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Supporting Information

[bmim]Cl: Promoted domino protocol of isocyanides-based [4 + 1]-cycloaddition reaction for the synthesis of diversely functionalized 3-alkylamino-2-alkyl/aryl/hetero-aryl indolizine-1-carbonitrile under solvent free condition.

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1. General procedure for the synthesis of diversely functionalized 3-alkylamino-2-alkyl/aryl/hetero-aryl indolizine-1-carbonitrile

To a mixture of 2-pyridylacetonitrile (1 mmol), isocyanides (1 mmol) and aldehydes (1 mmol) was added 100 mol % [bmim]Cl and the reaction mixture was kept room temperature with constant stirring for stipulated time (see table 2). After completion of the reaction as monitored by TLC, the crude product was extracted with ether. The combined organic layers were washed with brine solution, and dried over Na_2SO_4. The Na_2SO_4 was filtered off and the solvent was removed under vacuum. The solid crude product was recrystallized from ethanol to afford pure compound 4.

2. Spectral data of the compounds

4a: 3-(tert-butylamino)-2-(4-chlorophenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.56 (d, *J* = 10Hz, 1H), 7.78-7.75 (m, 2H), 7.59 (d, *J* = 10Hz, 1H), 7.56-7.54 (m, 2H), 7.21-7.18 (m, 1H), 6.97-6.94 (m, 1H), 4.63 (s, 1H), 0.85 (s, 9H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 134.8, 132.7, 132.7, 131.5, 128.9, 126.07, 125.0, 124.7, 123.8, 117.3, 116.9, 113.0, 78.5, 55.9, 30.2. HRMS m/z calcd for $C_{19}H_{18}ClN_3$ [M+] 323.8193, found 323.8190.

4b: 3-(tert-butylamino)-2-p-tolylindolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.55 (d, *J* = 5Hz, 1H), 7.63 (d, *J* = 10 Hz, 2H), 7.57 (d, *J* = 10Hz, 1H), 7.28 (d, *J* = 10Hz, 2H), 7.16 (t, *J* = 12Hz, 1H), 6.92 (t, *J* = 12Hz, 1H), 4.56 (s, 1H), 2.36 (s, 3H), 0.83 (s, 9H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 137.1, 134.7,

130.8, 129.6, 129.4, 126.1, 125.7, 124.8, 123.5, 117.6, 116.7, 112.7, 78.7, 55.8, 30.2, 21.2. HRMS m/z calcd for $C_{20}H_{21}N_3$ [M+] 303.4008, found 303.4002.

4c: 3-(tert-butylamino)-2-(4-fluorophenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.55 (d, *J* = 10Hz, 1H), 7.79-7.76 (m, 2H), 7.58 (d, *J* = 10Hz, 1H), 7.32 (t, *J* = 15Hz, 2H), 7.18-7.15 (m, 1H), 6.94-6.91 (m, 1H), 4.60 (s, 1H), 0.83 (s, 9H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 163.0, 161.1, 134.7, 131.8, 131.7, 130.2, 130.2, 125.9, 125.1, 124.9, 123.7, 117.4, 116.8, 115.8, 115.7, 112.9, 78.7, 55.7, 30.2. HRMS m/z calcd for $C_{19}H_{18}FN_3$ [M+] 307.3647, found 307.3643.

4d: 3-(tert-butylamino)-2-(4-methoxyphenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.54 (d, *J* = 5Hz, 1H), 7.67-7.65 (m, 2H), 7.56 (d, *J* = 10Hz, 1H), 7.17-7.14 (m, 1H), 7.04 (d, *J* = 10Hz, 2H), 6.93-6.90 (m, 1H), 4.53 (s, 1H), 3.81 (s, 3H), 0.84 (s, 9H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 159.1, 134.6, 130.9, 126.0, 125.9, 125.6, 124.8, 123.4, 117.7, 116.7, 114.3, 112.7, 78.6, 55.7, 55.5, 30.2. HRMS m/z calcd for $C_{20}H_{21}N_3O$ [M+] 319.4002, found 319.4007.

4e: 3-(tert-butylamino)-2-(4-ethoxyphenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.53 (d, *J* = 10Hz, 1H), 7.66 (d, *J* = 5Hz, 2H), 7.55 (d, *J* = 10Hz, 1H), 7.16-7.13 (m, 1H), 7.02 (d, *J* = 10Hz, 2H), 6.92-6.89 (m, 1H), 4.53 (s, 1H), 4.12-4.04 (m, 2H), 1.34 (t, *J* = 10Hz, 3H), 0.83 (s, 9H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 158.4, 149.9, 144.9, 138.1, 134.6, 130.9, 126.0, 124.8, 123.3, 120.6, 117.7, 116.7, 112.7, 78.6, 63.4, 55.7, 30.2, 15.1. HRMS m/z calcd for $C_{21}H_{23}N_3O$ [M+] 333.4268, found 333.4273.

4f: 3-(tert-butylamino)-2-(4-ethylphenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.55 (d, *J* = 10Hz, 1H), 7.65 (d, *J* = 10Hz, 2H), 7.57 (d, *J* = 10Hz, 1H), 7.31 (d, *J* = 10Hz, 2H), 7.18-7.15 (m, 1H), 6.93-6.90 (m, 1H), 2.67-2.63 (m, 2H), 1.22 (t, *J* = 15Hz, 3H), 0.83 (s, 9H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 143.4, 134.7, 131.1, 129.6, 128.2, 126.1, 125.8, 124.8, 123.5, 117.6, 116.7, 112.8, 78.7, 55.8, 30.2, 28.4, 15.9. HRMS m/z calcd for $C_{21}H_{23}N_3$ [M+] 317.4274, found 317.4270.

4g: 3-(tert-butylamino)-2-(2-fluorophenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.56 (d, *J* = 10Hz, 1H), 7.68-7.65 (m, 1H), 7.60 (d, *J* = 10Hz, 1H), 7.50-7.46 (m, 1H), 7.38-7.30 (m, 2H), 7.21-7.18 (m, 1H), 6.96-6.93 (m, 1H), 4.25 (s, 1H), 0.82 (s, 9H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 160.8, 158.9, 134.5, 132.8, 130.7, 130.6, 126.6, 124.9, 124.7, 123.8, 121.4, 121.3, 120.3, 116.8, 116.2, 116.1, 112.9, 80.0, 55.5, 29.9. HRMS m/z calcd for $C_{19}H_{18}FN_3$ [M+] 307.3647, found 307.3644.

4h: 2-(2-bromophenyl)-3-(tert-butylamino) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.55 (d, *J* = 5Hz, 1H), 7.77 (d, *J* = 10Hz, 1H), 7.60-7.56 (m, 2H), 7.50-7.47 (m, 1H), 7.37-7.34 (m, 1H), 7.19-7.16 (m, 1H), 6.95-6.92 (m, 1H), 4.08 (s, 1H), 0.84 (s, 9H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 134.6, 134.3, 133.4, 133.1, 130.4, 128.0, 126.3, 125.5, 124.8, 124.3, 123.7, 117.1, 116.9, 112.9, 80.5, 55.3, 30.0. HRMS m/z calcd for $C_{19}H_{18}BrN_3$ [M+] 368.2703, found 368.2705.

4i: 3-(tert-butylamino)-2-(2-chlorophenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.55 (d, *J* = 10Hz, 1H), 7.62-7.57 (m, 3H), 7.47-7.43 (m, 2H), 7.21-7.17 (m, 1H), 6.96-6.93 (m, 1H), 4.13 (s, 1H), 0.82 (s, 9H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 134.3, 133.6, 133.3, 130.3, 130.0, 127.5, 126.5, 124.8, 123.8, 123.8,

116.9, 116.8, 112.9, 80.4, 55.3, 29.9. HRMS m/z calcd for $C_{19}H_{18}ClN_3$ [M+] 323.8193, found 323.8191.

4j: 3-(tert-butylamino)-2-(3-chlorophenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.55 (d, *J* = 10Hz, 1H), 7.85 (s, 1H), 7.70 (d, *J* = 10Hz, 1H), 7.57 (d, *J* = 10Hz, 1H), 7.50 (t, *J* = 15Hz, 1H), 7.45-7.41 (m, 1H), 7.18 (t, *J* = 15Hz, 1H), 6.95-6.92 (m, 1H), 4.68 (s, 1H), 0.84 (s, 9H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 150.1, 143.6, 138.2, 135.9, 134.9, 133.6, 130.7, 129.3, 128.4, 127.8, 126.2, 124.9, 124.4, 123.9, 117.2, 113.0, 78.5, 55.8, 30.2. HRMS m/z calcd for $C_{19}H_{18}ClN3$ [M+] 323.8193, found 323.8195.

4k: 3-(tert-butylamino)-2-o-tolylindolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.54 (d, *J* = 5Hz, 1H), 7.58 (d, *J* = 10Hz, 1H), 7.38-7.25 (m, 4H), 7.19-7.16 (m, 1H), 6.95-6.92 (m, 1H), 4.25 (s, 1H), 2.30 (s, 3H), 0.80 (s, 9H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 137.0, 134.3, 133.2, 131.5, 130.5, 128.4, 126.4, 126.1, 126.0, 124.8, 123.4, 117.5, 116.8, 112.7, 80.2, 55.1, 30.1, 20.2. HRMS m/z calcd for $C_{20}H_{21}N_3$ [M+] 303.4008, found 303.4005.

4l: 3-(tert-butylamino)-2-(4-isopropylphenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.55 (d, *J* = 10Hz, 1H), 7.66 (d, *J* = 5Hz, 2H), 7.57 (d, *J* = 10Hz, 1H), 7.34 (d, *J* = 5Hz, 2H), 7.16 (t, *J* = 15Hz, 1H), 6.91 (t, *J* = 15Hz, 1H), 4.56 (s, 1H), 2.95-2.90 (m, 1H), 1.23 (d, *J* = 10Hz, 6H), 0.83 (s, 9H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 148.0, 134.7, 131.2, 129.6, 126.7, 126.1, 125.8, 124.8, 123.4, 117.6, 116.7, 112.7, 78.7, 55.8, 33.6, 30.2, 24.3. HRMS m/z calcd for $C_{22}H_{25}N_3$ [M+] 331.4540, found 331.4544.

4m: 3-(tert-butylamino)-2-(pyridin-3-yl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.95 (s, 1H), 8.60-8.56 (m, 2H), 8.14-8.12 (m, 1H), 7.60 (d, *J* = 5Hz, 1H), 7.53-7.51 (m, 1H), 7.22-7.19 (m, 1H), 6.96 (t, *J* = 10Hz, 1H), 4.64 (s, 1H), 0.86 (s, 9H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 150.1, 148.7, 137.0, 135.1, 129.9, 126.4, 125.0, 123.9, 123.9, 122.8, 117.0, 116.9, 113.0, 78.7, 55.7, 30.3. HRMS m/z calcd for $C_{18}H_{18}N_4$ [M+] 290.3623, found 290.3625.

4n: 3-(tert-butylamino)-2-isopropylindolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.38 (d, *J* = 5Hz, 1H), 7.45 (d, *J* = 10Hz, 1H), 7.08-7.04 (m, 1H), 6.82-6.79 (m, 1H), 4.42 (s, 1H), 3.31-3.22 (m, 1H), 1.34 (d, *J* = 10Hz, 6H), 1.10 (s, 9H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 135.3, 131.9, 124.9, 122.7, 118.0, 116.3, 112.0, 76.3, 55.0, 30.3, 25.2, 23.1. HRMS m/z calcd for $C_{16}H_{21}N_3$ [M+] 255.3580, found 255.3581.

4o: 3-(tert-butylamino)-2-phenethylindolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.40 (d, *J* = 10Hz, 1H), 7.50 (d, *J* = 5Hz, 1H), 7.33-7.26 (m, 4H), 7.22-7.19 (m, 1H), 7.11-7.07 (m, 1H), 6.85-6.82 (m, 1H), 4.24 (s, 1H), 3.06-2.96 (m, 4H), 1.10 (s, 9H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 141.9, 134.6, 128.9, 128.6, 126.5, 126.3, 125.2, 124.8, 122.9, 117.6, 116.5, 112.1, 78.9, 55.4, 36.1, 30.3, 28.0. HRMS m/z calcd for $C_{21}H_{23}N_3$ [M+] 317.4274, found 317.4276.

4p: 2-(4-chlorophenyl)-3-(cyclohexylamino) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.42 (d, *J* = 5Hz, 1H), 8.40 (d, *J* = 10Hz, 2H), 7.60-7.55 (m, 3H), 7.17 (t, *J* = 15Hz, 1H), 6.95 (t, *J* = 10Hz, 1H), 4.82 (d, *J* = 5Hz, 1H), 2.66-2.62 (m, 1H), 1.59-1.53 (m, 4H), 1.40-1.38 (m, 1H), 1.07-0.97 (m, 5H); ^{13}C NMR (500 MHz,

DMSO) δ_C (ppm) 134.6, 132.6, 131.9, 130.8, 129.0, 127.6, 124.1, 123.4, 121.0, 117.4, 117.0, 113.3, 78.0, 56.1, 33.6, 25.7, 24.6. HRMS m/z calcd for $C_{21}H_{20}ClN_3$ [M+] 349.8566, found 349.8567.

4q: 3-(cyclohexylamino)-2-(4-fluorophenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.41 (d, *J* = 5Hz, 1H), 7.82-7.80 (m, 2H), 7.58 (d, *J* = 5Hz, 1H), 7.33 (t, *J* = 15Hz, 2H), 7.14 (t, *J* = 15Hz, 1H), 6.93 (t, *J* = 15Hz, 1H), 4.79 (d, *J* = 5Hz, 1H), 2.64-2.61 (m, 1H), 1.56-1.49 (m, 4H), 1.38-1.34 (m, 1H), 1.08-0.93 (m, 5H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 162.9, 161.0, 134.4, 131.1, 131.0, 129.3, 127.4, 124.0, 123.2, 121.5, 117.5, 117.0, 116.0, 115.8, 113.1, 78.2, 56.0, 33.6, 25.7, 24.6. HRMS m/z calcd for $C_{21}H_{20}FN_3$ [M+] 333.4020, found 333.4028.

4r: 3-(cyclohexylamino)-2-(4-methoxyphenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.40 (d, *J* = 5Hz, 1H), 7.72 (d, *J* = 5Hz, 2H), 7.56 (d, *J* = 10Hz, 1H), 7.14-7.10 (m, 1H), 7.06 (d, *J* = 10Hz, 2H), 6.93-6.90 (m, 1H), 4.71 (d, J = 5Hz, 1H), 3.81 (s, 3H), 2.66-2.63 (m, 1H), 1.57-1.50 (m, 4H), 1.40-1.36 (m, 1H), 1.09-0.92 (m, 5H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 159.0, 134.3, 130.2, 126.9, 125.1, 123.9, 122.9, 122.4, 117.7, 116.8, 114.4, 113.0, 78.1, 55.9, 55.5, 33.6, 25.7, 24.6. HRMS m/z calcd for $C_{22}H_{23}N_3O$ [M+] 345.4375, found 345.4371.

4s: 3-(cyclohexylamino)-2-(4-ethoxyphenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.39 (d, *J* = 5Hz, 1H), 7.70 (d, *J* = 10Hz, 2H), 7.56 (d, *J* = 5Hz, 1H), 7.12 (t, *J* = 15Hz, 1H), 7.03 (d, *J* = 10Hz, 2H), 6.91 (t, *J* = 15Hz, 1H), 4.70 (d, *J* = 5Hz, 1H), 4.09-4.05 (m, 1H), 2.66-2.62 (m, 1H), 1.57-1.50 (m, 4H), 1.36-1.34 (m, 4H), 1.08-0.92 (m, 5H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 158.3, 134.3, 130.2, 126.9, 125.0, 123.9,

122.8, 122.4, 117.8, 116.8, 114.8, 112.9, 78.1, 63.4, 55.9, 33.6, 25.7, 24.6, 14.1. HRMS m/z calcd for $C_{23}H_{25}N_3O$ [M+] 359.4641, found 359.4639.

4t: 3-(cyclohexylamino)-2-(4-ethylphenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.41 (d, *J* = 5Hz, 1H), 7.69 (d, *J* = 5Hz, 2H), 7.57 (d, *J* = 5Hz, 1H), 7.32 (d, *J* = 5Hz, 2H), 7.14-7.11 (m, 1H), 6.92 (t, *J* = 15Hz, 1H), 4.74 (d, *J* = 5Hz, 1H), 2.68-2.63 (m, 2H), 1.57-1.49 (m, 4H), 1.39-1.37 (m, 1H), 1.22 (t, *J* = 15Hz, 3H), 1.09-0.91 (m, 5H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 143.3, 134.4, 130.3, 128.7, 128.3, 127.2, 123.9, 122.9, 122.4, 117.7, 116.9, 113.0, 78.2, 56.0, 33.6, 28.4, 25.7, 24.6, 15.8. HRMS m/z calcd for $C_{23}H_{25}N_3$ [M+] 343.4647, found 343.4653.

4u: 3-(cyclohexylamino)-2-(2-fluorophenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.37 (d, *J* = 5Hz, 1H), 7.64-7.58 (m, 2H), 7.50-7.46 (m, 1H), 7.38-7.31 (m, 2H), 7.13 (t, *J* = 15Hz, 1H), 6.93 (t, J = 15Hz, 1H), 4.54 (d, *J* = 5Hz, 1H), 2.64-2.61 (m, 1H), 1.57-1.46 (m, 4H), 1.36-1.32 (m, 1H), 1.01-0.88 (m, 5H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 160.9, 158.9, 134.0, 132.6, 130.6, 130.5, 128.1, 124.9, 123.9, 123.0, 120.6, 120.5, 117.0, 116.9, 116.2, 116.0, 115.9, 113.0, 79.7, 55.5, 33.4, 25.6, 24.5. HRMS m/z calcd for $C_{21}H_{20}FN_3$ [M+] 333.4020, found 333.4023.

4v: 2-(2-bromophenyl)-3-(cyclohexylamino) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.36 (d, *J* = 10Hz, 1H), 7.78 (d, *J* = 10Hz, 1H), 7.58 (d, *J* = 10Hz, 1H), 7.52-7.48 (m, 2H), 7.40-7.36 (m, 1H), 7.13 (t, *J* = 15Hz, 1H), 6.93 (t, *J* = 15Hz, 1H), 4.52 (d, *J* = 5Hz, 1H), 2.61-2.57 (m, 1H), 1.60-1.46 (m, 4H), 1.39-1.36 (m, 1H), 1.05-0.83 (m, 5H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 134.1, 133.5, 133.2, 132.9, 130.5,

128.0, 124.7, 123.9, 122.7, 120.3, 117.1, 113.0, 80.2, 55.3, 33.5, 33.4, 25.7, 24.6. HRMS m/z calcd for $C_{21}H_{20}BrN_3$ [M+] 394.3076, found 394.3079.

4w: 2-(2-chlorophenyl)-3-(cyclohexylamino) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.35 (d, *J* = 5Hz, 1H), 7.63-7.45 (m, 5H), 7.13 (t, *J* = 15Hz, 1H), 6.93 (t, *J* = 15Hz, 1H), 4.52 (d, *J* = 5Hz, 1H), 2.61-2.57 (m, 1H), 1.56-1.35 (m, 5H), 1.08-0.83 (m, 5H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 133.9, 133.6, 133.1, 132.0, 130.3, 129.8, 128.1, 127.5, 123.9, 122.8, 118.7, 117.1, 116.9, 113.0, 80.1, 55.2, 33.4, 25.7, 24.5. HRMS m/z calcd for $C_{21}H_{20}ClN_3$ [M+] 349.8566, found 349.8571.

4x: 3-(cyclohexylamino)-2-(3-fluorophenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.42 (d, *J* = 5Hz, 1H), 7.64-7.51 (m, 4H), 7.22-7.14 (m, 2H), 6.94 (t, *J* = 15Hz, 1H), 4.74 (d, *J* = 5Hz, 1H), 2.72-2.68 (m, 1H), 1.60-1.53 (m, 4H), 1.43-1.39 (m, 1H), 1.13-0.97 (m, 5H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 163.6, 161.7, 135.5, 135.4, 134.6, 130.8, 130.8, 127.8, 125.2, 125.2, 124.0, 123.3, 121.0, 117.2, 117.0, 115.7, 115.5, 114.6, 114.4, 113.2, 78.3, 56.2, 33.6, 25.7, 24.6. HRMS m/z calcd for $C_{21}H_{20}FN_3$ [M+] 333.4020, found 333.4021.

4y: 2-(3-chlorophenyl)-3-(cyclohexylamino) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.43 (d, *J* = 5Hz, 1H), 7.88 (d, *J* = 5Hz, 1H), 7.74 (d, *J* = 5Hz, 1H), 7.59 (d, *J* = 5Hz, 1H), 7.52 (t, *J* = 15Hz, 1H), 7.43 (d, *J* = 10Hz, 1H), 7.17 (t, *J* = 15Hz, 1H), 6.95 (t, *J* = 15Hz, 1H), 4.89 (d, *J* = 5Hz, 1H), 2.65-2.62 (m, 1H), 1.58-1.51 (m, 4H), 1.41-1.37 (m, 1H), 1.11-0.93 (m, 5H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 135.1,

134.6, 133.7, 130.8, 128.5, 127.8, 127.6, 124.1, 123.5, 120.5, 117.3, 117.1, 113.3, 78.0, 55.2, 33.7, 25.7, 24.6. HRMS m/z calcd for $C_{21}H_{20}ClN_3$ [M+] 349.8566, found 349.8569.

4z: 3-(cyclohexylamino)-2-p-tolylindolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.41 (d, *J* = 5Hz, 1H), 7.67 (d, *J* = 10Hz, 2H), 7.57 (d, *J* = 5Hz, 1H), 7.29 (d, *J* = 10Hz, 2H), 7.13 (t, *J* = 15Hz, 1H), 6.92 (t, *J* = 15Hz, 1H), 4.73 (d, *J* = 5Hz, 1H), 2.67-2.63 (m, 1H), 2.35 (s, 3H), 1.56-1.50 (m, 4H), 1.39-1.36 (m, 1H), 1.09-0.93 (m, 5H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 137.1, 134.4, 130.0, 129.6, 128.9, 127.2, 123.9, 123.0, 122.4, 117.7, 116.9, 113.0, 78.2, 56.0, 33.6, 25.7, 24.6, 21.3. HRMS m/z calcd for $C_{22}H_{23}N_3$ [M+] 329.4381, found 329.4387.

4aa: 3-(cyclohexylamino)-2-(4-isopropylphenyl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.40 (d, *J* = 10Hz, 1H), 7.71 (d, *J* = 5Hz, 2H), 7.56 (d, *J* = 10Hz, 1H), 7.34 (d, *J* = 10Hz, 2H), 7.12 (t, *J* = 15Hz, 1H), 6.90 (t, *J* = 15Hz, 1H), 4.74 (d, *J* = 5Hz, 1H), 2.95-2.89 (m, 1H), 2.67-2.63 (m, 1H), 1.57-1.49 (m, 4H), 1.39-1.35 (m, 1H), 1.23 (d, *J* = 10Hz, 6H), 1.10-0.90 (m, 5H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 147.9, 134.4, 130.4, 128.9, 127.2, 126.8, 123.9, 122.9, 122.3, 117.7, 116.9, 113.0, 78.2, 56.0, 33.6, 33.6, 25.7, 24.6, 24.2. HRMS m/z calcd for $C_{24}H_{27}N_3$ [M+] 357.4913, found 357.4910.

4ab: 3-(cyclohexylamino)-2-(pyridin-2-yl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.69 (d, *J* = 5Hz, 1H), 8.24 (d, *J* = 10Hz, 1H), 8.03-7.93 (m, 2H), 7.60 (d, *J* = 10Hz, 1H), 7.34 (t, *J* = 10Hz, 1H), 7.15 (t, *J* = 15Hz, 1H), 6.94 (t, *J* = 15Hz, 1H), 6.18 (d, *J* = 10Hz, 1H), 2.96-2.91 (m, 1H), 1.68-1.41 (m, 5H), 1.15-0.99 (m, 5H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 152.5, 149.5, 137.7, 134.9, 131.3, 124.1, 123.2,

122.4, 121.9, 117.7, 117.5, 116.3, 113.6, 76.8, 55.2, 33.7, 25.6, 24.7. HRMS m/z calcd for $C_{20}H_{20}N_4$ [M+] 316.3996, found 316.3998.

4ac: 3-(cyclohexylamino)-2-(pyridin-3-yl) indolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.97 (s, 1H), 8.60 (dd, *J* = 5, 5Hz, 1H), 8.42 (d, *J* = 10Hz, 1H), 8.15 (t, *J* = 10Hz, 1H), 7.60 (d, *J* = 10Hz, 1H), 7.54-7.51 (m, 1H), 7.19-7.16 (m, 1H), 6.97-6.94 (m, 1H), 4.81 (d, *J* = 5Hz, 1H), 2.71-2.67 (m, 1H), 1.59-1.52 (m, 4H), 1.42-1.38 (m, 1H), 1.11-0.95 (m, 5H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 149.6, 148.7, 136.3, 134.8, 129.1, 127.9, 124.1, 123.9, 123.4, 119.3, 117.1, 113.3, 78.3, 56.1, 33.6, 25.7, 24.6. HRMS m/z calcd for $C_{20}H_{20}N_4$ [M+] 316.3996, found 316.3998.

4ad: 3-(cyclohexylamino)-2-isopropylindolizine-1-carbonitrile

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.18 (d, *J* = 5Hz, 1H), 7.47 (d, *J* = 10Hz, 1H), 7.05 (t, *J* = 15Hz, 1H), 6.84 (t, *J* = 15Hz, 1H), 4.58 (s, 1H), 3.28-3.23 (m, 1H), 2.71-2.68 (m, 1H), 1.77-1.65 (m, 4H), 1.54-1.51 (m, 1H), 1.34 (d, *J* = 5Hz, 6H), 1.25-1.05 (m, 5H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 134.7, 129.5, 126.2, 123.9, 122.2, 117.9, 116.5, 112.4, 76.0, 56.5, 33.9, 25.9, 25.0, 23.2. HRMS m/z calcd for $C_{18}H_{23}N_3$ [M+] 281.3953, found 281.3955.

4ae: 3-(cyclohexylamino)-2-phenethylindolizine-1-carbonitrile

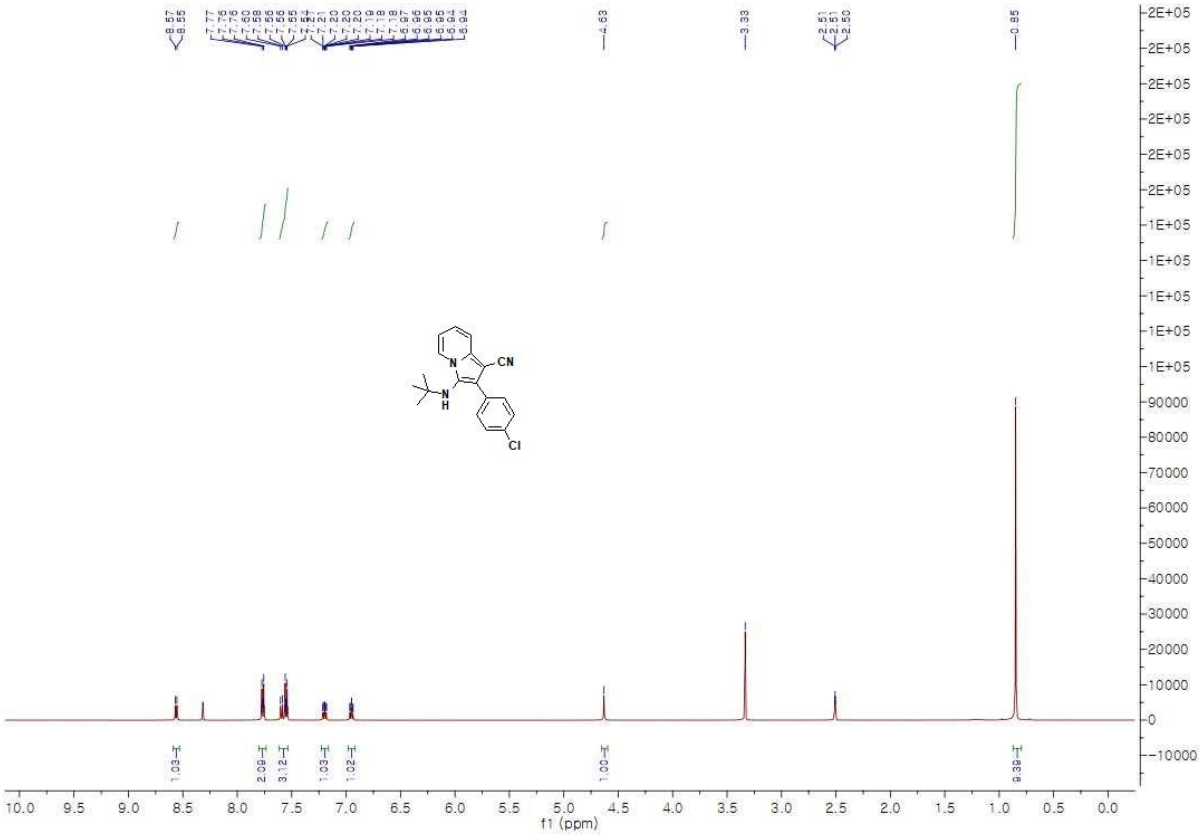
Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.20 (d, *J* = 5Hz, 1H), 7.51 (d, *J* = 10Hz, 1H), 7.30-7.17 (m, 5H), 7.06 (t, *J* = 15Hz, 1H), 6.84 (t, *J* = 15Hz, 1H), 4.43 (d, *J* = 5Hz, 1H), 2.97 (s, 4H), 2.64-2.61 (m, 1H), 1.72-1.62 (m, 4H), 1.51-1.47 (m, 1H), 1.22-1.07 (m, 5H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 141.8, 134.0, 128.8, 128.7, 127.8, 126.4, 123.8, 122.6, 122.3, 117.5,

116.7, 112.5, 78.6, 56.6, 36.3, 27.4, 25.8, 25.0. HRMS m/z calcd for $C_{23}H_{25}N_3$ [M+] 343.4647, found 343.4642.

6: 2, 2'-(1, 3-phenylene)bis(3-(tert-butylamino)indolizine-1-carbonitrile)

Pale yellow solid; ^{1}H NMR (500 MHz, DMSO) δ_H (ppm) 8.56 (d, *J* = 10Hz, 2H), 7.97 (s, 1H), 7.74 (d, *J* = 10Hz, 2H), 7.61-7.58 (m, 3H), 7.19 (t, *J* = 15Hz, 2H), 6.94 (t, *J* = 15Hz, 2H), 4.45 (s, 2H), 0.90 (s, 18H); ^{13}C NMR (500 MHz, DMSO) δ_C (ppm) 134.8, 134.1, 130.6, 129.1, 128.8, 126.1, 126.1, 124.9, 123.5, 117.3, 116.8, 112.8, 79.2, 55.9, 30.3. HRMS m/z calcd for $C_{32}H_{32}N_6$ [M+] 500.6367, found 500.6370.

^{1}H and ^{13}C NMR spectra of the compounds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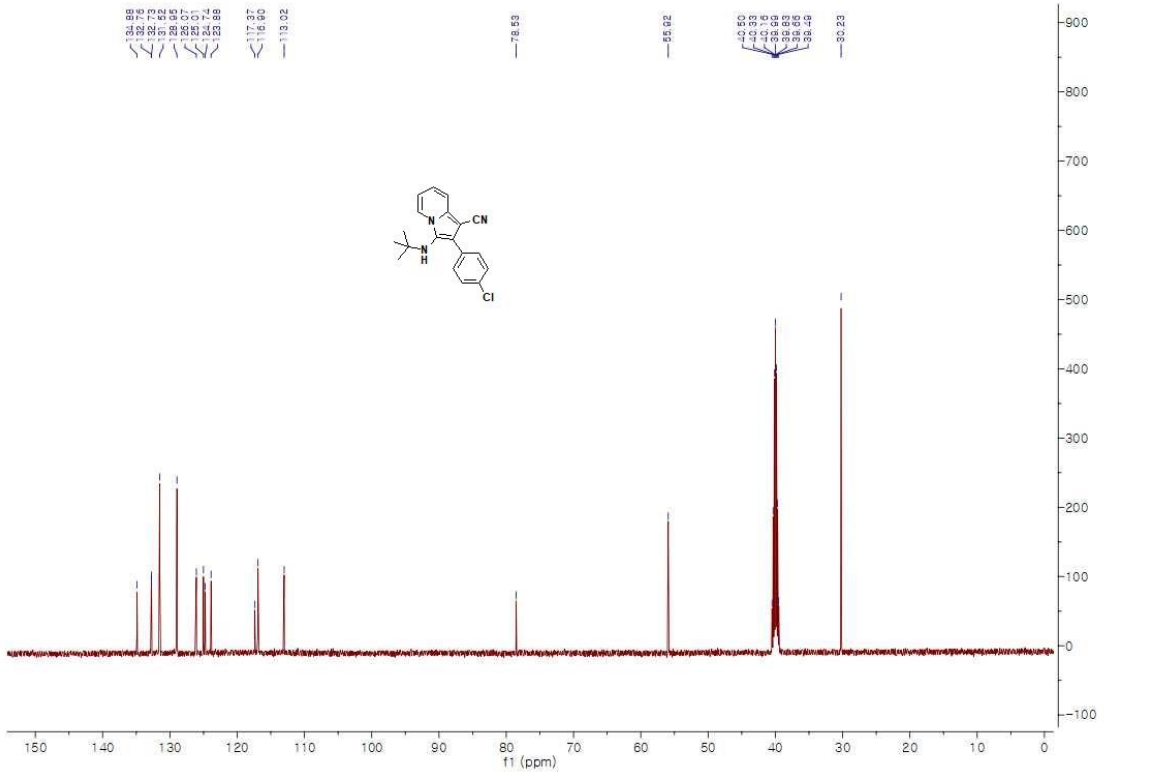
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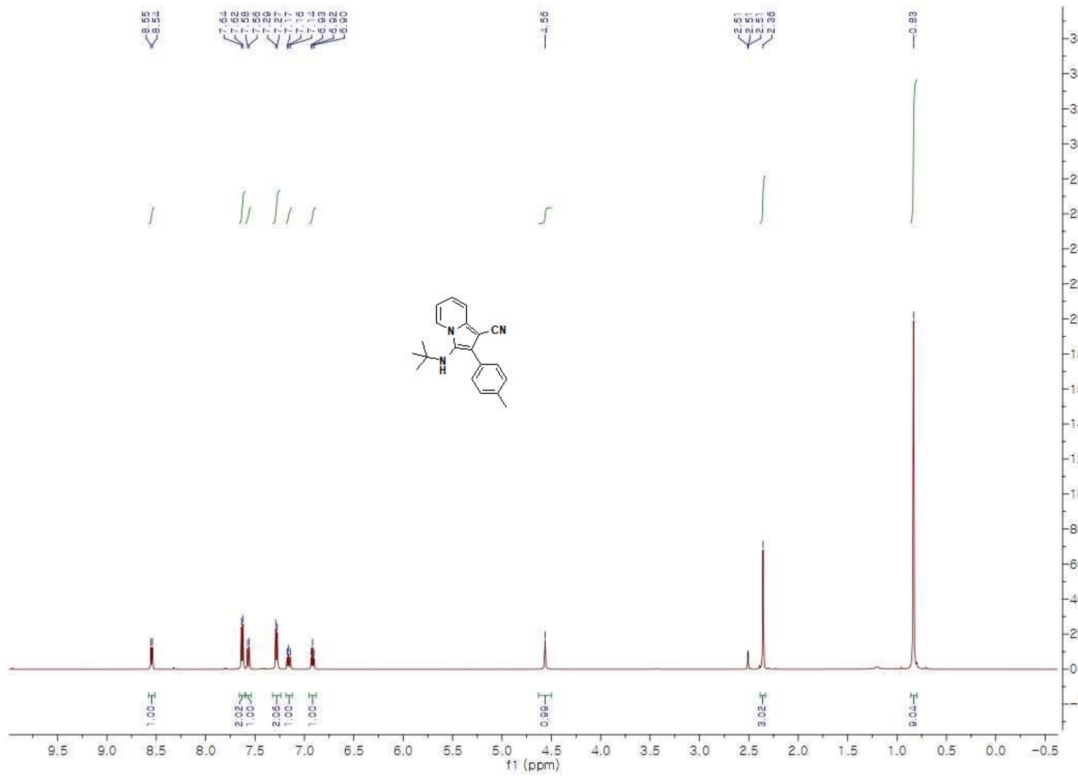
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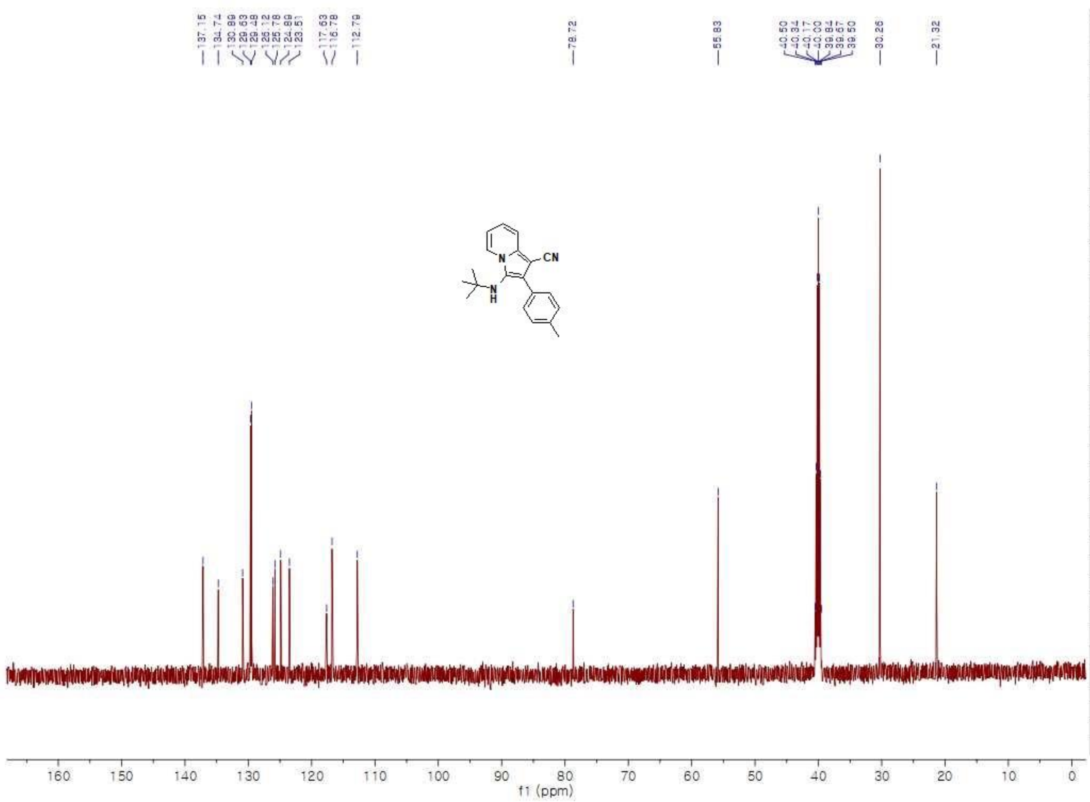
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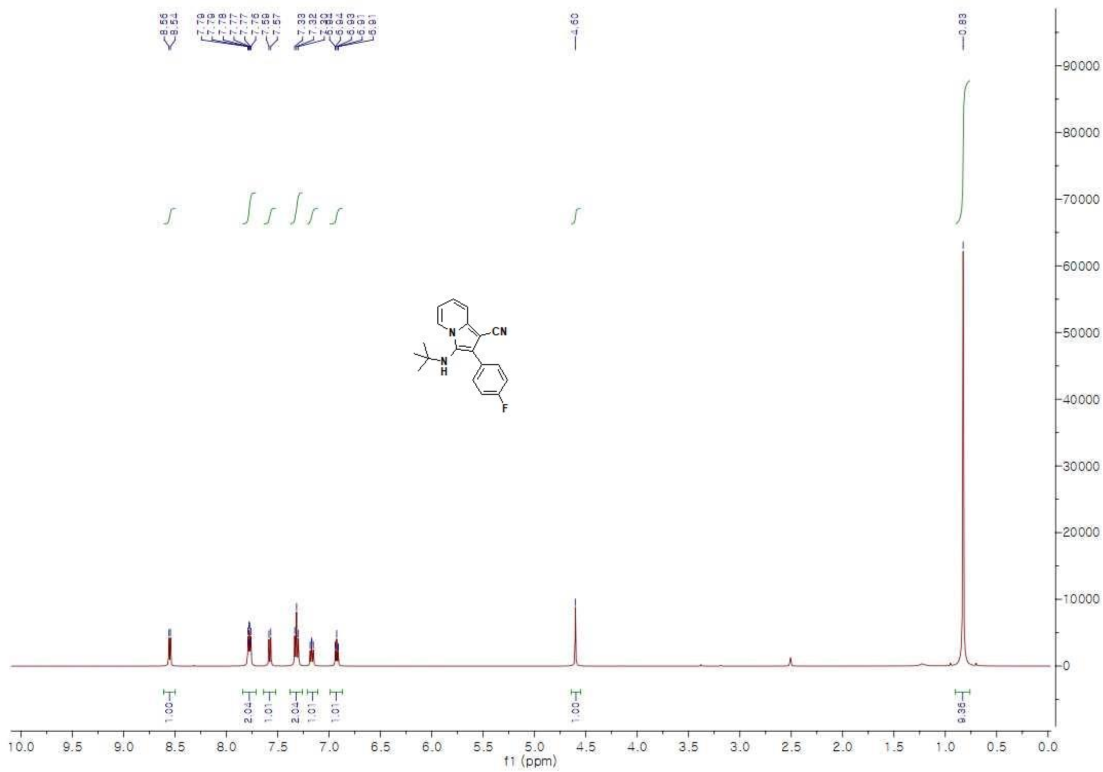
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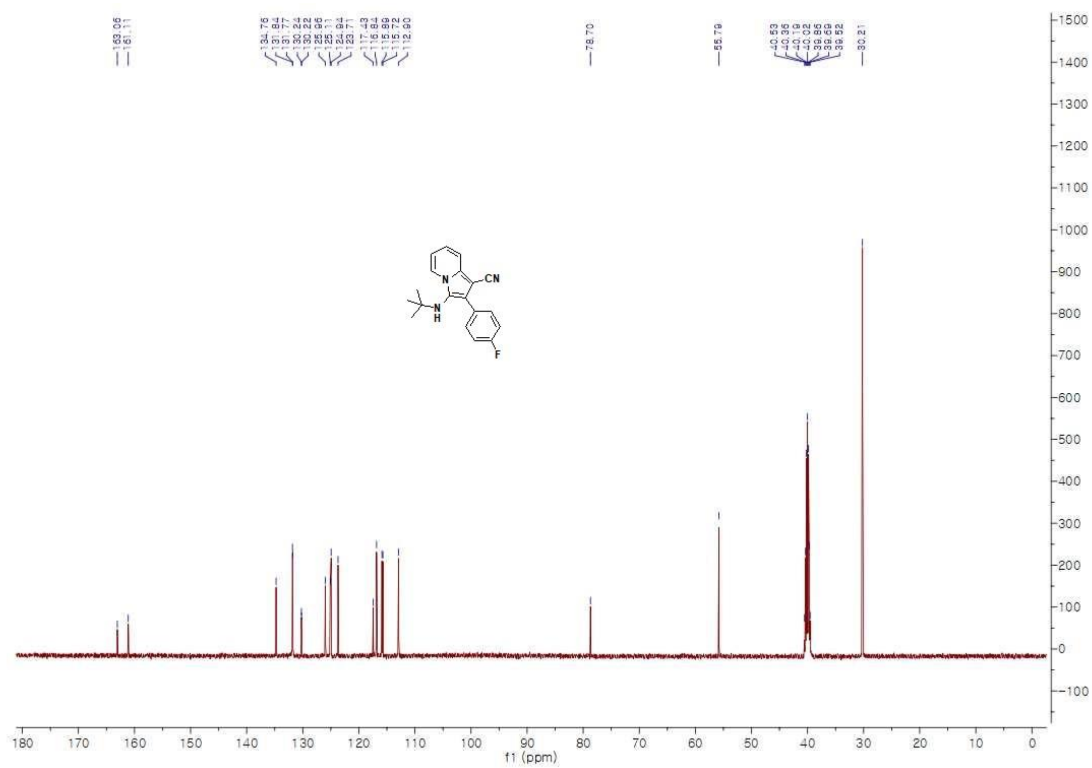
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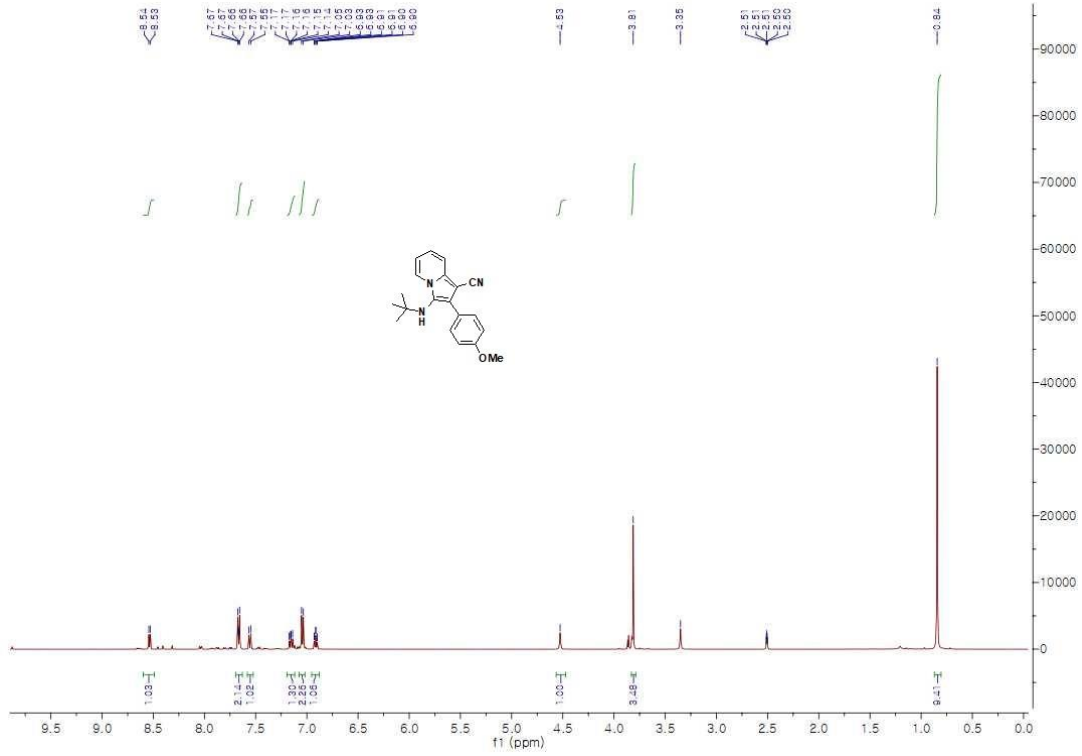
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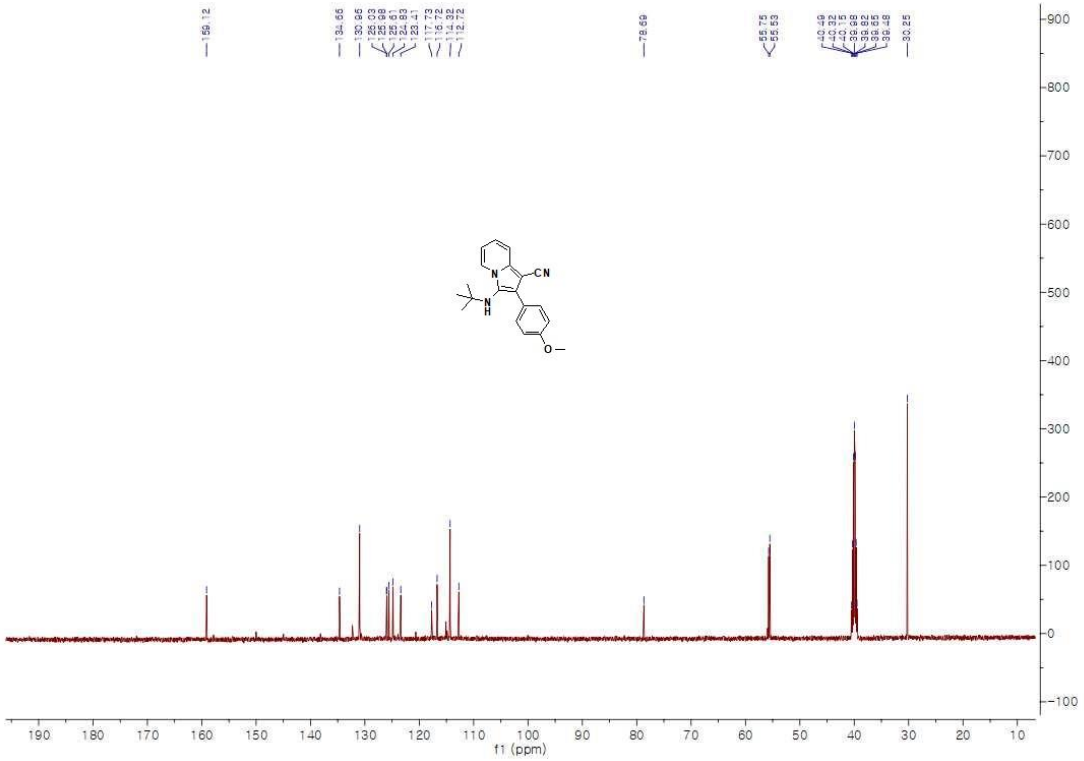
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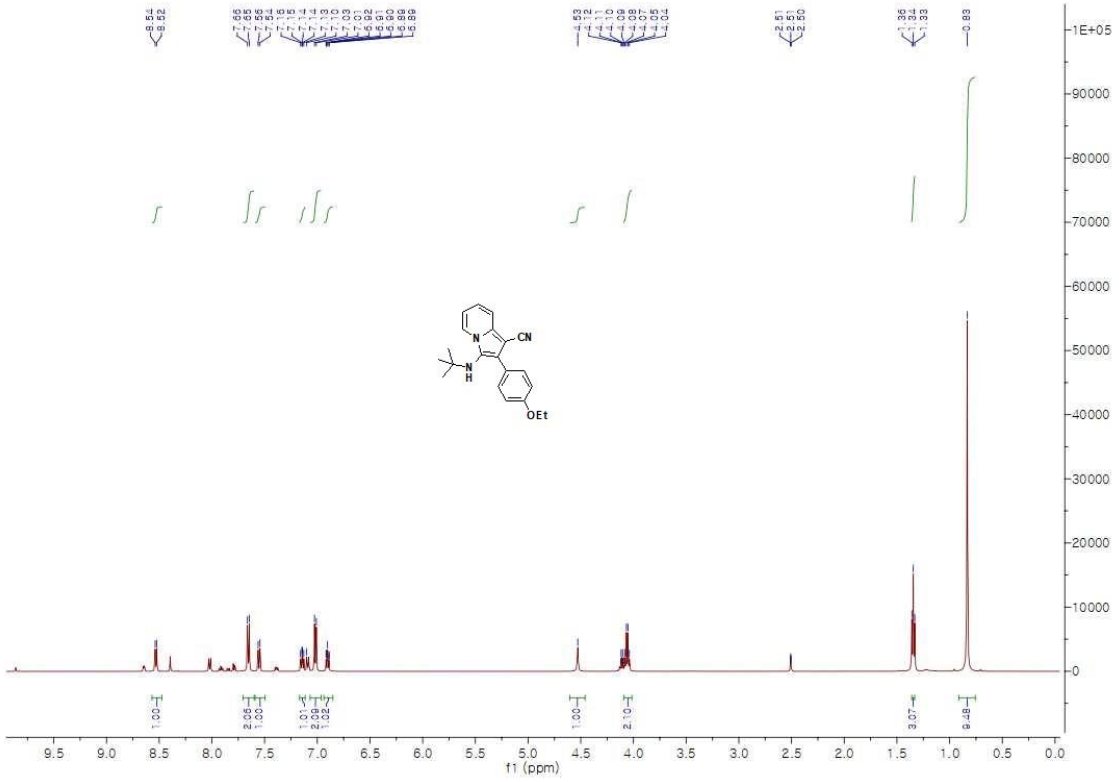
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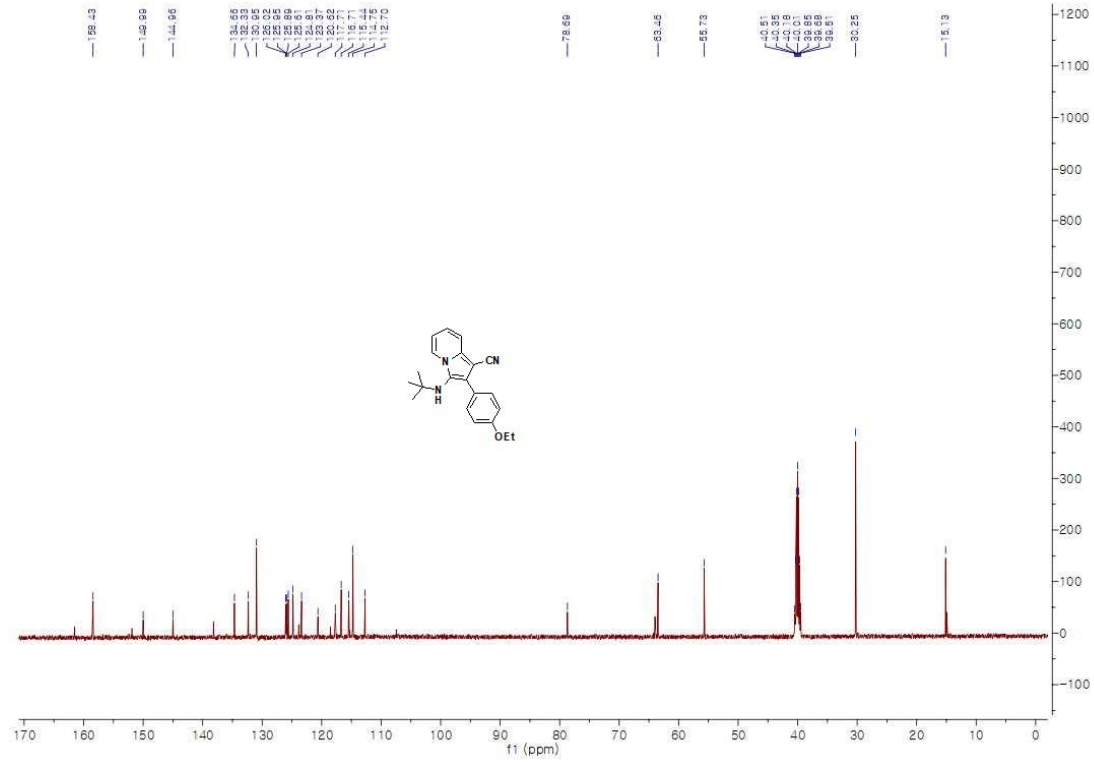
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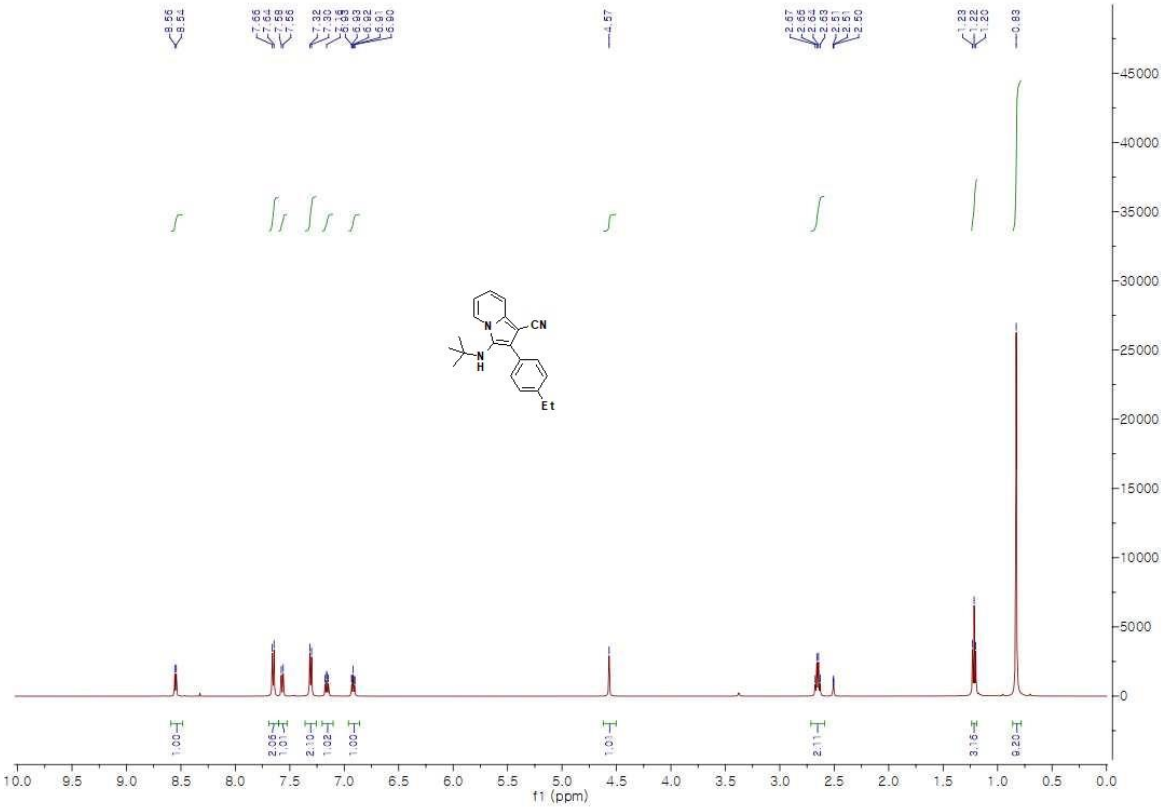
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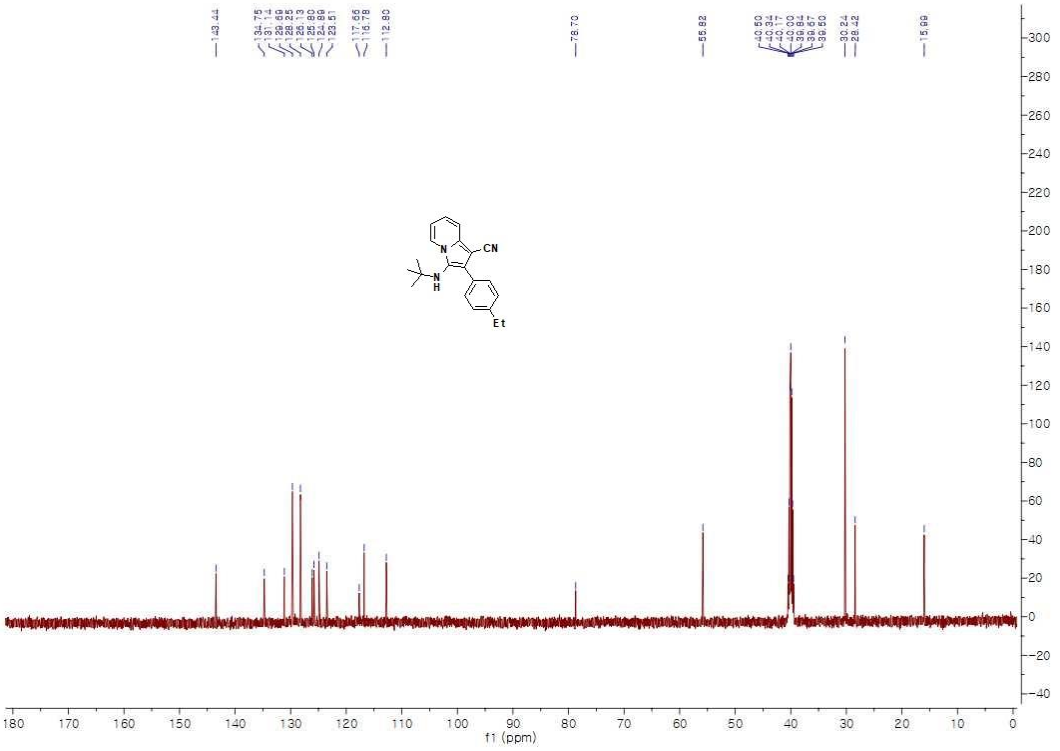
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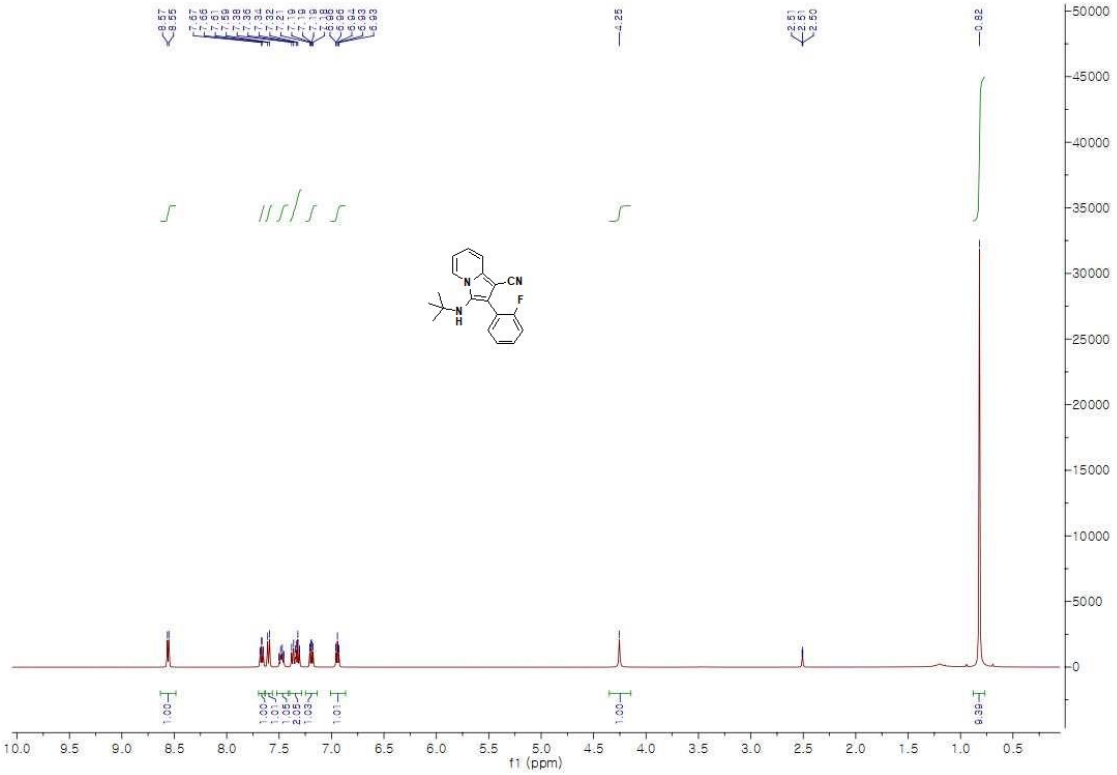
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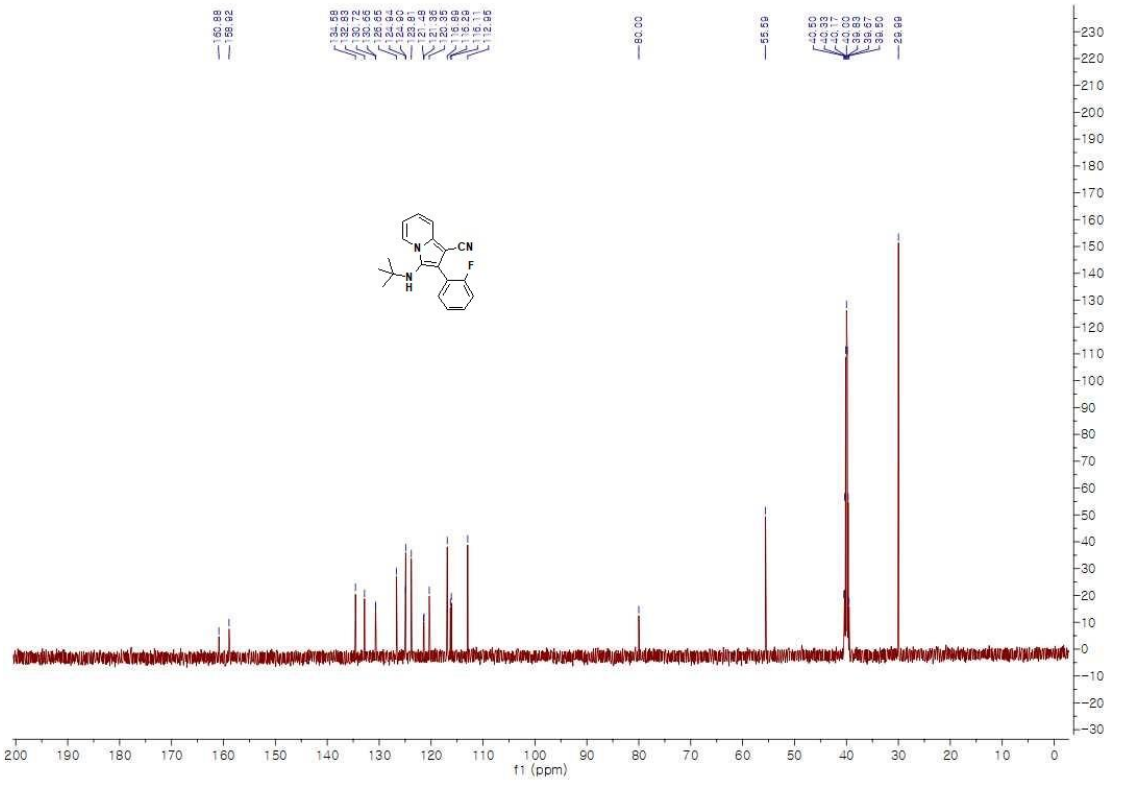
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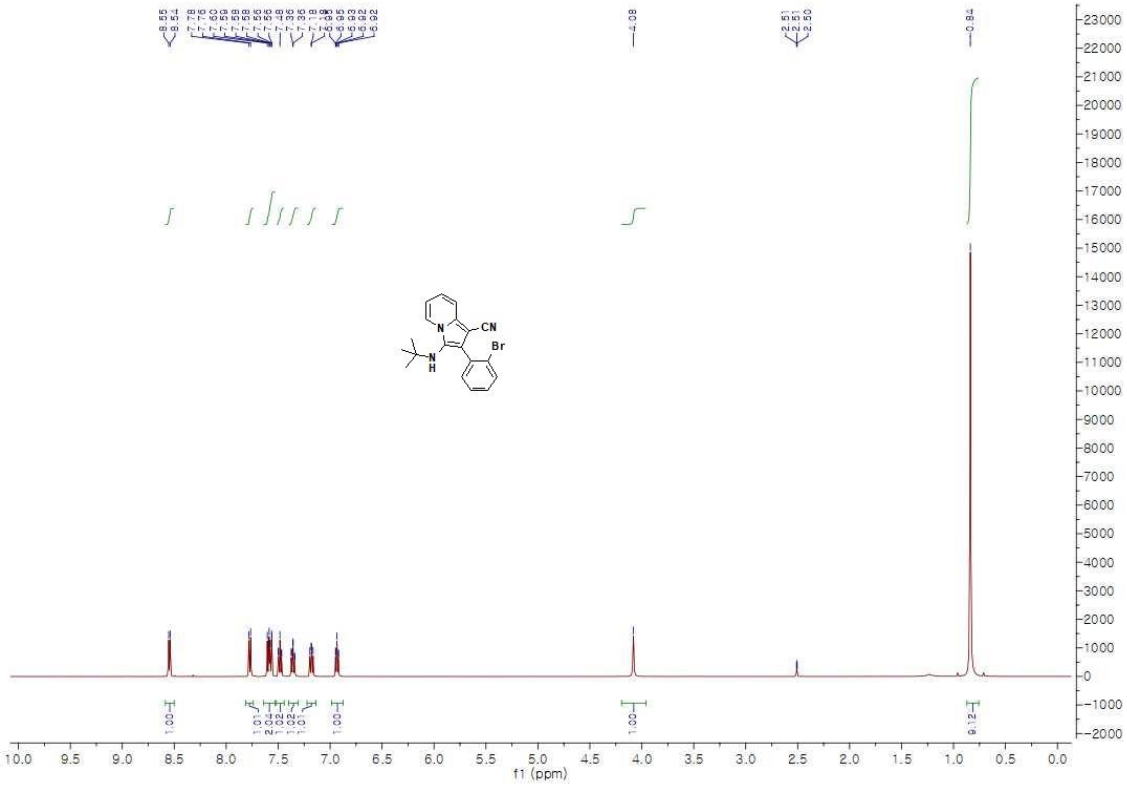
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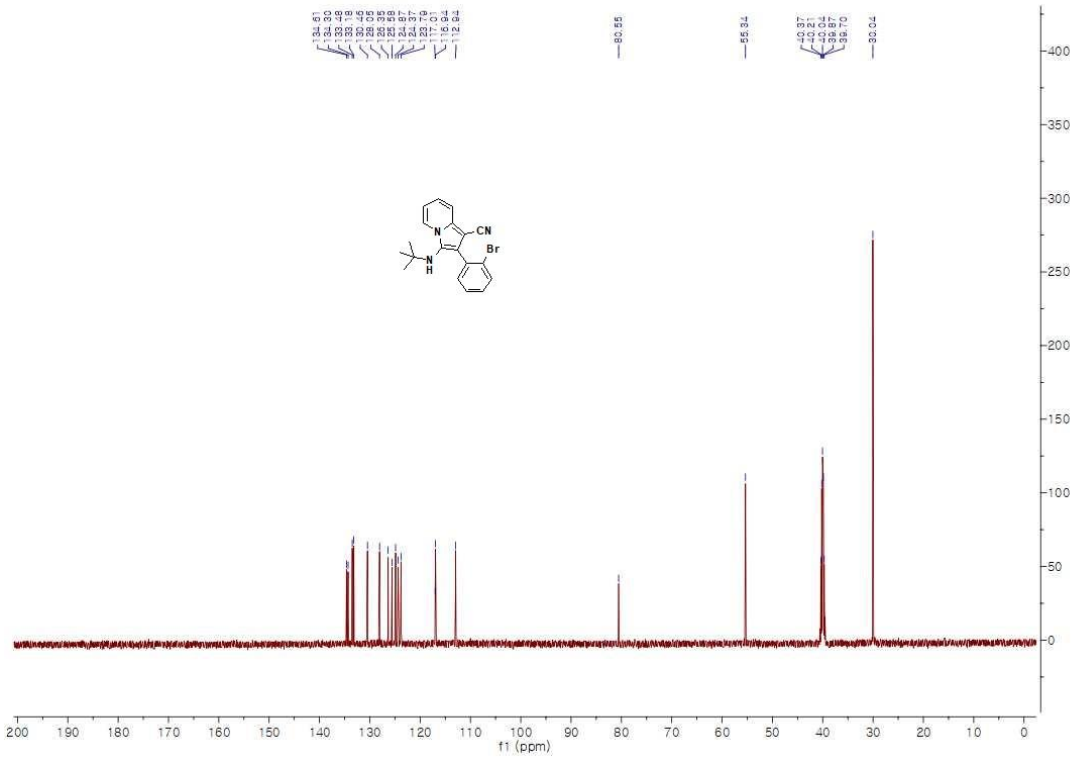
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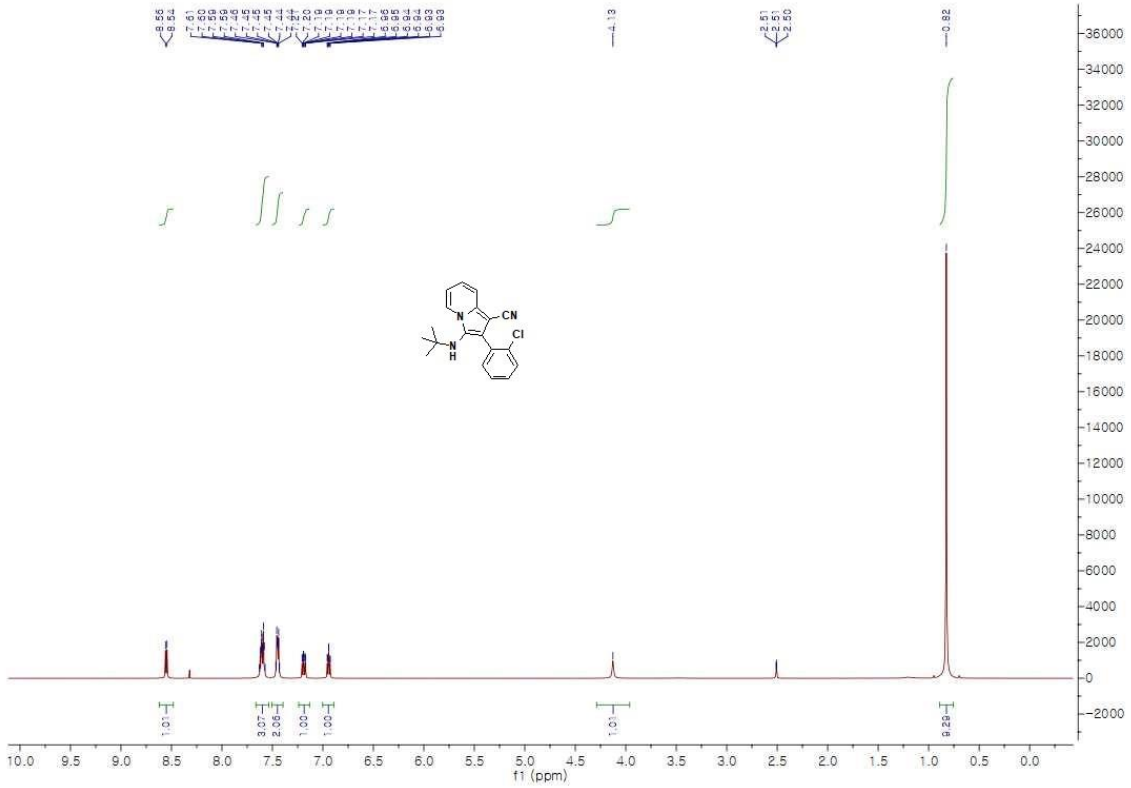
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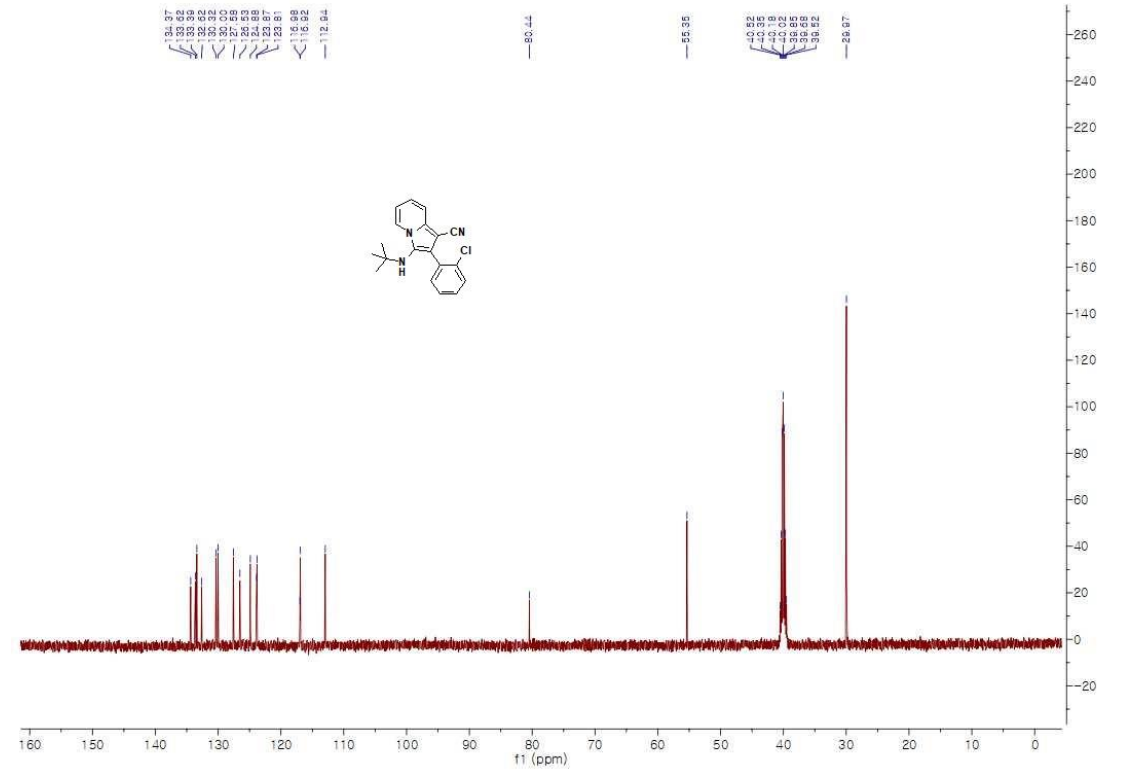
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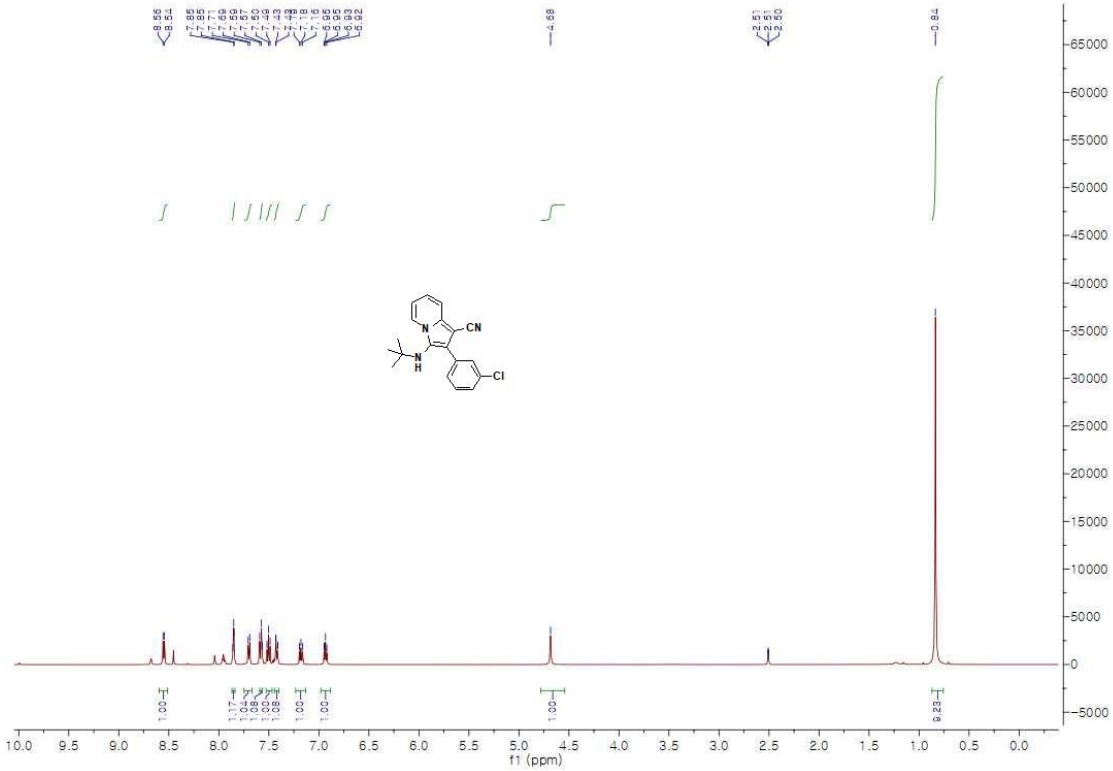
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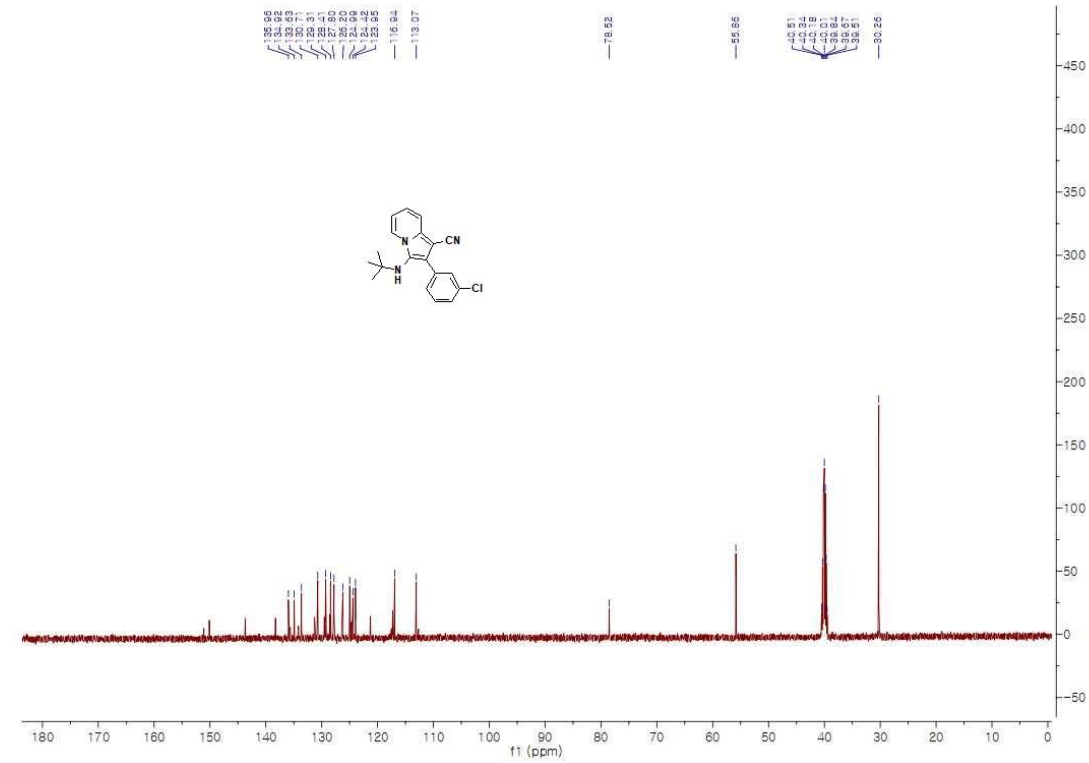
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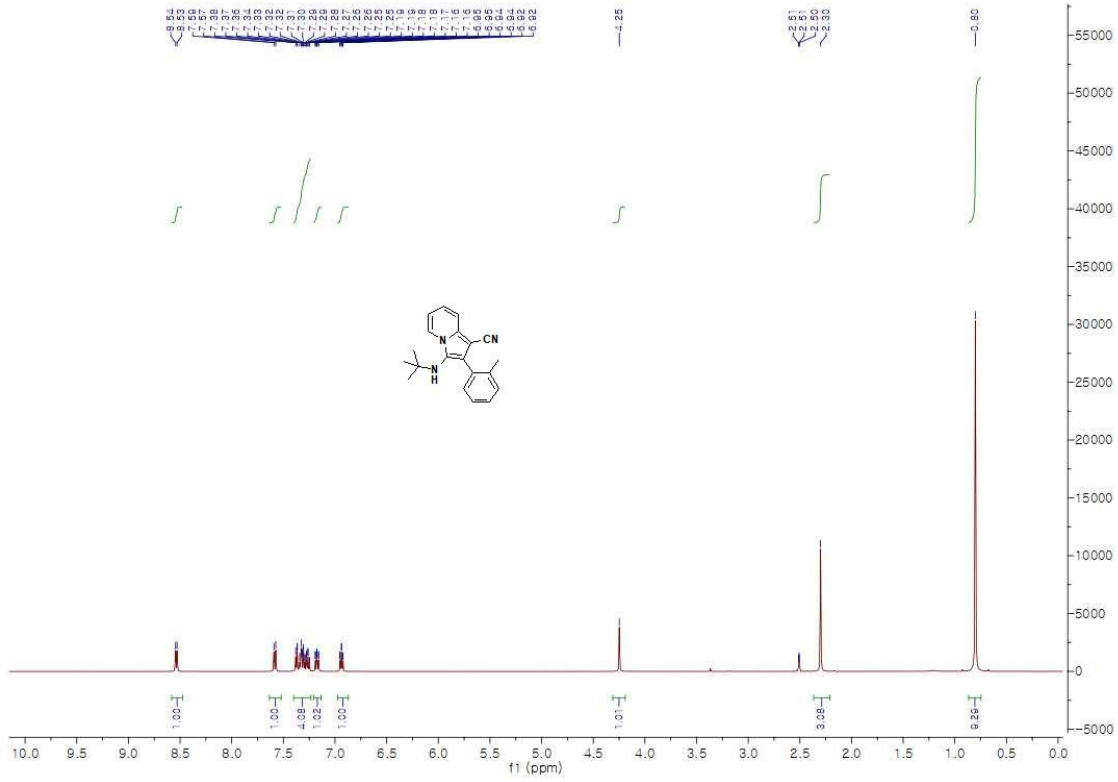
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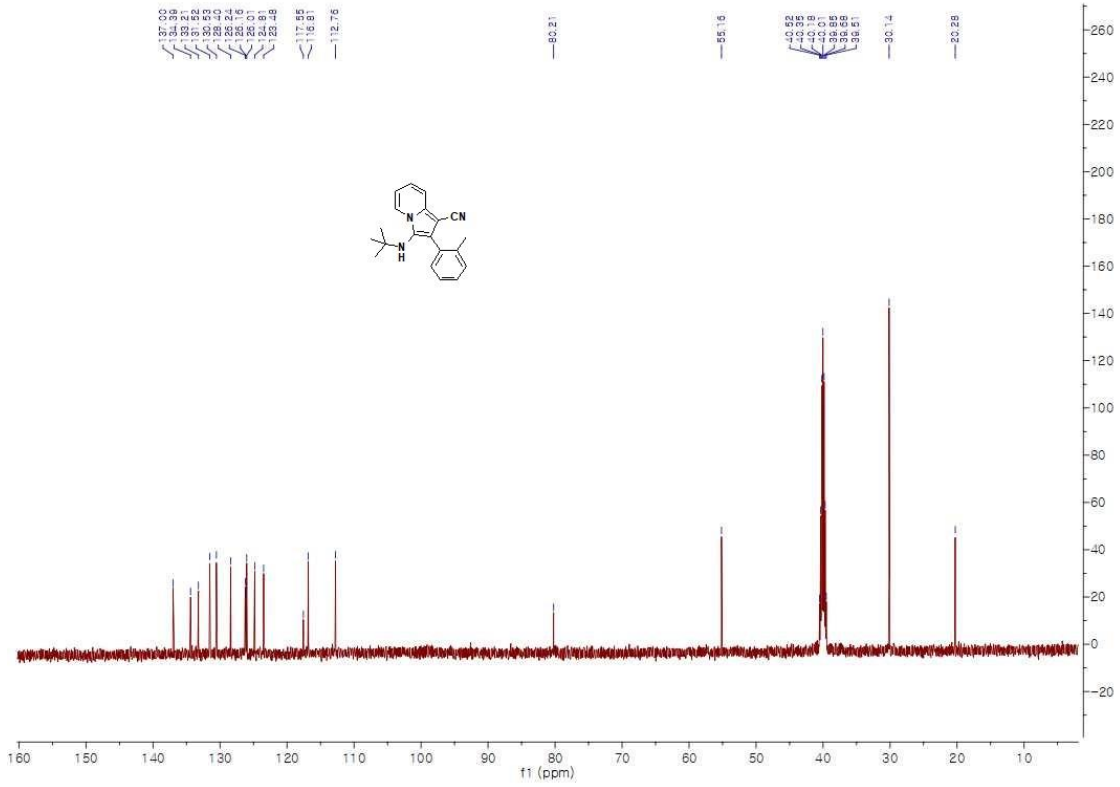
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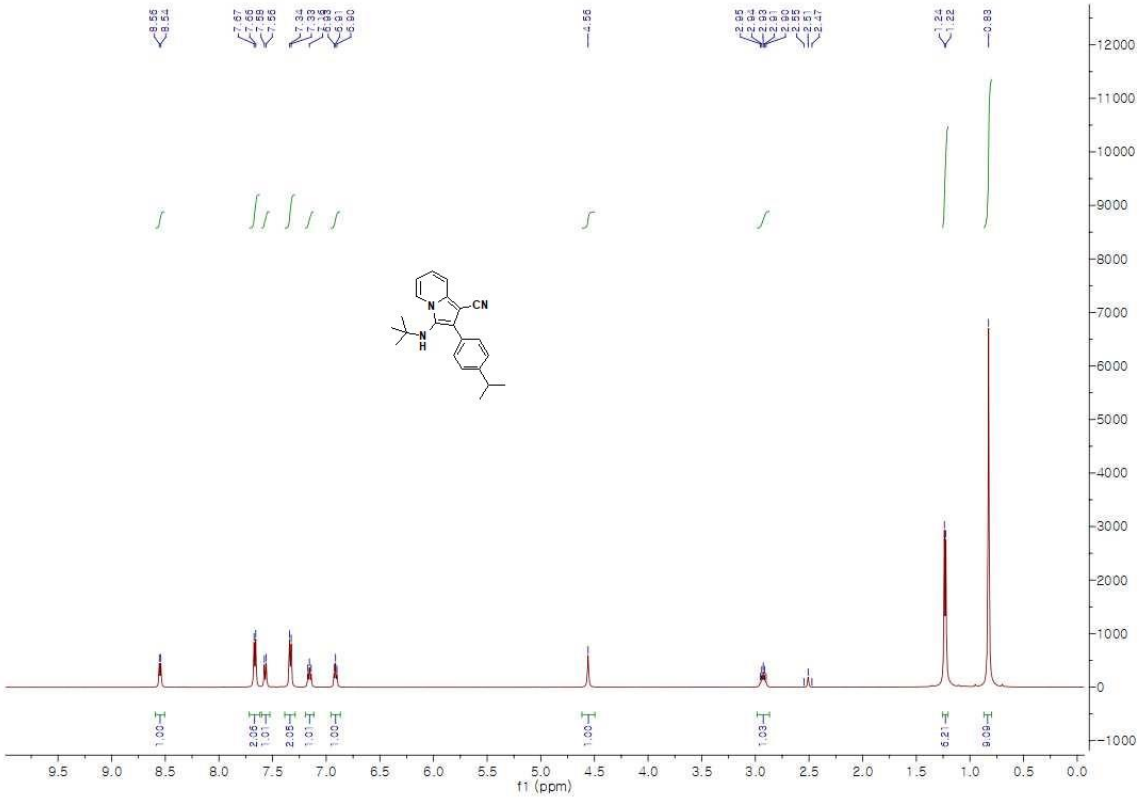
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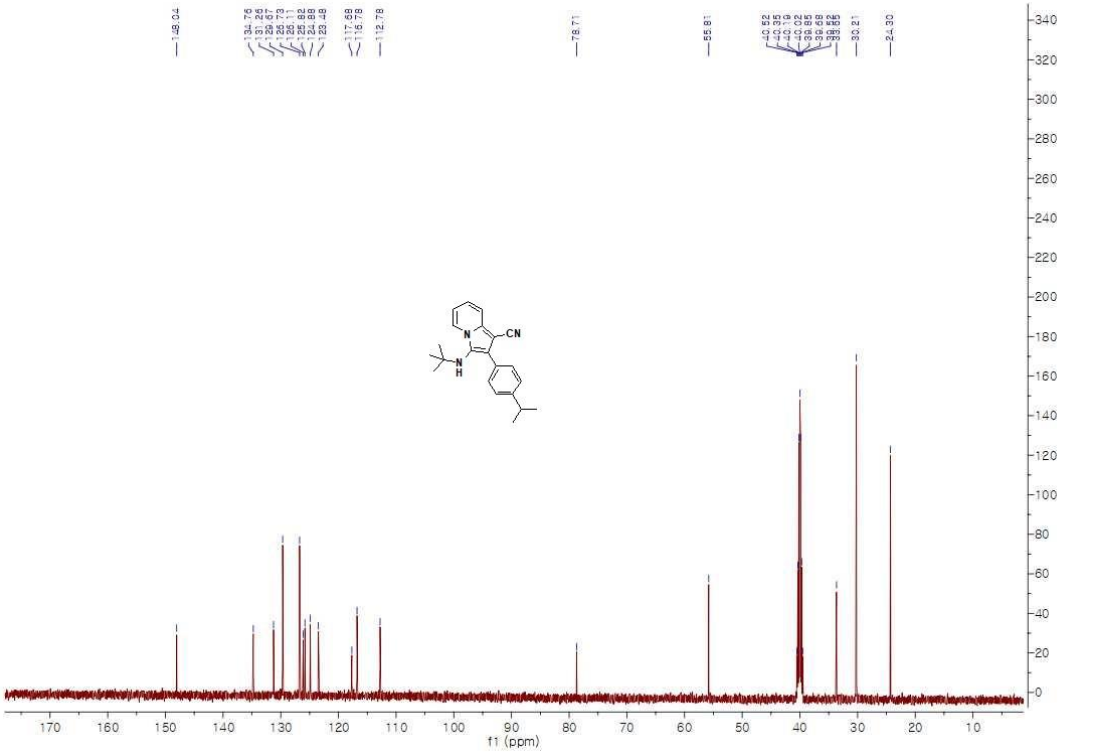
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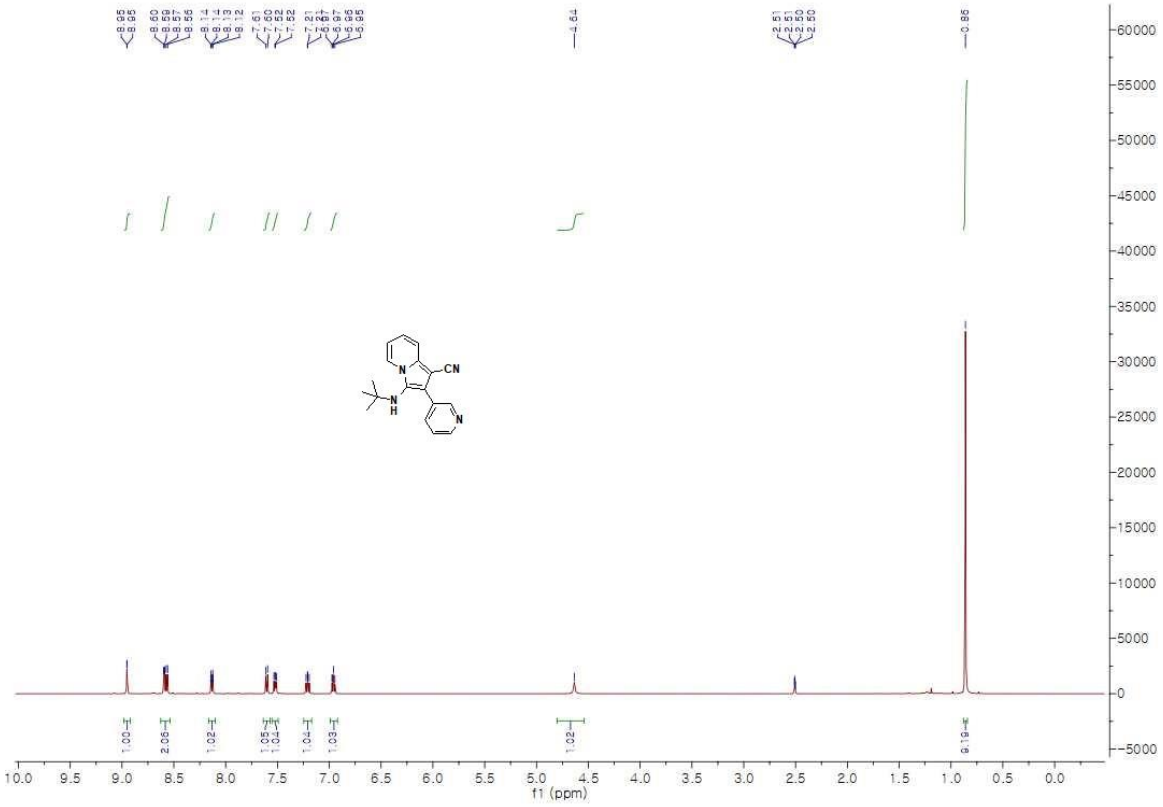
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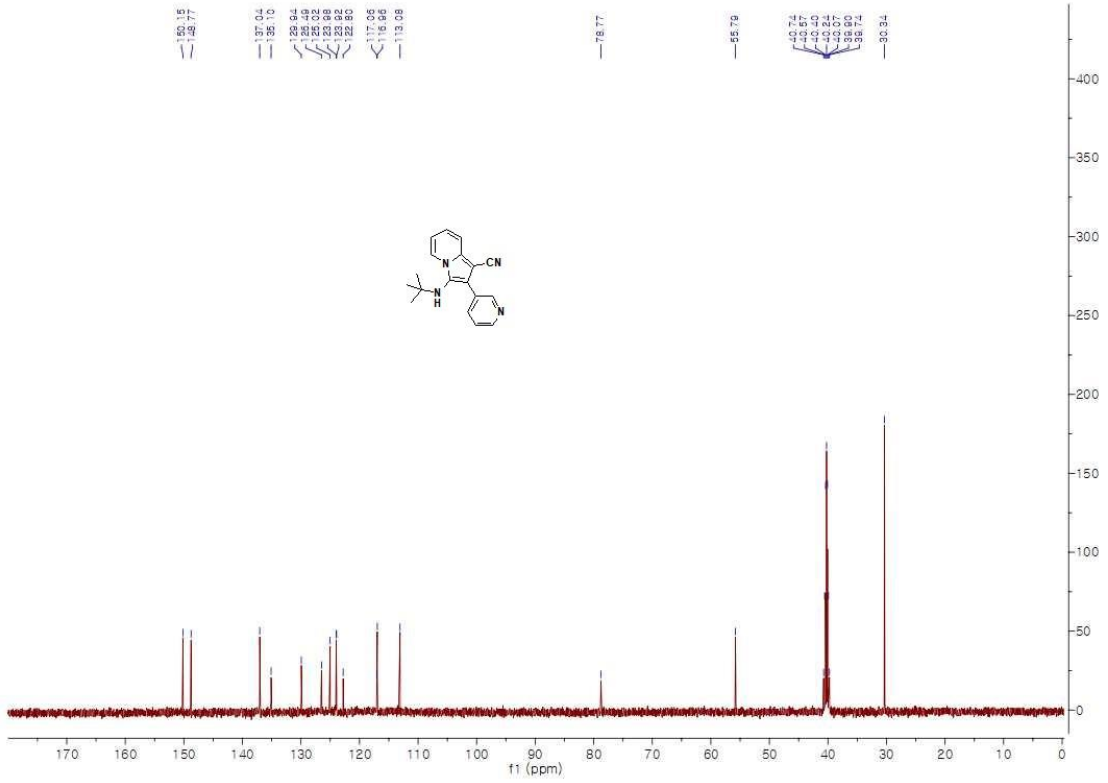
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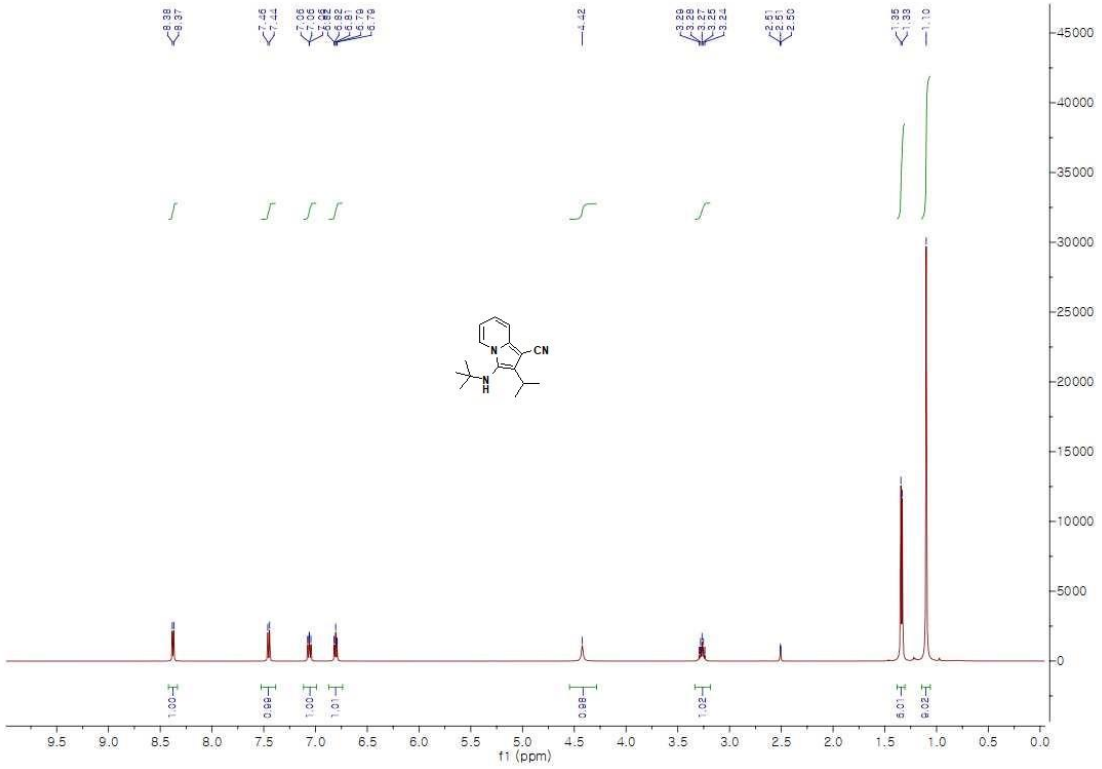
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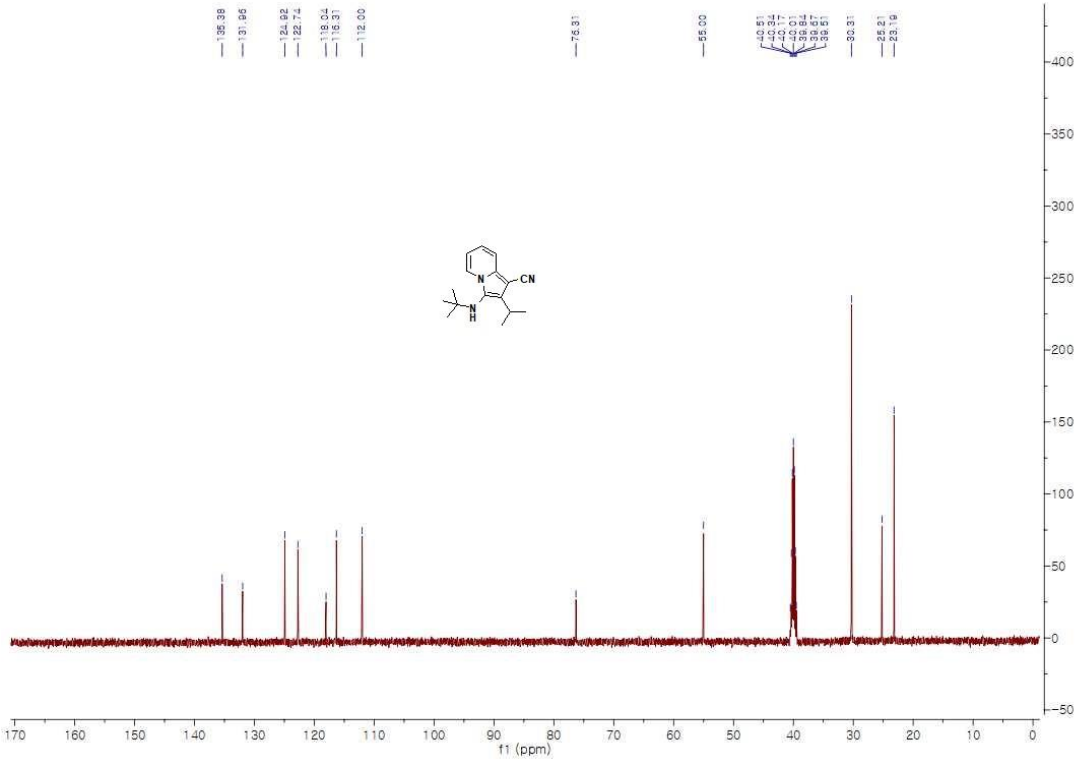
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CN
N
H
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150
100
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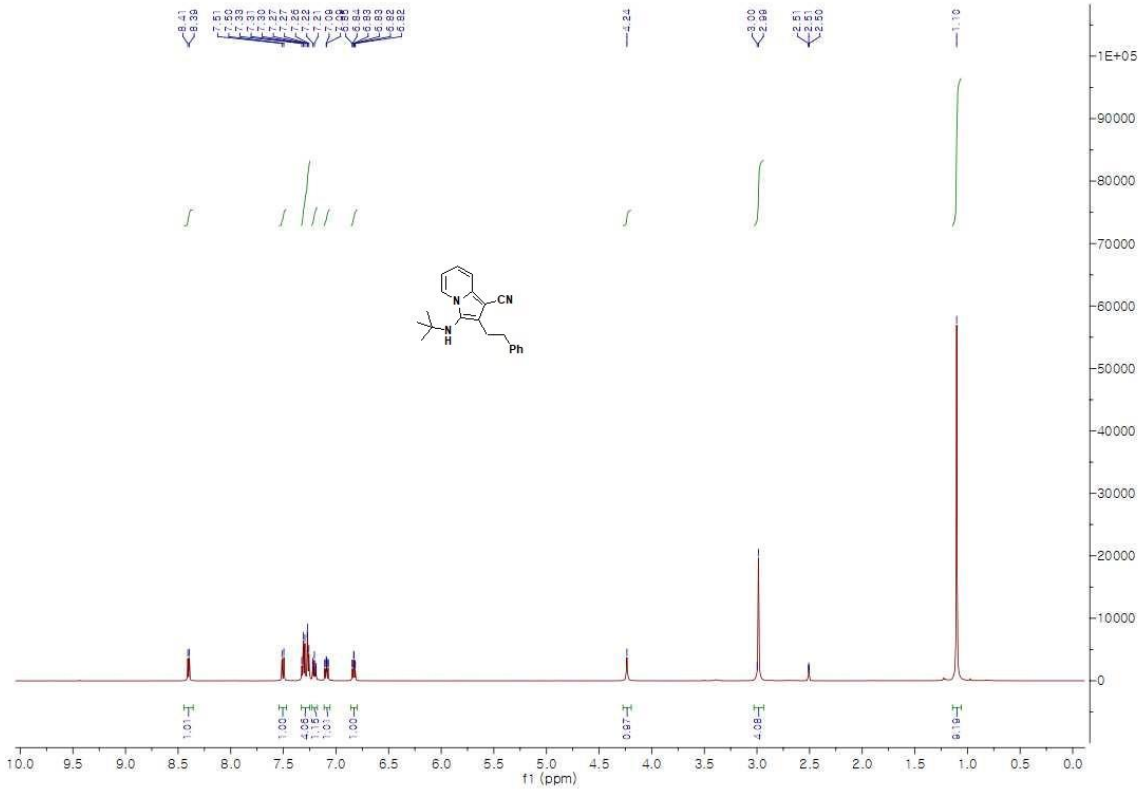
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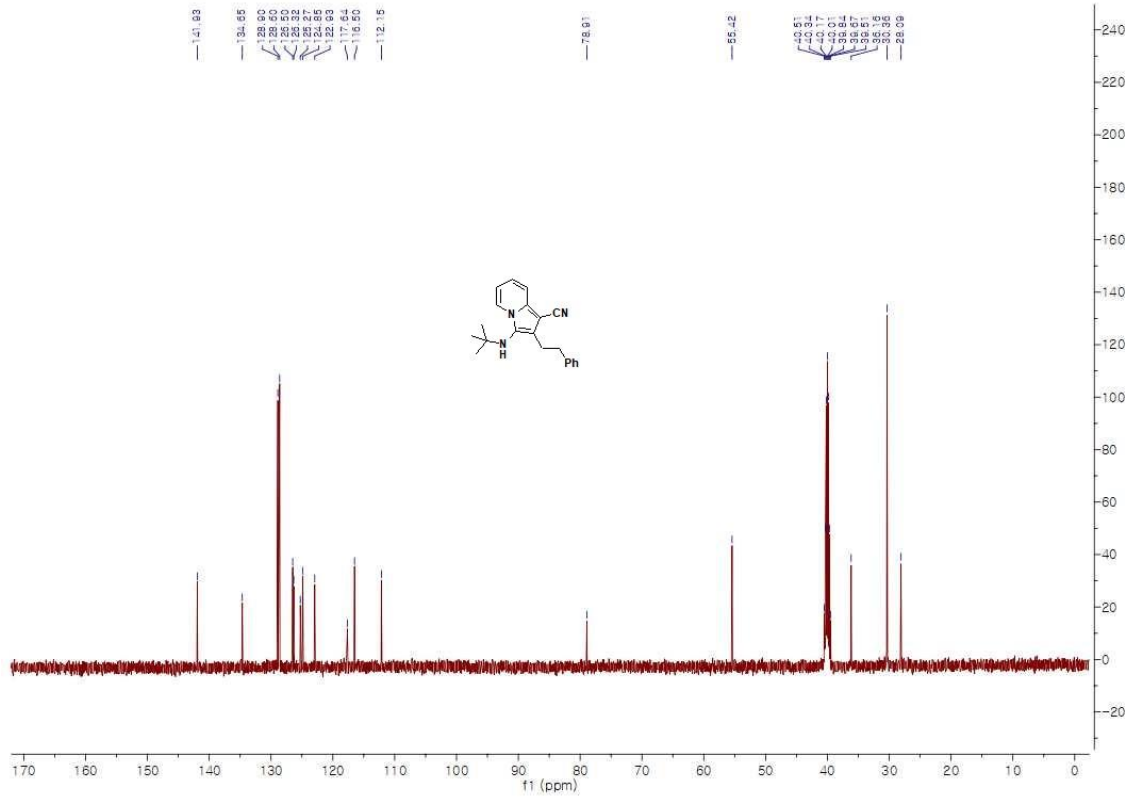
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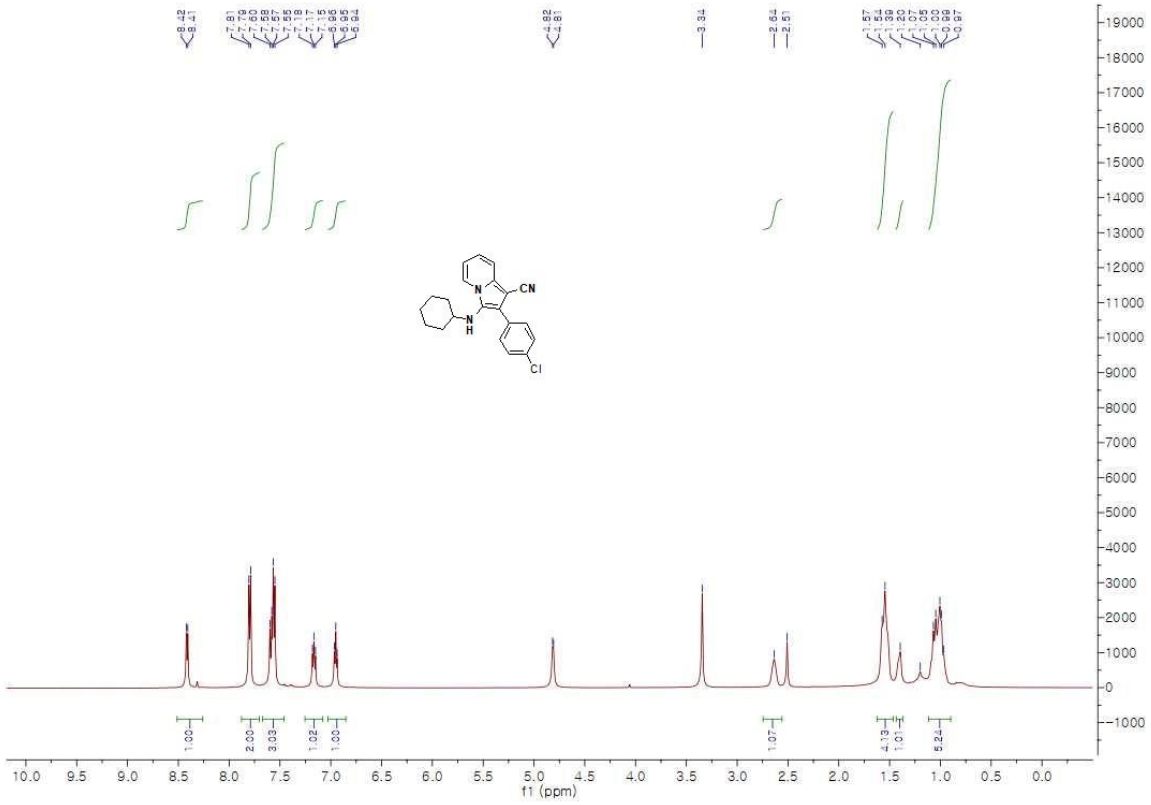
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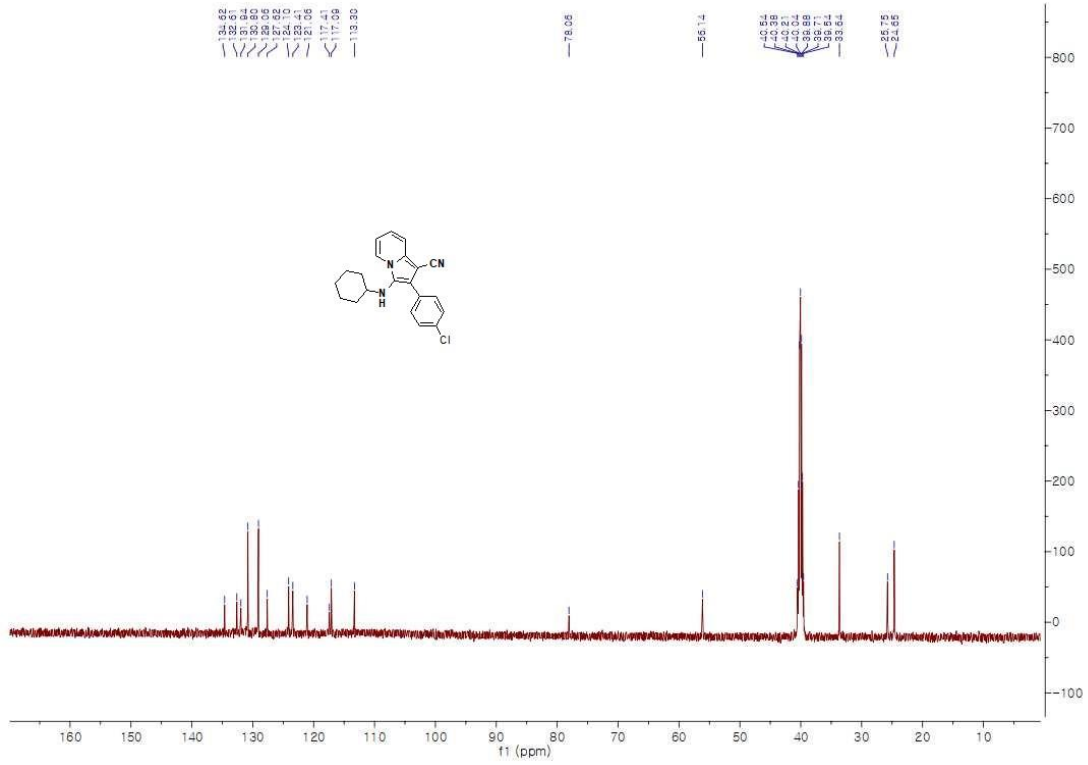
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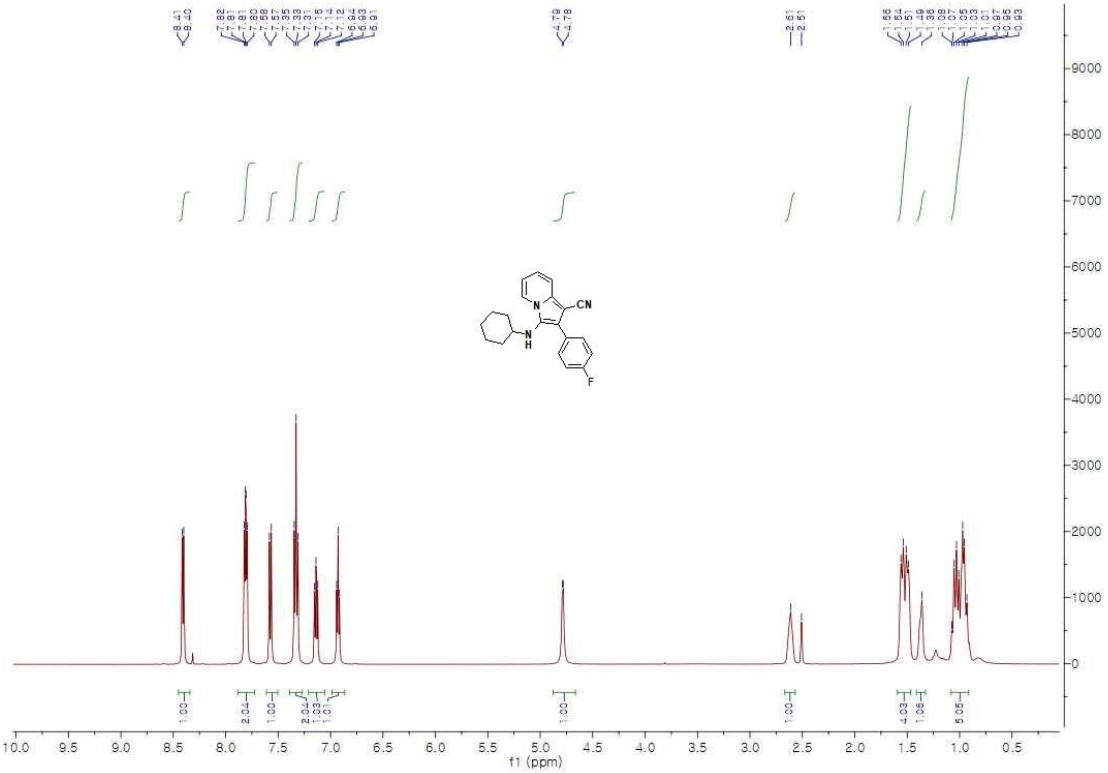
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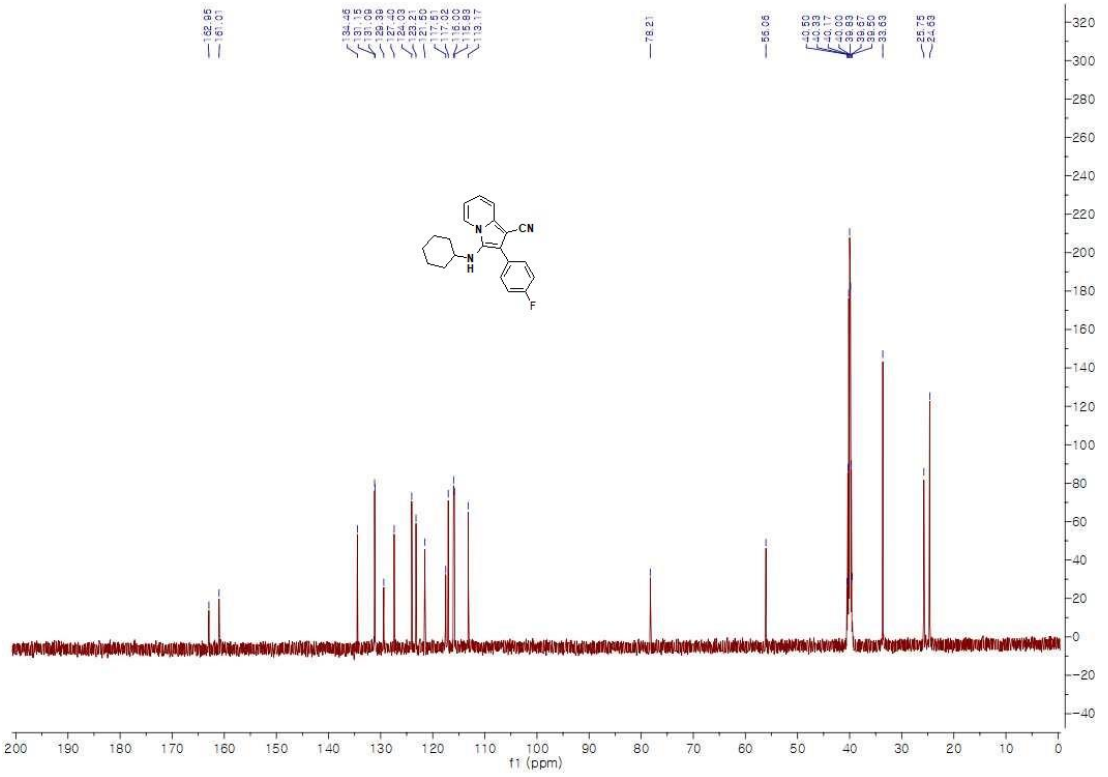
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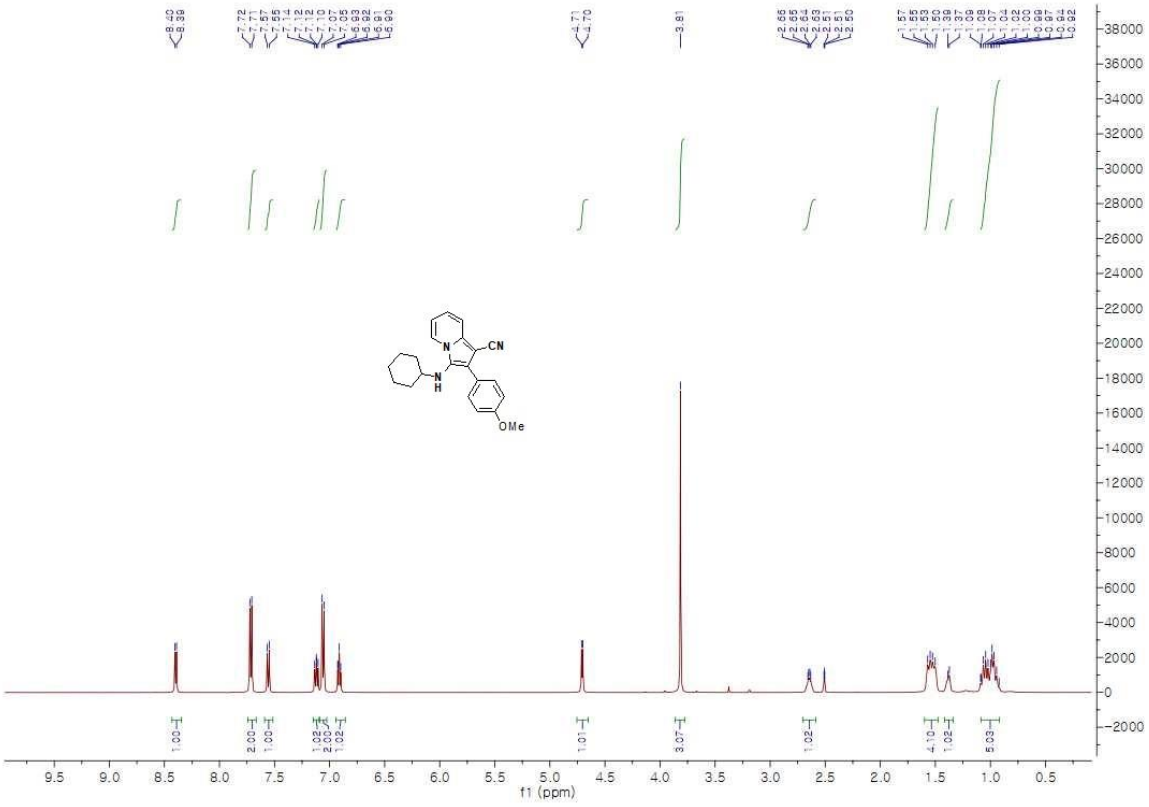
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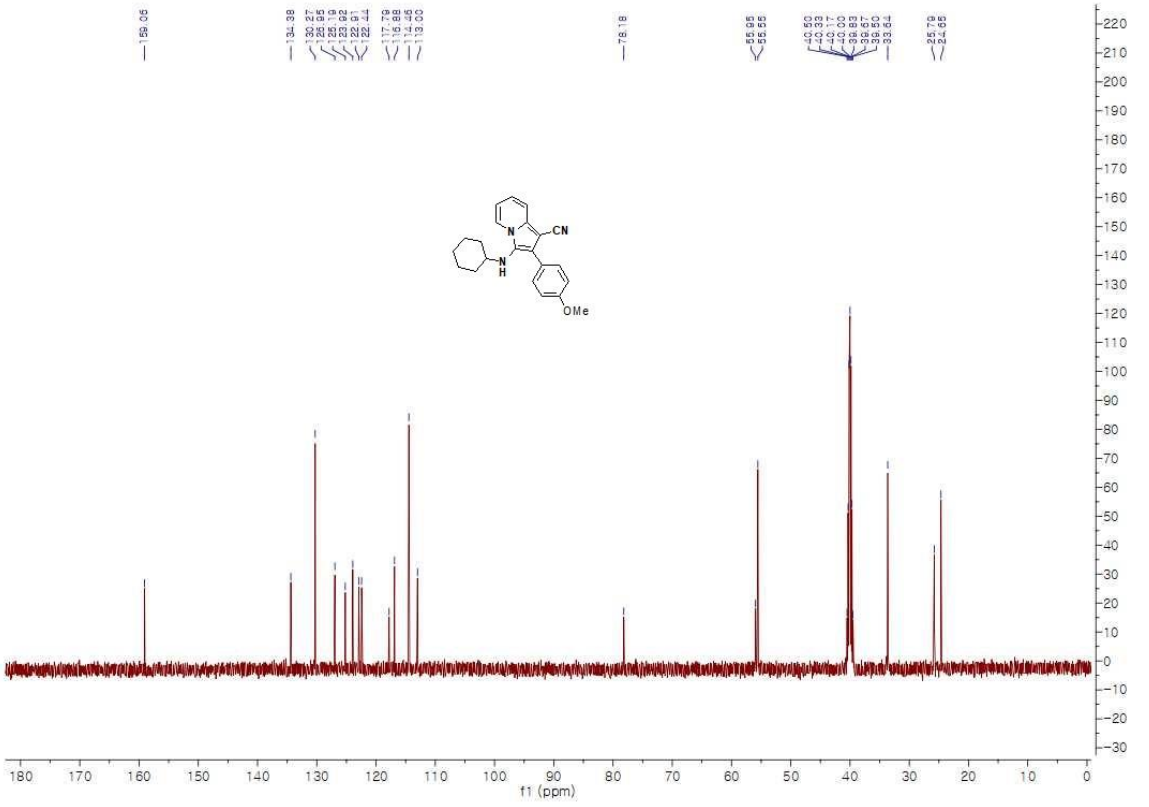
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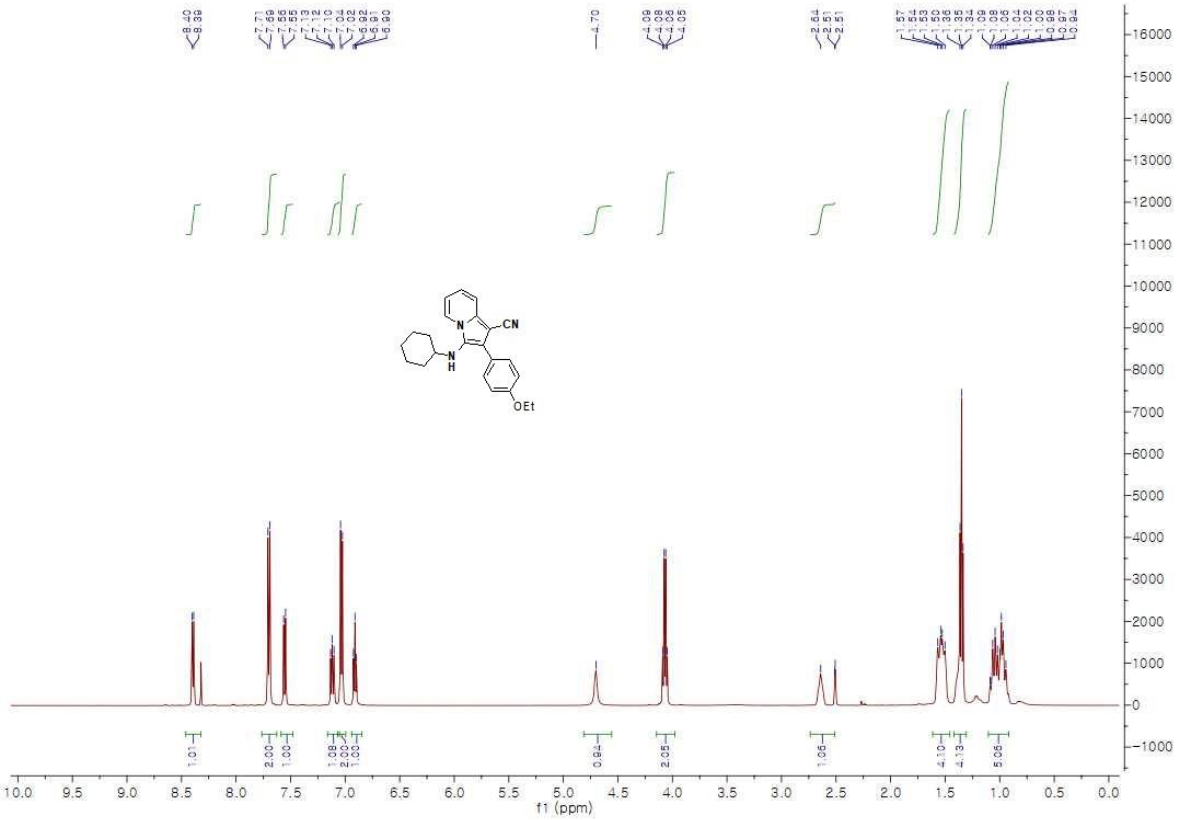
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H
OEt
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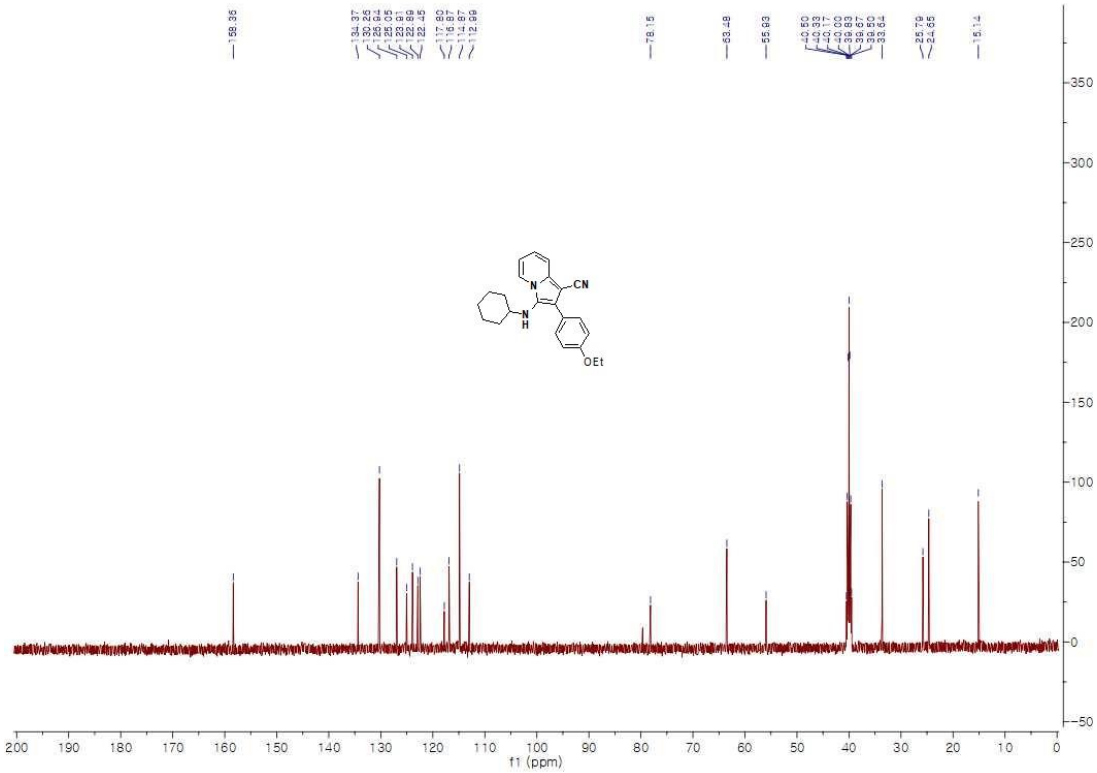
f1 (ppm)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39.53
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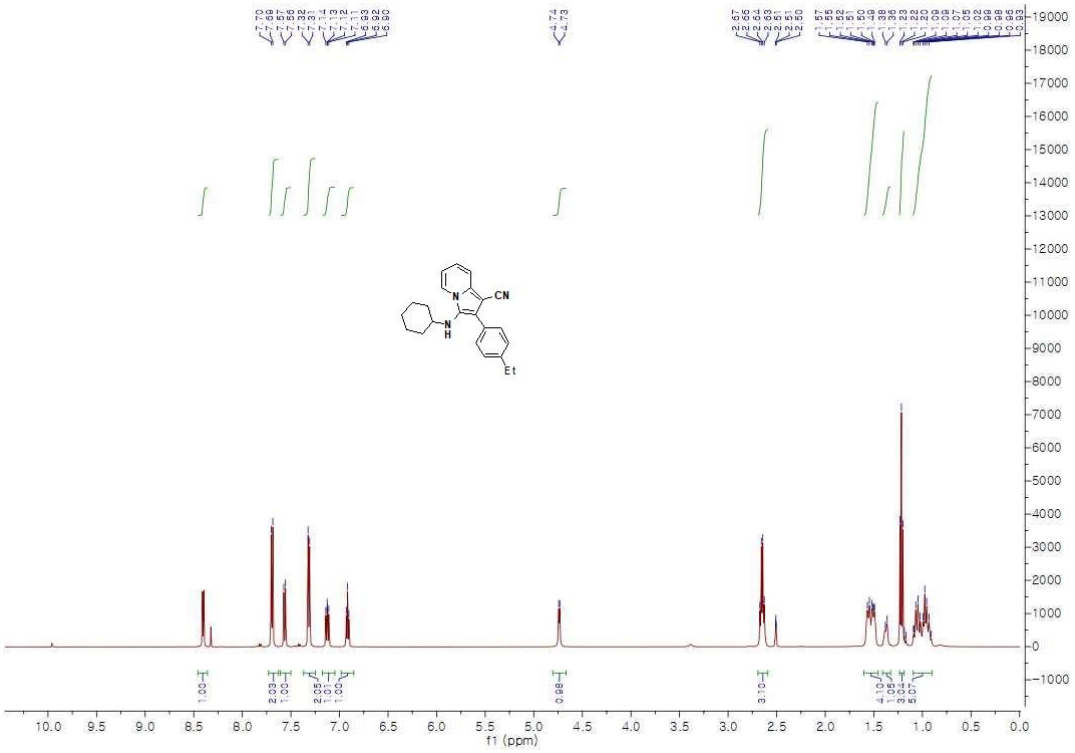
H
OEt
f1 (ppm)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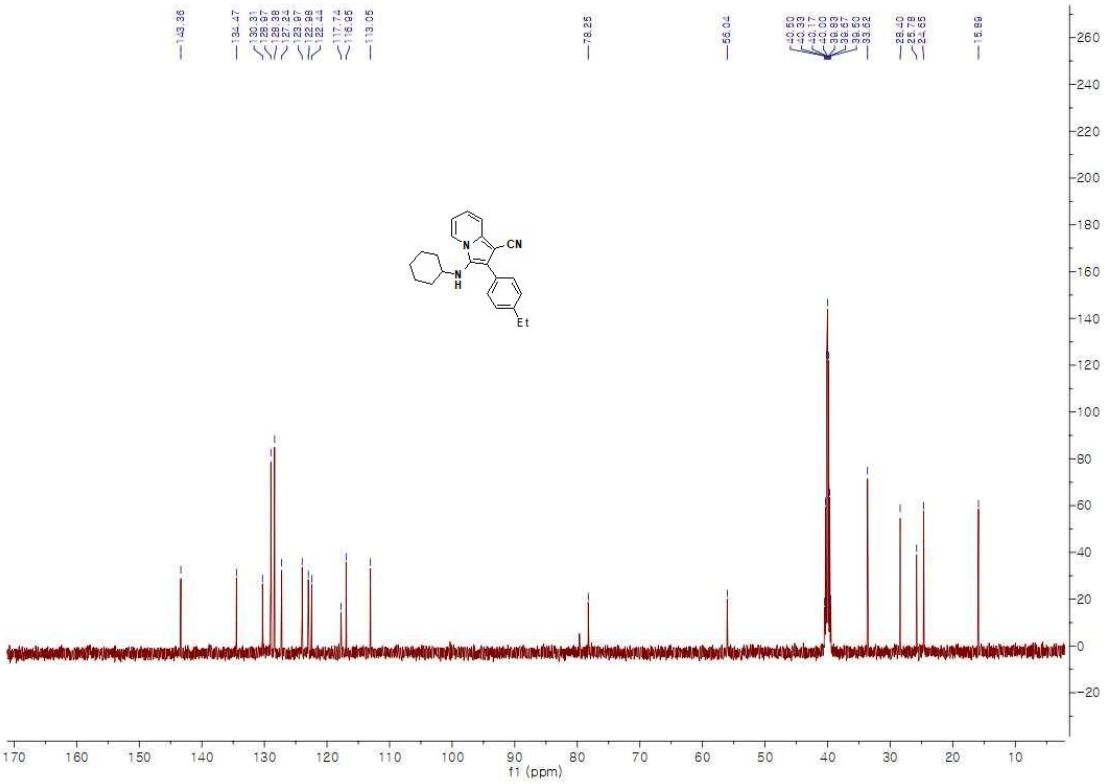
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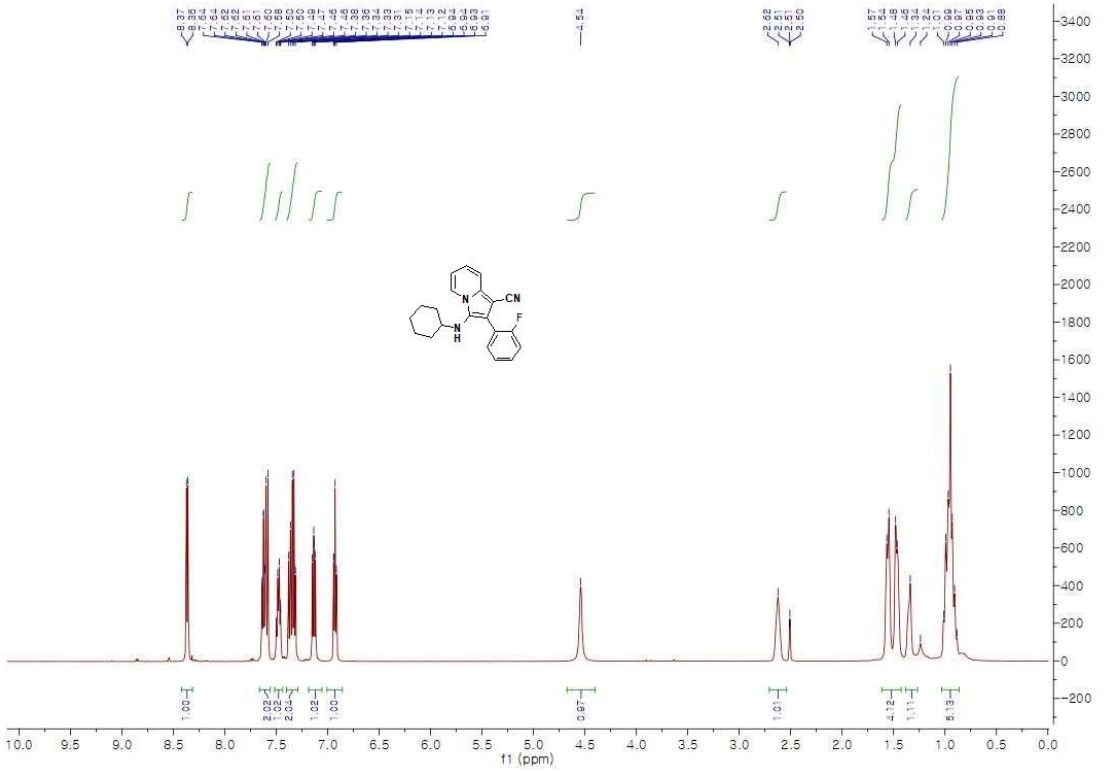
f1 (ppm)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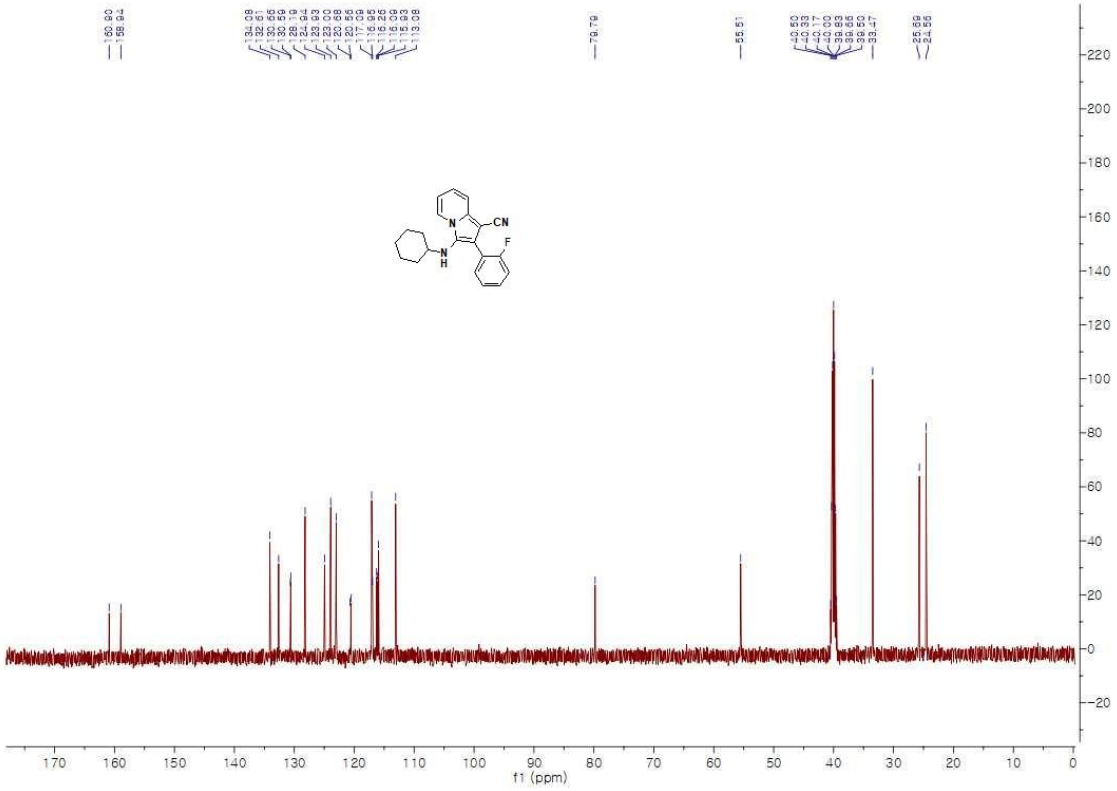
f1 (ppm)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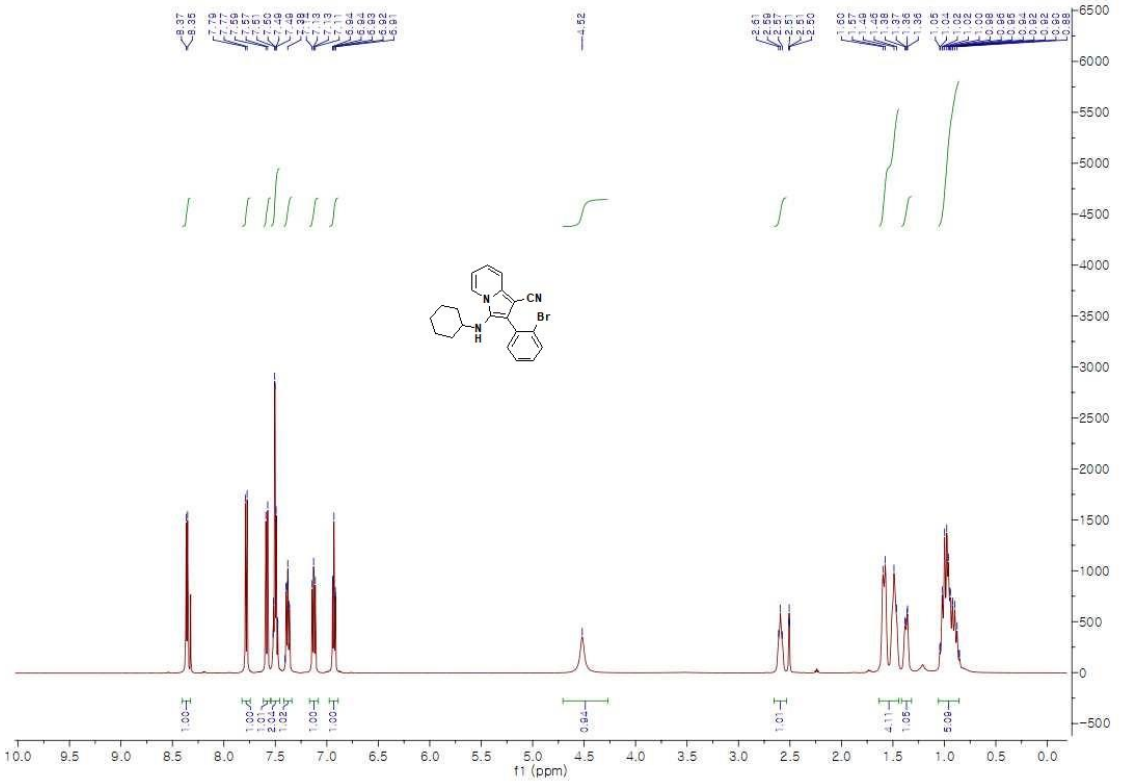
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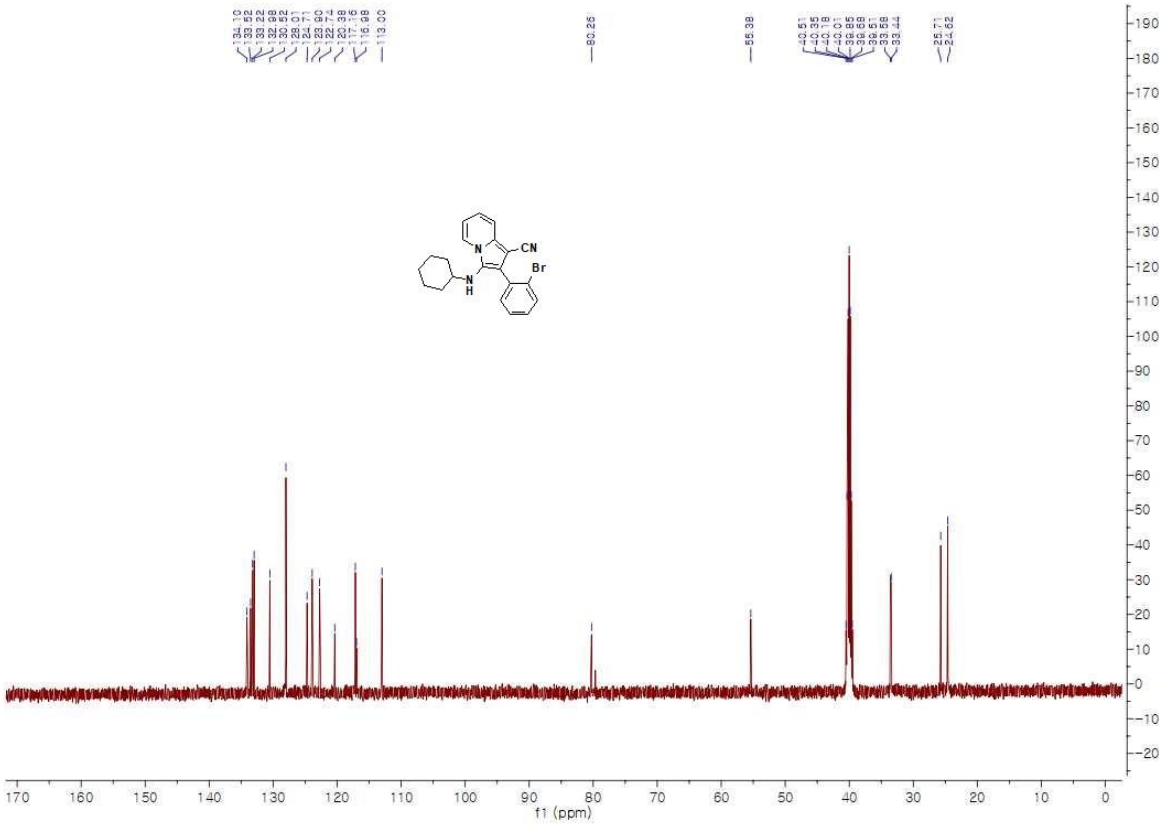
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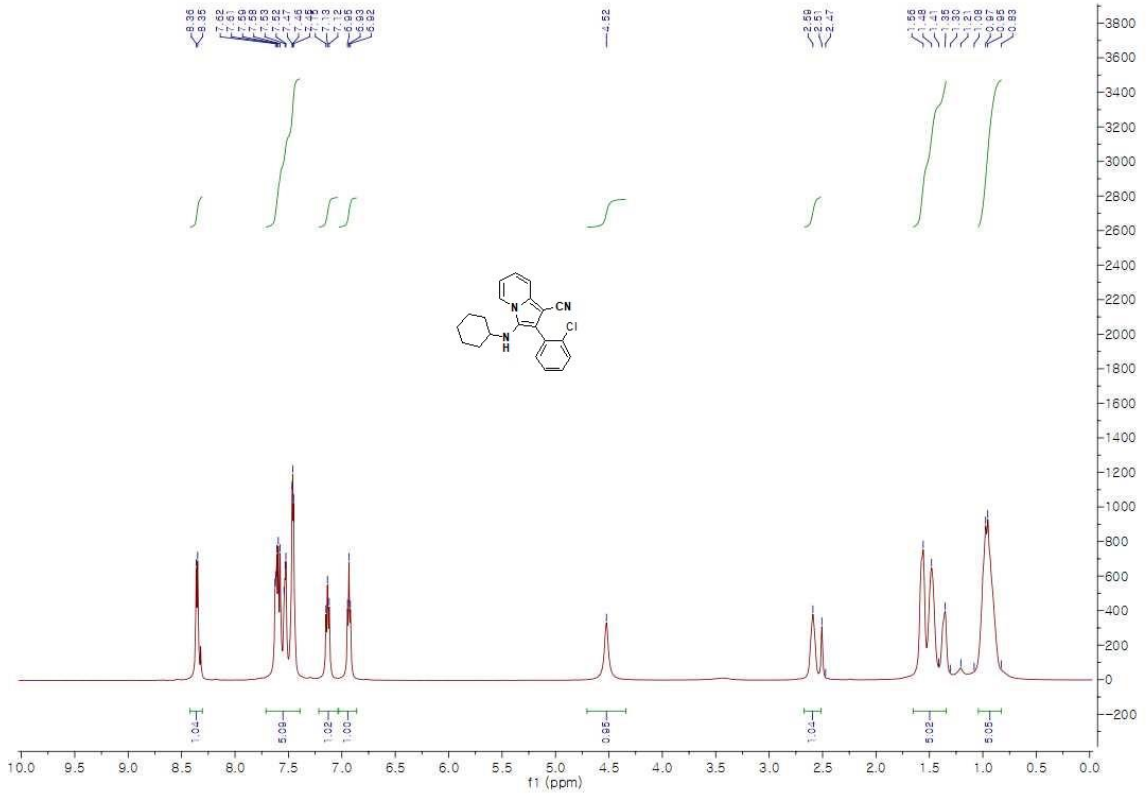
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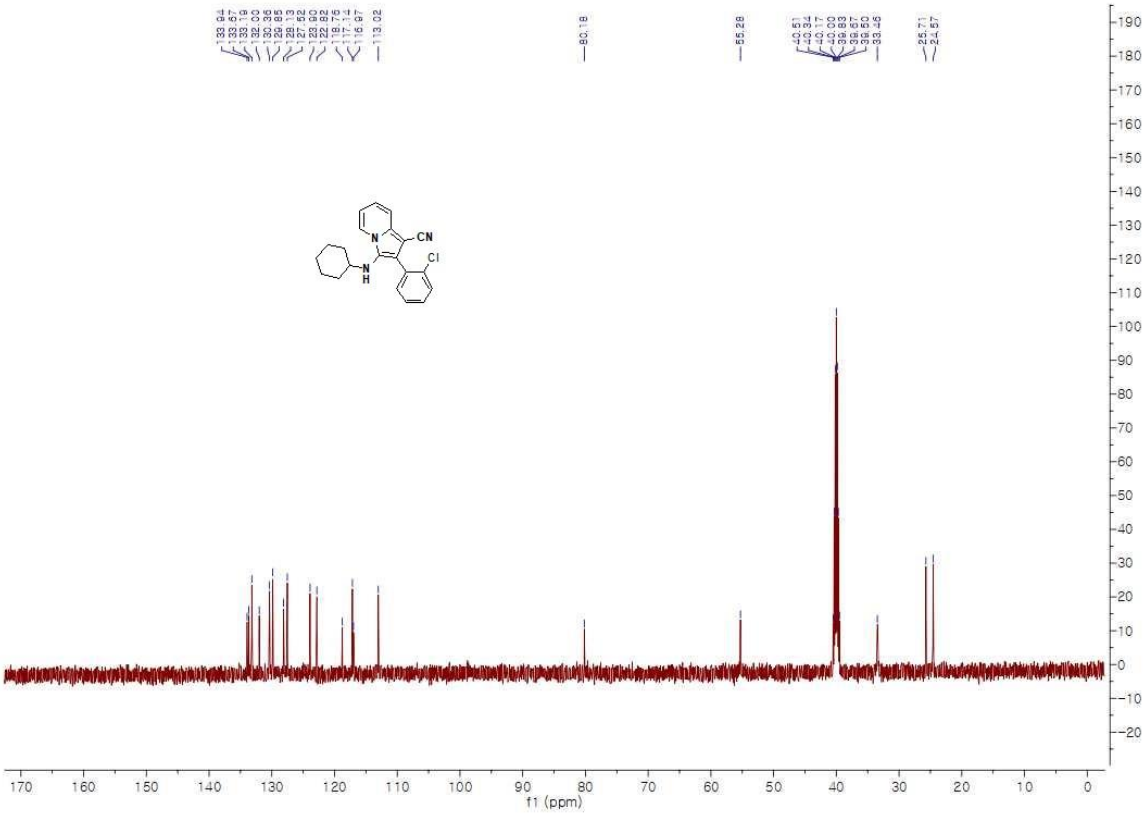
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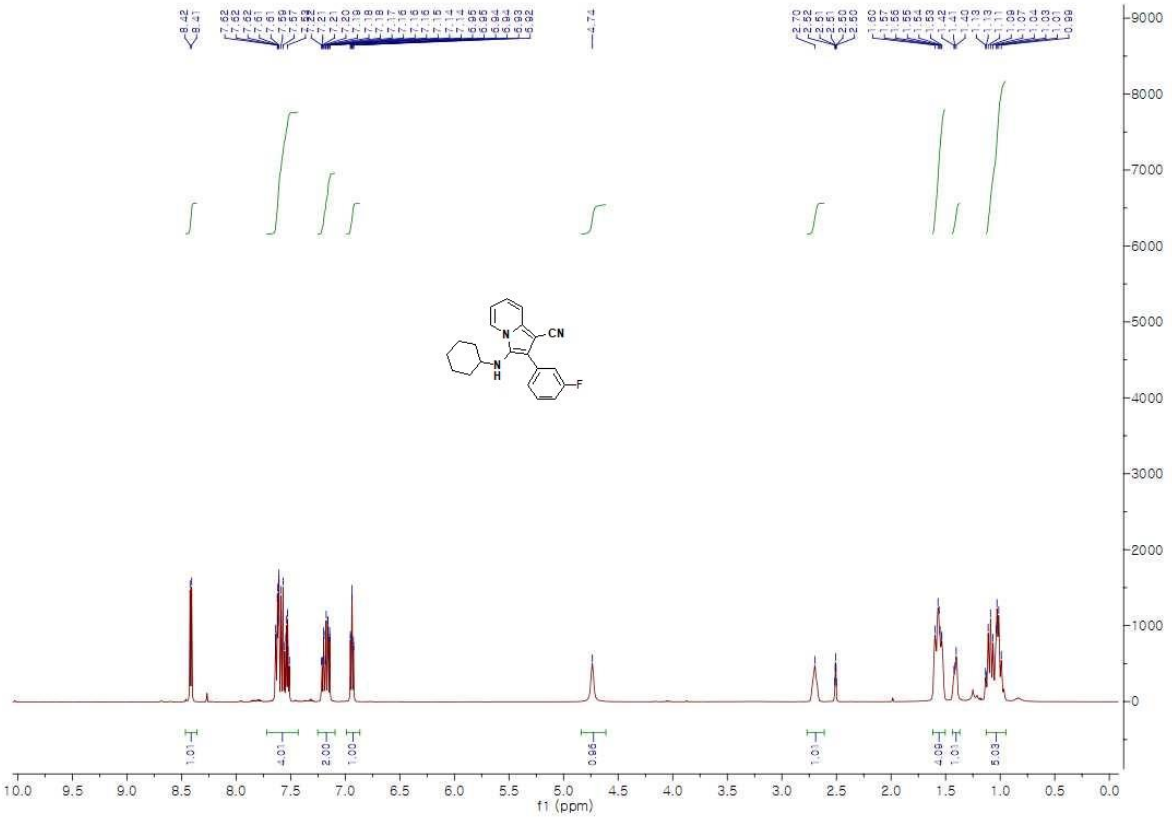
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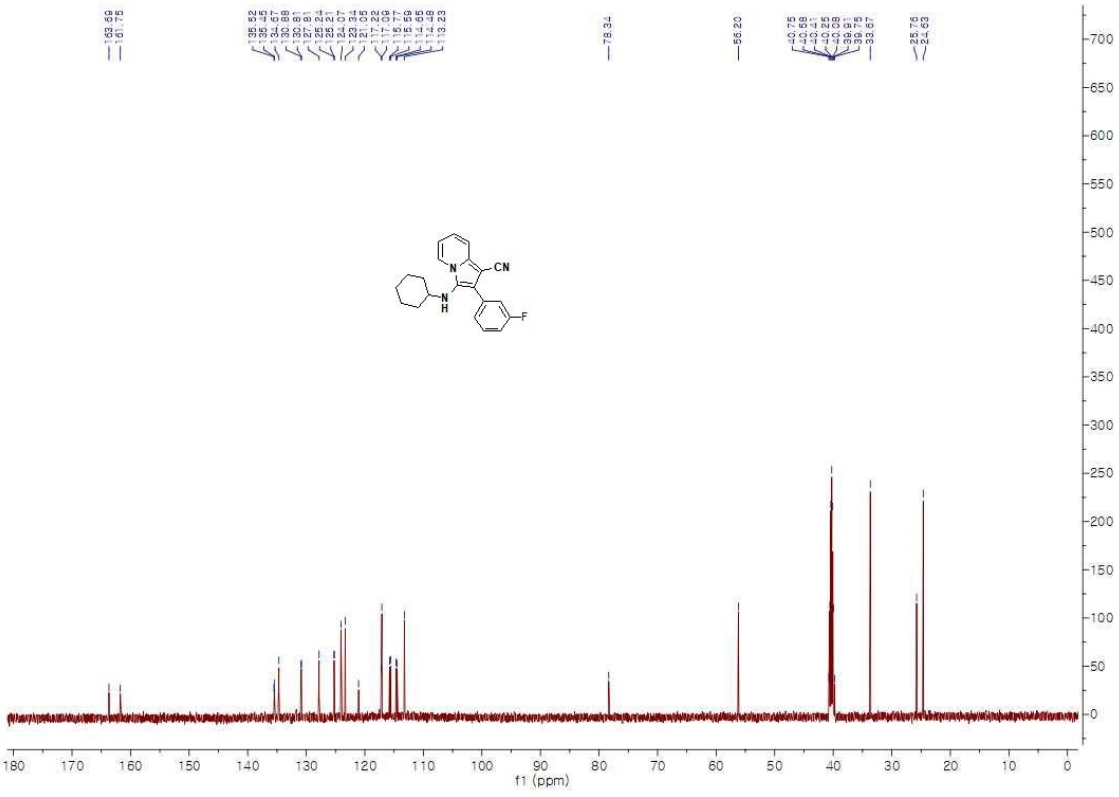
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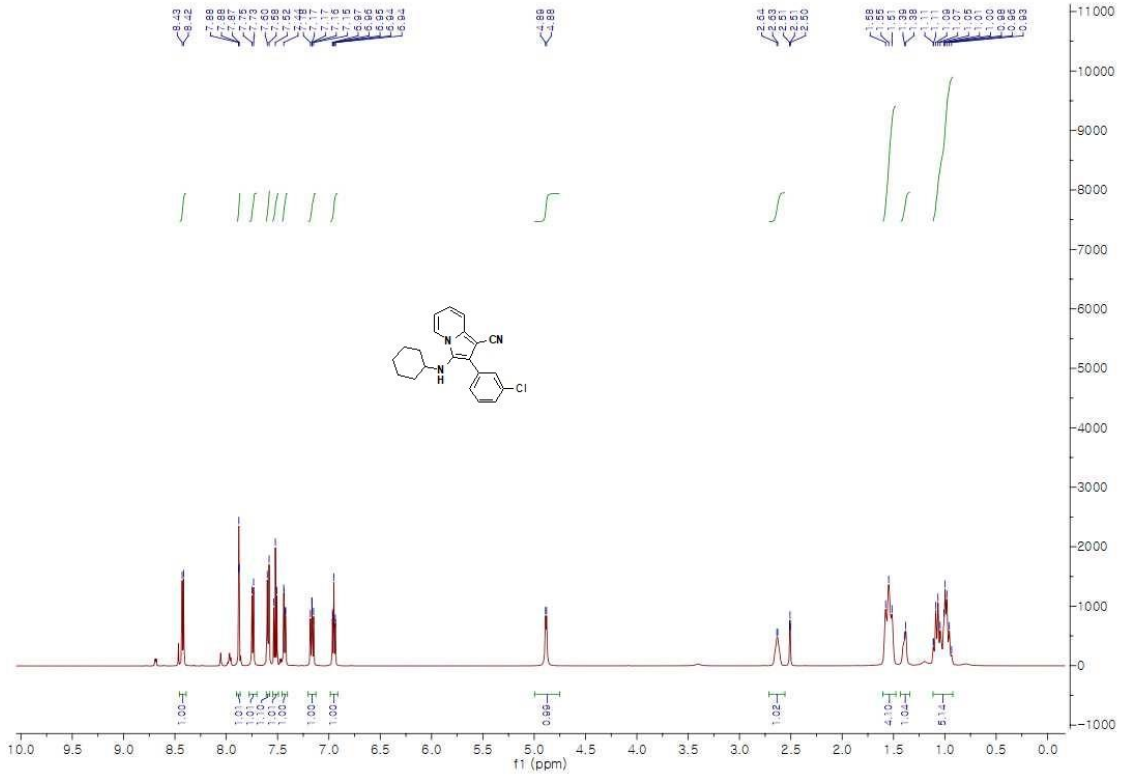
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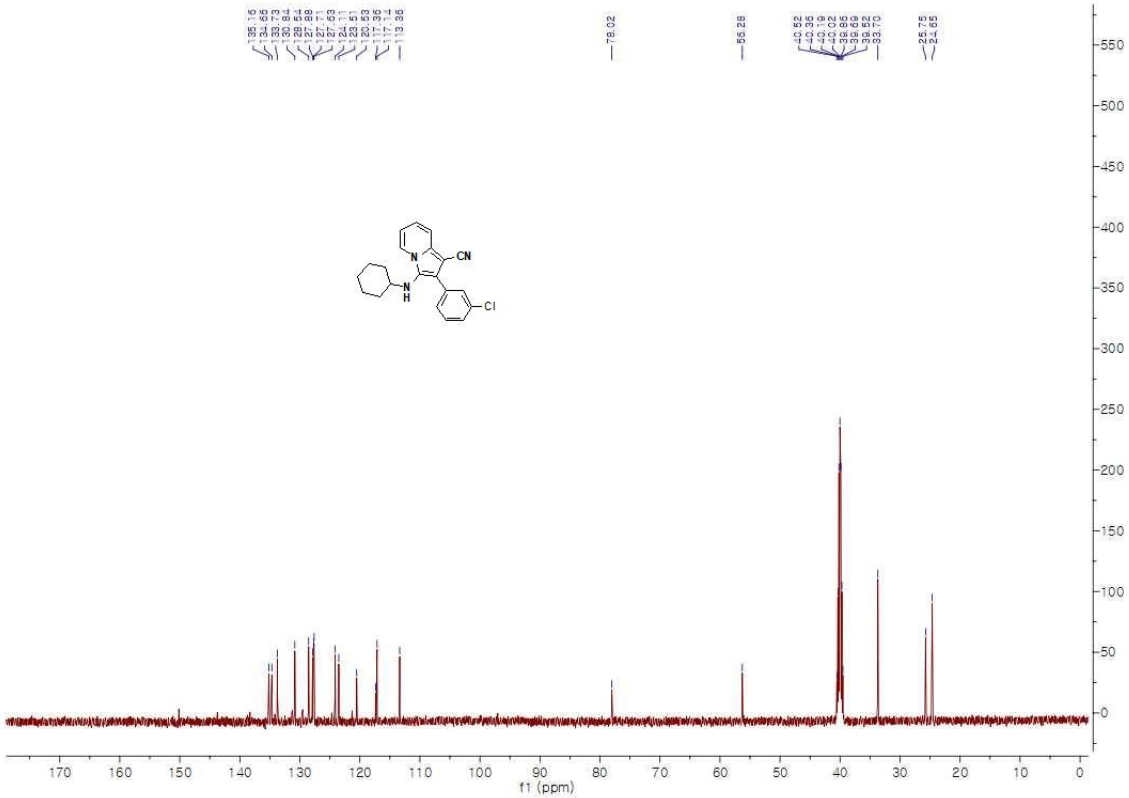
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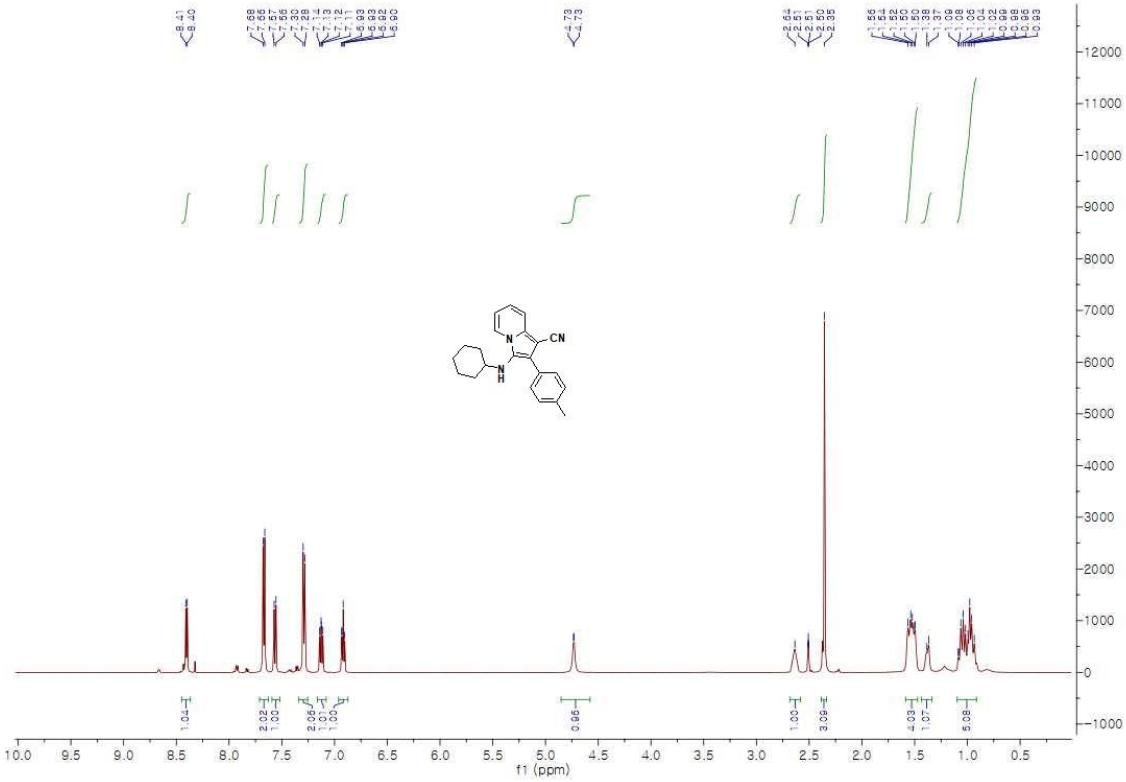
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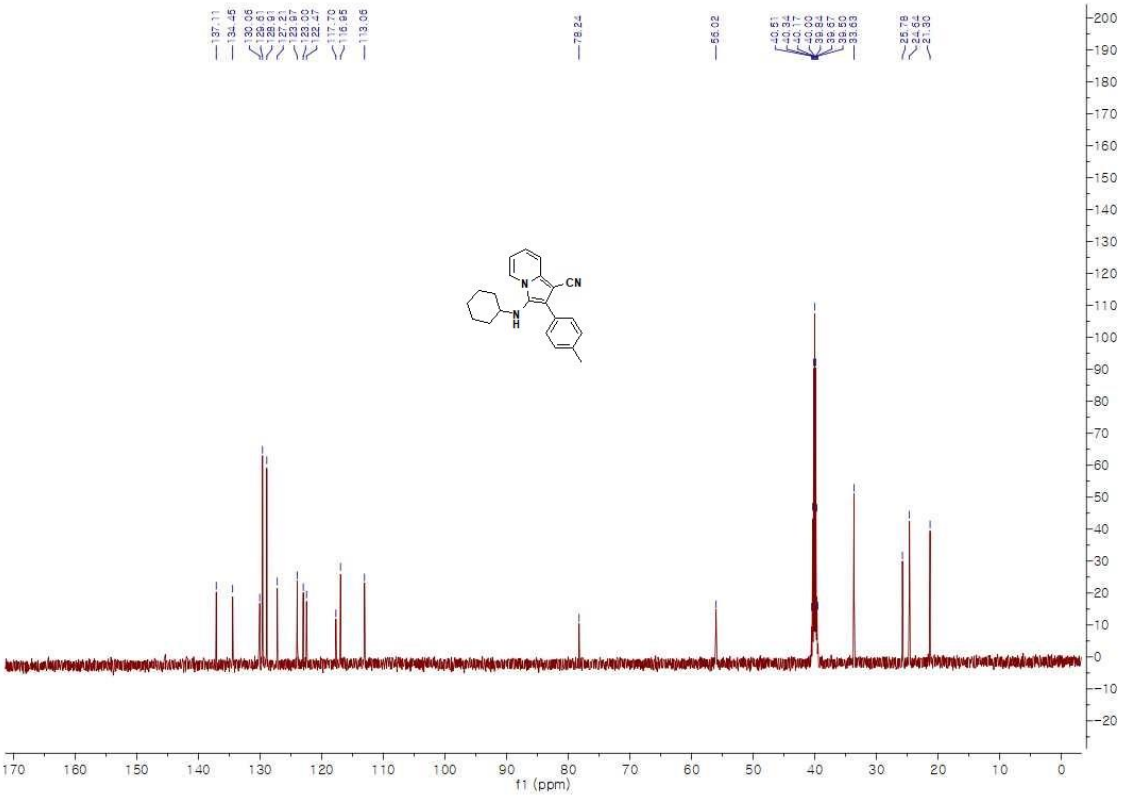
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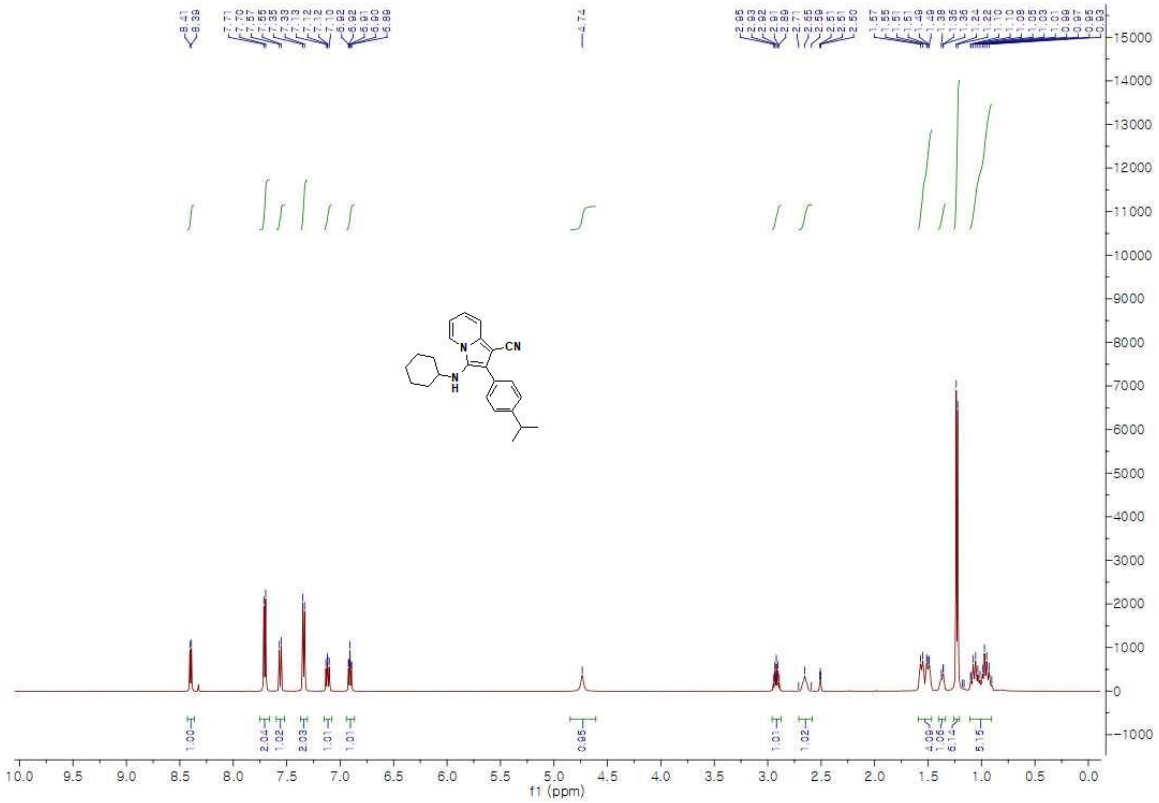
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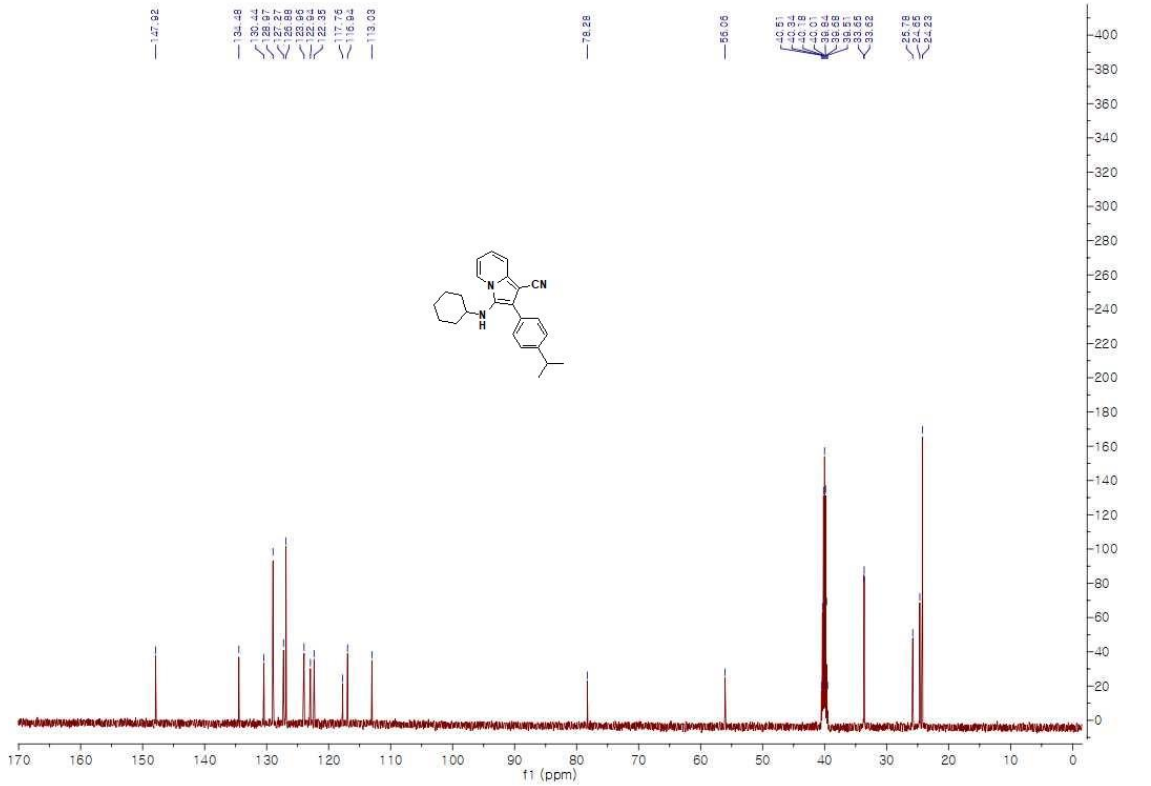
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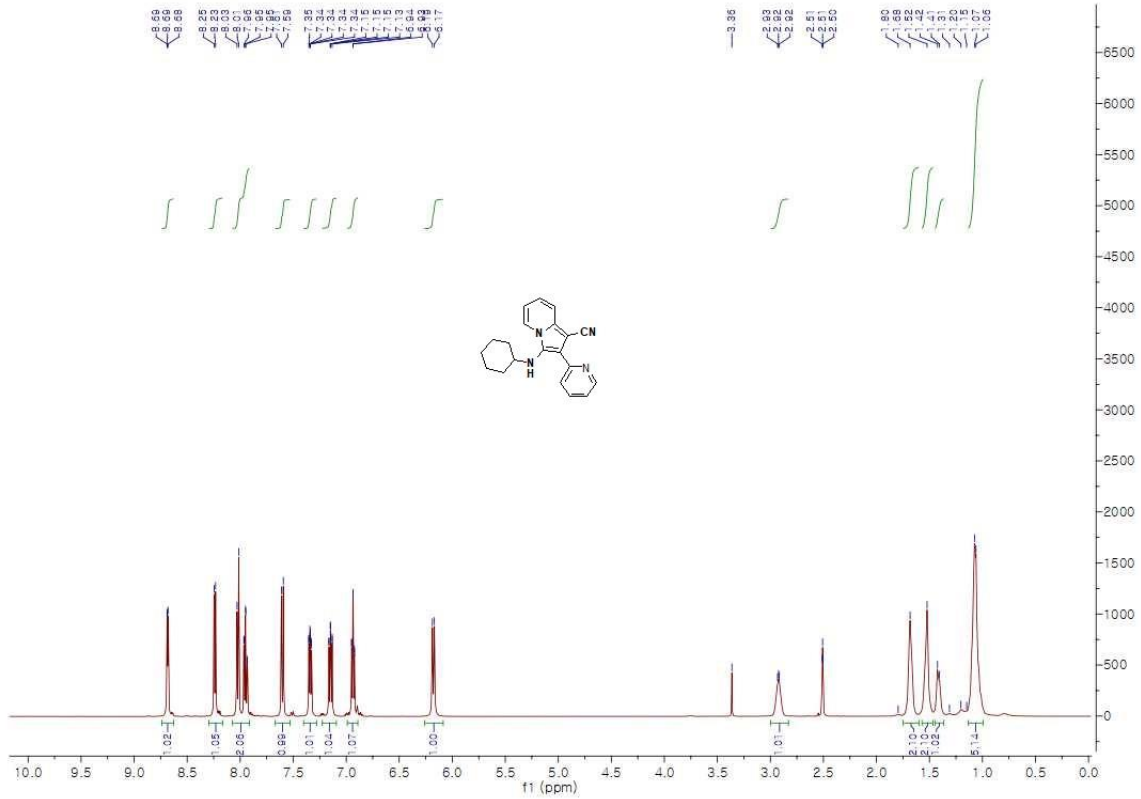
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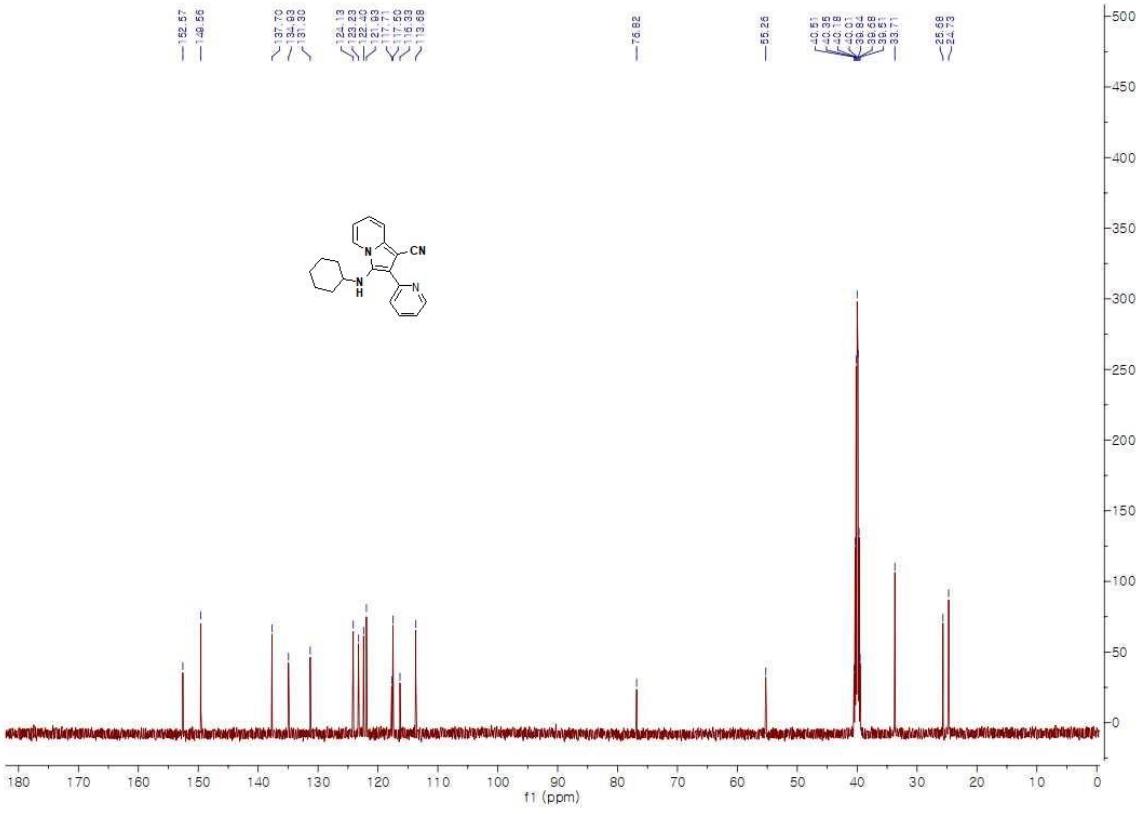
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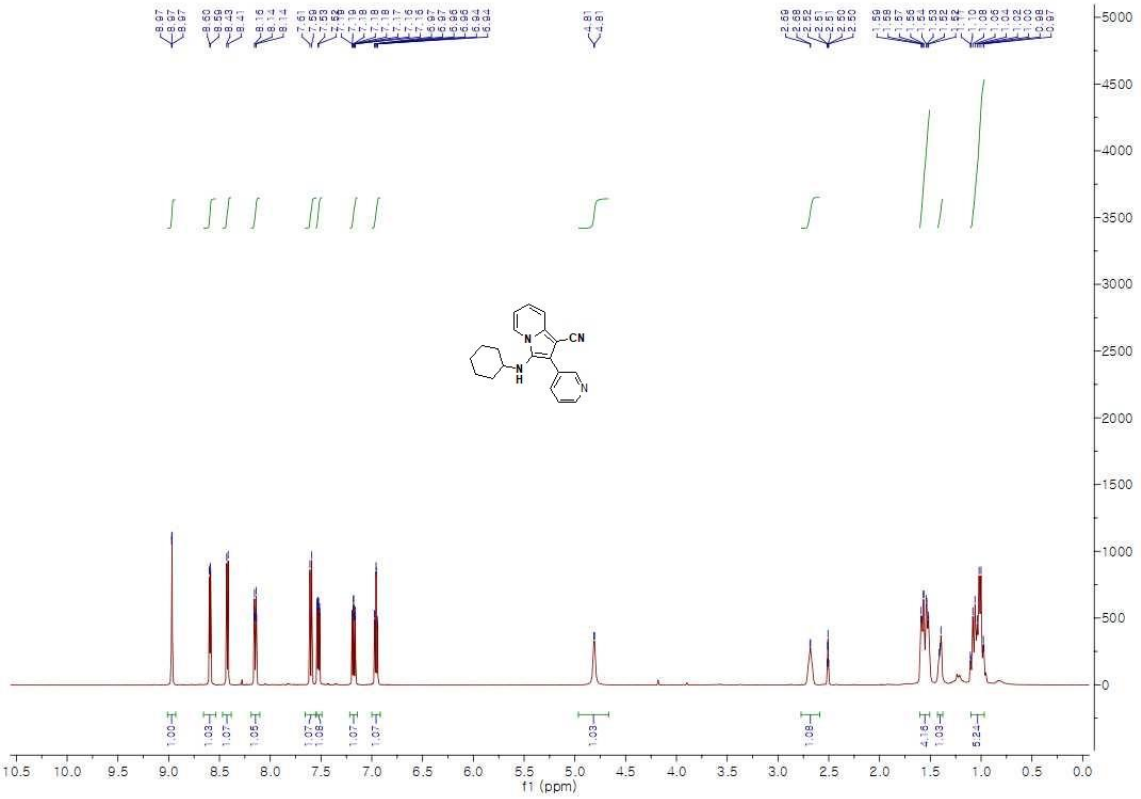
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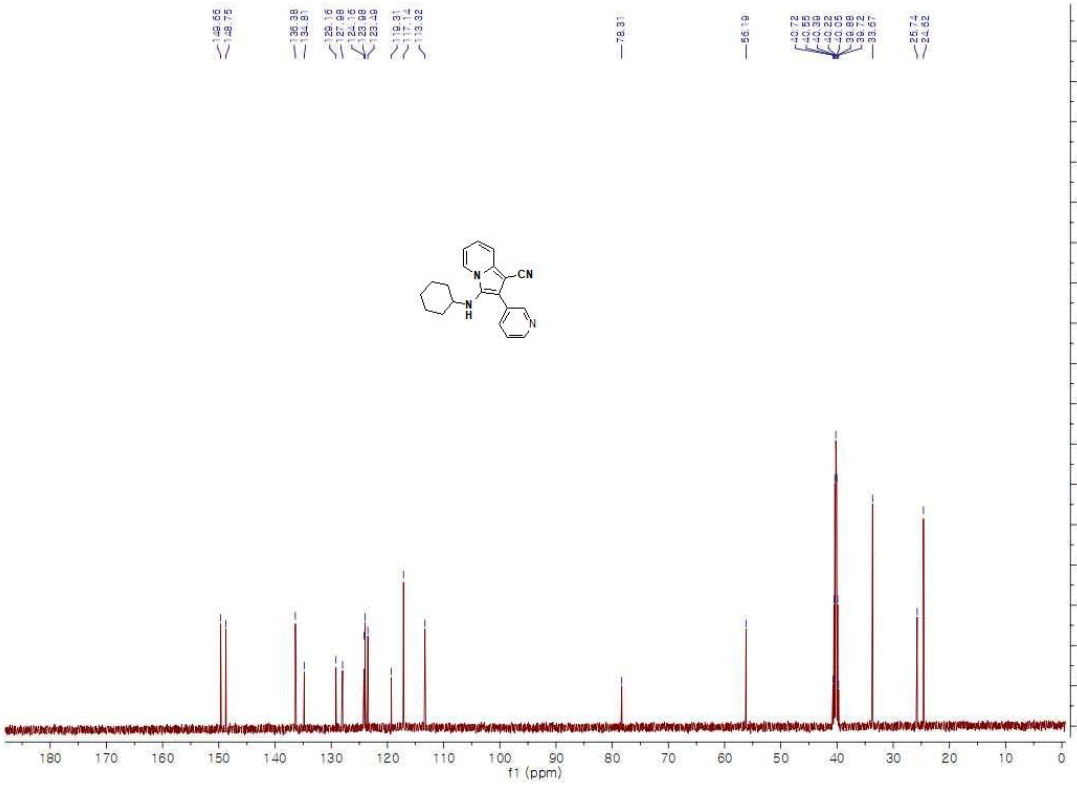
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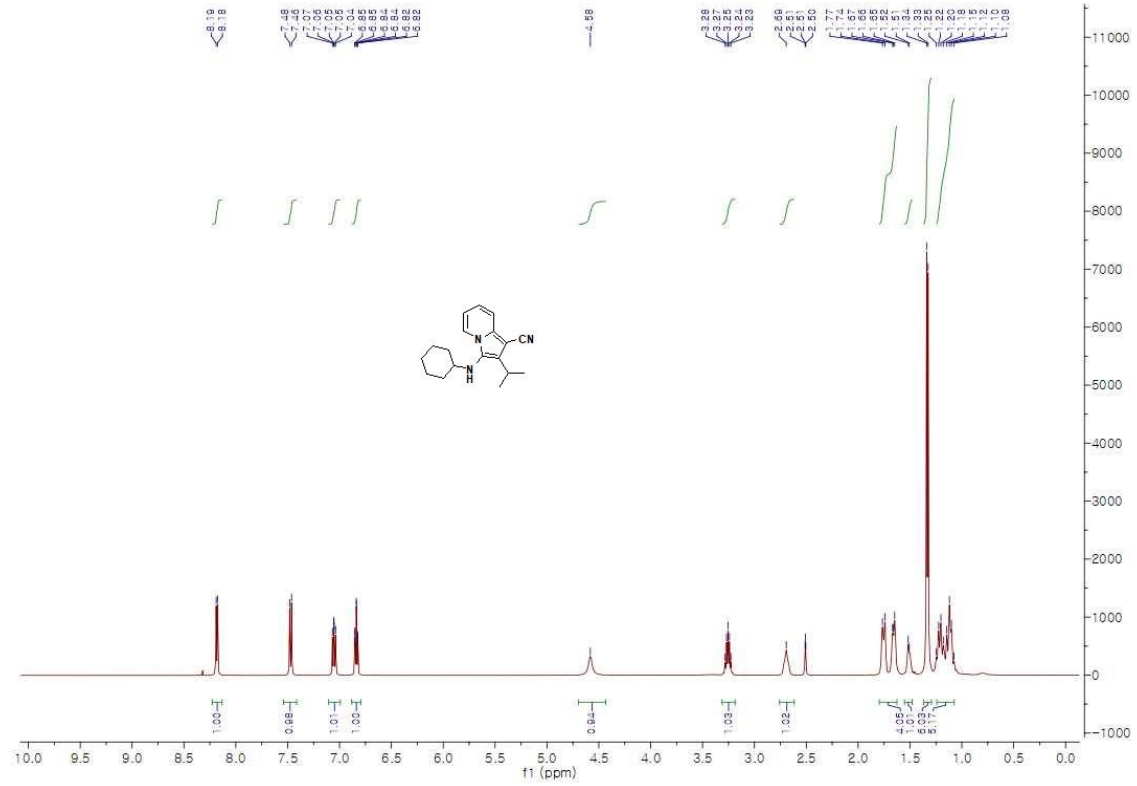
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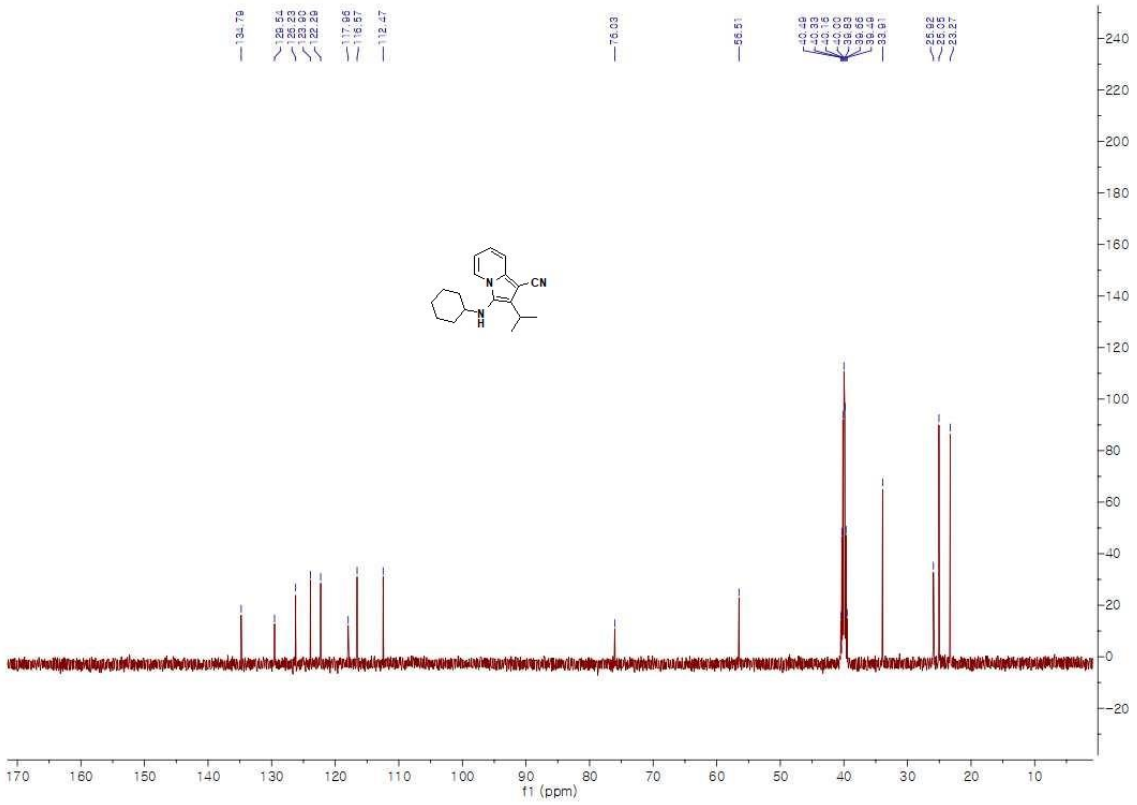
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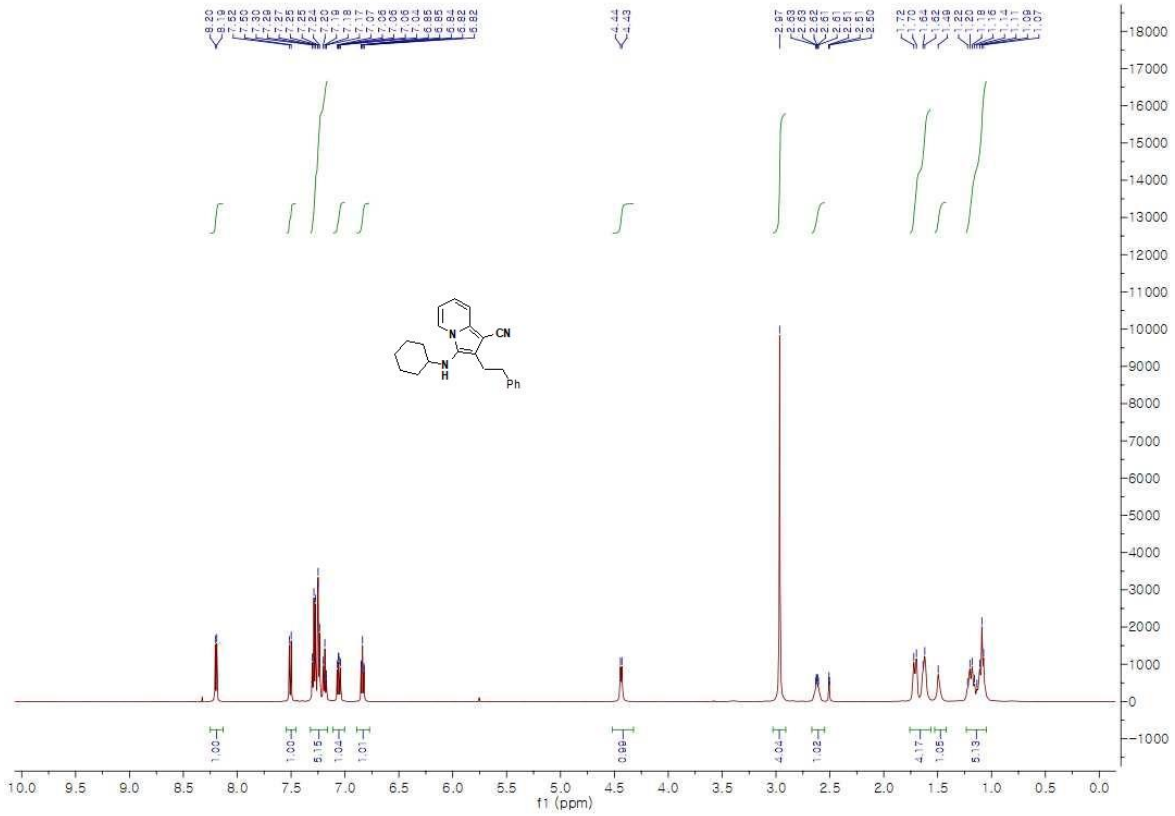
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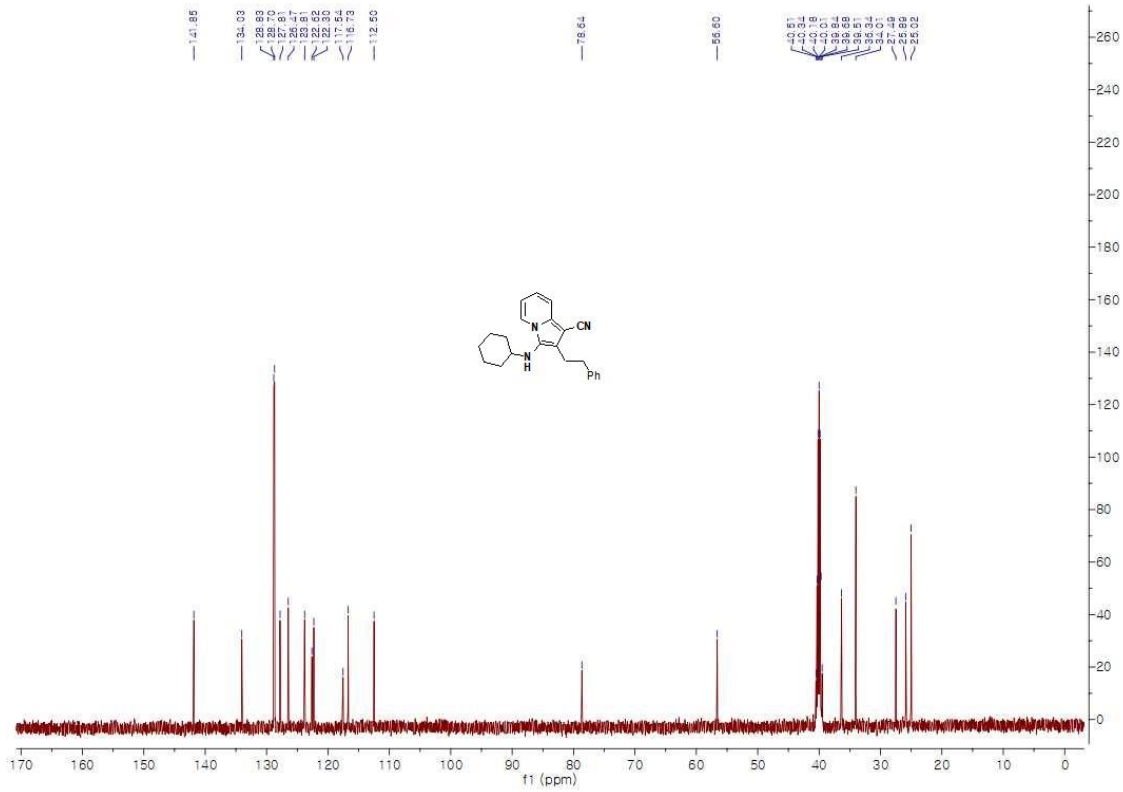
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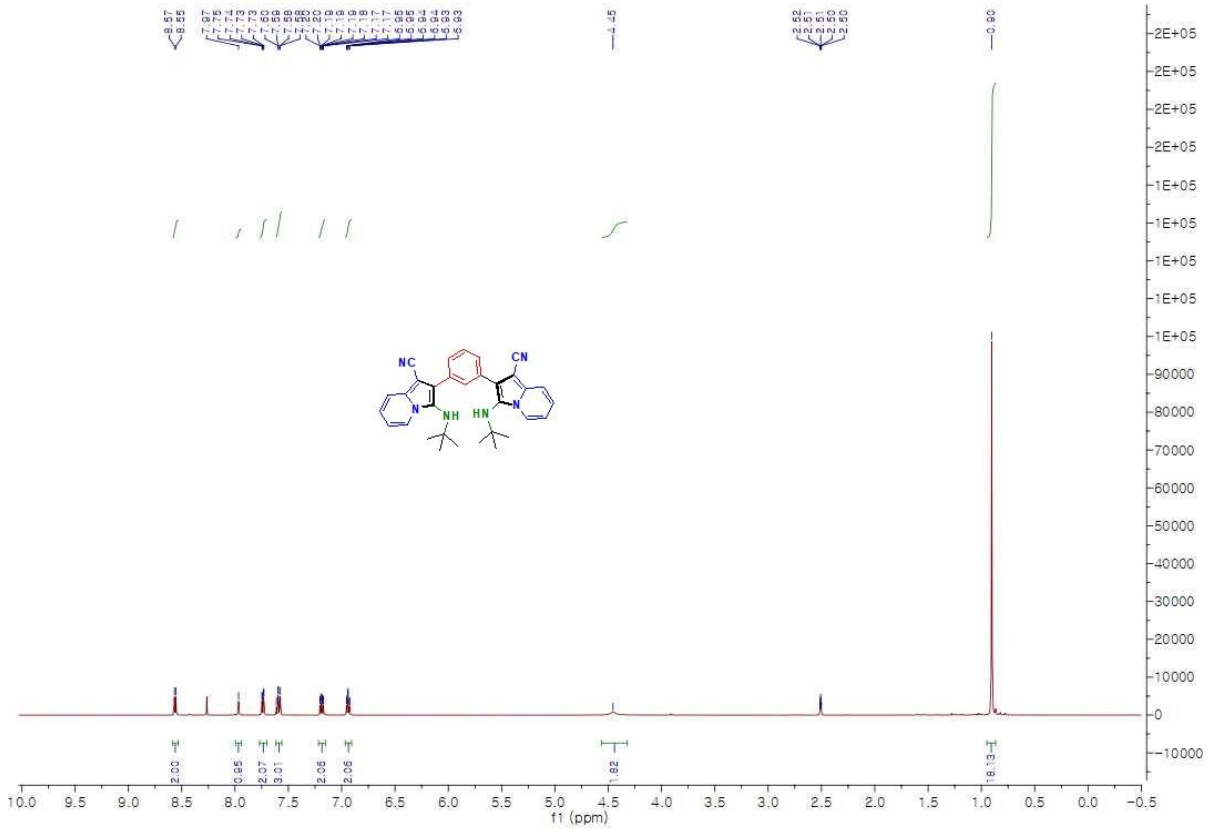
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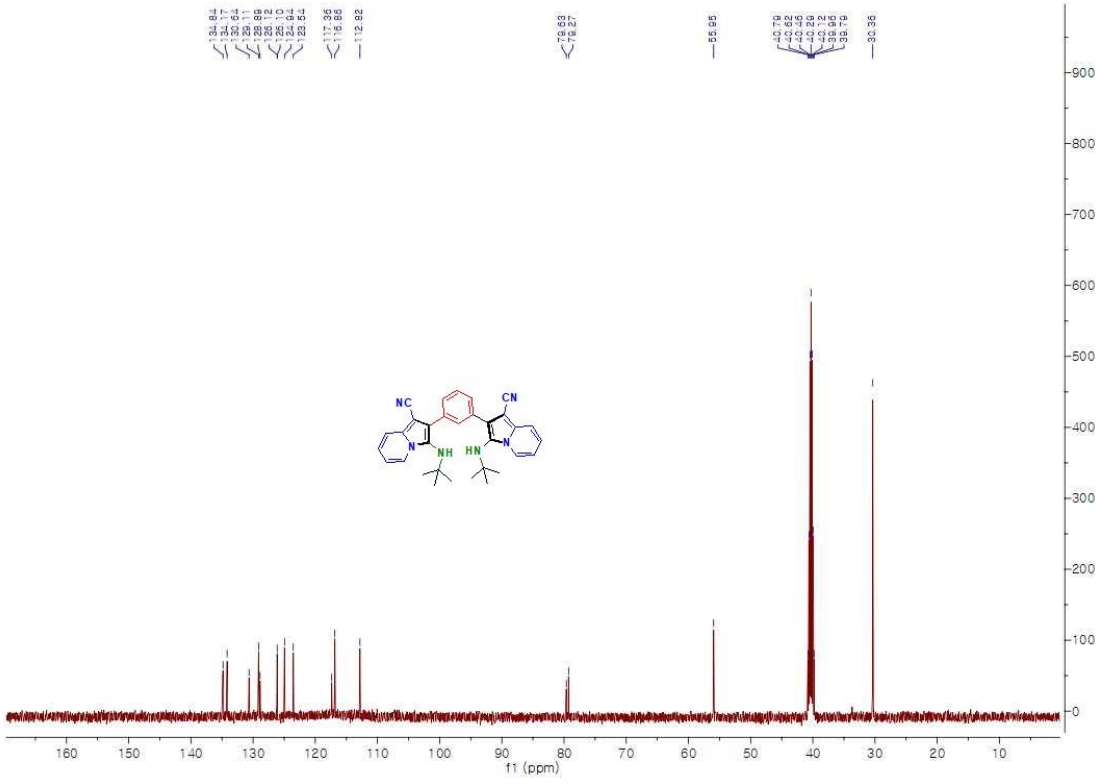
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