**SUPPORTING INFORMATION**

Facile one-pot synthesis of New [1,2,4]triazolo[1,5-*a*] pyridine derivatives by ultrasonic irradiation

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**Experimental part**

*Synthesis of 2-(5-phenyl-4H-1,2,4-triazol-3-yl)acetonitrile (****2a****).* A mixture of hydrazine monohydrate (1mmol) and ethyl cyanoacetate (1mmol) was stirred at 0 °C for 5 min; then, the imidate **1 (R1=H)** (1 mmol), dissolved in ethanol (15 cm3), was added to the reaction, and the mixture was refluxed for 4 h. When the reaction was over, the solvent was removed under reduced pressure, and the solid obtained was washed with ether to afford 2-(5-phenyl-4*H*-1,2,4-triazol-3-yl)acetonitrile (**2a**) as a white solid, yield: 77%; mp 166 °C ; 1H NMR (DMSO*d*6, 400 MHz) δ 0.62 (s, 2H, CH2), 3.82 (m, 3H, Ar), 7.98 (d, 2H, *J*= 8.0 Hz, Ar), 14.39 (br s, 1H, NH); 13C NMR (DMSO-*d*6, 100 MHz) δ 16.99, 117.09, 126.00, 127.48, 129.03, 130.15, 153.81, 156.32;

*Synthesis of 2-(5-(p-tolyl)-4H-1,2,4-triazol-3-yl)acetonitrile (****2b) :*** Following the procedure of**2a** but substituting imidate **1 (R1=CH3)** for imidate **1 (R1=H)** afforded the title compound **2b** as white solid; yield: 79%; mp 144 °C ; 1H NMR (DMSO-*d*6, 400 MHz) δ 7. 87 (d, 2H, *J*= 4.0 Hz, Ar), 7.33 (d, 2H, Ar), 4.20 (s, 2H, CH2), 2.36 (s, 3H, CH3); 13C NMR (DMSO-*d*6, 100 MHz) δ 17.53, 21.40, 117.61, 125.19, 126.47, 130.07, 140.45, 154.30, 156.76.

*5-Amino-2,7-diphenyl-[1,2,4]triazolo[1,5-a]pyridine-6,8-dicarbonitrile (****3a****)*: White solid; yield: 95%; IR (KBr) υmax 3437, 3291, 2223 cm-1; 1H NMR (DMSO-*d*6, 400 MHz) δ 7.52-8.24 (m, 10H, Ar), 9.24 (br s, 2H, NH2); 13 C NMR (DMSO-*d*6, 100 MHz) δ 79.4, 85.1, 115.4, 127.6, 129.1, 129.2, 129.4, 129.6, 130.7, 131.4, 134.9, 149.4, 151.9, 154.0, 164.7; HRMS (ESI-TOF): Calcd. for C20H12N6: [M+H]+ 337.1185. Found: 337.1196. Anal. Calcd: C, 71.42; H, 3.60; N, 24.99. Found: C, 71.53; H, 3.56; N, 24.97.

*5-Amino-2-phenyl-7-(p-tolyl)-[1,2,4]triazolo[1,5-a]pyridine-6,8-dicarbonitrile (****3b****)*: White solid; yield: 95%; IR (KBr) υmax 3441, 3298, 2221 cm-1; 1H NMR (DMSO-*d*6, 400 MHz) δ 9.26 (br s, 2H, NH2), 7.58-8.27 (m, 5H, Ar), 7.46 (d, 2H, *J*= 8.0 Hz, Ar), 7.39 (d, 2H, *J*= 8.0 Hz, Ar), 2.43 (s, 3H, CH3); 13C NMR (DMSO-*d*6, 100 MHz) δ 21.4, 79.4, 84.9, 115.5, 127.7, 129.2, 129.5, 129.7, 129.7, 131.5, 132.1, 140.5, 149.4, 152.1, 154.1, 164.9; HRMS (ESI-TOF): Calcd. for C21H14N6: [M+H]+ 351.1148. Found: 351.1353. Anal. Calcd: C, 71.99; H, 4.03; N, 23.99. Found: C, 71.70; H, 4.09; N, 23.75.

*5-Amino-7-(4-methoxyphenyl)-2-phenyl-[1,2,4]triazolo[1,5-a]pyridine-6,8-dicarbo nitrile (****3c****)*: Yellow solid; yield: 93%; IR (KBr) υmax 3351, 3307, 2221 cm-1; 1H NMR (DMSO-*d*6, 400 MHz) δ 9.19 (br s, 2H, NH2), 7.55-8.24 (m, 7H, Ar), 7.14 (d, 2H, *J*= 8.0 Hz, Ar), 3.84 (s, 3H, OCH3), 13C NMR (DMSO-*d*6, 100 MHz) δ 55.8, 79.4, 85.0, 115.6, 114.5, 126.8, 127.6, 129.4, 129.7, 130.9, 131.4, 149.4, 152.5, 153.8, 161.1, 164.6; HRMS (ESI-TOF): Calcd. for C21H14N6O: [M+H]+ 367.1296. Found: 367.1302. Anal. Calcd: C, 68.84; H, 3.85; N, 22.94. Found: C, 68.72; H, 3.85; N, 22.71.

*5-Amino-7-(3-methoxyphenyl)-2-phenyl-[1,2,4]triazolo[1,5-a]pyridine-6,8-dicarbo nitrile (****3d****)*: White solid; yield: 93%; IR (KBr) υmax 3399, 3289, 2228 cm-1; 1H NMR (DMSO-*d*6, 400 MHz) δ 9.21 (br s, 2H, NH2), 7.56-8.24 (m, 6H, Ar), 7.41 (d, 1H, *J*= 4.0 Hz, Ar), 7.27 (d, 1H, *J*= 8.0 Hz, Ar), 7.18 (d,1H, *J*= 8.0 Hz, Ar), 3.83 (s, 3H, OCH3); 13C NMR (DMSO-*d*6, 100 MHz) δ 56.2, 80.2, 86.1, 115.2, 112.5, 121.1, 123.5, 17.7, 129.4, 129.6, 130.6, 131.4, 132.5, 151.7, 149.1, 151.8, 156.4, 164.7; HRMS (ESI-TOF): Calcd. for C21H14N6O: [M+H]+ 367.1309. Found: 367.1302. Anal. Calcd: C, 68.84; H, 3.85; N, 22.94. Found: C, 68.80; H, 3.87; N, 22.75.

*5-Amino-7-(2-methoxyphenyl)-2-phenyl-[1,2,4]triazolo[1,5-a]pyridine-6,8-dicarbo nitrile (****3e****):* White solid; yield: 92%; IR (KBr) υmax 3400, 3288, 2228 cm-1; 1H NMR (DMSO-*d*6, 400 MHz) δ 9.21 (br s, 2H, NH2), 8.28 (q, 2H, *J*= 4.0 Hz, Ar), 8.11 (m, 1H, Ar), 7.59 (q, 3H, *J*= 4.0 Hz, Ar), 7.41 (q, 1H, *J*= 8.0 Hz, Ar), 7.28 (d, 1H, *J*= 8.0 Hz, Ar), 7.17 (t, 1H, *J*= 8.0 Hz, Ar), 3.84 (s, 3H, OCH3); 13C NMR (DMSO-*d*6, 100MHz) δ 56.2, 80.2, 86.1, 112.5, 115.2, 121.1, 123.6, 126.8, 127.7, 129.5, 129.7, 130.6, 131.5, 132.4, 149.2, 151.7, 151.9, 156.4, 164.7. Anal. Calcd: for C21H14N6O: C, 68.84; H, 3.85; N, 22.94. Found: C, 68.96; H, 3.81; N, 23.04.

*5-amino-7-(4-nitrophenyl)-2-phenyl-[1,2,4]triazolo[1,5-a]pyridine-6,8-dicarbonitrile (****3f****) :* Yellow solid ; yield : 85%; IR (KBr) υmax 3333, 3277, 2233; 1H NMR (DMSO-d6, 400 MHz) δ 9.38 (br s, 2H, NH2), 8.48 (d, 2H, *J*=8 Hz, Ar), 8.27 (dd, 2H, *J*=8Hz, Ar), 7.92 (d, 2H, *J*=12 Hz, Ar), 7.59 (m, 3H, Ar),; 13C NMR (DMSO-*d*6, 100 MHz) δ 79.19, 85.27, 115.03, 115.10, 124.39, 127.77, 129.51, 129.58, 131.04, 131.61, 141.31, 149.04, 129.44, 151.80, 151.96, 164.94. Anal. Calcd: for C20H11N7O2:C, 62.99; H, 2.91; N, 25.71. Found: C, 62.91; H, 2.94; N, 25.65.

*5-amino-7-(4-methoxyphenyl)-2-(p-tolyl)-[1,2,4]triazolo[1,5-a]pyridine-6,8-dicarbonitrile****(3g)***: White solid ; yield : 92%; IR (KBr) υmax 3345, 3286, 2240; 1H NMR (DMSO-d6, 400 MHz) δ 9.10 (br s, 2H, NH2), 8.13 (d, 2H, *J*=8 Hz, Ar), 7.56 (d, 2H, *J*=8Hz, Ar), 7,36 (d, 2H, *J*=8Hz, Ar), 7.16 (d, 2H, *J*=8Hz, Ar), 3.87(s, 3H,O CH3), 2,39(s, 3H, CH3),; 13C NMR (DMSO-*d*6, 100 MHz) δ 21.56, 55.84, 79.37, 85.04, 114.55, 115.59, 115.62, 126.91, 126.99, 127.66, 129.96, 130.98, 141.32, 149.34, 152.04, 153.71, 161.21, 164.85. Anal. Calcd: for C22H16N6O: C, 69.46; H, 4.24; N, 22.09. Found: C, 69.51; H, 4.20; N, 21.98.

*5-amino-7-(4-nitrophenyl)-2-(p-tolyl)-[1,2,4]triazolo[1,5-a]pyridine-6,8-dicarbonitrile* ***(3h) :*** Yellow solid ; yield : 83%; IR (KBr) υmax 3329, 3276, 2238; 1H NMR (DMSO-d6, 400 MHz) δ 9.30 (br s, 2H, NH2), 8.47 ( d, 2H, *J*=8 Hz, Ar), 8.16 (d, 2H, *J*=8Hz, Ar), 7.92 (d, 2H, *J*=12Hz, Ar), 7.40 (d, 2H, *J*=8Hz, Ar), 2.41(s, 3H, CH3),; 13C NMR (DMSO-*d*6, 100 MHz) δ 21.57, 79.12, 85.07, 115.07, 115.14, 124.36, 126.87, 127.75, 130.08, 131.03, 141.37, 141.53, 149.04, 149.39, 151.75, 151.87, 165.02. Anal. Calcd: for C21H13N7O2: C, 63.79; H, 3.31; N, 24.80. Found: C, 63.84; H, 3.29; N, 24.87.

*Ethyl 5-amino-8-cyano-2,7-diphenyl-[1,2,4]triazolo[1,5-a]pyridine-6-carboxylate (****4a****)* :White solid; yield: 83%; IR (KBr) υmax 3475, 3336, 2224, 1673 cm-1; 1H NMR (DMSO-*d*6, 400 MHz) δ 8.72 (br s, 2H, NH2), 7.45-8.25 (m, 10H, Ar), 3.82 (q, 2H, *J*= 8.0 Hz CH2), 0.62 (t, 3H, *J*= 8.0 Hz, CH3); 13C NMR (DMSO-*d*6, 100 MHz) δ 13.3, 61.1, 85.8, 97.1, 115.6, 127.6, 128.2, 128.5, 129.0, 129.3, 129.9, 131.3, 138.4, 147.5, 151.2, 153.0, 164.6, 166.0; HRMS (ESI-TOF): Calcd. for C22H17N5O2: [M+H]+ 384.1450. Found: 384.1455. Anal. Calcd: C, 68.92; H, 4.47; N, 18.27. Found: C, 69.16; H, 4.48; N, 18.19.

*Ethyl 5-amino-8-cyano-2-phenyl-7-(p-tolyl)-[1,2,4]triazolo[1,5-a]pyridine-6-carboxylate (****4b****)*: White solid; yield: 81%; IR (KBr) υmax 3382, 3266, 2291, 1679 cm-1;  1H NMR (DMSO-*d*6, 400 MHz) δ 8.68 (br s, 2H, NH2), 7.57-8.27 (m, 5H, Ar), 7.29 (d, 4H, *J*= 8.0 Hz, Ar), 3.88 (q, 2H, *J*= 8.0 Hz, CH2), 2.40 (s, 3H, CH3), 0.70 (t, 3H,  *J*= 8.0 Hz, CH3); 13C NMR (DMSO-*d*6, 100 MHz) δ 13.4, 21.3, 61.2, 85.4, 97.4, 115.9, 127.7, 128.2, 129.0, 129.4, 129.9, 131.3, 135.4, 138.6, 147.3, 151.3, 153.0, 164.5, 166.0; HRMS (ESI-TOF): Calcd. for C23H19N5O2: [M+H]+ 398.1621. Found: 398.1621. Anal. Calcd: C, 69.51; H, 4.82; N, 17.62. Found: C, 69.73; H, 4.86; N, 17.53.

*Ethyl 5-amino-8-cyano-7-(4-methoxyphenyl)-2-phenyl-[1,2,4]triazolo[1,5-a]pyridine-6-carboxylate (****4c****)*: White solid; yield: 80%; IR (KBr) υmax 3473, 3440, 2222, 1686 cm-1; 1H NMR (DMSO-*d*6, 400 MHz) δ 8.64 (br s, 2H, NH2), 8.27 (m, 2H, Ar), 7.57 (d, *J*= 4.0 Hz, 3H, Ar), 7.30 (d, 2H, *J*= 4.0 Hz, Ar), 7.05 (d, 2H, *J*= 4.0 Hz, Ar), 3.90 (q, 2H, *J*= 8.0 Hz, CH2), 3.82 (s, 3H, OCH3), 0.74 (t, 3H, *J*= 8.0 Hz, CH3); 13C NMR (DMSO-*d*6, 100 MHz) δ 13.5, 55.7, 61.2, 85.6, 97.6, 116.0, 114.0, 127.7, 129.4, 129.8, 130.0, 130.3, 131.3, 147.2, 151.4, 152.7, 160.2, 164.5, 166.1; HRMS (ESI-TOF): Calcd. for C23H19N5O3: [M+H]+ 414.1555. Found: 414.1561. Anal. Calcd: C, 66.82; H, 4.63; N, 16.94. Found: C, 67.01; H, 4.62; N, 16.79.

*Ethyl 5-amino-8-cyano-7-(3-methoxyphenyl)-2-phenyl-[1,2,4]triazolo[1,5-a]pyridine-6-carboxylate (****4d****)*: White solid; yield: 79%; IR (KBr) υmax 3470, 3457, 2222, 1689 cm-1; 1H NMR ( DMSO-*d*6, 400 MHz) δ 8.74 (br s, 2H, NH2), 7.58-8.28 (m, 5H, Ar), 7.42 (t, 1H, *J*= 6.0 Hz, Ar), 7.07 (d, 1H, *J*= 6.0 Hz, Ar), 6.93 (m, 2H, Ar), 3.88 (q, 2H, *J*= 8.0 Hz, CH2), 3.79 (s, 3H, CH3), 0.71 (t, 3H, *J*= 8.0 Hz CH3); 13C NMR (DMSO-*d*6, 100 MHz) δ 13.4, 55.7, 61.1, 85.6, 97.1, 115.7, 114.0, 114.5, 120.6, 127.7, 129.4, 129.7, 129.9, 131.4, 139.6, 147.4, 151.2, 152.6, 159.3, 164.6, 165.9; HRMS (ESI-TOF): Calcd. for C23H19N5O3: [M+H]+ 414,1549. Found: 414.1561. Anal. Calcd: C, 66.82; H, 4.63; N, 16.94; 11.61. Found: C, 67.02; H, 4.64; N, 11.83.

*Ethyl 5-amino-8-cyano-7-(2-methoxyphenyl)-2-phenyl-[1,2,4]triazolo[1,5-a]pyridine-6-carboxylate (****4e)***: White solid; yield: 80%; IR (KBr) υmax 3476, 3437, 2221, 1673 cm-1; 1H NMR (DMSO-*d*6, 400 MHz) δ 8.73 (br s, 2H, NH2), 7.15-8.27 (m, 9H, Ar), 3.86 (q, 2H, *J*= 8.0 Hz , CH2), 3.74 (s, 3H, CH3), 0.69 (t, 3H, *J*= 8.0 Hz, CH3), 13C NMR (DMSO-*d*6, 100 MHz) δ 13.3, 56.0, 61.0, 86.4, 97.1, 115.7, 111.4, 120.7, 127.2, 127.7, 129.4, 129.5, 129.9, 130.7, 131.3, 147.5, 150.3, 151.3, 156.0, 164.5, 165.9; HRMS (ESI-TOF): Calcd. for C23H19N5O3: [M+H]+ 414.1575. Found: 414.1561. Anal. Calcd: C, 66.82; H, 4.63; N, 16.94. Found: C, 67.06; H, 4.68; N, 16.97.

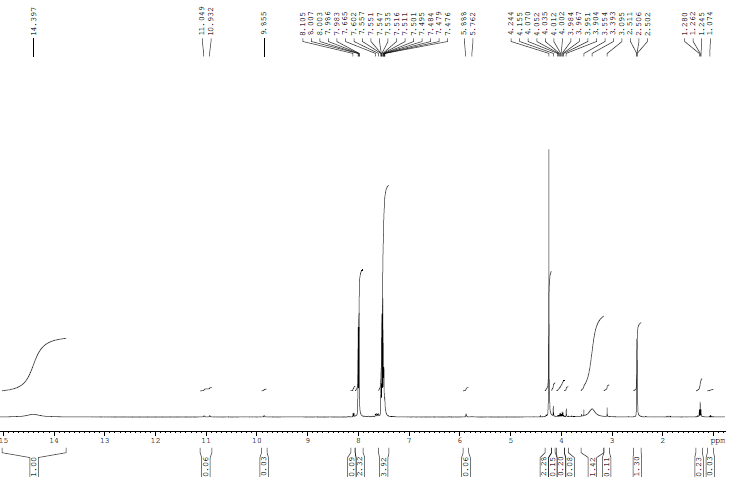
*Ethyl5-amino-8-cyano-7-(4-nitrophenyl)-2-phenyl-[1,2,4]triazolo[1,5-a]pyridine-6-carboxylate (****4f****) :* White solid ; yield : 84%; IR (KBr) υmax 3479, 3424, 2230, 1682 cm-1;1H NMR (DMSO d6) , 400 MHz) δ 8.95 (br s, 2H, NH2), 8.38 (d, 2H, *J*=8 Hz, Ar), 8.29 (dd, 2H, *J*=8Hz, Ar), 7.70 (d, 2H, *J*=8Hz, Ar), 7.59 (m, 3H, Ar), 3.90 (q, 2H, CH2), 0.68(t, 3H, CH3),; 13C NMR (DMSO-*d*6, 100 MHz) δ 13.33, 61.39, 85.94, 95.96, 115.36, 123.71, 127.76, 129.47, 129.79, 129.91, 131.51, 145.73, 147.95, 148.17, 151.03, 151.26, 164.82, 165.51. Anal. Calcd: for C22H16N6O4: C, 61.68; H, 3.76; N, 19.62. Found: C, 61.72; H, 3.74; N, 19.73.

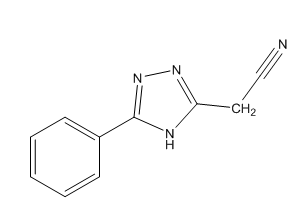
*Ethyl 5-amino-8-cyano-7-(4-methoxyphenyl)-2-(p-tolyl)-[1,2,4]triazolo[1,5-a]pyridine-6-carboxylate (****4g****) :* White solid ; yield: 91% ;IR (KBr) υmax 3480, 3419, 2238, 1670 cm-1;1H NMR (DMSO-d6, 400 MHz) δ 8.58 (br s, 2H, NH2), 8.15 (d, 2H, *J*=8 Hz, Ar), 7.36 (d, 2H, *J*=8Hz, Ar), 7.30 (d, 2H, *J*=8Hz, Ar), 7.06 (d, 2H, *J*=8Hz, Ar), 3.90(q, 2H,CH2), 3.83(s, 3H, OCH 3), 2.39(s, 3H, CH 3), 0.74(t, 3H, CH 3),; 13C NMR (DMSO-*d*6, 100 MHz) δ 13.54, 21.53, 55.76, 61.20, 85.75, 97.37, 114.01, 115.96, 127.24, 127.65, 129.80, 129.92, 130.46, 141.16, 147.23, 151.28, 152.67, 160.20, 164.70, 166.16. Anal. Calcd: for C24H21N5O3: C, 67.44; H, 4.95; N, 16.38. Found: C, 67.49; H, 4.92; N, 16.31.

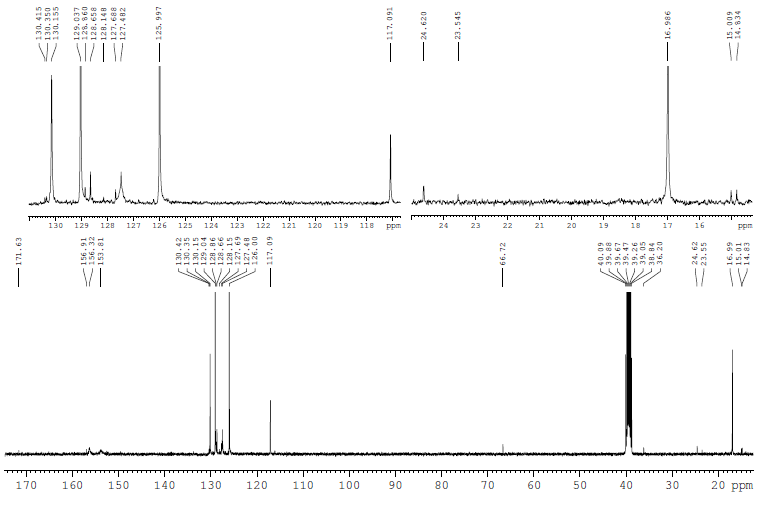
*5-amino-2-phenyl-7-(thiophen-2-yl)-[1,2,4]triazolo[1,5-a]pyridine-6,8-dicarbonitrile (****5a****)*: Yellow solid ; yield: 94%;IR (KBr) υmax 3290, 3256, 2248;1H NMR (DMSO-d6, 400 MHz) δ 9.24 (br s, 2H, NH2), 8.25 (dd, 2H, J=12 Hz,Ar), 7.98 (dd, 1H, *J*=8Hz, Ar), 7.58 (m, 4H, Ar), 7.33 (dd, 1H, *J*=8Hz, Ar),; 13C NMR (DMSO-*d*6, 100 MHz) δ 79.51, 85.53, 115.47, 127.72, 128.32, 129.46, 129.66, 131.02, 131.54, 133.91, 146. 28, 149.58, 152.09, 164.80. Anal. Calcd: for C18H10N6S: C, 63.15; H, 2.94; N, 24.55. Found: C, 63.22; H, 2.92; N, 24.61.

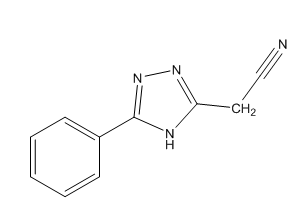
*5-amino-7-(thiophen-2-yl)-2-(p-tolyl)-[1,2,4]triazolo[1,5-a]pyridine-6,8-dicarbonitrile (****5b****)*: White solid ; yield: 93%;IR (KBr) υmax 3288, 3261, 2244;1H NMR (DMSO-d6, 400 MHz) δ 9.20 (br s, 2H, NH2), 8.13 (d, 2H, *J*=8 Hz, Ar), 7.98 (dd, 1H, *J*=4Hz, Ar), 7.58 (dd, 1H, *J*=4Hz, Ar), 7.37 (d, 2H, *J*=8Hz, Ar), 7.32 (dd, 1H, *J*=8Hz, Ar), 2.39(s, 3H, CH3),; 13C NMR (DMSO-*d*6, 100 MHz) δ 21.59, 79.38, 85.42, 115.45, 115.48, 126.89, 127.67, 128.30, 130.01, 130.99, 131.52, 133.92, 141.40, 146.13, 149.48, 152.01, 164.88 Anal. Calcd: for C19H12N6S: C, 64.03; H, 3.39; N, 23.58. Found: C, 64.09; H, 3.37; N, 23.48.

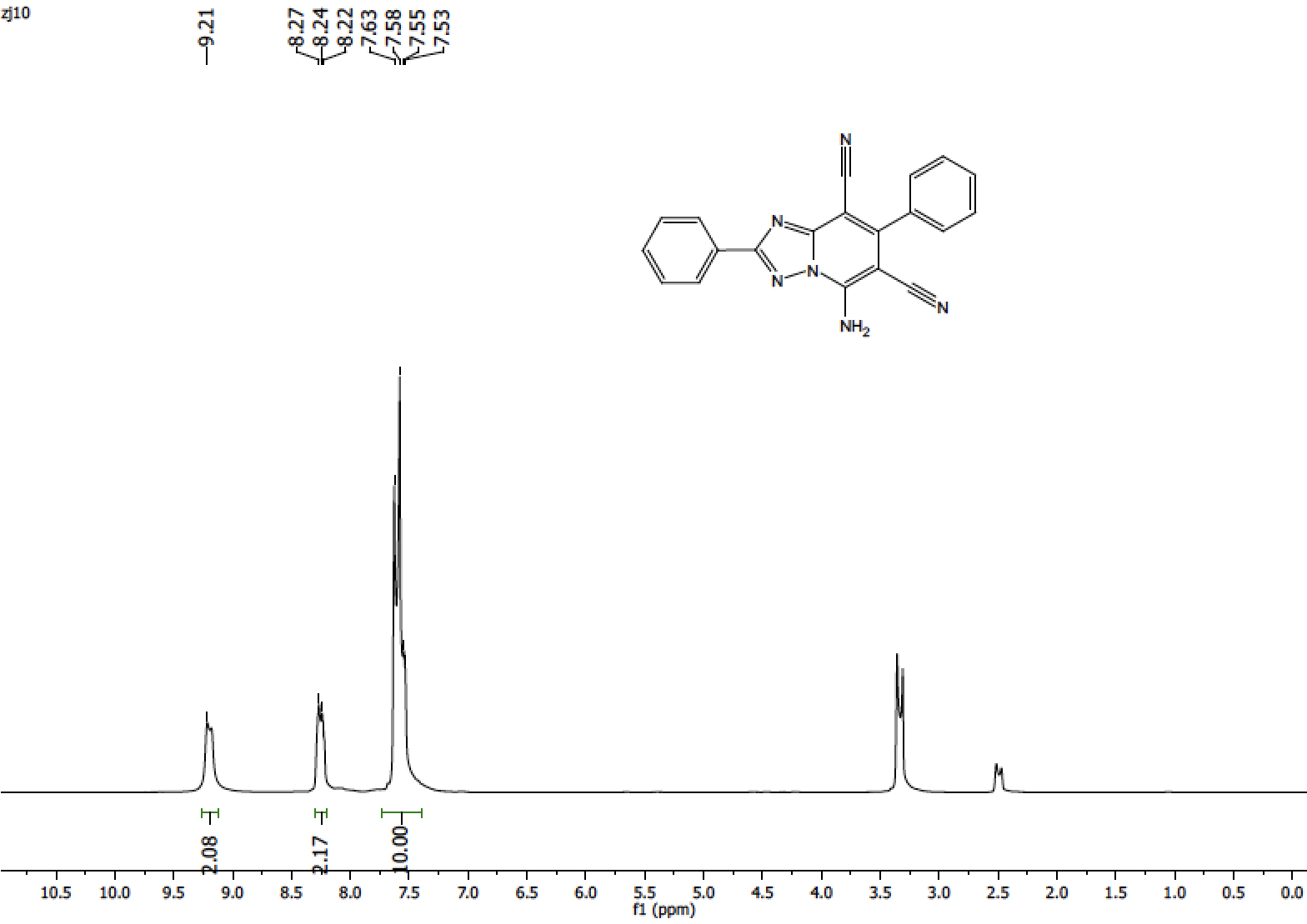
*Ethyl 5-amino-8-cyano-2-phenyl-7-(thiophen-2-yl)-[1,2,4]triazolo[1,5-a]pyridine-6-carboxylate (****5c****)*: White solid; yield: 93%; IR (KBr) υmax 3278, 3255, 2232, 1681;1H NMR (DMSO-d6, 400 MHz) δ 8.47 (br s, 2H, NH2), 8.06 (d, 2H, *J*=8 Hz, Ar), 7.98 (d, 1H, *J*=8 Hz, Ar), 7.88 (d, 1H, *J*=4 Hz, Ar), 7.53 (m, 3H, Ar), 7.29 (m, 1H, Ar), 2.39(q, 2H, CH2), 2.39(t, 3H, CH3); 13C NMR (DMSO-*d*6, 100 MHz) δ 23.27, 44.58, 85.42, 117.18, 125.28, 125.37, 126.73, 128.08, 128.69, 129.50, 130.64, 133.01, 136.10, 137.41, 156.96, 157.90. Anal. Calcd: for C20H15N5O2S: C, 61.68; H, 3.88; N, 17.98. Found: C, 61.61; H, 3.85; N, 17.92.



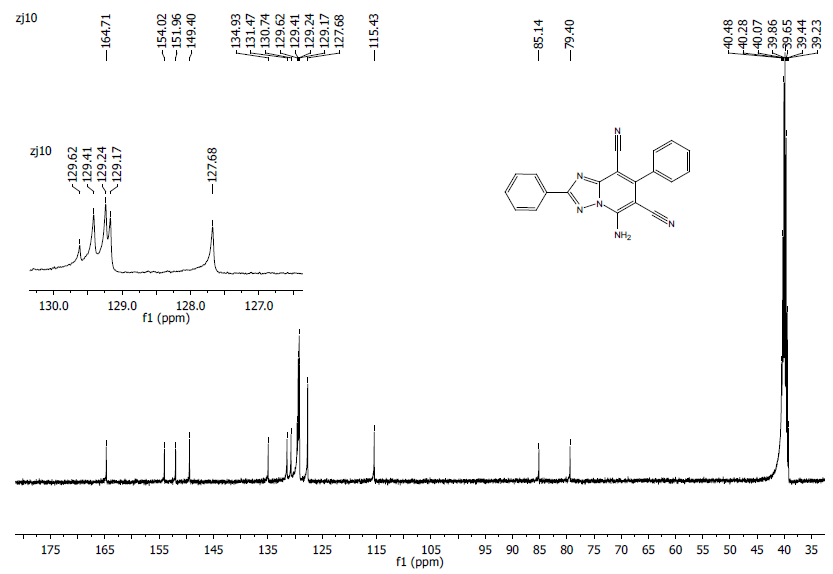




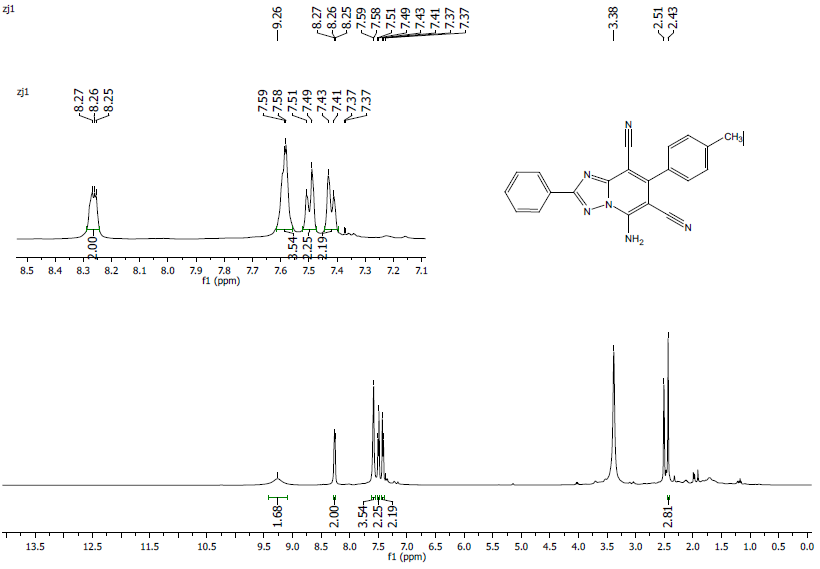




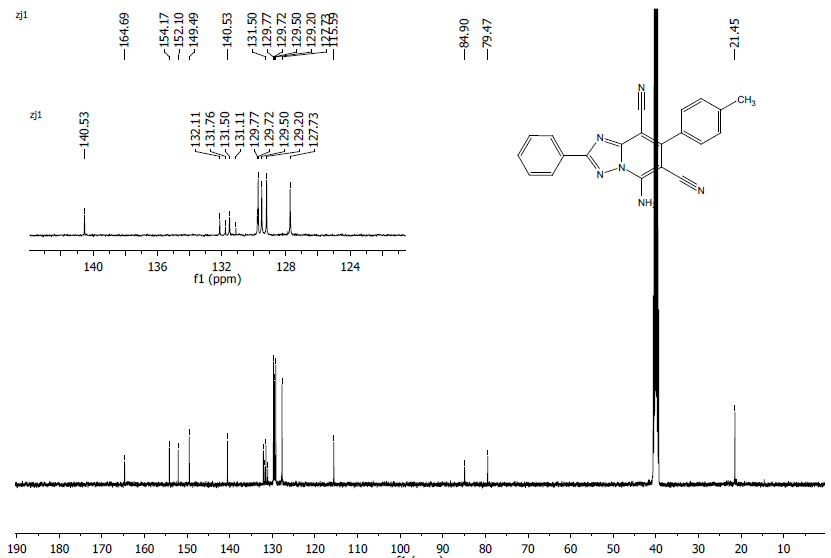
3a



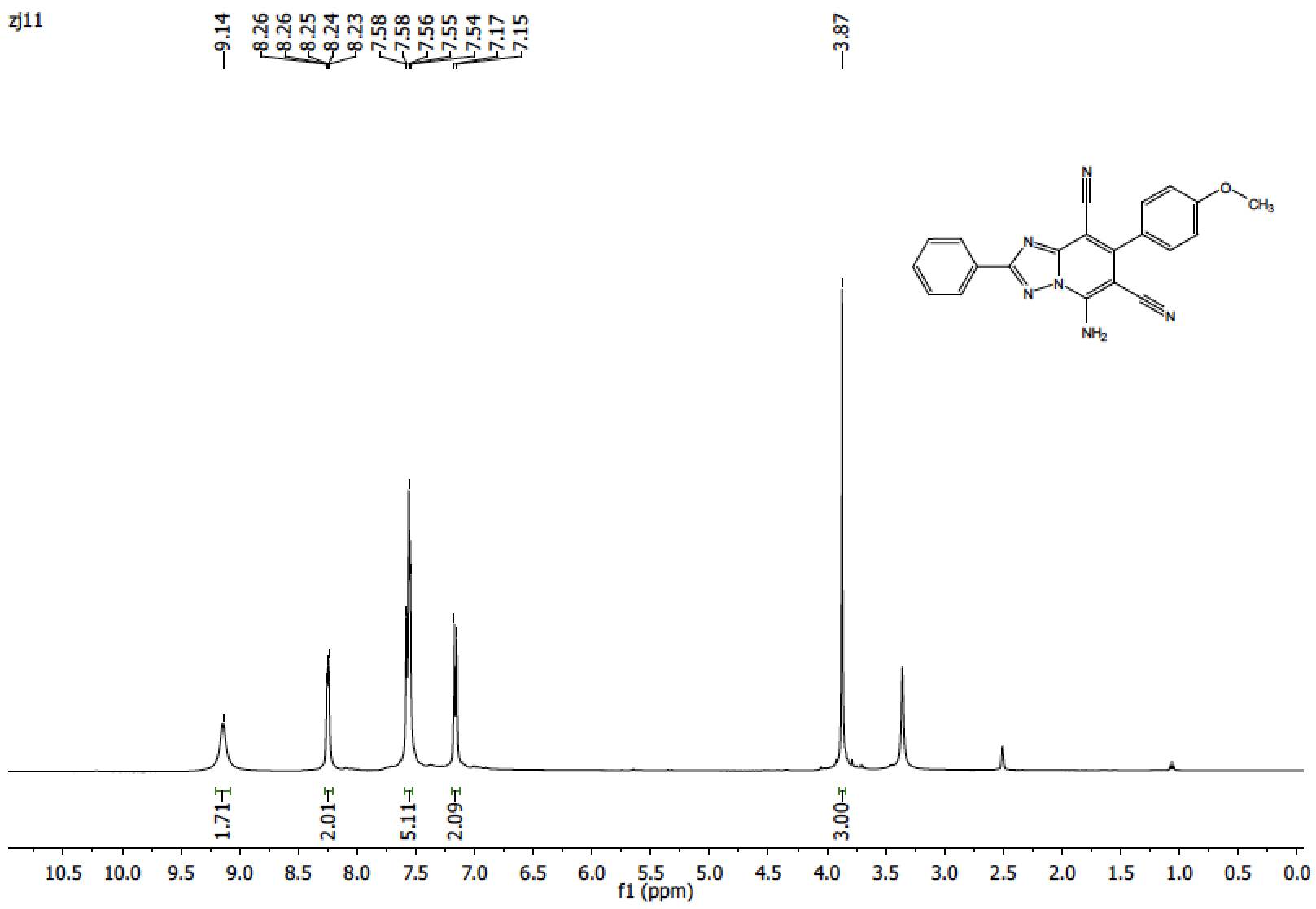
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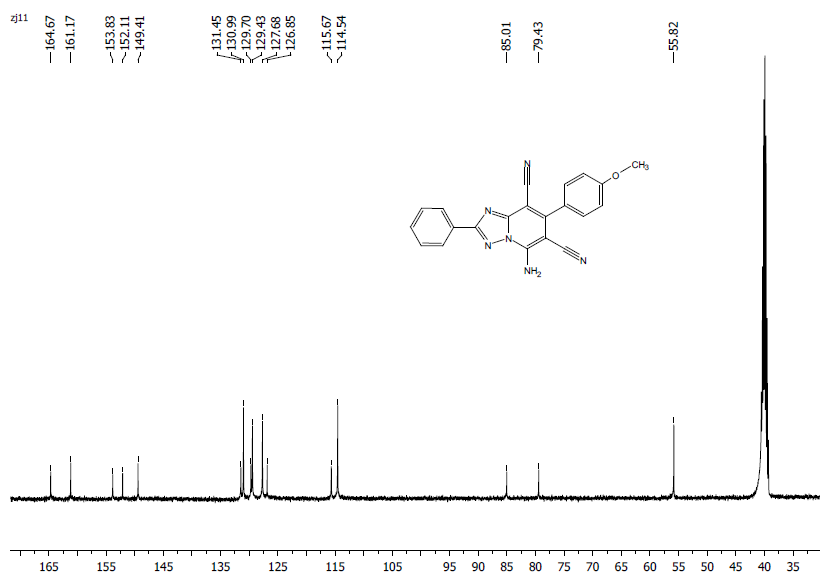
3b



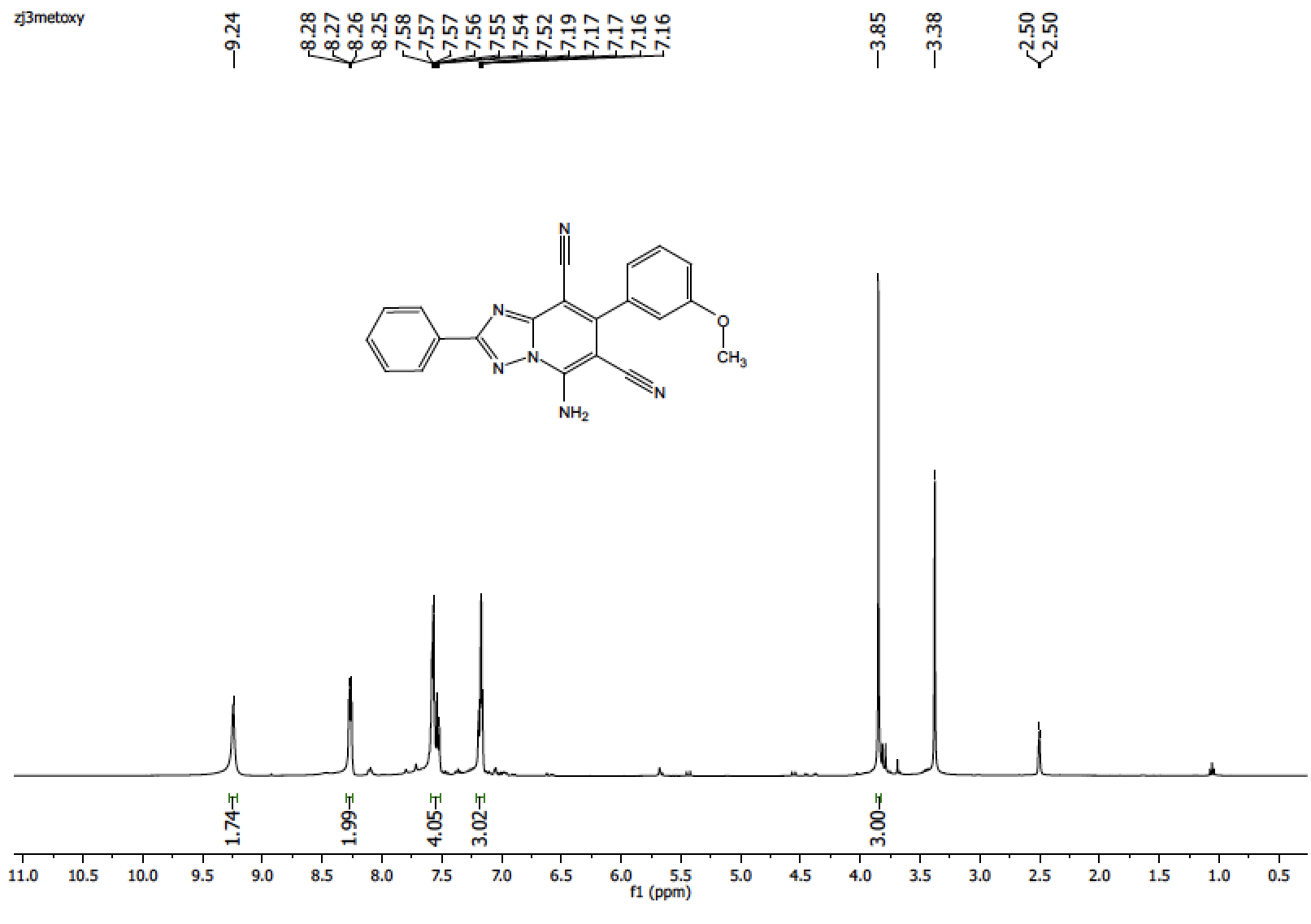
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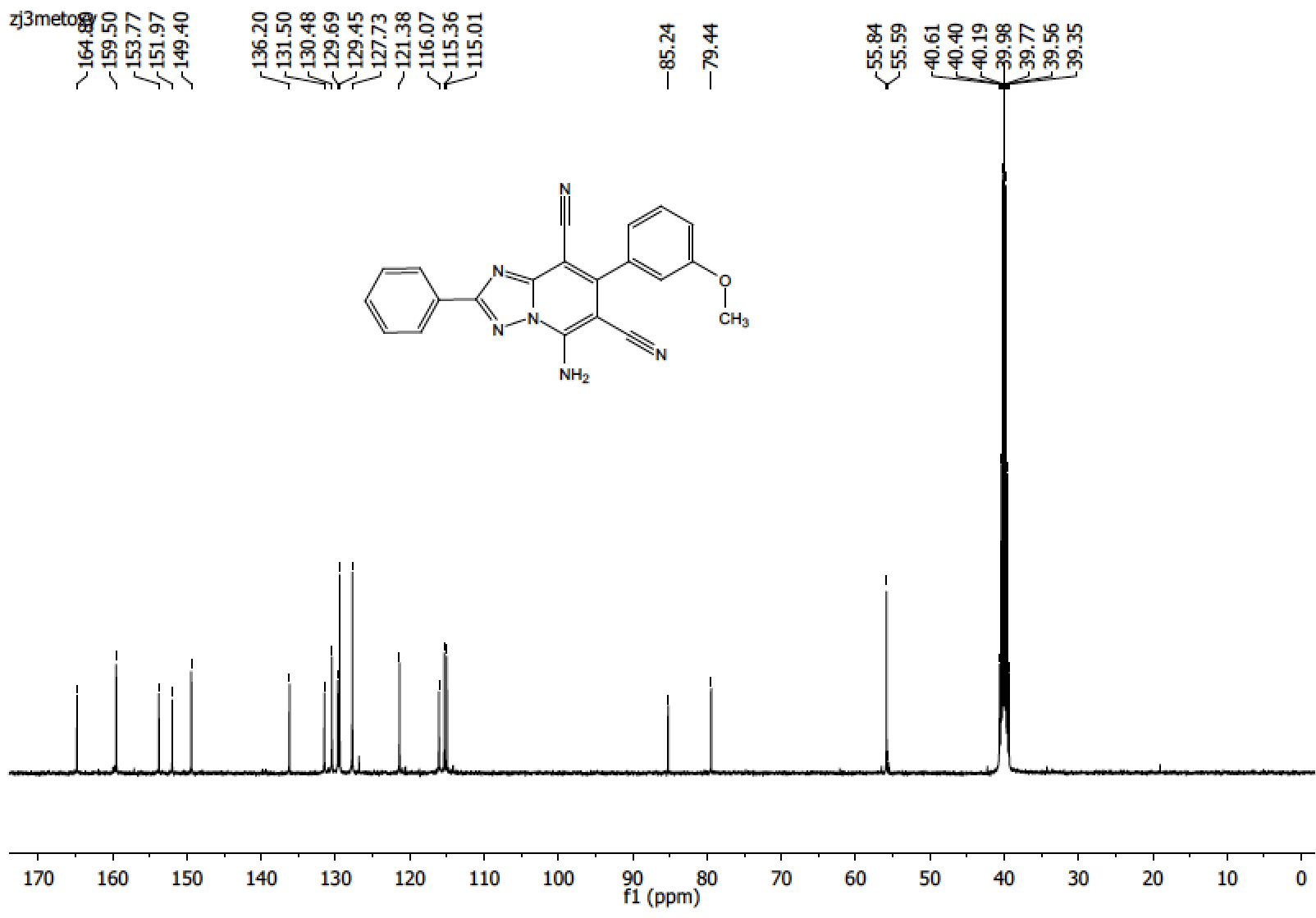
3c



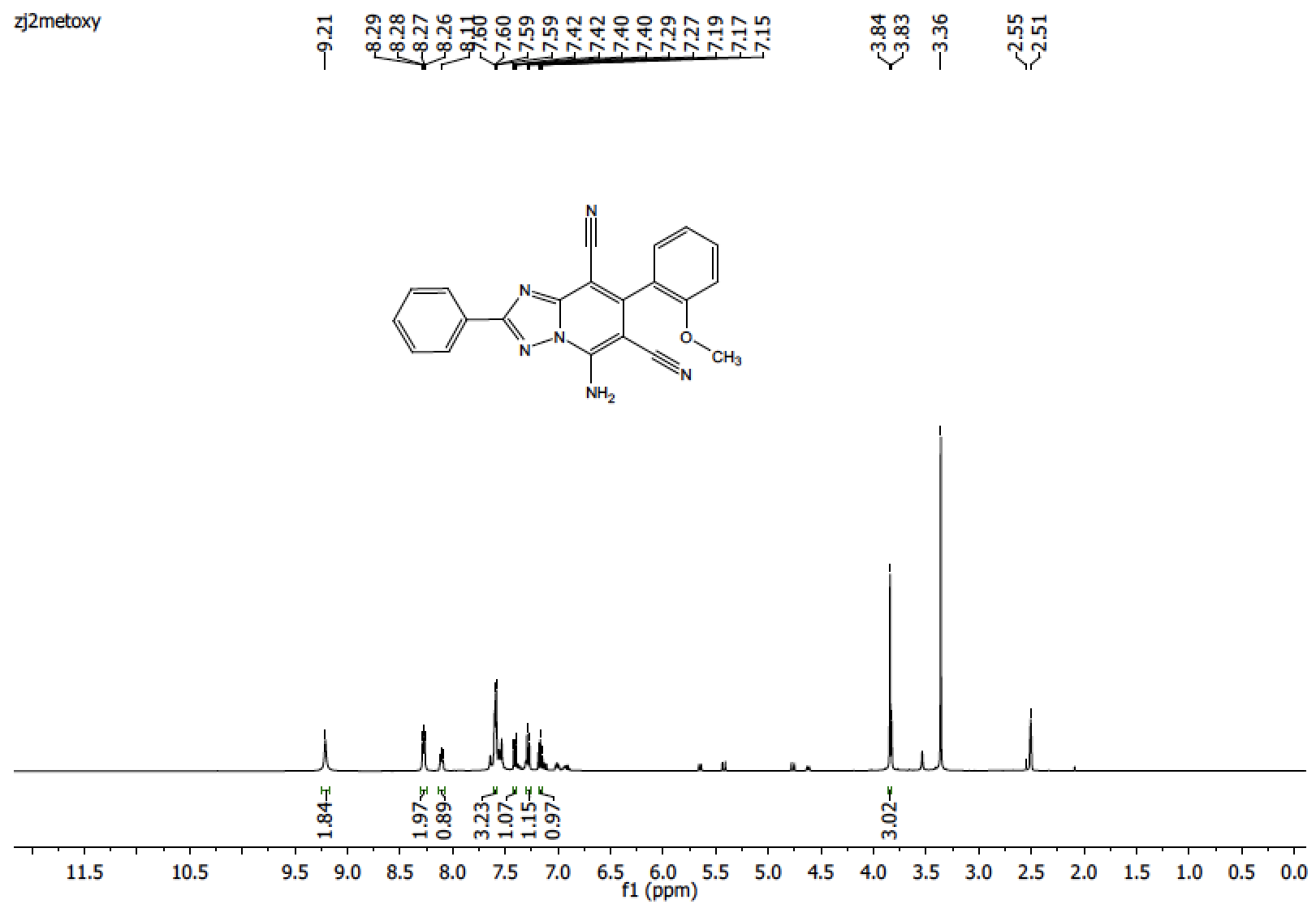
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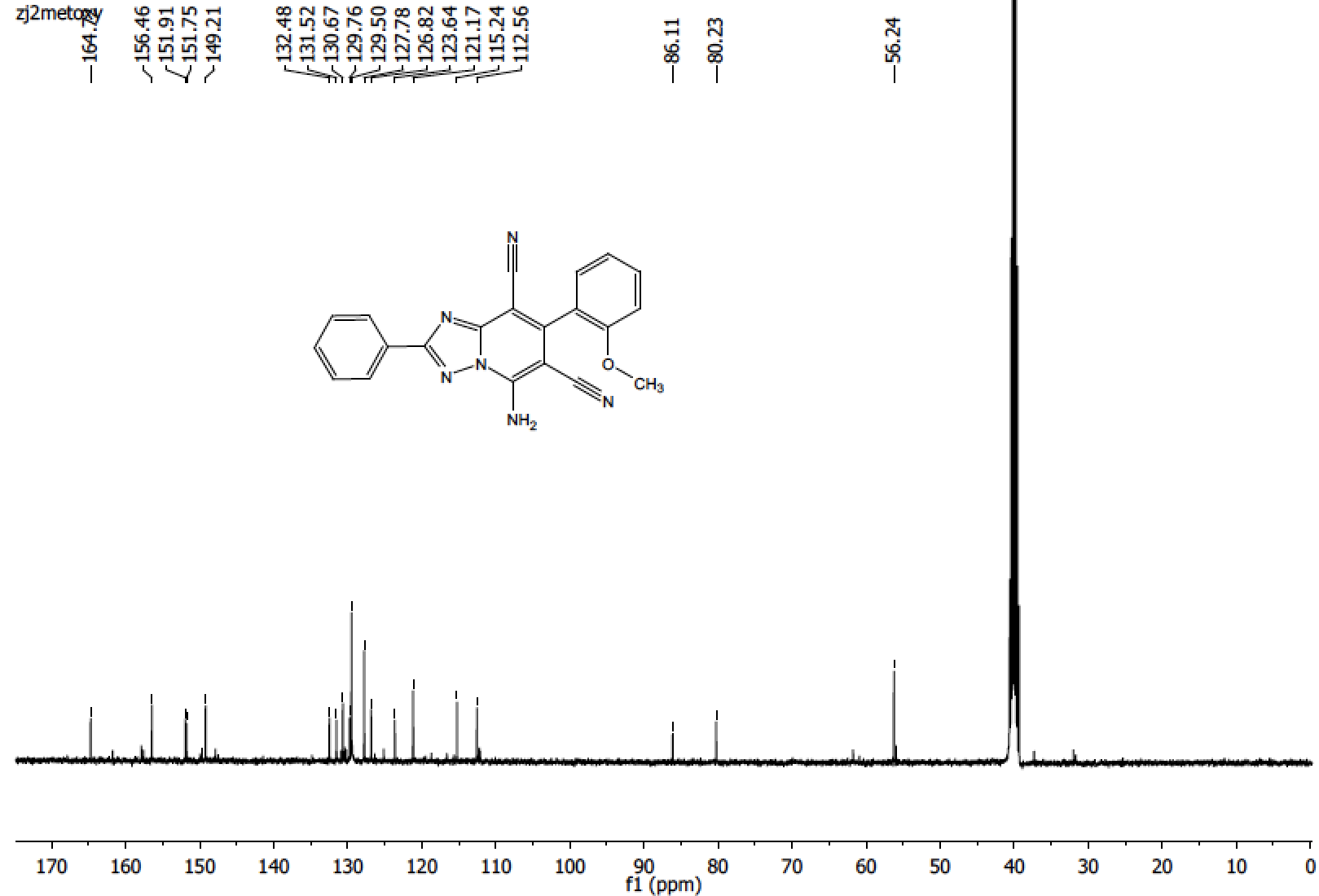
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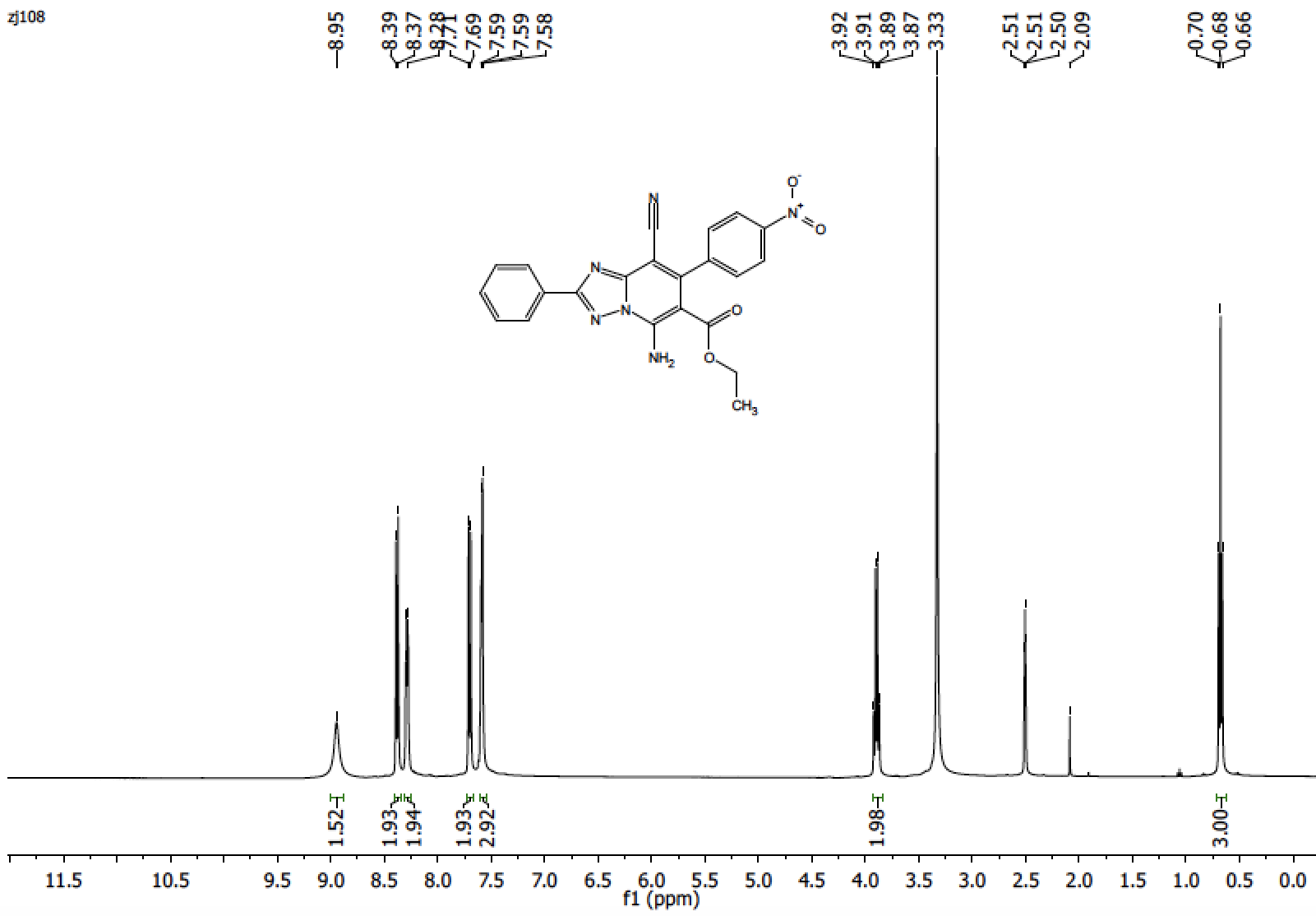
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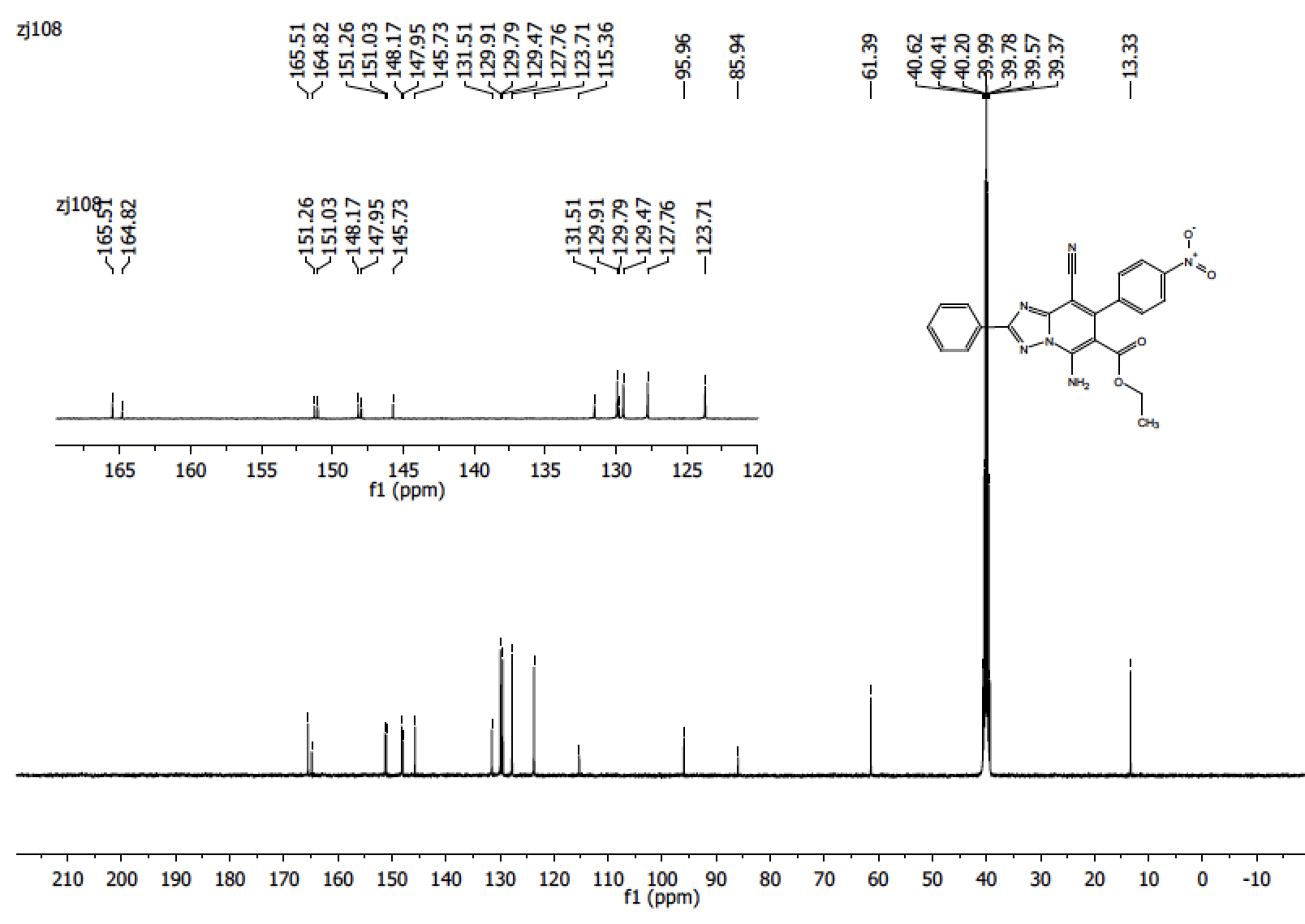
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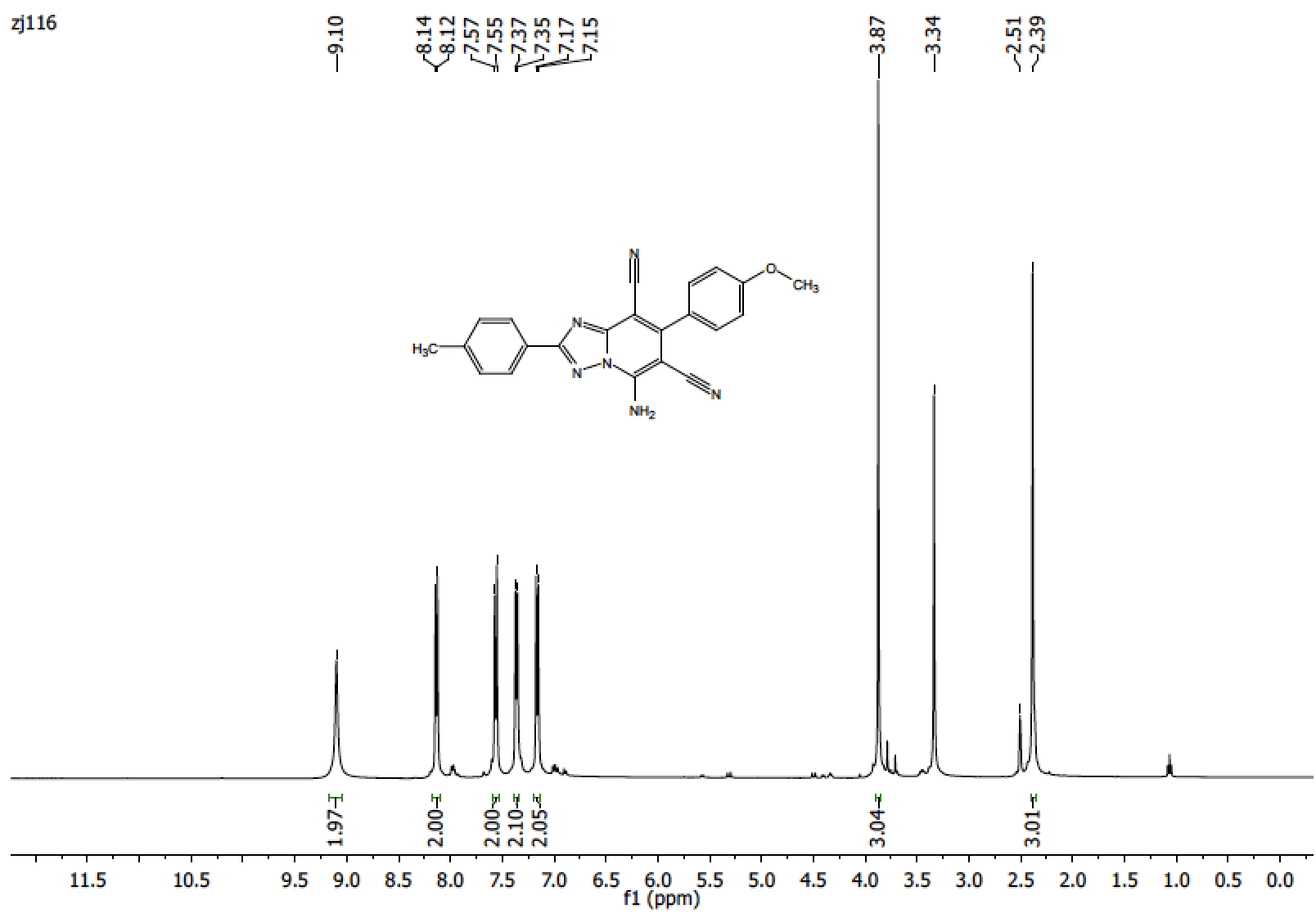
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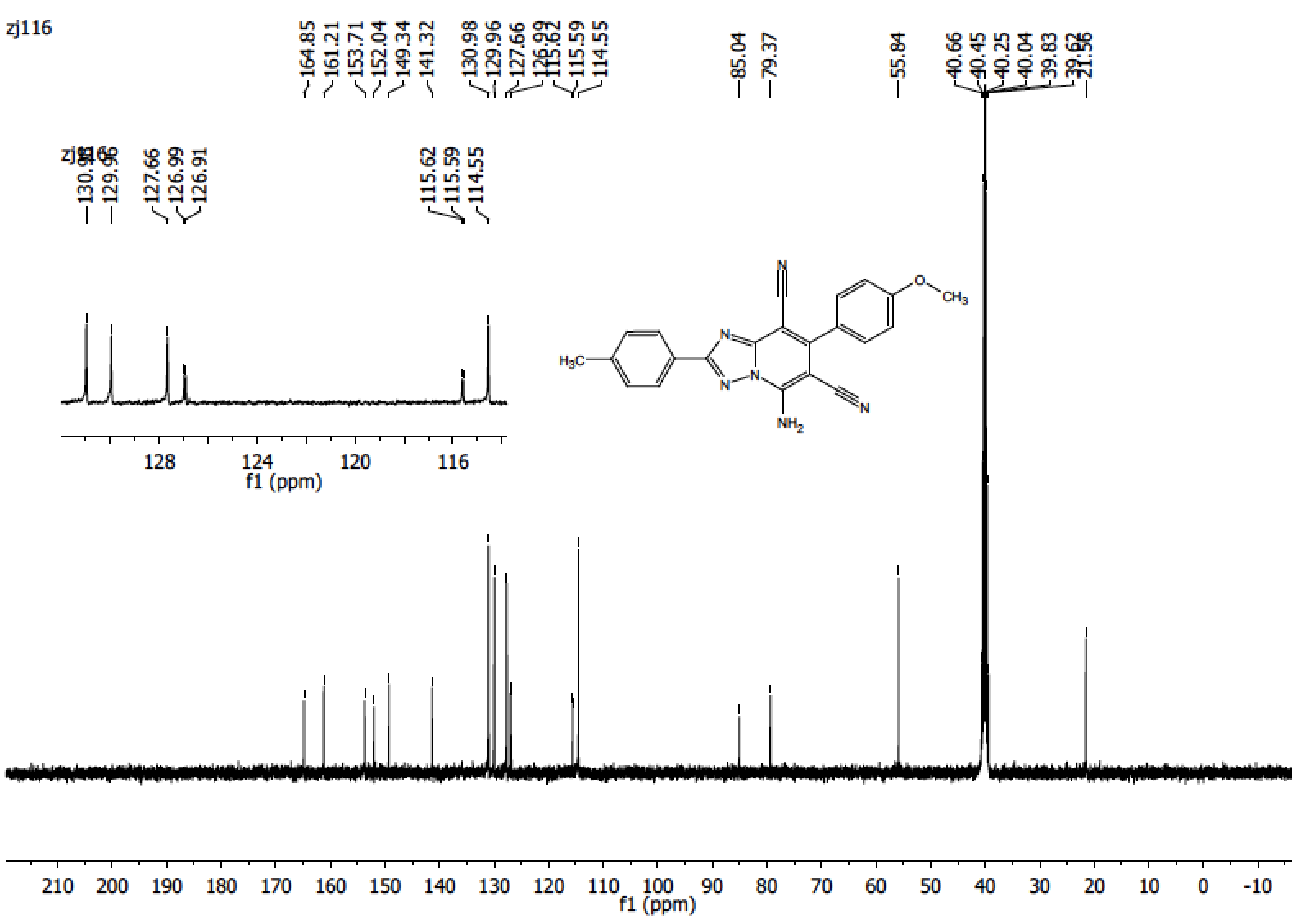
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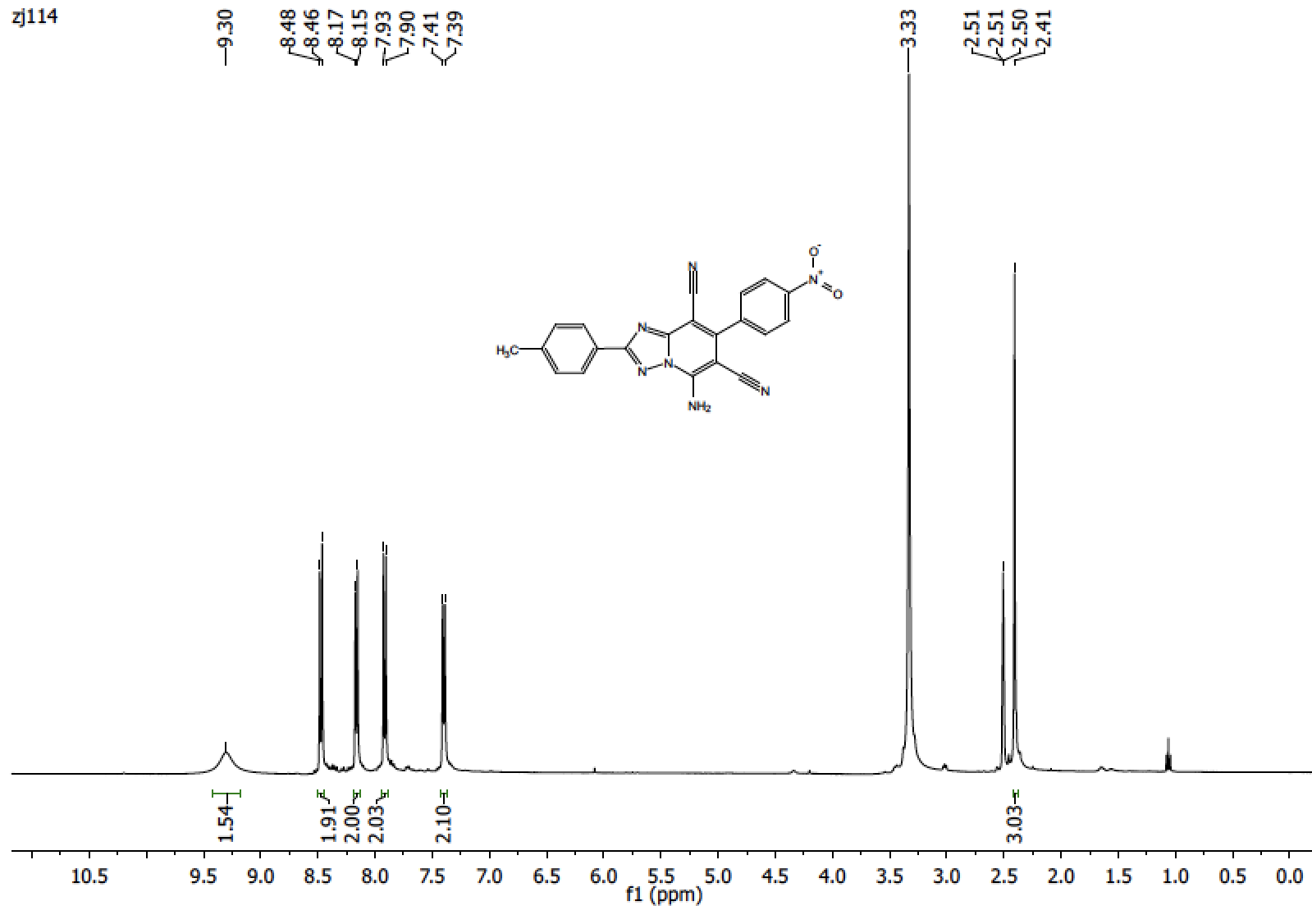
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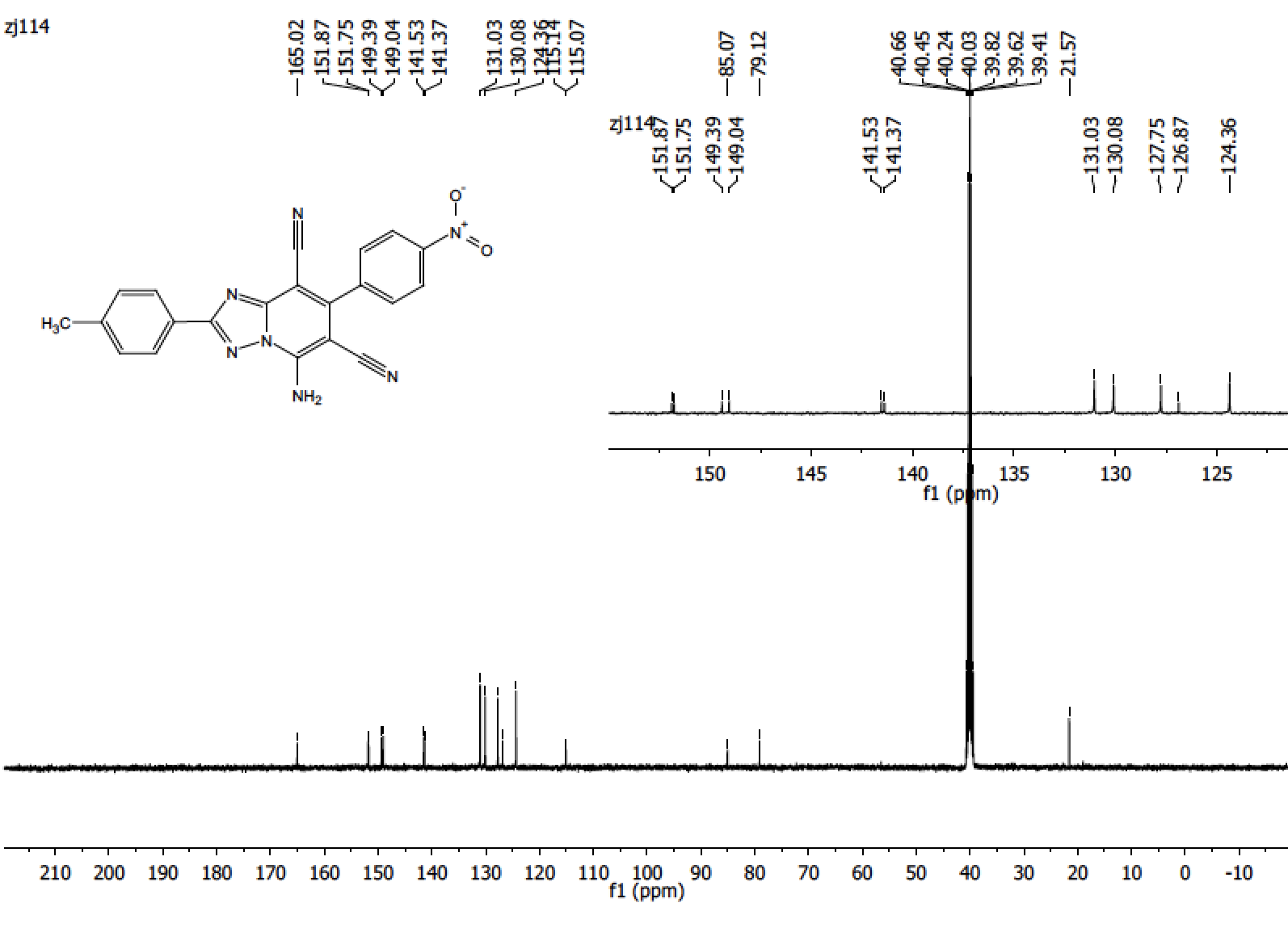
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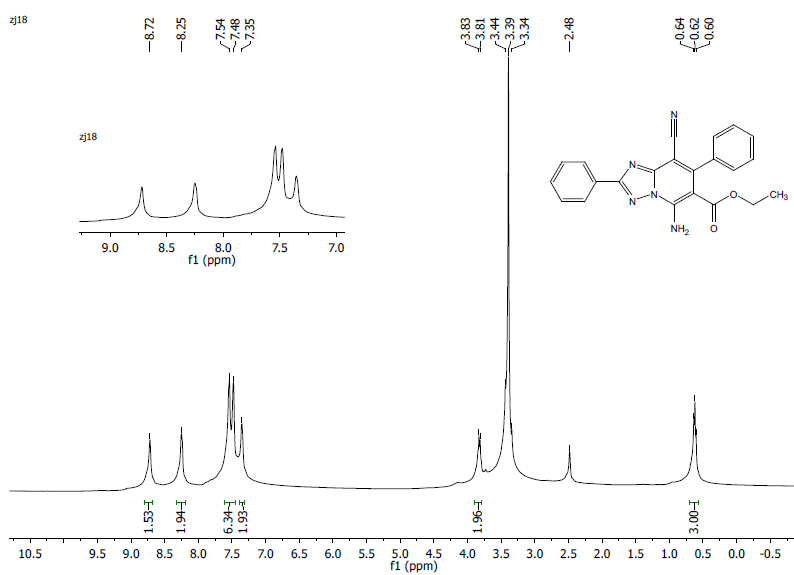
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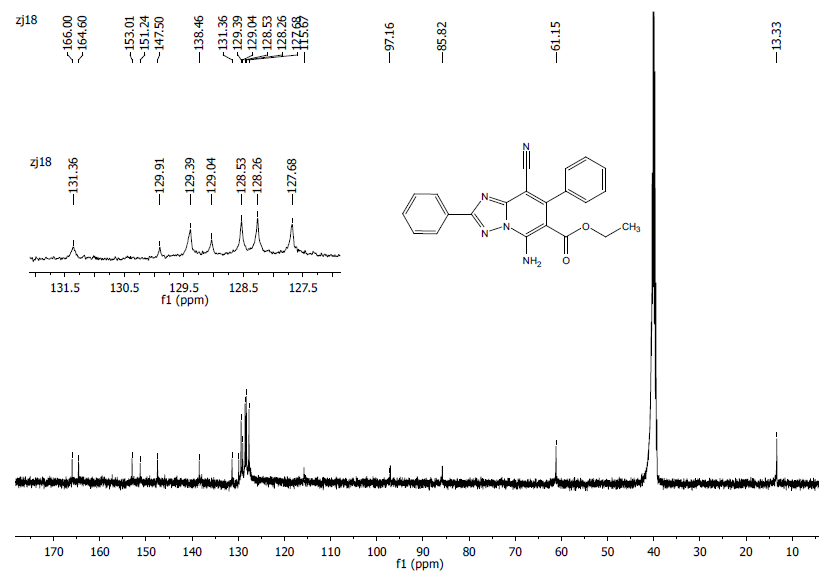
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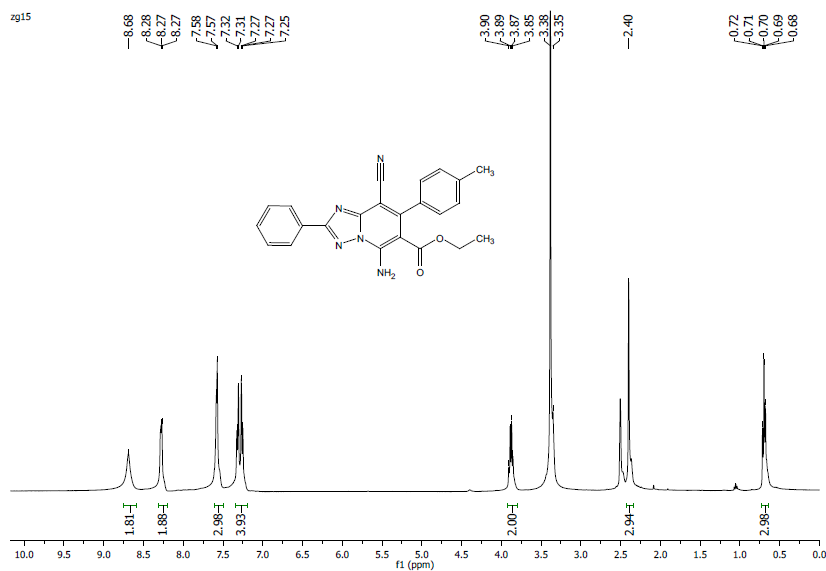
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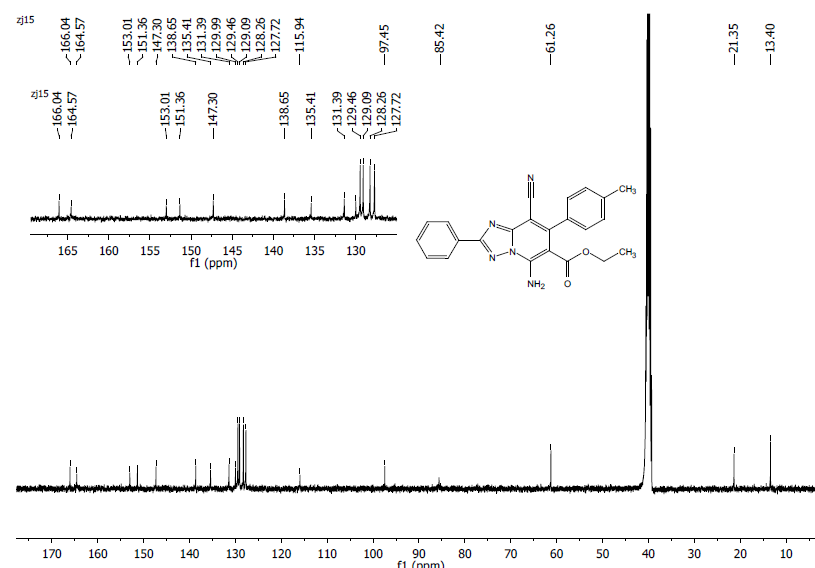
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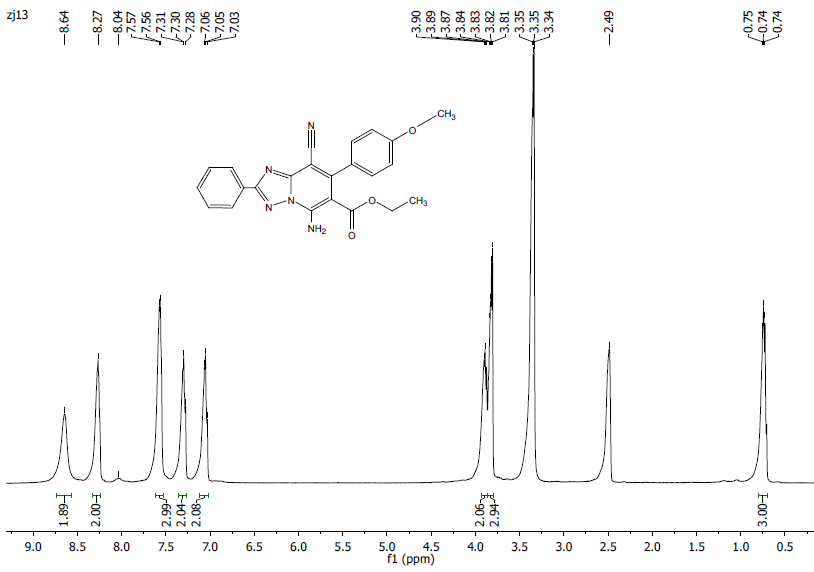
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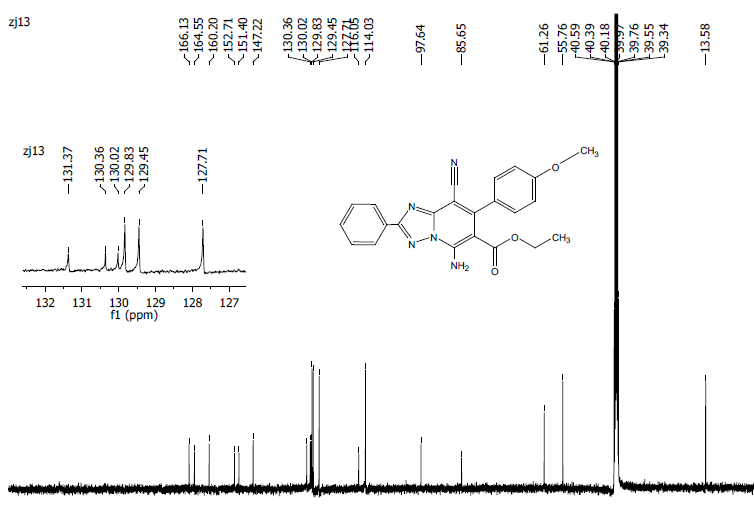
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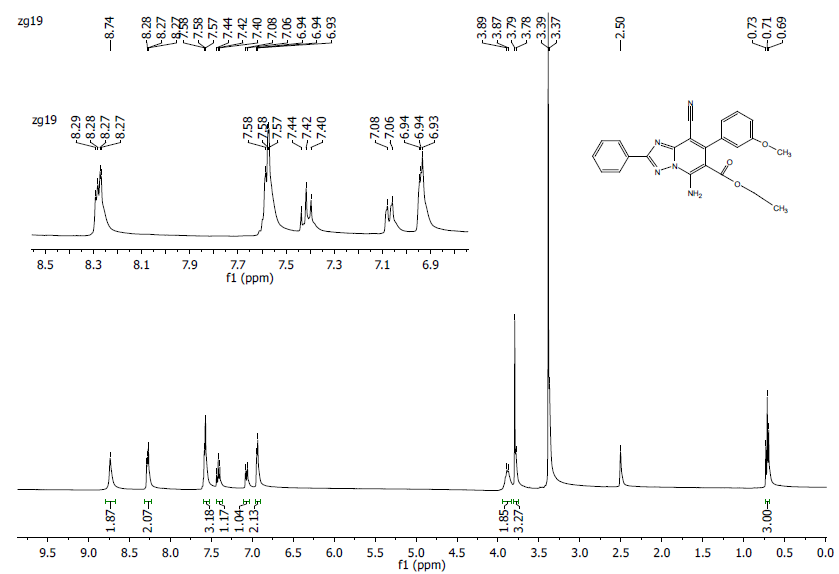
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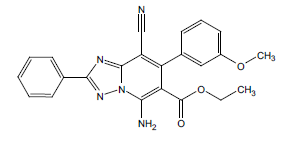
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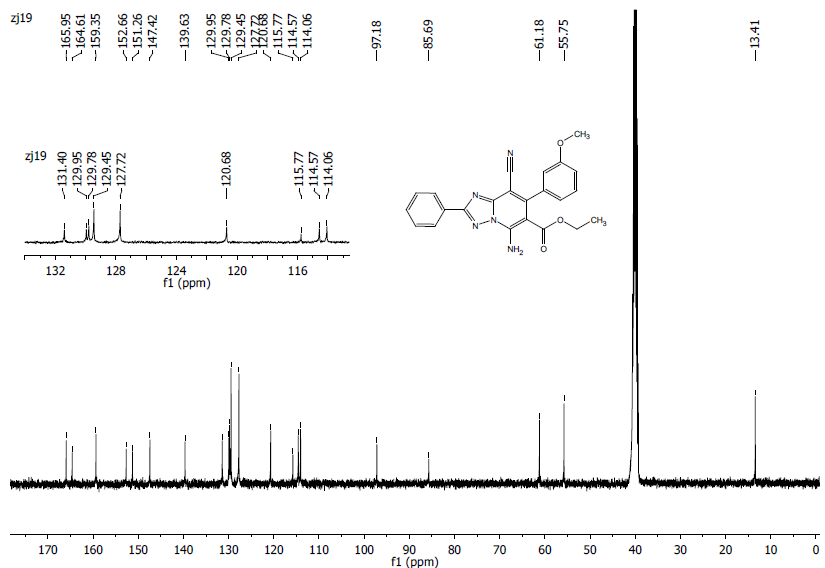


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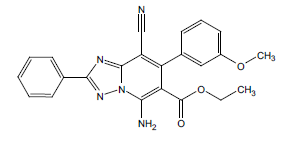


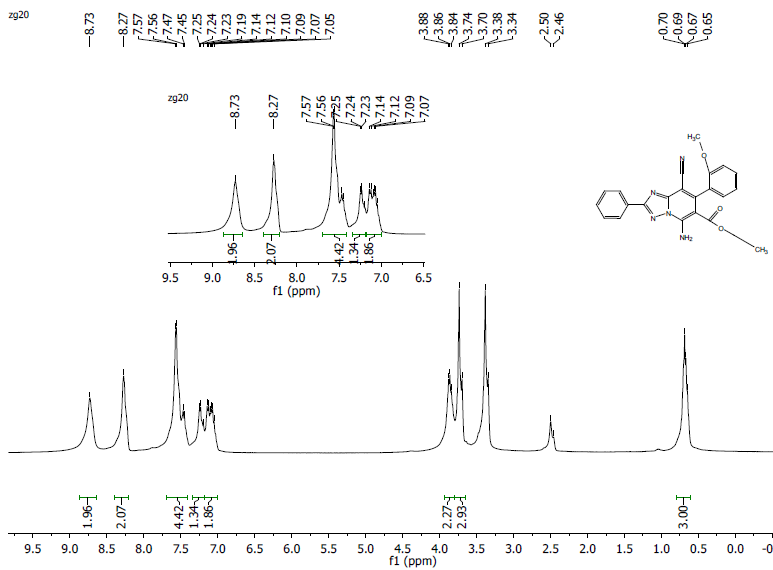
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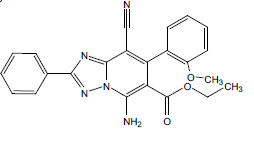




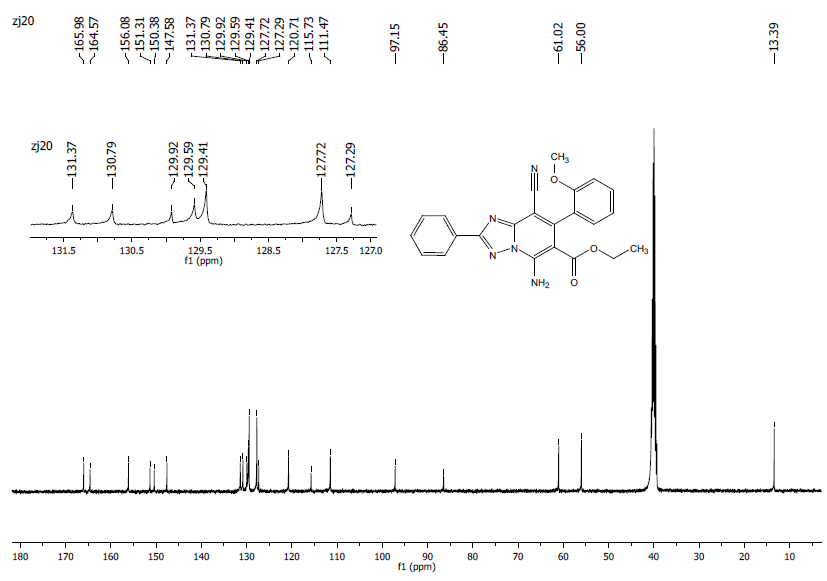
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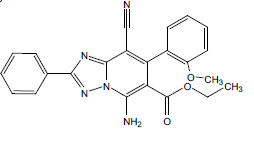




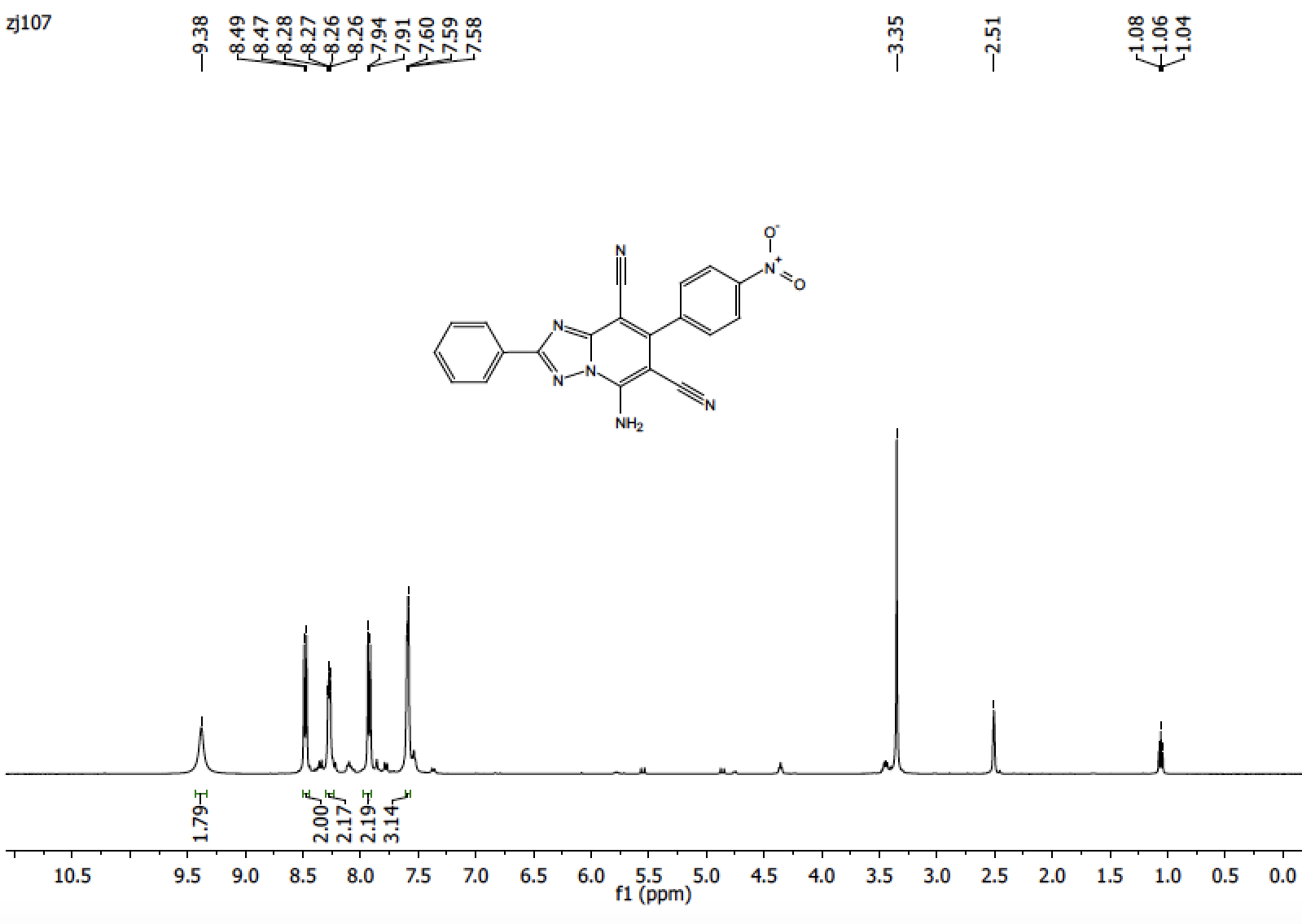


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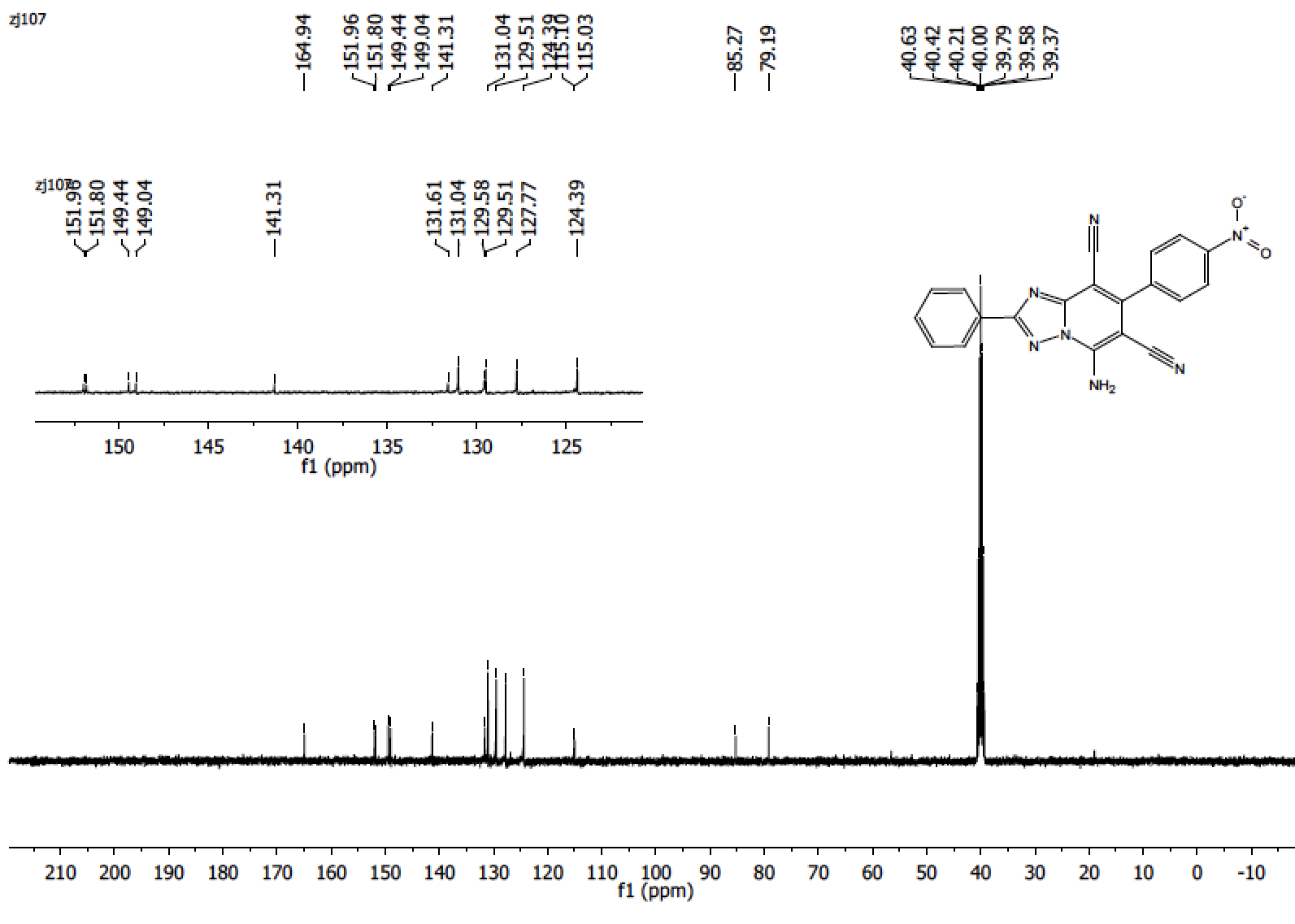




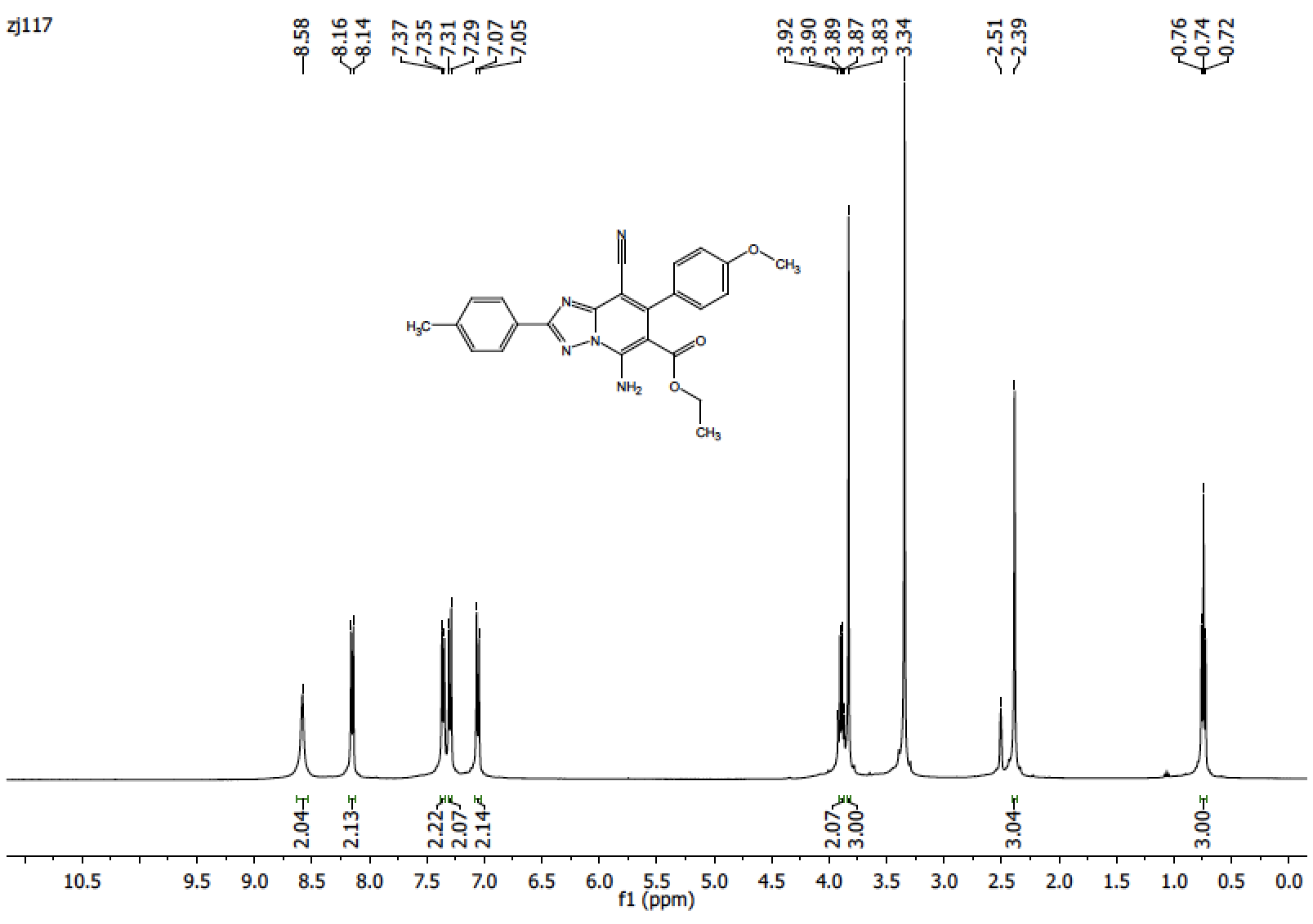
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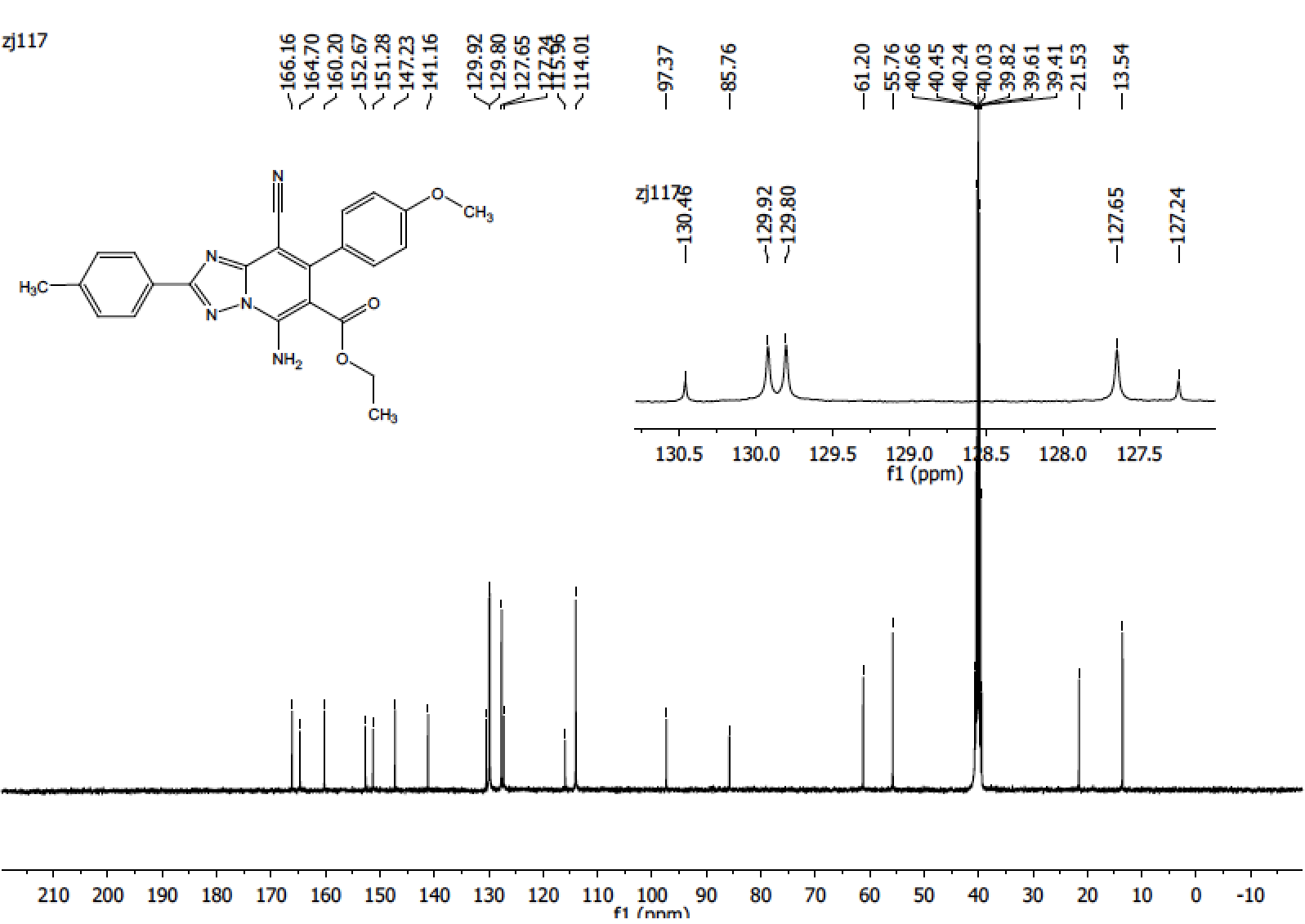
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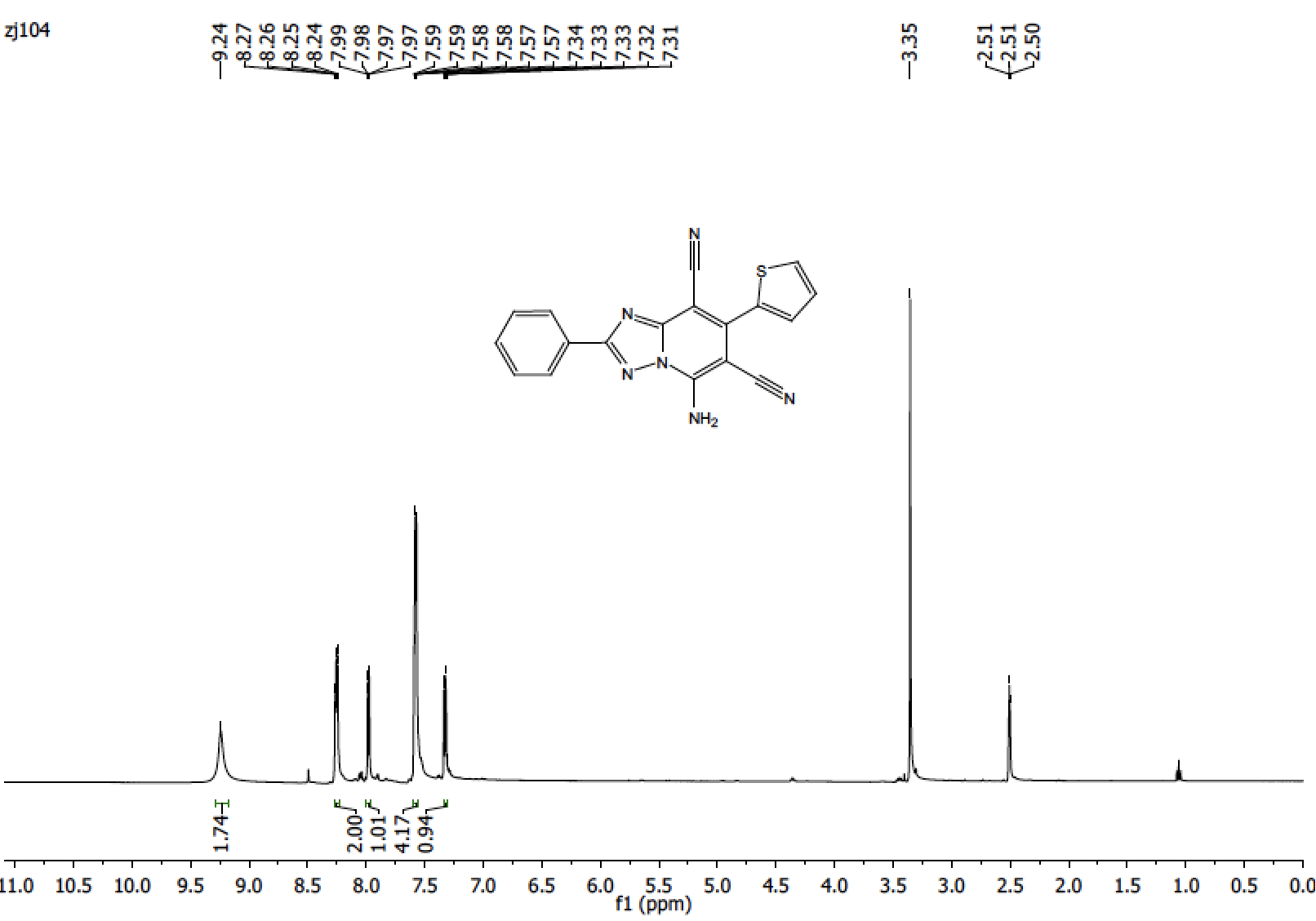
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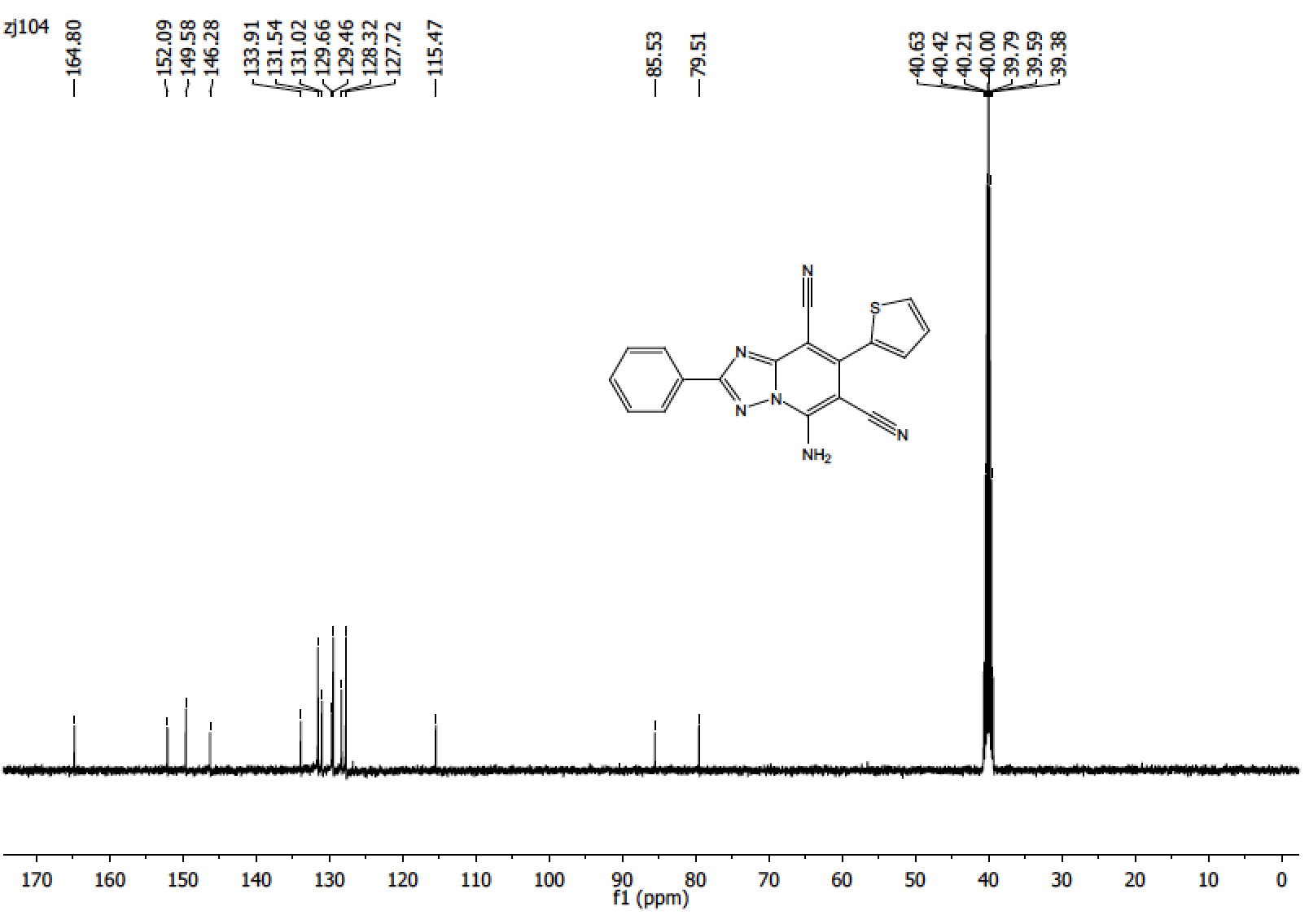
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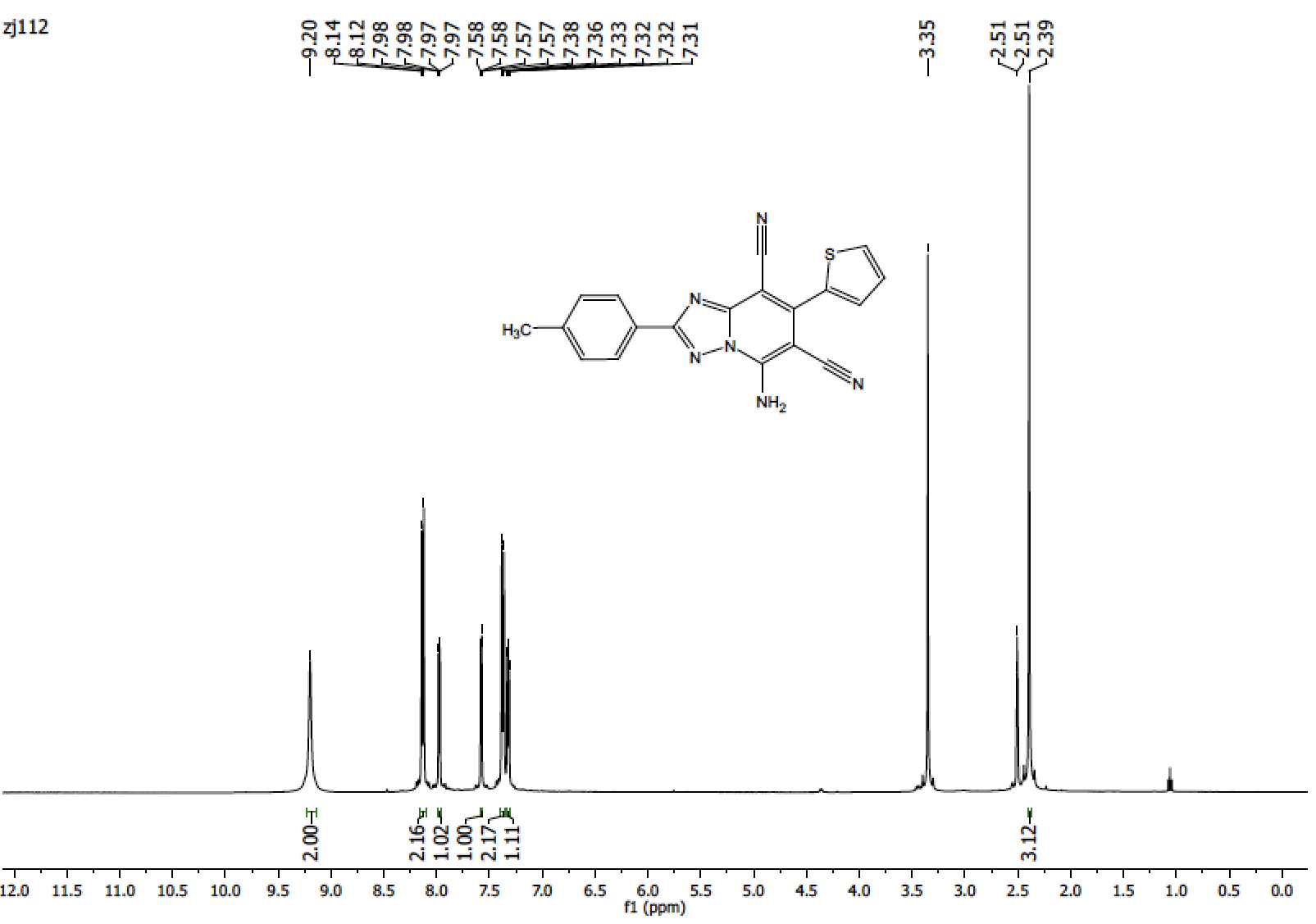
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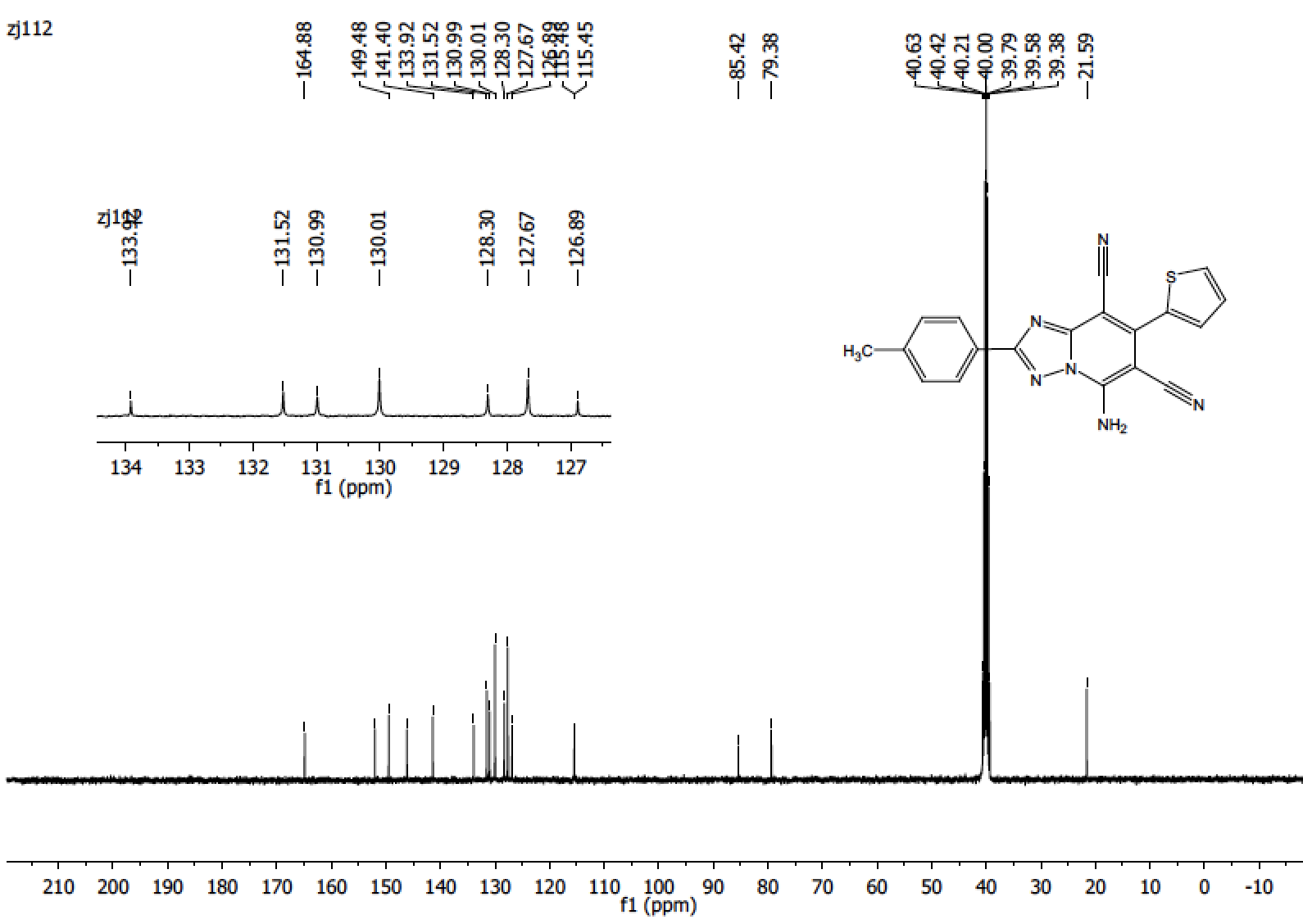
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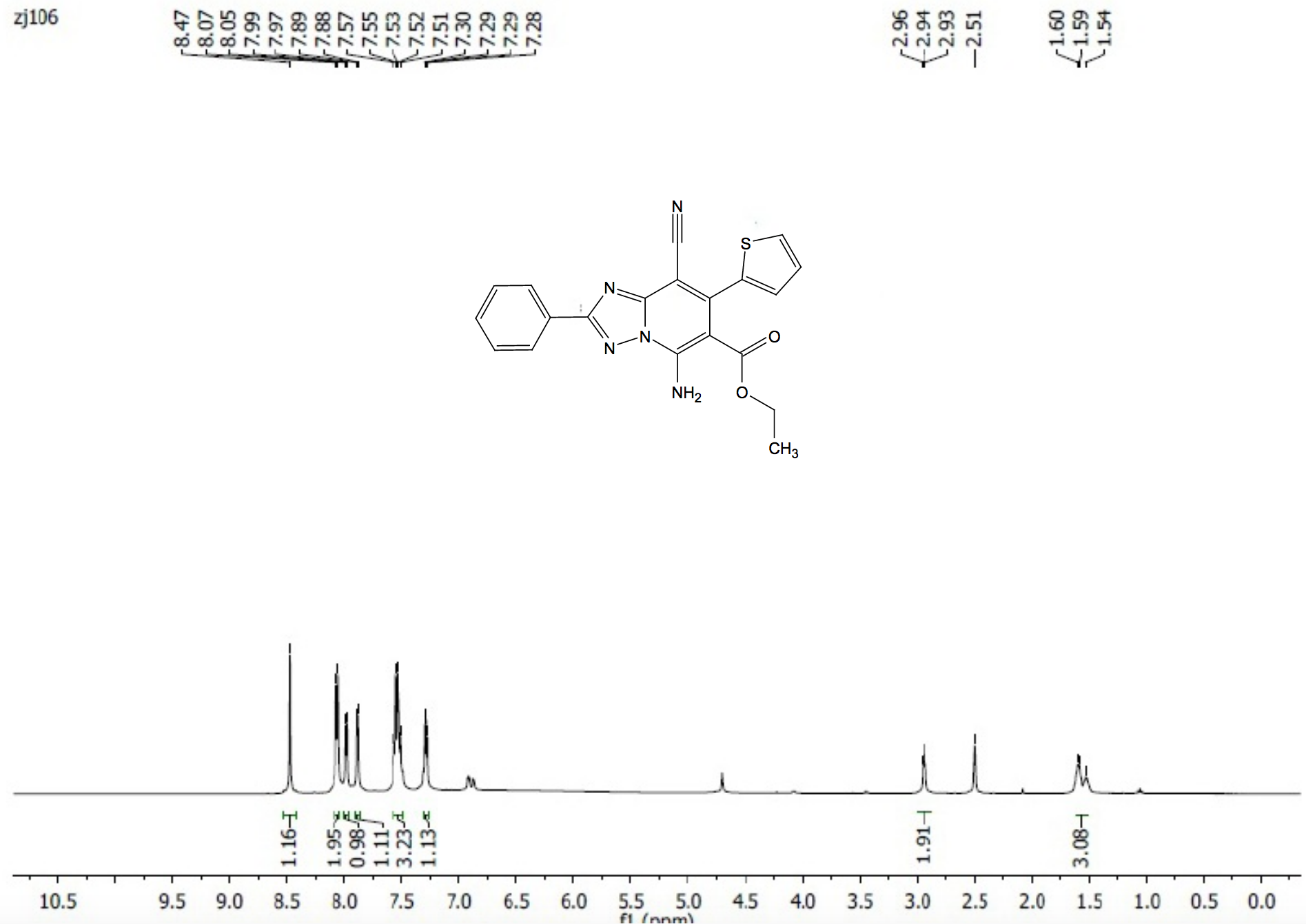
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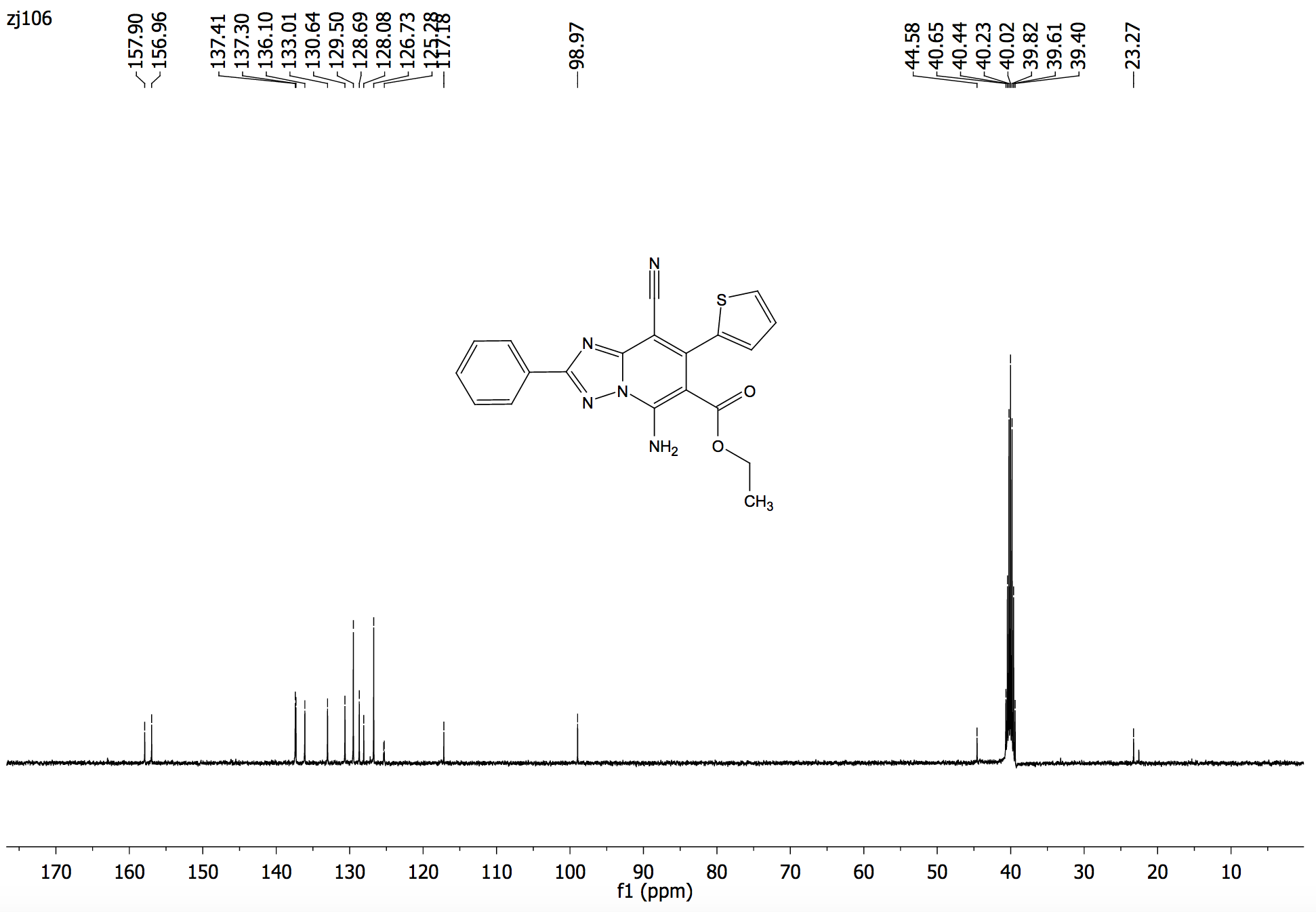
5b



5b



5c



5c