Supporting Information

Silver-mediated oxidative 1,2-alkylesterification of styrenes with nitriles and acids *via* C(sp^3)-H functionalization

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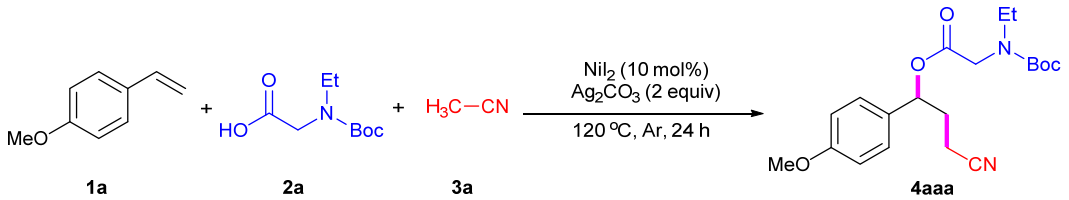
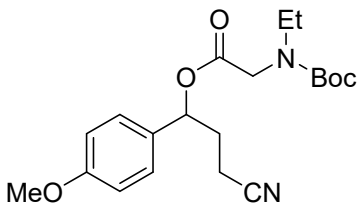
(A) Typical experimental procedure

To a Schlenk tube were added substrates**1a** (0.2 mmol), **2a** (2 equiv), Ag_2CO_3 (2 equiv), NiI_2 (10 mol%), and CH_3CN (2 mL), the tube was then charged with argon. The mixture was stirred at 120 °C until complete consumption of starting material as monitored by TLC and/or GC-MS analysis (about 24 h). After the reaction was finished, the reaction mixture was concentrated in vacuum, and the resulting residue was purified by silica gel column chromatography (hexane/ethyl acetate) to afford the desired product **4aaa**.



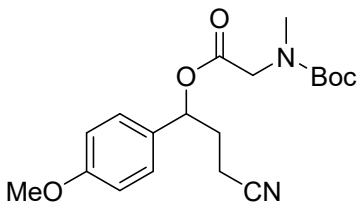
(B) Analytical data

3-Cyano-1-(4-methoxyphenyl)propyl *N*-(tert-butoxycarbonyl)-*N*-ethylglycinate (4aaa):



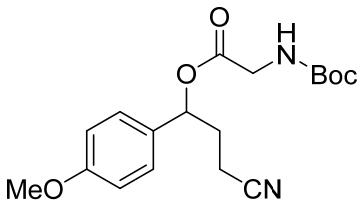
67.7 mg, 90% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.28-7.24 (m, 2H), 6.90-6.88 (m, 2H), 5.85-5.82 (m, 1H), 4.00-3.89 (m, 2H), 3.80 (s, 3H), 3.36-3.31 (m, 1H), 3.30-3.23 (m, 1H), 2.39-2.31 (m, 2H), 2.30-2.25 (m, 1H), 2.18-2.10 (m, 1H), 1.47 (s, 5H), 1.32 (s, 4H), 1.11-1.07 (m, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.3 (2C), 159.8, 159.7, 155.5, 154.8, 130.2, 130.0, 127.8, 127.6, 118.9, 118.7, 114.1, 114.7, 80.0, 74.5, 74.3, 55.2 (2C), 48.8 (2C), 43.4, 42.8, 31.9, 31.5, 28.3, 28.1, 13.7, 13.6 (2C), 13.2; HRMS m/z (ESI) calcd for $C_{20}H_{29}N_2O_5$ ($[M+H]^+$) 377.2071, found 377.2080.

3-Cyano-1-(4-methoxyphenyl)propyl*N*-(*tert*-butoxycarbonyl)-*N*-methylglycinate (4aba):



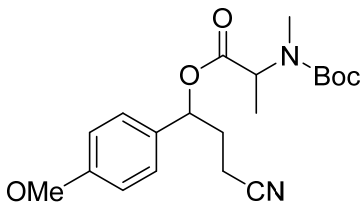
61.5 mg, 85% yield; Yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.28-7.24 (m, 2H), 6.89 (d, *J* = 8.5 Hz, 2H), 5.87-5.82 (m, 1H), 4.02-3.93 (m, 2H), 3.80 (s, 3H), 2.95-2.90 (m, 3H), 2.41-2.25 (m, 3H), 2.17-2.11 (m, 1H), 1.47 (s, 5H), 1.35 (s, 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ: 169.1, 169.0, 159.9, 159.8, 156.0, 155.3, 130.2, 130.0, 127.8, 127.6, 118.8, 118.6, 114.2, 80.3, 74.6, 74.4, 55.3, 51.1, 50.6, 35.7, 35.6, 31.9, 31.6, 28.3, 28.1, 13.7, 13.6; HRMS m/z (ESI) calcd for $C_{19}H_{27}N_2O_5$ ($[M+H]^+$) 363.1914, found 363.1921.

3-Cyano-1-(4-methoxyphenyl)propyl (*tert*-butoxycarbonyl)glycinate (4aca):



41.1 mg, 59% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.25 (d, *J* = 8.0 Hz, 2H), 6.90-6.88 (m, 2H), 5.85-5.83 (m, 1H), 5.00 (s, 1H), 4.01-3.96 (m, 1H), 3.89-3.84 (m, 1H), 3.80 (s, 3H), 2.40-2.27 (m, 3H), 2.18-2.11 (m, 1H), 1.44 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.6, 159.9, 155.7, 129.9, 127.8, 118.8, 114.2, 80.1, 74.9, 55.3, 42.6, 31.7, 28.3, 13.7; HRMS m/z (ESI) calcd for $C_{18}H_{25}N_2O_5$ ($[M+H]^+$) 349.1758, found 349.1763.

3-Cyano-1-(4-methoxyphenyl)propyl *N*-(*tert*-butoxycarbonyl)-*N*-methylalaninate (4ada):



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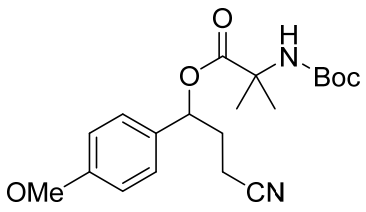
60.2 mg, 80% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.26-7.23 (m, 2H), 6.89 (d, *J* = 8.5 Hz, 2H), 5.81-5.76 (m, 1H), 4.85-4.81 (m, 0.27H), 4.69-4.65 (m, 0.27H), 4.56-4.51 (m, 0.42H), 3.80 (s, 3H), 2.85 (s, 0.64H), 2.82 (s, 0.84H), 2.78 (s, 0.65H), 2.71 (s, 0.85H), 2.38-2.31 (m, 2H), 2.29-2.23 (m, 1H), 2.15-2.09 (m, 1H), 1.48 (d, *J* = 6.5 Hz, 5H), 1.41-1.34 (m, 7H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 171.5, 171.4, 171.3, 171.2, 159.8, 159.7, 155.8, 155.2, 155.1, 130.5, 130.3, 130.2, 130.1, 127.8, 127.6, 127.5, 118.8, 118.7, 118.6, 114.2, 114.1, 80.4, 80.3, 80.2, 80.1, 74.5, 74.4, 74.3, 55.2, 54.9, 54.8, 54.0, 53.7, 32.1, 31.9, 31.8, 31.7, 31.0, 30.8 (2C), 30.5, 28.3, 28.1, 15.1,

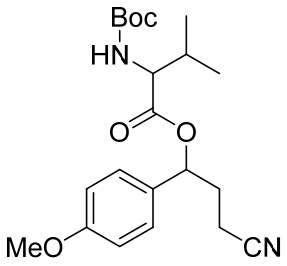
15.0, 14.5, 13.6 (2C); HRMS m/z (ESI) calcd for $C_{20}H_{29}N_2O_5$ ([M+H]$^+$) 377.2071, found 377.2075.

3-Cyano-1-(4-methoxyphenyl)propyl2-((*tert*-butoxycarbonyl)amino)-2-methylp-Ropanoate (4aea):



37.6 mg, 50% yield; Yellow solid; mp 112.7-113.1 °C(uncorrected); ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.26-7.24 (m, 2H), 6.89-6.88 (m, 2H), 5.81-5.78 (m, 1H), 4.99 (s, 1H), 3.80 (s, 3H), 2.42-2.36 (m, 2H), 2.31-2.23 (m, 1H), 2.17-2.11 (m, 1H), 1.47 (s, 3H), 1.44 (s, 3H), 1.42 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 173.6, 159.6, 154.5, 130.4, 127.6, 119.1, 114.1, 79.8, 74.55, 56,.0 55.3, 32.1, 28.3, 25.4, 25.1, 13.6; HRMS m/z (ESI) calcd for $C_{20}H_{29}N_2O_5$ ([M+H]$^+$) 377.2071, found 377.2076.

3-Cyano-1-(4-methoxyphenyl)propyl (*tert*-butoxycarbonyl)valinate (4afa):



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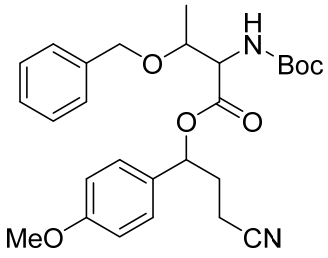
59.3 mg, 76% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.27-7.25 (m, 2H), 6.90-6.88 (m, 2H), 5.83-5.77 (m, 1H), 4.99-4.97 (m, 1H), 4.22-4.18 (m, 1H), 3.81 (s, 3H), 2.41-2.27 (m, 3H), 2.18-2.05 (m, 2H), 1.44 (d, *J* = 9.0 Hz, 9H), 0.96 (d, *J* = 7.0 Hz, 1.50H), 0.88 (t, *J* = 7.5 Hz, 3H), 0.70 (d, *J* = 7.0 Hz, 1.49H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 171.8, 171.4, 159.8, 155.8, 155.6, 130.0, 129.9, 127.9, 127.7, 118.8, 118.6, 114.2, 114.1, 79.9, 79.8, 74.7, 74.6, 58.7, 58.5, 55.3, 55.2, 31.8, 31.7, 31.2, 30.9, 28.2, 19.1, 19.0, 17.5, 17.3, 13.7(2C); HRMS m/z (ESI) calcd for $C_{21}H_{31}N_2O_5$ ([M+H]$^+$) 391.2227, found 391.2235.

3-Cyano-1-(4-methoxyphenyl)propyl3-(benzyloxy)-2-((*tert*-butoxycarbonyl)amino)butanoate (4aga):



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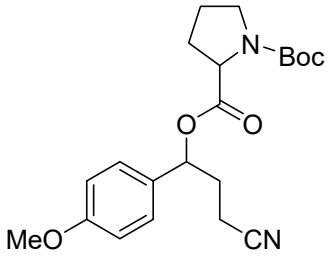
74.2 mg, 77% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.32-7.28 (m, 2H), 7.25-7.21 (m, 3H), 7.14-7.12 (m, 1H), 7.04-7.01 (m, 1H), 6.83 (d, *J* = 8.5 Hz, 1H), 6.76 (d, *J* = 8.5

Hz, 1H), 5.83 (t, *J* = 6.5 Hz, 0.50H), 5.77-5.75 (m, 0.50H), 5.30-5.25 (m, 1H), 4.50 (d, *J* = 11.5 Hz, 0.53H), 4.36-4.28 (m, 2H), 4.18-4.14 (m, 0.54H), 4.13-4.09 (m, 0.53H), 4.07 (d, *J* = 11.0 Hz, 0.52H), 3.78 (s, 1.53H), 3.70 (s, 1.52H), 2.30-2.23 (m, 2H), 2.17-1.99 (m, 2H), 1.48-1.43 (m, 9H), 1.28-1.23 (m, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 170.3 (2C), 159.8 (2C), 156.1, 156.0, 137.7 (2C), 130.0, 129.9, 128.4, 128.2, 127.9, 127.7 (2C), 127.6, 127.5, 127.4, 118.8, 114.1 (2C), 80.0, 79.9, 75.0, 74.8 (2C), 74.5, 71.0, 70.7, 58.4, 58.3, 55.3, 55.2, 31.9, 31.6, 28.3 (2C), 16.3, 16.2, 13.7, 13.5; HRMS m/z (ESI) calcd for $C_{27}H_{35}N_2O_6$ ($[M+H]^+$) 483.2490, found 483.2484.

1-(*Tert*-butyl)2-(3-cyano-1-(4-methoxyphenyl)propyl)pyrrolidine-1,2-dicarboxylate (4aha):



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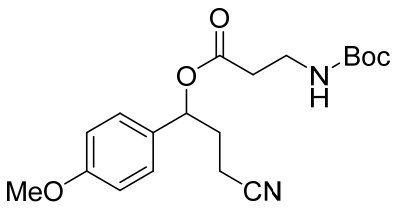
33.4 mg, 43% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.26 (d, *J* = 7.5 Hz, 2H), 6.90-6.88 (m, 2H), 5.84-5.78 (m, 1H), 4.33-4.27 (m, 1H), 3.80 (s, 3H), 3.54-3.34 (m, 2H), 2.46-2.43 (m, 1H), 2.36-2.25 (m, 2H), 2.22-2.12 (m, 2H), 1.88-1.81 (m, 3H), 1.46 (s, 5H), 1.35 (s, 4H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 172.3, 171.9, 159.8, 159.6, 154.4, 153.7, 130.5, 130.0, 127.7, 127.6, 119.1, 118.6, 114.2, 114.1, 80.0, 79.9, 74.2 (2C), 58.9, 58.7, 55.3 (2C), 46.5, 46.3, 32.2, 31.8, 30.6, 29.5, 28.4, 28.2, 24.3, 23.5, 13.7, 13.6.

33.4 mg, 43% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.28-7.23 (m, 2H), 6.89 (d, *J* = 9.0 Hz, 2H), 5.82-5.79 (m, 1H), 4.36-4.33 (m, 0.49H), 4.26-4.23 (m, 0.50H), 3.80 (s, 3H), 3.57-3.39 (m, 2H), 2.46-2.13 (m, 5H), 1.97-1.85 (m, 3H), 1.49 (s, 4H), 1.26 (s, 5H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 172.0, 171.9, 159.9, 159.6, 154.4, 153.8, 130.5, 130.0, 128.0, 127.4, 119.1, 118.6, 114.1 (2C), 80.0, 79.9, 74.3, 74.1, 59.2, 59.1, 55.3 (2C), 46.6, 46.3, 32.3, 31.5, 30.9, 29.9, 28.4, 28.1, 24.4, 23.5, 13.8, 13.5.

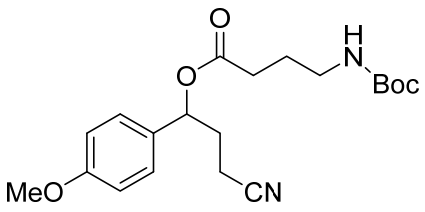
HRMS m/z (ESI) calcd for $C_{21}H_{29}N_2O_5$ ($[M+H]^+$) 389.2071, found 389.2075.

3-Cyano-1-(4-methoxyphenyl)propyl 3-((*tert*-butoxycarbonyl)amino)propanoate (4aia):



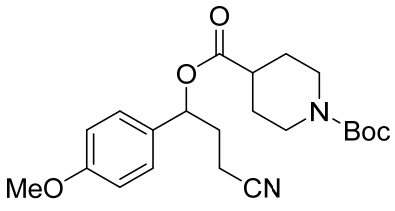
50.7 mg, 70% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.25 (d, *J* = 9 Hz, 2H), 6.90 (d, *J* = 8.5 Hz, 2H), 5.81-5.78 (m, 1H), 4.95 (s, 1H), 3.80 (s, 3H), 3.42-3.34 (m, 2H), 2.62-2.51 (m, 2H), 2.40-2.25 (m, 3H), 2.16-2.10 (m, 1H), 1.43 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 171.6, 159.8, 155.8, 130.4, 127.7, 118.8, 114.2, 79.4, 74.2, 55.3, 36.0, 34.7, 31.7, 28.4, 13.8; HRMS m/z (ESI) calcd for $C_{19}H_{27}N_2O_5$ ([M+H]$^+$) 363.1914, found 363.1910.

3-Cyano-1-(4-methoxyphenyl)propyl4-((*tert*-butoxycarbonyl)amino)butanoate (4aja):



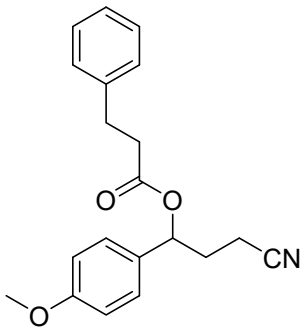
40.6 mg, 54% yield; Yellow solid; mp 65.7-68.4 ^{o}C(uncorrected); ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.25 (d, *J* = 8.5 Hz, 2H), 6.89 (d, *J* = 8.5 Hz, 2H), 5.78 (t, *J* = 6.5 Hz, 1H), 4.66 (s, 1H), 3.80 (s, 3H), 3.15-3.12(m, 2H), 2.46-2.33 (m, 4H), 2.30-2.23 (m, 1H), 2.15-2.08 (m, 1H), 1.82-1.77 (m, 2H), 1.43 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 172.2, 159.6, 155.9, 130.5, 127.7, 118.9, 114.1, 79.2, 73.9, 55.2, 39.6, 31.7, 31.4, 28.3, 25.1, 13.7; HRMS m/z (ESI) calcd for $C_{20}H_{29}N_2O_5$ ([M+H]$^+$) 377.2071, found 377.2073.

1-(*Tert*-butyl) 4-(3-cyano-1-(4-methoxyphenyl)propyl) piperidine-1,4-dicarboxyl-Ate (4aka):



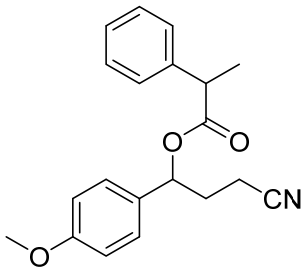
54.7 mg, 68% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.24 (d, *J* = 8.5 Hz, 2H), 6.89 (d, *J* = 8.5 Hz, 2H), 5.79-5.76 (m, 1H), 4.01 (s, 2H), 3.81 (s, 3H), 2.81 (s, 2H), 2.52-2.46 (m, 1H), 2.38-2.24 (m, 3H), 2.16-2.09 (m, 1H), 1.88 (s, 2H), 1.66-1.55 (m, 2H), 1.45 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 173.5, 159.7, 154.6, 130.5, 127.5, 118.8, 114.2, 79.6, 73.9, 55.3, 41.1, 31.7, 28.4, 27.9, 27.7, 13.7; HRMS m/z (ESI) calcd for $C_{22}H_{31}N_2O_5$ ([M+H]$^+$) 403.2227, found 403.2235.

3-Cyano-1-(4-methoxyphenyl)propyl 3-phenylpropanoate (4ala):



47.8 mg, 74% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.29-7.26 (m, 2H), 7.22-7.16 (m, 5H), 6.87 (d, *J* = 8.5 Hz, 2H), 5.76-5.73 (m, 1H), 3.80 (s, 3H), 2.94 (t, *J* = 7.5 Hz, 2H), 2.69-2.66 (m, 2H), 2.21-2.12 (m, 3H), 2.08-2.02 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 171.9, 159.6, 140.1, 130.5, 128.5, 128.2, 127.6, 126.3, 118.8, 114.1, 73.8, 55.3, 35.9, 31.7, 30.8, 13.5; HRMS *m/z* (ESI) calcd for $C_{20}H_{22}NO_3$ ($[M+H]^+$) 324.1594, found 324.1588.

3-Cyano-1-(4-methoxyphenyl)propyl 2-phenylpropanoate (4ama):



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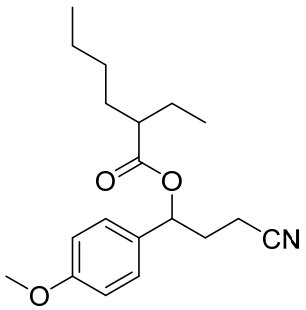
17.8 mg, 28% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.37-7.34 (m, 2H), 7.31-7.21 (m, 3H), 7.20 (d, *J* = 9.0 Hz, 2H), 6.87 (d, *J* = 8.5 Hz, 2H), 5.72-5.70 (m, 1H), 3.80 (s, 3H), 3.75-3.70 (m, 1H), 2.14-2.06 (m, 1H), 2.02-1.94 (m, 3H), 1.47 (d, *J* = 7.0 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 173.4, 159.6, 140.4, 130.6, 128.7, 127.6, 127.4, 127.3, 118.8, 114.1, 73.8, 55.3, 45.6, 31.8, 17.9, 13.2.

17.7 mg, 27% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.30-7.25 (m, 3H), 7.20-7.18 (m, 2H), 6.95 (d, *J* = 8.5 Hz, 2H), 6.75 (d, *J* = 8.5 Hz, 2H), 5.74-5.71 (m, 1H), 3.81-3.77 (m, 4H), 2.30-2.21 (m, 2H), 2.19-2.12 (m, 1H), 2.10-2.03 (m, 1H), 1.49 (d, *J* = 7.0 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 173.2, 159.4, 140.0, 130.5, 128.6, 127.5, 127.2 (2C), 118.9, 113.9, 73.9, 55.2, 45.5, 31.9, 18.0, 13.5.

HRMS *m/z* (ESI) calcd for $C_{20}H_{22}NO_3$ ($[M+H]^+$) 324.1594, found 324.1599.

3-Cyano-1-(4-methoxyphenyl)propyl 2-ethylhexanoate (4ana):

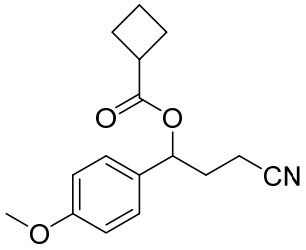


dr = 1:1

36.8 mg, 58% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.26 (d, *J* = 8.0 Hz, 2H), 6.88 (d, *J* = 8.5 Hz, 2H), 5.77 (t, *J* = 6.5 Hz, 1H), 3.80 (s, 3H), 2.36-2.24 (m, 4H), 2.15-2.08 (m, 1H), 1.63-1.56 (m, 2H), 1.52-1.42 (m, 2H), 1.30-1.21(m, 2H), 1.18-1.07 (m, 2H), 0.86 (t, *J* = 7.5 Hz, 3H), 0.81 (t, *J* = 5.5 Hz, 1.54H), 0.78 (t, *J* = 5.5 Hz, 1.51H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 175.3 (2C),

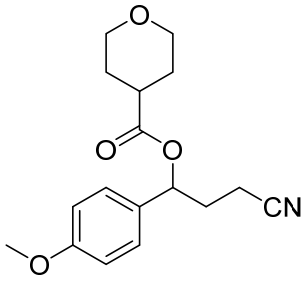
159.6, 130.8, 127.8, 127.7, 118.8, 114.0, 73.4, 55.3, 47.4, 47.3, 31.9 (2C), 31.8, 31.6, 29.6, 29.4, 25.5, 25.3, 22.6, 22.5, 13.9 (2C), 13.7 (2C), 11.9, 11.7; HRMS *m/z* (ESI) calcd for $C_{19}H_{28}NO_3$([M+H]$^+$) 318.2064, found 318.2073.

3-Cyno-1-(4-methoxyphenyl)propyl cyclobutanecarboxylate (4aoa):



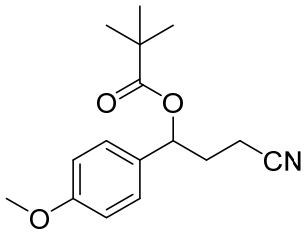
25.7 mg, 47% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.25 (d, *J* = 9.0 Hz, 2H), 6.89 (d, *J* = 8.5 Hz, 2H), 5.77-5.75 (m, 1H), 3.80 (s, 3H), 3.21-3.14 (m, 1H), 2.38-2.19 (m, 7H), 2.15-2.09 (m, 1H), 2.02-1.94 (m, 1H), 1.93-1.84 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ:174.4, 159.6, 130.9, 127.6, 118.9, 114.2, 73.5, 55.3, 38.1, 32.0, 25.2, 25.1, 18.4, 13.8; HRMS *m/z* (ESI) calcd for $C_{16}H_{20}NO_3$([M+H]$^+$) 274.1438, found 274.1445.

3-Cyano-1-(4-methoxyphenyl)propyl tetrahydro-2*H*-pyran-4-carboxylate (4apa):



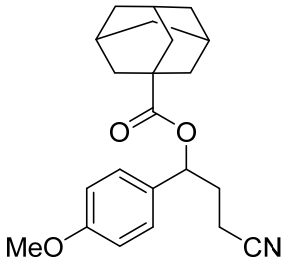
25.5 mg, 42% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.24 (d, *J* = 9 Hz, 2H), 6.89 (d, *J* = 8.5 Hz, 2H), 5.79 (t, *J* = 6.5 Hz, 1H), 3.98-3.92 (m, 2H), 3.81 (s, 3H), 3.45-3.39 (m, 2H), 2.62-2.55 (m, 1H), 2.38-2.24 (m, 3H), 2.17-2.10 (m, 1H), 1.87-1.72 (m, 4H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 173.4, 159.7, 130.5, 127.6, 118.8, 114.2, 73.9, 67.0, 66.95, 55.3, 40.1, 31.8, 28.5 (2C), 13.7; HRMS *m/z* (ESI) calcd for $C_{17}H_{22}NO_4$ ([M+H]$^+$) 304.1543, found 304.1546.

3-Cyano-1-(4-methoxyphenyl)propyl pivalate (4aqa):



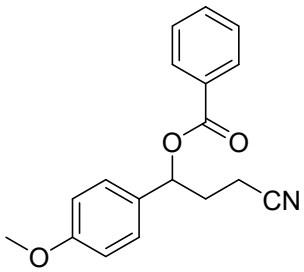
27.5 mg, 50% yield; Yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.24 (d, *J* = 8.8 Hz, 2H), 6.89 (d, *J* = 8.8 Hz, 2H), 5.72 (t, *J* = 6.8 Hz, 1H), 3.80 (s, 3H), 2.37-2.30 (m, 2H), 2.28-2.21 (m, 1H), 2.17-2.08 (m, 1H), 1.21 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ: 177.3, 159.6, 130.9, 127.4, 118.8, 114.2, 73.5, 55.3, 38.8, 32.1, 27.0, 13.6; HRMS *m/z* (ESI) calcd for $C_{16}H_{22}NO_3$ ([M+H]$^+$) 276.1594, found 276.1601.

3-Cyano-1-(4-methoxyphenyl)propyl adamantane-1-carboxylate (4ara):



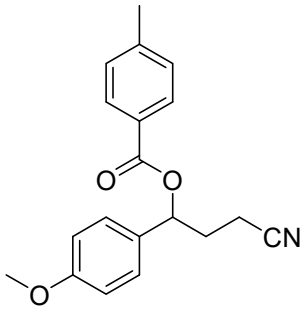
35.3 mg, 50% yield; White solid; mp 115.1-116.4 ^{o}C(uncorrected); ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.16 (d, *J* = 9 Hz, 2H), 6.82 (d, *J* = 8.5 Hz, 2H), 5.67-5.64 (m, 1H), 3.73 (s, 3H), 2.33-2.25 (m, 2H), 2.22-2.14 (m, 1H), 2.09-2.03 (m, 1H), 1.95 (s, 3H), 1.82 (s, 6H), 1.68-1.61 (m, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 176.4, 159.5, 131.1, 127.3, 119.0, 114.1, 55.2, 40.8, 38.7, 36.4, 32.2, 27.8, 13.6; HRMS m/z (ESI) calcd for $C_{22}H_{28}NO_3$ ($[M+H]^+$) 354.2064, found 354.2074.

3-Cyano-1-(4-methoxyphenyl)propyl benzoate (4asa):



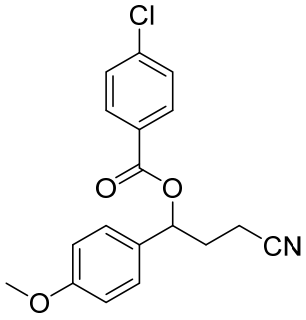
50.2 mg, 85% yield; Yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 8.07 (d, *J* = 7.2 Hz, 2H), 7.57 (t, *J* = 7.6 Hz, 1H), 7.45 (t, *J* = 7.8 Hz, 2H), 7.35 (d, *J* = 8.4 Hz, 2H), 6.91 (d, *J* = 8.8 Hz 2H), 6.03 (t, *J* = 6.0 Hz, 1H), 3.80 (s, 1H), 2.45-2.39 (m, 3H), 2.29-2.24 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ: 165.5, 159.8, 133.2, 130.6, 130.2, 129.7, 128.4, 127.7, 118.8, 114.3, 74.4, 55.3, 32.1, 13.8; HRMS *m/z* (ESI) calcd for $C_{18}H_{18}NO_3$($[M+H]^+$) 296.1281, found 296.1287.

3-Cyano-1-(4-methoxyphenyl)propyl 4-methylbenzoate (4ata):



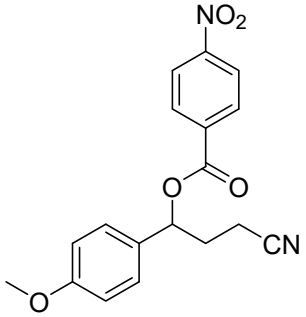
38.3 mg, 62% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.96 (d, *J* = 8.0 Hz, 2H), 7.34 (d, *J* = 8.5 Hz, 2H), 7.24 (d, *J* = 8.0 Hz, 2H), 6.90 (d, *J* = 8.5 Hz, 2H), 6.01 (t, *J* = 5.5 Hz, 1H), 3.78 (s, 3H), 2.44-2.37 (m, 6H), 2.29-2.22 (m, 1H);^{13}C NMR (125 MHz, $CDCl_3$) δ: 165.5, 159.6, 144.0, 130.7, 129.7, 129.1, 127.6, 126.9, 118.9, 114.1, 74.1, 55.2, 32.0, 21.6, 13.7; HRMS *m/z* (ESI) calcd for $C_{19}H_{20}NO_3$ ($[M+H]^+$) 310.1438, found 310.1432.

3-Cyano-1-(4-methoxyphenyl)propyl 4-chlorobenzoate (4aua):



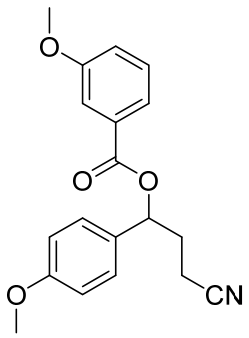
25 mg, 38% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.00 (d, *J* = 8.5 Hz, 2H), 7.42 (d, *J* = 8.5 Hz, 2H), 7.34 (d, *J* = 8.5 Hz, 2H), 6.91 (d, *J* = 9 Hz, 2H), 6.03-6.00 (m, 1H), 3.80 (s, 3H), 2.44-2.36 (m, 3H), 2.29-2.24 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 164.7, 159.8, 139.8, 131.1, 130.3, 128.8, 128.2, 127.7, 118.8, 114.3, 74.7, 55.3, 31.9, 13.8; HRMS *m/z* (ESI) calcd for $C_{18}H_{17}ClNO_3$ ($[M+H]^+$) 330.0891, found 330.0897.

3-Cyano-1-(4-methoxyphenyl)propyl 4-nitrobenzoate (4ava):



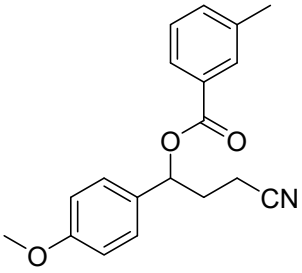
32.6 mg, 48% yield; Yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 8.31-8.23 (m, 4H), 7.36 (d, *J* = 7.4 Hz, 2H), 6.93 (d, *J* = 8.4 Hz, 2H), 6.07 (t, *J* = 6.4 Hz, 1H), 3.81 (s, 3H), 2.49-2.40 (m, 3H), 2.33-2.26 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ: 163.7, 160.1, 150.7, 135.2, 130.8, 129.8, 127.8, 123.6, 118.7, 114.4, 75.7, 55.3, 31.7, 13.9; HRMS *m/z* (ESI) calcd for $C_{18}H_{17}N_2O_5$ ($[M+H]^+$) 341.1132, found 341.1137.

3-Cyano-1-(4-methoxyphenyl)propyl 3-methoxybenzoate (4awa):



35.1 mg, 54% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.68-7.66 (m, 1H), 7.59-7.58 (m, 1H), 7.38-7.34 (m, 3H), 7.13-7.10 (m, 1H), 6.91 (d, *J* = 8.5 Hz, 2H), 6.02 (t, *J* = 6 Hz, 1H), 3.85 (s, 3H), 3.80 (s, 3H), 2.45-2.38 (m, 3H), 2.31-2.24 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 165.4, 159.7, 159.5, 131.0, 130.5, 129.5, 127.6, 122.0, 119.6, 118.9, 114.3, 114.2, 74.5, 55.5, 55.3, 32.0, 13.8; HRMS *m/z* (ESI) calcd for $C_{19}H_{20}NO_4$ ($[M+H]^+$) 326.1387, found 326.1379.

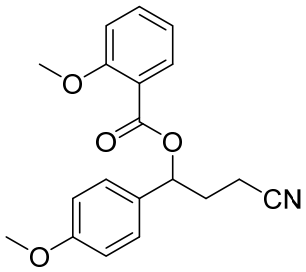
3-Cyano-1-(4-methoxyphenyl)propyl 3-methylbenzoate (4axa):



34.6 mg, 56% yield; Yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.88-7.86 (m, 2H), 7.39-7.31 (m, 4H), 6.90 (d, *J* = 8.8 Hz, 2H), 6.02 (t, *J* = 6.8 Hz, 1H), 3.80 (s, 1H), 2.45-2.37 (m, 6H), 2.32-2.24 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ: 165.7, 159.7, 138.3, 134.0, 130.7, 130.2, 129.7, 128.3, 127.7, 126.8,

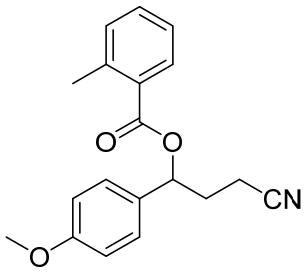
118.9, 114.2, 74.3, 55.3, 32.1, 21.2, 13.8; HRMS *m/z* (ESI) calcd for $C_{19}H_{20}NO_3$ ($[M+H]^+$) 310.1438, found 310.1445.

3-Cyano-1-(4-methoxyphenyl)propyl 2-methoxybenzoate (4aya):



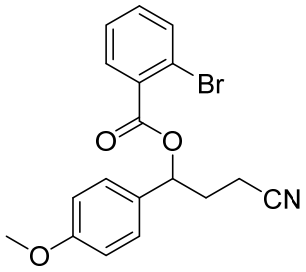
50.1 mg, 77% yield; Yellow solid; mp 75.7-76.5ºC(uncorrected); ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.81-7.79 (m, 1H), 7.50-7.46 (m, 1H), 7.35 (d, *J* = 9 Hz, 1H), 7.00-6.97 (m, 2H), 6.90 (t, *J* = 9 Hz, 1H), 6.01-5.99 (m, 1H), 3.90 (s, 3H), 3.80 (s, 3H), 2.48-2.42 (m, 2H), 2.41-2.35 (m, 1H), 2.27-2.21 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 165.2, 159.5, 159.2, 133.8, 131.7, 130.8, 127.7, 120.1, 119.6, 119.0, 114.1, 111.9, 74.0, 55.8, 55.2, 32.2, 13.6; HRMS *m/z* (ESI) calcd for $C_{19}H_{20}NO_4$ ($[M+H]^+$) 326.1387, found 326.1393.

3-Cyano-1-(4-methoxyphenyl)propyl 2-methylbenzoate (4aza):



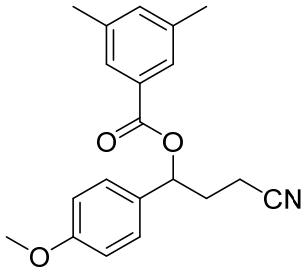
43.9 mg, 71% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.98-7.96 (m, 1H), 7.42-7.39 (m, 1H), 7.35 (d, *J* = 8.5 Hz, 2H), 7.27-7.23 (m, 2H), 6.91 (d, *J* = 9.0 Hz, 2H), 5.99 (t, *J* = 6.0 Hz, 1H), 3.79 (s, 3H), 2.57 (s, 3H), 2.45-2.36 (m, 3H), 2.28-2.20 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 166.2, 159.6, 140.5, 132.2, 131.8, 130.6, 130.5, 128.9, 127.7, 125.7, 118.8, 114.2, 74.1, 55.2, 32.0, 21.8, 13.8; HRMS *m/z* (ESI) calcd for $C_{19}H_{20}NO_3$($[M+H]^+$) 310.1438, found 310.1431.

3-Cyano-1-(4-methoxyphenyl)propyl 2-bromobenzoate (4aAa):



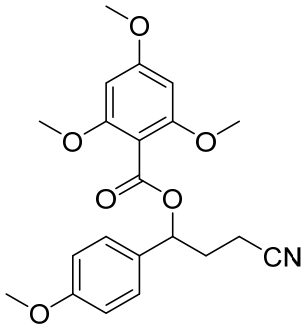
48.5 mg, 65% yield; Yellow solid; mp 77.3-78.5ºC(uncorrected); ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.80-7.78 (m, 1H), 7.67-7.65 (m, 1H), 7.38-7.31 (m, 4H), 6.92 (d, *J* = 8.8 Hz, 1H), 6.02 (t, *J* = 6.0 Hz, 2H), 3.81 (s, 3H), 2.50-2.41 (m, 3H), 2.30-2.23 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ: 165.1, 159.9, 134.4, 132.7, 131.8, 131.4, 130.1, 128.0, 127.2, 121.5, 118.7, 114.2, 75.4, 55.3, 31.9, 13.8; HRMS *m/z* (ESI) calcd for $C_{19}H_{20}NO_3$ ($[M+H]^+$) 374.0386, found 374.0391.

3-Cyano-1-(4-methoxyphenyl)propyl 3,5-dimethylbenzoate (4aBa):



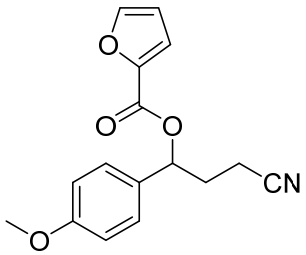
41.4 mg, 64% yield; Yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.67 (s, 2H), 7.34 (d, *J* = 8.4 Hz, 2H), 7.20 (s, 1H), 6.90 (d, *J* = 8.8 Hz, 2H), 6.00 (t, *J* = 6.0 Hz, 1H), 3.79 (s, 3H), 2.45-2.39 (m, 3H), 2.36 (s, 6H), 2.31-2.23 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ: 165.8, 159.7, 138.1, 134.9, 130.7, 129.7, 127.6, 127.4, 118.9, 114.2, 74.1, 55.3, 32.1, 21.1, 13.8; HRMS *m/z* (ESI) calcd for $C_{20}H_{22}NO_3$ ($[M+H]^+$) 324.1594, found 324.1599.

3-Cyano-1-(4-methoxyphenyl)propyl 2,4,6-trimethoxybenzoate (4aCa):



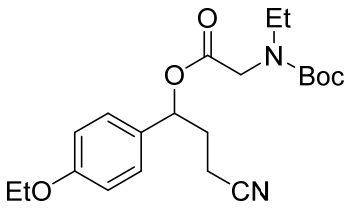
46.2 mg, 60% yield; Yellow solid; mp 81.4-82.7°C(uncorrected); ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.33 (d, *J* = 9 Hz, 2H), 6.89 (d, *J* = 8.5 Hz, 2H), 6.10 (s, 2H), 6.02-5.99 (m, 1H), 3.82 (s, 3H), 3.81 (s, 3H), 3.77 (s, 6H), 2.51-2.48 (m, 2H), 2.31-2.22 (m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 165.4, 162.7, 159.4, 158.6, 130.9, 127.6, 119.3, 113.8, 105.5, 90.5, 73.9, 55.8, 55.5, 55.3, 32.3, 13.4; HRMS *m/z* (ESI) calcd for $C_{21}H_{24}NO_6$ ($[M+H]^+$) 386.1598, found 386.1591.

3-Cyano-1-(4-methoxyphenyl)propyl furan-2-carboxylate (4aDa):



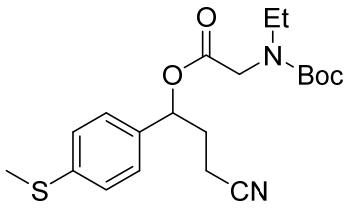
27.4 mg, 48% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.59-7.58 (m, 1H), 7.34 (d, *J* = 9 Hz, 2H), 7.25-7.24 (m, 1H), 6.90 (d, *J* = 8.5 Hz, 2H), 6.52-6.51 (m, 1H), 6.00 (t, *J* = 5.5 Hz, 1H), 3.80 (s, 3H), 2.44-2.37 (m, 3H), 2.28-2.23 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 159.8, 157.7, 146.6, 144.2, 130.2, 127.8, 118.8, 118.6, 1 14.2, 112.0, 74.3, 55.3, 31.9, 13.8; HRMS *m/z* (ESI) calcd for $C_{16}H_{16}NO_4$ ($[M+H]^+$) 286.1074, found 286.1073.

3-Cyano-1-(4-ethoxyphenyl)propyl *N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4baa):



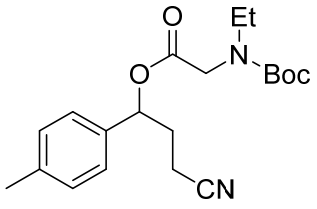
46.0 mg, 59% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.24 (t, *J* = 7.5 Hz, 2H), 6.87 (d, *J* = 7.0 Hz, 2H), 5.85-5.81 (m, 1H), 4.04-4.00 (m, 2H), 3.97-3.90 (m, 2H), 3.36-3.31 (m,1H), 3.29-3.25 (m,1H), 2.39-2.25 (m, 3H), 2.18-2.10 (m,1H), 1.47 (s, 5H), 1.41 (t, *J* = 7.0 Hz, 3H), 1.32 (s, 4H), 1.11-1.07 (m, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.4, 169.3, 159.2, 159.1, 155.6, 154.8, 130.0, 129.8, 127.8, 127.7, 118.9, 118.7, 114.7, 114.6, 80.1, 74.5, 74.4, 63.5, 63.4, 48.9, 48.8, 43.4, 42.9, 31.9, 31.5, 29.6, 28.3, 28.1, 14.7, 13.7, 13.6 (2C), 13.2; HRMS m/z (ESI) calcd for $C_{21}H_{31}N_2O_5$ ([M+H]+) 391.2227, found 391.2221.

3-Cyano-1-(4-(methylthio)phenyl)propyl*N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4caa):



56.4 mg, 72% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.27-7.24 (s, 4H), 5.86-5.82 (m, 1H), 4.01-3.91 (m, 2H), 3.36-3.32 (m, 1H), 3.30-3.24 (m, 1H), 2.47 (s, 3H), 2.41-2.33 (m, 2H), 2.30-2.23 (m, 1H), 2.18-2.10 (m, 1H), 1.47 (s, 5H), 1.32 (s, 4H), 1.09 (t, *J* = 7.0 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.2 (2C), 155.5, 154.7, 139.4, 139.1, 134.7, 134.5, 126.8, 126.6, 126.4, 118.8, 118.5, 80.0, 74.3, 74.2, 48.7, 43.4, 42.8, 31.8, 31.4, 28.2, 28.0, 15.4, 13.6 (2C), 13.4, 13.2; HRMS m/z (ESI) calcd for $C_{20}H_{29}N_2O_4S$ ($[M+H]^+$) 393.1843, found 393.1847.

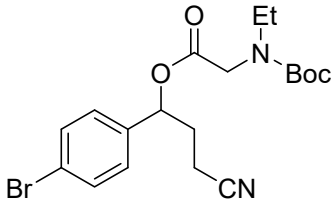
3-Cyano-1-(*p*-tolyl)propyl *N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4daa):



44.6 mg, 62% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.22-7.16 (m, 4H), 5.86-5.84 (m, 1H), 4.01-3.91 (m, 2H), 3.36-3.32 (m, 1H), 3.30-3.25 (m, 1H), 2.39-2.24 (m, 6H), 2.19-2.13 (m, 1H), 1.47 (s, 5H), 1.33 (s, 4H), 1.11-1.07 (m, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.3 (2C), 155.6, 154.8, 138.7, 138.4, 135.2, 135.0, 129.5 (2C), 126.3, 126.2, 118.9, 118.7, 80.1, 74.6, 74.5, 48.8 (2C), 43.5, 42.9, 32.1, 31.7, 28.3, 28.1, 21.1, 13.7, 13.6, 13.5, 13.2; HRMS m/z (ESI) calcd for $C_{20}H_{29}N_2O_4$ ($[M+H]^+$) 361.2122, found 361.2127.

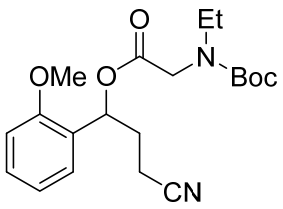
1-(4-Bromophenyl)-3-cyanopropyl *N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate

(4eaa):



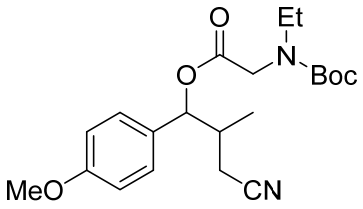
42.4 mg, 50% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.52-7.49 (m, 2H), 7.21 (t, *J* = 8.0 Hz, 2H), 5.86-5.82 (m, 1H), 4.02-3.92 (m, 2H), 3.36-3.32 (m, 1H), 3.31-3.26 (m, 1H), 2.44-2.30 (m, 2H), 2.29-2.20 (m, 1H), 2.17-2.11 (m, 1H), 1.47 (s, 5H), 1.33 (s, 4H), 1.10 (t, *J* = 7.5 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.3 (2C), 155.6, 154.7, 137.3, 137.1, 132.1, 132.0, 128.1, 127.9, 122.8, 122.6, 118.7, 118.4, 80.2, 74.0, 73.9, 48.8 (2C), 43.5, 42.9, 32.0, 31.5, 28.3, 28.1, 13.7, 13.5, 13.3; HRMS m/z (ESI) calcd for $C_{19}H_{26}BrN_2O_4$ ($[M+H]^+$) 425.1070, found 425.1065.

3-Cyano-1-(2-methoxyphenyl)propyl *N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4faa):



39.9 mg, 53% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.31-7.26 (m, 2H), 6.98-6.94 (m, 1H), 6.88 (t, *J* = 7.5 Hz, 1H), 6.29-6.26 (m, 1H), 4.04-3.97 (m, 2H), 3.85 (d, *J* = 6 Hz, 3H), 3.39-3.34 (m, 1H), 3.33-3.29 (m, 1H), 2.41-3.34 (m, 2H), 2.23-2.17 (m, 2H), 1.48 (s, 5H), 1.37 (s, 4H), 1.12 (t, *J* = 7.0 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.3, 169.2, 155.9, 155.8, 155.6, 154.9, 129.4, 129.3, 126.8, 126.6, 126.0, 120.7, 119.3, 119.1, 110.7, 110.6, 80.2, 80.1, 69.8, 69.7, 55.4, 48.8, 43.5, 42.9, 30.9, 30.7, 28.4, 28.2, 13.7, 13.5, 13.4, 13.3; HRMS m/z (ESI) calcd for $C_{20}H_{29}N_2O_5$ ($[M+H]^+$) 377.2071, found 377.2077.

3-Cyano-1-(4-methoxyphenyl)-2-methylpropyl*N*-(*tert*-butoxycarbonyl)-*N*-ethyl-gycinat (4gaa):

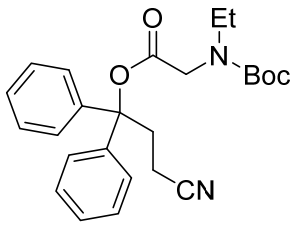


dr = 2.7:1

42.1 mg, 54% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.24-7.20 (m, 2H), 6.88 (d, *J* = 8.0 Hz, 2H), 5.69-5.65 (m, 0.27H), 5.58-5.54 (m, 0.72H), 3.99-3.90 (m, 2H), 3.80 (s, 3H), 3.34-3.24 (m, 2H), 2.61-2.46 (m, 1H), 2.42-2.29 (m, 2H), 1.48 (s, 5H), 1.33 (s, 4H), 1.19-1.14 (m, 0.83H), 1.11-1.06 (m, 3H), 0.99 (d, *J* = 6.0 Hz,

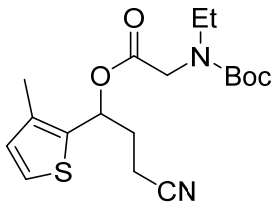
2.22H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.2, 159.8, 159.7, 159.6, 155.5, 154.8, 129.7, 129.6, 129.2 (2C), 128.2, 128.1, 127.9, 118.4, 118.1, 117.8, 114.1, 114.0, 80.1, 78.8, 78.7, 78.4, 78.1, 55.2, 48.8 (2C), 43.4 (2C), 42.8, 36.2, 36.1, 35.9, 35.8, 29.6, 29.3, 28.3, 28.1, 21.1, 21.0, 20.9, 16.1 (2C), 15.7, 15.1, 13.6, 13.2; HRMS m/z (ESI) calcd for $C_{21}H_{31}N_2O_5$ ($[M+H]^+$) 391.2227, found 391.2236.

4-Cyano-1,1-diphenylbutan-2-yl *N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4haa):



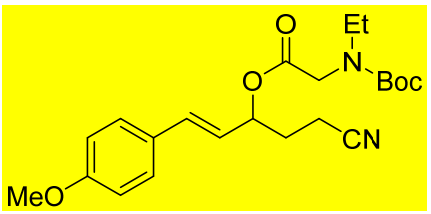
43.9 mg, 52% yield; Yellow solid; mp 99.7-101.5 °C(uncorrected); ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.33-7.29 (m, 8H), 7.28-7.24 (m, 2H), 4.04 (s, 1H), 3.98 (s, 1H), 3.39-3.31 (m, 2H), 3.20-3.16 (m, 2H), 2.29 (t, J = 8.0 Hz, 1H), 2.17 (t, J = 7.5 Hz, 1H), 1.49 (s, 5H), 1.36 (s, 4H), 1.13-1.08 (m, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 168.3, 168.2, 155.6, 154.9, 142.8, 142.6, 128.5, 128.4, 127.8, 127.7, 125.8, 125.7, 119.6, 119.2, 85.7, 85.5, 80.2, 80.1, 49.8, 49.2, 43.7, 42.8, 32.9, 32.3, 28.4, 28.2, 13.8, 13.2, 12.0, 11.6; HRMS m/z (ESI) calcd for $C_{25}H_{31}N_2O_4$ ($[M+H]^+$) 423.2278, found 423.2271.

3-Cyano-1-(3-methylthiophen-2-yl)propyl*N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4iaa):



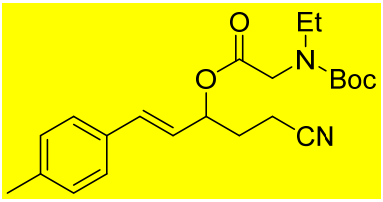
46.8 mg, 64% yield; Yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.21 (d, *J* = 5.2 Hz, 1H), 6.80 (d, *J* = 4.8 Hz, 1H), 6.21 (t, *J* = 6.8 Hz, 1H), 3.95 (s, 1H), 3.89 (s, 1H), 3.34-3.25 (m, 2H), 2.45-2.35 (m, 3H), 2.30 (d, *J* = 10.8 Hz, 3H), 2.22-2.15 (m, 1H), 1.47 (s, 5H), 1.33 (s, 4H), 1.11-1.07 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ: 169.2, 155.6, 154.8, 136.6, 136.2, 134.3, 134.1, 130.1, 124.7, 124.5, 118.6, 118.4, 80.1, 68.8, 48.8, 43.5, 42.9, 32.4, 32.1, 28.3, 28.1, 13.9, 13.7, 13.6, 13.2; HRMS m/z (ESI) calcd for $C_{18}H_{27}N_2O_4S$ ($[M+H]^+$) 367.1686, found 367.1685.

(*E*)-5-Cyano-1-(4-methoxyphenyl)pent-2-en-1-yl*N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4jaa):



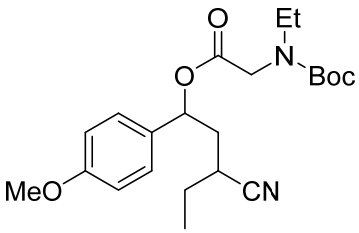
63.5 mg, 79% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.32 (d, *J* = 8 Hz, 2H), 6.86 (d, *J* = 8.5 Hz, 2H), 6.65 (t, *J* = 16.5 Hz, 1H), 5.96-5.90 (m, 1H), 5.55-5.50 (m, 1H), 3.97 (s, 1H), 3.90 (s, 1H), 3.81 (s, 3H), 3.39-3.34 (m, 1H), 3.33-3.28 (m, 1H), 2.47-2.42 (m, 2H), 2.16-2.04 (m, 2H), 1.47 (s, 5H), 1.37 (s, 4H), 1.12 (t, *J* = 7.5 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.4, 159.8, 159.7, 155.6, 154.9, 134.6, 133.8, 128.3, 128.1, 128.0, 122.5, 122.2, 119.1, 118.8, 114.0, 80.2, 80.1, 74.0, 73.8, 55.3, 48.9, 48.8, 43.5, 42.9, 30.4, 30.2, 28.3, 28.2, 13.6, 13.4, 13.3 (2C); HRMS m/z (ESI) calcd for $C_{22}H_{31}N_2O_5$ ($[M+H]^+$) 403.2227, found 403.2225.

(*E*)-5-Cyano-1-(*p*-tolyl)pent-2-en-1-yl *N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4kaa):



44.8 mg, 58% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.27 (d, *J* = 6.5 Hz, 2H), 7.14 (d, *J* = 7.5 Hz, 2H), 6.67 (t, *J* = 15 Hz, 1H), 6.05-5.99 (m, 1H), 5.57-5.52 (m, 1H), 3.98 (s, 1H), 3.91 (s, 1H), 3.39-3.34 (m, 1H), 3.33-3.28 (m, 1H), 2.47-2.42 (m, 2H), 2.34 (s, 3H), 2.16-2.06 (m, 2H), 1.47 (s, 5H), 1.37 (s, 4H), 1.12 (t, *J* = 7.5 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.4, 155.6, 154.9, 138.5, 138.4, 134.8, 134.1, 132.7, 132.5, 129.3 (2C), 126.6, 123.8, 123.5, 119.1, 118.8, 80.2, 80.1, 77.2, 77.0, 76.7, 73.8, 73.6, 48.9, 48.8, 43.5, 42.9, 30.4, 30.1, 28.3, 28.2, 21.2, 13.7, 13.4, 13.3, 13.2; HRMS m/z (ESI) calcd for $C_{22}H_{31}N_2O_4$ ($[M+H]^+$) 387.2278, found 387.2273.

3-Cyano-1-(4-methoxyphenyl)pentyl *N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4aab):

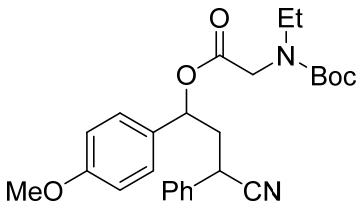


dr = 1:1

30.7 mg, 38% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.31-7.26 (m, 2H), 6.89 (d, *J* = 8.5 Hz, 2H), 5.94-5.88 (m, 1H), 4.01-3.89 (m, 2H), 3.80 (s, 3H), 3.36-3.31 (m, 1H), 3.29-3.25 (m, 1H), 2.67-2.56 (m, 0.54H),

2.42-2.28 (m, 1H), 2.19-2.05 (m, 1H), 1.99-1.91 (m, 0.54H), 1.70-1.61 (m, 2H), 1.47 (s, 4H), 1.33 (s, 3H), 1.30 (s, 2H), 1.10-1.05 (m, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.4, 169.3 (2C), 159.9, 159.8, 159.7, 155.6, 154.9, 130.9, 130.8, 130.6, 130.5, 128.1, 128.0, 127.8, 127.7, 121.4, 121.3, 121.2, 114.2, 114.1, 80.1, 80.0, 74.2, 73.7, 55.3, 49.0, 48.9, 48.7, 43.4, 42.9, 38.7, 38.2, 38.1, 38.0, 30.1, 29.7 (2C), 29.6, 28.3 (2C), 28.2, 28.1, 25.7, 25.6, 25.5, 25.3, 13.6, 13.3, 11.3, 11.2; HRMS m/z (ESI) calcd for $C_{22}H_{33}N_2O_5$ ($[M+H]^+$) 405.2384, found 405.2382.

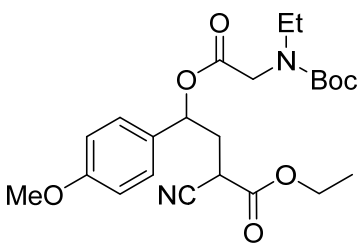
3-Cyano-1-(4-methoxyphenyl)-3-phenylpropyl*N*-(*tert*-butoxycarbonyl)-*N*-ethyl-glycinate (4aac):



dr = 1.5:1

45.2 mg, 50% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.40-7.21 (m, 7H), 6.90-6.85 (m, 2H), 5.88-5.81 (m, 0.60H), 5.65-5.62 (m, 0.40H), 3.94-3.87 (m, 2H), 3.84-3.81 (m, 0.59H), 3.80 (d, *J* = 4.0 Hz, 3H), 3.70-3.64 (m, 0.39H), 3.35-3.25 (m, 2H), 2.72-2.45 (m, 1H), 2.43-2.18 (m, 1H), 1.50-1.46 (m, 5H), 1.34-1.29 (m, 4H), 1.09 (t, *J* = 7.0 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.3 (2C), 169.2, 159.9, 159.8 (2C), 159.7, 155.7, 155.6, 154.8, 135.0, 134.9, 134.7, 130.5, 130.4, 130.3, 129.3 (2C), 129.2, 128.5, 128.4, 128.3, 128.1 (2C), 127.9, 127.7, 127.4, 127.3, 127.2, 120.6, 120.3, 120.1, 114.2, 114.1, 80.1 (2C), 73.8, 73.5, 73.0, 55.3 (2C), 49.0, 48.9 (2C), 48.7, 43.6, 43.4, 42.9, 42.1, 41.8, 41.7, 41.6, 34.3, 33.9, 33.8, 33.7, 28.4, 28.3, 28.1, 13.7, 13.6, 13.3, 13.2; HRMS m/z (ESI) calcd for $C_{26}H_{33}N_2O_5$ ($[M+H]^+$) 453.2384, found 453.2387.

Ethyl4-((*N*-(*tert*-butoxycarbonyl)-*N*-ethylglycyl)oxy)-2-cyano-4-(4-methoxyphe-nyl)butanoate (4aad)：

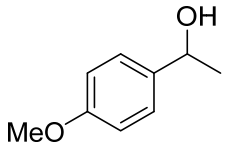


dr = 1:1

35.8 mg, 40% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.32-7.28 (m, 2H), 6.91-6.88 (m, 2H), 5.99-5.94 (m, 0.50H), 5.93-5.90 (m, 0.49H), 4.28-4.22 (m, 2H), 3.96 (d, *J* = 4.5 Hz, 1H), 3.91 (s, 0.50H), 3.88 (s,

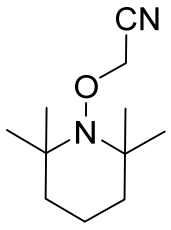
0.50H), 3.80 (s, 3H), 3.74-3.71 (m, 0.25H), 3.58-3.51 (m, 0.51H), 3.41-3.38 (m, 0.26H), 3.36-3.31 (m, 1H), 3.30-3.25 (m, 1H), 2.62-2.30 (m, 2H), 1.47 (d, J = 2.0 Hz, 5H), 1.34-1.30 (s, 7H), 1.10-1.07 (m, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 169.3 (2C), 169.2, 169.1, 165.5, 165.4, 165.2, 160.0, 159.9 (2C), 159.7, 155.6 (2C), 154.8 (2C), 130.0, 129.8, 129.6, 128.1, 127.9 (2C), 127.8, 116.1, 116.0, 115.9, 115.7, 114.2 (2C), 114.1 (2C), 80.1 (2C), 73.5, 73.3, 72.9, 72.8, 63.2, 63.1, 63.0, 55.3 (2C), 55.2, 48.8, 48.6, 43.4 (2C), 42.8, 36.0, 35.8, 35.6, 35.4, 34.4, 34.1, 33.9, 28.3, 28.1, 13.9 (2C), 13.6, 13.2; HRMS m/z (ESI) calcd for $C_{23}H_{33}N_2O_7$ ([M+H]$^+$) 449.2282, found 449.2287.

1-(4-methoxyphenyl)ethan-1-ol (4aaa'):



22.3mg, 49% yield; Colorless liquid; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.30 (d, J = 8.5 Hz, 2H), 6.88 (d, J = 8.5Hz, 2H), 4.88-4.85 (m, 1H), 3.81 (s, 3H), 1.73 (s, 1H), 1.48 (d, J = 8.5 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 13C NMR (126 MHz, CDCl3) δ 159.0, 138.0, 126.7, 113.8, 70.0, 55.3, 25.0; HRMS m/z (ESI) calcd for $C_9H_{12}O_2$ ([M+H]$^+$) 153.0916, found 153.0920.

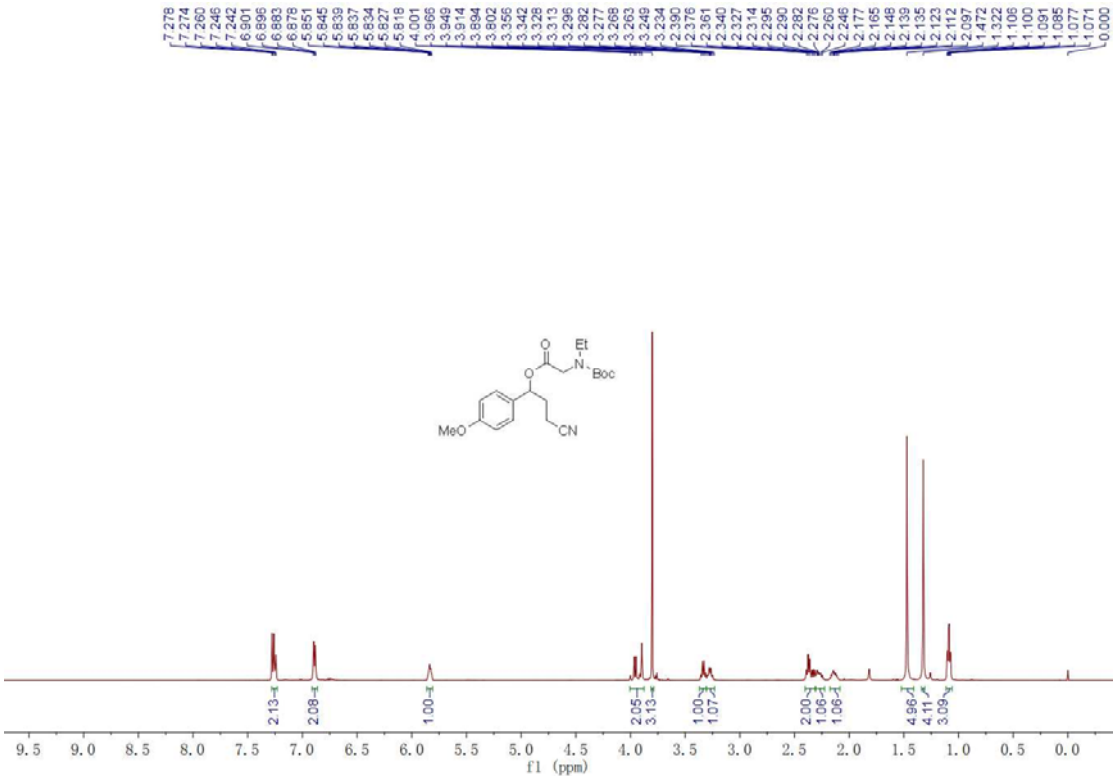
2-((2,2,6,6-Tetramethylpiperidin-1-yl)oxy)acetonitrile (5):

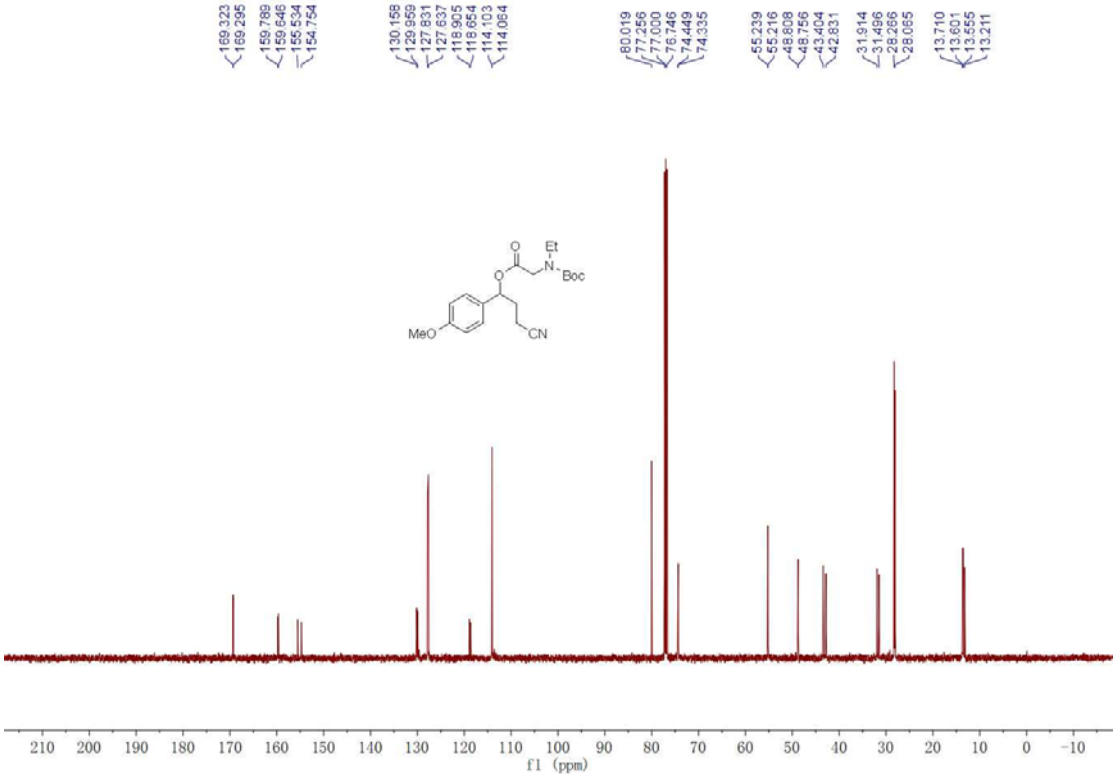


29.4 mg, 75% yield; Colorless liquid; ^{1}H NMR (500 MHz, $CDCl_3$) δ: 4.52 (s, 2H), 1.60-1.31 (m, 6H), 1.20 (s, 6H), 1.10 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 116.0, 62.6, 60.3, 39.5, 32.9, 19.8, 16.8; HRMS m/z (ESI) calcd for $C_{11}H_{21}N_2O$ ([M+H]$^+$) 197.1648, found 197.1641.

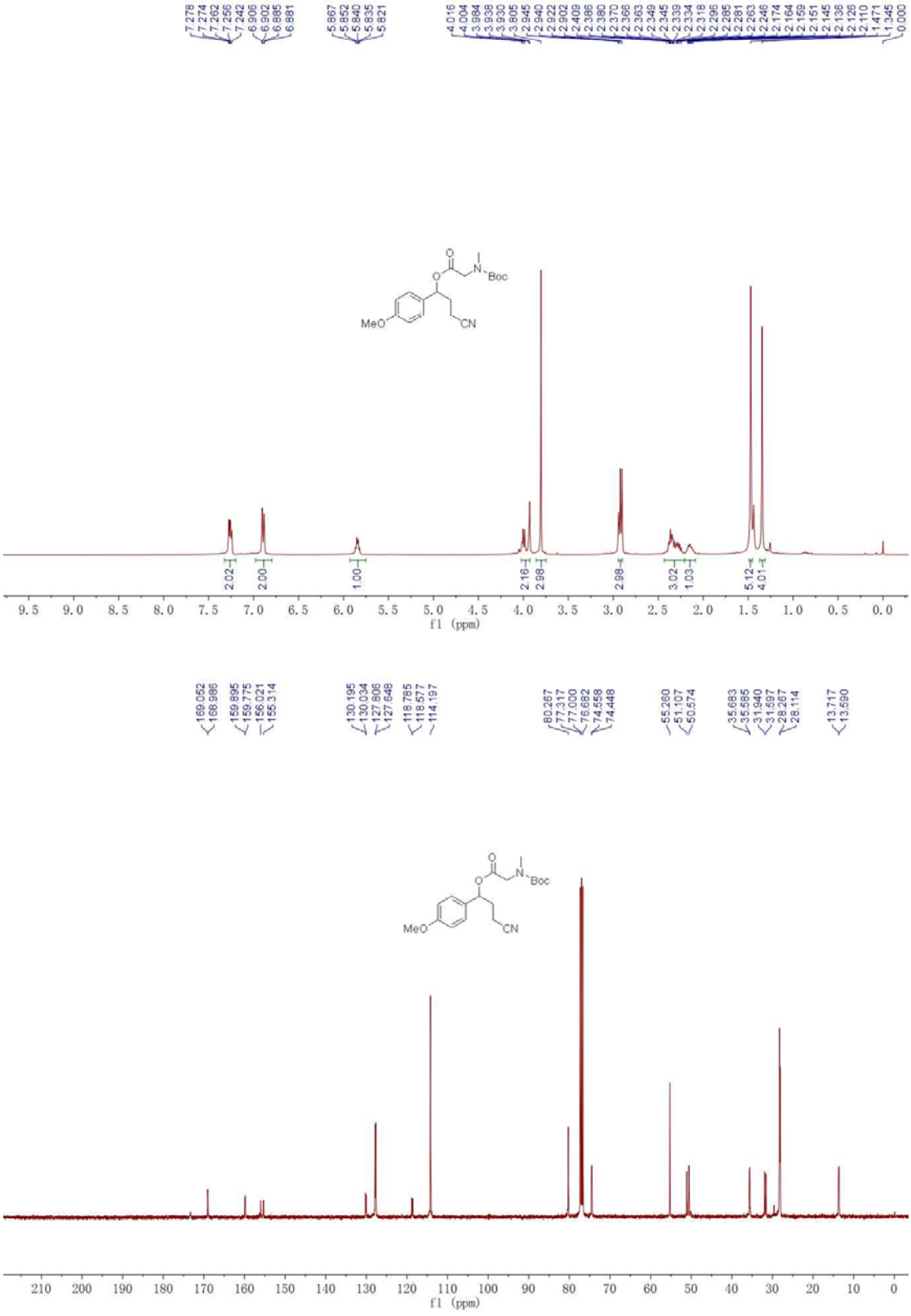
(C) Spectra

3-Cyano-1-(4-methoxyphenyl)propyl *N*-(tert-butoxycarbonyl)-*N*-ethylglycinate (4aaa)

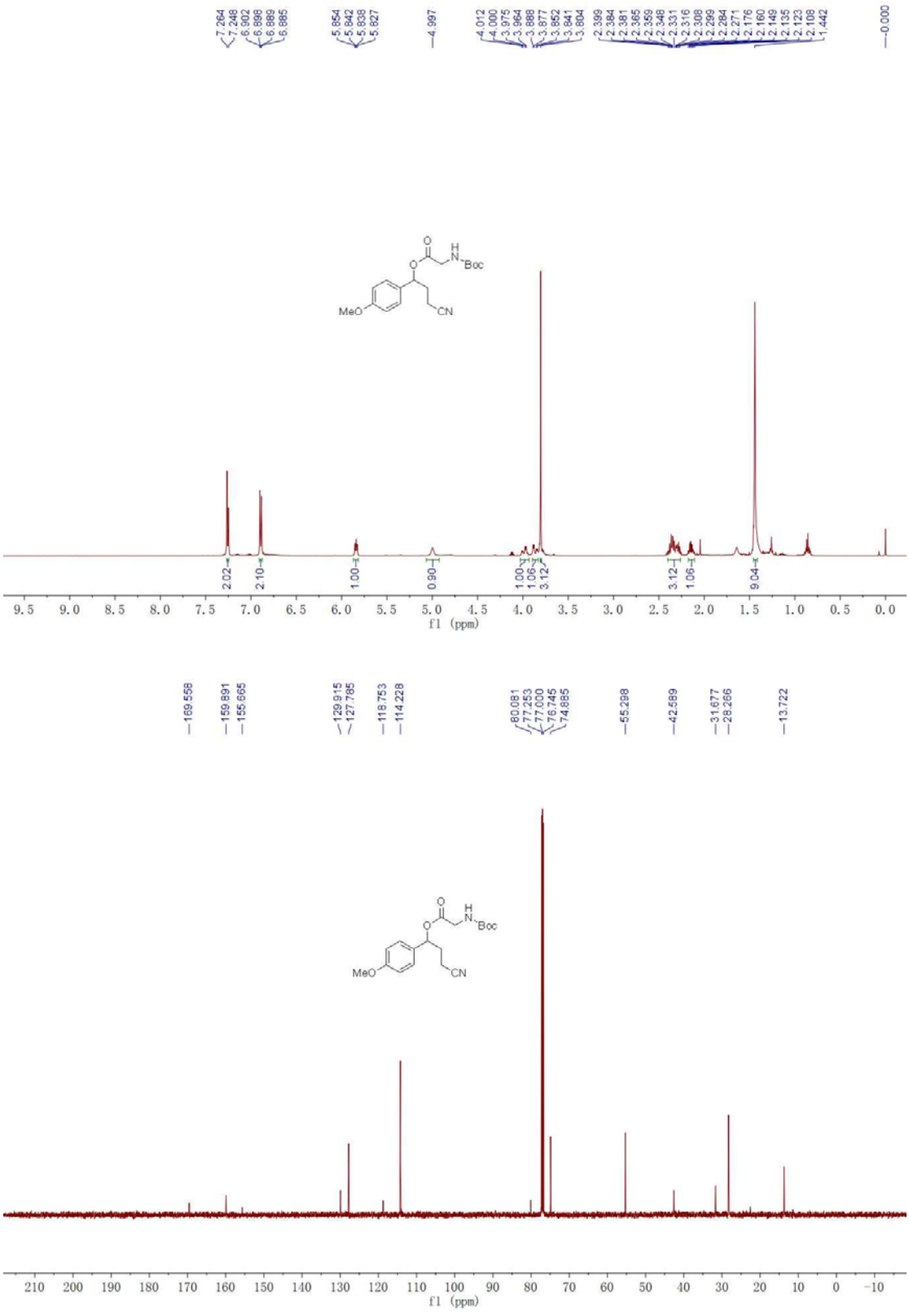




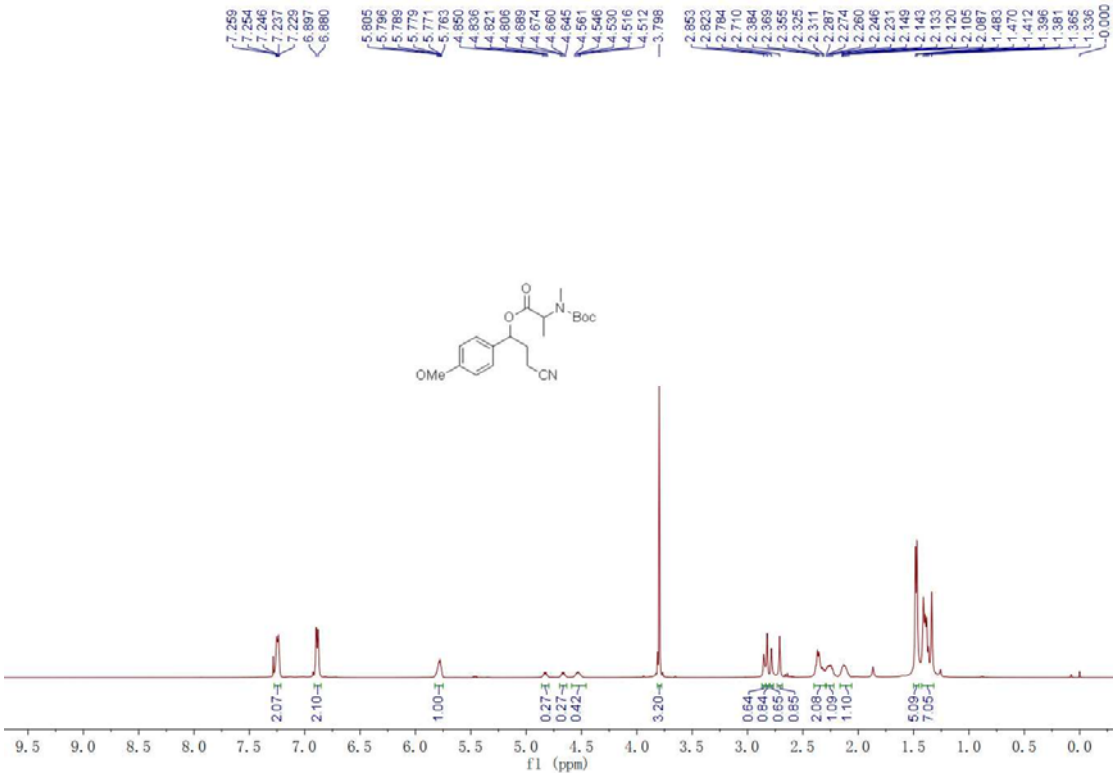
3-Cyano-1-(4-methoxyphenyl)propyl*N*-(*tert*-butoxycarbonyl)-*N*-methylglycinate (4aba)

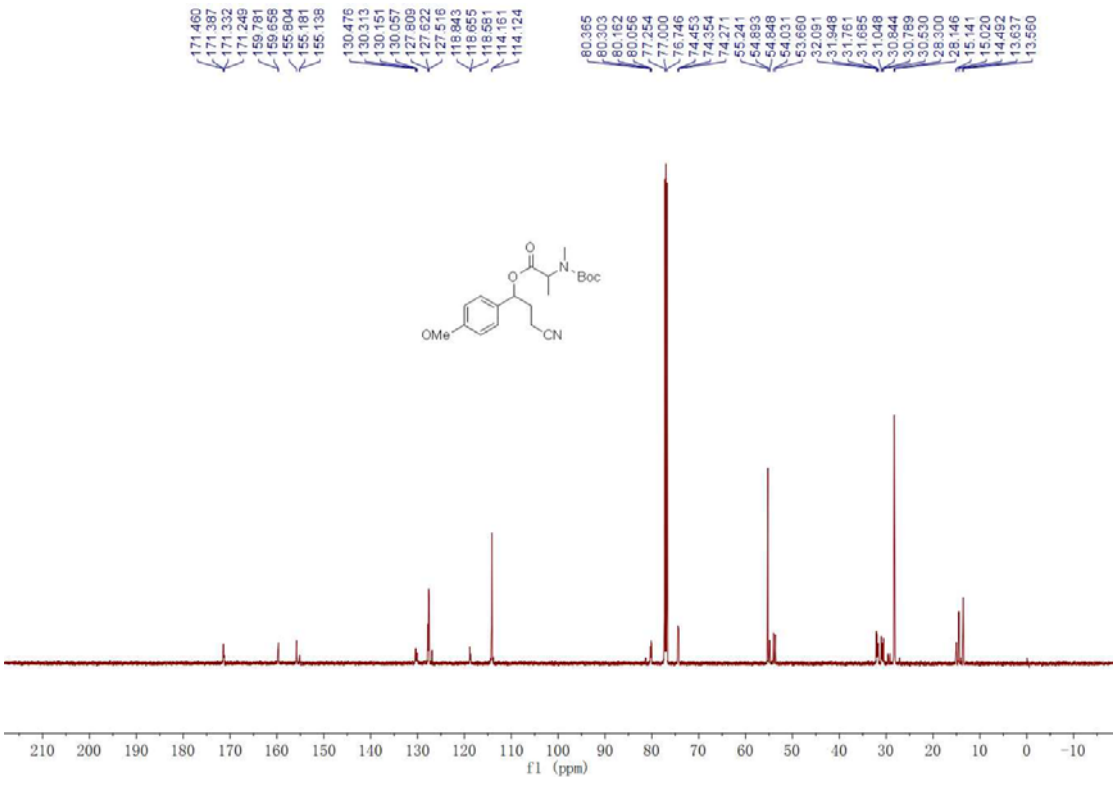


3-Cyano-1-(4-methoxyphenyl)propyl (*tert*-butoxycarbonyl)glycinate (4aca)

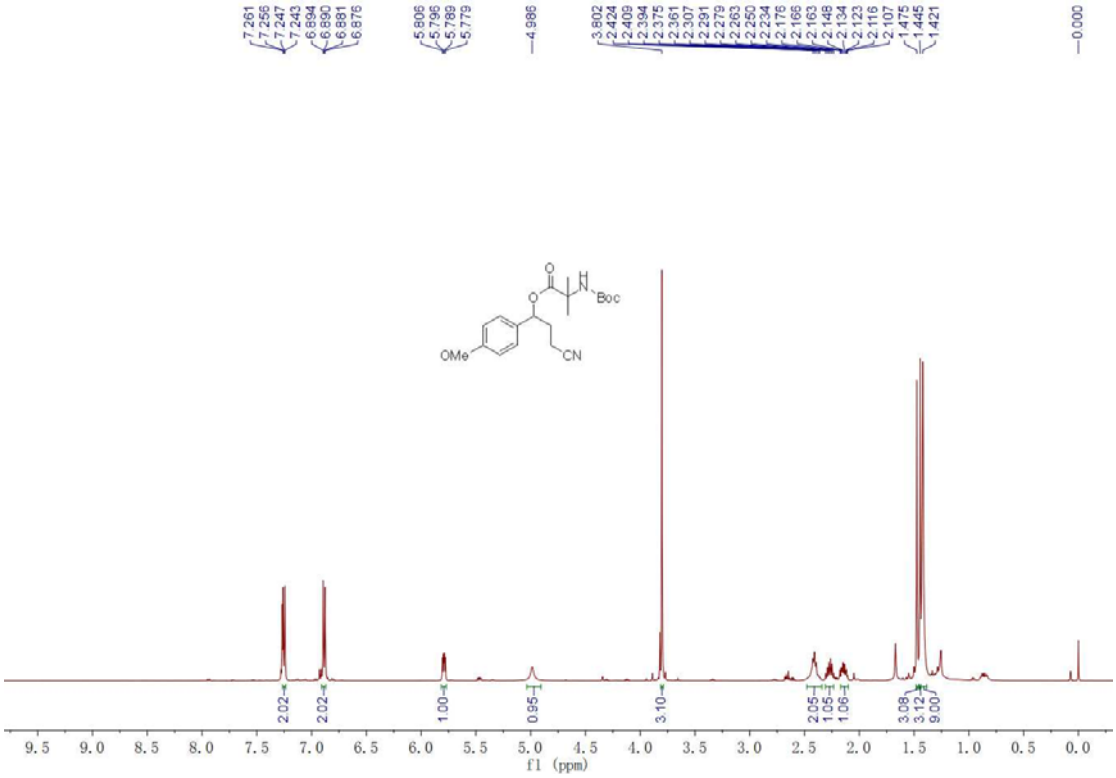


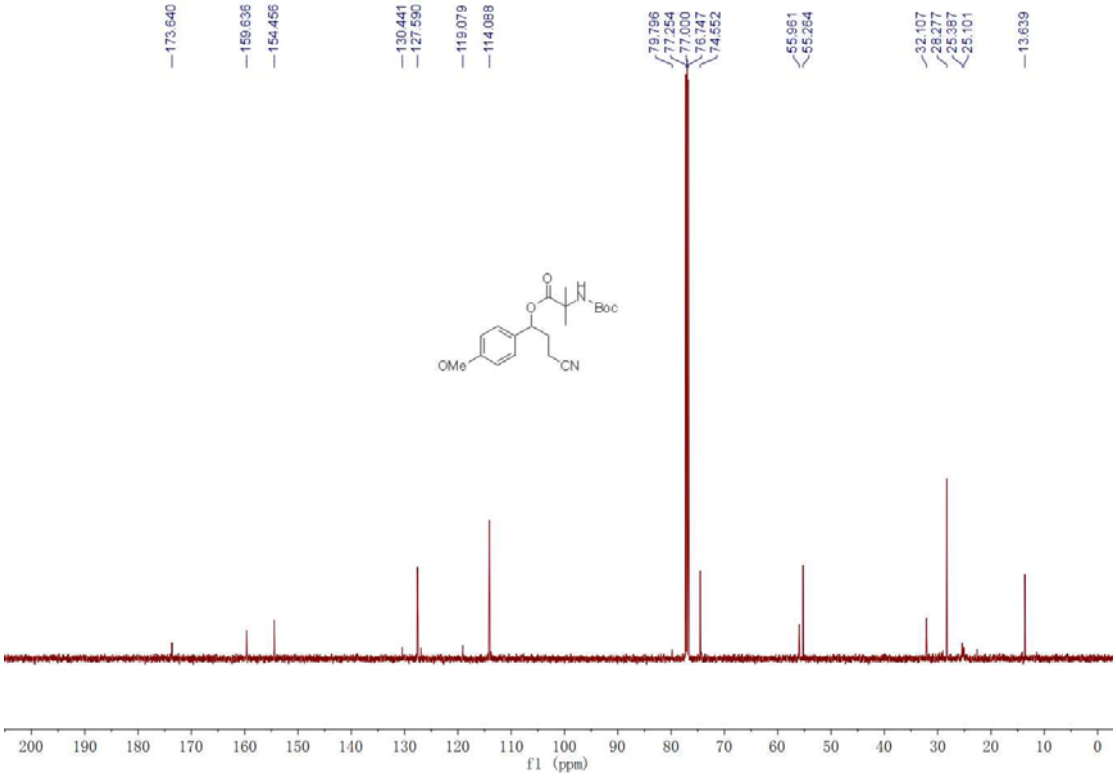
3-Cyano-1-(4-methoxyphenyl)propyl *N*-(*tert*-butoxycarbonyl)-*N*-methylalaninate (4ada)



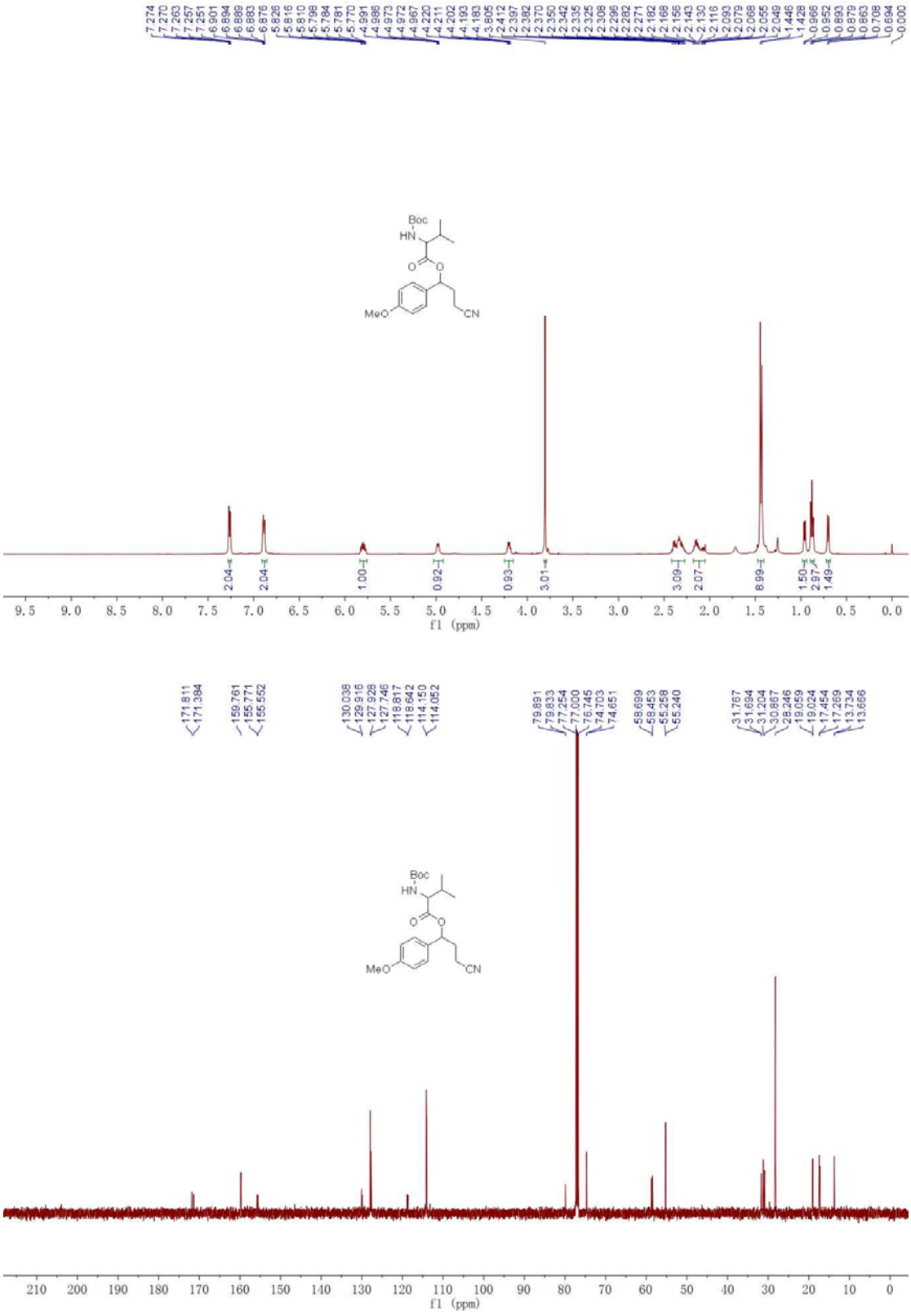


3-Cyano-1-(4-methoxyphenyl)propyl2-((*tert*-butoxycarbonyl)amino)-2-methylp-ropanoate (4aea)

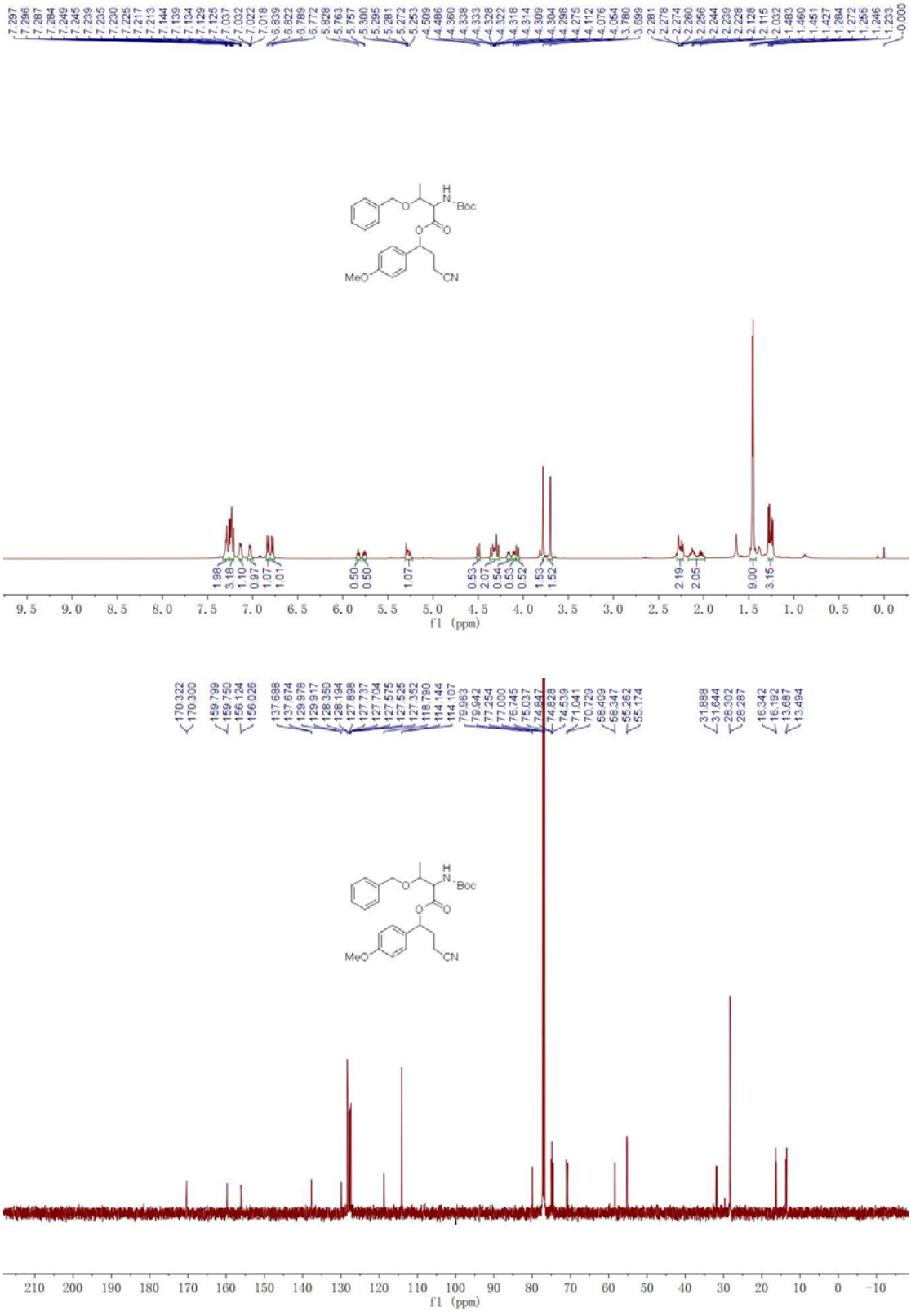




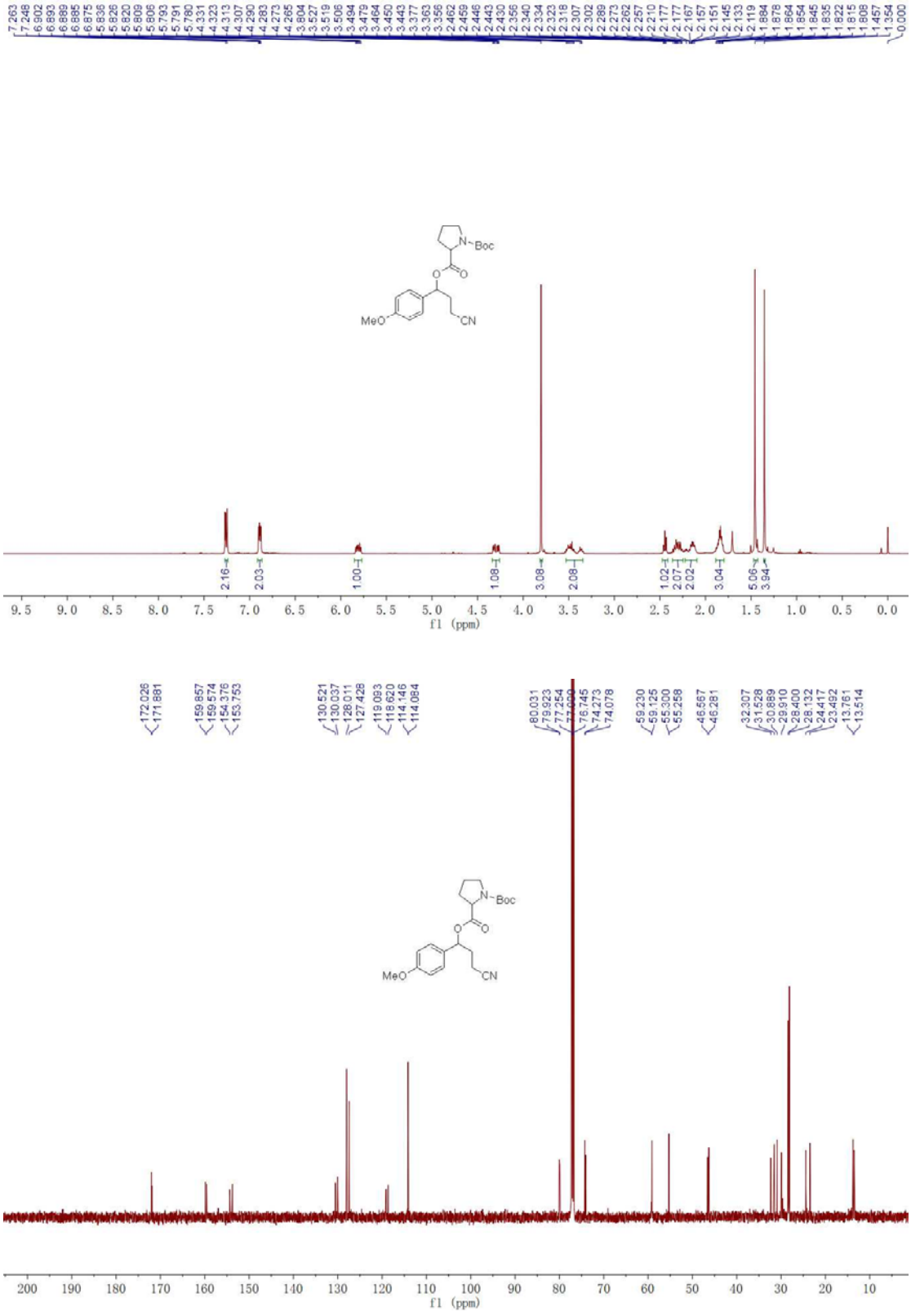
3-Cyano-1-(4-methoxyphenyl)propyl (*tert*-butoxycarbonyl)valinate (4afa)



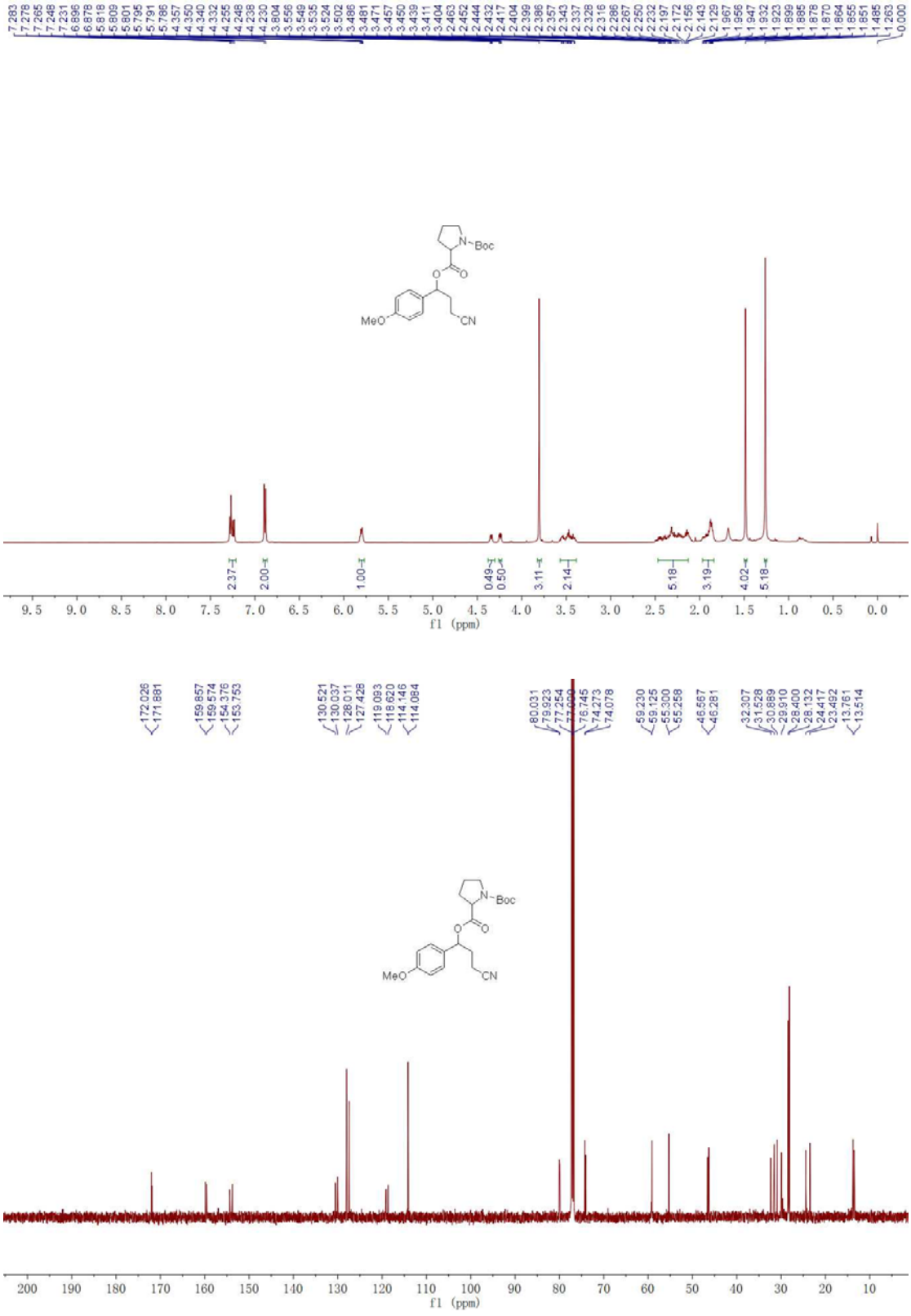
3-Cyano-1-(4-methoxyphenyl)propyl3-(benzyloxy)-2-((*tert*-butoxycarbonyl)amino)butanoate (4aga)



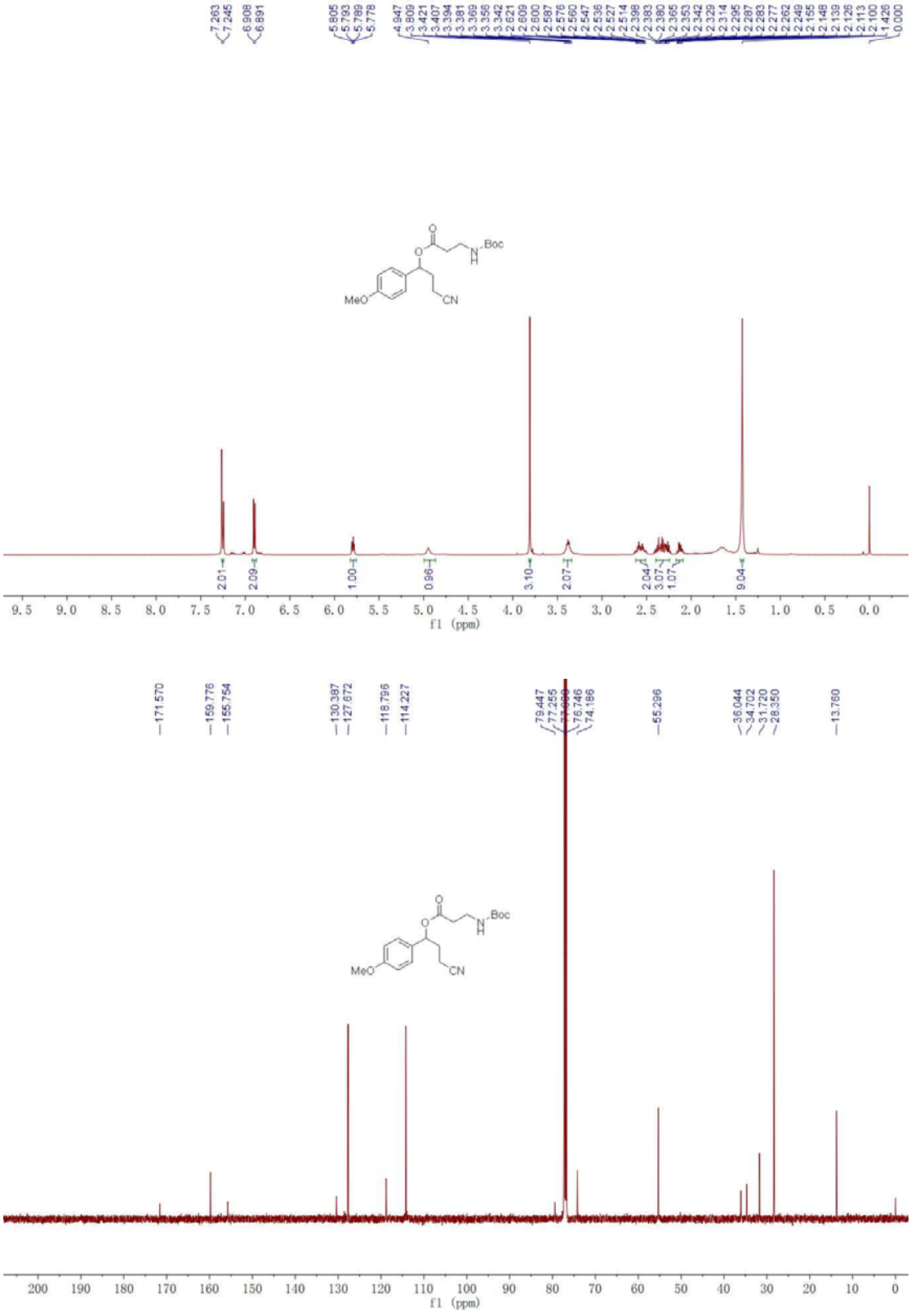
1-(*Tert*-butyl)2-(3-cyano-1-(4-methoxyphenyl)propyl)pyrrolidine-1,2-dicarboxy-late (4aha)



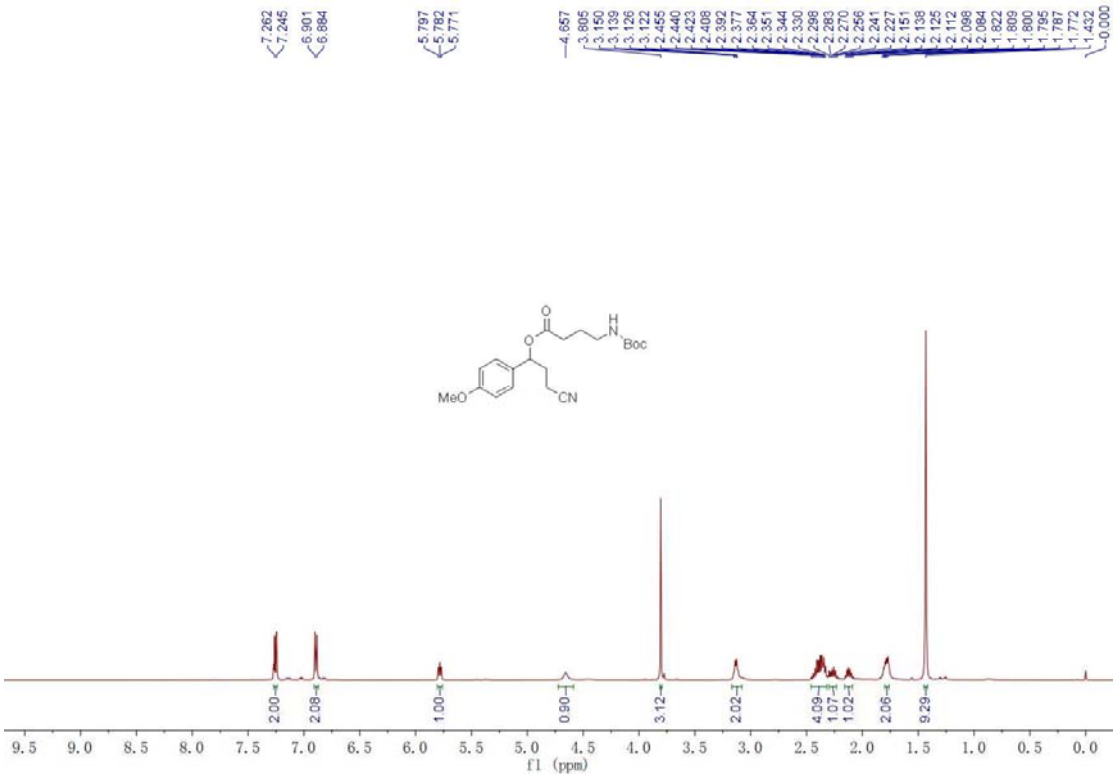
1-(*Tert*-butyl)2-(3-cyano-1-(4-methoxyphenyl)propyl)pyrrolidine-1,2-dicarboxy-late (4aha)

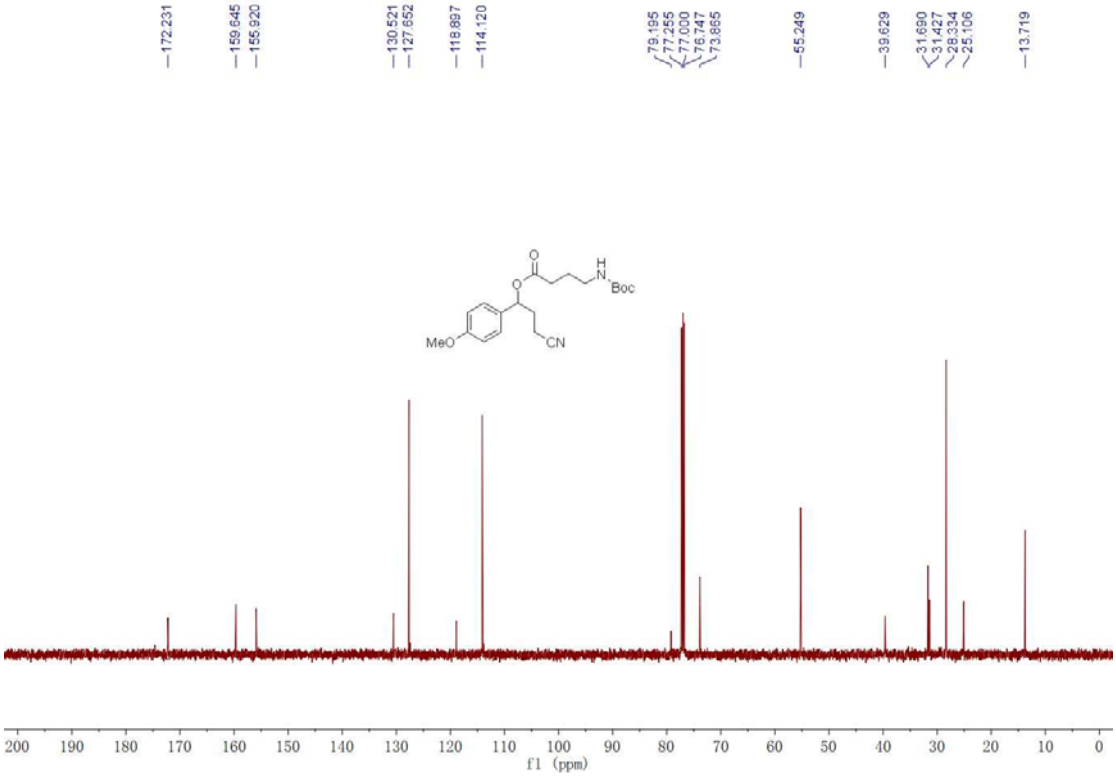


3-Cyano-1-(4-methoxyphenyl)propyl 3-((*tert*-butoxycarbonyl)amino)propanoate (4aia)

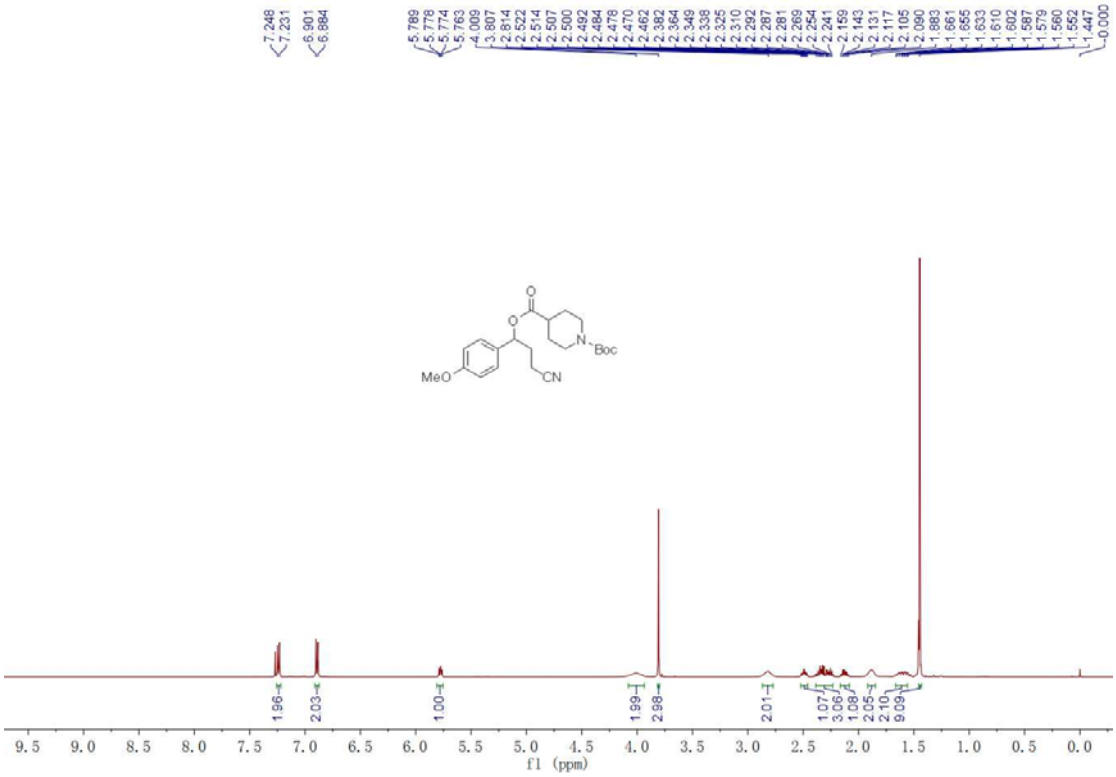


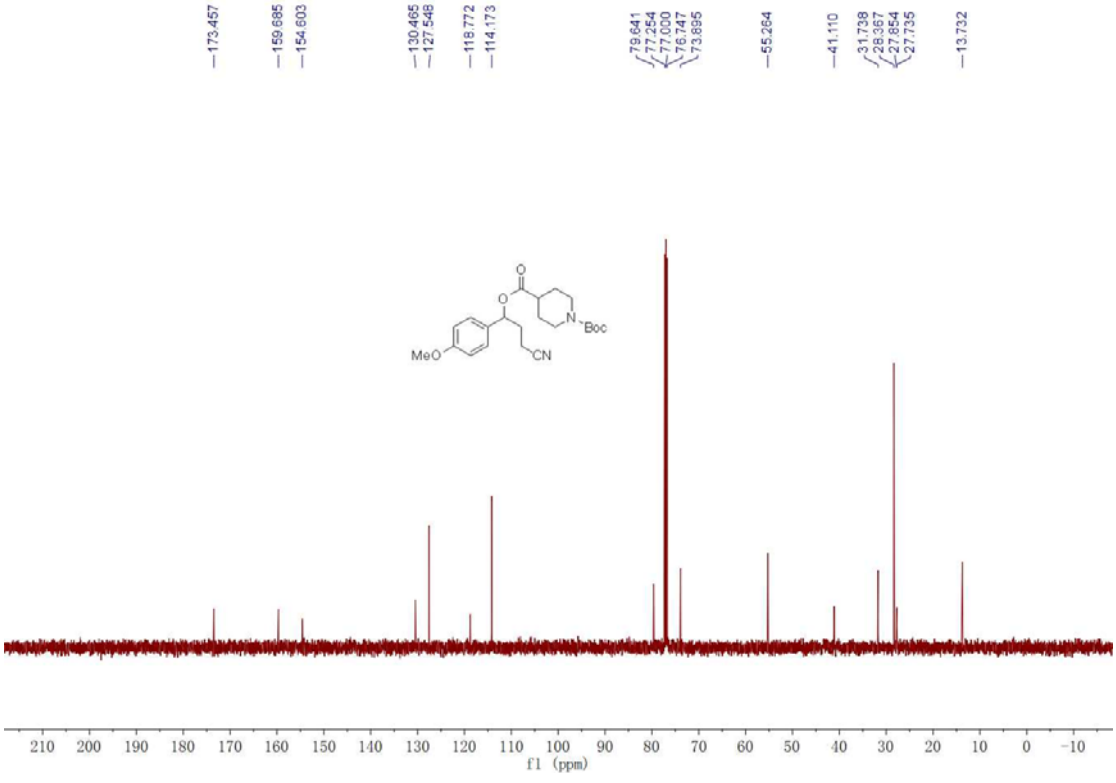
3-Cyano-1-(4-methoxyphenyl)propyl4-((*tert*-butoxycarbonyl)amino)butanoate (4aja)



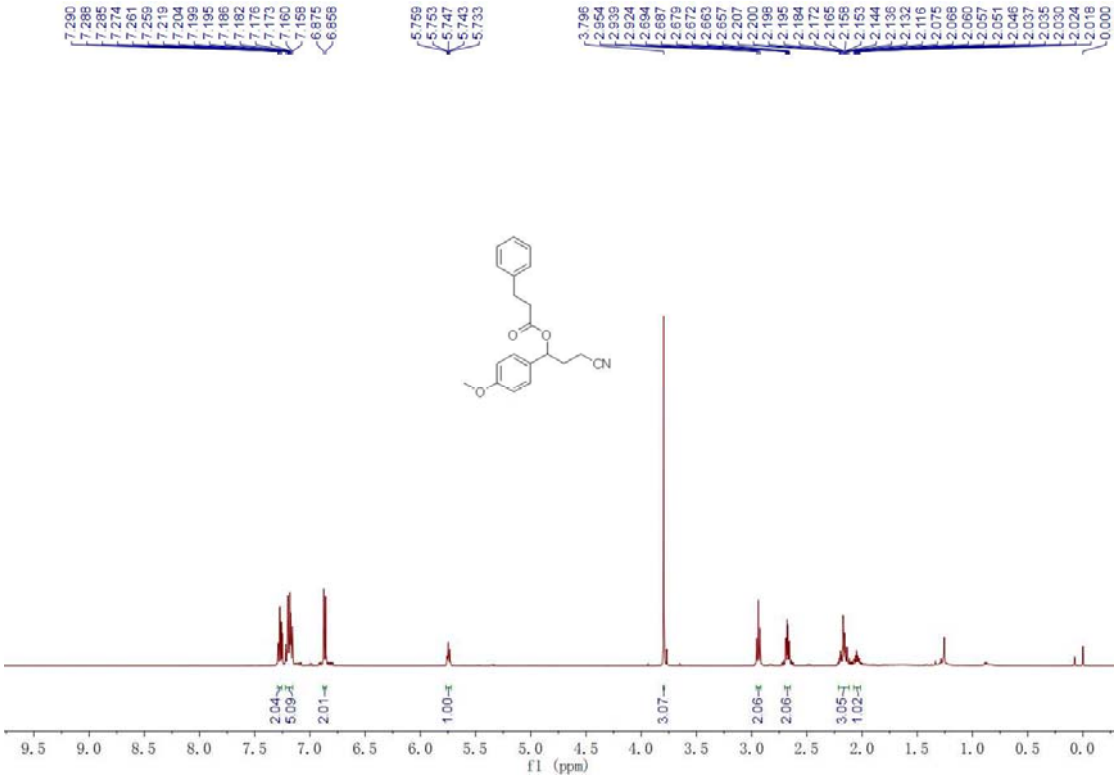


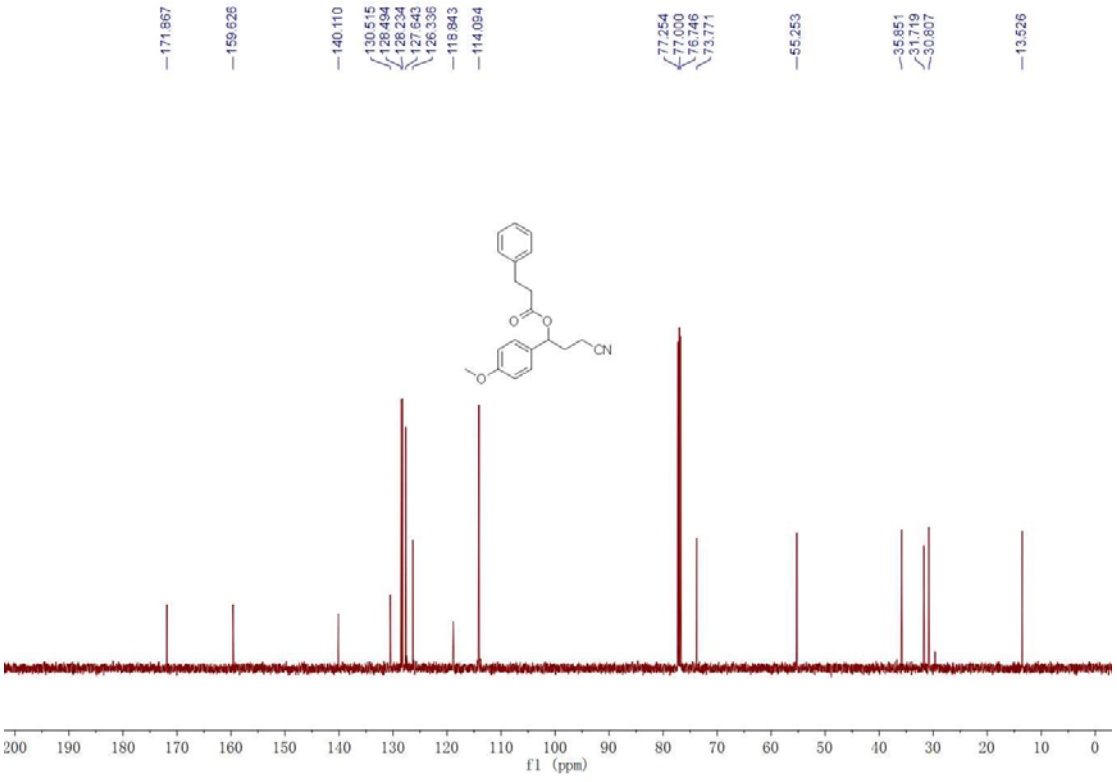
1-(*Tert*-butyl) 4-(3-cyano-1-(4-methoxyphenyl)propyl) piperidine-1,4-dicarboxyl-Ate (4aka)



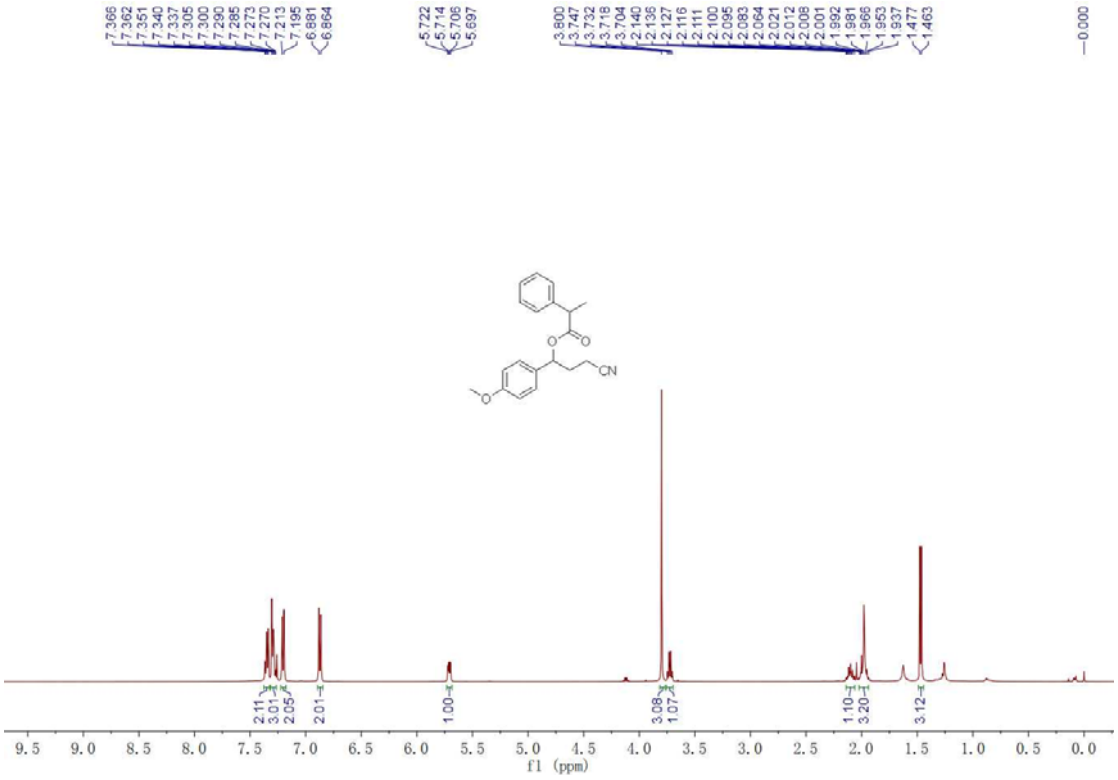


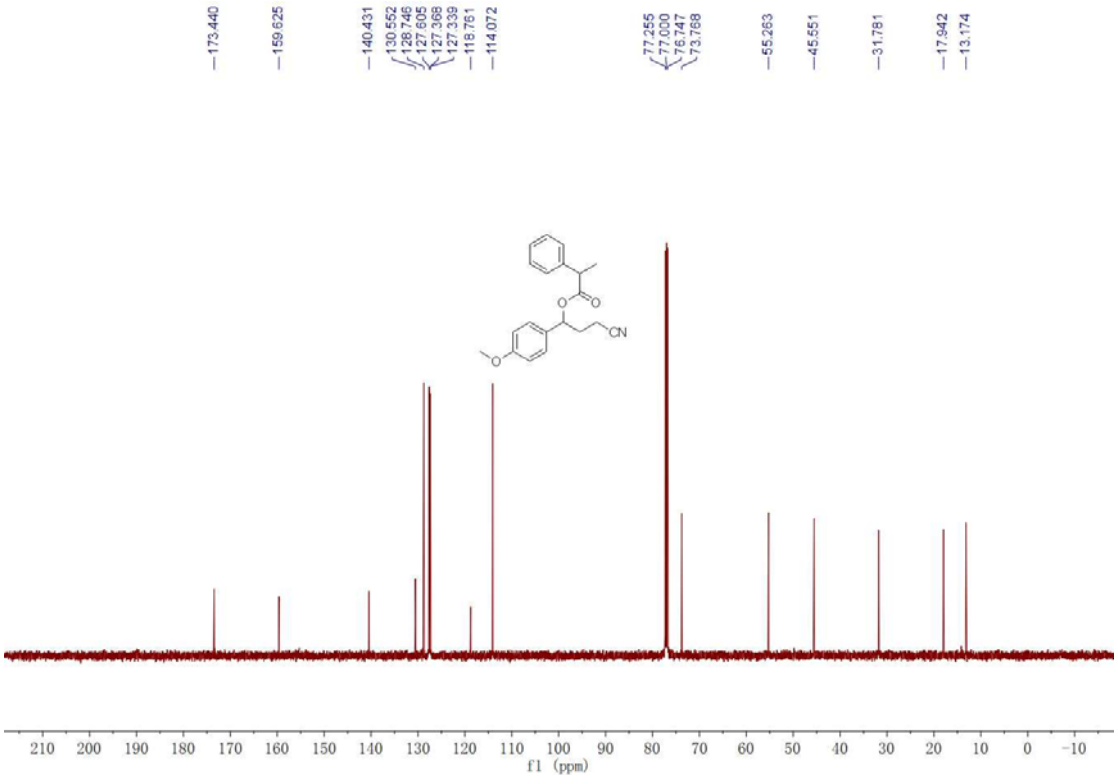
3-Cyano-1-(4-methoxyphenyl)propyl 3-phenylpropanoate (4ala)



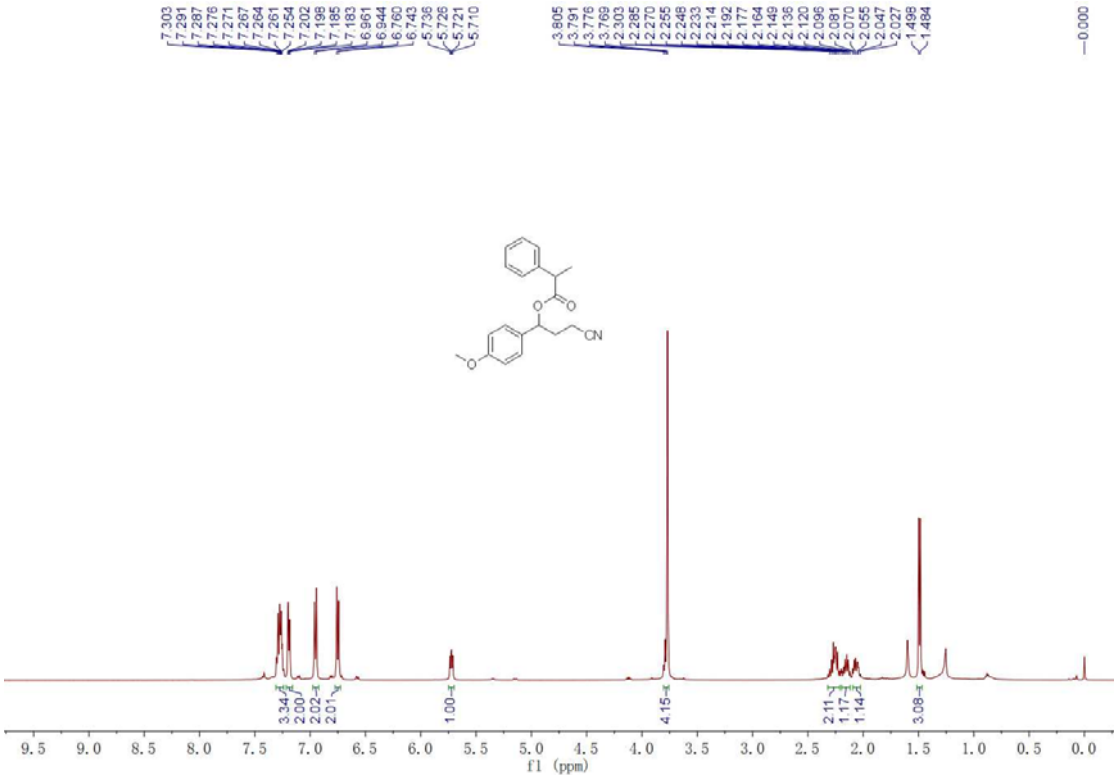


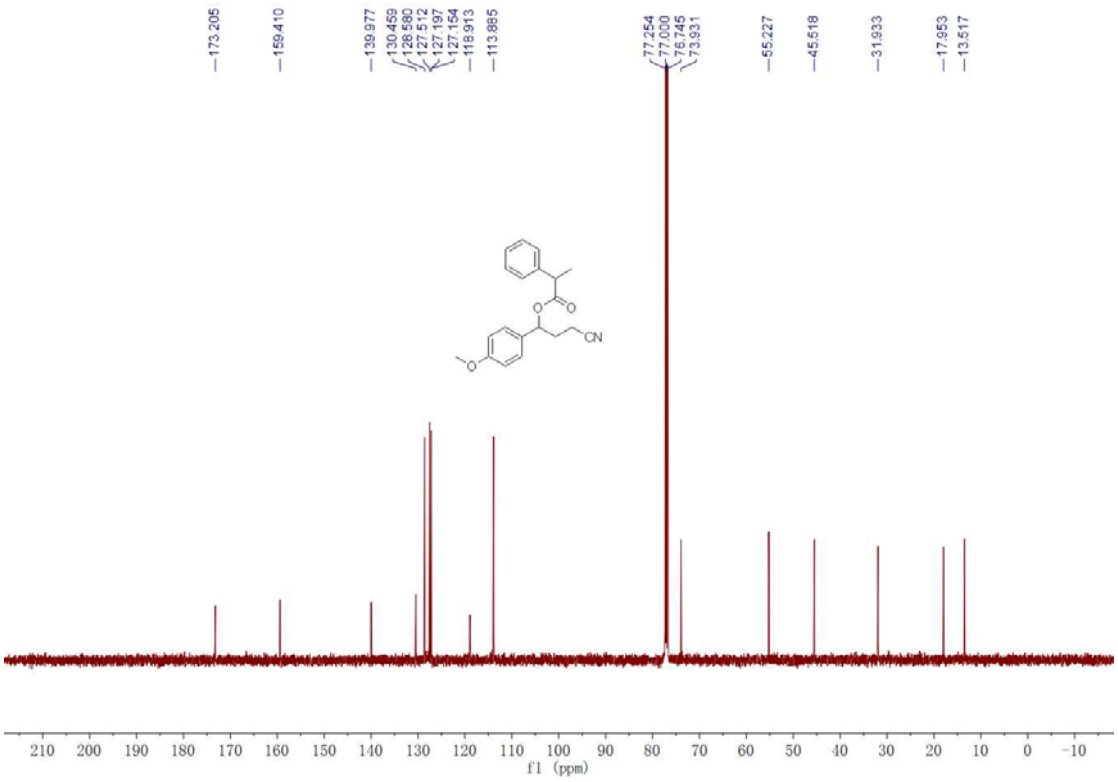
3-Cyano-1-(4-methoxyphenyl)propyl 2-phenylpropanoate (4ama)



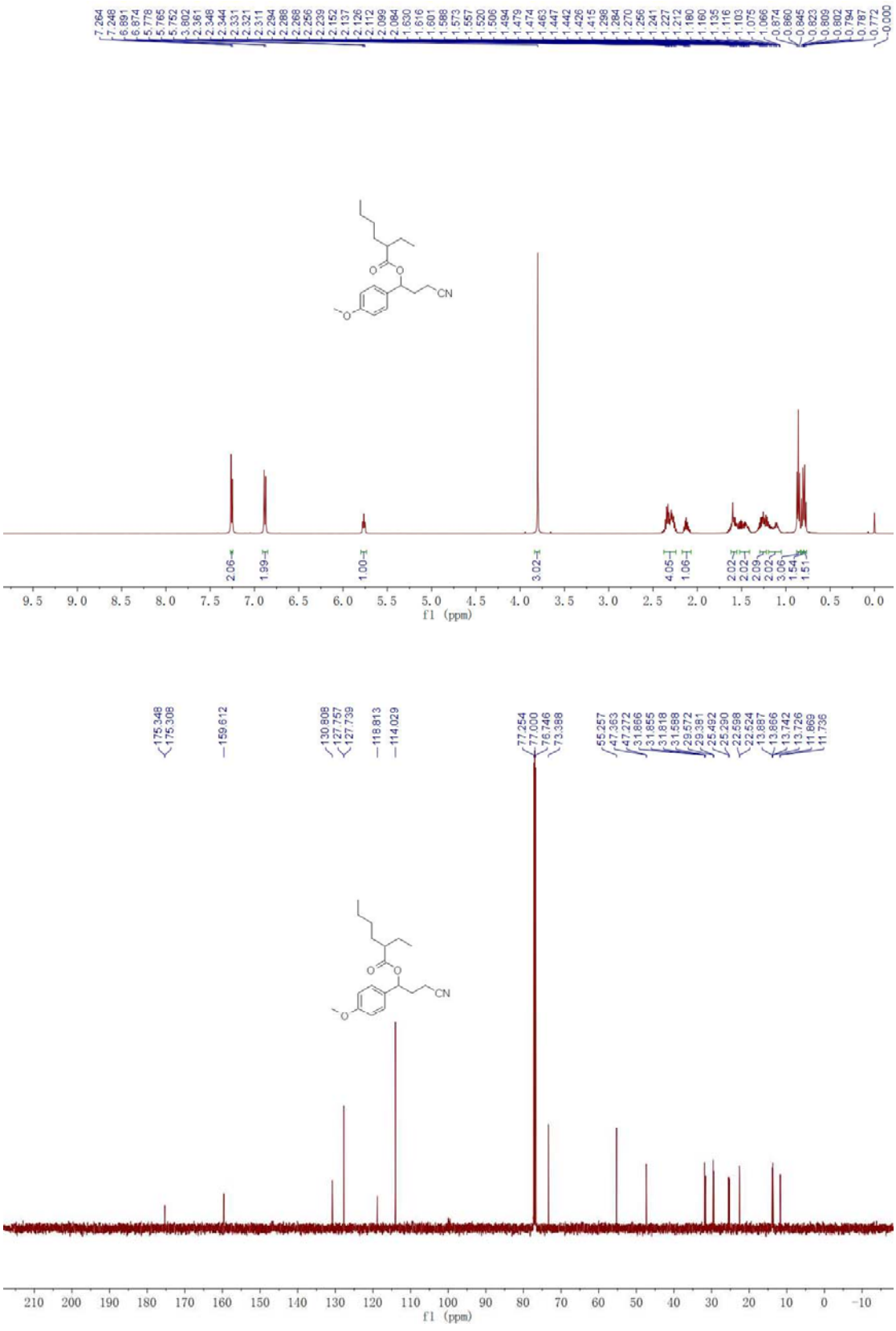


3-Cyano-1-(4-methoxyphenyl)propyl 2-phenylpropanoate (4ama)

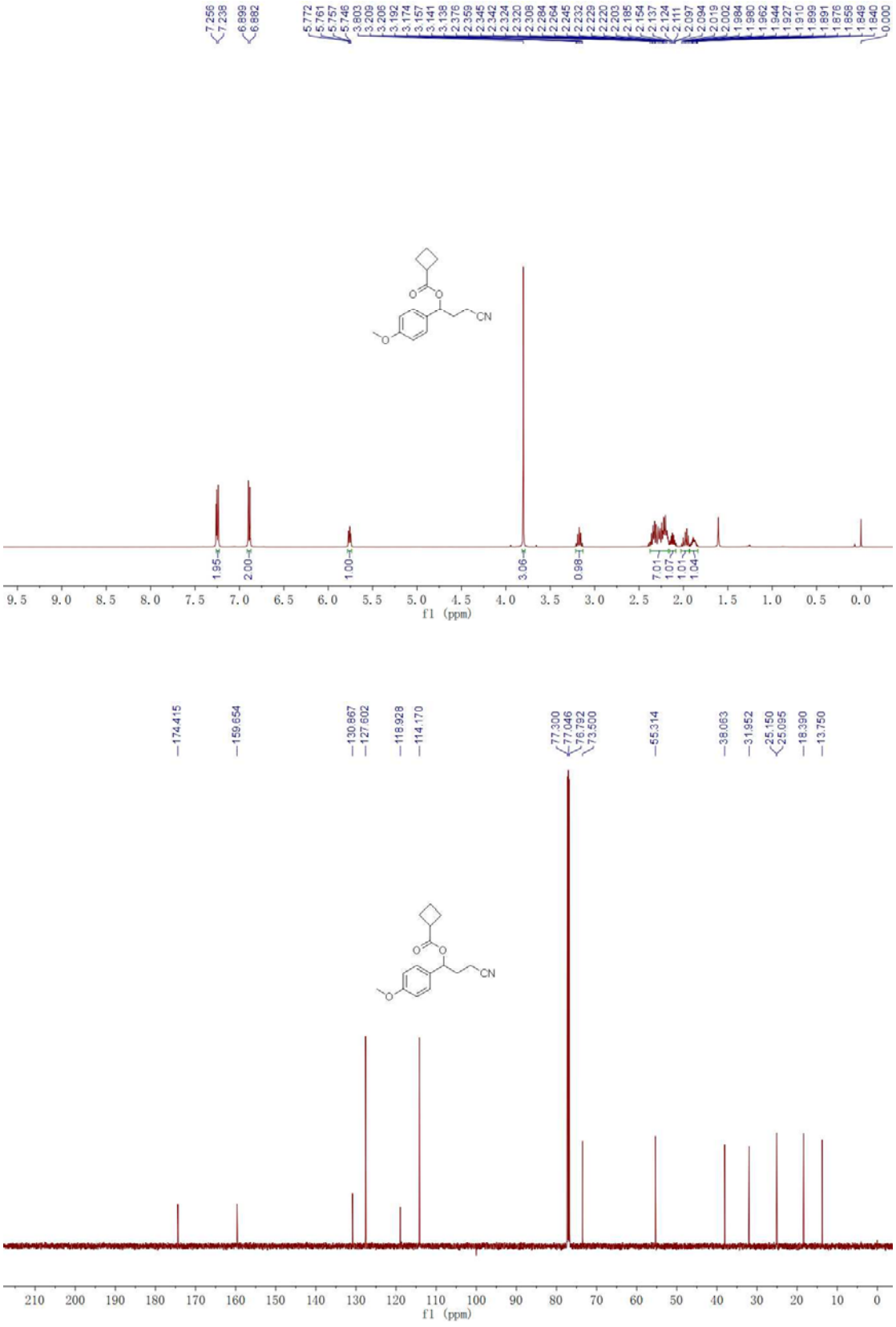




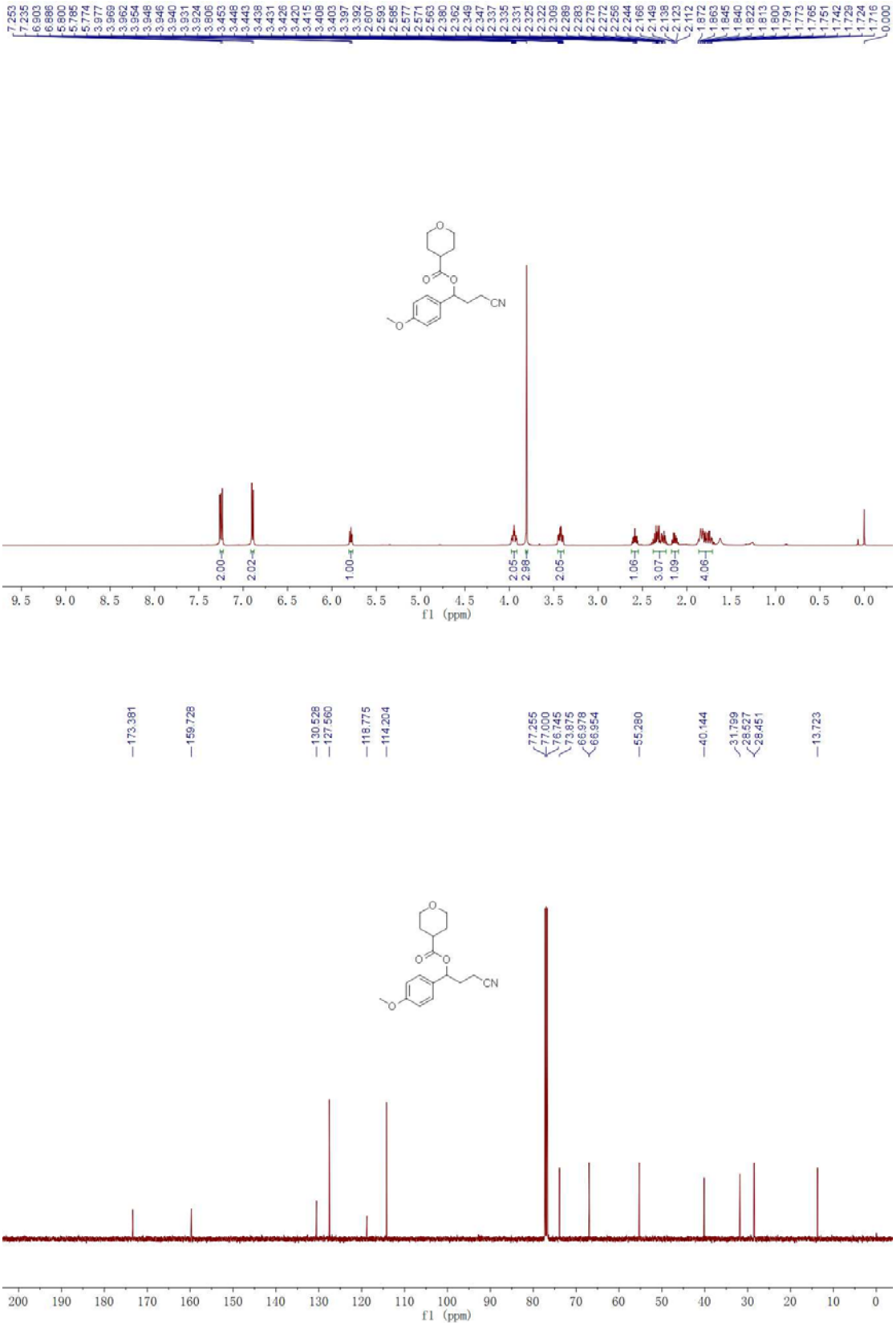
3-Cyano-1-(4-methoxyphenyl)propyl 2-ethylhexanoate (4ana)



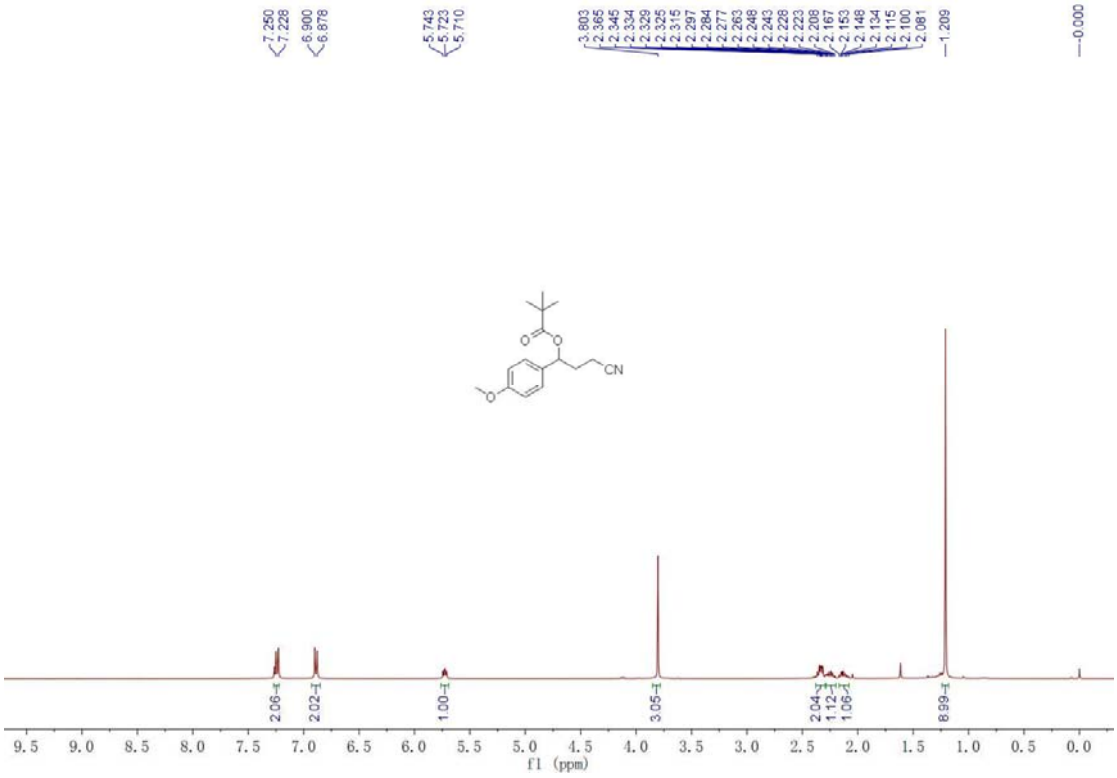
3-Cyno-1-(4-methoxyphenyl)propyl cyclobutanecarboxylate (4aoa)

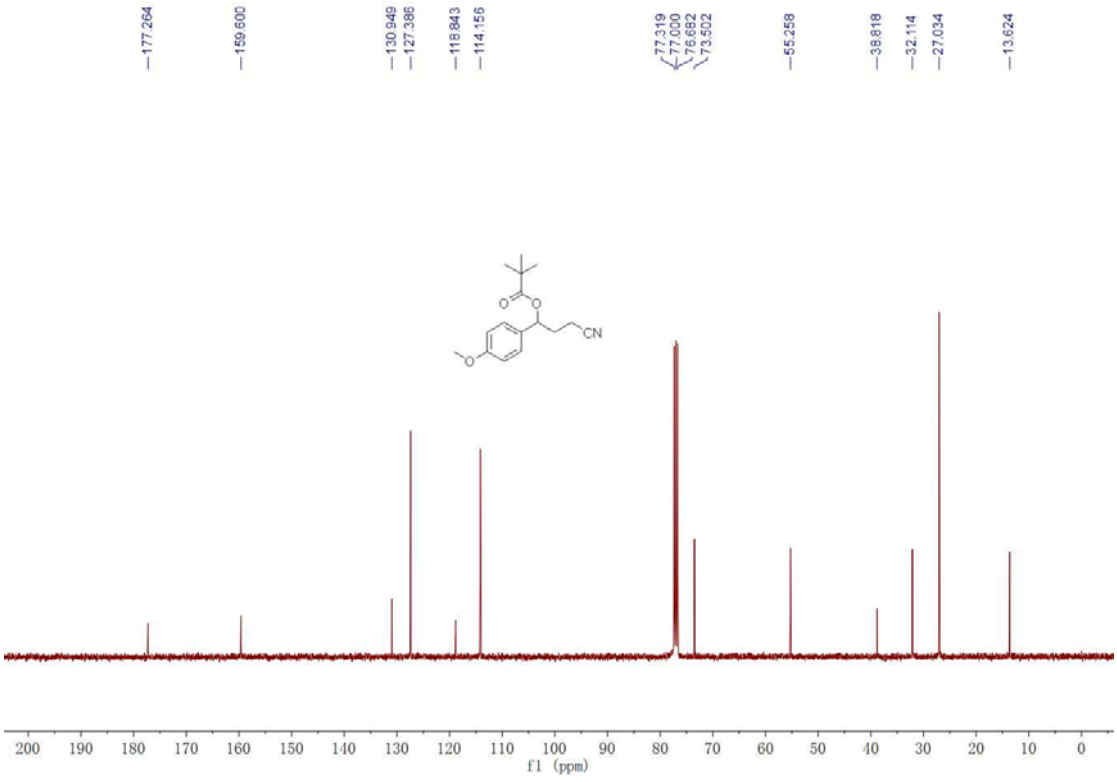


3-Cyano-1-(4-methoxyphenyl)propyl tetrahydro-2*H*-pyran-4-carboxylate (4apa)

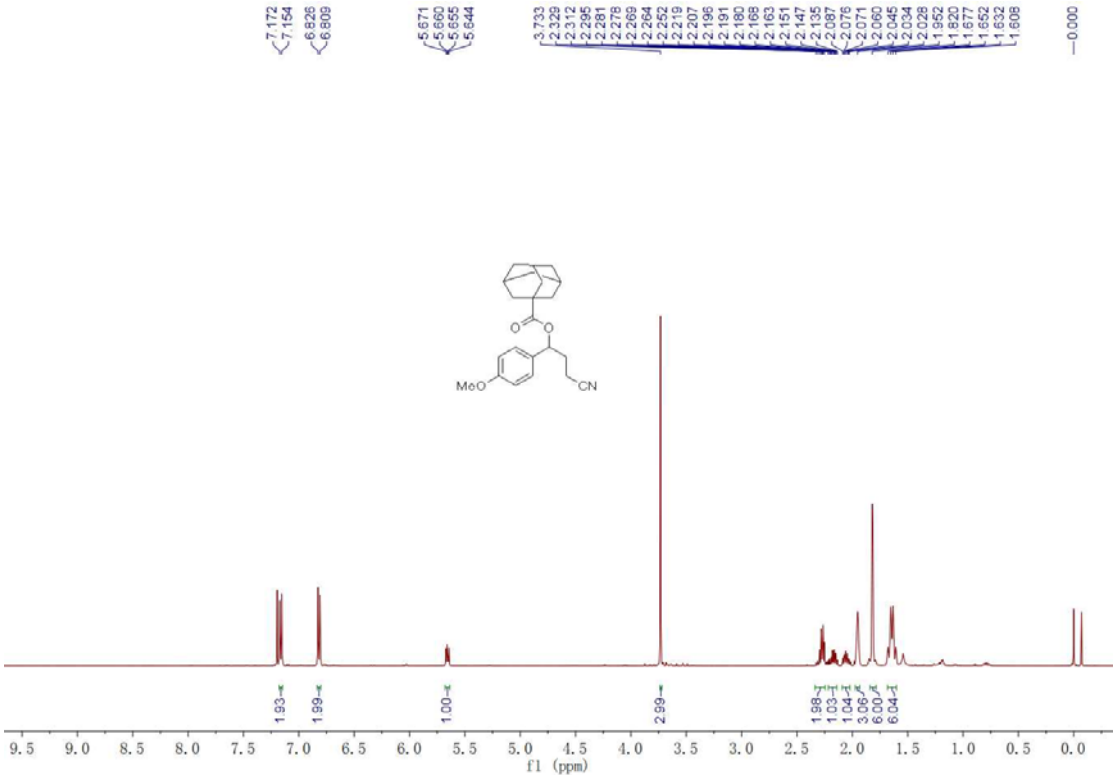


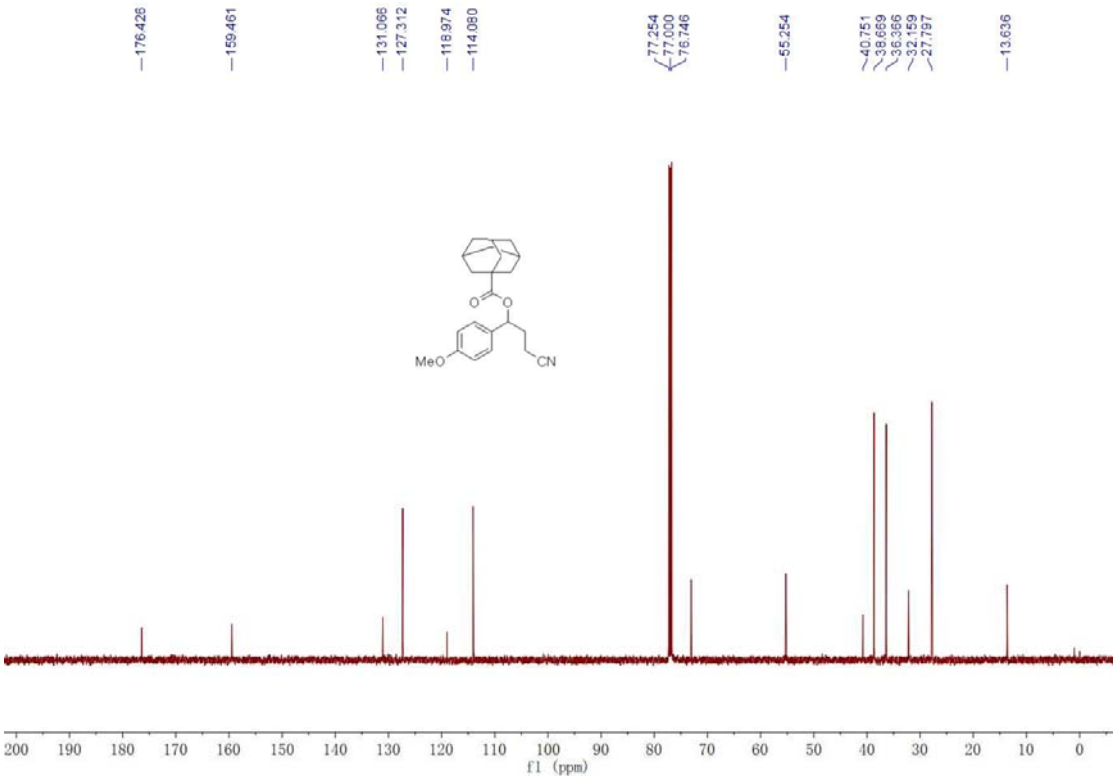
3-Cyano-1-(4-methoxyphenyl)propyl pivalate (4aqa)



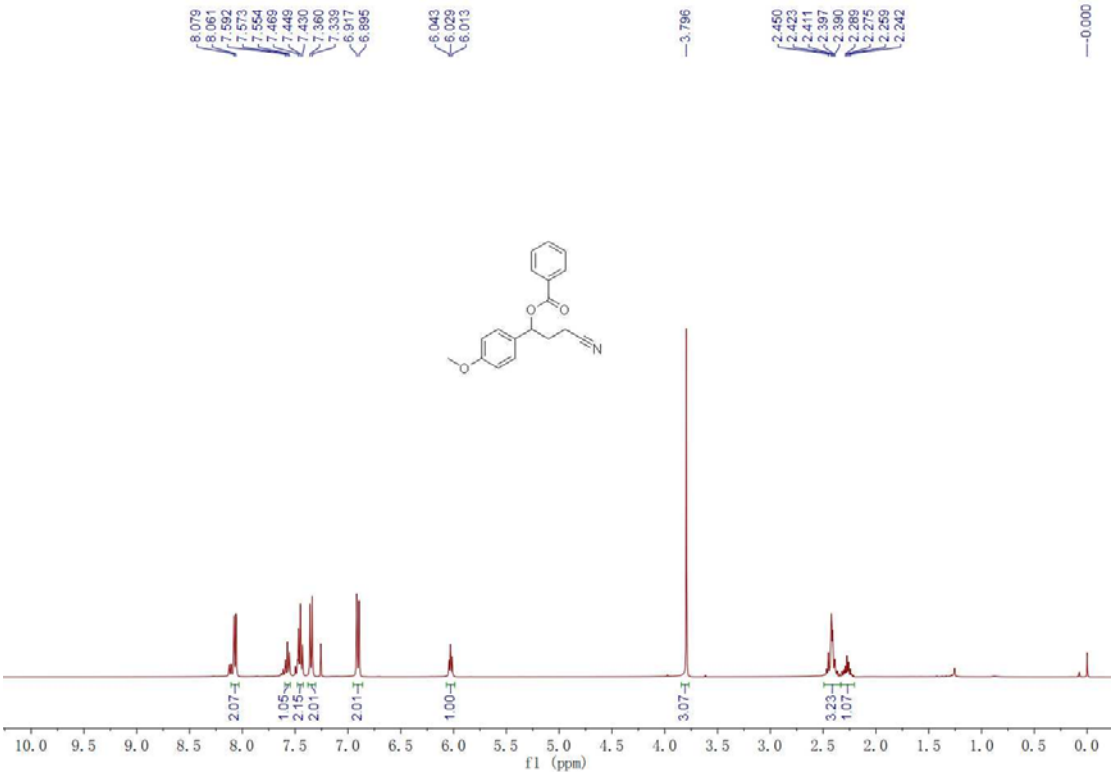


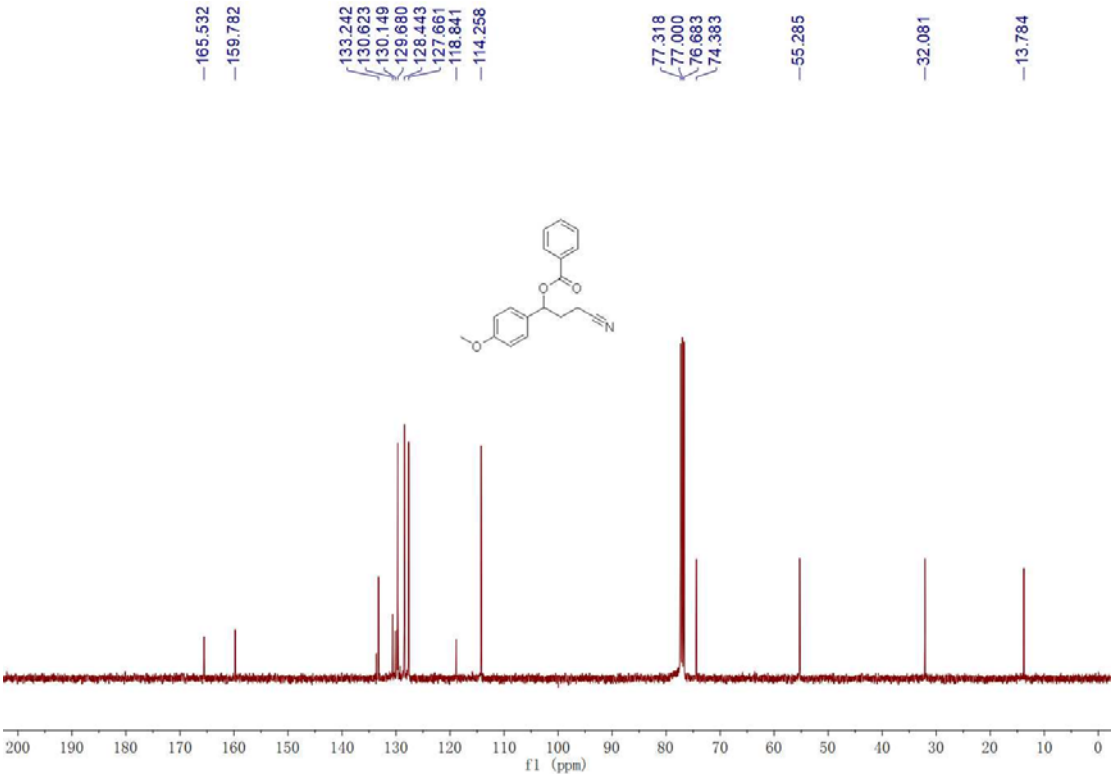
3-Cyano-1-(4-methoxyphenyl)propyl adamantane-1-carboxylate (4ara)



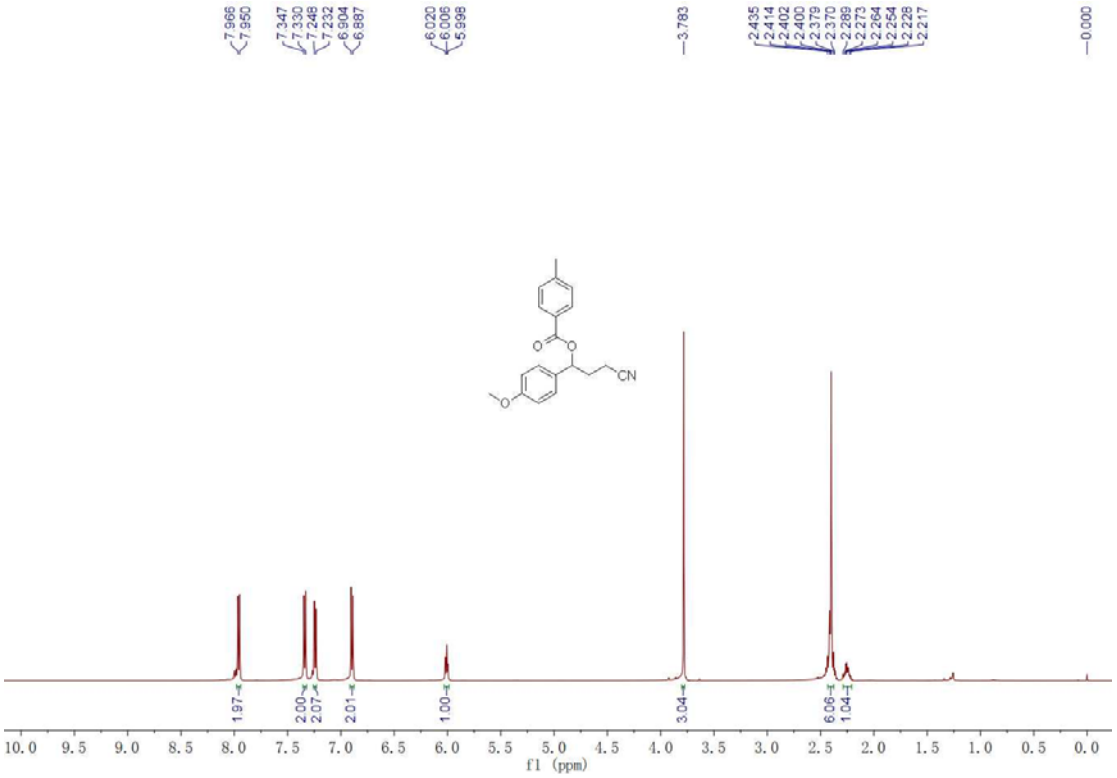


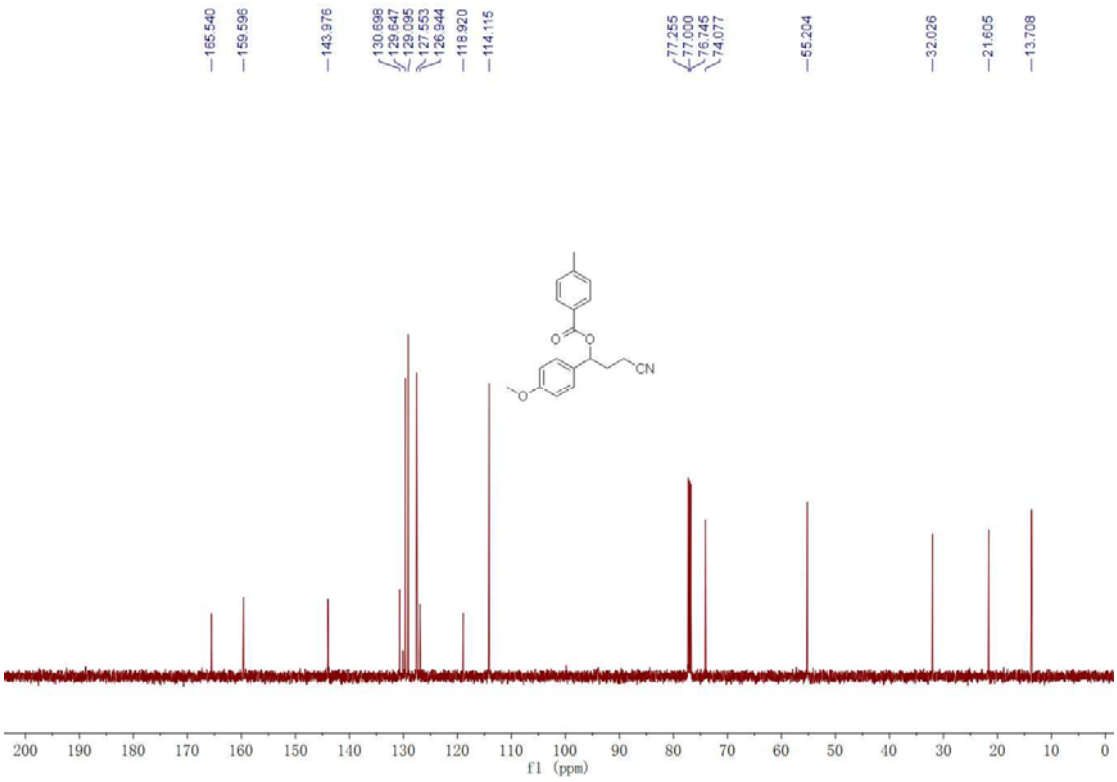
3-Cyano-1-(4-methoxyphenyl)propyl benzoate (4asa)



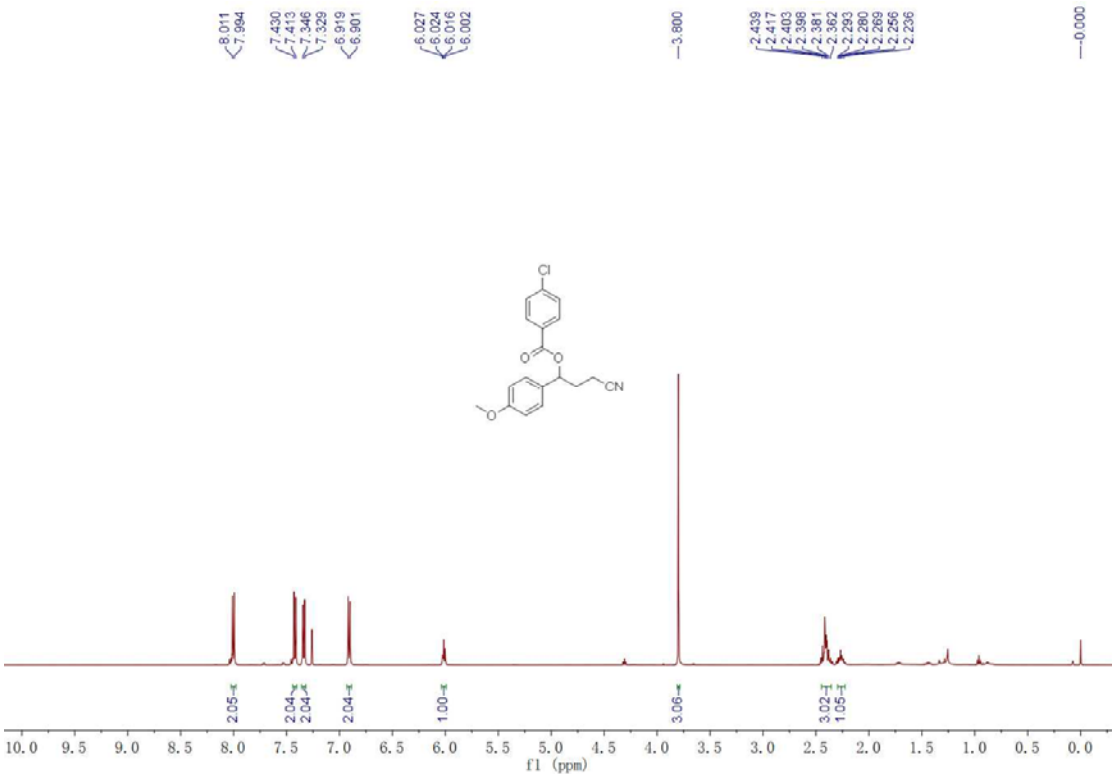


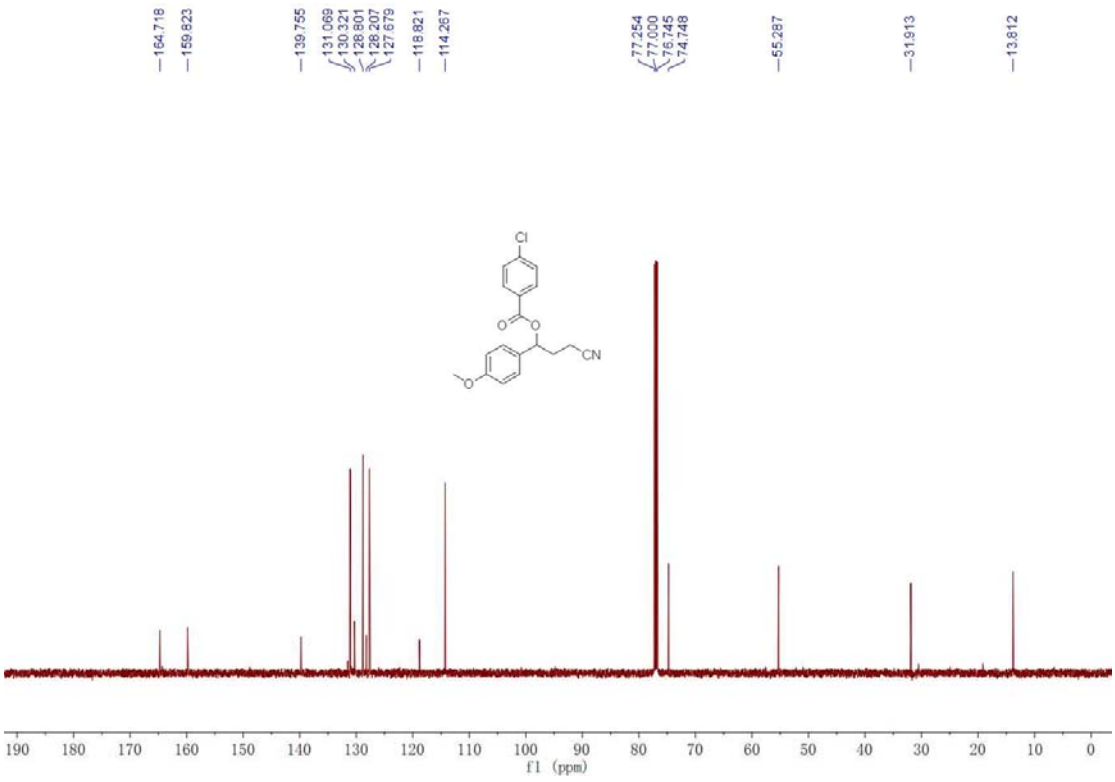
3-Cyano-1-(4-methoxyphenyl)propyl 4-methylbenzoate (4ata)



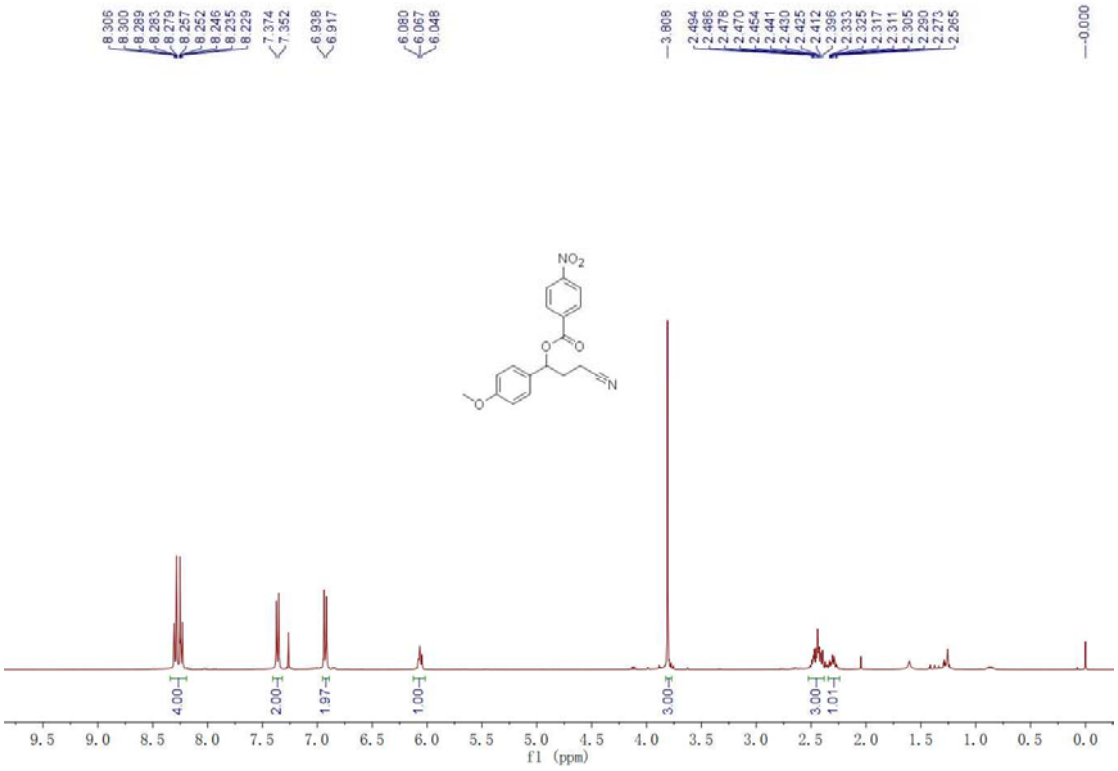


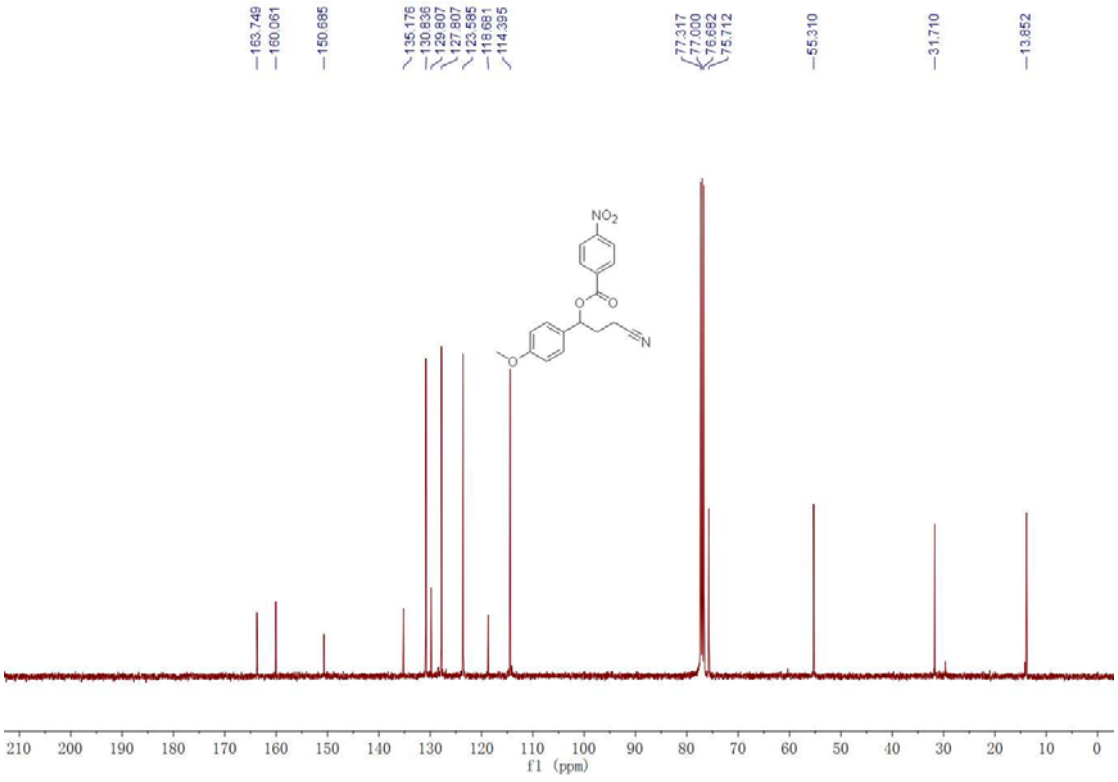
3-Cyano-1-(4-methoxyphenyl)propyl 4-chlorobenzoate (4aua)



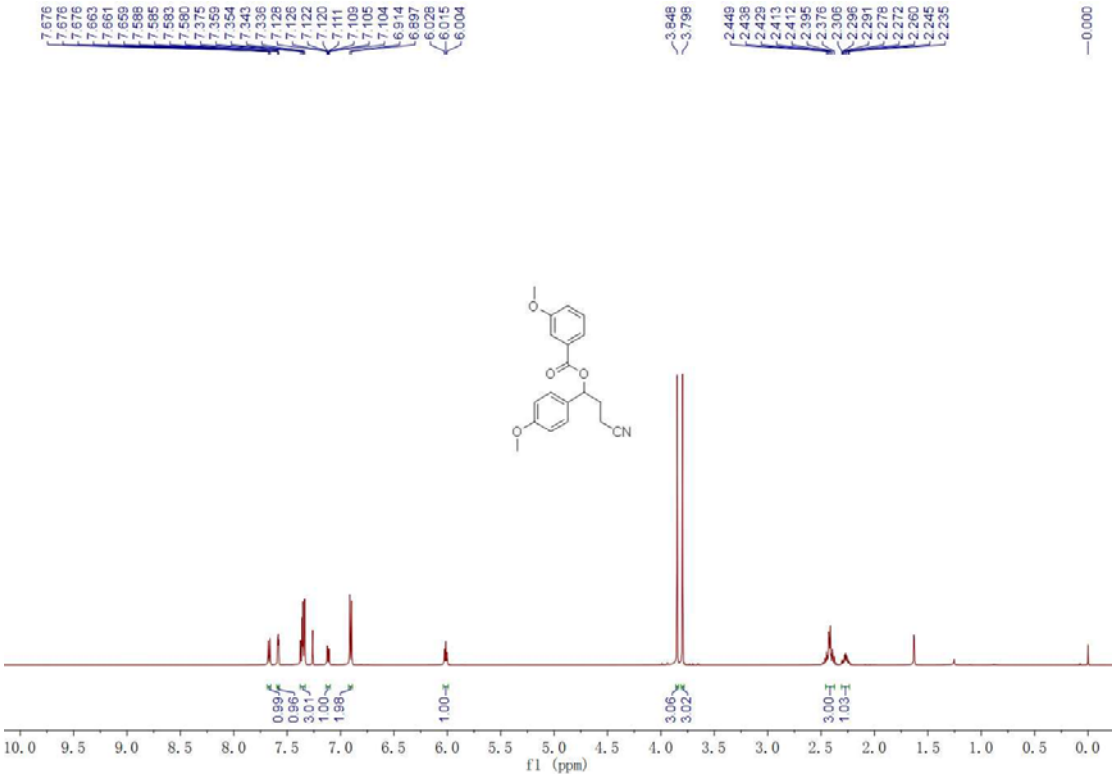


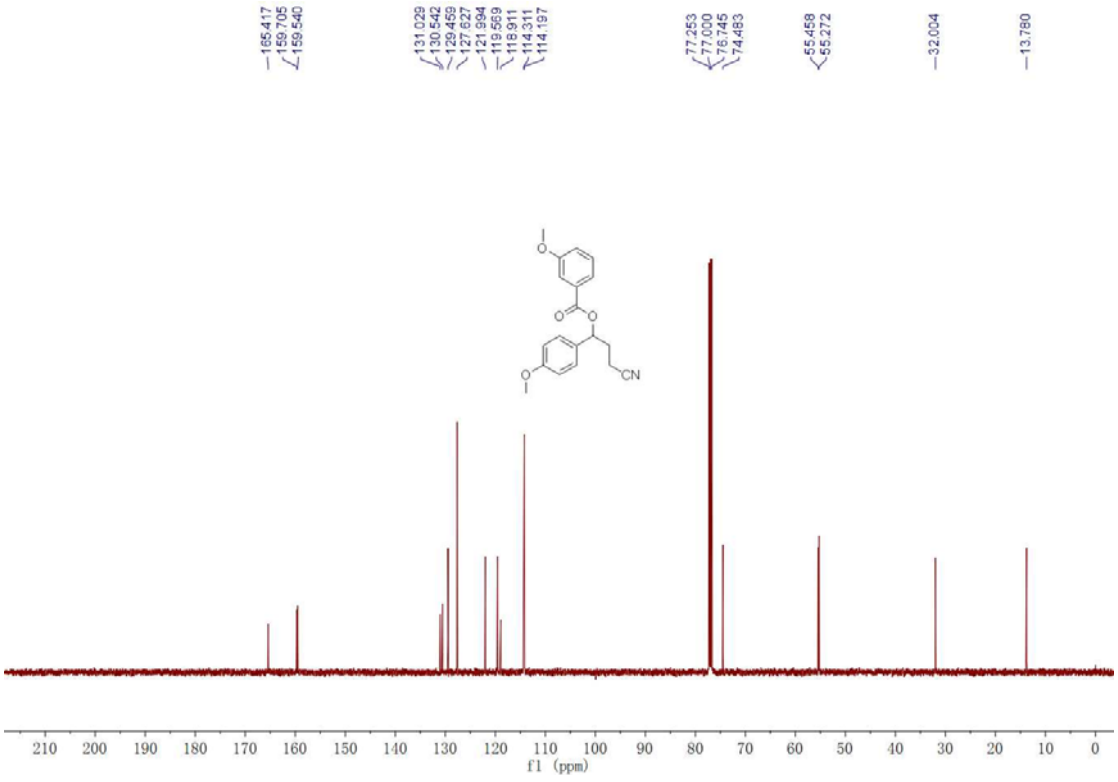
3-Cyano-1-(4-methoxyphenyl)propyl 4-nitrobenzoate (4ava)



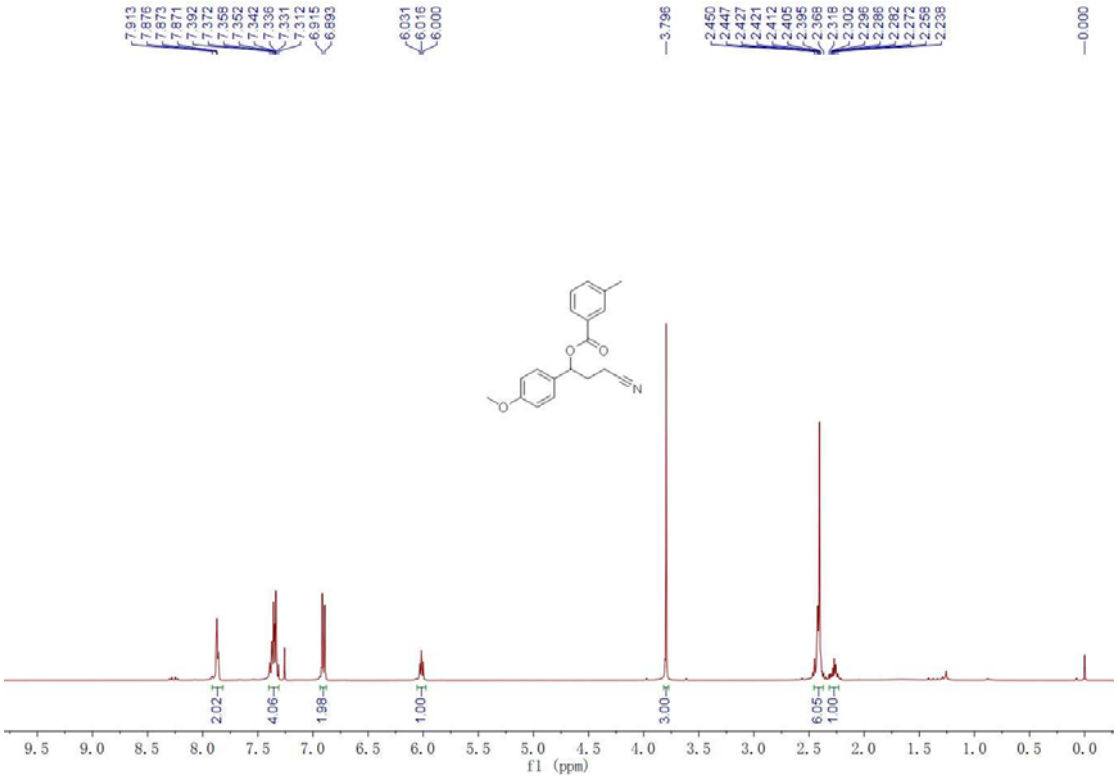


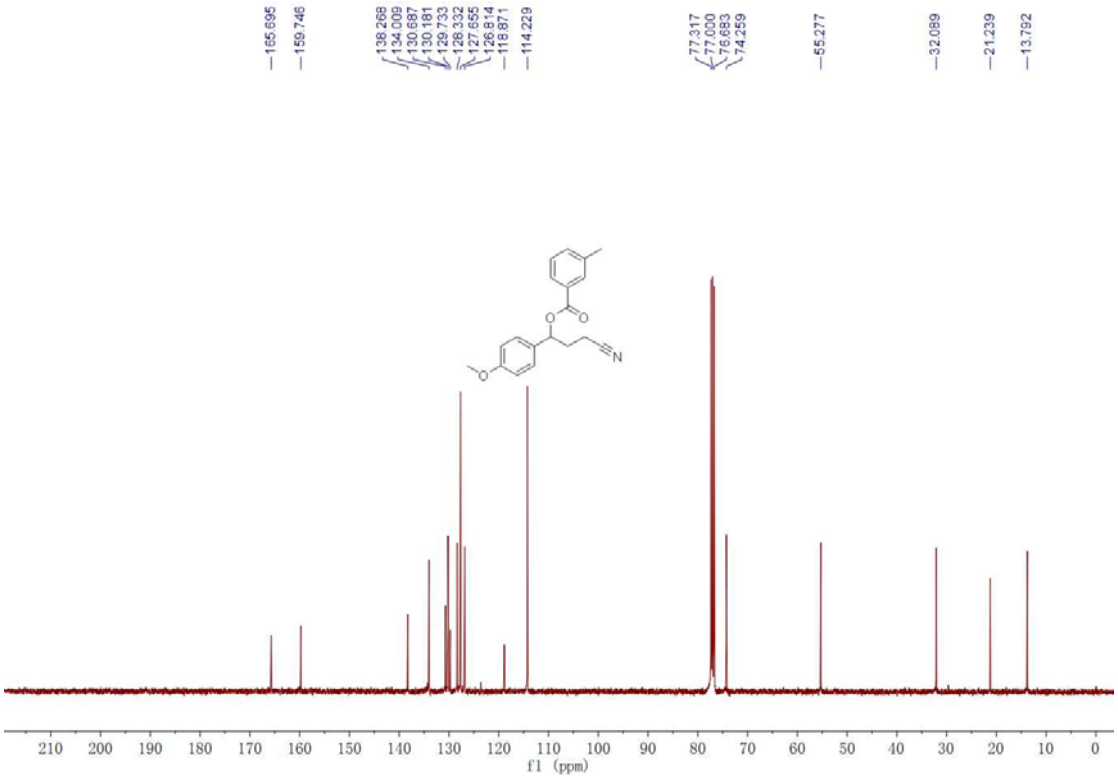
3-Cyano-1-(4-methoxyphenyl)propyl 3-methoxybenzoate (4awa)



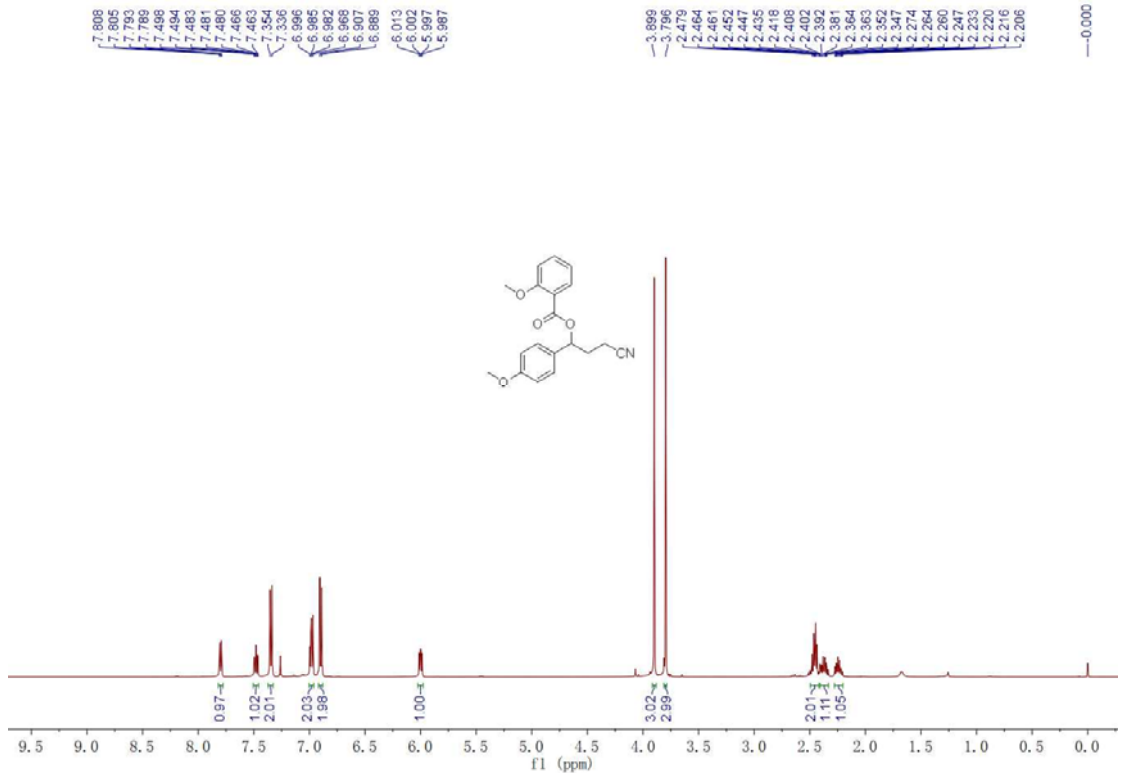


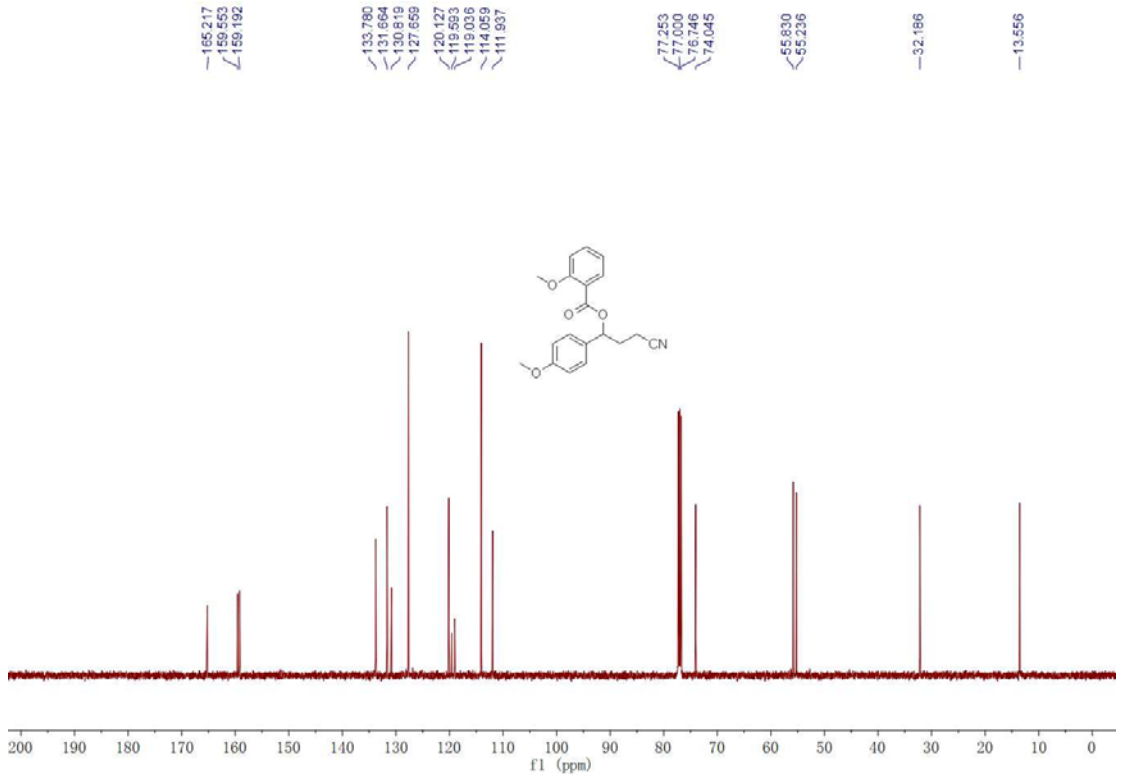
3-Cyano-1-(4-methoxyphenyl)propyl 3-methylbenzoate (4axa)



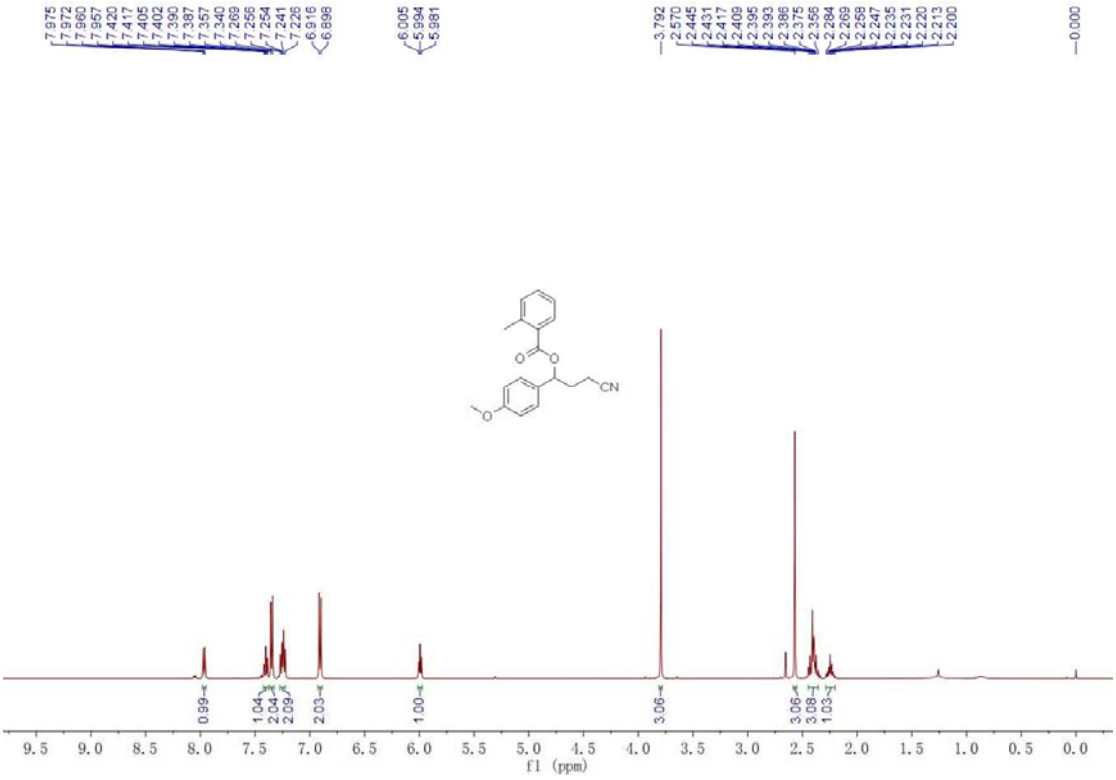


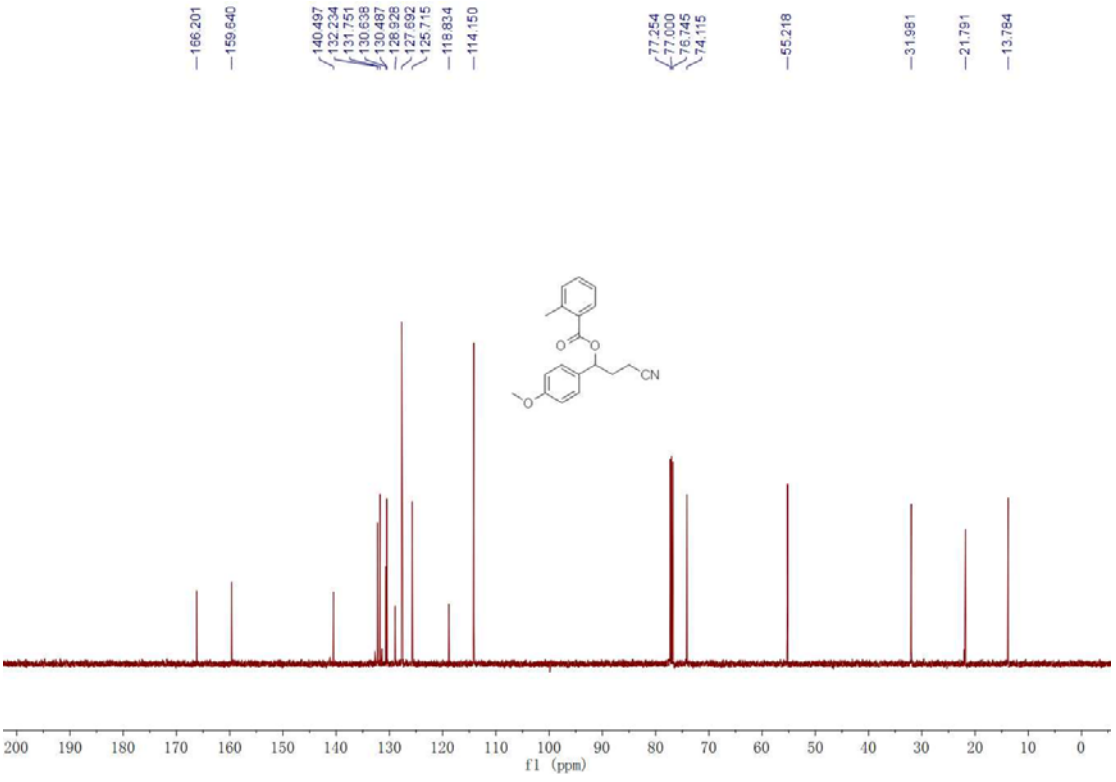
3-Cyano-1-(4-methoxyphenyl)propyl 2-methoxybenzoate (4aya)



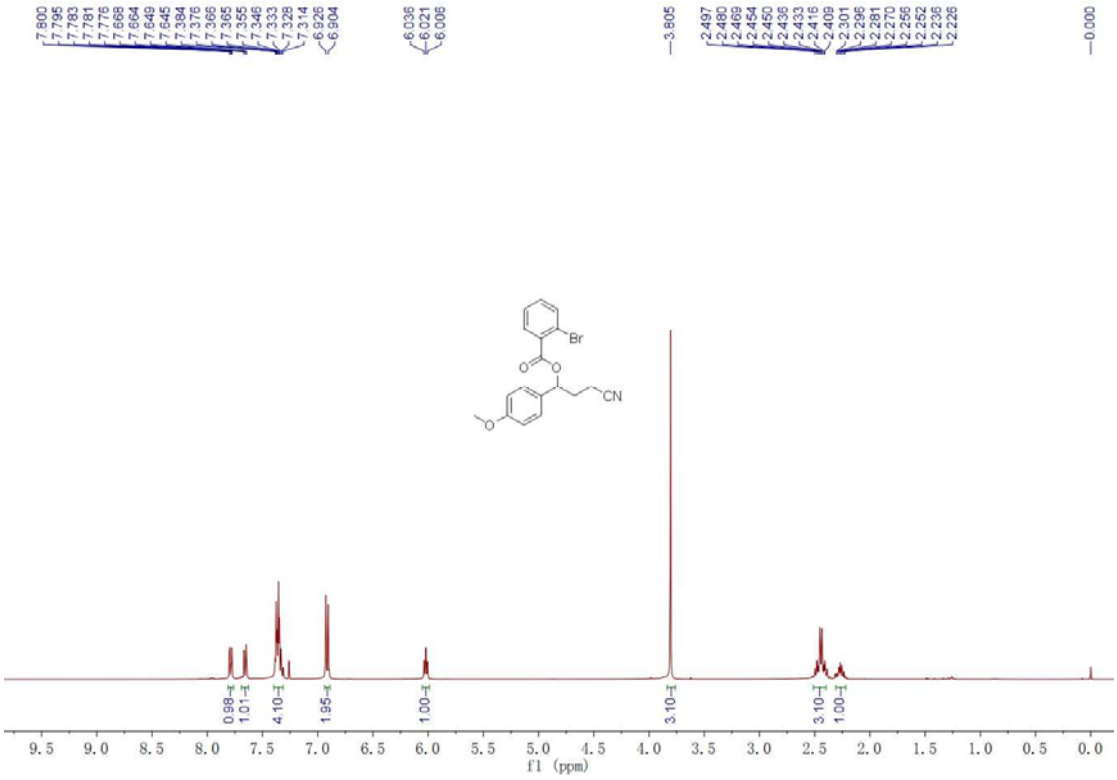


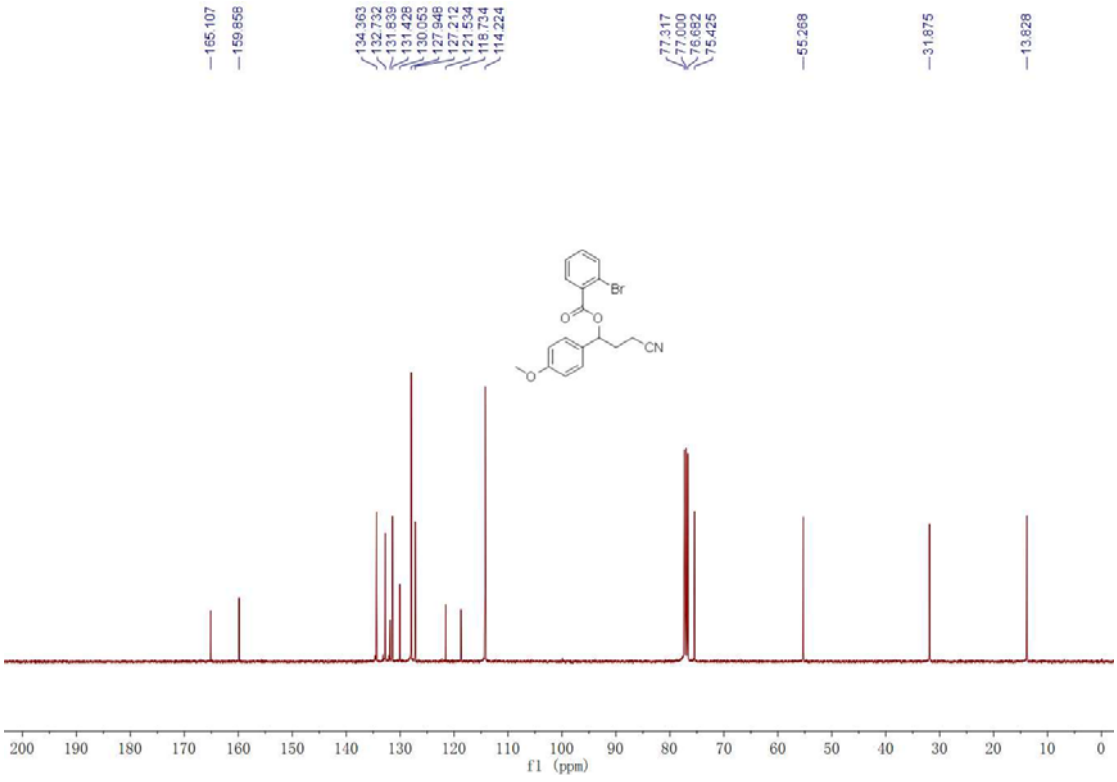
3-Cyano-1-(4-methoxyphenyl)propyl 2-methylbenzoate (4aza)



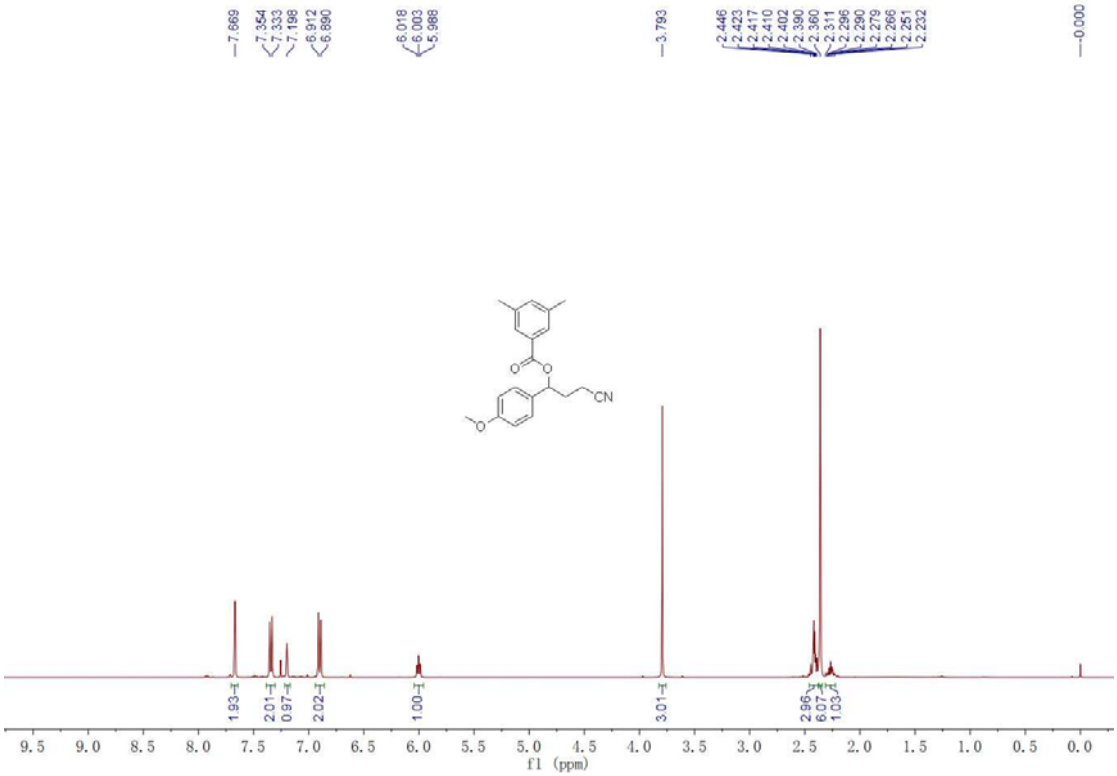


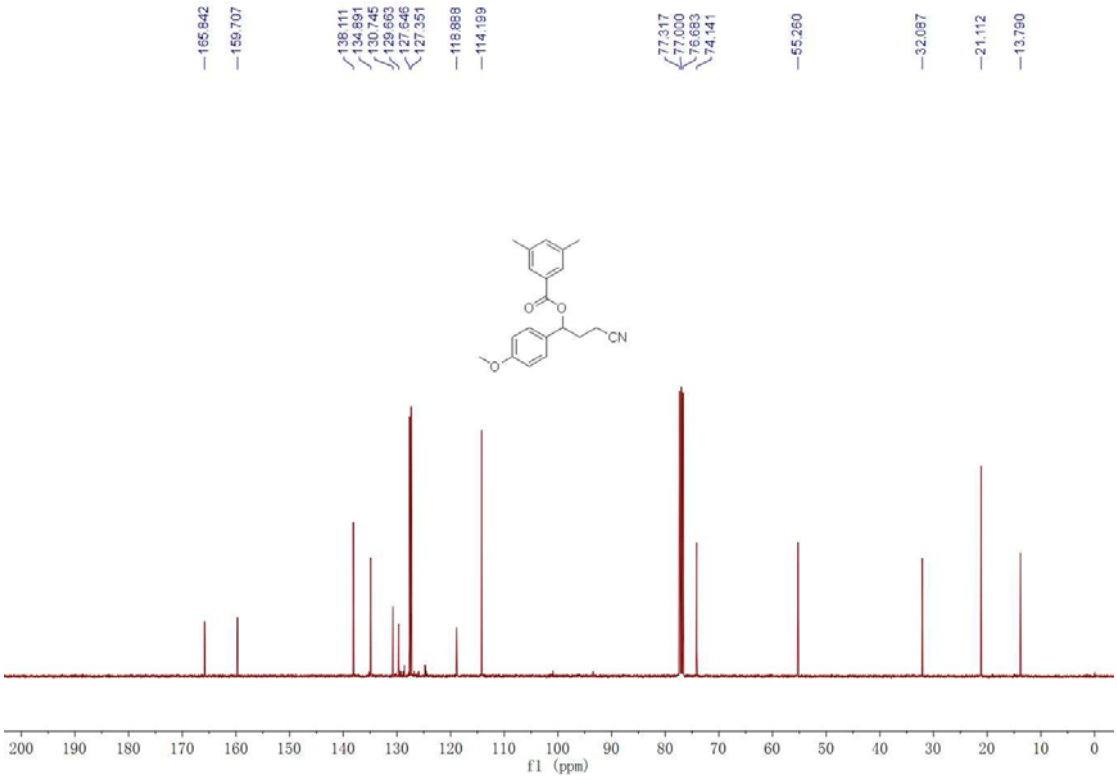
3-Cyano-1-(4-methoxyphenyl)propyl 2-bromobenzoate (4aAa)



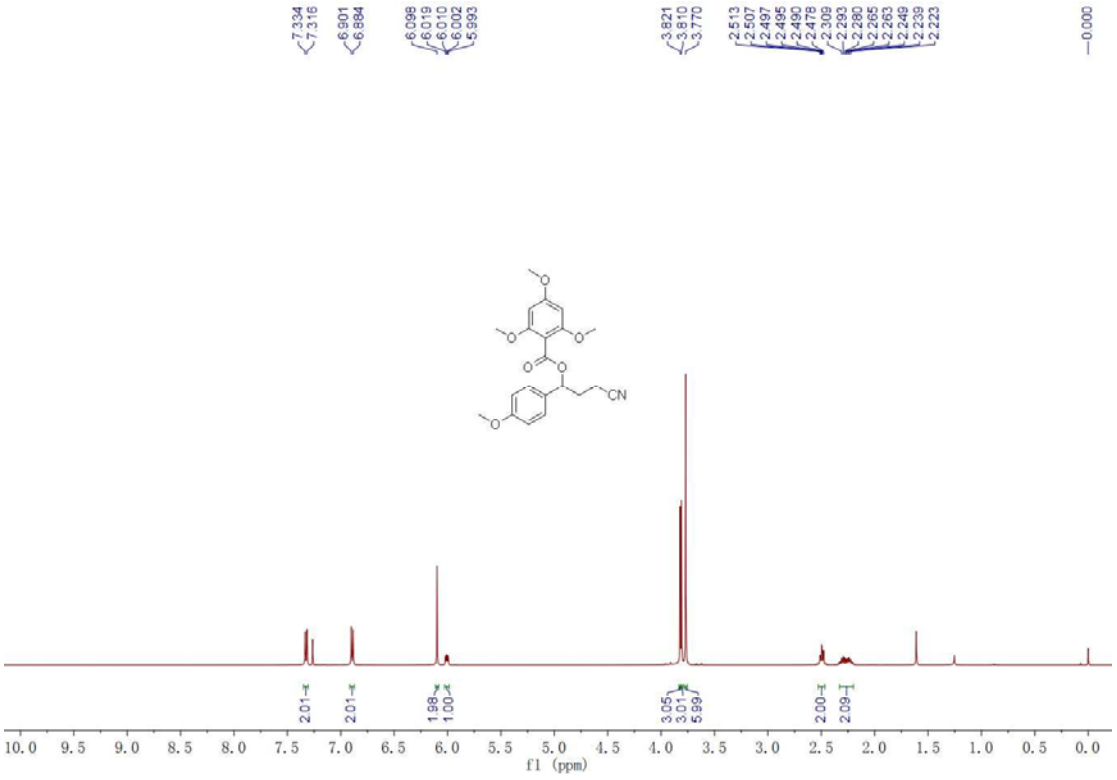


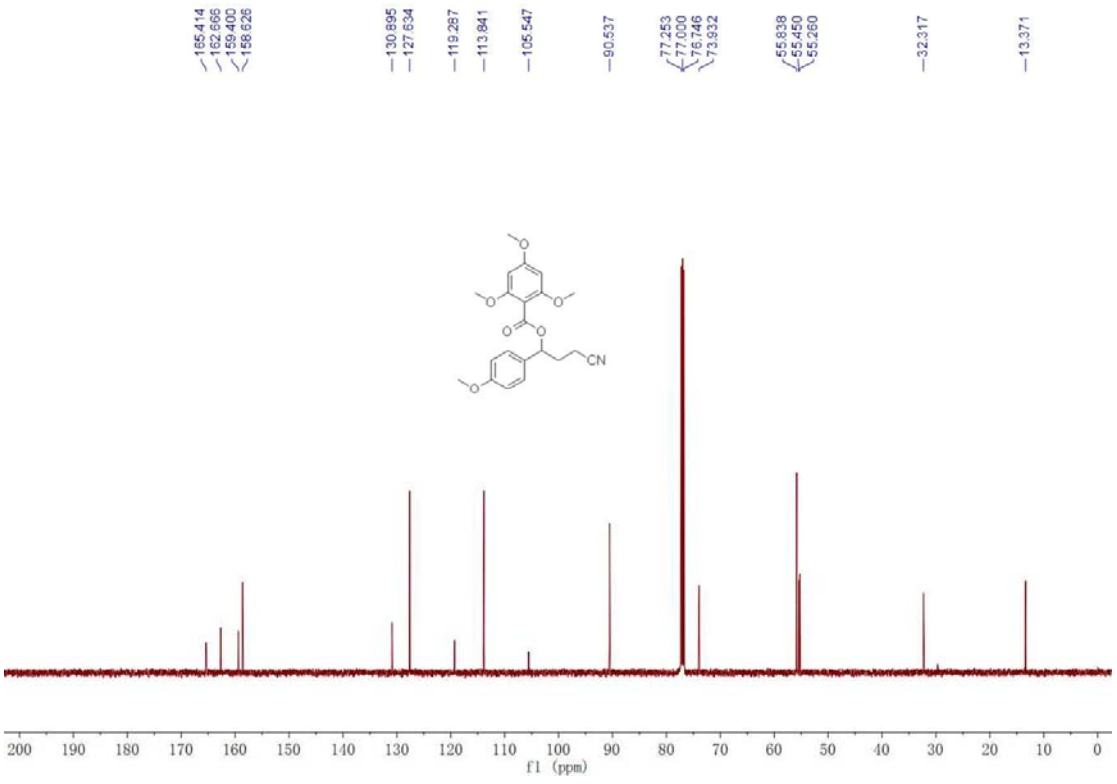
3-Cyano-1-(4-methoxyphenyl)propyl 3,5-dimethylbenzoate (4aBa)



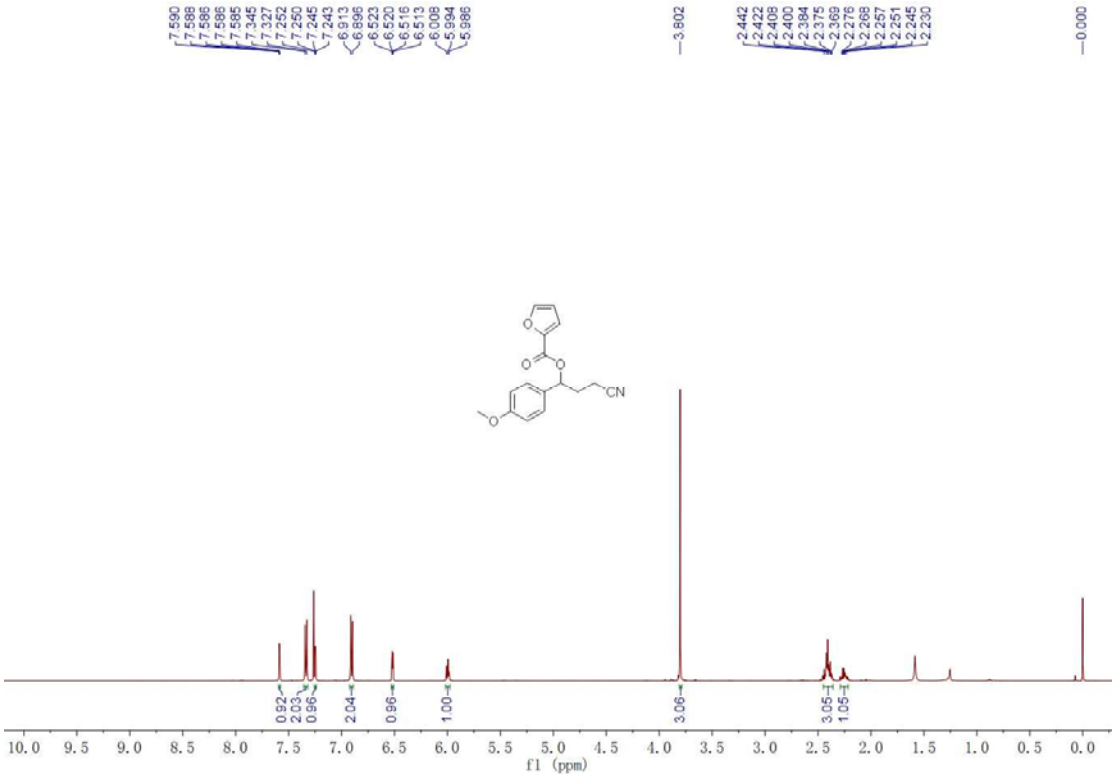


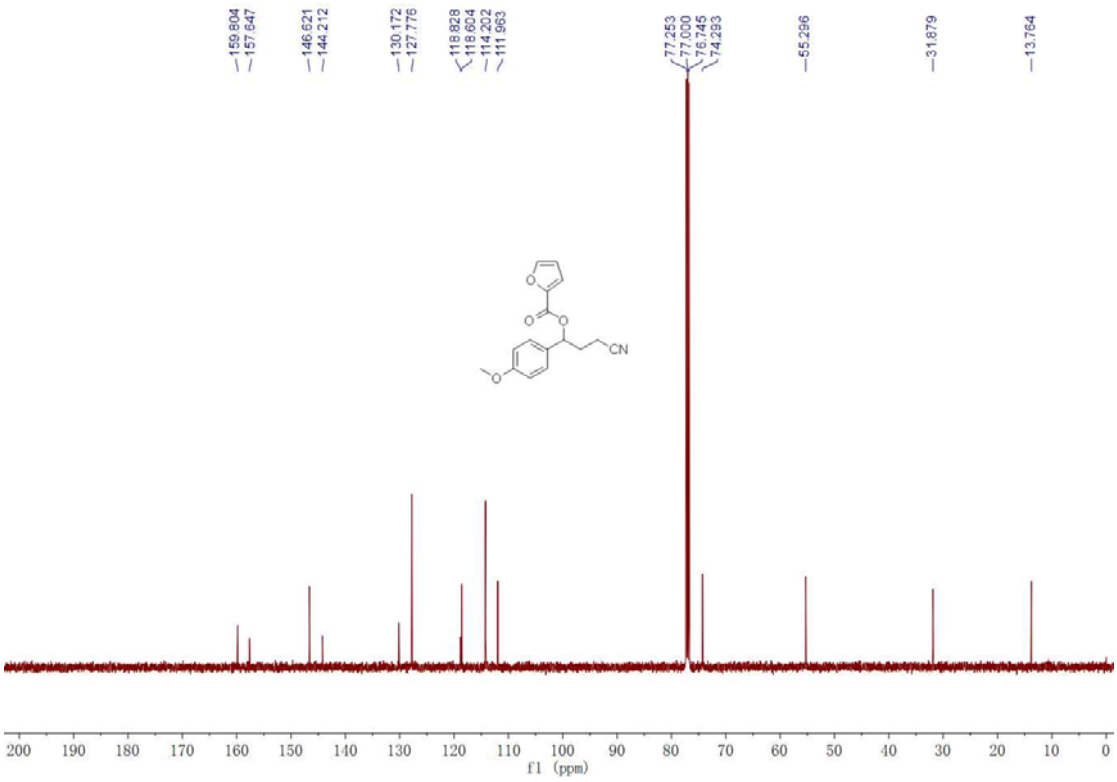
3-Cyano-1-(4-methoxyphenyl)propyl 2,4,6-trimethoxybenzoate (4aCa)



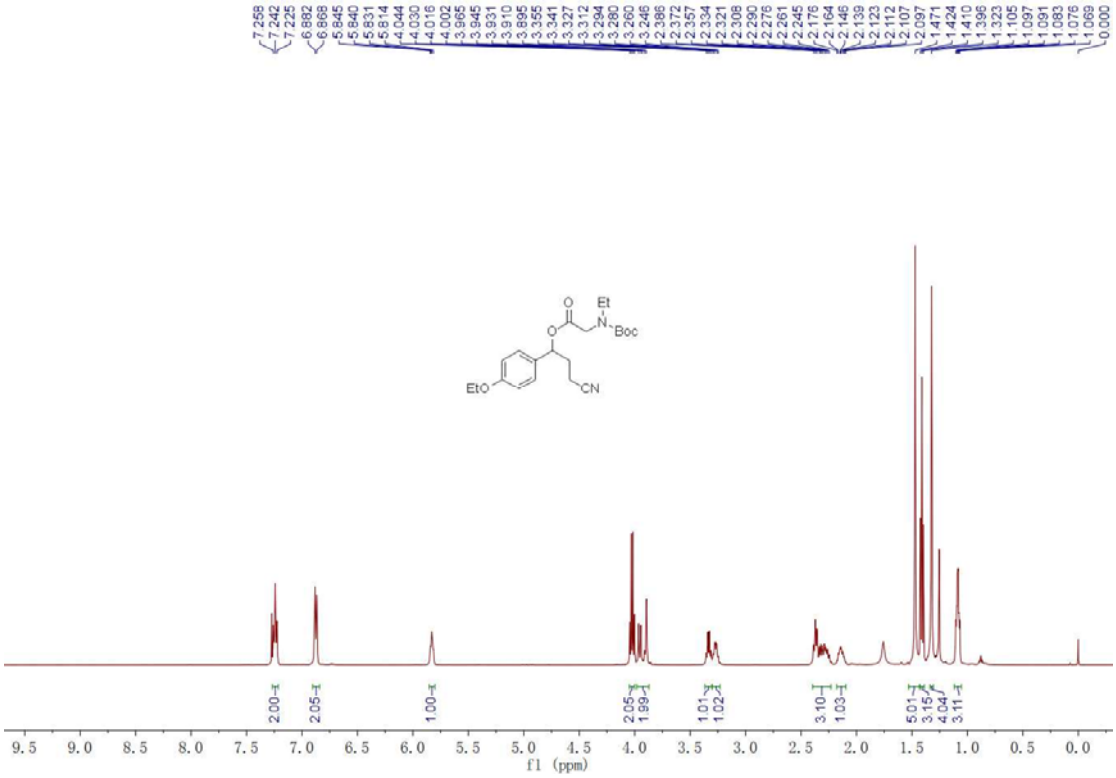


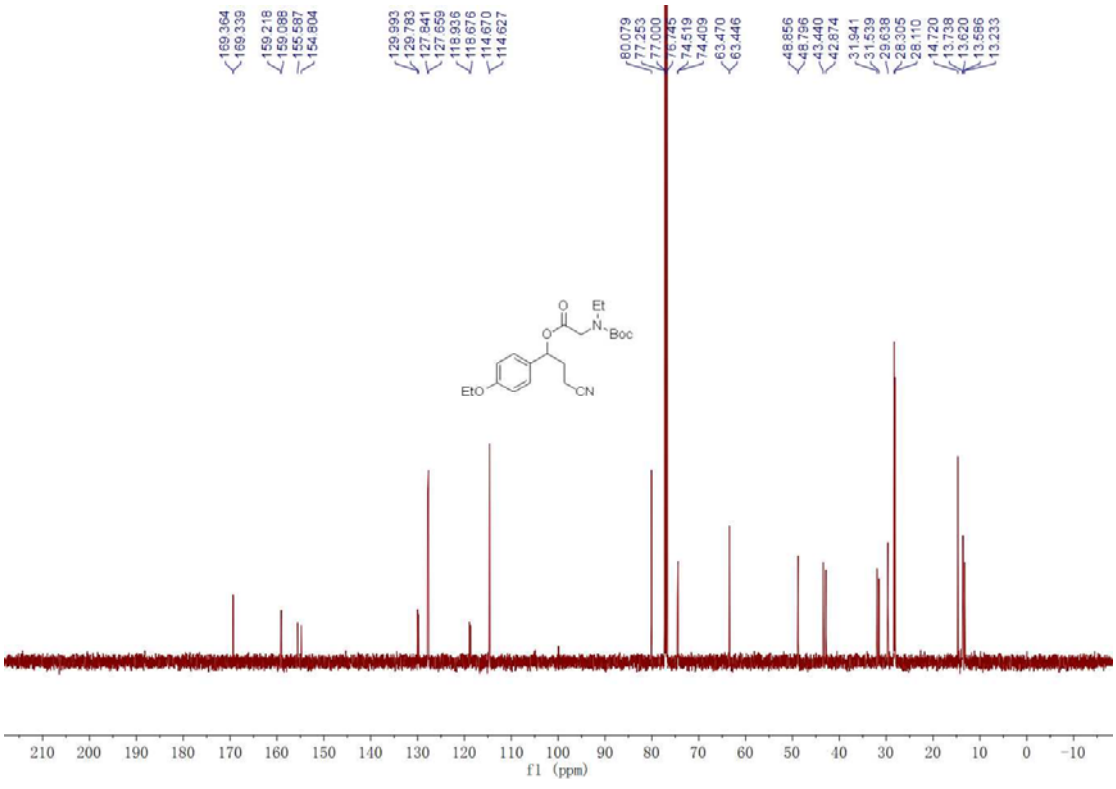
3-Cyano-1-(4-methoxyphenyl)propyl furan-2-carboxylate (4aDa)



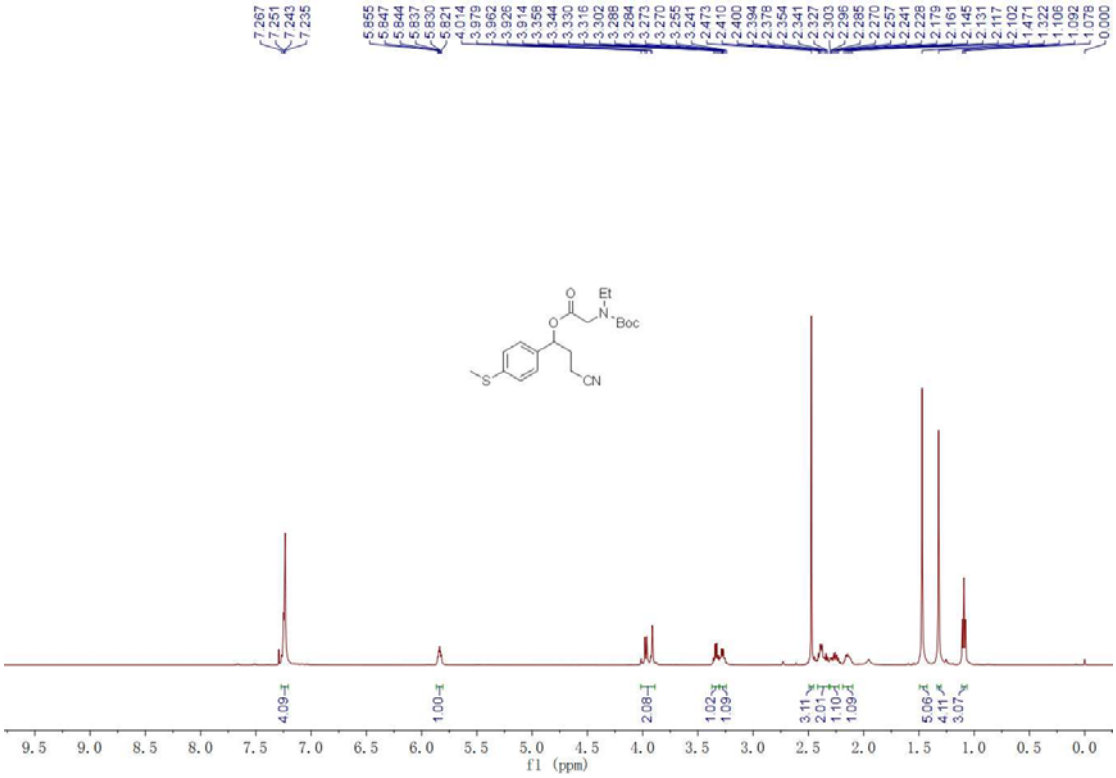


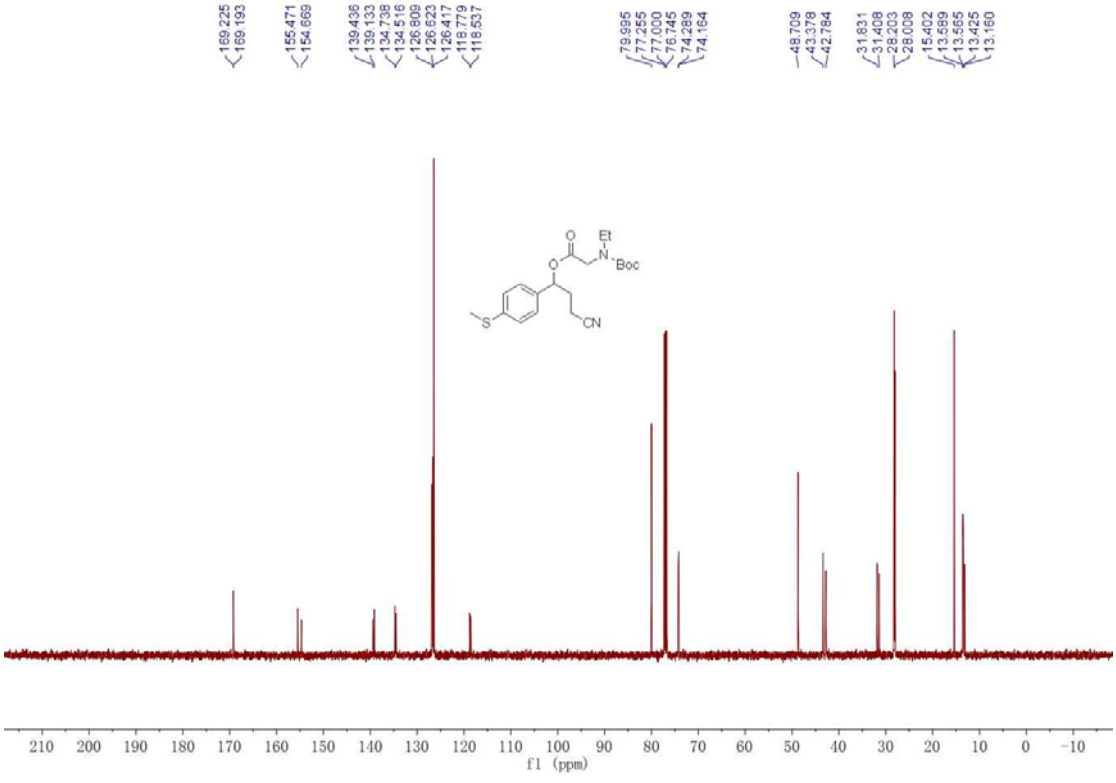
3-Cyano-1-(4-ethoxyphenyl)propyl *N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4baa)



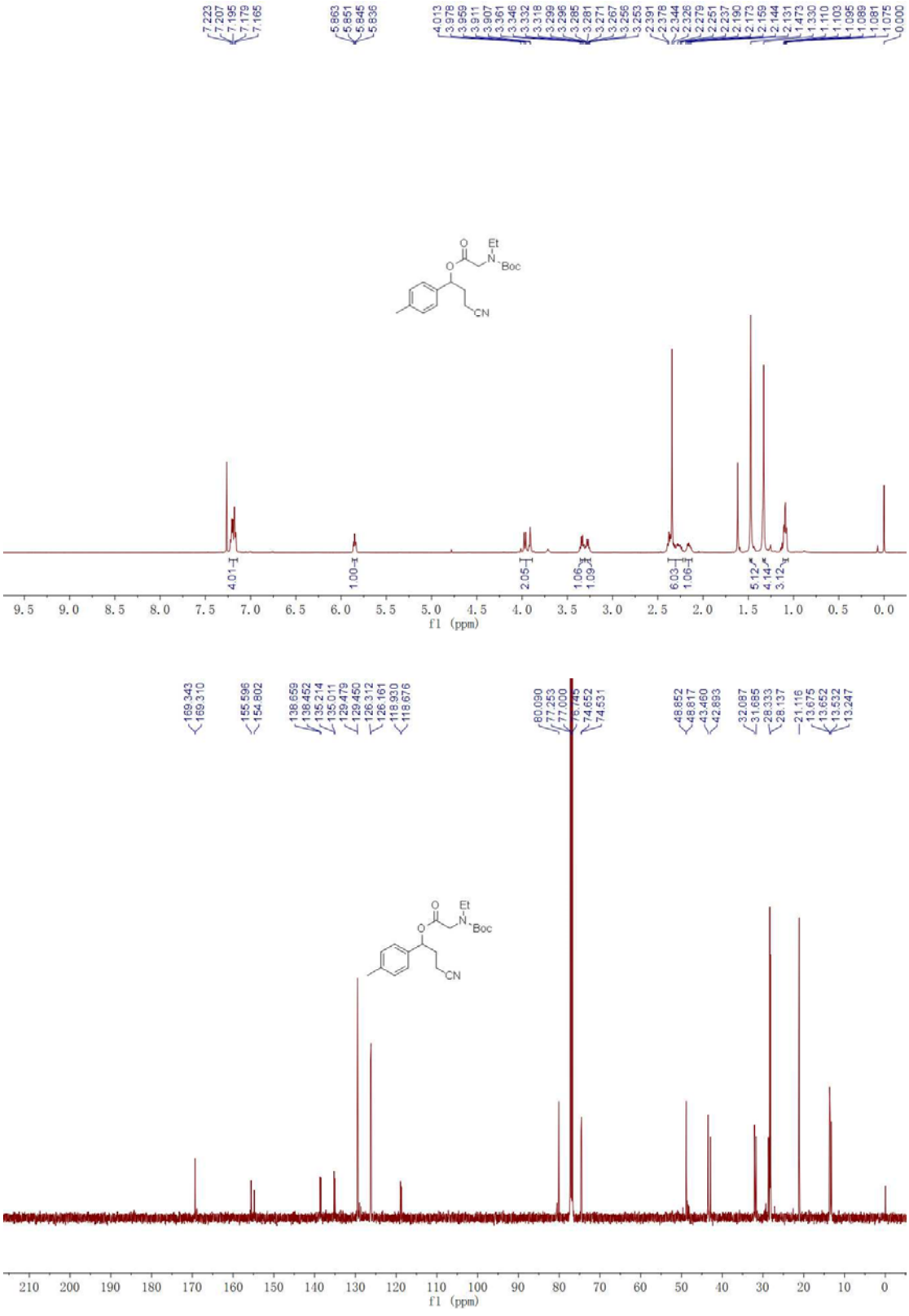


3-Cyano-1-(4-(methylthio)phenyl)propyl*N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4caa)

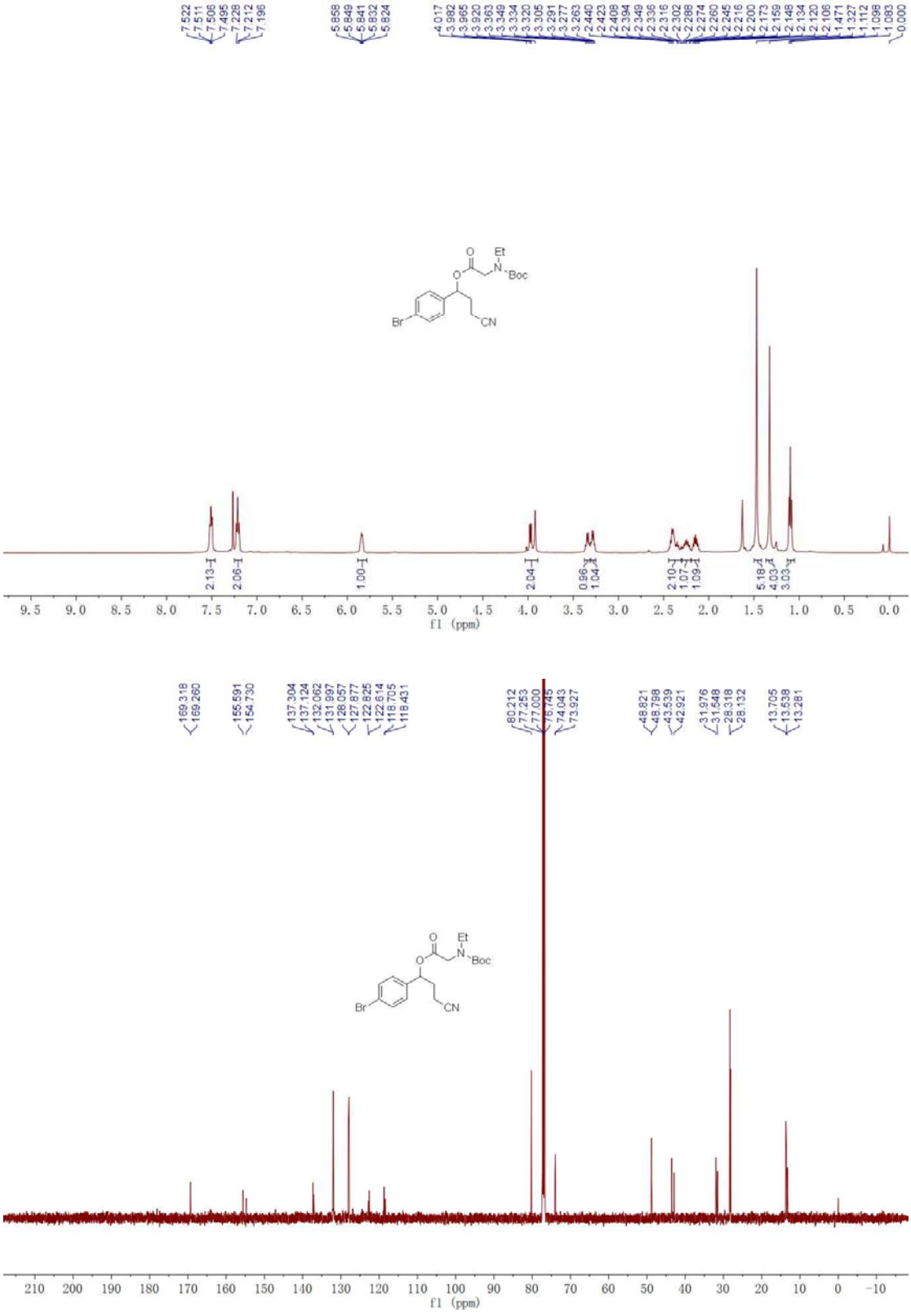




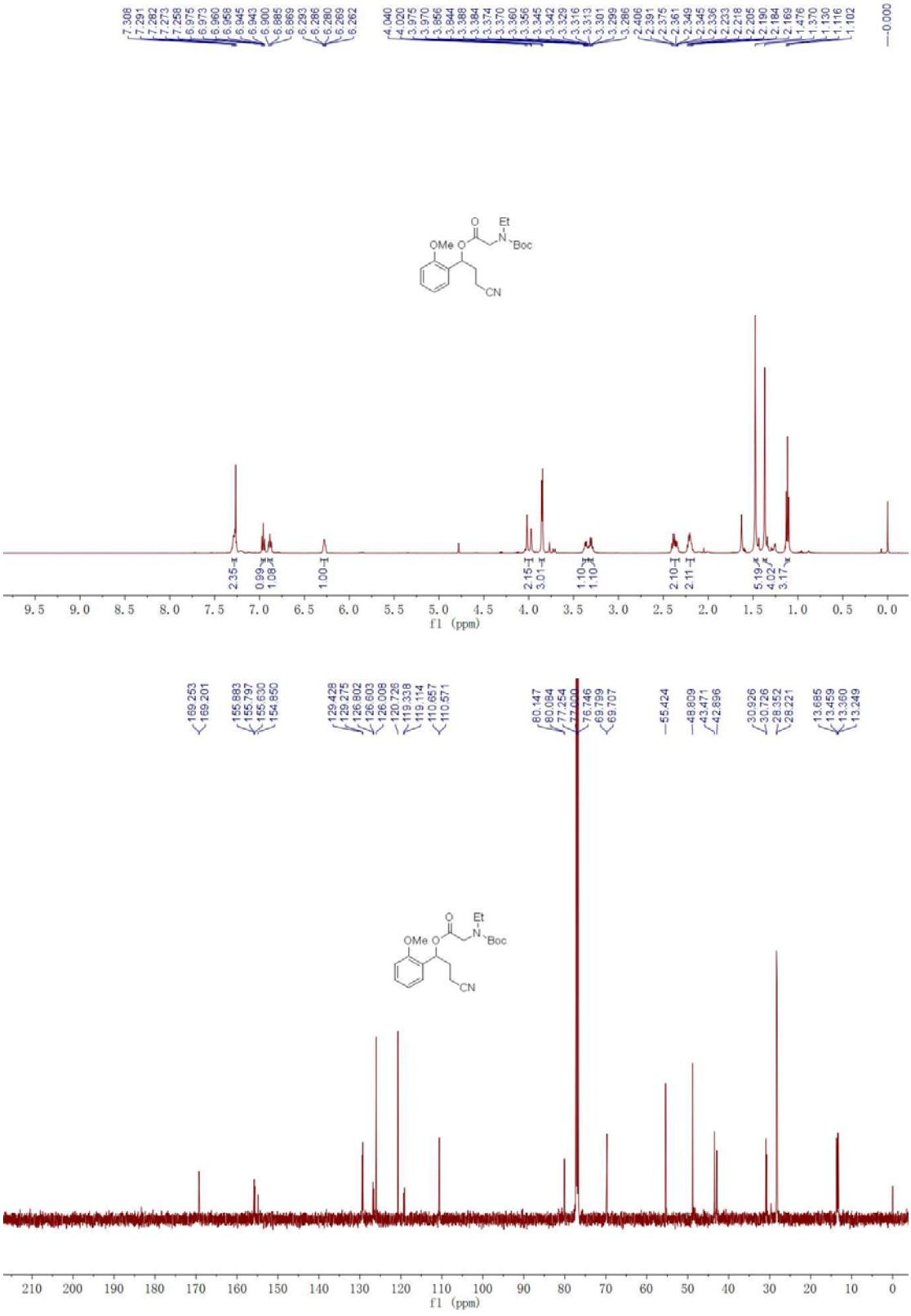
3-Cyano-1-(*p*-tolyl)propyl *N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4daa)



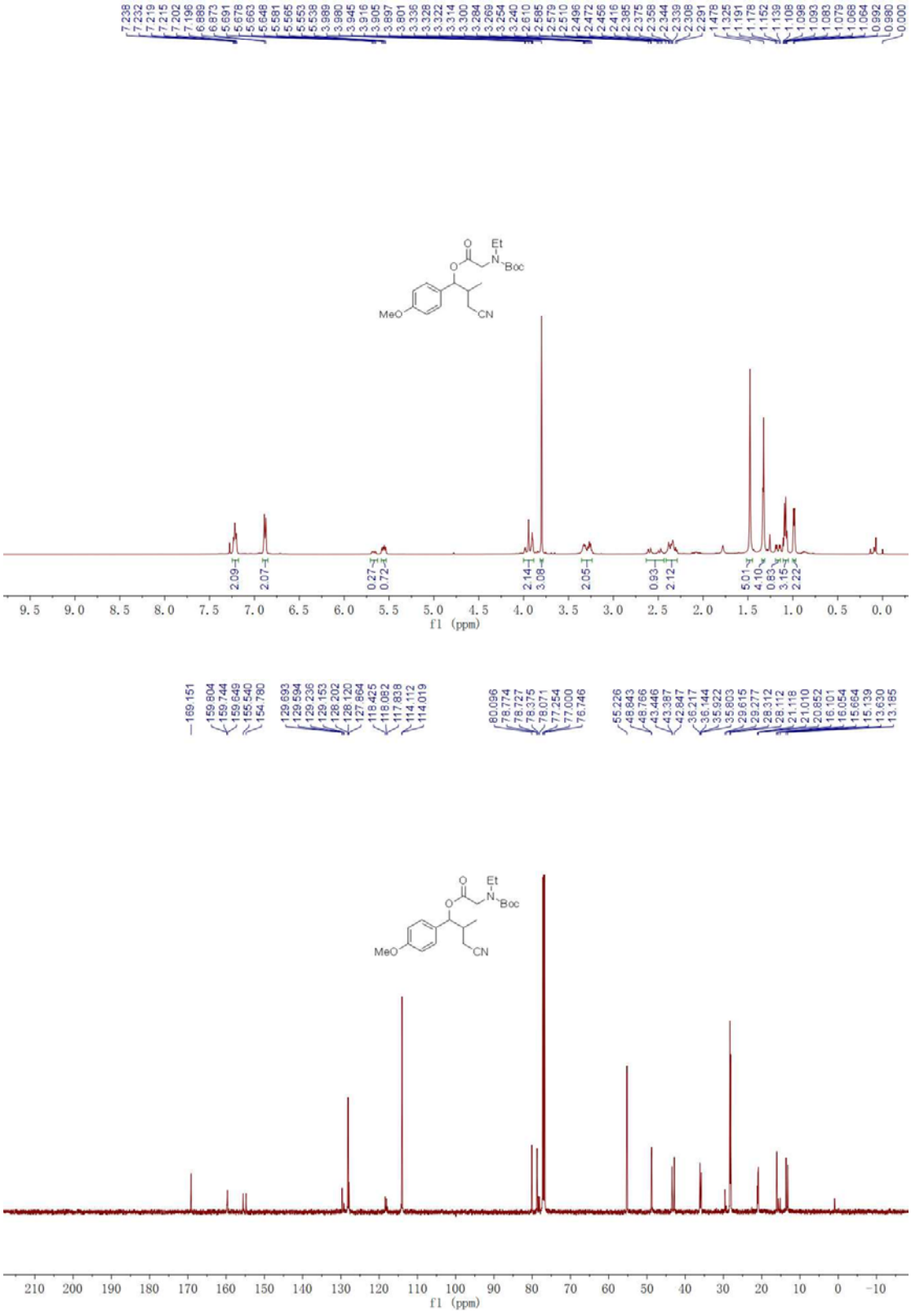
1-(4-Bromophenyl)-3-cyanopropyl *N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4eaa)



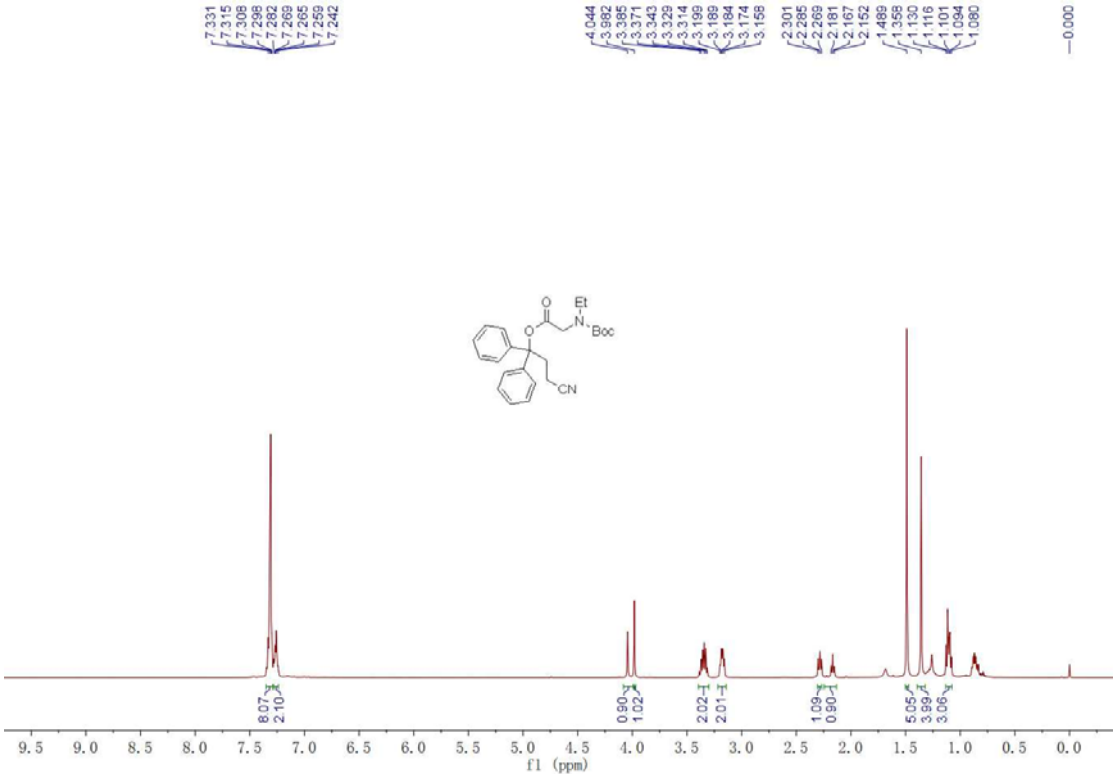
3-Cyano-1-(2-methoxyphenyl)propyl *N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4faa)

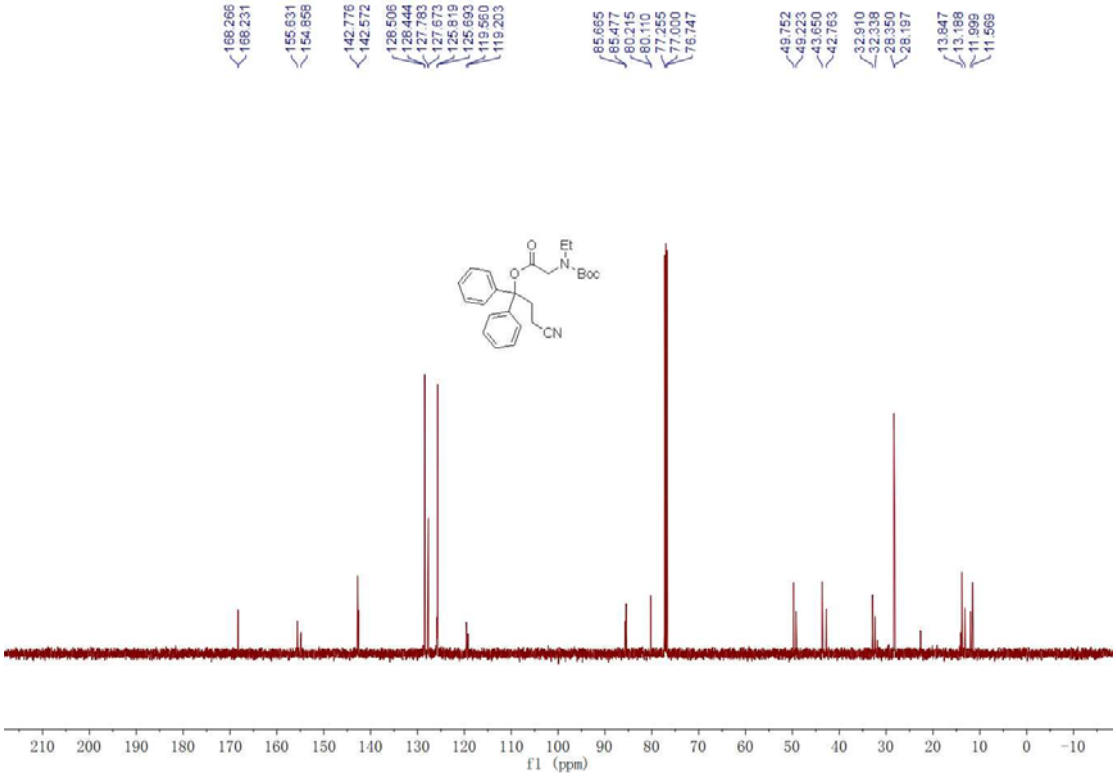


3-Cyano-1-(4-methoxyphenyl)-2-methylpropyl*N*-(*tert*-butoxycarbonyl)-*N*-ethyl-gycinat (4gaa)

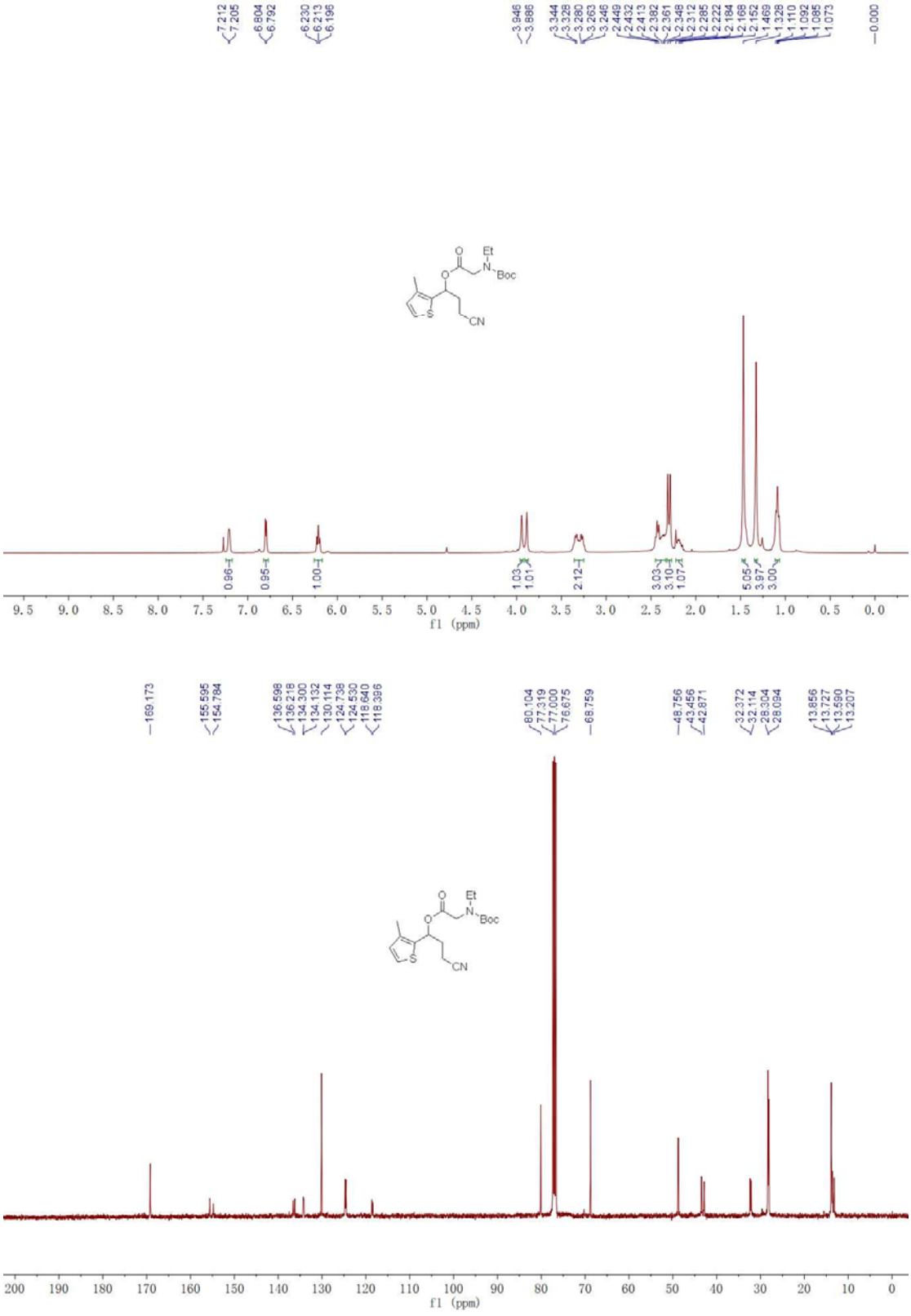


4-Cyano-1,1-diphenylbutan-2-yl *N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4haa)

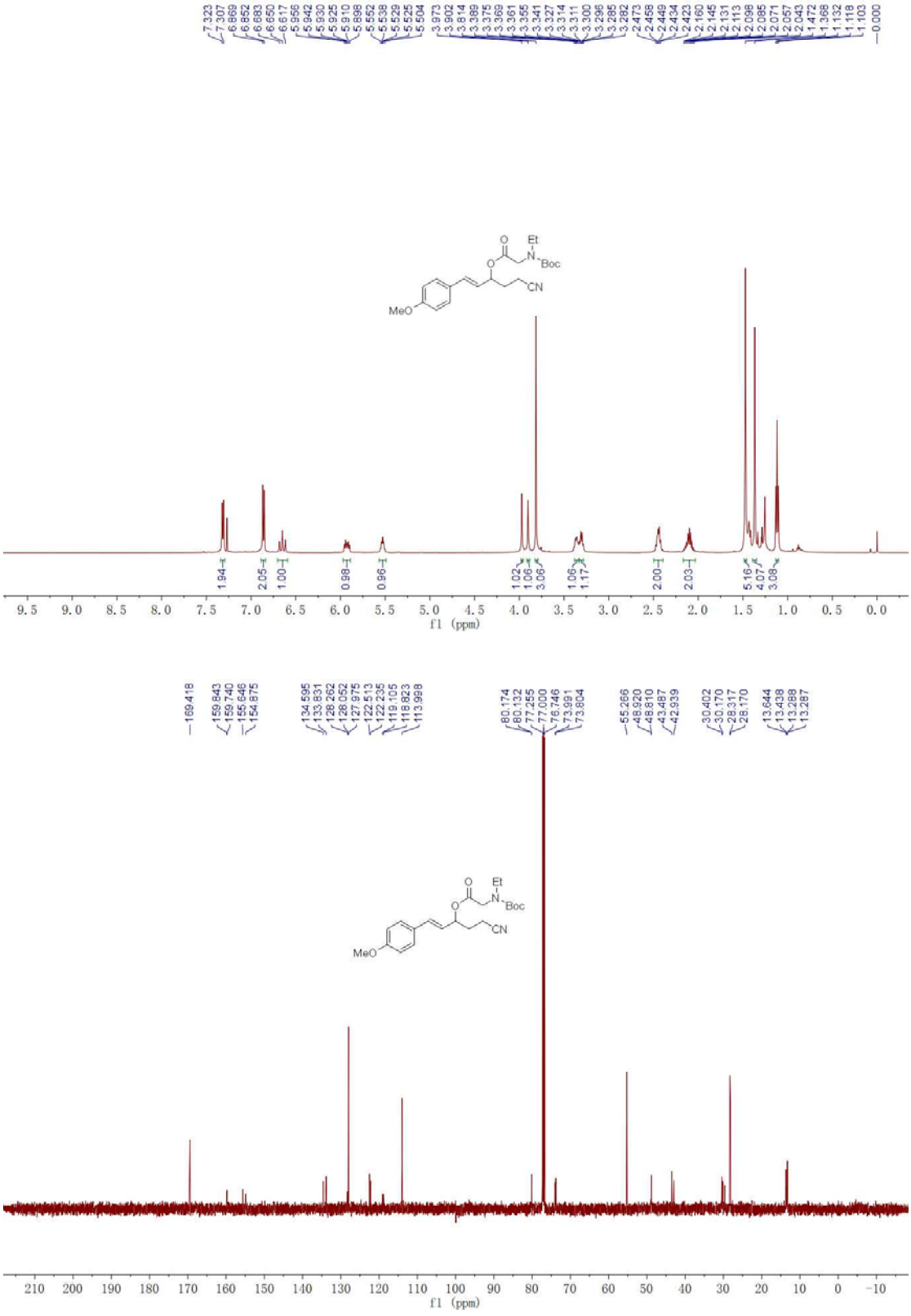




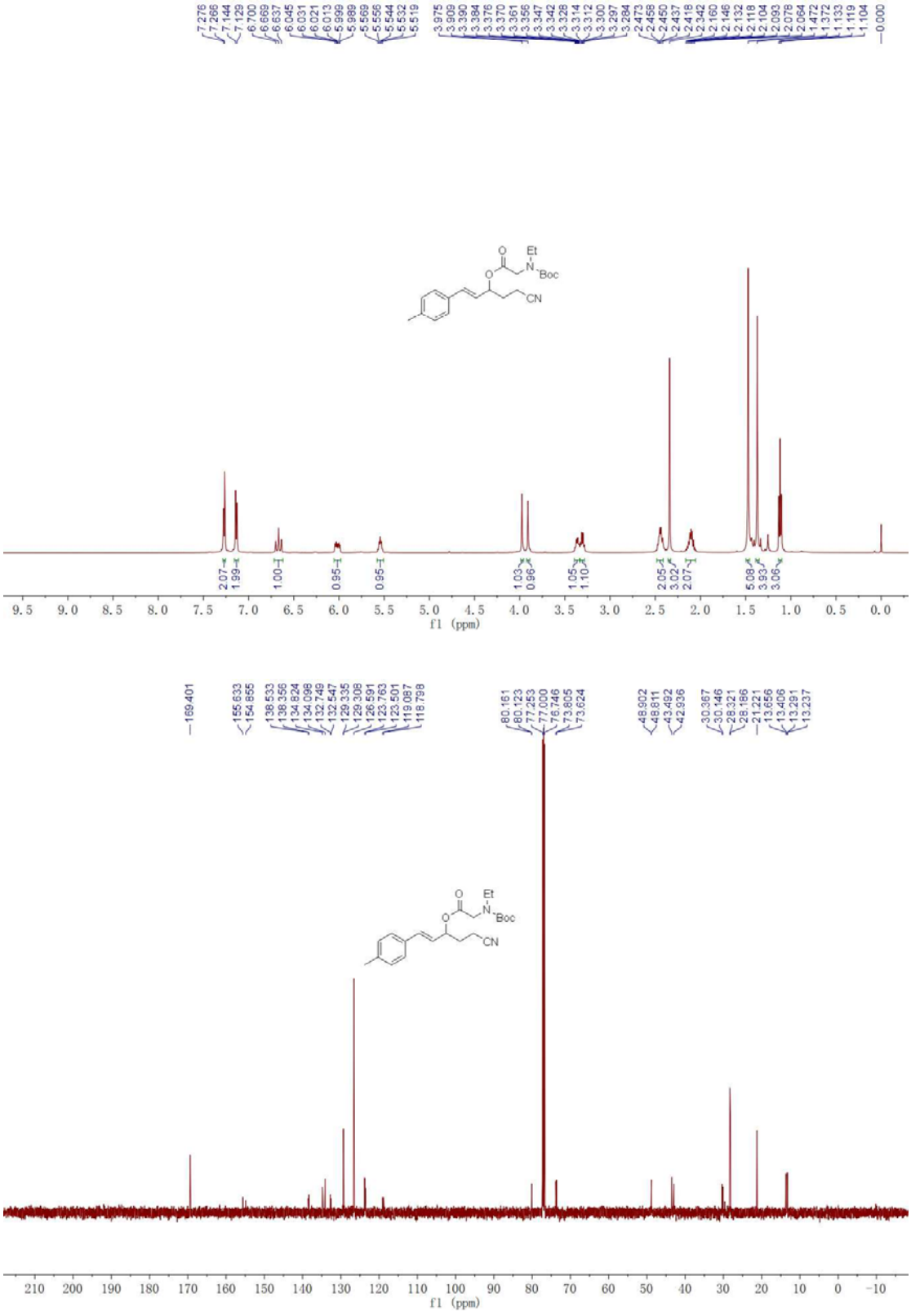
3-Cyano-1-(3-methylthiophen-2-yl)propyl*N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4iaa)



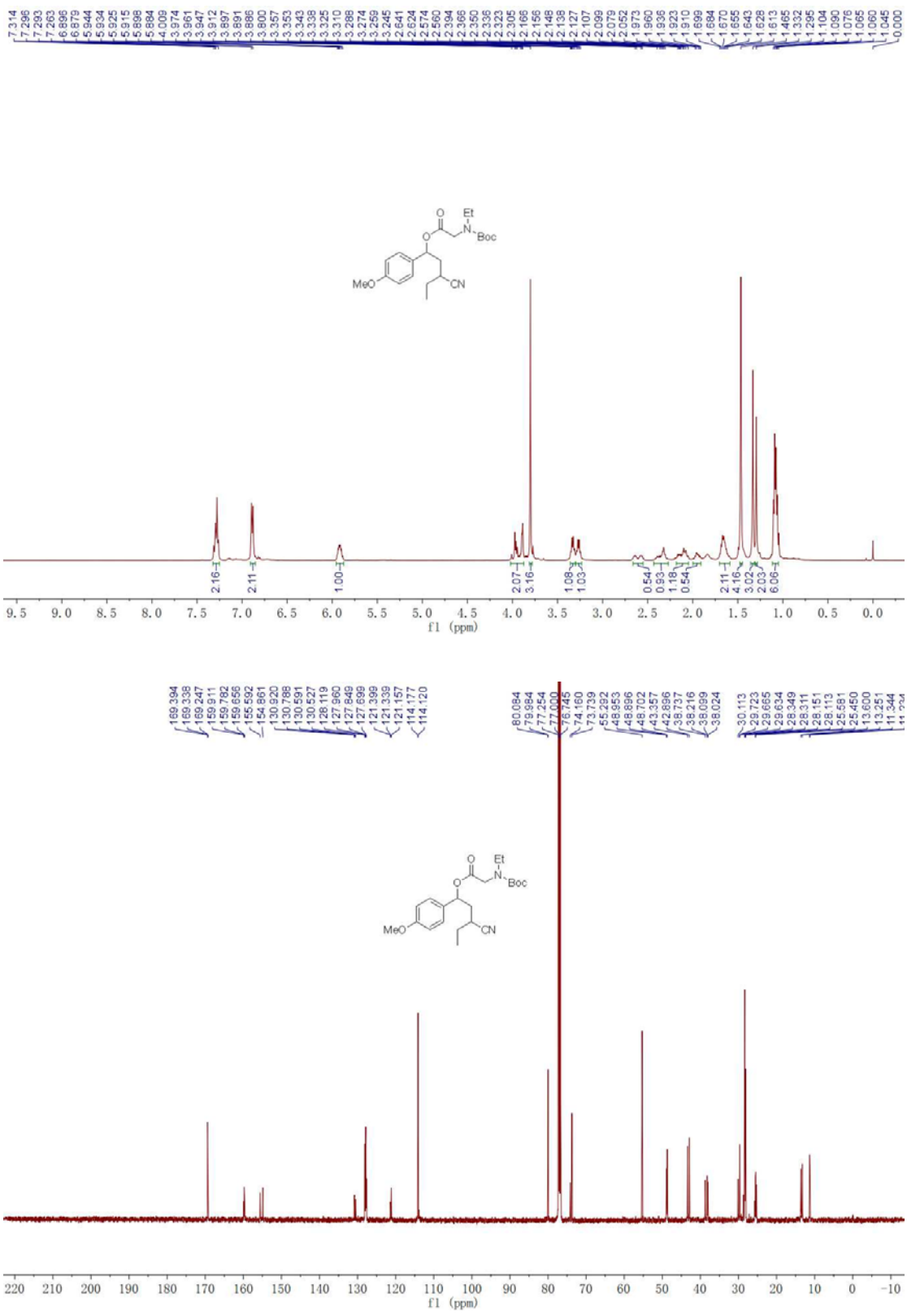
(*E*)-5-Cyano-1-(4-methoxyphenyl)pent-2-en-1-yl*N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4jaa)



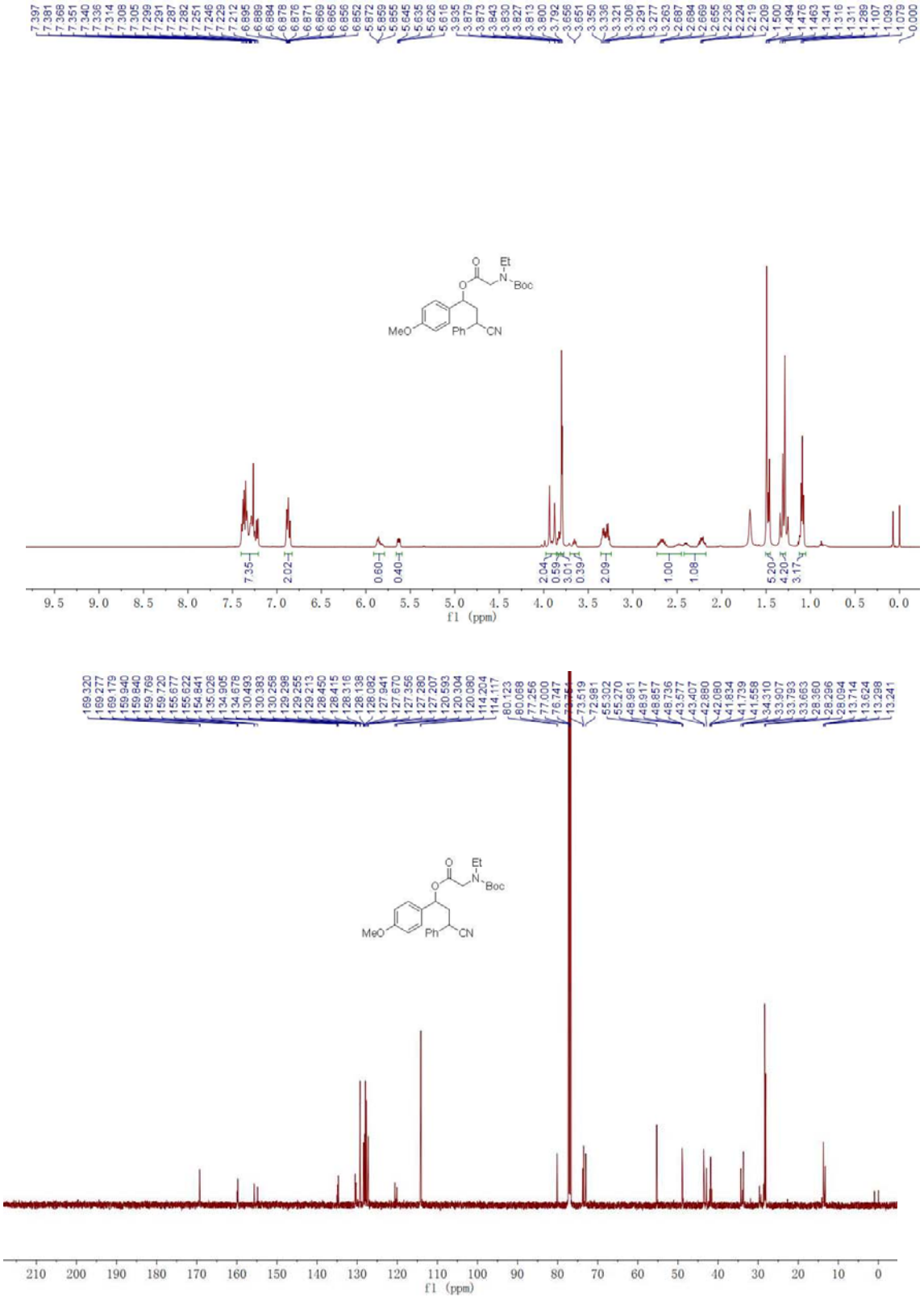
(*E*)-5-Cyano-1-(*p*-tolyl)pent-2-en-1-yl *N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4kaa)



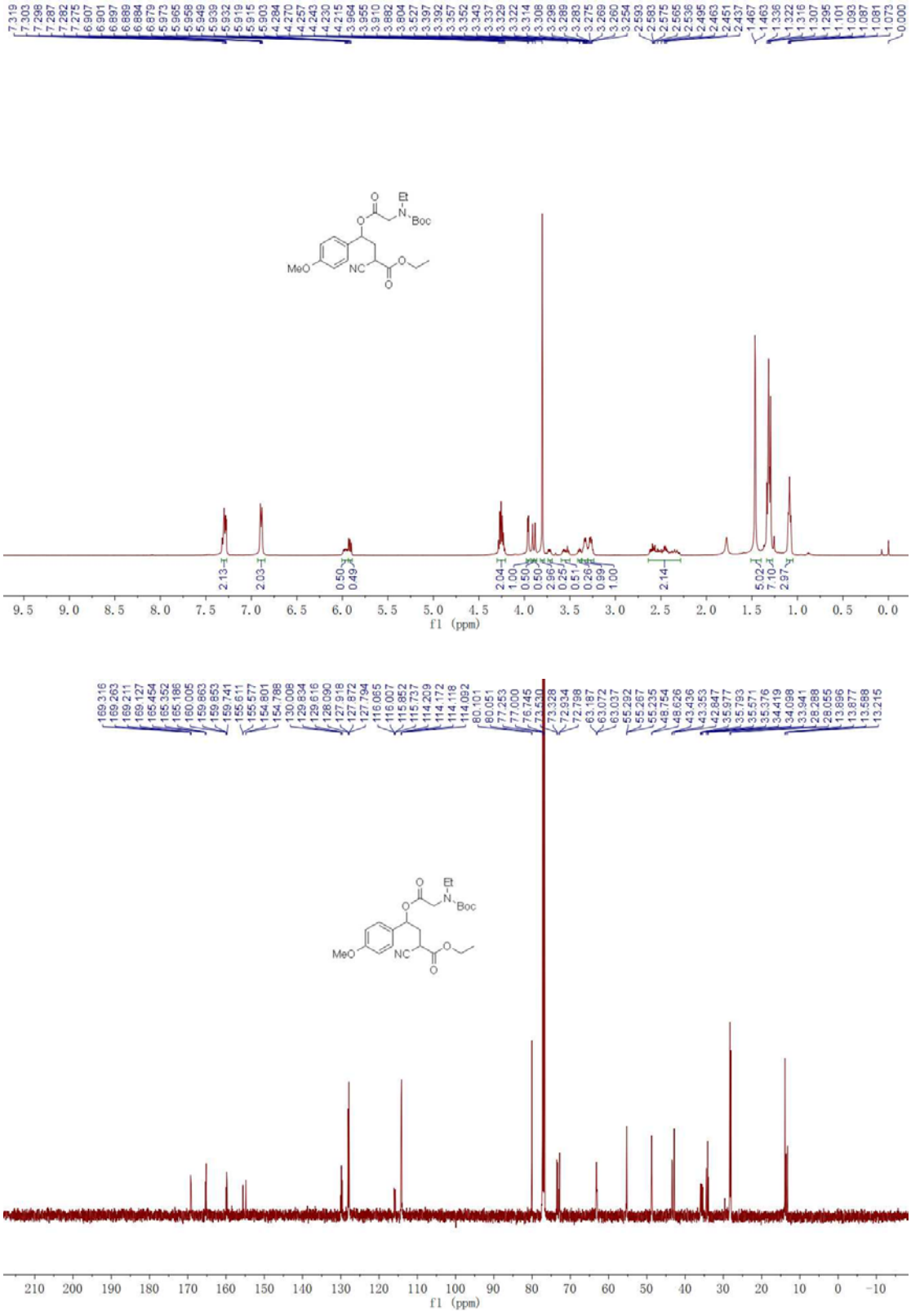
3-Cyano-1-(4-methoxyphenyl)pentyl *N*-(*tert*-butoxycarbonyl)-*N*-ethylglycinate (4aab)



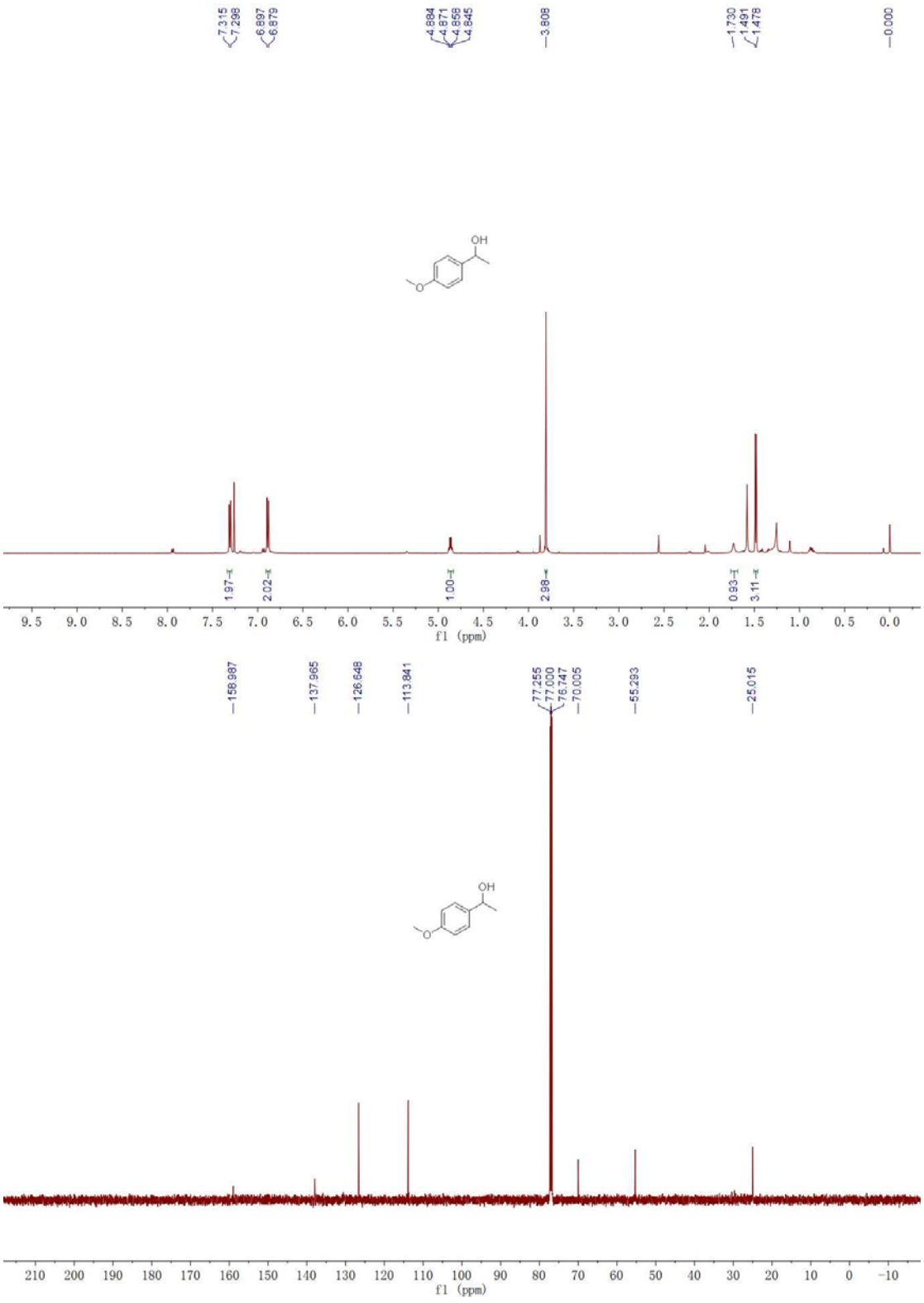
3-Cyano-1-(4-methoxyphenyl)-3-phenylpropyl*N*-(*tert*-butoxycarbonyl)-*N*-ethyl-glycinate (4aac)



Ethyl4-((*N*-(*tert*-butoxycarbonyl)-*N*-ethylglycyl)oxy)-2-cyano-4-(4-methoxyphenyl)butanoate (4aad)



1-(4-methoxyphenyl)ethan-1-ol (4aaa’)



2-((2,2,6,6-Tetramethylpiperidin-1-yl)oxy)acetonitrile (5):