Supporting Information

Titanium-Catalyzed Cyano-Borrowing Reaction for the Direct Amination of Cyanohydrins with Ammonia

Qing-Hua Li,*,† Zhao-Feng Li,† Jing Tao,† Wan-Fang Li,‡ Li-Qing Ren, Qian Li,† †Yun-Gui Peng† Tang-Lin Liu,*,†

†School of Chemistry and Chemical Engineering, Southwest University, Chongqing 400715, China.

‡College of Science, University of Shanghai for Science and Technology, Shanghai 200093, China.

Email: liuschop@swu.edu.cn, liqinghua@swu.edu.cn

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I. General information

^{1}H and **^{13}C NMR** spectra were recorded on a Bruker Avance 600 MHZ instruments. Chemical shifts were reported in parts per million (ppm), and the residual solvent peak was used as an internal reference: proton (chloroform δ 7.26), carbon (chloroform δ 77.0) or tetramethylsilane (TMS δ 0.00) was used as a reference. Multiplicity was indicated as follows: s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet), dd (doublet of doublet), bs (broad singlet). Coupling constants were reported in Hertz (Hz). All high resolution mass spectra (**HRMS**) were obtained on a Bruker Apex-2. For thin layer chromatography (**TLC**), Qingdao Haiyang Chemical were used, and compounds were visualized with a UV light at 254 nm. Further visualization was achieved by staining with iodine, or potassium permanganate solution followed by heating using a heat gun. Flash chromatography separations were performed on Qingdao Haiyang Chemical 300-400 mesh silica gel. All commercially available reagents were used as received for the reactions without any purification. All solvents were dried on alumina columns using a solvent dispensing system.

II. General procedure for the Titanium-Catalyzed Cyano-Borrowing Reaction for the Direct Amination of Cyanohydrins with Ammonia.

Method A: To a vial equipped with a dried stir bar was added ammonia (7.0 M solution in MeOH) 0.2 mL, ketone cyanohydrins (0.4 mmol), $Ti(O^{i}Pr)_4$ (10 mol%), benzoic acid (40 mol%), TBME (0.8 mL) in the glovebox. The reaction mixture was taken outside the glovebox after stirring fried mixed evenly. Then, the reaction mixture was allowed to stir at the settle temperature for 18 hours. The reaction mixture was added to water (10 mL), extracted with EtOAc (3 × 5 mL). The organic layer was washed with aqueous $NaHCO_3$ and brine and dried over Na_2SO_4. And the residue was purified by column chromatography with silica gel to give pure products. All ketone cyanohydrins used method A.

Method B: To a vial equipped with a dried stir bar was added 0.2 mL ammonia (7.0 M solution in MeOH), aldehyde cyanohydrins (0.4 mmol), $Ti(O^{i}Pr)_4$ (10 mol%), MeOH (0.8 mL) in the glovebox. The reaction mixture was taken outside the glovebox after stirring fried mixed evenly. Then, the reaction mixture was allowed to stir at the settle temperature for 18 hours. The reaction mixture was added to water (10 mL), extracted with EtOAc (3 × 5 mL). The organic layer was washed with aqueous $NaHCO_3$ and brine and dried over Na_2SO_4. And the residue was purified by column chromatography with silica gel to give pure products. All aldehyde cyanohydrins used method B.

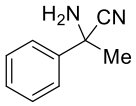
III. General Procedure for the Gram Scale reaction.

Scheme 5(1): To a vial equipped with a dried stir bar was added ammonia (7.0 M solution in MeOH) 5.0 mL, ketone cyanohydrins (10.0 mmol), $Ti(O^{i}Pr)_4$ (10 mol%), benzoic acid (40 mol%), TBME (15 mL) in the glovebox. The reaction mixture was taken outside the glovebox after stirring fried mixed evenly. Then, the reaction mixture was allowed to stir at the settle temperature for 18 hours. The reaction mixture was added to water (30 mL), extracted with EtOAc (3 × 25 mL). The organic layer was washed with aqueous $NaHCO_3$ and brine and dried over Na_2SO_4. And the residue was purified by column chromatography with silica gel to give 0.83 g of product **2a** with 57% isolated yield.

Scheme 5(2): To a vial equipped with a dried stir bar was added 10.0 mL ammonia (7.0 M solution in MeOH), aldehyde cyanohydrins (20 mmol), $Ti(O^{i}Pr)_4$ (10 mol%), MeOH (20 mL) in the glovebox. The reaction mixture was taken outside the glovebox after stirring fried mixed evenly. Then, the reaction mixture was allowed to stir at the settle temperature for 18 hours. The reaction mixture was added to water (30 mL), extracted with EtOAc (3 × 25 mL). The organic layer was washed with aqueous $NaHCO_3$ and brine and dried over Na_2SO_4. And the residue was purified by column chromatography with silica gel to give 2.30 g of product **6a** with 87% isolated yield.

IV The analytical and spectral characterization data

2-amino-2-phenylpropanenitrile (2a)[1]



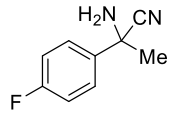
2a

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.4 in hexane:ethyl acetate = 2:1) resulting in 37.4 mg of Colorless oil product **2a** with 64% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.60 (d, *J* = 7.6 Hz, 2H), 7.34 (t, *J* = 7.5 Hz, 2H), 7.30 (d, *J* = 7.3 Hz, 1H), 2.27 (s, 2H), 1.73 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 141.23, 128.85, 128.65, 124.94, 124.17, 53.64, 31.79.

2-amino-2-(4-fluorophenyl)propanenitrile (2b)[2]



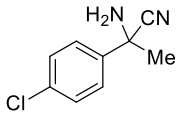
2b

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.4 in hexane:ethyl acetate = 2:1) resulting in 42.6 mg of Colorless oil product **2b** with 65% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.57 (dd, *J* = 8.2 Hz, 5.3 Hz, 2H), 7.01 (t, *J* = 8.5 Hz, 2H), 1.99 (s, 2H), 1.67 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 163.53, 161.89, 137.08, 126.88 (d, *J* = 8.3 Hz), 123.97, 115.70 (d, *J* = 21.8 Hz), 53.14, 31.92.

2-amino-2-(4-chlorophenyl)propanenitrile (2c)[3]



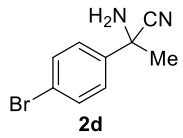
2c

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.4 in hexane:ethyl acetate = 2:1) resulting in 46.1 mg of Colorless oil product **2c** with 64% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.62 (d, *J* = 8.6 Hz, 2H), 7.39 (d, *J* = 8.6 Hz, 2H), 2.15 (s, 1H), 1.76 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 139.86, 134.59, 128.99, 126.48, 123.76, 53.22, 31.81.

2-amino-2-(4-bromophenyl)propanenitrile (2d)[2]



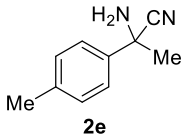
2d

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.4 in hexane:ethyl acetate = 2:1) resulting in 57.3 mg of yellow oil product **2d** with 65% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.74-7.44 (m, 4H), 2.18 (s, 2H), 1.77 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 140.40, 131.97, 126.80, 123.68, 122.71, 53.28, 31.78.

2-amino-2-(p-tolyl)propanenitrile (2e)[3]



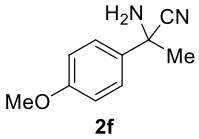
2e

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.4 in hexane:ethyl acetate = 2:1) resulting in 39.7 mg of Colorless oil product **2e** with 62% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.46 (d, *J* = 8.2 Hz, 2H), 7.13 (d, *J* = 7.9 Hz, 2H), 2.29 (s, 3H), 1.99 (s, 2H), 1.68 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 138.51, 129.47, 128.44, 124.83, 124.29, 53.41, 31.73, 21.00.

2-amino-2-(4-methoxyphenyl)propanenitrile (2f)[4]



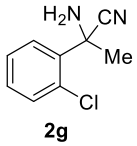
2f

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.4 in hexane:ethyl acetate = 2:1) resulting in 42.2 mg of Colorless oil product **2f** with 60% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.49 (d, *J* = 8.8 Hz, 2H), 6.84 (d, *J* = 8.8 Hz, 2H), 3.74 (s, 3H), 1.96 (s, 2H), 1.67 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 159.76, 133.33, 126.20, 124.34, 114.12, 55.36, 53.12, 31.75.

2-amino-2-(2-chlorophenyl)propanenitrile (2g)



2g

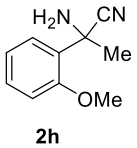
The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.4 in hexane: ethyl acetate = 2:1) resulting in 50.4 mg of Colorless oil product **2g** with 70% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.68 (dd, *J* = 7.3 Hz, 2.0 Hz, 1H), 7.37 (dd, *J* = 7.2 Hz, 1.8 Hz, 1H), 7.28-7.21 (m, 2H), 2.25 (s, 2H), 1.86 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 137.06, 132.47, 131.60, 129.98, 127.39, 126.63, 123.11, 51.52, 27.88.

HRMS (ESI): m/z Calcd. for $[C_9H_9ClN_2, M+H]^+$: 181.0527; Found: 181.0530.

2-amino-2-(2-methoxyphenyl)propanenitrile (2h)



2h

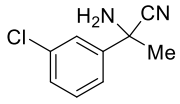
The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane: ethyl acetate = 2:1) resulting in 42.9 mg of Colorless oil product **2h** with 61% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.39 (d, *J* = 7.6 Hz, 1H), 7.27 (dd, *J* = 11.2 Hz, 4.3 Hz, 1H), 6.91 (t, *J* = 8.2 Hz, 2H), 3.89 (s, 3H), 2.22 (s, 2H), 1.80 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 157.11, 130.02, 128.60, 125.37, 124.22, 120.94, 112.00, 55.73, 49.91, 27.51.

HRMS (ESI): m/z Calcd. for $[C_{10}H_{12}N_2O, M+H]^+$: 177.1022; Found: 177.1018.

2-amino-2-(3-chlorophenyl)propanenitrile (2i)



2i

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.4 in hexane:ethyl acetate = 2:1) resulting in 51.1 mg of Colorless oil product **2i** with 71% isolated yield.

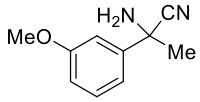
^{1}H NMR (600 MHz, $CDCl_3$) δ 7.60 (s, 1H), 7.48 (m, 1H), 7.30-7.24 (m, 2H), 2.06 (s, 2H), 1.68 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 143.32, 134.90, 130.13, 128.89, 125.33, 123.60, 123.34,

53.29, 31.78.

HRMS (ESI): m/z Calcd. for $[C_9H_9ClN_2, M+H]^+$: 181.0527; Found: 181.0523.

2-amino-2-(3-methoxyphenyl)propanenitrile (2j)



2j

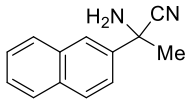
The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 48.6 mg of Colorless oil product **2j** with 69% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.24 (t, *J* = 7.9 Hz, 1H), 7.17-7.09 (m, 2H), 6.81 (d, *J* = 8.0 Hz, 1H), 3.75 (s, 3H), 2.04 (s, 2H), 1.68 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 159.99, 142.90, 129.91, 124.14, 117.25, 114.05, 110.77, 55.36, 53.57, 31.75.

HRMS (ESI): m/z Calcd. for $[C_{10}H_{12}N_2O, M+H]^+$: 177.1022; Found: 177.1017.

2-amino-2-(naphthalen-2-yl)propanenitrile (2k)



2k

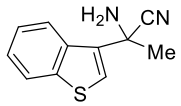
The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 42.3 mg of yellow solid product **2k** with 54% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 8.06 (s, 1H), 7.80 (d, *J* = 8.5 Hz, 2H), 7.77-7.74 (m, 1H), 7.63 (dd, *J* = 8.7 Hz, 1.7 Hz, 1H), 7.46-7.41 (m, 2H), 2.13 (s, 2H), 1.76 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 138.43, 133.23, 133.02, 128.91, 128.31, 127.64, 126.70, 126.69, 124.17, 122.69, 53.81, 31.63.

HRMS (ESI): m/z Calcd. for $[C_{13}H_{12}N_2, M+H]^+$: 197.1073; Found: 197.1067.

2-amino-2-(benzo[b]thiophen-3-yl)propanenitrile (2l)



2l

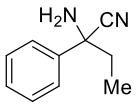
The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 41.2 mg of yellow solid product **2l** with 51% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.80 (d, *J* = 7.3 Hz, 1H), 7.74 (d, *J* = 7.4 Hz, 1H), 7.50 (s, 1H), 7.41-7.30 (m, 2H), 2.32 (s, 2H), 1.92 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 146.47, 139.38, 138.93, 125.02, 124.75, 123.98, 122.77, 122.47, 121.39, 51.34, 32.10.

HRMS (ESI): m/z Calcd. for $[C_{11}H_{10}N_2S, M+H]^+$: 203.0637; Found: 203.0639.

2-amino-2-phenylbutanenitrile (2m)[1]



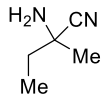
2m

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 43.5 mg of colorless oil product **2m** with 68% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.59-7.52 (m, 2H), 7.33 (t, *J* = 7.4 Hz, 2H), 7.28 (t, *J* = 7.3 Hz, 1H), 2.04 (s, 2H), 1.95-1.83 (m, 2H), 0.91 (t, *J* = 7.4 Hz, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 139.95, 128.68, 128.61, 125.60, 123.27, 58.79, 37.25, 9.02.

2-amino-2-methylbutanenitrile (2n)[5]



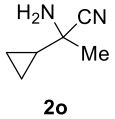
2n

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 18.0 mg of colorless oil product **2n** with 46% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 1.73 (s, 2H), 1.69 (dd, *J* = 14.0 Hz, 6.8 Hz, 2H), 1.47 (s, 3H), 1.10 (t, *J* = 7.5 Hz, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 124.32, 50.51, 34.86, 27.14, 8.86.

2-amino-2-cyclopropylpropanenitrile (2o)[6]



2o

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane: ethyl acetate = 2:1) resulting in 18.9 mg of colorless oil product **2o** with 43% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 1.91 (s, 2H), 1.50 (s, 3H), 1.02 (m, 1H), 0.56-0.44 (m, 4H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 120.62, 50.57, 26.01, 18.70, 8.75.

2-amino-3-chloro-2-methylpropanenitrile (2p)

2p

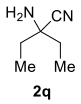
The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 22.2 mg of colorless oil product **2p** with 47% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 3.65 (d, *J* = 11.1 Hz, 1H), 3.51 (d, *J* = 11.1 Hz, 1H), 2.09 (s, 2H), 1.59 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 121.89, 51.47, 51.42, 25.70.

HRMS (ESI): m/z Calcd. for $[C_4H_7ClN_2, M+H]^+$: 119.0371; Found: 119.0371.

2-amino-2-ethylbutanenitrile (2q)[3]



2q

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane: ethyl acetate = 2:1) resulting in 25.5 mg of colorless oil product **2q** with 57% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 1.86 (s, 2H), 1.70 (dt, *J* = 14.8 Hz, 7.5 Hz, 2H), 1.57 (dt, *J* = 14.6 Hz, 7.4 Hz, 2H), 1.03 (t, *J* = 7.5 Hz, 6H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 123.55, 54.98, 32.75, 8.44.

1-aminocyclopentane-1-carbonitrile (2r)[7]

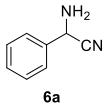
2r

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 27.7 mg of colorless oil product **2r** with 63% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 2.06 (s, 2H), 1.81 (d, *J* = 10.8 Hz, 2H), 1.79-1.73 (m, 4H), 1.70 (m, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 125.12, 54.57, 40.87, 23.63.

2-amino-2-phenylacetonitrile (6a)[8]



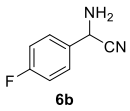
6a

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 47.0 mg of white solid product **6a** with 89% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.45 (d, *J* = 7.4 Hz, 2H), 7.32 (dt, *J* = 23.6 Hz, 7.2 Hz, 3H), 4.82 (s, 1H), 1.89 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 136.36, 129.12, 129.05, 126.66, 120.92, 47.32.

2-amino-2-(4-fluorophenyl)acetonitrile (6b) [9]



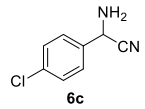
6b

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 53.4 mg of yellow solid product **6b** with 89% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.55 (dd, *J* = 7.3, 5.3 Hz, 2H), 7.13 (t, *J* = 8.3 Hz, 2H), 4.93 (s, 1H), 1.96 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 163.82, 162.17, 128.54 (d, *J* = 8.4 Hz), 120.72, 116.05 (d, *J* = 21.9 Hz), 46.64.

2-amino-2-(4-chlorophenyl)acetonitrile (6c)[10]



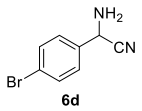
6c

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 57.8 mg of yellow solid product **6c** with 87% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.41 (d, *J* = 8.4 Hz, 2H), 7.32 (d, *J* = 8.4 Hz, 2H), 4.82 (s, 1H), 1.88 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 135.07, 134.79, 129.26, 128.07, 120.54, 46.69.

2-amino-2-(4-bromophenyl)acetonitrile (6d)[10]



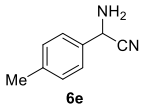
6d

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 69.7 mg of yellow solid product **6d** with 83% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.48 (d, *J* = 8.0 Hz, 2H), 7.35 (d, *J* = 7.8 Hz, 2H), 4.80 (s, 1H), 1.85 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 135.30, 132.23, 128.36, 123.19, 120.45, 46.75.

2-amino-2-(p-tolyl)acetonitrile (6e)[10]



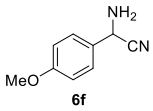
6e

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 53.1 mg of yellow solid product **6e** with 91% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.32 (d, *J* = 7.8 Hz, 2H), 7.13 (d, *J* = 7.7 Hz, 2H), 4.77 (s, 1H), 2.28 (s, 3H), 1.84 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 138.95, 133.57, 129.74, 126.55, 121.09, 47.08, 21.11.

2-amino-2-(4-methoxyphenyl)acetonitrile (6f)[10]



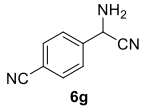
6f

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.2 in hexane:ethyl acetate = 2:1) resulting in 24.6 mg of yellow solid product **6f** with 38% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.37 (d, *J* = 8.6 Hz, 2H), 6.86 (d, *J* = 8.7 Hz, 2H), 4.79 (s, 1H), 3.75 (s, 3H), 1.79 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 160.13, 128.52, 127.94, 121.07, 114.46, 55.38, 46.77.

4-(amino(cyano)methyl)benzonitrile (6g)[11]



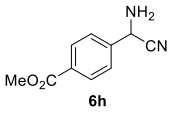
6g

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.2 in hexane:ethyl acetate = 2:1) resulting in 36.4 mg of yellow solid product **6g** with 58% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.65 (q, *J* = 8.5 Hz, 4H), 4.92 (s, 1H), 1.94 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 141.13, 132.83, 127.55, 119.91, 118.06, 113.16, 46.85.

methyl 4-(amino(cyano)methyl)benzoate (6h)[11]



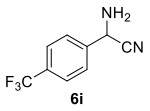
6h

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.2 in hexane:ethyl acetate = 2:1) resulting in 40.3 mg of yellow solid product **6h** with 53% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 8.01 (d, *J* = 8.3 Hz, 2H), 7.56 (d, *J* = 8.2 Hz, 2H), 4.90 (s, 1H), 3.86 (s, 3H), 1.94 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 166.35, 140.89, 130.90, 130.32, 126.73, 120.38, 52.29, 47.03.

2-amino-2-(4-(trifluoromethyl)phenyl)acetonitrile (6i)[12]



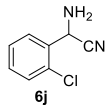
6i

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.2 in hexane:ethyl acetate = 2:1) resulting in 64.8 mg of yellow solid product **6i** with 81% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.51-7.36 (m, 2H), 7.03 (t, *J* = 8.4 Hz, 2H), 4.82 (s, 1H), 1.83 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 163.81, 162.17, 132.18, 128.55 (q, *J* = 8.4 Hz), 120.74, 116.04 (q, *J* = 21.9 Hz), 46.63.

2-amino-2-(2-chlorophenyl)acetonitrile (6j)[10]



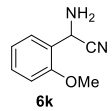
6j

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 44.5 mg of yellow solid product **6j** with 67% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.68-7.63 (m, 1H), 7.44 (d, *J* = 7.1 Hz, 1H), 7.39-7.32 (m, 2H), 5.25 (s, 1H), 2.04 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 134.45, 132.82, 130.48, 130.32, 128.17, 127.78, 119.83, 45.19.

2-amino-2-(2-methoxyphenyl)acetonitrile (6k)[13]



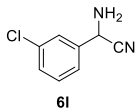
6k

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.2 in hexane:ethyl acetate = 2:1) resulting in 48.0 mg of yellow solid product **6k** with 74% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.44 (dd, *J* = 7.5 Hz, 1.4 Hz, 1H), 7.38 (dt, *J* = 8.2 Hz, 1.6 Hz, 1H), 7.02 (dt, *J* = 7.5 Hz, 0.7 Hz, 1H), 6.96 (d, *J* = 8.2 Hz, 1H), 5.07 (s, 1H), 3.92 (s, 3H), 2.16 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 156.64, 130.43, 127.74, 125.27, 121.06, 120.74, 111.23, 55.65, 43.51.

2-amino-2-(3-chlorophenyl)acetonitrile (6l)[11]



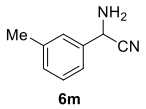
6l

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.2 in hexane:ethyl acetate = 2:1) resulting in 59.1 mg of yellow solid product **6l** with 89% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.49 (s, 1H), 7.38-7.34 (m, 1H), 7.29 (d, *J* = 4.8 Hz, 2H), 4.83 (s, 1H), 1.85 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 138.16, 135.09, 130.35, 129.28, 126.96, 124.82, 120.35, 46.76.

2-amino-2-(m-tolyl)acetonitrile (6m)[10]



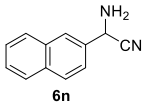
6m

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.2 in hexane:ethyl acetate = 2:1) resulting in 42.0 mg of yellow solid product **6m** with 72% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.32 (m, 3H), 7.19 (d, *J* = 6.1 Hz, 1H), 4.87 (s, 1H), 2.39 (s, 3H), 1.93 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 139.03, 136.30, 129.78, 129.01, 127.30, 123.68, 120.99, 47.30, 21.36.

2-amino-2-(naphthalen-2-yl)acetonitrile (6n)



6n

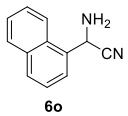
The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.4 in hexane:ethyl acetate = 2:1) resulting in 51.0 mg of white solid product **6n** with 70% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.93 (s, 1H), 7.82-7.78 (m, 3H), 7.51 (d, *J* = 8.2 Hz, 1H), 7.45 (dd, *J* = 5.6 Hz, 2.9 Hz, 2H), 4.98 (s, 1H), 1.89 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 133.63, 133.37, 133.14, 129.17, 128.17, 127.75, 126.87, 126.80, 125.73, 124.17, 120.89, 47.49.

HRMS (ESI): m/z Calcd. for $[C_{12}H_{10}N_2, M+H]^+$:183.0917; Found: 183.0912.

2-amino-2-(naphthalen-1-yl)acetonitrile (6o)[14]



6o

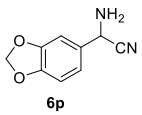
The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.4 in hexane:ethyl acetate = 2:1) resulting in 52.4 mg of white solid product **6o** with 72% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 8.16 (d, *J* = 8.5 Hz, 1H), 7.93 (t, *J* = 9.1 Hz, 2H), 7.83 (d, *J* = 7.1 Hz, 1H), 7.64 (t, *J* = 7.6 Hz, 1H), 7.58 (t, *J* = 7.5 Hz, 1H), 7.53 (t, *J* = 7.7 Hz, 1H), 5.61 (s, 1H), 2.01 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 134.12, 131.74, 130.09, 130.03, 129.12, 127.12, 126.34,

125.26, 124.96, 122.82, 120.95, 45.39.

2-amino-2-(benzo[d][1,3]dioxol-5-yl)acetonitrile (6p)[15]



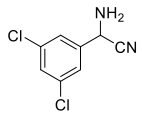
6p

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.2 in hexane:ethyl acetate = 2:1) resulting in 57.7 mg of yellow solid product **6p** with 82% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 6.99 (d, *J* = 8.0 Hz, 2H), 6.84-6.79 (m, 1H), 5.99 (d, *J* = 0.9 Hz, 2H), 4.81 (s, 1H), 1.89 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 148.31, 148.19, 130.28, 120.96, 120.23, 108.49, 107.23, 101.51, 47.02.

2-amino-2-(3,5-dichlorophenyl)acetonitrile (6q)



6q

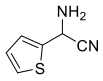
The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.2 in hexane:ethyl acetate = 2:1) resulting in 72.8 mg of yellow solid product **6q** with 91% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.39 (d, *J* = 1.0 Hz, 2H), 7.31 (s, 1H), 4.81 (s, 1H), 1.92 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 139.38, 135.76, 129.28, 125.34, 119.86, 46.33.

HRMS (ESI): m/z Calcd. for $[C_8H_6Cl_2N_2, M+H]^+$: 200.9981; Found: 200.9975.

2-amino-2-(thiophen-2-yl)acetonitrile (6r)[10]



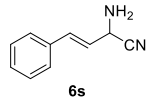
6r

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 50.2 mg of yellow solid product **6r** with 58% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.29-7.24 (m, 1H), 7.16 (dd, *J* = 2.4 Hz, 1.1 Hz, 1H), 6.93 (dd, *J* = 5.0 Hz, 3.7 Hz, 1H), 5.05 (s, 1H), 1.97 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 139.82, 127.01, 126.62, 125.94, 120.08, 43.38.

2-amino-4-phenylbut-3-enenitrile (6s)



6s

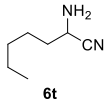
The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 34.1 mg of white solid product **6s** with 54% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.31 (t, *J* = 7.5 Hz, 2H), 7.24 (dd, *J* = 12.4 Hz, 5.0 Hz, 1H), 7.19 (d, *J* = 7.5 Hz, 2H), 5.42 (t, *J* = 7.5 Hz, 1H), 3.39 (d, *J* = 7.5 Hz, 2H), 3.28 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 138.07, 128.84, 128.21, 126.75, 117.79, 117.47, 116.67, 43.45.

HRMS (ESI): m/z Calcd. for $[C_{10}H_{10}N_2, M+H]^+$: 159.0917; Found: 159.0920.

2-aminoheptanenitrile (6t)



6t

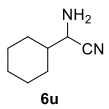
The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 43.8 mg of Colorless oil product **6t** with 87% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 3.68 (t, *J* = 7.1 Hz, 1H), 1.74 (dd, *J* = 15.1 Hz, 7.8 Hz, 2H), 1.63 (s, 2H), 1.55-1.46 (m, 2H), 1.34 (dd, *J* = 6.8 Hz, 3.3 Hz, 4H), 0.91 (t, *J* = 6.8 Hz, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 122.23, 43.44, 35.33, 31.13, 25.11, 22.38, 13.89.

HRMS (ESI): m/z Calcd. for $[C_7H_{14}N_2, M+H]^+$: 127.1230; Found: 127.1231.

2-amino-2-cyclohexylacetonitrile (6u)[16]



6u

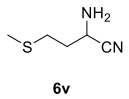
The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 46.9 mg of Colorless oil product **6u** with 85% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 3.52 (d, *J* = 6.0 Hz, 1H), 1.91-1.78 (m, 4H), 1.71 (m,

1H), 1.63 (s, 2H), 1.34 (d, *J* = 3.4 Hz, 1H), 1.29-1.25 (m, 2H), 1.22-1.10 (m, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 121.42, 49.02, 42.14, 29.28, 28.27, 25.98.

2-amino-4-(methylthio)butanenitrile (6v)[17]



6v

The title compound was prepared according to the general procedure as described, silica gel flash column chromatography was performed using hexanes and ethyl acetate (4:1) (R*f* = 0.3 in hexane:ethyl acetate = 2:1) resulting in 19.2 mg of yellow oil product **6v** with 37% isolated yield.

^{1}H NMR (600 MHz, $CDCl_3$) δ 3.93 (t, *J* = 7.1 Hz, 1H), 2.75-2.71 (m, 1H), 2.68-2.66 (m, 1H), 2.13 (s, 3H), 2.07-1.99 (m, 2H), 1.84 (s, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 121.79, 41.99, 34.42, 29.89, 15.45.

V References

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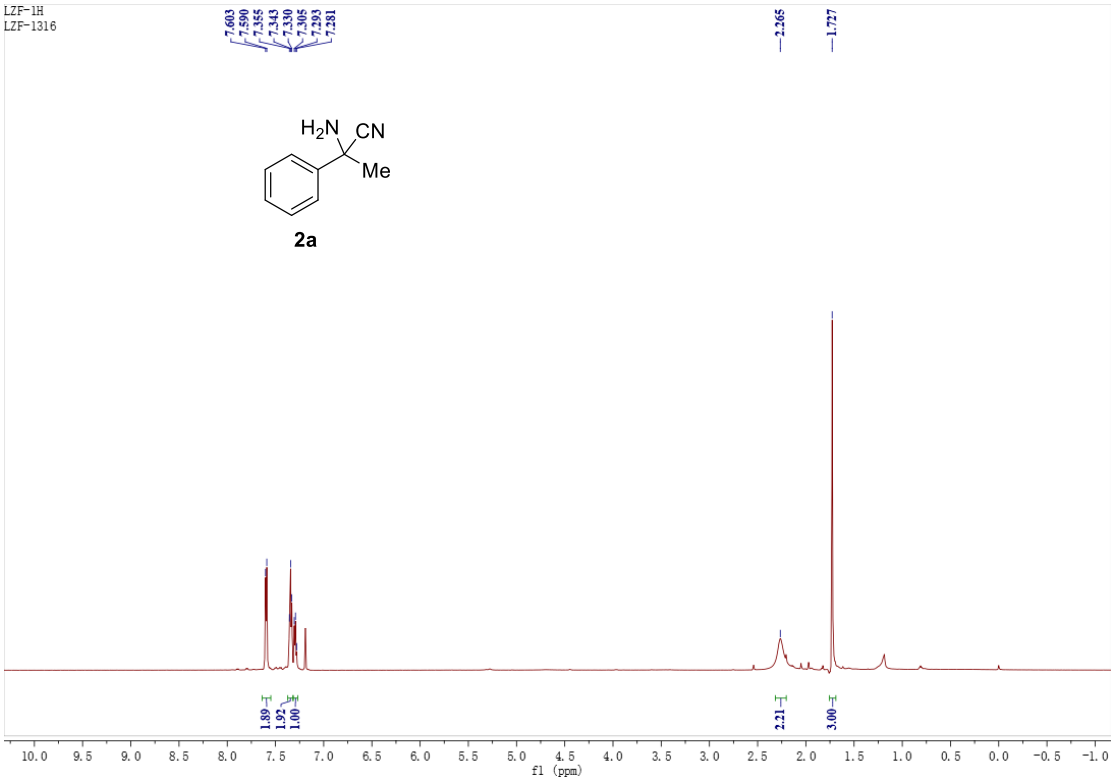
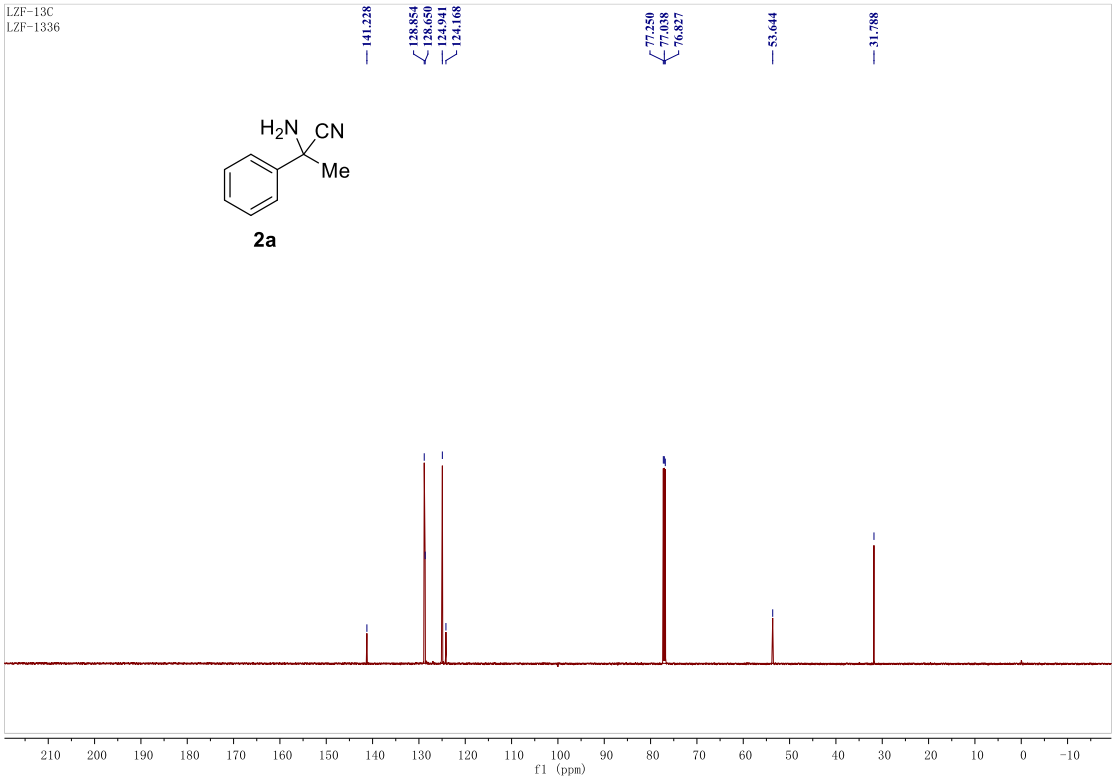
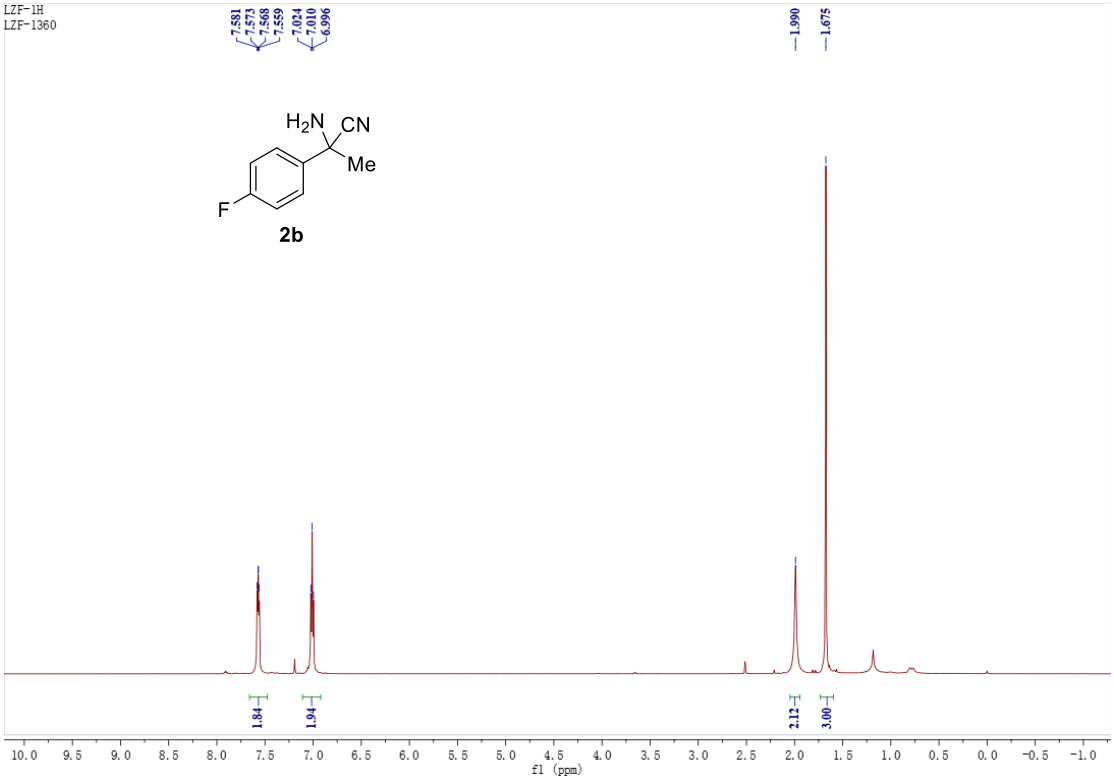
VI NMR spectra of the products



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1.675
H2N
CN
Me
F
2b
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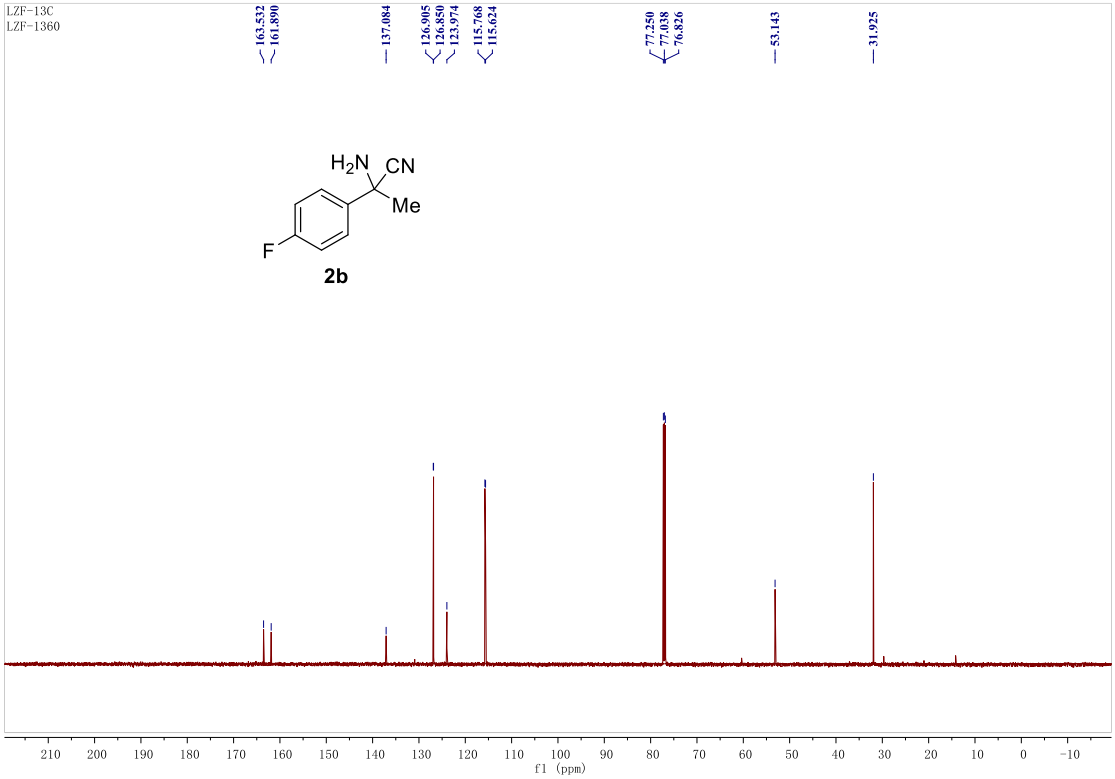
1.94
2.12
3.00
f1 (ppm)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77.038
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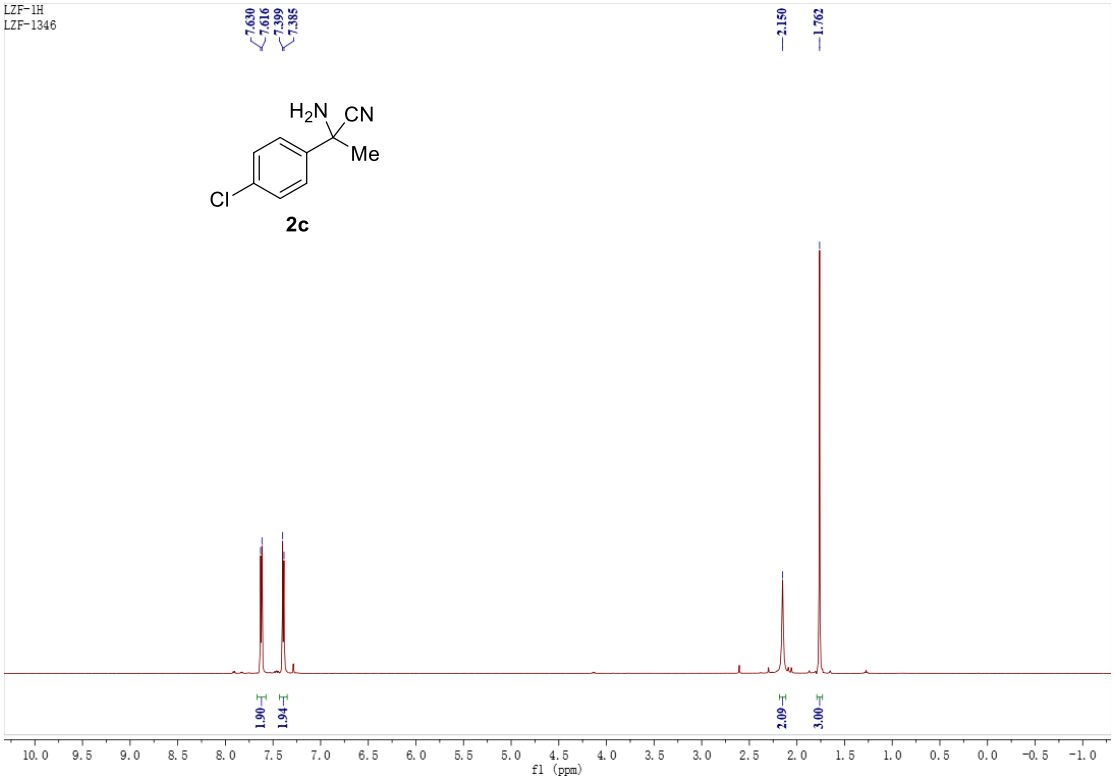
53.143
31.925
H2N
CN
Me
F
2b
f1 (ppm)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Cl
2c
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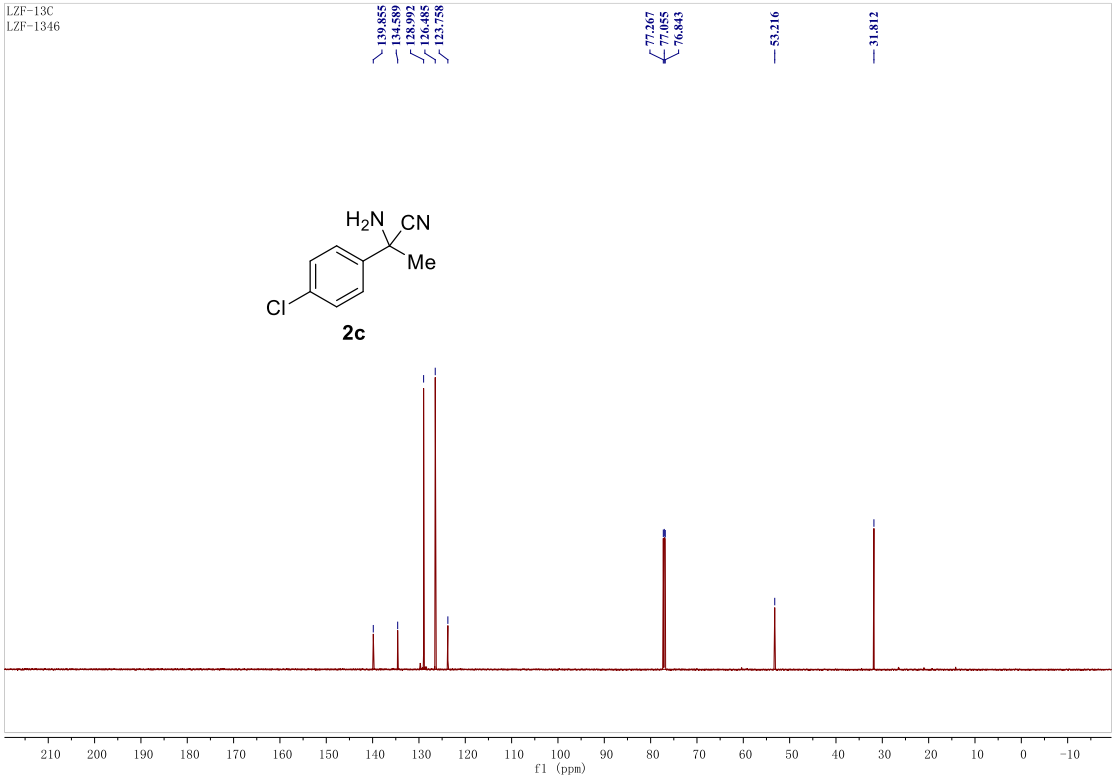
1.94
2.09
3.00
f1 (ppm)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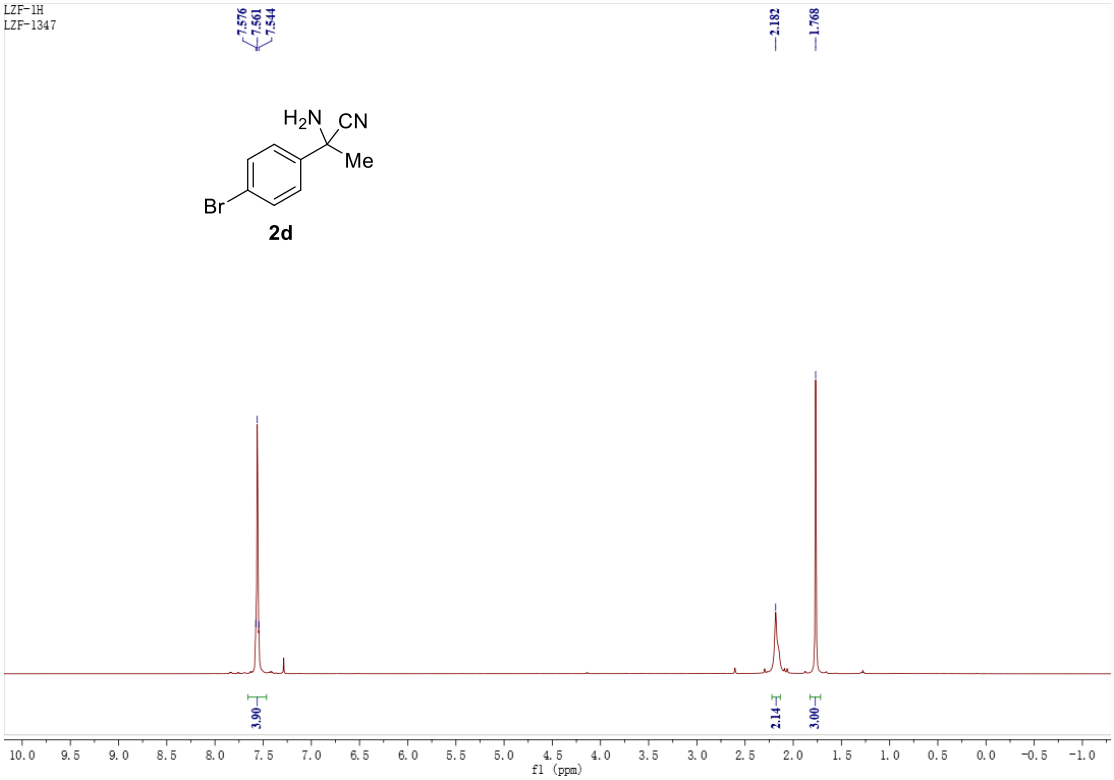
Cl
2c
f1 (ppm)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Me
Br
2d
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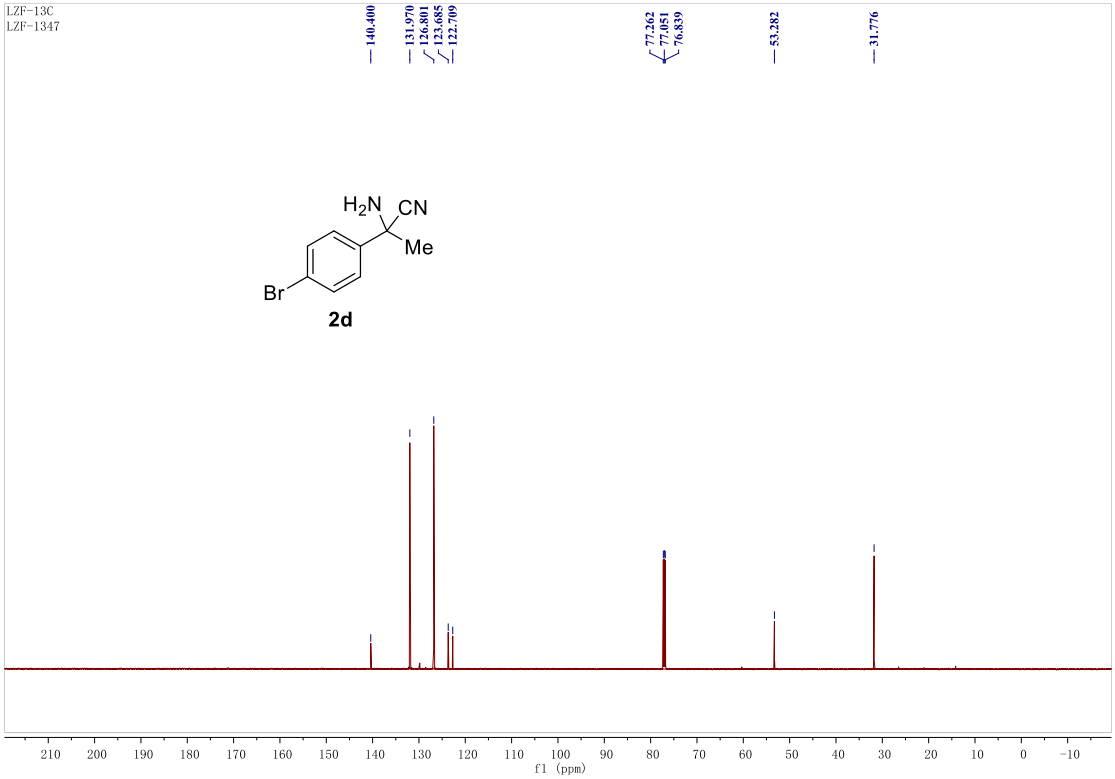
3.00
f1 (ppm)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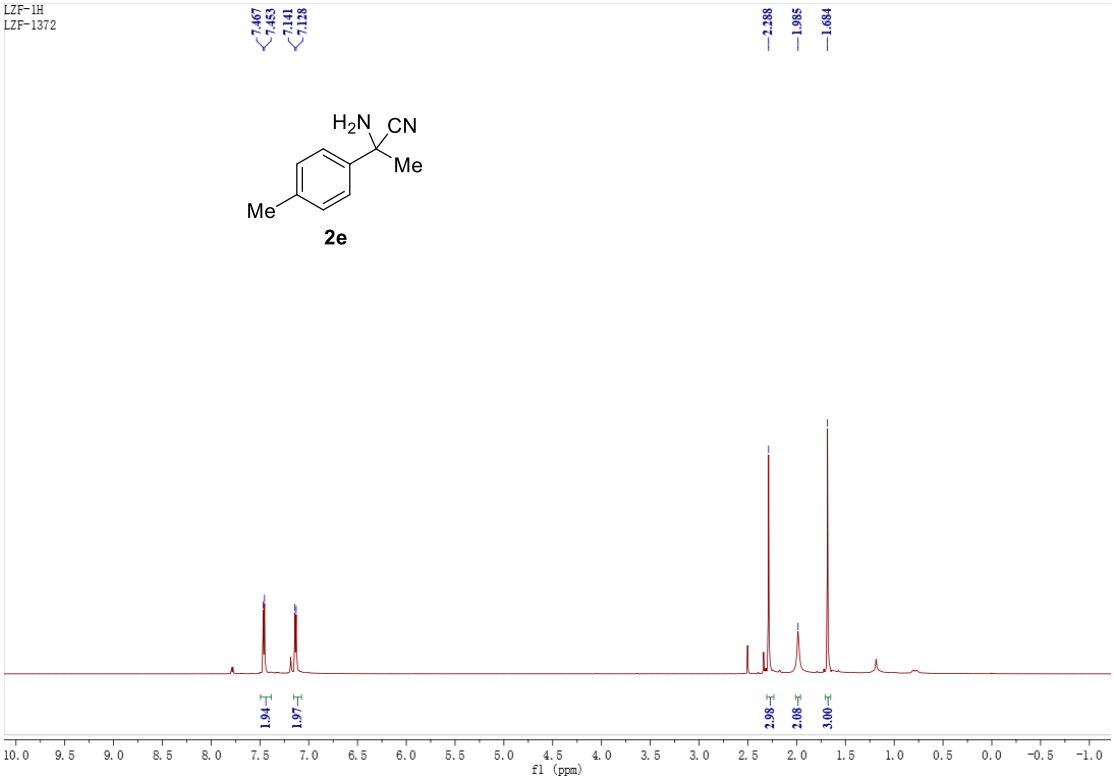
Me
Br
2d
f1 (ppm)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CN
Me
Me
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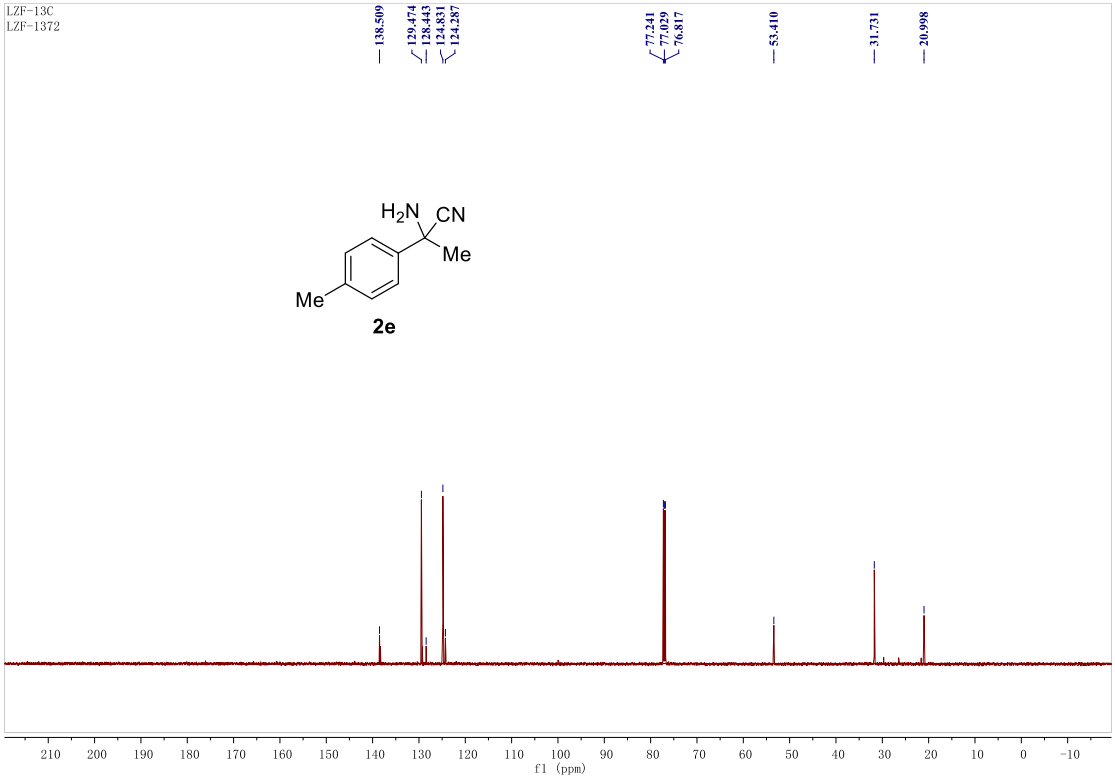
1.94
1.97
2.98
2.08
3.00
f1 (ppm)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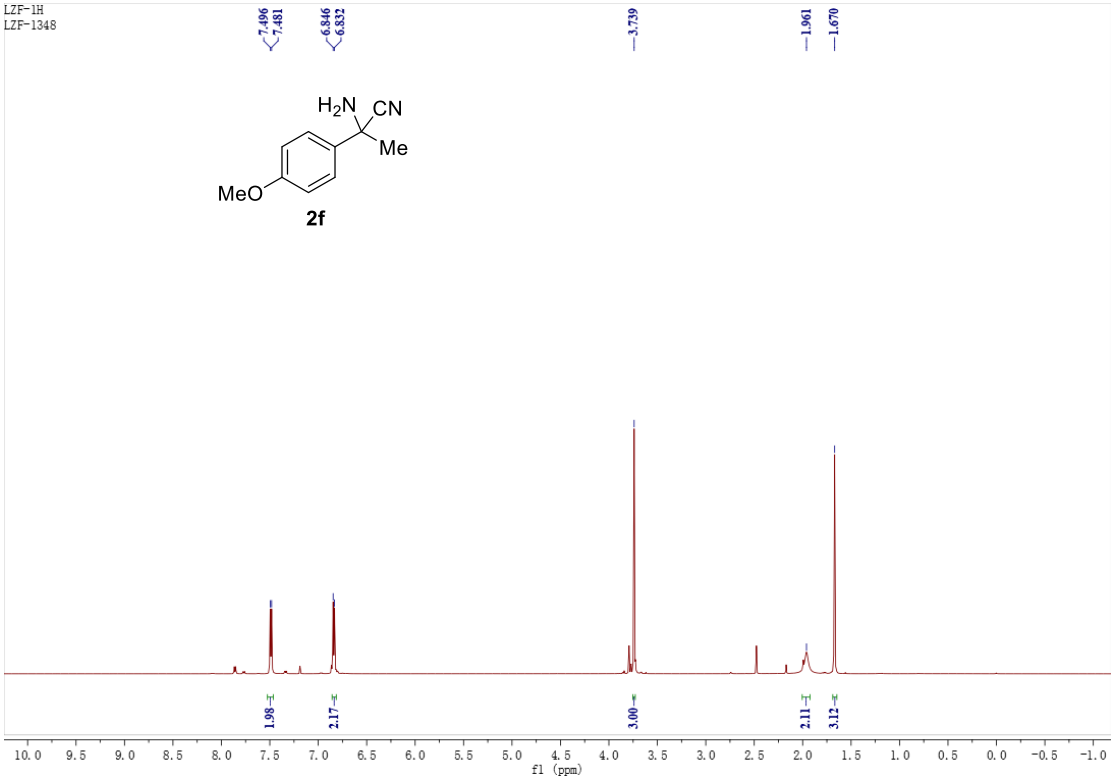
H2N
CN
Me
Me
2e
f1 (ppm)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Me
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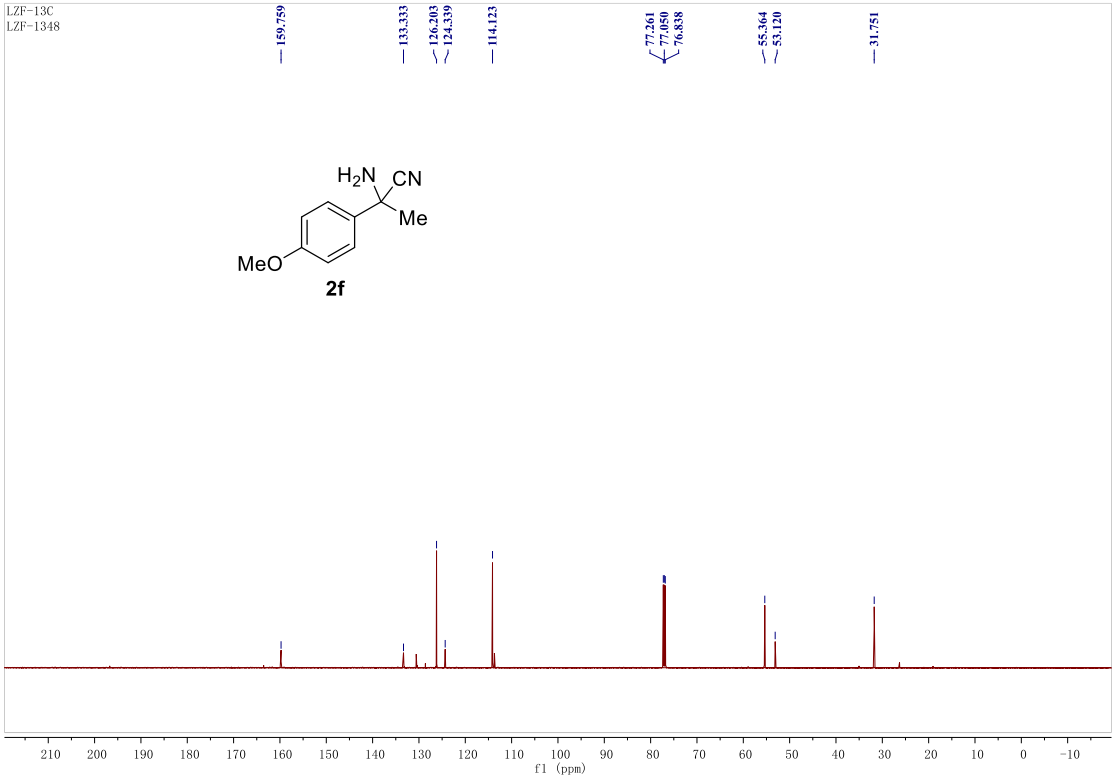
2f
1.98
2.17
3.00
2.11
3.12
f1 (ppm)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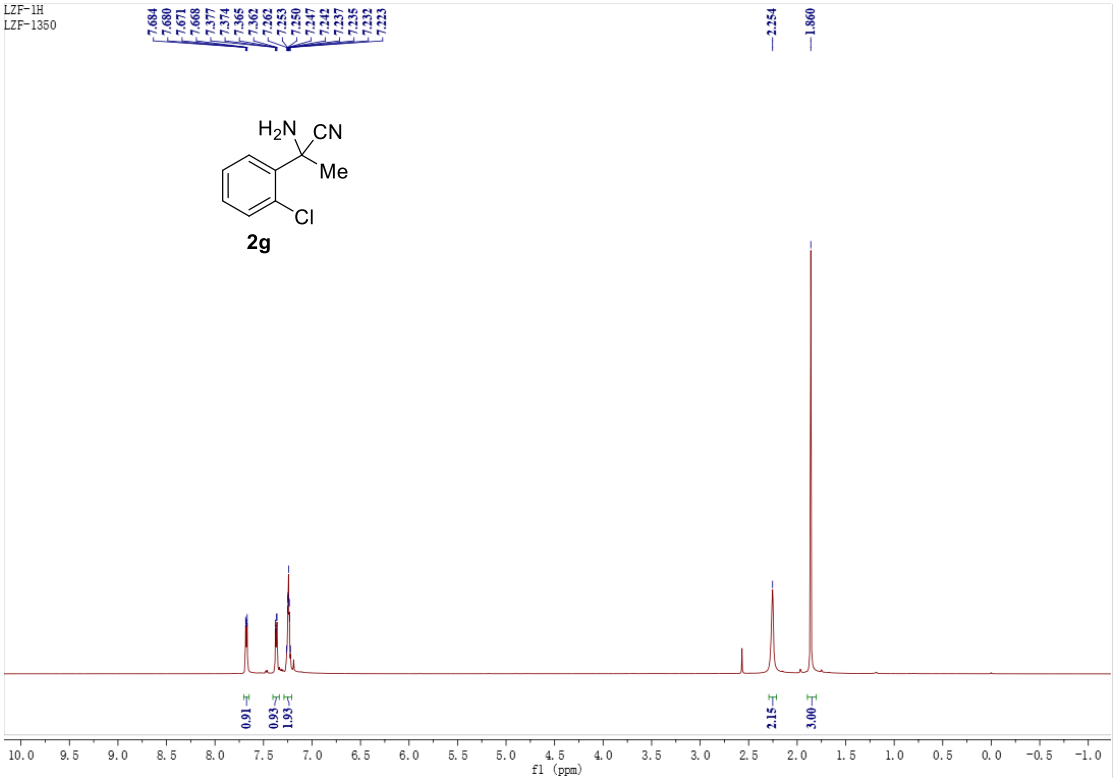
H_2N CN
Me
MeO
2f
f1 (ppm)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7.668
7.377
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7.365
7.362
7.253
7.250
7.247
7.242
7.237
7.235
7.232
7.223
2.254
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H2N
CN
Me
Cl
2g
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1.93
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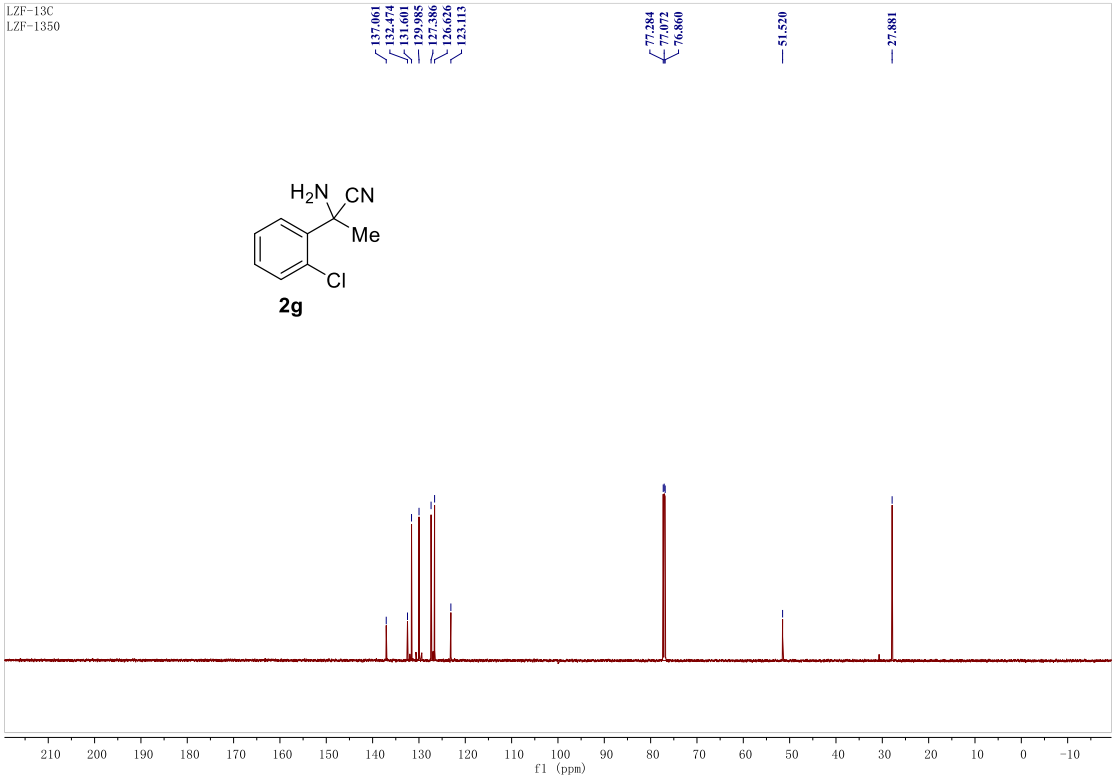
3.00
f1 (ppm)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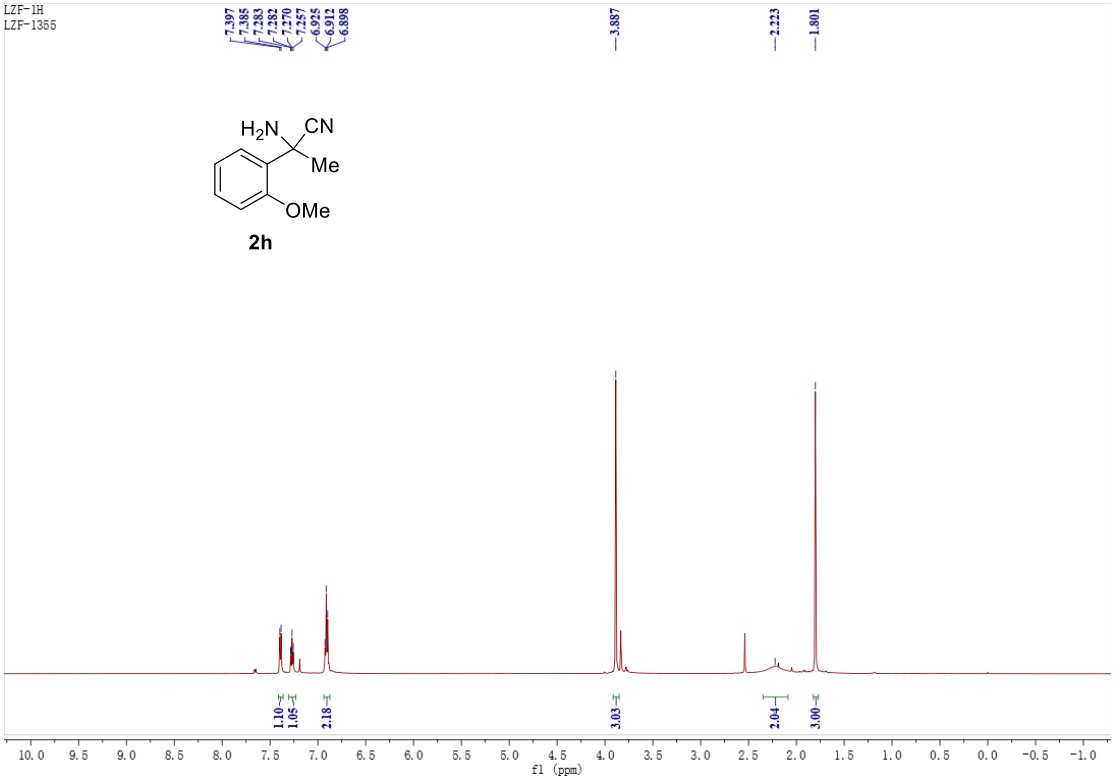
Cl
2g
f1 (ppm)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7.270
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3.887
2.223
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CN
Me
OMe
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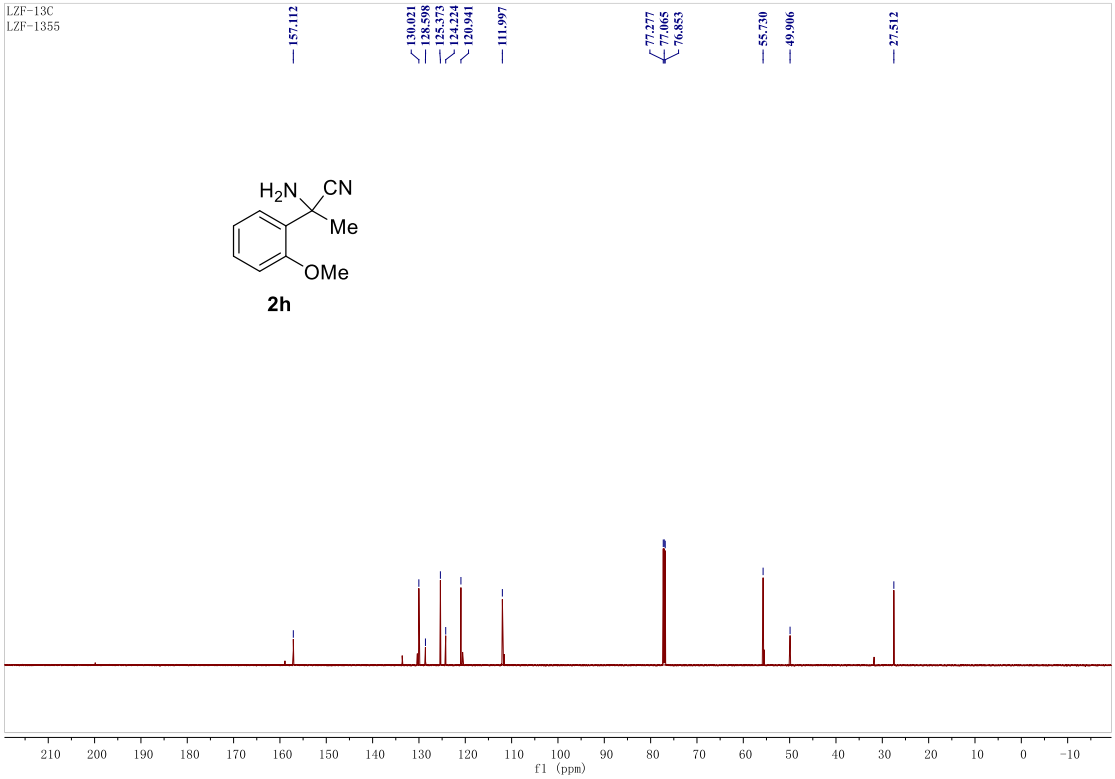
1.05
2.18
3.03
2.04
3.00
f1 (ppm)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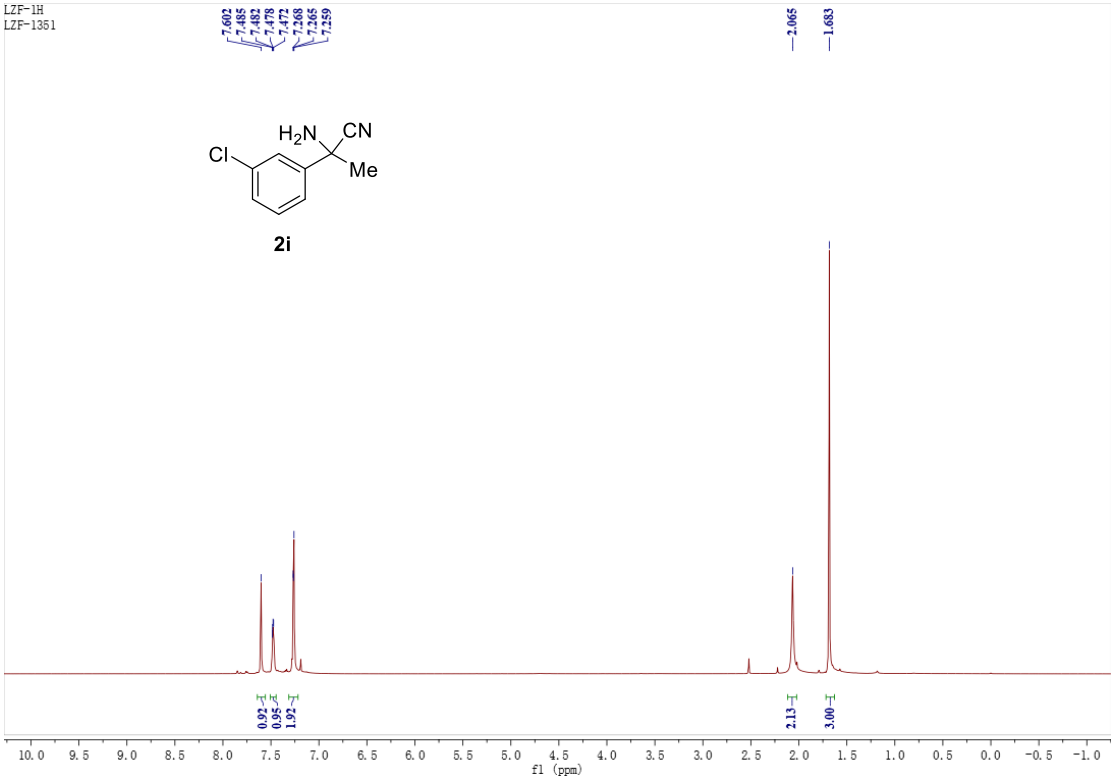
H2N
CN
Me
OMe
2h
f1 (ppm)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7.472
7.268
7.265
7.259
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CN
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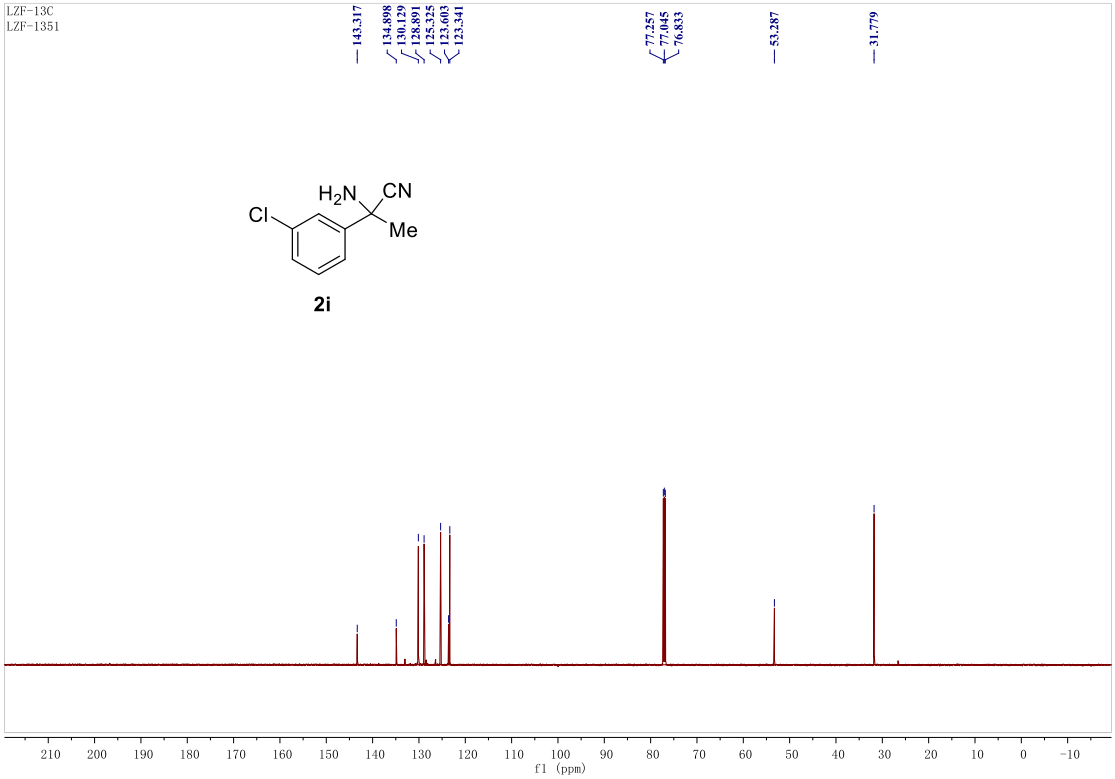
3.00
f1 (ppm)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31.779
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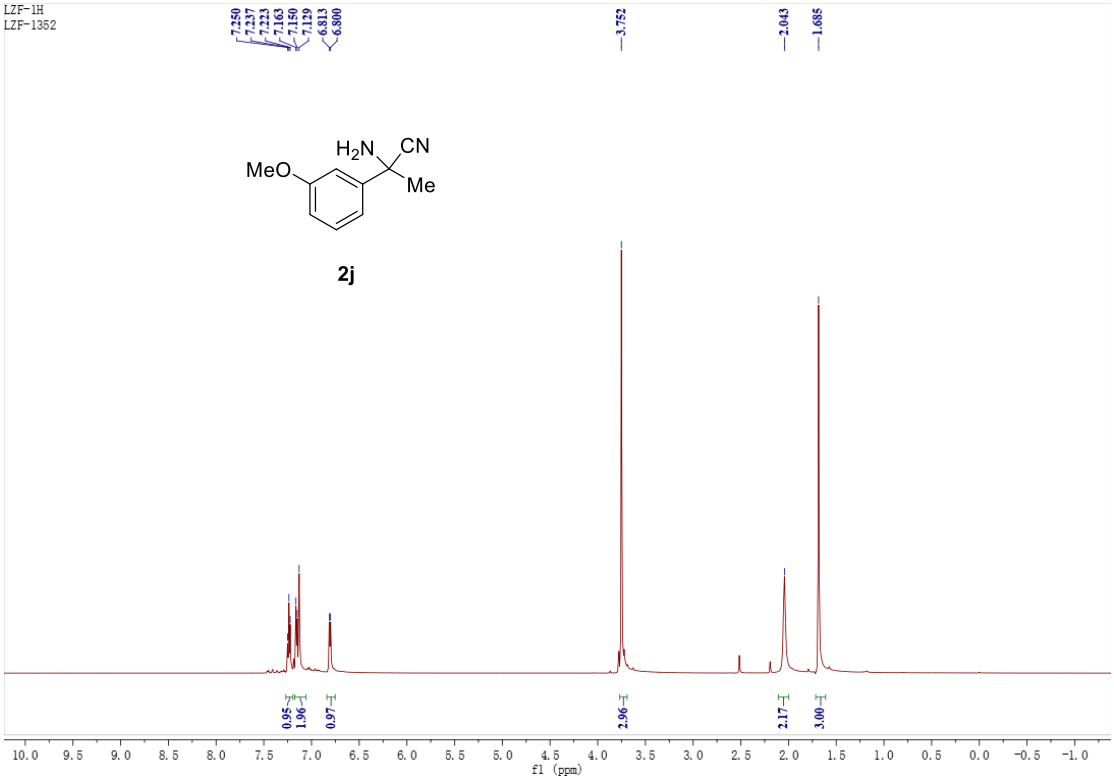
CN
Cl
Me
2i
f1 (ppm)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6.800
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2.043
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Me
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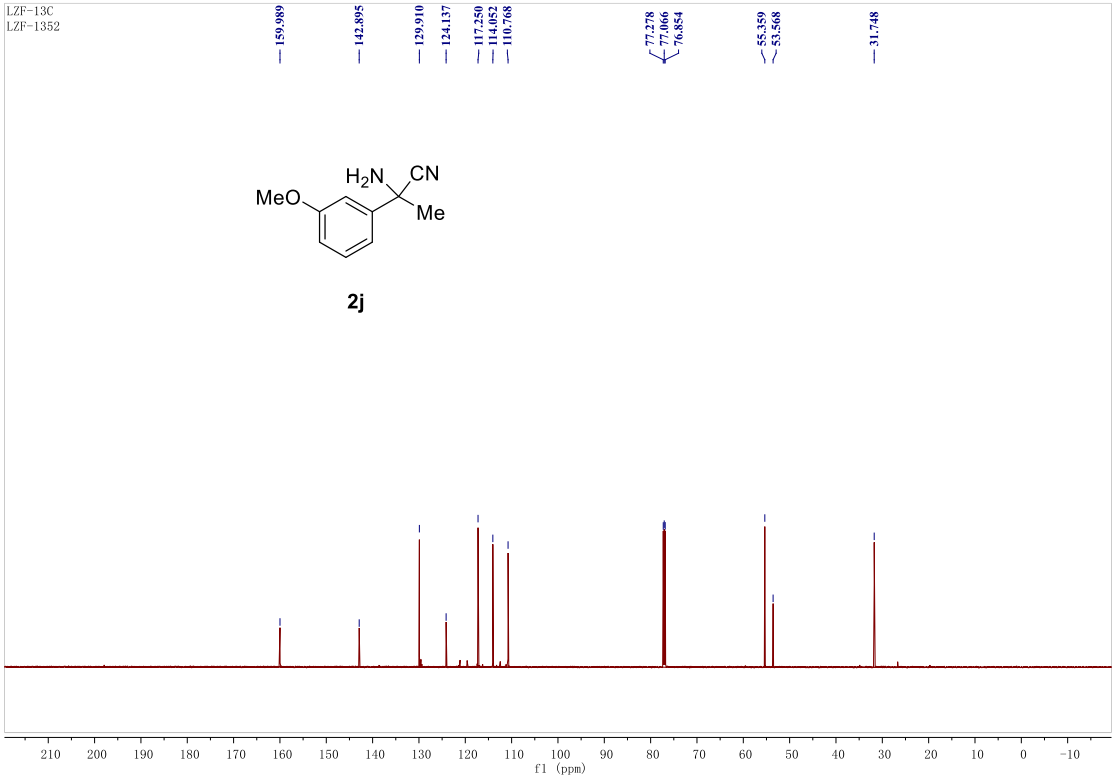
1.96
0.97
2.96
2.17
3.00
f1 (ppm)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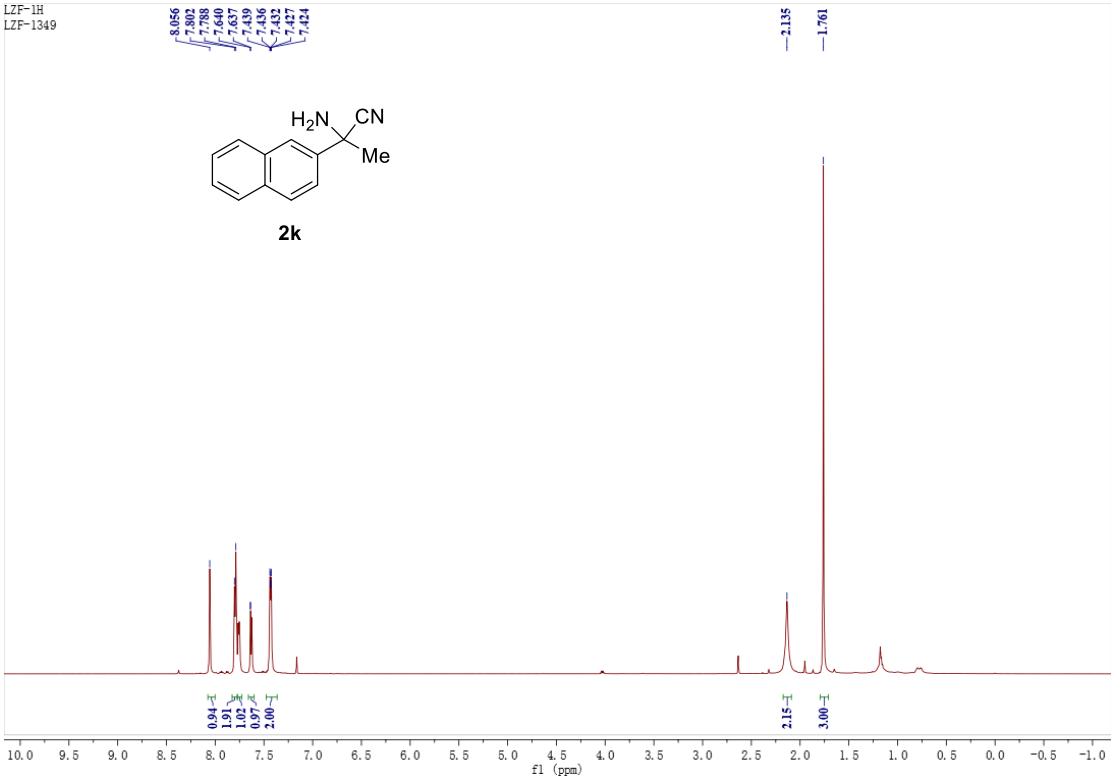
CN
MeO
Me
2j
f1 (ppm)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7.640
7.637
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7.436
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7.427
7.424
2.135
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CN
Me
2k
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1.91
1.02
0.97
2.00
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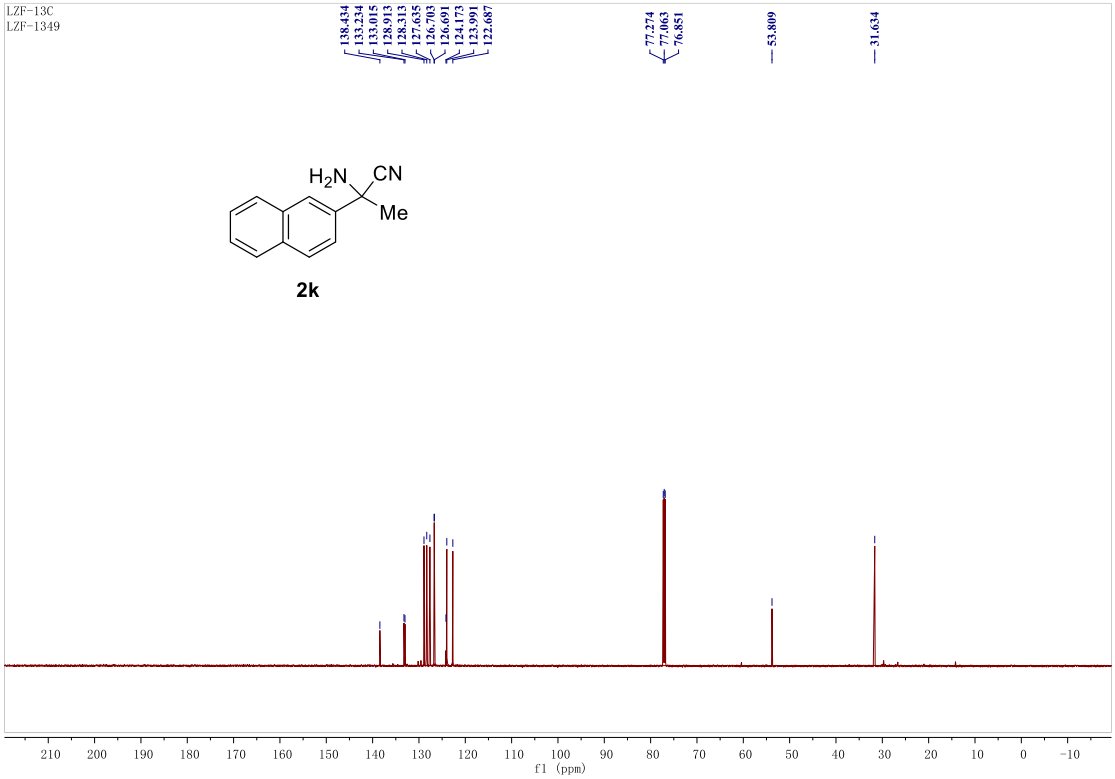
3.00
f1 (ppm)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76.851
53.809
31.634
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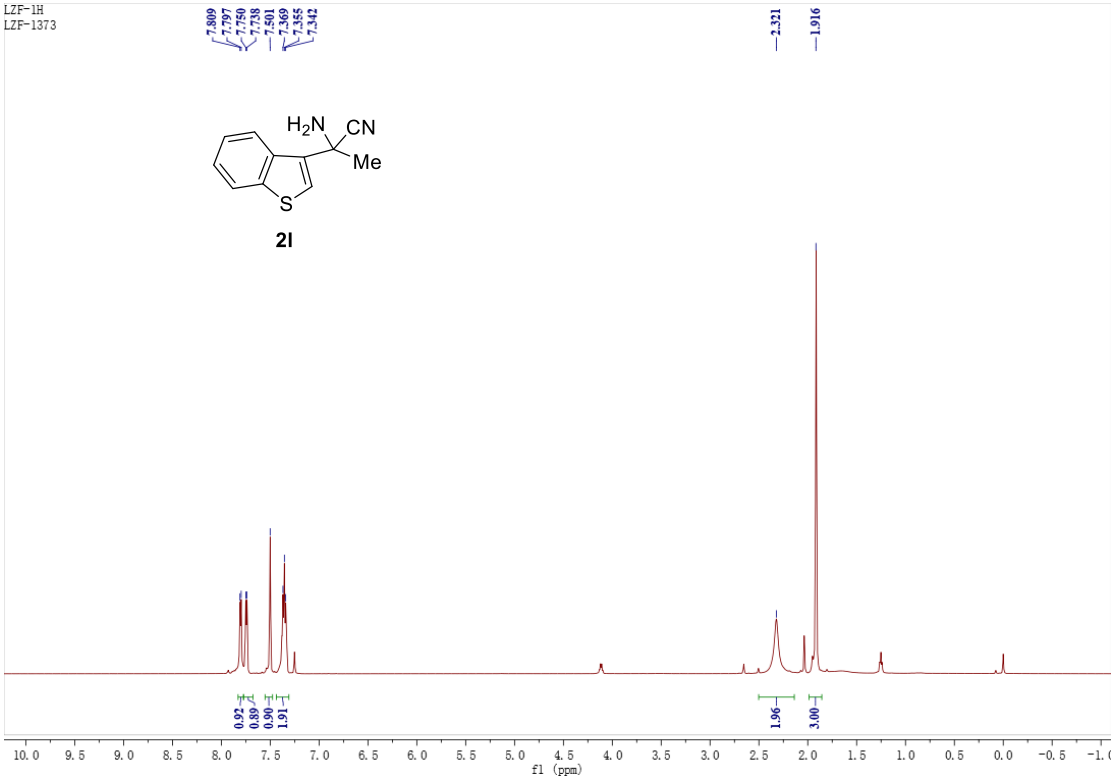
CN
Me
2k
f1 (ppm)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7.355
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CN
Me
S
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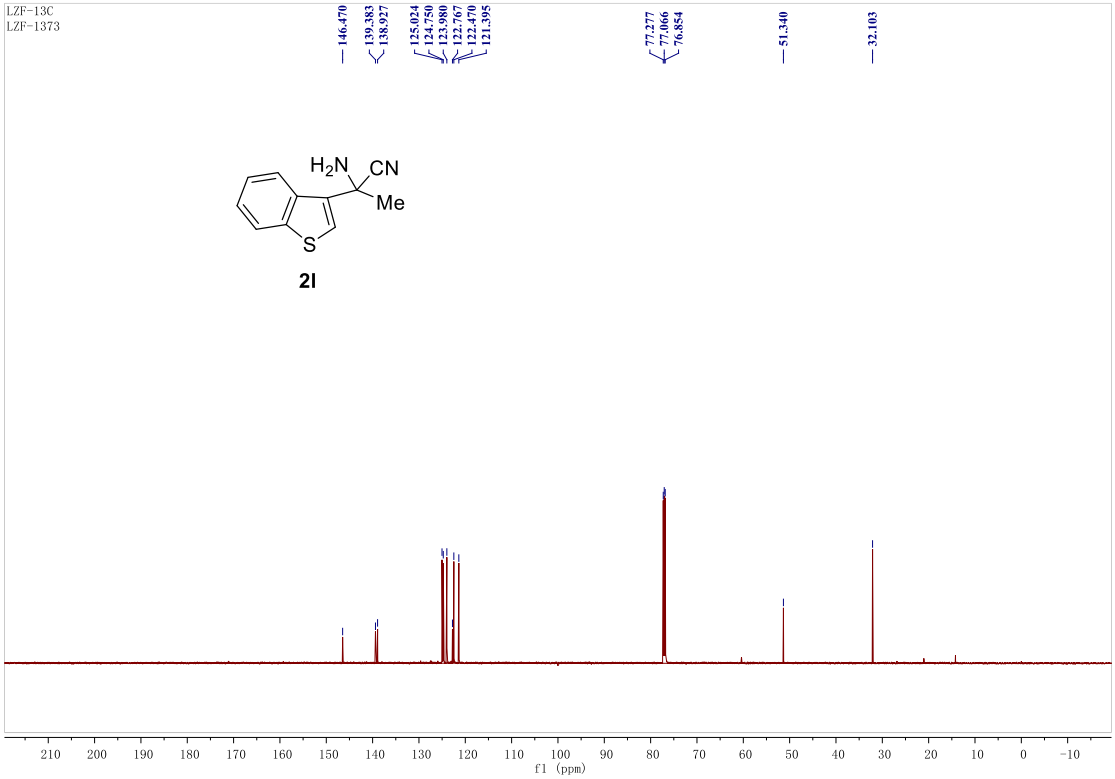
f1 (ppm)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77.066
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51.340
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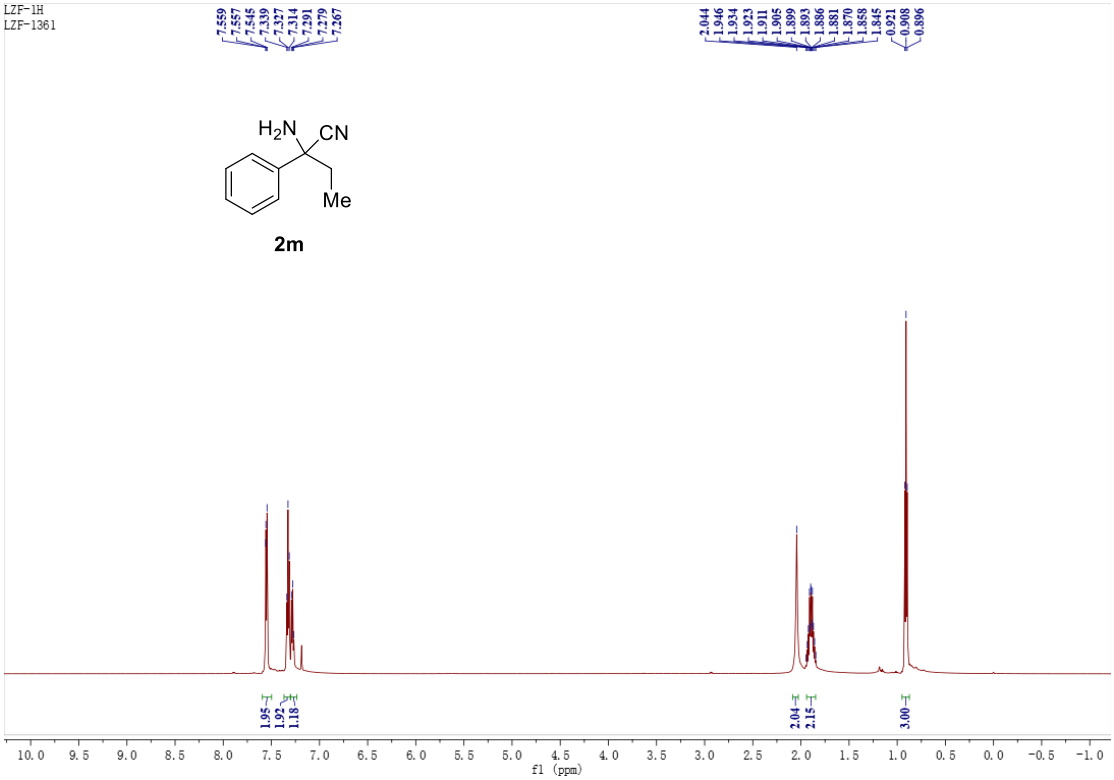
Me
S
2l
f1 (ppm)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7.291
7.279
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1.934
1.923
1.911
1.905
1.899
1.893
1.886
1.881
1.870
1.858
1.845
0.921
0.908
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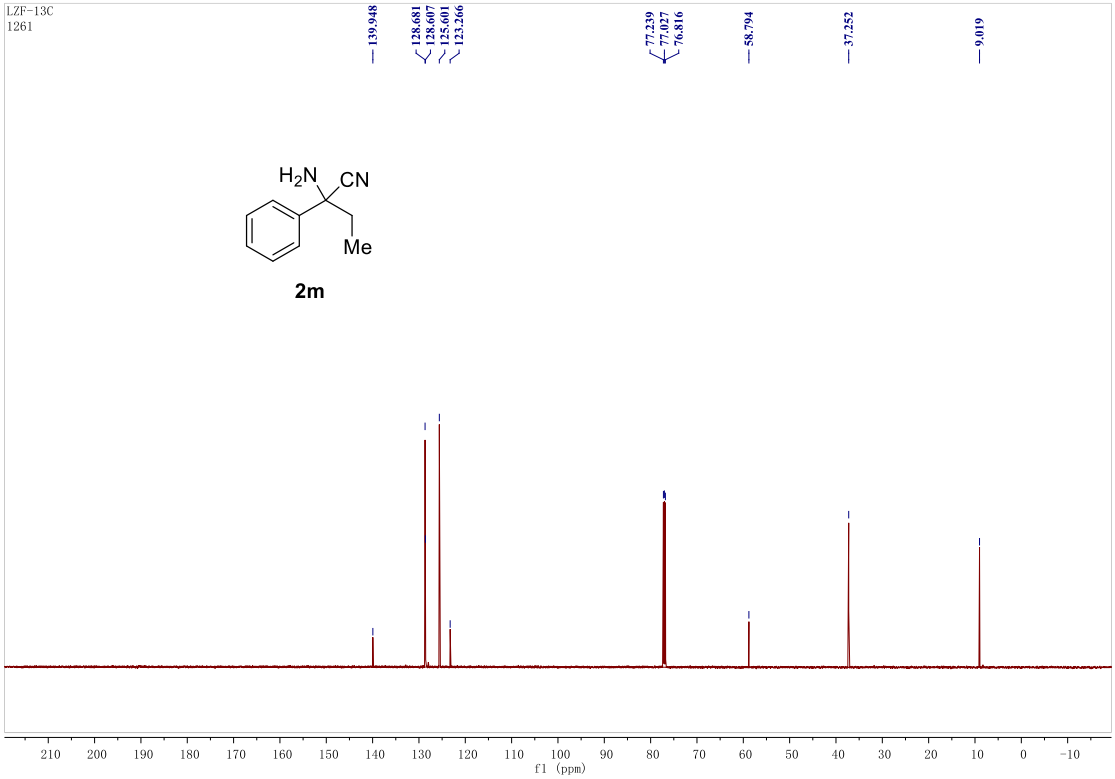
1.92
1.18
2.04
2.15
3.00
f1 (ppm)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9.019
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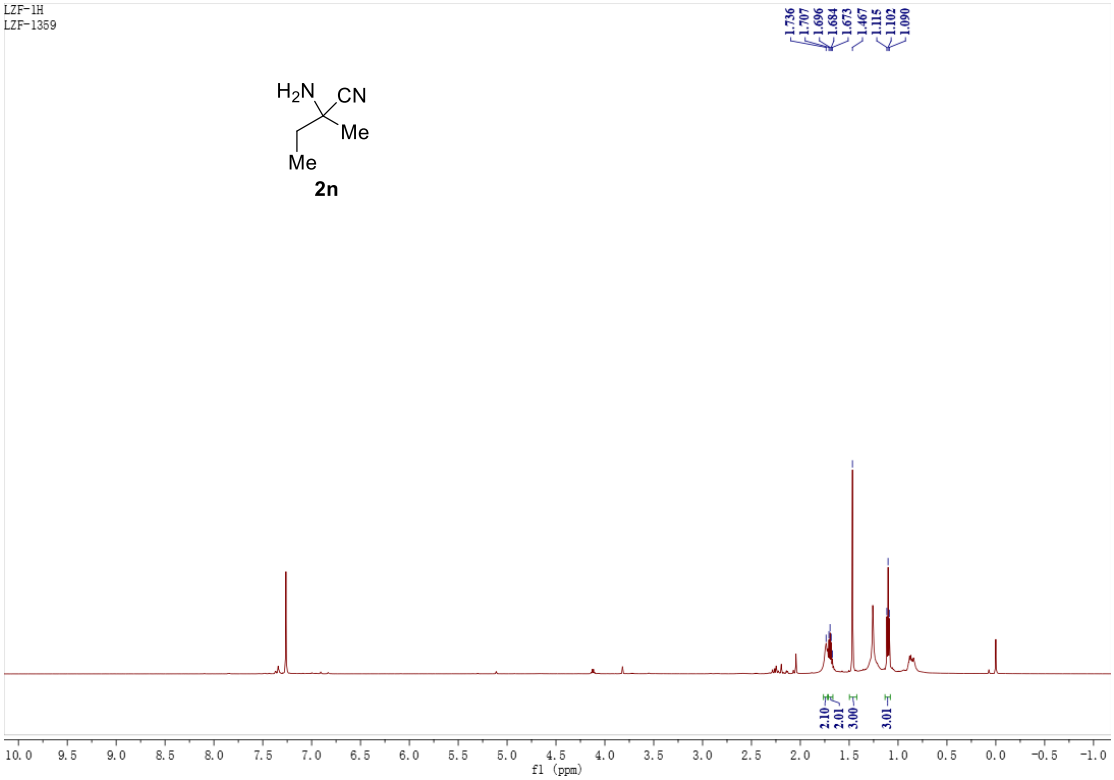
CN
Me
2m
f1 (ppm)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1.673
1.467
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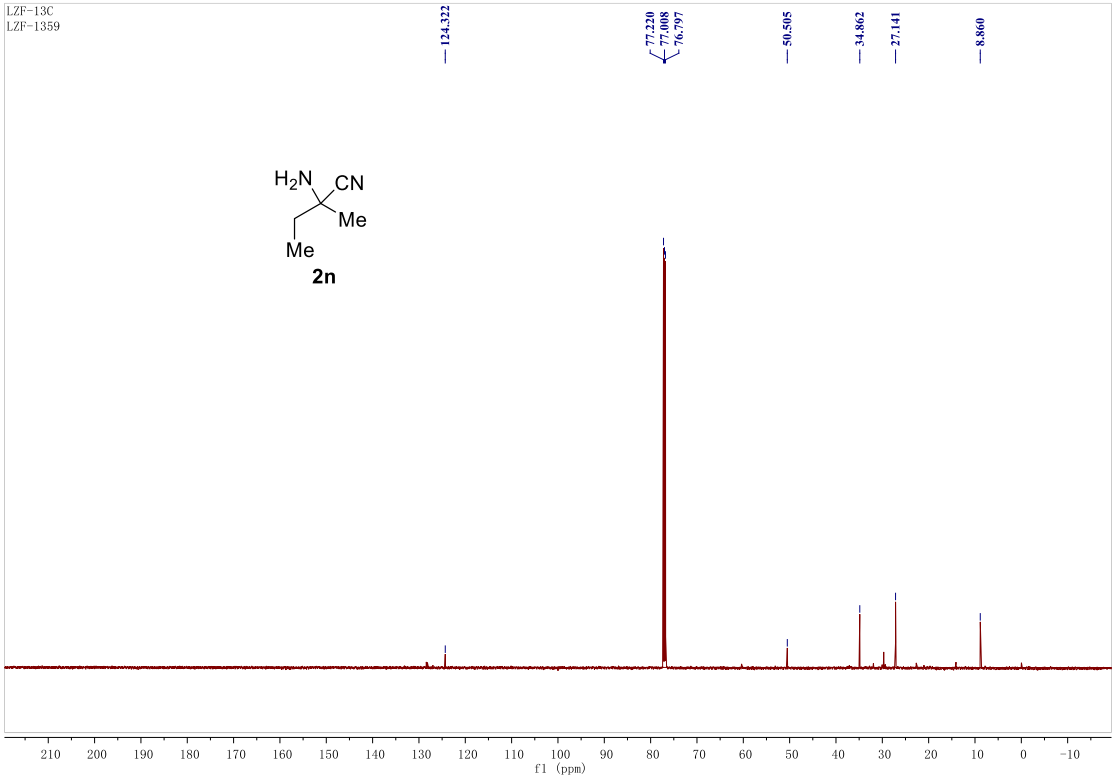
1.090
H2N
CN
Me
Me
2n
2.10
2.01
3.00
3.01
f1 (ppm)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8.860
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CN
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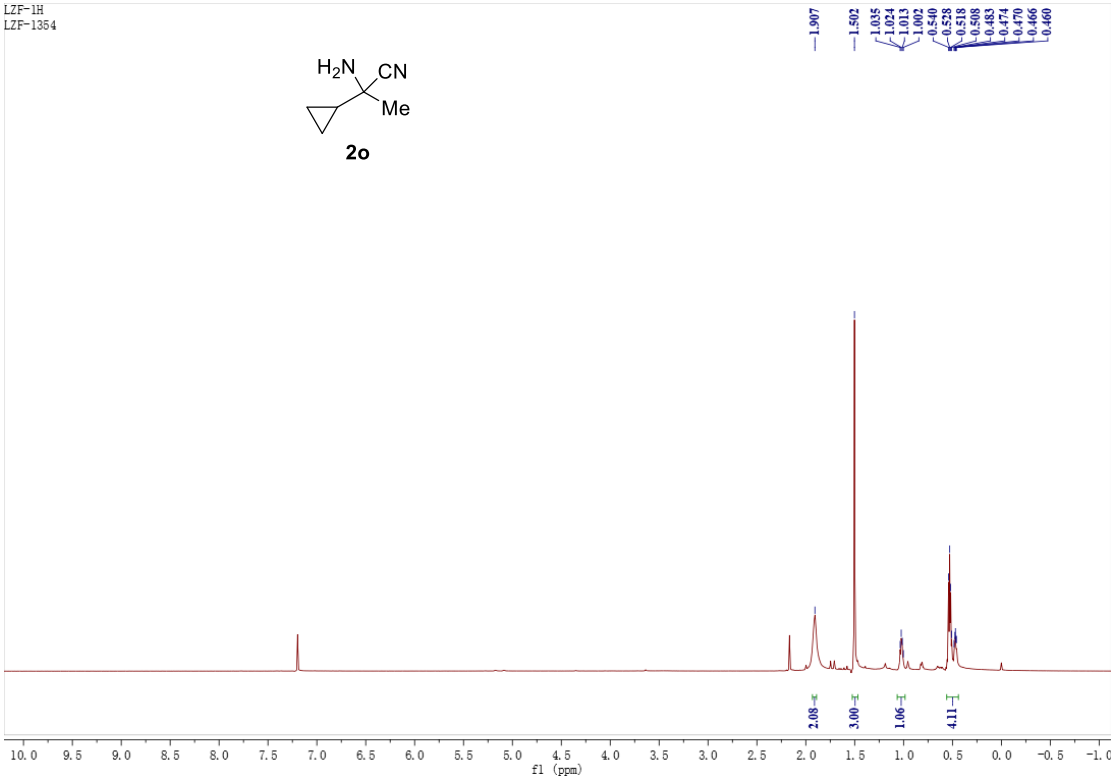
Me
2n
f1 (ppm)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1.035
1.024
1.013
1.002
0.540
0.528
0.518
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0.483
0.474
0.470
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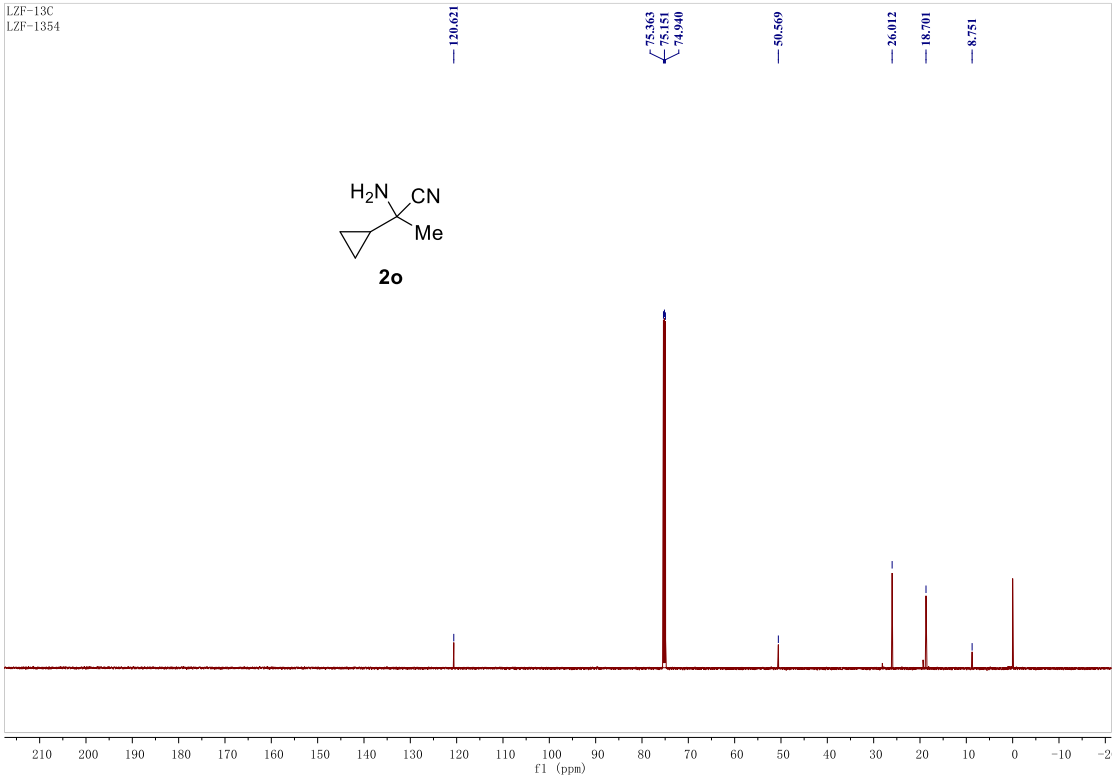
0.460
2o
2.08
3.00
1.06
4.11
f1 (ppm)


LZF-13C
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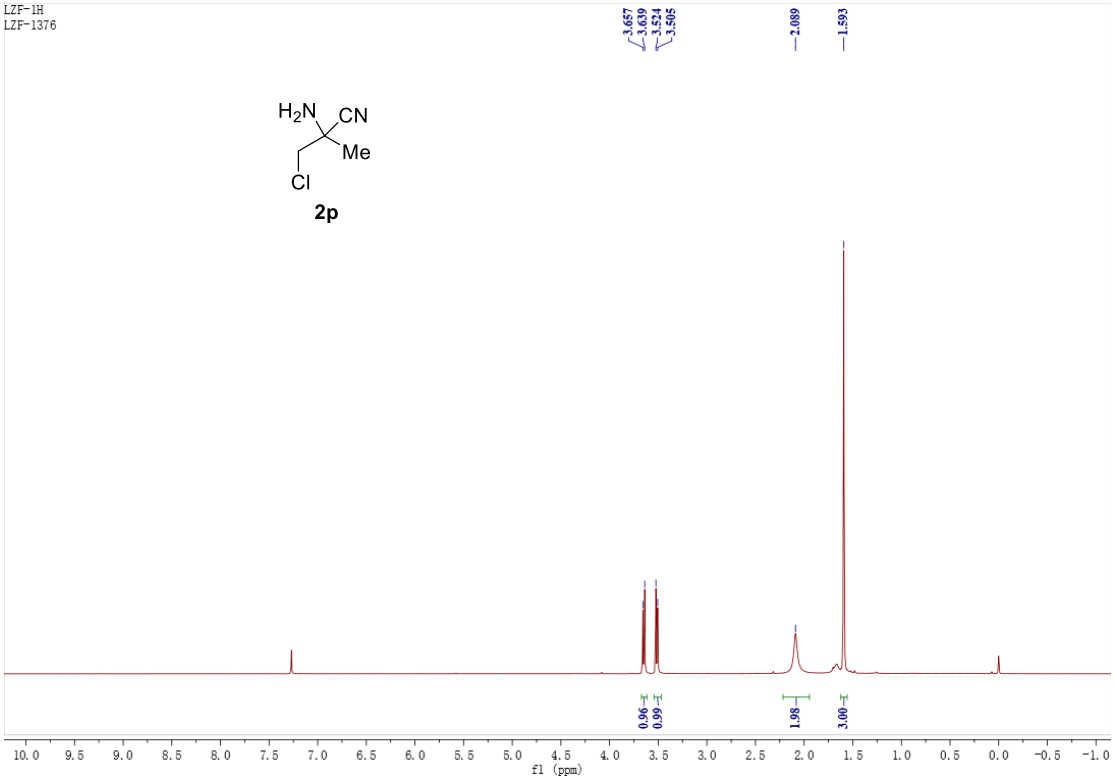
50.569
26.012
18.701
8.751
2o
f1 (ppm)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3.524
3.505
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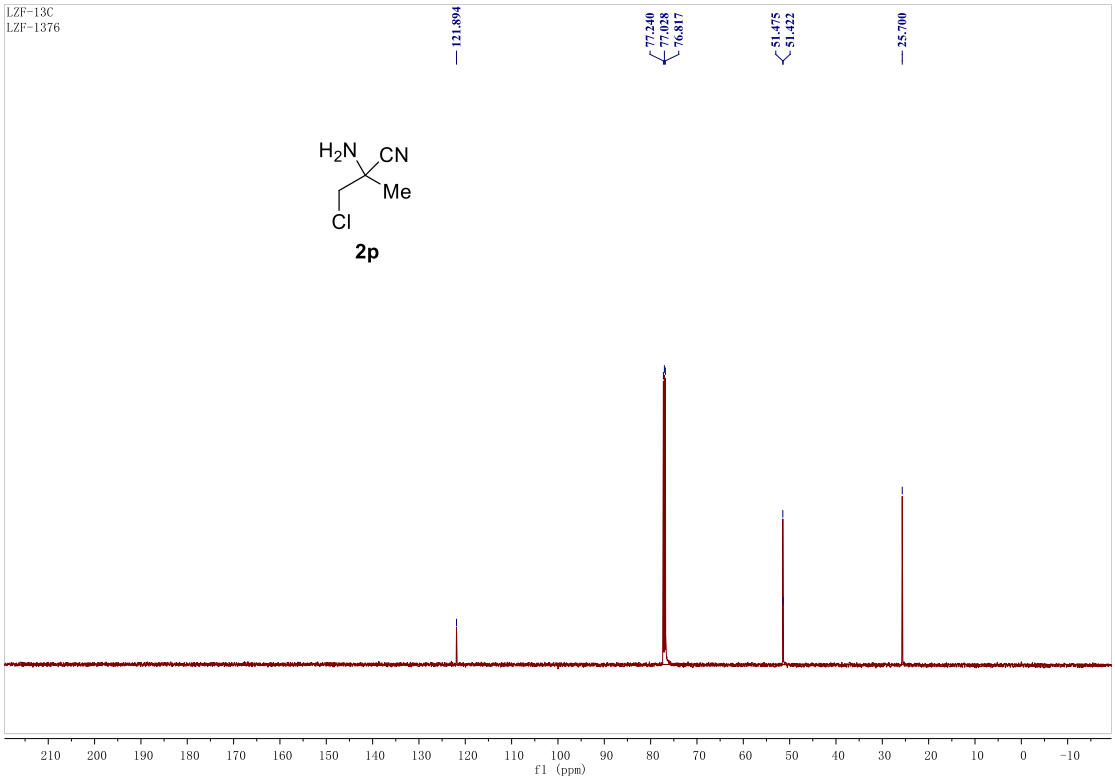
CN
Me
Cl
2p
0.96
0.99
1.98
3.00
f1 (ppm)


LZF-13C
LZF-1376
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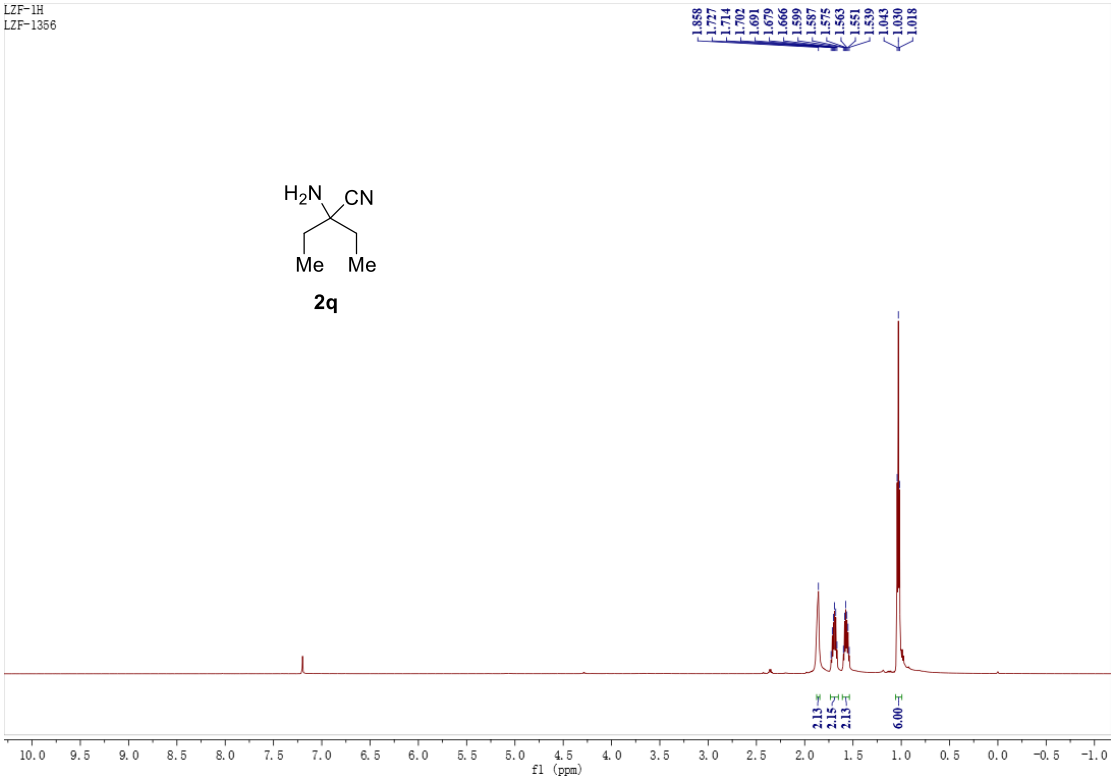
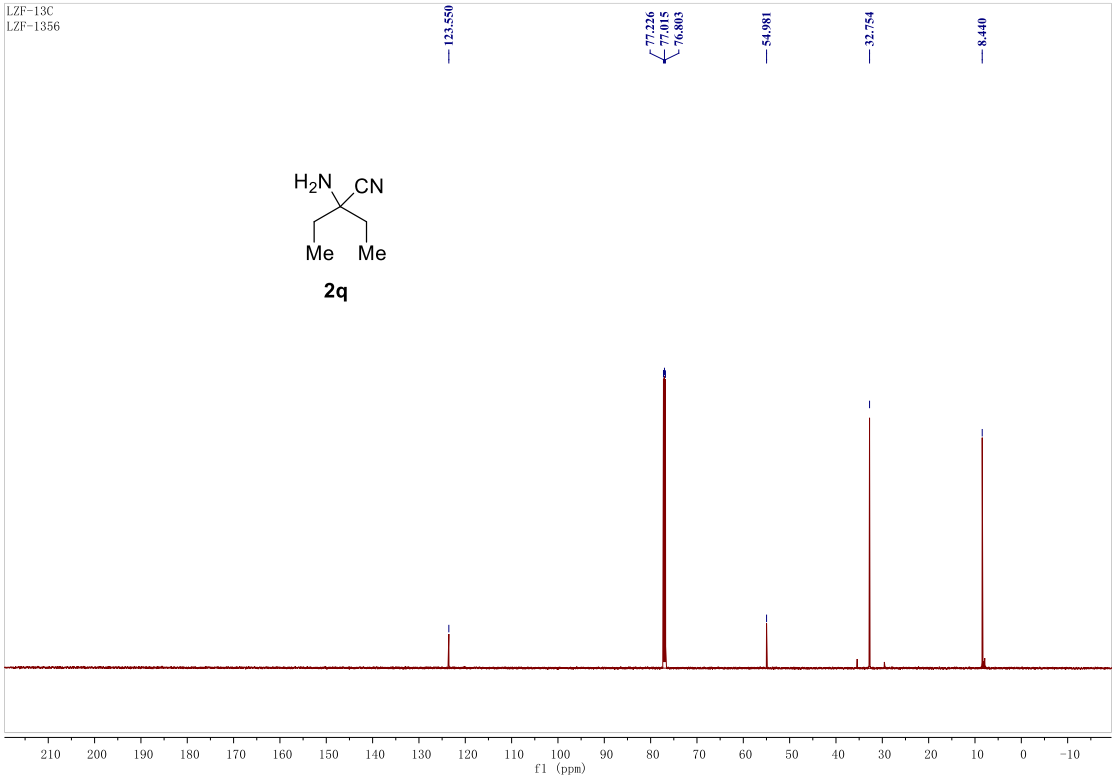
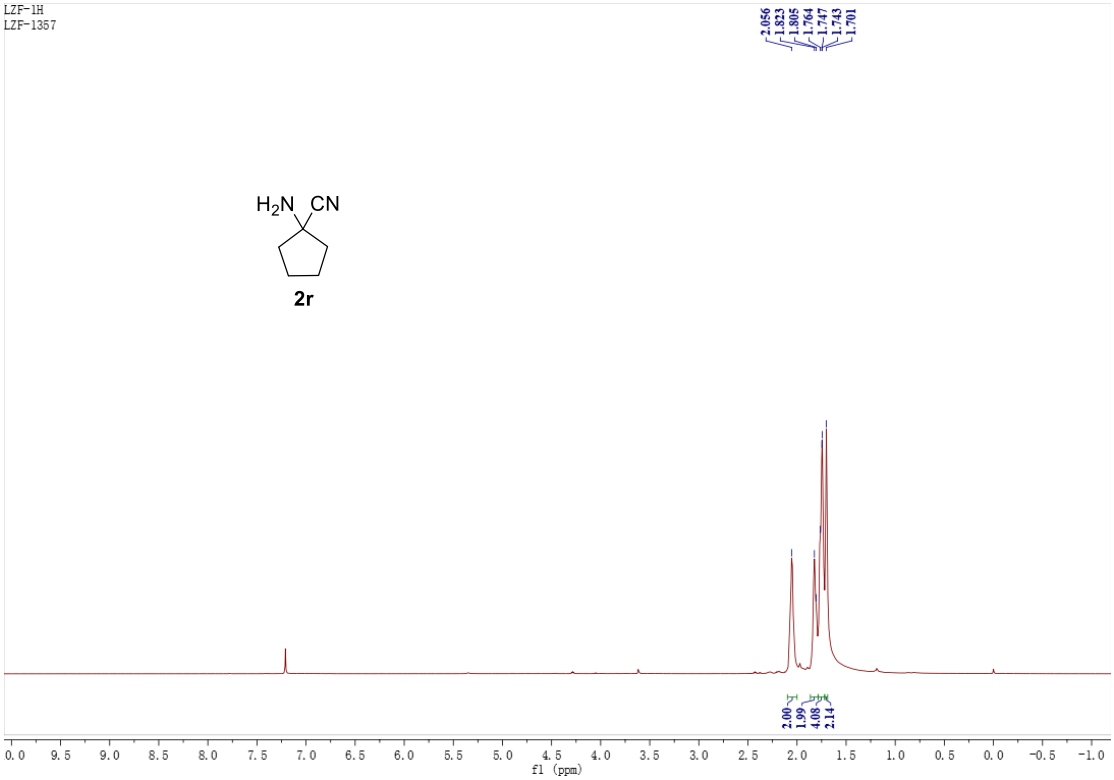
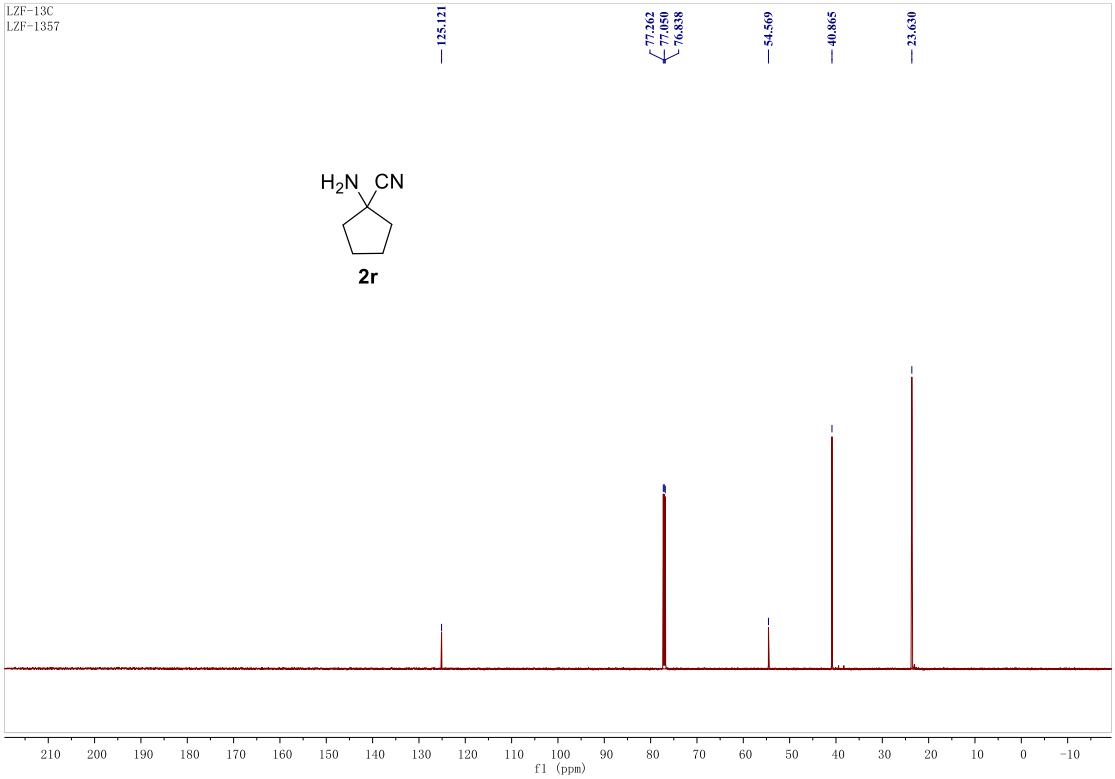
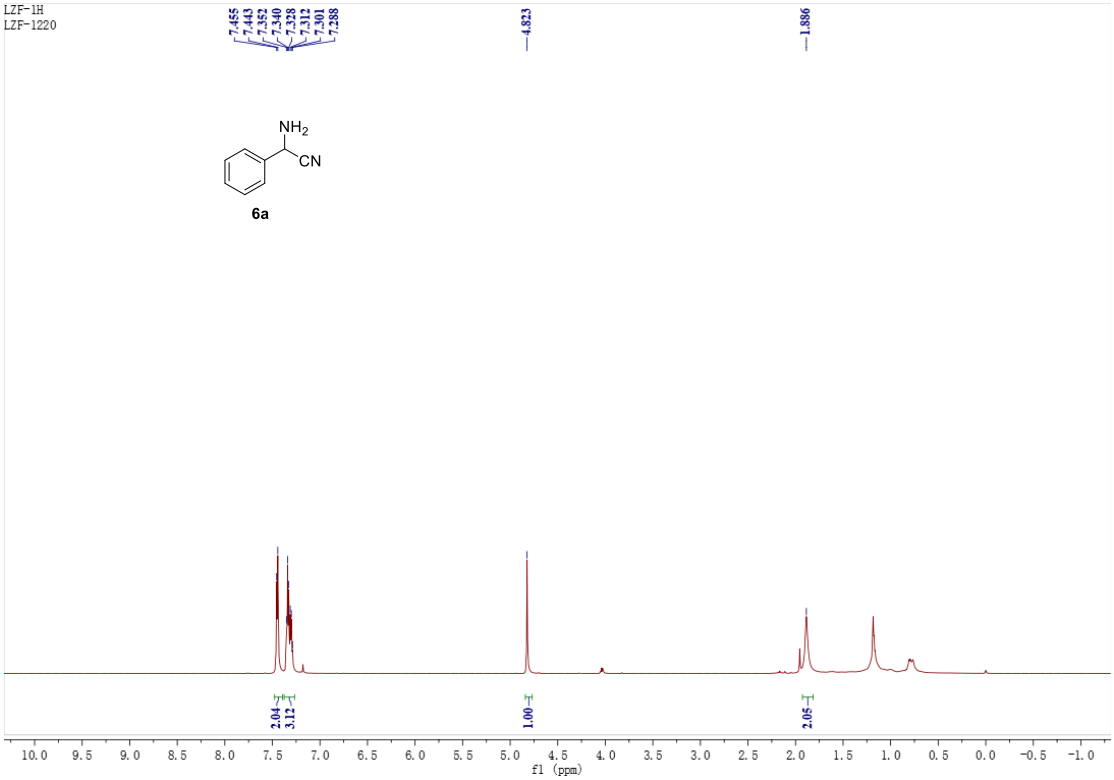
77.028
76.817
51.475
51.422
25.700
H2N
CN
Me
Cl
2p
f1 (ppm)

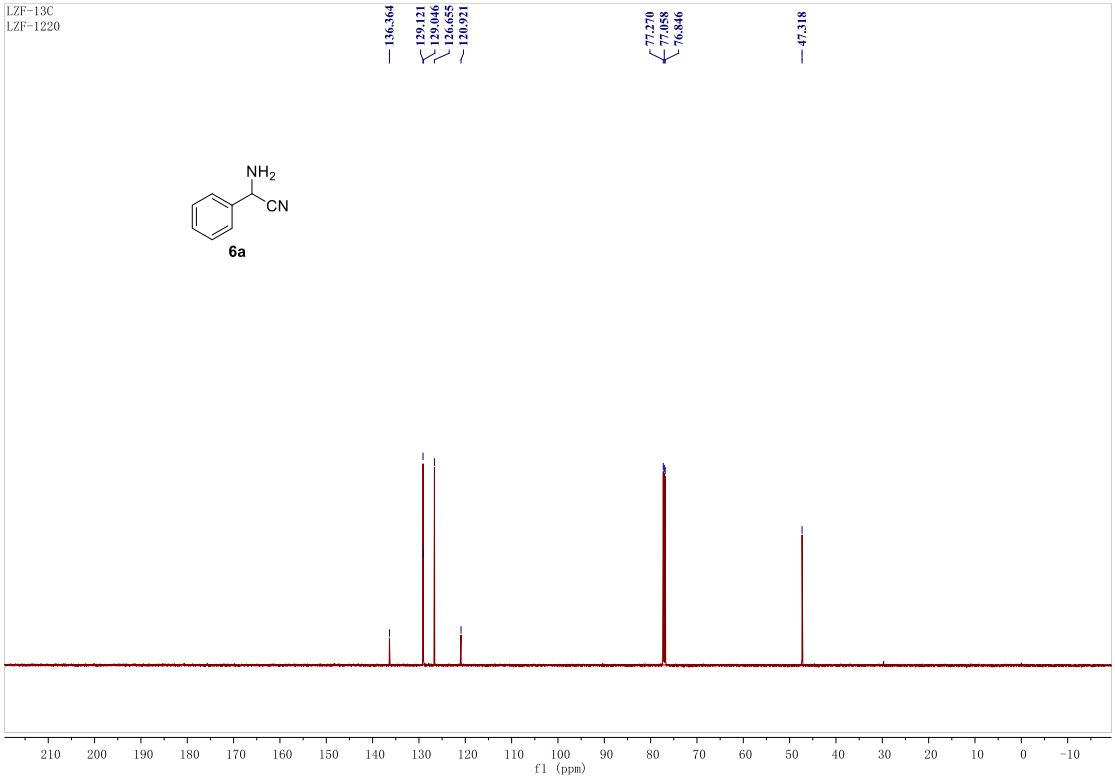

LZF-1H
LZF-1356
1.858
1.727
1.714
1.702
1.691
1.679
1.666
1.599
1.587
1.575
1.563
1.551
1.539
1.043
1.030
1.018
H2N
CN
Me
Me
2q
2.13
2.15
2.13
6.00
f1 (ppm)

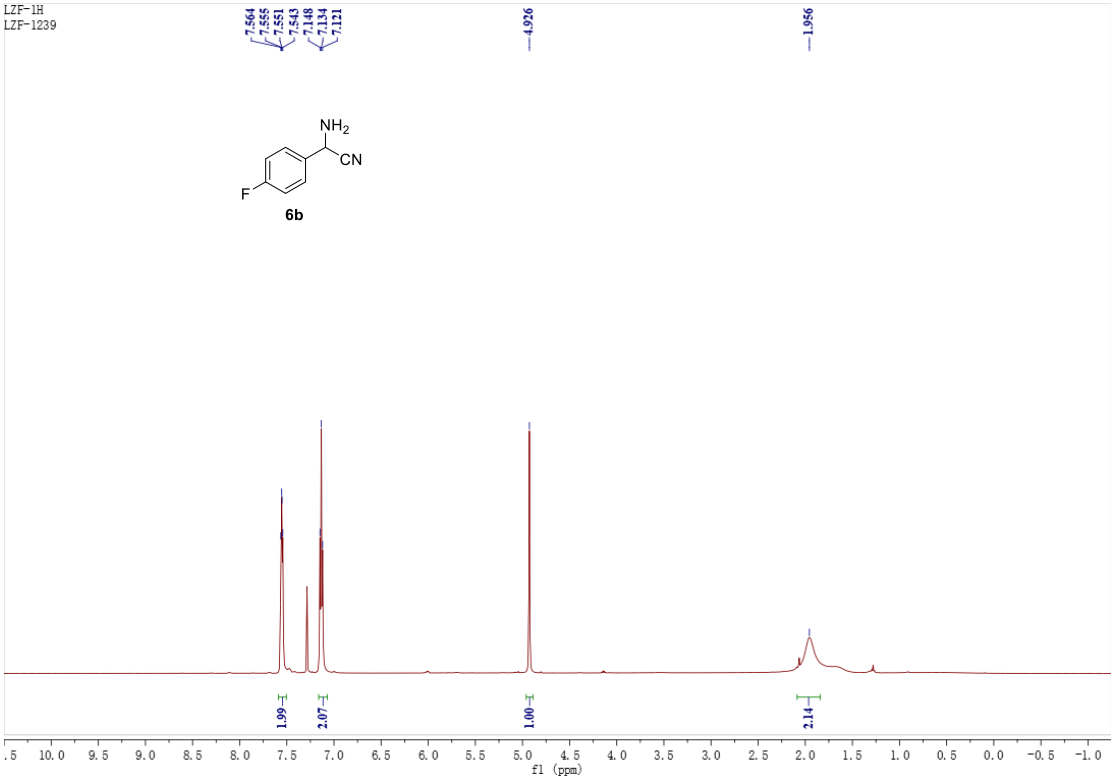

LZF-13C
LZF-1356
123.550
77.226
77.015
76.803
54.981
32.754
8.440
H2N
CN
Me
Me
2q
f1 (ppm)

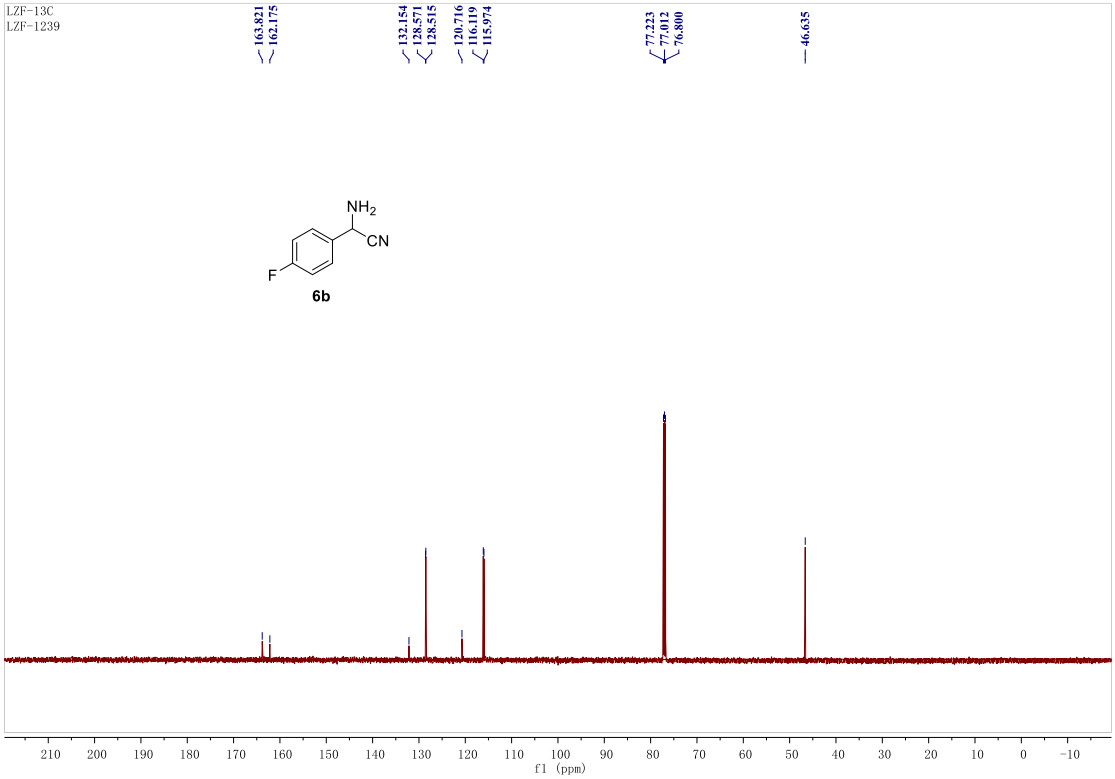

LZF-1H
LZF-1357
2.056
1.823
1.805
1.764
1.747
1.743
1.701
H2N CN
2r
2.00
1.99
4.08
2.14
f1 (ppm)

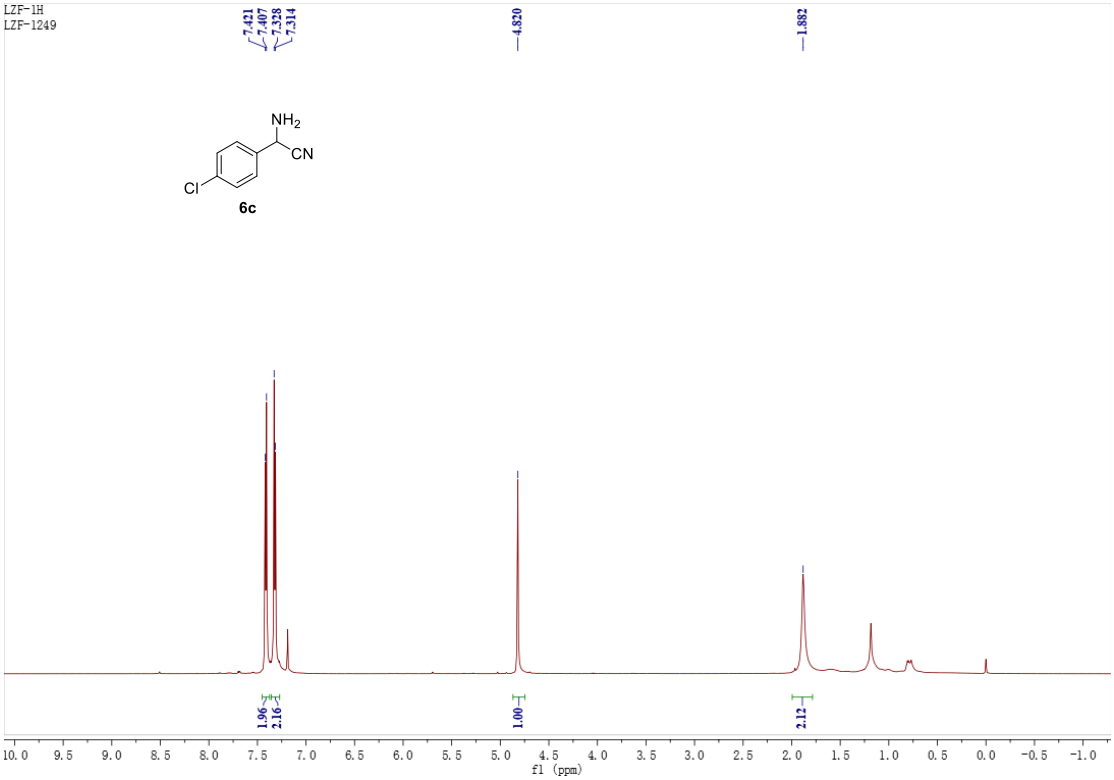

LZF-13C
LZF-1357
125.121
77.262
77.050
76.838
54.569
40.865
23.630
H2N CN
2r
f1 (ppm)

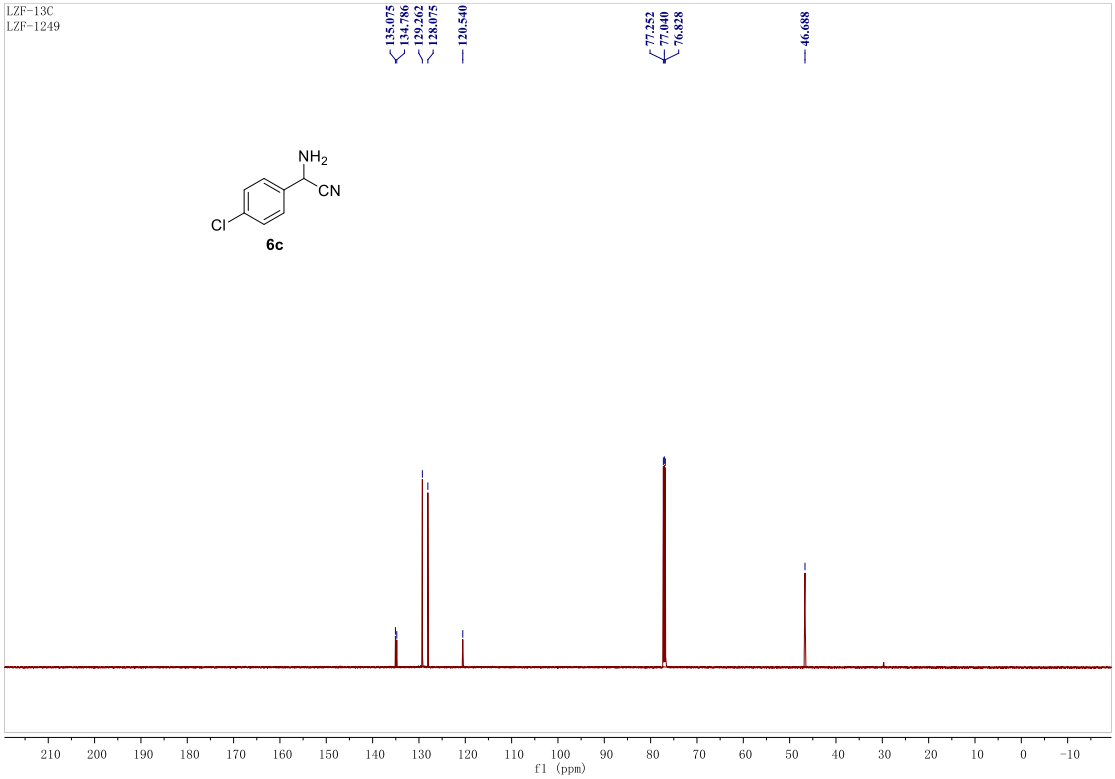

LZF-1H
LZF-1220
7.455
7.443
7.352
7.340
7.328
7.312
7.301
7.288
4.823
1.886
NH2
CN
6a
2.04
3.12
1.00
2.05
f1 (ppm)

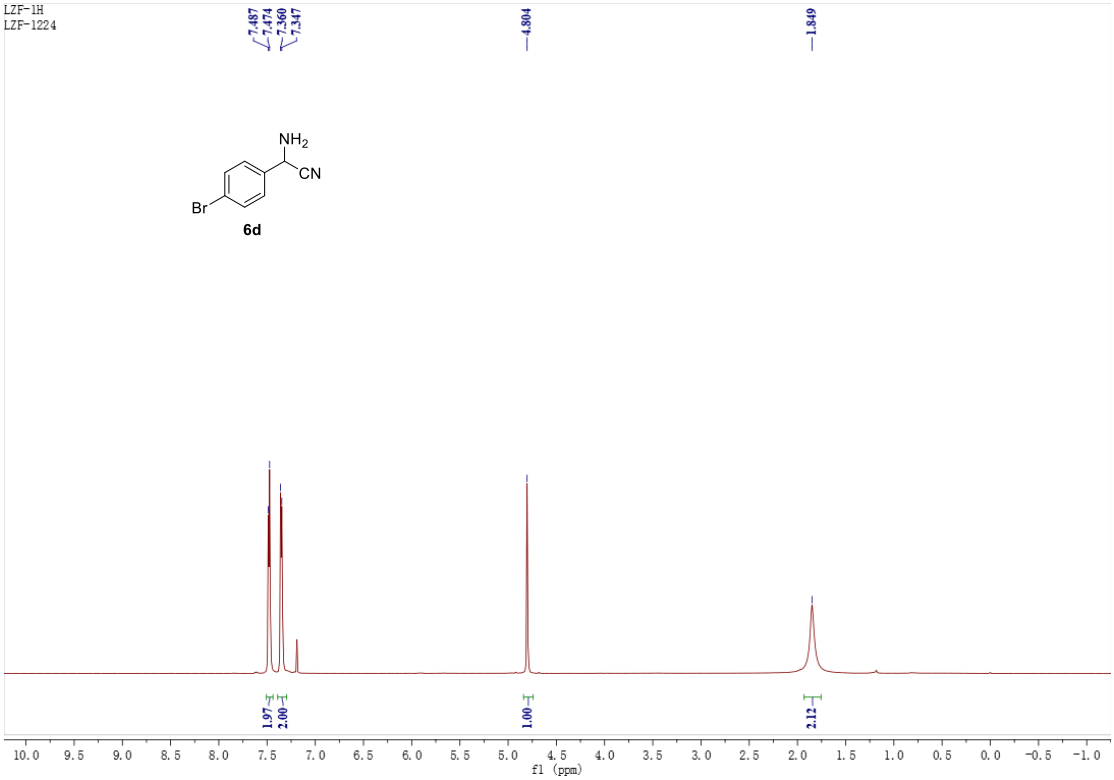

LZF-13C
LZF-1220
136.364
129.121
129.046
126.655
120.921
77.270
77.058
76.846
47.318
NH2
CN
6a
f1 (ppm)

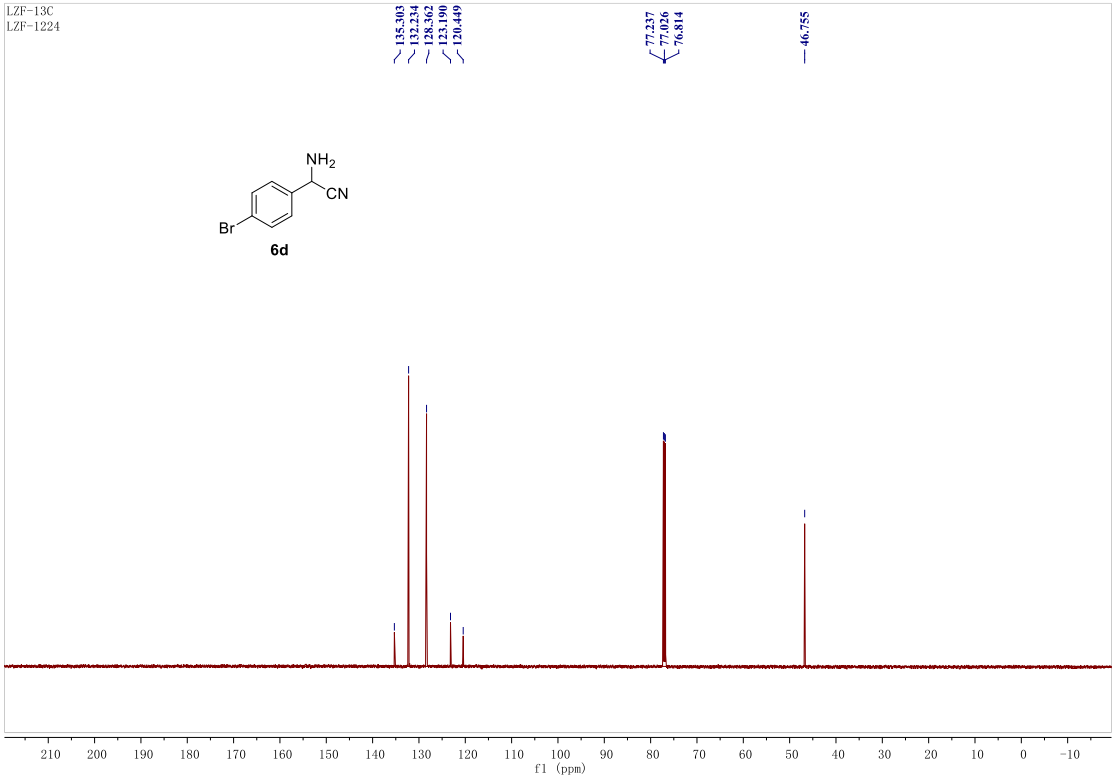

LZF-1H
LZF-1239
7.564
7.555
7.551
7.543
7.148
7.134
7.121
4.926
1.956
NH2
CN
F
6b
1.99
2.07
1.00
2.14
f1 (ppm)

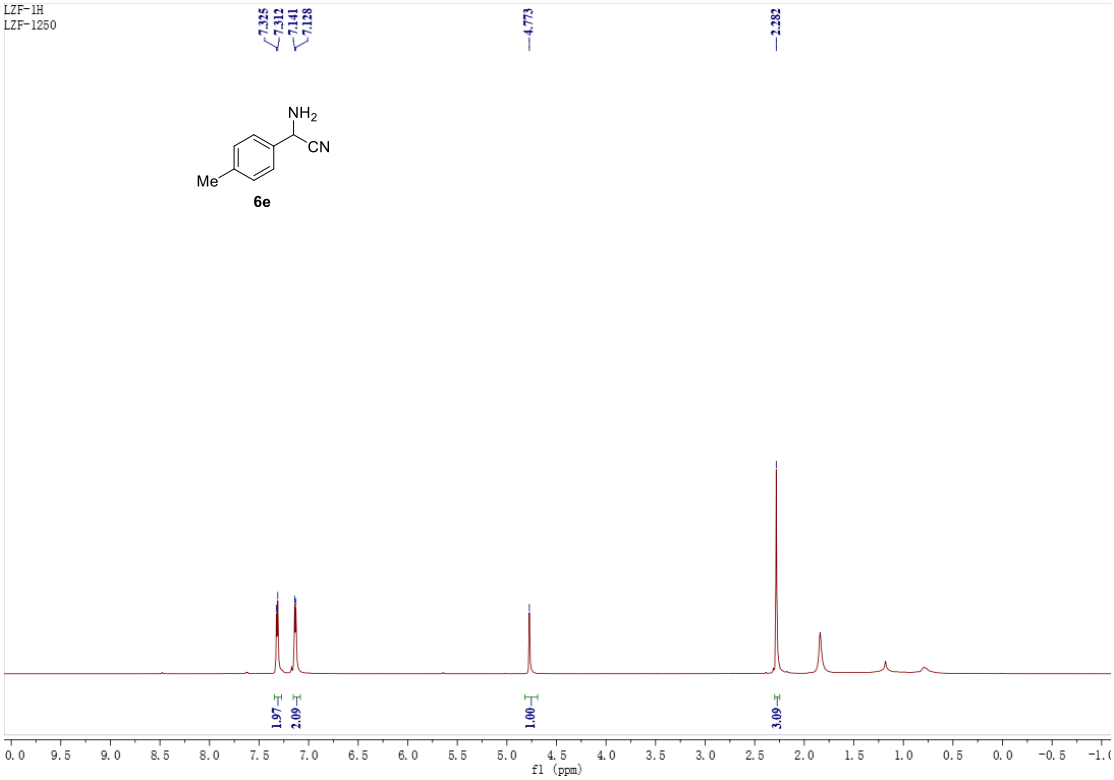

LZF-13C
LZF-1239
163.821
162.175
132.154
128.571
128.515
120.716
116.119
115.974
77.223
77.012
76.800
46.635
NH2
CN
F
6b
f1 (ppm)

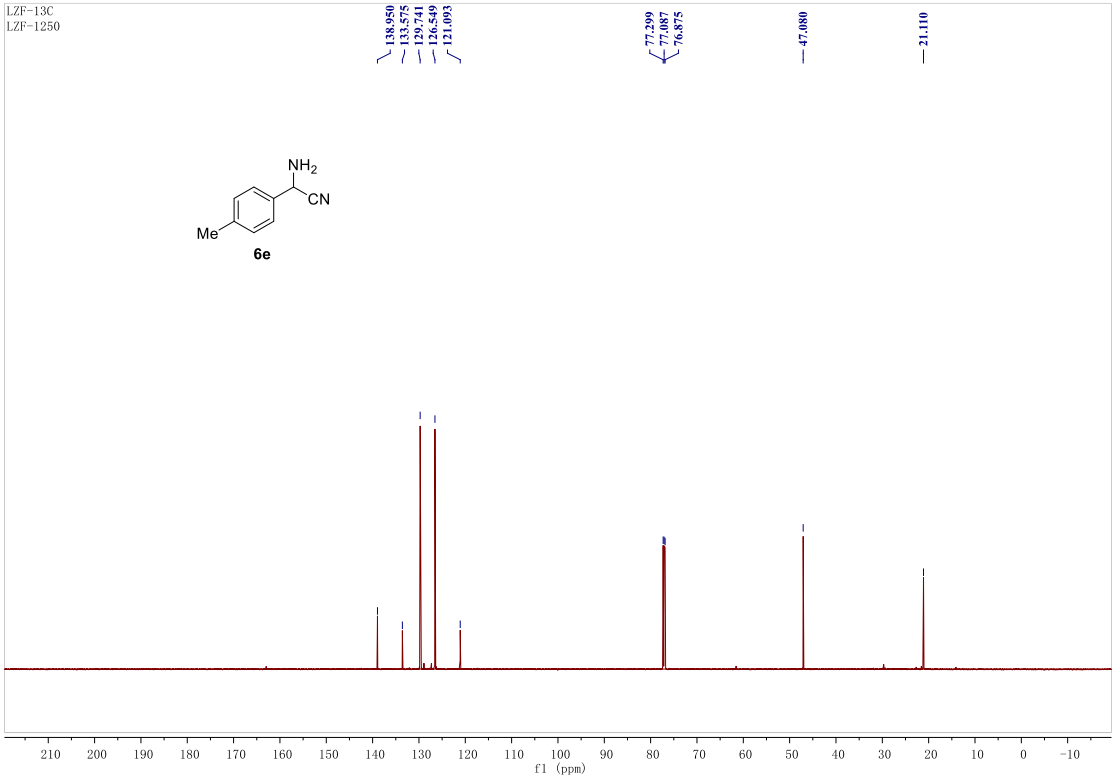

LZF-1H
LZF-1249
7.421
7.407
7.328
7.314
4.820
1.882
NH2
CN
Cl
6c
1.96
2.16
1.00
2.12
f1 (ppm)

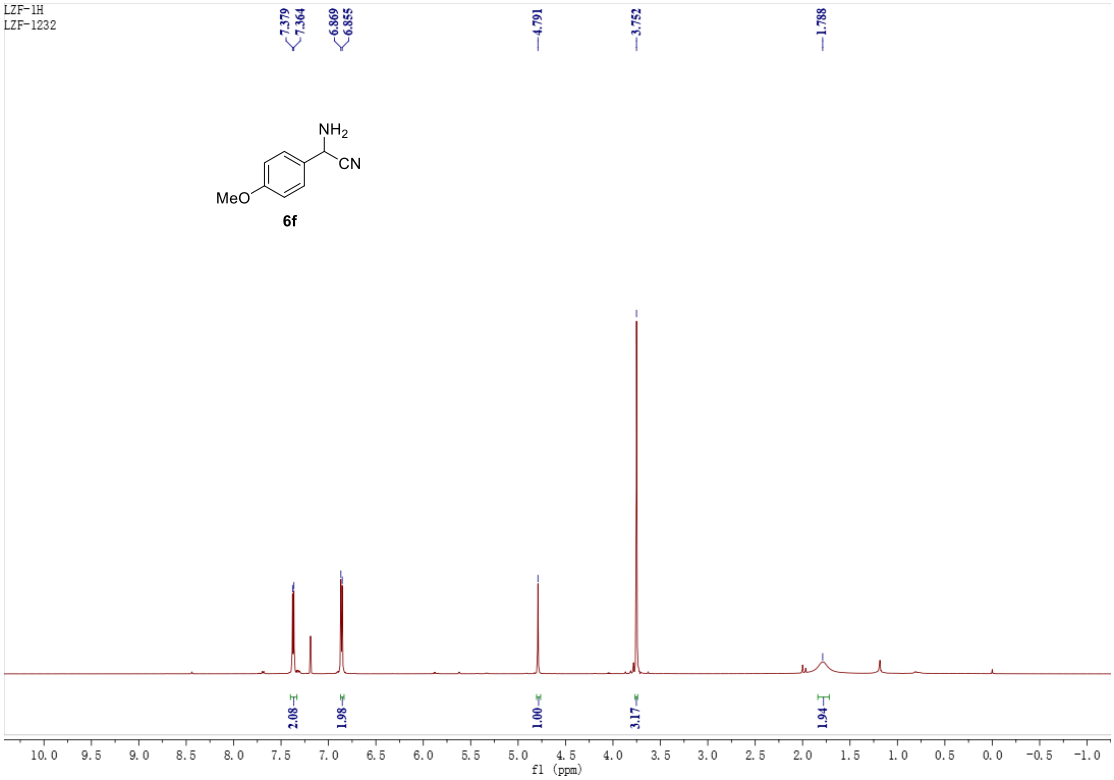

LZF-13C
LZF-1249
135.075
134.786
129.262
128.075
120.540
77.252
77.040
76.828
46.688
NH2
CN
Cl
6c
f1 (ppm)

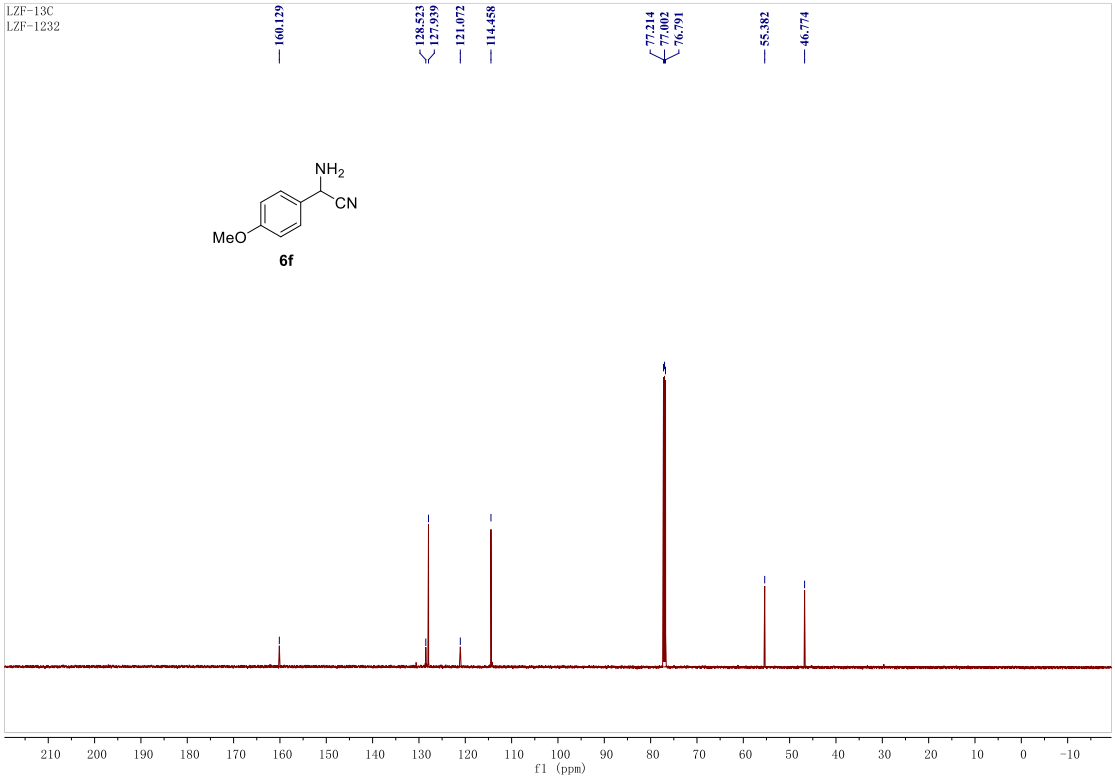

LZF-1H
LZF-1224
7.487
7.474
7.360
7.347
4.804
1.849
NH2
CN
Br
6d
1.97
2.00
1.00
2.12
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)

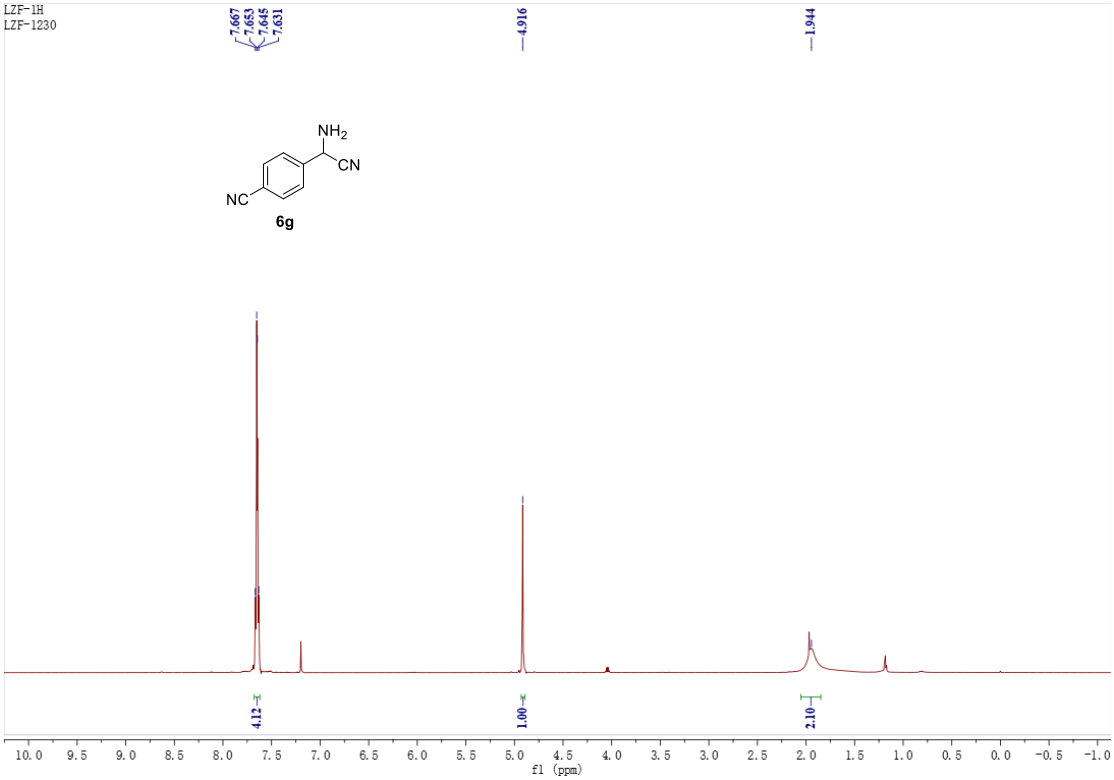

LZF-13C
LZF-1224
135.303
132.234
128.362
123.190
120.449
77.237
77.026
76.814
46.755
NH2
CN
Br
6d
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

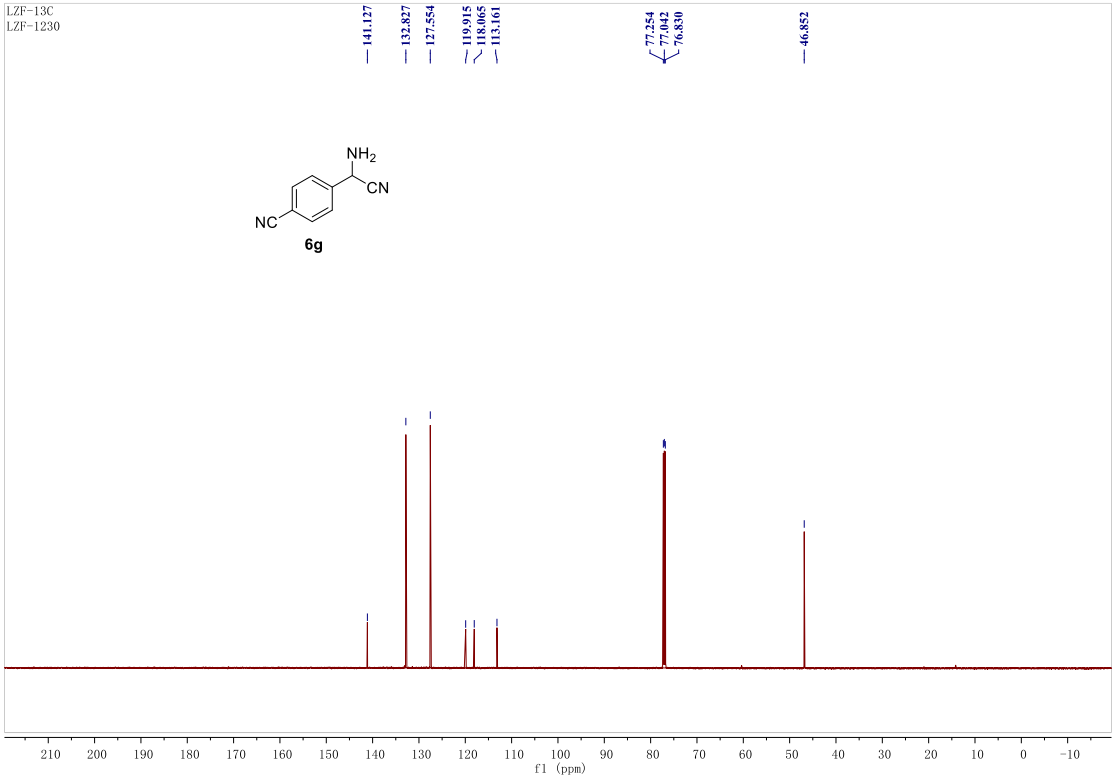

LZF-1H
LZF-1250
7.325
7.312
7.141
7.128
4.773
2.282
NH2
CN
Me
6e
1.97
2.09
1.00
3.09
f1 (ppm)

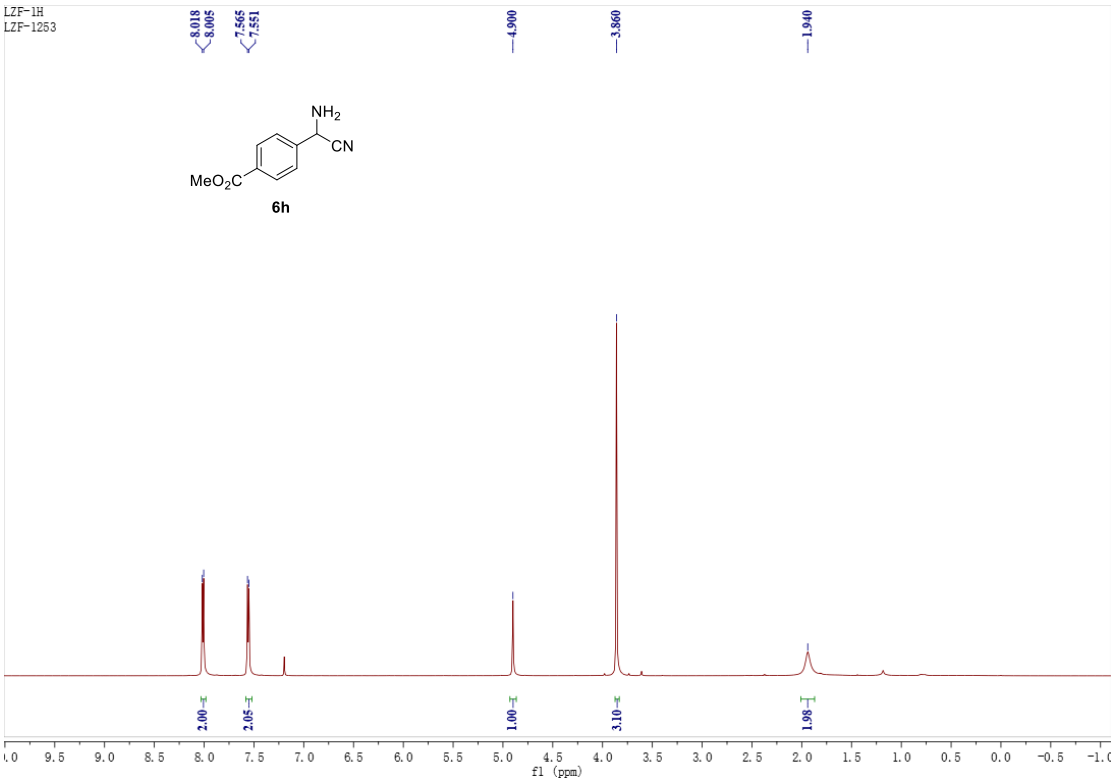

LZF-13C
LZF-1250
138.950
133.575
129.741
126.549
121.093
77.299
77.087
76.875
47.080
21.110
NH2
CN
Me
6e
f1 (ppm)

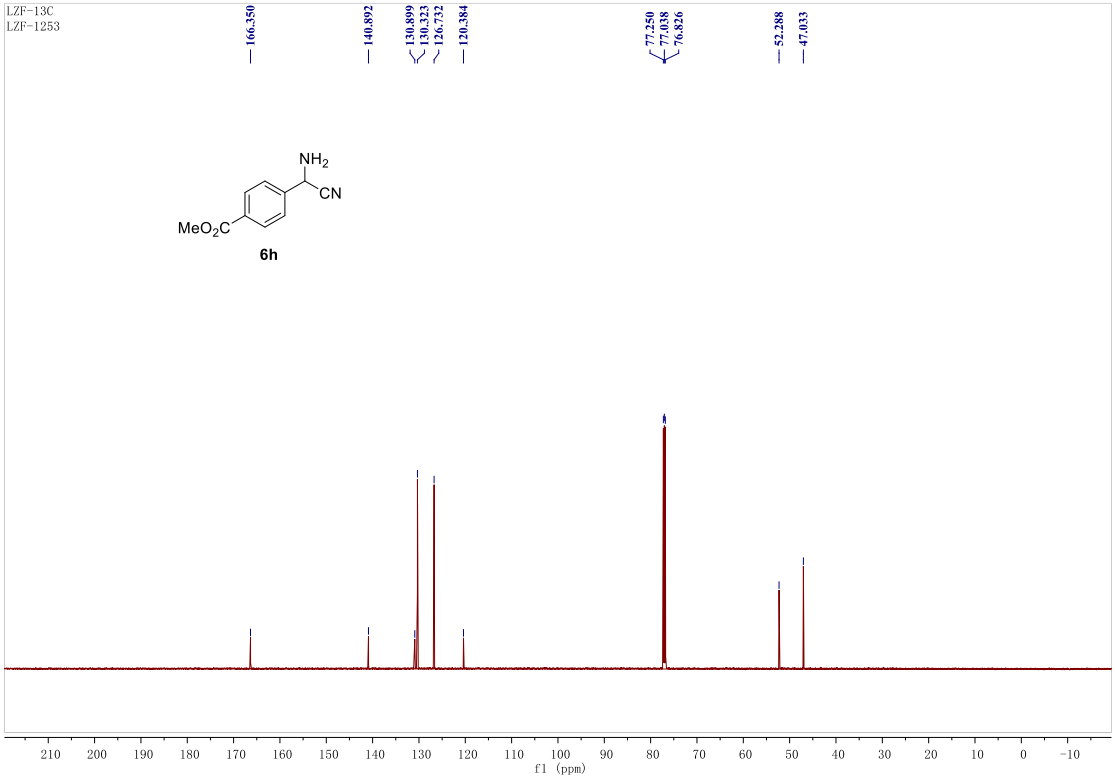

LZF-1H
LZF-1232
7.379
7.364
6.869
6.855
4.791
3.752
1.788
NH2
CN
MeO
6f
2.08
1.98
1.00
3.17
1.94
f1 (ppm)

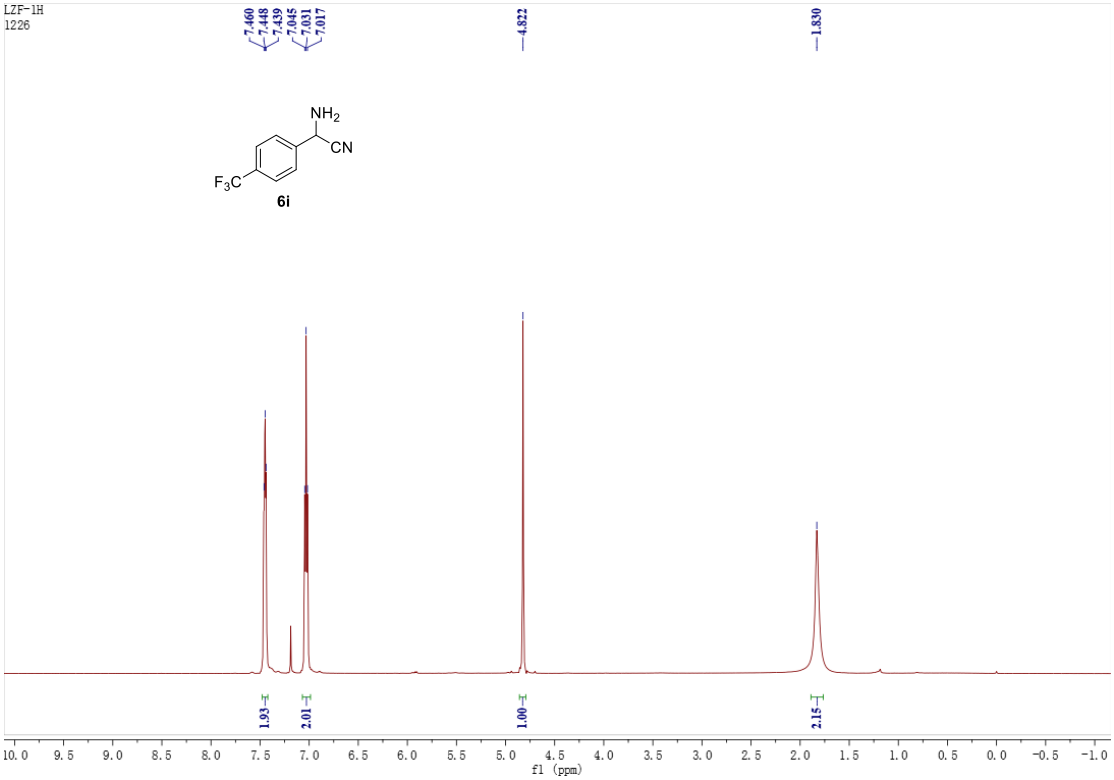

LZF-13C
LZF-1232
160.129
128.523
127.939
121.072
114.458
77.214
77.002
76.791
55.382
46.774
NH2
CN
MeO
6f
f1 (ppm)

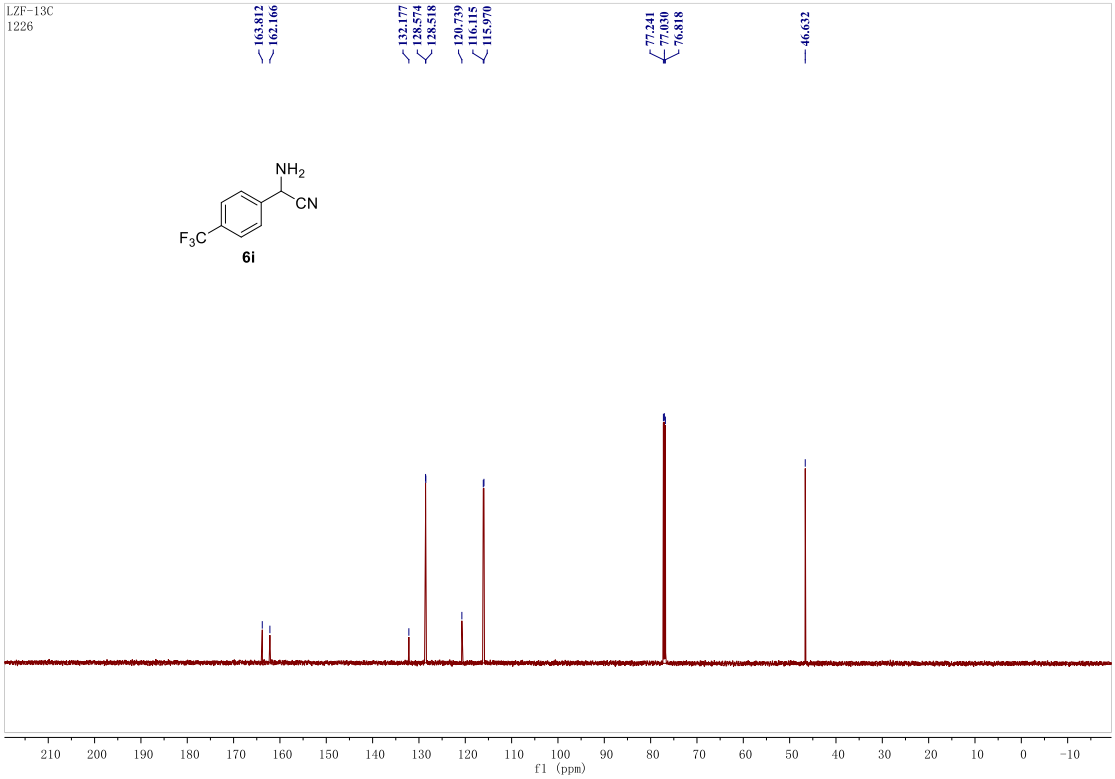

LZF-1H
LZF-1230
7.667
7.653
7.645
7.631
4.916
1.944
NH2
CN
NC
6g
4.12
1.00
2.10
f1 (ppm)

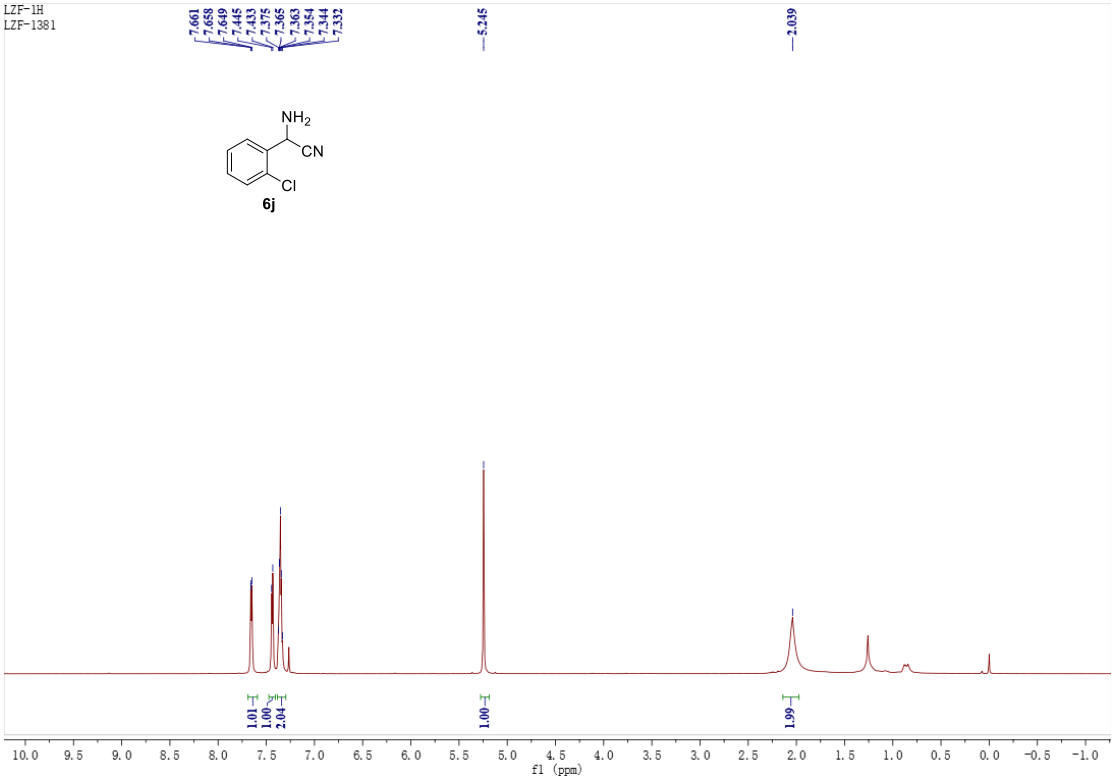

LZF-13C
LZF-1230
141.127
132.827
127.554
119.915
118.065
113.161
77.254
77.042
76.830
46.852
NH2
CN
NC
6g
f1 (ppm)

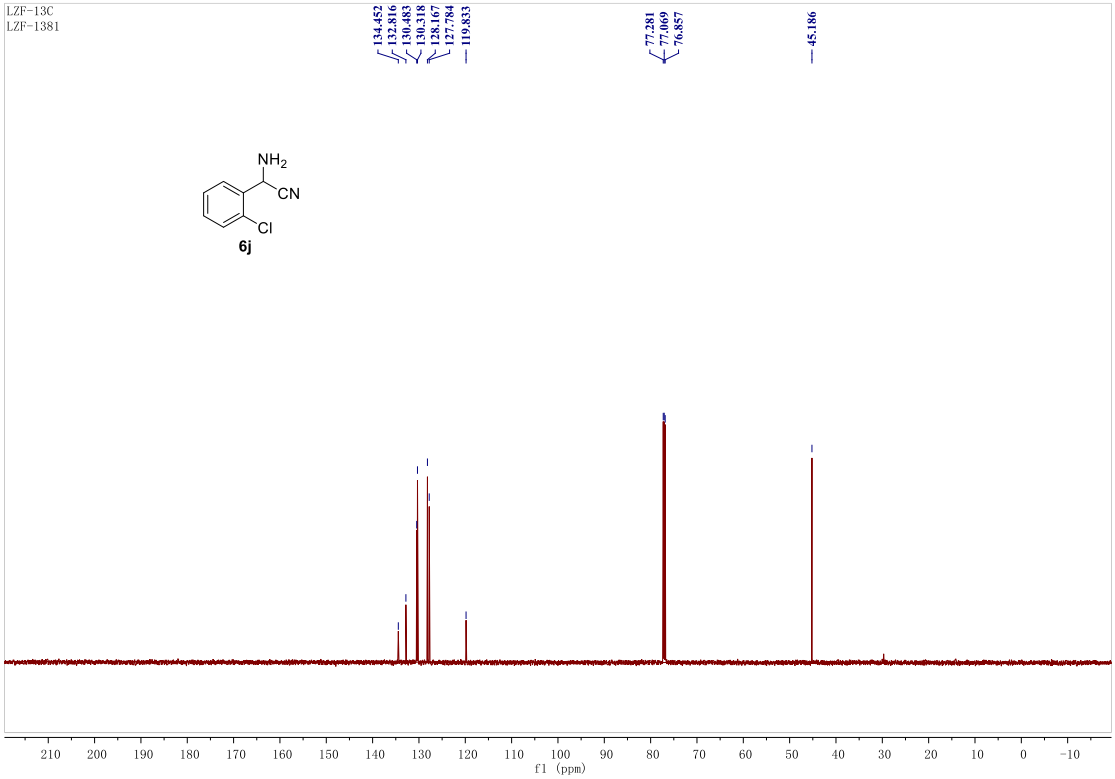

LZF-1H
LZF-1253
8.018
8.005
7.565
7.551
4.900
3.860
1.940
NH2
CN
MeO2C
6h
2.00
2.05
1.00
3.10
1.98
f1 (ppm)

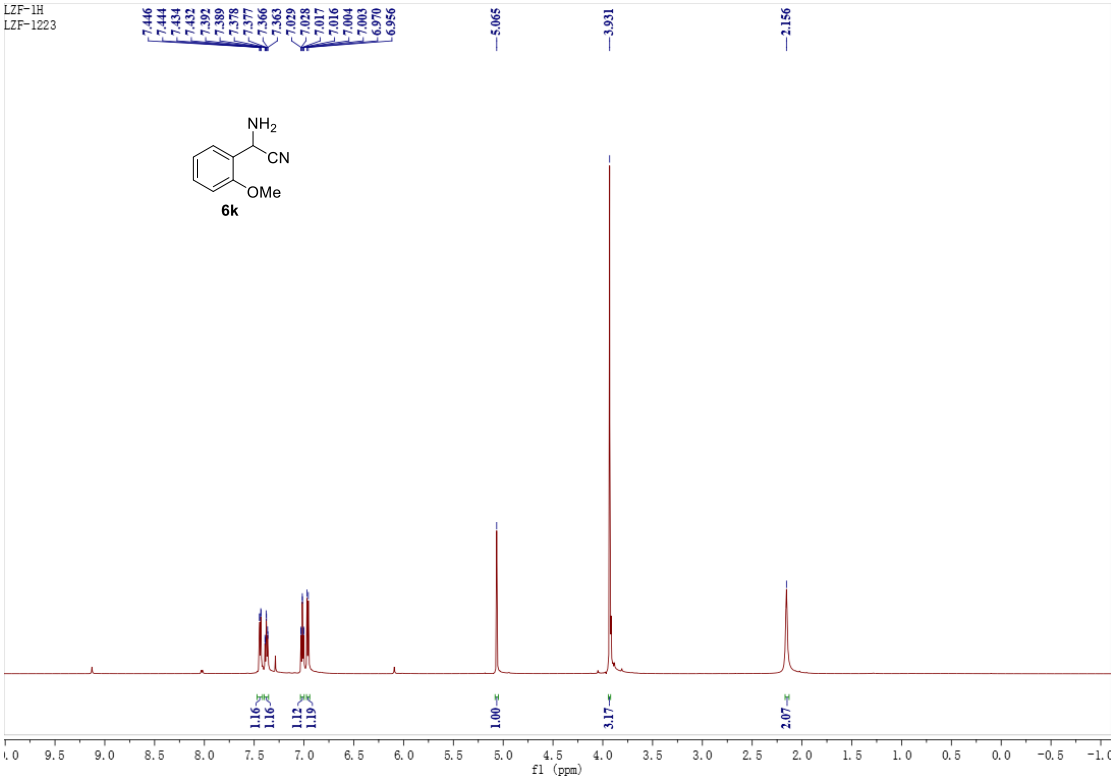

LZF-13C
LZF-1253
166.350
140.892
130.899
130.323
126.732
120.384
77.250
77.038
76.826
52.288
47.033
NH2
CN
MeO2C
6h
f1 (ppm)

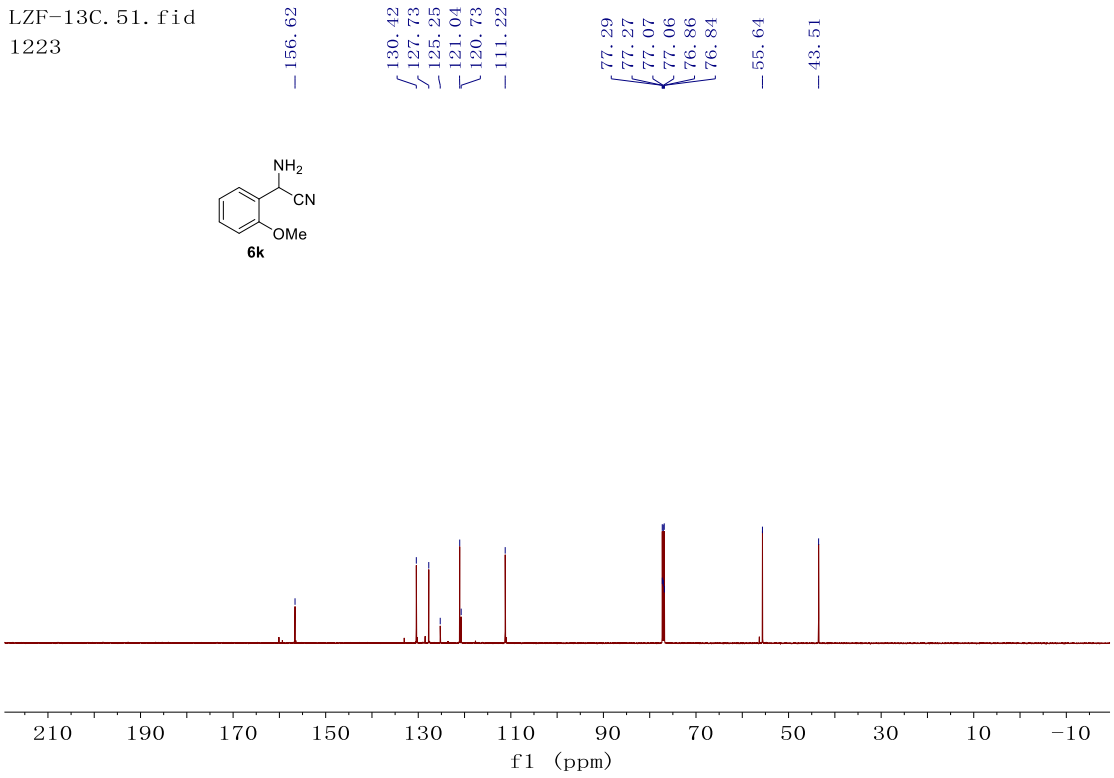

LZF-1H
1226
7.460
7.448
7.439
7.045
7.031
7.017
4.822
1.830
NH2
CN
F3C
6i
1.93
2.01
1.00
2.15
f1 (ppm)

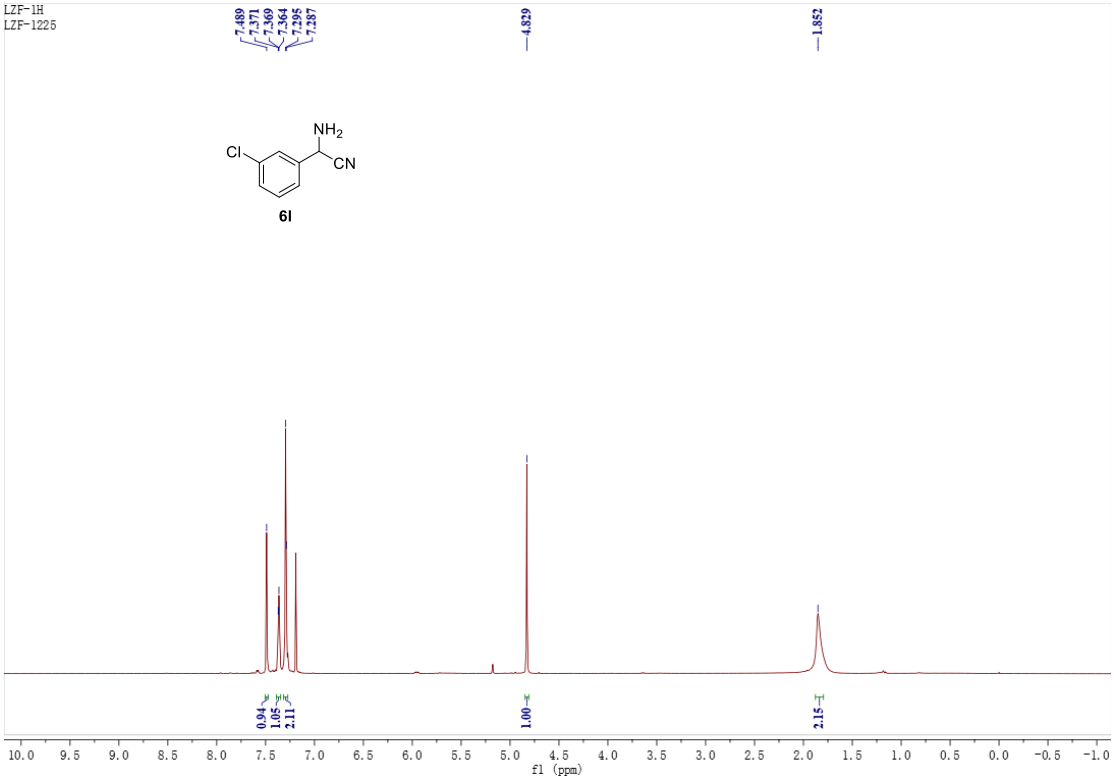

LZF-13C
1226
163.812
162.166
132.177
128.574
128.518
120.739
116.115
115.970
77.241
77.030
76.818
46.632
NH2
CN
F3C
6i
f1 (ppm)

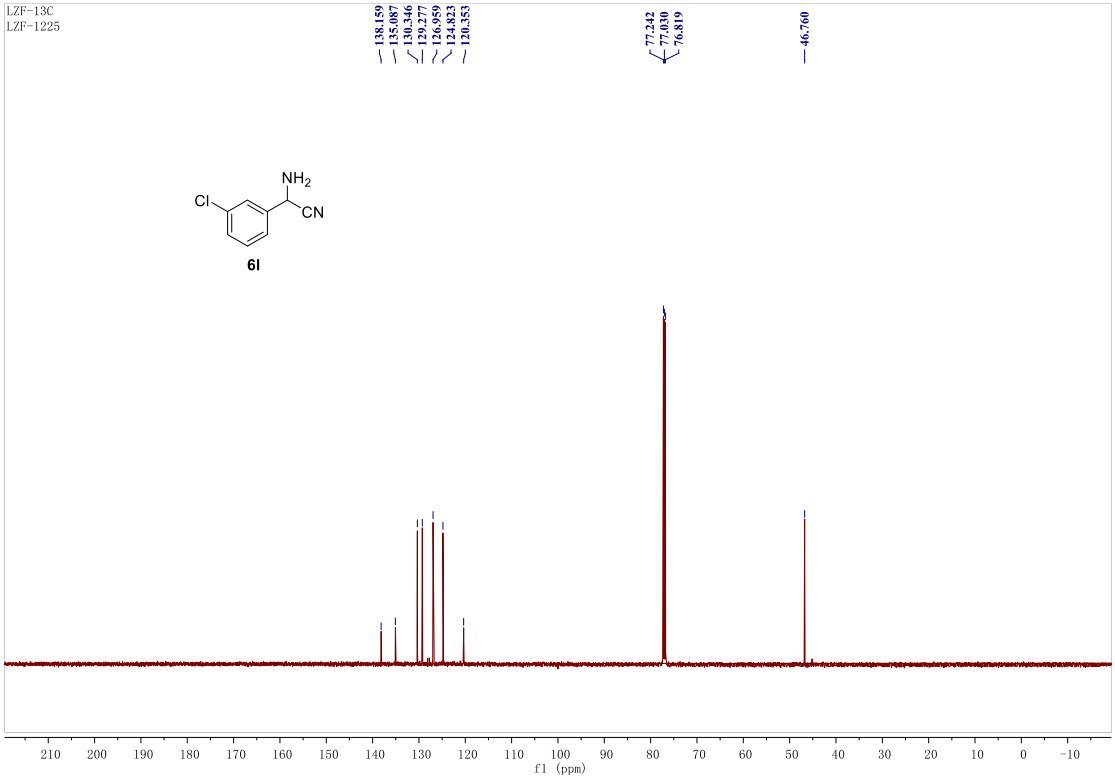

LZF-1H
LZF-1381
7.661
7.658
7.649
7.445
7.433
7.375
7.365
7.363
7.354
7.344
7.332
5.245
2.039
NH2
CN
Cl
6j
1.01
1.00
2.04
1.00
1.99
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)

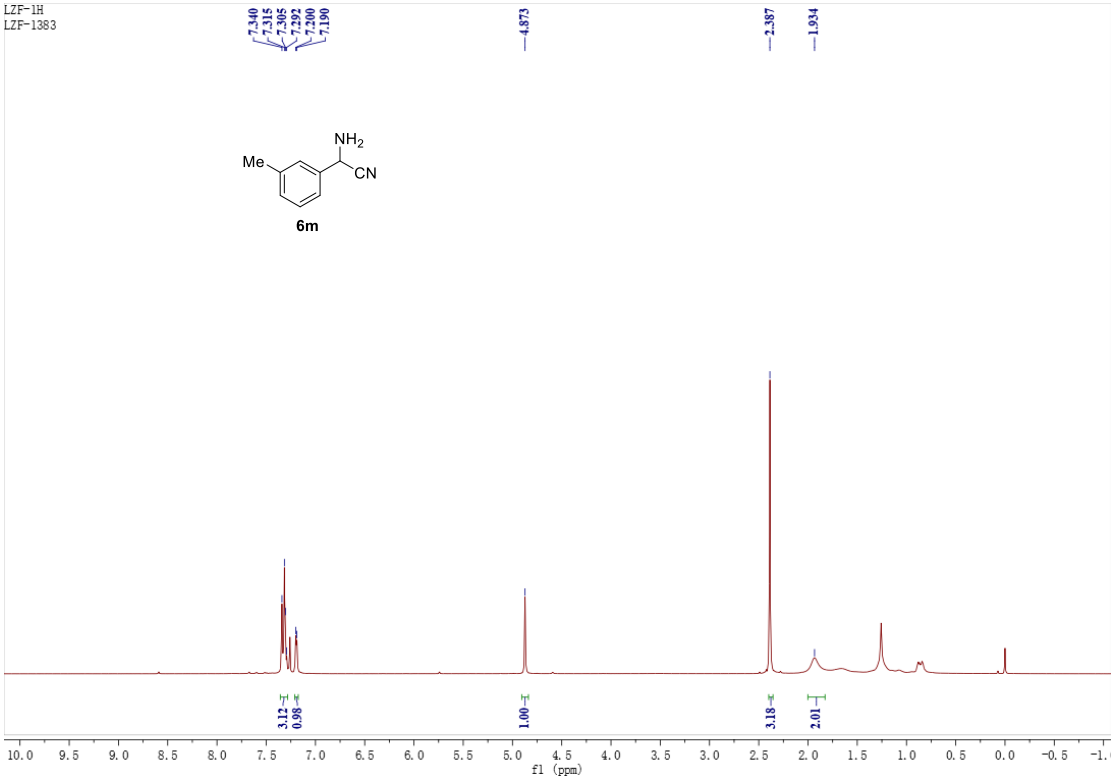

LZF-13C
LZF-1381
134.452
132.816
130.483
130.318
128.167
127.784
119.833
77.281
77.069
76.857
45.186
NH2
CN
Cl
6j
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

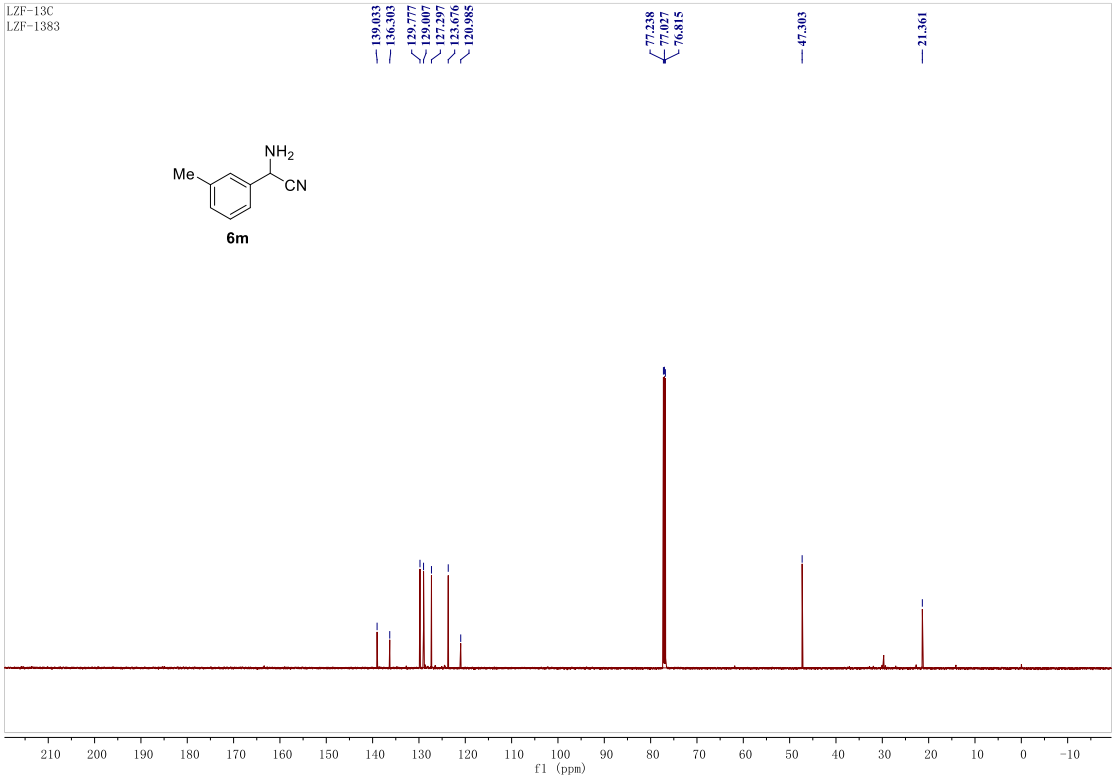

LZF-1H
LZF-1223
7.446
7.444
7.434
7.432
7.392
7.389
7.378
7.377
7.366
7.363
7.029
7.028
7.017
7.016
7.004
7.003
6.970
6.956
5.065
3.931
2.156
NH2
CN
OMe
6k
1.16
1.16
1.13
1.19
1.00
3.17
2.07
f1 (ppm)

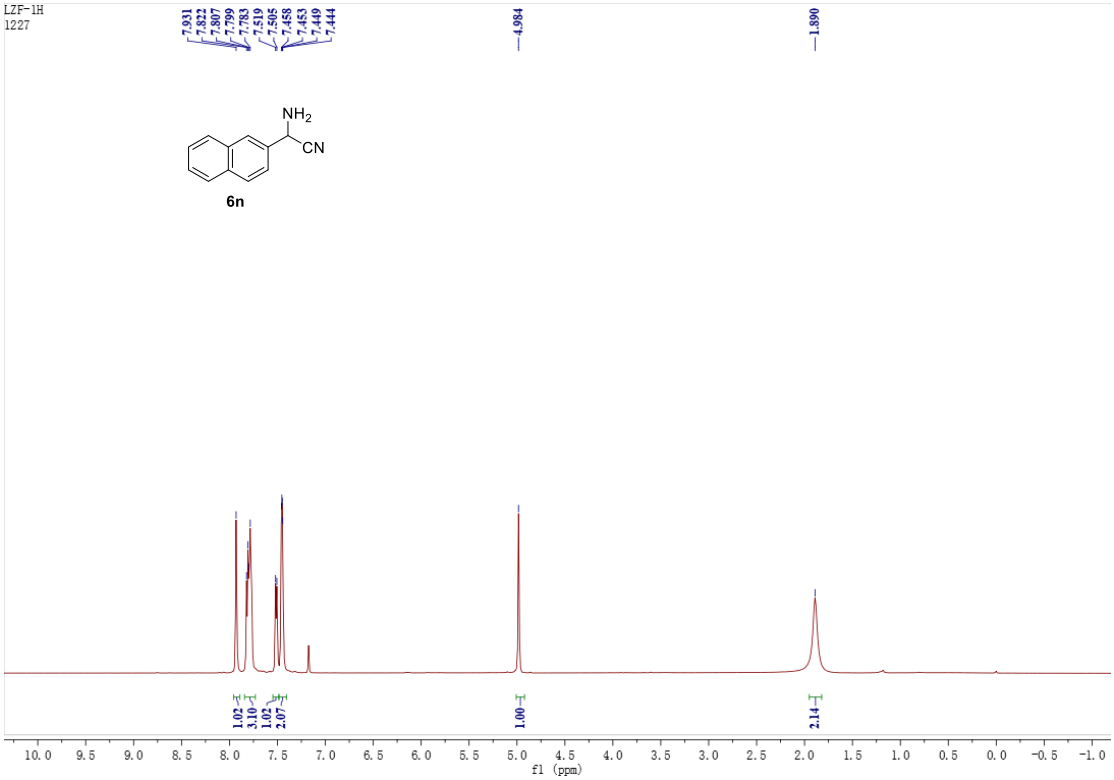

LZF-13C.51.fid
1223
156.62
130.42
127.73
125.25
121.04
120.73
111.22
77.29
77.27
77.07
77.06
76.86
76.84
55.64
43.51
NH2
CN
OMe
6k
210
190
170
150
130
110
90
70
50
30
10
-10
f1 (ppm)

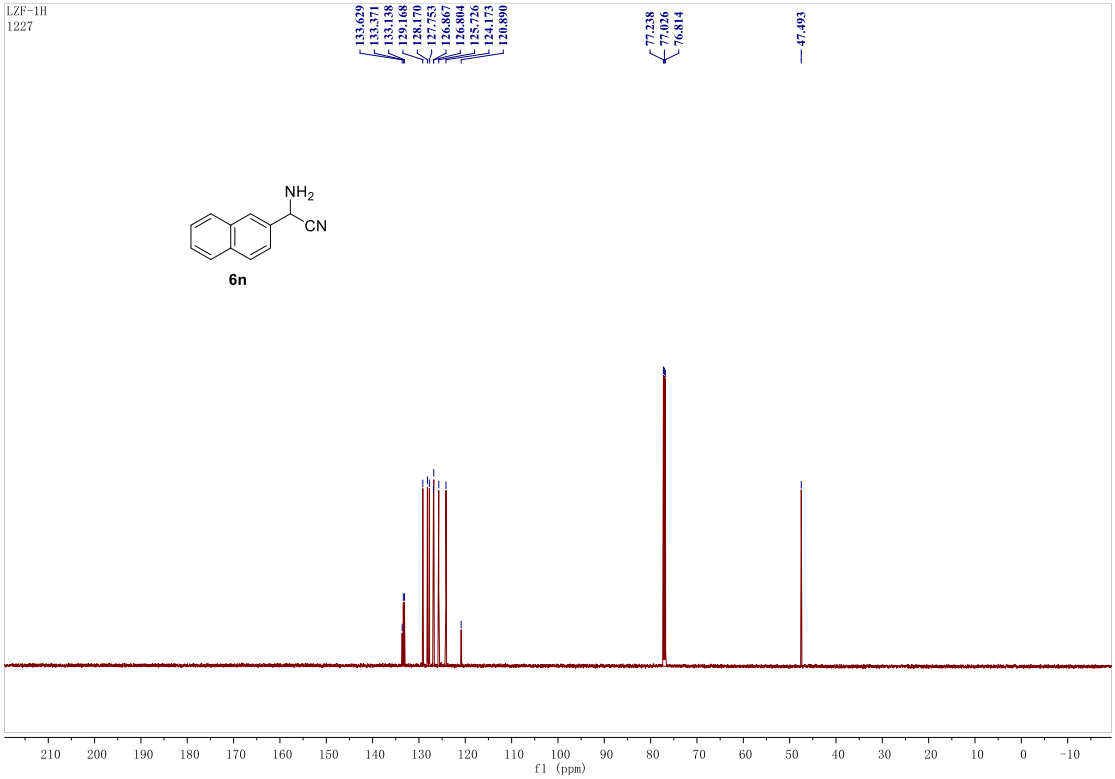

LZF-1H
LZF-1225
7.489
7.371
7.369
7.364
7.295
7.287
4.829
1.852
NH2
Cl
CN
6l
0.94
1.05
2.11
1.00
2.15
f1 (ppm)

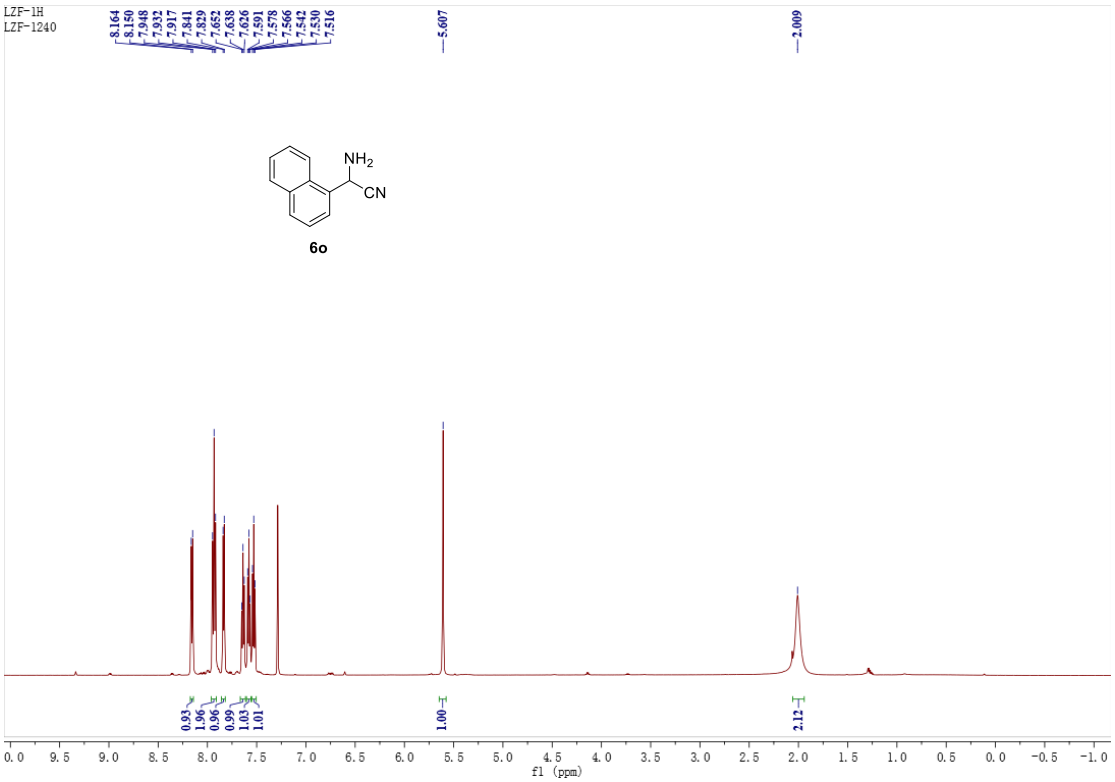

LZF-13C
LZF-1225
138.159
135.687
130.346
129.277
126.959
124.823
120.353
77.242
77.030
76.819
46.760
NH2
Cl
CN
6l
f1 (ppm)

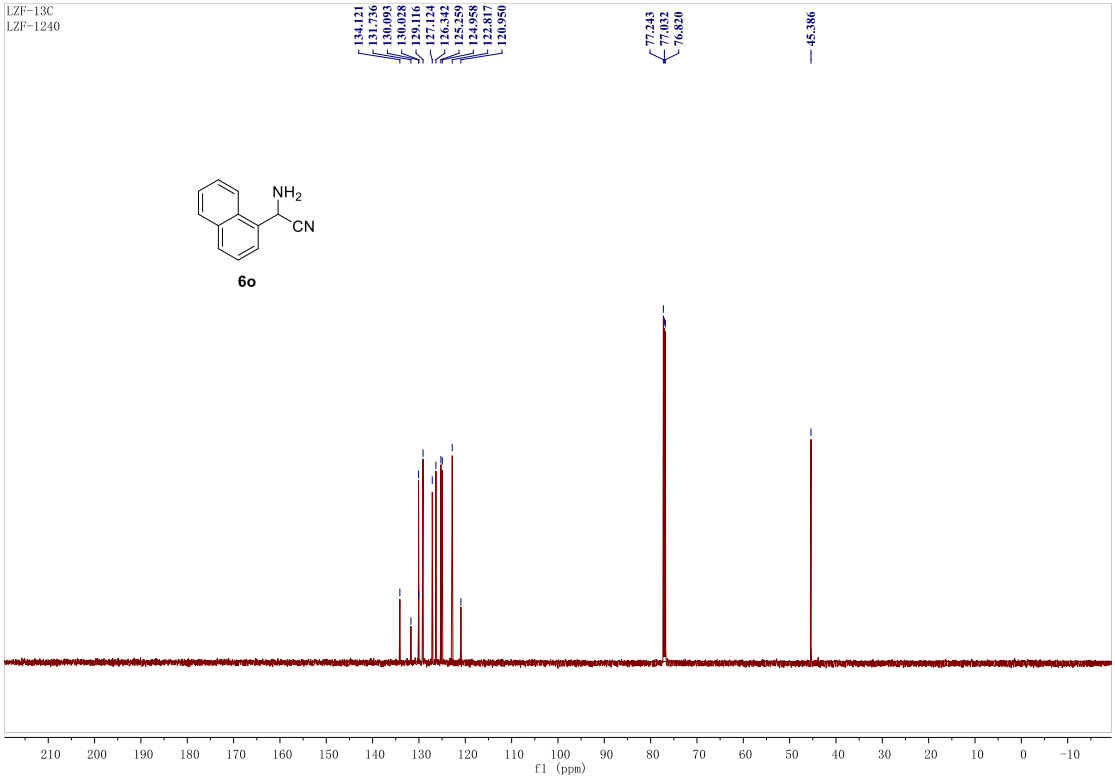

LZF-1H
LZF-1383
7.340
7.315
7.305
7.292
7.200
7.190
4.873
2.387
1.934
NH2
Me
CN
6m
3.12
0.98
1.00
3.18
2.01
f1 (ppm)

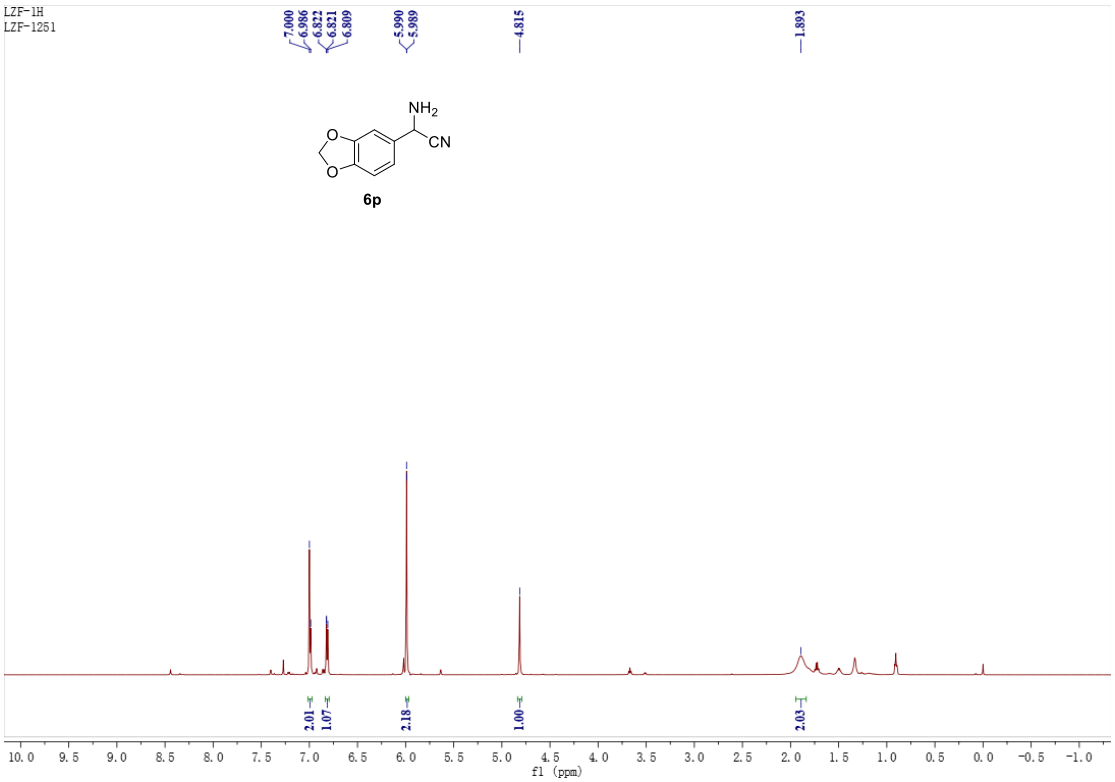

LZF-13C
LZF-1383
139.033
136.303
129.777
129.007
127.297
123.676
120.985
77.238
77.027
76.815
47.303
21.361
NH2
Me
CN
6m
f1 (ppm)

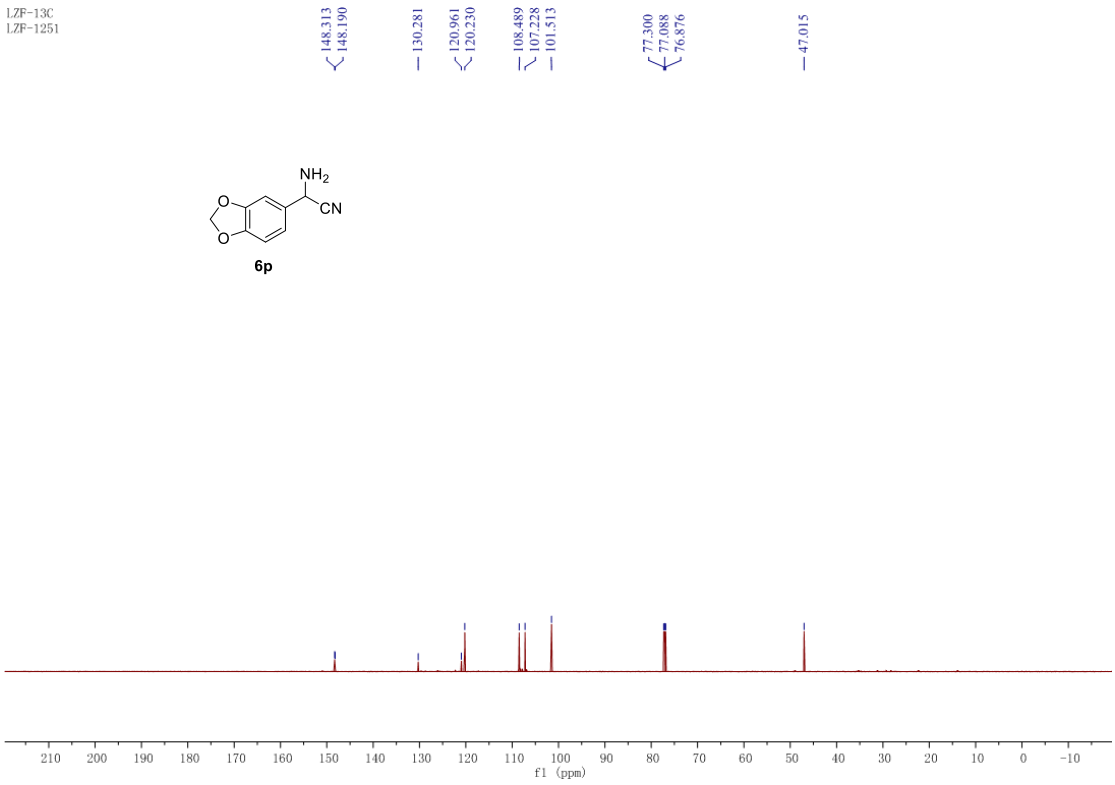

LZF-1H
1227
7.931
7.822
7.807
7.799
7.783
7.519
7.505
7.458
7.453
7.449
7.444
4.984
1.890
NH2
CN
6n
1.02
3.10
1.02
2.07
1.00
2.14
f1 (ppm)

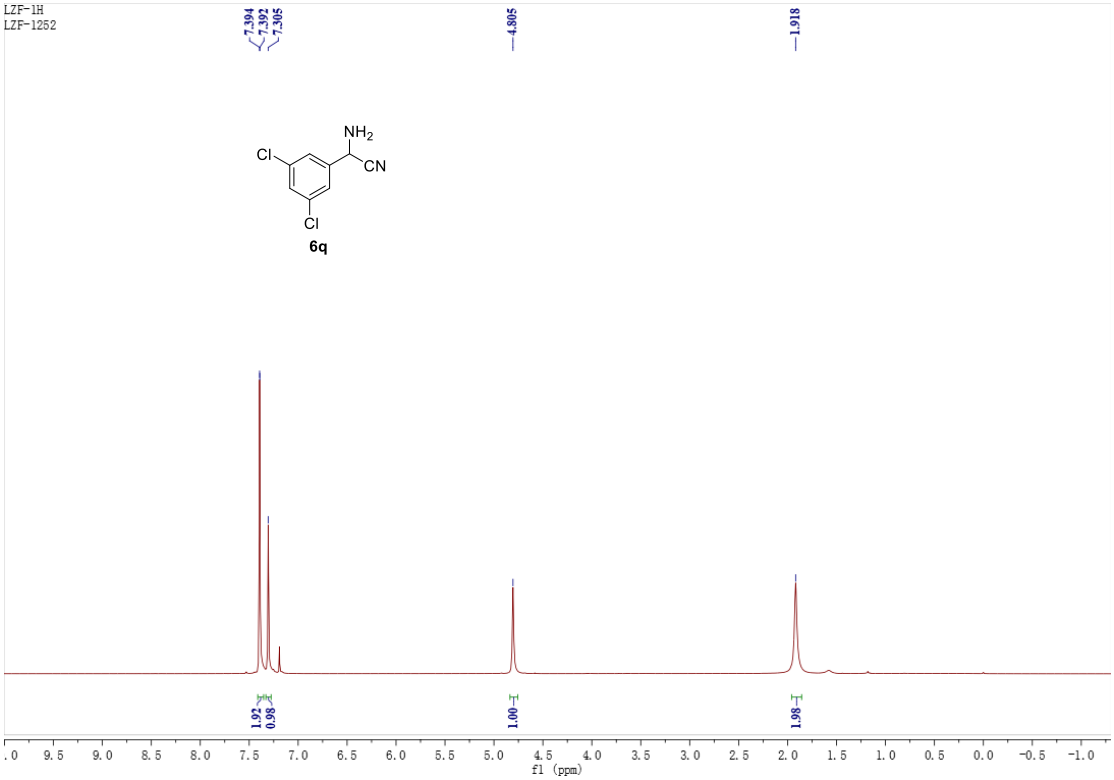

LZF-1H
1227
133.629
133.371
133.138
129.168
128.170
127.753
126.867
126.804
125.726
124.173
120.890
77.238
77.026
76.814
47.493
NH2
CN
6n
f1 (ppm)

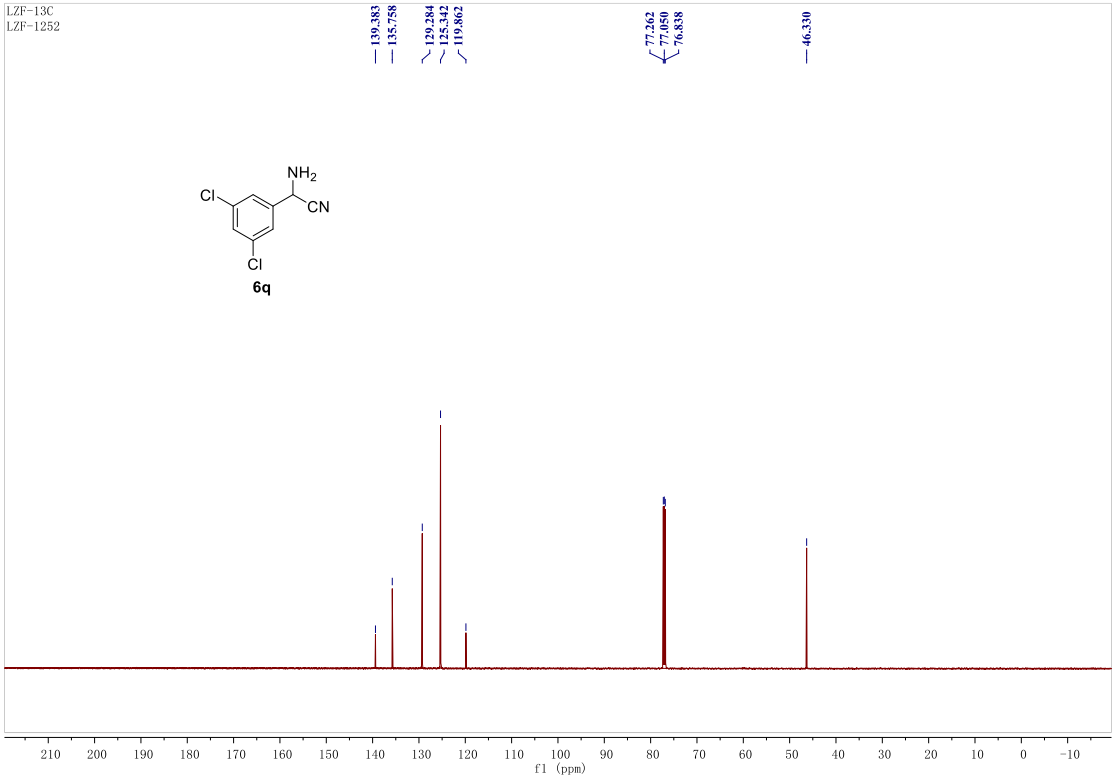

LZF-1H
LZF-1240
8.164
8.150
7.948
7.932
7.917
7.841
7.829
7.652
7.638
7.626
7.591
7.578
7.566
7.542
7.530
7.516
5.607
2.009
NH2
CN
6o
0.93
1.96
0.96
0.99
1.03
1.01
1.00
2.12
f1 (ppm)

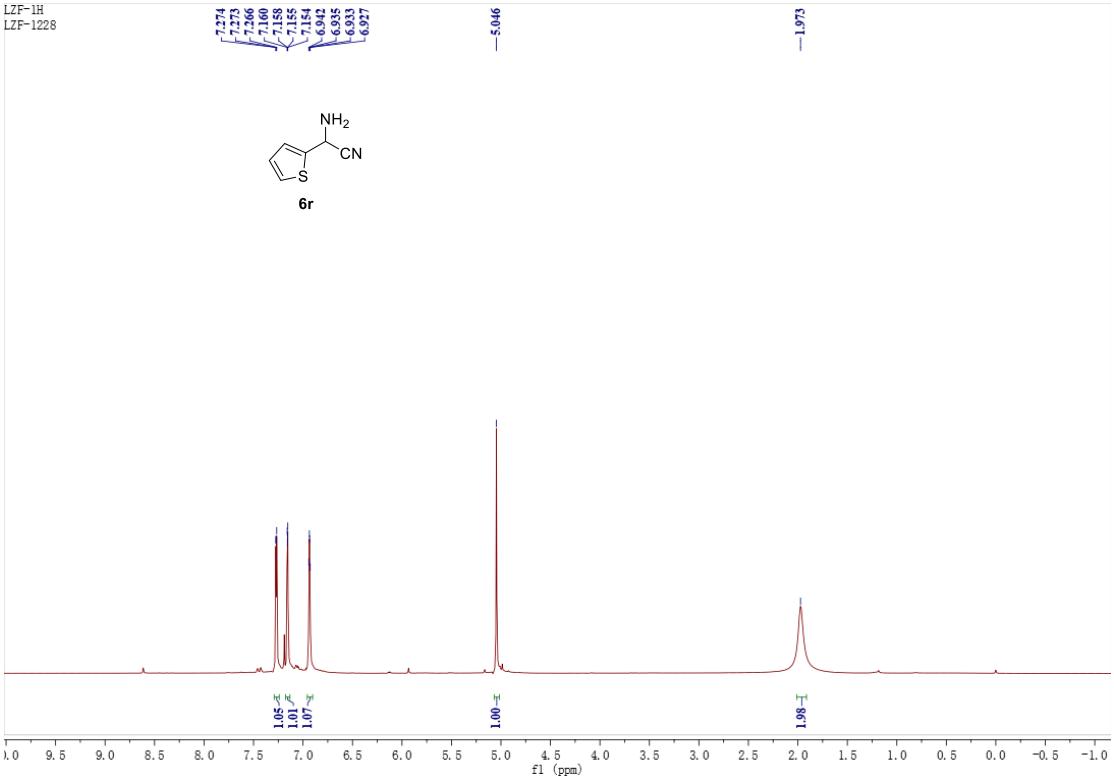

LZF-13C
LZF-1240
134.121
131.736
130.093
130.028
129.116
127.124
126.342
125.259
124.958
122.817
120.950
77.243
77.032
76.820
45.386
NH2
CN
6o
f1 (ppm)

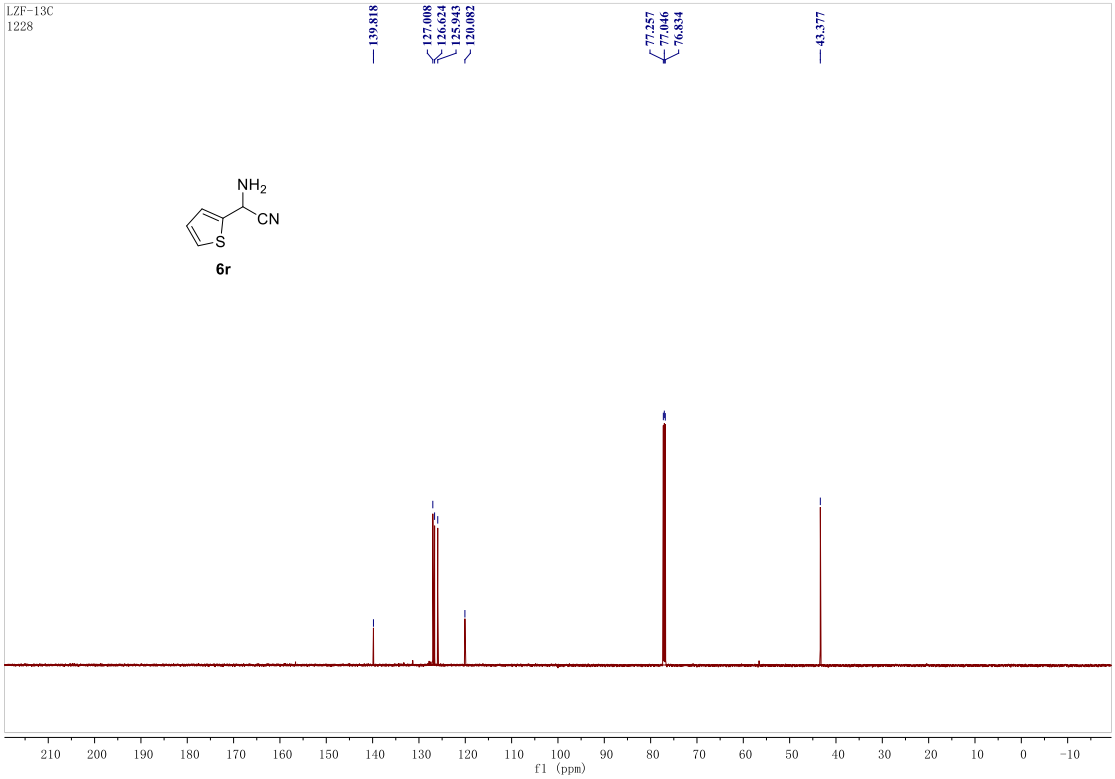

LZF-1H
LZF-1251
7.000
6.986
6.822
6.821
6.809
5.990
5.989
4.815
1.893
NH2
CN
O
O
6p
2.01
1.07
2.18
1.00
2.03
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)

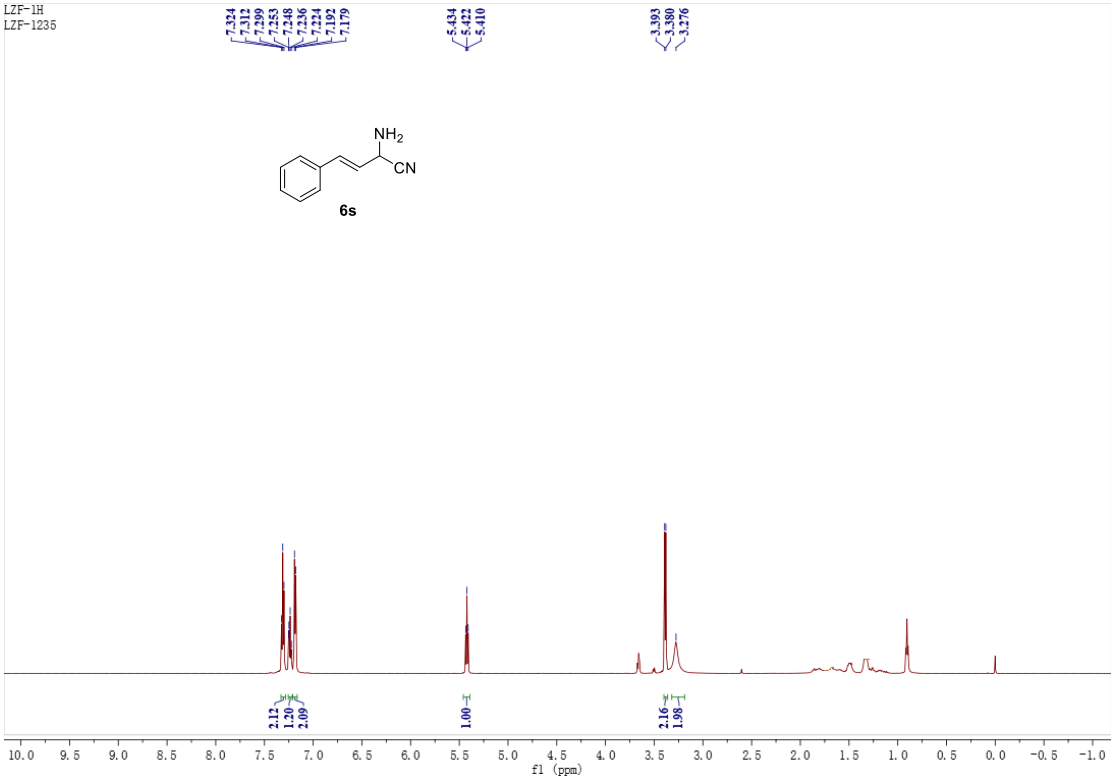

LZF-13C
LZF-1251
148.313
148.190
130.281
120.961
120.230
108.489
107.228
101.513
77.300
77.088
76.876
47.015
NH2
CN
O
O
6p
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

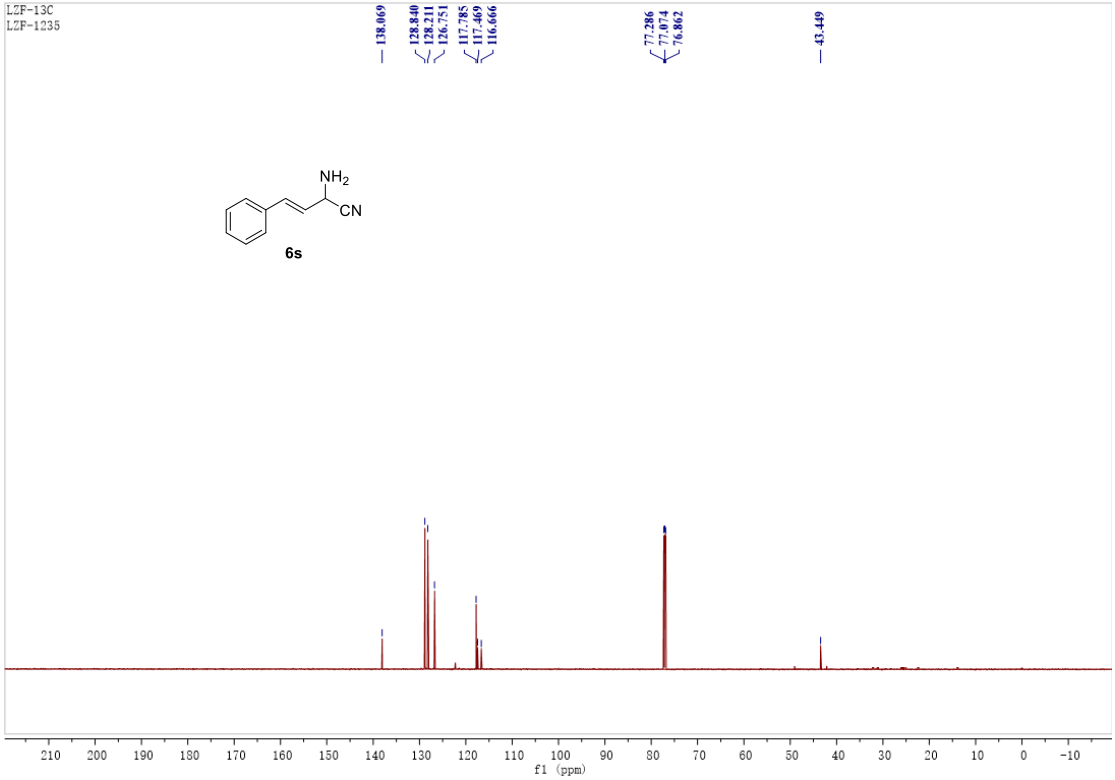

LZF-1H
LZF-1252
7.394
7.392
7.305
4.805
1.918
NH2
Cl
CN
Cl
6q
1.92
0.98
1.00
1.98
f1 (ppm)

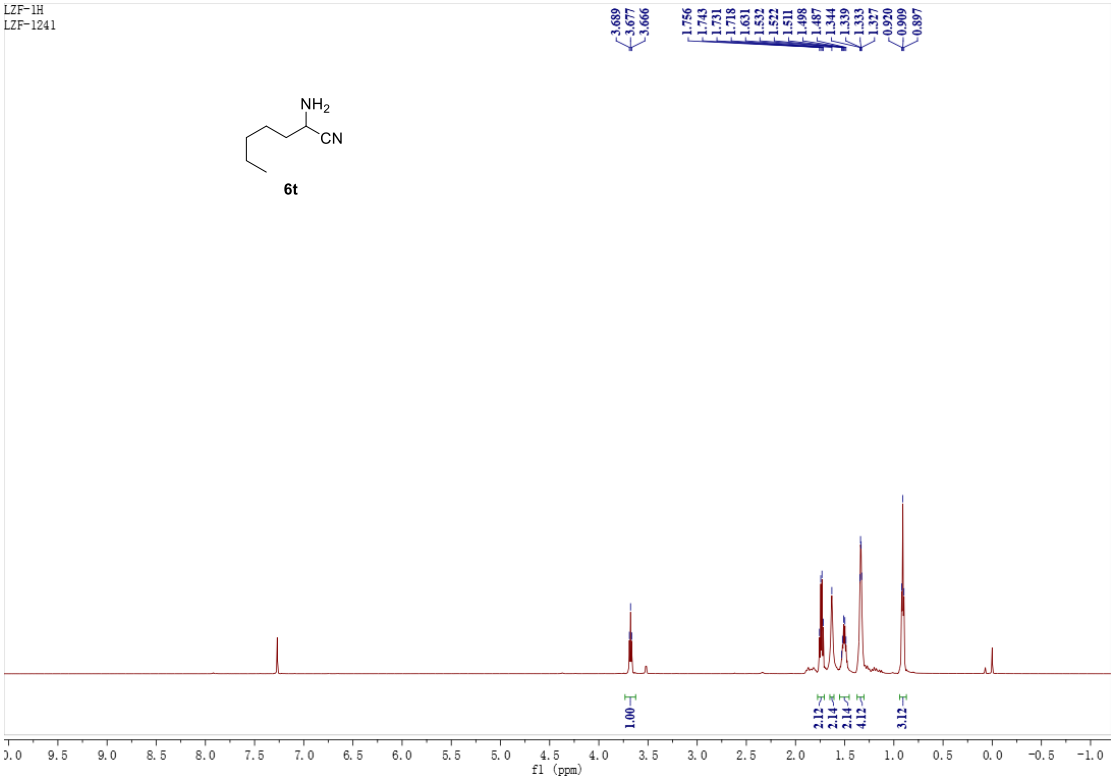

LZF-13C
LZF-1252
139.383
135.758
129.284
125.342
119.862
77.262
77.050
76.838
46.330
NH2
Cl
CN
Cl
6q
f1 (ppm)

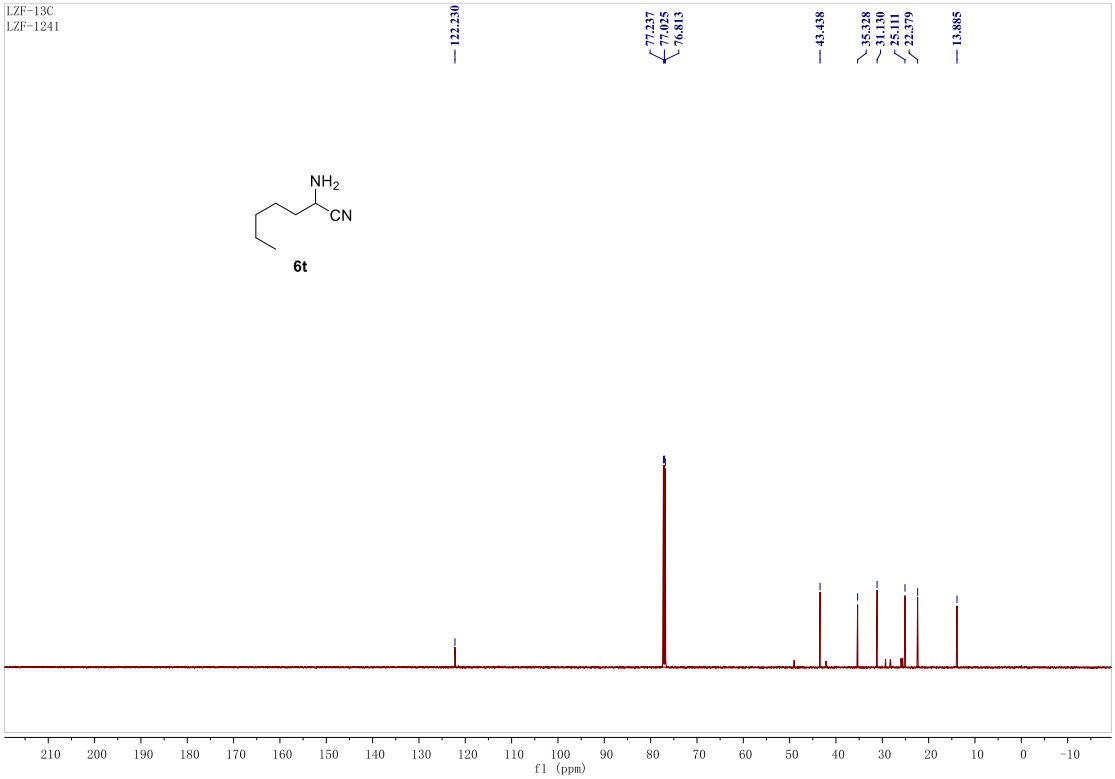

LZF-1H
LZF-1228
7.274
7.273
7.266
7.160
7.158
7.155
7.154
6.942
6.935
6.933
6.927
5.046
1.973
NH2
CN
S
6r
1.05
1.01
1.07
1.00
1.98
f1 (ppm)

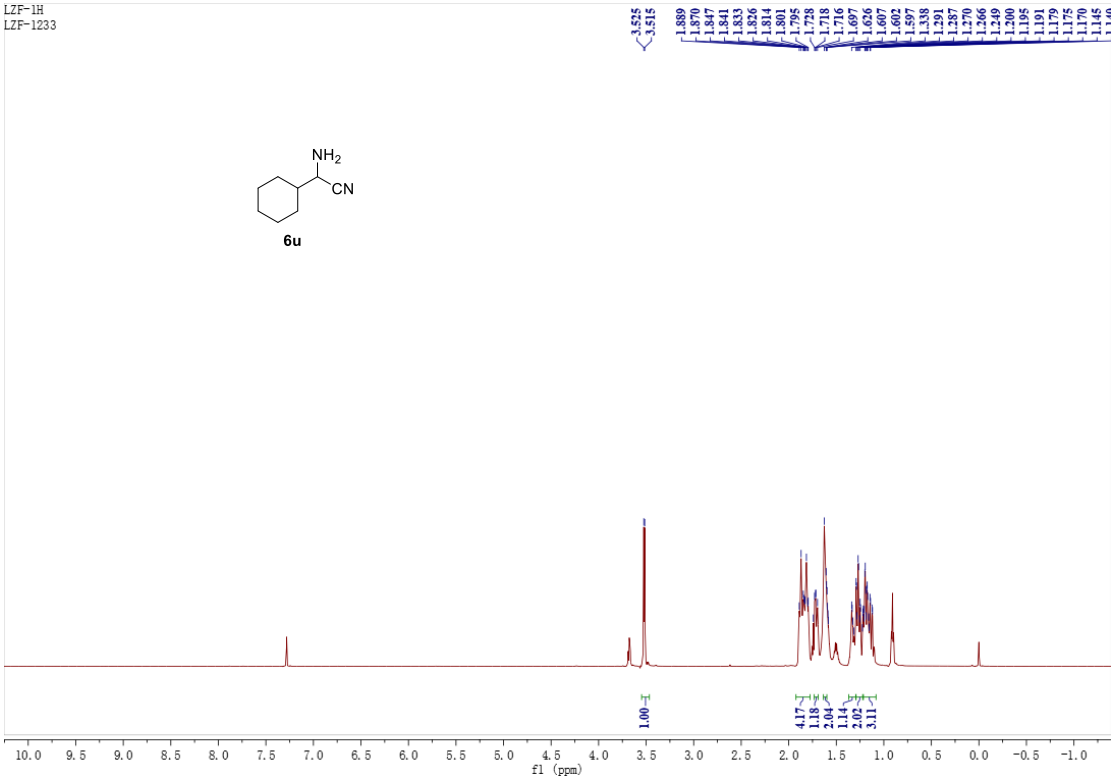

LZF-13C
1228
139.818
127.008
126.624
125.943
120.082
77.257
77.046
76.834
43.377
NH2
CN
S
6r
f1 (ppm)

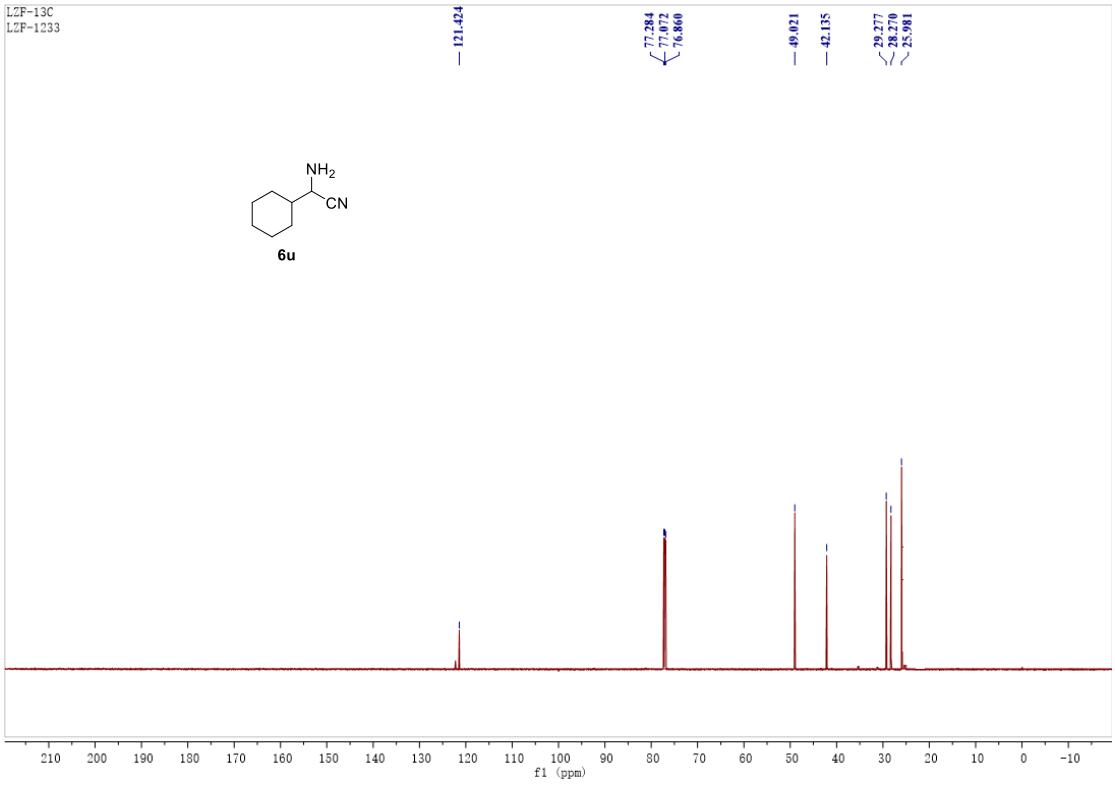

LZF-1H
LZF-1235
7.324
7.312
7.299
7.253
7.248
7.236
7.224
7.192
7.179
5.434
5.422
5.410
3.393
3.380
3.276
NH2
CN
6s
2.12
1.20
2.09
1.00
2.16
1.98
f1 (ppm)

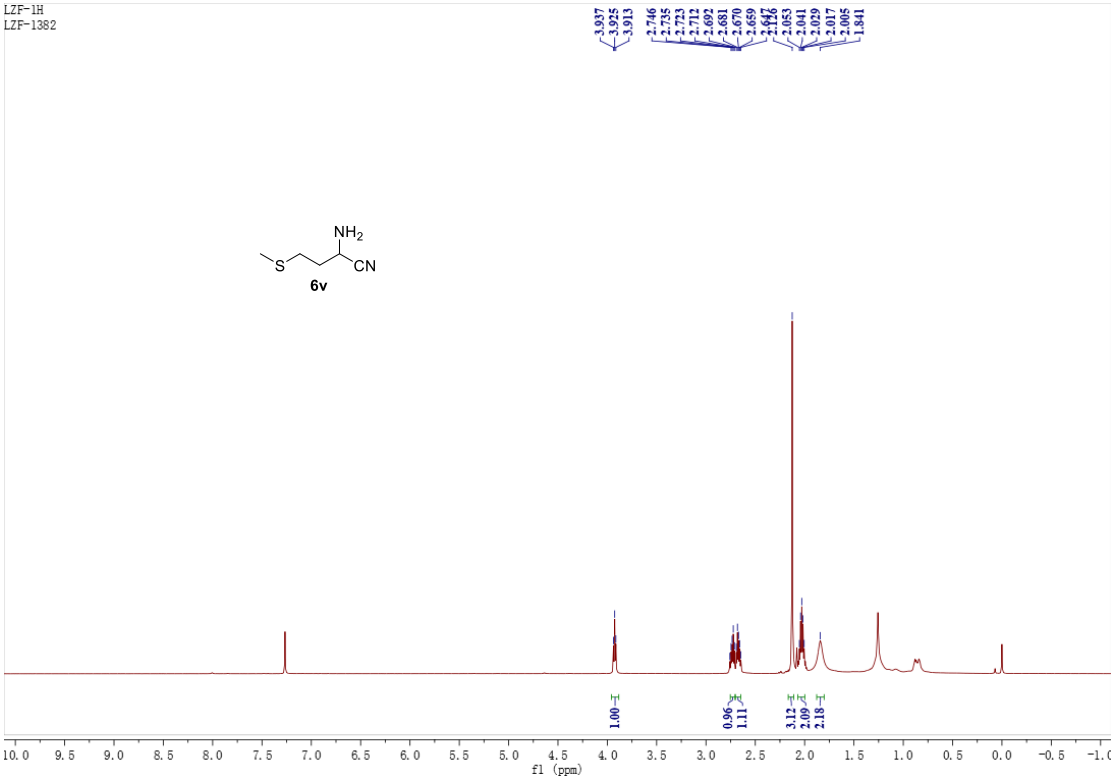

LZF-13C
LZF-1235
138.069
128.840
128.211
126.751
117.785
117.469
116.666
77.286
77.074
76.862
43.449
NH2
CN
6s
f1 (ppm)

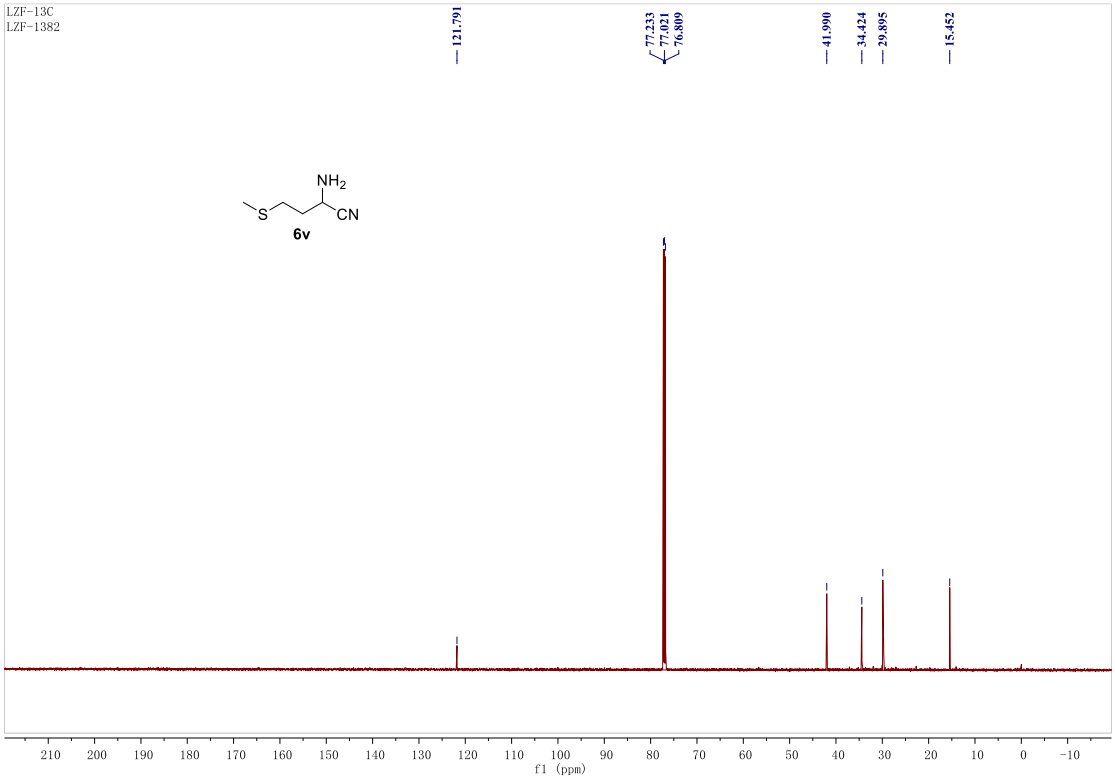

LZF-1H
LZF-1241
3.689
3.677
3.666
1.756
1.743
1.731
1.718
1.631
1.532
1.522
1.511
1.498
1.487
1.344
1.339
1.333
1.327
0.920
0.909
0.897
NH2
CN
6t
1.00
2.12
2.14
2.14
4.12
3.12
f1 (ppm)


LZF-13C
LZF-1241
122.230
77.237
77.025
76.813
43.438
35.328
31.130
25.111
22.379
13.885
NH2
CN
6t
f1 (ppm)


LZF-1H
LZF-1233
3.525
3.515
1.889
1.870
1.847
1.841
1.833
1.826
1.814
1.801
1.795
1.728
1.718
1.716
1.697
1.626
1.607
1.602
1.597
1.338
1.291
1.287
1.270
1.266
1.249
1.200
1.195
1.191
1.179
1.175
1.170
1.145
NH2
CN
6u
1.00
4.17
1.18
2.04
1.14
2.02
3.11
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)


LZF-13C
LZF-1233
121.424
77.284
77.072
76.860
49.021
42.135
29.277
28.270
25.981
NH2
CN
6u
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


LZF-1H
LZF-1382
3.937
3.925
3.913
2.746
2.735
2.723
2.712
2.692
2.681
2.670
2.659
2.647
2.116
2.053
2.041
2.029
2.017
2.005
1.841
NH2
S
CN
6v
1.00
0.96
1.11
3.12
2.09
2.18
f1 (ppm)


LZF-13C
LZF-1382
121.791
77.233
77.021
76.809
41.990
34.424
29.895
15.452
NH2
S
CN
6v
f1 (ppm)