, 114.8, 114.3, 78.5, 69.6, 57.1, 55.6, 37.2, 28.6. HRMS: [M+Na]⁺ calcd for C₂₈H₃₂N₂O₅Na 499.2203, found 499.2201.

2.5 General Procedure for Synthesis of dipeptides (P63-P67)

To a 10 mL tube were added amine (0.5 mmol, 1.0 equiv.), carboxylic acid (0.5 mmol, 1.0 equiv.), (*o*-CF₃PhO)₃P (386 mg, 0.75 mmol, 1.0 equiv.) and CH₃CN (0.5 mL). The mixture was warmed to 100 °C in an oil bath and stirred for the indicated reaction time using magnetic stirring. Then, the solvent was concentrated under reduced pressure and the crude product was further purified by column chromatography on silica gel to give the pure product (P63-P67). The er values of all compounds were determined by HPLC with a chiral column with Chirasil OD-H column (25 cm × 4.6 mm), Chirasil IC column (25 cm × 4.6 mm).

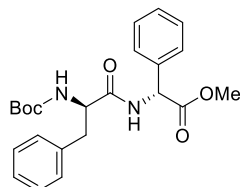
(R)-2-((S)-3-(4-(benzyloxy)phenyl)-2-((tert-butoxycarbonyl)amino)propanamido)-2-phenylacetate (P63)



White solid, mp: 104-106 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 2:1), 69% yield, 179 mg, 99% er. ¹H NMR (600 MHz, DMSO-*d*₆):

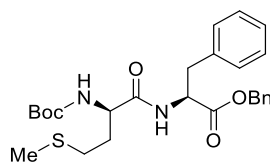
δ 8.72-8.79 (m, 1H), 7.37-7.44 (m, 9H), 7.31-7.33 (m, 1H), 7.21-7.26 (m, 2H), 6.90-6.93 (m, 2H), 5.42-5.47 (m, 1H), 5.06 (s, 2H), 4.17-4.27 (m, 1H), 3.63 (s, 3H), 2.90-2.96 (m, 1H), 2.67-2.71 (m, 1H), 1.29 (s, 9H). ^{13}C NMR (150 MHz, DMSO- d_6): δ 172.5, 171.4, 157.4, 155.8, 137.7, 136.5, 130.7, 130.7, 129.2, 128.9, 128.8, 128.2, 128.2, 128.1, 114.8, 78.5, 69.6, 56.7, 56.0, 52.8, 36.9, 28.6. HRMS: $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{30}\text{H}_{35}\text{N}_2\text{O}_6$ 519.2490, found 519.2485.

(2-tert-Butoxycarbonylamino-3-phenyl-propionylamino)-phenyl-acetic acid methyl ester (P64)



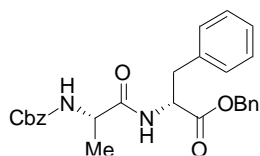
Known compound,^[19] white solid, mp: 150-152 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 5:1), 60% yield, 124 mg, 94% er. ^1H NMR (400 MHz, DMSO- d_6): δ 8.74-8.81 (m, 1H), 7.17-7.42 (m, 10H), 6.92-6.98 (m, 1H), 5.42-5.45 (m, 1H), 4.22-4.36 (m, 1H), 3.64 (d, J = 4.0 Hz, 3H), 2.87-3.03 (m, 1H), 2.67-2.77 (m, 1H), 1.28 (s, 9H). ^{13}C NMR (100 MHz, DMSO- d_6): δ 172.4, 171.4, 155.7, 138.6, 136.9, 129.7, 129.2, 128.8, 128.4, 127.9, 126.6, 78.5, 56.7, 55.8, 52.8, 37.8, 28.6.

2-(2-tert-Butoxycarbonylamino-4-methylsulfanyl-butrylamino)-3-phenyl-propionic acid benzyl ester (P65)



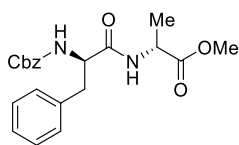
White solid, mp: 100-102 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 5:1), 75% yield, 182 mg, >99% er. ^1H NMR (400 MHz, DMSO- d_6): δ 8.28 (d, J = 4.0 Hz, 1H), 7.32-7.37 (m, 3H), 7.19-7.27 (m, 7H), 6.92 (d, J = 2.0 Hz, 1H), 5.02-5.10 (m, 2H), 4.51-4.56 (m, 1H), 3.97-4.05 (m, 1H), 2.95-3.07 (m, 2H), 2.33-2.41 (m, 2H), 1.99 (s, 3H), 1.67-1.77 (m, 2H), 1.36 (s, 9H). ^{13}C NMR (100 MHz, DMSO- d_6): δ 172.3, 171.7, 155.7, 137.4, 136.1, 129.6, 128.8, 128.7, 128.5, 128.3, 127.0, 78.6, 66.5, 54.0, 53.8, 37.0, 32.3, 30.1, 28.6, 15.1. HRMS: $[\text{M}-\text{H}]^-$ calcd for $\text{C}_{26}\text{H}_{33}\text{N}_2\text{O}_5\text{S}$ 485.2116, found 485.2122.

2-(2-Benzoyloxycarbonylamino-propionylamino)-3-phenyl-propionic acid benzyl ester (P66)



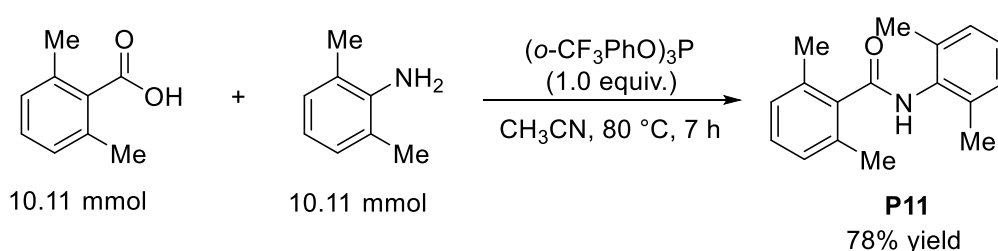
White solid, mp: 109-111 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 3:1), 93% yield, 214 mg, >99% er. ^1H NMR (400 MHz, DMSO- d_6): δ 8.35 (d, J = 4.0 Hz, 1H), 7.18-7.38 (m, 16H), 5.08-5.15 (m, 2H), 4.97-5.05 (m, 2H), 4.53-4.58 (m, 1H), 4.03-4.10 (m, 1H), 3.05-3.10 (m, 1H), 2.89-2.94 (m, 1H), 1.01 (d, J = 4.0 Hz, 3H). ^{13}C NMR (100 MHz, DMSO- d_6): δ 173.0, 171.7, 156.0, 137.5, 137.4, 136.2, 129.7, 128.9, 128.8, 128.6, 128.5, 128.3, 128.2, 128.2, 127.0, 66.5, 65.8, 53.8, 50.3, 37.3, 18.8. HRMS: $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{27}\text{H}_{28}\text{N}_2\text{O}_5\text{Na}$ 483.1890, found 483.1889.

2-(2-Benzoyloxycarbonylamino-3-phenyl-propionylamino)-propionic acid methyl ester (P67)



Known compound,^[20] white solid, mp: 127-129 °C, purified by silica gel chromatography (petroleum ether/ethyl acetate = 3:1), 87% yield, 167 mg, 98% er. ¹H NMR (400 MHz, DMSO-*d*₆): δ 8.46 (d, *J* = 2.0 Hz, 1H), 7.48 (d, *J* = 4.0 Hz, 1H), 7.20-7.34 (m, 10H), 4.93-4.98 (m, 2H), 4.26-4.34 (m, 2H), 3.64 (s, 3H), 2.94-2.97 (m, 1H), 2.74-2.78 (m, 1H), 1.24 (d, *J* = 2.0 Hz, 3H). ¹³C NMR (100 MHz, DMSO-*d*₆): δ 173.4, 172.1, 156.3, 138.6, 137.5, 129.7, 128.7, 128.5, 128.1, 127.9, 126.7, 65.6, 56.3, 52.4, 48.1, 37.8, 17.3.

3. PMI calculations



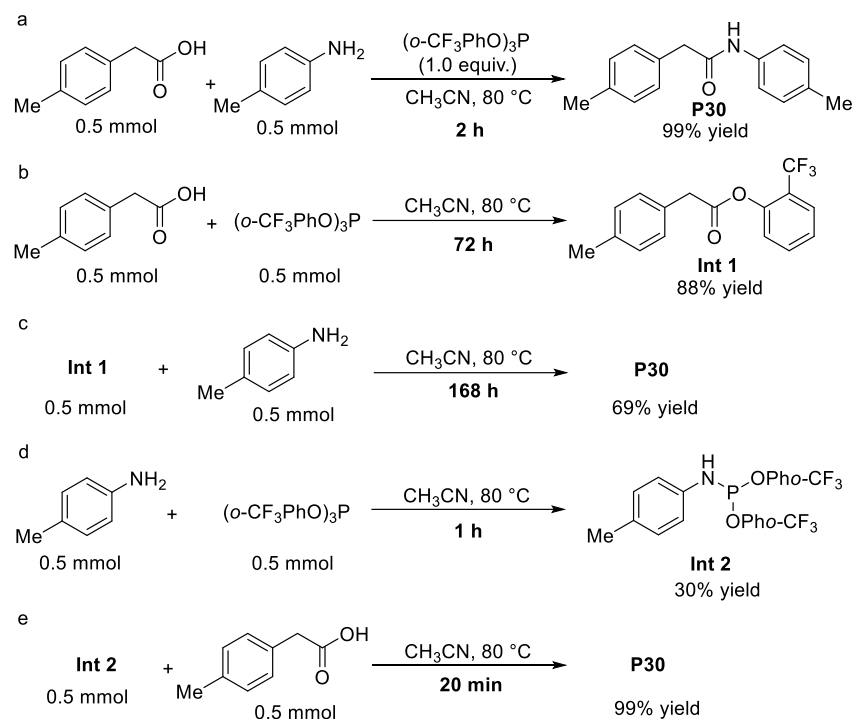
To a 25 mL round-bottom flask were added 2,6-dimethylbenzoic acid (10.11 mmol, 1.52 g, 1.0 equiv.), 2,6-dimethylaniline (10.11 mmol, 1.23 g, 1.0 equiv.), (*o*-CF₃PhO)₃P (10.11 mmol, 5.20 g, 1.0 equiv.) and CH₃CN (10 mL). The mixture was warmed to 80 °C in an oil bath and stirred for 7 h using magnetic stirring. The reaction was cooled down to room temperature and lots of white solid were precipitated. The mixture was further stored at 0 °C for 0.5 h. Then, the solid was filtered and recrystallized by hexane to give pure product **P11** (78%, 2.00 g).

Table S1. PMI calculation for **P11** purified from recrystallization

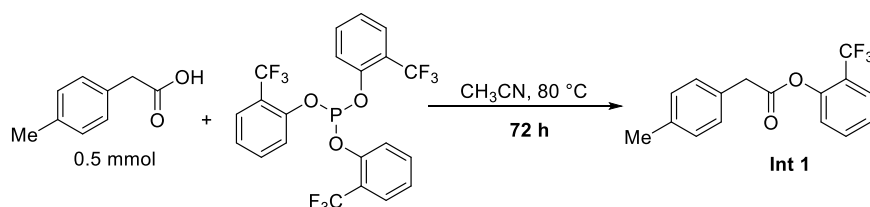
		Equivalents used	MW (g / mol)	mmol	g	Density g / mL	Volume (mL)
Reactants	2,6-dimethylbenzoic acid	1.0	150.07	10.11	1.52		
	2,6-dimethylaniline	1.0	121.09	10.11	1.23		
	(<i>o</i> -CF ₃ PhO) ₃ P	1.0	514.04	10.11	5.20		
Auxiliary materials	CH ₃ CN		101.19		7.86	0.7857	10
	Hexane				6.60	0.66	10
Product	N-(2,6-dimethylphenyl)-2,6-dimethylbenzamide (P11)		253.15	7.90	2.00		
PMI			11.2				

4. Mechanistic studies

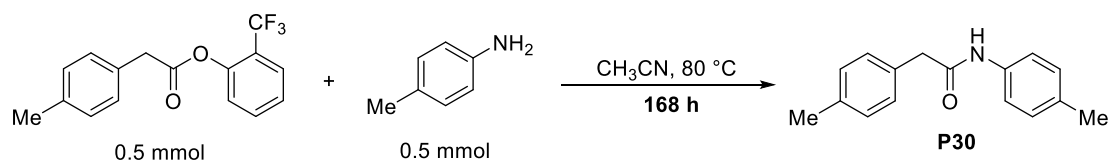
4.1 Control experiments



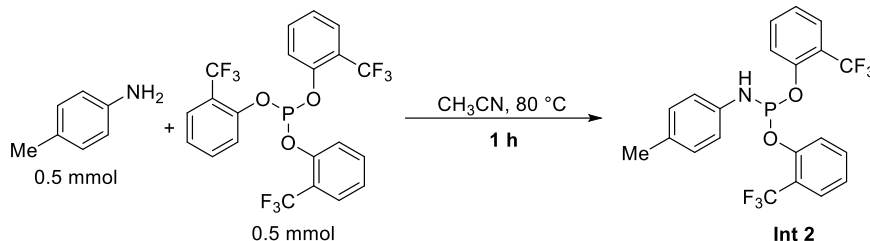
Scheme S1. Control experiments.



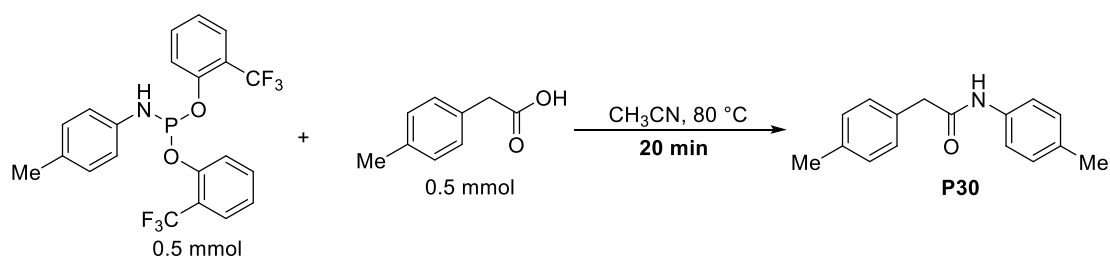
To a 10 mL tube were added *p*-methylphenylacetic acid (75 mg, 0.5 mmol, 1.0 equiv.), (*o*-CF₃PhO)₃P (257 mg, 0.5 mmol, 1.0 equiv.) and CH₃CN (1 mL). The mixture was warmed to 80 °C in an oil bath and stirred for 72 h using magnetic stirring. Then, the solvent was concentrated under reduced pressure and the crude product was further purified by column chromatography on silica gel (petroleum ether/ethyl acetate = 30:1) to give the product (**Int 1**) as a colorless oil (129 mg, 88% yield). ¹H NMR (DMSO-*d*₆, 600 MHz): δ 7.79 (d, *J* = 3.0 Hz, 1H), 7.73-7.76 (m, 1H), 7.47-7.50 (m, 1H), 7.41 (d, *J* = 3.0 Hz, 1H), 7.24 (d, *J* = 6.0 Hz, 2H), 7.18 (d, *J* = 3.0 Hz, 2H), 3.96 (s, 2H), 2.30 (s, 3H). ¹³C NMR (150 MHz, DMSO): δ 170.3, 148.2, 136.7, 134.6, 130.6, 129.9, 129.5, 127.3 (dd, *J*_{C-F} = 9.0 Hz, *J*_{C-F} = 4.5 Hz), 127.1, 125.3, 124.3, 125.5, 121.9 (dd, *J*_{C-F} = 60 Hz, *J*_{C-F} = 30 Hz), 21.1. HRMS: [M-H]⁻ calcd for C₁₆H₁₂O₂F₃ 293.0795, found 293.0785.



To a 10 mL tube were added 2-(trifluoromethyl)phenyl 2-(*p*-tolyl)acetate (147 mg, 0.5 mmol, 1.0 equiv.), *p*-toluidine (54 mg, 0.5 mmol, 1.0 equiv.) and CH₃CN (1mL). The mixture was warmed to 80 °C in an oil bath and stirred for 168 h using magnetic stirring. Then, the solvent was concentrated under reduced pressure and the crude product was further purified by column chromatography on silica gel (petroleum ether/ethyl acetate = 5:1) to give **P30** in 69% yield (83 mg).



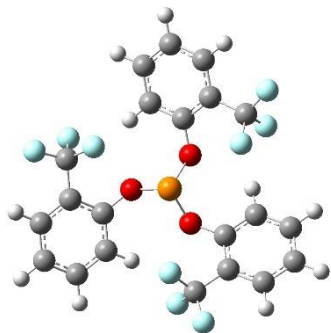
To a 10 mL tube were added *p*-toluidine (54 mg, 0.5 mmol, 1.0 equiv.), *p*-toluidine (54 mg, 0.5 mmol, 1.0 equiv.), (*o*-CF₃PhO)₃P (257 mg, 0.5 mmol, 1.0 equiv.) and CH₃CN (1mL). The mixture was warmed to 80 °C in an oil bath and stirred for 1 h using magnetic stirring. Then, the solvent was concentrated under reduced pressure and the crude product was further purified by column chromatography on silica gel (petroleum ether/ethyl acetate = 30:1) to give (**Int 2** as colorless oil (67 mg, 30% yield). ¹H NMR (CDCl₃-*d*₆, 600 MHz): δ 7.62 (d, *J* = 2.0 Hz, 2H), 7.45-7.47 (m, 2H), 7.35 (d, *J* = 3.0 Hz, 2H), 7.15-7.18 (m, 2H), 7.05 (d, *J* = 6.0 Hz, 2H), 6.97 (d, *J* = 3.0 Hz, 2H), 5.41 (d, *J* = 3.0 Hz, 1H), 2.28 (s, 3H). ¹³C NMR (150 MHz, CDCl₃): δ 149.9, 136.5 (d, *J*_{C-F} = 12.0 Hz), 132.2, 130.7, 128.9, 126.3 (d, *J*_{C-F} = 4.5 Hz), 123.2, 122.2, 121.4, 119.5 (d, *J*_{C-F} = 13.5 Hz), 117.7 (d, *J*_{C-F} = 10.5 Hz), 19.6. HRMS: [M+Na]⁺ calcd for C₂₁H₁₆NO₂F₆PNa 482.0715, found 482.0725.



To a 10 mL tube were added *p*-methylphenylacetic acid (75 mg, 0.5 mmol, 1.0 equiv.), *p*-toluidine (54 mg, 0.5 mmol, 1.0 equiv.), bis(2-(trifluoromethyl)phenyl)*p*-tolylphosphoramidite (230 mg, 0.5 mmol, 1.0 equiv.) and CH₃CN (1mL). The mixture was warmed to 80 °C in an oil bath and stirred for 20 min using magnetic stirring. Then, the solvent was concentrated under reduced pressure and the crude product was further purified by column chromatography on silica gel (petroleum ether/ethyl acetate = 5:1) to give **P30** in 99% yield (119 mg).

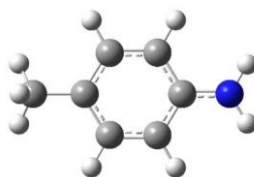
4.2 DFT calculation.

Gaussian 16 (A.03) program package was employed for all calculations.^[21] Geometry optimizations and the TS searches were calculated at the level of b3lyp/6-311g (d, p).^[22,23] Frequency calculations at the reference T of 298 K were performed to characterize their thermodynamic properties at the same level with d3 dispersion correction.^[24,25]

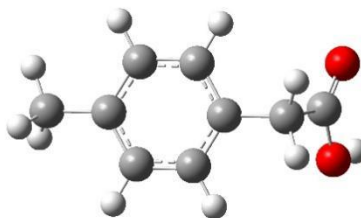


P	-0.00008200	-0.00101900	0.00936700
O	-1.36938300	-0.42084900	-0.84594500
O	1.04826700	-0.97652100	-0.84629500
O	0.32047600	1.39514400	-0.84546700
C	2.39388500	-1.04533300	-0.53632400
C	3.23760200	0.00624600	-0.87247900
C	2.90254800	-2.19704000	0.07553900
C	4.59671900	-0.08554500	-0.59039300
H	2.81634900	0.88301400	-1.34132600
C	4.26859700	-2.28108800	0.34119000
C	5.11523600	-1.22728700	0.01360500
H	5.24701100	0.74257300	-0.84480400
H	4.65918400	-3.17256400	0.81221900
H	6.17357000	-1.29992200	0.23031400
C	-0.29166700	2.59484200	-0.53317100
C	0.45324700	3.61078900	0.07716700
C	-1.62514600	2.79997500	-0.86535500
C	-0.15621600	4.83563200	0.34553400
C	-2.22438500	4.02270400	-0.58064600
H	-2.17523700	1.99701600	-1.33295500
C	-1.49311700	5.04216800	0.02200300
H	0.42190900	5.61932200	0.81538700
H	-3.26745900	4.17196000	-0.83184400
H	-1.95875400	5.99486300	0.24077600
C	-2.10272600	-1.55074000	-0.53438600
C	-3.35559500	-1.41333900	0.07473600
C	-1.61374400	-2.80826000	-0.86637100
C	-4.11213900	-2.55340800	0.34230600
C	-2.37362300	-3.93839700	-0.58249600
H	-0.64310300	-2.88343700	-1.33348700
C	-3.62260800	-3.81457000	0.01911000
H	-5.08034500	-2.44434600	0.81117400
H	-1.98146600	-4.91642300	-0.83361500
H	-4.21531300	-4.69402700	0.23720500
C	1.98931400	-3.33512500	0.42758400

C	-3.88512400	-0.05226600	0.42157800
C	1.89656900	3.38870400	0.42458700
F	2.07537900	2.30060800	1.21103100
F	2.66427300	3.20014000	-0.67731700
F	2.42586400	4.43750400	1.08687600
F	2.63437100	-4.31625800	1.09093400
F	1.43991900	-3.90840400	-0.67182600
F	0.95917200	-2.94410700	1.21518100
F	-4.10389300	0.70706400	-0.68056100
F	-5.05907500	-0.11817700	1.08207400
F	-3.03331700	0.64641600	1.20940700

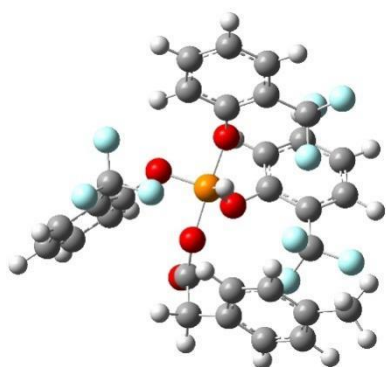


C	-1.39879100	0.00000800	-0.01192000
C	-0.67036400	-1.19223700	-0.01017400
C	0.71848700	-1.20259800	-0.00192600
C	1.44233100	0.00000400	0.00376300
C	0.71849500	1.20260200	-0.00192900
C	-0.67036400	1.19224200	-0.01017300
H	-1.20064300	-2.13947700	-0.01739600
H	1.25248600	-2.14748500	-0.00476500
H	1.25248900	2.14749100	-0.00477000
H	-1.20063500	2.13948600	-0.01739700
C	-2.90707100	-0.00000500	0.01442000
H	-3.31352200	-0.88277300	-0.48545600
H	-3.29197900	-0.00042600	1.04062900
H	-3.31351500	0.88317200	-0.48473400
N	2.82094800	-0.00000800	0.01030300
H	3.33616300	-0.86031500	0.00468400
H	3.33617900	0.86029100	0.00472800



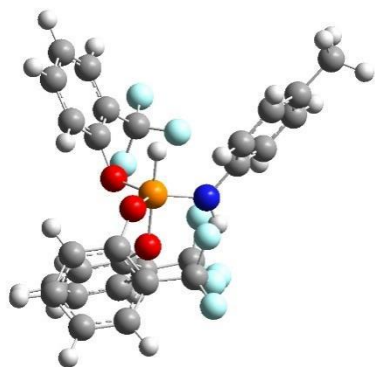
C	-2.44494800	0.03126700	-0.16203500
C	-1.79575600	-1.18539900	0.07042000
C	-0.46447100	-1.22375800	0.46783400
C	0.25745200	-0.04295900	0.65061100

C	-0.38096000	1.17393800	0.41184700	C	4.07046300	0.29293200	-2.13851400
C	-1.71397500	1.20790900	0.01305800	C	2.93695800	2.00621500	-3.40775900
H	-2.34049800	-2.11467100	-0.06176300	H	0.77413600	2.01413000	-3.24227600
H	0.02150600	-2.17859700	0.63545100	C	4.11907000	1.38991500	-2.99666300
H	0.17186500	2.09917600	0.53098800	H	4.98160700	-0.20005400	-1.82088800
H	-2.19341300	2.16464100	-0.16462400	H	2.97117500	2.85961400	-4.07815700
C	-3.89323300	0.06292800	-0.58090500	H	5.07806800	1.75908300	-3.34587600
H	-4.06452100	-0.56369300	-1.46077300	C	-0.11958400	2.89810300	0.40375400
H	-4.54260100	-0.31230500	0.21628100	C	0.99396700	3.29822000	1.16329000
H	-4.21432000	1.07767100	-0.82251200	C	-1.37738400	3.43648200	0.68063500
C	1.71842500	-0.07561300	1.05460100	C	0.83301700	4.23818700	2.18281500
H	1.95687100	-1.02439100	1.53670900	C	-1.52687300	4.36431400	1.71000500
H	1.94625200	0.74197200	1.73868600	H	-2.22324300	3.11490400	0.08969300
C	2.59220500	0.10231900	-0.17062600	C	-0.42449900	4.77035700	2.46137600
O	3.02391000	1.16567600	-0.58541600	H	1.69806100	4.54288900	2.75991800
O	2.81233500	-1.08026600	-0.79941000	H	-2.51234600	4.76870500	1.92164600
H	3.32047900	-0.87687100	-1.59866700	H	-0.54003700	5.49533500	3.26086700
				C	-3.91430000	0.47990800	1.15443600
				C	2.35026200	2.71900600	0.87481400
				C	2.76529200	-1.40740900	-0.80280800
				F	2.07591000	-1.17979400	0.34051800
				F	2.14682500	-2.42700100	-1.43900300
				F	3.99061300	-1.84435700	-0.44120400
				F	-4.85772000	0.02917800	2.00633400
				F	-4.02419400	1.83012600	1.12330700
				F	-2.71314700	0.20136600	1.71978000
				F	2.77461900	2.99900300	-0.37478700
				F	3.29019000	3.18989200	1.72575800
				F	2.35466400	1.36766400	1.00131200
				C	2.03878900	-3.50875900	2.78261000
				C	0.85707500	-2.79135700	3.00687800
				C	-0.19265700	-2.83050100	2.09372100
				C	-0.09102500	-3.59272400	0.92453400
				C	1.07651900	-4.32731000	0.70689800
				C	2.12517800	-4.28693100	1.62401000
				H	0.76230700	-2.18768700	3.90659900
				H	-1.08918100	-2.24357300	2.27234200
				H	1.17509300	-4.91999000	-0.19867600
				H	3.02933600	-4.85899800	1.42979200
				C	3.19868900	-3.41458000	3.74288400
				H	3.88025700	-2.60338600	3.45432600
				H	2.86003100	-3.20823900	4.76367100
				H	3.78362300	-4.34032700	3.75897100
				C	-1.18104300	-3.55751800	-0.12355700
P	-0.52968400	0.40714800	-0.49380300				
O	0.05573200	2.00702700	-0.62229700				
O	-2.01625800	0.92805400	-0.97141200				
O	0.46710600	-0.09085500	-1.67186500				
C	-3.11278400	0.11085900	-1.21803100				
C	-3.28217700	-0.40694200	-2.49593100				
C	-4.06406000	-0.12019400	-0.21561800				
C	-4.40941600	-1.17490400	-2.78375000				
H	-2.51243400	-0.23133400	-3.23686400				
C	-5.19009900	-0.88910000	-0.51853400				
C	-5.36299200	-1.41822800	-1.79649800				
H	-4.53226200	-1.58950700	-3.77929400				
H	-5.92750200	-1.07032700	0.25417300				
H	-6.24021900	-2.01801200	-2.01688500				
C	1.67017600	0.45590700	-2.08860000				
C	2.84315600	-0.18565000	-1.67942700				
C	1.70418900	1.53906200	-2.95549000				



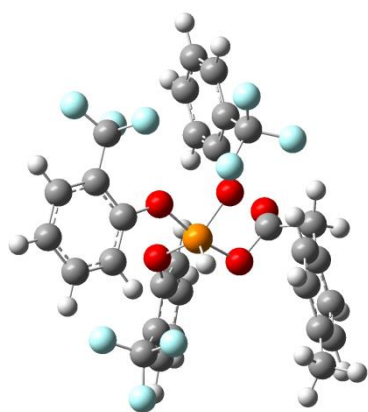
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H	-2.16966900	-3.52315200	0.35212100	C	4.87240000	1.37847900	0.73671100
H	-1.14634400	-4.43407300	-0.77403500	C	4.65629100	-0.41915300	2.32554500
C	-1.07539200	-2.32559100	-1.01588400	H	2.62857600	-0.85320500	2.95066800
O	-1.05133900	-2.34068400	-2.22181100	C	5.45935300	0.38898300	1.52207900
O	-1.05537300	-1.21485600	-0.23843600	H	5.49025200	2.02573800	0.12566600
H	-0.24506600	0.39196900	0.87074000	H	5.10203400	-1.18337700	2.95540600



B

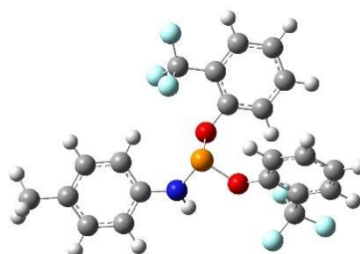
P	0.12756800	0.32872600	0.59447600	F	1.92100800	3.33783400	0.48919800
O	1.32333700	0.89714000	1.61472000	F	3.84787600	3.55720300	-0.48700600
O	1.26475800	-0.37358700	-0.48932200	C	2.38672600	2.16938800	-1.28635100
O	-0.38387900	-1.22767300	0.97459600	C	-3.64603700	4.00247700	-0.45846300
C	1.41056000	-1.68092900	-0.85346800	C	-2.56833500	4.11241000	0.42570200
C	2.11750900	-2.56487800	-0.03512500	C	-1.48526100	3.23583700	0.36084700
C	0.93287100	-2.13004700	-2.09798000	C	-1.48255300	2.20410900	-0.58030900
C	2.33515600	-3.87909100	-0.43517300	C	-2.55798500	2.07301200	-1.46642600
H	2.49401800	-2.19980300	0.91128100	C	-3.61738400	2.97181900	-1.40915900
C	1.15750400	-3.45352900	-2.48928500	H	-2.56452300	4.90814000	1.16657900
C	1.85377100	-4.33112300	-1.66456300	H	-0.63175000	3.35782300	1.01876200
H	2.88545100	-4.55200800	0.21650800	H	-2.55700200	1.25351800	-2.17781300
H	0.78307800	-3.78760000	-3.44961600	H	-4.44752800	2.86187300	-2.10296700
H	2.02089100	-5.35588400	-1.98054500	C	-4.79706800	4.97778200	-0.41305100
C	-1.32808800	-1.46354000	1.94097300	H	-4.83431100	5.50744500	0.54413500
C	-2.57886800	-1.96733500	1.55768500	H	-4.71039600	5.73416100	-1.20419800
C	-1.03329800	-1.25337900	3.28666900	H	-5.75756500	4.47022300	-0.55657000
C	-3.52033100	-2.27822300	2.53866200	N	-0.39966500	1.28875600	-0.65773500
C	-1.98581800	-1.56013200	4.25829100	H	-0.80372300	0.90459500	1.48316000
H	-0.06213400	-0.85066700	3.55411500	H	-0.01880000	1.10174600	-1.57591500
C	-3.22639100	-2.07831000	3.88743600				
H	-4.48511300	-2.66987900	2.23844700				
H	-1.75429000	-1.39454000	5.30630500				
H	-3.96642200	-2.32191700	4.64302800				
C	2.68468800	0.72695200	1.51723200				
C	3.48752900	1.56683100	0.73036800				
C	3.27411700	-0.24464300	2.32555800				



TS_{A1}

P	-0.24092700	0.02163800	0.01526600
O	0.79145300	1.25471600	-0.51265100
O	-1.50357500	0.80288000	-0.69598900
O	0.83031700	-1.07348100	-0.69328100
C	-2.77548700	0.27052800	-0.88850100
C	-3.01100100	-0.55555700	-1.98068700
C	-3.81969000	0.63242100	-0.02936600
C	-4.30002600	-1.02201300	-2.22754400
H	-2.17929200	-0.86402100	-2.59934300
C	-5.10955500	0.16353500	-0.29140500
C	-5.35269100	-0.66002800	-1.38750700
H	-4.47522800	-1.67729500	-3.07504000
H	-5.91685900	0.44505400	0.37396400
H	-6.35777200	-1.02193400	-1.57873300
C	1.67520400	-0.88069000	-1.78062800
C	3.05937700	-0.83218500	-1.59952100
C	1.11310700	-0.82403700	-3.05063000
C	3.87942900	-0.71546100	-2.72253900
C	1.94360900	-0.70759500	-4.16261900
H	0.03742100	-0.88236500	-3.15155900
C	3.32682700	-0.65124000	-3.99932700
H	4.95255100	-0.66084700	-2.58596200
H	1.50612200	-0.65892900	-5.15486400
H	3.97685500	-0.55283000	-4.86271000
C	0.78110900	2.56301100	-0.12036100
C	1.73437900	3.40851200	-0.71996600
C	-0.09495500	3.08479700	0.83428900
C	1.79062500	4.75449600	-0.35707900
C	-0.02343000	4.43234000	1.18410500
H	-0.84324900	2.46175100	1.29746300
C	0.91431300	5.27481500	0.59249700
H	2.52852800	5.39204700	-0.82921200
H	-0.72006200	4.81872600	1.92228300
H	0.96427200	6.32459700	0.86254500

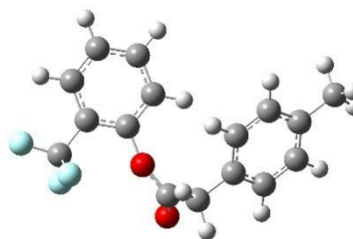
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C	2.72120800	2.86583800	-1.71498600
C	3.67431100	-0.92777500	-0.23304700
F	3.08843500	-0.11195900	0.67034900
F	3.56836300	-2.19321900	0.26225700
F	4.98665400	-0.62776700	-0.24725400
F	-4.66245800	1.64002700	1.93807600
F	-3.21579100	2.77463600	0.78283200
F	-2.57023900	1.05190400	1.94414200
F	2.13134300	2.18815100	-2.72221600
F	3.45164900	3.85322800	-2.28456400
F	3.60841700	2.02170700	-1.13085700
C	-0.07192700	-2.13654400	4.68451400
C	-1.03026400	-2.94723200	4.05995700
C	-0.87042900	-3.36028200	2.74190800
C	0.25266400	-2.97849900	1.99679900
C	1.21543700	-2.17946500	2.61875300
C	1.05058900	-1.76272300	3.94135900
H	-1.91436400	-3.25319700	4.61492000
H	-1.63633300	-3.97422800	2.27389800
H	2.10112900	-1.87958900	2.07349900
H	1.81300700	-1.13887000	4.40225300
C	-0.24200600	-1.70496400	6.12062200
H	-1.26690400	-1.37157200	6.31976500
H	-0.03139100	-2.53056100	6.81297000
H	0.43582700	-0.88347600	6.37322000
C	0.36006900	-3.36671400	0.54296800
H	-0.04483800	-4.37029100	0.37595400
H	1.40042700	-3.38522000	0.20889300
C	-0.42623700	-2.45283400	-0.41172900
O	-0.79132700	-2.80613900	-1.51003600
O	-1.08635500	-1.39325300	0.26771900
H	-0.06865800	0.29087000	1.37007300



Int 2

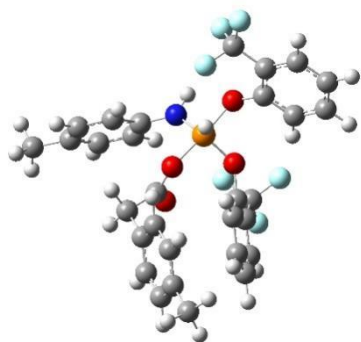
C	-5.61819600	-1.74970200	0.16102600
C	-4.95210600	-0.53931300	0.35695800
C	-3.57027700	-0.43631000	0.22829700
C	-2.81100100	-1.57040500	-0.06857400

C	-3.46408400	-2.79020800	-0.26884700
C	-4.84637700	-2.86913800	-0.16657700
H	-5.52334200	0.35290500	0.58995000
H	-3.09369800	0.53000300	0.33215700
H	-2.88193300	-3.67576100	-0.49941200
H	-5.33417600	-3.82351500	-0.33542000
C	-7.11489400	-1.85501000	0.31202000
H	-7.38627600	-2.24293600	1.29984400
H	-7.59390200	-0.88025900	0.19926700
H	-7.54413900	-2.53024200	-0.43232300
N	-1.40371600	-1.51164100	-0.16519000
H	-0.95411000	-2.16706200	-0.79260100
P	-0.43144200	-0.35294700	0.55082500
O	0.97313400	-1.26230100	0.27860800
O	-0.27887900	0.71870800	-0.75957600
C	2.16524800	-1.06062000	0.91293000
C	2.29838900	-0.33385100	2.09525100
C	3.29739600	-1.63654400	0.31742800
C	3.55400900	-0.17578400	2.67205500
H	1.42380900	0.10634200	2.55530400
C	4.54701800	-1.47386300	0.91143100
C	4.68203500	-0.74233500	2.08614100
H	3.64510200	0.39439900	3.58888000
H	5.41171400	-1.92328100	0.44272700
H	5.65739100	-0.61920100	2.53912300
C	0.57038700	1.79785800	-0.71451000
C	1.90861700	1.63374800	-1.06390900
C	0.08715500	3.06689100	-0.36634600
C	2.76899200	2.72604000	-1.04731200
H	2.25025100	0.65170800	-1.35892600
C	0.95859400	4.15550400	-0.35976000
C	2.29848400	3.98745100	-0.69167900
H	3.80900800	2.58805200	-1.31790200
H	0.57850700	5.13216800	-0.09322300
H	2.96703100	4.83912200	-0.68110400
C	3.15670500	-2.40686400	-0.96503400
C	-1.36327400	3.25349300	-0.02367700
F	2.30841100	-3.45000800	-0.85799000
F	4.34152500	-2.90687900	-1.37982700
F	2.69286800	-1.62983200	-1.97741500
F	-2.18330400	2.89494600	-1.03168400
F	-1.65021400	4.53706400	0.28101000
F	-1.73201300	2.51090600	1.05496100



Int 1

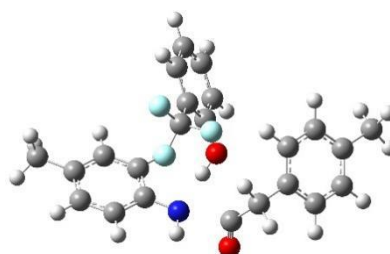
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C	2.31062200	-1.07323200	0.56345700
C	3.32005300	-1.45777100	-0.31892300
C	4.40496300	-0.62048300	-0.56189800
H	3.54788200	1.96869700	1.43790900
H	1.62166400	0.49288400	1.86325200
H	3.25120900	-2.41461300	-0.82448100
H	5.18132500	-0.93917500	-1.24925900
C	5.69128800	1.52807800	-0.18508200
H	5.36641000	2.52693600	-0.48987400
H	6.29639200	1.64541200	0.71938800
H	6.33771800	1.13031600	-0.96935700
C	1.11546700	-1.97545100	0.80078000
H	0.62722700	-1.71761800	1.74131600
H	1.42315000	-3.02080200	0.83073000
C	0.12773400	-1.82662400	-0.33876600
O	0.09327300	-2.51983800	-1.34246700
O	-0.72856100	-0.81120100	-0.29330900
C	-1.23251600	0.47604800	-0.31660800
C	-2.59145500	0.68940400	-0.05714000
C	-0.38234100	1.54933100	-0.55295100
C	-3.08443700	1.99329500	-0.03383600
C	0.88985600	2.84449400	-0.53906500
H	0.66064800	1.35384400	-0.75283100
C	-2.23829600	3.06989100	-0.27800700
H	-4.13414000	2.15545700	0.16861800
H	-0.22381800	3.67588200	-0.73545500
H	-2.63260800	4.07817400	-0.26419200
C	-3.50432200	-0.47223400	0.20832500
F	-3.47633000	-1.38766000	-0.78948800
F	-3.17525300	-1.13093700	1.34715800
F	-4.78929800	-0.08638300	0.34513500



C

C	1.50463800	5.23021300	0.20023200
C	0.98685500	4.69304000	-0.98122500
C	0.09299300	3.62734900	-0.95412200
C	-0.27927800	3.06256600	0.26292400
C	0.23376600	3.58124800	1.44991500
C	1.10819300	4.65967700	1.41404800
H	1.27872600	5.11944000	-1.93498100
H	-0.31221800	3.21922200	-1.87159700
H	-0.02474300	3.10563400	2.38739000
H	1.50943800	5.04927200	2.34327700
C	2.44614200	6.40736400	0.17171000
H	3.19882200	6.33248300	0.95990100
H	2.96316700	6.48054500	-0.78716900
H	1.90337000	7.34593100	0.32621700
N	-1.19834400	1.97200300	0.30429500
H	-2.08381200	2.14729000	0.75854000
P	-1.03528100	0.39191800	-0.15811100
O	-0.65443900	-0.82874100	0.86878700
O	-2.69466400	0.21084400	0.31326900
C	0.49921200	-1.55117500	1.05543500
C	1.13590900	-2.19865800	0.00679000
C	0.95961900	-1.68744100	2.36754200
C	2.27287500	-2.95794500	0.26201600
H	0.76264000	-2.08286600	-1.00058000
C	2.09483600	-2.45515600	2.61036800
C	2.75737800	-3.08284800	1.55965200
H	2.78388400	-3.43557200	-0.56284000
H	2.45565200	-2.55361200	3.62481500
H	3.64699400	-3.66797600	1.75598900
C	-3.41945600	-0.90669000	0.03712500
C	-3.31522400	-2.04963800	0.83186200
C	-4.33096700	-0.88533800	-1.03156600
C	-4.10123100	-3.16188100	0.55312600
H	-2.62334400	-2.03891200	1.66150800
C	-5.11752200	-2.00628400	-1.29676500

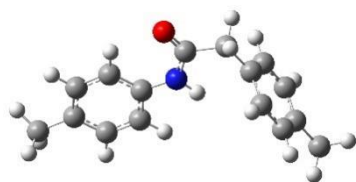
C	-4.99920900	-3.14734400	-0.51219200
H	-4.01423900	-4.04351600	1.17744100
H	-5.82109300	-1.97536000	-2.11743600
H	-5.61174700	-4.01461200	-0.72512900
C	0.21038300	-1.04168400	3.49976600
C	-4.48722500	0.36058100	-1.85589700
F	0.03692700	0.28403600	3.34697200
F	0.84444900	-1.22029400	4.68053400
F	-1.02891700	-1.58155200	3.64517300
F	-4.86099700	1.42740800	-1.12115800
F	-5.41468800	0.21039200	-2.82739700
F	-3.33279300	0.71331200	-2.48755500
C	4.51301100	-2.47644000	-2.56057400
C	3.38677100	-1.90259600	-3.15957500
C	2.86129600	-0.70115100	-2.69730100
C	3.44427300	-0.03680400	-1.61612800
C	4.55856700	-0.61223700	-1.00643300
C	5.08685300	-1.81112400	-1.47493700
H	2.91899400	-2.40158900	-4.00214500
H	1.98410700	-0.27571600	-3.17128600
H	5.01041600	-0.12162600	-0.15162000
H	5.95534500	-2.23922200	-0.98533800
C	5.10323100	-3.75967600	-3.08881600
H	4.32916500	-4.42108200	-3.48506600
H	5.80962700	-3.56078200	-3.90168800
H	5.64569800	-4.29892300	-2.30920800
C	2.85549700	1.25092900	-1.08337400
H	2.46761000	1.86236500	-1.89915100
H	3.60737400	1.82084800	-0.53887400
C	1.72331500	0.96505800	-0.11364000
O	1.82770200	1.00102100	1.08338900
O	0.59392200	0.62960100	-0.77745800
H	-1.31120500	-0.07147000	-1.44216900



TSA2

C	5.17426500	0.16680300	-0.81285900
C	4.14385300	0.88060300	-0.18511100
C	3.13018500	0.22748600	0.50620200
C	3.12854200	-1.16865500	0.59492300

C	-2.71457900	-1.53372100	-3.39441700	C	3.90244700	-1.28678500	0.00057400
H	-2.90432200	-0.62489100	-1.44404300	C	3.50575600	-0.68450800	-1.19668300
C	-0.50110900	-1.51104200	-4.34034500	C	2.74273500	0.47857400	-1.19694700
C	-1.84908600	-1.83983600	-4.44020300	C	2.34896500	1.08059400	0.00210900
H	-3.76629800	-1.78335100	-3.46566000	C	2.74217100	0.47665300	1.20037500
H	0.18193700	-1.74568600	-5.14505200	C	3.50520800	-0.68641200	1.19860500
H	-2.21885400	-2.33074400	-5.33149200	H	3.79889000	-1.13133500	-2.14086900
C	-4.33886800	0.00218600	1.33310800	H	2.44266700	0.92455500	-2.13938100
C	1.44753700	-0.55261000	-3.07592900	H	2.44165500	0.92112300	2.14337900
F	-3.93565400	0.77445600	2.36340000	H	3.79790100	-1.13475100	2.14221200
F	-5.68480500	0.08732300	1.28050600	C	4.75895000	-2.52736800	-0.00021200
F	-3.87132400	0.58993100	0.20214000	H	4.57251400	-3.13919100	-0.88539900
F	1.67201000	0.77307200	-2.91738100	H	5.82265000	-2.26673300	0.00032800
F	2.14830200	-0.93841600	-4.15991900	H	4.57198000	-3.14067900	0.88383300
F	2.00773200	-1.16894600	-2.00638800	C	1.46446100	2.29872000	0.00287900
C	6.65177800	-0.99206800	1.32588500	H	1.66103000	2.92521200	-0.87078200
C	5.92970500	-1.17286500	0.14654600	H	1.66007100	2.92344300	0.87800700
C	4.68407200	-0.57496300	-0.03372700	C	-0.05639400	2.05764900	0.00177000
C	4.12973500	0.22583500	0.96270200	O	-0.82398300	3.00192000	0.00304700
C	4.84426500	0.40355500	2.15140500	N	-0.43068800	0.74204400	-0.00075700
C	6.08390000	-0.19609300	2.32734600	H	0.32527900	0.07255700	-0.00130700
H	6.34281500	-1.79263000	-0.64261100	C	-1.72721500	0.19200500	-0.00220300
H	4.13631200	-0.74025300	-0.95298500	C	-2.89384600	0.96337200	-0.00458900
H	4.40949100	0.99723900	2.94638300	C	-1.83353900	-1.20392900	-0.00667500
H	6.62105300	-0.04768600	3.25876600	C	-4.13191200	0.32839300	-0.00899600
C	8.00999500	-1.61890600	1.51751300	H	-2.81676700	2.03897900	-0.00657500
H	8.20183200	-2.38783100	0.76649000	C	-3.07864200	-1.81612800	-0.01110900
H	8.80493300	-0.86997700	1.43631200	H	-0.93262700	-1.80970100	-0.01106500
H	8.09865700	-2.08012600	2.50483200	C	-4.25554800	-1.06213200	-0.00971600
C	2.77827200	0.87808400	0.77160900	H	-5.02808800	0.94020600	-0.01404800
H	2.46243400	0.78850600	-0.26431200	H	-3.13574700	-2.89958600	-0.01776500
H	2.82563700	1.93993200	1.02550800	C	-5.60768700	-1.72881100	0.01878100
C	1.74693500	0.26181600	1.69764200	H	-5.59423200	-2.68007900	-0.51859000
O	1.79050400	0.26210000	2.89659400	H	-5.92376400	-1.93825300	1.04662300
O	1.14836000	-1.00014300	1.03973700	H	-6.37218900	-1.09476200	-0.43545700
H	-0.53109700	-1.89006300	-0.06554300				



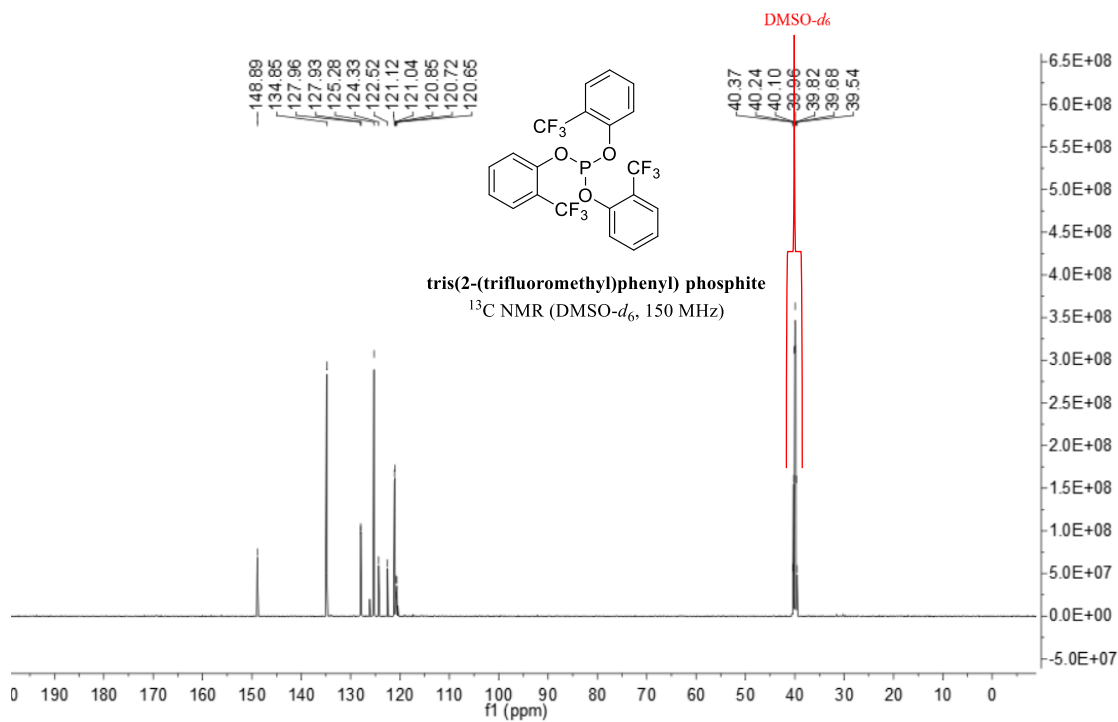
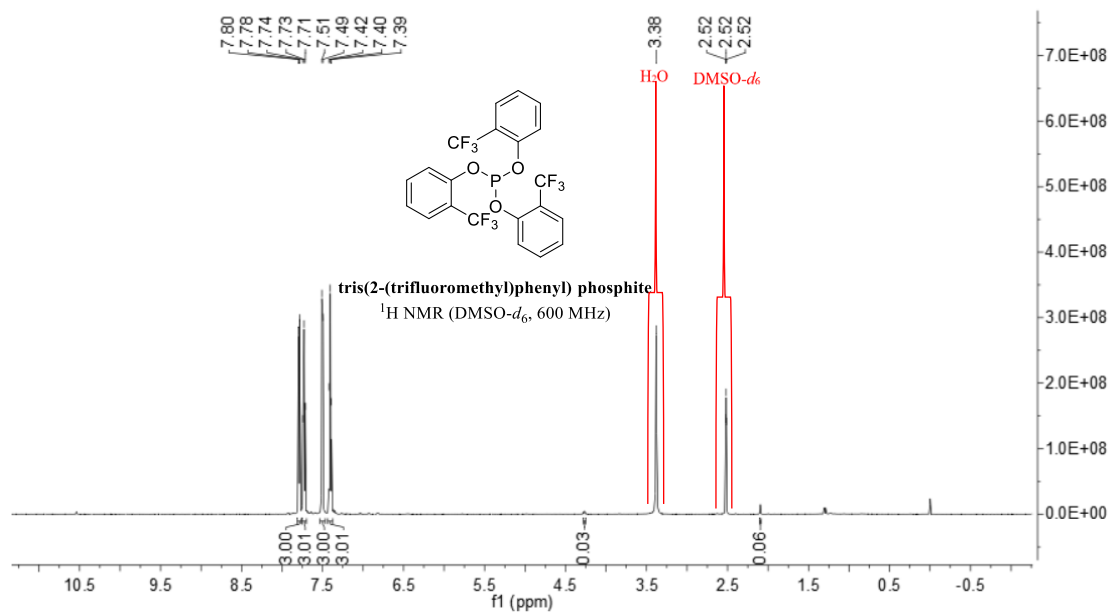
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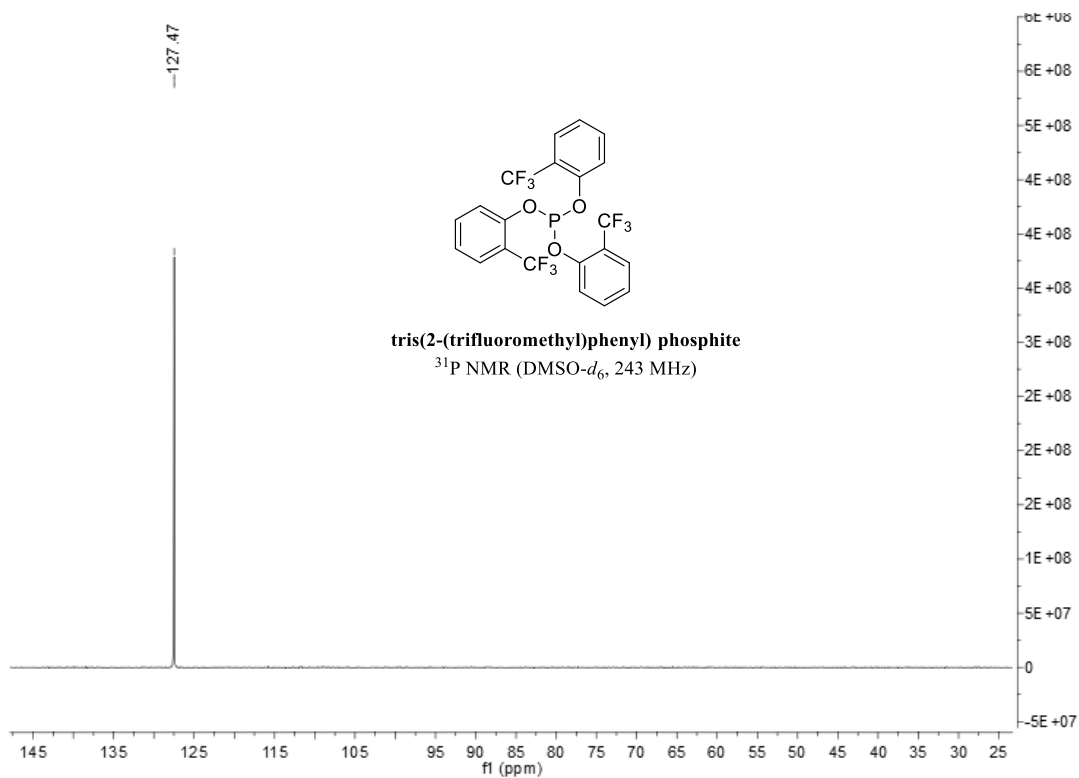
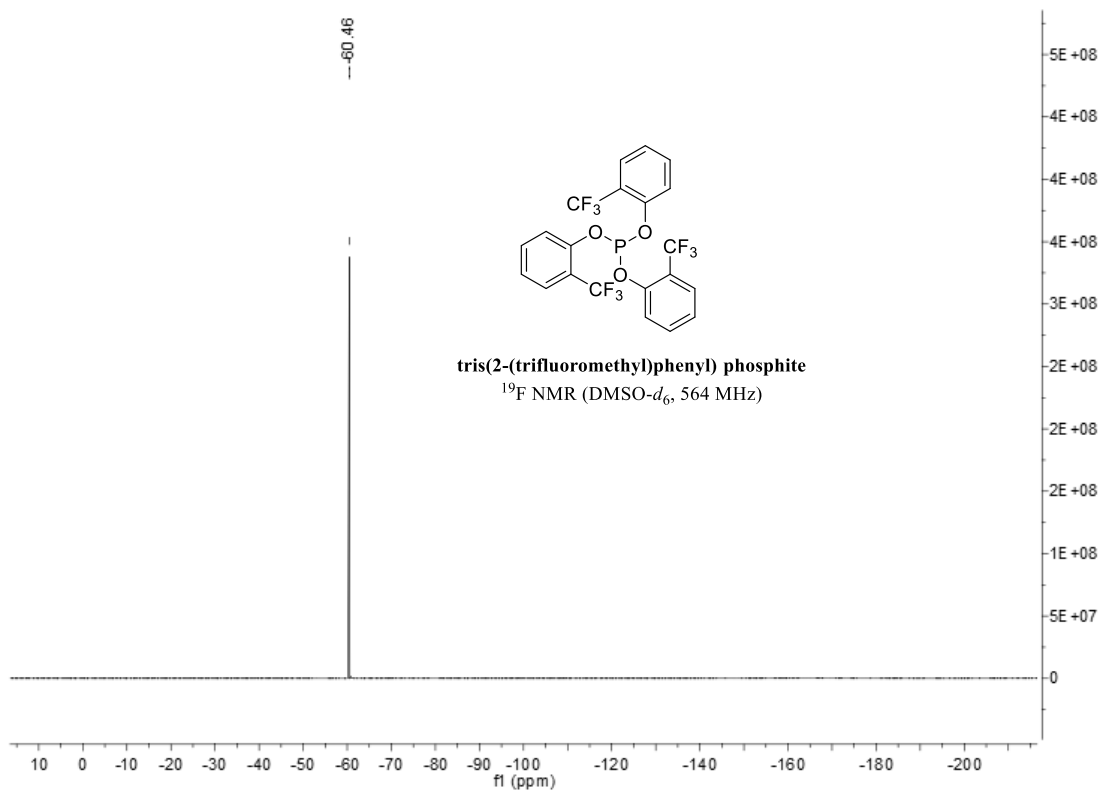
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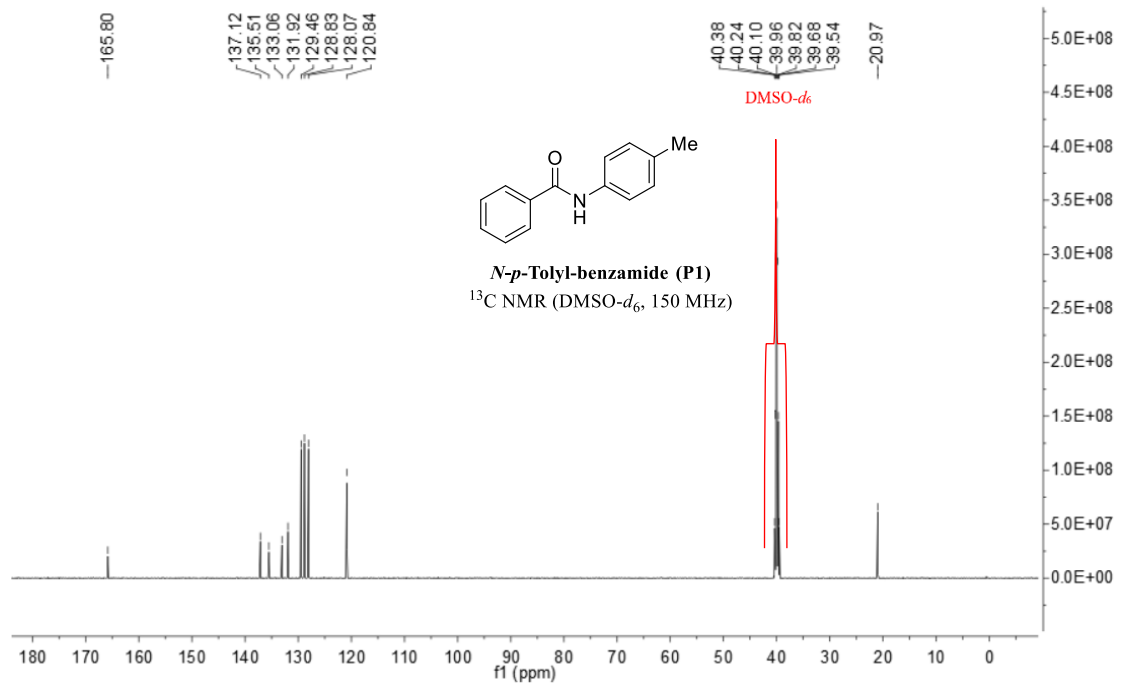
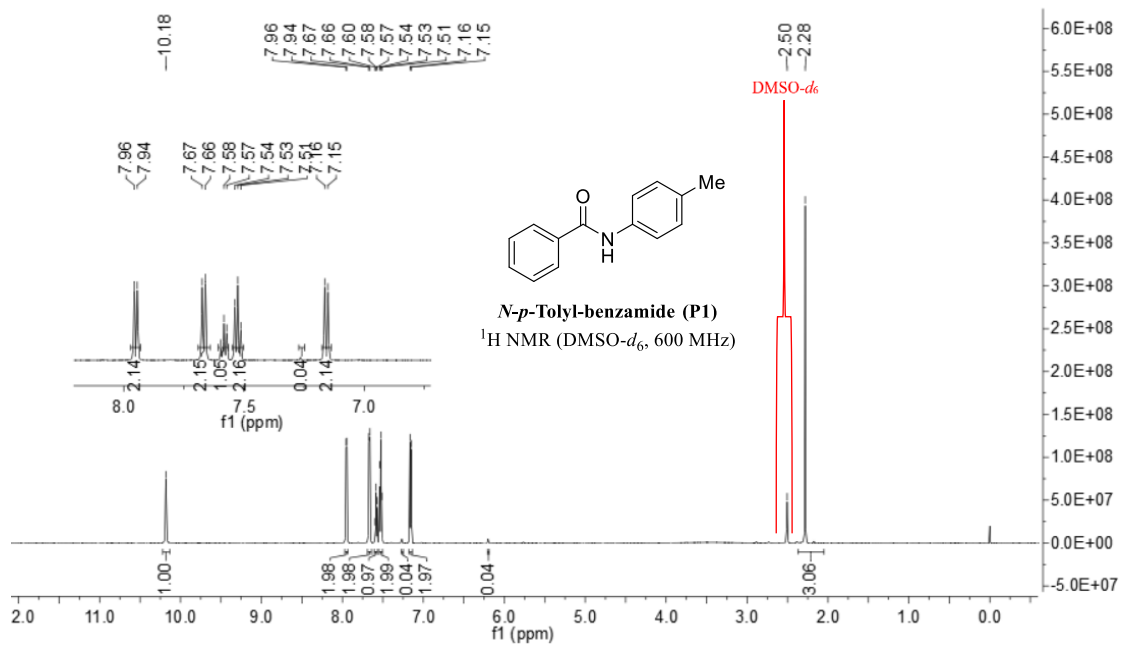
- [1] R. Zhang, W.-Z. Yao, L. Qian, W. Sang, Y. Yuan, M.-C. Du, H. Cheng, C. Chen, X. Qin, A practical and sustainable protocol for direct amidation of unactivated esters under transition-metal-free and solvent-free conditions. *Green Chemistry*. **2021**, *23*, 3972-3982.
- [2] D. Saha, Surabhia, P. Gupta, J. Shabira, M. Dhamaa, S. Mozumdar, Diamine-functionalized porous graphene oxide sheet decorated with palladium oxide nanoparticles for the oxidative amidation of aldehydes. *New J. Chem.* **2022**, *46*, 20828-20843.
- [3] T. Fan, A. Wang, J.-Q. Li, J.-L. Ye, X. Zheng, P.-Q. Huang, Versatile One-Pot Synthesis of Polysubstituted Cyclopent-2-enimines from α , β -Unsaturated Amides: Imino-Nazarov Reaction. *Angew. Chem. Int. Ed.* **2018**, *57*, 10352-10356.
- [4] F. Wang, Y. Tong, G. Zou, Nickel-Catalyzed, Manganese-Assisted denitrogenative cross-electrophile-coupling of benzotriazinones with alkyl halides for ortho-alkylated benzamides. *Org. Lett.* **2022**, *24*, 5741-5745.
- [5] L. Zhang, Q. Chen, L. Li, N. Ma, J. Tian, H. Sun, Q. Xu, Y. Yang, C. Li, Synthesis of N-Unsubstituted and N3-substituted quinazoline-2, 4 (1H, 3H)-diones from o-aminobenzamides and CO₂ at atmospheric pressure and room temperature. *Org. Lett.* **2023**, *25*, 2471-2475.
- [6] Q. Teng, G. Sun, F. Huang, K. Wang, F. Liang, Visible-light induced Cerium-catalyzed N-demethylation of N-methyl amides under air conditions. *Adv. Synth. Catal.* **2023**, *365*, 307-311.
- [7] T. Lundrigan, J. P. Tassone, M. Stradiotto, Nickel-Catalyzed N-Arylation of Amides with (Hetero)aryl Electrophiles using a DBU/NaTFA Dual-Base System. *Synlett*. **2021**, *32*, 1665-1669.
- [8] J. Su, J.-N. Mo, X. Chen, A. Umanzor, Z. Zhang, K. N. Houk, J. Zhao, Generation of oxyphosphonium ions by photoredox/cobaloxime catalysis for scalable amide and peptide synthesis in batch and continuous-flow. *Angew. Chem. Int. Ed.* **2022**, *61*, e202116873.
- [9] D. Han, J. Sun, J. Jin, Picolinamide ligands: Nickel-catalyzed reductive cross-coupling of aryl bromides with bromocyclopropane and beyond. *Chem. Asian. J.* **2023**, *18*, e202201132.
- [10] W. I. Nicholson, F. Barreteau, J. A. Leitch, R. Payne, I. Priestley, E. Godineau, C. Battilocchio, D. L. Browne, Direct Amidation of Esters via Ball Milling. *Angew. Chem. Int. Ed.* **2021**, *60*, 21868-21874.
- [11] D. Marcos-Atanes, C. Vidal, C. D. Navo, F. Peccati, G. Jiménez-Osés, J. L. Mascareñas, Iridium-Catalyzed ortho-Selective Borylation of Aromatic Amides Enabled by 5-Trifluoromethylated Bipyridine Ligands. *Angew. Chem. Int. Ed.* **2023**, *62*, e202214510.
- [12] L.-M. Yang, S.-S. Li, Y.-Y. Zhang, J.-L. Lu, J.-T. Deng, A.-J. Ma, X.-Z. Zhang, S.-Y. Zhang, J.-B. Peng, Palladium catalyzed aminocarbonylation of benzylic ammonium triflates with nitroarenes: Synthesis of phenylacetamides. *Adv. Synth. Catal.* **2021**, *363*, 2061-2065.
- [13] N. Vasudevan, G. R. Jachak, D. S. Reddy, Breaking and making of rings: A method for the preparation of 4-quinolone-3-carboxylic acid amides and the expensive drug ivacaftor. *Eur. J. Org. Chem.* **2015**, *2015*, 7433-7437.
- [14] S. N. C. Sridhar, S. Palawat, A. T. Paul. Design, synthesis, biological evaluation and molecular modelling studies of indole glyoxylamides as a new class of potential pancreatic lipase inhibitors. *Bioorg. Chem.* **2019**, *85*, 373-381.
- [15] M. J. Thompson, V. Borsenberger, J. C. Louth, K. E. Judd, B. Chen, Design, synthesis, and structure-activity relationship of indole-3-glyoxylamide libraries possessing highly potent activity in a cell line model of prion disease. *J. Med. Chem.* **2009**, *52*, 7503-7511.
- [16] J. Kang, L. Chen, H. Cui, L. Zhang, C.-Y. Su. N-H Insertion reactions catalyzed by a dirhodium

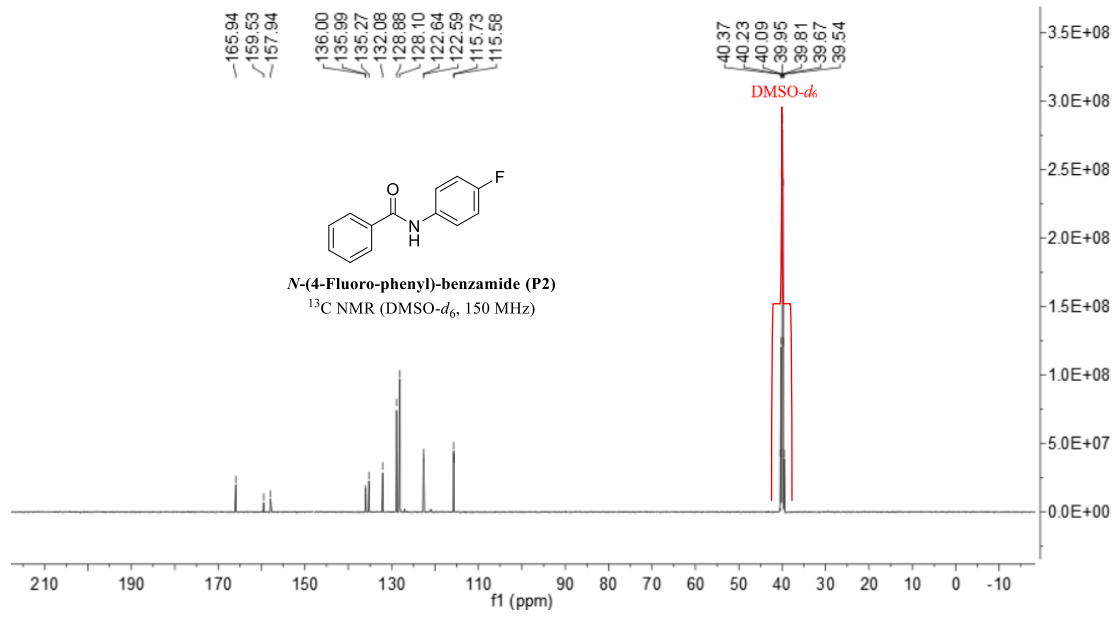
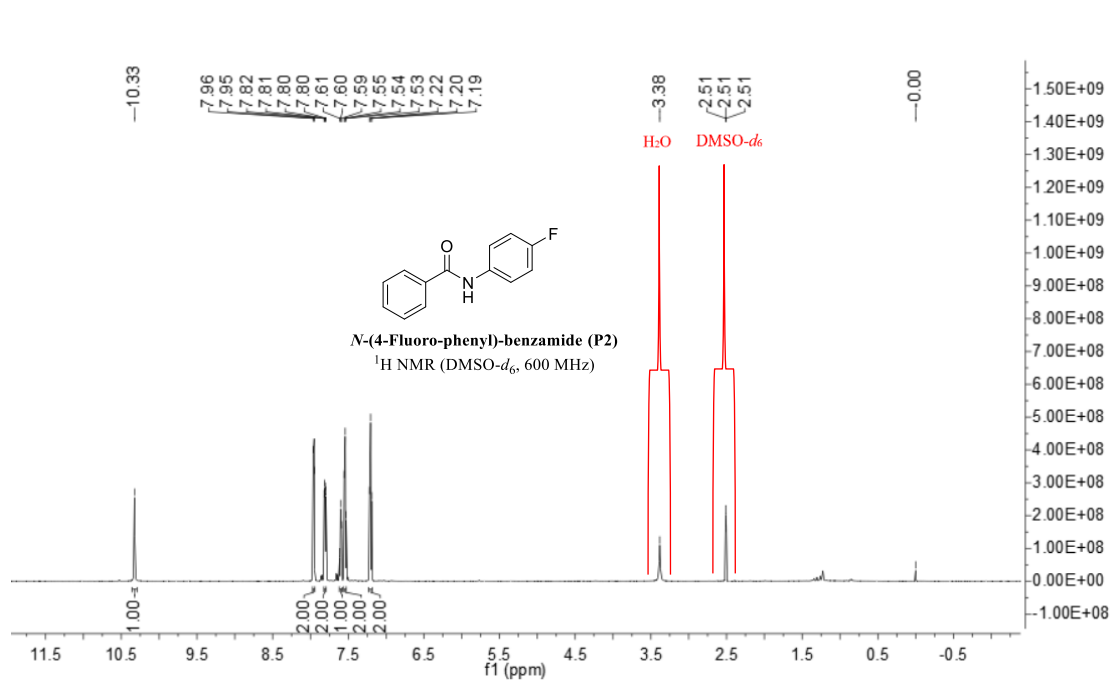
- metal-organic cage: A facile and recyclable approach for C-N bond formation. *Chinese J. Chem.* **2017**, *35*, 964-968.
- [17] T. Alam, A. Rakshit, H. N. Dhara, A. Palai, B. K. Patel, Electrochemical amidation: benzoyl hydrazine/carbazate and amine as coupling partners. *Org. Lett.* **2022**, *24*, 6619-6624.
- [18] N. Benamara, M. Merabet-Khelassi, L. Aribi-Zouiouche, O. Riant. CAL-B-mediated efficient synthesis of a set of valuable amides by direct amidation of phenoxy- and aryl-propionic acids. *Chem. Pap.* **2021**, *75*, 4045-4053.
- [19] D. Podder, S. R. Chowdhury, S. K. Nandi, D. Haldar, Tripeptide based super-organogelators: Structure and function. *New J. Chem.* **2019**, *43*, 3743-3749.
- [20] S. Pal, E. N. Prabhakaran, Trimodular solution-phase protocol for rapid large-scale synthesis of hydrogen bond surrogate-constrained α -helicomimics. *Eur. J. Org. Chem.* **2021**, *2021*, 1714-1719.
- [21] M. J. Frisch, G. W. T., H. B. Schlegel, G. E. Scuseria, M. A. Robb, J. R. Cheeseman, G. Scalmani, V. Barone, G. A. Petersson, H. Nakatsuji, X. Li, M. Caricato, A. Marenich, J. Bloino, B. G. Janesko, R. Gomperts, B. Mennucci, H. P. Hratchian, J. V. Ortiz, A. F. Izmaylov, J. L. Sonnenberg, D. Williams-Young, F. Ding, F. Lipparini, F. Egidi, J. Goings, B. Peng, A. Petrone, T. Henderson, D. Ranasinghe, V. G. Zakrzewski, J. Gao, N. Rega, G. Zheng, W. Liang, M. Hada, M. Ehara, K. Toyota, R. Fukuda, J. Hasegawa, M. Ishida, T. Nakajima, Y. Honda, O. Kitao, H. Nakai, T. Vreven, K. Throssell, J. A. Montgomery, Jr., J. E. Peralta, F. Ogliaro, M. Bearpark, J. J. Heyd, E. Brothers, K. N. Kudin, V. N. Staroverov, T. Keith, R. Kobayashi, J. Normand, K. Raghavachari, A. Rendell, J. C. Burant, S. S. Iyengar, J. Tomasi, M. Cossi, J. M. Millam, M. Klene, C. Adamo, R. Cammi, J. W. Ochterski, R. L. Martin, K. Morokuma, O. Farkas, J. B. Foresman, and D. J. Fox, Gaussian, Inc., Wallingford CT 2016.
- [22] A. D. Becke, Density-functional thermochemistry. III. The role of exact exchange. *J. Chem. Phys.* **1993**, *98*, 5648-5652.
- [23] C. Lee, W. Y, R. G. Parr, Development of the Colle-Salvetti correlation-energy into a function of the electron density. *Phys. Rev. B* **1988**, *37*, 785-789.
- [24] S. Grimme, J. Antony, S. Ehrlich, H. Krieg, A consistent and accurate ab initio parametrization of density functional dispersion correction (DFT-D) for the 94 elements H-Pu. *J. Chem. Phys.* **2010**, *132*, 154104.
- [25] S. Grimme, S. Ehrlich, L. Goerigk, Effect of the damping function in dispersion corrected density functional theory. *J. Comput. Chem.* **2011**, *32*, 1456-1465.

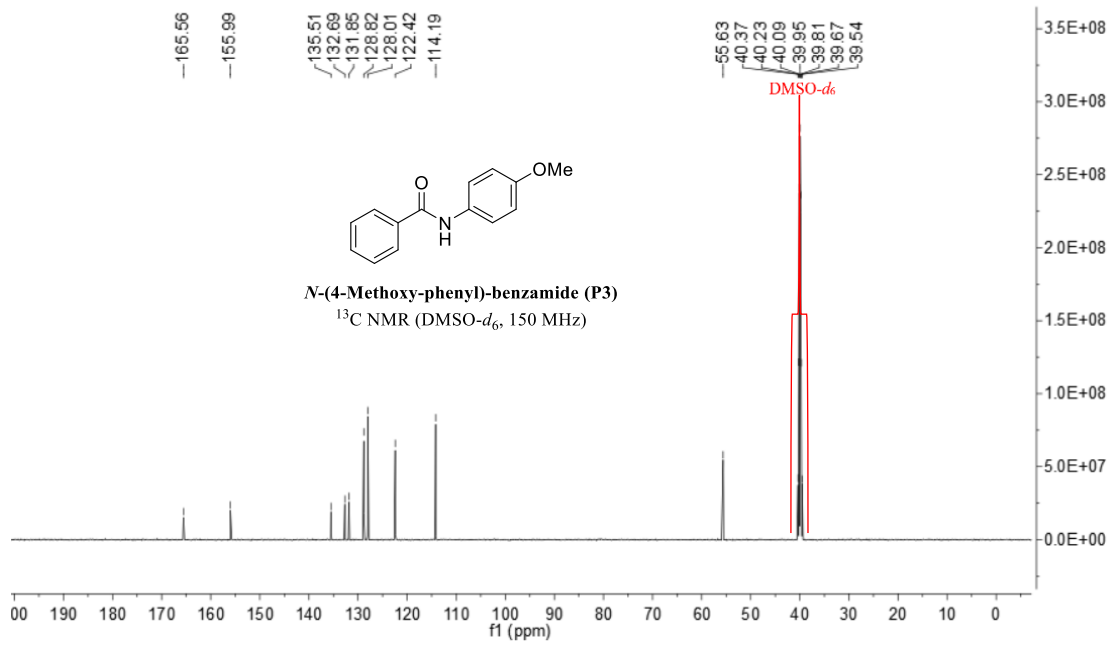
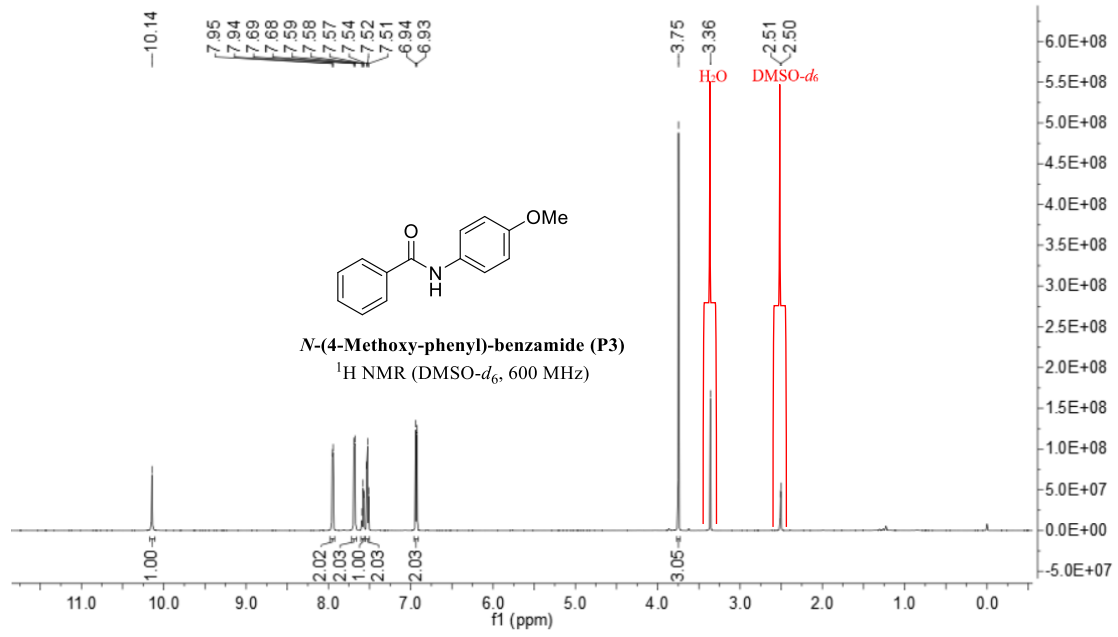
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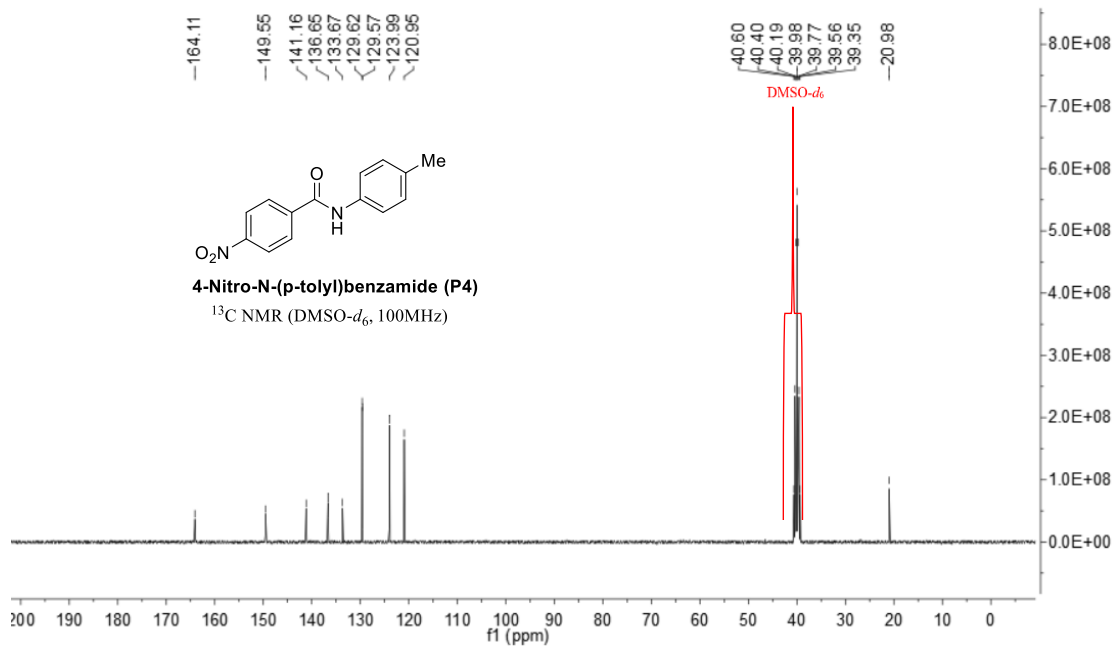
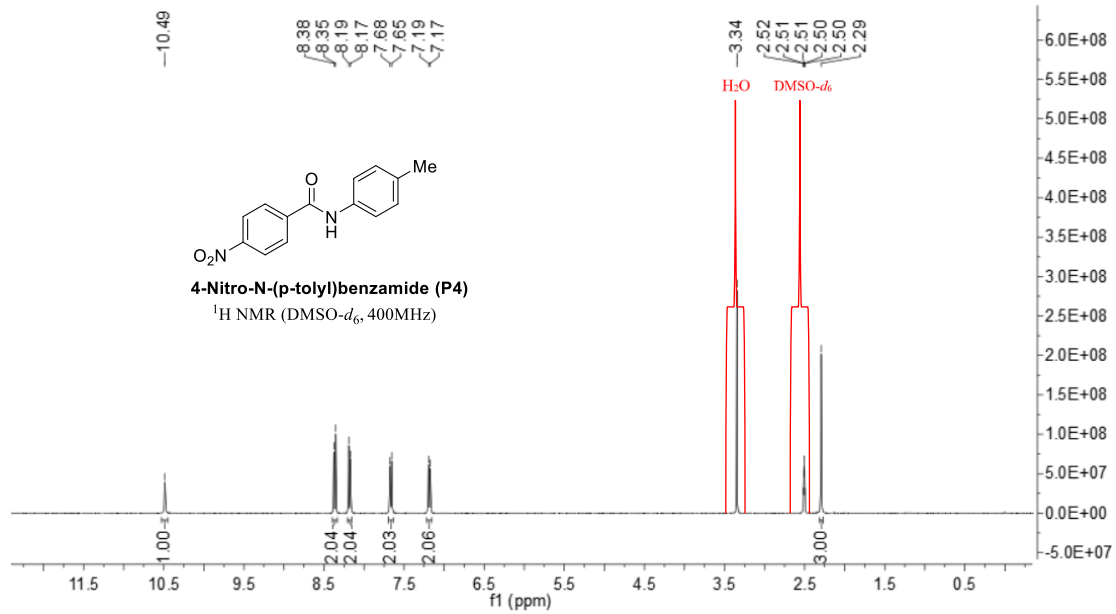


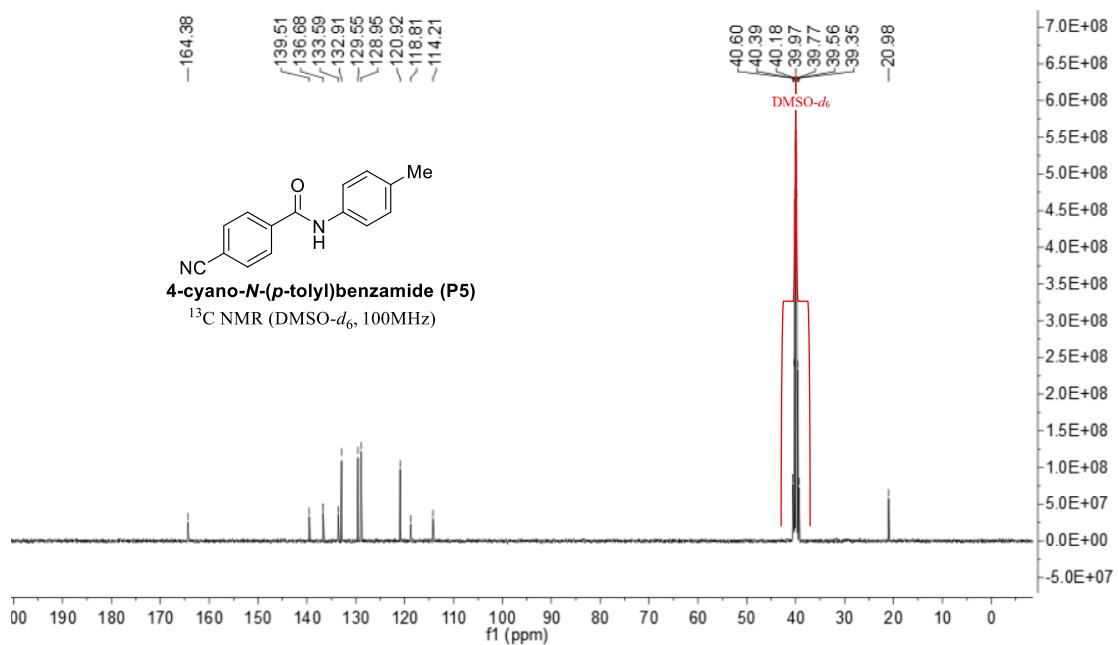
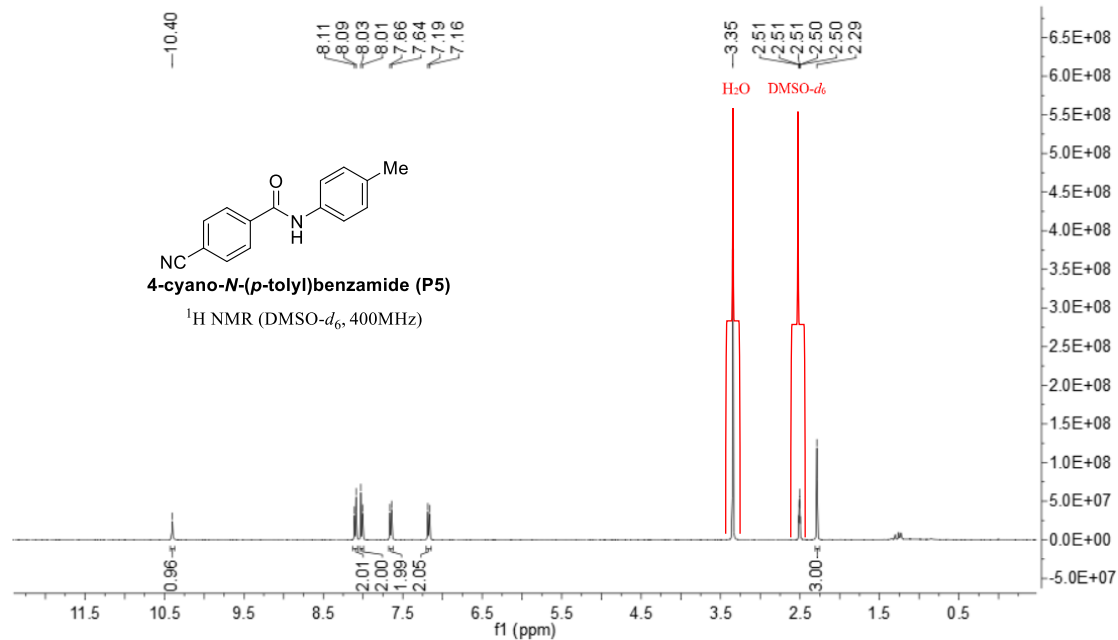


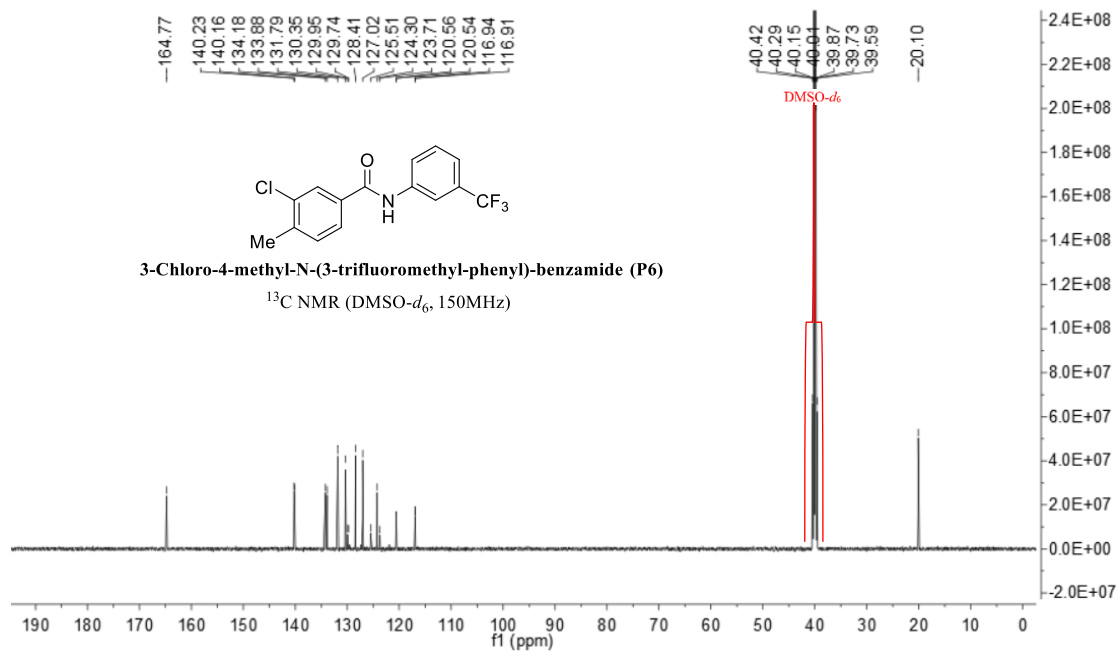
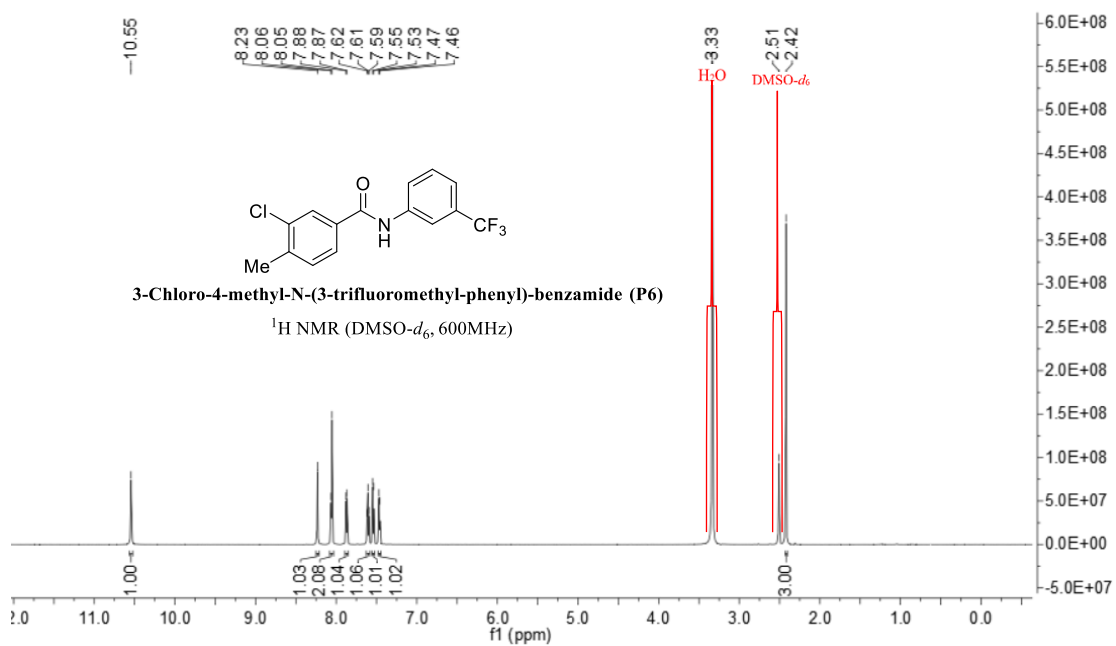


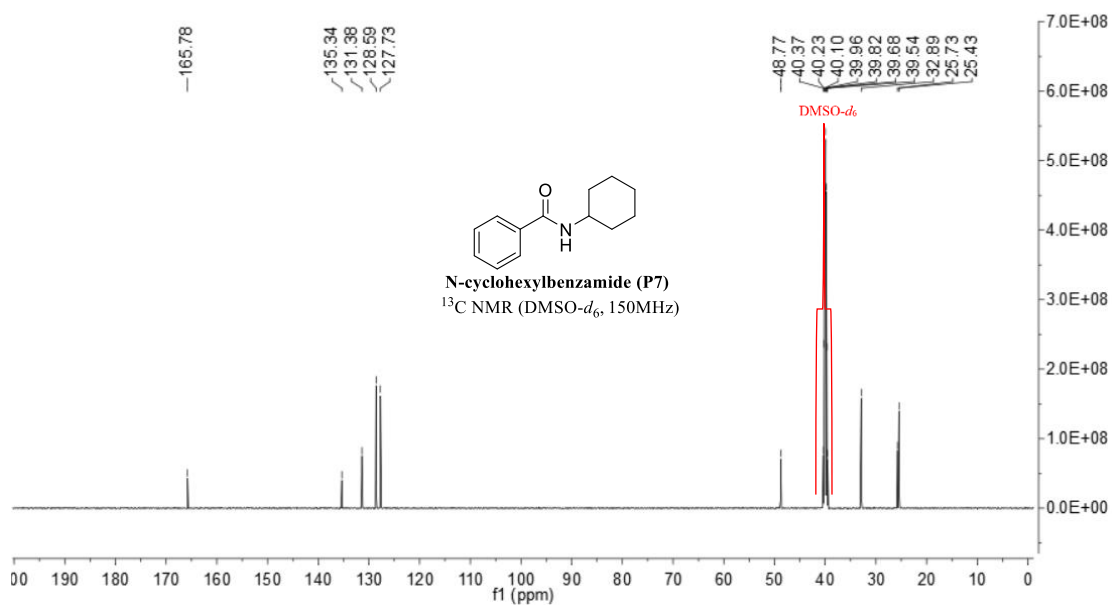
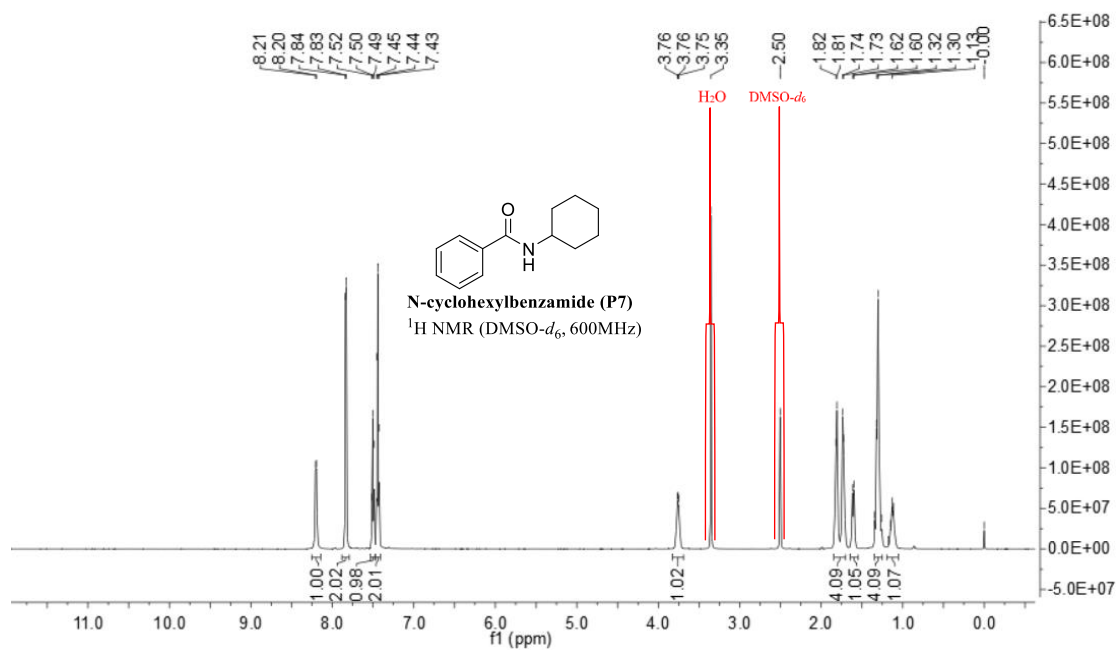


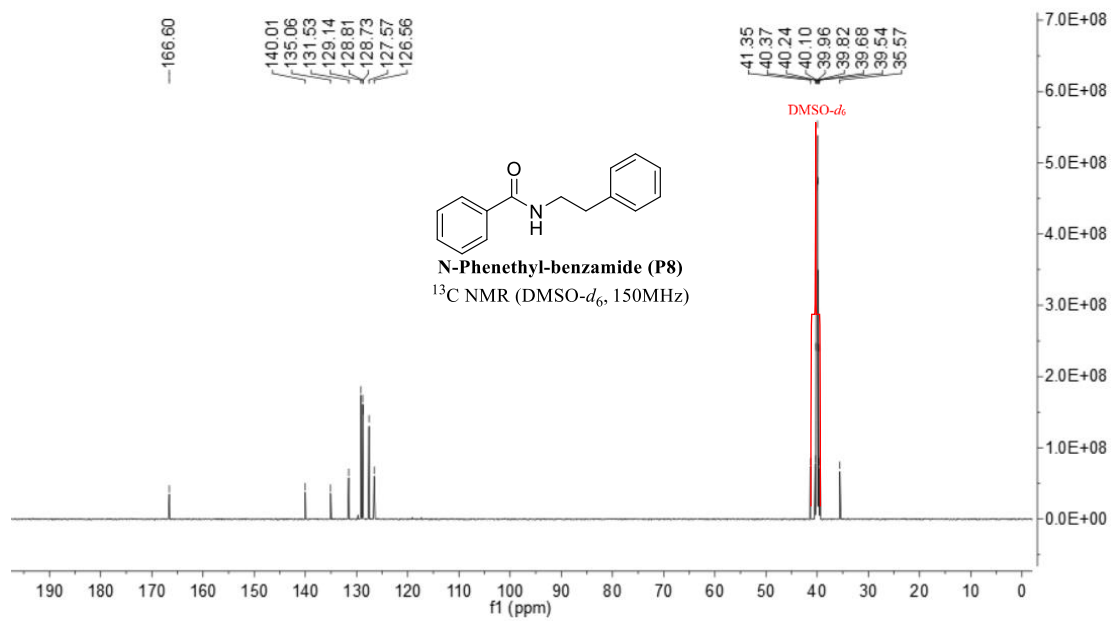
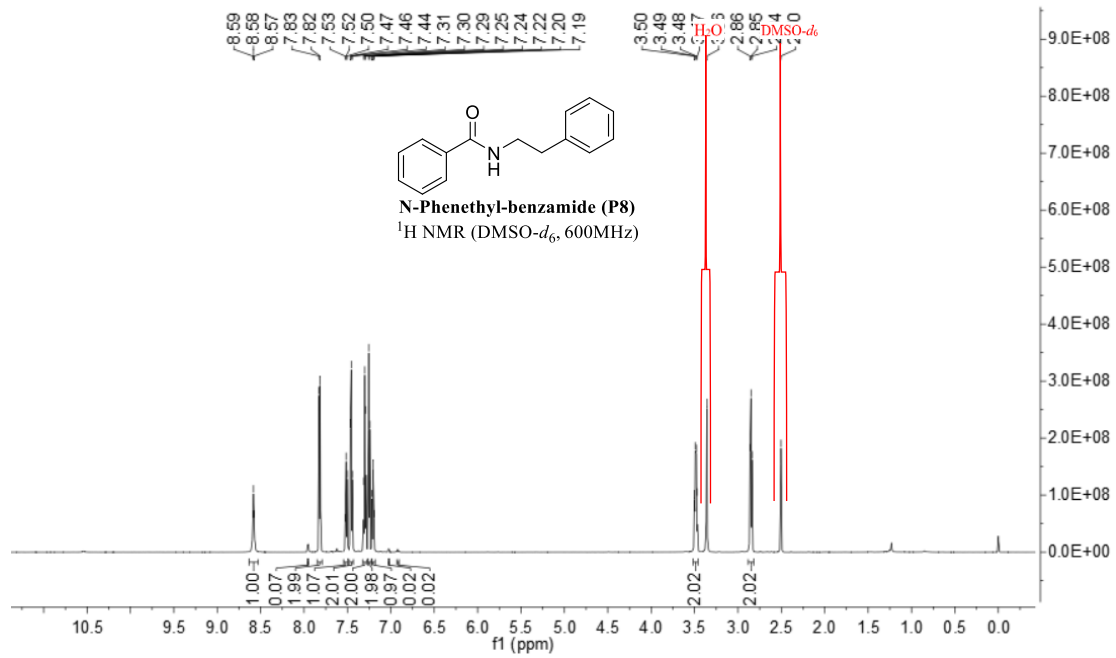


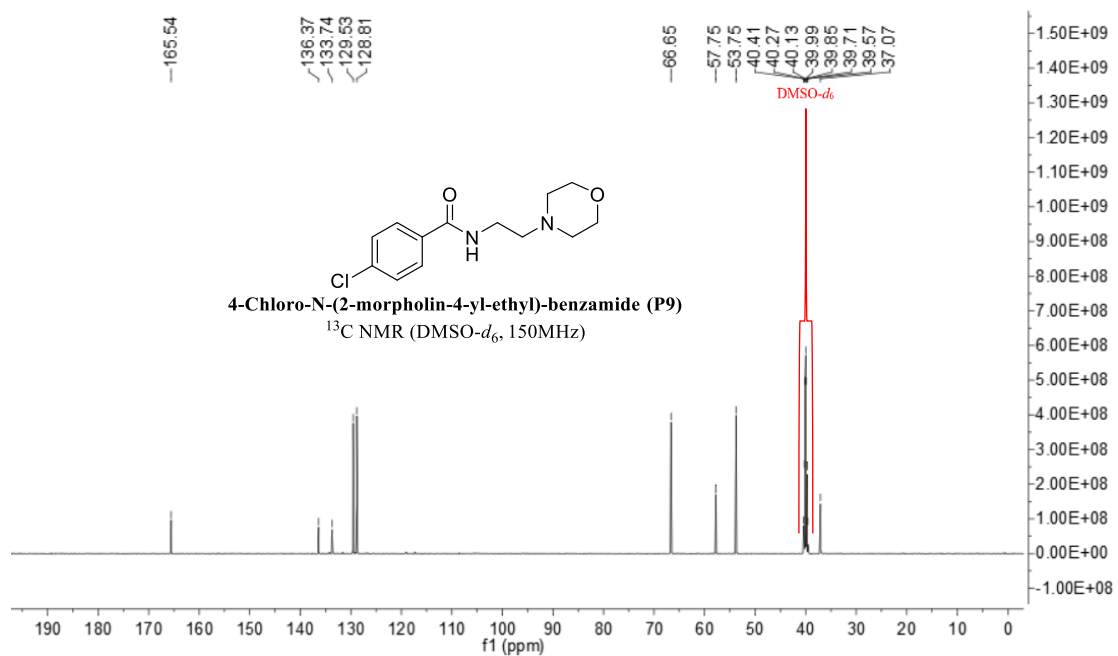
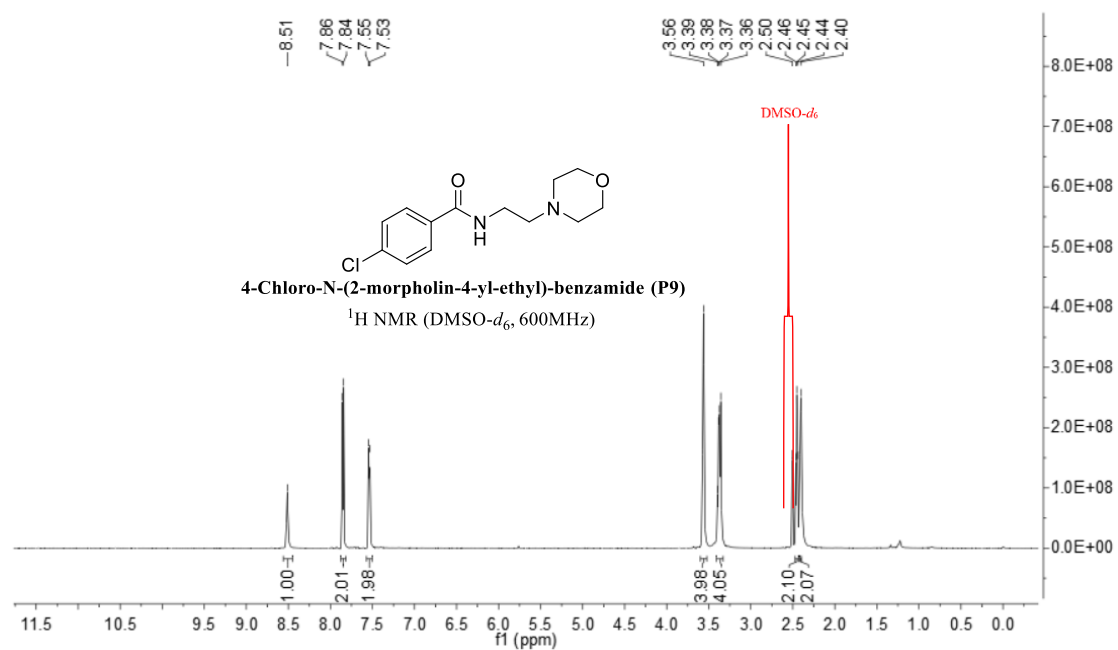


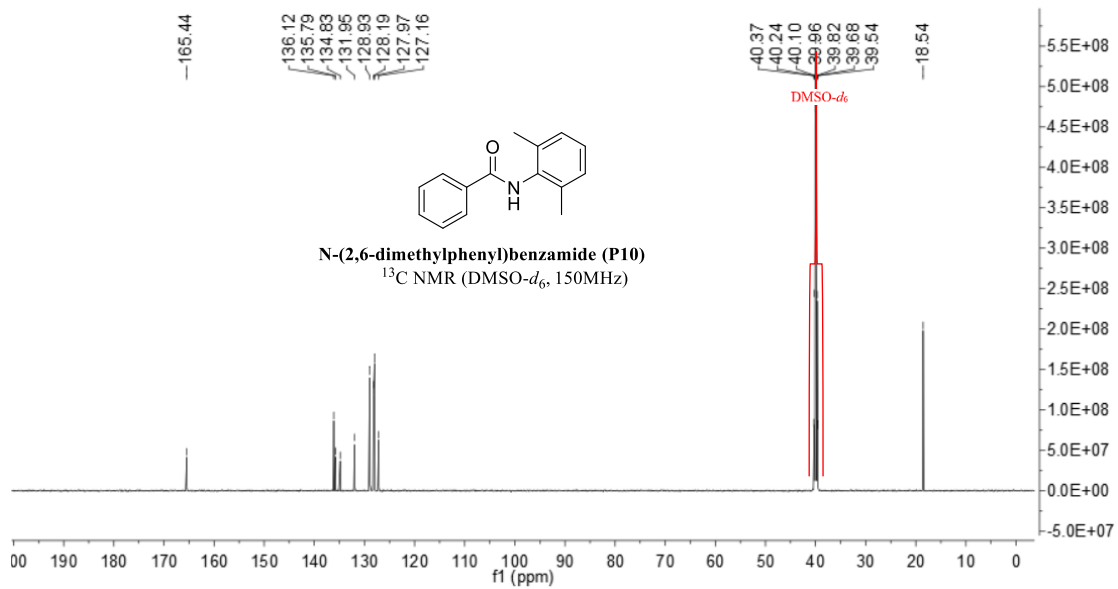
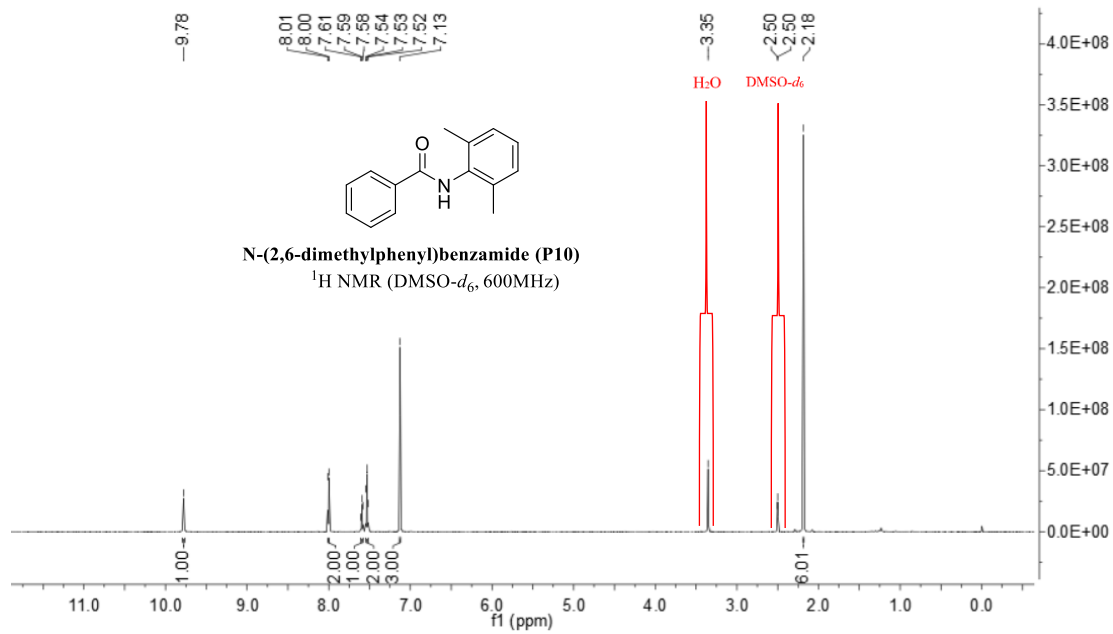


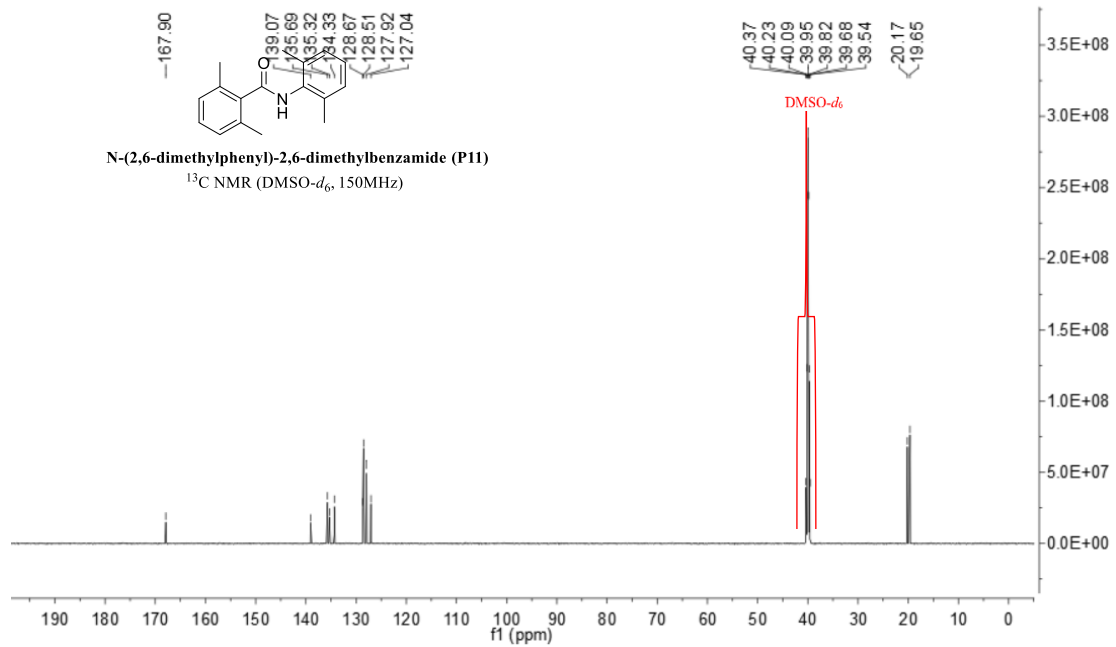
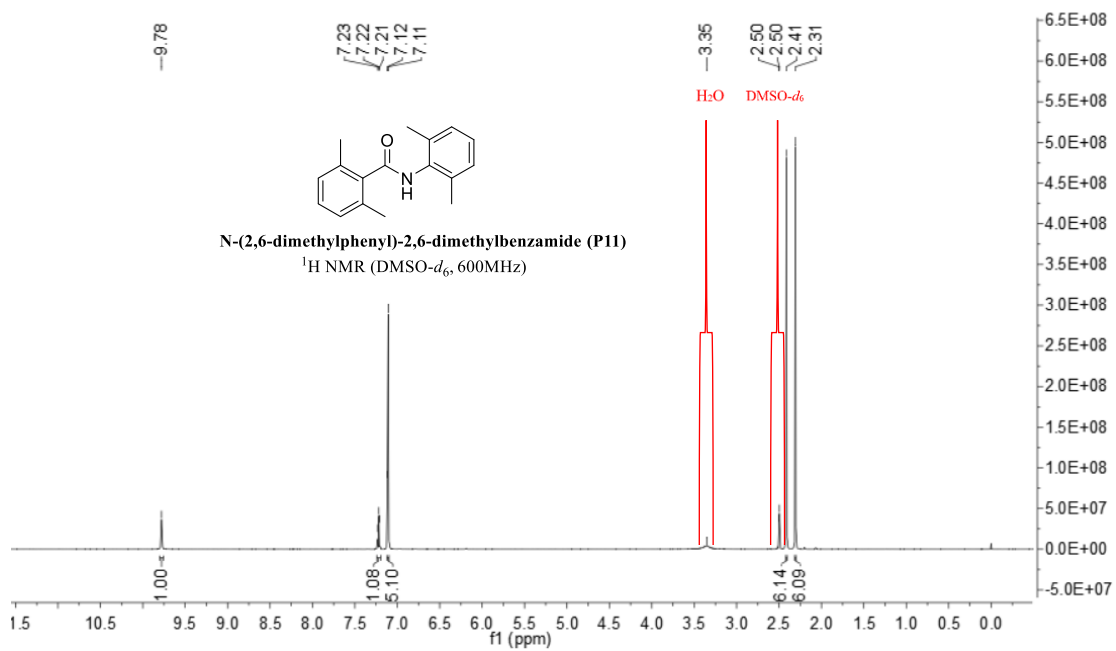


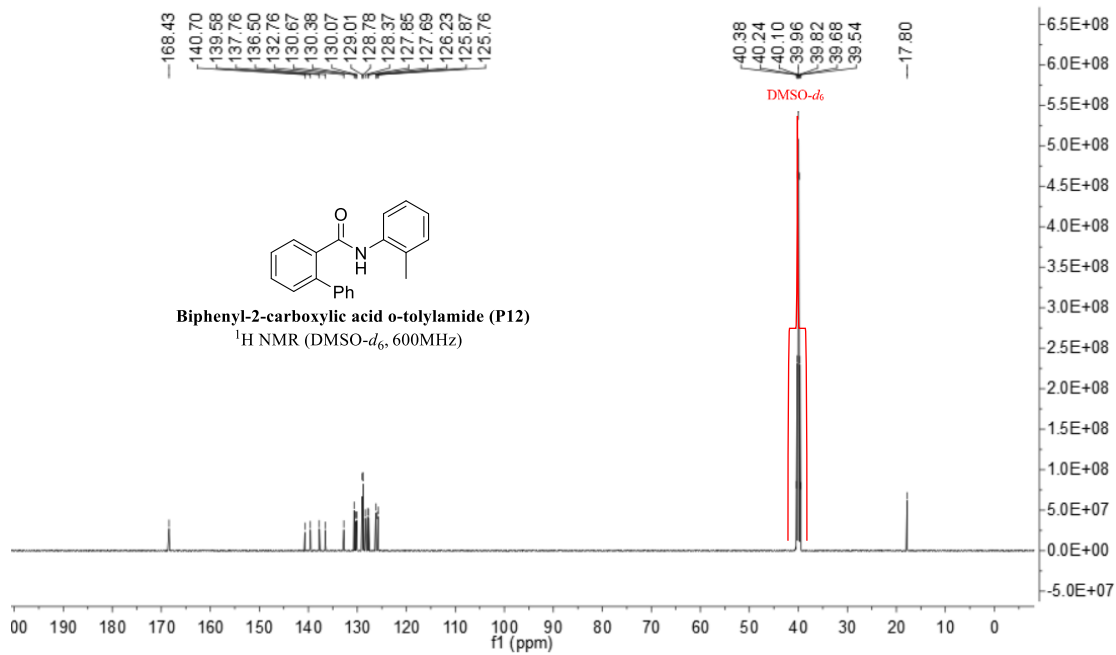
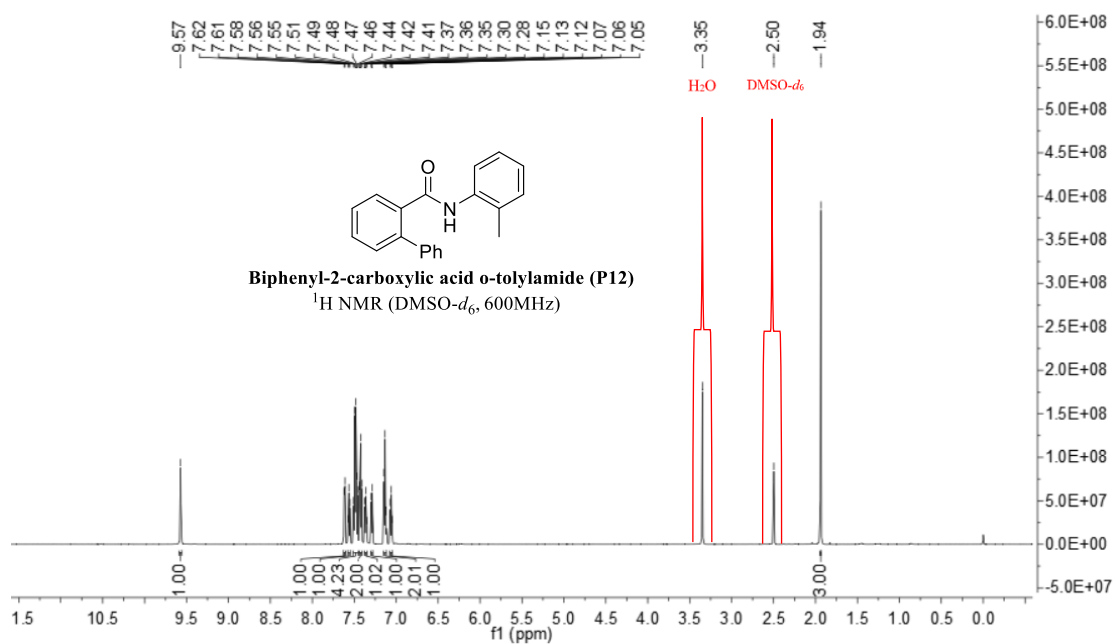


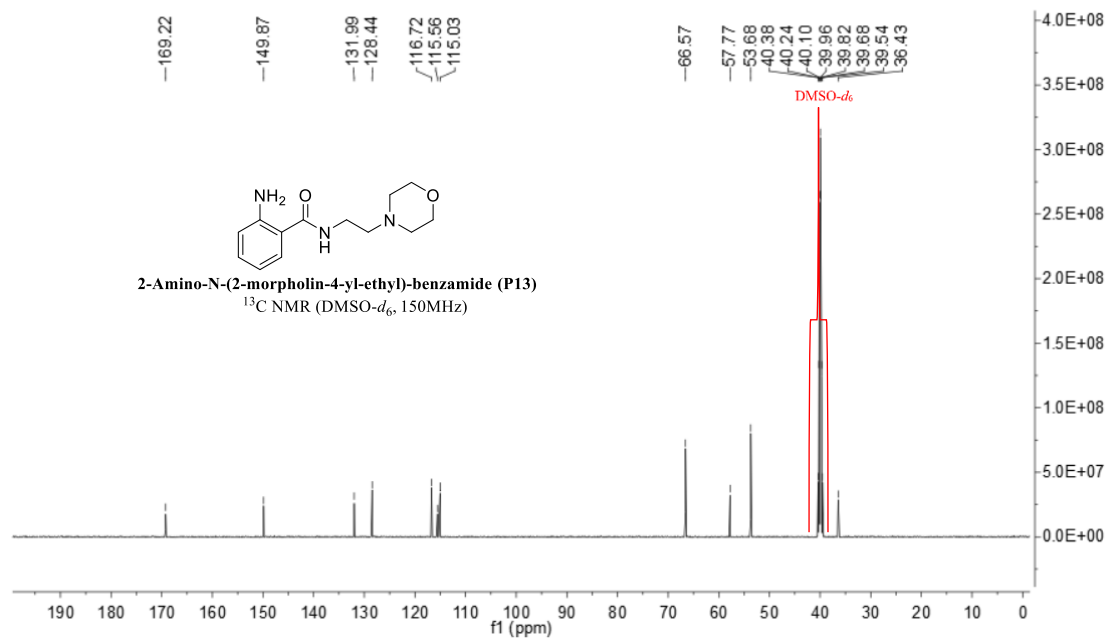
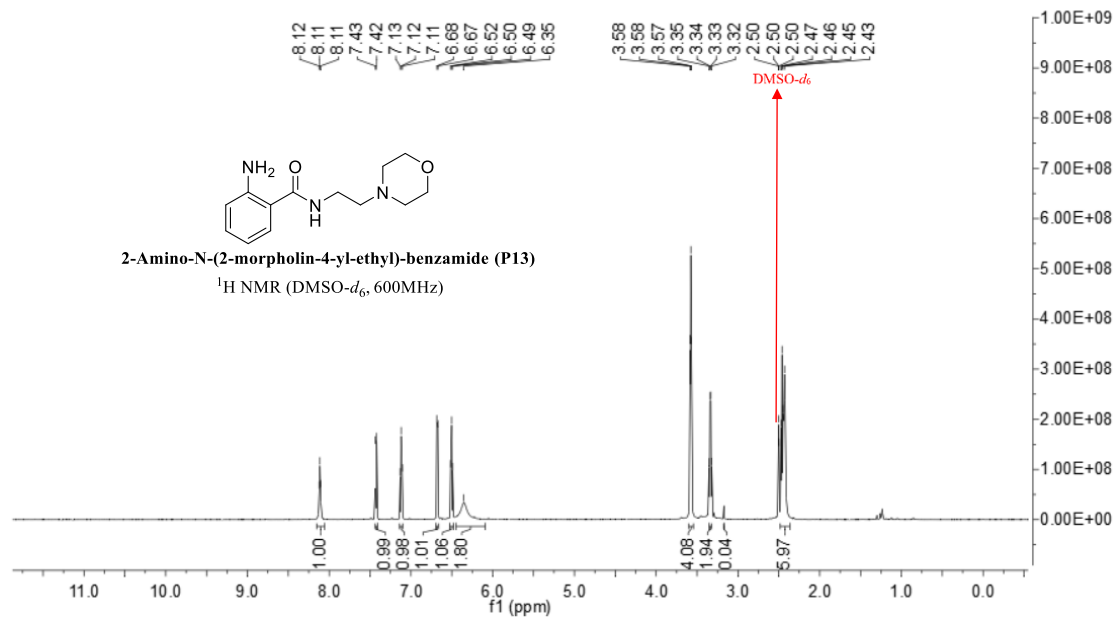


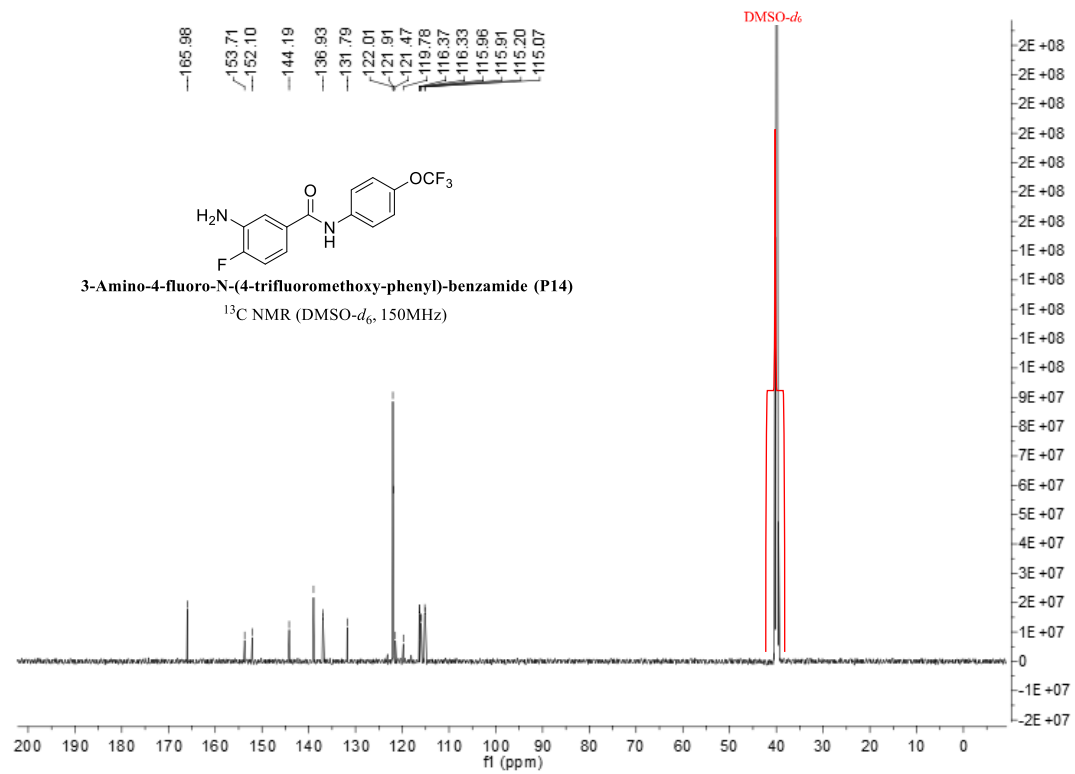
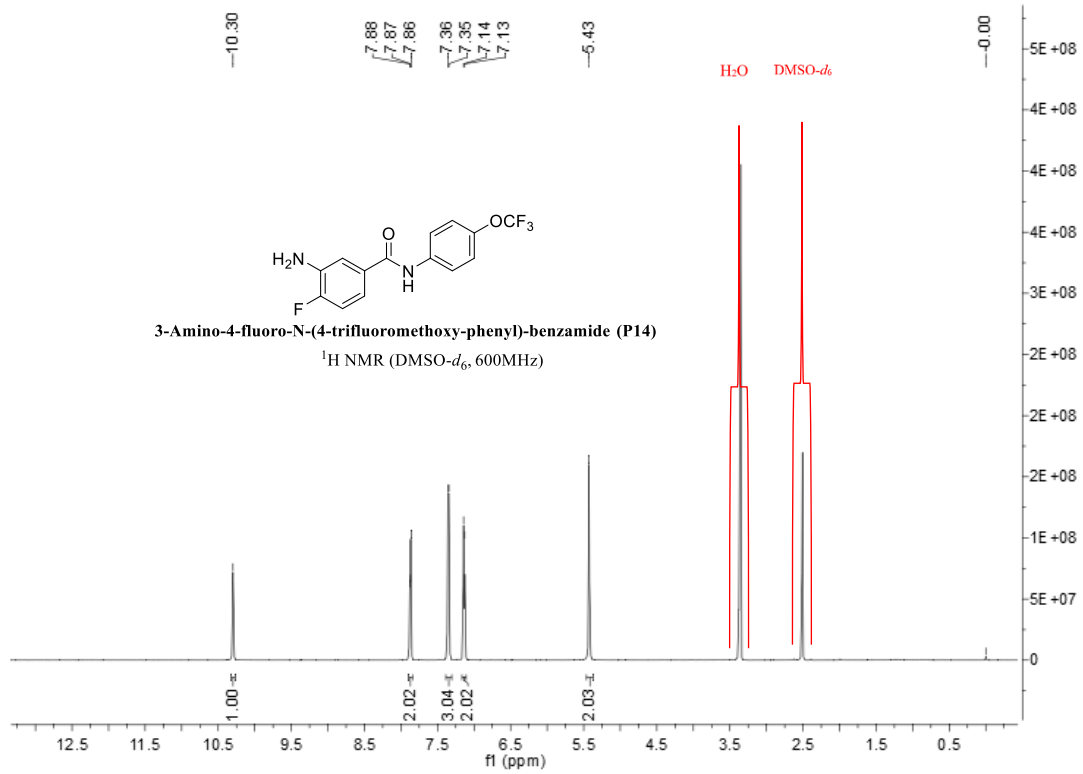


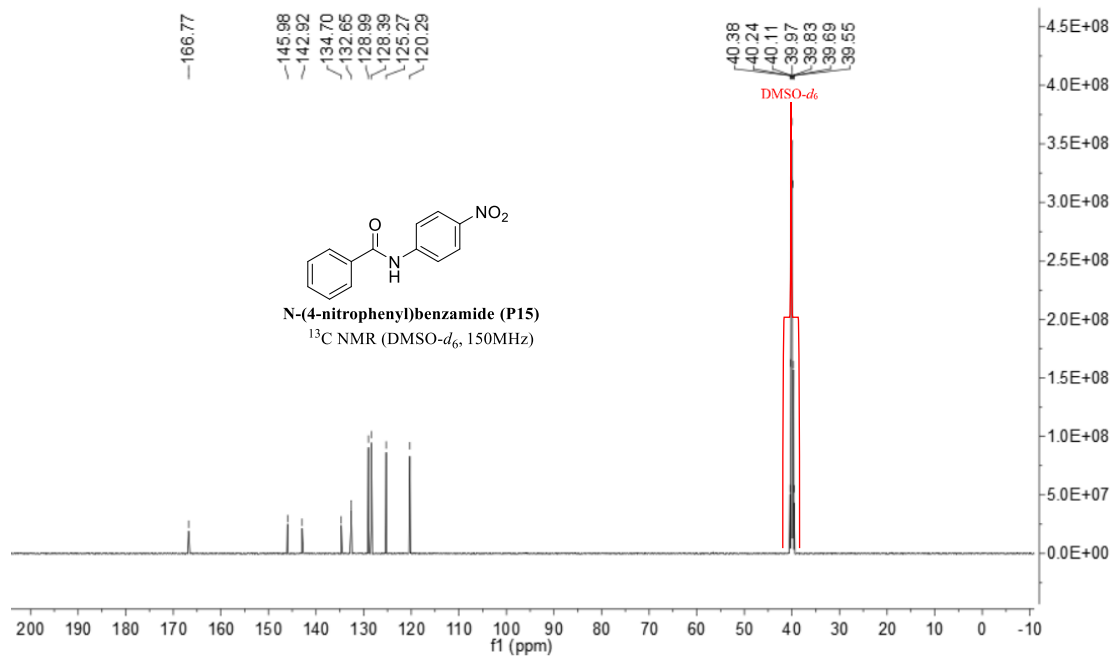
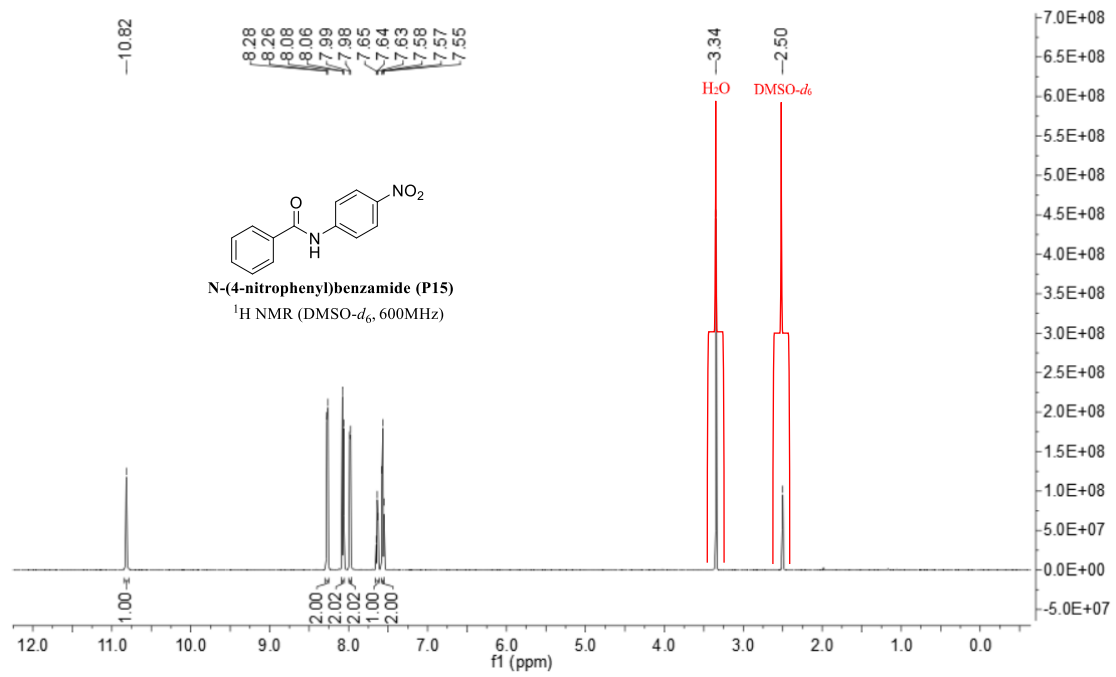


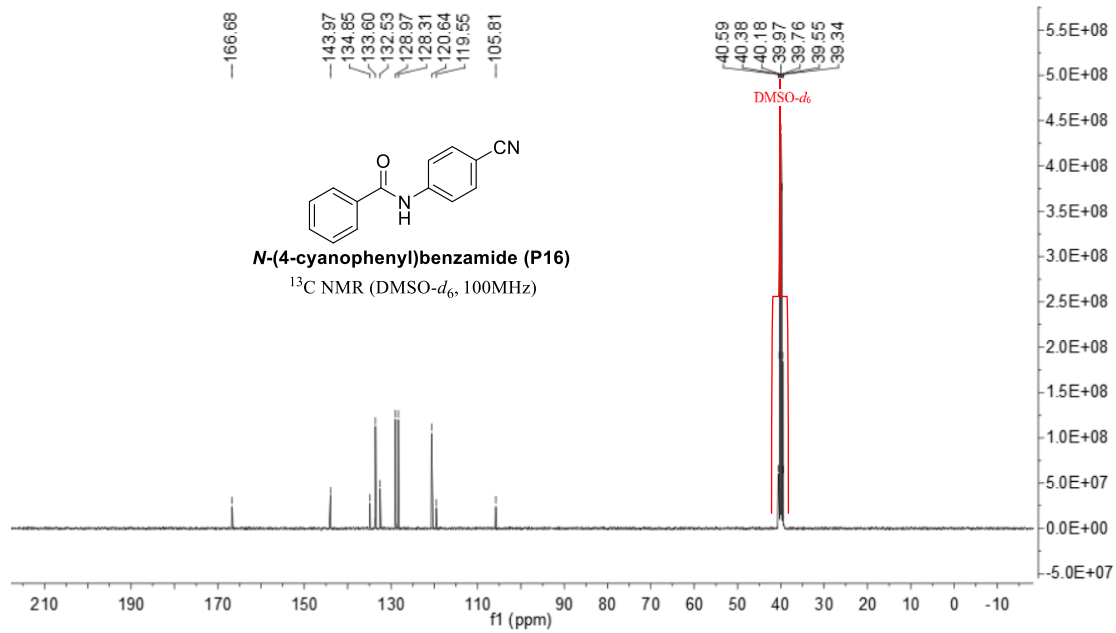
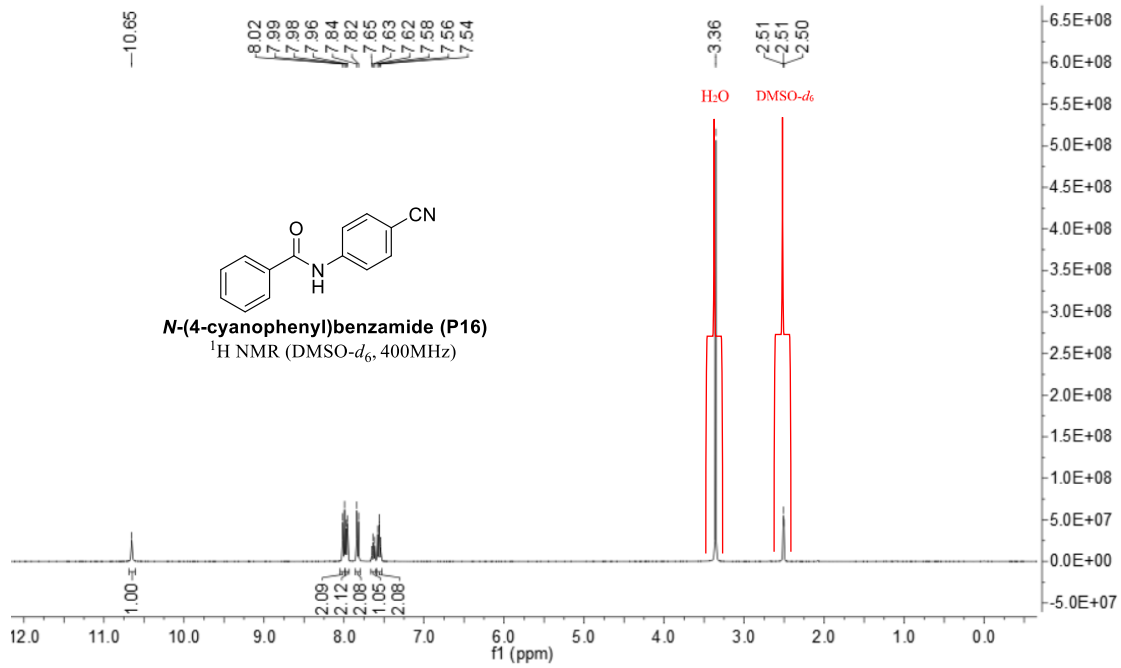


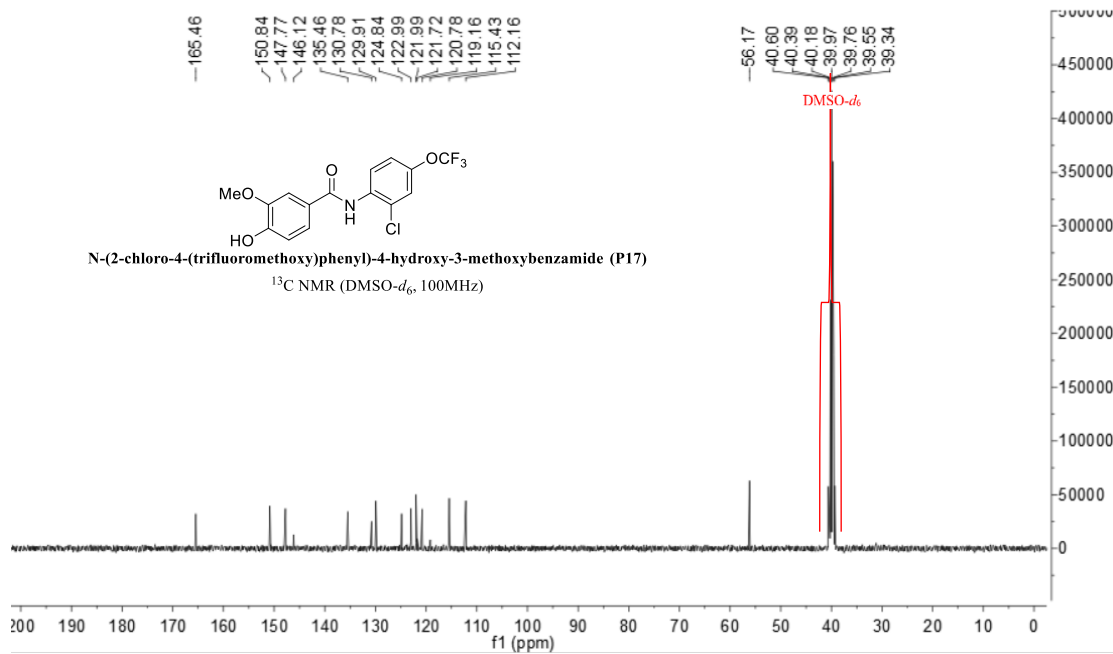
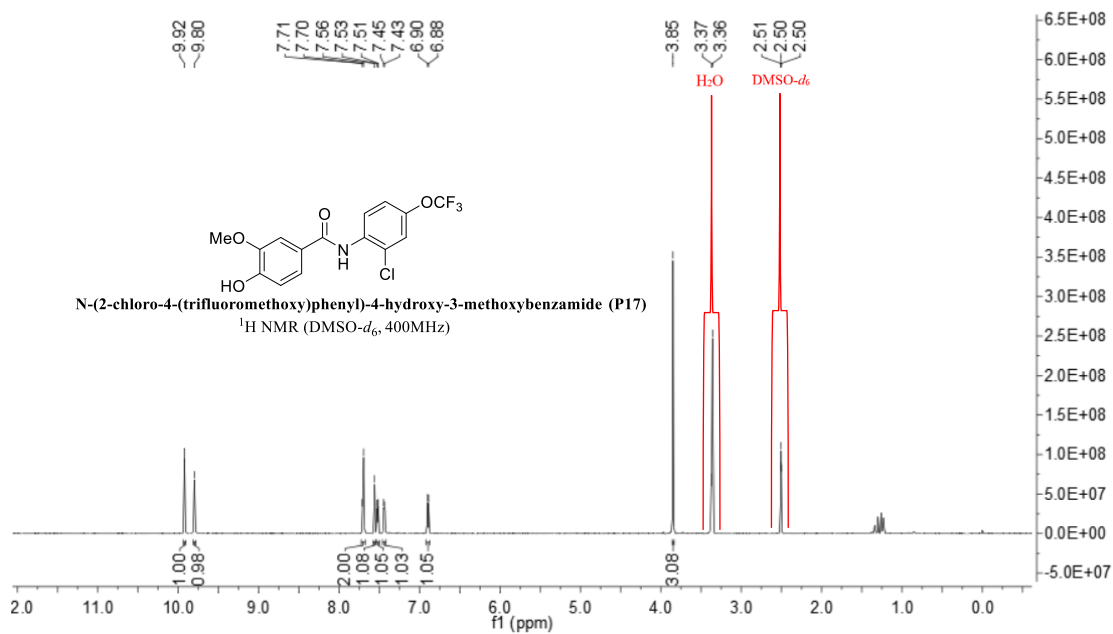


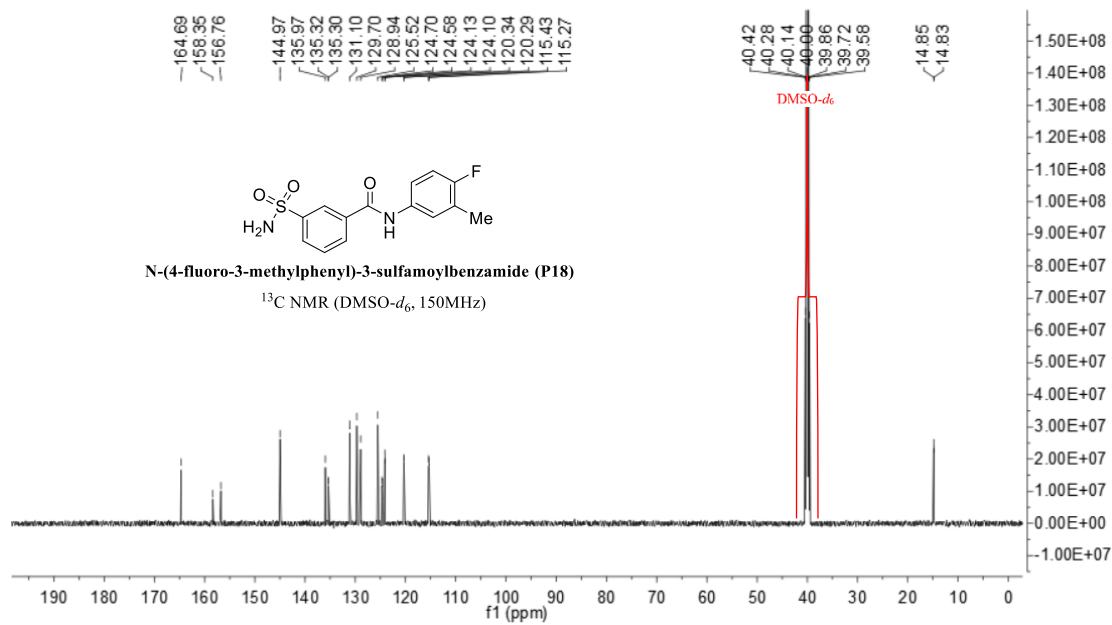
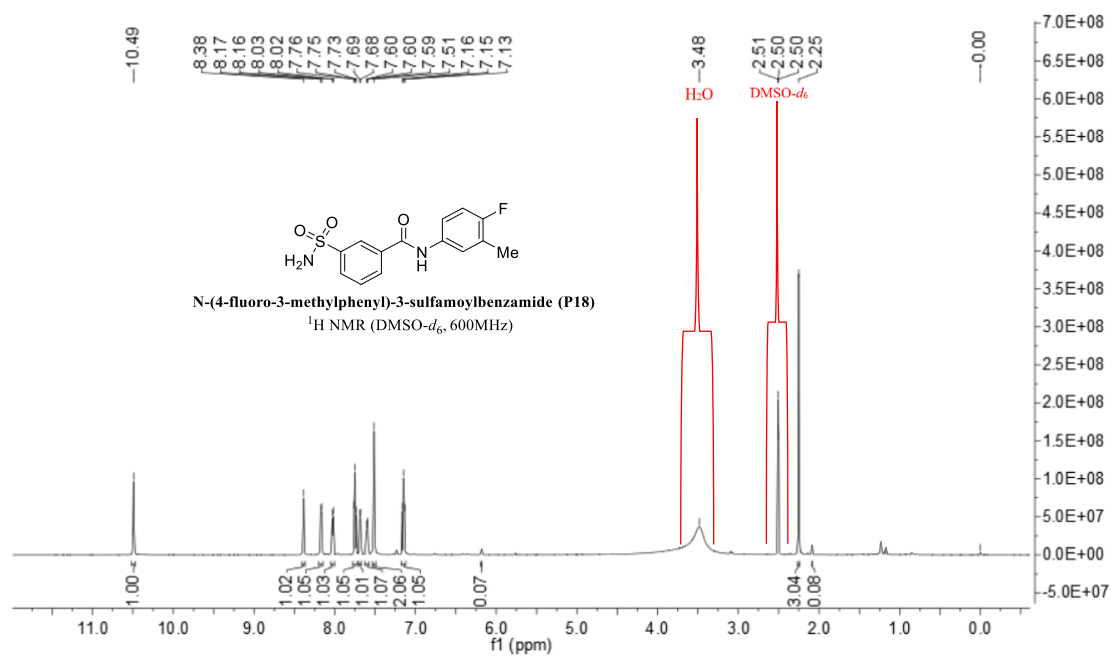


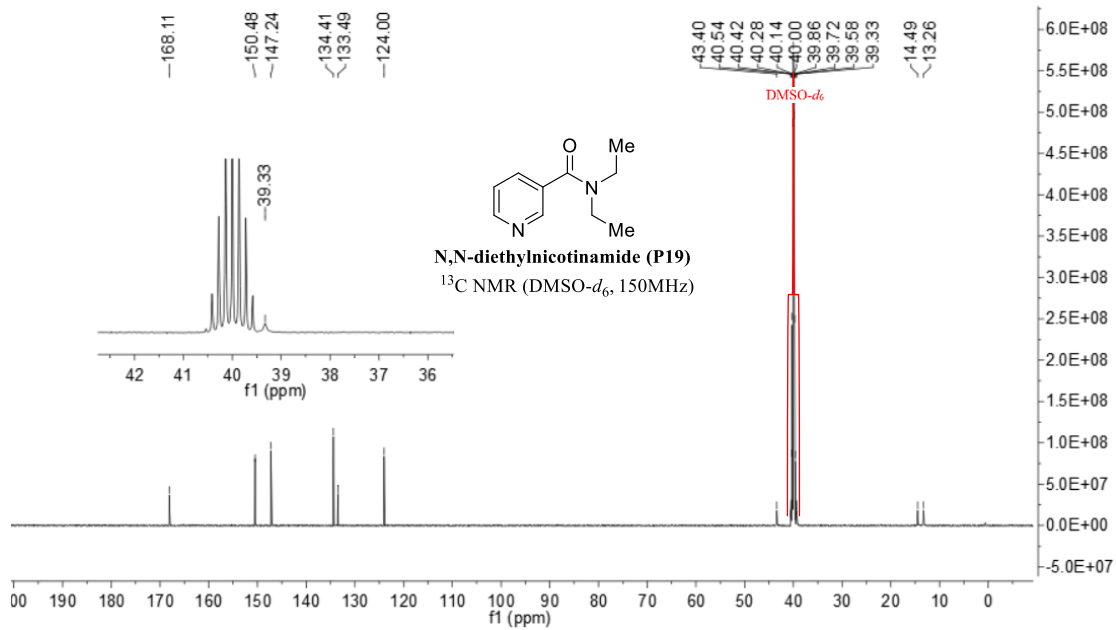
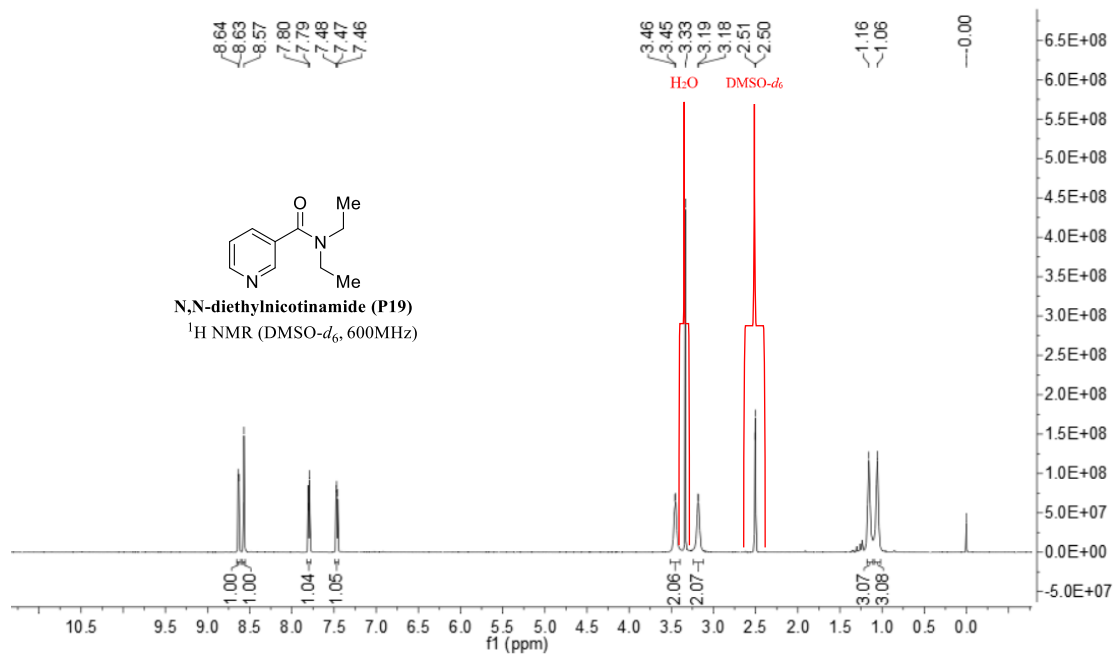


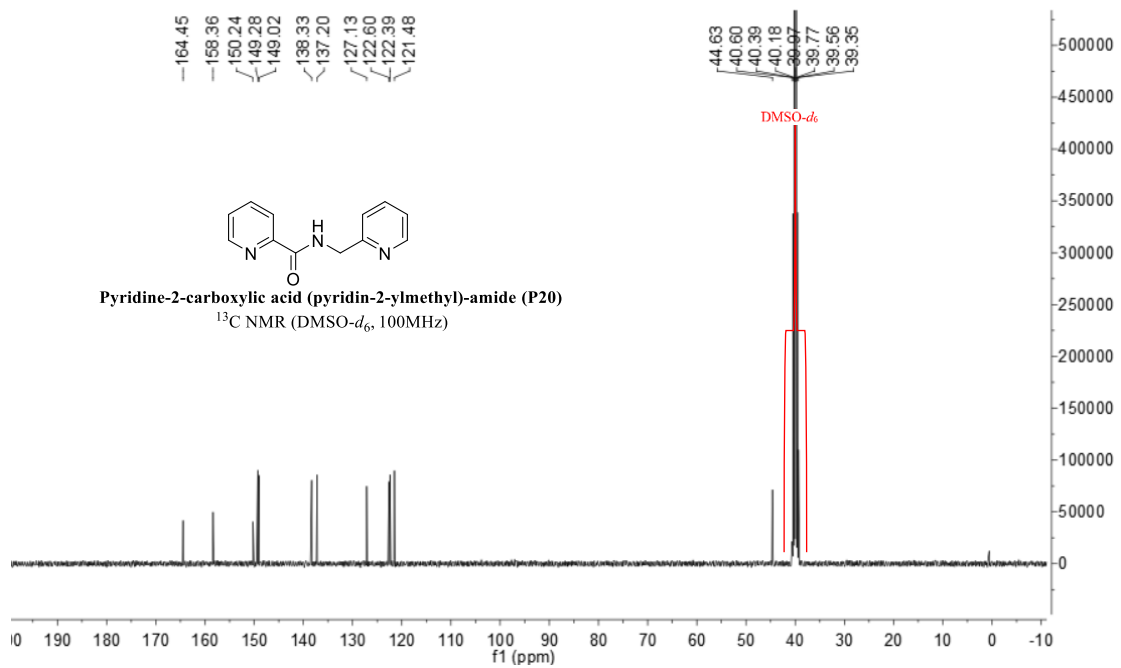
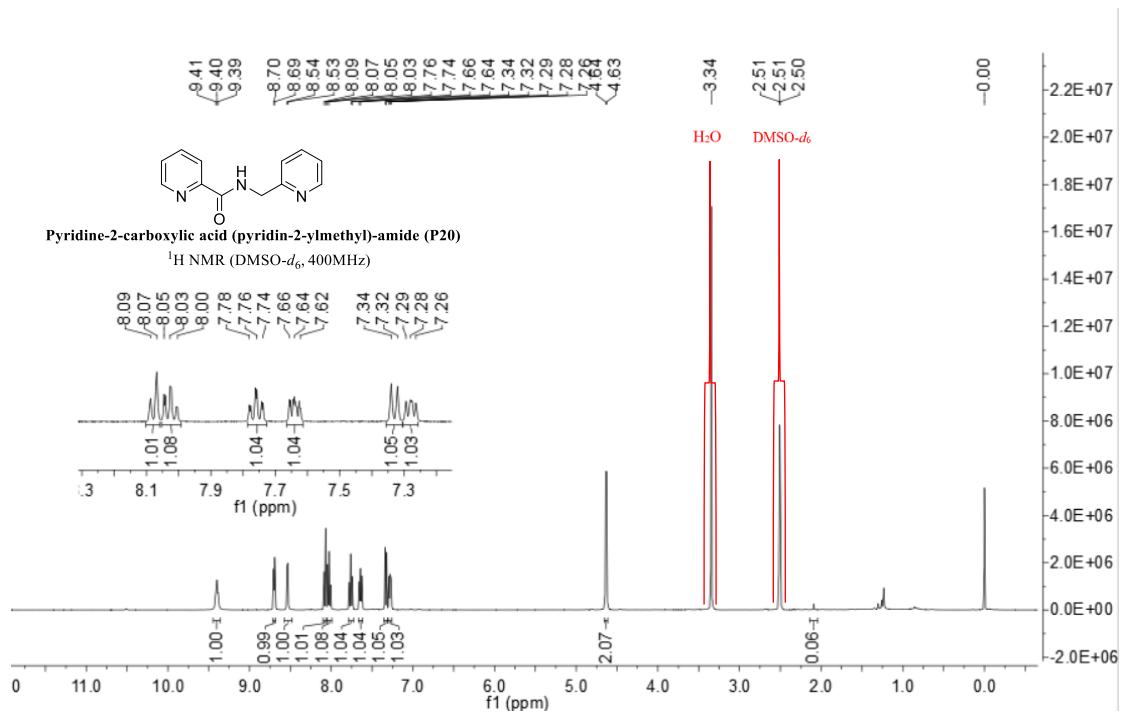


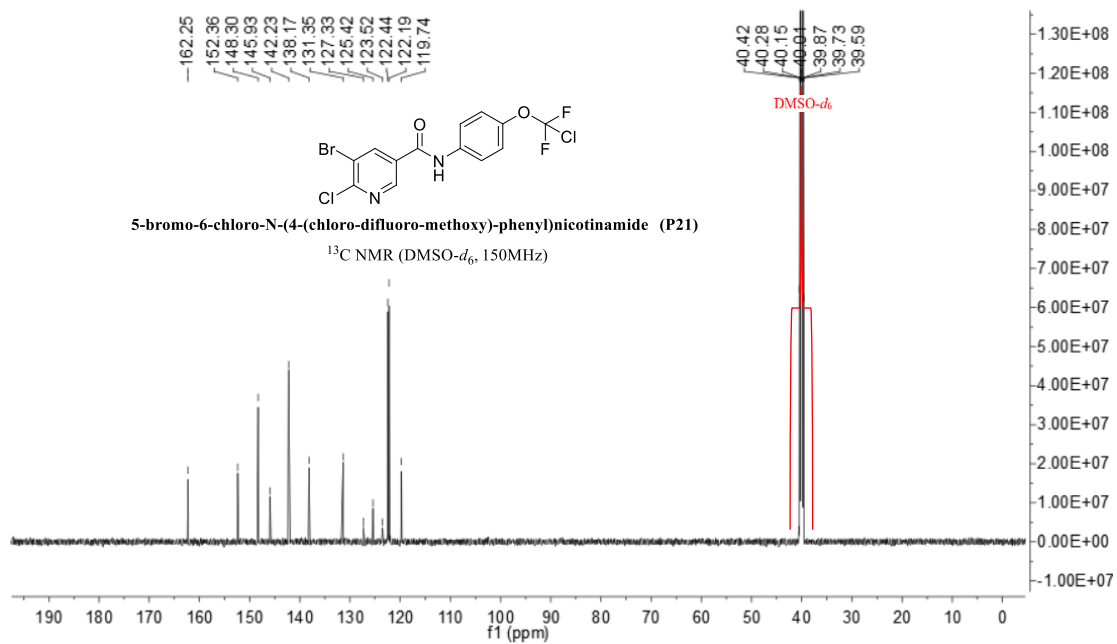
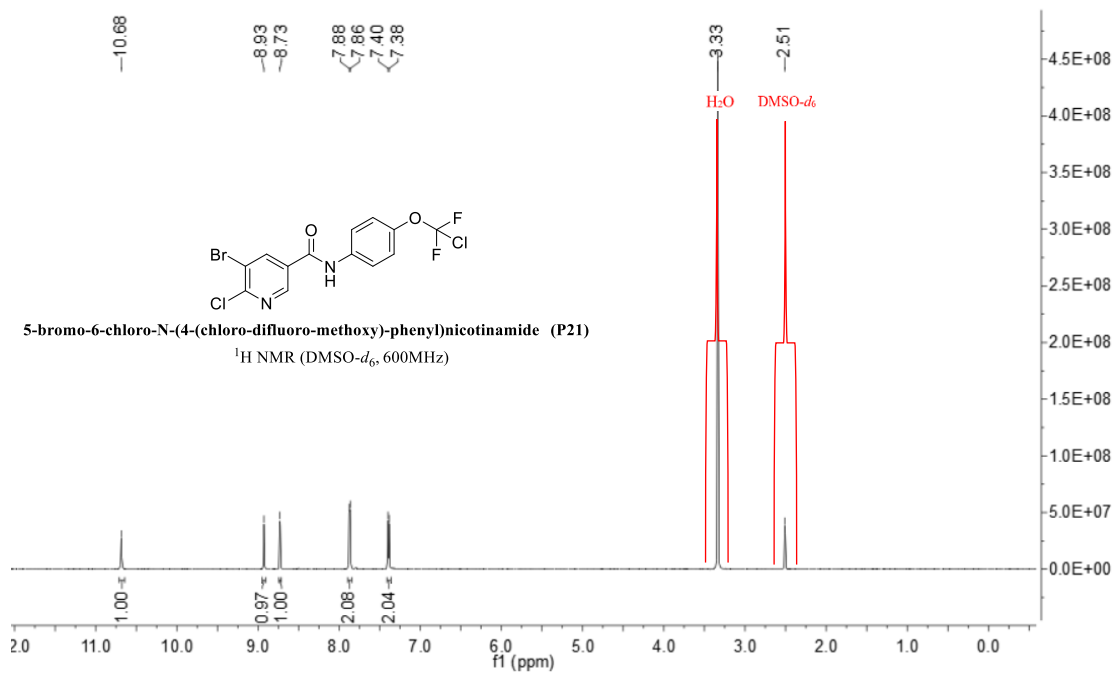


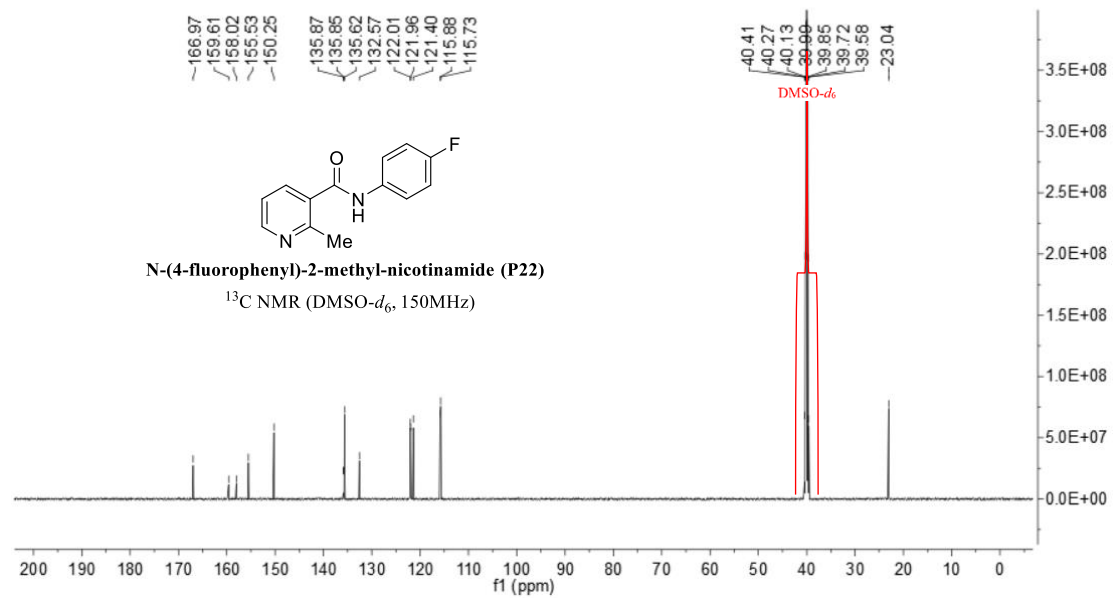
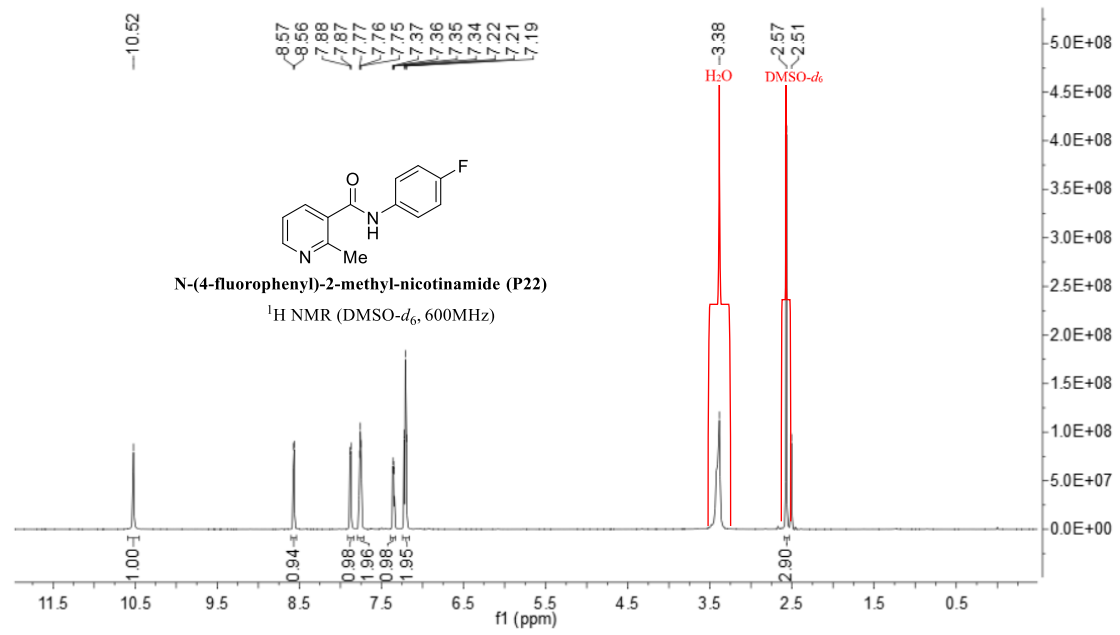


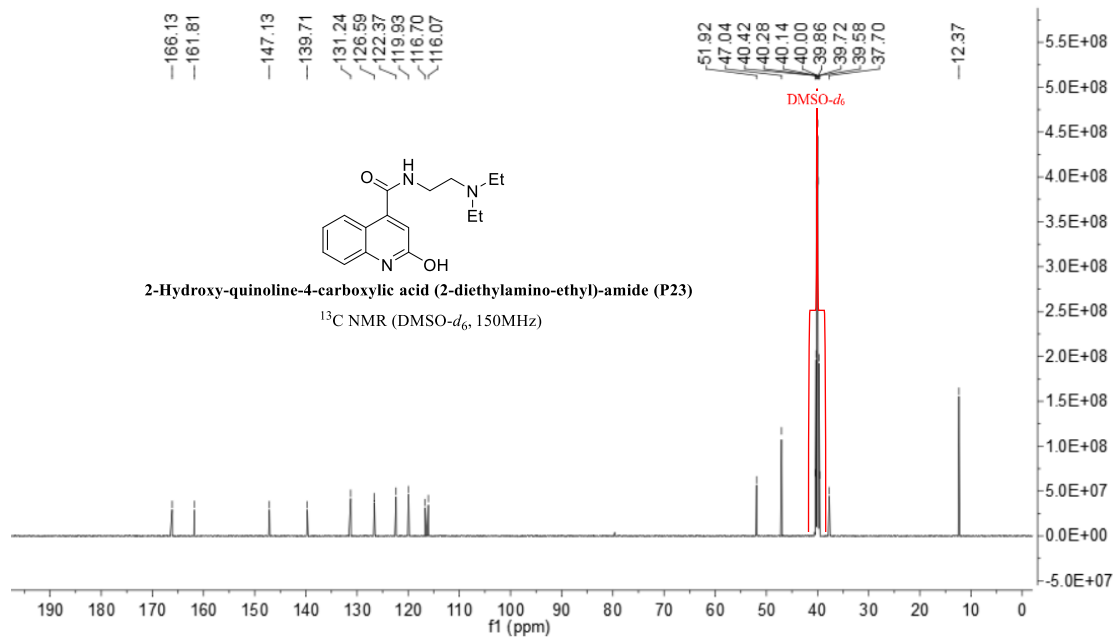
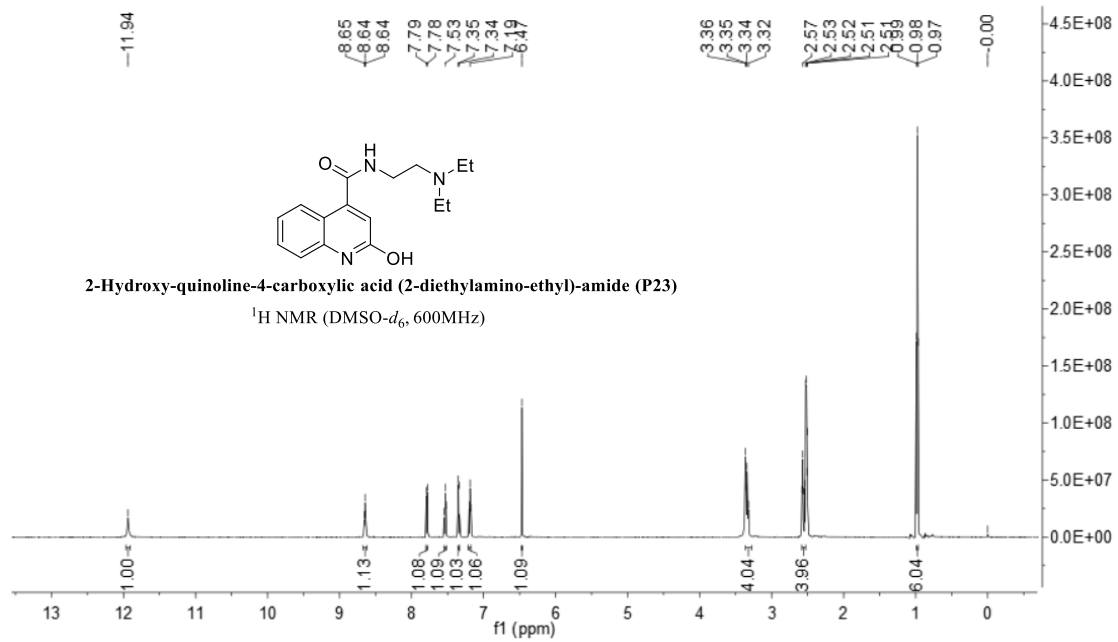


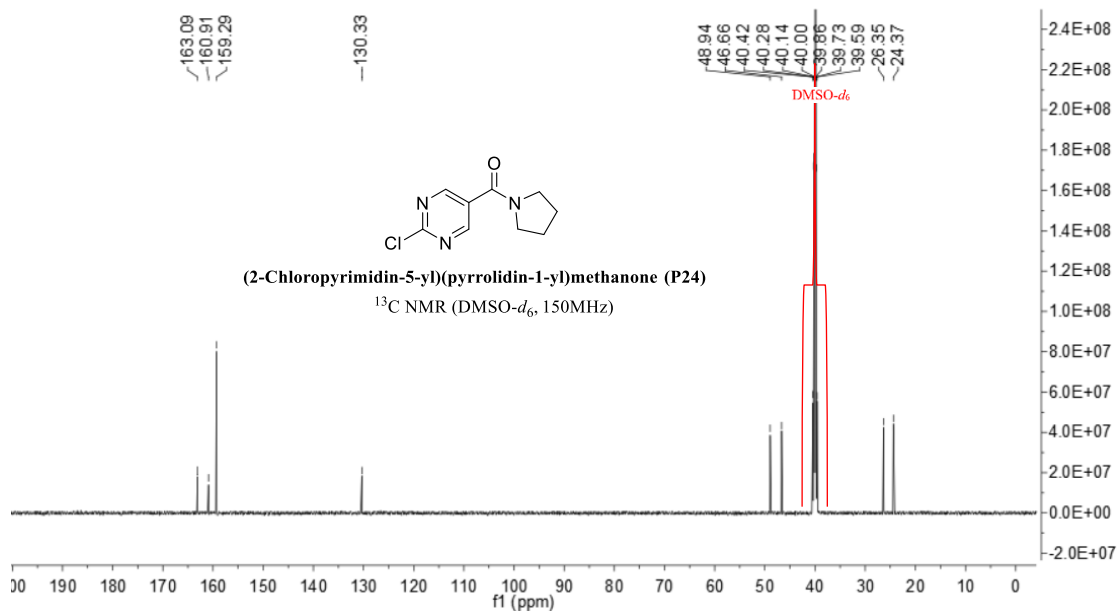
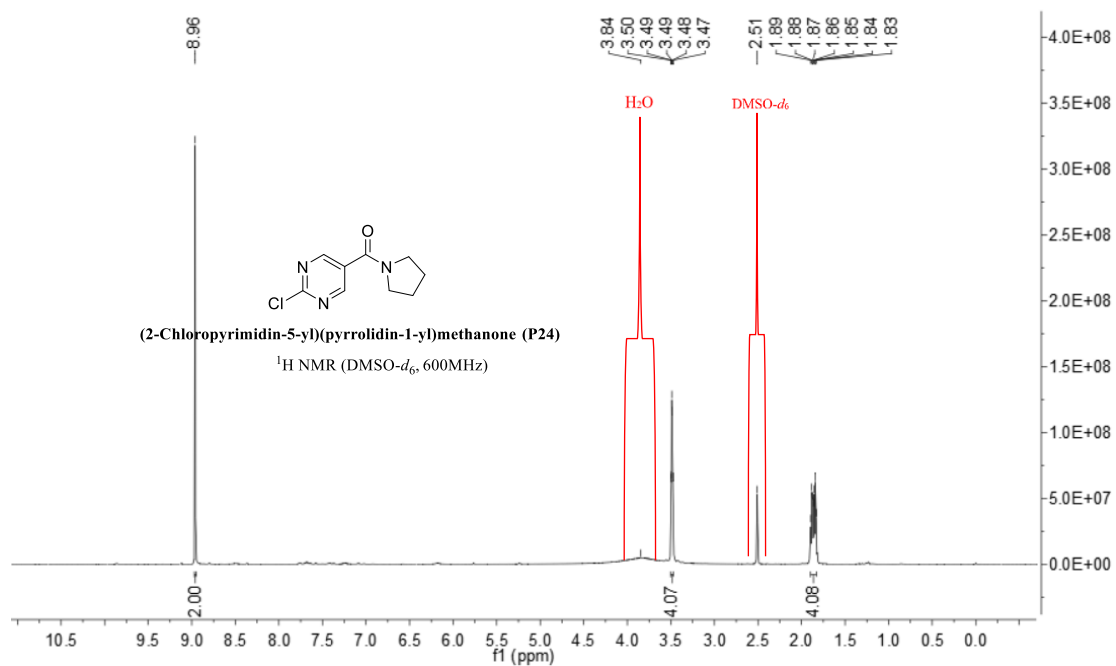


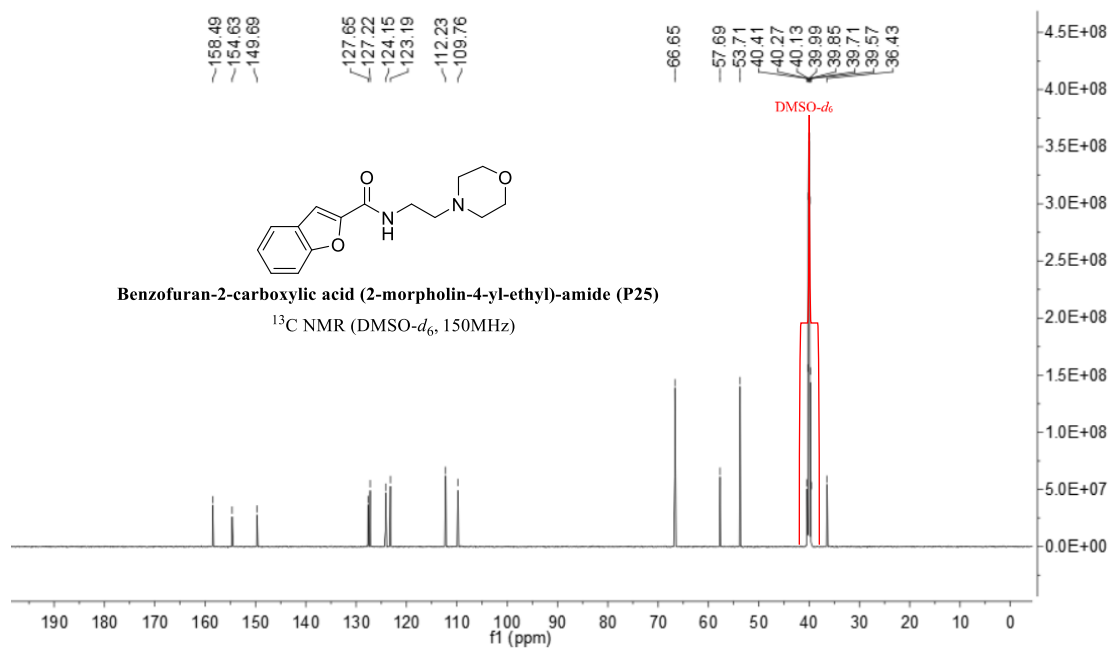
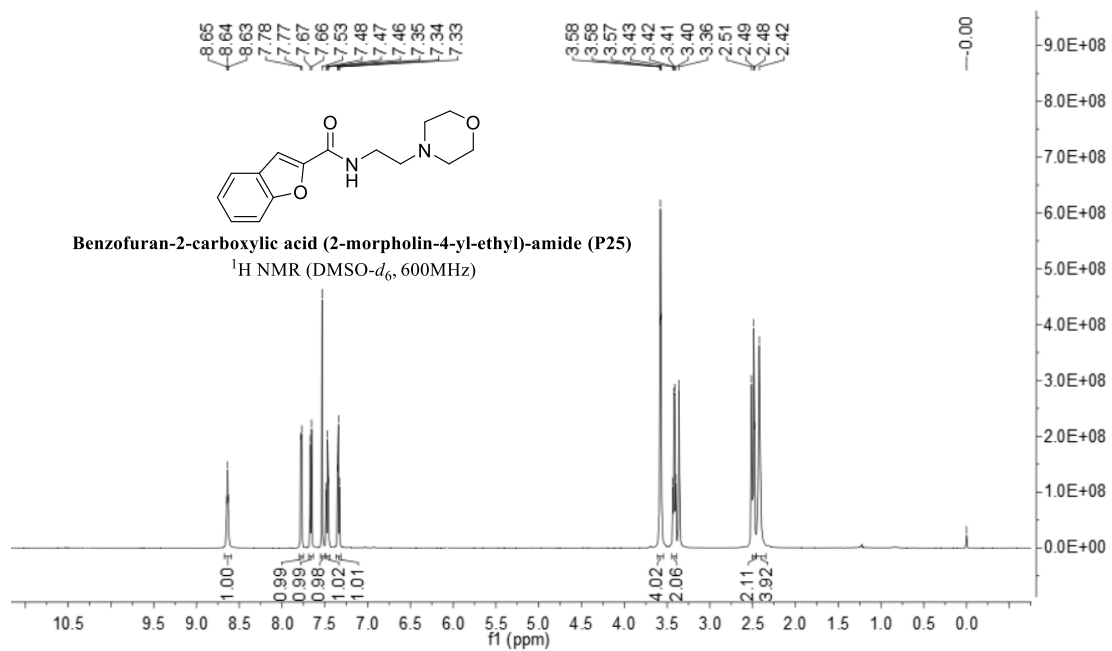


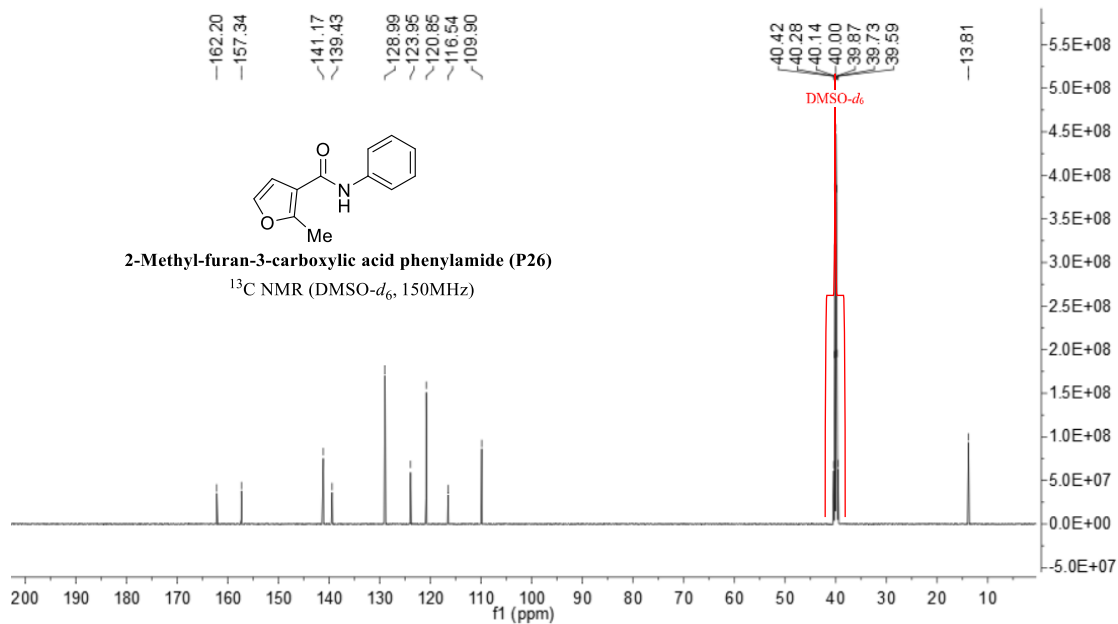
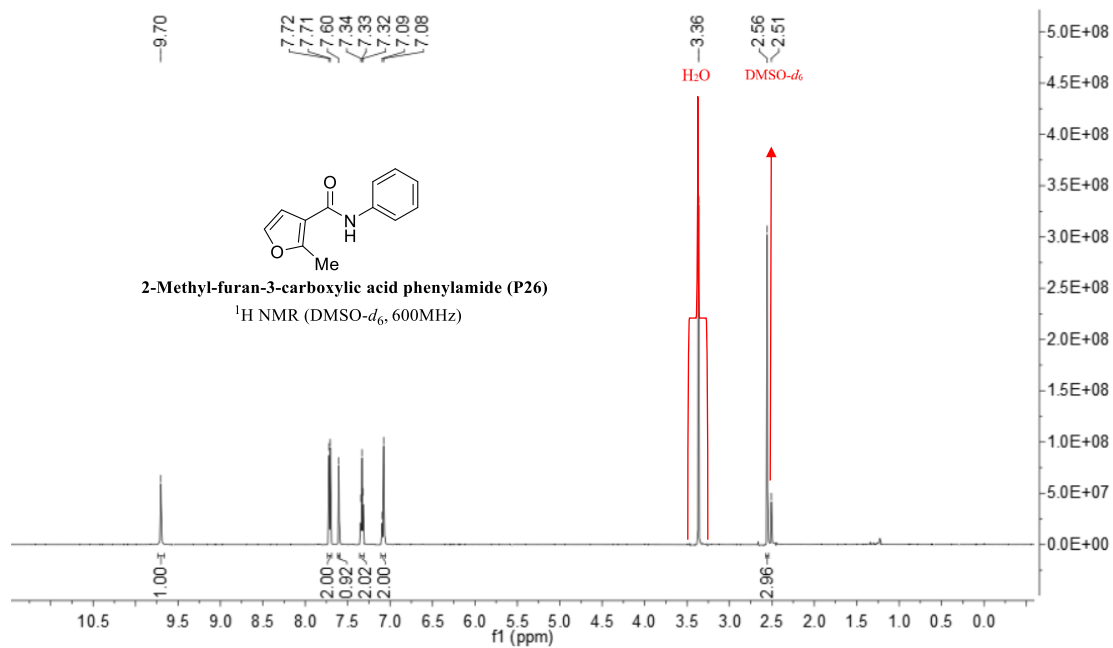


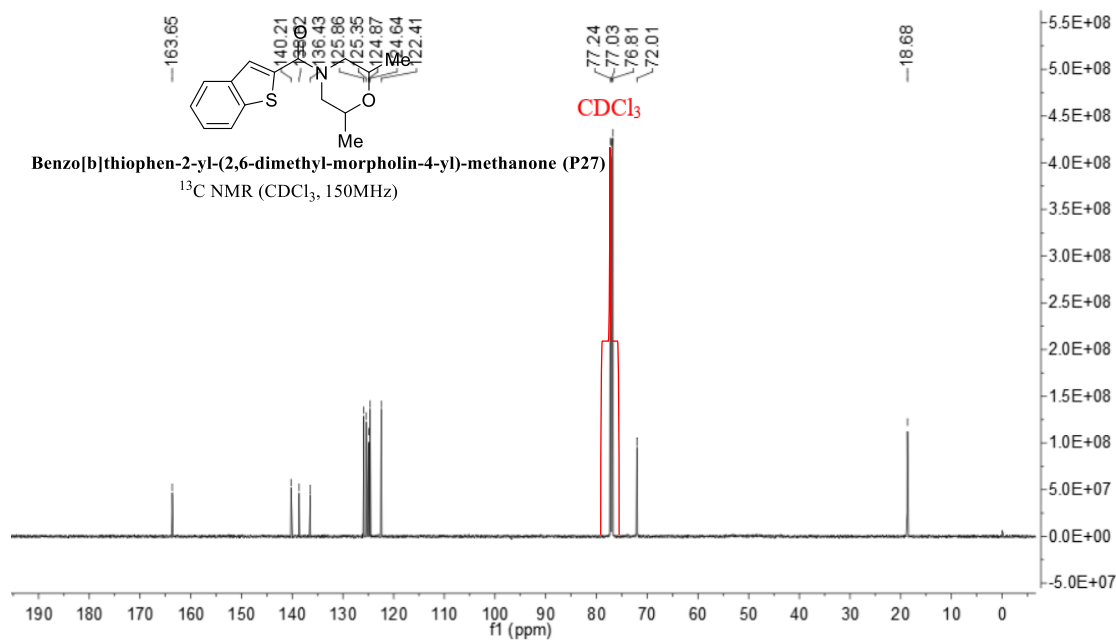
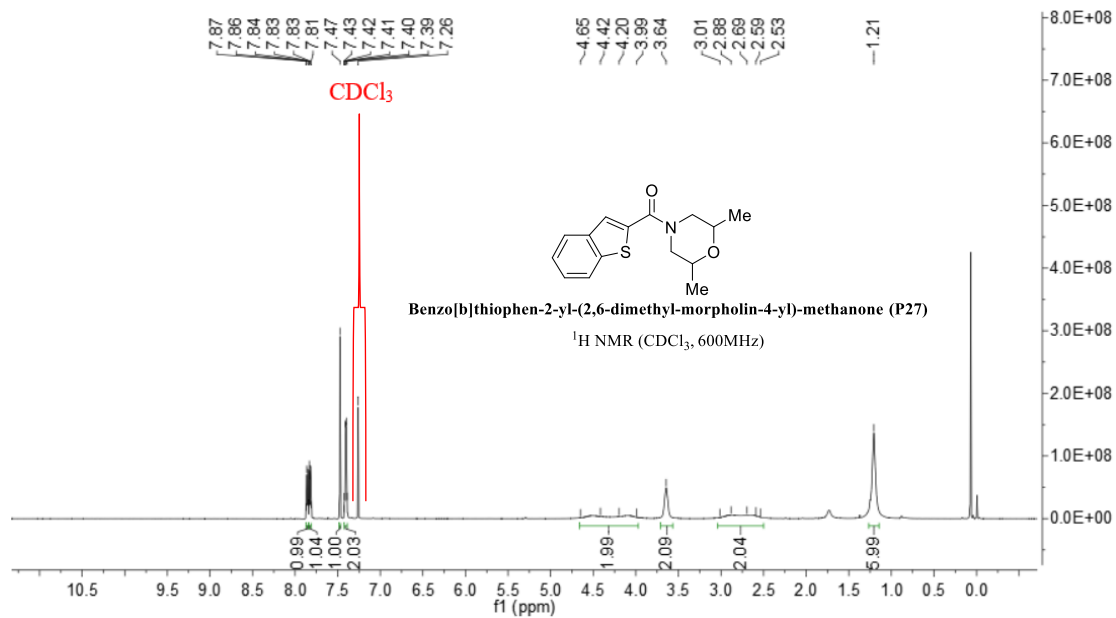


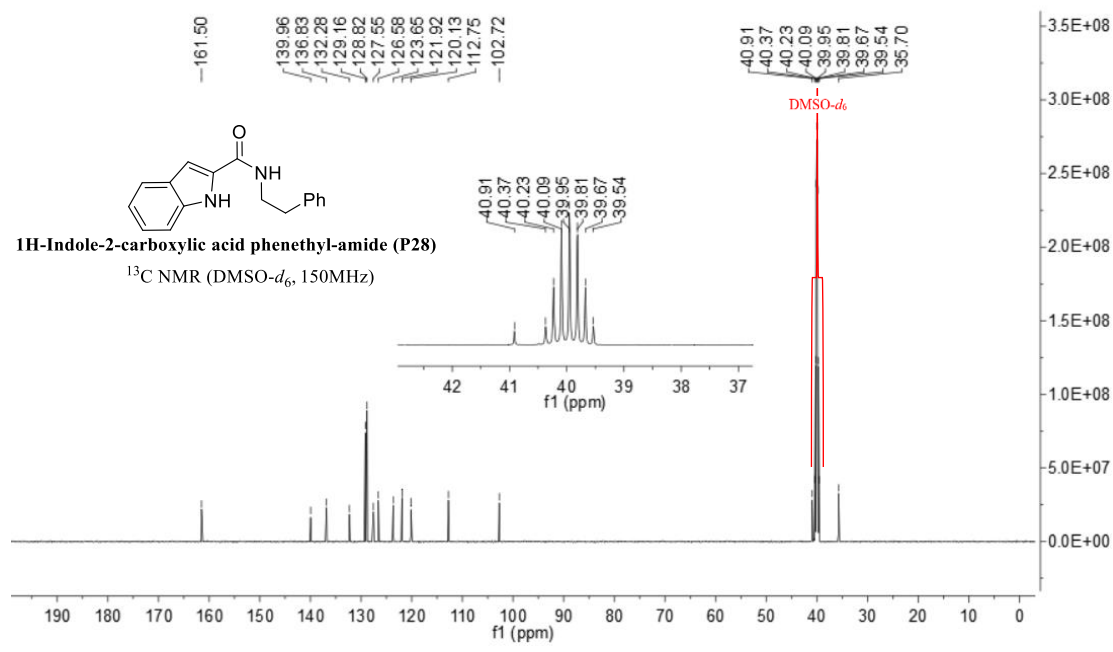
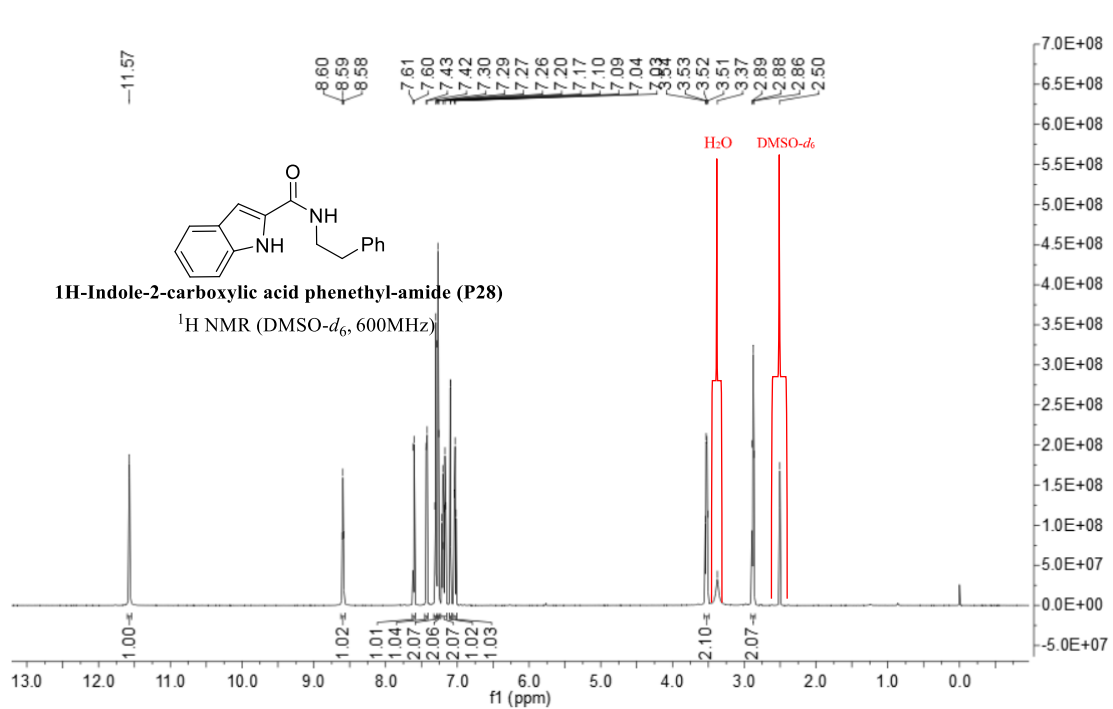


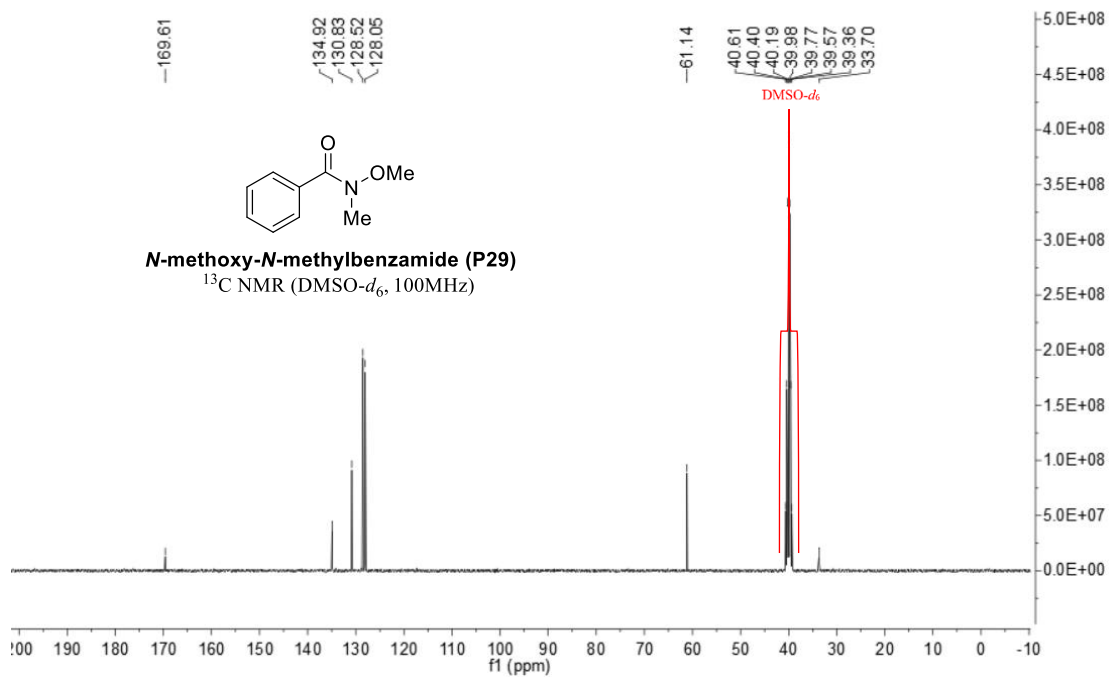
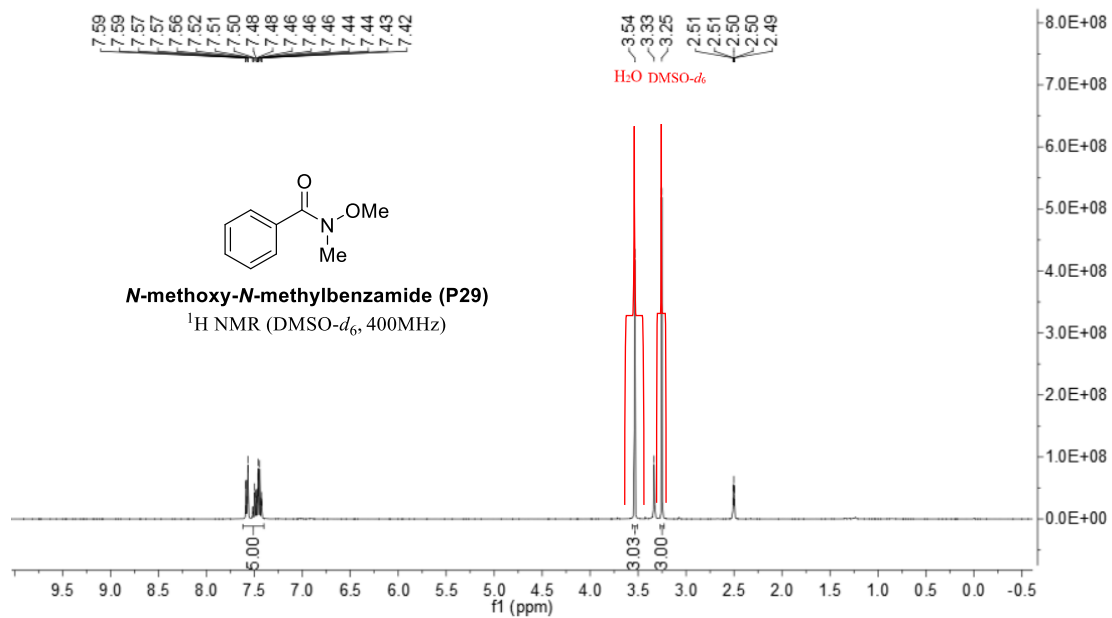


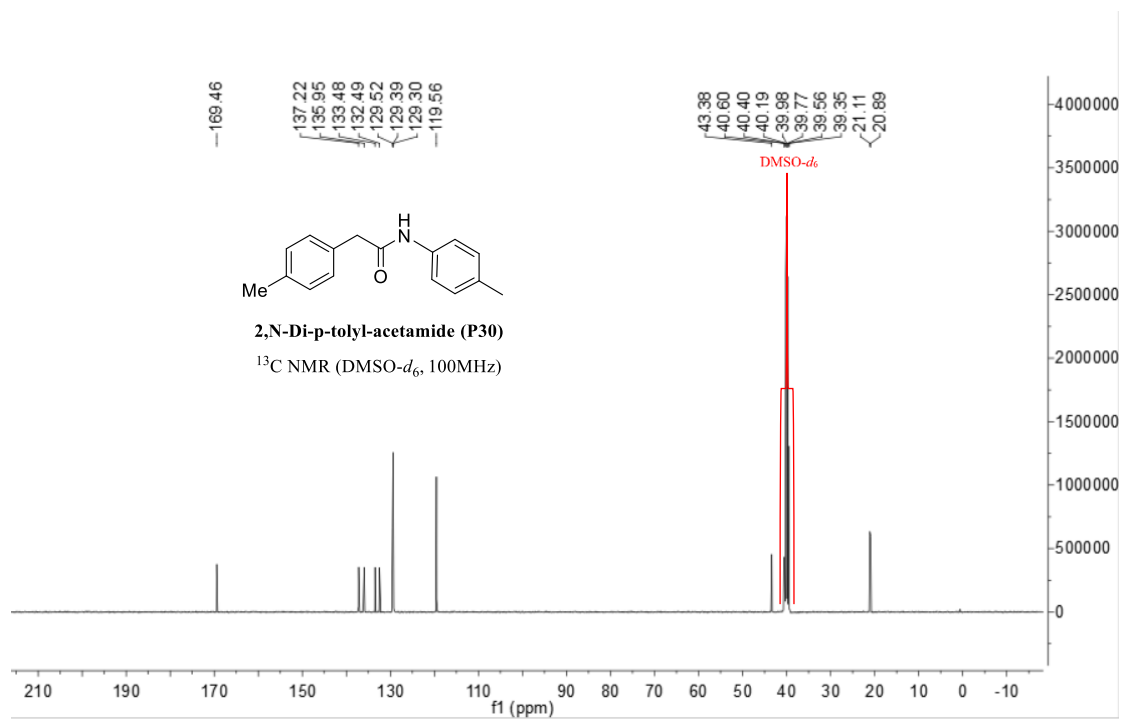
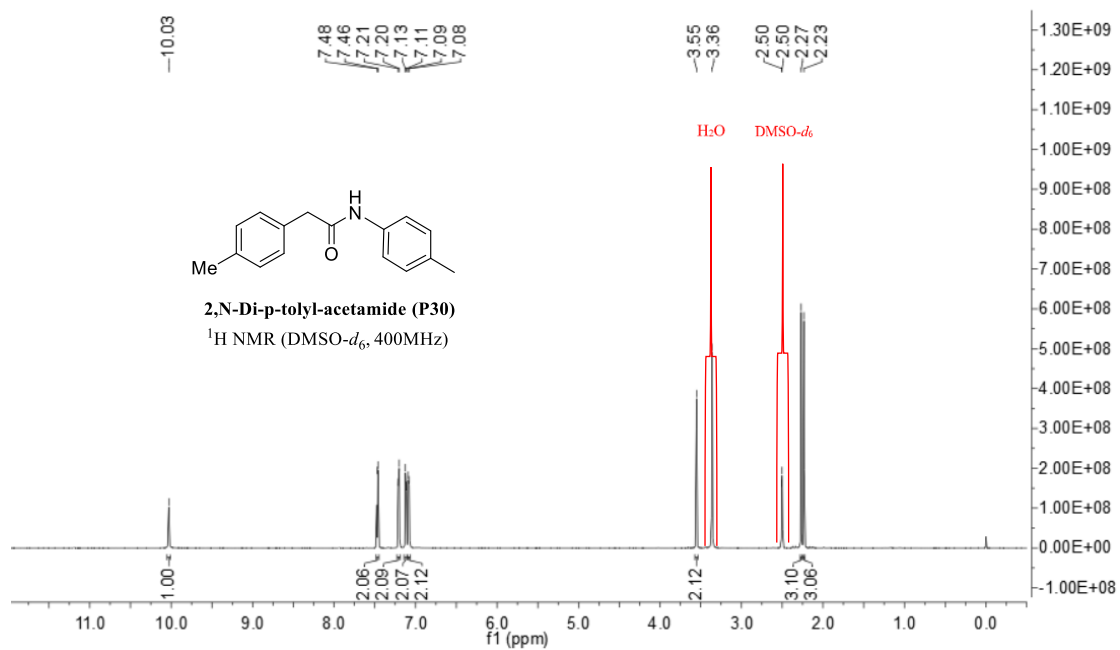


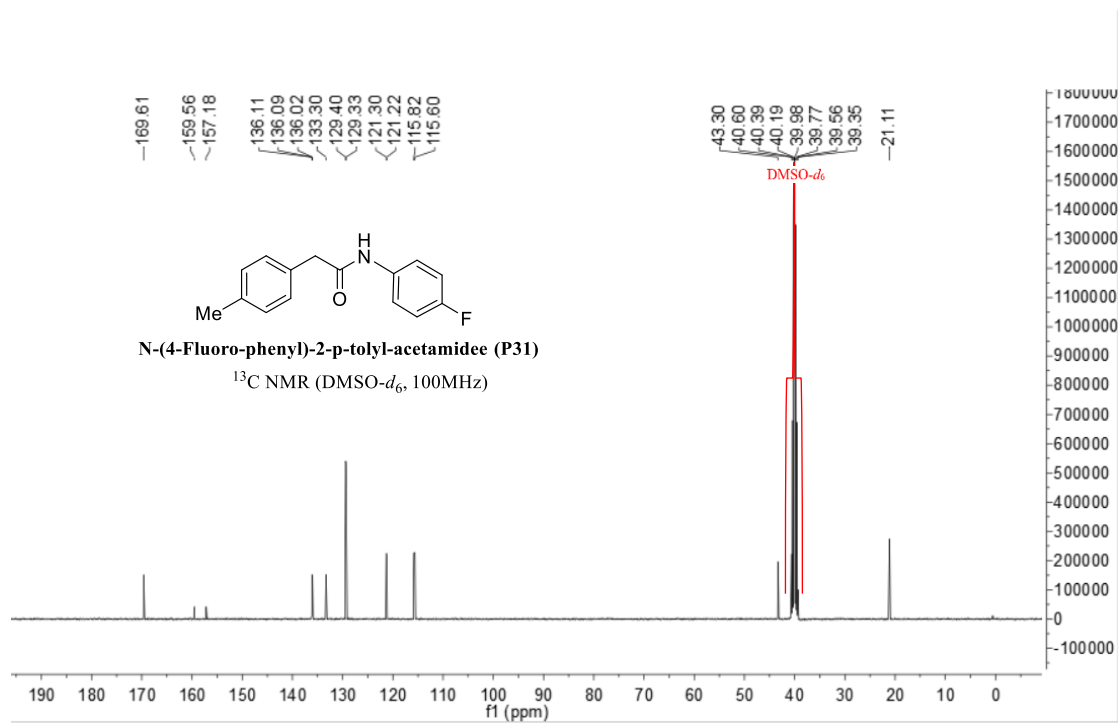
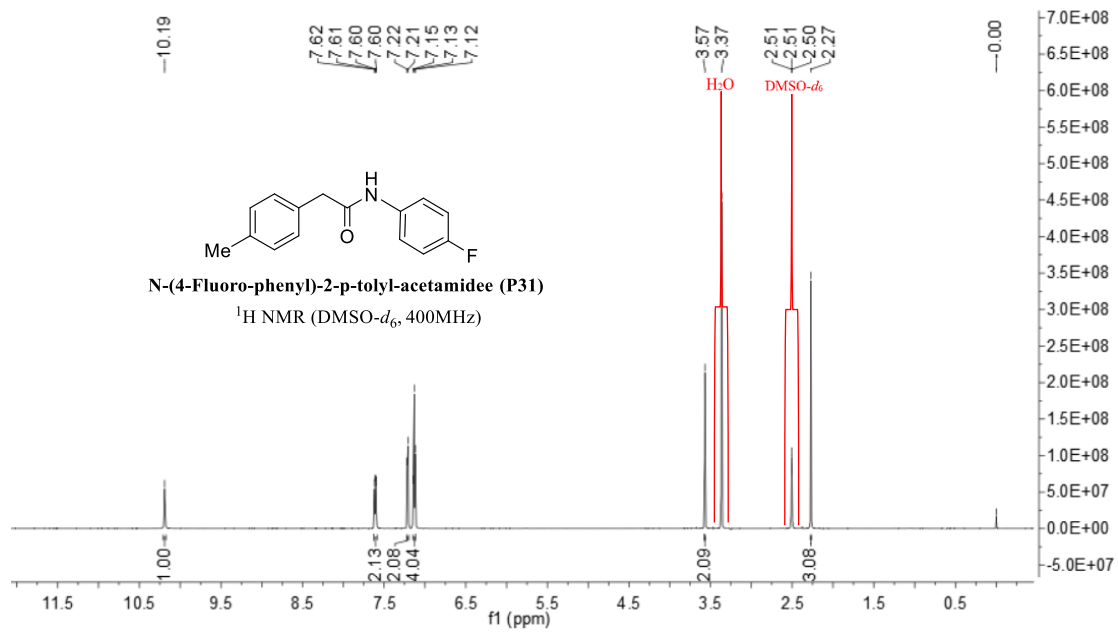


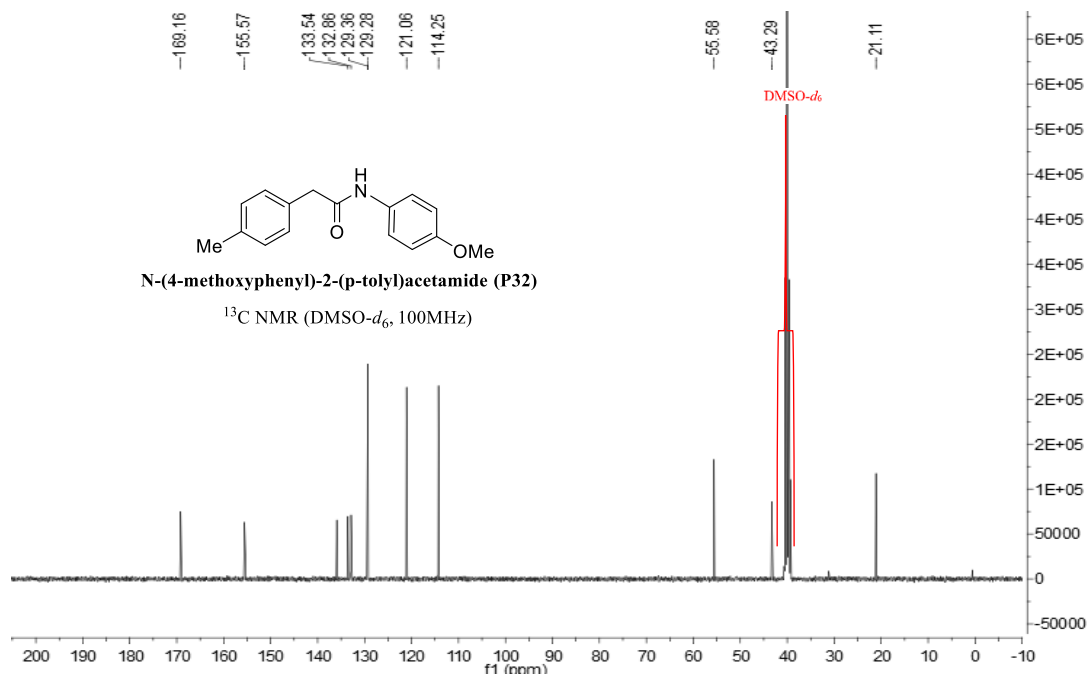
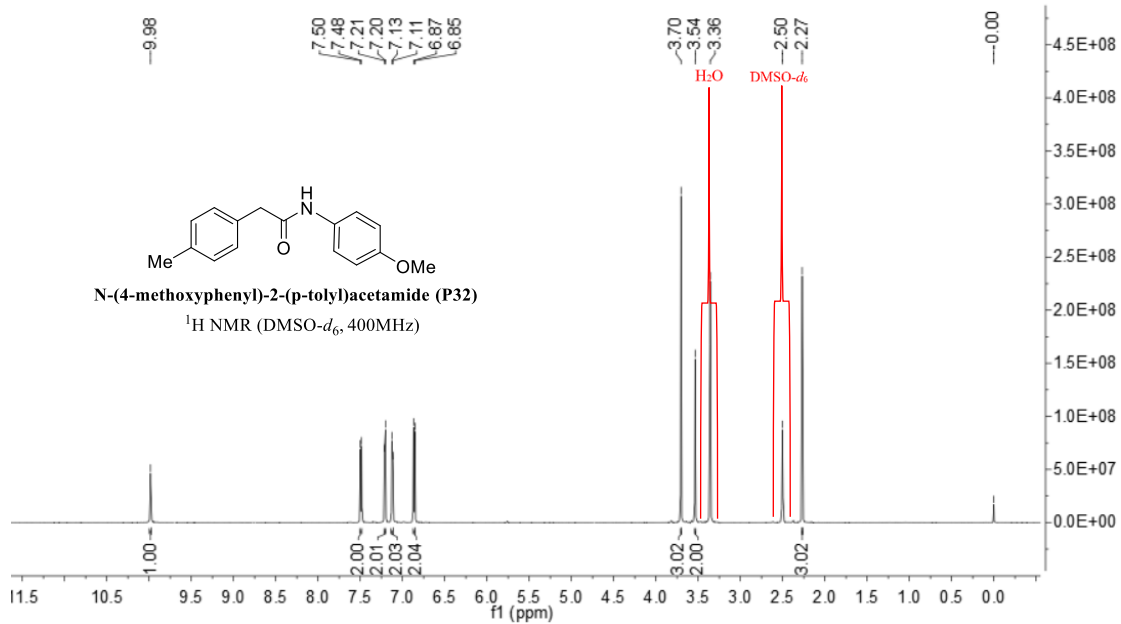


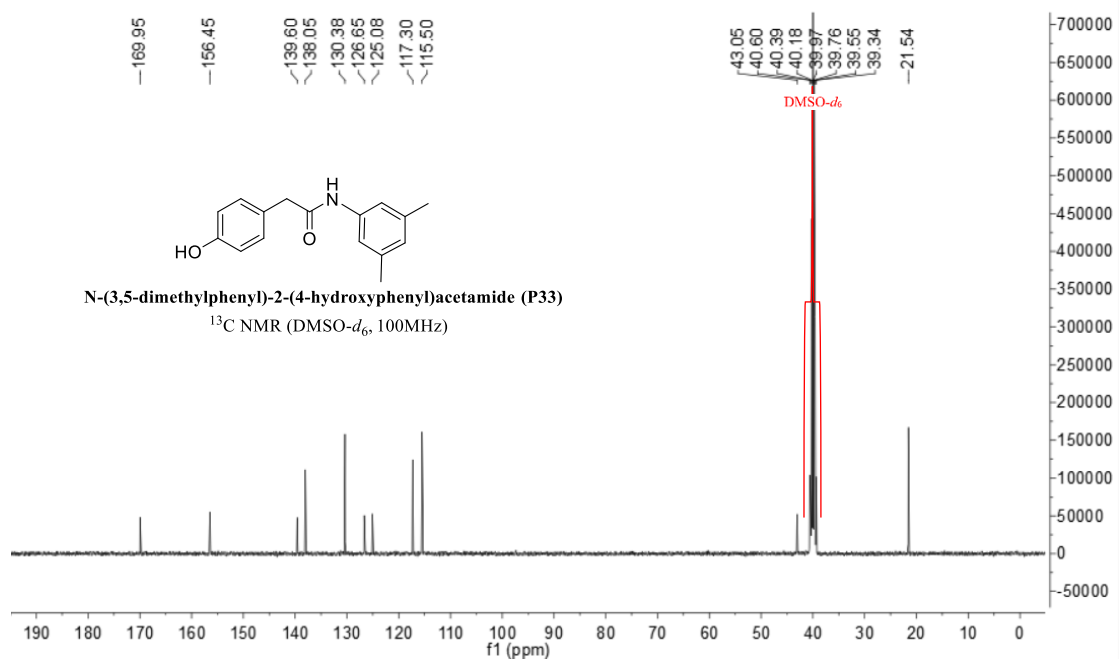
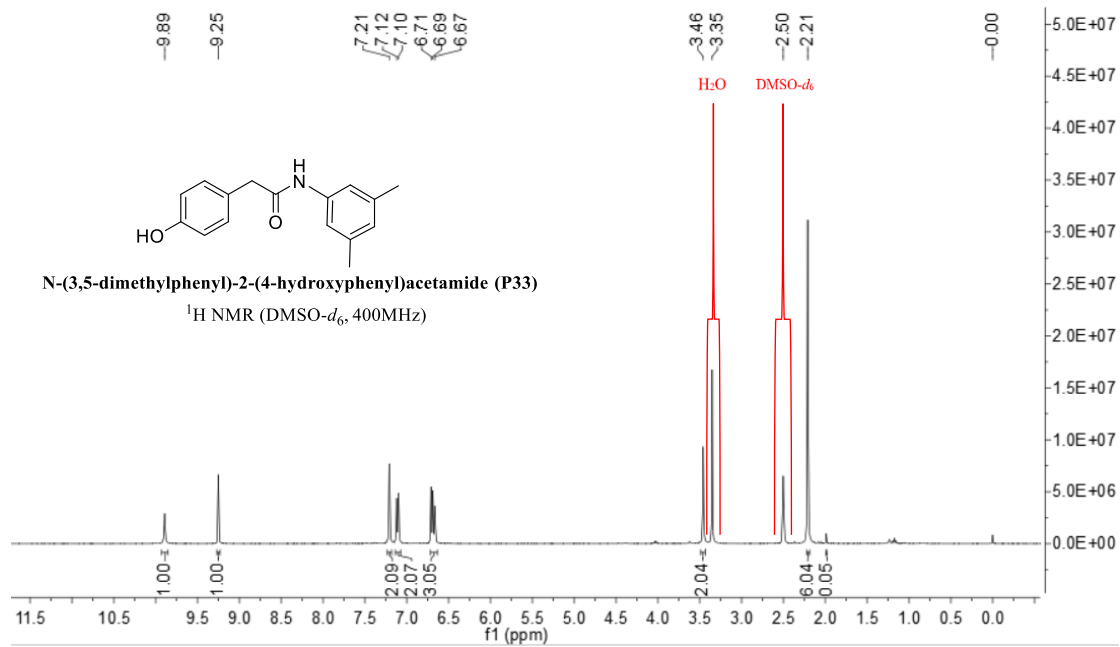


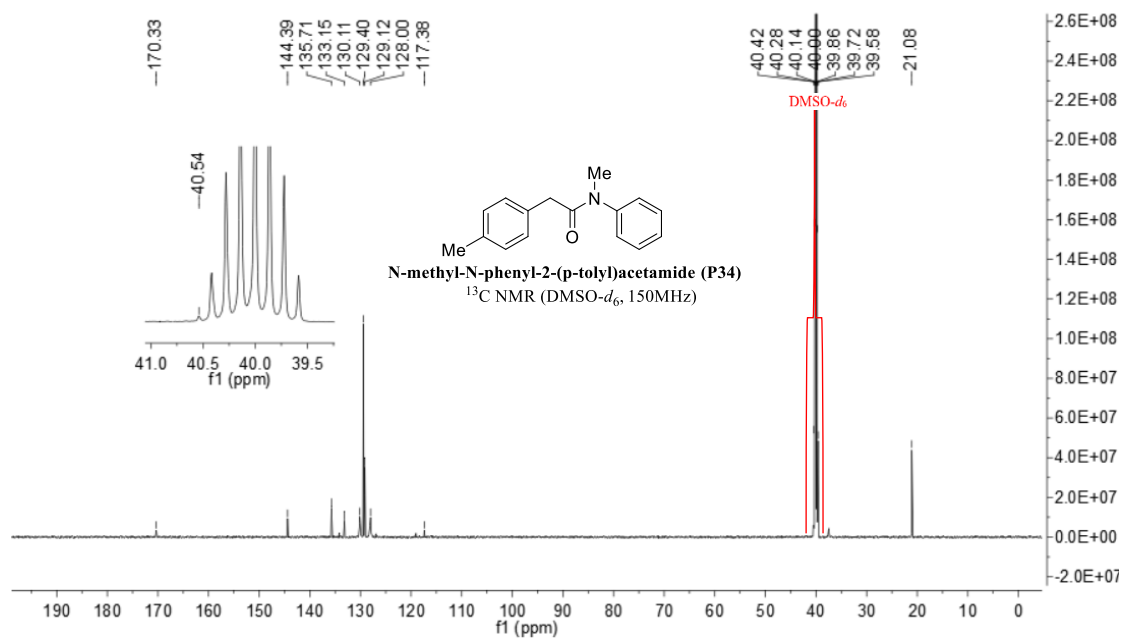
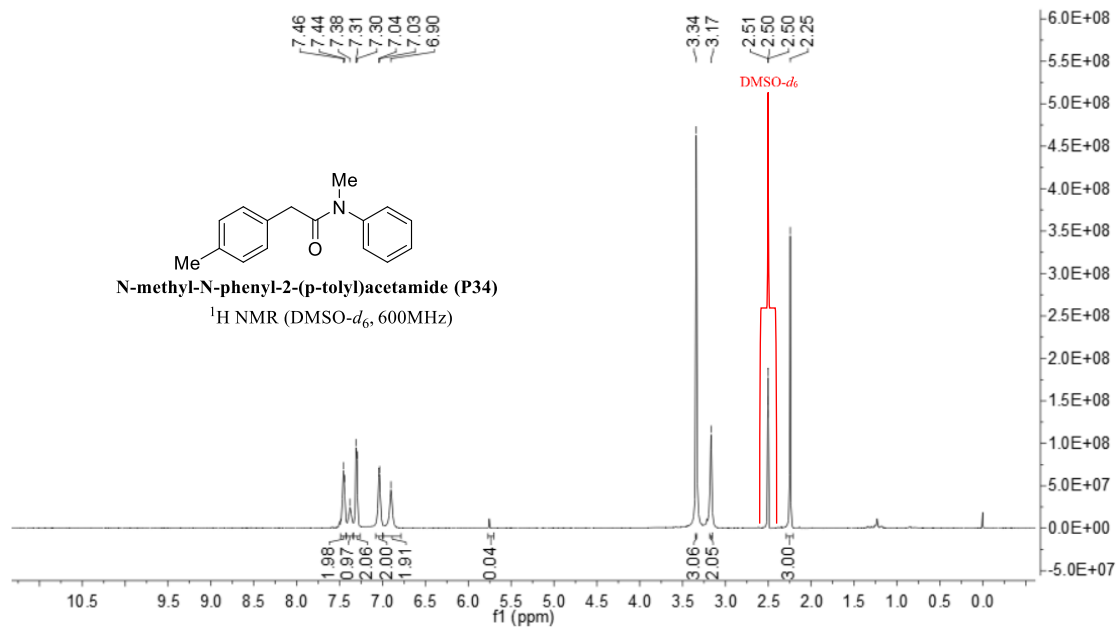


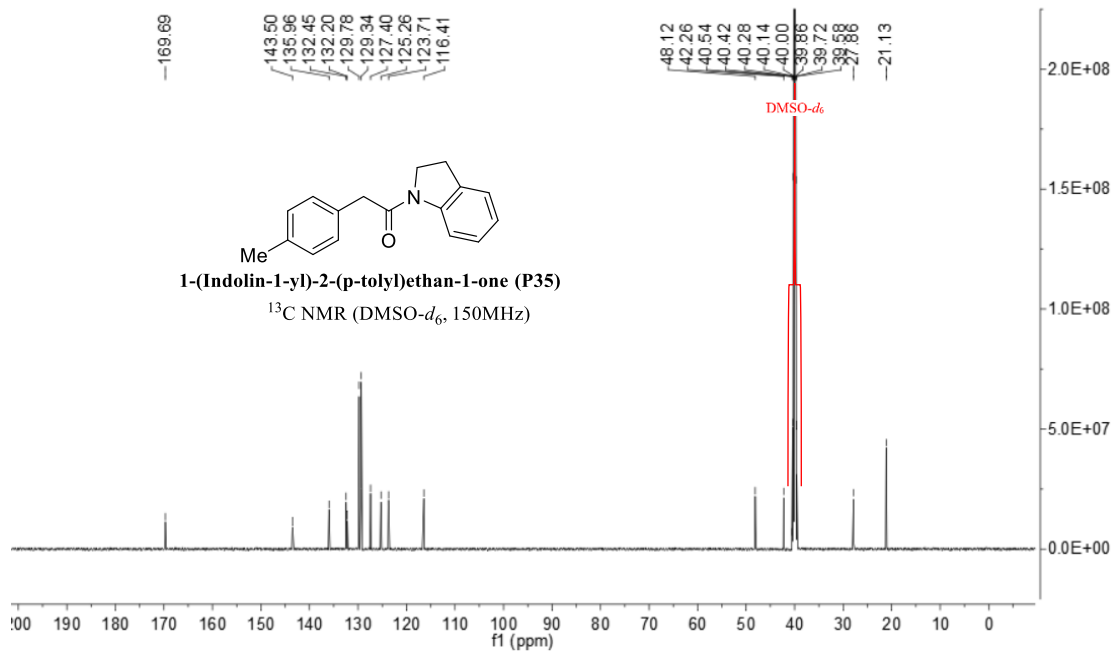
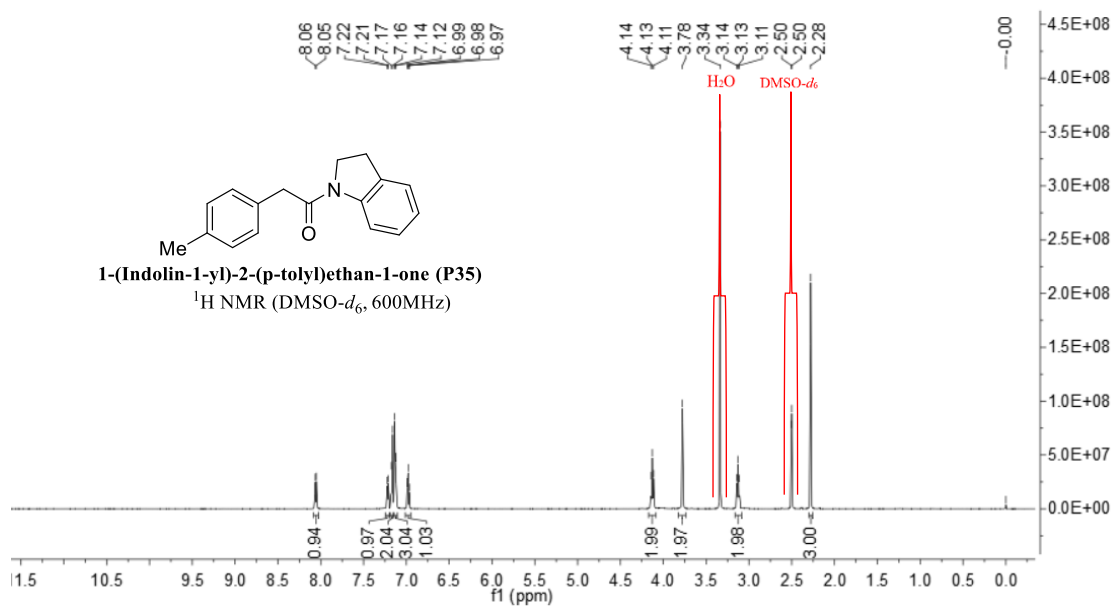


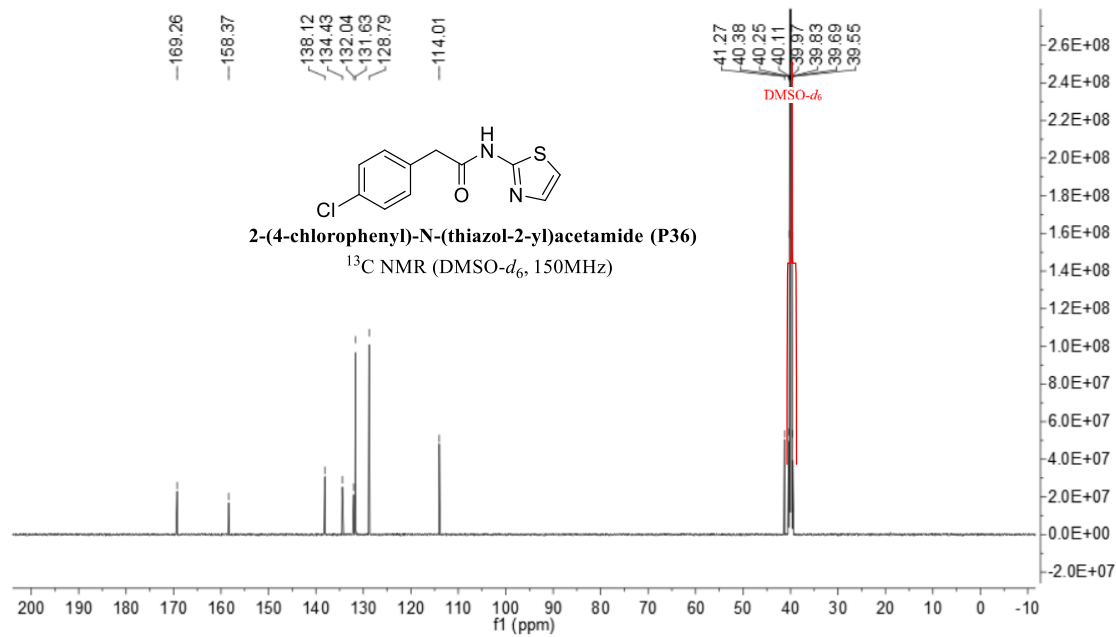
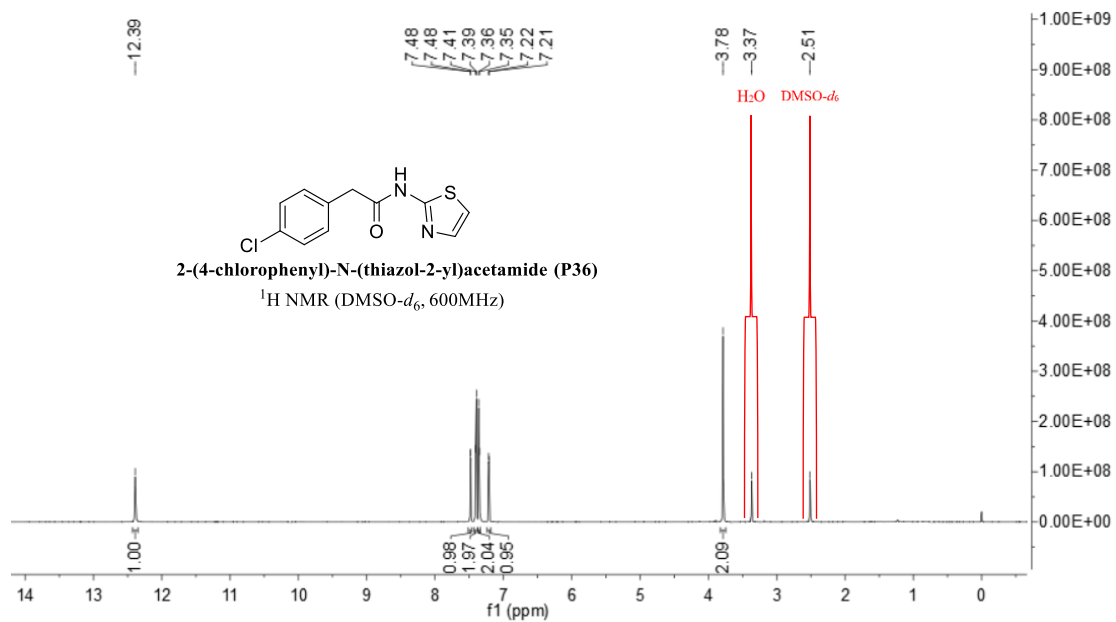


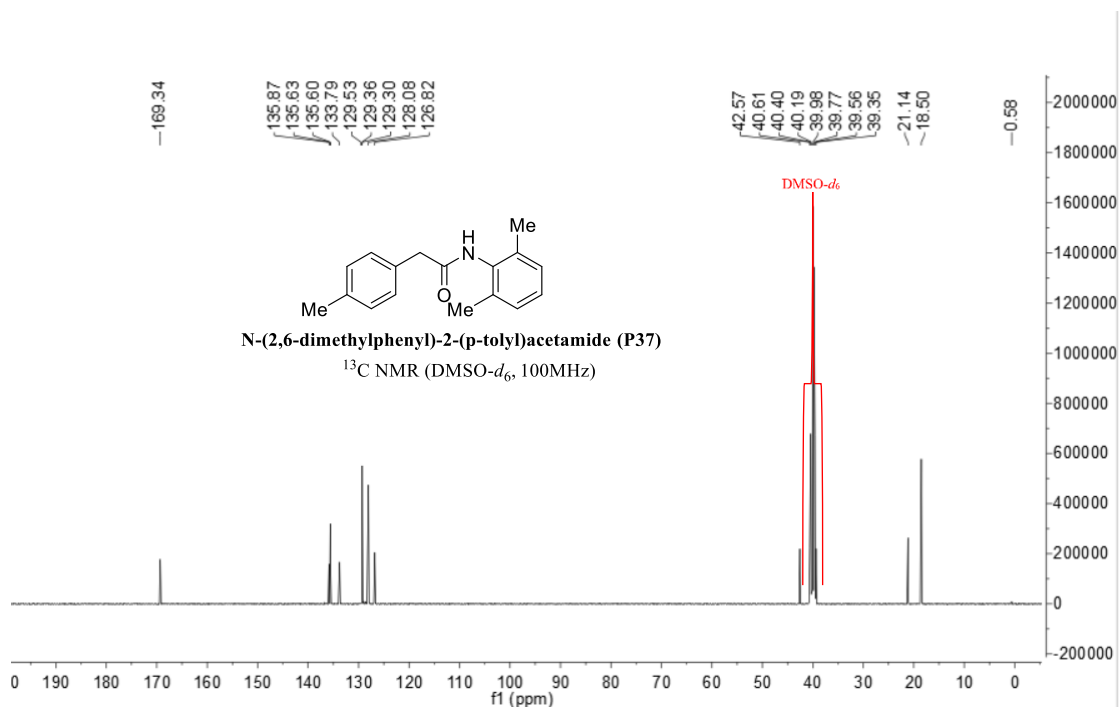
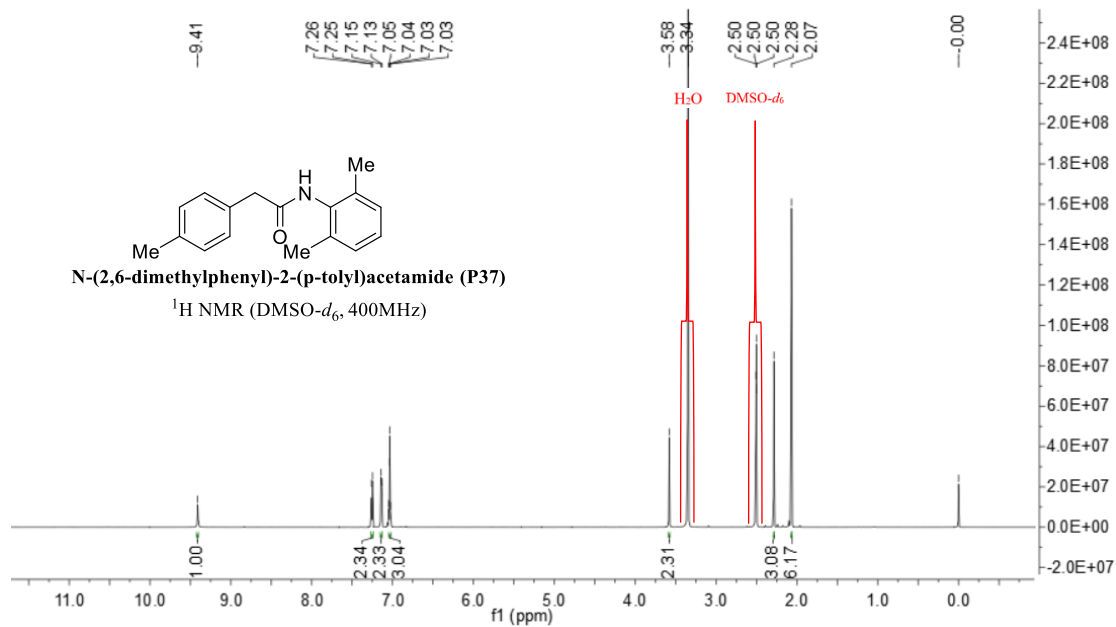


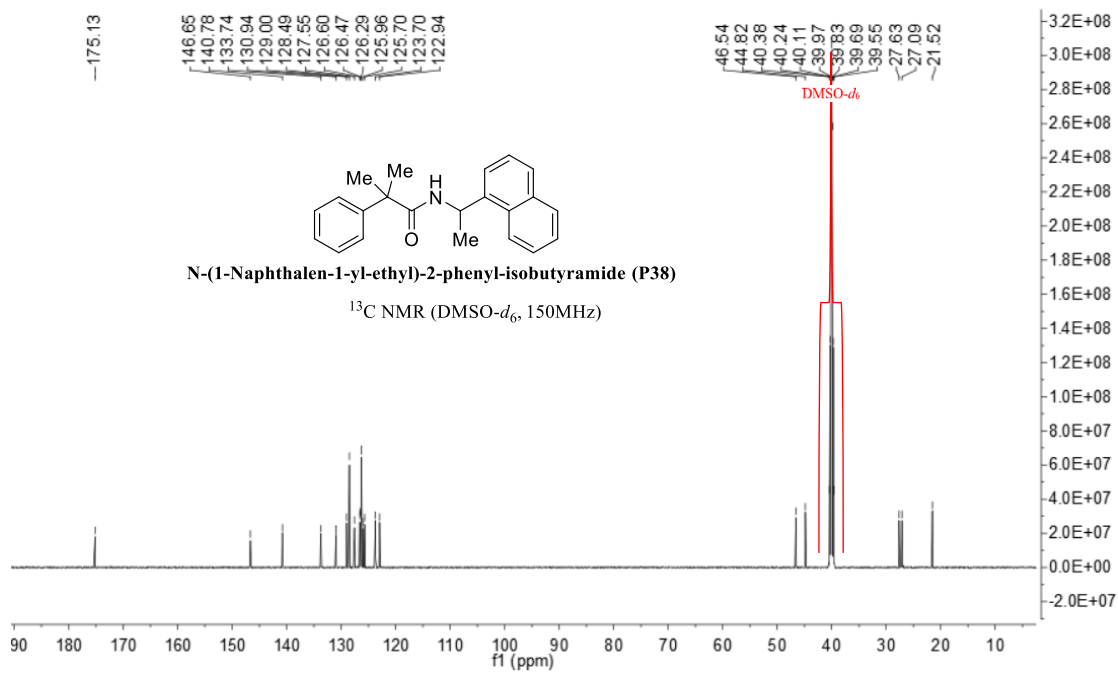
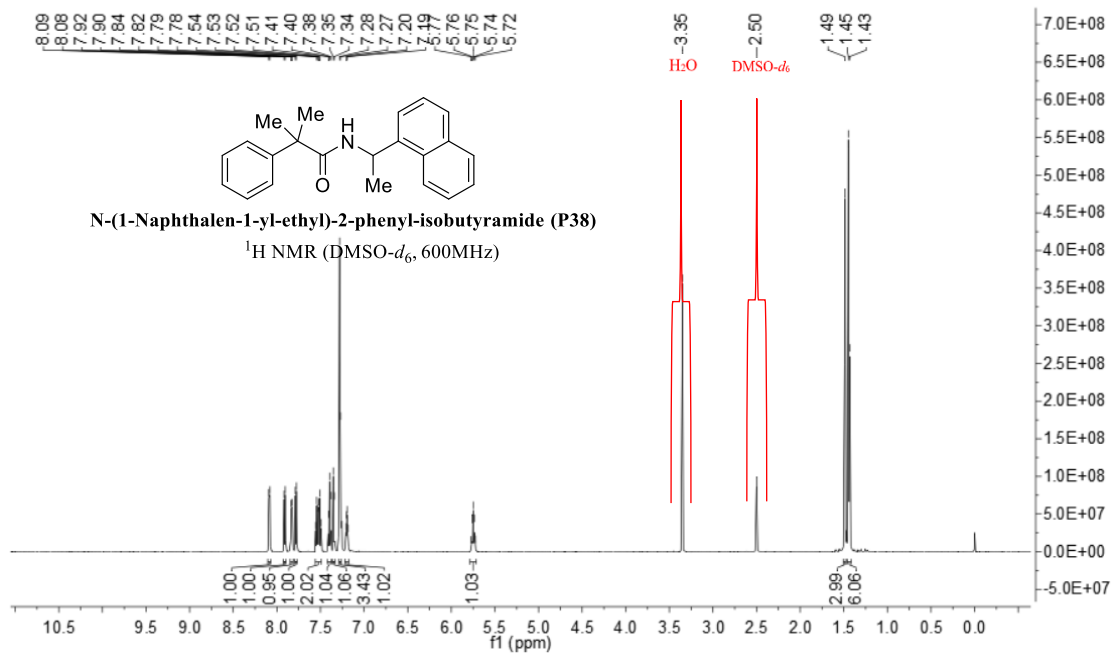


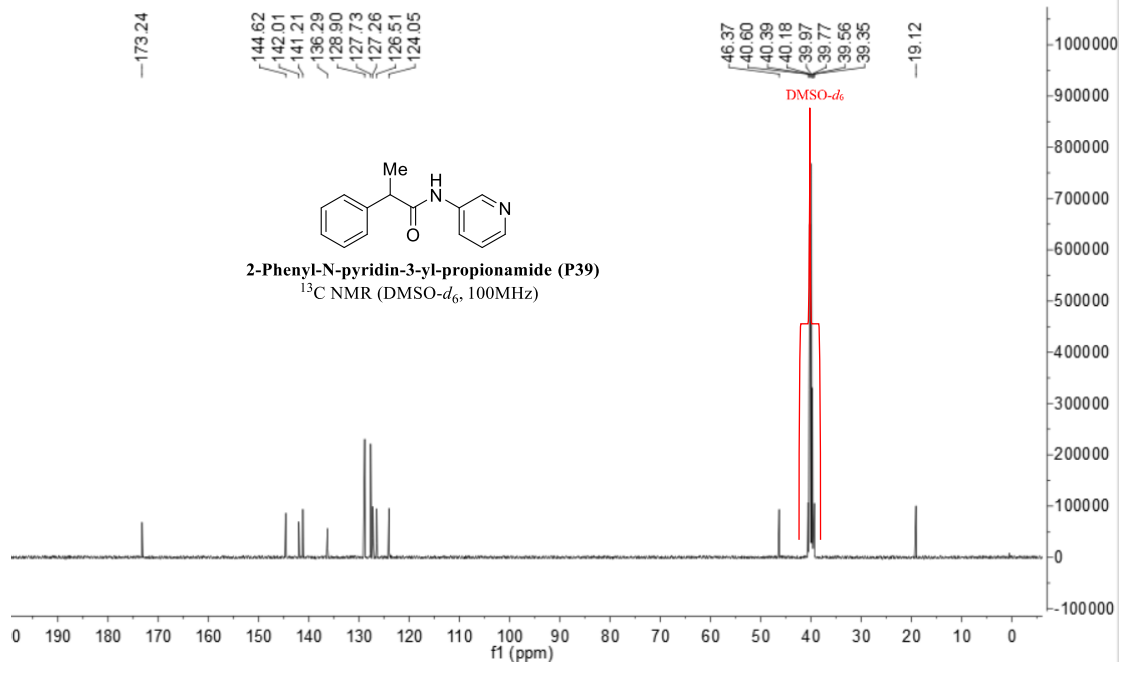
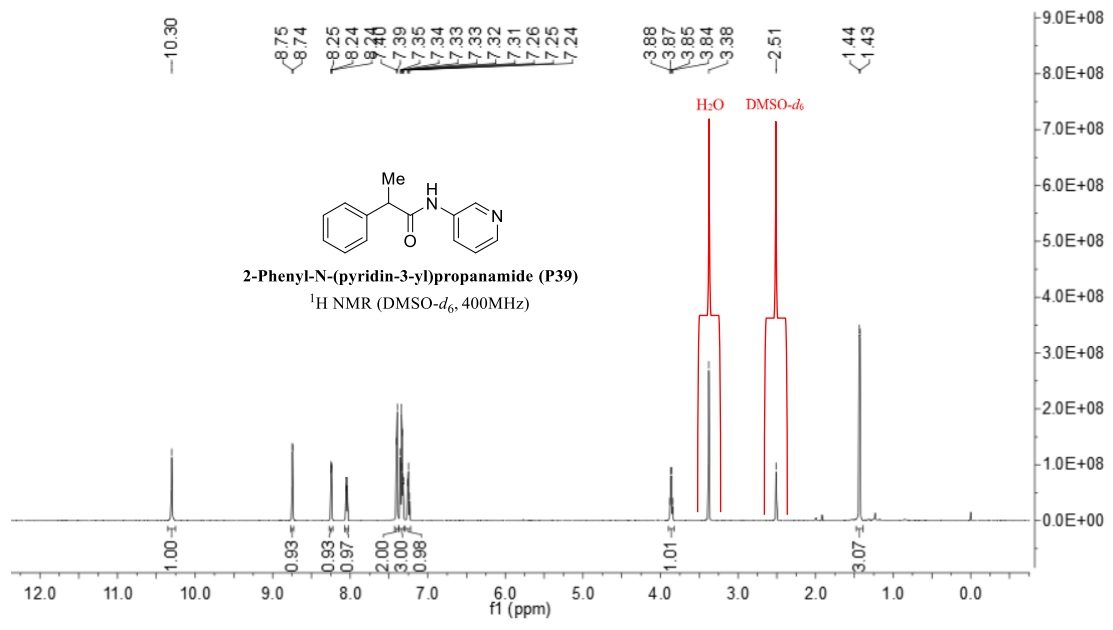


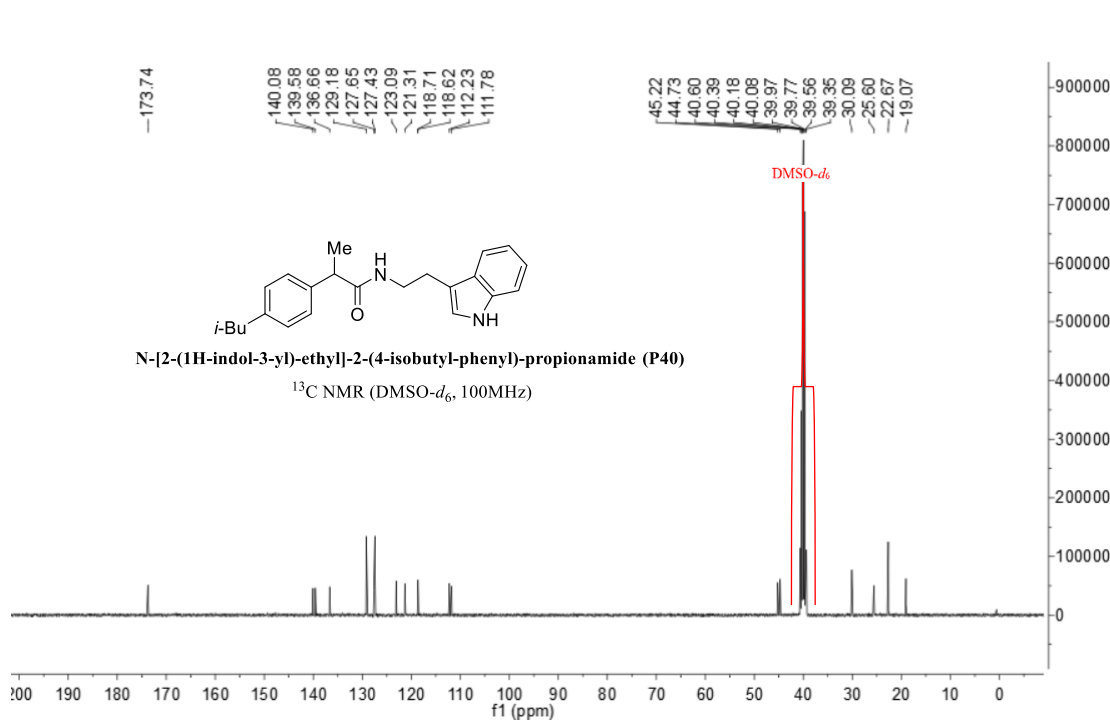
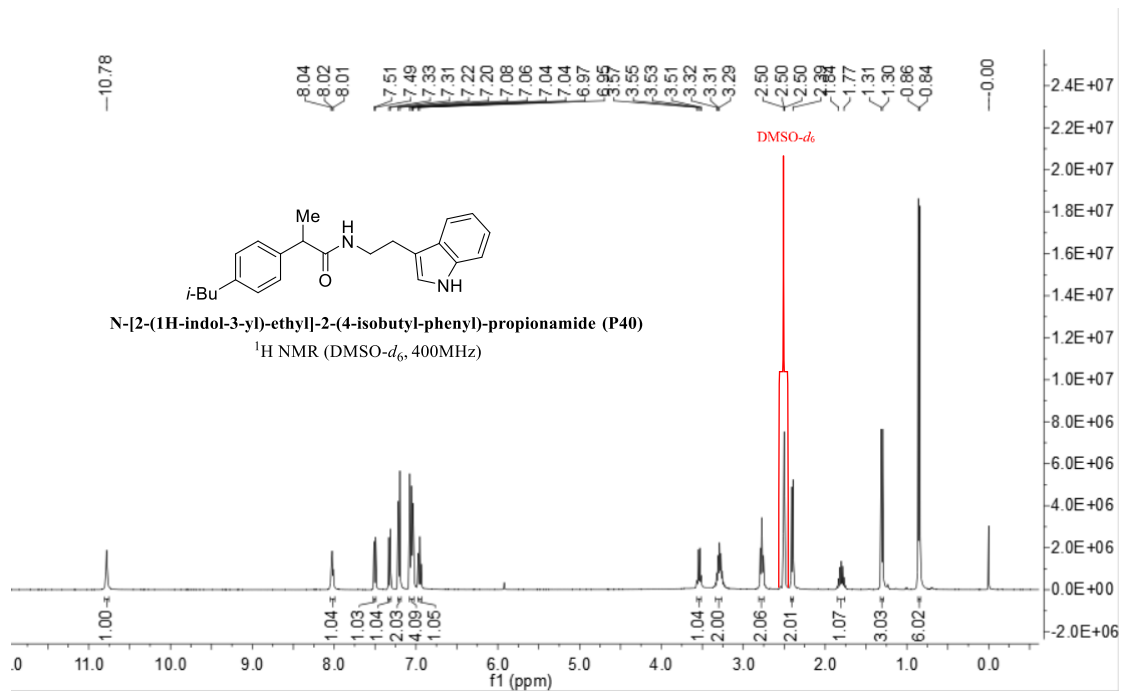


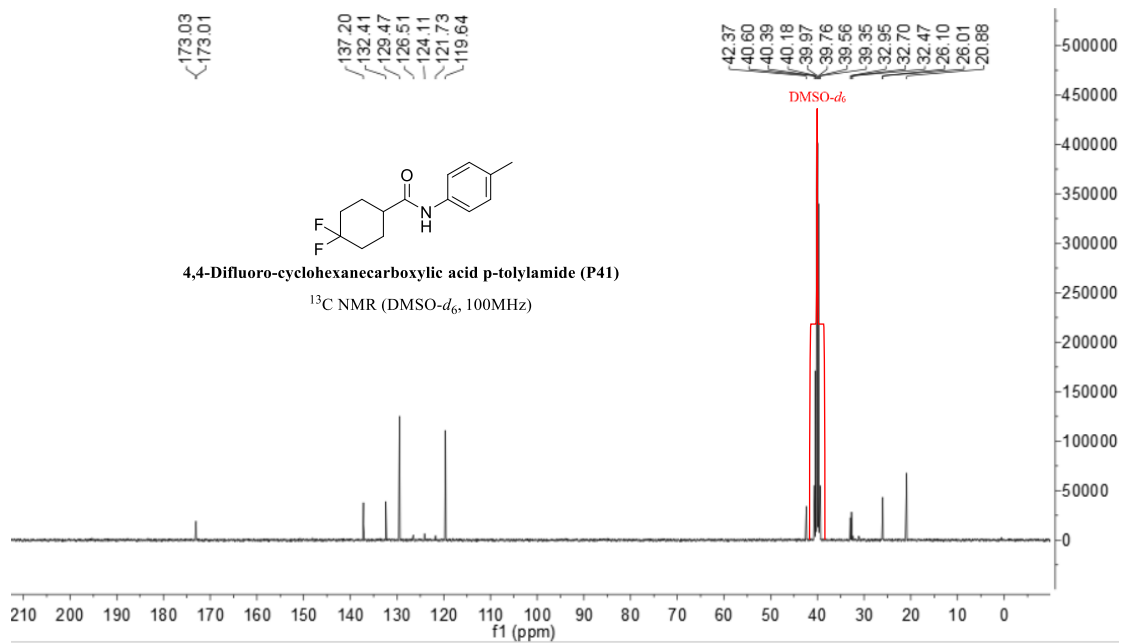
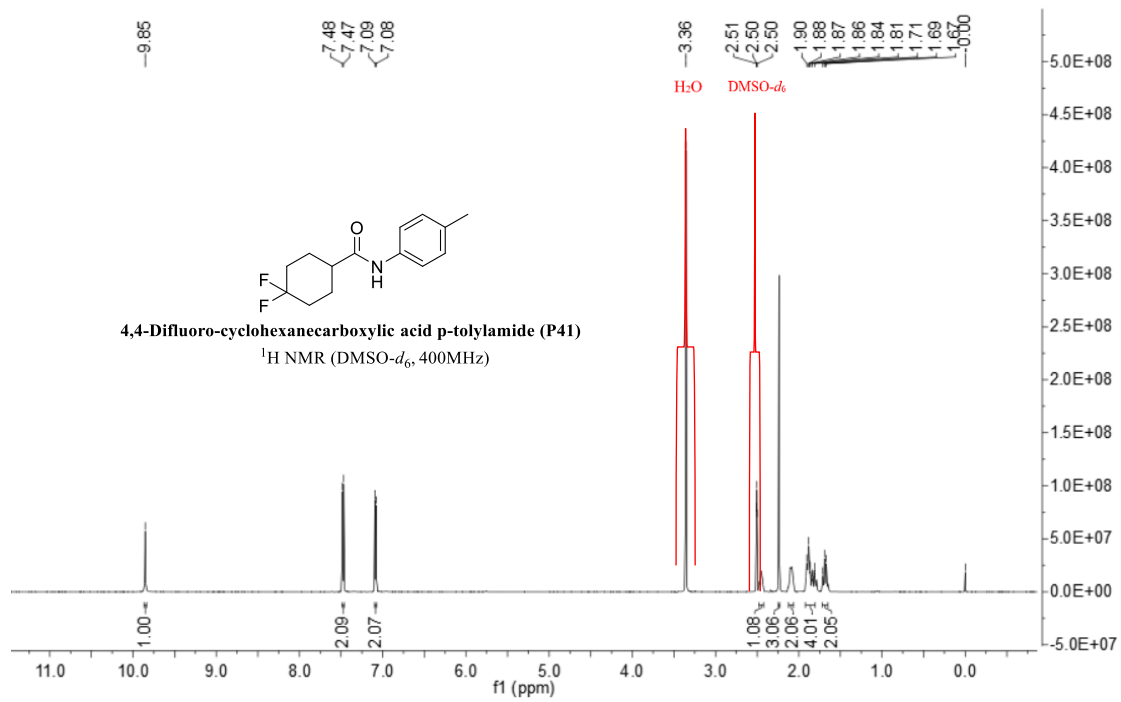


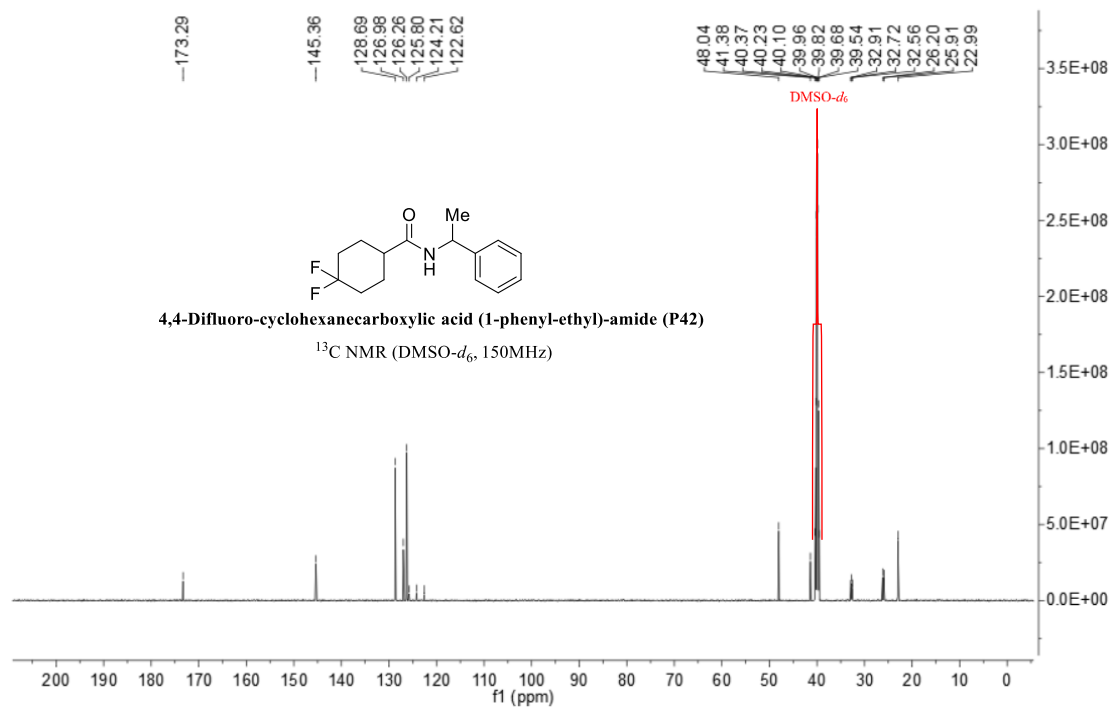
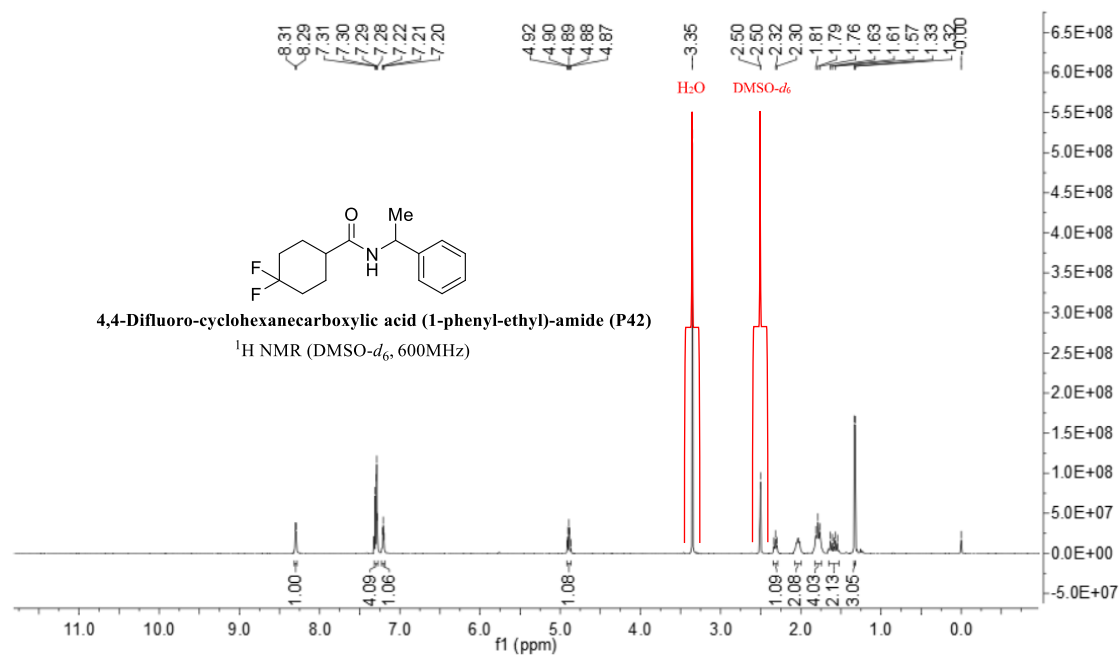


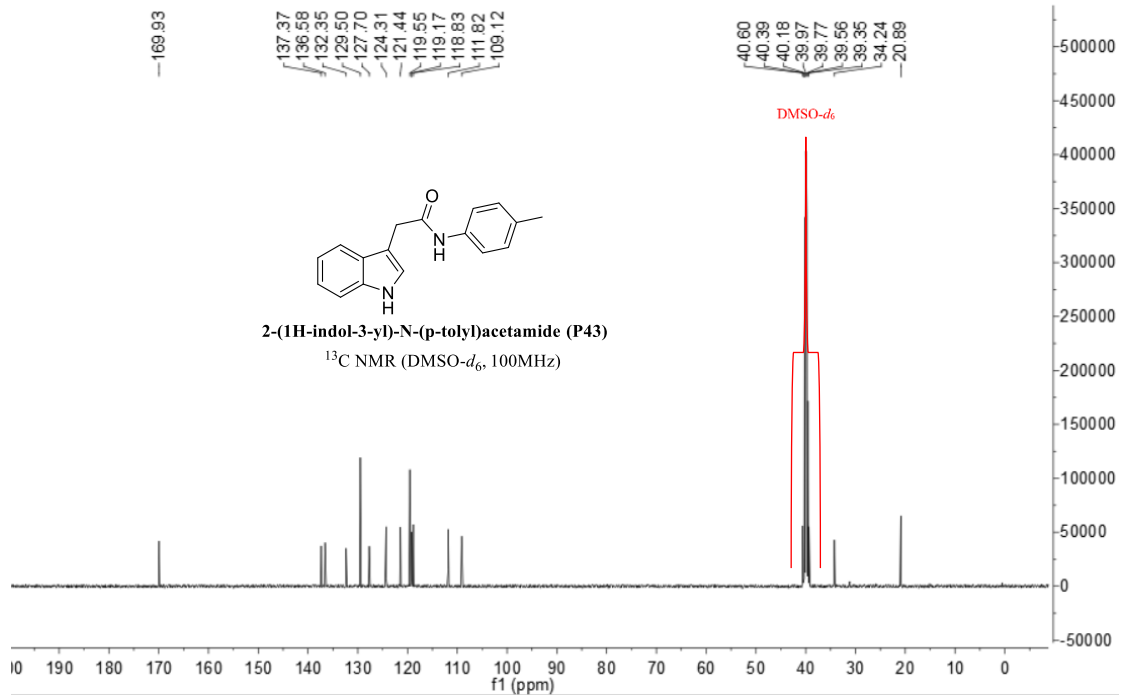
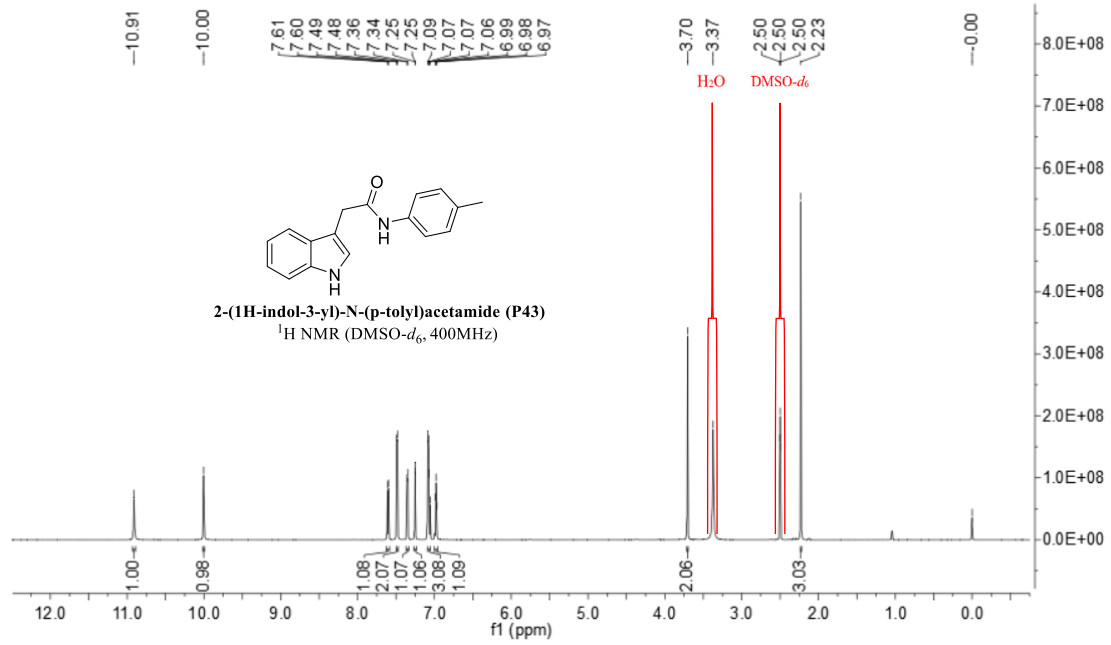


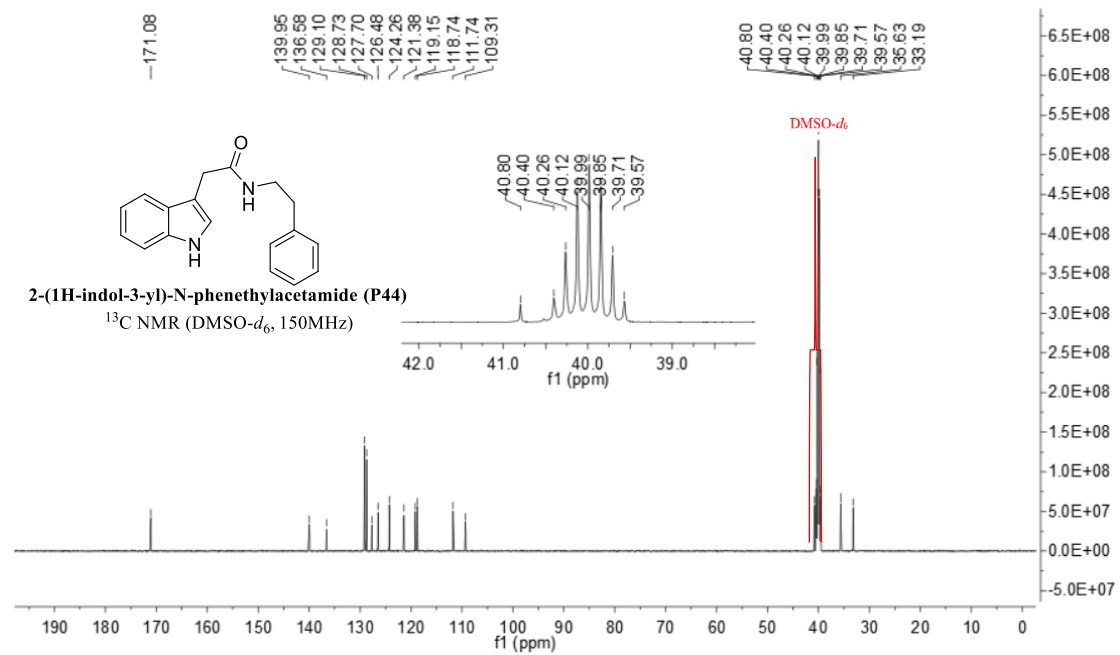
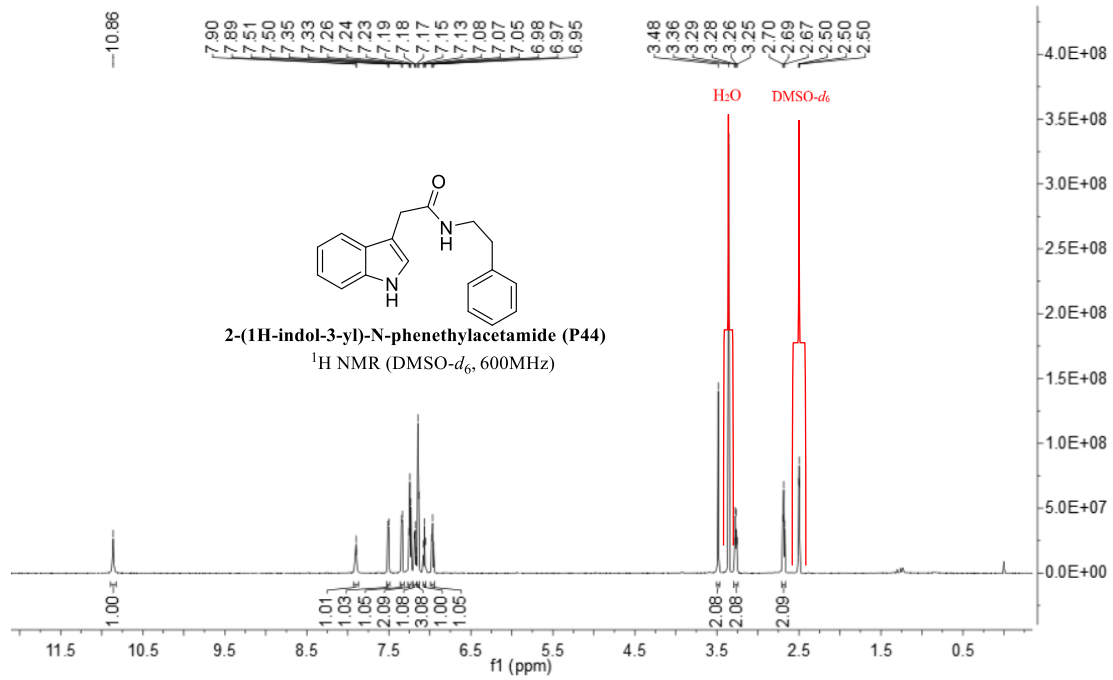


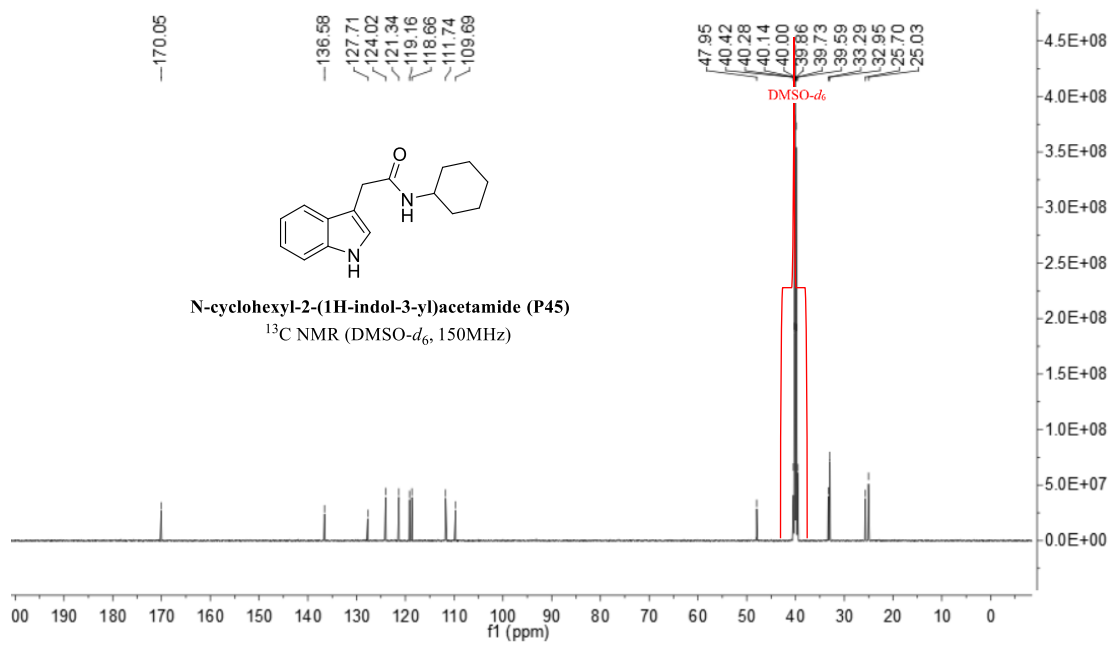
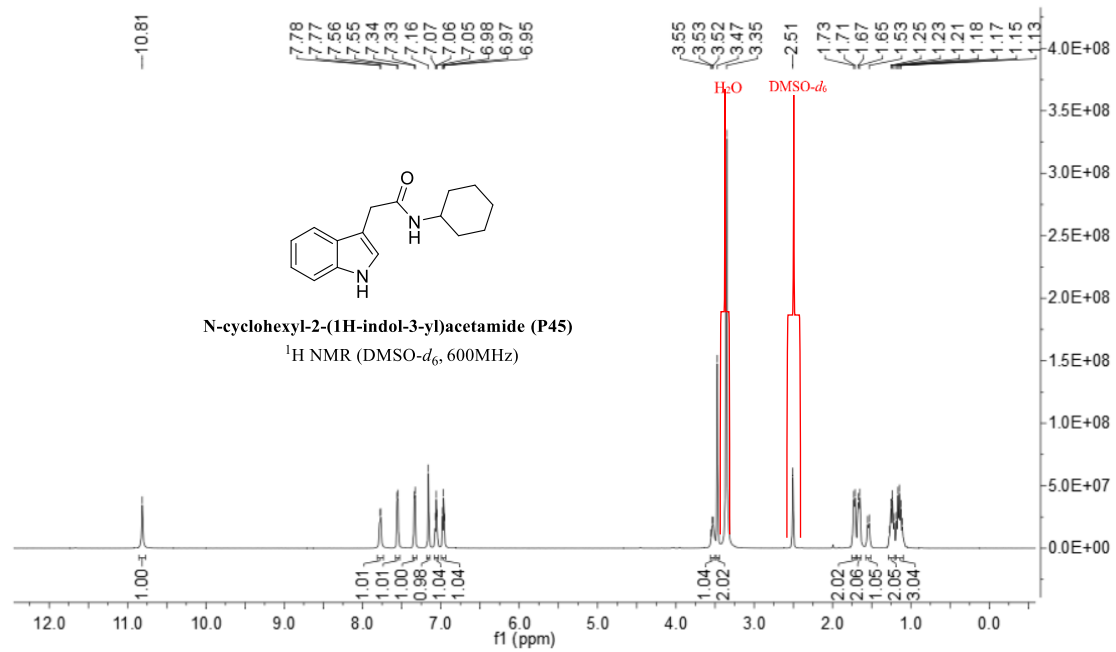


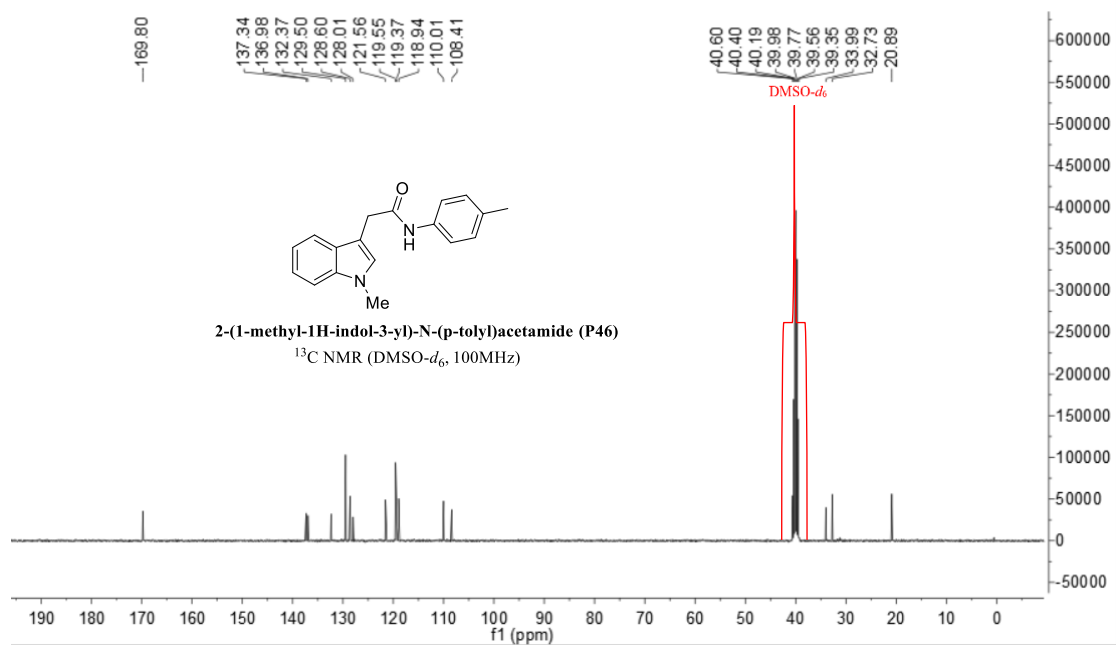
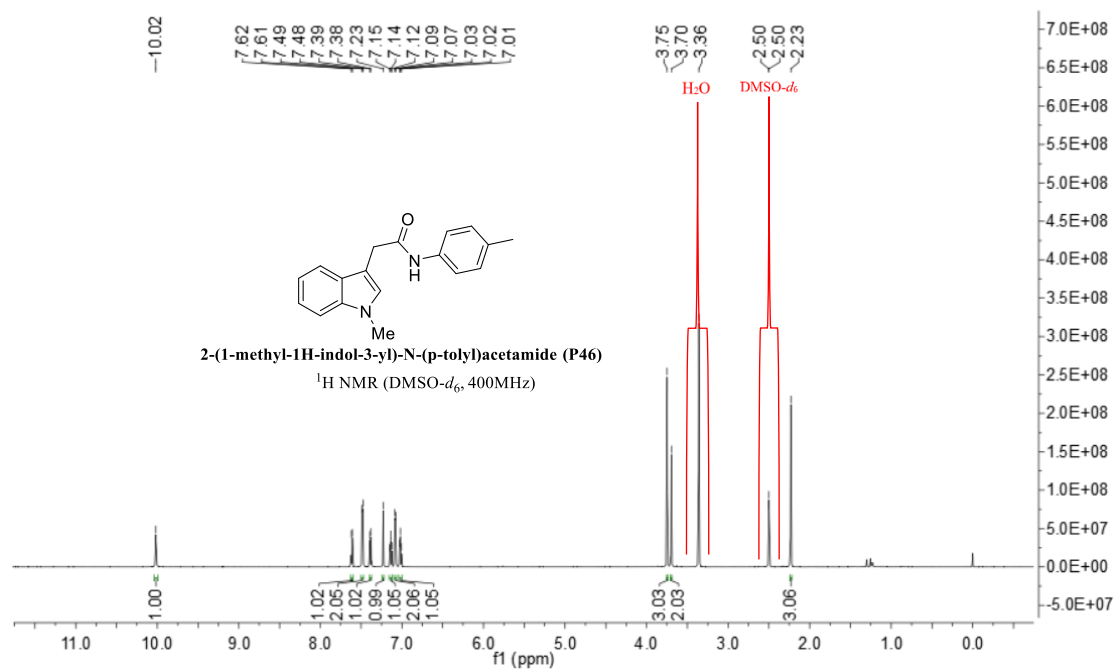


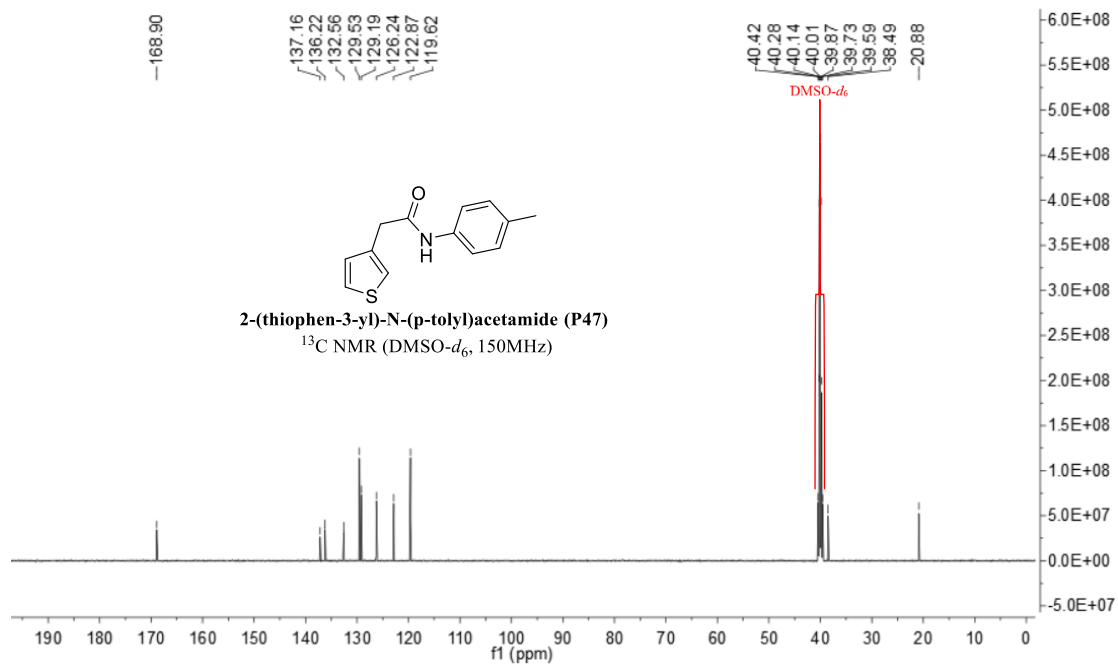
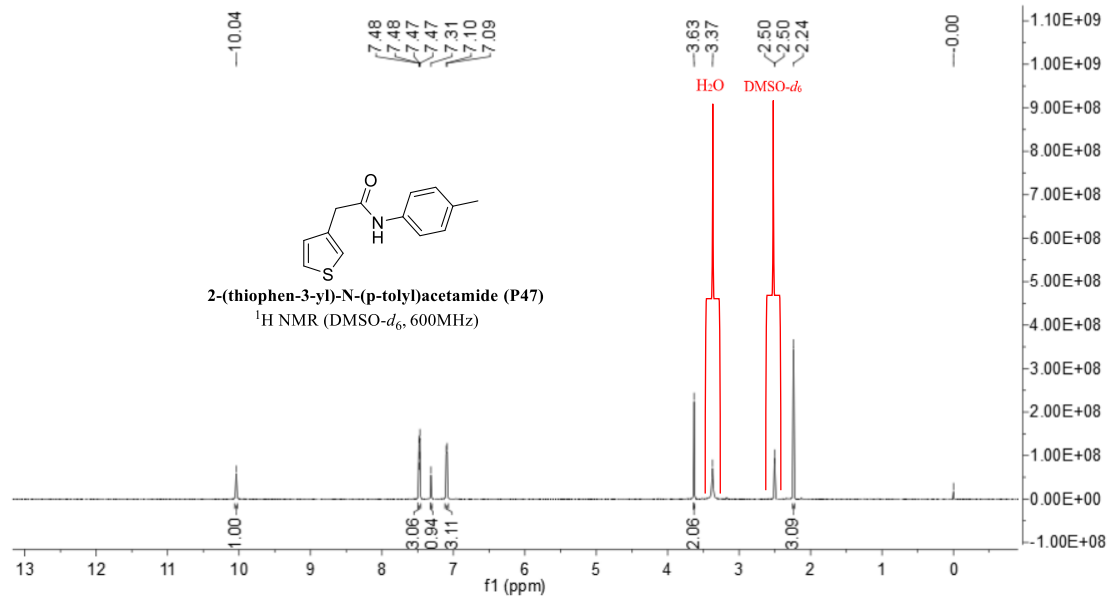


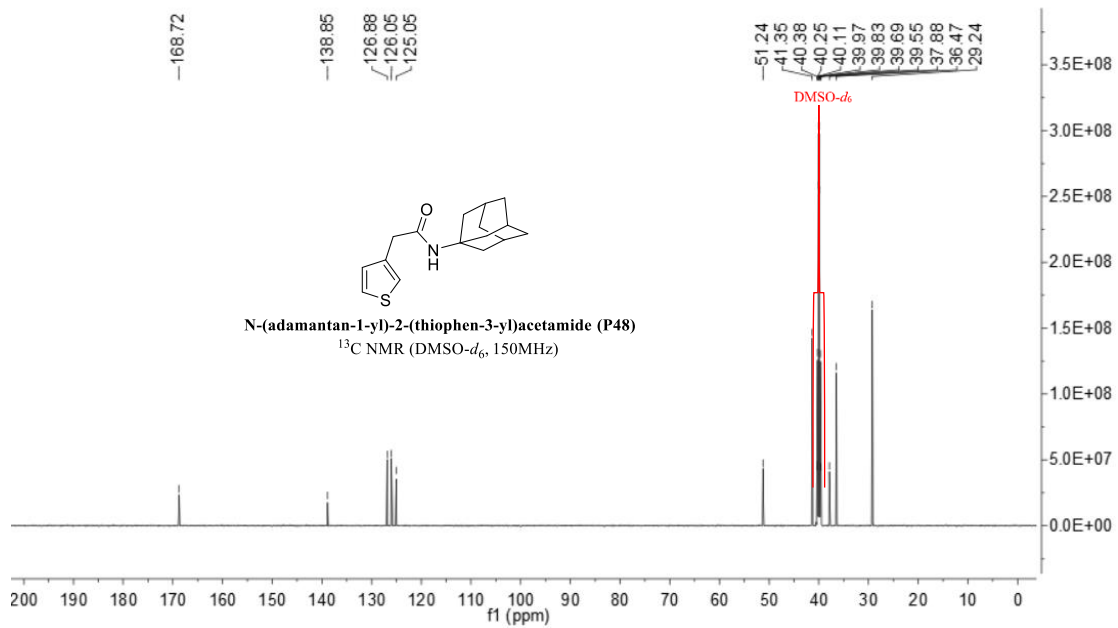
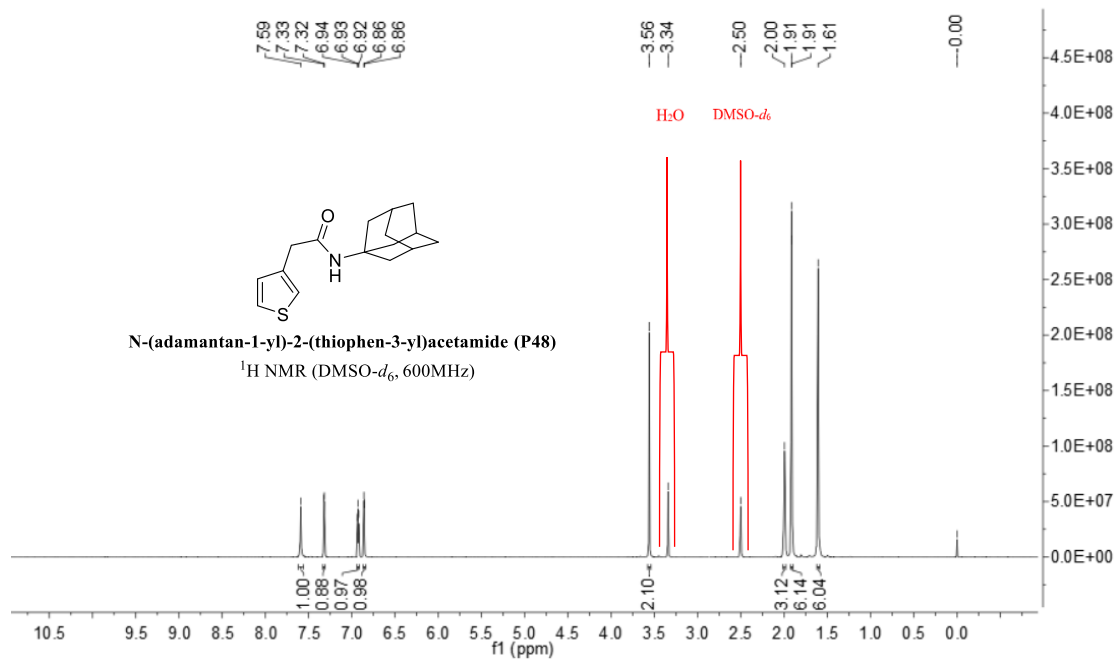


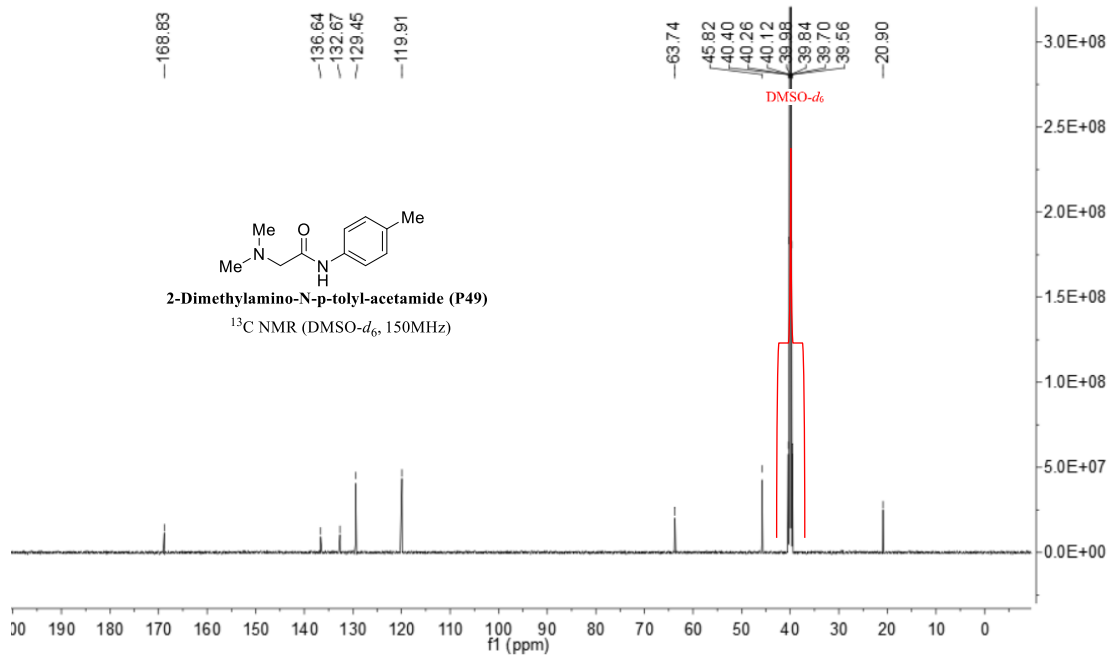
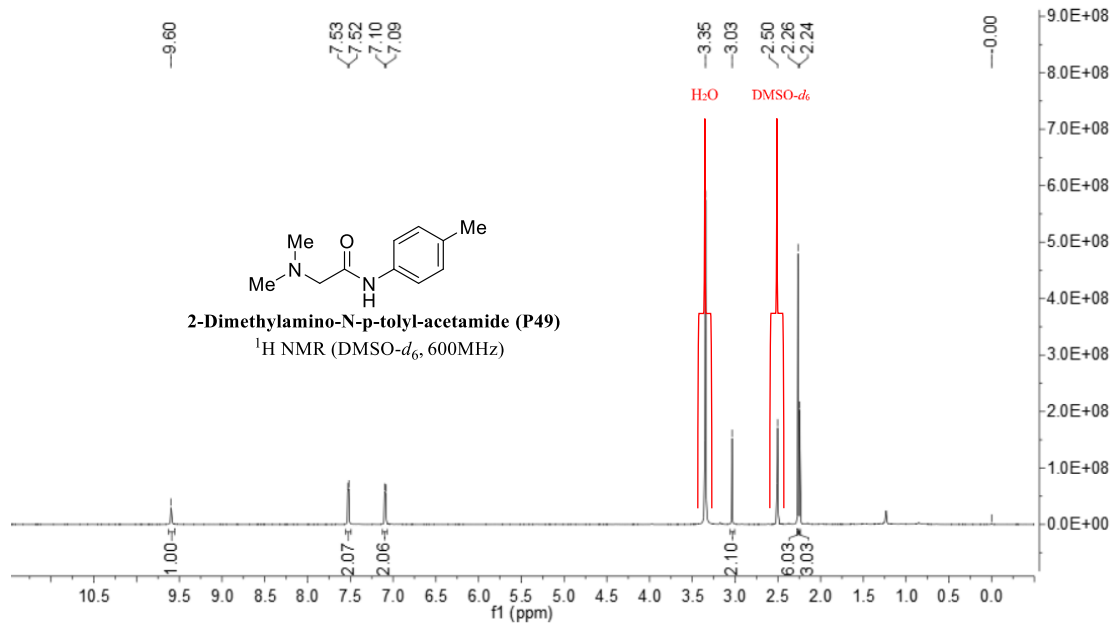


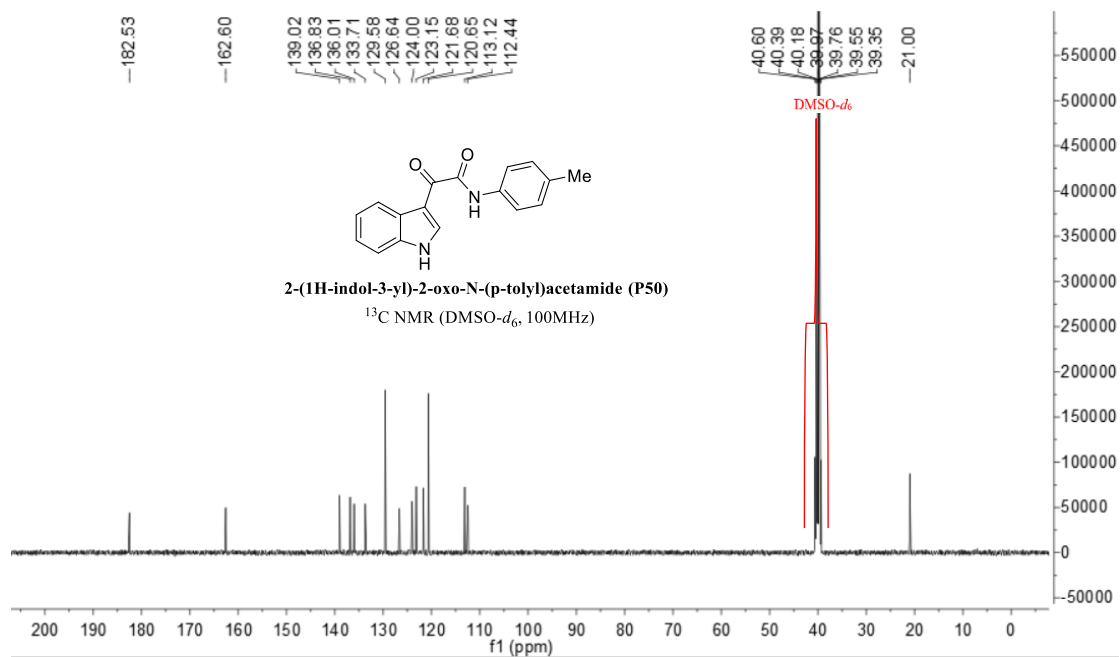
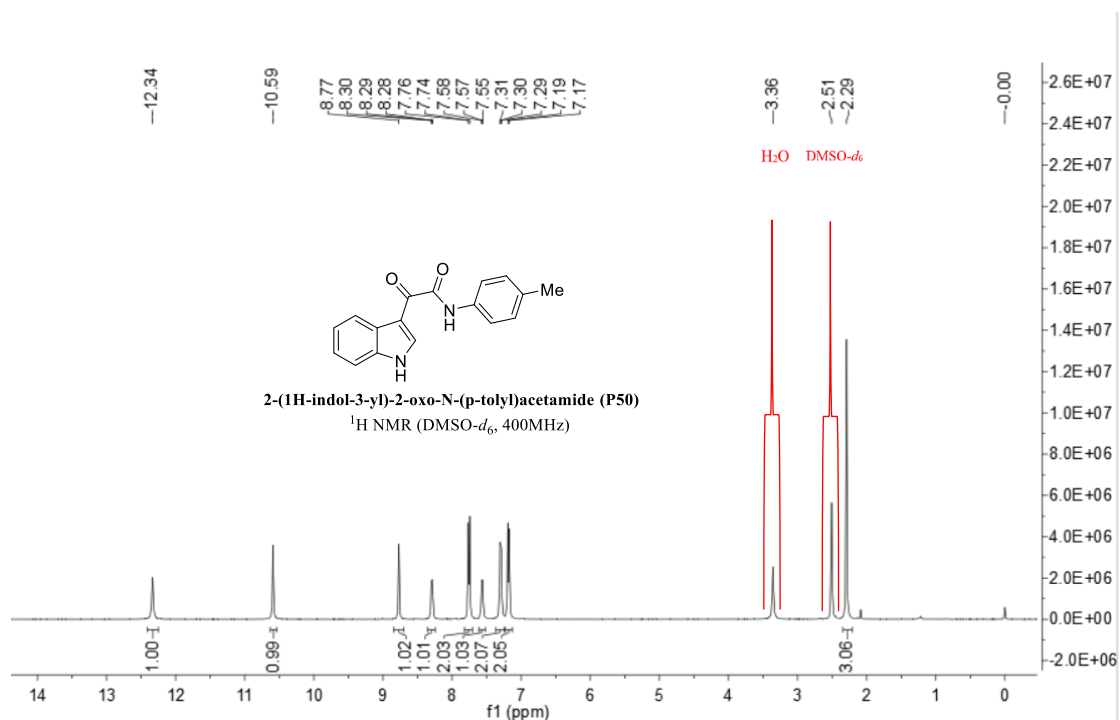


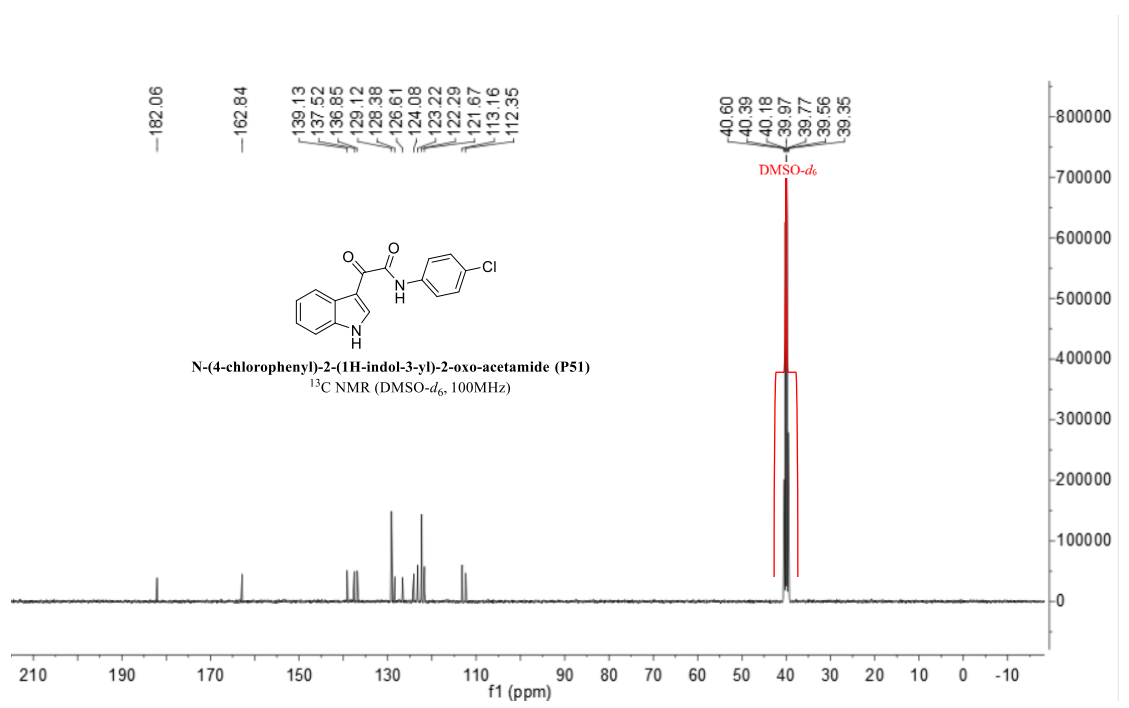
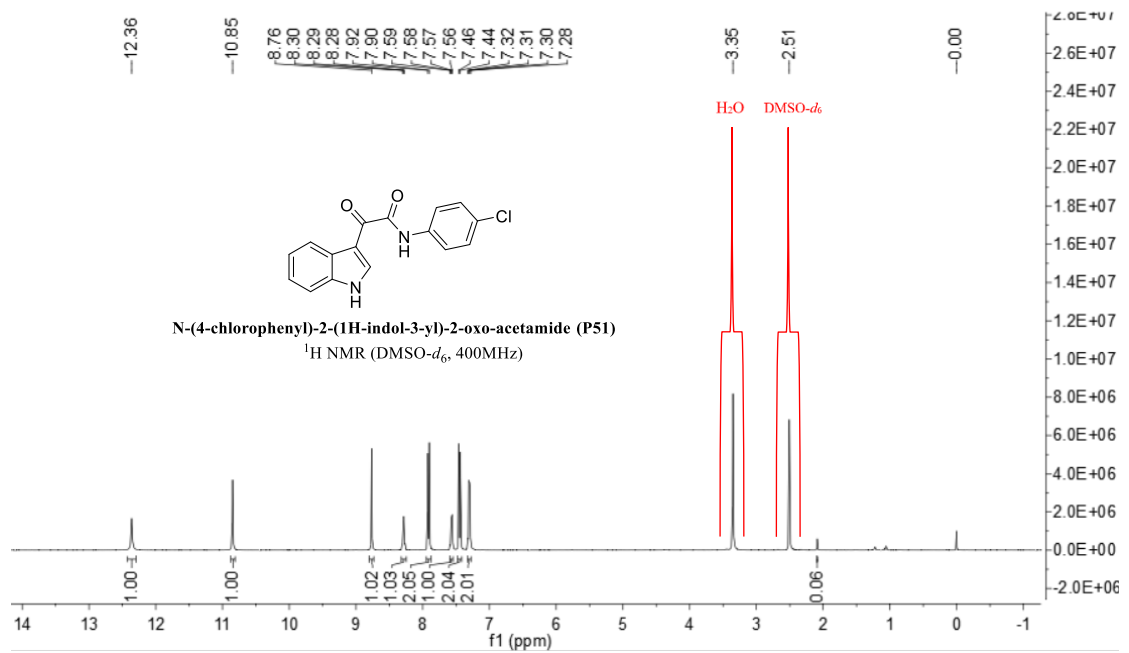


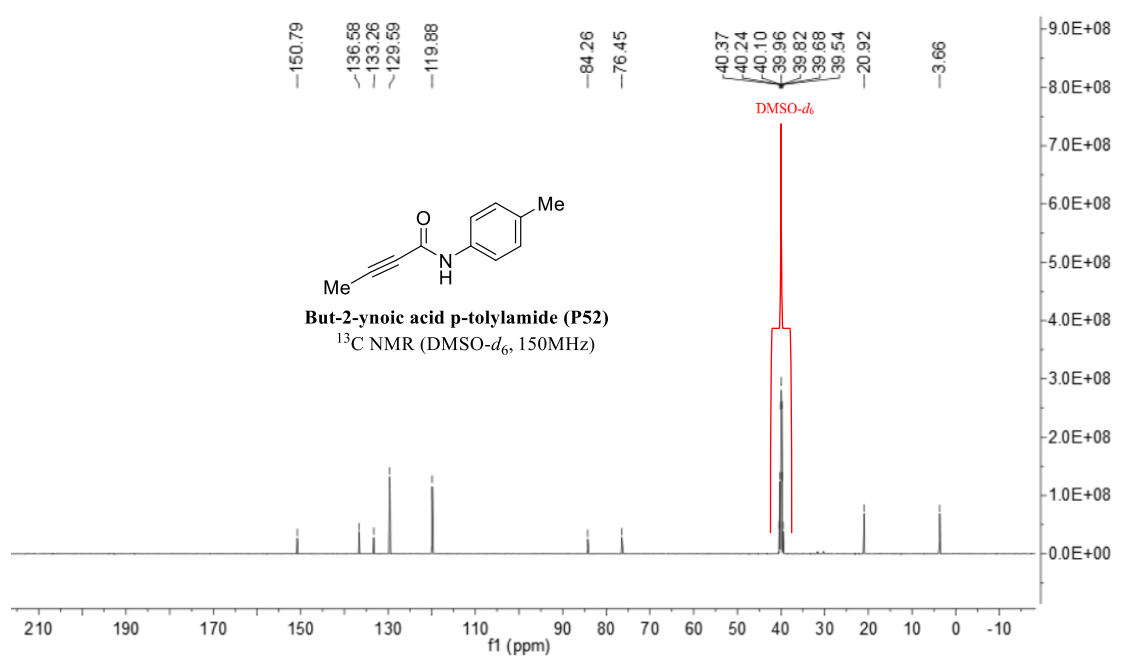
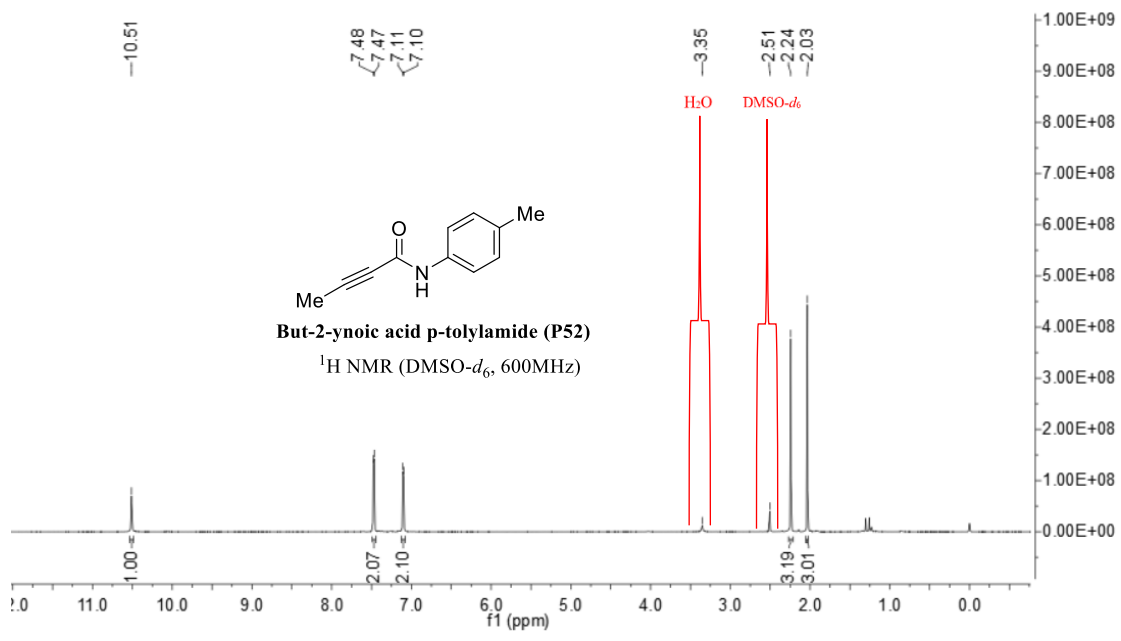


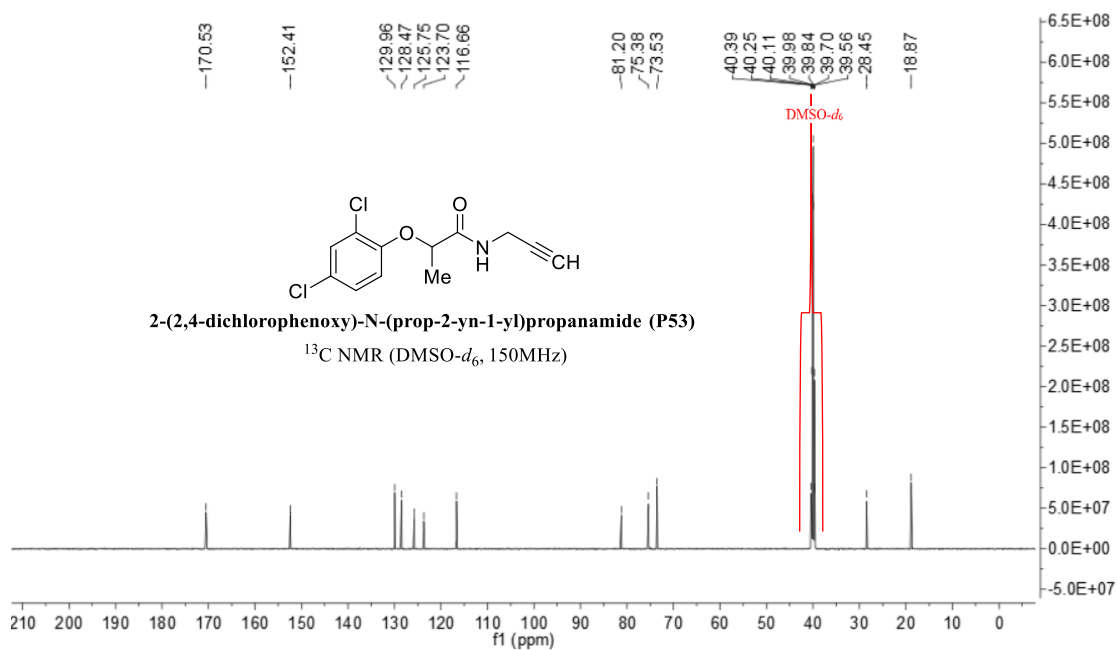
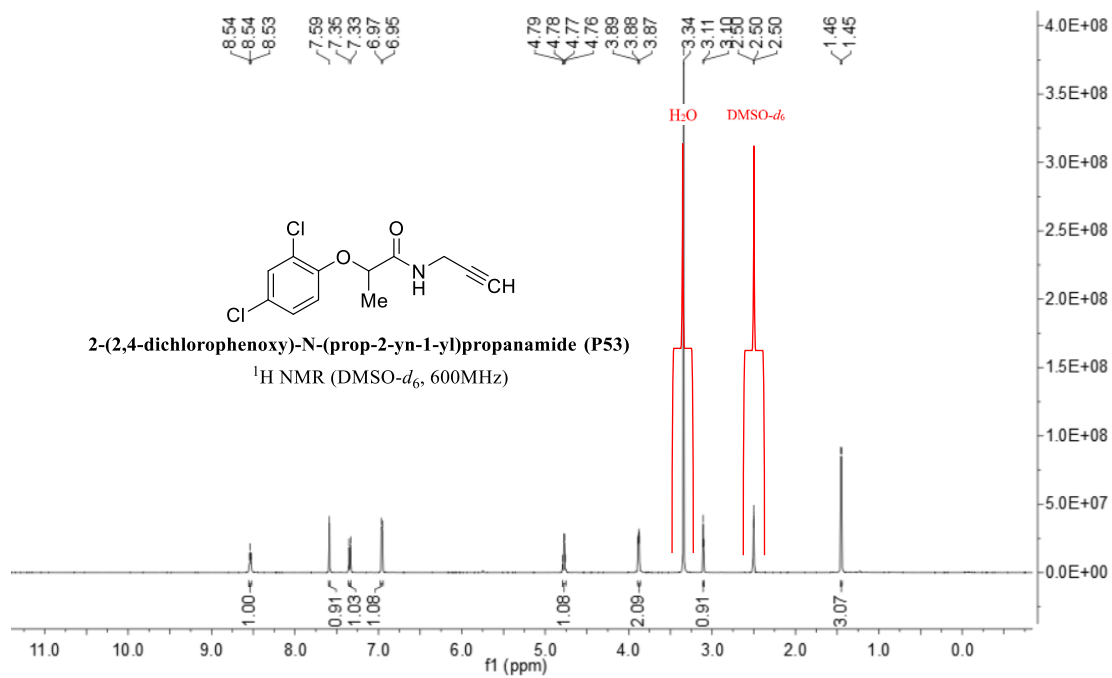


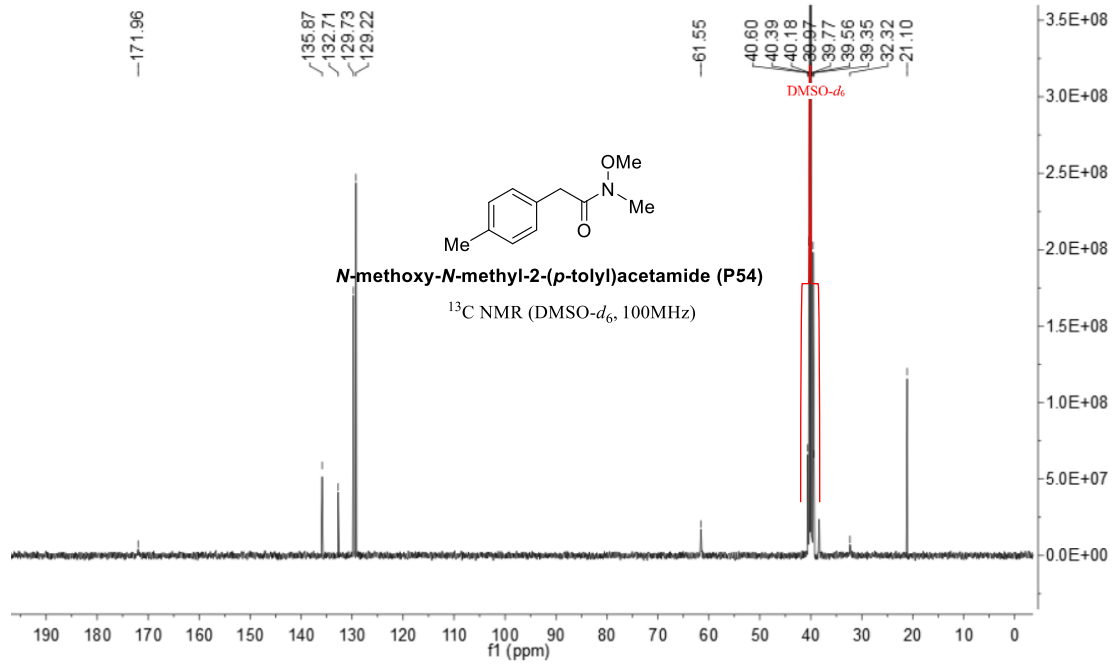
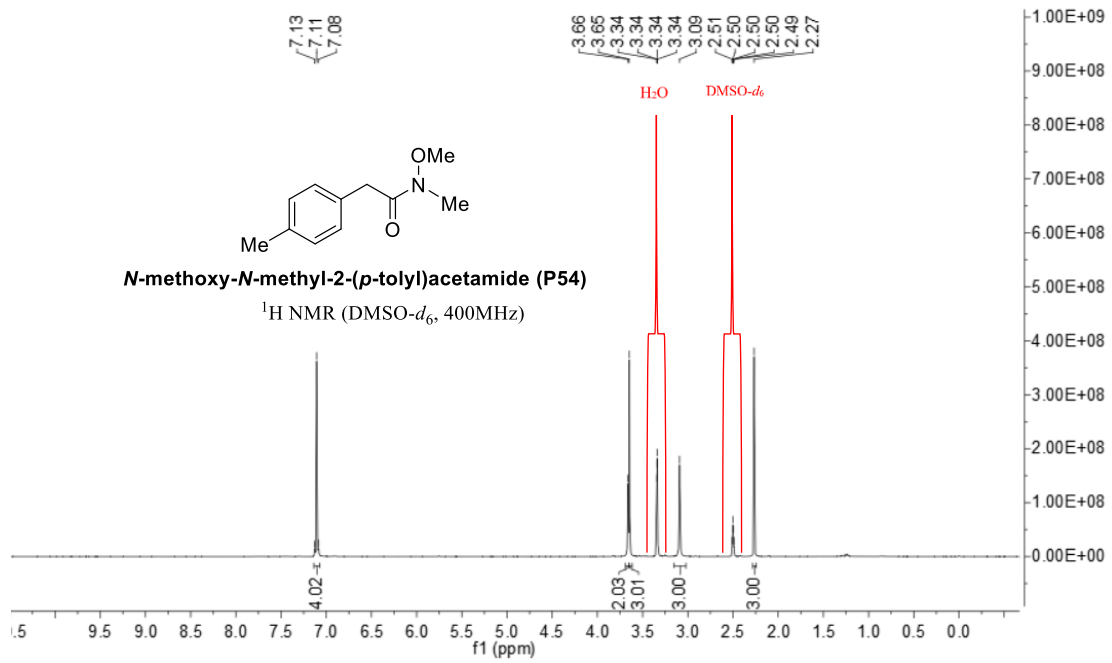


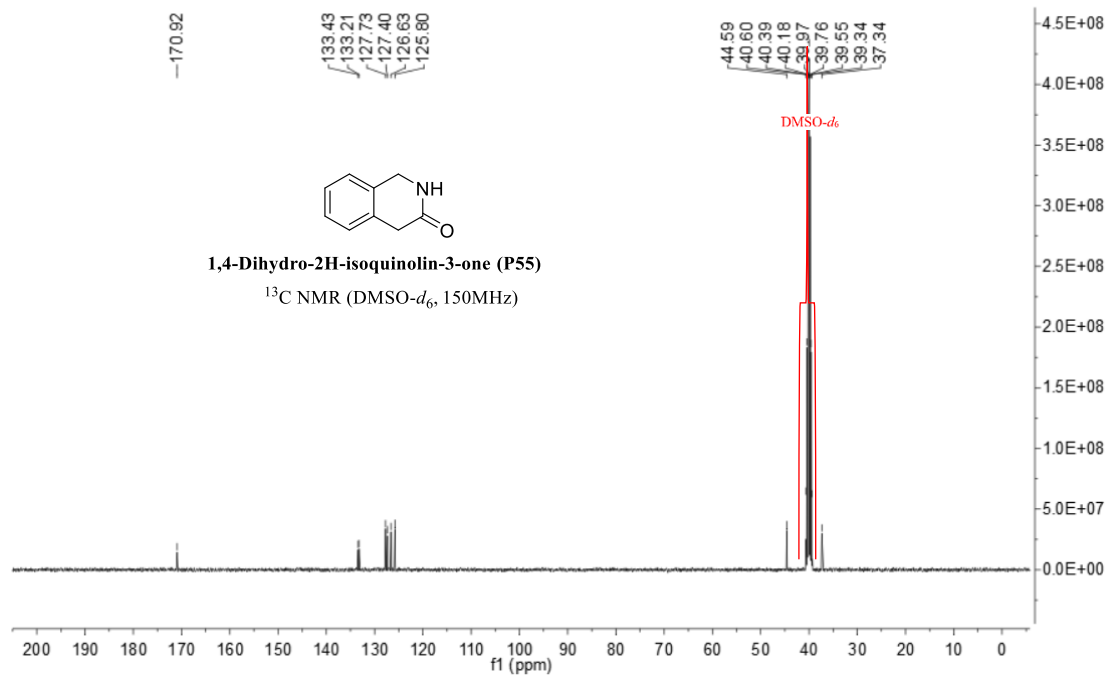
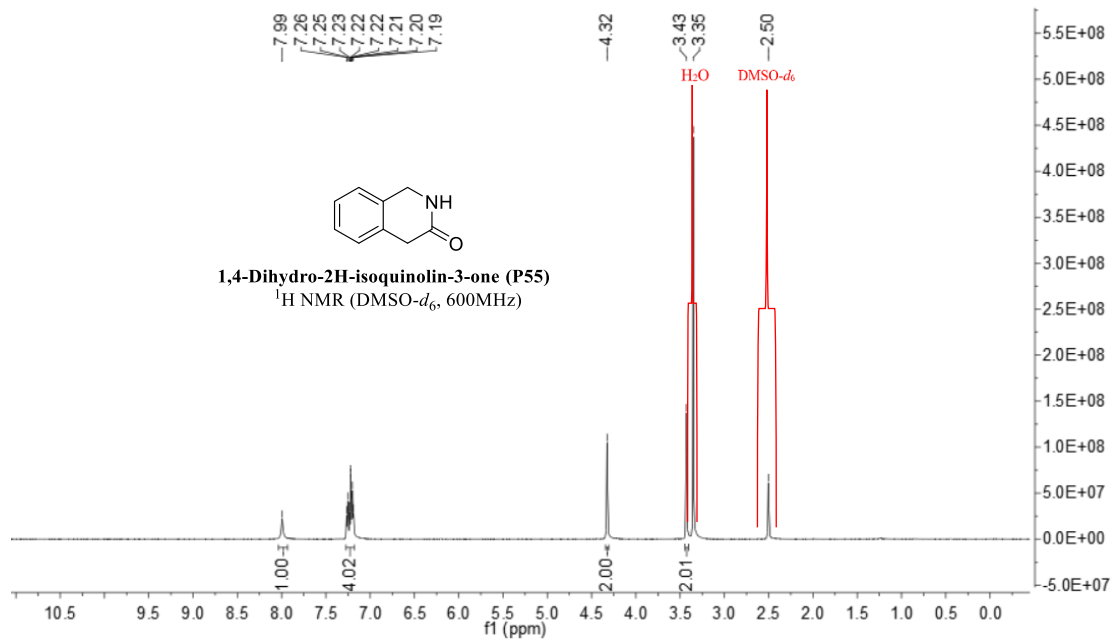


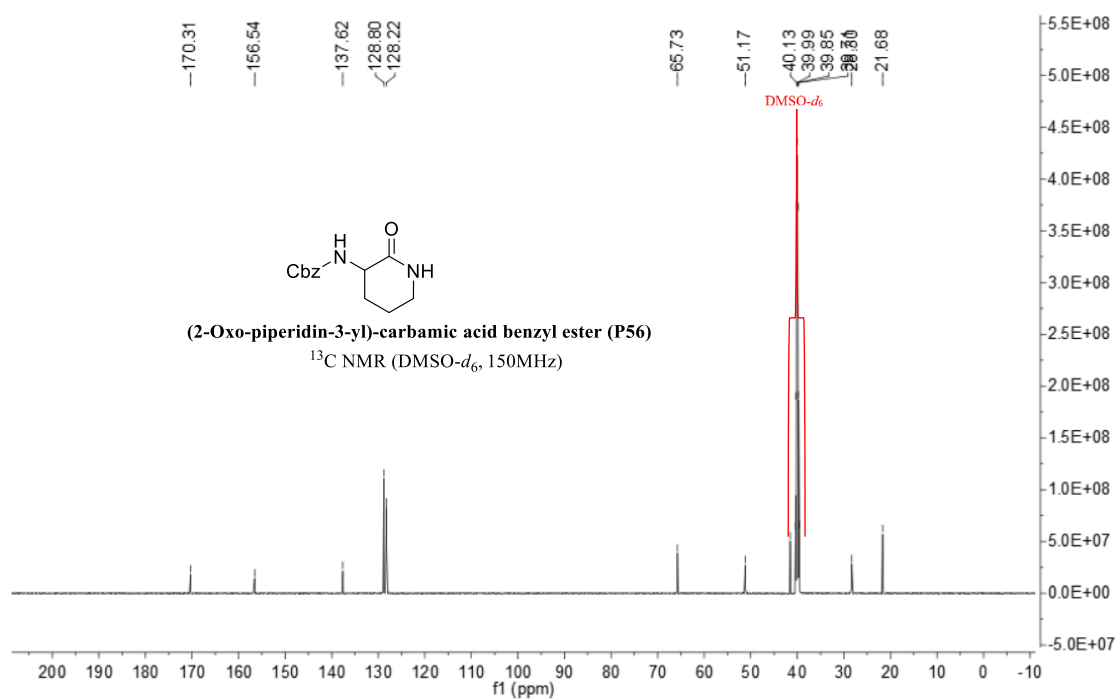
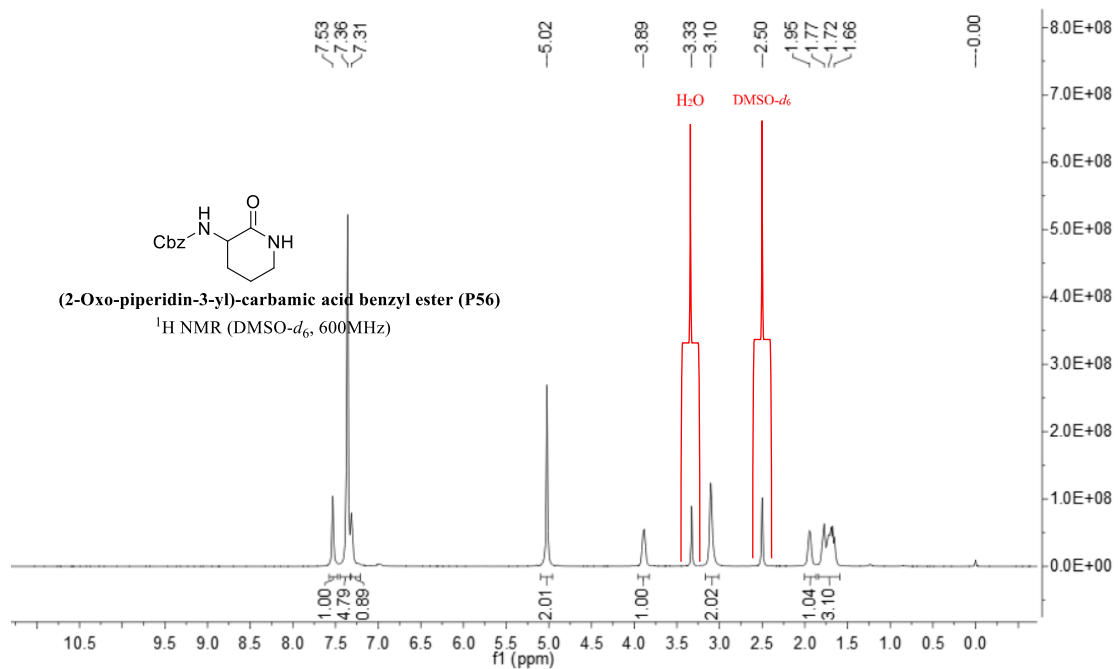


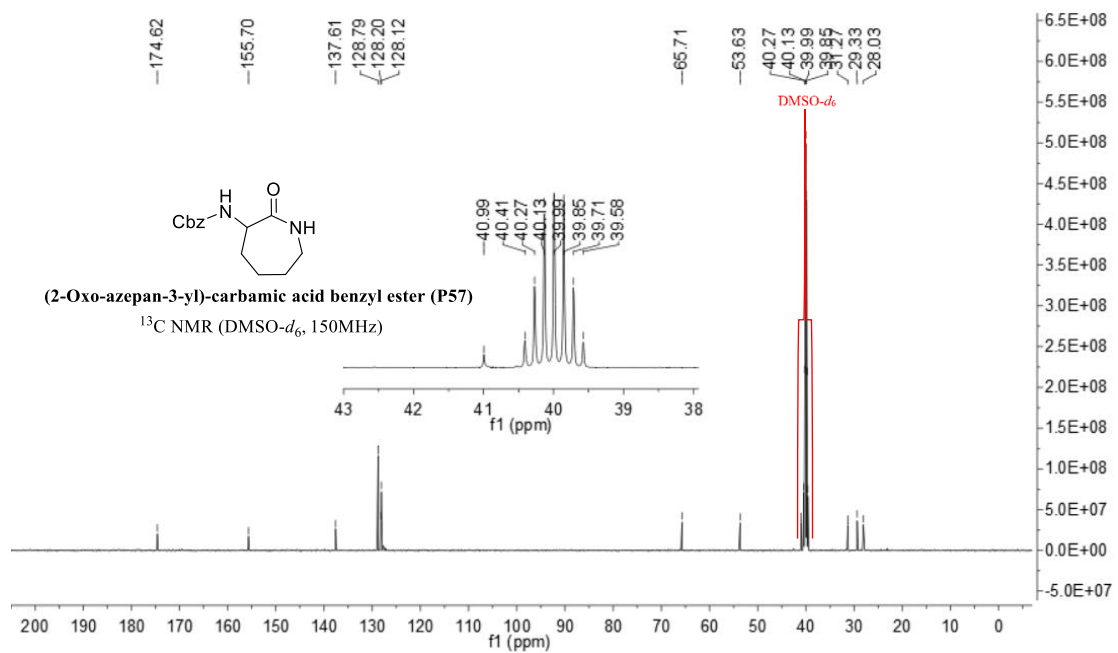
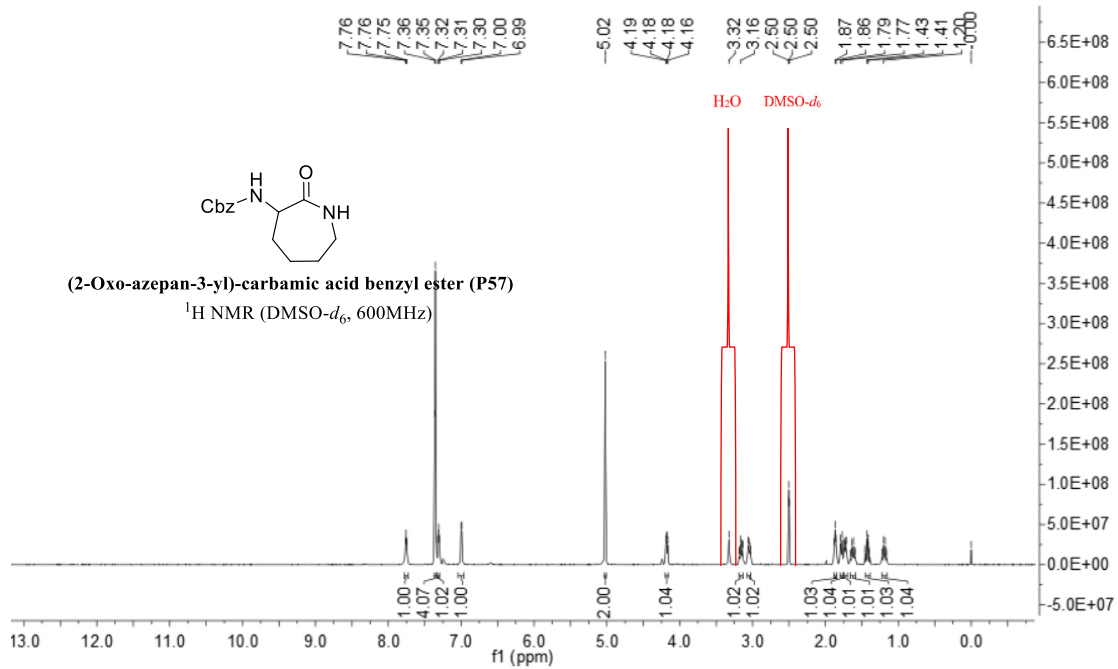


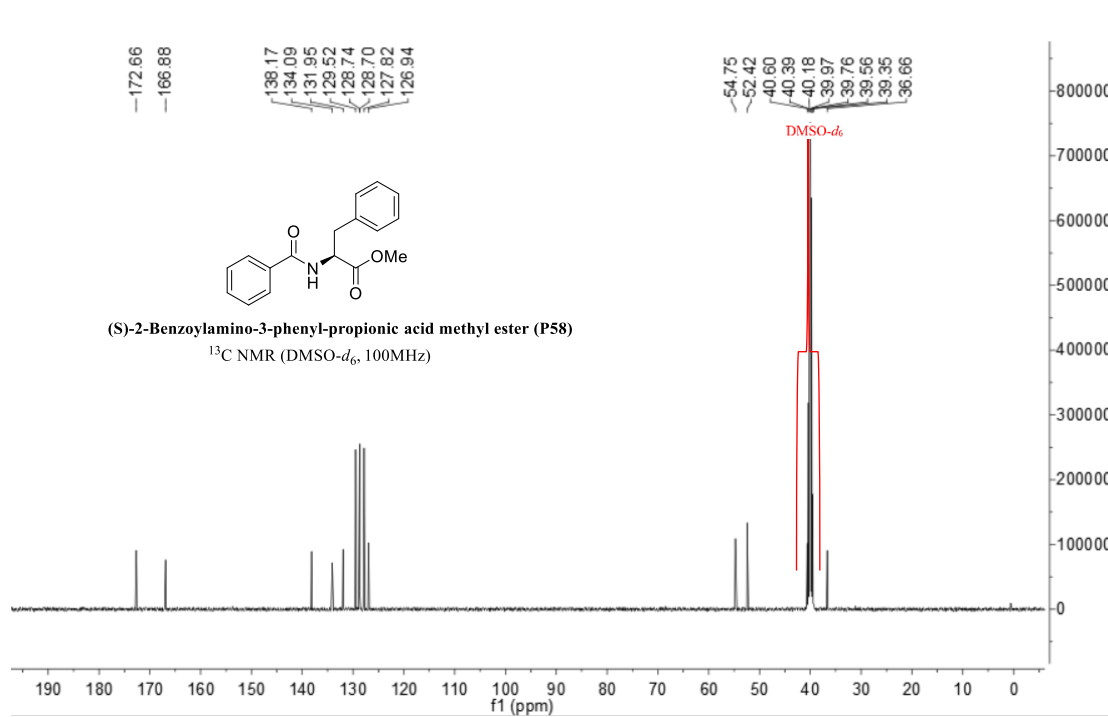
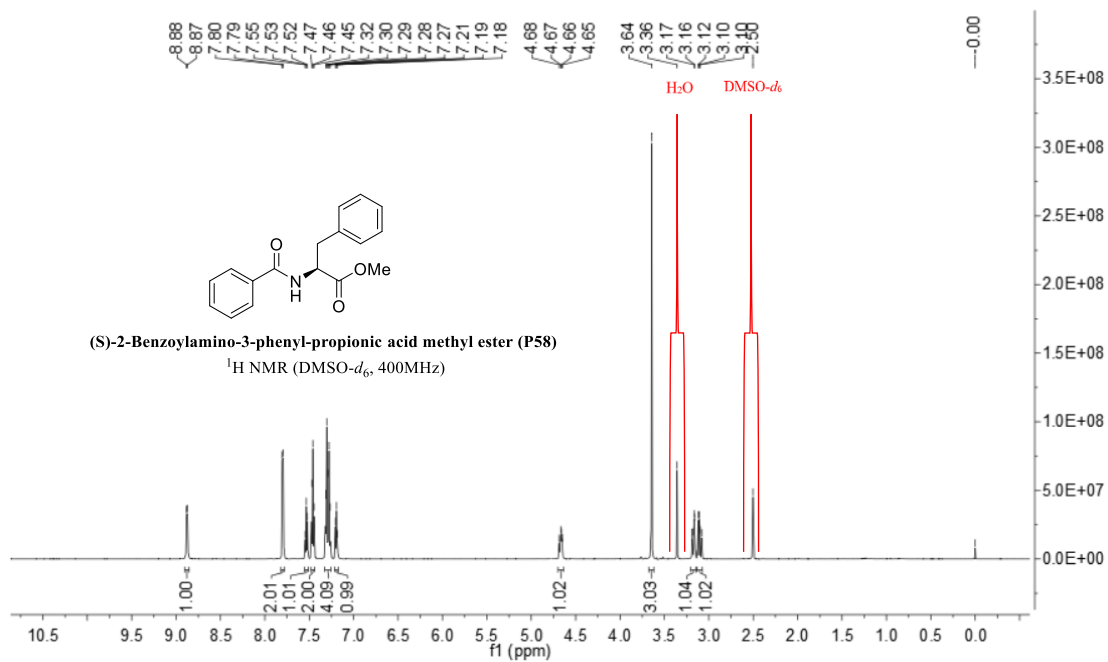


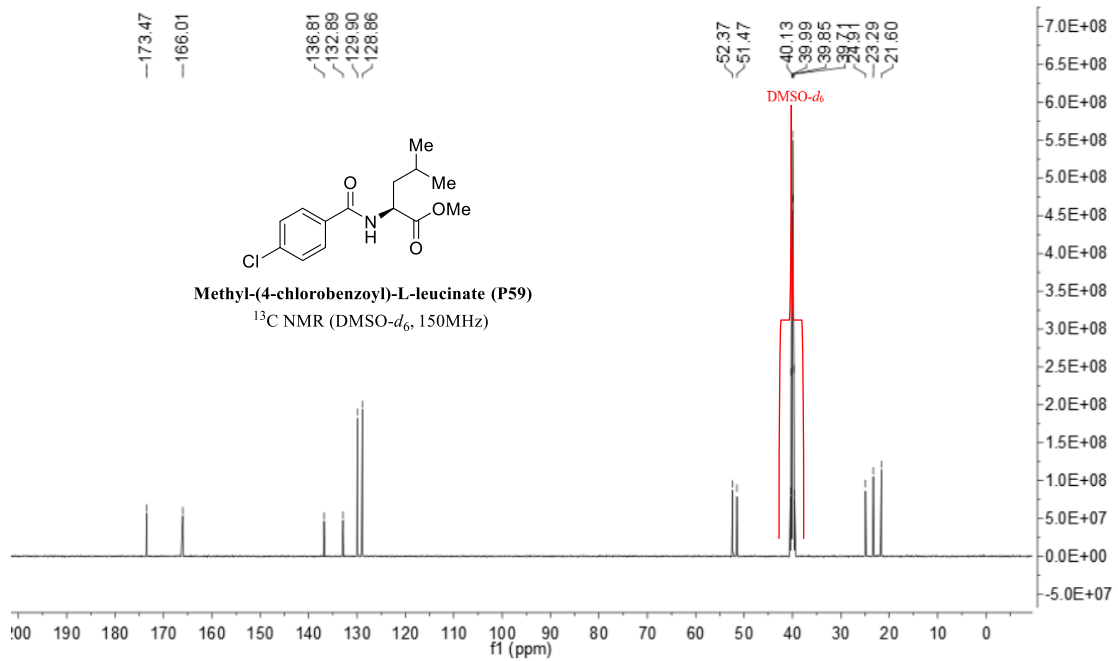
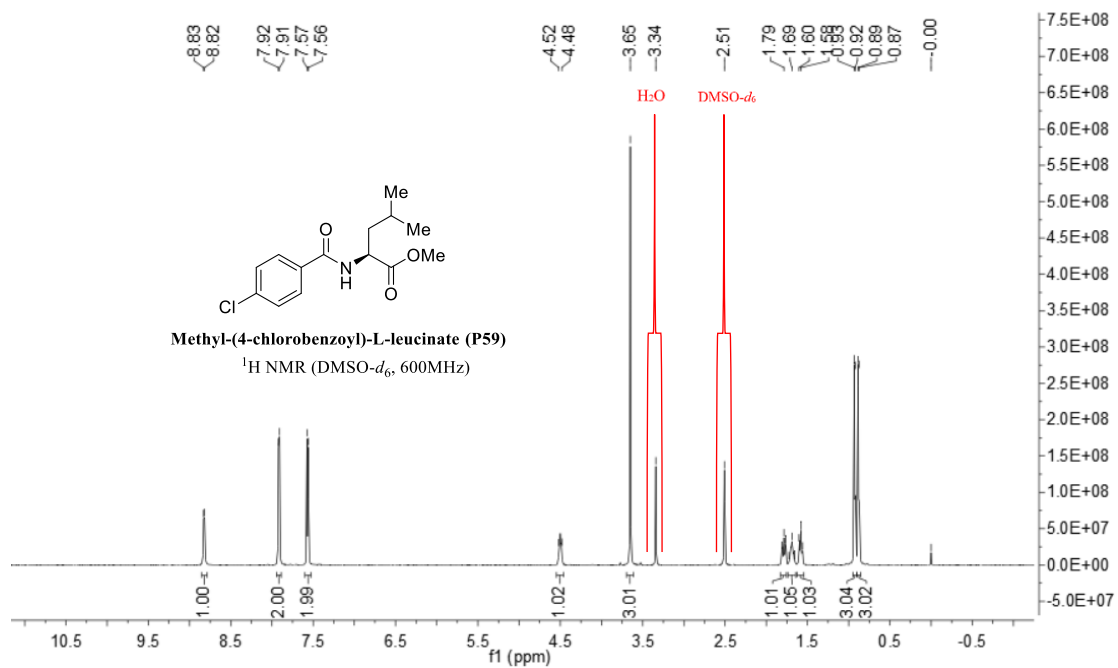


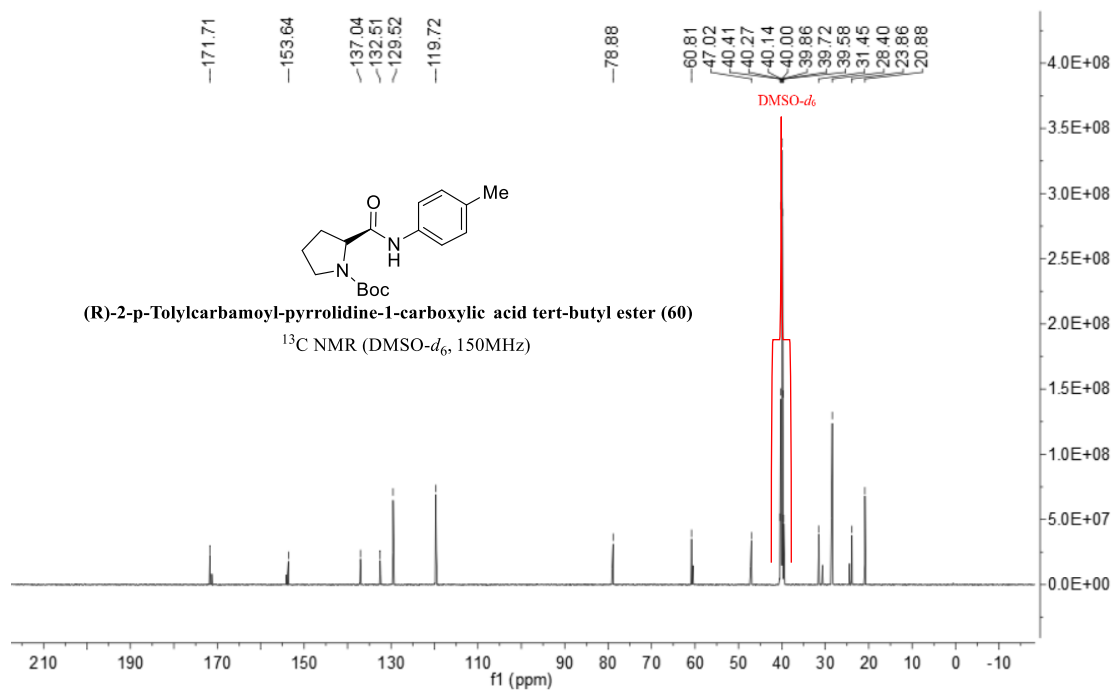
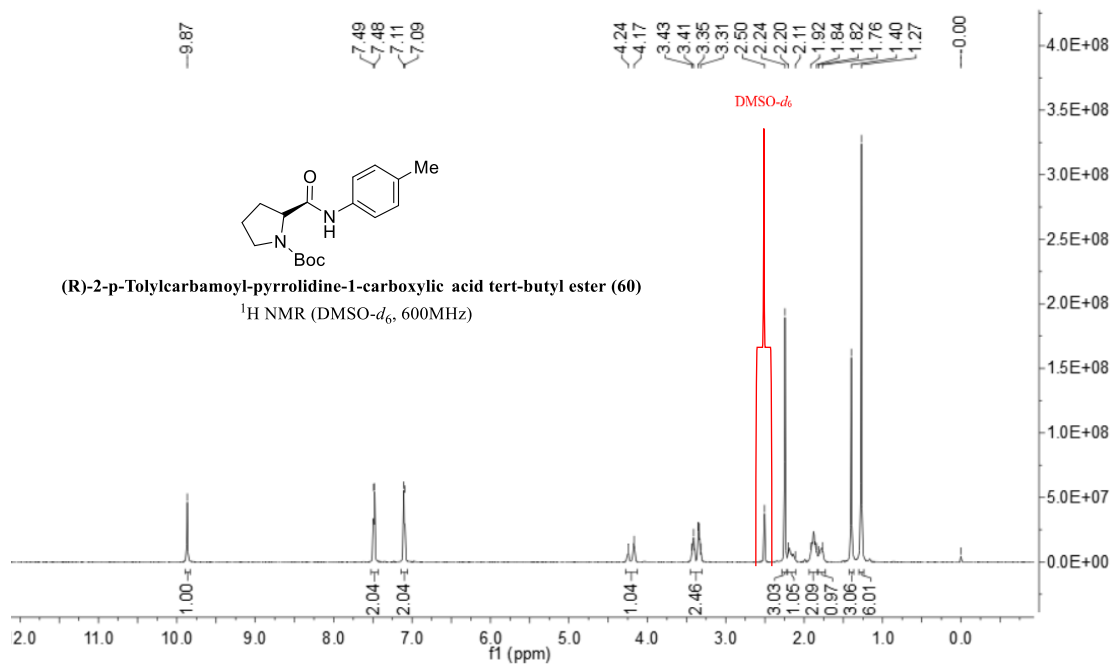


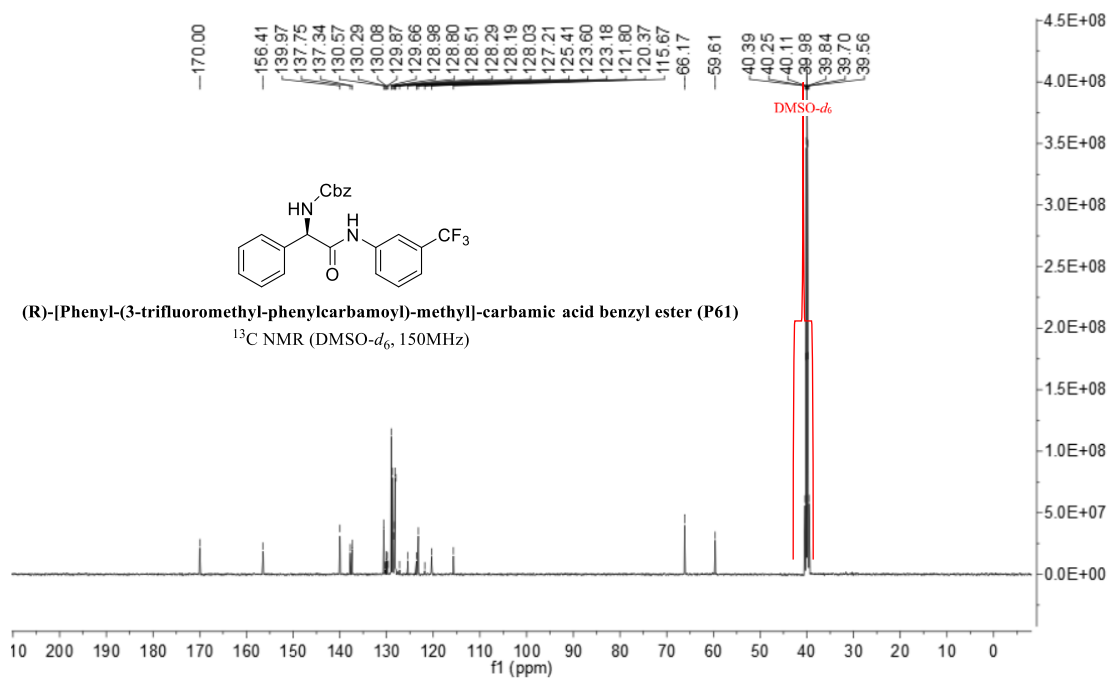
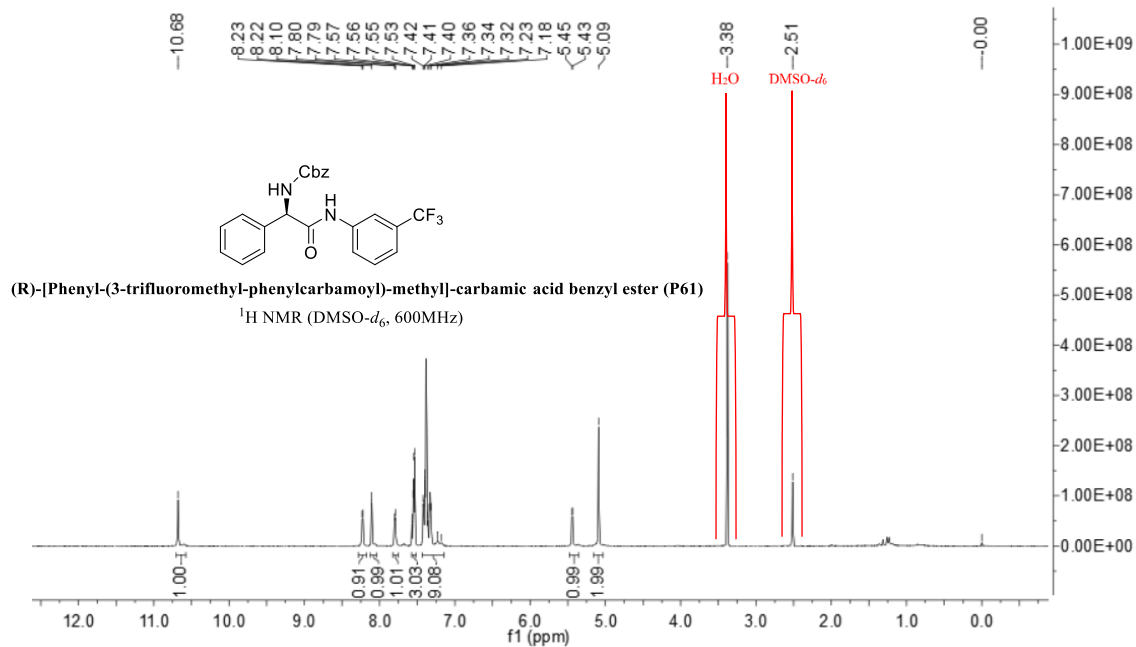


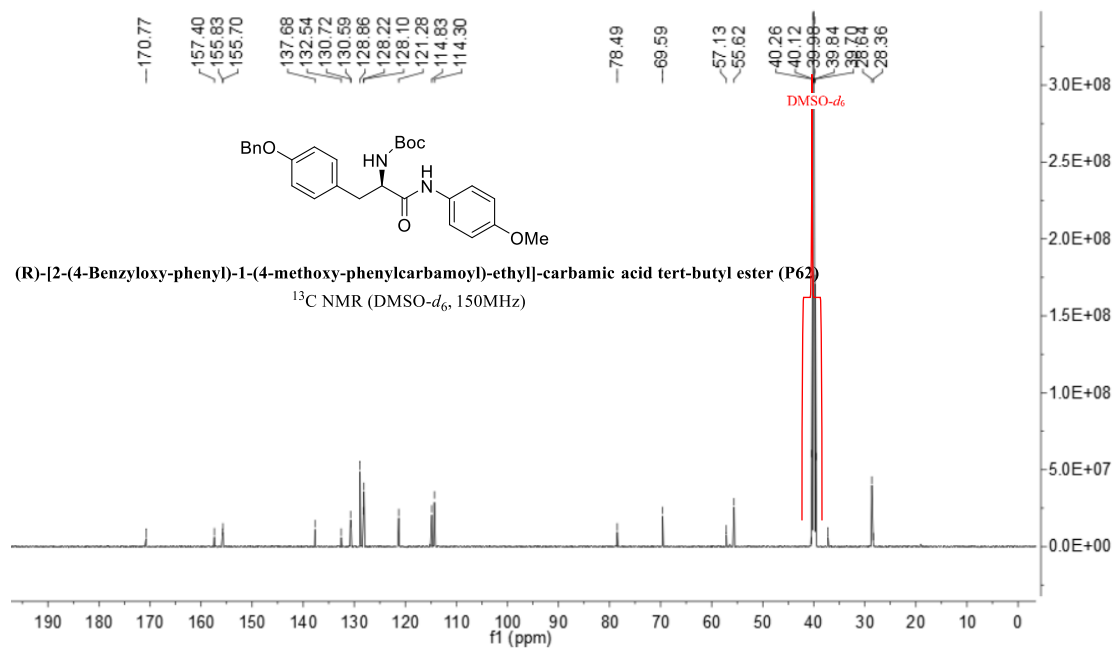
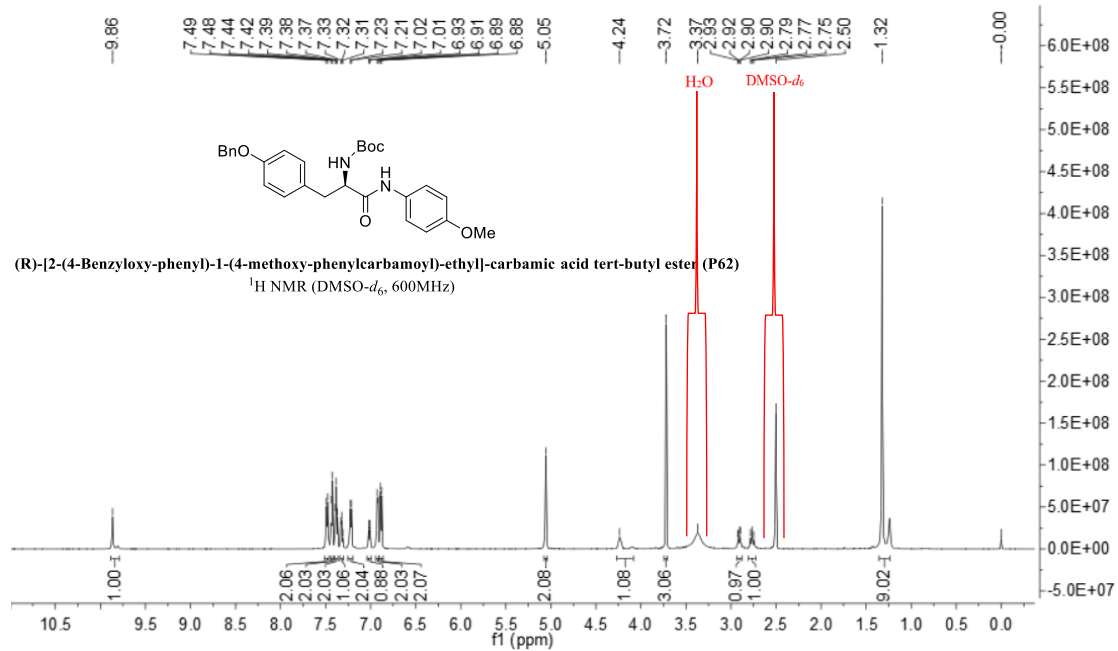


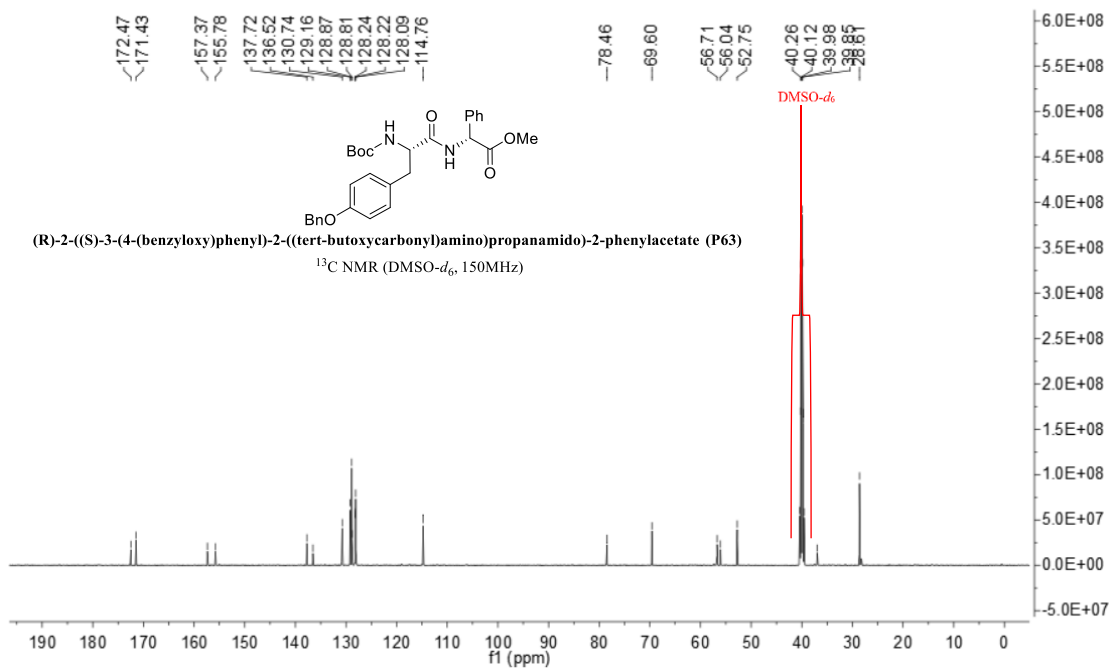
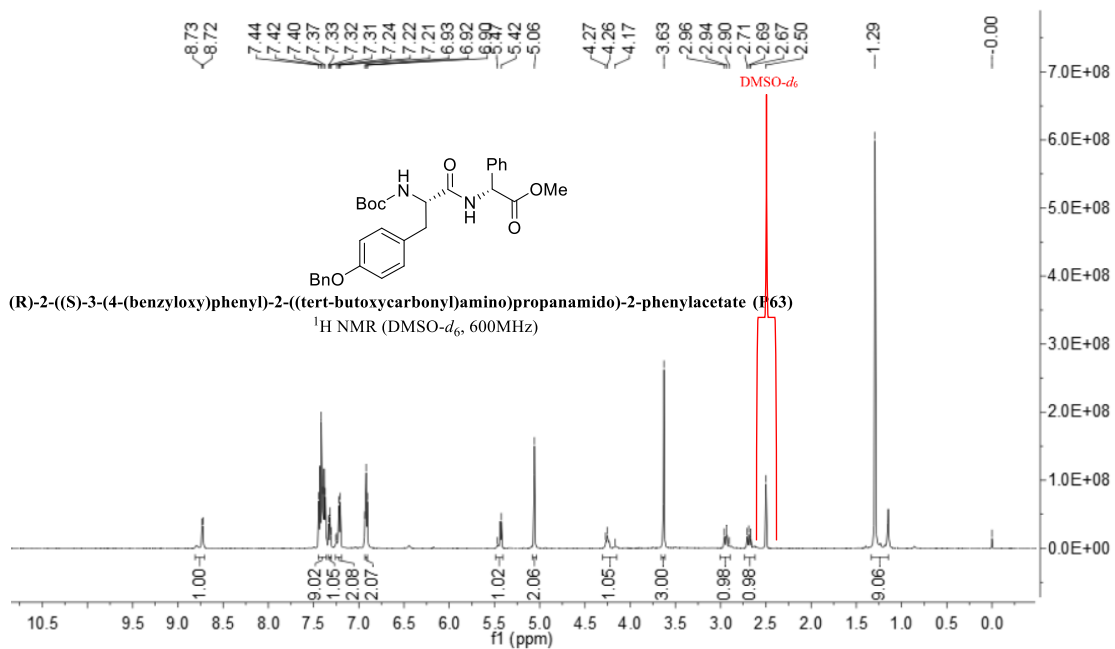


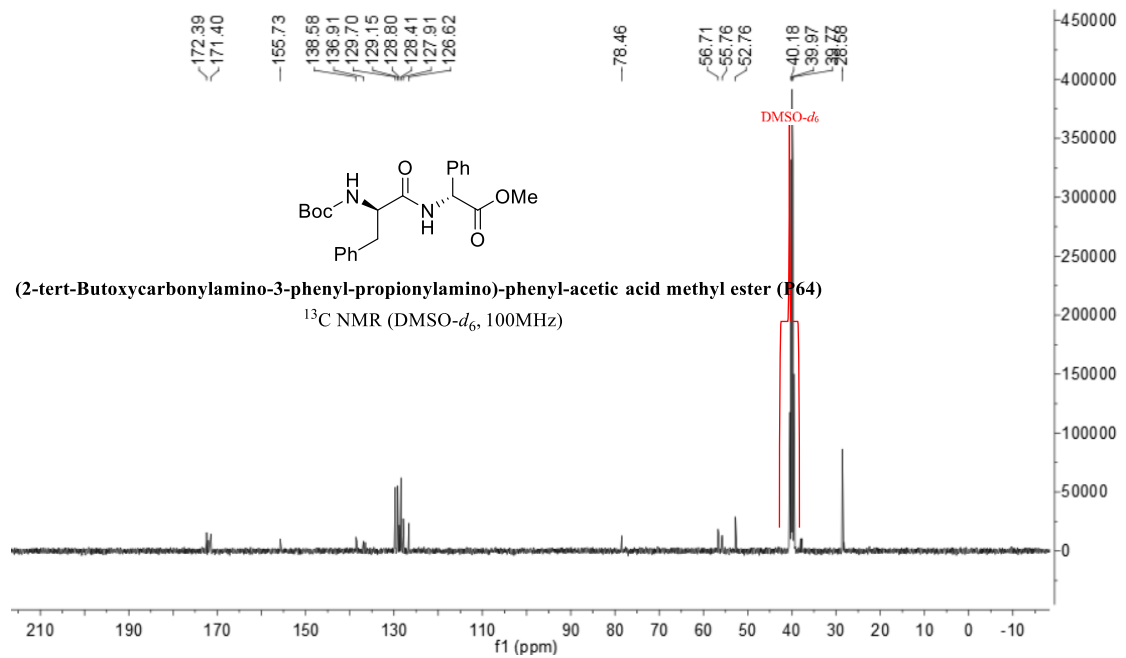
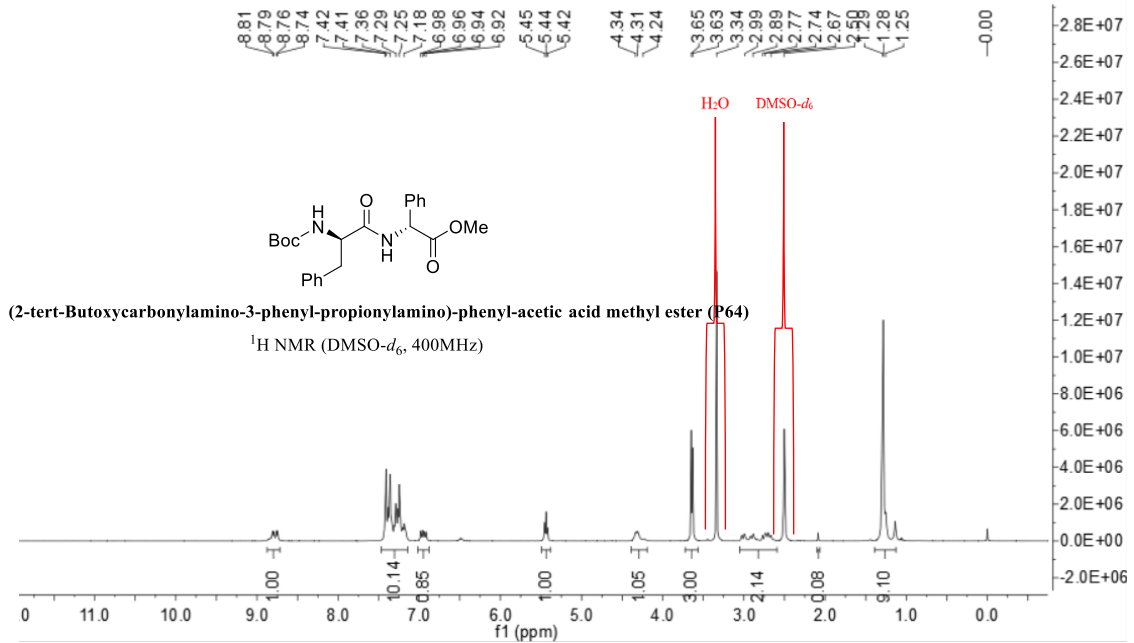


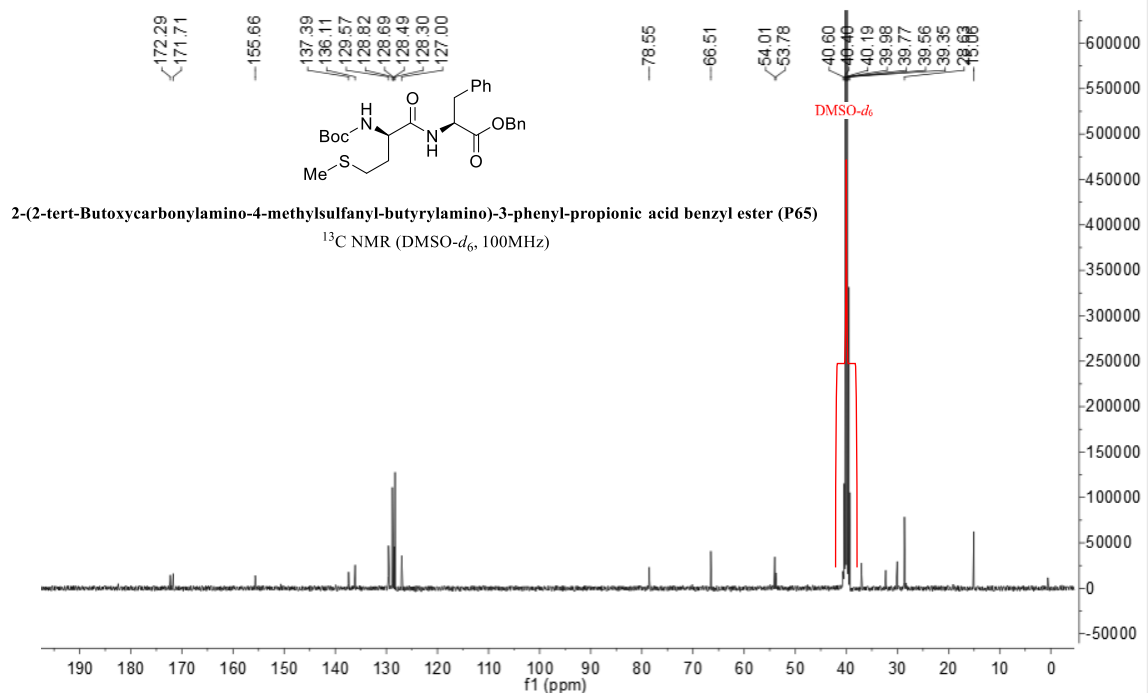
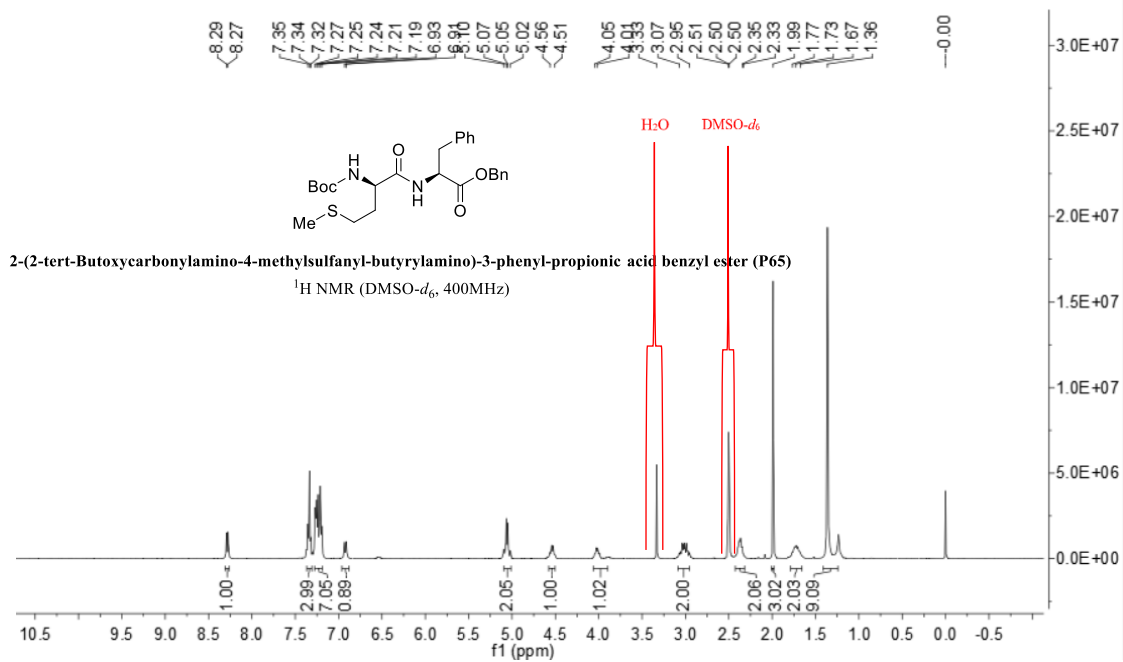


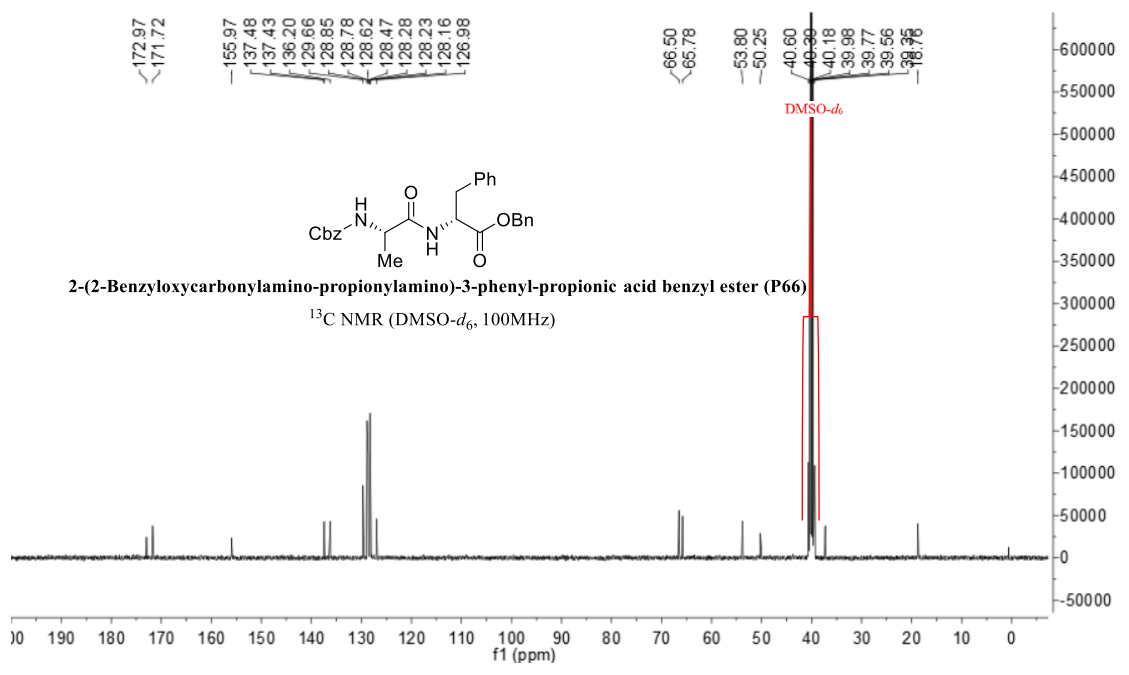
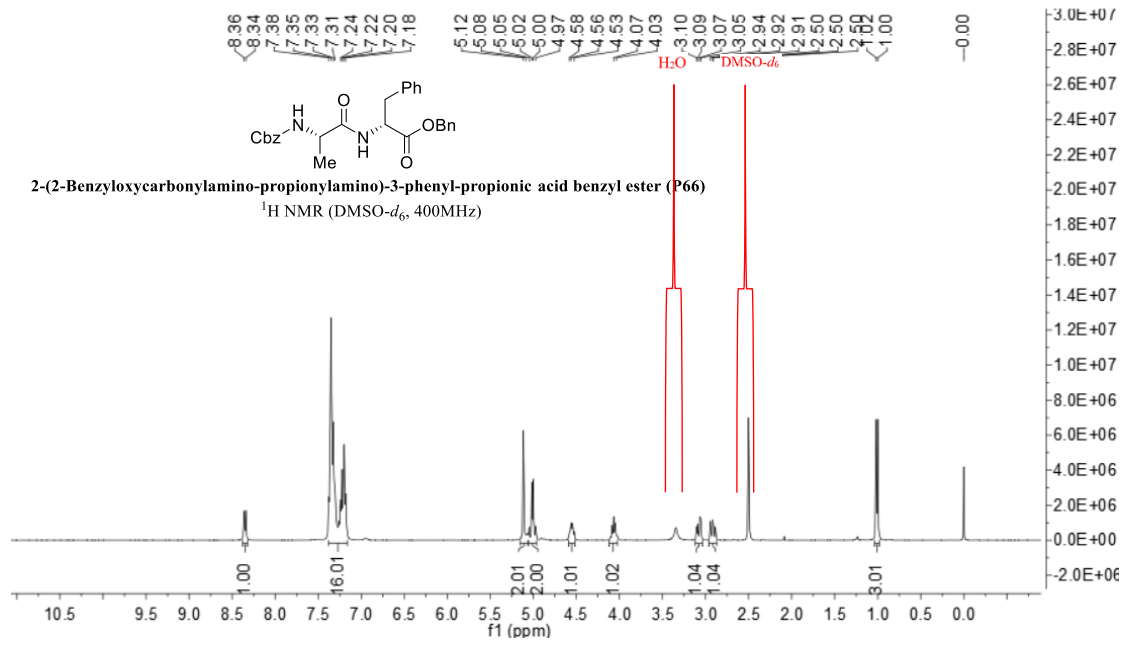


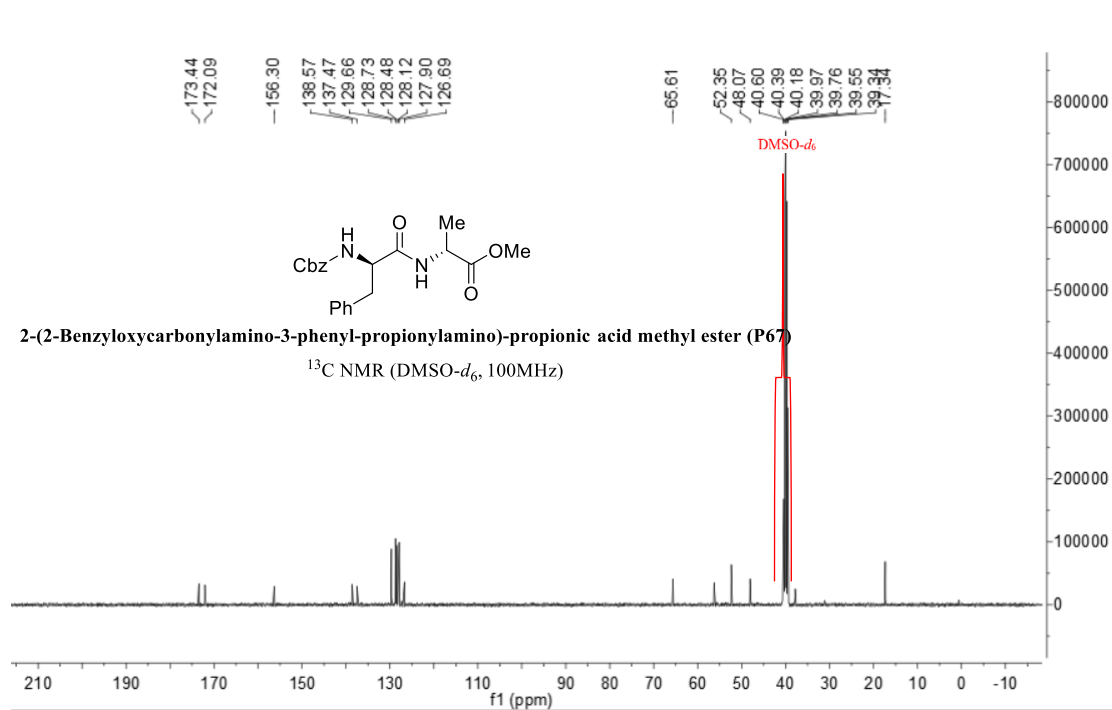
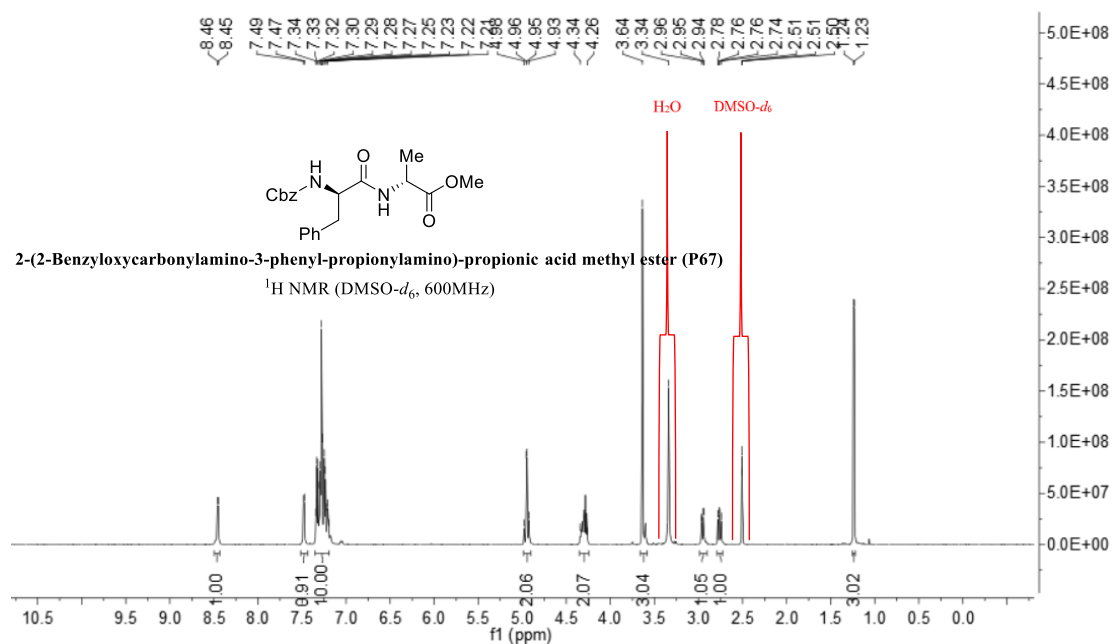


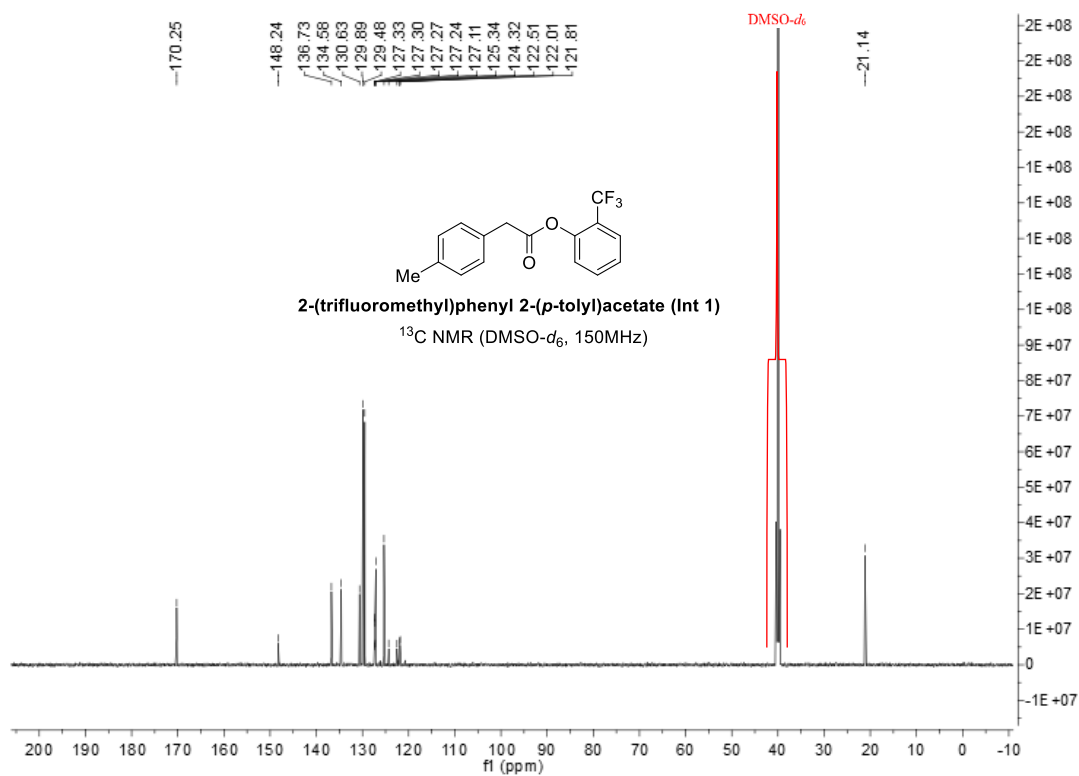
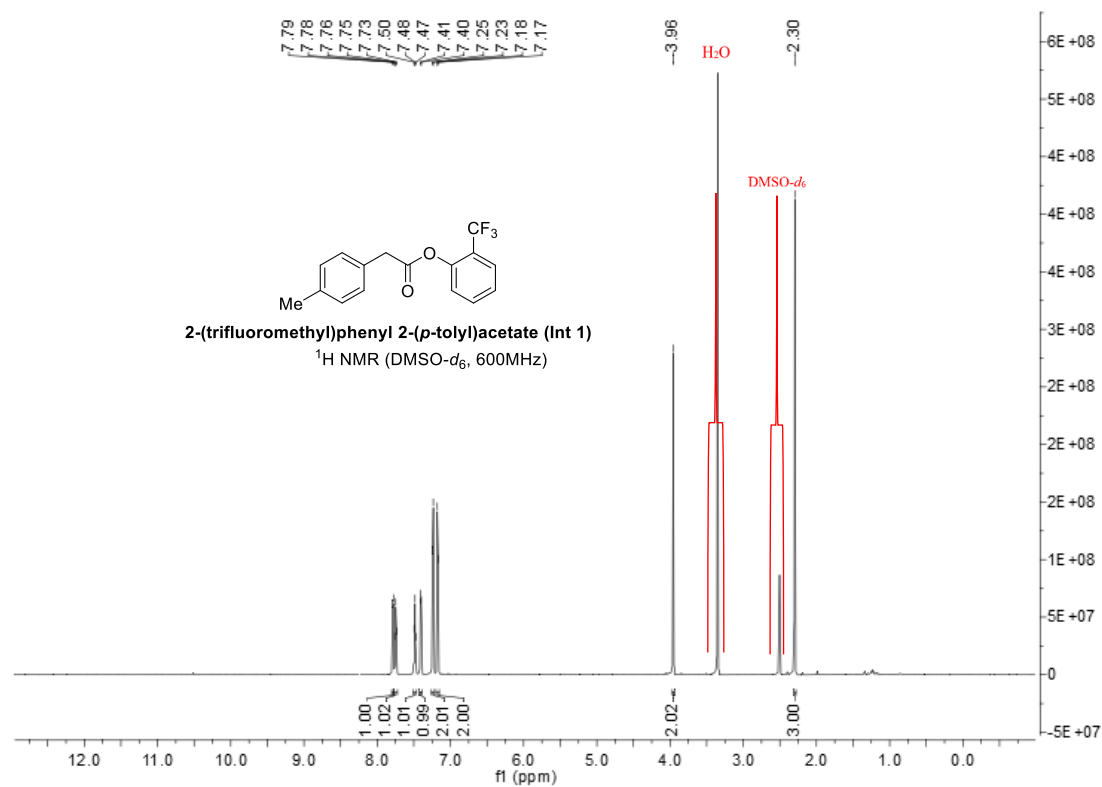


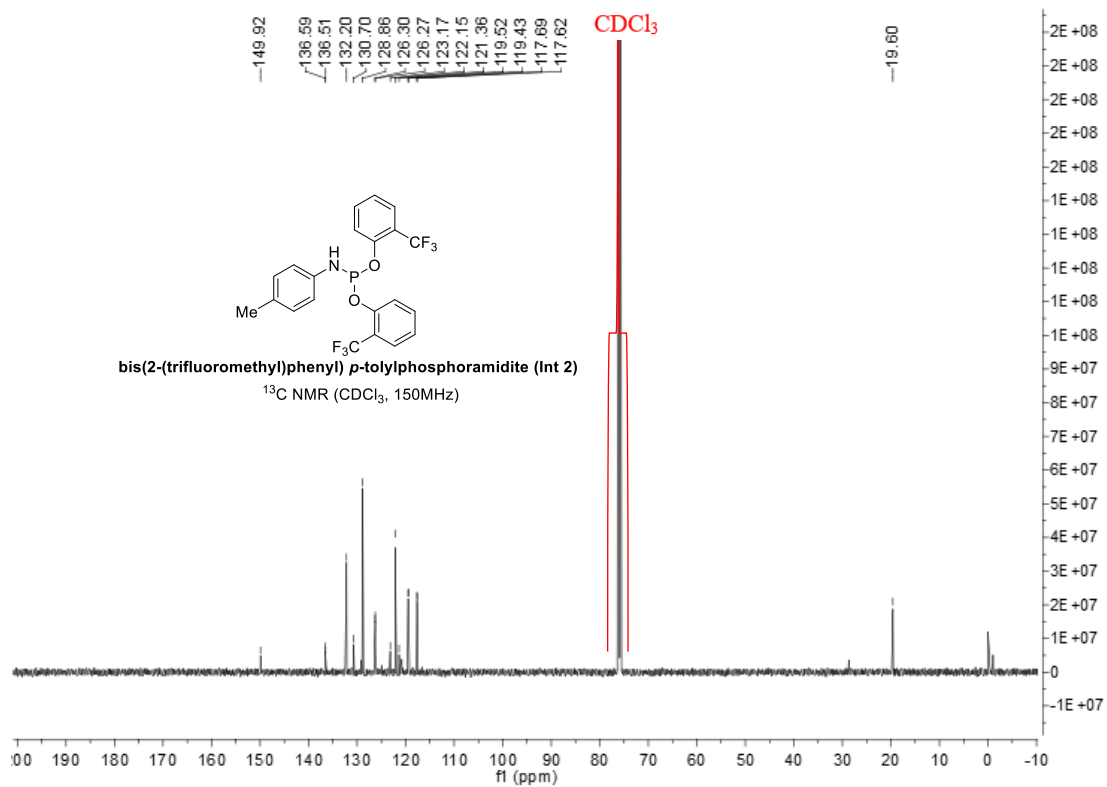
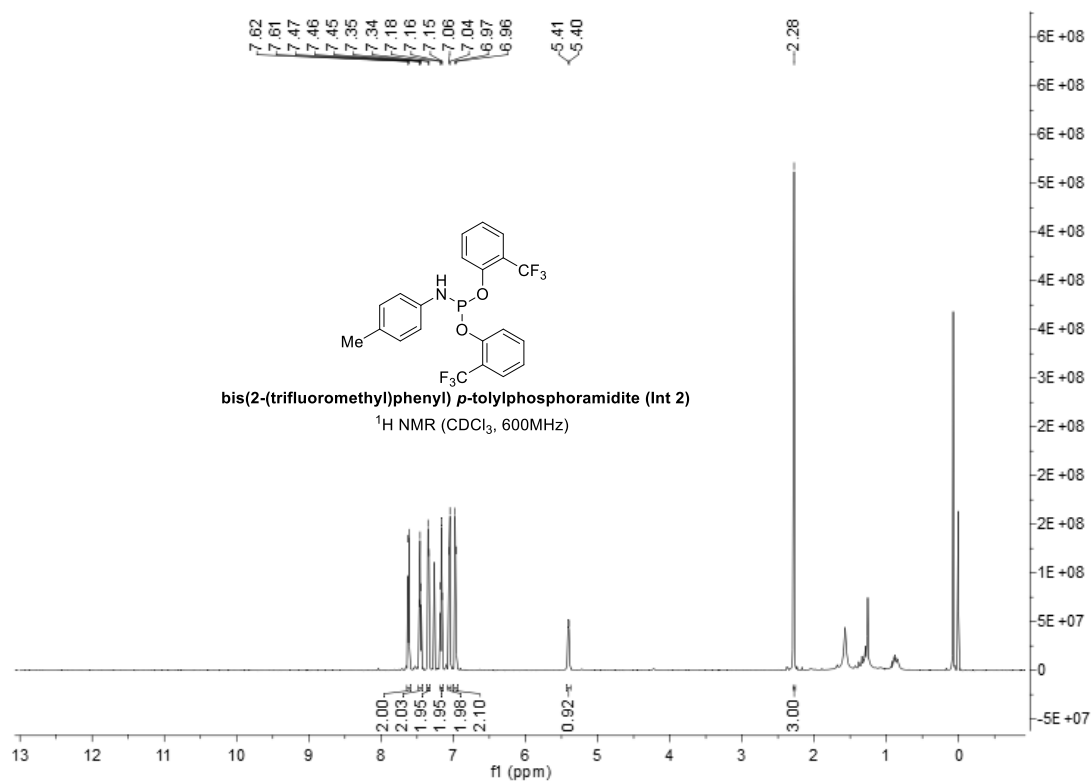






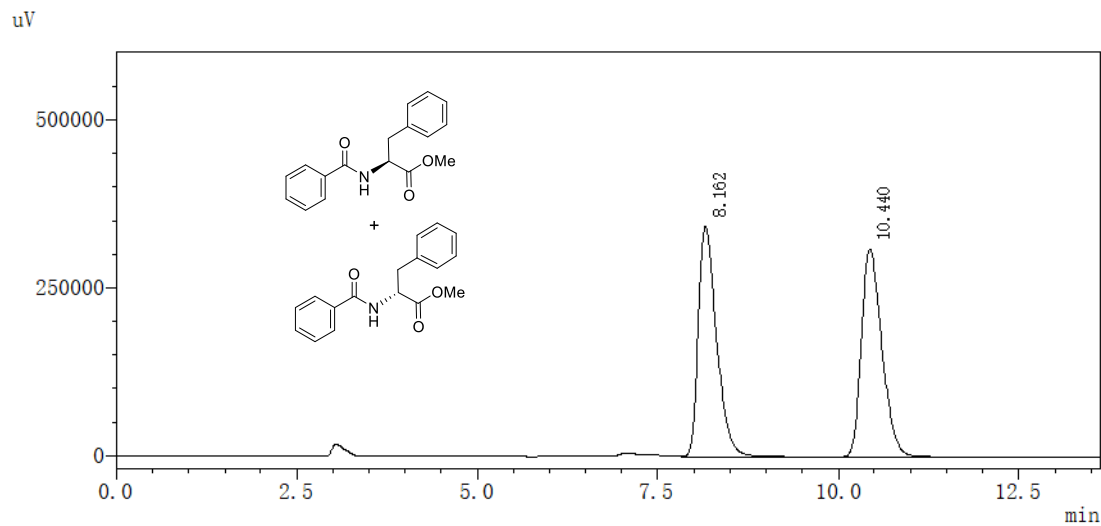




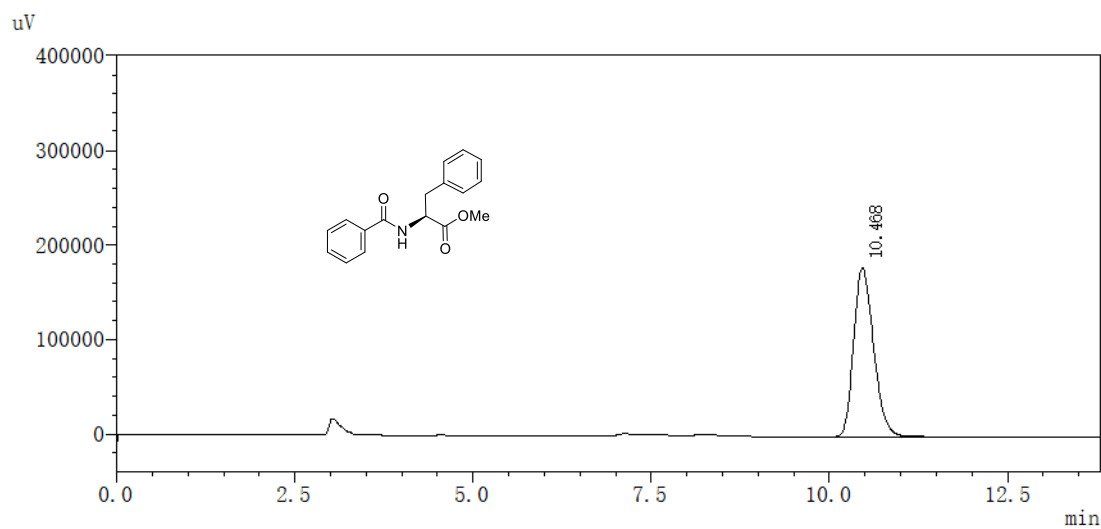


6. Chiral HPLC analysis

HPLC condition: Chiralcel OD-H column; hexanes: isopropanol = 85:15; flow rate = 1.0 ml/min; detection wavelength = 254 nm; column temperature: 30°C.

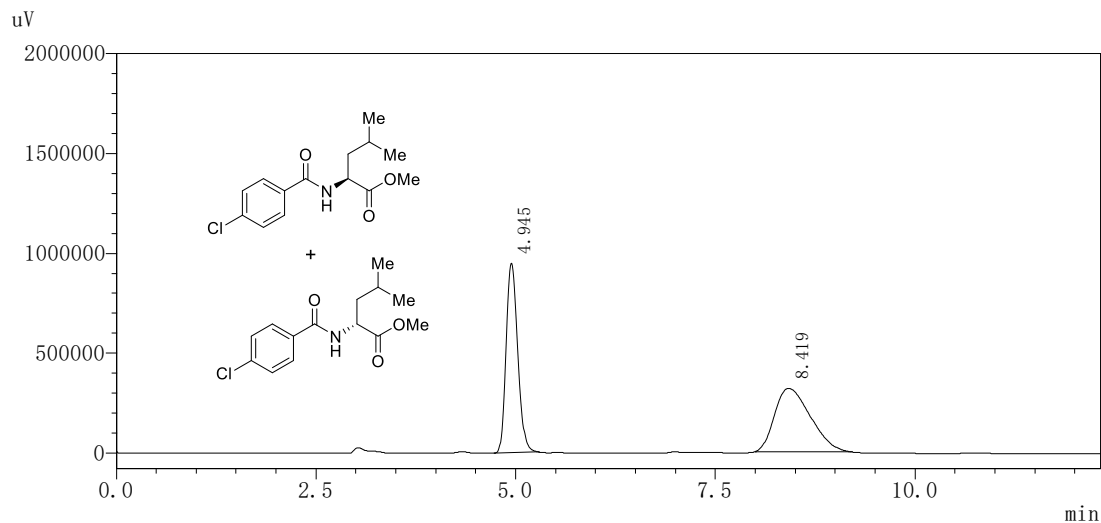


Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	49.642	6087885	8.162	344471
2	50.358	6175731	10.440	309287

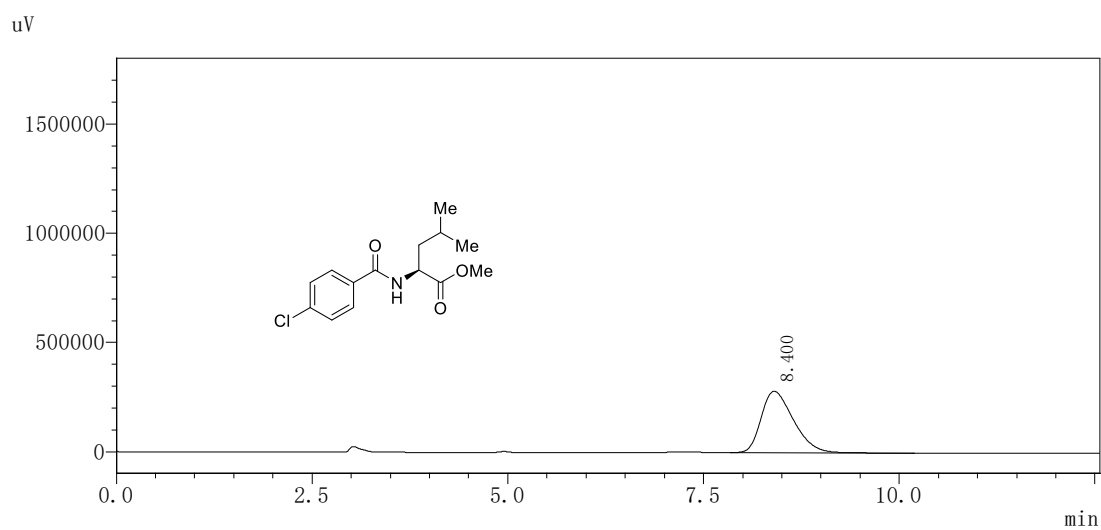


Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	100.000	3513938	10.468	178537
Total	100.000	3529386		179848

HPLC condition: Chiralcel OD-H column; hexanes: isopropanol= 85:15; flow rate= 1.0 ml/min;
detection wavelength= 254 nm; column temperature: 30°C.

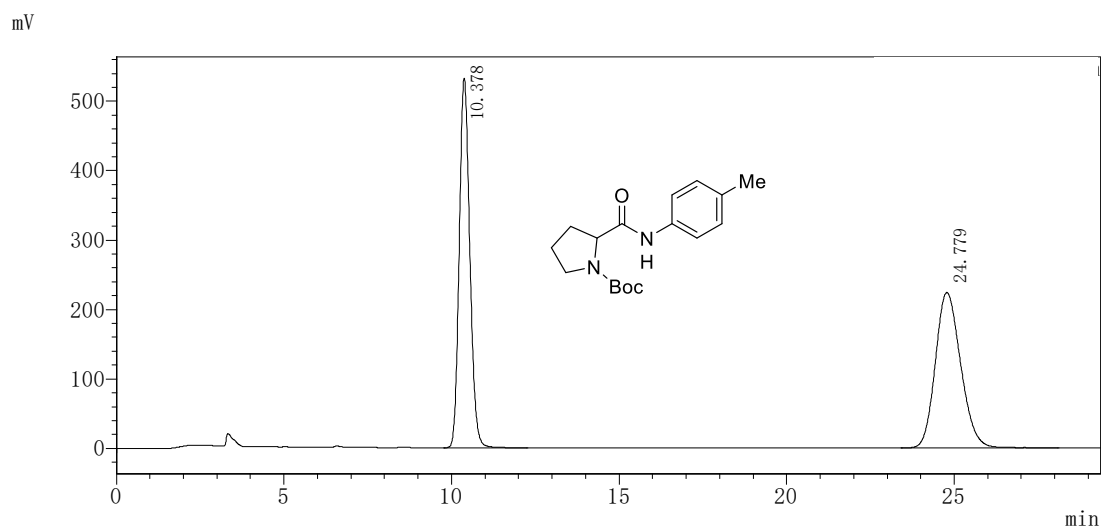


Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	49.678	9746188	4.945	950072
2	50.322	9872510	8.419	316551

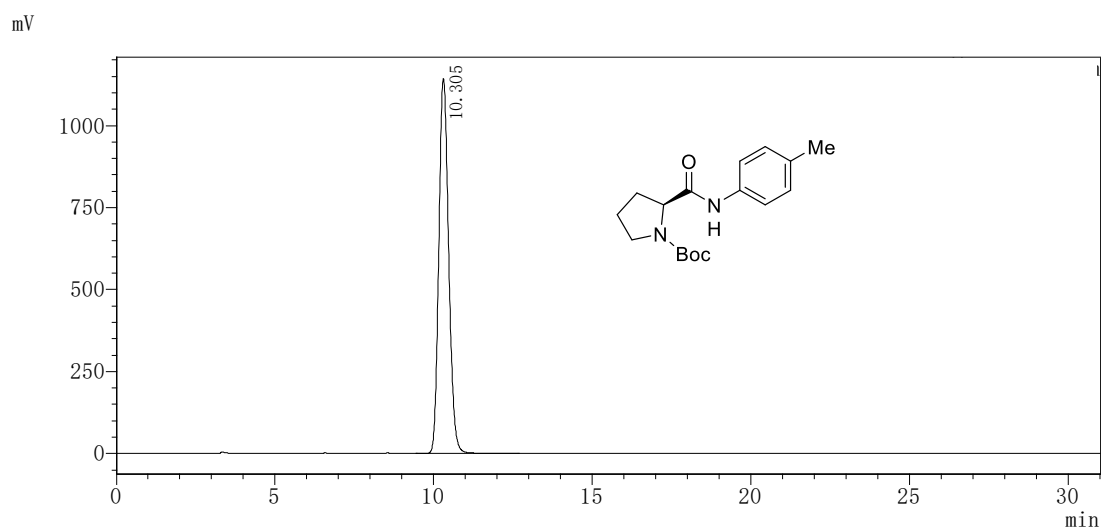


Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	100.000	8222508	8.400	282816
Total	100.000	8222508		282816

HPLC condition: Chiralcel IC column; hexanes: isopropanol= 85:15; flow rate= 1.0 ml/min; detection wavelength= 254 nm; column temperature: Room Temperature.

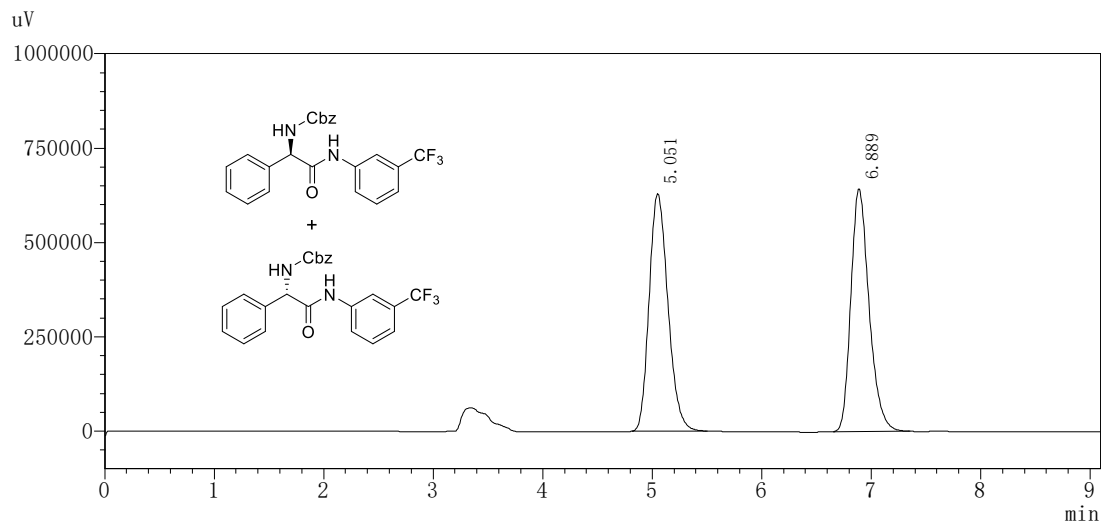


Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	49.827	11660938	10.378	532368
2	50.173	11742121	24.779	223708

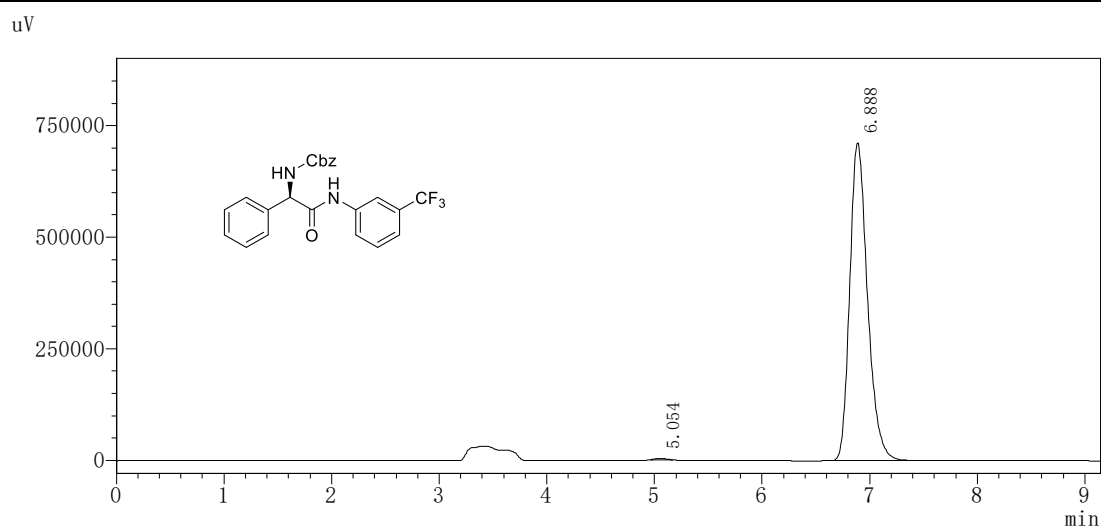


Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	100.000	24711234	10.305	1143869
Total	100.000	24711234		1143869

HPLC condition: IC column; hexanes: isopropanol= 85:15; flow rate= 1.0 ml/min; detection wavelength= 254 nm; column temperature: 30°C.

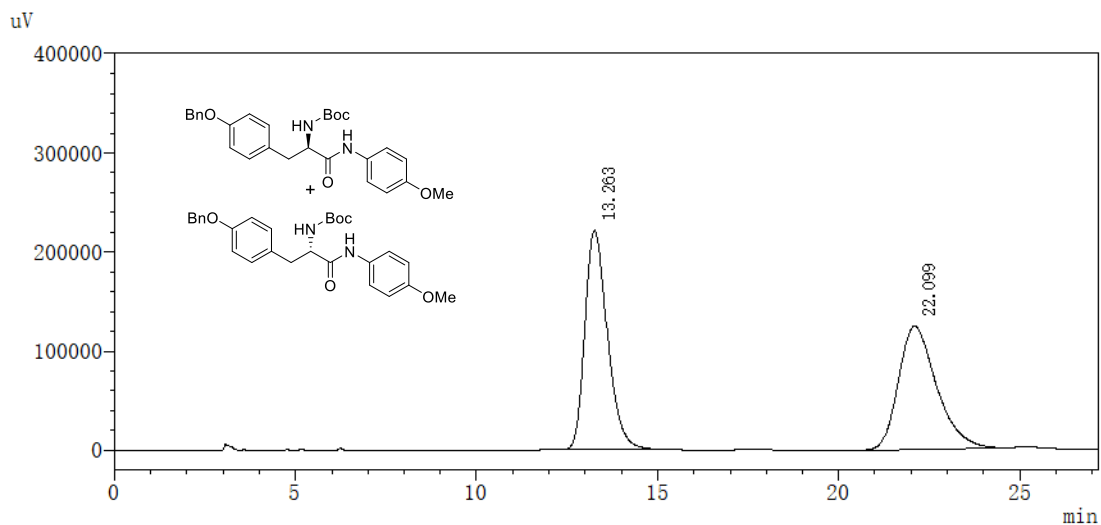


Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	50.299	7517823	5.501	629083
2	49.701	7428321	6.889	642783

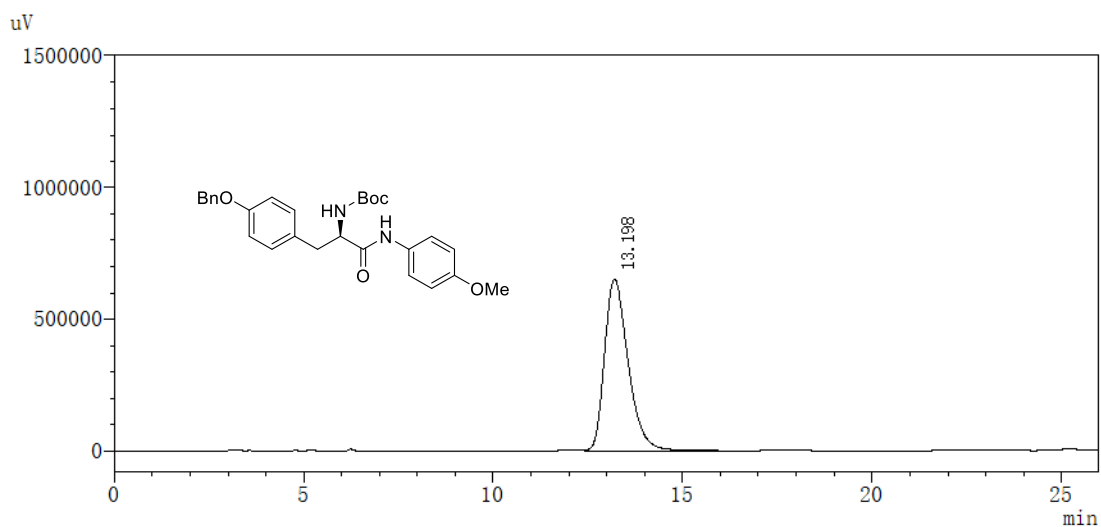


Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	0.231	18809	5.504	2685
2	99.769	8136532	6.888	710629

HPLC condition: Chiralcel OD-H column; hexanes: isopropanol= 90:10; flow rate= 1.0 ml/min; detection wavelength= 254 nm; column temperature: 30°C.

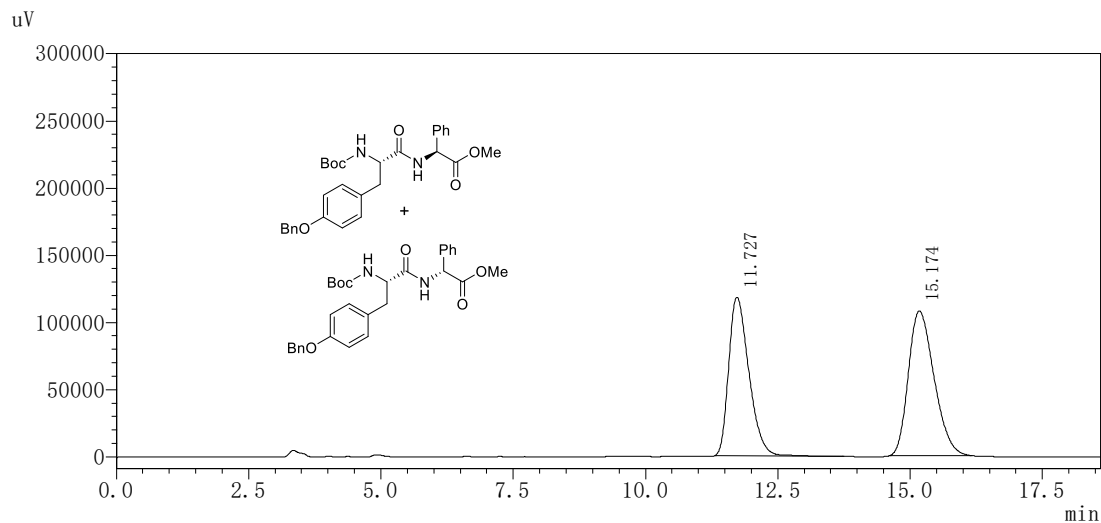


Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	50.957	9453700	13.263	220333
2	49.043	9098572	22.099	123923

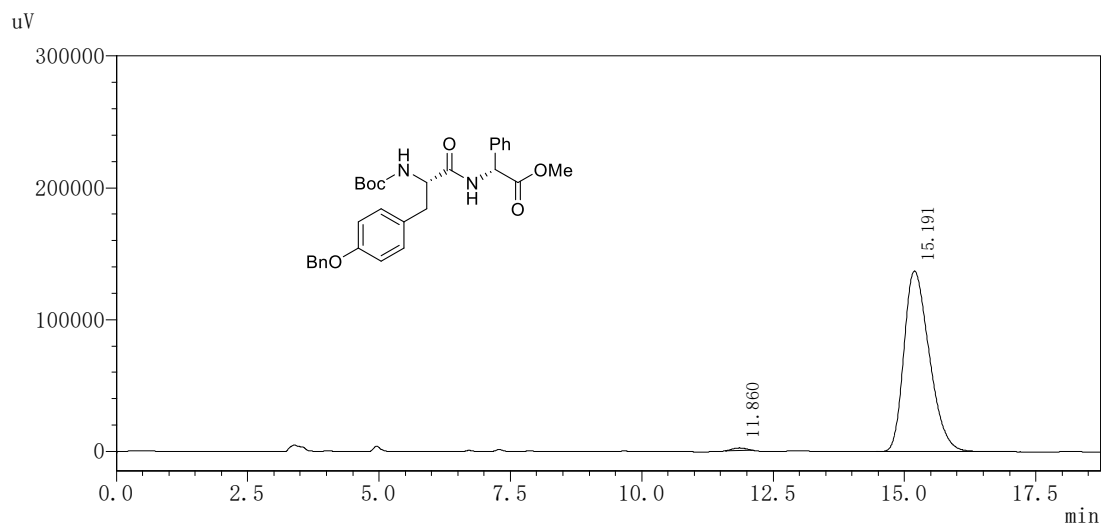


Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	100.000	28331229	13.198	653877
Total	100.000	28331229		653877

HPLC condition: IC column; hexanes: isopropanol= 85:15; flow rate= 1.0 ml/min; detection wavelength= 254 nm; column temperature: 30°C.

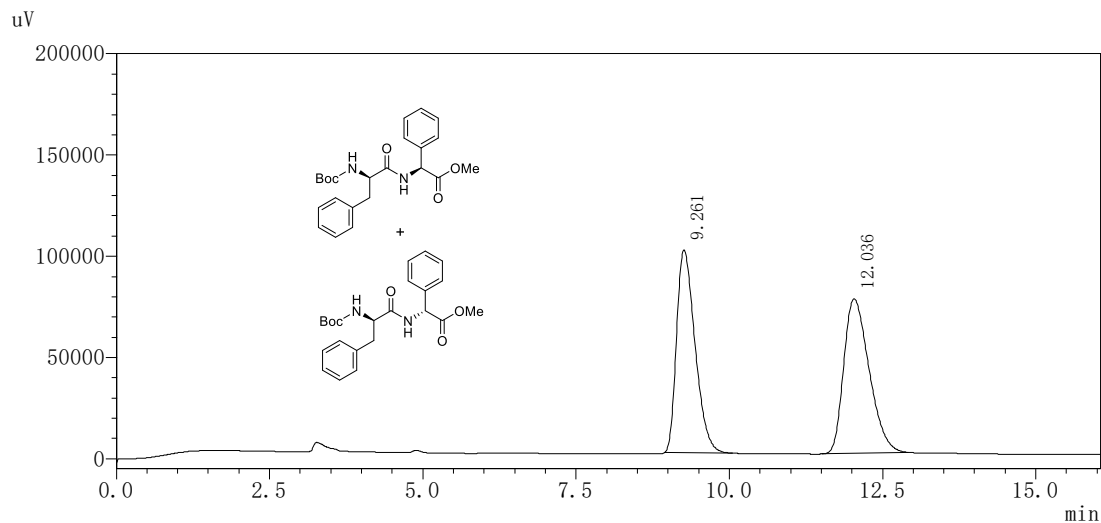


Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	46.308	3131752	11.727	117951
2	53.692	3631061	15.174	107670

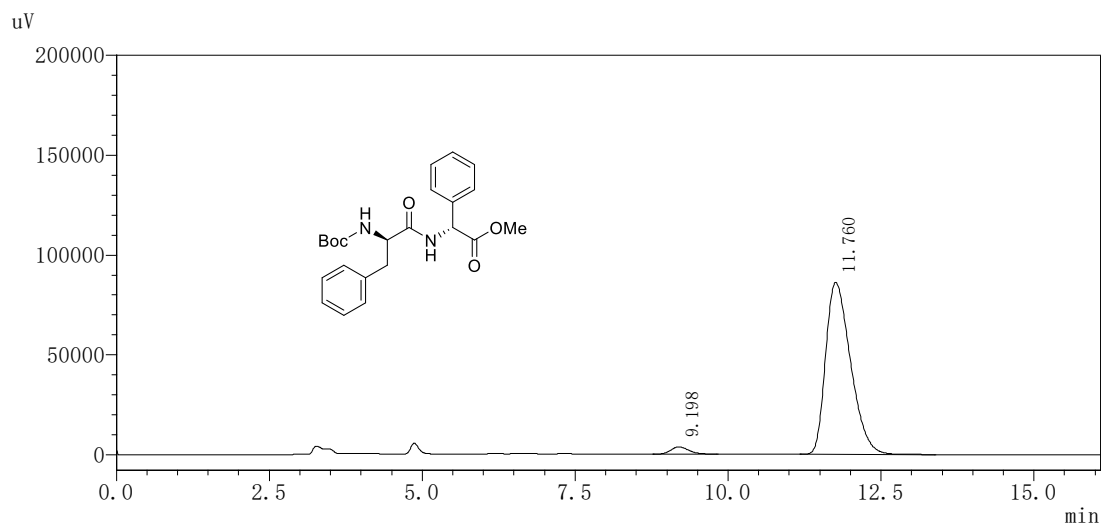


Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	0.719	33406	11.860	1899
2	99.281	4615303	15.191	137179

HPLC condition: IC column; hexanes: isopropanal= 85:15; flow rate= 1.0 ml/min; detection wavelength= 254 nm; column temperature: 30°C.



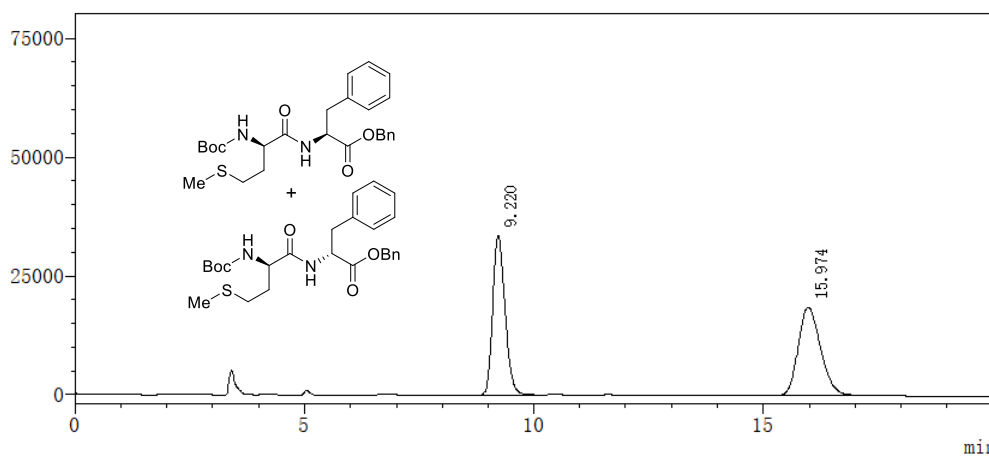
Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	48.835	2098406	9.261	100039
2	51.165	2198561	12.036	76321



Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	2.881	72611	9.198	3638
2	97.119	2447380	11.760	86135

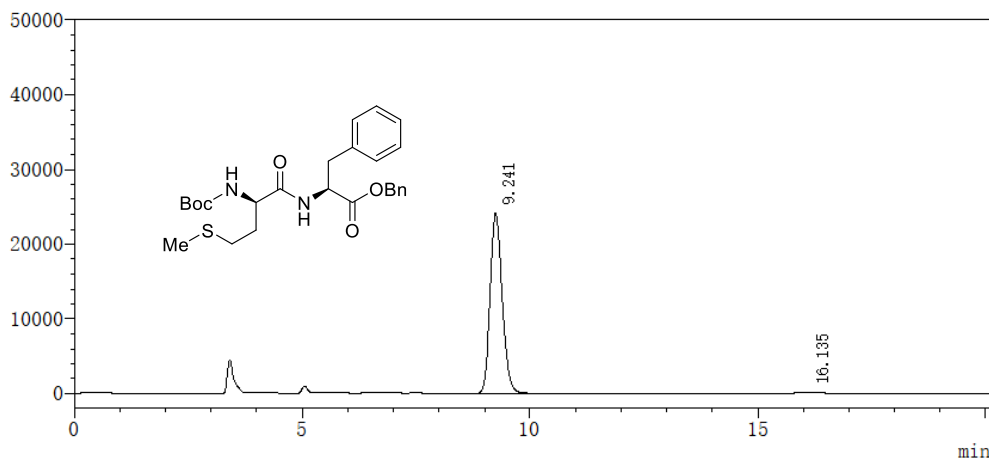
HPLC condition: IC column; hexanes: isopropanal= 85:15; flow rate= 1.0 ml/min; detection wavelength= 254 nm; column temperature: 30°C.

uV



Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	50.219	640207	9.220	33669
2	49.781	634628	15.974	18622

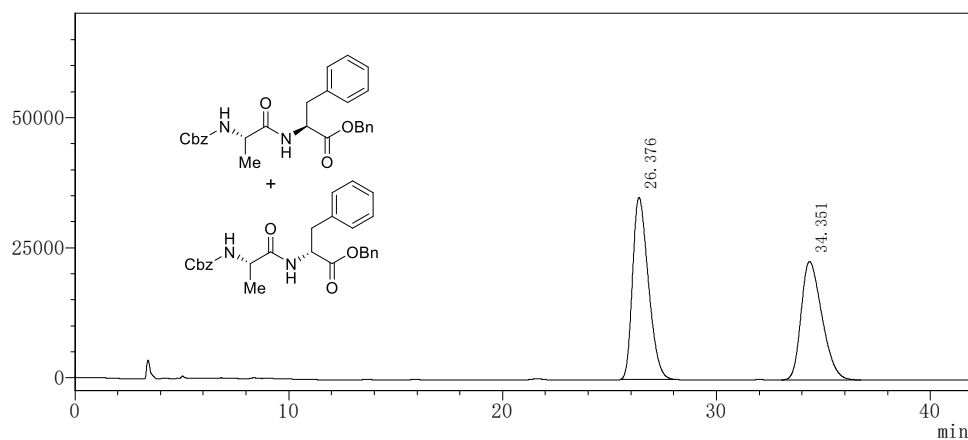
uV



Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	99.641	453639	9.241	24136
2	0.359	1634	16.135	83

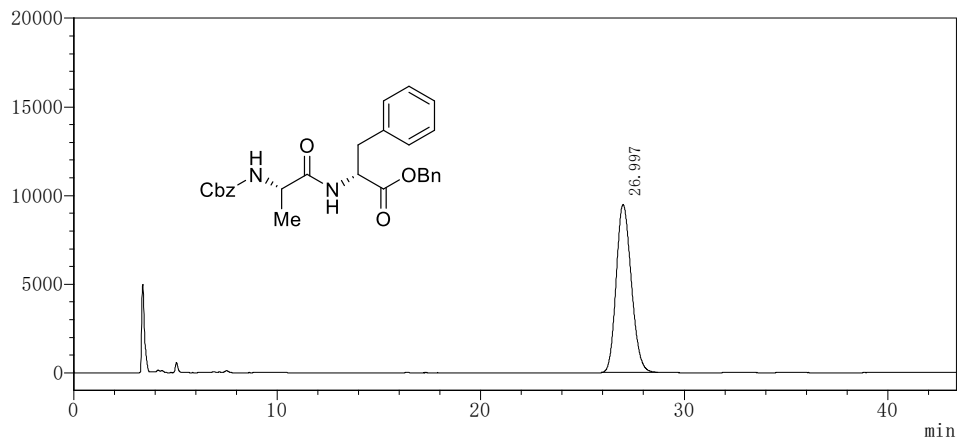
HPLC condition: IC column; hexanes: isopropanal= 85:15; flow rate= 1.0 ml/min; detection wavelength= 254 nm; column temperature: 30°C.

uV



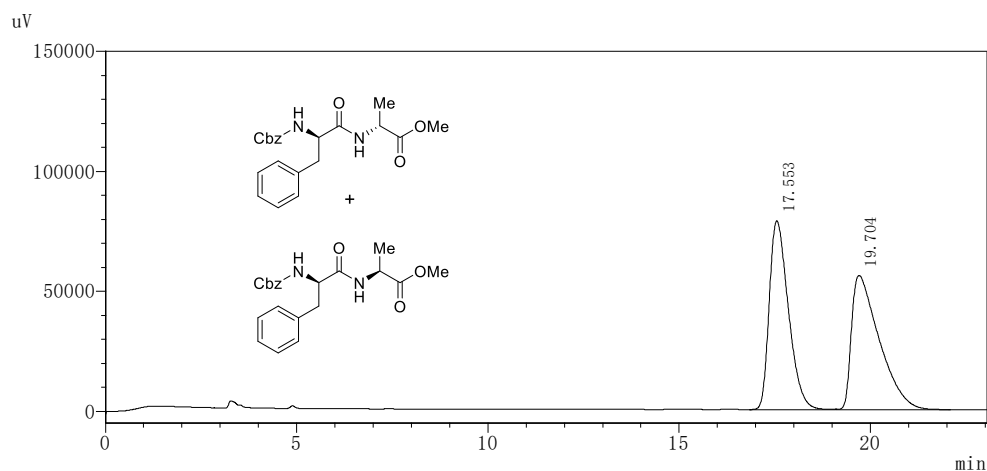
Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	53.839	1796792	26.376	34984
2	46.161	1540575	34.351	22751

uV

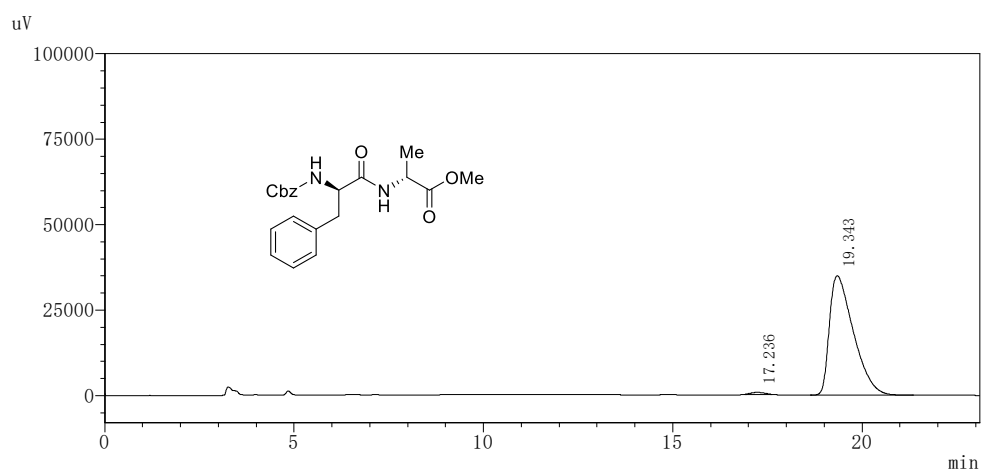


Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	100.000	488867	26.997	9479
Total	100.000	488867		9479

HPLC condition: IC column; hexanes: isopropanal= 85:15; flow rate= 1.0 ml/min; detection wavelength= 254 nm; column temperature: 30°C.



Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	49.258	2737860	17.553	78664
2	50.742	2820400	19.704	55900



Peak NO	Area(%)	Area	RT(min)	Height(mAU)
1	1.132	17528	17.236	650
2	98.868	1531363	19.343	34852