Supporting Information

A General and Efficient Strategy for Erythrinan and Homoerythrinan Alkaloids: Syntheses of (±)-3-demethoxyerythratidinone and (±)-Erysotramidine

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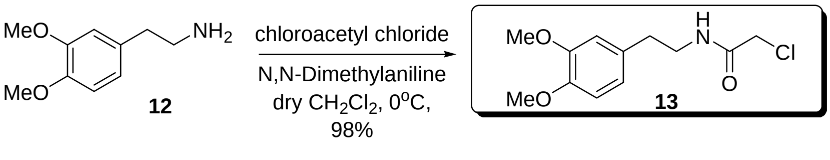
1. Experimental Procedures and Spectroscopic and Analytical Data of the Products

Note: ^{1}H and ^{13}C NMR spectra were recorded in $CDCl_3$ solution on Varian Mercury-300 or 400 MHz. The MS data were obtained with EI (70 eV), and the relative intensity (%) is given in brackets. High-resolution mass spectral analysis (HRMS) data were measured on the Bruker ApexII by means of the SIMS or ESI technique.

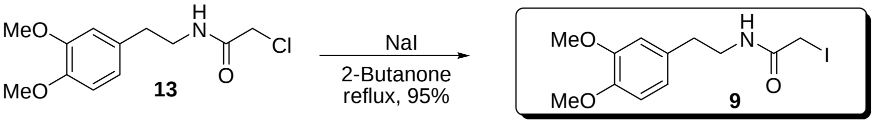
1.1—— Synthesis of amide 13.



To a solution of 2-(3,4-Dimethoxyphenyl)ethylamine **12** (3.0 g, 16.6 mmol) in dry CH_2Cl_2 (100 mL) was added N,N-dimethylaniline (3.36 mL, 26.6 mmol). The mixture was cooled to 0 °C, and chloroacetyl chloride (1.38 mL, 17.4mmol) was added. After the mixture was stirred for 1 h, 1 N HCl (50 mL) was added, and the resulting mixture was extracted with CH_2Cl_2 (100 mL). The combined extracts were washed with 1 N HCl (25×3 mL) and dried over Na_2SO_4, and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/EtOAc 4:1 to 1:1) afforded **13** (4.2 g, 98%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.72-6.69 (d, J=11.6, 1H), 6.63-6.67 (m, 2H), 3.88 (s, 2H), 3.75 (s,3H), 3.73 (s,3H), 3.45-3.38 (dd, J = 17.2, 9.2 Hz, 2H), 2.70-2.65 ppm (t, J=9.2, 2H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 165.5, 148.5, 147.2, 130.5, 120.2, 111.5, 111.0, 55.4, 55.3, 42.1, 40.7, 34.4 ppm; **EI MS** (70 eV): m/z (%): 257 (5.2) $[M]^+$, 164 (100), 151 (61), 107 (13).

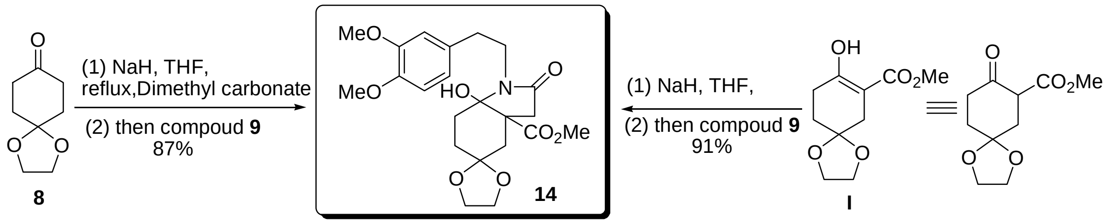
1.2—— Synthesis of amide 9.



To a solution of **13** (3.0 g, 11.6 mmol) in 2-butanone (30 mL) was added NaI (1.92 g, 12.8 mmol). The mixture was heated to reflux for 2 h. The resulting red solution was cooled to room temperature, then the solvent was removed *in vacuo*, the obtained residue was diluted with CH_2Cl_2 (100 mL). The organic layer was washed with saturated aqueous $Na_2S_2O_3$ (25×3 mL) and dried over Na_2SO_4, and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/EtOAc 1:1) afforded **9** (3.9 g, 95%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.80-6.78 (d, J=8.0, 1H), 6.73-6.71 (d, J=8.0, 1H), 6.70 (s, 1H), 3.85 (s, 3H), 3.83 (s, 3H), 3.63 (s, 2H), 3.50-3.45 (dd, J=12.8, 6.42 Hz, 2H), 2.77-2.73 ppm (d, J=6.4, 2H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 116.9, 148.9, 147.7, 130.9, 120.6, 111.9, 111.4, 55.8, 41.5, 34.7, -0.5 ppm; **EI MS** (70 eV): m/z (%): 349 (2) $[M]^+$, 198 (0.4), 164 (100).

1.3— Synthesis of *N*-arylethylhydroindole 14.



Method A:

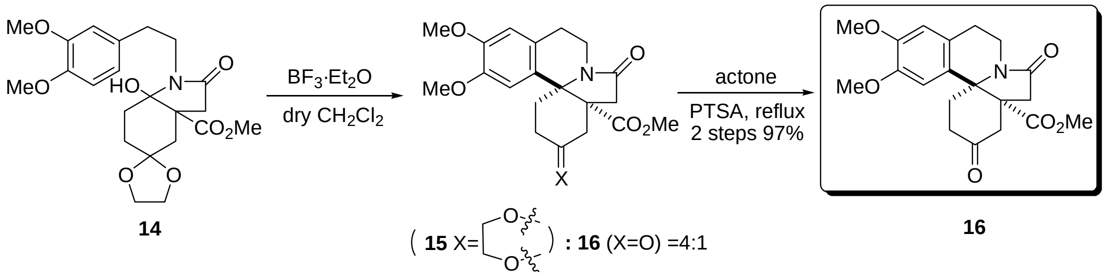
To a solution of **8** (500 mg, 3.20 mmol) in dry THF (20 mL) was added NaH (231 mg, 12.8 mmol) under argon atmosphere. The mixture was heated to reflux for 30 min and dimethyl carbonate (1.1 mL, 12.8 mmol) was added. The mixture was stirred at reflux for another 1 h. A solution of **9** (1.06 g, 3.04 mmol) in THF (8 mL) was added dropwise over a 1 min interval. The reaction mixture was stirred for an additional 30 min and then allowed to cool to room temperature. The reaction was quenched by addition of H_2O (25 mL). The aqueous solution was extracted with CH_2Cl_2 (3×20 mL). The combined extracts were dried over Na_2SO_4 and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/actone 3:1 to 1:1) afforded **14** (1.15 g, 87%).

Method B:

To a solution of **I** (500 mg, 2.34 mmol) in dry THF (20 mL) was added NaH (112.1 mg, 2.80 mmol) at 0 ^{o}C under argon atmosphere. The mixture was heated to room temperature for 30 min. A solution of **9** (776 mg, 2.22 mmol) in THF (8 mL) was added dropwise over a 1 min interval. The reaction mixture was stirred for an additional 30 min at room temperature. The reaction was quenched by addition of H_2O (25 mL). The aqueous solution was extracted with CH_2Cl_2 (3×20 mL). The combined extracts were dried over Na_2SO_4 and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/actone 3:1 to 1:1) afforded **14** (879 mg, 91%).

^{1}**H NMR** (400 MHz, $CDCl_3$): δ = 6.67 (m, 3H), 4.80 (s, 1H), 3.86-3.80 (m, 4H), 3.78 (s, 3H), 3.75 (s, 3H), 3.64 (s, 3H), 3.55-3.48 (m, 1H), 3.15-3.10 (m, 1H), 2.79-2.74 (m, 2H), 2.71-2.66 (d, J=15.9, 1H), 2.34-2.29 (d, J=15.9, 1H), 2.21-2.13 (m, 2H), 2.05-1.91 (m, 1H), 1.65-1.56 (m, 2H), 1.41-1.36 ppm (m, 1H); ^{13}**C NMR** (100 MHz, $CDCl_3$): δ = 174.8, 173.4, 148.7, 147.3, 131.5, 120.4, 111.9, 111.2, 106.3, 89.8, 64.3, 64.2, 55.6 (2C), 52.2, 49.9, 40.8, 39.9, 39.5, 34.7, 30.9, 30.4 ppm; **EI MS** (70 eV): *m*/*z* (%): 435 (0.8) [M]$^{+}$, 255 (2), 227 (0.8), 195 (2), 164 (100), 151 (16).

1.4— Synthesis of 15 and 16.



To a solution of **14** (1.07 mg, 2.46 mmol) in dry CH_2Cl_2 (30 mL) was added $BF_3{\cdot}Et_2O$ (0.62 mL, 4.9 mmol) at 0 ^oC under argon atmosphere. After the mixture was stirred for 1 h at room temperature, saturated $NaHCO_3$ (15 mL) was added, and the resulting mixture was extracted with CH_2Cl_2 (30 mL). The combined extracts were washed with saturated $NaHCO_3$ (25×3 mL) and dried over Na_2SO_4, and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/actone 4:1 to 1:1) afforded **15** (796 mg) and **16** (178 mg, 97% overall yield).

To a solution of **15** (796 mg, 1.91 mmol) in actone (30 mL) was added cat. PTSA. The mixture was heated to reflux for 3 h. The resulting solution was cooled to room temperature, then the solvent was removed *in vacuo*, the obtained residue was diluted with CH_2Cl_2 (100 mL). The organic layer was washed with saturated aqueous $NaHCO_3$ (25 mL) and dried over Na_2SO_4, and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/actone 1:1) afforded **16** (712 mg, 99%).

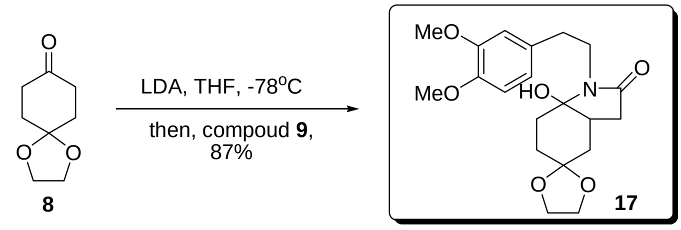
Compound **15**

^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.56 (s, 1H), 6.49 (s, 1H), 4.30-4.25 (m, 1H), 3.99-3.79 (m, 4H), 3.77 (s, 3H), 3.76 (s, 3H), 3.19-3.15 (d, J=17.2, 1H), 3.00 (s, 3H), 2.94-2.88 (m, 1H), 2.80-2.72 (m, 1H), 2.60-2.49 (m, 3H), 2.15-2.11 (d, J=15.6, 1H), 2.03-1.94 (m, 2H), 1.86-1.80 (m, 1H), 1.73-1.66 ppm (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 173.7, 171.4, 147.6, 146.9, 130.3, 126.7, 111.2, 108.5, 107.9, 65.3, 64.3, 63.4, 55.8, 55.6, 51.4, 50.5, 39.6, 37.8, 34.9, 34.5, 30.3, 28.2 ppm; **EI MS** (70 eV): *m*/*z* (%): 417 (0.07) $[M]^+$, 303 (6), 258 (3), 244 (6).

Compound **16**

^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.55 (s, 1H), 6.53 (s, 1H), 4.42-4.34 (m, 1H), 3.80 (s, 6H), 3.30-3.25 (d, J=17.2, 1H), 3.06 (s, 3H), 3.00-2.94 (m, 1H), 2.88-2.75 (m, 3H), 2.61-2.57 (d, J=15.6, 1H), 2.45-2.26 ppm (m, 5H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 208.6, 172.4, 170.5, 148.0, 147.2, 129.5, 127.0, 111.3, 108.5, 65.8, 56.0, 55.7, 51.9, 50.5, 44.9, 41.7, 35.4, 34.9, 34.3, 28.2 ppm; **EI MS** (70 eV): *m*/*z* (%): 373 (6) $[M]^+$, 314 (14), 302 (10), 258 (58), 164 (42).

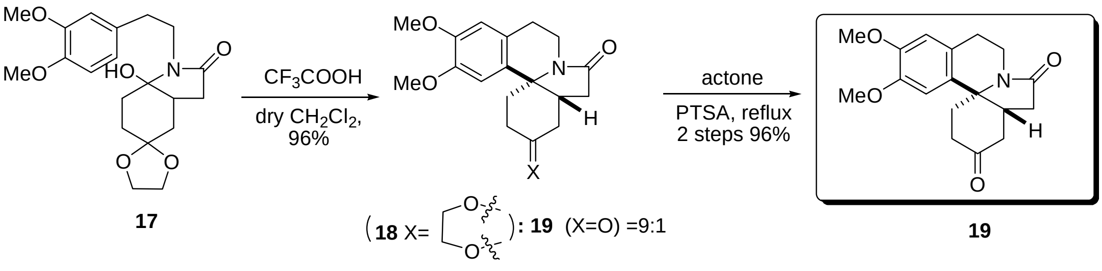
1.5 Synthesis of 17.



To a solution of lithium diisopropylamide (LDA) (1.88 mmol, from diisopropylamine (0.33 mL, 2.36 mmol) and *n*-BuLi (0.94 mL, 2.0 M in hexane, 1.88 mmol)) in THF (20 mL) at –78 ^oC under argon atmosphere was added dropwise a solution of ketone **8** (246 mg, 1.57 mmol) in THF (5 mL). The mixture was stirred at –78 ^oC for 30 min. A solution of **9** (500 mg, 1.43 mmol) in THF (5 mL) was added dropwise over a 3 min interval. The reaction mixture was stirred for an additional 5 min at –78 ^oC and then allowed to warm to room temperature over 30 min. The reaction was quenched by addition of H_2O (25 mL). The aqueous solution was extracted with CH_2Cl_2 (3×20 mL). The combined extracts were dried over Na_2SO_4 and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/actone 4:1 to 1:1) afforded the desired **17** (470 mg, 87%).

^{1}**H NMR** (400 MHz, $CDCl_3$): δ = 6.75-6.64 (m, 3H), 3.98-3.83 (m, 4H), 3.81 (s, 3H), 3.80 (s, 3H), 3.56-3.50 (m, 2H), 3.25-3.18 (m, 1H), 2.90-2.83 (m, 1H), 2.79-2.71 (m, 1H), 2.60-2.54 (m, 1H), 2.32-2.19 (m, 3H), 2.04-1.98 (m, 1H), 1.92-1.83 (m, 2H), 1.70-1.58 (m, 1H), 1.47-1.42 ppm (m, 1H); ^{13}**C NMR** (100 MHz, $CDCl_3$): δ = 174.6, 148.8, 147.5, 131.8, 120.6, 112.1, 111.3, 107.7, 89.5, 64.2, 64.0, 55.8 (2C), 40.9, 40.7, 35.9, 35.0, 34.7, 30.7, 30.3 ppm; **EI MS** (70 eV): *m/z* (%): 359 (13), 273 (15), 253 (12), 208 (30), 164 (100), 151 (97).

1.6—— Synthesis of 18 and 19.



To a solution of **17** (760 mg, 2.01 mmol) in dry CH_2Cl_2 (20 mL) was added CF_3COOH (0.31 mL, 4.02 mmol) at 0 °C under argon atmosphere. After the mixture was stirred for 5 h at room temperature, saturated $NaHCO_3$ (15 mL) was added, and the resulting mixture was extracted with CH_2Cl_2 (30 mL). The combined extracts were washed with saturated $NaHCO_3$ (25×3 mL) and dried over Na_2SO_4, and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/actone 4:1 to 1:1) afforded **18** (623 mg) and **19** (61mg, 96% overall yield).

To a solution of **18** (623 mg, 1.74 mmol) in actone (30 mL) was added cat. PTSA. The mixture was heated to reflux for 3 h. The resulting solution was cooled to room temperature, then the solvent was removed *in vacuo*, the obtained residue was diluted with CH_2Cl_2 (100 mL). The organic layer was washed with saturated aqueous $NaHCO_3$ (25 mL) and dried over Na_2SO_4, and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/actone 1:1) afforded **19** (548 mg, 99%).

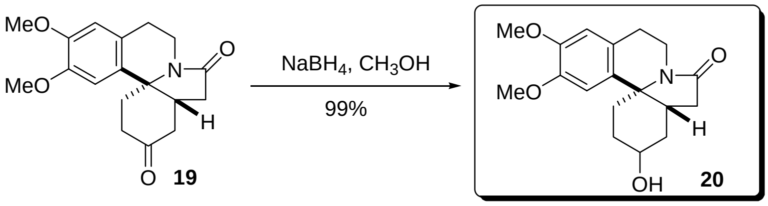
Compound **18**

^{1}**H NMR** (400 MHz, $CDCl_3$): δ = 6.72 (s, 1H), 6.50 (s, 1H), 4.13-4.08 (m, 1H), 3.95-3.86 (m, 4H), 3.82 (s, 3H), 3.80 (s, 3H), 3.16-3.10 (m, 1H), 2.99-2.92 (m, 1H), 2.73-2.70 (m, 1H), 2.59-2.54 (m, 1H), 2.43-2.27 (m, 2H), 2.08-1.92 (m, 3H), 1.82-1.77 (m, 1H), 1.68-1.63 ppm (m, 2H); ^{13}**C NMR** (100 MHz, $CDCl_3$): δ = 174.8, 147.8, 147.3, 123.7, 125.7, 111.7, 107.8, 107.6, 64.2, 63.8, 62.0, 56.0, 37.0, 36.9, 36.5, 34.7, 33.2, 30.2, 26.6 ppm; **EI MS** (70 eV): *m/z* (%): 359 (0.5) $[M]^+$, 258 (1), 245 (6), 216 (4), 164 (4), 101 (100).

Compound **19**

^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.67 (s, 1H), 6.56 (s, 1H), 4.38-4.33 (m, 1H), 3.86 (s, 3H), 3.84 (s, 3H), 3.08-2.96 (m, 4H), 2.74-2.56 (m, 3H), 2.40-2.39 (m, 1H), 2.33-2.22 (m, 3H), 2.15-2.08 ppm (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 209.9, 172.0, 148.4, 148.3, 134.3, 125.5, 111.8, 107.3, 62.4, 56.3, 55.9, 43.2, 37.7, 37.4, 35.2, 34.7, 33.4, 27.5 ppm; **EI MS** (70 eV): *m/z* (%): 315 (0.53) $[M]^+$, 258 (10), 244 (3), 164 (2), 84 (100).

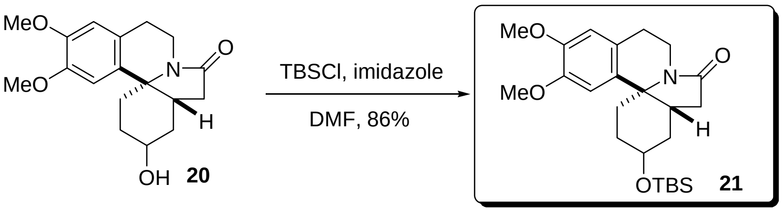
1.7—— Synthesis of 20.



To a solution of **19** (454 mg, 1.44 mmol) in MeOH (20 mL) was added $NaBH_4$ (55 mg, 1.44 mmol) at 0 °C and the mixture was stirred for 30 min, then the solvent was removed *in vacuo*, the obtained residue was diluted with CH_2Cl_2 (50 mL) and saturated aqueous NH_4Cl (30 mL), and the aqueous layer was extracted with CH_2Cl_2 (20 mL). The combined organic layer was dried over anhydrous Na_2SO_4 and concentrated. Purification of the residue through column chromatography on silica gel (petroleum/actone 1:1) afforded **20** (456 mg, 99%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.62 (s, 1H), 6.49 (s, 1H), 4.13-4.08 (m, 1H), 3.92-3.87 (m, 1H), 3.81 (s, 3H), 3.77 (s, 3H), 3.21-3.13 (m, 1H), 3.04-2.96 (m, 1H), 2.66-2.52 (m, 2H), 2.27-2.26 (m, 1H), 2.16-2.09 (m, 2H), 1.81-1.37 ppm (m, 4H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 176.6, 147.8, 147.1, 133.2, 126.1, 111.8, 107.4, 67.2, 62.5, 55.9, 55.6, 38.2, 37.1, 36.7, 34.7, 33.4, 29.6, 26.1 ppm; **EI MS** (70 eV): *m/z* (%): 317 (9) $[M]^+$, 258 (100), 245 (21), 216 (11).

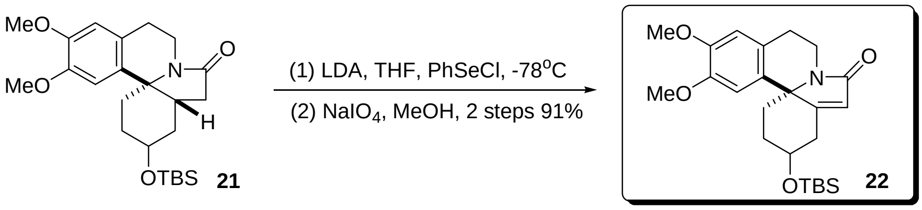
1.8—— Synthesis of 21.



To a solution of **20** (458 mg, 1.44 mmol) in dry DMF (5 mL) was added imidazole (235 mg, 3.46 mmol) and TBSCl (262 mg, 1.73 mmol). The reaction mixture was stirred for 1 h at room temperature, then diluted with EtOAc (100 mL), washed successively with water and brine, dried over anhydrous Na_2SO_4, and evaporated *in vacuo*. Purification of the residue through column chromatography on silica gel (petroleum/actone 5:1) afforded **21** (4534 mg, 86%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.65 (s, 1H), 6.51 (s, 1H), 4.06-3.98 (m, 2H), 3.80 (s, 3H), 3.76 (s, 3H), 3.19-3.15 (m, 1H), 2.96-2.91 (m, 1H), 2.62-2.52 (m, 3H), 2.28-2.26 (m, 1H), 2.11-2.01 (m, 2H), 1.72-1.62 (m, 3H), 1.50-1.48 (m, 1H), 0.82 (s, 9H), 0.014 (s, 3H), 0.004 ppm (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 174.9, 147.7, 147.1, 133.9, 125.9, 111.8, 107.5, 67.2, 61.9, 55.9, 55.6, 37.9, 36.9, 36.0, 34.7, 32.1, 29.6, 26.6, 25.6 (3C), 17.8, -4.9, -5.0 ppm; **EI MS** (70 eV): *m*/*z* (%): 431 (3) $[M]^+$, 416 (1), 374 (15), 258 (100).

1.9—— Synthesis of 22.

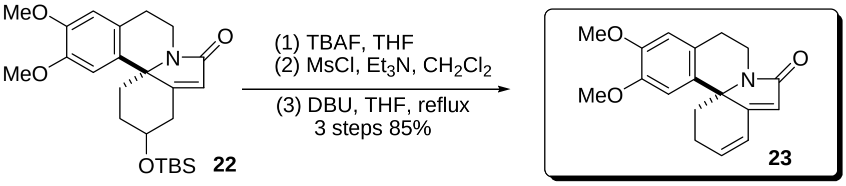


To a solution of lithium diisopropylamide (LDA) (1.86 mmol, from diisopropylamine (0.33 mL, 2.32 mmol) and *n*-BuLi (0.93 mL, 2.0 M in hexane, 1.86 mmol)) in THF (20 mL) at –78 °C under argon atmosphere was added dropwise a solution of ketone **21** (667 mg, 1.55 mmol) in THF (5 mL). The mixture was stirred at –78 °C for 30 min. A solution of PhSeCl (310 mg, 1.62 mmol) in THF (5 mL) was added dropwise over a 1 min interval. The reaction mixture was stirred for an additional 5 min at –78 °C and then allowed to warm to room temperature over 30 min. The reaction was quenched by addition of H_2O (25 mL). The aqueous solution was extracted with CH_2Cl_2 (20 mL). The combined extracts were dried over Na_2SO_4 and concentrated under reduced pressure. The residue was purified by column chromatography and directly used in the next reaction.

To a solution of the above residue in MeOH:H_2O (15:5 mL) was added $NaIO_4$ (2.0 g, 9.3 mmol). The reaction mixture was stirred for 1 h at room temperature, then the solvent was removed *in vacuo*, the obtained residue was diluted with CH_2Cl_2 (50 mL). The organic layer was washed with brine (25 mL) and dried over anhydrous Na_2SO_4 and concentrated. Purification of the residue through column chromatography on silica gel (petroleum/actone 3:1) afforded **22** (604 mg, 91%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.89 (s, 1H), 6.67 (s, 1H), 5.90 (s, 1H), 4.39 (s, 1H), 4.03-3.96 (m, 1H), 3.80 (s, 6H), 3.45-3.39 (m, 1H), 3.00-2.85 (m, 4H), 2.11-1.99 (m, 2H), 1.83-1.80 (m, 1H), 1.68-1.64 (m, 1H), 0.79 (s, 9H), 0.02 (s, 3H), -0.02 ppm (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 169.8, 160.1, 147.9, 146.5, 129.7, 127.0, 123.9, 112.3, 108.9, 67.5, 66.0, 56.1, 55.6, 38.2, 36.2, 35.1, 29.3, 28.0, 25.5, 17.8, -5.0, -5.1 ppm; **EI MS** (70 eV): *m*/*z* (%): 429 (8) $[M]^+$, 414 (2), 372 (20), 297 (100), 258 (30).

1.10—— Synthesis of 23.



To a solution of **22** (604 mg, 1.42 mmol) in THF (10 mL) was added TBAF (445 mg, 1.7

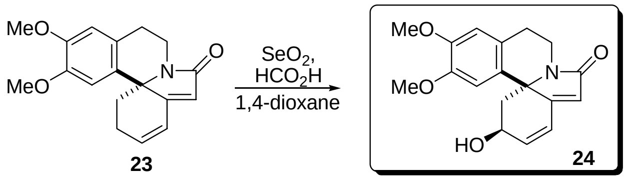
mmol) at room temperature under argon atmosphere. After the mixture was stirred for 5 h at room temperature, saturated brine (10 mL) was added, and the resulting mixture was extracted with CH_2Cl_2 (50 mL). The combined extracts were washed with saturated brine (25×3 mL) and dried over Na_2SO_4, and concentrated under reduced pressure. The residue was directly used in the next reaction.

To a solution of the above residue in dry CH_2Cl_2 (20 mL) was added Et_3N (0.43 mL, 3.06 mmol). The mixture was cooled to 0 ^{o}C, and MsCl (0.12 mL, 1.53mmol) was added. After the mixture was stirred for 1 h, H_2O (20 mL) was added, and the resulting mixture was extracted with CH_2Cl_2 (100 mL). The combined extracts were dried over Na_2SO_4, and concentrated under reduced pressure. The residue was directly used in the next reaction.

To a solution of the above residue in dry THF (20 mL) was added DBU (2.13 mL, 13.3 mmol). The mixture was heated to reflux for 3 h, then H_2O (20 mL) was added, and the resulting mixture was extracted with CH_2Cl_2 (100 mL). The combined extracts were dried over Na_2SO_4, and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/actone 3:1) afforded **23** (356 mg, 85% 3 steps).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.93 (s, 1H), 6.78-6.74 (m, 1H), 6.64 (s, 1H), 6.25-6.21 (m, 1H), 5.81 (s, 1H), 3.98-3.92 (m, 1H), 3.84 (s, 3H), 3.78 (s, 3H), 3.52-3.46 (m, 1H), 2.93-2.90 (m, 2H), 2.36-2.23 (m, 2H), 2.14-2.09 (m, 1H), 1.80-1.76 ppm (m, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 170.9, 157.7, 147.9, 146.6, 135.8, 128.4, 126.0, 123.7, 118.6, 111.8, 108.3, 64.3, 55.7, 55.6, 36.7, 34.7, 26.9, 24.3 ppm; **EI MS** (70 eV): *m/z* (%): 297 (100) $[M]^+$, 282 (16), 268 (22), 254 (20), 238 (7).

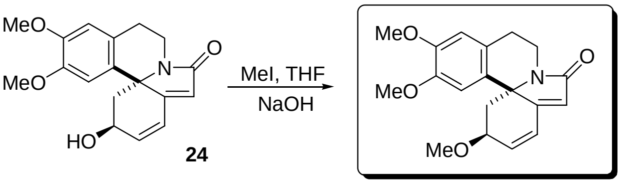
1.11—— Synthesis of 24.



To a solution containing (327mg, 1.1 mmol) of **23** in 5 mL of 1,4-dioxane at room temperature was added (1.22g 11.0 mmol) of selenium dioxide and (506 mg 11.0 mmol) of formic acid. The reaction mixture was heated at reflux for 4 days with stirring. After cooling, 10 mL of a 10 % NaOH solution was added and the mixture was extracted with $CHCl_3$. The combined organic layers were dried over anhydrous Na_2SO4, filtered, and concentrated under reduced pressure. Purification of the residue by column chromatography (petroleum/actone 1:1) provided **24** (86 mg, 31%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.88-6.85 (dd, 1H, *J* = 10.4 and 2.4 Hz), 6.79 (s, 1H), 6.71 (s, 1H), 6.33-6.31 (d, 1H, *J* = 10.0 Hz), 6.01 (s, 1H), 4.32 (brs, 1H), 4.00-3.93 (m, 1H), 3.86 (s, 3H), 3.75 (s, 3H), 3.63-3.57 (m, 1H), 3.10-2.96 (m, 2H), 2.83-2.79 (m, 1H), 2.46 (brs, 1H), 1.72-1.66 ppm (t, *J* = 10.8 Hz 1H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 170.9, 157.3, 148.5, 147.0, 139.6, 128.6, 126.4, 123.3, 120.0, 112.0, 108.2, 66.6, 66.2, 56.0, 55.9, 44.9, 37.3, 26.9 ppm; **EI MS** (70 eV): *m/z* (%):313 (6) $[M]^+$, 294 (3), 284 (4), 270 (2), 142 (13).

1.12—— Synthesis of 2.

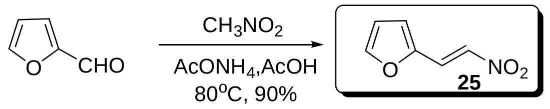


Erysotramidine (**2**)

To a mixture containing (90 mg 0.27 mmol) of **25** in 7 mL of THF and 4 mL of methyl iodide was added (180 mg 3.2 mmol) of NaOH and (170 mg 0.8 mmol) of tetraethylammonium bromide. The reaction mixture was stirred for 36 h at room temperature. The solution was poured into ice-water and the resulting mixture was extracted with $CHCl_3$. The combined organic layers were dried over anhydrous Na_2SO_4, filtered, and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/actone 2:1) afforded (80 mg 91%) of (±)-erysotramidine **2.**

^{1}**H NMR** (400 MHz, $CDCl_3$): δ = 6.91-6.88 (dd, 1H, J = 10.0 and 2.0 Hz), 6.78 (s, 1H), 6.71 (s, 1H), 6.33-6.31 (d, 1H, J = 10.0 Hz), 6.01 (s, 1H), 3.99-3.94 (m, 1H), 3.85 (m, 1H), 3.85 (s, 3H), 3.75 (s, 3H), 3.63-3.57 (m, 1H), 3.33 (s, 3H), 3.10-2.96 (m, 2H), 2.82-2.78 (m, 1H), 1.72-1.66 ppm (m, 1H); ^{13}**C NMR** (100 MHz, $CDCl_3$): δ = 170.8, 157.0, 148.6, 147.0, 136.3, 128.7, 126.5, 124.0, 120.2, 112.3, 108.3, 74.9, 66.3, 56.3, 56.1, 55.9, 41.4, 37.2, 27.0 ppm; **EI MS** (70 eV): m/z (%): 327 (85) $[M]^+$, 312 (57), 297 (18), 296 (68), 295 (36), 294 (100), 284 (15), 266 (48), 252 (24), 238 (14), 224 (15).

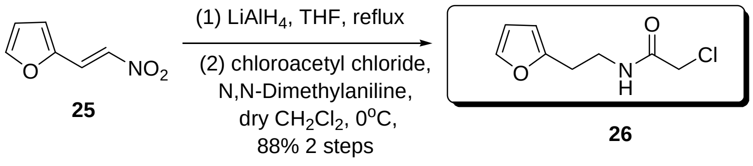
1.13—— Synthesis of 25.



To a solution of Furfural (3.0 g, 31.3 mmol) in AcOH (100 mL) was added CH_3NO_2 (3.4 mL, 62.6 mmol) and $AcONH_4$ (7.2 g, 94.9 mmol). The mixture was heated to 80 °C for 5 h. Then, the resulting red solution was poured into ice water (100 mL). The mixture was filtered and washed with CH_3CH_2OH (100 mL). The obtained yellow solid was further dried and afforded **25** (3.9 g, 90%).

^{1}**H NMR** (400 MHz, $CDCl_3$): δ = 7.78-7.72 (bs, 1H), 7.56 (bs, 1H), 7.51-7.45 (m, 1H), 6.89 (bs, 1H), ppm 6.56-6.54 (bs, 1H); ^{13}**C NMR** (100 MHz, $CDCl_3$): δ = 146.8, 146.4, 134.6, 125.3, 120.1, 113.2 ppm; **EI MS** (70 eV): m/z (%): 139 (42) $[M]^+$, 122(6), 96 (77), 92 (62), 83 (73).

1.14—— Synthesis of 26.

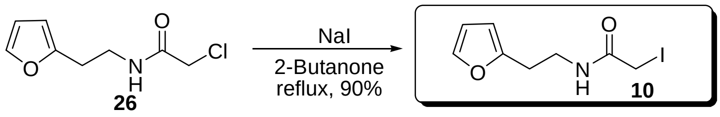


To a solution of $LiAlH_4$ (3.3 g, 86.3 mmol) in dry THF (200 mL) was slowly added at 0 °C **25** (4.0 g, 28.8 mmol) under argon atmosphere over a 30 min interval. The solution was stirred at reflux for an additional 4 h. Then, the reaction mixture was cooled to room temperature and H_2O (20 mL) was slowly added. The obtained residue was filtered, and washed with CH_2Cl_2 (100 mL). The combined organic solution was dried over Na_2SO_4, and concentrated under reduced pressure. The residue was directly used in the next reaction.

To a solution of the above residue in dry CH_2Cl_2 (100 mL) was added N,N-dimethylaniline (5.5 mL, 43.2 mmol). The mixture was cooled to 0 °C and chloroacetyl chloride (2.4 mL, 30.2 mmol) was added. After the mixture was stirred for 1 h, 1 N HCl (50 mL) was added, and the resulting mixture was extracted with CH_2Cl_2 (100 mL). The combined extracts were washed with 1 N HCl (25×3 mL) and dried over Na_2SO_4, and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/EtOAc 4:1 to 1:1) afforded **26** (4.8 g, 88% 2 steps).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.25 (bs, 1H), 7.00 (bs, 1H), 6.22-6.21 (bs, 1H), 6.01-6.00 (bs, 1H), 3.93 (s, 2H), 3.50-3.46 (m, 2H), 2.81-2.78 ppm (t, 2H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 165.9, 152.2, 141.4, 110.1, 106.2, 42.3, 38.9, 27.5 ppm; **EI MS** (70 eV): *m*/*z* (%): 187 (9) $[M]^+$, 186 (64), 108 (30), 106 (15), 97 (26).

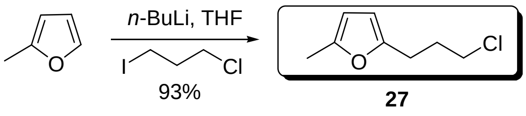
1.15—— Synthesis of 10.



To a solution of **26** (3.8 g, 20.3 mmol) in 2-butanone (50 mL) was added NaI (3.6 g, 24.3 mmol). The mixture was heated to reflux for 2 h. The resulting red solution was cooled to room temperature, then the solvent was removed *in vacuo*, the obtained residue was diluted with CH_2Cl_2 (200 mL). The organic layer was washed with saturated aqueous $Na_2S_2O_3$ (25×3 mL) and dried over Na_2SO_4, and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/EtOAc 1:1) afforded **10** (5.1 g, 90%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.27-7.25 (m, 1H), 7.17 (bs, 1H), 6.24-6.23 (bs, 1H), 6.04-6.03 (bs, 1H), 3.64 (s, 2H), 3.49-3.44 (t, 2H), 2.83-2.80 ppm (t, 2H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 167.8, 152.4, 141.3, 110.1, 106.2, 38.7, 27.4, -0.43 ppm; **EI MS** (70 eV): *m*/*z* (%): 279 (3) $[M]^+$, 169 (7), 141 (9), 127(1), 94 (100).

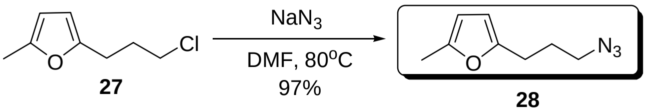
1.16—— Synthesis of 27.



A solution of *n*-BuLi (36.6 mL, 73.2 mmol, 2.0 M in hexane) was added at –78 °C over 15 min to a solution of 2-methyl furan (5 g, 61 mmol) in dry THF (100 mL), and then the mixture was stirred for 0.5 h at –78 °C. A solution of 1-chloro-3-iodopropane (6.23 mL, 58 mmol) in THF (15 mL) was added dropwise over a 10 min interval. The reaction mixture was stirred for an additional 30 min at –78 °C and then allowed to warm to room temperature over 30 min. The reaction was quenched by addition of H_2O (100 mL). The aqueous solution was extracted with Et_2O (50×3 mL). The combined extracts were washed with saturated brine (25×3 mL) and dried over Na_2SO_4 and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/EtOAc 40:1) afforded **27** (9.0 g, 93%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 5.88 (bs, 1H), 5.83 (bs, 1H), 3.55-3.52 (m, 2H), 2.74-2.71 (t, J=7.6, 2H), 2.23 (s, 3H), 2.08-2.04 ppm (m, 2H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 152.3, 150.5, 106.1, 105.8, 44.0, 30.9, 25.1, 13.4 ppm; **EI MS** (70 eV): *m*/*z* (%): 158 (1) $[M]^+$, 108 (5), 95 (100).

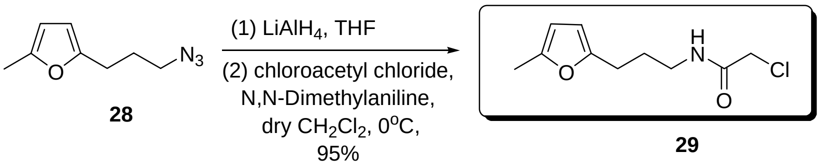
1.17—— Synthesis of 28.



To a solution of **27** (8.24 g, 52 mmol) in DMF (20 mL) was added NaN_3 (10 g, 156 mmol). The mixture was heated to 75 °C for 2 h. The resulting solution was cooled to room temperature and diluted with Et_2O (200 mL). The organic layer was washed successively with saturated brine and dried over Na_2SO_4, and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/EtOAc 20:1) afforded **28** (8.3 g, 97%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 5.89 (bs, 1H), 5.83 (bs, 1H), 3.30-3.26 (m, 2H), 2.67-2.63 (t, J=6.8, 2H), 2.23 (s, 3H), 1.90-1.86 ppm (m, 2H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 152.4, 150.4, 105.9, 105.7, 50.4, 27.3, 24.9, 13.2 ppm; **EI MS** (70 eV): *m*/*z* (%): 137 (22), 122 (43), 109 (100), 95 (66).

1.18—— Synthesis of 29.

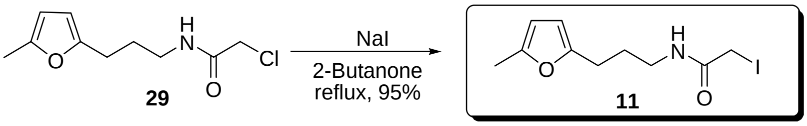


To a solution of $LiAlH_4$ (4.6 g, 121.5 mmol) in dry THF (200 mL) was slowly added at 0 °C **28** (8.0 g, 48.5 mmol) under argon atmosphere over a 30 min interval. The solution was stirred at room temperature for an additional 1 h. Then, the reaction mixture was cooled to 0 °C again and H_2O (20 mL) was slowly added. The obtained residue was filtered, and washed with CH_2Cl_2 (100 mL). The combined organic solution was dried over Na_2SO_4, and concentrated under reduced pressure. The residue was directly used in the next reaction.

To a solution of the above residue in dry CH_2Cl_2 (100 mL) was added N,N-dimethylaniline (9.22 mL, 72.8 mmol). The mixture was cooled to 0 ^{o}C, and chloroacetyl chloride (4.0 mL, 50.9 mmol) was added. After the mixture was stirred for 1 h, 1 N HCl (50 mL) was added, and the resulting mixture was extracted with CH_2Cl_2 (100 mL). The combined extracts were washed with 1 N HCl (25×3 mL) and dried over Na_2SO_4, and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/EtOAc 4:1 to 1:1) afforded **29** (9.9 g, 95% 2 steps).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.96 (bs, 1H), 5.80 (bs, 1H), 5.76 (bs, 1H), 3.94 (s, 2H), 3.28-3.24 (m, 2H), 2.56-2.53 (t, *J*=7.2 Hz, 2H), 2.16 (s, 3H), 1.83-1.77 ppm (m, 2H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 165.8, 152.5, 150.1, 105.6, 42.3, 39.0, 27.3, 25.0, 13.1 ppm; **EI MS** (70 eV): *m/z* (%): 215 (23) $[M]^+$, 138 (11), 122 (75), 107 (48), 95 (100).

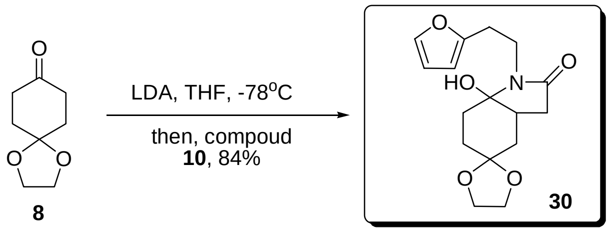
1.19 Synthesis of 11.



To a solution of **29** (10 g, 46.4 mmol) in 2-butanone (50 mL) was added NaI (8.4 g, 55.7 mmol). The mixture was heated to reflux for 2 h. The resulting red solution was cooled to room temperature, then the solvent was removed *in vacuo*, the obtained residue was diluted with CH_2Cl_2 (200 mL). The organic layer was washed with saturated aqueous $Na_2S_2O_3$ (25×3 mL) and dried over Na_2SO_4, and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/EtOAc 1:1) afforded **11** (13.9 g, 98%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.36 (bs, 1H), 5.83 (bs, 1H), 5.79 (bs, 1H), 3.69 (s, 2H), 3.28-3.23 (m, 2H), 2.61-2.57 (t, *J*=7.6 Hz, 2H), 2.19 (s, 3H), 1.84-1.80 ppm (m, 2H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 168.0, 152.8, 150.1, 105.7, 39.6, 27.4, 25.1, 13.4, -0.3 ppm; **EI MS** (70 eV): *m/z* (%): 307 (3) $[M]^+$, 180 (42), 169 (10), 141 (19), 95 (47), 72 (100).

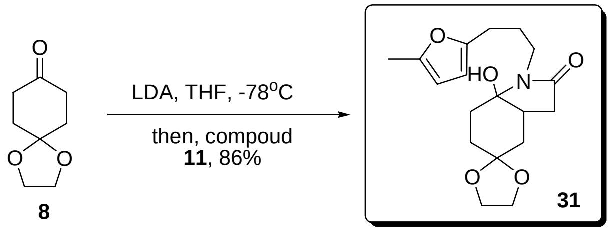
1.20 Synthesis of 30.



To a solution of lithium diisopropylamide (LDA) (1.3 mmol, from diisopropylamine (0.21 mL, 1.5 mmol) and *n*-BuLi (0.65 mL, 2.0 M in hexane, 1.3 mmol)) in THF (50 mL) at –78 ^{o}C under argon atmosphere was added dropwise a solution of ketone **8** (156 mg, 1.0 mmol) in THF (8 mL). The mixture was stirred at –78 ^{o}C for 30 min. A solution of **10** (251 mg, 0.9 mmol) in THF (10 mL) was added dropwise over a 3 min interval. The reaction mixture was stirred for an additional 5 min at –78 °C and then allowed to warm to room temperature over 30 min. The reaction was quenched by addition of H_2O (25 mL). The aqueous solution was extracted with CH_2Cl_2 (3×20 mL). The combined extracts were dried over Na_2SO_4 and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/actone 4:1 to 1:1) afforded the desired **30** (232 mg, 84%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.26 (bs, 1H), 6.23-6.22 (bs, 1H), 6.02-6.01 (bs, 1H), 3.87 (s, 4H), 3.63-3.54 (m, 1H), 3.35-3.25 (m, 1H), 2.97-2.80 (m, 2H), 2.80-2.53 (m, 1H), 2.35-2.28 (m, 1H), 2.22-2.15 (m, 1H), 2.04-1.98 (m, 1H), 1.88-1.82 (m, 2H), 1.69-1.66 (m, 1H), 1.46-1.39 ppm (m, 2H); **^{13}C NMR** (100 MHz, $CDCl_3$): δ = 174.9, 153.0, 141.2, 110.1, 107.7, 106.1, 89.6, 64.2, 64.0, 40.7, 37.6, 35.9, 35.6, 30.6, 30.3, 27.5 ppm; **EI MS** (70 eV): *m*/*z* (%): 307 (2) $[M]^+$, 289 (11), 226 (4), 208 (11), 203 (8), 197 (15), 122 (33), 94 (100).

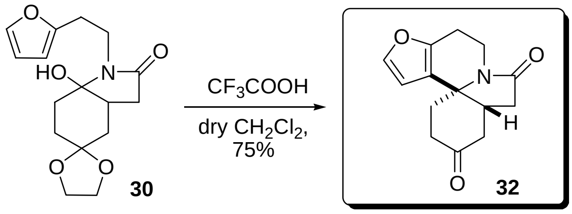
1.21 Synthesis of 31.



To a solution of lithium diisopropylamide (LDA) (5.0 mmol, from diisopropylamine (0.9 mL, 6.2 mmol) and *n*-BuLi (2.5 mL, 2.0 M in hexane, 5.0 mmol)) in THF (50 mL) at –78 °C under argon atmosphere was added dropwise a solution of ketone **8** (610 mg, 3.9 mmol) in THF (8 mL). The mixture was stirred at –78 °C for 30 min. A solution of **11** (1.1 g, 3.5 mmol) in THF (10 mL) was added dropwise over a 3 min interval. The reaction mixture was stirred for an additional 5 min at –78 °C and then allowed to warm to room temperature over 30 min. The reaction was quenched by addition of H_2O (25 mL). The aqueous solution was extracted with CH_2Cl_2 (3×20 mL). The combined extracts were dried over Na_2SO_4 and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/actone 4:1 to 1:1) afforded the desired **31** (1.0 g, 86%).

^{1}H NMR (400 MHz, CD_3COCD_3): δ = 5.92 (bs, 1H), 5.86 (bs, 1H), 5.14 (s, 1H), 3.89 (s, 4H), 3.39-3.32 (m, 1H), 3.20-3.14 (m, 1H), 2.61-2.55 (m, 3H), 2.39-2.36 (m, 1H), 2.19 (s, 3H), 2.11-1.81 (m, 6H), 1.72-1.65 (m, 1H), 1.54-1.48 (m, 1H), 1.41-1.35 ppm (m, 1H); **^{13}C NMR** (100 MHz, CD_3COCD_3): δ = 174.7, 153.9, 150.1, 107.9, 106.2, 105.7, 89.6, 64.3, 64.2, 40.6, 38.3, 36.7, 36.1, 31.0, 30.9, 28.1, 25.8, 13.0 ppm; **EI MS** (70 eV): *m*/*z* (%): 335 (0.1) $[M]^+$, 317 (16), 231 (14), 209 (11), 123 (85), 95 (100).

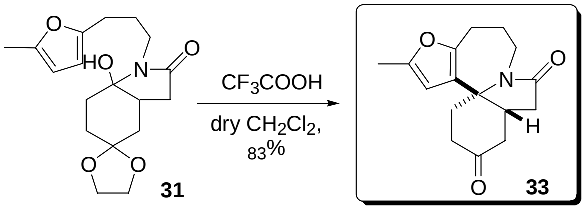
1.22 Synthesis of 32.



To a solution of **30** (100 mg, 0.32 mmol) in dry CH_2Cl_2 (5 mL) was added CF_3COOH (0.05 mL, 0.65 mmol) at 0 °C under argon atmosphere. After the mixture was stirred for 24 h at room temperature, saturated $NaHCO_3$ (5 mL) was added, and the resulting mixture was extracted with CH_2Cl_2 (30 mL). The combined extracts were washed with saturated $NaHCO_3$ (5×8 mL) and dried over Na_2SO_4, and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/actone 4:1 to 1:1) afforded **32** (59 mg 75%).

^{1}**H NMR** (400 MHz, $CDCl_3$): δ = 7.32 (bs, 1H), 6.28 (bs, 1H), 4.51-4.46 (m, 1H), 3.08-3.01 (m, 1H), 2.88-2.79 (m, 3H), 2.72-2.61 (m, 2H), 2.55-2.40 (m, 2H), 2.35-2.27 (m, 1H), 2.21-2.14 ppm (m, 3H); ^{13}**C NMR** (100 MHz, $CDCl_3$): δ = 208.9, 172.3, 147.3, 142.3, 123.4, 106.0, 60.7, 41.8, 37.6, 36.8, 35.3, 34.2, 31.9, 23.1 ppm; **EI MS** (70 eV): *m*/*z* (%): 245 (7) $[M]^+$, 195 (3), 188 (100), 174 (31), 160 (18), 146 (10).

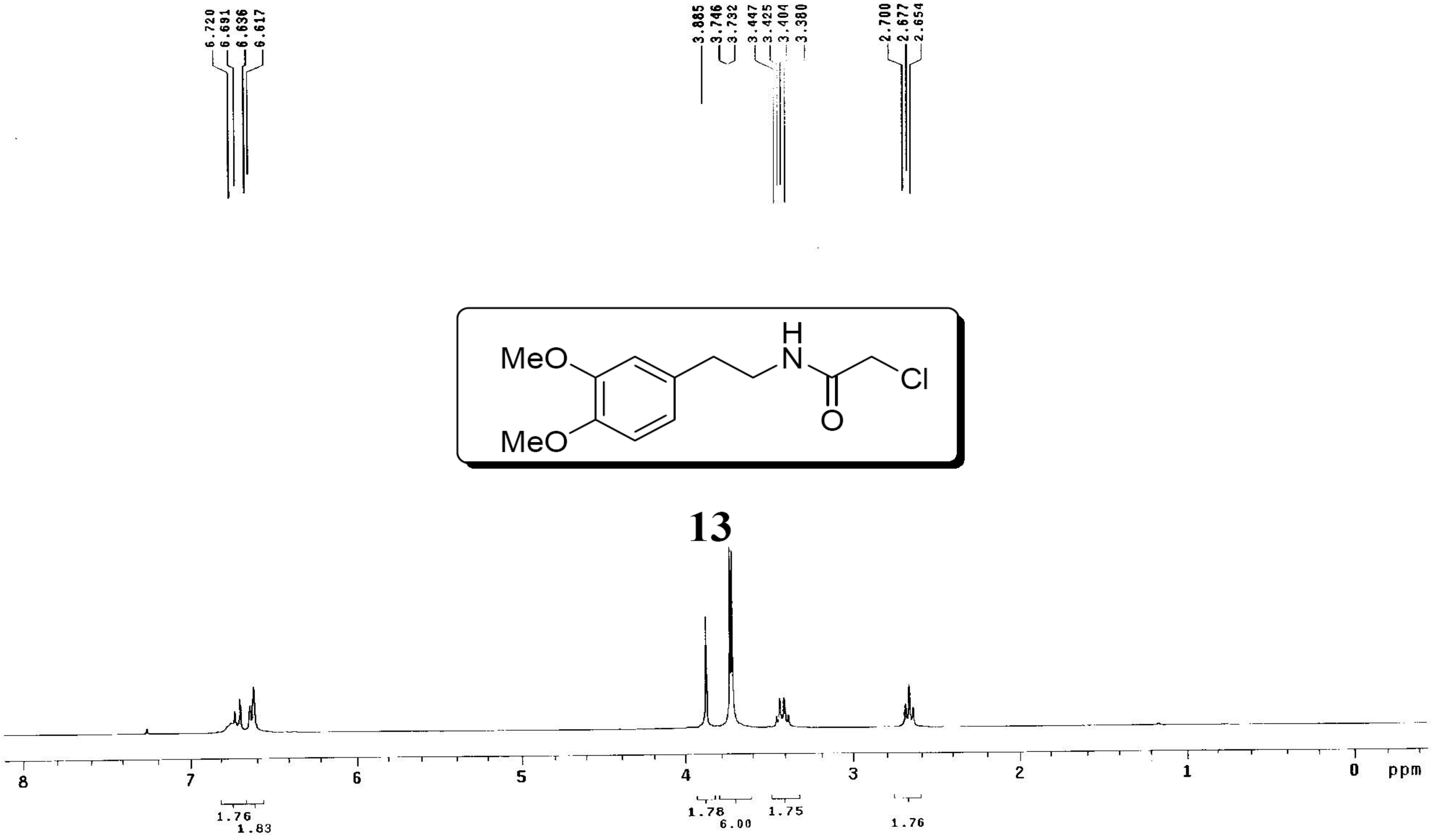
1.23—— Synthesis of 33.



To a solution of **31** (500 mg, 1.5 mmol) in dry CH_2Cl_2 (15 mL) was added CF_3COOH (0.23 mL, 3.0 mmol) at 0 °C under argon atmosphere. After the mixture was stirred for 24 h at room temperature, saturated $NaHCO_3$ (15 mL) was added, and the resulting mixture was extracted with CH_2Cl_2 (30 mL). The combined extracts were washed with saturated $NaHCO_3$ (10×3 mL) and dried over Na_2SO_4, and concentrated under reduced pressure. Purification of the residue through column chromatography on silica gel (petroleum/actone 4:1 to 1:1) afforded **33** (338 mg, 83%).

^{1}**H NMR** (400 MHz, $CDCl_3$): δ = 5.77 (s, 1H), 4.28-4.22 (m, 1H), 2.92-2.57 (m, 6H), 2.36-2.17 (m, 5H), 2.14 (s, 3H), 2.00-1.94 (m, 1H), 1.86-1.81 ppm (m, 2H); ^{13}**C NMR** (100 MHz, $CDCl_3$): δ = 209.9, 172.9, 149.8, 148.6, 126.2, 104.5, 62.2, 42.8, 39.5, 36.8, 36.7, 34.9, 31.7, 26.4, 25.0, 13.2 ppm; **EI MS** (70 eV): *m*/*z* (%): 273 (13) $[M]^+$, 216 (100), 202 (53), 188 (16).

3. Copies of NMR Spectra of the Products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2.654
MeO
MeO
H
N
O
Cl
8
7
6
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1
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ppm
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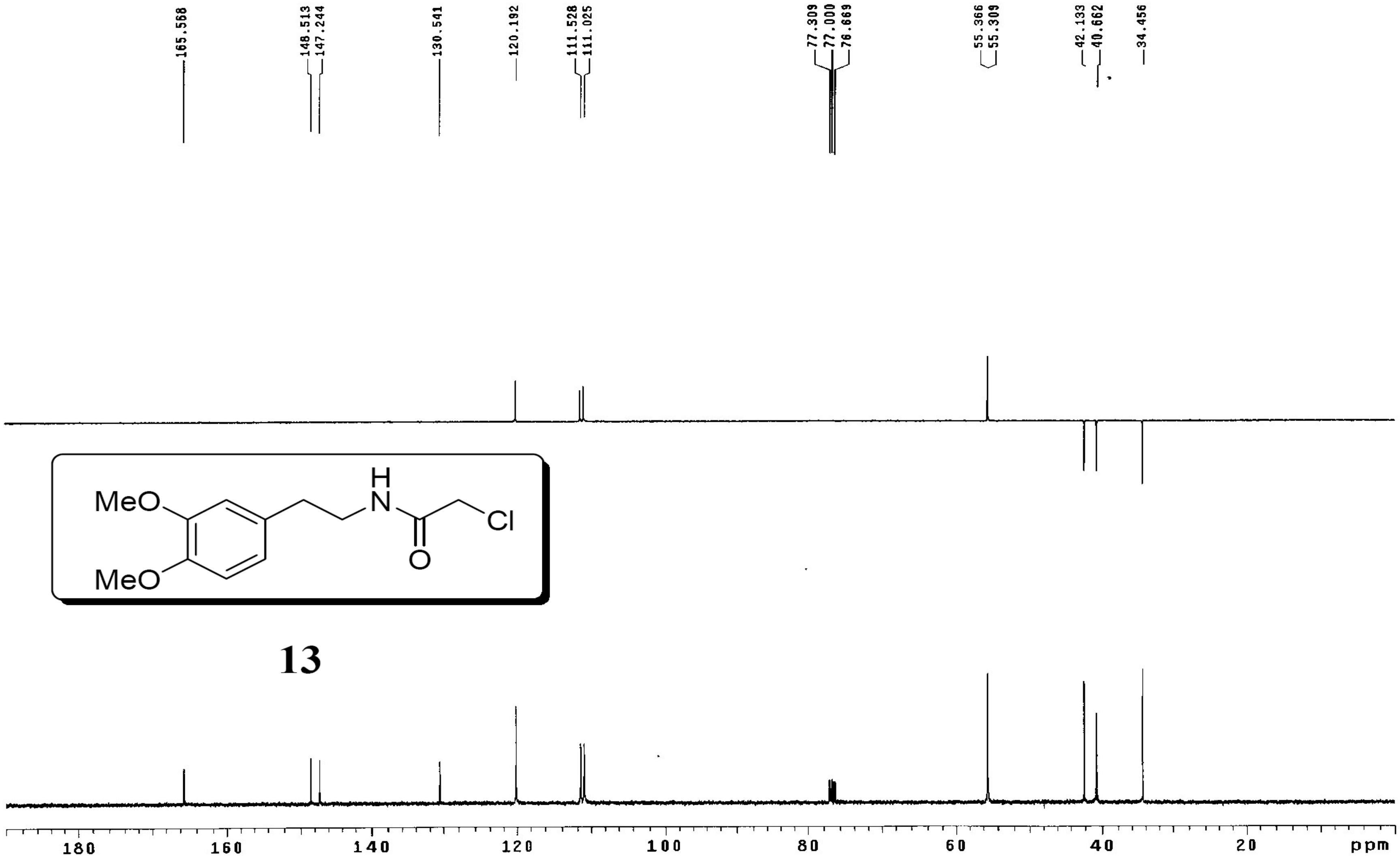
6.00
1.75
1.76

13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40.662
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N
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Cl
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120
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60
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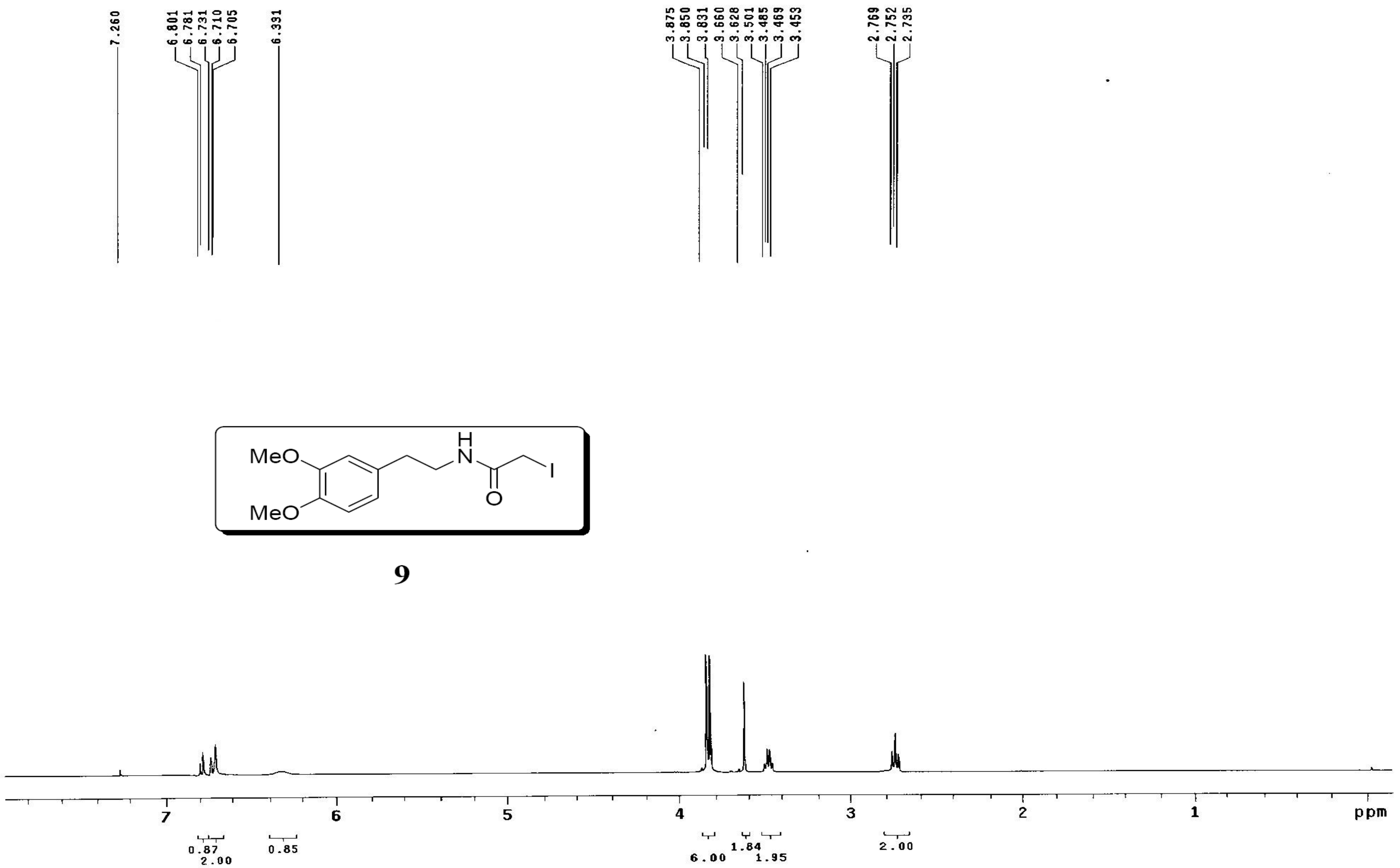
20
ppm

13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2.769
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2.735
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MeO
H
N
O
I
7
6
5
4
3
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1
ppm
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0.85
6.00
1.84
1.95
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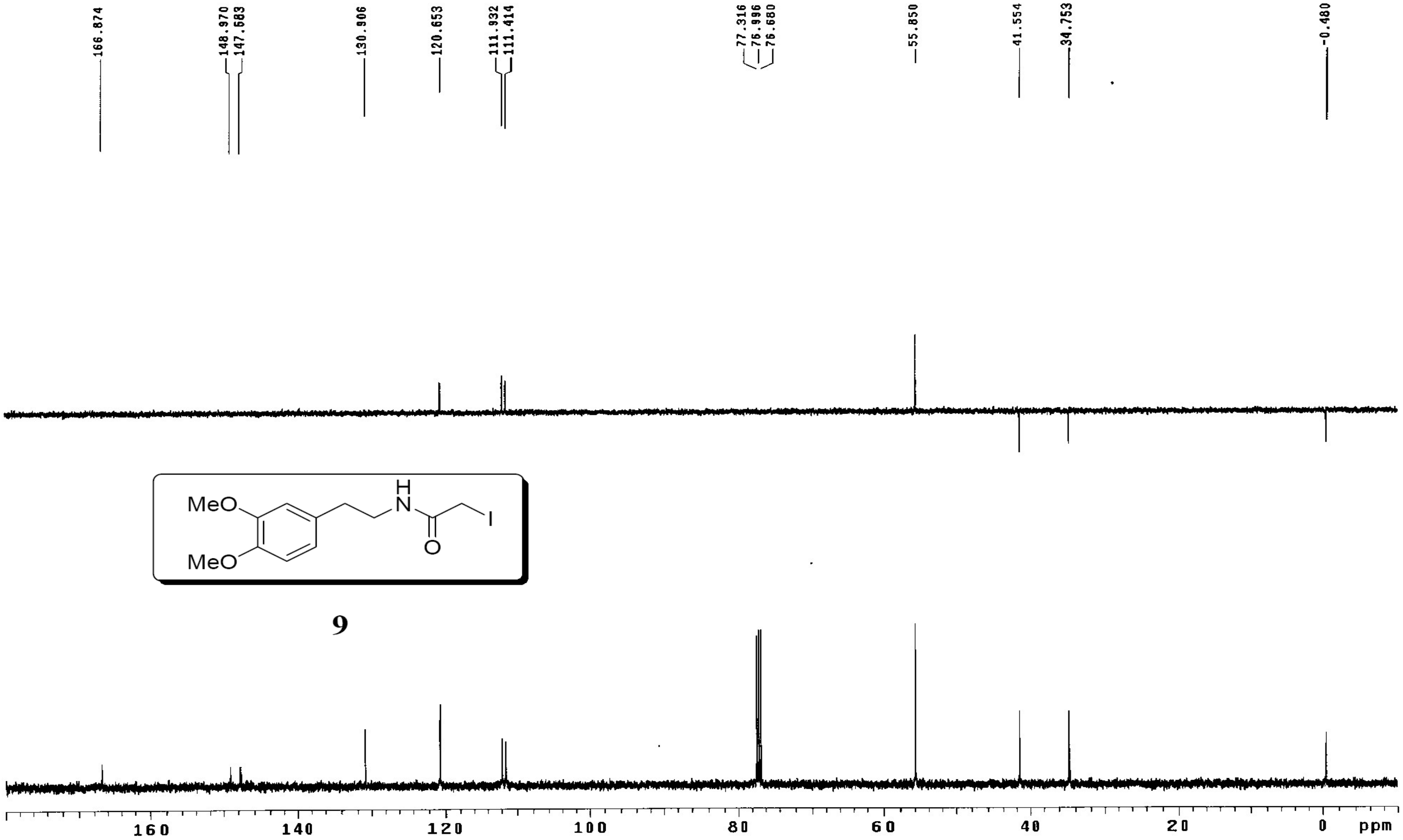
9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34.753
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MeO
H
N
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20
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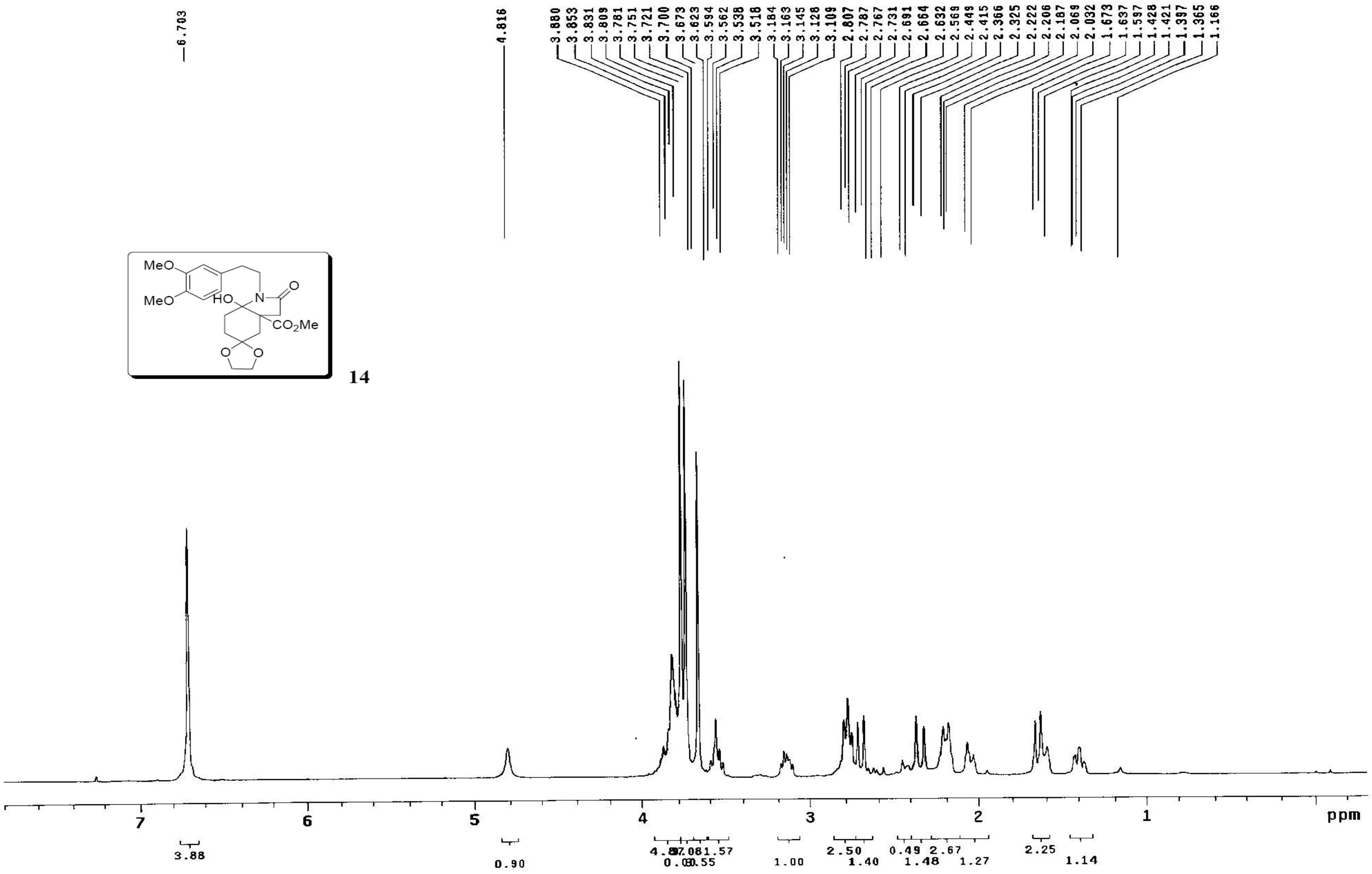
ppm

9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3.594
3.562
3.538
3.518
3.184
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3.145
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2.569
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2.366
2.325
2.222
2.206
2.187
2.069
2.032
1.673
1.637
1.597
1.428
1.421
1.397
1.365
1.166
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MeO
HO
N
O
CO_2Me
O
O
14
7
6
5
4
3
2
1
ppm
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4.87
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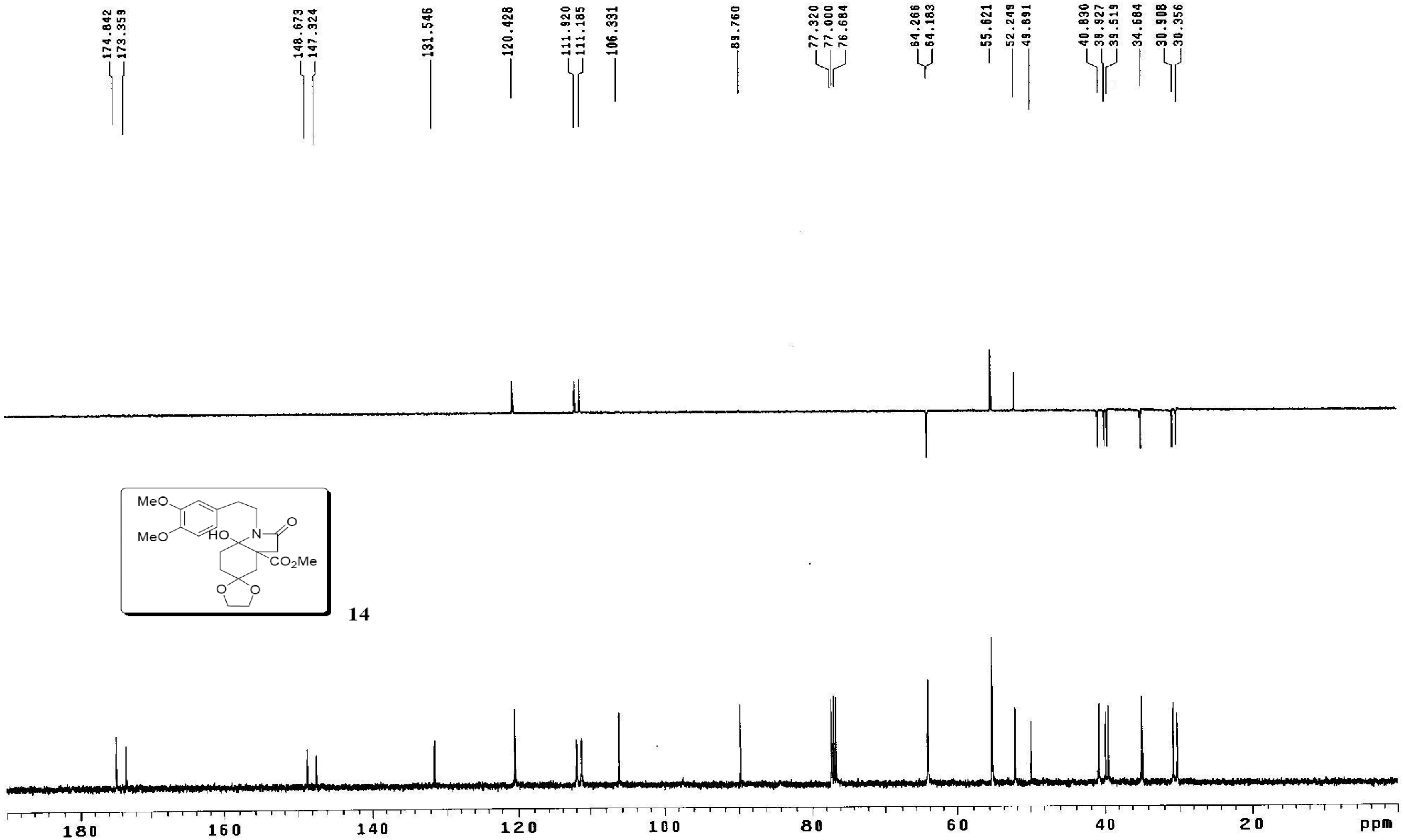
2.25
1.14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64.183
55.621
52.249
49.891
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34.684
30.908
30.356
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O
CO_2Me
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40
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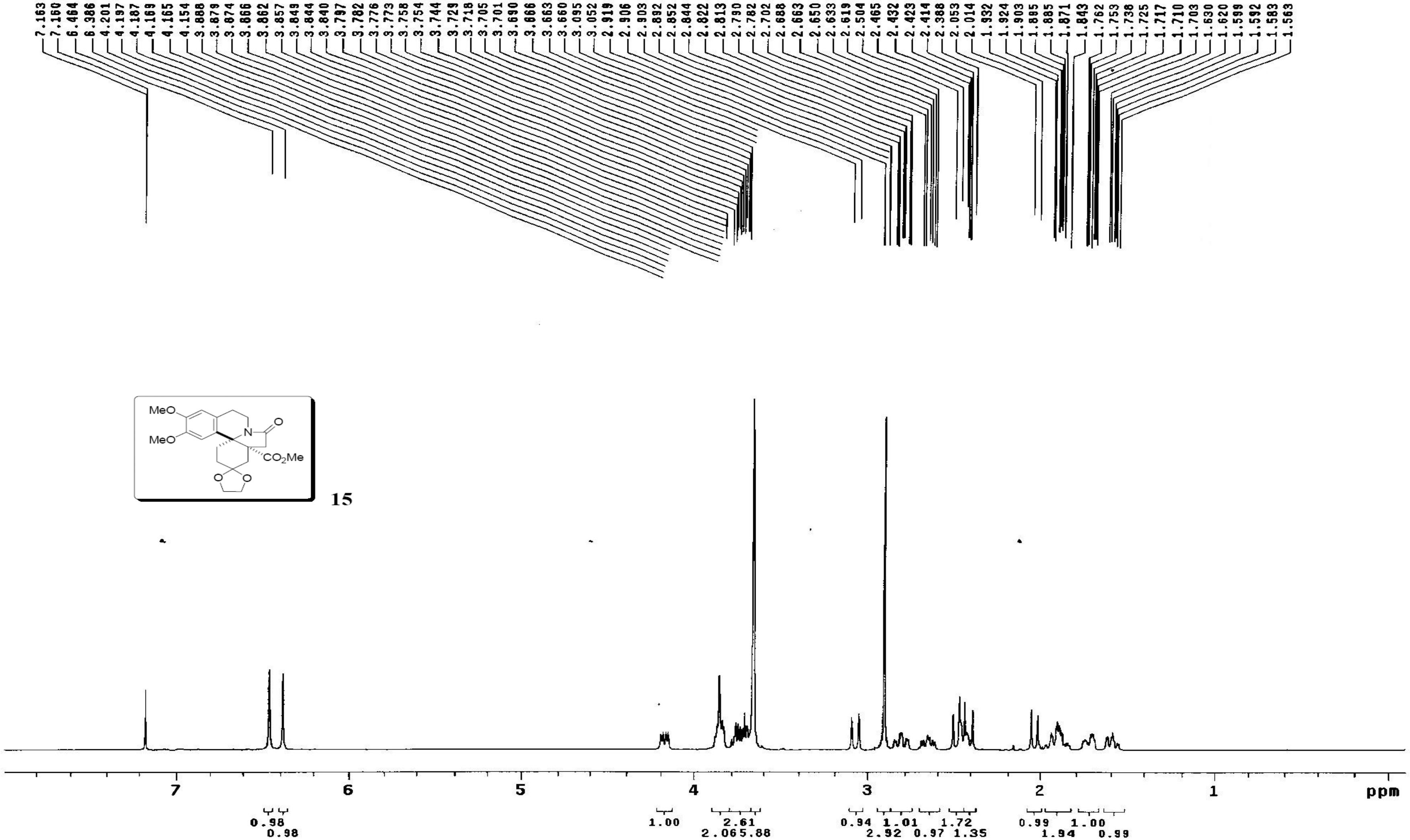
ppm

14



15

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3.095
3.052
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2.822
2.813
2.790
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2.702
2.688
2.663
2.650
2.633
2.619
2.504
2.465
2.432
2.423
2.414
2.388
2.053
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1.932
1.924
1.903
1.895
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1.843
1.762
1.753
1.738
1.725
1.717
1.710
1.703
1.630
1.620
1.599
1.592
1.583
1.563
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MeO
N
O
CO2Me
O
O
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6
5
4
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1
ppm
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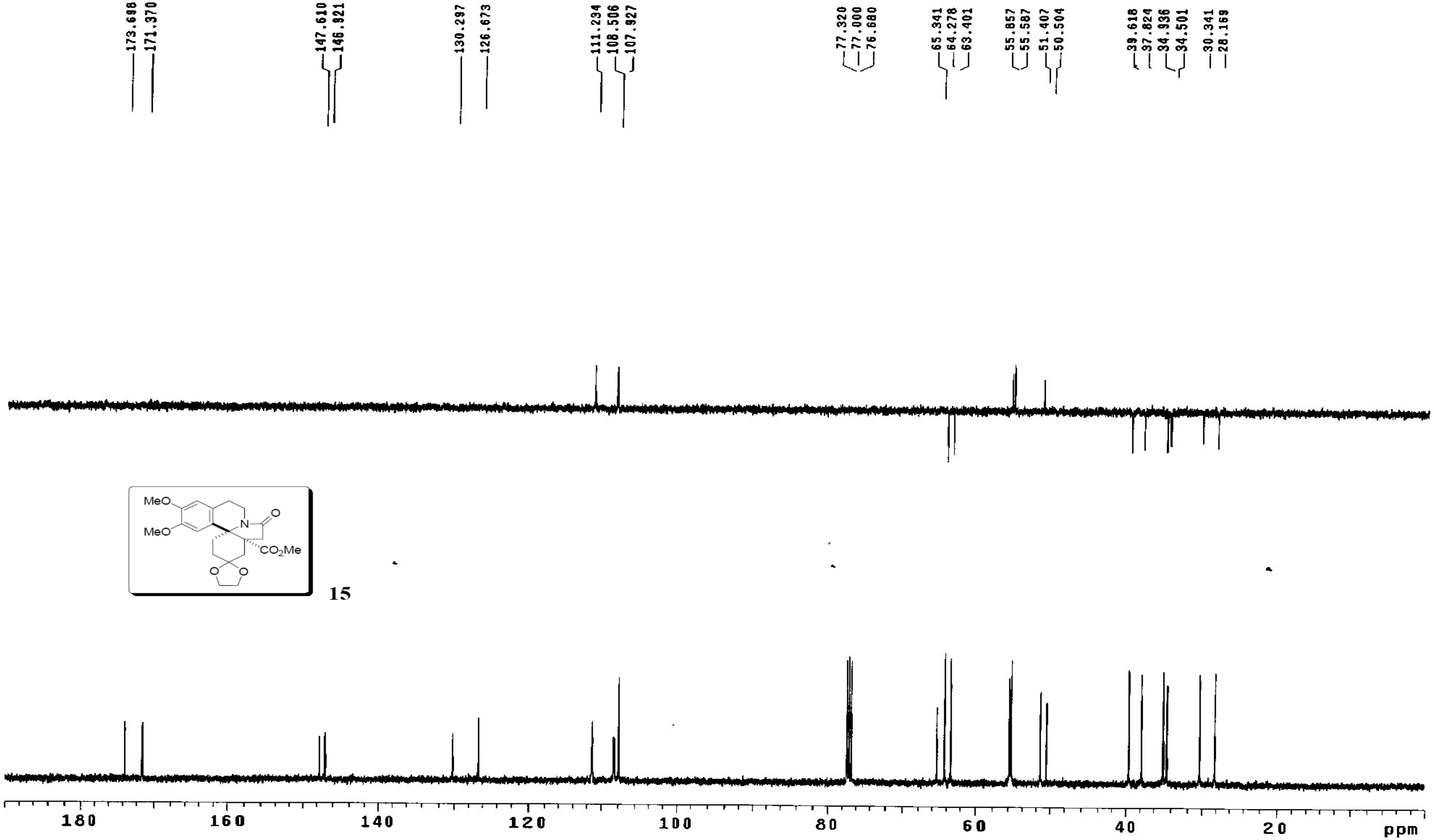
0.99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64.278
63.401
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51.407
50.504
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37.824
34.936
34.501
30.341
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CO2Me
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40
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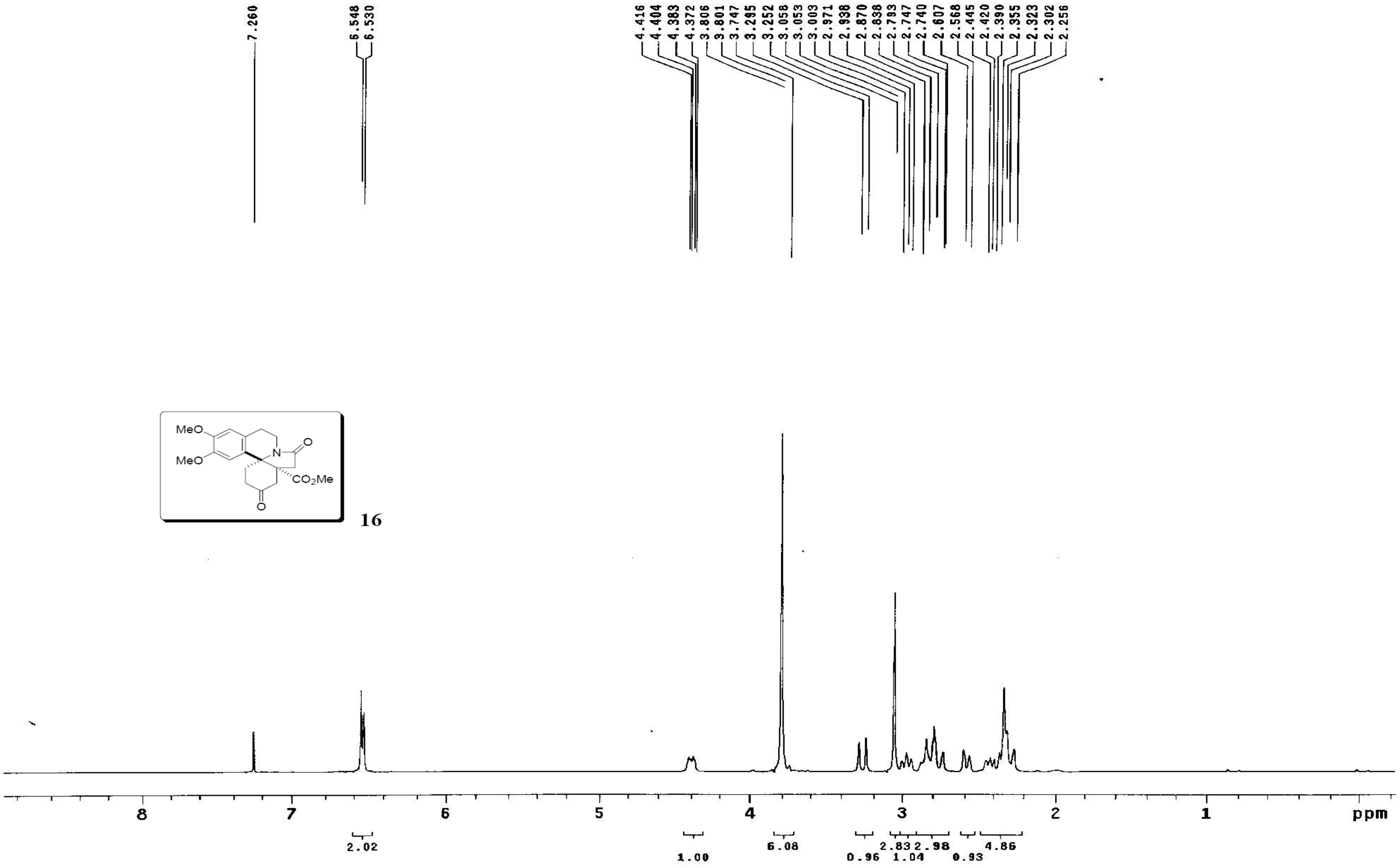
ppm

15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3.053
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2.938
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2.793
2.747
2.740
2.607
2.568
2.445
2.420
2.390
2.355
2.323
2.302
2.256
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MeO
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O
CO2Me
O
8
7
6
5
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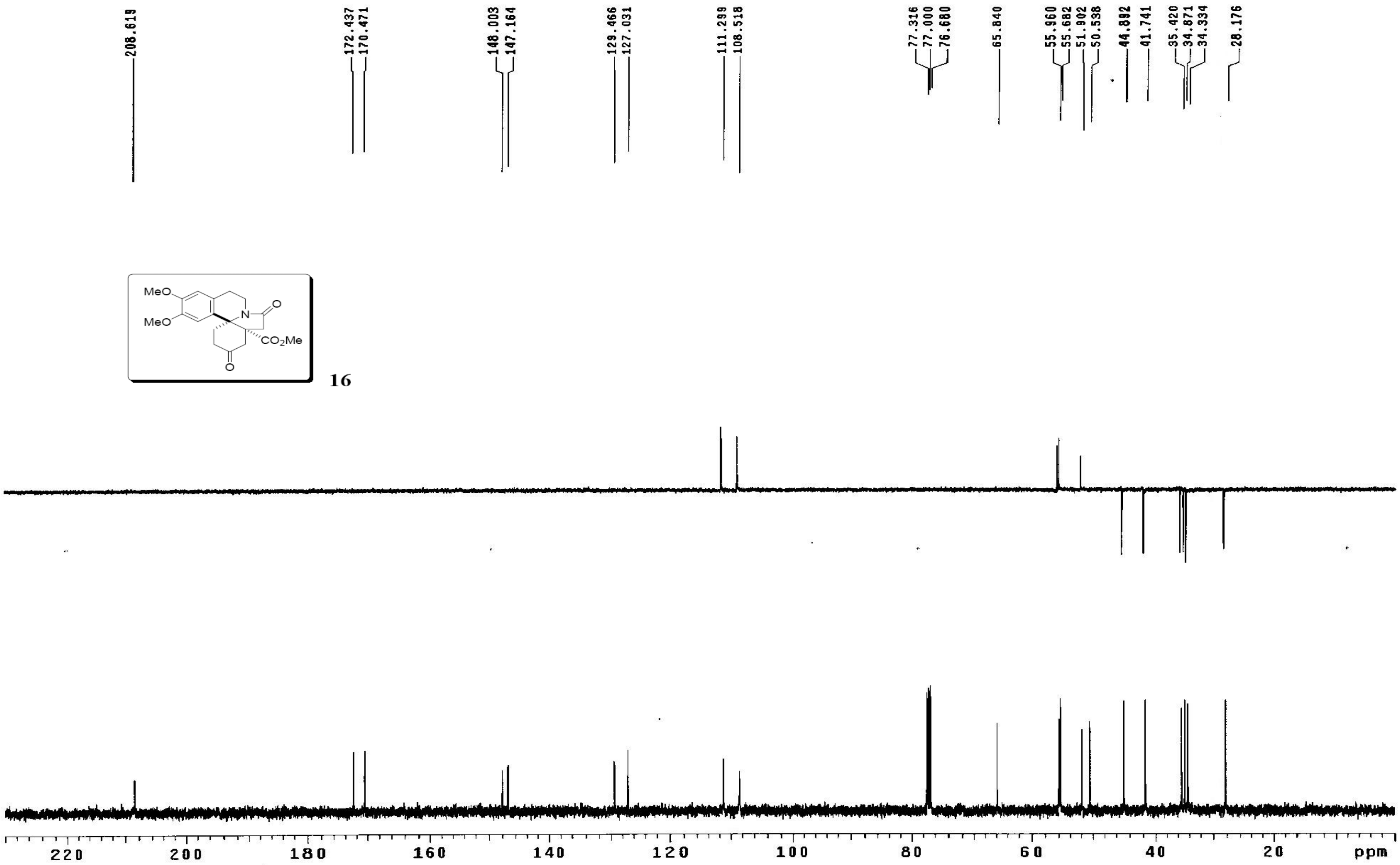
16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65.840
55.960
55.682
51.902
50.538
44.892
41.741
35.420
34.871
34.334
28.176
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MeO
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O
CO$_2$Me
O
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200
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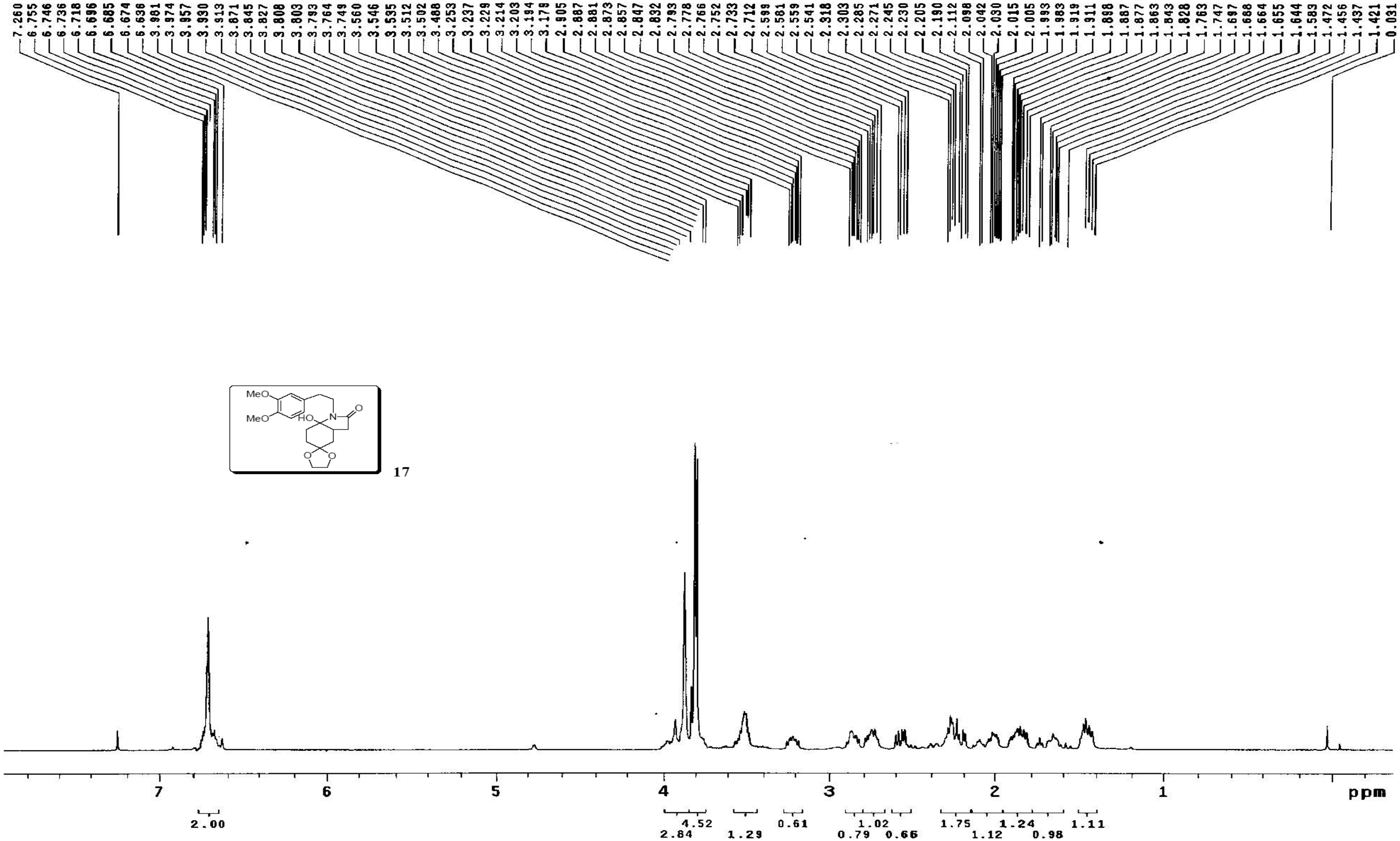
160
140
120
100
80
60
40
20
ppm

16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3.913
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3.845
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3.502
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2.873
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2.847
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2.793
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2.712
2.599
2.581
2.559
2.541
2.318
2.303
2.285
2.271
2.245
2.230
2.205
2.190
2.112
2.098
2.042
2.030
2.015
2.005
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1.911
1.898
1.887
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1.863
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1.828
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1.747
1.697
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1.664
1.655
1.644
1.583
1.472
1.456
1.437
1.421
0.031
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MeO
HO
N
O
O
O
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7
6
5
4
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2
1
ppm
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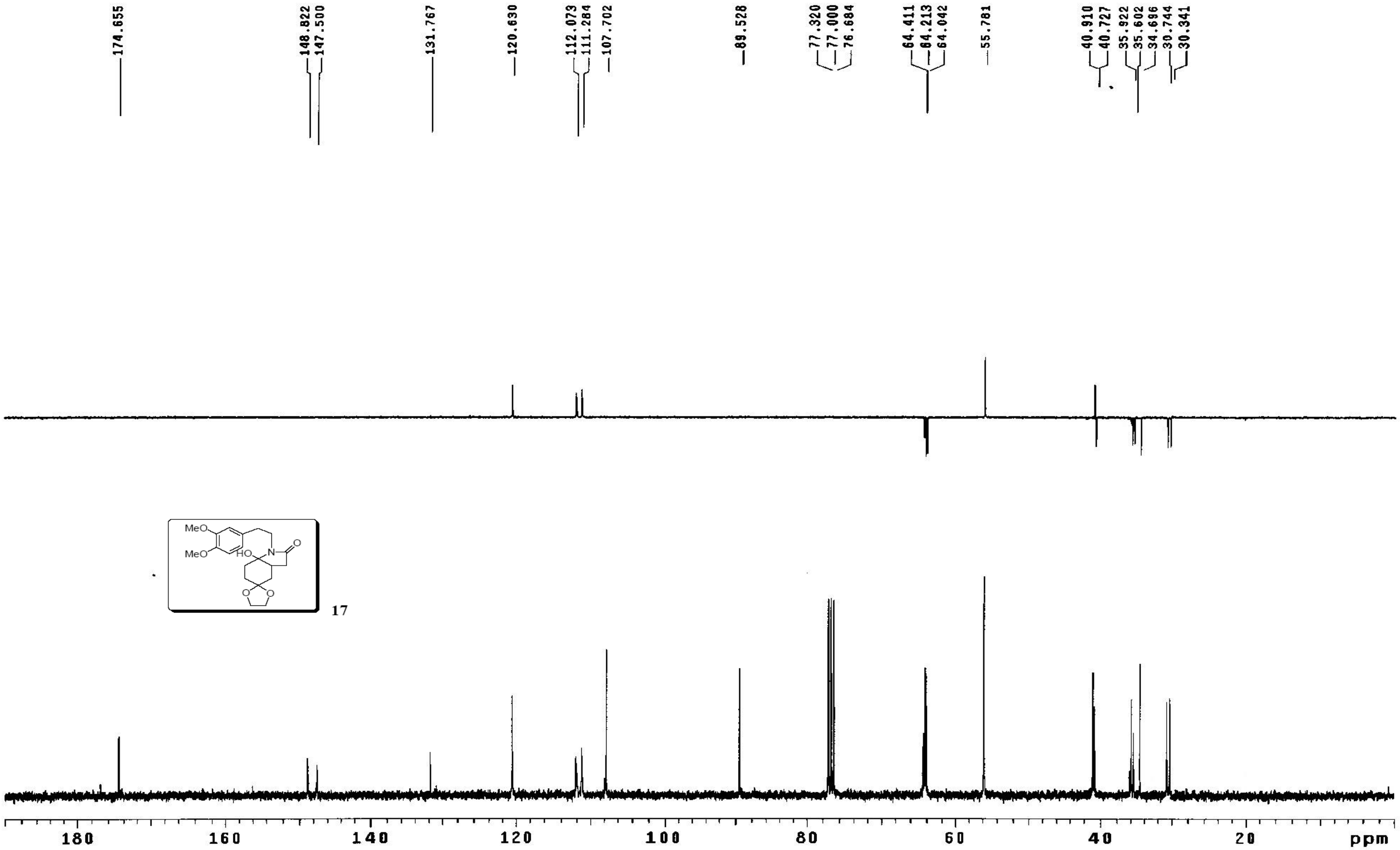
1.11

174.655
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64.213
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40.910
40.727
35.922
35.602
34.696
30.744
30.341
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MeO
HO
N
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O
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120
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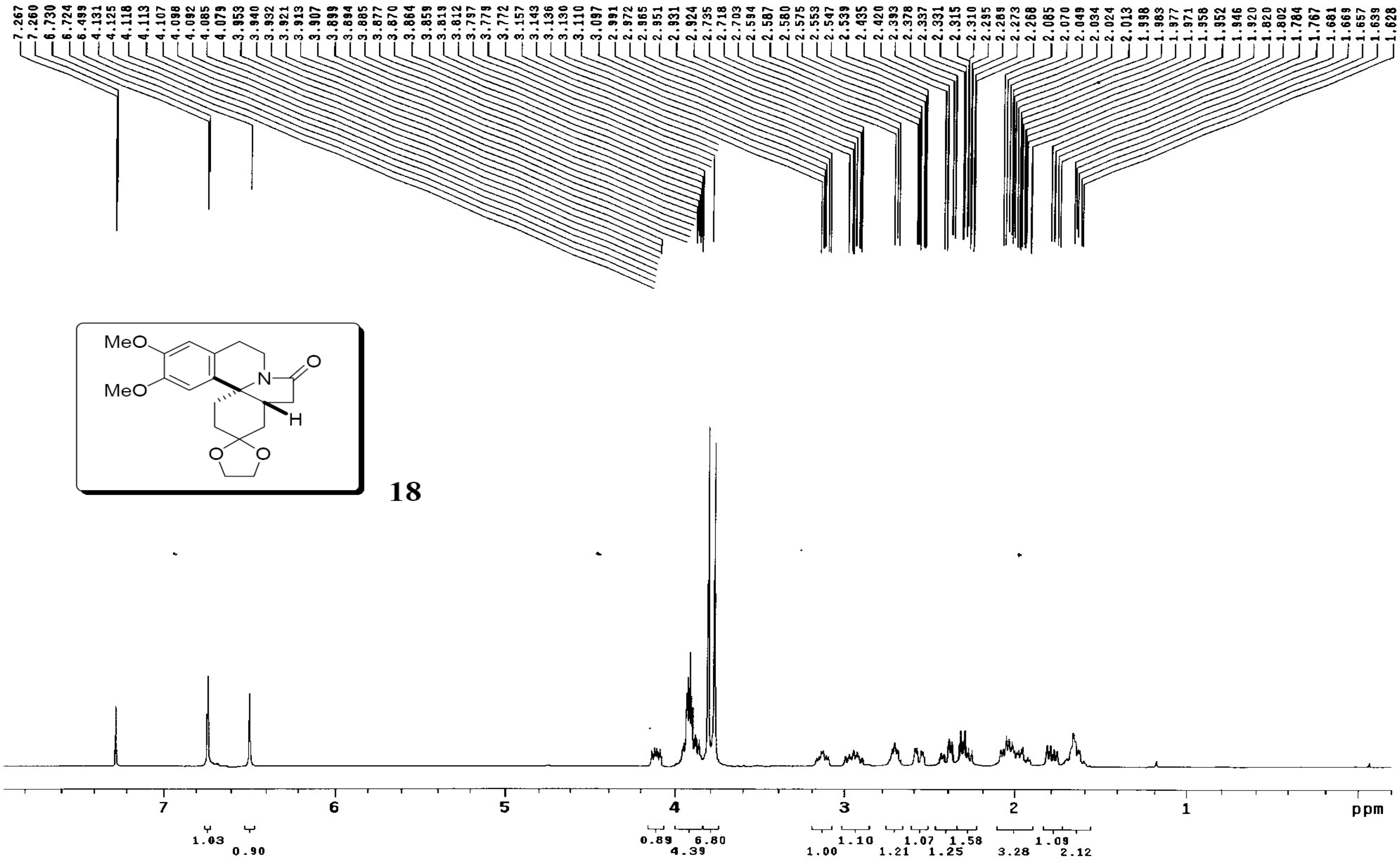
60
40
20
ppm

17

7.267
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3.812
3.797
3.779
3.772
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3.110
3.097
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2.924
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2.295
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2.273
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2.034
2.024
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1.971
1.958
1.952
1.946
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1.820
1.802
1.784
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1.669
1.657
1.639
1.628
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MeO
N
O
H
O
O
7
6
5
4
3
2
1
ppm
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1.58
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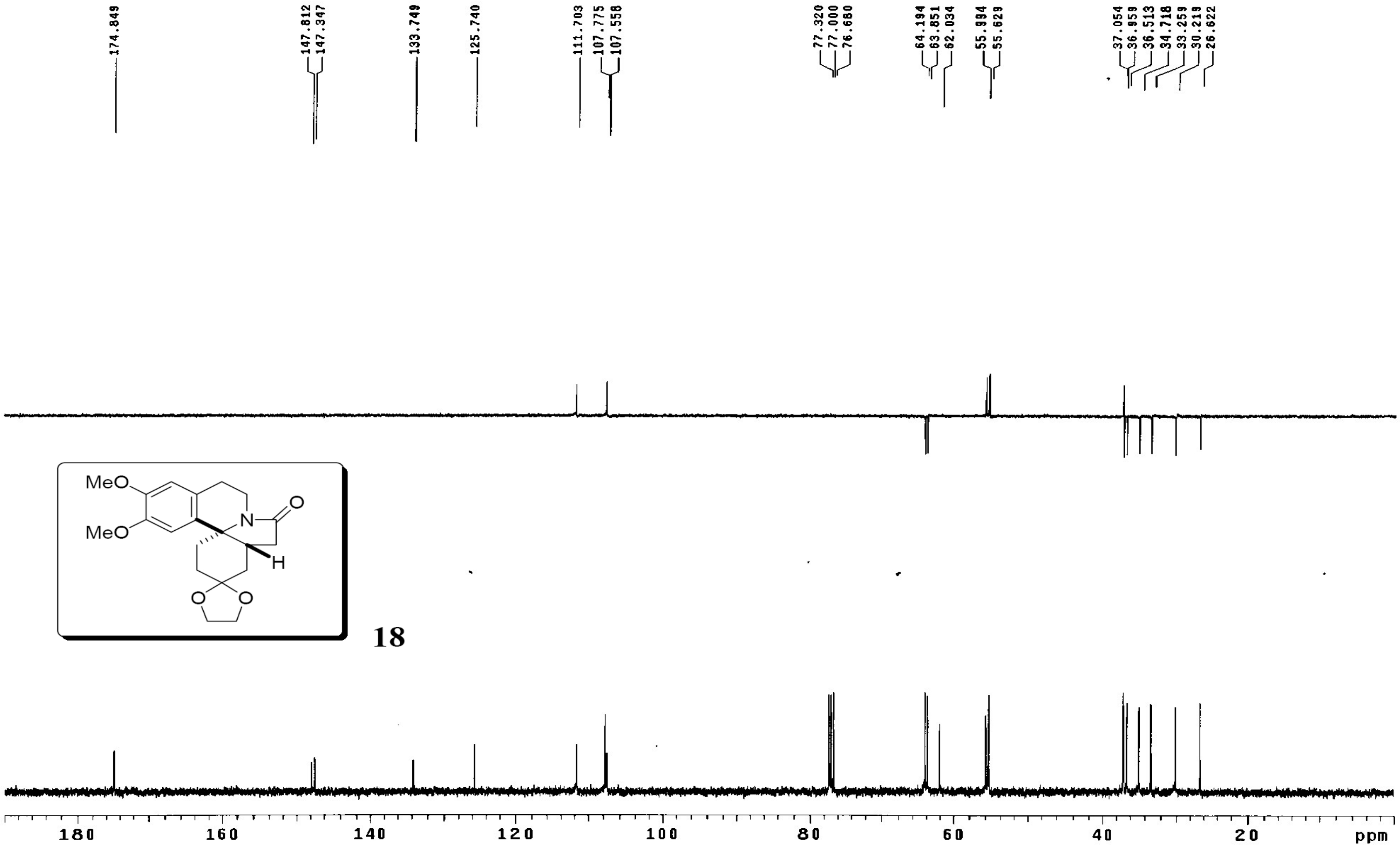
1.09
2.12

18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62.034
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55.629
37.054
36.959
36.513
34.718
33.259
30.219
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N
O
H
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120
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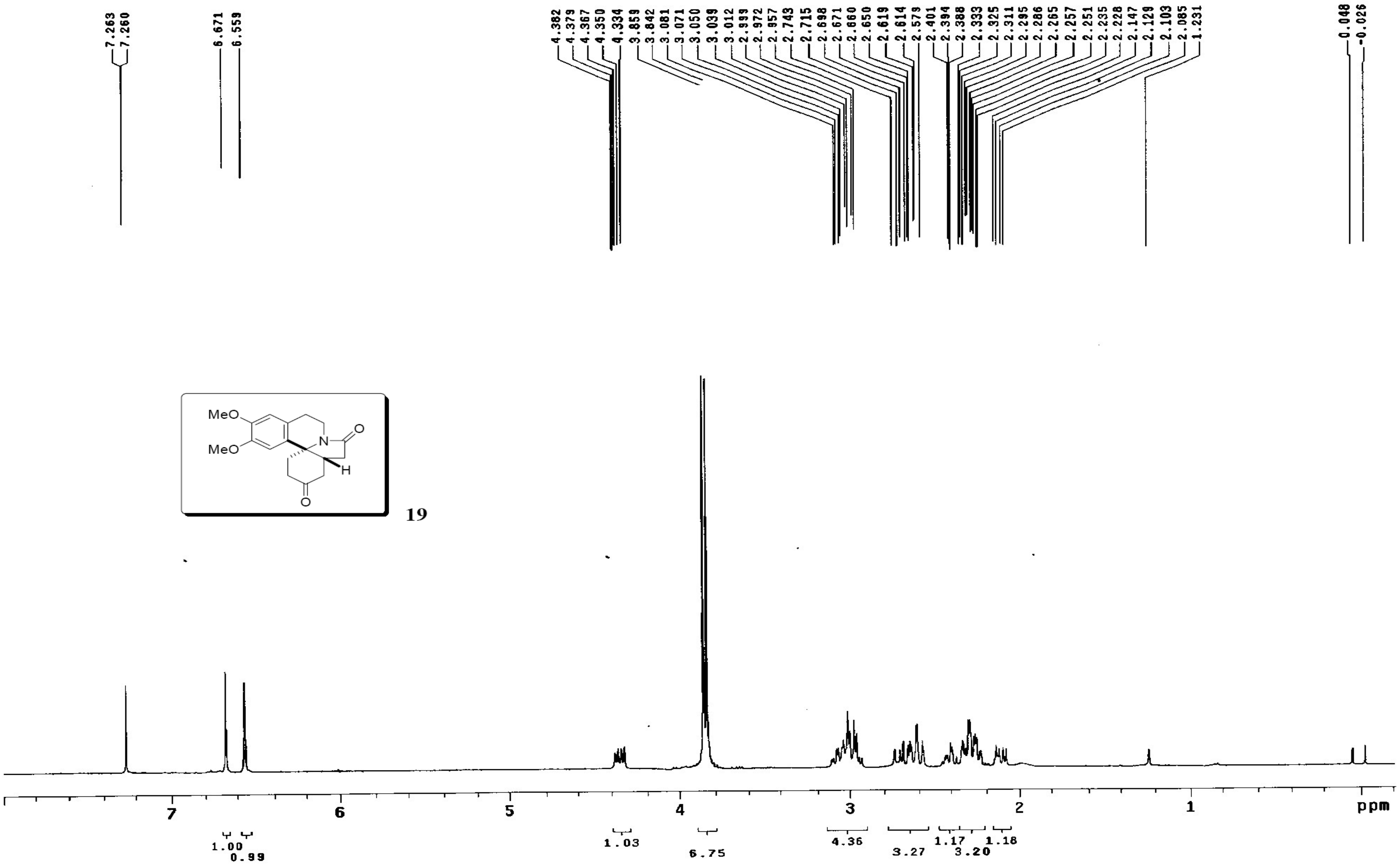
40
20
ppm

18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3.050
3.039
3.012
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2.579
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2.333
2.325
2.311
2.295
2.286
2.265
2.257
2.251
2.235
2.228
2.147
2.129
2.103
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MeO
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O
H
O
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6
5
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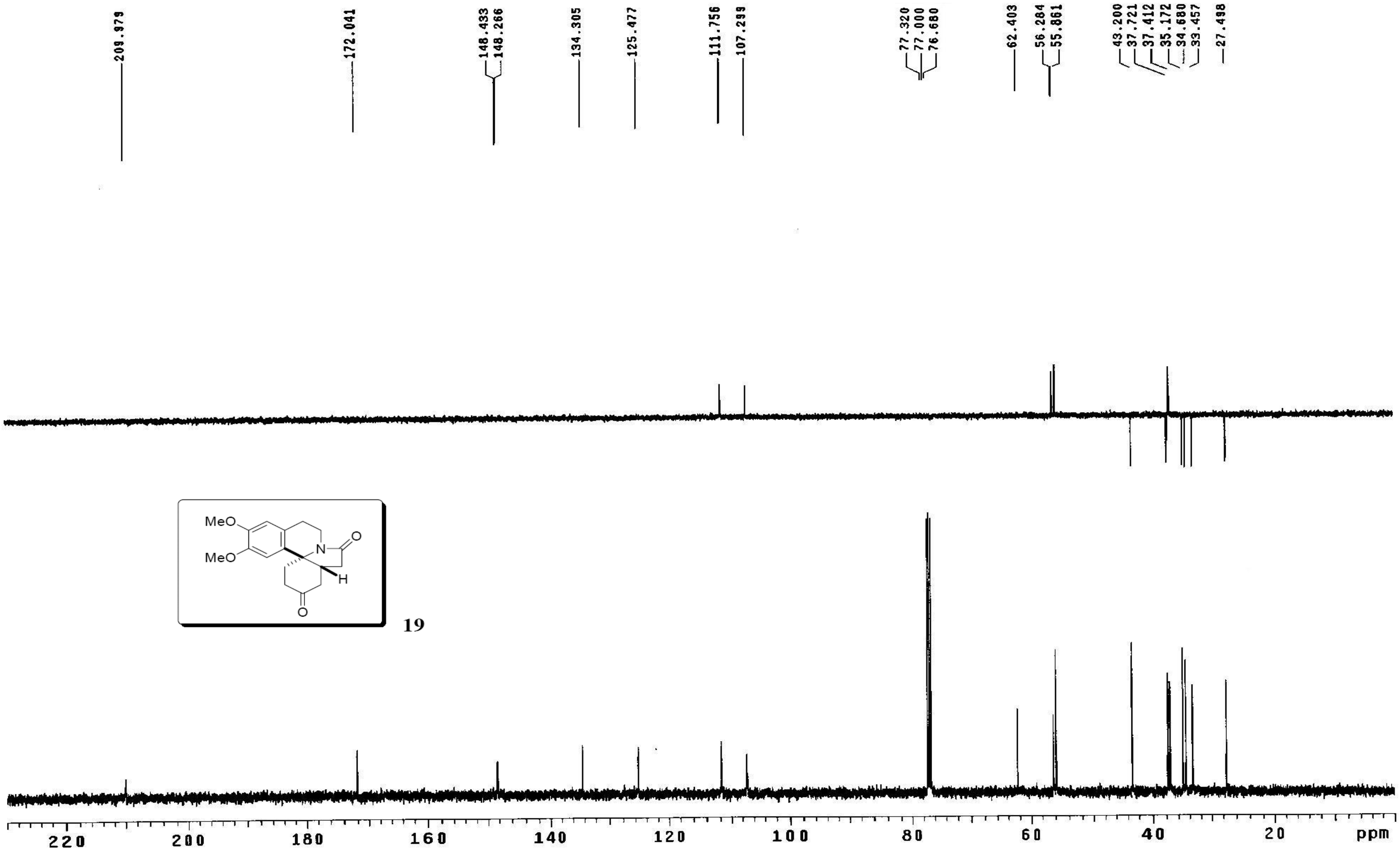
19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37.412
35.172
34.680
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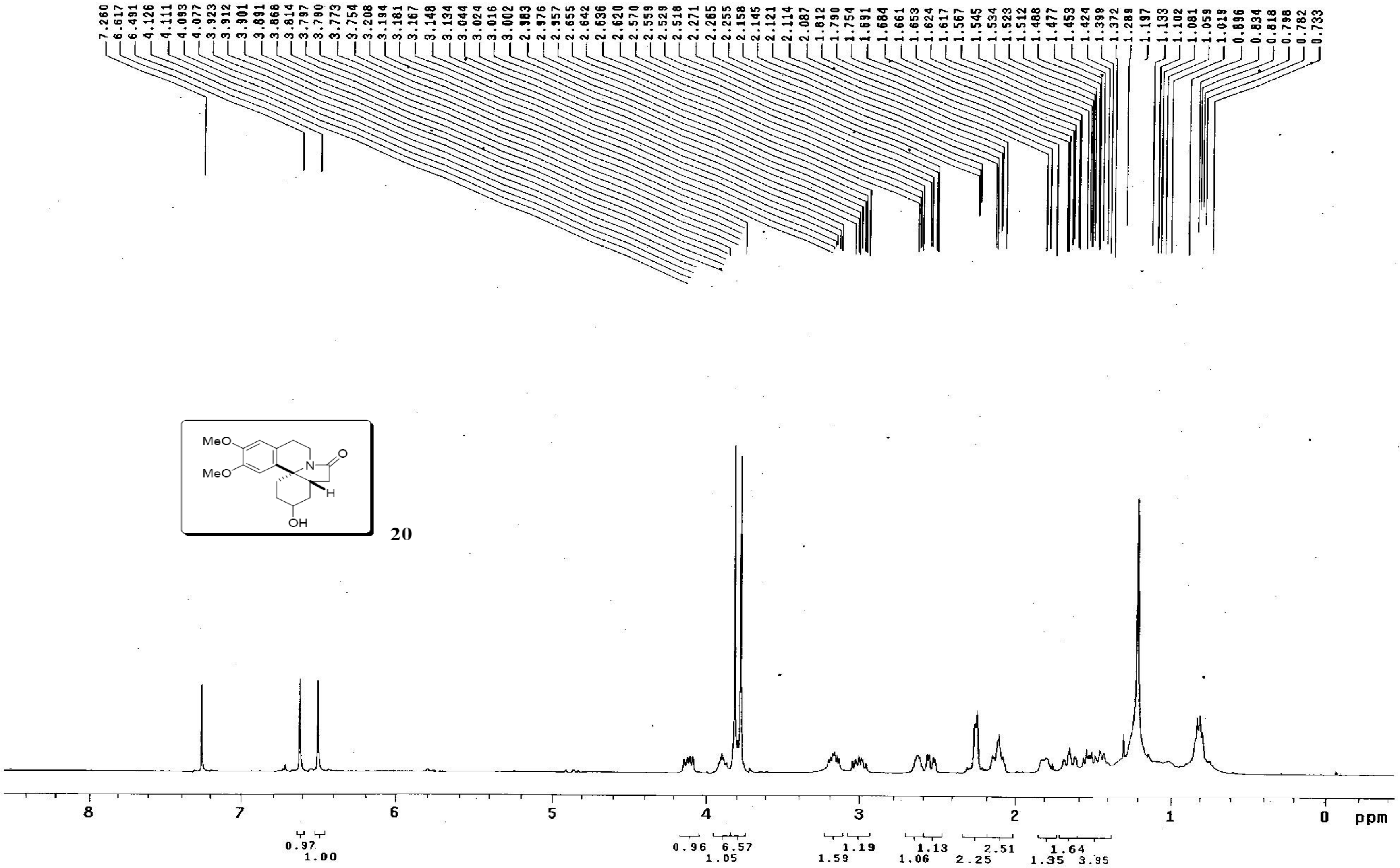
ppm

19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3.797
3.780
3.773
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3.016
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1.523
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1.019
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0.782
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MeO
N
O
H
OH
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7
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5
4
3
2
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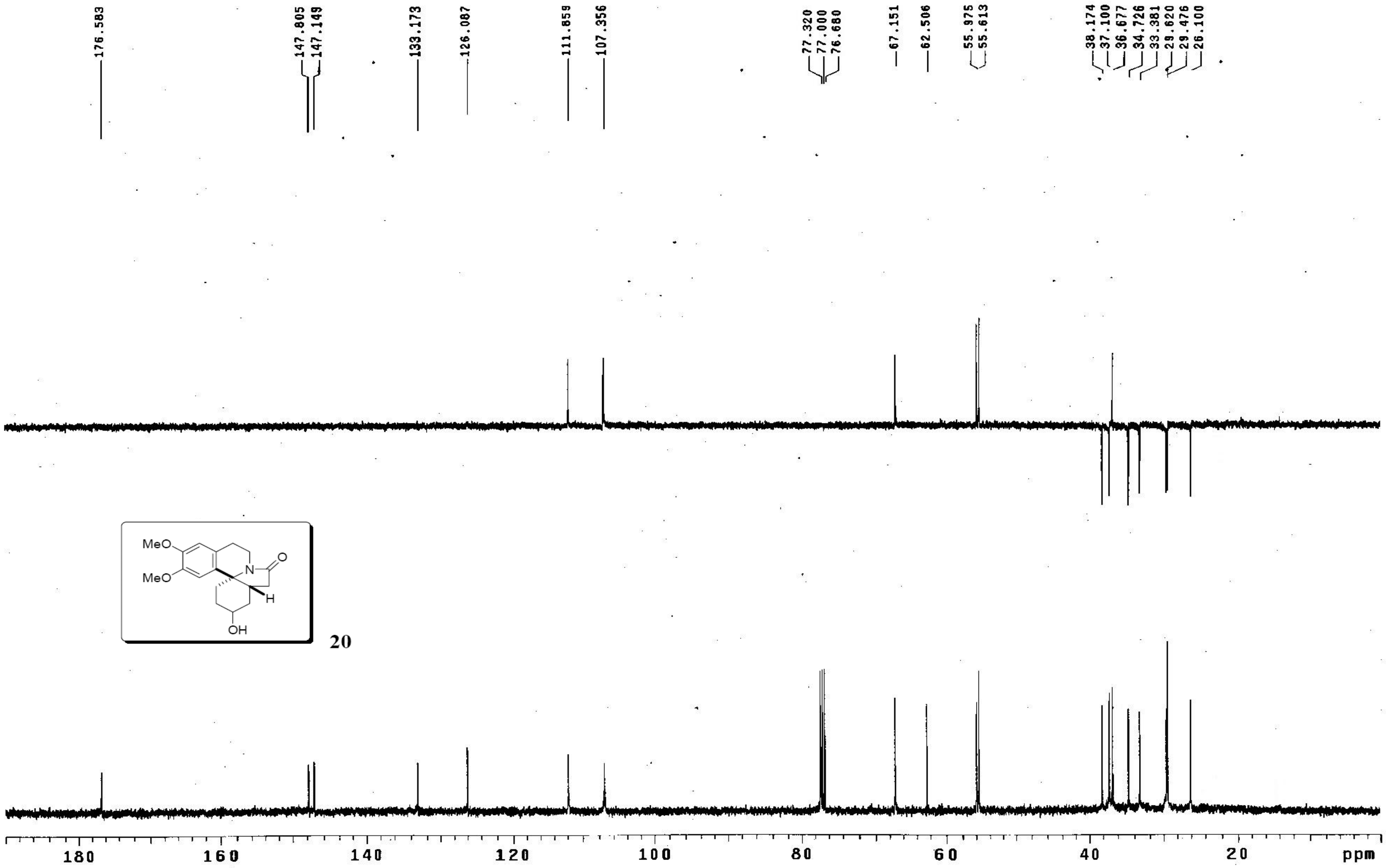
20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37.100
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34.726
33.381
29.620
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MeO
N
O
H
OH
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120
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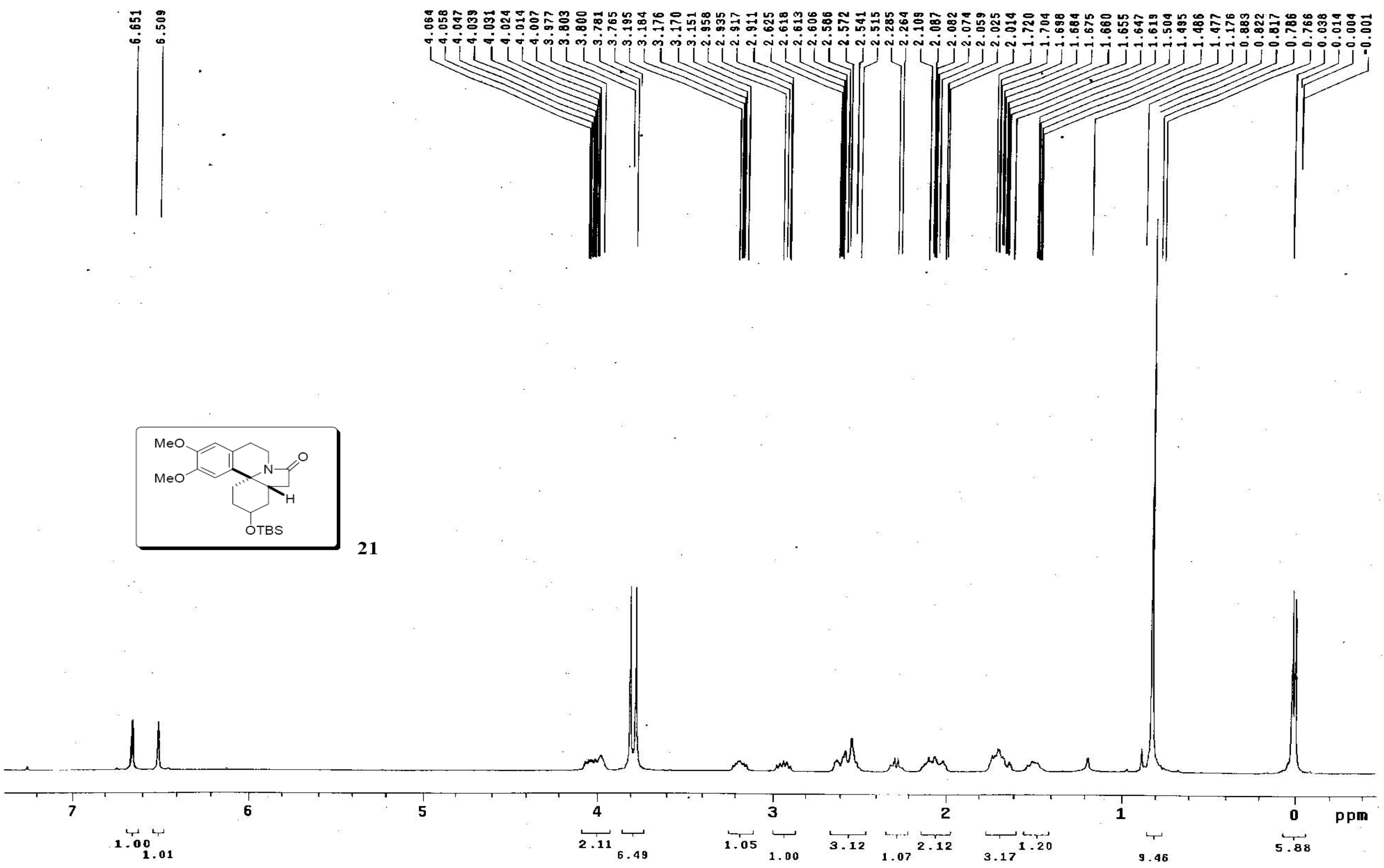
ppm

20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2.618
2.613
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2.572
2.541
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N
O
H
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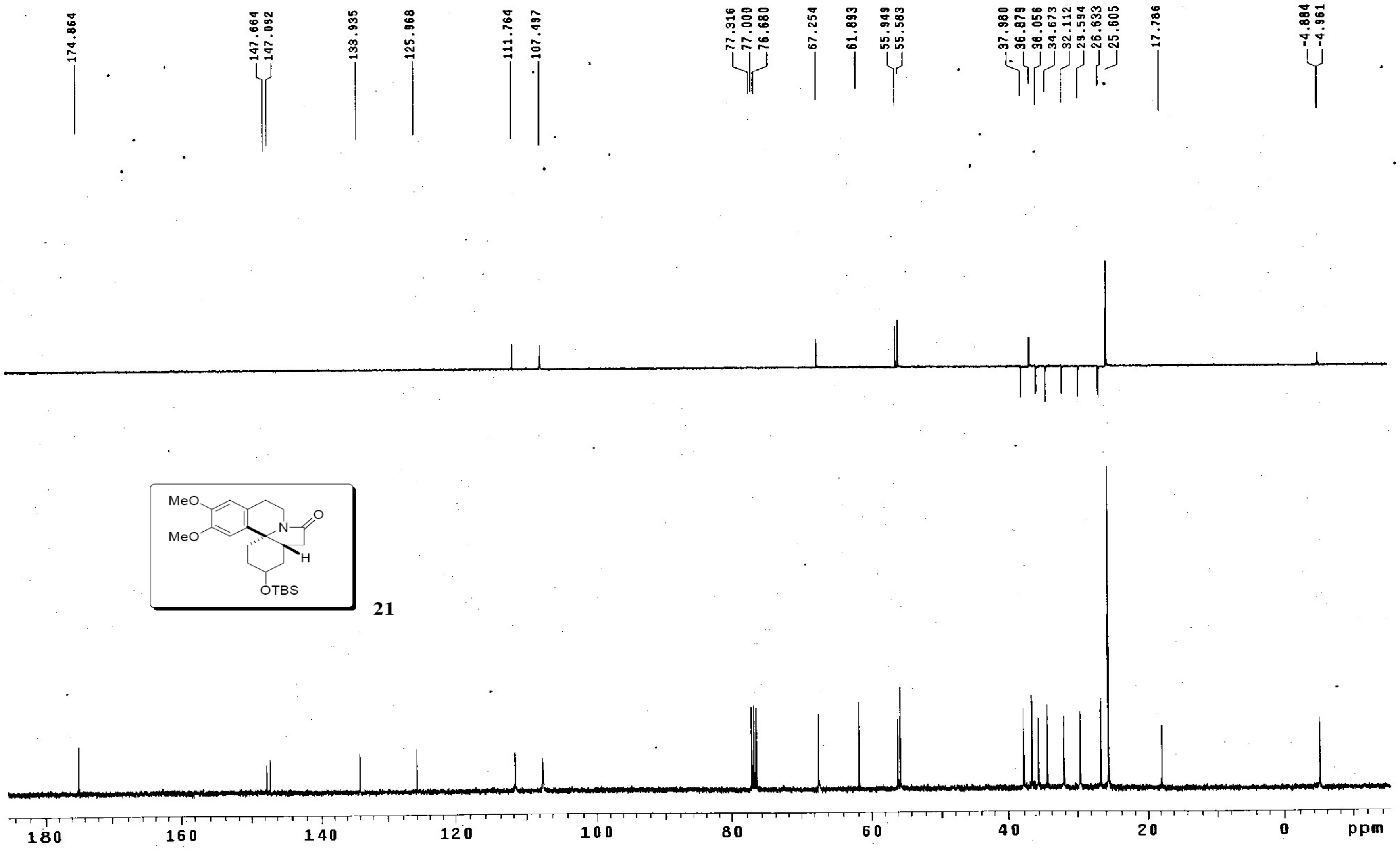
21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36.879
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34.673
32.112
29.594
26.633
25.605
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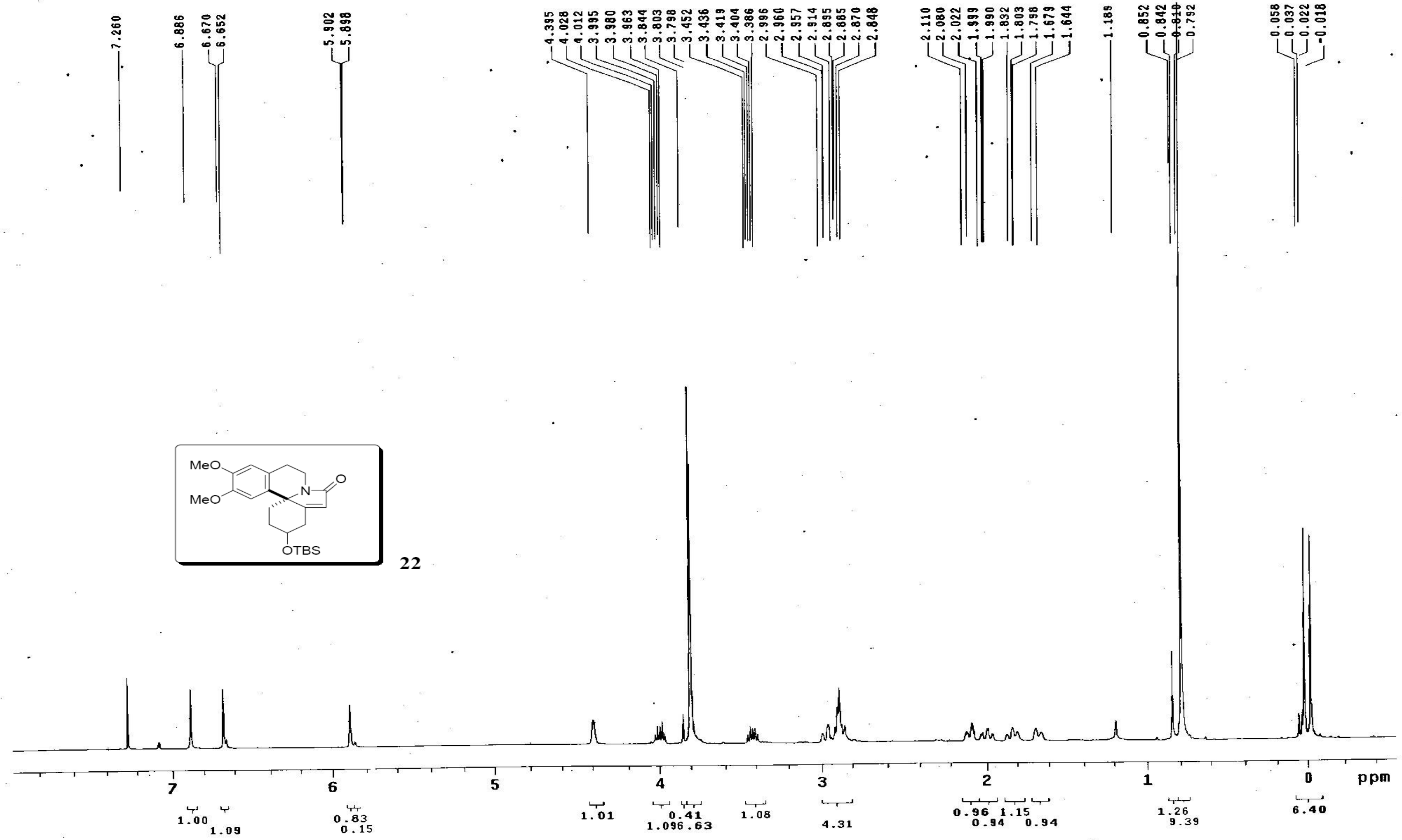
ppm

21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3.419
3.404
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1.832
1.803
1.798
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1.644
1.189
0.852
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0.022
-0.018
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MeO
N
O
OTBS
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6
5
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3
2
1
0
ppm
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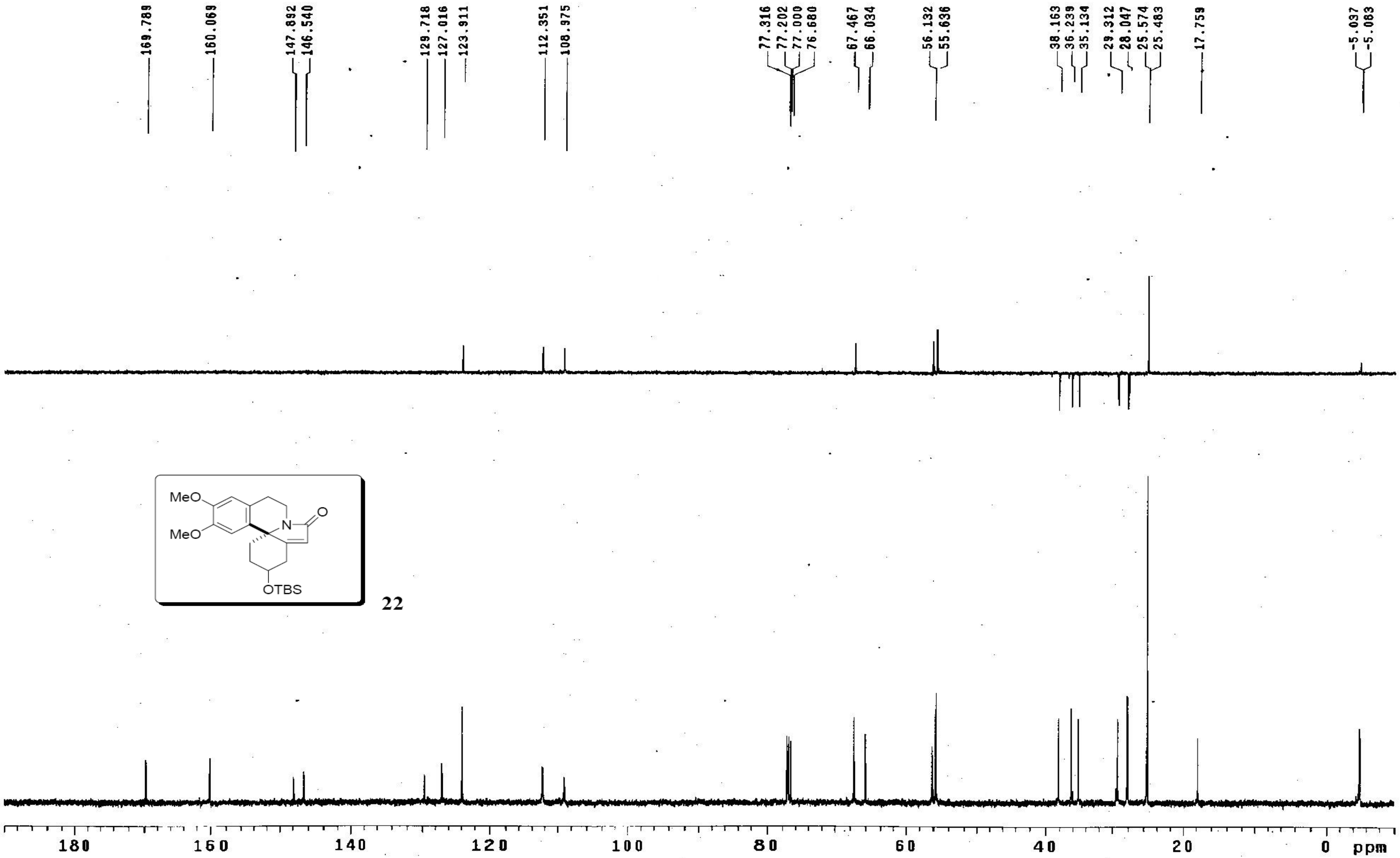
22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76.680
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55.636
38.163
36.239
35.134
29.312
28.047
25.574
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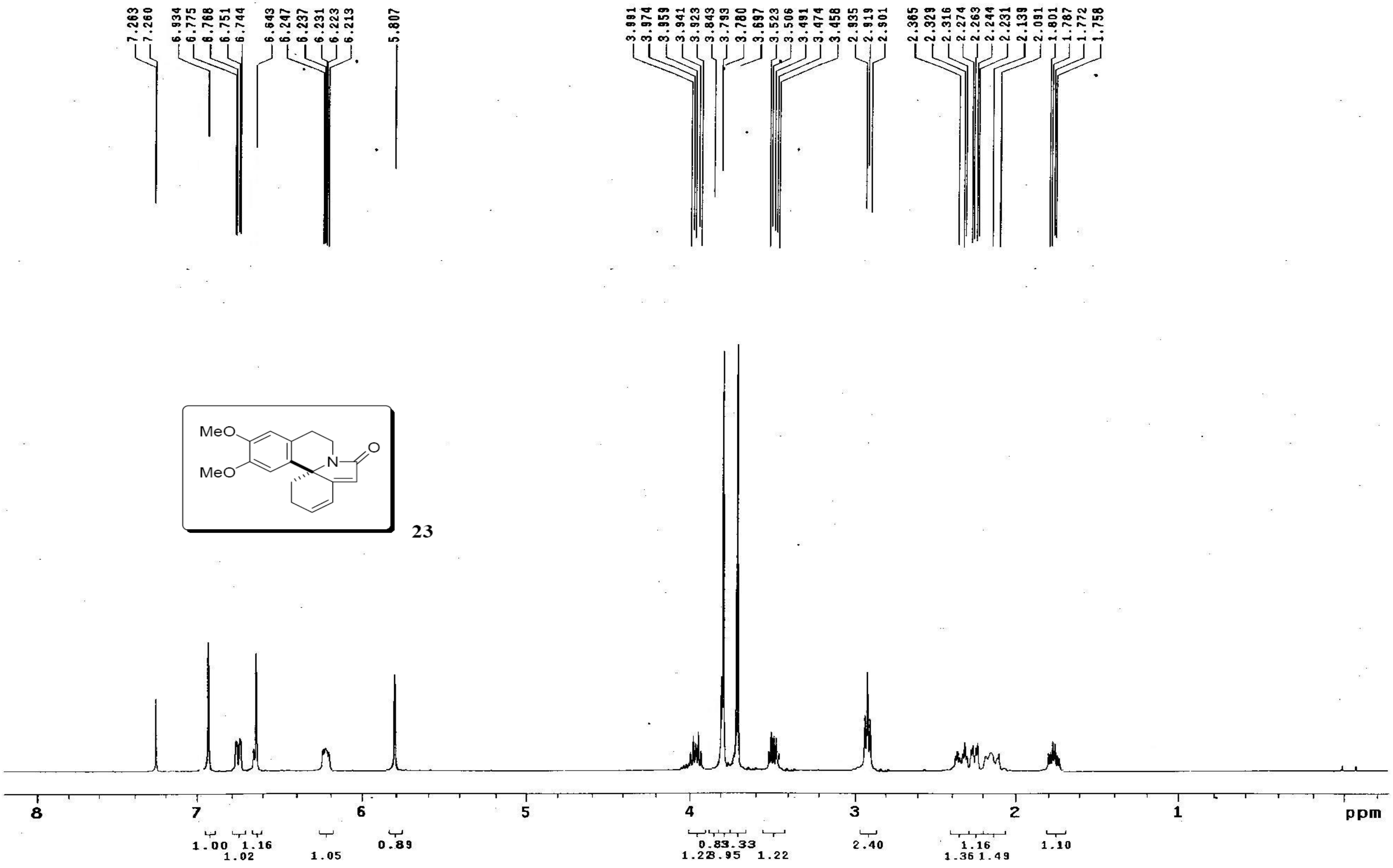
ppm

22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O
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7
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ppm
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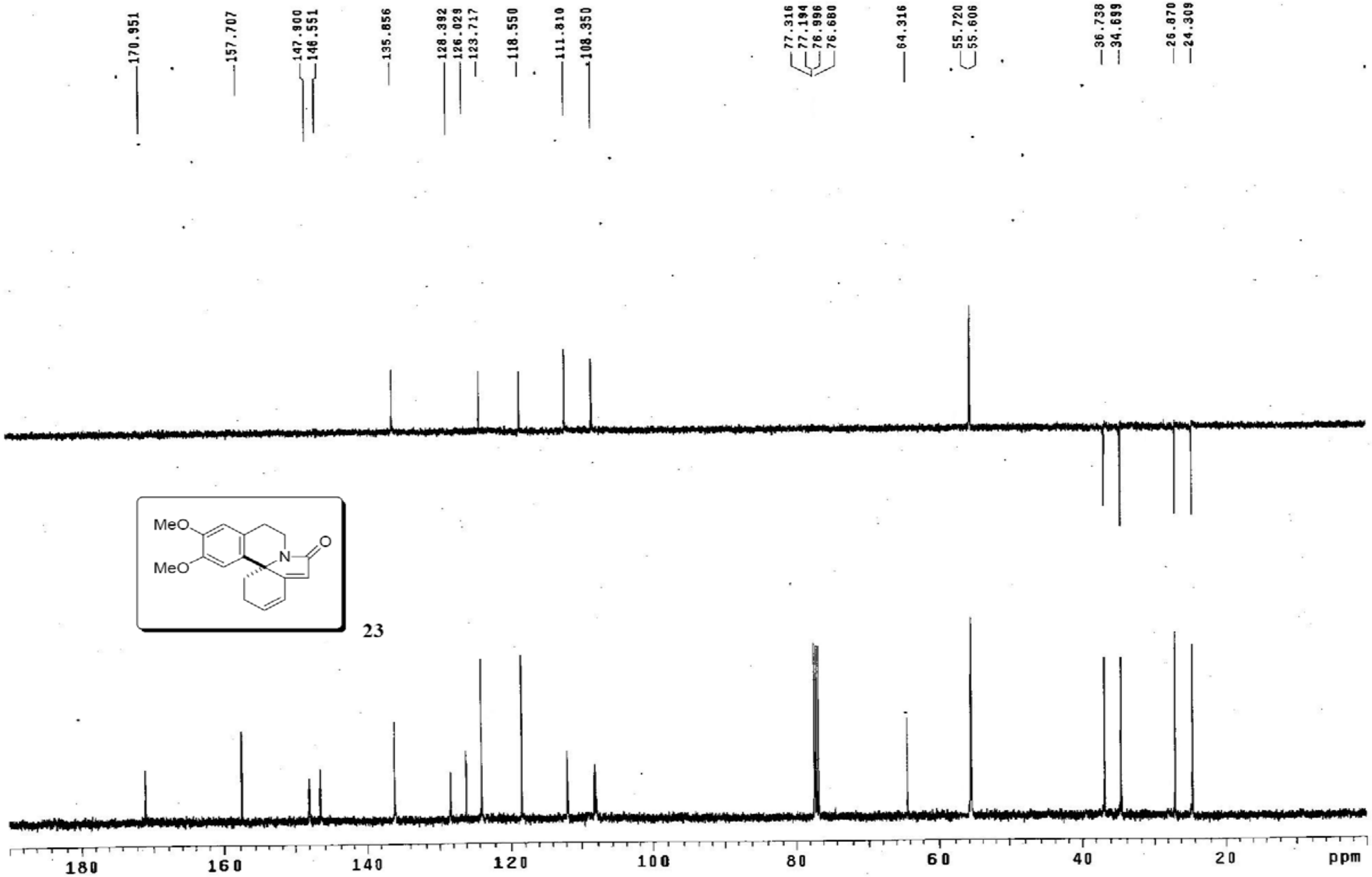
1.49
1.10

23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76.996
76.680
64.316
55.720
55.606
36.738
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MeO
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O
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40
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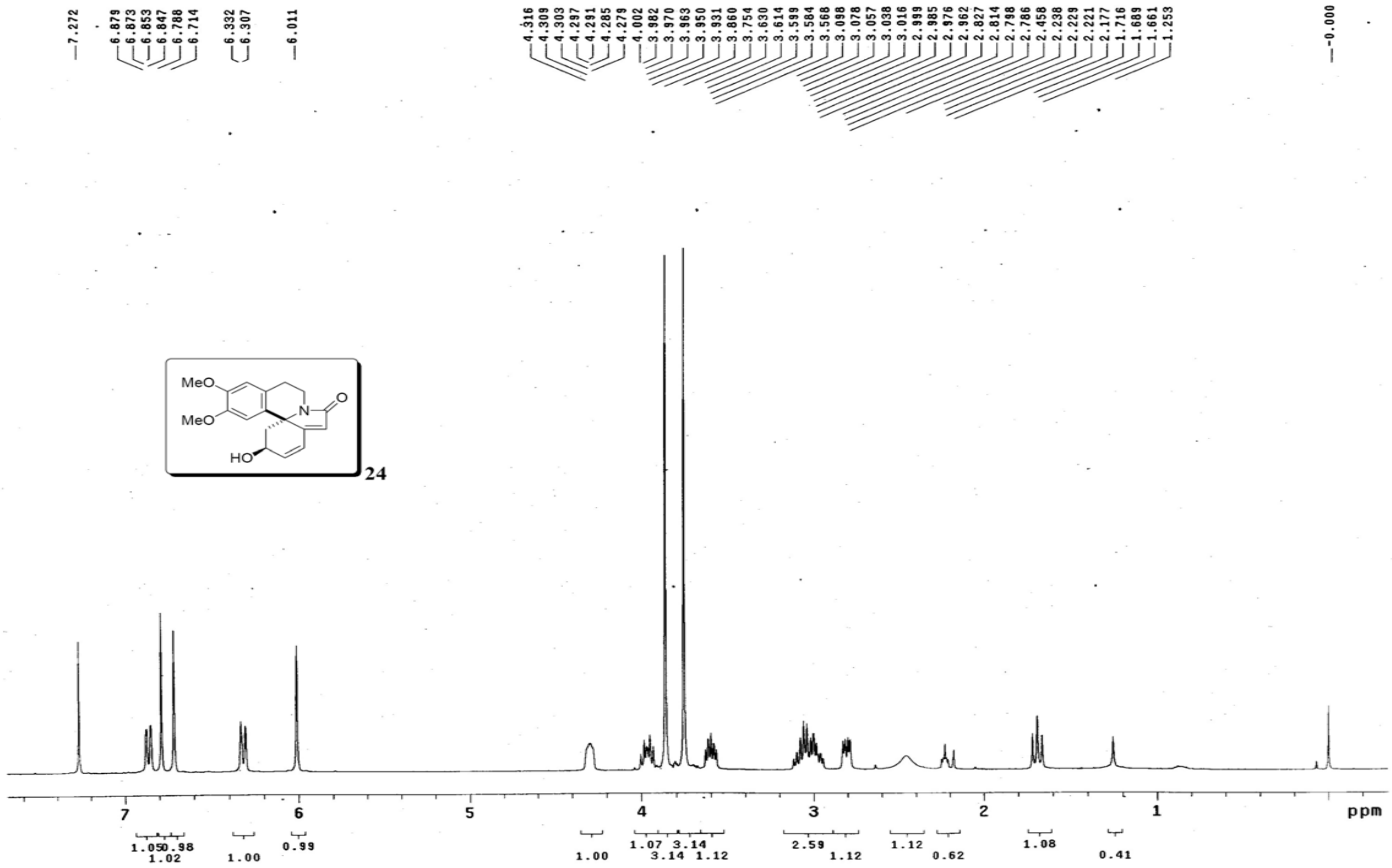
ppm

23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6.011
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4.309
4.303
4.297
4.291
4.285
4.279
4.002
3.982
3.970
3.963
3.950
3.931
3.860
3.754
3.630
3.614
3.599
3.584
3.568
3.098
3.078
3.057
3.038
3.016
2.999
2.985
2.976
2.962
2.827
2.814
2.798
2.786
2.458
2.238
2.229
2.221
2.177
1.716
1.689
1.661
1.253
-0.000
MeO
MeO
N
O
HO
24
7
6
5
4
3
2
1
ppm
1.05
0.98
1.02
1.00
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1.00
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3.14
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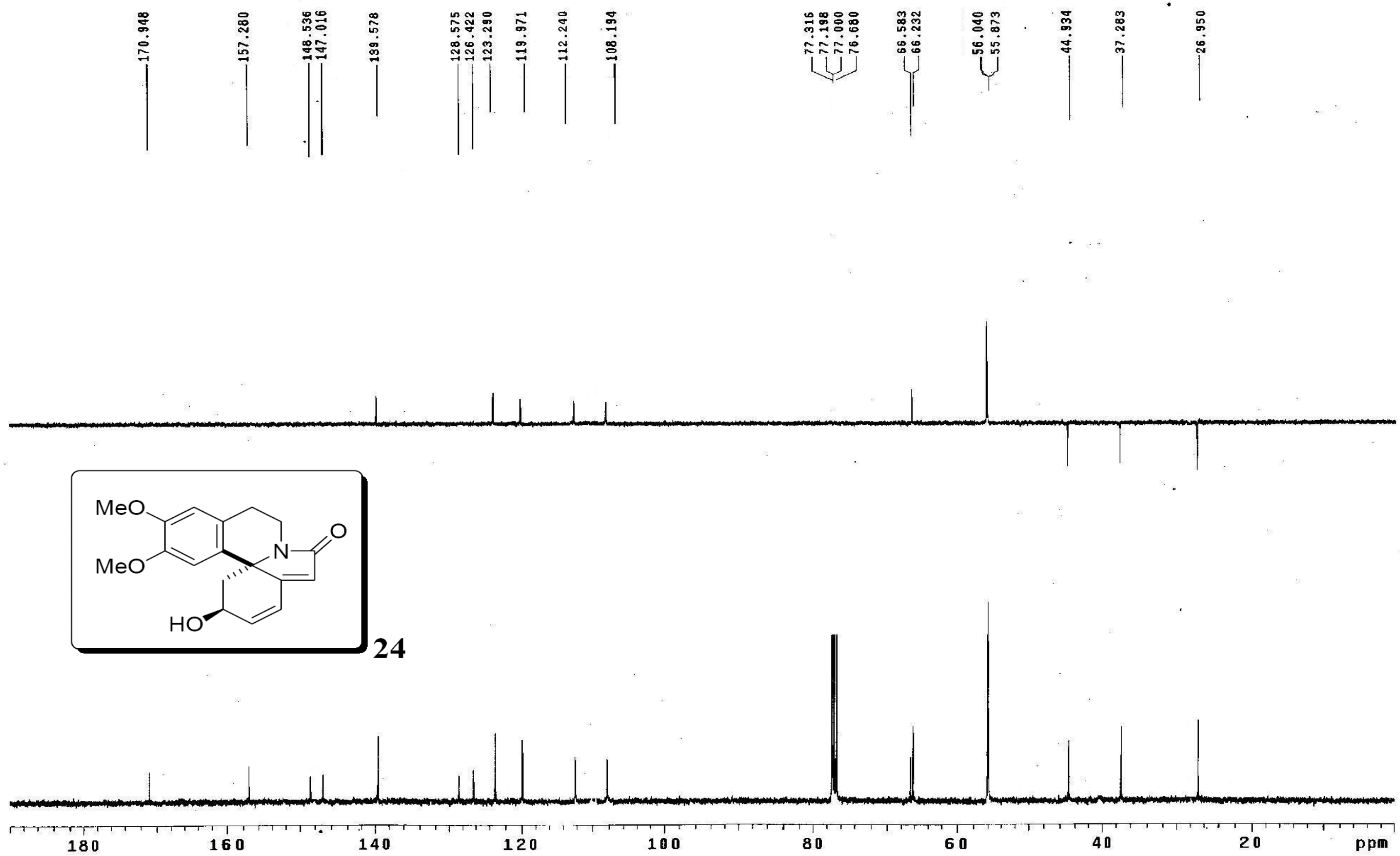
1.08
0.41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77.000
76.680
66.583
66.232
56.040
55.873
44.934
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MeO
N
O
HO
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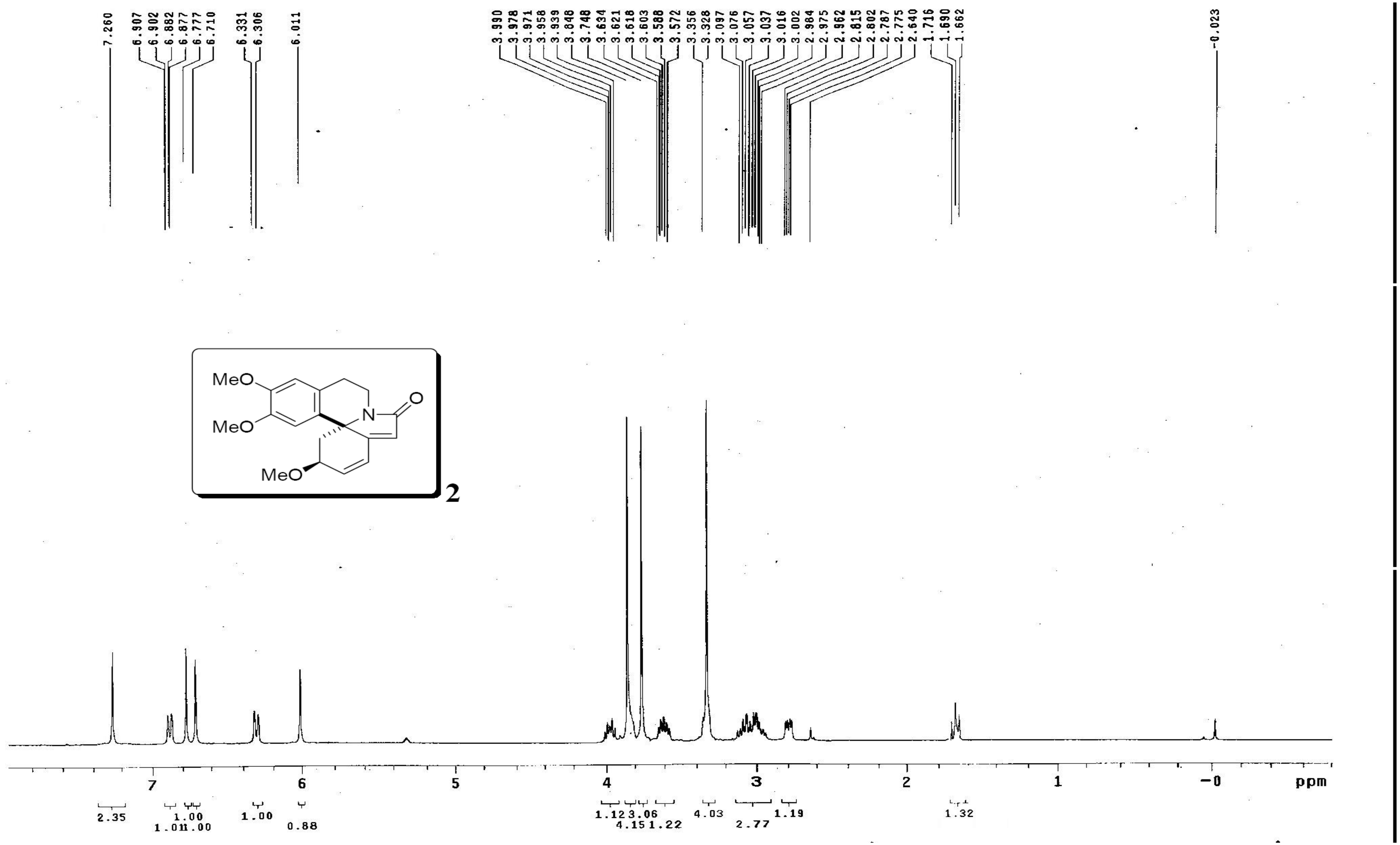

2

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3.978
3.971
3.958
3.939
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3.748
3.634
3.621
3.618
3.603
3.588
3.572
3.356
3.328
3.097
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3.057
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3.002
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2.975
2.962
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2.802
2.787
2.775
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1.662
-0.023
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MeO
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O
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5
4
3
2
1
-0
ppm
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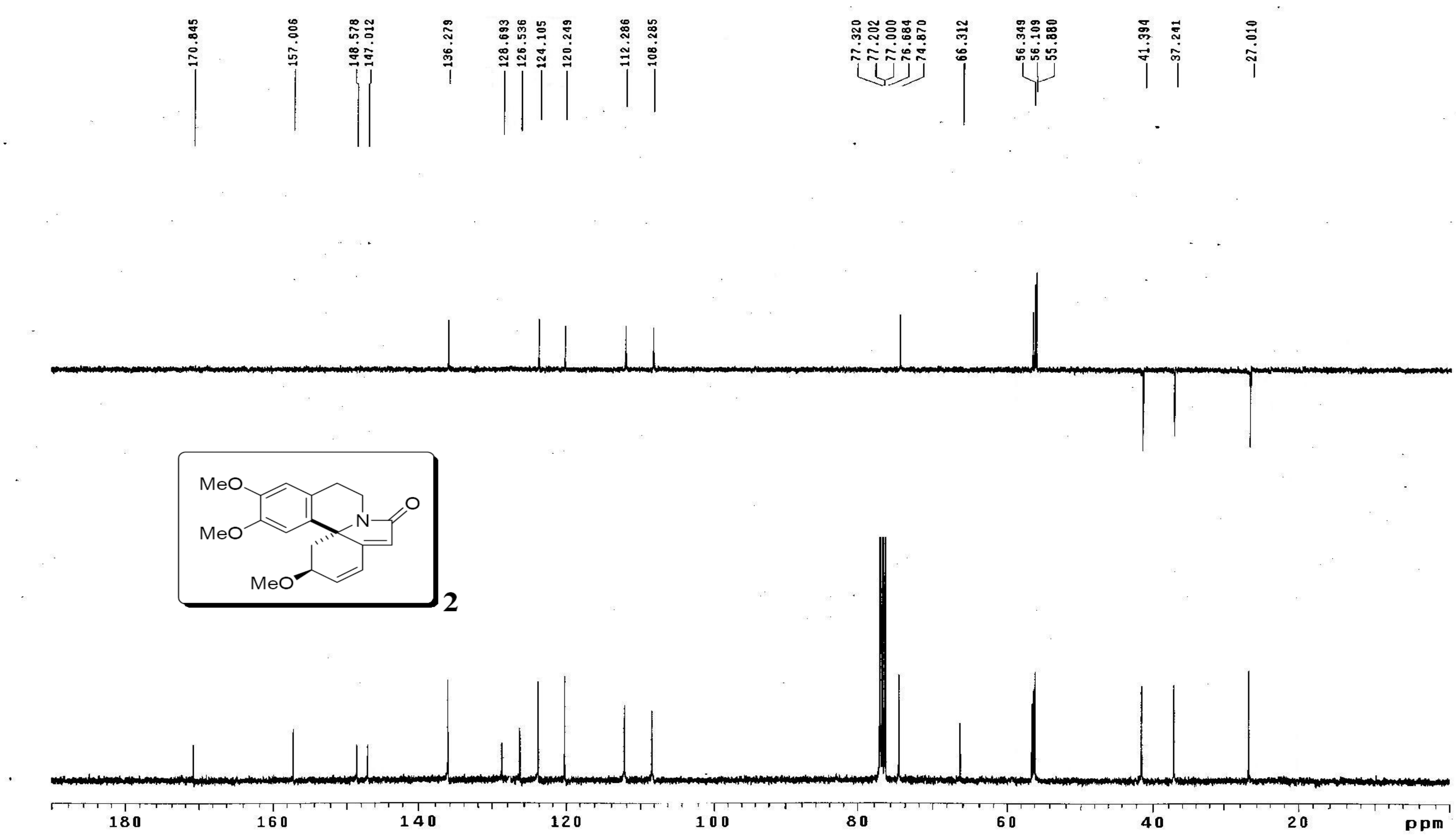
1.32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77.202
77.000
76.684
74.870
66.312
56.349
56.109
55.880
41.394
37.241
27.010
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MeO
N
O
MeO
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160
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120
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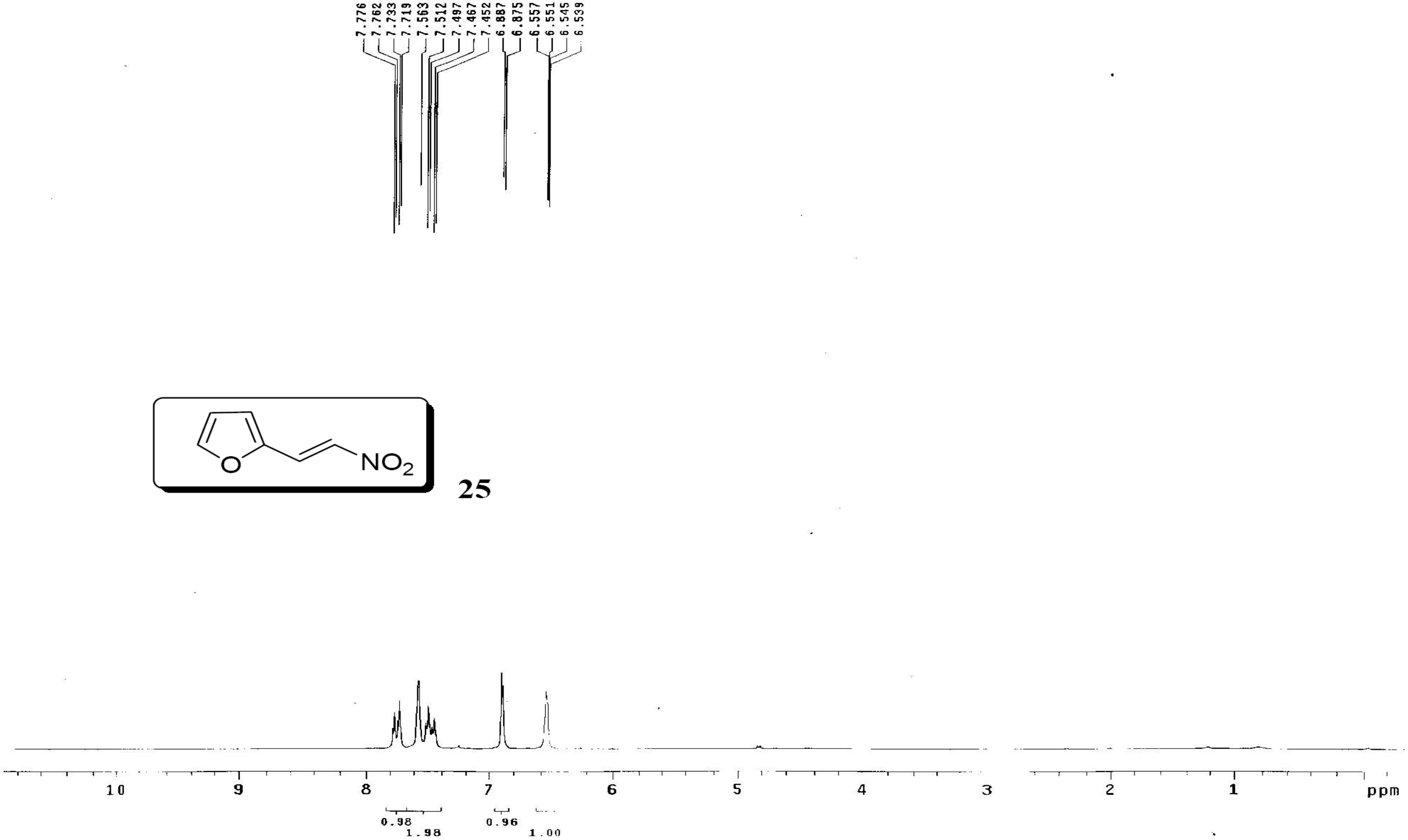
80
60
40
20
ppm

2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7.733
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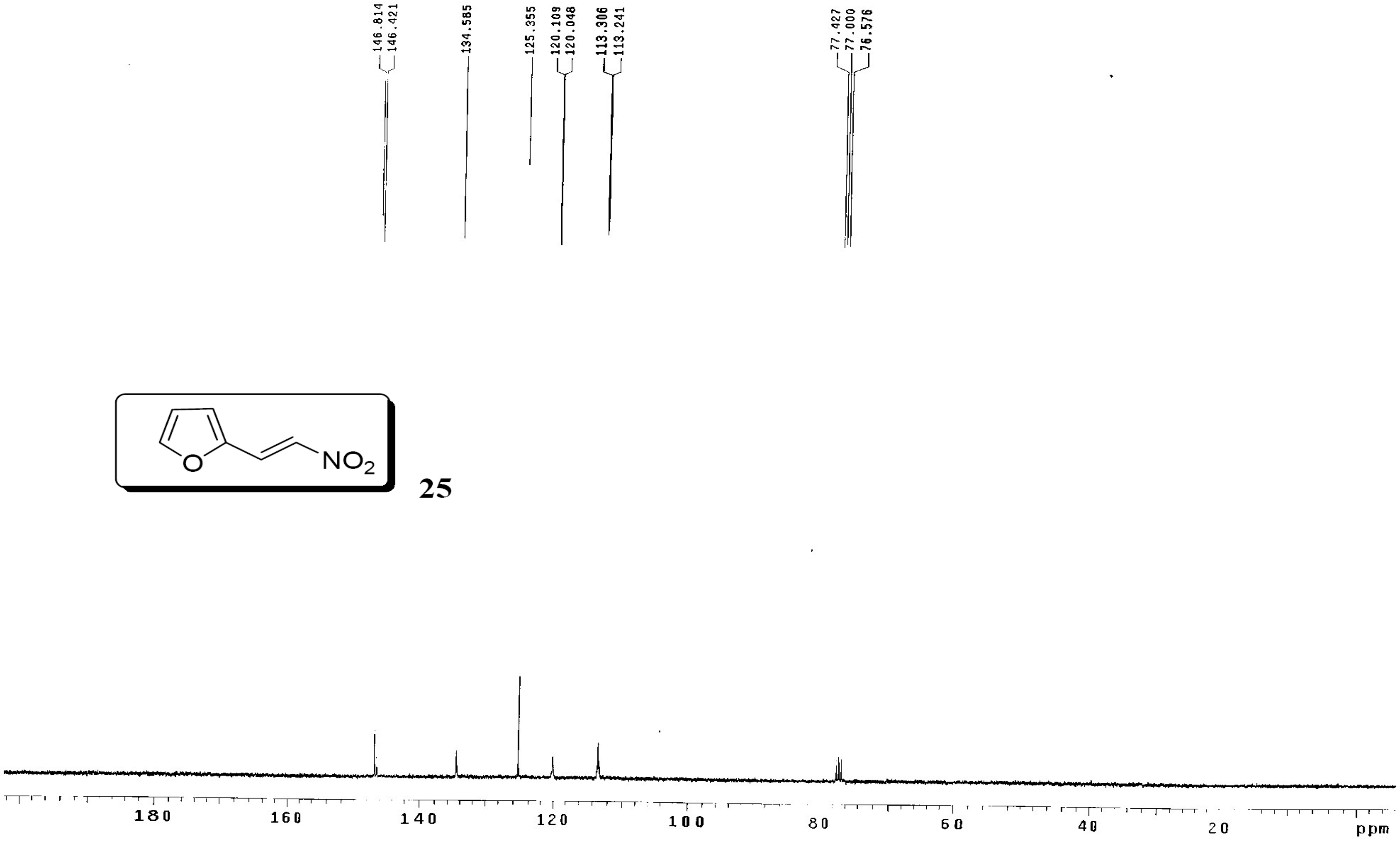
7.452
6.887
6.875
6.557
6.551
6.545
6.539
O
NO2
10
9
8
7
6
5
4
3
2
1
ppm
0.98
1.98
0.96
1.00

25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146.421
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120.109
120.048
113.306
113.241
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77.000
76.576
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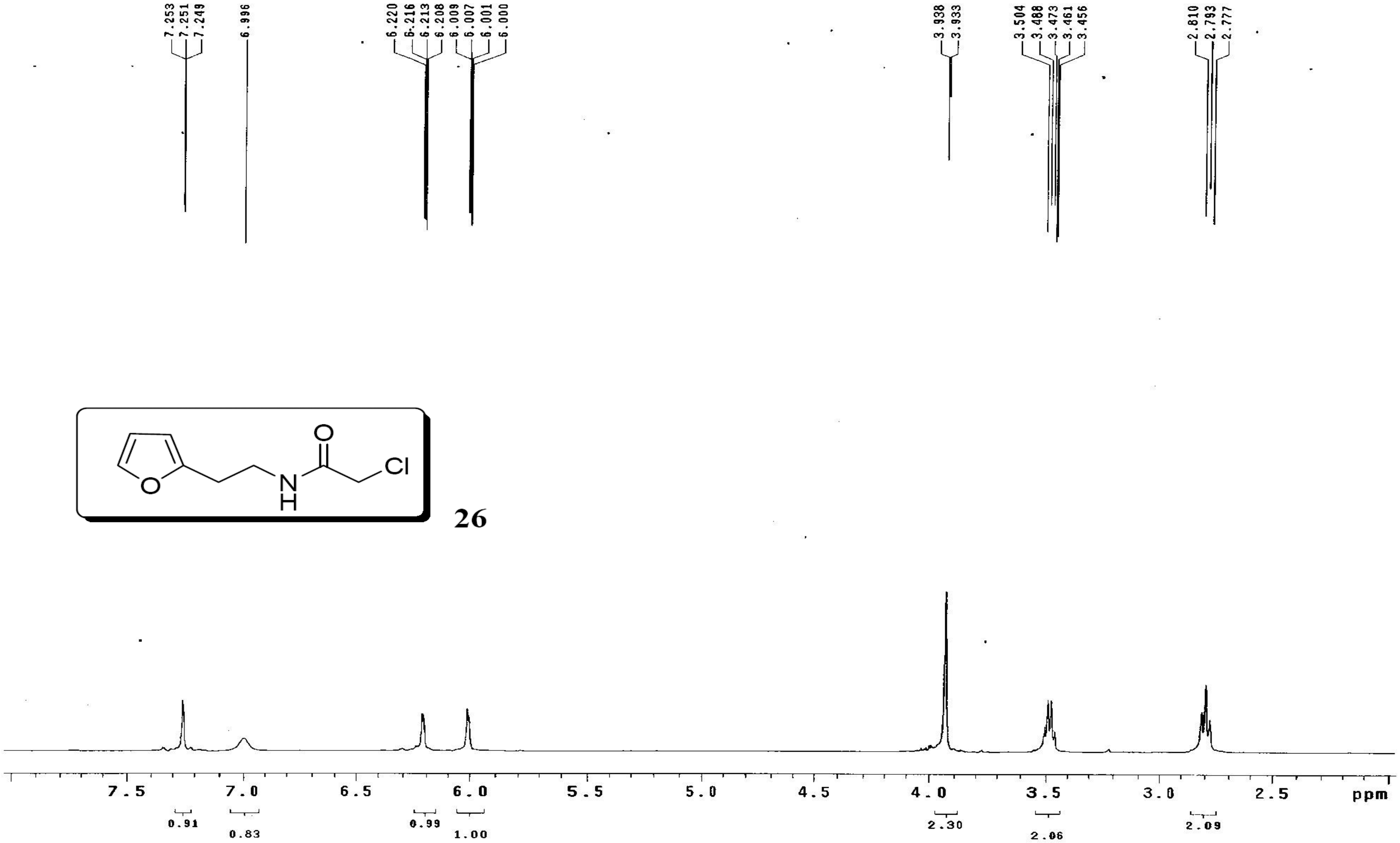
160
140
120
100
80
60
40
20
ppm

25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7.251
7.249
6.996
6.220
6.216
6.213
6.208
6.009
6.007
6.001
6.000
3.938
3.933
3.504
3.488
3.473
3.461
3.456
2.810
2.793
2.777
O
N
H
Cl
7.5
7.0
6.5
6.0
5.5
5.0
4.5
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3.5
3.0
2.5
ppm
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0.83
0.99
1.00
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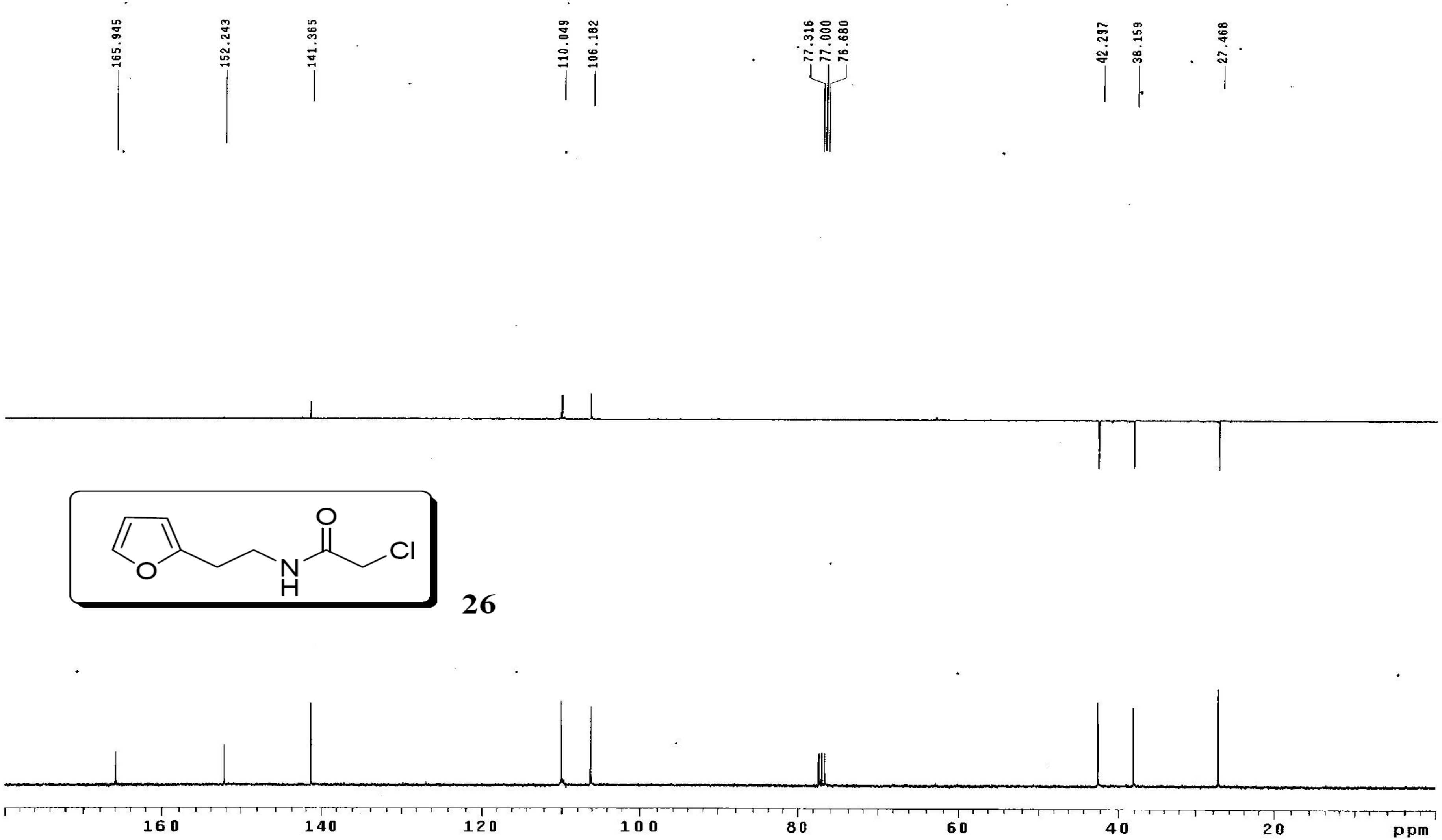
2.06
2.09

26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141.365
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77.000
76.680
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27.468
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H
O
Cl
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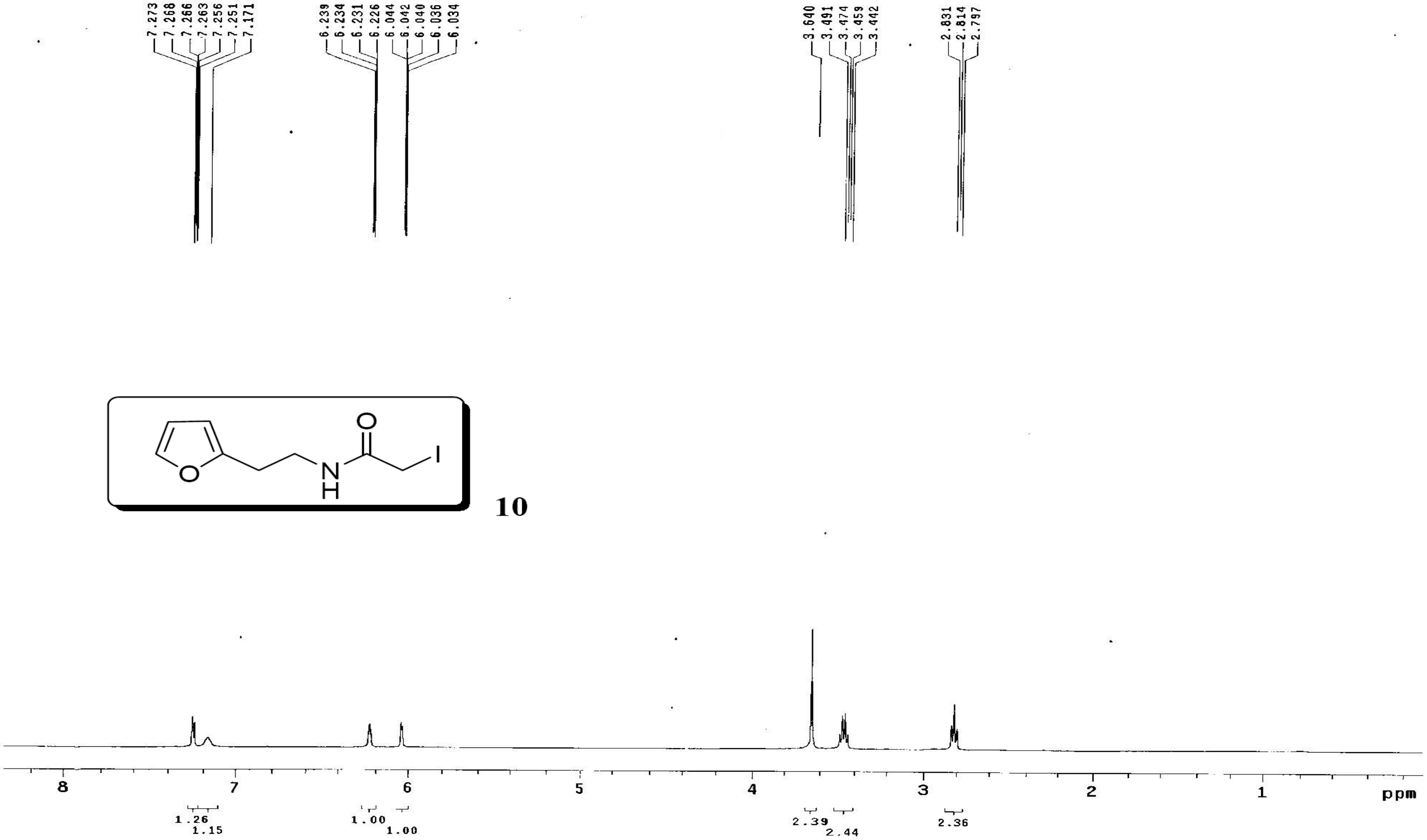
140
120
100
80
60
40
20
ppm

26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7.266
7.263
7.256
7.251
7.171
6.239
6.234
6.231
6.226
6.044
6.042
6.040
6.036
6.034
3.640
3.491
3.474
3.459
3.442
2.831
2.814
2.797
O
N
H
O
I
8
7
6
5
4
3
2
1
ppm
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1.00
1.00
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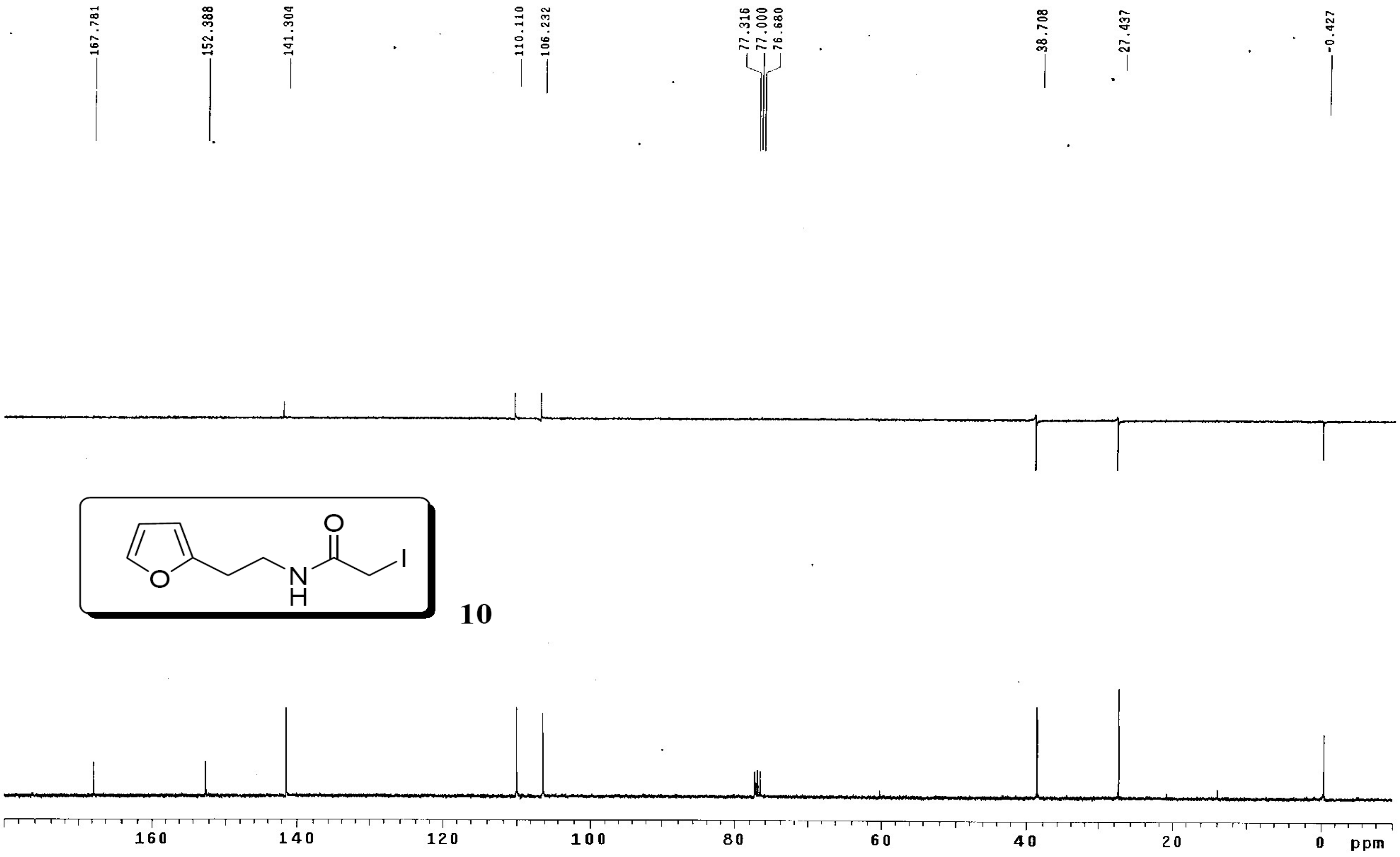
2.44
2.36

10



10

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141.304
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120
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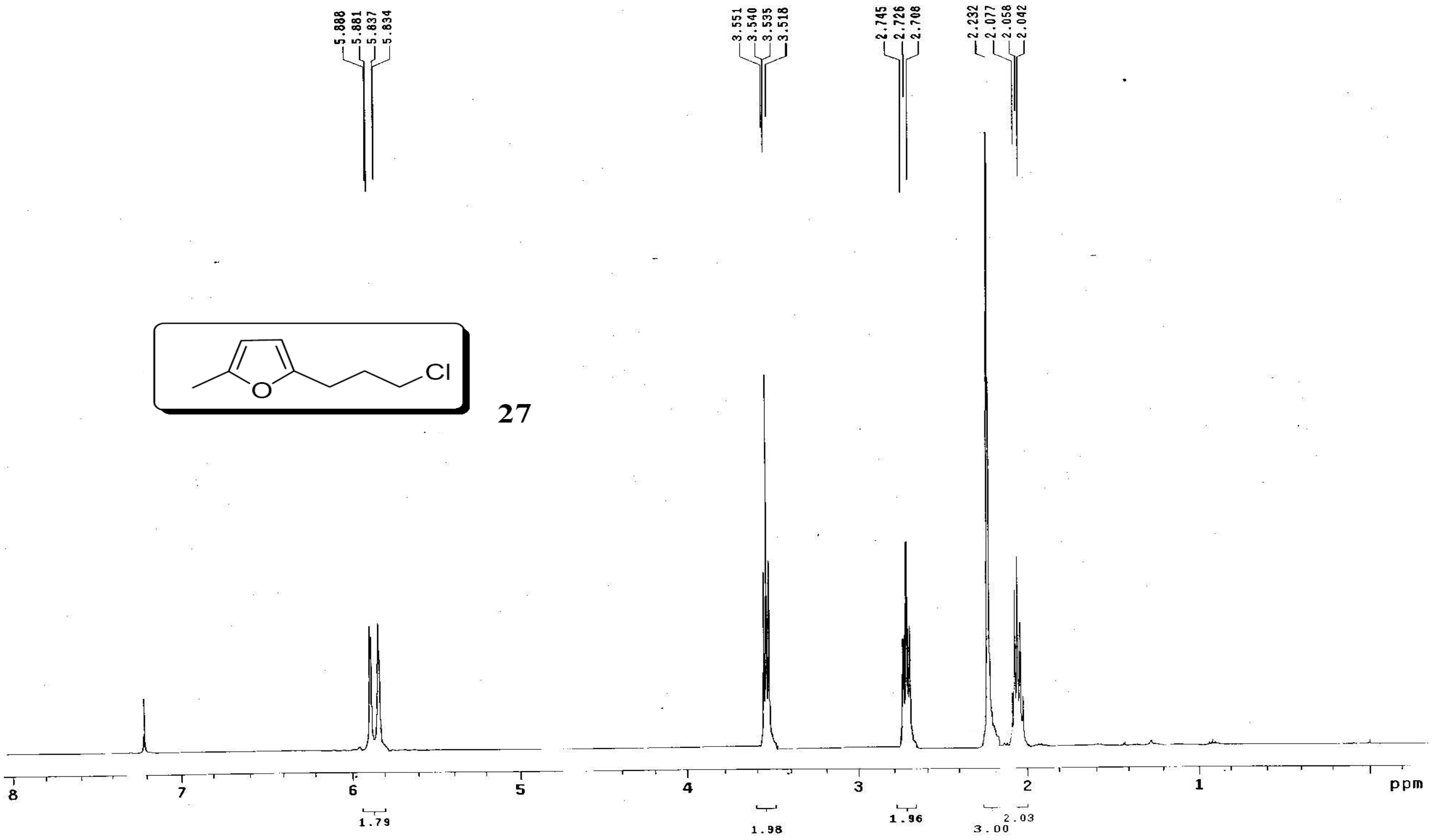
60
40
20
0
ppm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2.726
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2.232
2.077
2.058
2.042
Cl
O
8
7
6
5
4
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2
1
ppm
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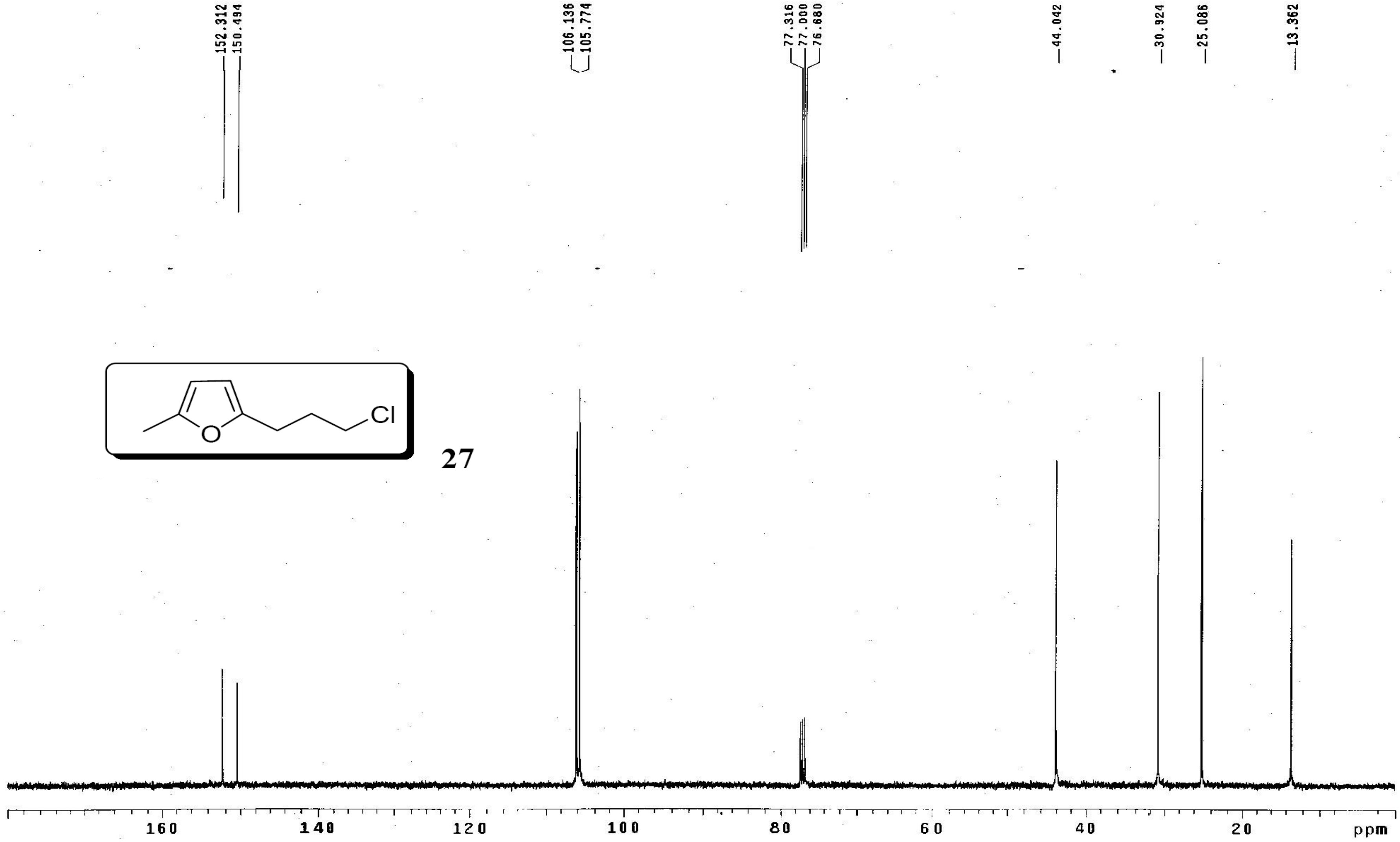
1.98
1.96
3.00
2.03

27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77.000
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O
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120
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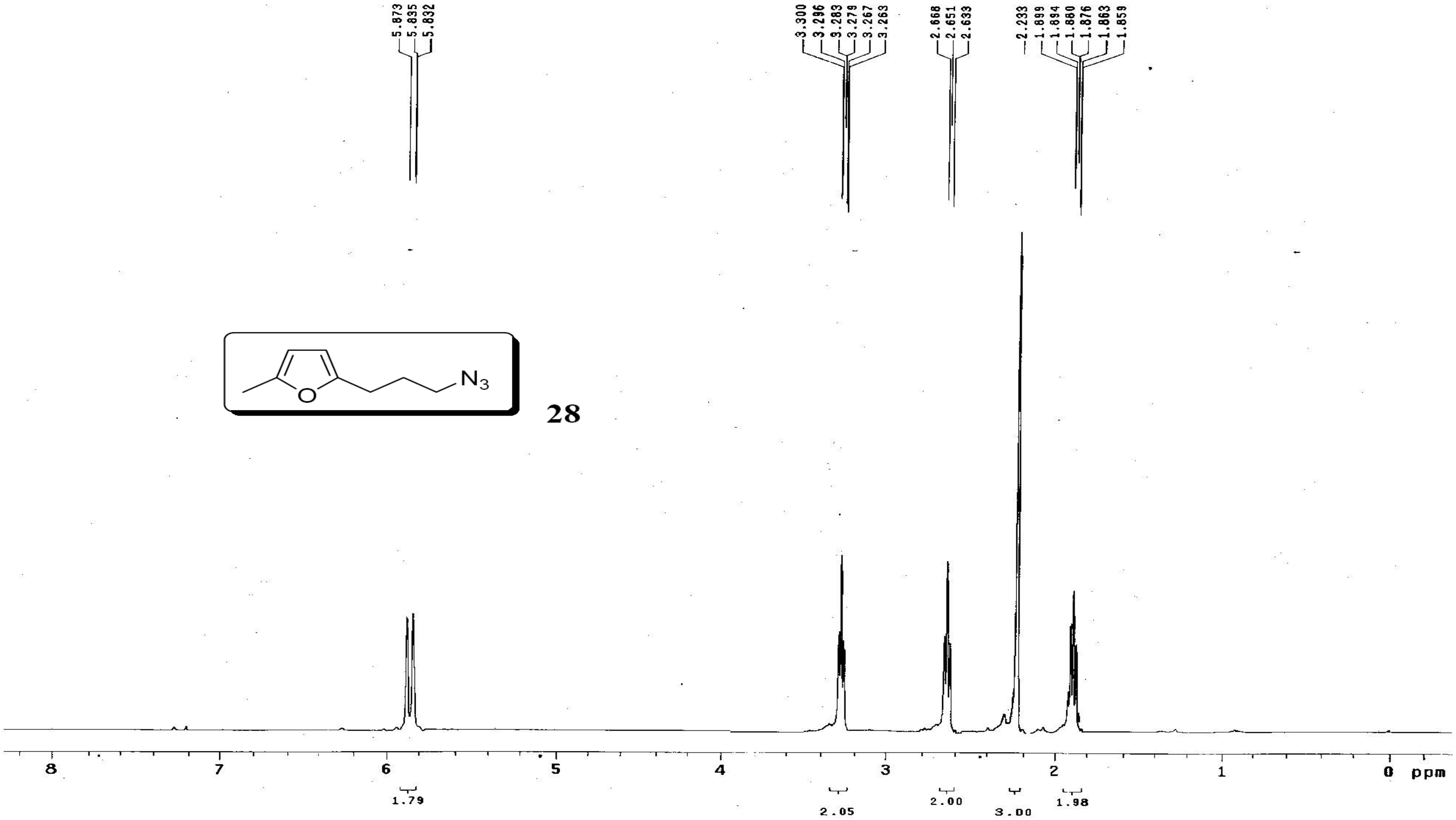
60
40
20
ppm

27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3.283
3.279
3.267
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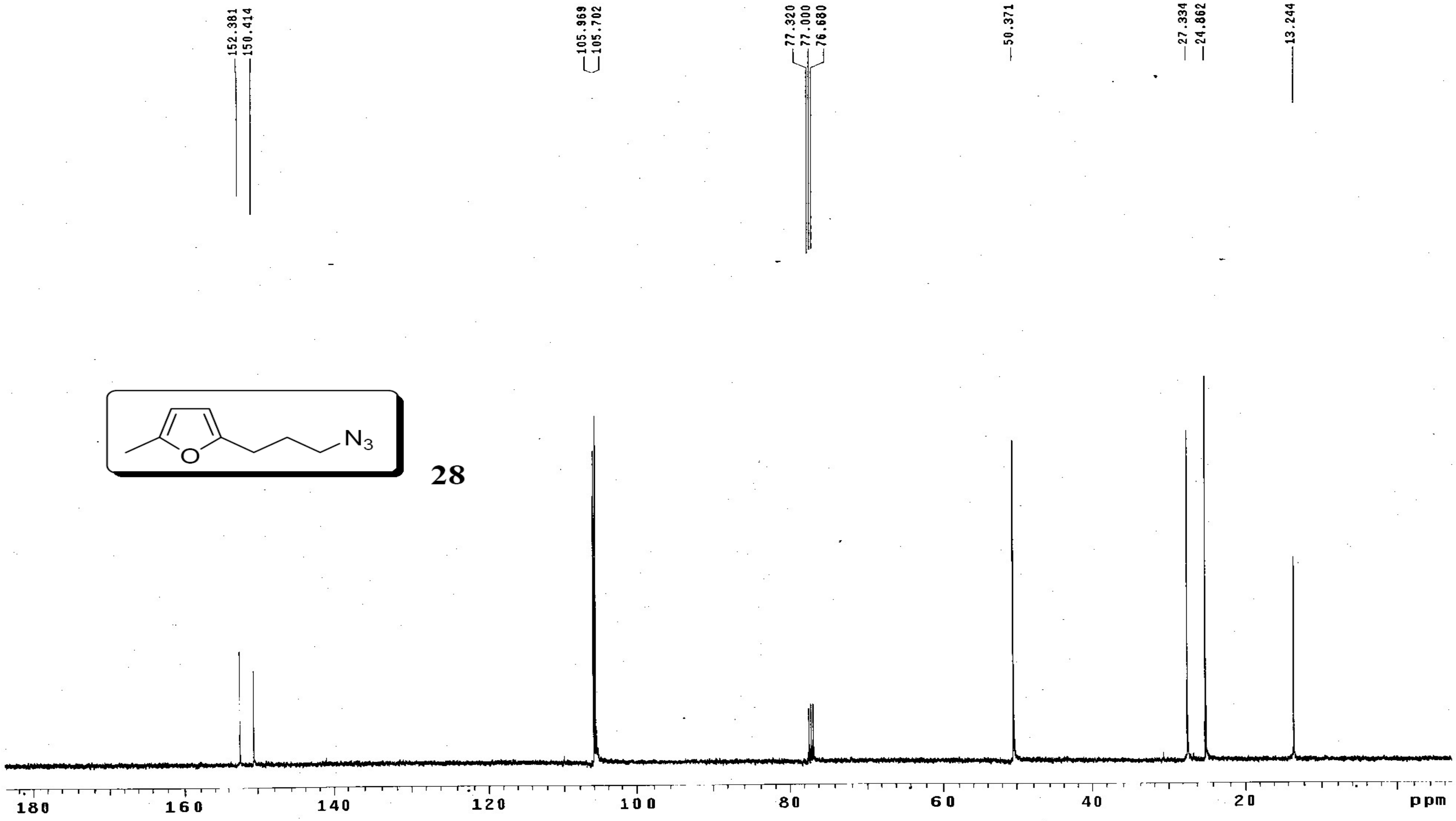
2.668
2.651
2.633
2.233
1.899
1.894
1.880
1.876
1.863
1.859
O
N3
8
7
6
5
4
3
2
1
0 ppm
1.79
2.05
2.00
3.00
1.98

28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13.244
O
N3
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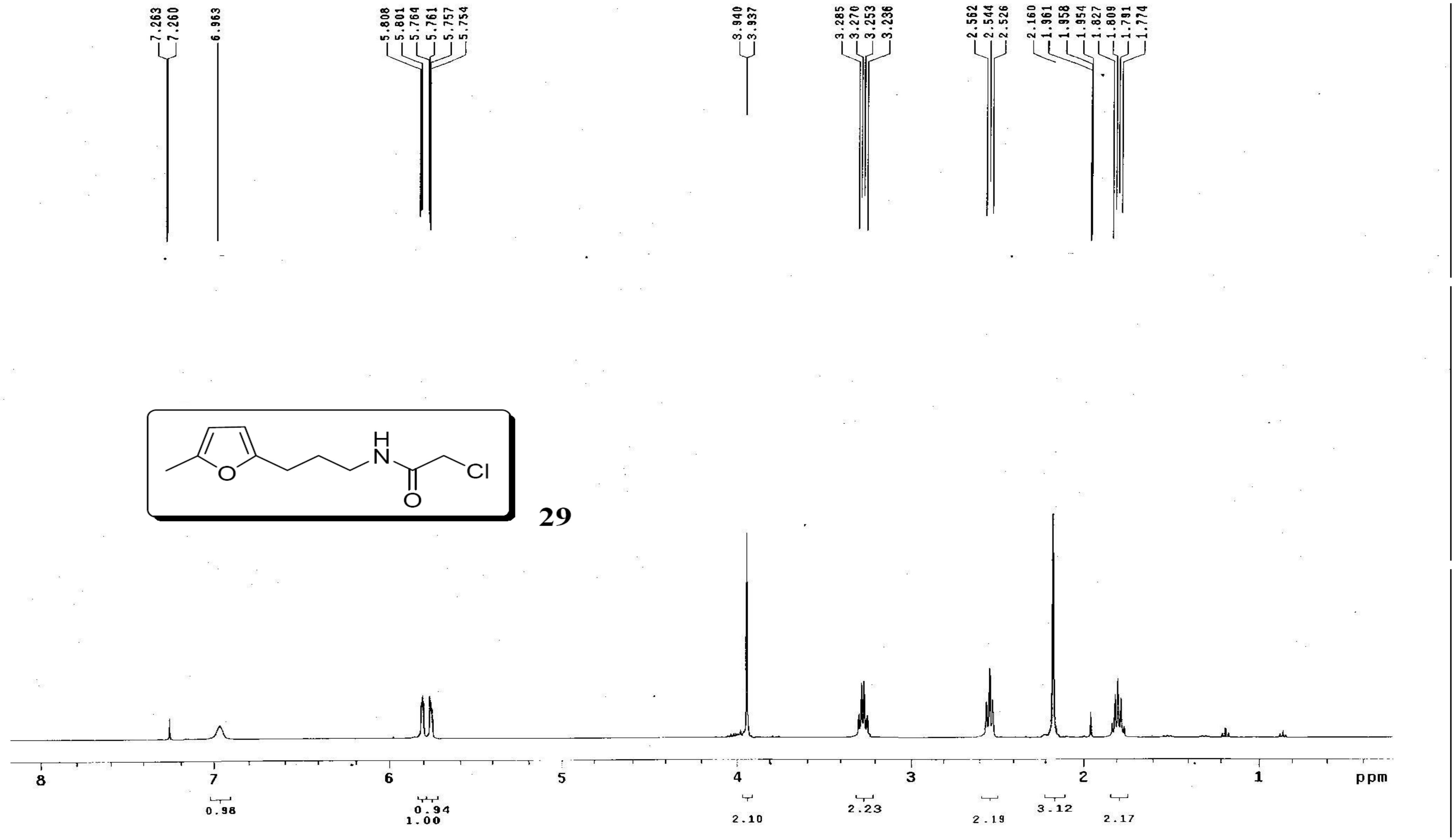
160
140
120
100
80
60
40
20
ppm

28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3.270
3.253
3.236
2.562
2.544
2.526
2.160
1.961
1.958
1.954
1.827
1.809
1.791
1.774
H
N
O
O
Cl
8
7
6
5
4
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ppm
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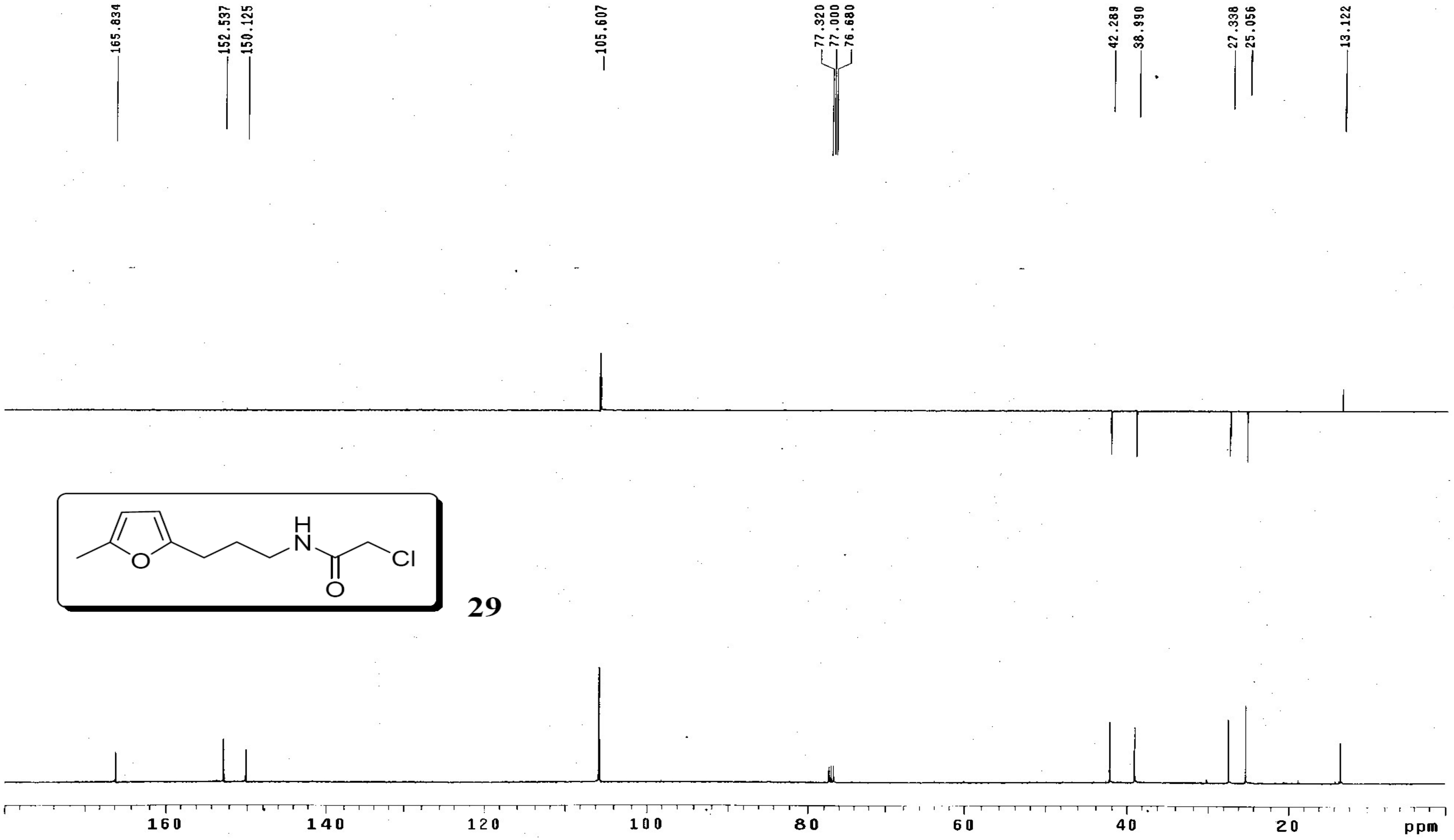
3.12
2.17

29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120
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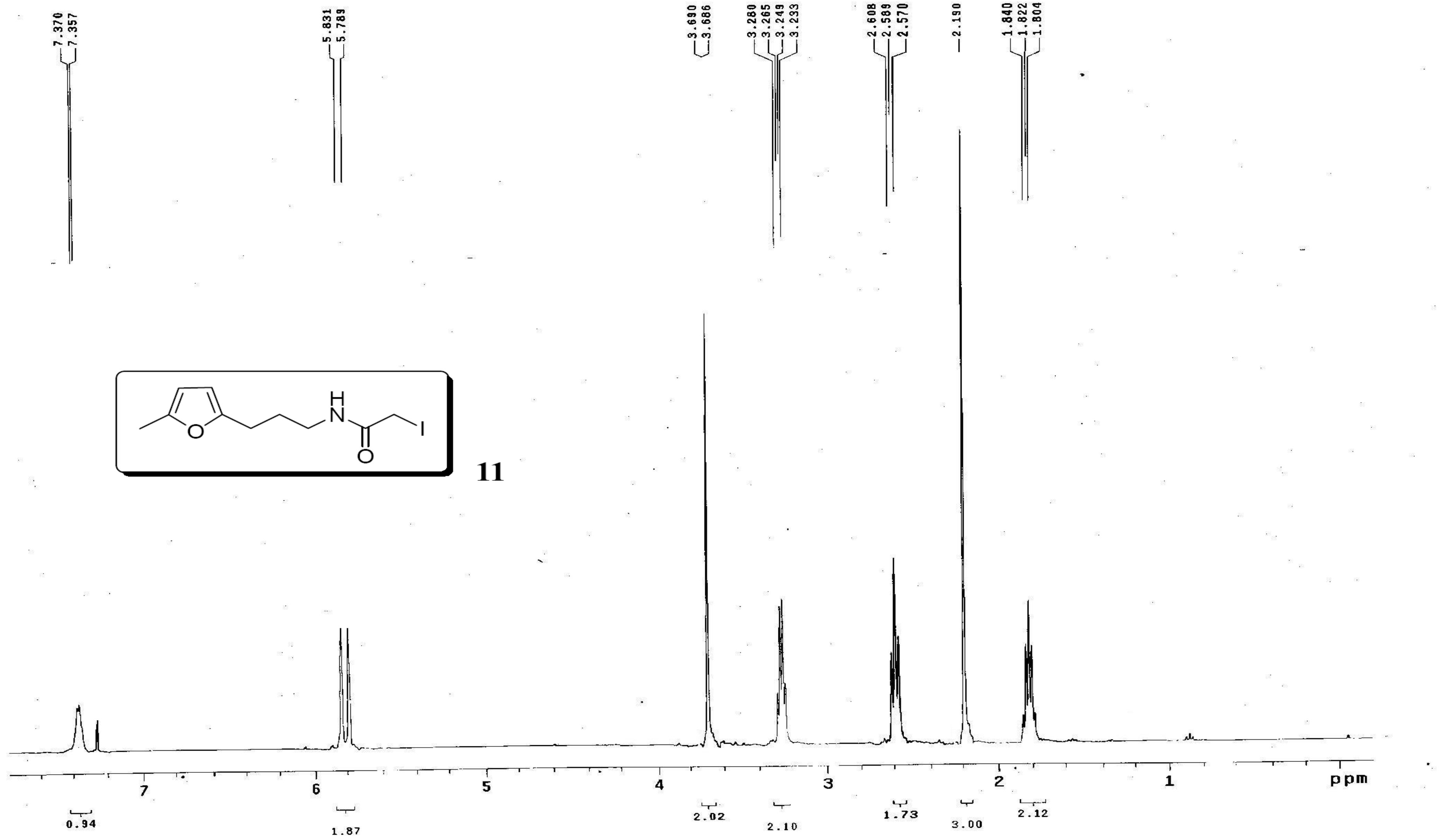
80
60
40
20
ppm

29



11

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3.249
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2.589
2.570
2.190
1.840
1.822
1.804
H
N
O
O
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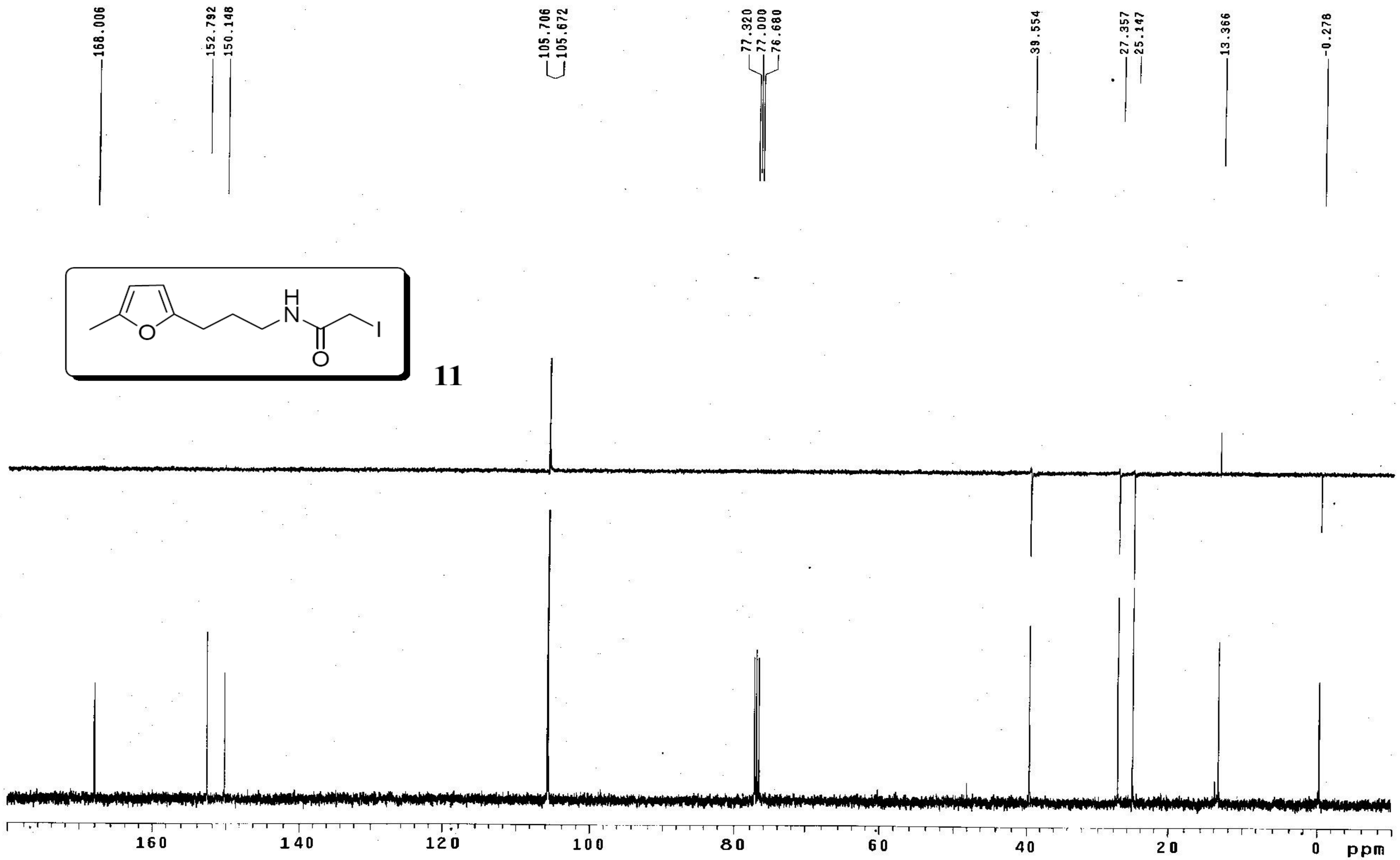
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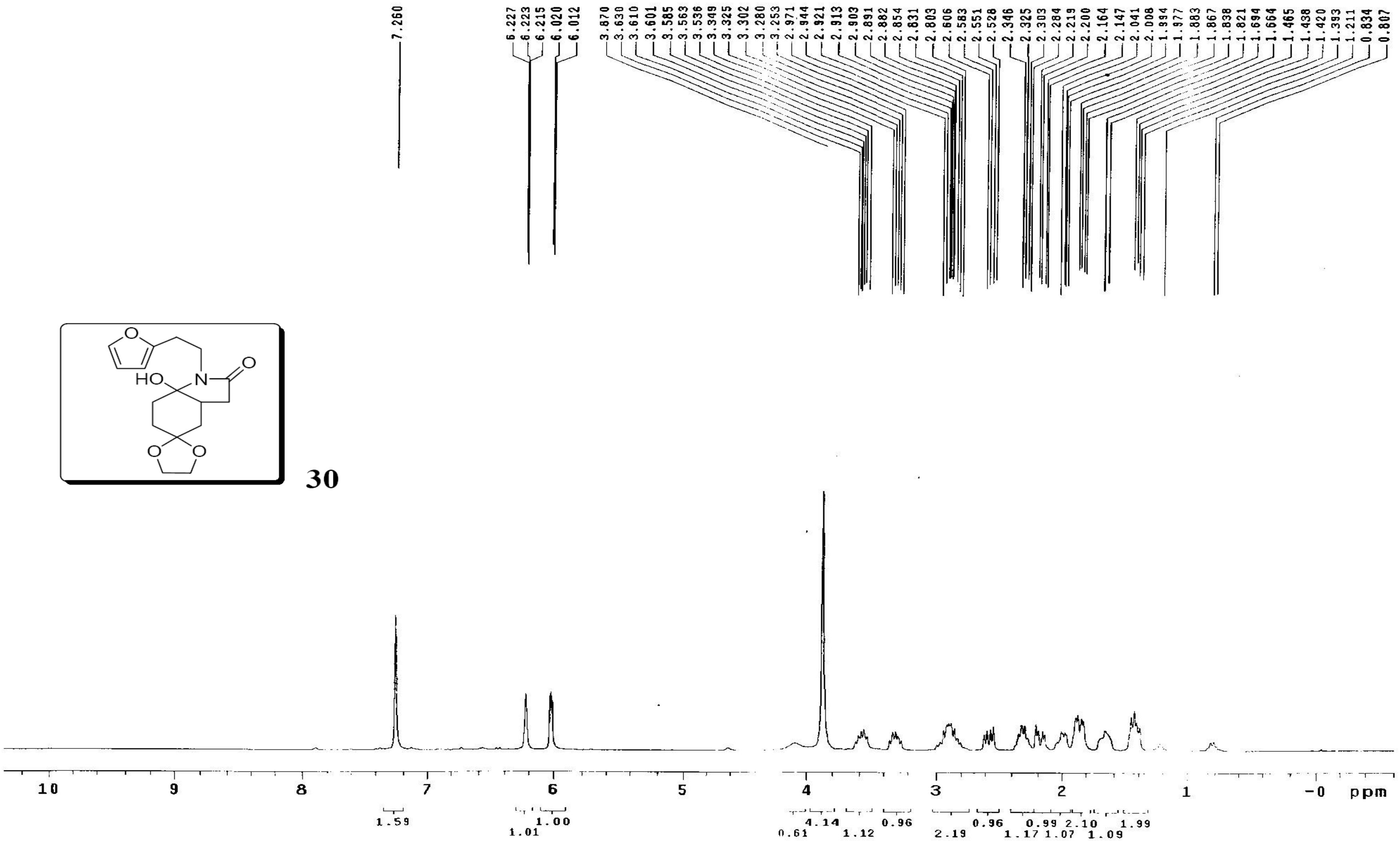
11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3.536
3.349
3.325
3.302
3.280
3.253
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2.944
2.921
2.913
2.903
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2.882
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2.831
2.803
2.606
2.583
2.551
2.528
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2.325
2.303
2.284
2.219
2.200
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2.147
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2.008
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1.883
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1.821
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1.664
1.465
1.438
1.420
1.393
1.211
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0.807
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HO
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O
O
O
10
9
8
7
6
5
4
3
2
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-0
ppm
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1.00
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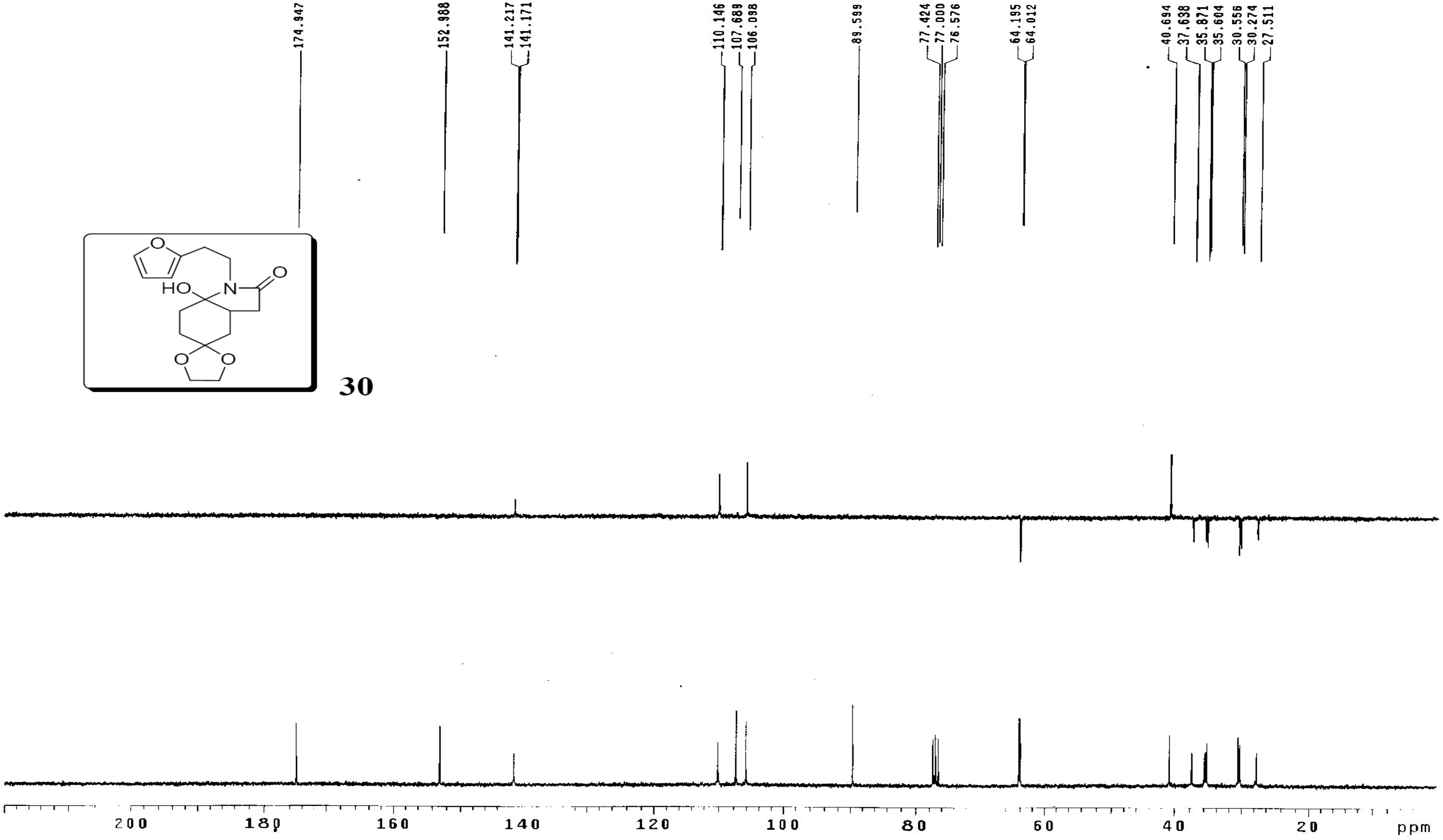
1.99

30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37.638
35.871
35.604
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120
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40
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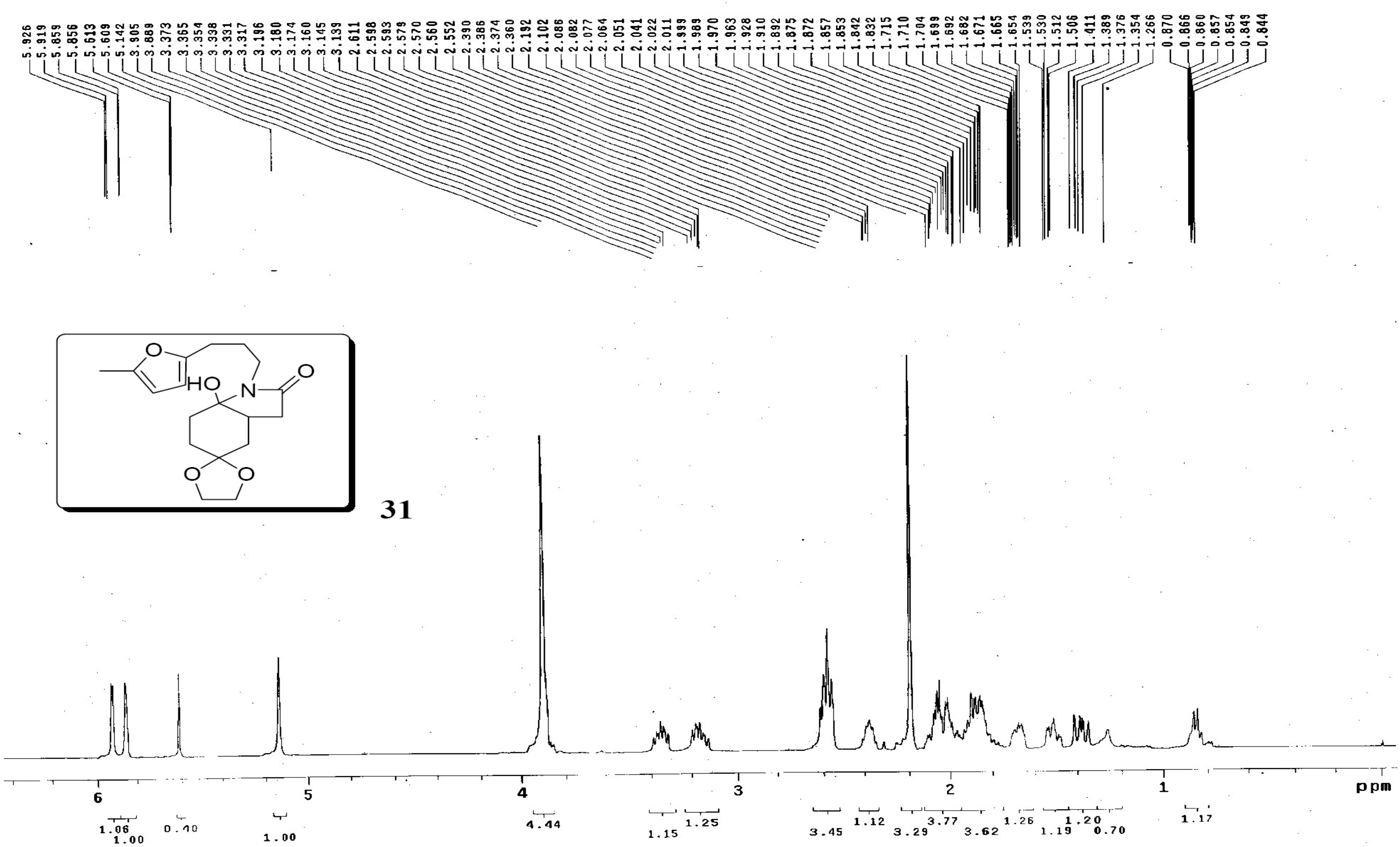
ppm

30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3.317
3.196
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2.593
2.579
2.570
2.560
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2.386
2.374
2.360
2.192
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2.082
2.077
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2.041
2.022
2.011
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1.857
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0.860
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0.854
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O
HO
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O
O
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5
4
3
2
1
ppm
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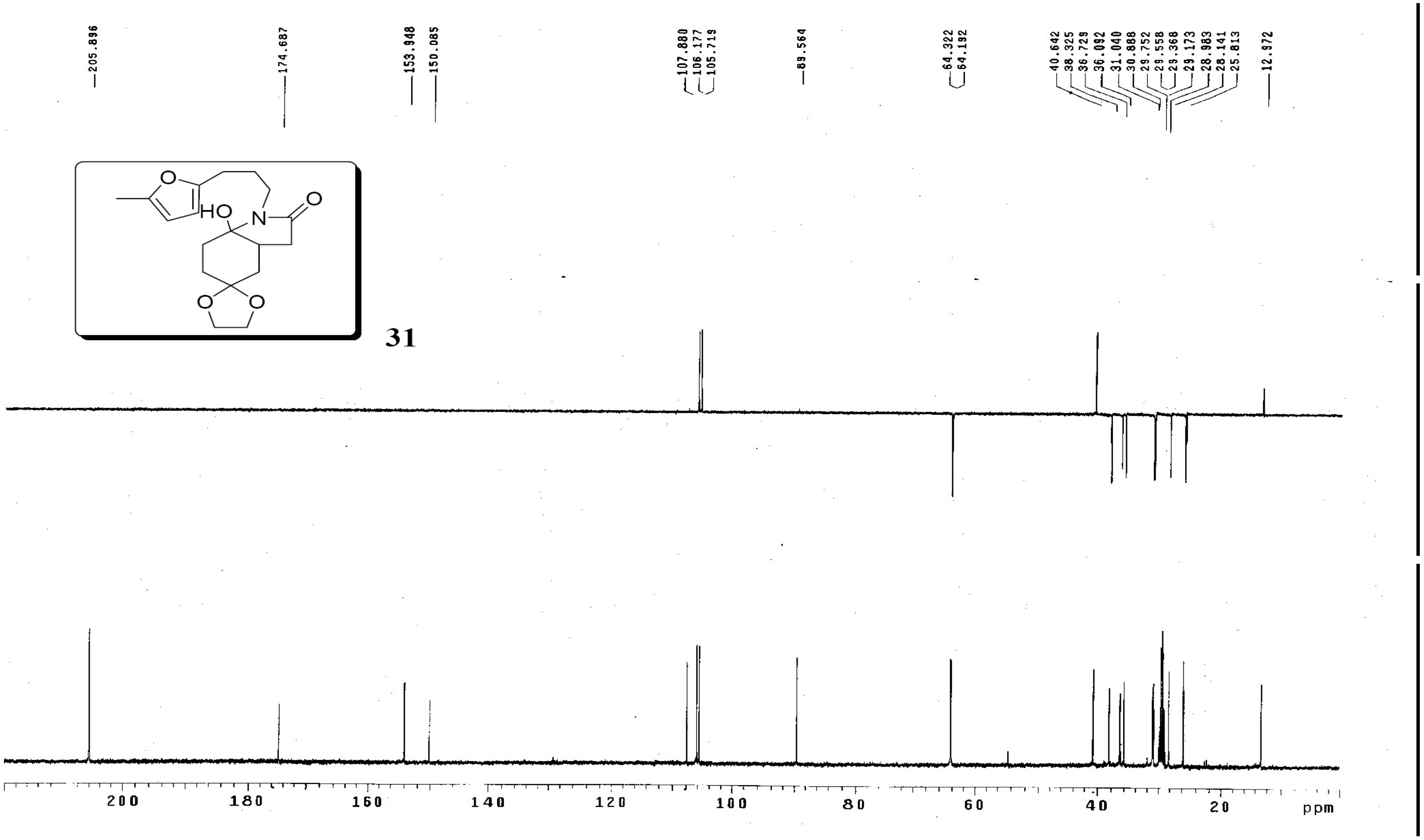
31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64.192
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36.729
36.092
31.040
30.888
29.752
29.558
29.368
29.173
28.983
28.141
25.813
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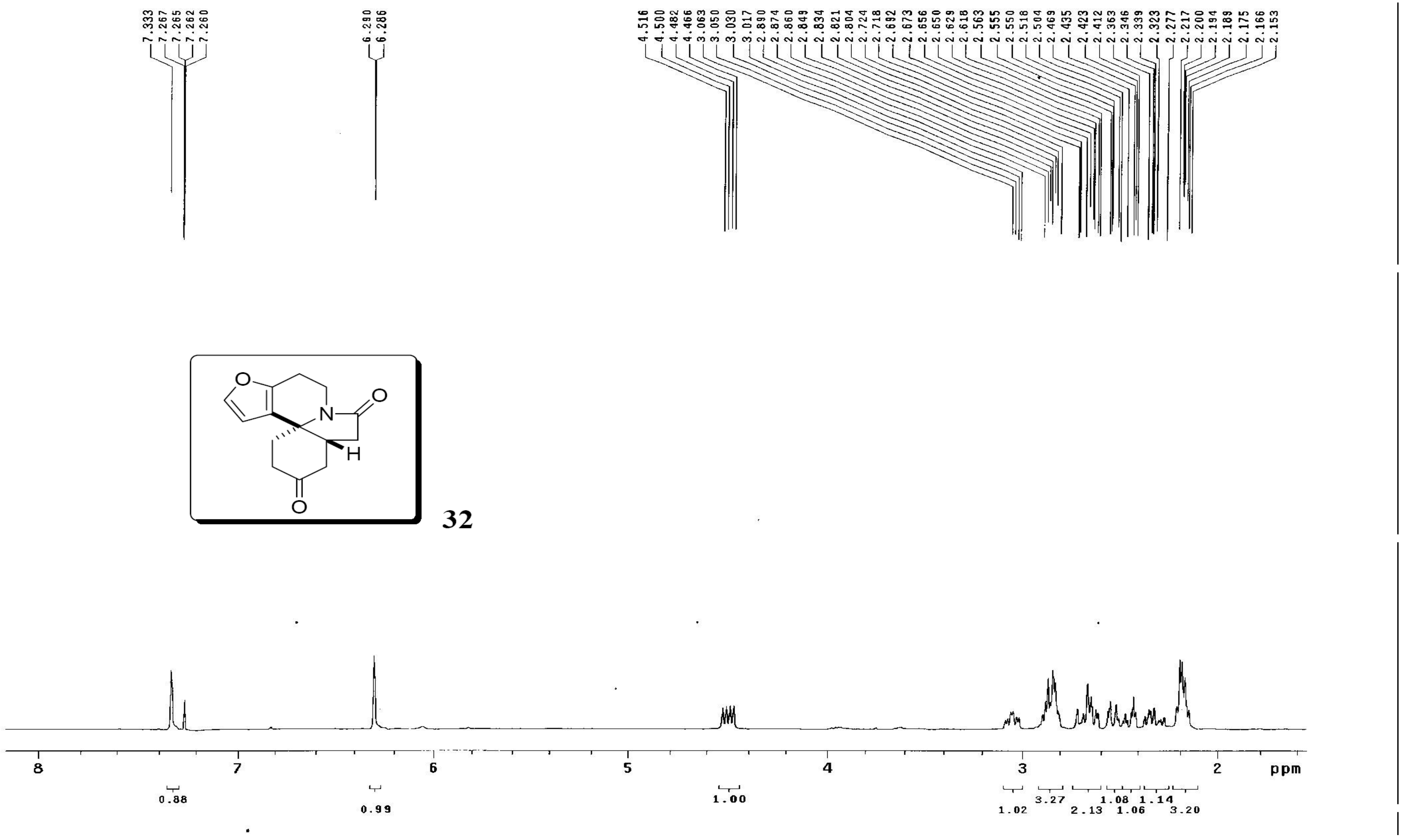
31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3.030
3.017
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2.724
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2.650
2.629
2.618
2.563
2.555
2.550
2.518
2.504
2.469
2.435
2.423
2.412
2.363
2.346
2.339
2.323
2.277
2.217
2.200
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O
N
O
H
O
8
7
6
5
4
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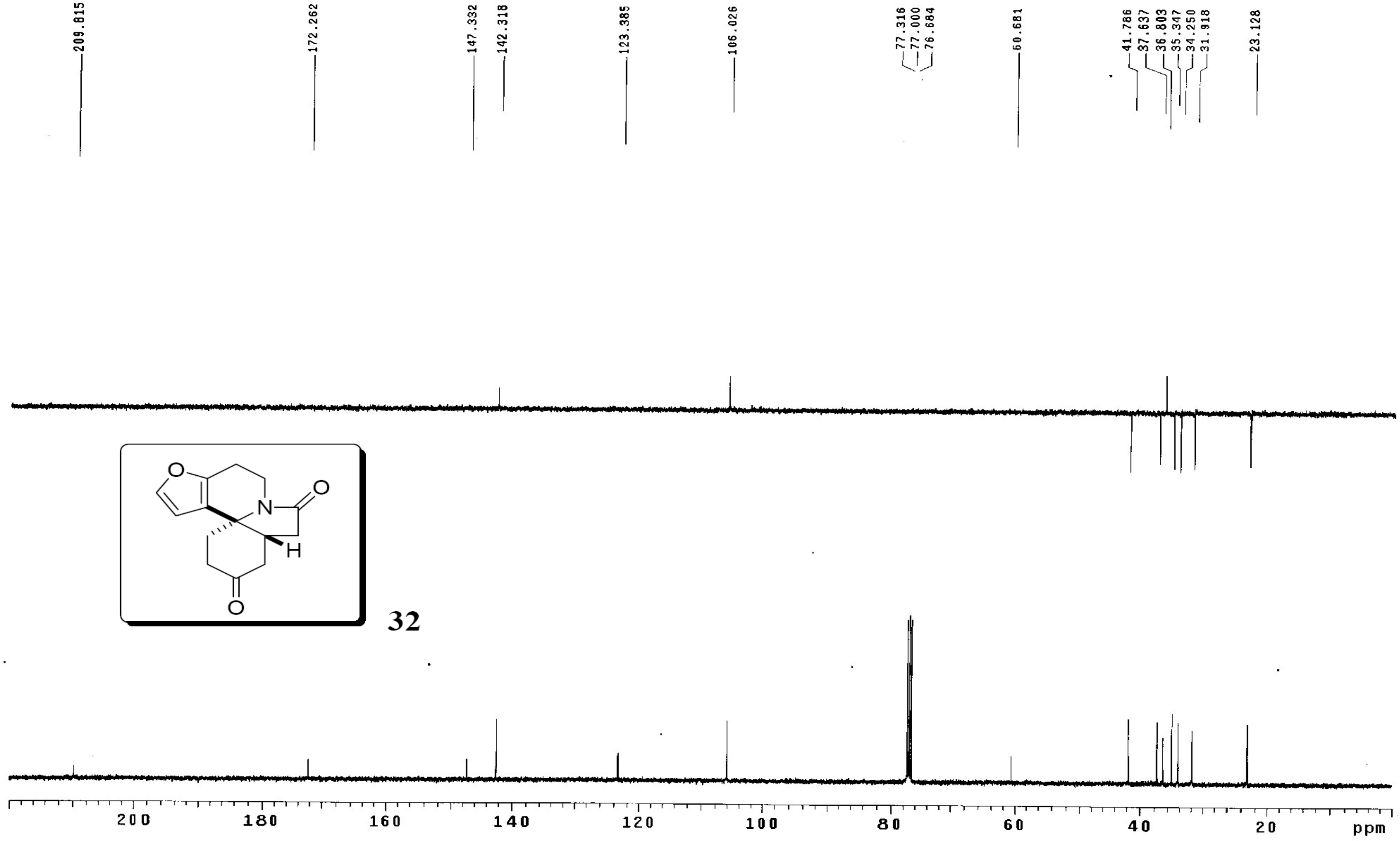
32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35.347
34.250
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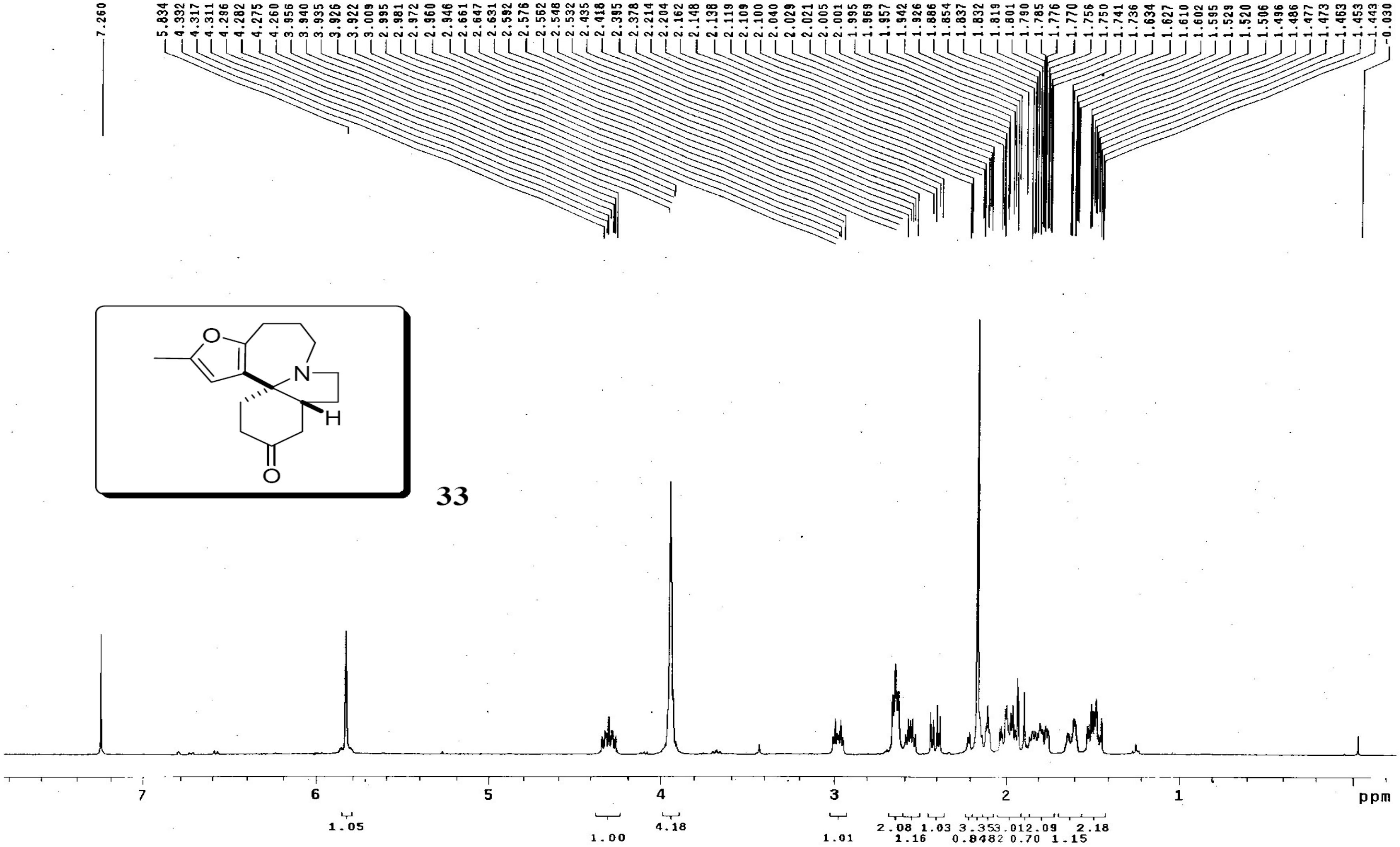
40
20
ppm

32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1.443
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O
N
H
O
7
6
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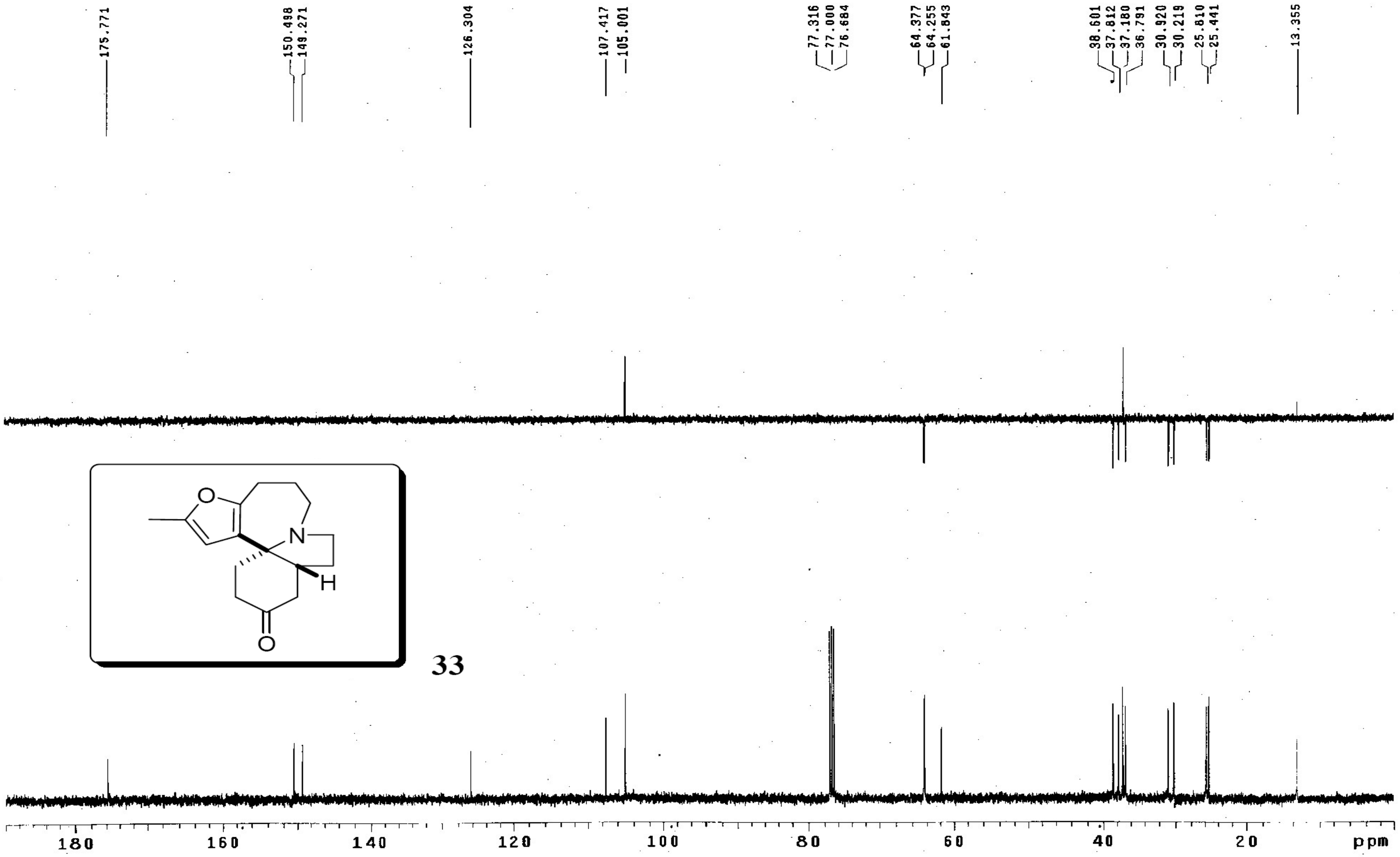
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H
O
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140
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40
20
ppm