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Supporting Information

Enantioselective C-C Bond Formation to Sulfonylimines Using 2-Pyridylsuofonyl Group as a Novel Stereocontroller

Shuichi Nakamura*, Hiroki Nakashima, Hideki Sugimoto, Hideaki Sano, Masataka Hattori, Norio Shibata and Takeshi Toru*[a]

[a] Department of Applied Chemistry, Graduate School of Engineering Nagoya Institute of Technology, Gokiso, Showa-ku, Nagoya 466-8555, Japan

E-mail: toru@nitech.ac.jp, snakamur@nitech.ac.jp; Tel & Fax: 81-52-735-5217

General Methods

Toluene was distilled from calcium hydride under nitrogen prior to use. All of the reactions were monitored by thin-layer chromatography (TLC) carried out on 0.25 mm Merck silica-gel plate (60f-254). The TLC plates were visualized with UV light and 7% phosphomolybdic acid or *p*-anisaldehyde in ethanol/heat. Column chromatography was carried out on a column packed with KANTO KAGAKU silica gel 60N 37571. Optical rotations were measured on a HORIBA SEPA-300 operating at λ=589 nm corresponding to the sodium D line. Melting points were recorded on a YANAGIMOTO micro melting point apparatus and are uncorrected. ^{1}H NMR (200 MHz) and ^{13}C NMR (50.3 MHz) spectra for solution in $CDCl_3$ were recorded on a Varian Mercury-200. Chemical shifts are expressed in ppm downfield from internal tetramethylsilane. Infrared spectra were record on a JASCO FT/IR-200 spectrometer. Mass spectra were recorded on a SHIMADZU QCMS-QP5050-A spectrometer (EI) and SHIMADZU LCMS-2010EV (ESI). Microanalyses were performed with a Perkin Elmer-240. HPLC analyses were performed on a JASCO PU-2080 Plus or SHIMADZU LC-2010A HT using 4.6 x 250 mm CHIRALPAK AD-H or CHIRALCEL OJ-H or CHIRALCEL OD-H or CHIRALPAK AS-H column.

Experimental Procedure

N-Benzylidene-2,4,6-triisopropylphenylsulfonamide (1e).

The reaction was carried out as described in the typical procedure except for using 2,4,6-triisopropylsulfonamide (500 mg, 1.76 mmol), benzaldehyde (187 mg, 1.76 mmol), triethylamine (0.74 mL, 5.28 mmol), and titanium(IV) chloride (1.00 mol L^{-1} in CH_2Cl_2, 1.76 mL, 1.76 mmol). Usual work-up gave the crude product which was recrystallized with hexane/ethyl acetate to afford **1e** (459 mg, 70%); mp 128.0-130.0˚C; R_f= 0.50 (hexane/ethyl

acetate = 80/20); ^{1}H NMR δ 1.26 (d, *J* = 6.6 Hz, 12H), 1.29 (d, *J* = 6.6 Hz, 6H), 2.91 (sep, *J* = 6.6 Hz, 1H), 4.36 (sep, *J* = 6.6 Hz, 2H), 7.20 (s, 2H), 7.45-7.95 (m, 5H), 9.02 (s, 1H); ^{13}C NMR δ 23.8, 25.0, 30.0, 34.4, 123.7, 129.0, 130.7, 130.8, 132.5, 134.4, 150.9, 153.4, 168.4; IR (KBr) 1607, 1311, 1149, 787, 770, 674, 532 cm^{-1}; EIMS m/z (rel. intensity) 371 (M^+, 22), 292 (100), 229 (30), 186 (49), 160 (35), 90 (23); Anal. Calcd for $C_{22}H_{29}NO_2S$: C, 71.12; H, 7.87; N, 3.77. Found: C, 71.22; H, 7.75; N, 3.79.

***N*-Benzylidene-8-quinolinesulfonamide (1f).**

The reaction was carried out as described in the typical procedure except for using 8-quinolinesulfonamide (500 mg, 2.40 mmol), benzaldehyde (0.25 mL, 2.40 mmol), triethylamine (1.00 mL, 7.20 mmol), and titanium(IV) chloride (1.00 mol L^{-1} in CH_2Cl_2, 2.40 mL, 2.40 mmol). Usual work-up gave the crude product which was recrystallized from hexane/ethyl acetate to afford **1f** (285 mg, 40%); mp 190.0-192.0 ˚C; R_f= 0.37 (hexane/ethyl acetate = 60/40); ^{1}H NMR δ 7.41-7.76 (m, 5H), 7.96-8.23 (m, 4H) 8.72-8.76 (m, 1H), 8.91-8.94 (m, 1H), 9.59 (s, 1H); ^{13}C NMR δ 121.8, 125.4, 128.6, 128.9, 131.2, 132.5, 133.9, 134.5, 134.6, 136.3, 143.3, 151.1, 175.0; IR (KBr) 1599, 1572, 1314, 1171, 1114, 816 cm^{-1}; EIMS m/z (rel. intensity) 298 (M^++1, 100), 209 (10), 129 (18), 102 (40); Anal. Calcd for $C_{16}H_{12}N_2O_2S$: C, 64.85; H, 4.08; N, 9.45. Found: C, 64.70; H, 4.14; N, 9.54.

***N*-Benzylidene-2-thiophenesulfonamide (1g).**

The reaction was carried out as described in the typical procedure except for using 2-thiophenesulfonamide (500 mg, 3.06 mmol), benzaldehyde (0.32 mL, 3.06 mmol), triethylamine (1.28 mL, 9.18 mmol), and titanium(IV) chloride (1.00 mol L^{-1} in CH_2Cl_2, 3.06 mL, 3.06 mmol). Usual work-up gave the crude product which was recrystallized from

hexane/ethyl acetate to afford **1g** (292 mg, 38%); R_f= 0.54 (hexane/ethyl acetate = 60/40); ^{1}H NMR δ 7.14 (dd, *J* = 3.3, 4.9 Hz, 1H), 7.48 (t, *J* = 7.7 Hz, 2H) 7.63 (t, *J* = 8.1 Hz, 1H), 7.71 (dd, *J* = 1.3, 4.9 Hz, 1H), 7.80 (dd, *J* = 1.3, 3.7 Hz, 1H), 7.95 (d, *J* = 8.1 Hz, 2H), 9.02 (s, 1H); ^{13}C NMR δ 127.7, 129.0, 131.4, 132.1, 133.8, 134.5, 135.1, 138.1, 170.2; IR (KBr) 1596, 1564, 1322, 1151, 795, 587 cm^{-1}; EIMS m/z (rel. intensity) 251 (M^+, 35), 187 (30), 147 (100); Anal. Calcd for $C_{11}H_9NO_2S_2$: C, 52.57; H, 3.61; N, 5.57. Found: C, 52.57; H, 3.79; N, 5.60.

***N*-Benzylidene-2-furylsulfonamide (1h).**

The reaction was carried out as described in the typical procedure except for using 2-furylsulfonamide (500 mg, 3.40 mmol), benzaldehyde (0.35 mL, 3.40 mmol), triethylamine (1.42 mL, 10.2 mmol), and titanium(IV) chloride (1.00 mol L^{-1} in CH_2Cl_2, 3.40 mL, 3.40 mmol). Usual work-up gave the crude product which was recrystallized from hexane/ethyl acetate to afford **1h** (511 mg, 64%); mp 127.3-128.1 ˚C; R_f= 0.60 (hexane/ethyl acetate = 50/50); ^{1}H NMR δ 6.58 (s, 1H), 7.28 (d, *J* = 4.0 Hz, 1H), 7.49-7.56 (m, 2H), 7.64-7.71 (m, 2H), 7.64-7.71 (m, 2H), 7.98 (d, *J* = 8.0 Hz, 2H), 9.07 (s, 1H); ^{13}C NMR δ 111.6, 118.5, 129.0, 131.3, 131.8, 135.2, 146.4, 147.3, 171.9; IR (KBr) 1567, 1452, 1318, 1153, 1119, 811 cm^{-1}; EIMS m/z (rel. intensity) 235 (M^+, 60), 171 (100), 155 (85), 143 (80), 131 (63).

***N*-[(4-Methylphenyl)methylidene]-2-pyridinesulfonamide (1i).**

The reaction was carried out as described in the typical procedure except for using 2-pyridylsulfonamide (703 mg, 4.44 mmol), 4-methylbenzaldehyde (1.05 mL, 8.89 mmol), triethylamine (1.86 mL, 13.3 mmol), and titanium(IV) chloride (1.00 mol L^{-1} in CH_2Cl_2, 4.44 mL, 4.44 mmol). Usual work-up gave the crude product which was recrystallized from

hexane/ethyl acetate to afford **1i** (736 mg, 60%); R_f= 0.35 (hexane/ethyl acetate = 60/40); ^{1}H NMR δ 2.44 (s, 3H), 7.20-7.45 (m, 2H), 7.50-7.60 (m, 1H), 7.80-8.10 (m, 3H), 8.20-8.30 (m, 1H), 8.90-9.00 (m, 1H), 9.20 (s, 1H); ^{13}C NMR δ 22.2, 123.1, 127.0, 129.6, 129.7, 131.6, 137.8, 146.7, 150.1, 155.7, 173.7; IR (KBr) 1594, 1305, 1169, 810 cm^{-1}; EIMS m/z (rel. intensity) 261 (M^++1, 16), 247 (25), 195 (100), 168 (90), 154 (95); Anal. Calcd for $C_{13}H_{12}N_2O_2S$: C, 59.98; H, 4.65; N, 10.76. Found: C, 60.01; H, 4.81; N, 10.56.

***N*-[(4-Methoxyphenyl)methylidene]-2-pyridinesulfonamide (1j).**

The reaction was carried out as described in the typical procedure except for using 2-pyridylsulfonamide (500 mg, 3.16 mmol), *p*-anisaldehyde (0.424 mL, 3.48 mmol), triethylamine (1.32 mL, 9.48 mmol), and titanium(IV) chloride (1.00 mol L^{-1} in CH_2Cl_2, 3.16 mL, 3.16 mmol). Usual work-up gave the crude product which was recrystallized from hexane/ethyl to afford **1j** (451 mg, 52%); R_f= 0.35 (hexane/ethyl acetate = 60/40); ^{1}H NMR δ 3.91 (s, 3H), 7.05 (d = 9.0 Hz, 2H), 7.49-7.56 (m, 1H), 7.93-8.01 (m, 3H), 8.25 (d, *J* = 8.0 Hz, 1H), 8.72-8.74 (m, 1H), 9.17 (s, 1H), ^{13}C NMR δ 55.6, 113.9, 122.6, 124.6, 126.7, 131.4, 133.6, 137.6, 149.7, 155.6, 172.5; IR (KBr) 1590, 1304, 1169, 814 cm^{-1}; EIMS m/z (rel. intensity) 276 (M^+, 60), 212 (100), 199 (65); Anal. Calcd for $C_{13}H_{12}N_2O_3S$: C, 56.51; H, 4.38; N, 10.14. Found: C, 56.90; H, 4.24; N, 9.89.

***N*-[(3-Methoxyphenyl)methylidene]-2-pyridinesulfonamide (1k).**

The reaction was carried out as described in the typical procedure except for using 2-pyridylsulfonamide (500 mg, 3.16 mmol), *m*-anisaldehyde (0.424 mL, 3.48 mmol), triethylamine (1.32 mL, 9.48 mmol), and titanium(IV) chloride (1.00 mol L^{-1} in CH_2Cl_2, 3.16 mL, 3.16 mmol). Usual work-up gave the crude product which was recrystallized from

hexane/ethyl acetate to afford **1k** (451 mg, 52%); mp 148.0-150.0 ˚C; R_f= 0.35 (hexane/ethyl acetate = 60/40); ^{1}H NMR δ 3.83 (s, 3H), 7.15-7.56 (m, 5H), 7.93-8.26 (m, 1H), 8.24 (d, *J* = 6.6 Hz, 1H), 8.71-8.73 (m, 1H), 9.20 (s, 1H), ^{13}C NMR δ 56.0, 113.7, 123.0, 123.5, 126.0, 127.4, 130.3, 133.7, 138.2, 150.5, 155.5, 160.1, 174.3; IR (KBr) 1572, 1324, 1174, 828 cm^{-1}; EIMS m/z (rel. intensity) 276 (M^+, 56), 242 (90), 211 (100), 199 (60); Anal. Calcd for $C_{13}H_{12}N_2O_3S$: C, 56.51; H, 4.38; N, 10.14. Found: C, 56.24; H, 4.37; N, 9.97.

***N*-[(4-Chlorophenyl)methylidene]-2-pyridinesulfonamide (1l).**

The reaction was carried out as described in the typical procedure except for using 2-pyridylsulfonamide (403 mg, 2.55 mmol), 4-chlorolbenzaldehyde (716 mg, 5.10 mmol), triethylamine (1.07 mL, 7.65 mmol), and titanium(IV) chloride (1.00 mol L^{-1} in CH_2Cl_2, 2.55 mL, 2.55 mmol). Usual work-up gave the crude product which was recrystallized from hexane/ethyl acetate to afford **1l** (407 mg, 57%); R_f= 0.35 (hexane/ethyl acetate = 60/40), ^{1}H NMR δ 7.40-7.60 (m, 3H), 7.80-8.10 (m, 3H), 8.20-8.30 (m, 1H), 8.80-8.90 (m, 1H), 9.21 (s, 1H), ^{13}C NMR δ 123.2, 127.2, 129.5, 130.5, 132.5, 137.9, 141.7, 150.2, 155.3, 172.5; IR (KBr) 1567, 1306, 1169, 809 cm^{-1}; EIMS m/z (rel. intensity) 281 (M^++1, 25), 247 (58), 215 (75), 154 (100), 138 (95); Anal. Calcd for $C_{12}H_9ClN_2O_2S$: C, 51.34; H, 3.23; N, 9.98. Found: C, 51.30; H, 2.98; N, 10.09.

***N*-(1-Naphthylmethylidene)-2-pyridinesulfonamide (1m).**

The reaction was carried out as described in the typical procedure except for using 2-pyridylsulfonamide (300 mg, 1.90 mmol), 1-naphthaldehyde (296 mg, 1.90 mmol), triethylamine (0.79 mL, 5.62 mmol), and titanium(IV) chloride (1.00 mol L^{-1} in CH_2Cl_2, 1.9 mL, 1.90 mmol). Usual work-up gave the crude product which was recrystallized from

hexane/ethyl acetate to afford **1m** (291 mg, 39%); mp 99.0-100.0 ˚C; R_f= 0.33 (hexane/ethyl acetate = 60/40); ^{1}H NMR δ 7.25-7.68 (m, 4H), 7.90-8.02 (m, 2H), 8.11-8.73 (m, 3H), 8.85-8.90 (m, 1H), 8.99-8.90 (m, 1H), 9.81 (s, 1H); ^{13}C NMR δ 123.1, 124.2, 124.9, 126.8, 131.6, 133.5, 135.7, 136.4, 137.9 150.1, 155.7, 173.5; IR (KBr) 1559, 1318, 1171, 758, 641, 590 cm^{-1}; EIMS m/z (rel. intensity) 296 (M^+, 13), 231 (42), 203 (10), 153 (100), 126 (38), 78 (96); Anal. Calcd for $C_{16}H_{12}N_2O_2S$: C, 64.85; H, 4.08; N, 9.45. Found: C, 64.80; H, 4.05; N, 9.53.

***N*-(2-Naphthylmethylidene)-2-pyridinesulfonamide (1n)**

The reaction was carried out as described in the typical procedure except for using 2-pyridylsulfonamide (500 mg, 3.16 mmol), 2-naphthaldehyde (0.43 mg, 3.16 mmol), triethylamine (1.32 mL, 9.48 mmol), and titanium(IV) chloride (1.00 mol L^{-1} in CH_2Cl_2, 3.16 mL, 3.16 mmol). Usual work-up gave the crude product which was recrystallized from hexane/ethyl acetate to afford **1n** (291 mg, 31%); mp 149.0-150.0 ˚C; R_f = 0.33 (hexane/ethyl acetate = 60/40); ^{1}H NMR δ 7.25-7.68 (m, 3H), 7.86-8.06 (m, 5H), 8.25-8.29 (m, 1H), 8.40 (s, 1H), 8.70-8.73 (m, 1H), 9.39 (s, 1H); ^{13}C NMR δ 123.4, 124.3, 126.8, 127.2, 127.3, 128.0, 129.2, 129.6, 129.7, 130.3, 132.6, 136.8, 138.1, 150.4, 160.6, 174.2; IR (KBr): 1584, 1317, 1169, 1114, 784, 605 cm^{-1}; EIMS m/z (rel. intensity): 296 (M^+, 5), 232 (10), 203 (5), 153 (8), 127 (24), 78 (100). Anal. Calcd for $C_{16}H_{12}N_2O_2S$: C, 64.85; H, 4.08; N, 9.45. Found: C, 64.80; H, 4.05; N, 9.53.

***N*-(2-Furfurylidene)-2-pyridinesulfonamide (1o).**

The reaction was carried out as described in the typical procedure except for using 2-pyridylsulfonamide (800 mg, 5.06 mmol), furfural (0.42 mL, 5.06 mmol), triethylamine

(2.1 mL, 15.1 mmol), and titanium(IV) chloride (1.00 mol L^{-1} in CH_2Cl_2, 5.1 mL, 5.1 mmol). Usual work-up gave the crude product which was recrystallized from hexane/ethyl acetate to afford **1o** (604 mg, 50%); mp 144.5-147.8 ˚C; R_f= 0.22 (hexane/ethyl acetate = 60/40); ^{1}H-NMR δ 6.68 (dd, *J* =2.0, 3.7 Hz, 1H), 7.25-7.63 (m, 2H), 7.91-8.00 (m, 1H), 8.19-8.23 (m, 2H), 8.72-8.75 (m, 1H), 9.00 (s, 1H); ^{13}C NMR δ 113.8, 123.2, 125.9, 127.0, 137.9, 148.8, 150.1, 150.1, 155.4, 158.8; IR (KBr) 1604, 1289, 1170, 1112, 829, 553 cm^{-1}; FABMS m/z (rel. intensity) 237 (M^++1, 100), 185 (22), 154 (8), 93 (45); Anal. Calcd for $C_{10}H_8N_2O_3S$: C, 50.84; H, 3.41; N, 11.86. Found: C, 50.95; H, 3.26; N, 11.89.

***N*-(3-Phenylpropenylidene)-2-pyridinesulfonamide (1p).**

The reaction was carried out as described in the typical procedure except for using 2-pyridylsulfonamide (802 mg, 5.07 mmol), *trans*-cinnamaldehyde (0.64 mL, 5.07 mmol), triethylamine (2.1 mL, 15.1 mmol), and titanium(IV) chloride (1.00 mol L^{-1} in CH_2Cl_2, 5.1 mL, 5.1 mmol). Usual work-up gave the crude product which was recrystallized from hexane/ethyl acetate to afford **1p** (624 mg, 45%); mp 107.5-108.2 ˚C; R_f= 0.26 (hexane/ethyl acetate = 60/40); ^{1}H-NMR δ 7.03 (dd, *J* = 9.5, 16 Hz, 1H), 7.25-7.63 (m, 7H), 7.91-8.00 (m, 1H), 8.19-8.23 (m, 1H), 8.72-8.75 (m, 1H), 9.27 (d, *J* = 9.5 Hz, 1H); ^{13}C NMR δ 123.0, 124.5, 127.0, 128.6, 129.0, 131.7, 133.8, 137.8, 150.1, 155.0, 156.1, 174.5; IR (KBr) 1579, 1558, 1302, 1166, 1115, 785 cm^{-1}; EIMS m/z (rel. intensity) 272 (M^+, 13), 207 (18), 129 (68), 102 (10) 78 (100); Anal. Calcd for $C_{14}H_{12}N_2O_2S$: C, 61.75; H, 4.44; N, 10.29. Found: C, 61.72; H, 4.37; N, 10.25.

***N*-(1-Phenylethyl)-2,4,6-triisopropylbenzenesulfonamide (2e).**

To a solution of bis(oxazoline)-Ph (30.1 mg, 0.09 mmol) and imine **1e** (22.3 mg, 0.06 mmol)

in toluene (3 mL) was added MeMgI (0.66 mol L^{-1} in Et_2O, 0.18 mL, 0.12 mmol) at -78 ˚C and the reaction mixture was stirred for 1 h. Usual workup gave the crude product which was purified by column chromatography (SiO_2 10g, benzene/ethyl acetate = 90/10) to afford **2e** (16.1 mg, 69%, 20% ee); mp. 108.0-110.0 ˚C; R_f= 0.48 (hexane/ethyl acetate = 80/20); ^{1}H NMR δ 1.17 (d, *J* = 6.8 Hz, 12H), 1.25 (d, *J* = 6.8 Hz, 6H), 1.45 (d, *J* = 6.8 Hz, 3H), 2.91 (sep, *J* = 6.8 Hz, 1H), 4.36 (sep, *J* = 6.8 Hz, 2H), 4.53-4.70 (m, 2H), 7.20-7.30 (m, 7H); ^{13}C NMR δ 23.8, 24.8, 25.1, 29.8, 34.3, 53.5, 123.4, 125.9, 127.4, 128.3, 142.0, 132.4, 149.6, 152.3; IR (KBr) 3312, 1459, 1318, 1158, 660, 552 cm^{-1}; FABMS m/z (rel. intensity) 388 (M^++1, 46), 284 (66), 267 (28), 105 (100); Anal. Calcd for $C_{23}H_{33}NO_2S$: C, 71.27; H, 8.58; N, 3.61. Found: C, 71.29; H, 8.56; N, 3.60. HPLC (CHIRALPAK AD-H, hexane/*i*-PrOH = 98:2, 0.5 mL min^{-1}), t_R 21 (minor), 23 (major) min.

***N*-(1-Phenylethyl)quinoline-8-sulfonamide (2f).**

To a solution of bis(oxazoline)-Ph (30.1 mg, 0.09 mmol) and imine **1f** (17.9 mg, 0.06 mmol) in toluene (3 mL) was added MeMgI (0.66 mol L^{-1} in Et_2O, 0.18 mL, 0.12 mmol) at -78 ˚C and the reaction mixture was stirred for 1 h. Usual workup gave the crude product which was purified by column chromatography (SiO_2 10g, benzene/ethyl acetate = 90/10) to afford **2f** (9.7 mg, 52%, 0% ee); mp. 190-192 ˚C; R_f= 0.32 (hexane/ethyl acetate = 60/40); ^{1}H NMR δ 1.42 (d, *J* = 7.0 Hz, 3H), 4.47 (dq, *J* = 7.0, 7.8 Hz, 1H), 6.57 (d, *J* = 7.8 Hz, 1H), 6.84 (m, 5H), 7.30-7.60 (m, 2H), 7.80-7.90 (m, 1H), 8.10-8.40 (m, 2H), 8.85-8.95 (m, 1H); ^{13}C NMR δ 23.3, 54.6, 121.7, 125.3, 125.7, 126.9, 127.4, 128.3, 130.4, 132.6, 136.5, 140.9, 142.7, 143.4, 150.4; IR (KBr) 3293, 1321, 1141, 793, 700, 614 cm^{-1}; FABMS m/z (rel.intensity) 313 (M^++1, 100), 209 (40), 105 (42); Anal. Calcd for $C_{17}H_{16}N_2O_2S$: C, 65.36; H, 5.16; N, 8.97. Found: C, 65.43; H, 5.03; N, 9.03. HPLC (CHIRALCEL OD-H, hexane/*i*-PrOH = 80:20, 0.5

mL min^{-1}), t_R 51, 56 min.

***N*-[1-(4-Methylphenyl)ethyl]-2-pyridinesulfonamide (2i).**

To a solution of bis(oxazoline)-Ph (38.5 mg, 0.115 mmol) and imine **1i** (20.0 mg, 0.07 mmol) in toluene (4 mL) was added MeMgBr (1.44 mol L^{-1} in Et_2O, 0.107 mL, 0.154 mmol) at -95 ˚C and the reaction mixture was stirred for 1 h. Usual workup gave the crude product which was purified by column chromatography (SiO_2 10g, benzene/ethyl acetate = 90/10) to afford **2i** (14.3 mg, 67%, 83% ee); $[\alpha]_D^{25}$ –44.6 (*c* 0.67, $CHCl_3$, 83% ee); mp. 117.5-120.3 ˚C; R_f= 0.30 (hexane/ethyl acetate = 50/50); ^{1}H NMR δ 1.46 (d, *J* = 7.0 Hz, 3H), 3.25 (s, 3H), 4.55 (dq, *J* = 7.0, 8.4 Hz, 1H), 5.28 (d, *J* = 8.4 Hz, 1H), 6.80-7.10 (m, 4H), 7.20-7.45 (m, 1H), 7.60-7.90 (m, 2H), 8.50-8.65 (m, 1H); ^{13}C NMR δ 21.1, 23.3, 55.0, 121.9, 125.8, 126.0, 128.9, 136.7, 137.2, 138.6, 149.3, 157.5; IR (KBr) 3096, 2854, 1331, 1173, 607 cm^{-1}; EIMS m/z (rel. intensity) 277 (M^+, 6) 261 (100), 212 (53), 197 (73); Anal. Calcd for $C_{14}H_{16}N_2O_2S$: C, 60.85; H, 5.84; N, 10.14. Found: C, 60.76; H, 5.78; N, 10.20. HPLC (CHIRALCEL OJ-H, hexane/*i*-PrOH = 70:30, flow rate 1.5 mL min^{-1}), t_R 17 (major), 27 (minor) min.

***N*-[1-(4-Methoxyphenyl)ethyl]-2-pyridinesulfonamide (2j).**

To a solution of bis(oxazoline)-Ph (36.0 mg, 0.108 mmol) and imine **1j** (20.0 mg, 0.07 mmol) in toluene (4 mL) was added MeMgBr (0.78 mol L^{-1} in Et_2O, 0.18 mL, 0.144 mmol) at –95 ˚C and the reaction mixture was stirred for 1 h. Usual workup gave the crude product which was purified by column chromatography (SiO_2 10g, benzene/ethyl acetate = 90/10) to afford **2j** (20.7mg, 98%, 80% ee); $[\alpha]_D^{25}$ –24.2 (*c* 0.32, $CHCl_3$, 80% ee); mp. 121.4-123.0 ˚C; R_f= 0.30 (hexane/ethyl acetate = 40/60); ^{1}H NMR δ 1.49 (d, *J* = 7.0 Hz, 3H), 3.71 (s, 3H), 4.56 (dq, *J* = 7.0, 7.8 Hz, 1H), 5.47 (d, *J* = 7.8 Hz, 1H), 6.62-6.71 (m, 3H), 7.00-7.09 (m, 1H),

7.31-7.38 (m, 1H), 7.70-7.78 (m, 2H), 8.55 (d, J = 5.6 Hz, 1H); ^{13}C NMR δ 23.7, 54.1, 55.7, 113.9, 122.3, 126.3, 127.7, 134.0, 137.7, 149.8, 158.0, 158.8; IR (KBr) 3244, 1511, 1331, 1299, 1179, 742 cm^{-1}; ESIMS: m/z 315 [M+Na^{+}]. HPLC (CHIRALCEL OJ-H, hexane/*i*-PrOH = 80:20, flow rate 1.5 mL min^{-1}), t_R 11.7 (major), 16.7 (minor) min.

***N*-[1-(3-Methoxyphenyl)ethyl]-2-pyridinesulfonamide (2k).**

To a solution of bis(oxazoline)-Ph (36.0 mg, 0.108 mmol) and imine **1k** (20.0 mg, 0.07 mmol) in toluene (4 mL) was added MeMgBr (0.78 mol L^{-1} in Et_2O, 0.18 mL, 0.144 mmol) at -95 ˚C and the reaction mixture was stirred for 1 h. Usual workup gave the crude product which was purified by column chromatography (SiO_2 10g, benzene/ethyl acetate = 90/10) to afford **2k** (17.4 mg, 74%, 88% ee); $[\alpha]_D^{25}$ –38.7 (*c* 0.67, $CHCl_3$, 88% ee); mp. 126.2-127.1 ˚C; R_f= 0.30 (hexane/ethyl acetate = 40/60); ^{1}H NMR δ 1.44 (d, J = 6.9 Hz, 3H), 3.72 (s, 3H), 4.55 (dq, J = 6.8, 6.9 Hz, 1H), 5.65 (d, J = 6.8 Hz, 1H), 6.63 (d, J = 8.6 Hz, 2H), 7.02 (d, J = 8.4 Hz, 2H), 7.25-7.38 (m, 1H), 7.66-7.74 (m, 2H), 8.54 (d, J = 4.6 Hz, 1H); ^{13}C NMR δ 23.8, 54.6, 55.6, 111.9, 113.3, 118.9, 122.3, 126.3, 129.5, 137.6, 143.4, 149.7, 157.9, 159.5; IR (KBr) 3086, 2856, 1337, 1179, 614 cm^{-1}; ESIMS: m/z 315 [M+Na^{+}]; HPLC (CHIRALCEL OD-H, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL min^{-1}), t_R 14.0 (minor), 15.5 (major) min.

***N*-[1-(4-Chlorophenyl)ethyl]-2-pyridinesulfonamide (2l).**

To a solution of bis(oxazoline)-Ph (35.7 mg, 0.107 mmol) and imine **1l** (20.0 mg, 0.07 mmol) in toluene (4 mL) was added MeMgBr (1.44 mol L^{-1} in Et_2O, 0.09 mL, 0.142 mmol) at -95 ˚C and the reaction mixture was stirred for 1 h. Usual workup gave the crude product which was purified by column chromatography (SiO_2 10g, benzene/ethyl acetate = 90/10) to afford **2l** (16.2 mg, 77%, 76% ee); $[\alpha]_D^{24}$ –39.4 (*c* 0.54, $CHCl_3$, 76% ee); mp. 146.5-148.0 ˚C; R_f=

0.33 (hexane/ethyl acetate = 50/50); ^{1}H NMR δ 1.45 (d, *J* = 6.8 Hz, 3H), 4.58 (dq, *J* = 6.8, 8.2 Hz, 1H), 5.40-5.60 (br, 1H), 6.90-7.10 (m, 4H), 7.30-7.50 (m, 1H), 7.70-7.80 (m, 2H), 8.50-8.70 (m, 1H); ^{13}C NMR δ 23.0, 53.2, 121.9, 126.0, 127.4, 127.9, 132.5, 137.5, 140.3, 149.1, 157.2; IR (KBr) 3122, 1336, 1177, 604 cm^{-1}; EIMS m/z (rel. intensity) 297 (M^+, 2.5), 247 (25), 217 (30), 154 (100); Anal. Calcd for $C_{13}H_{13}Cl_2N_2O_2S$: C, 52.61; H, 4.42; N, 9.44. Found: C, 52.40; H, 4.03; N, 9.56. HPLC (CHIRALCEL OD-H, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL min^{-1}), t_R 19 (minor), 23 (major) min.

***N*-[1-(1-Naphthyl)ethyl]-2-pyridinesulfonamide (2m).**

To a solution of bis(oxazoline)-Ph (40.0 mg, 0.120 mmol) and imine **1m** (17.8 mg, 0.06 mmol) in toluene (4 mL) was added MeMgBr (1.00 mol L^{-1} in Et_2O, 0.12 mL, 0.120 mmol) at -95 ˚C and the reaction mixture was stirred for 1 h. Usual workup gave the crude product which was purified by column chromatography (SiO_2 10g, benzene/ethyl acetate = 90/10) to afford **2m** (13.9 mg, 74%, 76% ee); Recrystallization from hexane/CH_2Cl_2 afforded **2m** with 95% ee; $[\alpha]_D^{25}$ +49.0 (*c* 0.55, $CHCl_3$, 95% ee); mp. 140.0-145.0 ˚C; R_f= 0.27 (hexane/ethyl acetate = 60/40); ^{1}H NMR δ 1.60 (d, *J* = 6.8 Hz, 3H), 5.30-5.60 (br, 2H), 7.19-7.78 (m, 9H), 7.97-8.02 (m, 1H), 8.41-8.43 (m, 1H); ^{13}C NMR δ 23.3, 50.1, 121.7, 122.6, 123.5, 124.9, 125.4, 125.9, 126.0, 127.8, 128.5, 129.9, 133.4, 137.0, 137.2, 149.2, 157.2; IR (KBr) 3098, 1333, 1172, 1112, 779, 593 cm^{-1}; FABMS m/z (rel. intensity) 313 (M^++1, 50), 170 (70), 155 (100); Anal. Calcd for $C_{17}H_{16}N_2O_2S$: C, 65.36; H, 5.16; N, 8.97. Found: C, 65.36; H, 5.43; N, 8.70. HPLC (CHIRALCEL OD-H, hexane/*i*-PrOH = 80:20, 1.0 mL min^{-1}), t_R 12 (minor), 15 (major) min.

***N*-[1-(2-Furyl)ethyl]-2-pyridinesulfonamide (2o).**

To a solution of bis(oxazoline)-Ph (226 mg, 0.677 mmol) and imine **1o** (80.0 mg, 0.339 mmol) in toluene (12 mL) was added MeMgBr (1.44 mol L^{-1} in Et_2O, 0.47 mL, 0.677 mmol) at -95 ˚C and the reaction mixture was stirred for 1 h. Usual workup gave the crude product which was purified by column chromatography (SiO_2 10g, benzene/ethyl acetate = 90/10) to afford **2o** (32.3 mg, 38%, 87% ee); $[\alpha]_D^{27}$ –60.8 (*c* 0.70, $CHCl_3$, 87% ee); mp.110.0-111.0 ˚C; R_f= 0.27 (hexane/ethyl acetate = 60/40); ^{1}H NMR δ 1.50 (d, *J* = 7.0 Hz, 3H), 4.68 (dq, *J* = 7.0, 8.4 Hz, 1H), 5.47 (d, *J* = 8.4 Hz, 1H), 5.94-5.96 (m, 1H), 6.06-6.09 (m, 1H), 7.06-7.08 (m, 1H), 7.26-7.43 (m, 1H), 7.78-7.93 (m, 2H), 8.55-8.59 (m, 1H); ^{13}C NMR δ 20.9, 47.9, 106.0, 109.8, 121.7, 126.1, 137.5, 141.6, 149.6, 153.4, 157.4; IR (KBr) 3087, 2877, 1337, 1149, 769, 597 cm^{-1}; FABMS m/z (rel. intensity) 253 (M^++1, 40), 110 (22), 95 (100), 93 (20); Anal. Calcd for $C_{11}H_{12}N_2O_3S$: C, 52.37; H, 4.79; N, 11.10. Found: C, 52.32; H, 4.99; N, 10.95. HPLC (CHIRALCEL OJ-H, hexane/*i*-PrOH = 80:20, 1.5 mL min^{-1}), t_R 18 (major), 21 (minor) min.

***N*-[2-(4-Phenyl-3-butenyl)]-2-pyridinesulfonamide (2p).**

To a solution of bis(oxazoline)-Ph (36.8 mg, 0.588 mmol) and imine **1p** (20.0 mg, 0.07 mmol) in toluene (12 mL) was added MeMgBr (1.44 mol L^{-1} in Et_2O, 0.102 mL, 0.147 mmol) at -95 ˚C and the reaction mixture was stirred for 1 h. Usual workup gave the crude product which was purified by column chromatography (SiO_2 10g, benzene/ethyl acetate = 90/10) to afford **2p** (20.8 mg, 98%, 82% ee); $[\alpha]_D^{25}$ –90.8 (*c* 0.69, $CHCl_3$, 82% ee); mp. 102.0-104.5 ˚C; R_f= 0.30 (hexane/ethyl acetate = 60/40); ^{1}H NMR δ 1.33 (d, *J* = 7.0 Hz, 3H), 4.15-4.25 (m, 1H), 5.50-5.70 (m, 1H), 5.82 (dd, *J* = 7.0, 15.8 Hz, 1H), 6.30 (d, *J* = 15.8 Hz, 1H), 7.07-7.35 (m, 6H), 7.68-7.80 (m, 1H), 7.90-8.10 (m, 1H), 8.66-8.80 (m, 1H); ^{13}C NMR δ 22.0, 52.5, 122.2, 126.1, 126.2, 127.5, 128.2, 129.6, 130.4, 135.8, 137.6, 149.5, 157.8; IR

(KBr) 3173, 1333, 1174, 1120, 701, 599 cm^{-1}; FABMS m/z (rel. intensity) 289 (M^++1, 21), 159 (5), 131 (100); Anal. Calcd for $C_{15}H_{16}N_2O_2S$: C, 62.48; H, 5.59; N, 9.71. Found: C, 62.32; H, 5.54; N, 9.66. HPLC (CHIRALCEL OJ-H, hexane/*i*-PrOH = 70:30, 1.2 mL min^{-1}), t_R 14 (minor),17 (major) min.

***N*-(1-Phenylpropyl)-2-pyridinesulfonamide (2q).**

To a solution of bis(oxazoline)-Ph (30.1 mg, 0.09 mmol) and imine **1a** (14.8 mg, 0.06 mmol) in toluene (3 mL) was added EtMgBr (1.83 mol L^{-1} in Et_2O, 0.07 mL, 0.12 mmol) at -95 ˚C and the reaction mixture was stirred for 1 h. Usual workup gave the crude product which was purified by column chromatography (SiO_2 10g, benzene/ethyl acetate = 90/10) to afford **2q** (12.3 mg, 74%, 50% ee); $[\alpha]_D^{25}$ −10.8 (*c* 0.31, $CHCl_3$, 50% ee); mp. 92.0-93.0 ˚C, R_f= 0.32 (hexane/ethyl acetate = 60/40); ^{1}H NMR δ 0.83 (t, *J* = 7.4 Hz, 3H), 1.69-1.96 (m, 2H), 4.31 (ddd, *J* = 7.4, 7.6, 8.0 Hz, 1H), 5.24 (br, 1H), 6.96-7.10 (m, 5H), 7.28-8.51 (m, 4H); ^{13}C NMR δ 10.8, 30.5, 60.4, 121.8, 125.8, 126.5, 127.0, 128.0, 137.2, 139.9, 149.4, 157.4; IR (KBr) 3173, 1333, 1174, 1120, 701, 599 $cm^{-1;}$ FABMS m/z (rel. intensity) 277 (M^++1, 85), 159 (95), 134 (15), 119 (100), 91 (52); Anal. Calcd for $C_{14}H_{16}N_2O_2S$: C, 60.85; H, 5.84; N, 10.14. Found: C, 60.88; H, 5.72; N, 10.23. HPLC (CHIRALCEL OJ-H, hexane/*i*-PrOH = 70:30, 1.0 mL min^{-1}), t_R 11 (major), 23 (minor) min.

***N*-(1-Phenylpentyl)-2-pyridinesulfonamide (2r).**

To a solution of bis(oxazoline)-Ph (30.1 mg, 0.09 mmol) and imine **1a** (14.8 mg, 0.06 mmol) in toluene (3 mL) was added BuMgBr (0.68 mol L^{-1} in Et_2O, 0.18 mL, 0.12 mmol) at -95 ˚C and the reaction mixture was stirred for 1 h. Usual workup gave the crude product which was purified by column chromatography (SiO_2 10g, benzene/ethyl acetate = 90/10) to afford **2r**

(12.7 mg, 69%, 51% ee); $[\alpha]_D^{26}$ –4.8 (*c* 0.36, $CHCl_3$, 51% ee); mp. 101.0-102.3 ˚C; R_f= 0.20 (hexane/ethyl acetate = 90/10); ^{1}H-NMR δ 0.79-1.00 (m, 3H), 1.01-1.24 (m, 4H), 1.25-2.00 (m, 2H), 4.30-4.45 (m, 1H), 5.55 (d, *J* = 8.0 Hz, 1H), 6.99-7.05 (m, 5H), 7.24-7.31 (m, 1H), 7.56-7.63 (m, 2H), 8.45-8.78 (m, 1H); ^{13}C NMR δ 14.1, 22.4, 37.2, 58.9, 121,8, 125.8, 126.4, 127.0, 128.0, 137.1, 140.3, 149.4, 157.4; IR (KBr) 3084, 2866, 1334, 1177, 768, 614 cm^{-1}; Anal. Calcd $C_{16}H_{20}N_2O_2S$: C, 63.13; H, 6.62; N, 9.20. Found: C, 63.05; H, 6.58; N, 9.41. EIMS m/z (rel. intensity) 305 (M^+, 1), 279 8 (50), 252 (52), 167 (95), 149 (100); HPLC (CHIRALCEL OJ-H, = hexane/*i*-PrOH 80:20, 1.0 ml/min), t_R 15 (minor), 20 (major) min.

***N*-(1,4-Diphenylpropynyl)-2-pyridinesulfonamide (2s).**

To a solution of Dietyl-bis(oxazoline)-Ph (44.0 mg, 0.122 mmol) and imine **1a** (20.0mg, 0.081 mmol) in toluene (1 mL) was added PhC≡CMgBr (0.96 mol L^{-1} in Et_2O, 0.13 mL, 0.12 mmol) and Phenylacetylene (0.0178ml, 0.162mmol) at -78 ˚C and the reaction mixture was stirred for 1 h. Usual workup gave the crude product which was purified by column chromatography (SiO_2 10g, benzene/ethyl acetate = 90/10) to afford **2s** (16.8 mg, 60%, 78% ee); mp. 152.4-153.8 ˚C; R_f= 0.35 (hexane/ethyl acetate = 90/10); ^{1}H NMR δ 5.63 (d, *J* = 9.2 Hz, 1H), 6.33 (br, 1H), 7.08-7.33 (m, 9H), 7.50-7.55 (m, 2H), 7.69-7.74 (m, 1H), 7.93-7.98 (m, 1H), 8.48 (d, *J* = 5.6 Hz, 1H); ^{13}C NMR δ 50.7, 85.8, 87.0, 122.1, 122.5, 126.6, 127.7, 128.3, 128.5, 128.6, 128.8, 131.7, 137.4, 137.8, 149.9, 157.52; IR (KBr) 3080, 1338, 1177, 1124, 609 cm^{-1}; ESIMS: m/z 347 [M－H]; HPLC (CHIRALPAK AS, hexane/*i*-PrOH = 85:15, 2.0 mL min^{-1}), t_R 17 (minor), 26 (major) min.

***N*-(Phenyl-4-methylphenyl-methyl)-2-pyridinesulfonamide (2t).**

To a solution of bis(oxazoline)-Ph (45.3 mg, 0.09 mmol) and imine **1i** (20.0 mg, 0.07 mmol)

in toluene (3 mL) was added PhMgBr (1.07 mol L^{-1} in Et_2O, 0.14 mL, 0.153 mmol) at -78˚C and the reaction mixture was stirred for 1 h. Usual workup gave the crude product which was purified by column chromatography (SiO_2 10g, benzene/ethyl acetate = 90/10) to afford **2t** (19.7 mg, 72%, 61% ee); $[\alpha]_D^{25}$ +4.97 (*c* 0.62, $CHCl_3$, 61% ee); mp.170-172 ˚C; ^{1}H NMR 2.26 (s, 3H), 4.21 (d, *J* =8.0 Hz, 1H), 5.80-5.90 (m, 1H), 6.85-7.20 (m, 9H), 7.21-7.90 (m, 3H), 8.40-8.55 (m, 1H); ^{13}C NMR δ 21.2, 61.51, 121.9, 125.9, 127.2, 128.1, 128.8, 137.0, 137.1, 137.2, 140.1, 149.4, 157.2; IR (KBr) 3068, 1334, 1174, 735 cm^{-1}; EIMS m/z (rel. intensity) 339 (M^++1, 1), 196 (100), 165 (17); Anal. Calcd for $C_{19}H_{18}N_2O_2S$: C, 67.43; H, 5.36; N, 8.28. Found: C, 67.41; H, 5.27; N, 8.38; HPLC (CHIRALCEL OJ-H, hexane/*i*-PrOH = 70:30, 1.0 mL min^{-1}), t_R 11 (major):14 (minor) min.

2-(2-Pyridylsulfonyl)amino-2-(4-methylphenyl)acetonitrile (3i)

The reaction was carried out as described in the typical procedure except for using imine **1i** (20.0 mg, 0.077 mmol), bis(oxazoline)-Ph (2.8 mg, 11 mol%), $Mg(OTf)_2$ (2.5 mg, 10 mol%), and trimethylsilyl cyanide (12 μl, 0.10 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 90/10) to afford **3i** (22.0 mg, 99%, 72% ee) as a white solid; mp 164-165 ºC; $[\alpha]_D^{27}$ +36 (*c* 0.03, $CHCl_3$, 72% ee); R_f = 0.30 (benzene/ethyl acetate = 80/20); ^{1}H NMR (DMSO-D_6) δ 2.27 (s, 3H), 5.83 (d, *J* = 8.0 Hz, 1H), 7.16 (d, *J* = 8.1 Hz, 2H), 7.27 (d, *J* = 8.1 Hz, 2H), 7.63-7.70 (m, 1H), 7.91-7.95 (m, 1H), 8.03-8.11 (m, 1H), 8.70-8.73 (m, 1H), 9.52 (d, *J* = 8.0 Hz, 1H); IR (KBr) 3096, 1354, 1183, 614 cm^{-1}; EIMS m/z (rel. intensity) 287 (M^+, 1), 223 (5), 145 (25), 91 (38), 79 (100); Anal. Calcd for $C_{14}H_{13}N_3O_2S$: C, 58.52; H, 4.56; N, 14.62. Found: C: 58.29, H: 4.67, N: 14.30. HPLC (Daicel CHIRALPAK IA, hexane/*i*-PrOH = 90/10; 0.5 mL/min; t_R = 12.9 min (major),

t_R = 15.4 min (minor)).

2-(2-Pyridylsulfonyl)amino-2-(4-methoxyphenyl)acetonitrile (3j)

The reaction was carried out as described in the typical procedure except for using imine **1j** (20.0 mg, 0.072 mmol), bis(oxazoline)-Ph (2.6 mg, 11 mol%), $Mg(OTf)_2$ (2.3 mg, 10 mol%), and trimethylsilyl cyanide (12 μl, 0.094 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 90/10) to afford **3j** (21.7 mg, 99%, 84% ee) as a white solid; mp 140.0-141.0 ºC; $[\alpha]_D^{26}$ +35 (*c* 0.03, $CHCl_3$, 84% ee); R_f = 0.32 (benzene/ethyl acetate = 80/20); ^{1}H NMR (DMSO-D_6) δ 3.72 (s, 3H), 5.80 (d, *J* = 9.0 Hz, 1H), 6.91 (d, *J* = 8.8 Hz, 2H), 7.30 (d, *J* = 8.8 Hz, 2H), 7.63-7.66 (m, 1H), 7.90-7.94 (m, 1H), 8.06-8.10 (m, 1H), 8.69 (m, 1H), 9.46-9.51 (d, *J* = 9.0 Hz, 1H); IR (KBr) 3292, 3116, 1514, 1349, 1182, 770, 614 cm^{-1}; EIMS m/z (rel. intensity) 303 (M^+, 1), 272 (2), 239 (4), 161 (47), 146 (12), 134 (8), 79 (100); Anal. Calcd for $C_{14}H_{13}N_3O_3S$: C, 55.43; H, 4.32; N, 13.85. Found: C: 55.32, H: 4.36, N: 13.16. HPLC (Daicel CHIRALPAK IA, hexane/*i*-PrOH = 90/10, 0.5 mL/min, t_R = 19.6min(major), t_R = 24.2 min (minor)).

2-(2-Pyridylsulfonyl)amino-2-(3-methoxyphenyl)acetonitrile (3k)

The reaction was carried out as described in the typical procedure except for using imine **1k** (20.0 mg, 0.072 mmol), bis(oxazoline)-Ph (2.6 mg, 11 mol%), $Mg(OTf)_2$ (2.3 mg, 10 mol%), and trimethylsilyl cyanide (12 μl, 0.094 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 90/10) to afford **3k** (21.0 mg, 93%, 78% ee) as a white solid; mp 156.2-158.3 ºC; $[\alpha]_D^{25}$ +28 (*c* 0.06, $CHCl_3$, 78% ee); R_f = 0.30 (benzene/ethyl acetate = 80/20); ^{1}H NMR (DMSO-D_6) δ 3.73 (s, 3H), 5.82-5.89 (m, 1H), 6.90-7.02 (m, 3H), 7.26-7.34 (m, 1H), 7.64-7.71 (m, 1H), 7.89-8.13 (m, 2H), 8.71-8.74 (m,

1H), 8.59 (d, J = 7.8 Hz, 1H); IR (KBr) 3292, 3094, 1347, 1184, 1047, 620 cm^{-1}; ESIMS : m/z 326 [M+Na^+]; HPLC (Daicel CHIRALPAK AD-H, hexane/*i*-PrOH = 80/20, 1.0 mL/min, t_R = 14.9min(minor), t_R = 18.3 min (major)).

2-(2-Pyridylsulfonyl)amino-2-(4-chlorophenyl)acetonitrile (3l)

The reaction was carried out as described in the typical procedure except for using imine **1l** (20.0 mg, 0.071 mmol), bis(oxazoline)-Ph (2.6 mg, 11 mol%), $Mg(OTf)_2$ (2.3 mg, 10 mol%), and trimethylsilyl cyanide (12 μl, 0.094 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 90/10) to afford **3l** (21.7 mg, 99%, 72% ee) as a white solid; mp 162-163 ºC; $[\alpha]_D^{27}$ +21 (*c* 0.03, $CHCl_3$, 72% ee); R_f = 0.35 (benzene/ethyl acetate = 80/20); ^{1}H NMR (DMSO-D_6) δ 5.96 (d, J = 9.2 Hz, 1H), 7.38-7.48 (m, 4H), 7.65-7.71 (m, 1H), 7.91-7.95 (m, 1H), 8.04-8.11 (m, 1H), 8.70-8.72 (m, 1H), 9.62 (d, J = 9.2 Hz, 1H); IR (KBr) 3312, 3098, 1348, 1185, 612 cm^{-1}; EIMS m/z (rel. intensity) 308 (M^+, 2) 243 (9), 165 (19), 111 (17), 78 (100); Anal. Calcd for $C_{13}H_{10}ClN_3O_2S$: C, 50.73; H, 3.28; N, 13.65. Found: C: 51.17, H: 3.58, N: 13.31. HPLC (Daicel CHIRALCEL OJ-H, hexane/*i*-PrOH = 70/30; 1.0 mL/min; t_R = 17.9min (minor), t_R = 21.2 min (major)).

2-(2-Pyridylsulfonyl)amino-2-(1-naphthyl)acetonitrile (3m)

The reaction was carried out as described in the typical procedure except for using imine **1m** (20.0 mg, 0.067 mmol), bis(oxazoline)-Ph (2.5 mg, 11 mol%), $Mg(OTf)_2$ (2.2 mg, 10 mol%), and trimethylsilyl cyanide (11 μl, 0.087 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 90/10) to afford **3m** (22.1 mg, 99%, 75% ee) as a white solid; mp 166.0-167.0 ºC; $[\alpha]_D^{27}$ +43 (*c* 0.03, $CHCl_3$, 75% ee); R_f = 0.32 (benzene/ethyl acetate = 80/20); ^{1}H NMR (DMSO-D_6) δ 6.50 (d, J = 8.8 Hz, 1H),

7.48-7.70 (m, 5H), 7.89-8.14 (m, 5H), 8.64 (m, 1H), 9.57 (d, J = 8.8 Hz, 1H); IR (KBr) 3230, 3090, 1348, 1185, 777, 610 cm^{-1}; EIMS m/z (rel. intensity) 323 (M^+, 2), 259 (5), 232 (13), 181 (20), 154 (56), 127 (28), 79 (100); HPLC (Daicel CHIRALPAK AD-H, hexane/*i*-PrOH = 80/20, 1.5 mL/min, t_R = 15.0min (minor), t_R = 45.1 min (major)).

2-(2-Pyridylsulfonyl)amino-2-(2-naphthyl)acetonitrile (3n)

The reaction was carried out as described in the typical procedure except for using imine **1n** (20.0 mg, 0.067 mmol), bis(oxazoline)-Ph (2.5 mg, 11 mol%), $Mg(OTf)_2$ (2.2 mg, 10 mol%), and trimethylsilyl cyanide (11 μl, 0.087 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 90/10) to afford **3n** (21.5 mg, 99%, 73% ee) as a white solid; mp 170.0-171.0 ºC; $[\alpha]_D^{27}$ +31 (*c* 0.029, $CHCl_3$, 75% ee); R_f = 0.31 (benzene/ethyl acetate = 80/20); ^{1}H NMR (DMSO-D_6) δ 6.09 (d, J = 9.0 Hz, 1H), 7.46-7.68 (m, 4H), 7.88-8.06 (m, 6H), 8.70-8.73 (m, 1H), 9.67 (d, J = 9.0 Hz, 1H); IR (KBr) 3095, 1348, 1184, 735, 608 cm^{-1}; EIMS m/z (rel. intensity) 323 (M^+, 1), 296 (15), 232 (30), 181 (54), 153 (31), 127 (85), 78 (100); HPLC (Daicel CHIRALPAK AD-H, hexane/*i*-PrOH = 80/20, 1.5 mL/min, t_R = 18.7 min (minor), t_R = 22.6 min (major)).

(*R*)-Methyl 2,2-dimethyl-3-phenyl-3-[(8-quinolylsulfonyl)amino]propionate (4f)

The reaction was carried out as described in the typical procedure except for using imine **1f** (20.0 mg, 0.067 mmol), bis(oxazoline)-Ph (2.5 mg, 0.0074 mmol), $Cu(OTf)_2$ (2.5 mg, 0.0067 mmol), and silylketene acetal (18 μl, 0.087 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 90/10) to afford **4f** (5.2 mg, 19%, 1% ee) as a white solid; mp 91.5-92.5 ºC; $[\alpha]_D^{20}$ +0.081 (*c* 1, $CHCl_3$, 1.0% ee); R_f =0.68 (benzene/ethyl acetate = 70/30); ^{1}H NMR δ 1.11 (s, 3H), 1.36 (s, 3H), 3.60 (s, 3H),

4.49 (d, J =10 Hz, 1H), 6.53-6.67 (m, 4H), 6.66 (d, J =6 Hz, 1H), 7.23-7.31 (m, 2H), 7.44-7.54 (m, 1H), 7.72-7.76 (m, 1H), 7.99-8.09 (m, 2H), 9.06 (d, J =4 Hz, 1H); ^{13}C NMR δ 22.9, 23.2, 47.8, 52.2, 58.9, 115.9, 120.2, 121.3, 122.1, 126.6, 127.3, 127.4, 127.5, 127.7, 131.1, 141.0, 177.3; IR (KBr) 3244, 1740, 1491, 1323, 1136, 1048, 720 cm^{-1}; EIMS m/z (rel. intensity) 399 (M^++1, 26), 247 (100), 209 (36), 128 (90); Anal. Calcd for $C_{21}H_{22}N_2O_4S$: C, 63.30; H, 5.56; N, 7.03. Found: C, 63.55; H, 5.26; N, 6.89. HPLC (CHIRALCEL AS-H, hexane/^{i}PrOH=80:20, 1.0 ml/min) t_R 14.6 (major), 18.1 (minor) min.

(*R*)-Methyl 2,2-dimethyl-3-phenyl-3-[(2-thienylsulfonyl)amino]propionate (4g)

The reaction was carried out as described in the typical procedure except for using imine **1g** (25.0 mg, 0.098 mmol), bis(oxazoline)-Ph (3.7 mg, 0.0108 mmol), $Cu(OTf)_2$ (3.6 mg, 0.0098 mmol), and silylketene acetal (26 μl, 0.128 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 95/5) to afford **4g** (17.4 mg, 47%, 0.5% ee) as a white solid; mp 106.1-108.5 °C; $[\alpha]_D^{20}$ –0.024 (*c* 1, $CHCl_3$, 0.5% ee); R_f =0.50 (benzene/ethyl acetate = 90/10); ^{1}H NMR δ 1.11 (s, 3H), 1.38 (s, 3H), 3.65 (s, 3H), 4.40 (d, J =10 Hz, 1H), 6.31 (d, J =8 Hz, 1H), 6.69-6.74 (m, 1H), 6.96-7.01 (m, 2H), 7.06-7.15 (m, 3H), 7.27-7.28 (s, 2H); ^{13}C NMR δ 22.7, 24.9, 47.2, 52.2, 65.1, 126.6, 127.4, 127.6, 127.8, 131.1, 131.7, 136.7, 141.5, 176.0; IR (KBr) 3283, 1734, 1457, 1331, 1157, 1134, 706 cm^{-1}; EIMS m/z (rel. intensity) 353 (M^+, 14), 313 (38), 252 (60), 236 (100); Anal. Calcd for $C_{16}H_{19}NO_4S_2$: C, 54.37; H, 5.42; N, 3.96. Found: C, 54.45; H, 5.47; N, 3.41. HPLC (CHIRALPAK AD-H, hexane/^{i}PrOH=90:10, 1.0 ml/min) t_R 21.2 (major), 24.2 (minor) min.

(*R*)-Methyl 2,2-dimethyl-3-phenyl-3-[(2-furylsulfonyl)amino]propionate (4h)

The reaction was carried out as described in the typical procedure except for using imine **1h** (25.0 mg, 0.0106 mmol), bis(oxazoline)-Ph (4.0 mg, 0.012 mmol), $Cu(OTf)_2$ (3.6 mg, 0.011 mmol), and silylketene acetal (28 μl, 0.138 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 90/10) to afford **4h** (21.0 mg, 59%, 8% ee) as a white solid; mp 89.6-90.5 ^{o}C; $[\alpha]_D^{20}$ +3.06 (*c* 1, $CHCl_3$, 8.0% ee); R_f = 0.53 (benzene/ethyl acetate = 90/10); ^{1}H NMR δ 1.08 (s, 3H), 1.37 (s, 3H), 3.65 (s, 3H), 4.32 (d, *J* =10 Hz, 1H), 6.09-6.12 (m, 1H), 6.42 (d, *J* =10 Hz, 1H), 6.59-6.61 (m, 1H), 6.97-7.14 (m, 6H); ^{13}C NMR δ 22.7, 25.0, 47.0, 52.3, 65.0, 110.6, 115.8, 127.4, 127.8, 136.8, 145.1, 145.2, 148.0, 176.0; IR (KBr) 3283, 1733, 1457, 1350, 1162, 1131, 636 cm^{-1}; EIMS m/z (rel. intensity) 337 (M^+, 40), 281 (100), 236 (80); Anal. Calcd for $C_{16}H_{19}NO_5S$: C, 56.96; H, 5.68; N, 4.15. Found: C, 56.72; H, 5.65; N, 3.99. HPLC (CHIRALPAK AD-H, hexane/^{i}PrOH=80:20, 1.0 ml/min) t_R 10.3 (major), 12.6 (minor) min.

(*R*)-Methyl 2,2-dimethyl-3-(4-methylphenyl)-3-[(2-pyridylsulfonyl)amino]propionate (4i)

The reaction was carried out as described in the typical procedure except for using imine **1i** (25.0 mg, 0.0096 mmol), bis(oxazoline)-Ph (3.7 mg, 0.011 mmol), $Cu(OTf)_2$ (3.5 mg, 0.011 mmol), and silylketene acetal (25 μl, 0.096 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 85/15) to afford **4i** (13.9 mg, 40%, 70% ee) as a white solid; mp 118.3-119.0 ^{o}C; $[\alpha]_D^{20}$ −10.4 (*c* 1, $CHCl_3$, 70% ee); R_f = 0.59 (benzene/ethyl acetate = 70/30); ^{1}H NMR δ 1.09 (s, 3H), 1.38 (s, 3H), 2.18 (s, 3H), 3.66 (s, 3H), 4.40 (d, *J* =10 Hz, 1H), 6.46 (d, *J* =10 Hz, 1H), 6.77 (s, 3H), 7.14-7.23 (m, 2H), 7.50-7.52 (m, 2H), 8.42-8.44 (s, 1H); ^{13}C NMR δ 21.0, 22.6, 24.8, 47.0, 52.1, 64.9, 121.6, 125.4, 127.6, 128.0, 133.5, 136.4, 136.8, 149.2, 157.0, 175.9; IR (KBr) 2933, 1734, 1573,

1429, 1341, 1178, 779 cm^{-1}; EIMS m/z (rel. intensity) 362 (M^+, 15), 279 (32), 261 (100), 220 (73); Anal. Calcd for $C_{18}H_{22}N_2O_4S$: C, 59.65; H, 6.12; N, 7.73. Found: C, 59.55; H, 6.24; N, 7.60. HPLC (CHIRALPAK AD-H, hexane/^{i}PrOH=80:20, 1.0 ml/min) t_R 11.7 (major), 17.2 (minor) min.

(*R*)-Methyl 2,2-dimethyl-3-(4-methoxyphenyl)-3-[(2-pyridylsulfonyl)amino]propionate (4j)

The reaction was carried out as described in the typical procedure except for using imine **1j** (25.0 mg, 0.0092 mmol), bis(oxazoline)-Ph (3.5 mg, 0.010 mmol), $Cu(OTf)_2$ (3.4 mg, 0.0092 mmol), and silylketene acetal (24 μl, 0.118 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 90/10) to afford **4j** (16.6 mg, 49%, 40% ee) as a white solid; mp 111.3-120.0 °C; $[\alpha]_D^{20}$ −36.3 (*c* 1.0, $CHCl_3$, 40% ee); R_f = 0.45 (benzene/ethyl acetate = 70/30); ^{1}H NMR δ 1.09 (s, 3H), 1.38 (s, 3H), 3.66 (s, 3H), 3.70 (s, 3H), 4.40 (d, *J* =10 Hz, 1H), 6.47 (d, *J* =2 Hz, 1H), 6.52 (d, *J* =2 Hz, 1H), 6.79 (d, *J* =8 Hz, 2H), 7.20-7.30 (m, 2H), 7.52-7.54 (m, 2H), 8.44-8.46 (m, 1H); ^{13}C NMR δ 22.7, 24.6, 47.2, 52.2, 55.2, 64.6, 112.9, 121.6, 125.6, 128.4, 128.7, 128.9, 136.9, 149.3, 158.3, 175.9; IR (KBr) 2955, 1736, 1516, 1431, 1178, 1120, 607 cm^{-1}; EIMS m/z (rel. intensity) 378 (M^+, 28), 277 (100), 236 (72); Anal. Calcd for $C_{18}H_{22}N_2O_5S$: C, 57.13; H, 5.86; N, 7.40. Found: C, 57.36; H, 6.08; N, 7.48. HPLC (CHIRALPAK AD-H, hexane/^{i}PrOH=80:20, 1.0 ml/min) t_R 12.1 (minor), 17.3 (major) min.

(*R*)-Methyl 2,2-dimethyl-3-(4-chlorophenyl)-3-[(2-pyridylsulfonyl)amino]propionate (4k)

The reaction was carried out as described in the typical procedure except for using imine **1l**

(25.0 mg, 0.0091 mmol), bis(oxazoline)-Ph (3.4 mg, 0.010 mmol), $Cu(OTf)_2$ (3.3 mg, 0.009 mmol), and silylketene acetal (24 μl, 0.118 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 85/15) to afford **4l** (29.5 mg, 52%, 75% ee) as a white solid; mp 141.3-142.0 °C; $[\alpha]_D^{20}$ –17.2 (*c* 1, $CHCl_3$, 62% ee); R_f = 0.53 (benzene/ethyl acetate = 70/30); ^{1}H NMR δ 1.09 (s, 3H), 1.41 (s, 3H), 3.66 (s, 3H), 4.42 (d, *J* =10 Hz, 1H), 6.58 (d, *J* =10 Hz, 1H), 6.87 (d, *J* = 14 Hz, 1H), 6.98 (d, *J* =9 Hz, 1H), 7.30 (s, 1H), 7.56-7.59 (m, 4H), 8.46 (d, *J* = 4 Hz, 1H); ^{13}C NMR δ 22.7, 24.8, 47.0, 52.3, 64.5, 121.6, 125.7, 127.5, 129.2, 133.0, 135.4, 137.0, 149.4, 157.0, 175.7; IR (KBr) 3343, 1737, 1425, 1341, 1179, 1119, 779 cm^{-1}; EIMS m/z (rel. intensity) 382 (M^+, 7), 351 (100), 318 (60); Anal. Calcd for $C_{17}H_{19}ClN_2O_4S$: C, 53.33; H, 5.00; N, 7.32. Found: C, 53.55; H, 5.03; N, 7.21. HPLC (CHIRALPAK AD-H, hexane/^{i}PrOH=80:20, 1.0 ml/min) t_R 15.7 (major), 24.7 (minor) min.

(*R*)-Methyl 2,2-dimethyl-3-(1-naphthyl)-3-[(2-pyridylsulfonyl)amino]propionate (4m)

The reaction was carried out as described in the typical procedure except for using imine **1m** (25.0 mg, 0.0084 mmol), bis(oxazoline)-Ph (3.2 mg, 0.0092 mmol), $Cu(OTf)_2$ (3.1 mg, 0.0084 mmol), and silylketene acetal (22 μl, 0.109 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 90/10) to afford **4m** (18.0 mg, 50%, 71% ee) as a white solid; mp 115.1-116.0 °C; $[\alpha]_D^{20}$ + 63.4 (*c* 1, $CHCl_3$, 71% ee); R_f = 0.63 (benzene/ethyl acetate = 70/30); ^{1}H NMR δ 1.08 (s, 3H), 1.48 (s, 3H), 3.68 (s, 3H), 5.46 (d, *J* =10 Hz, 1H), 6.56 (d, *J* =10 Hz, 1H), 6.83-6.89 (m, 1H), 6.98-7.25 (m, 4H), 7.40-7.48 (m, 3H), 7.64-7.68 (m, 1H), 8.03-8.13 (m, 2H); ^{13}C NMR δ 22.1, 25.4, 48.1, 52.3, 57.7, 121.4, 122.7, 124.5, 125.2, 126.0, 126.4, 127.8, 128.2, 128.4, 131.4, 132.8, 133.5, 136.1, 148.8, 156.4, 176.0; IR(KBr) 3297, 1732, 1431, 1337, 1172, 1120, 775 cm^{-1}; EIMS m/z (rel.

intensity) 398 (M^+, 26), 297 (100), 256 (76), 217 (60); Anal. Calcd for $C_{21}H_{22}N_2O_4S$: C, 63.30; H, 5.56; N, 7.03. Found: C, 63.00; H, 5.54; N, 6.85. HPLC (CHIRALPAK AD-H, hexane/^{i}PrOH=80:20, 0.30 ml/min) t_R 68.4 (major), 72.7 (minor) min.

(*R*)-Methyl 2,2-dimethyl-3-(2-naphthyl)-3-[(2-pyridylsulfonyl)amino]propionate (4n)

The reaction was carried out as described in the typical procedure except for using imine **1n** (25.0 mg, 0.0084 mmol), bis(oxazoline)-Ph (3.2 mg, 0.0092 mmol), $Cu(OTf)_2$ (3.1 mg, 0.0084 mmol), and silylketene acetal (22 μl, 0.011 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 90/10) to afford **4n** (20.6 mg, 62%, 64% ee) as a white solid; mp 109.8-110.5 ^oC; $[\alpha]_D^{20}$ –23.6 (*c* 1, $CHCl_3$, 64% ee); R_f = 0.63 (benzene/ethyl acetate = 70/30); ^1H NMR δ 1.15 (s, 3H), 1.47 (s, 3H), 3.68 (s, 3H), 4.60 (d, *J* =10 Hz, 1H), 6.68 (d, *J* =10 Hz, 1H), 6.81-6.88 (m, 1H), 7.03 (d, *J* =8 Hz, 1H), 7.15-7.23 (m, 1H), 7.36-7.48 (m, 5H), 7.59-7.68 (m, 2H), 8.26 (d, *J* = 4 Hz, 1H); ^{13}C NMR δ 22.7, 24.9, 47.1, 52.2, 65.3, 121.5, 125.2, 125.3, 125.8, 127.0, 127.1, 127.4, 127.5, 132.0, 132.1, 133.8, 136.4, 149.1, 156.8, 175.9; IR (KBr) 2952, 1733, 1433, 1336, 1176, 1122, 746 $cm^{-1;}$ EIMS m/z (rel. intensity) 398 (M^+, 15), 367 (19), 344 (55), 256 (100); Anal. Calcd for $C_{21}H_{22}N_2O_4S$: C, 63.30; H, 5.56; N, 7.03. Found: C, 63.34; H, 5.69; N, 6.86. HPLC (CHIRALPAK AD-H, hexane/^{i}PrOH=80:20, 1.0 ml/min) t_R 14.3 (major), 22.4 (minor) min.

***(R)*-Methyl 2,2-dimethyl-3-(2-furyl)-3-[(2-pyridylsulfonyl)amino]propionate (4o)**

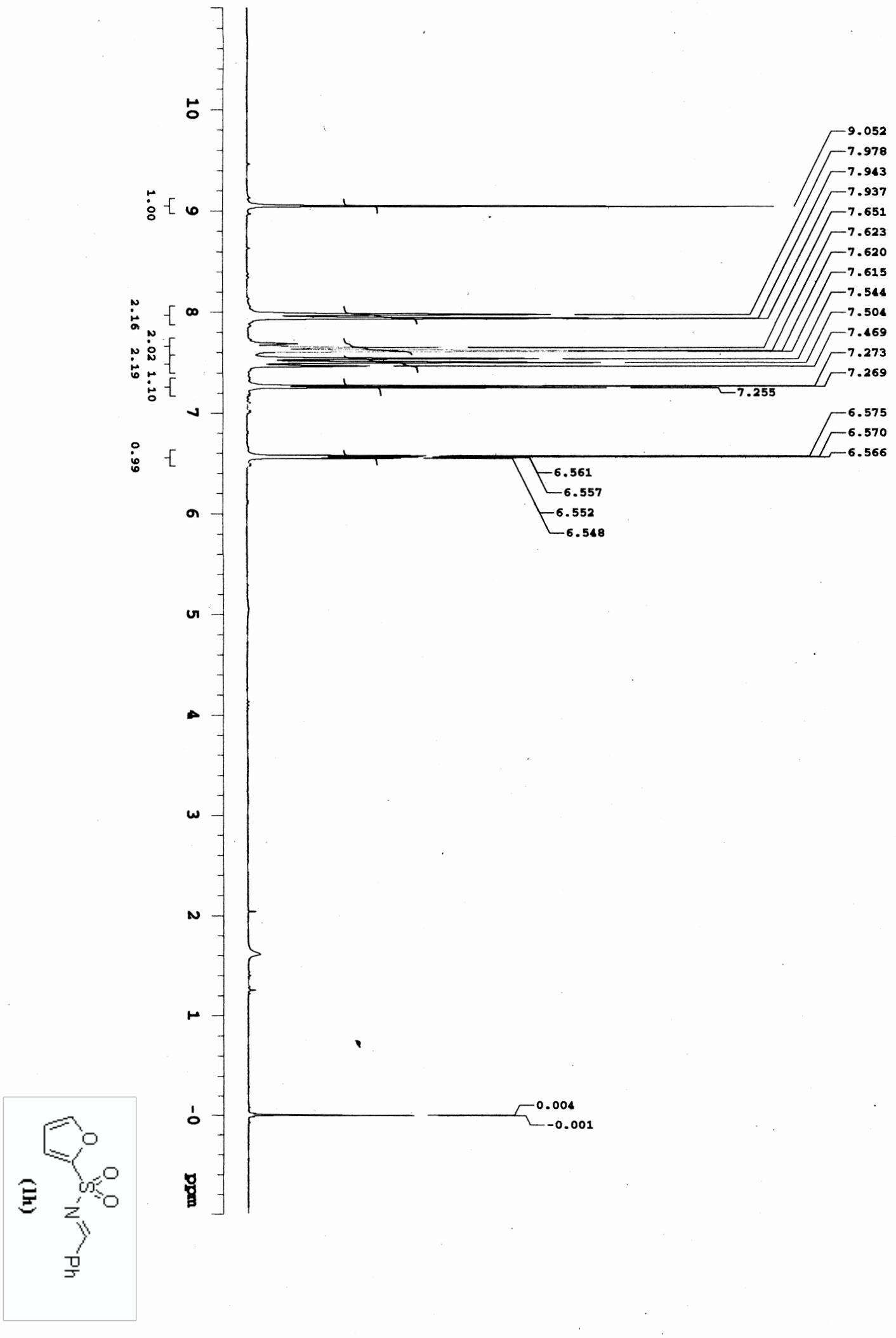
The reaction was carried out as described in the typical procedure except for using imine **1o** (25.0 mg, 0.108 mmol), bis(oxazoline)-Ph (4.1 mg, 0.0119 mmol), $Cu(OTf)_2$ (4.0 mg, 0.0108 mmol), and silylketene acetal (28 μl, 0.014 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 75/25) to afford **4o** (19.1 mg,

52%, 73% ee) as a white solid; mp 108.0-109.2 ^{o}C; $[\alpha]_D^{20}$ –19.1 (*c* 1, $CHCl_3$, 73% ee); R_f = 0.48 (benzene/ethyl acetate = 70/30); ^{1}H NMR δ 1.19 (s, 3H), 1.33 (s, 3H), 3.70 (s, 3H), 4.55 (d, *J* =10 Hz, 1H), 6.19 (d, *J* =12 Hz, 1H), 7.01-7.02 (m, 1H), 7.27-7.36 (m, 3H), 7.72-7.81 (m, 2H), 8.47 (d, *J* = 6 Hz, 1H); ^{13}C NMR δ 22.6, 23.6, 46.9, 52.2, 58.3, 108.1, 109.7, 121.5, 125.8, 137.2, 141.4, 149.4, 150.0, 156.8, 175.5; IR (KBr) 2921, 1737, 1436, 1342, 1181, 1121, 752 cm^{-1}; EIMS m/z (rel. intensity) 338 (M^+, 35), 277 (69), 261 (100), 175 (57); Anal. Calcd for $C_{15}H_{18}N_2O_5S$: C, 53.24; H, 5.36; N, 8.28. Found: C, 53.38; H, 5.27; N, 8.17. HPLC (CHIRALPAK AD-H, hexane/^{i}PrOH=80:20, 0.60 ml/min) t_R 35.0 (major), t_S 38.1 (minor) min.

***(R)*-(*E*)-Methyl 2,2-dimethyl-5-phenyl-3-[(2-pyridylsulfonyl)amino]pent-4-enoate (4p)**

The reaction was carried out as described in the typical procedure except for using imine **1p** (25.0 mg, 0.094 mmol), bis(oxazoline)-Ph (3.5 mg, 0.0103 mmol), $Cu(OTf)_2$ (3.4 mg, 0.0094 mmol), and silylketene acetal (25 μl, 0.0122 mmol). Usual work-up gave the crude product which was purified by chromatography (benzene/ethyl acetate = 90/10) to afford **4p** (14.9 mg, 43%, 71% ee) as a white solid; mp 97.5-98.9 ^{o}C; $[\alpha]_D^{20}$ –51.8 (*c* 1, $CHCl_3$, 71% ee); R_f = 0.65 (benzene/ethyl acetate = 70/30); ^{1}H NMR δ 1.19 (s, 3H), 1.38 (s, 3H), 3.70 (s, 3H), 3.93 (dd, *J* =9, 10 Hz, 1H), 5.71 (dd, *J* =10, 10 Hz, 1H), 5.96 (d, *J* =14 Hz, 1H), 6.95-6.98 (m, 2H), 7.09-7.20 (m, 4H), 7.57-7.65 (m, 2H), 7.87 (d, *J* =8 Hz, 1H), 8.54 (d, *J* =1 Hz, 1H); ^{13}C NMR δ 23.1, 23.7, 46.6, 52.1, 64.0, 121.9, 124.2, 125.2, 125.9, 127.6, 128.0, 133.4, 135.4, 137.2, 149.6, 157.4, 175.9; IR (KBr) 3245, 1733, 1429, 1339, 1120, 1179, 600 cm^{-1}; EIMS m/z (rel. intensity) 374 (M^+, 20), 367 (45), 343 (100), 281 (60); Anal. Calcd for $C_{19}H_{22}N_2O_4S$: C, 60.94; H, 5.92; N, 7.48. Found: C, 61.02; H, 5.78; N, 7.31. HPLC

(CHIRALPAK AD-H, hexane/^{i}PrOH=80:20, 1.0 ml/min) t_R 11.6 (major), t_S 17.0 (minor) min.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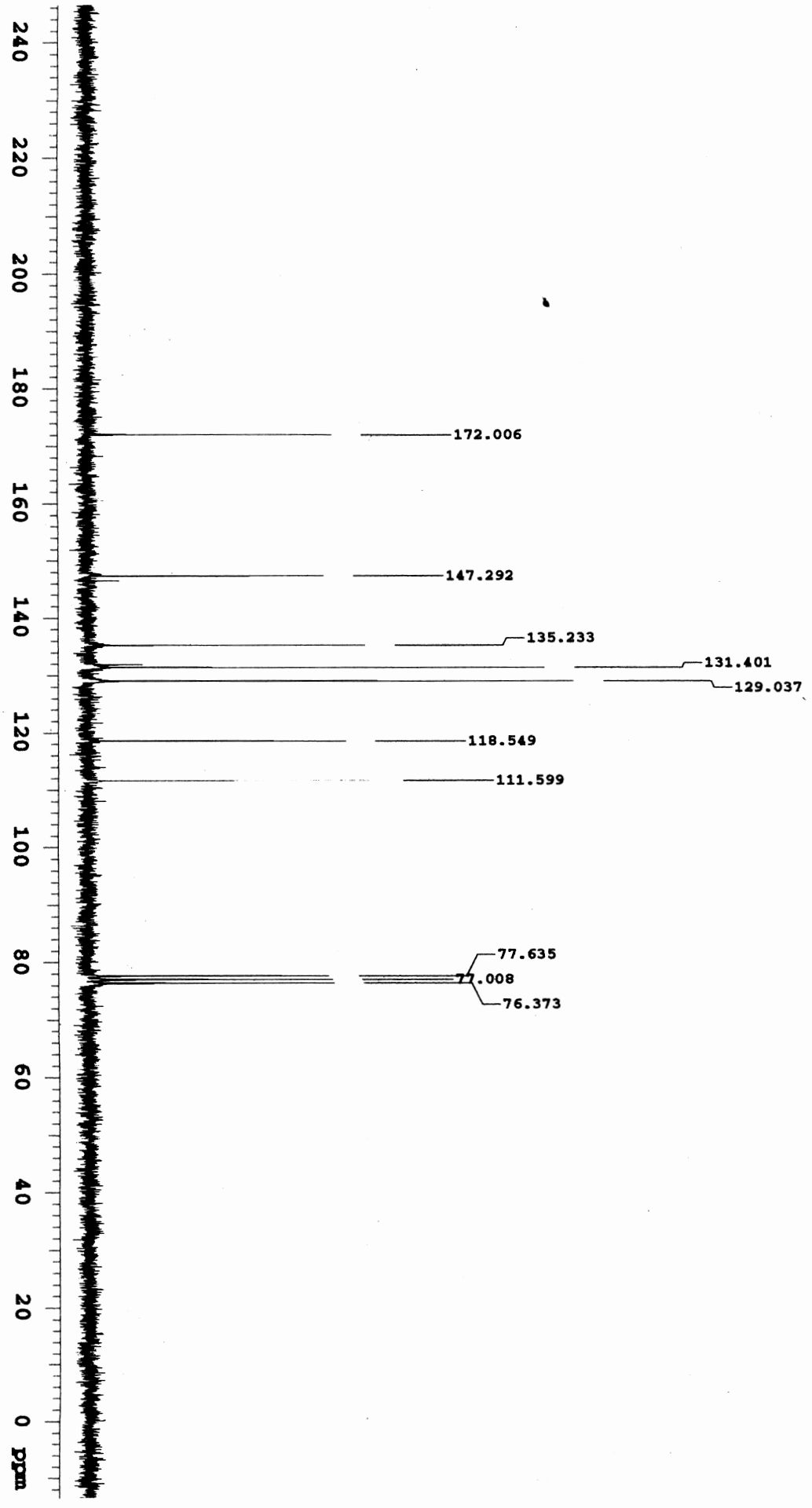
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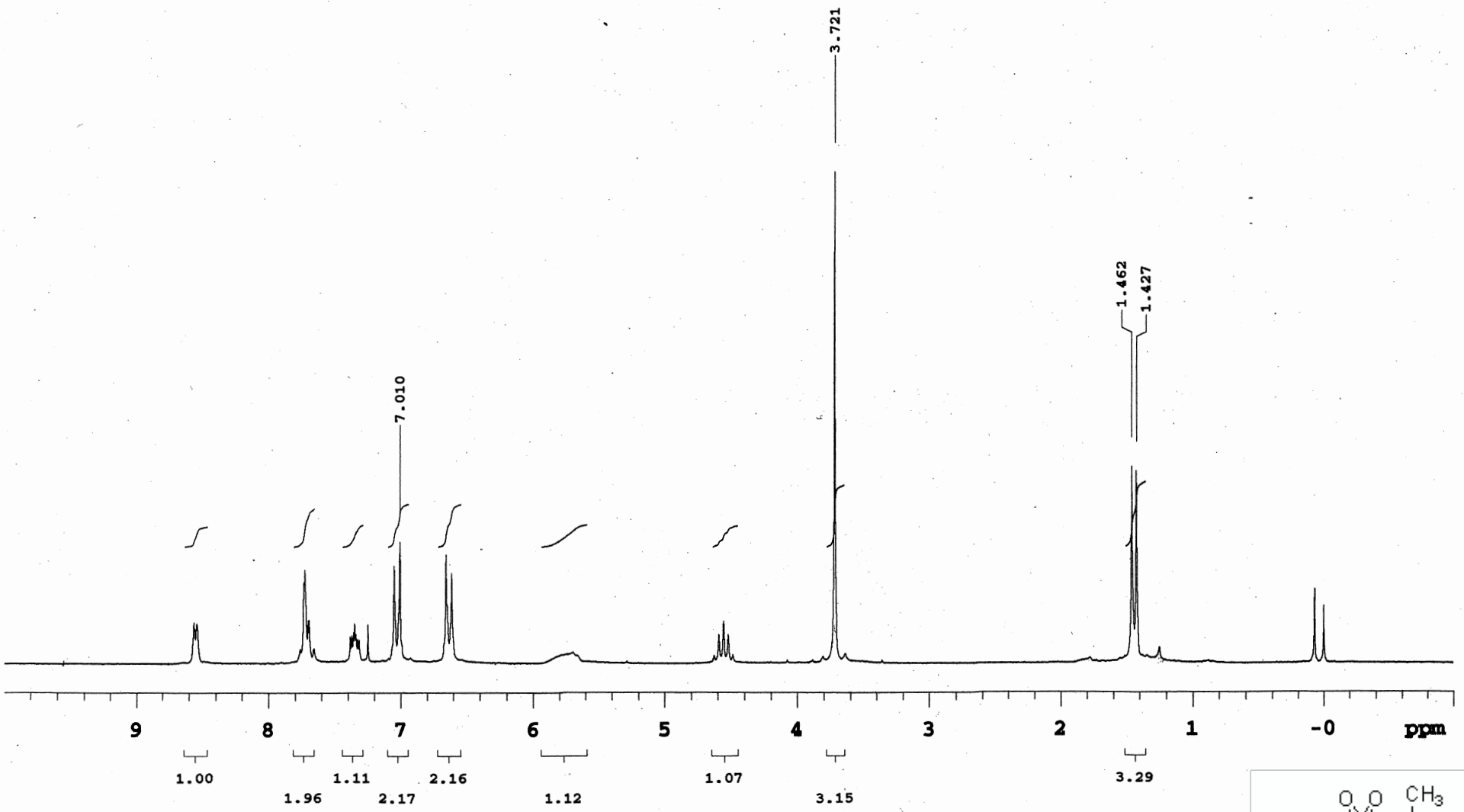
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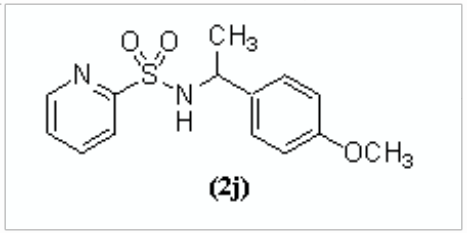
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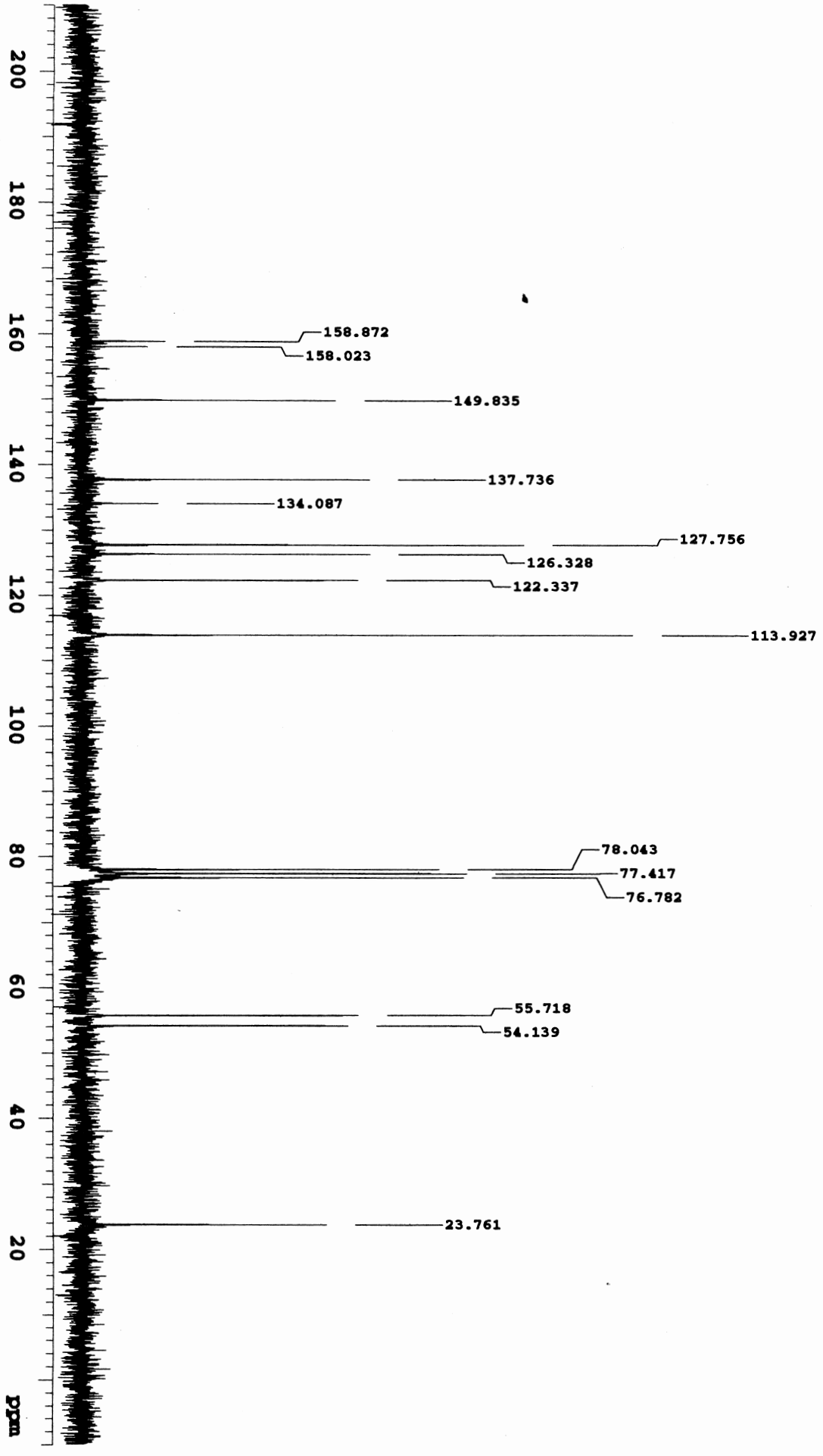
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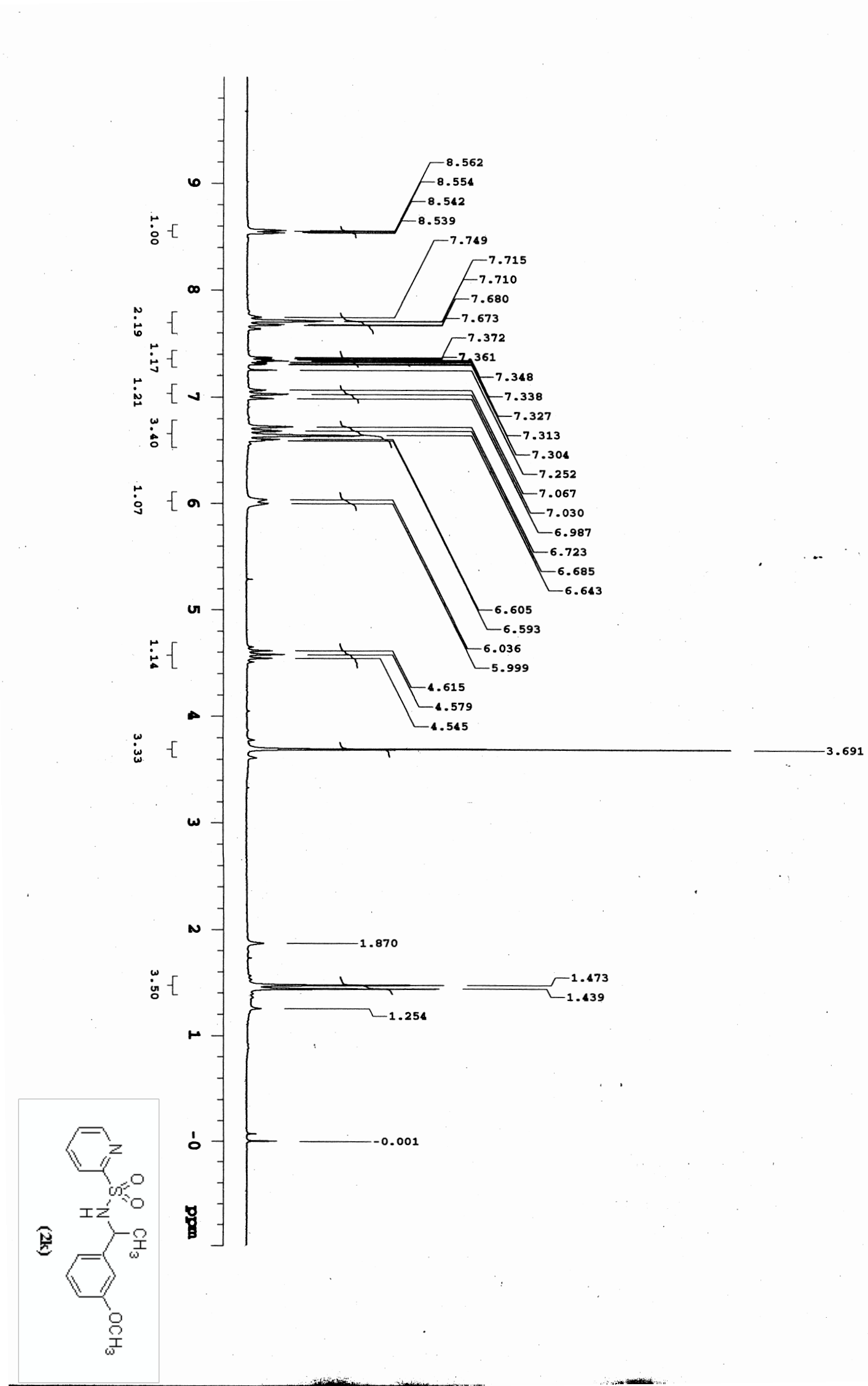
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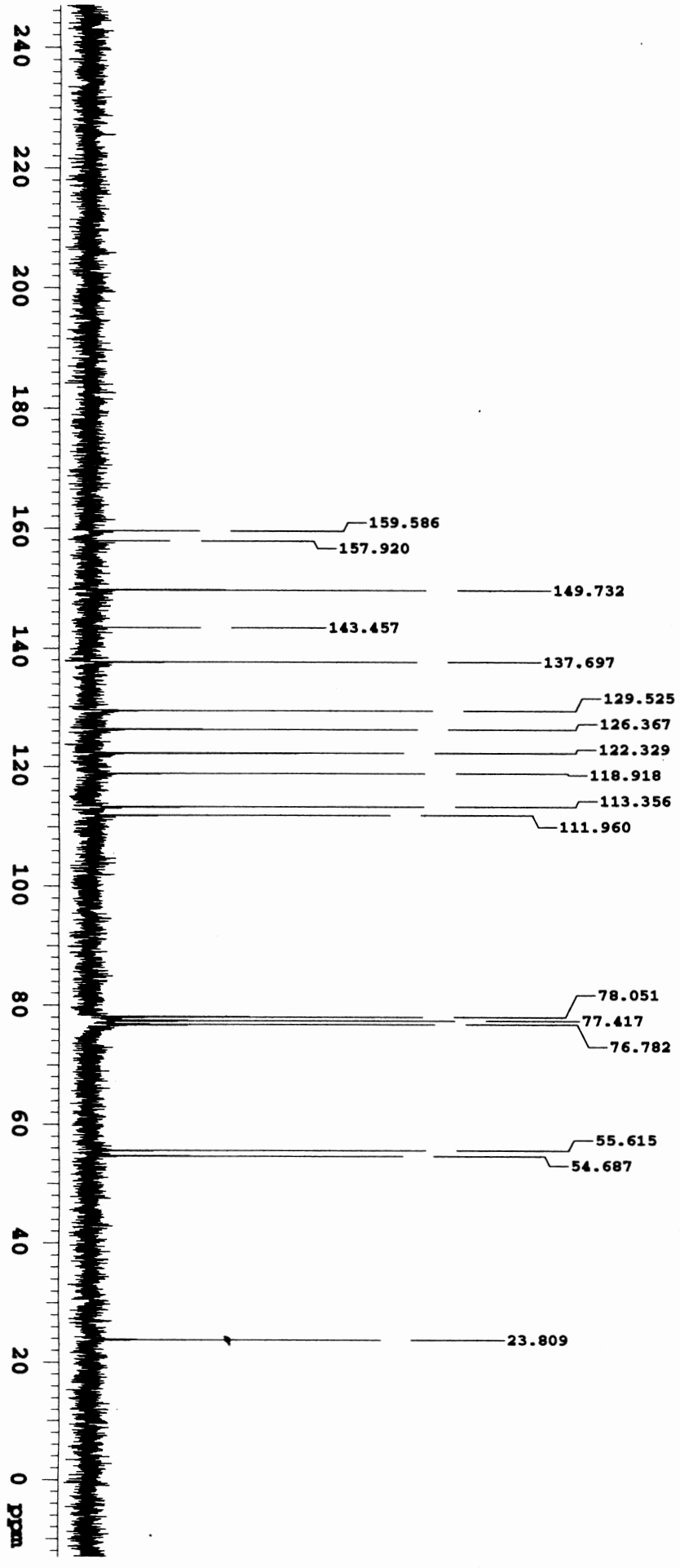
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20
0 ppm
159.586
157.920
149.732
143.457
137.697
129.525
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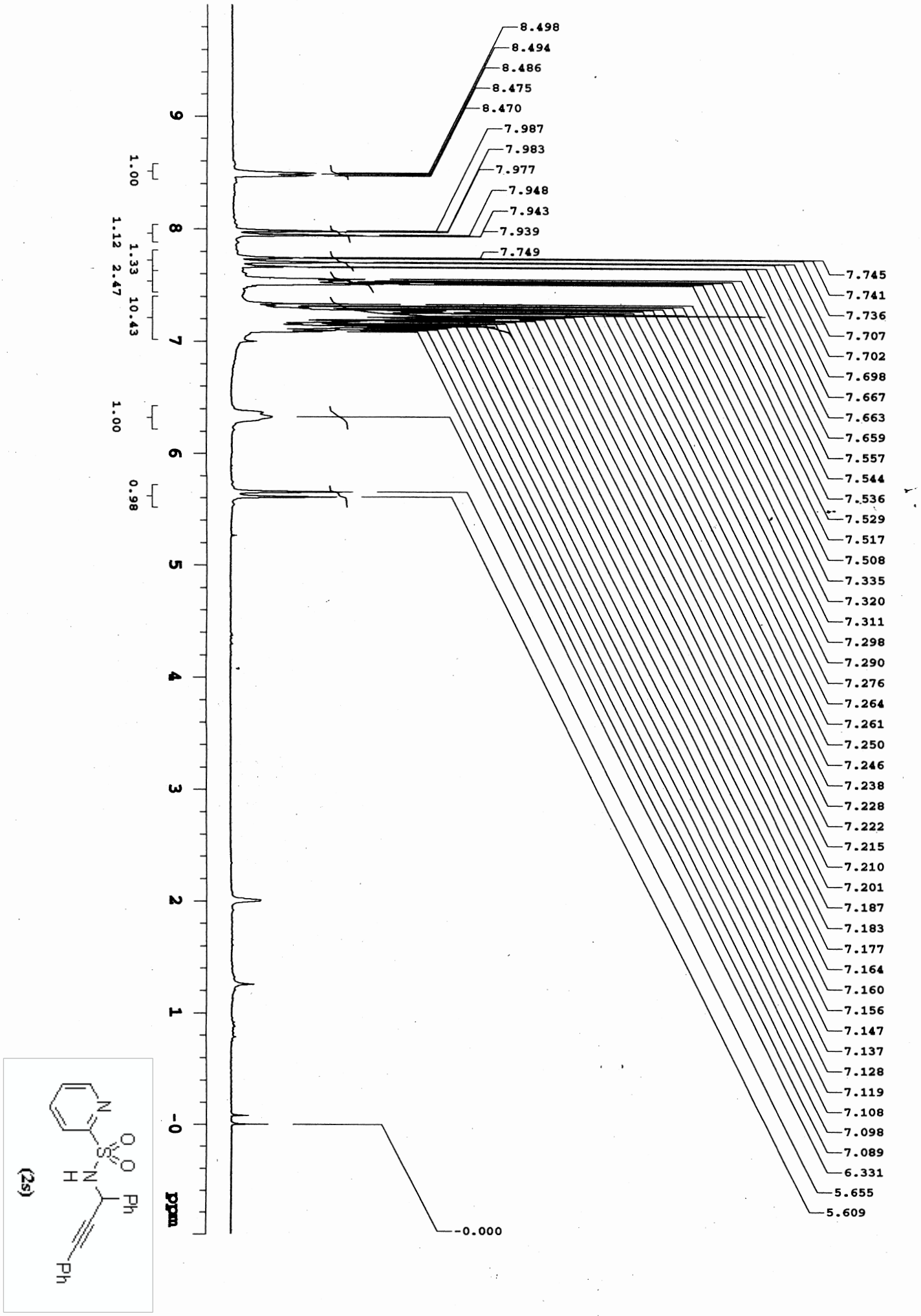
122.329
118.918
113.356
111.960
78.051
77.417
76.782
55.615
54.687
23.809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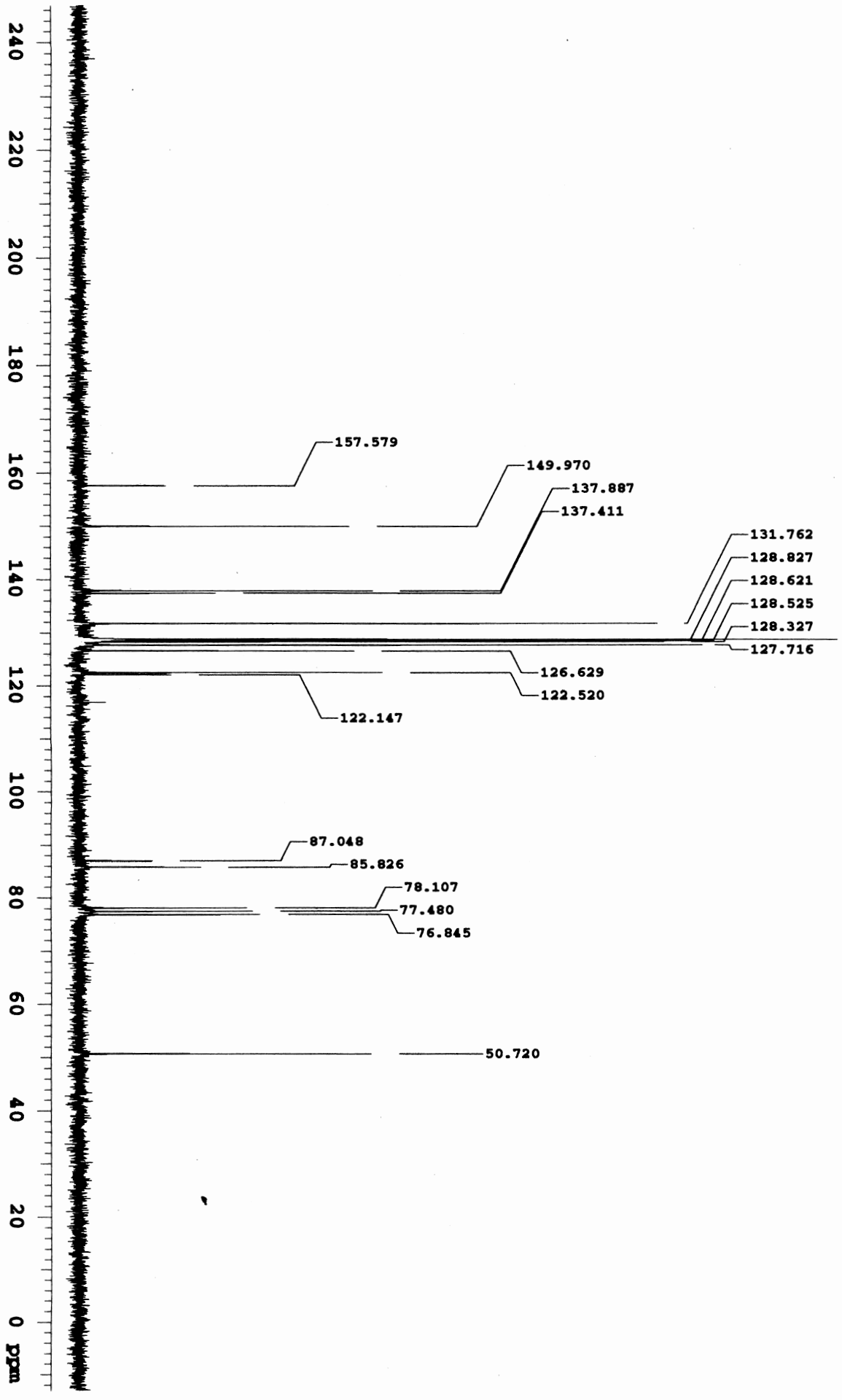
8.486
8.475
8.470
7.987
7.983
7.977
7.948
7.943
7.939
7.749
7.745
7.741
7.736
7.707
7.702
7.698
7.667
7.663
7.659
7.557
7.544
7.536
7.529
7.517
7.508
7.335
7.320
7.311
7.298
7.290
7.276
7.264
7.261
7.250
7.246
7.238
7.228
7.222
7.215
7.210
7.201
7.187
7.183
7.177
7.164
7.160
7.156
7.147
7.137
7.128
7.119
7.108
7.098
7.089
6.331
5.655
5.609
-0.000
1.00
1.12
1.33
2.47
10.43
1.00
0.98
9
8
7
6
5
4
3
2
1
-0
ppm
N
O
O
S
N
H
Ph
Ph
(2s)


240
220
200
180
160
140
120
100
80
60
40
20
0 ppm
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149.970
137.887
137.411
131.762
128.827
128.621
128.525
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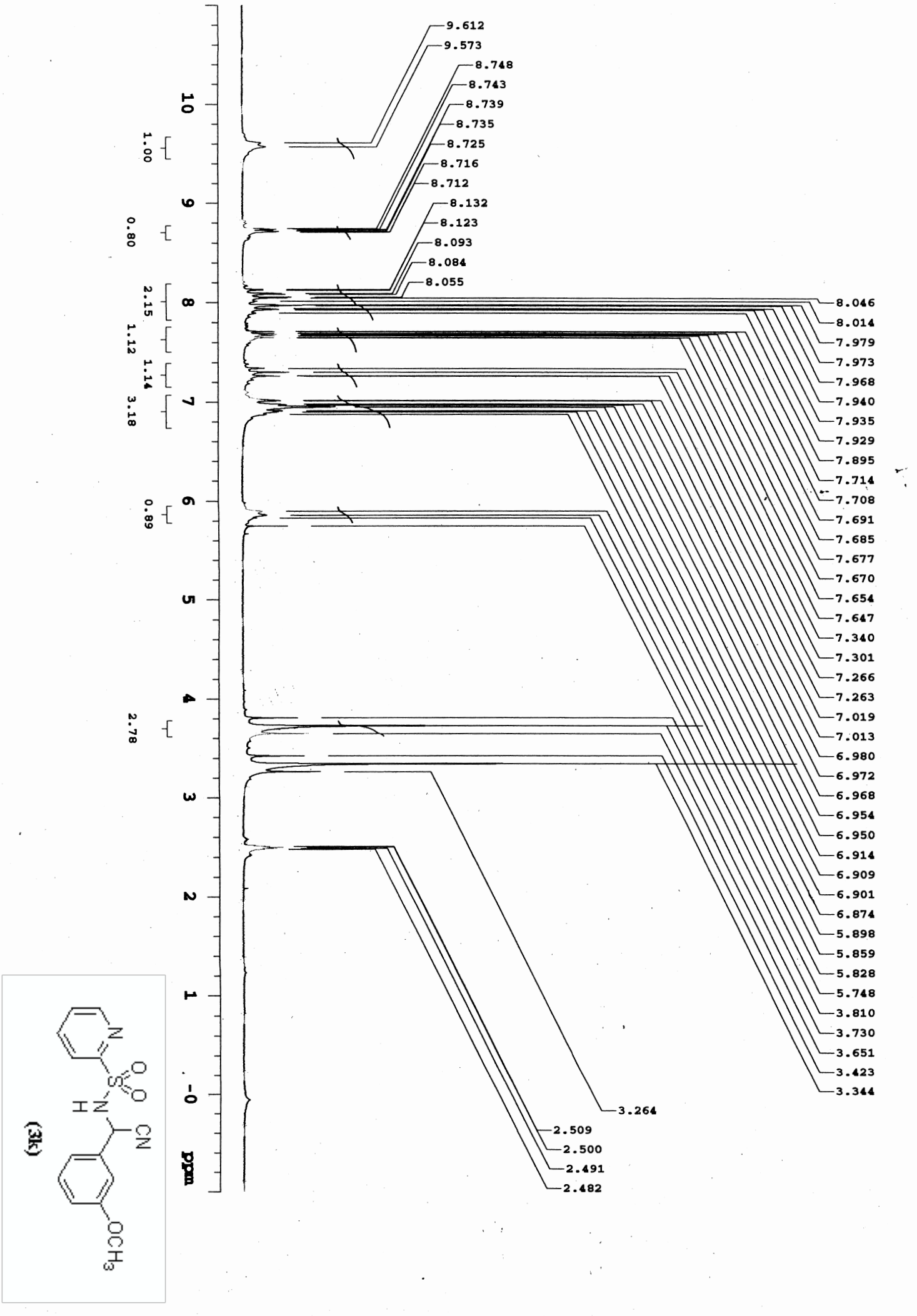
127.716
126.629
122.520
122.147
87.048
85.826
78.107
77.480
76.845
50.720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9.573
8.748
8.743
8.739
8.735
8.725
8.716
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8.132
8.123
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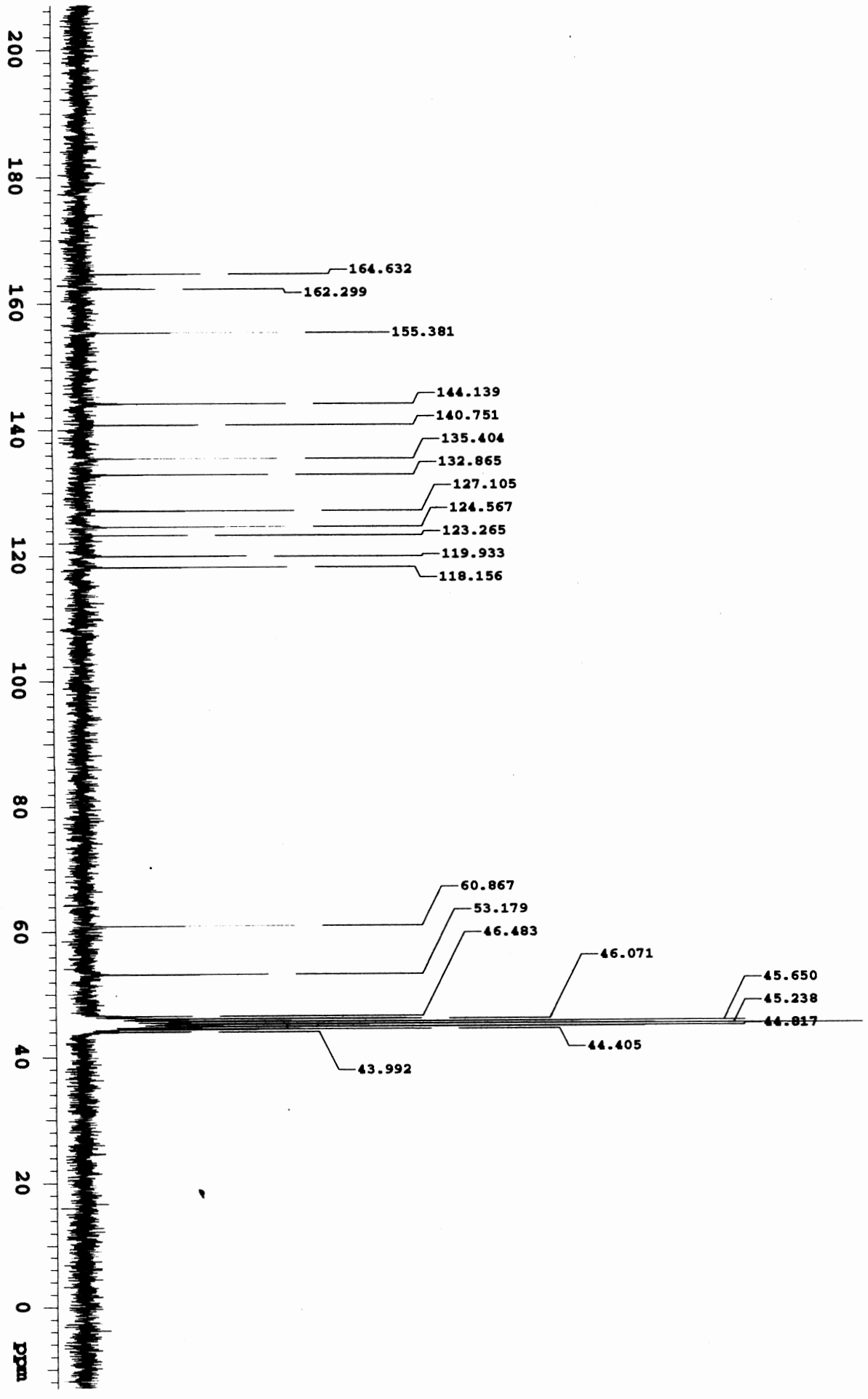
8.084
8.055
8.046
8.014
7.979
7.973
7.968
7.940
7.935
7.929
7.895
7.714
7.708
7.691
7.685
7.677
7.670
7.654
7.647
7.340
7.301
7.266
7.263
7.019
7.013
6.980
6.972
6.968
6.954
6.950
6.914
6.909
6.901
6.874
5.898
5.859
5.828
5.748
3.810
3.730
3.651
3.423
3.344
3.264
2.509
2.500
2.491
2.482
1.00
0.80
2.15
1.12
1.14
3.18
0.89
2.78
10
9
8
7
6
5
4
3
2
1
-0
ppm
(3k)
N
O
O
S
N
H
CN
OCH3


200
180
160
140
120
100
80
60
40
20
0
ppm
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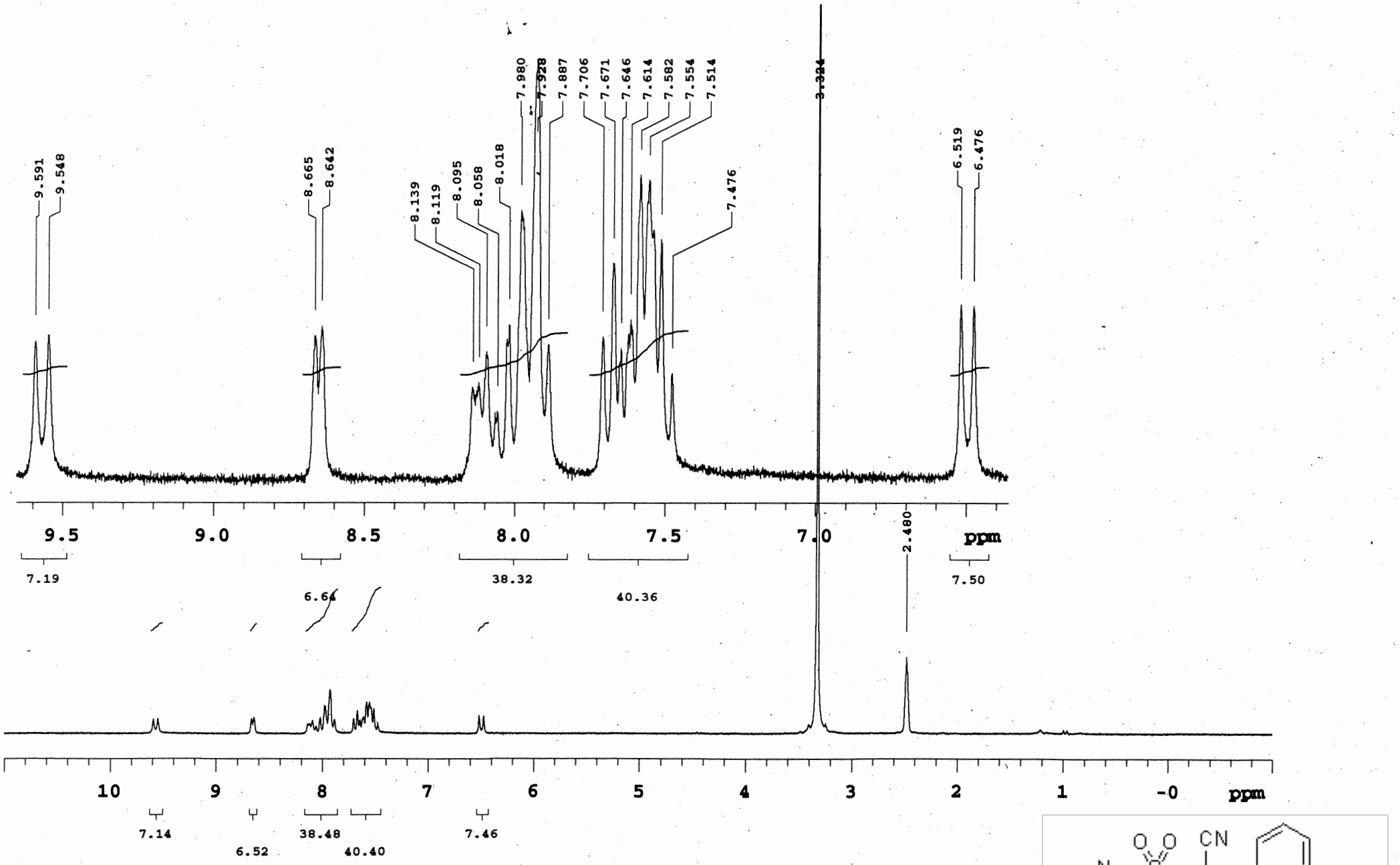
162.299
155.381
144.139
140.751
135.404
132.865
127.105
124.567
123.265
119.933
118.156
60.867
53.179
46.483
46.071
45.650
45.238
44.817
44.405
43.992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8.665
8.642
8.139
8.119
8.095
8.058
8.018
7.980
7.928
7.887
7.706
7.671
7.646
7.614
7.582
7.554
7.514
7.476
3.334
6.519
6.476
2.480
9.5
9.0
8.5
8.0
7.5
7.0
ppm
7.19
6.64
38.32
40.36
7.50
10
9
8
7
6
5
4
3
2
1
-0
ppm
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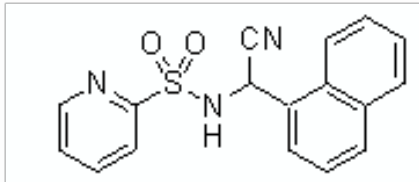
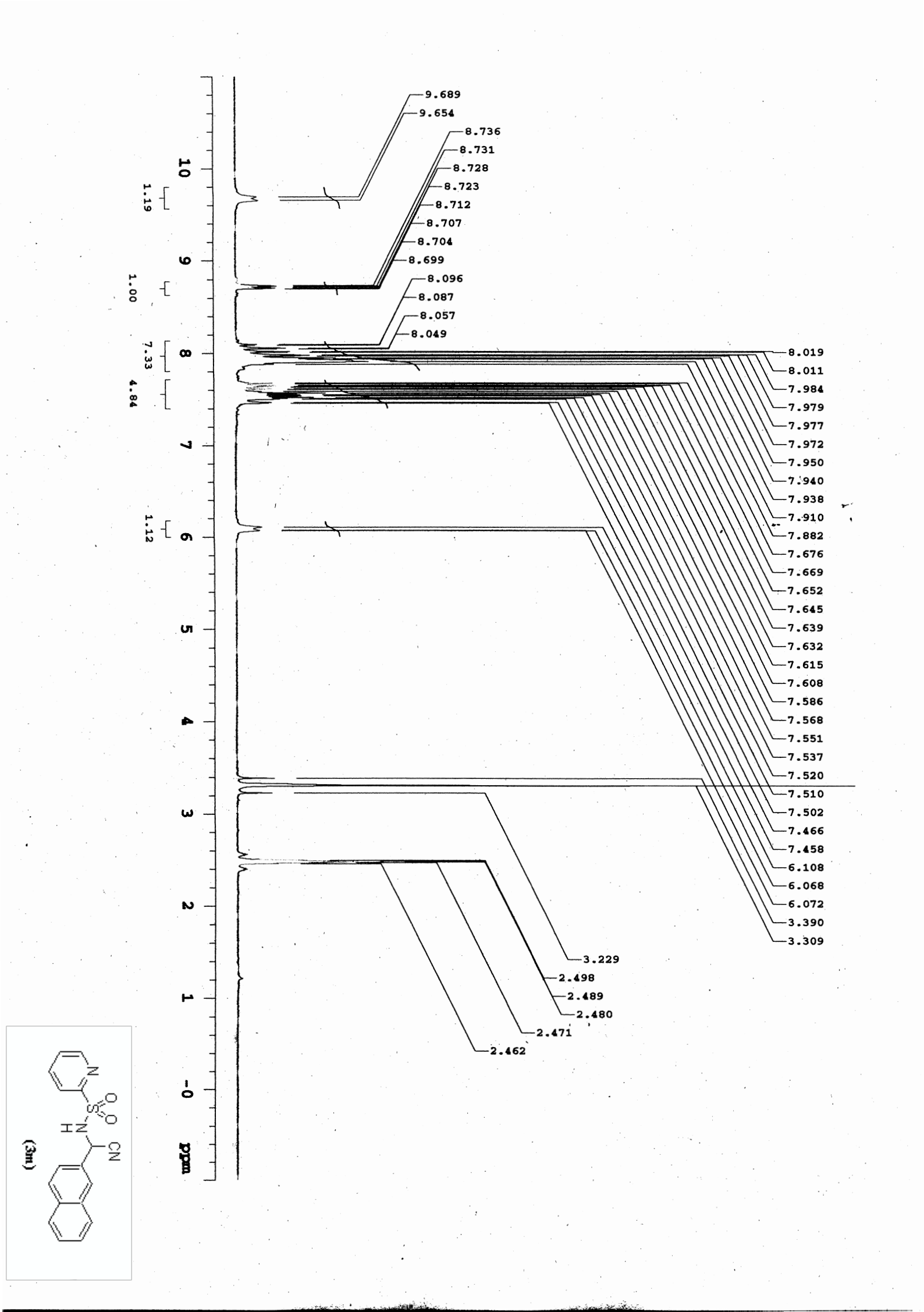
6.52
38.48
40.40
7.46


O
O
CN
N
S
N
H

(3m)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8.723
8.712
8.707
8.704
8.699
8.096
8.087
8.057
8.049
8.019
8.011
7.984
7.979
7.977
7.972
7.950
7.940
7.938
7.910
7.882
7.676
7.669
7.652
7.645
7.639
7.632
7.615
7.608
7.586
7.568
7.551
7.537
7.520
7.510
7.502
7.466
7.458
6.108
6.068
6.072
3.390
3.309
3.229
2.498
2.489
2.480
2.471
2.462
1.19
1.00
7.33
4.84
1.12
10
9
8
7
6
5
4
3
2
1
-0
ppm
(3m)