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Supporting Information

for

p-Pyridinyl oxime carbamates: synthesis, DNA binding, DNA photocleaving activity and theoretical photodegradation studies

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Experimental part

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1. Synthesis of O−carbamoyl oximes

1.1. General procedure for the synthesis of O−carbamoyl amidoximes

(*Z*)-*N'*-Hydroxyisonicotinimidamide **1** [68] (274 mg, 2 mmol) was dissolved in dry chloroform (12 mL) under Ar atmosphere. Triethylamine (0.3 mL, 2.2 mmol) was added at 0 °C, followed by slow addition (15 min) of the proper isocyanate (2.2 mmol). The mixture was stirred at rt or refluxed for the indicated period of time. Then, water (30 mL) was added and the mixture was extracted with dichloromethane (3 × 30 mL). After drying (Na_2SO_4) the organic solvent was removed in a rotary evaporator and the crude residue was either recrystallized or subjected to a column chromatography and then recrystallized.

1.2. General procedure for the synthesis of O-carbamoyl ethanone oximes

(*E*)-1-(Pyridin-4-yl)ethan-1-one oxime **14** [69] (136 mg, 1 mmol) was dissolved in dry chloroform or tetrahydrofuran (6 mL) under Ar atmosphere. Triethylamine (0.15 mL, 1.1 mmol) was added at 0 °C, followed by slow addition (15 min) of the proper isocyanate (1.1–1.8 mmol). The mixture was stirred at rt or refluxed for the indicated period of time. Then, water (20 mL) was added and the mixture was extracted with dichloromethane (3 × 20 mL). After drying (Na_2SO_4) the organic solvent was removed in a rotary evaporator and the crude residue was either recrystallized or subjected to a column chromatography and then recrystallized.

1.3. General procedure for the synthesis of O-carbamoyl aldoximes

(*E*)-Isonicotinaldehyde oxime **21** [70] (244 mg, 2 mmol) was dissolved in tetrahydrofuran or other indicated solvent (25 mL) under Ar atmosphere. Triethylamine (0.3 mL, 2.2 mmol) was added at 0 °C, followed by slow addition (15 min) of the proper isocyanate (2.2 mmol). The mixture was stirred at rt or refluxed for the indicated period of time. Then, water (30 mL) was added and the mixture was extracted with dichloromethane (3 × 30 mL). After drying (Na_2SO_4) the organic solvent was removed in a rotary evaporator and the crude residue was either recrystallized or subjected to a column chromatography and then recrystallized.

1.4. Data analysis of O-carbamoyl amidoximes 8–13, O-carbamoyl ethanone oximes 15−20, and O-carbamoyl amidoximes 22−27

(Z)-N'-[(Benzyl-carbamoyl)oxy]isonicotinimidamide (8).

Reaction time: 1 h (rt); method of purification: recrystallization; yield: 408 mg (75%); white crystals, mp 132 °C (ethyl acetate/hexanes); IR (KBr): 3378, 3292, 3111, 1701 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$ + DMSO-d_6) δ 4.28 (d, J = 6.0 Hz, 2H), 6.13 (br s, 2H), 6.97 (br t, J = 5.1 Hz, 1H), 7.04–7.19 (m, 5H), 7.50 (d, J = 4.9 Hz, 2H), 8.45 (d, J = 5.0 Hz, 2H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$ + DMSO-d_6) δ 44.0, 120.2, 126.5, 126.6, 127.8, 137.9, 138.3, 149.2, 151.9, 155.2 ppm; HRMS (ESI) calc $C_{14}H_{15}N_4O_2$ $[M + H]^+$ 271.1190; found 271.1189.

(Z)-N'-[(Phenyl-carbamoyl)oxy]isonicotinimidamide (9).

Reaction time: 2 h (rt); method of purification: column chromatography (eluent: CH_2Cl_2/MeOH 20/1); yield: 353 mg (69%); beige crystals, mp 168 °C (MeOH/H_2O); IR (KBr): 3413, 3304, 1718 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$ + DMSO−d_6) δ 6.63 (br s 2H), 7.00 (t, J = 7.4 Hz, 1H), 7.24 (t, J = 7.8 Hz, 2H), 7.46 (d, J = 7.8 Hz, 2H), 7.71 (d, J = 6.0 Hz, 2H), 8.61 (d, J = 6.0 Hz, 2H), 8.98 (br s, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$ + DMSO−d_6) δ 118.2, 119.9, 122.2, 127.6, 136.8, 137.8, 148.7, 151.3, 152.3 ppm; HRMS (ESI) calc $C_{13}H_{13}N_4O_2$ $[M + H]^+$ 257.1033; found 257.1030.

(Z)-N'-[(4-Methoxyphenyl-carbamoyl)oxy]isonicotinimidamide (10).

Reaction time: 24 h (rt); method of purification: column chromatography (eluent: CH_2Cl_2/MeOH 40/3); yield: 401 mg (70%); grey crystals, mp 167 °C (ethyl acetate); IR (KBr): 3468, 3326, 1718 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6) δ 3.73 (s, 3H), 6.91 (d, J = 9.0 Hz, 2H), 7.04 (br s, 2H), 7.44

(d, J = 9.0 Hz, 2H), 7.84 (d, J = 6.1 Hz, 2H), 8.69 (d, J = 6.1, Hz, 2H), 9.24 (s, 1H) ppm; ^{13}C NMR (125 MHz, DMSO-d_6) δ 55.2, 113.9, 121.0, 121.4, 131.3, 138.8, 150.0, 152.7, 153.2, 155.4 ppm; HRMS (ESI) calc $C_{14}H_{15}N_4O_3$ $[M + H]^+$ 287.1139; found 287.1135.

(Z)-N'-[(4-Nitrophenyl-carbamoyl)oxy]isonicotinimidamide (11).

Reaction time: 4 h (reflux); method of purification: recrystallization; yield: 556 mg (92%); yellow-orange crystals, mp 202 °C (EtOH/H_2O); IR (KBr): 3482, 3358, 3316, 1719 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.10 (br s, 2H), 7.79 (d, J = 6.1 Hz, 2H), 7.80 (d, J = 9.1 Hz, 2H), 8.24 (d, J = 9.3 Hz, 2H), 8.71 (d, J = 6.1 Hz, 2H), 10.14 (br s 1H) ppm; ^{13}C NMR (125 MHz, DMSO-d_6) δ 118.4, 121.0, 125.0, 138.6, 142.0, 145.1, 150.0, 151.9, 154.6 ppm; HRMS (ESI) calc $C_{13}H_{12}N_5O_4$ $[M + H]^+$ 302.0884; found 302.0886.

(Z)-N'-[(4-Chlorophenyl-carbamoyl)oxy]isonicotinimidamide (12).

Reaction time: 24 h (reflux); method of purification: recrystallization; yield: 522 mg (90%); grey crystals, mp 197 °C (EtOH/H_2O); IR (KBr): 3467, 3327, 3176, 1703 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$ + DMSO-d_6) δ 6.59 (br s 2H), 7.20 (d, J = 8.8 Hz, 2H), 7.46 (d, J = 8.8 Hz, 2H), 7.70 (d, J = 6.1 Hz, 2H), 8.61 (d, J = 6.0 Hz, 2H), 9.08 (br s, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$ + DMSO-d_6) δ 119.6, 120.1, 126.9, 127.6, 135.8, 137.9, 148.8, 151.3, 152.5 ppm; HRMS (ESI) calc $C_{13}H_{12}ClN_4O_2$ $[M + H]^+$ 291.0643; found 291.0650, 293.0614 (3:1).

(Z)-N'-[(4-Fluorophenyl-carbamoyl)oxy]isonicotinimidamide (13).

Reaction time: 4 h (reflux); method of purification: recrystallization; yield: 525 mg (96%); grey crystals, mp 182 °C (EtOH/H_2O); IR (KBr): 3408, 3297, 3158, 1714 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.06 (br s, 2H), 7.17 (t, $^3J_{HF}$ = $^3J_{HH}$ = 8.9 Hz, 2H), 7.56 (dd, $^3J_{HH}$ = 8.9 Hz, $^4J_{HF}$ = 5.0 Hz, 2H), 7.82 (d, J = 5.9 Hz, 2H), 8.69 (d, J = 6.0 Hz, 2H), 9.47 (br s, 1H) ppm; ^{13}C NMR (125 MHz, DMSO-d_6) δ 115.3 (d, $^2J_{CF}$ = 22.2 Hz), 121.0, 121.4 (d, $^3J_{CF}$ = 7.9 Hz), 134.8 (d, $^4J_{CF}$ = 2.5 Hz), 138.8, 150.0, 152.6, 153.5, 158.1 (d, $^1J_{CF}$ = 238.0 Hz) ppm; HRMS (ESI) calc $C_{13}H_{12}FN_4O_2$ $[M + H]^+$ 275.0939; found 275.0934.

(E)-1-(Pyridin-4-yl)ethanone O-benzylcarbamoyl oxime (15).

Reaction time: 24 h (reflux); solvent: chloroform; method of purification: column chromatography (eluent: ethyl acetate/hexanes 2/1); yield: 207 mg (77%); off-white crystals, mp 118 °C (ethyl acetate/hexanes); IR (KBr): 3334, 1720 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) δ 2.42 (s, 3H), 4.53 (d, J = 6.0 Hz, 2H), 6.67 (s, 1H), 7.28–7.37 (m, 5H), 7.53 (d, J = 5.0 Hz, 2H), 8.67 (d, J = 5.6 Hz, 2H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 13.9, 45.2, 120.8, 127.6, 127.7, 128.7, 137.7, 142.3, 150.1, 154.8, 158.3 ppm; HRMS (ESI) calc $C_{15}H_{16}N_3O_2$ $[M + H]^+$ 270.1237; found 270.1235.

(E)-1-(Pyridin-4-yl)ethanone O-phenylcarbamoyl oxime (16).

Reaction time: 2 h (reflux); solvent: chloroform; method of purification: column chromatography (eluent: ethyl acetate/hexanes 2/1); yield: 225 mg (88%); pale yellow crystals, mp 148 °C (ethyl acetate); IR (KBr): 3230, 1756 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) δ 2.49 (s, 3H), 7.15 (t, J = 7.4 Hz, 1H), 7.37 (t, J = 7.8 Hz, 2H), 7.52 (d, J = 8.1 Hz, 2H), 7.66 (d, J = 5.6 Hz, 2H), 8.16 (br s, 1H), 8.75 (d, J = 5.6 Hz, 2H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 14.2, 119.7, 121.1, 124.6, 129.2, 136.6, 142.8, 149.7, 151.4, 158.6 ppm; HRMS (ESI) calc $C_{14}H_{14}N_3O_2$ $[M + H]^+$ 256.1081; found 256.1078.

(E)-1-(Pyridin-4-yl)ethanone O-4-methoxyphenylcarbamoyl oxime (17).

Reaction time: 24 h (rt); solvent: tetrahydrofuran; method of purification: column chromatography (eluent: ethyl acetate/hexanes 2/1); yield: 201 mg (70%); yellow crystals, mp 147 °C (ethyl acetate/hexanes); IR (KBr): 3246, 1752 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) δ 2.47 (s, 3H), 3.80 (s, 3H), 6.89 (d, J = 8.9 Hz, 2H), 7.41 (d, J = 8.8 Hz, 2H), 7.60 (d, J = 6.1 Hz, 2H), 8.09 (br s,

1H), 8.73 (d, J = 5.9 Hz, 2H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 14.2, 55.5, 114.3, 120.8, 121.9, 129.6, 142.2, 150.3, 152.0, 156.8, 158.7 ppm; HRMS (ESI) calc $C_{15}H_{16}N_3O_3$ $[M + H]^+$ 286.1186; found 286.1189.

(E)-1-(Pyridin-4-yl)ethanone O-4-nitrophenylcarbamoyl oxime (18).

Reaction time: 24 h (reflux); solvent: tetrahydrofuran; method of purification: recrystallization; yield: 291 mg (97%); yellow crystals, mp 169 °C (DMF/H_2O), IR (KBr): 3204, 1786 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6) δ 2.46 (s, 3H), 7.77 (d, J = 5.0 Hz, 2H), 7.79 (d, J = 9.0 Hz, 2H), 8.26 (d, J = 8.8 Hz, 2H), 8.72 (d, J = 4.8 Hz, 2H), 10.66 (br s, 1H) ppm; ^{13}C NMR (125 MHz, DMSO-d_6) δ 13.6, 118.5, 121.0, 125.1, 141.8, 142.3, 144.8, 150.3, 151.1, 160.4 ppm; HRMS (ESI) calc $C_{14}H_{13}N_4O_4$ $[M + H]^+$ 301.0931; found 301.0931.

(E)-1-(Pyridin-4-yl)ethanone O-4-chlorophenylcarbamoyl oxime (19).

Reaction time: 24 h (reflux); solvent: tetrahydrofuran; method of purification: column chromatography (eluent: ethyl acetate/hexanes 2/1); yield: 212 mg (73%); pale yellow crystals, mp 169 °C (ethyl acetate/hexanes), IR (KBr): 3223, 1760 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) δ 2.47 (s, 3H), 7.31 (d, J = 8.8 Hz, 2H), 7.47 (d, J = 8.8 Hz, 2H), 7.59 (d, J = 6.2 Hz, 2H), 8.24 (br s, 1H), 8.73 (d, J = 6.1 Hz, 2H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 14.3, 120.8, 120.9, 129.2, 129.6, 135.3, 142.0, 150.4, 151.4, 159.2 ppm; HRMS (ESI) calc $C_{14}H_{13}ClN_3O_2$ $[M + H]^+$ 290.0691; found 290.0689, 292.0658 (3:1).

(E)-1-(Pyridin-4-yl)ethanone O-4-fluorophenylcarbamoyl oxime (20).

Reaction time: 2 h (reflux); solvent: tetrahydrofuran; method of purification: column chromatography (eluent: ethyl acetate/hexanes 2/1); yield: 172 mg (63%); pale yellow crystals, mp 181 °C (CH_2Cl_2/hexanes), IR (KBr): 3197, 1752 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$ + DMSO-d_6) δ 2.40 (s, 3H), 7.03 (t, $^3J_{HF} = {}^3J_{HH}$ = 8.8 Hz, 2H), 7.53 (dd, $^3J_{HH}$ = 8.8 Hz, $^4J_{HF}$ = 4.9 Hz, 2H), 7.72 (d, J = 6.1 Hz, 2H), 8.64 (d, J = 6.1 Hz, 2H), 9.74 (s, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$ + DMSO-d_6) δ 11.7, 113.4 (d, $^2J_{CF}$ = 22.2 Hz), 119.2, 119.4 (d, $^3J_{CF}$ = 6.1 Hz), 132.7 (d, $^4J_{CF}$ = 2.5 Hz), 140.3, 148.3, 150.0, 156.6 (d, $^1J_{CF}$ = 239.5 Hz), 157.0 ppm; HRMS (ESI) calc $C_{14}H_{13}FN_3O_2$ $[M + H]^+$ 274.0986; found 274.0984.

(E)-Isonicotinaldehyde O-benzylcarbamoyl oxime (22).

Reaction time: 24 h (rt); solvent: tetrahydrofuran; method of purification: column chromatography (eluent: CH_2Cl_2/MeOH 20/1); yield: 100 mg (20%); white crystals, mp 101 °C (ethyl acetate); IR (KBr): 3398, 1718 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6) δ 4.34 (d, J = 6.2 Hz, 2H), 7.27–7.24 (m, 1H), 7.37–7.30 (m, 4H), 7.78 (d, J = 6.0 Hz, 2H), 8.34 (br t, J = 6.0 Hz, 1H), 8.64 (s, 1H), 8.72 (d, J = 6.0 Hz, 2H) ppm; ^{13}C NMR (125 MHz, DMSO-d_6) δ 44.0, 121.8, 126.9, 127.1, 128.3, 137.9, 139.2, 150.4, 152.2, 154.6 ppm; HRMS (ESI) calc $C_{14}H_{14}N_3O_2$ $[M + H]^+$ 256.1081; found 256.1075.

(E)-Isonicotinaldehyde O-phenylcarbamoyl oxime (23).[71]

Reaction time: 24 h (rt); solvent: tetrahydrofuran; method of purification: column chromatography (eluent: CH_2Cl_2/MeOH 20/1); yield: 203 mg (42%); pale yellow crystals, mp 136 °C (MeOH); IR (KBr): 3180, 1750 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.08 (t, J = 7.6 Hz, 1H), 7.34 (t, J = 7.8 Hz, 2H), 7.54 (d, J = 7.8 Hz, 2H), 7.77 (d, J = 4.9 Hz, 2H), 8.69 (s, 1H), 8.73 (d, J = 5.0 Hz, 2H), 10.01 (s, 1H) ppm; ^{13}C NMR (125 MHz, DMSO-d_6) δ 119.3, 121.8, 123.4, 128.9, 137.8, 138.1, 150.5, 151.4, 153.3 ppm; HRMS (ESI) calc $C_{13}H_{12}N_3O_2$ $[M + H]^+$ 242.0924; found 242.0927.

(E)-Isonicotinaldehyde O-4-methoxyphenylcarbamoyl oxime (24).

Reaction time: 24 h (rt); solvent: tetrahydrofuran; method of purification: column chromatography (eluent: CH_2Cl_2/MeOH 40/1); yield: 191 mg (35%); pale brown-beige crystals, mp

159 °C (ethyl acetate); IR (KBr): 3195, 1763 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6) δ 3.73 (s, 3H), 6.92 (d, J = 8.9 Hz, 2H), 7.43 (d, J = 8.8 Hz, 2H), 7.77 (d, J = 4.6 Hz, 2H), 8.67 (s, 1H), 8.73 (d, J = 4.6 Hz, 2H), 9.79 (s, 1H) ppm; ^{13}C NMR (125 MHz, DMSO-d_6) δ 55.2, 114.1, 121.3, 121.8, 131.0, 137.9, 150.5, 151.6, 153.0, 155.6 ppm; HRMS (ESI) calc $C_{14}H_{14}N_3O_3$ $[M + H]^+$ 272.1030; found 272.1025.

(E)/(Z)-Isonicotinaldehyde O-4-nitrophenylcarbamoyl oxime (25).

Reaction time: 4 h (reflux); solvent: tetrahydrofuran; method of purification: column chromatography (eluent: CH_2Cl_2/MeOH 40/1); yield: 307 mg (54%); yellow crystals (ethyl acetate); IR (KBr): 3210, 1760 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6, mixture of *E*/*Z* isomers *ca.* 9:1) δ 6.59 (d, J = 9.1 Hz, 0.2H), 7.54 (d, J = 5.7 Hz, 0.2H), 7.76 (d, J = 5.6 Hz, 1.8H), 7.79 (d, J = 9.1 Hz, 1.8H), 7.94 (d, J = 9.1 Hz, 0.2H), 8.17 (s, 0.1H), 8.26 (d, J = 9.1 Hz, 1.8H), 8.59 (d, J = 5.6 Hz, 0.2H), 8.74 (s, 0.9H), 8.74 (d, J = 5.6 Hz, 1.8H), 10.74 (br s, 0.9H), 11.80 (br s, 0.1H) ppm; ^{13}C NMR (125 MHz, DMSO-d_6, mixture of *E*/*Z* isomers *ca.* 9:1) δ 112.4, 118.6, 120.6, 121.9, 125.1, 126.4, 137.6, 140.3, 142.3, 144.7, 146.6, 150.1, 150.5, 151.0, 154.2, 155.7, 156.1 ppm; HRMS (ESI) calc $C_{13}H_{11}N_4O_4$ $[M + H]^+$ 287.0775; found 287.0771.

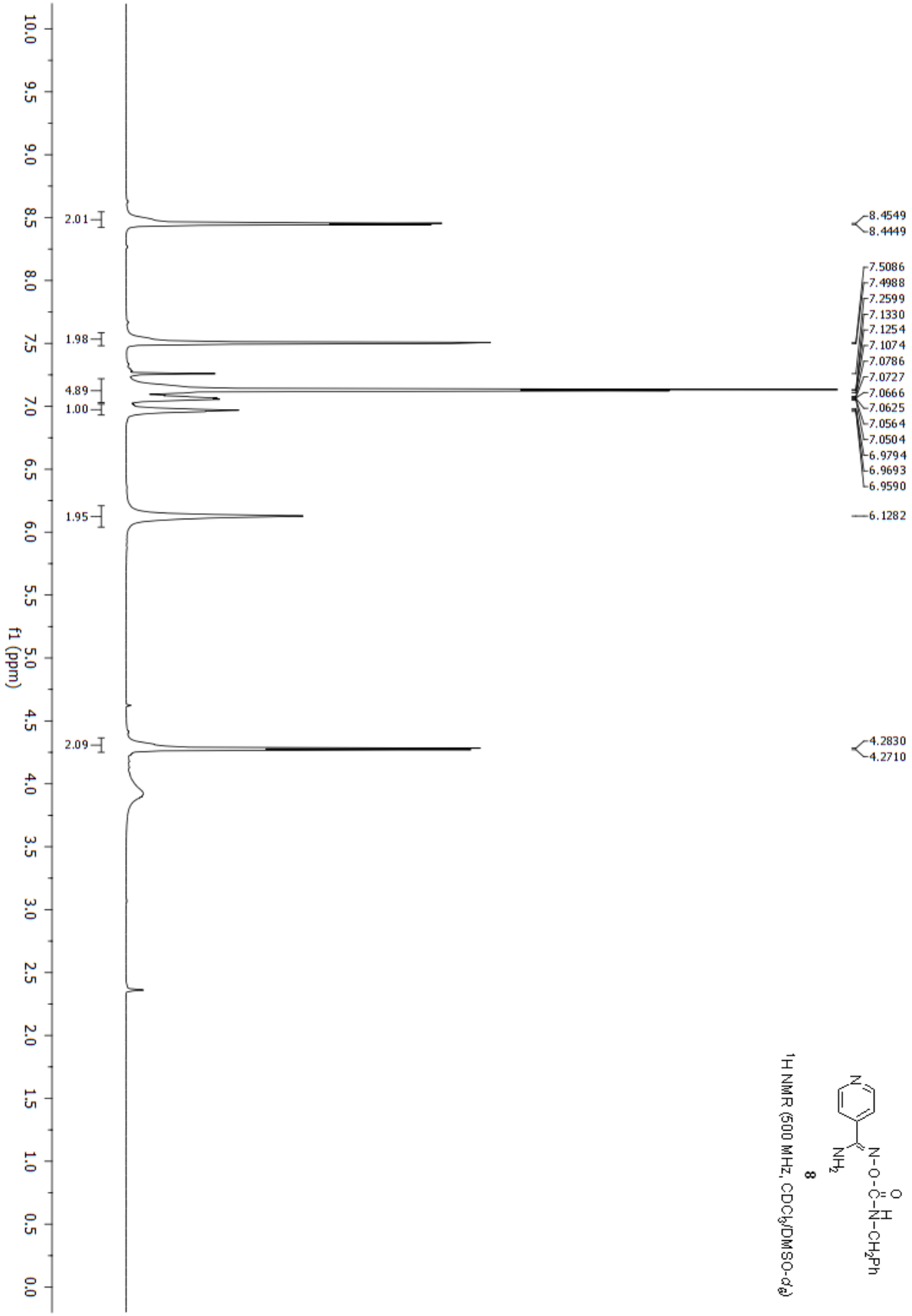
(E)/(Z)-Isonicotinaldehyde O-4-chlorophenylcarbamoyl oxime (26).

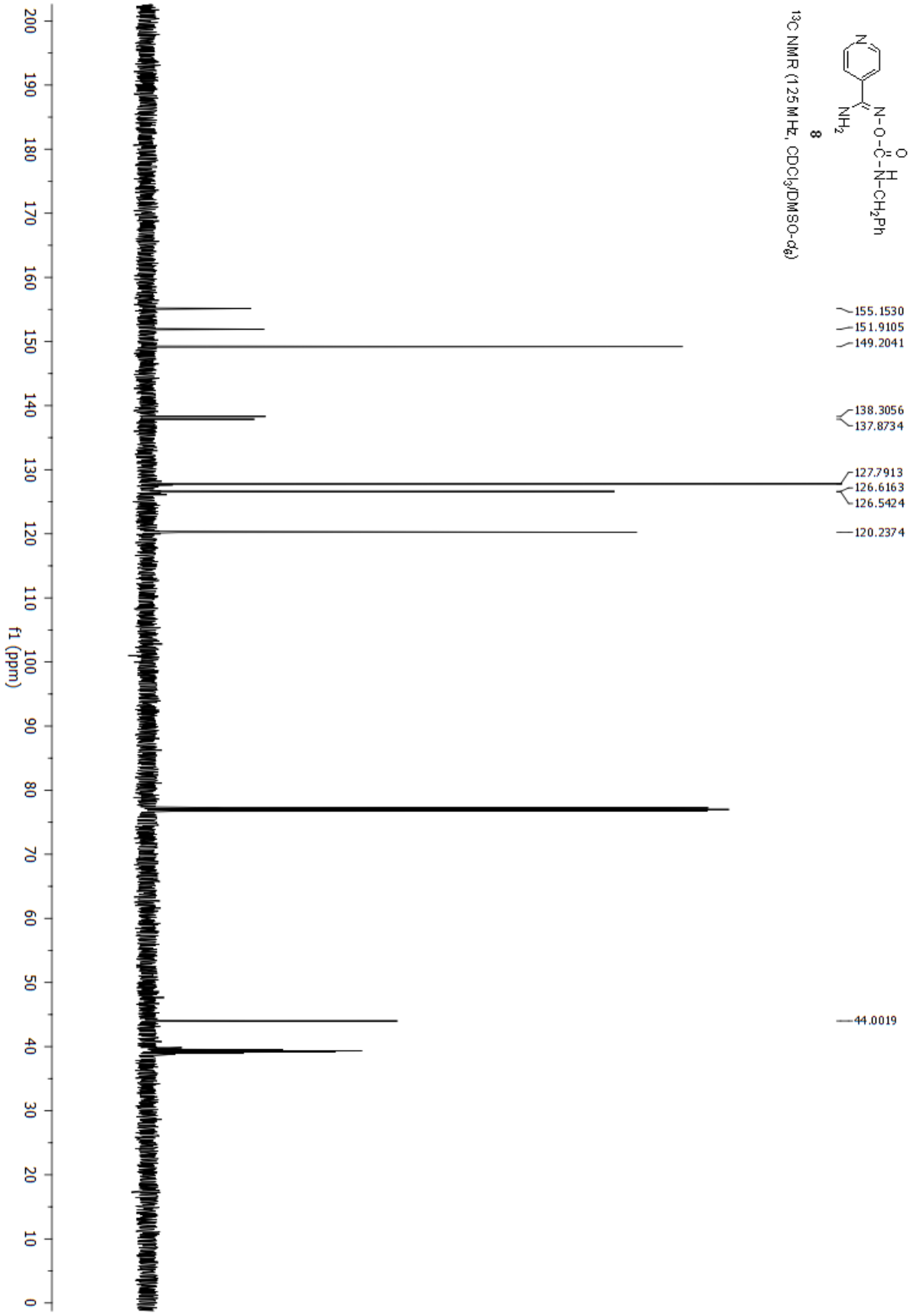
Reaction time: 24 h (reflux); solvent: chloroform; method of purification: column chromatography (eluent: ethyl acetate/hexanes 2/1); yield: 447 mg (81%); white crystals (ethyl acetate); IR (KBr): 3247, 1762 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6, mixture of *E*/*Z* isomers *ca.* 9:1) δ 6.54 (d, J = 8.7 Hz, 0.2H), 7.00 (d, J = 8.7 Hz, 0.2H), 7.40 (d, J = 8.8 Hz, 1.8H), 7.54 (d, J = 6.0 Hz, 0.2H), 7.57 (d, J = 8.9 Hz, 1.8H), 7.76 (d, J = 6.0 Hz, 1.8H), 8.17 (s, 0.1H), 8.59 (d, J = 6.0 Hz, 0.2H), 8.70 (s, 0.9H), 8.73 (d, J = 5.9 Hz, 1.8H), 10.15 (s, 0.9H), 11.80 (s, 0.1H) ppm; ^{13}C NMR (125 MHz, DMSO-d_6, mixture of *E*/*Z* isomers *ca.* 9:1) δ 115.2, 120.6, 120.7, 121.8, 127.1, 128.5, 128.8, 137.1, 137.7, 140.3, 146.6, 150.1, 150.5, 151.3, 153.5 ppm; HRMS (ESI) calc $C_{13}H_{11}ClN_3O_2$ $[M + H]^+$ 276.0534; found 276.0529, 278.0501 (3:1).

(E)/(Z)-Isonicotinaldehyde O-4-fluorophenylcarbamoyl oxime (27).

Reaction time: 24 h (rt); solvent: tetrahydrofuran; method of purification: column chromatography (eluent: CH_2Cl_2/MeOH 40/1); yield: 120 mg (23%); pale yellow crystals, (ethyl acetate/1,4-dioxane); IR (KBr): 3218, 1763 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6, mixture of *E*/*Z* isomers *ca.* 9:1) δ 7.11 (t, $^{3}J_{HF}$ = $^{3}J_{HH}$ = 8.9 Hz, 0.2H), 7.19 (t, $^{3}J_{HF}$ = $^{3}J_{HH}$ = 8.8 Hz, 1.8H), 7.45 (dd, $^{4}J_{HF}$ = 8.9 Hz, $^{3}J_{HH}$ = 5.0 Hz, 0.2H), 7.55 (d, J = 5.8 Hz, 0.2H, obscured), 7.55 (dd, J = 9.1, 5.0 Hz, 1.8H), 7.77 (d, J = 5.7 Hz, 1.8H), 8.17 (s, 0.1H), 8.59 (d, J = 5.8 Hz, 0.2H), 8.69 (s, 0.9H), 8.73 (d, J = 5.7 Hz, 1.8H), 10.03 (s, 0.9H), 11.80 (s, 0.1H) ppm; ^{13}C NMR (125 MHz, DMSO-d_6, mixture of *E*/*Z* isomers *ca.* 9:1) δ 115.2 (d, $^{2}J_{CF}$ = 22.1 Hz, minor isomer), 115.5 (d, $^{2}J_{CF}$ = 22.3 Hz, major isomer), 120.0 (d, $^{3}J_{CF}$ = 7.6 Hz, minor isomer), 120.6, 121.2 (d, $^{3}J_{CF}$ = 7.6 Hz, major isomer), 121.8, 134.4 (d, $^{4}J_{CF}$ = 2.4 Hz, major isomer), 136.0 (d, $^{4}J_{CF}$ = 2.2 Hz, minor isomer), 137.8, 140.3, 146.6, 150.1, 150.5, 151.5, 153.3, 157.3 (d, $^{1}J_{CF}$ = 236.8 Hz, minor isomer), 158.2 (d, $^{1}J_{CF}$ = 238.5 Hz, major isomer) ppm; HRMS (ESI) calc $C_{13}H_{11}FN_3O_2$ $[M + H]^+$ 260.0830; found 260.0833.

2. *^{1}H NMR and ^{13}C NMR of amidoxime, ethanone oxime and aldoxime carbamates*

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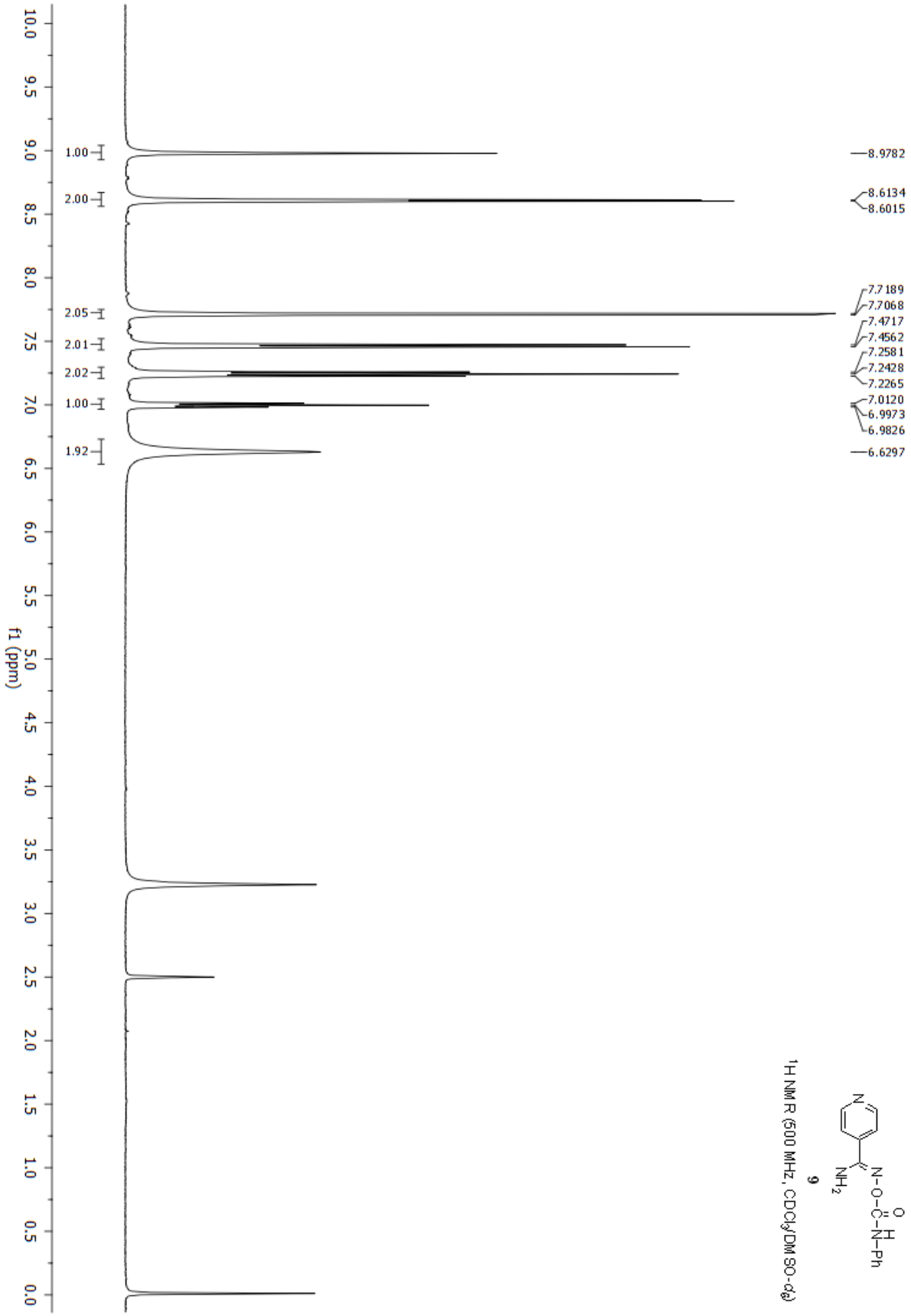

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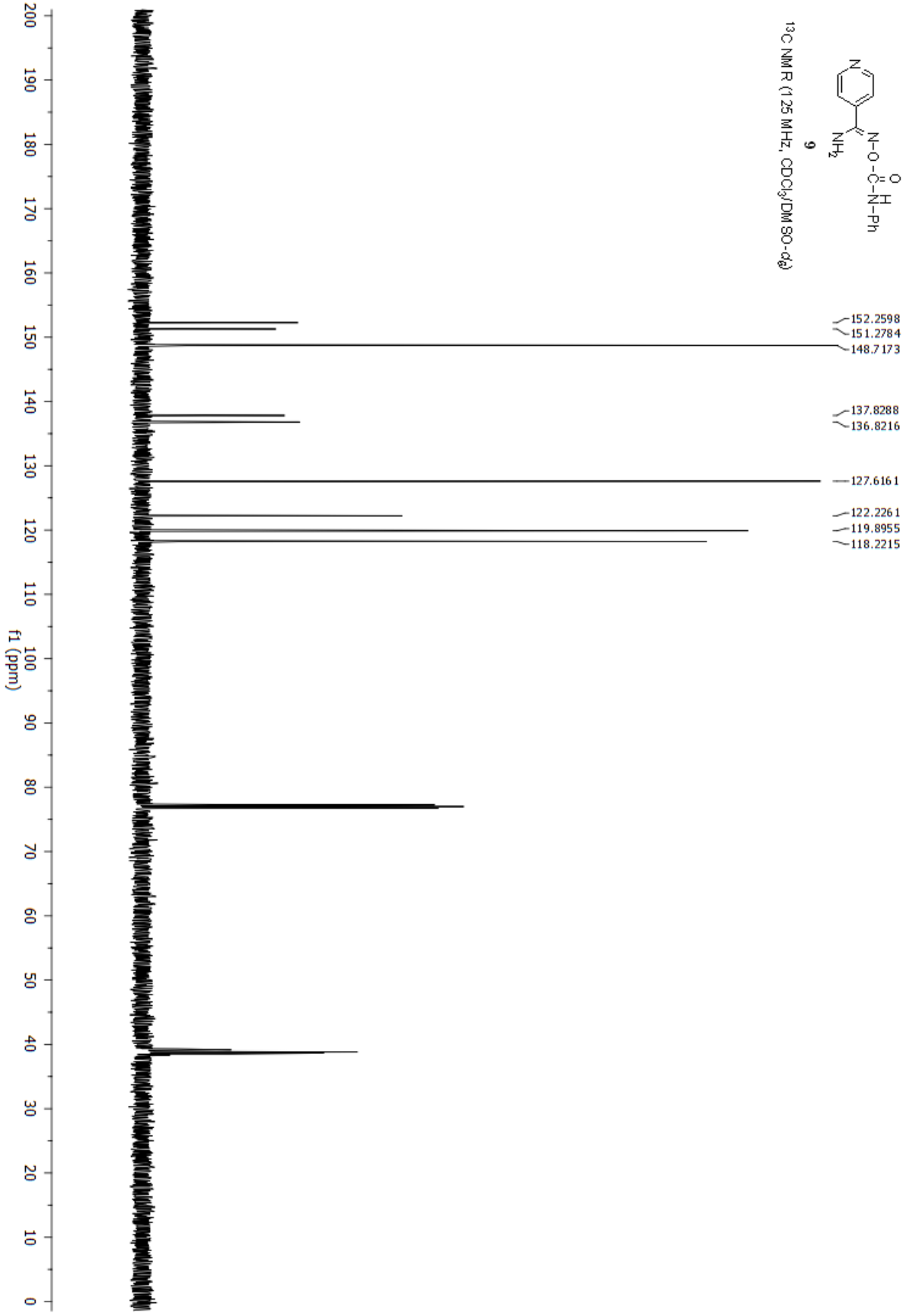
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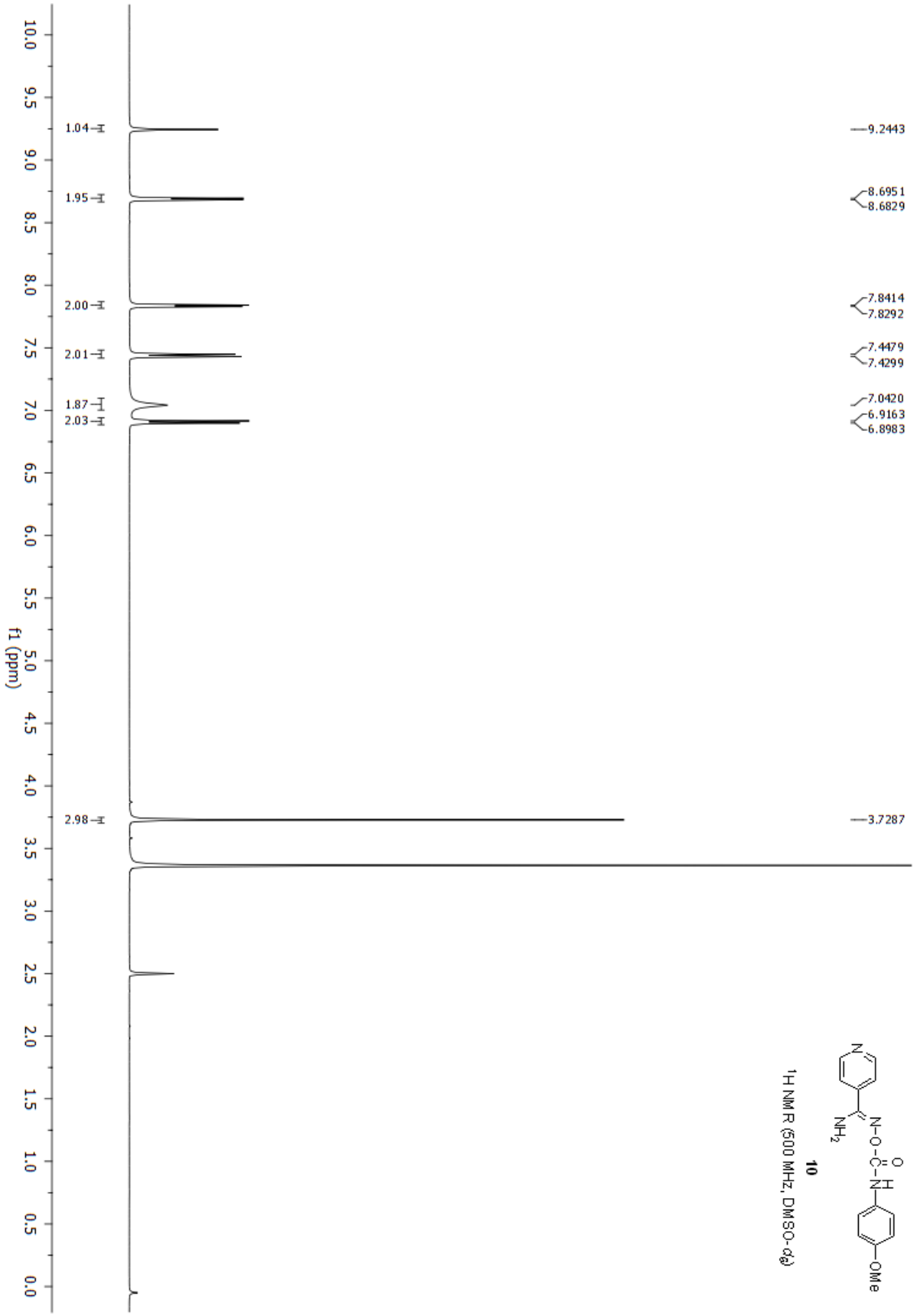
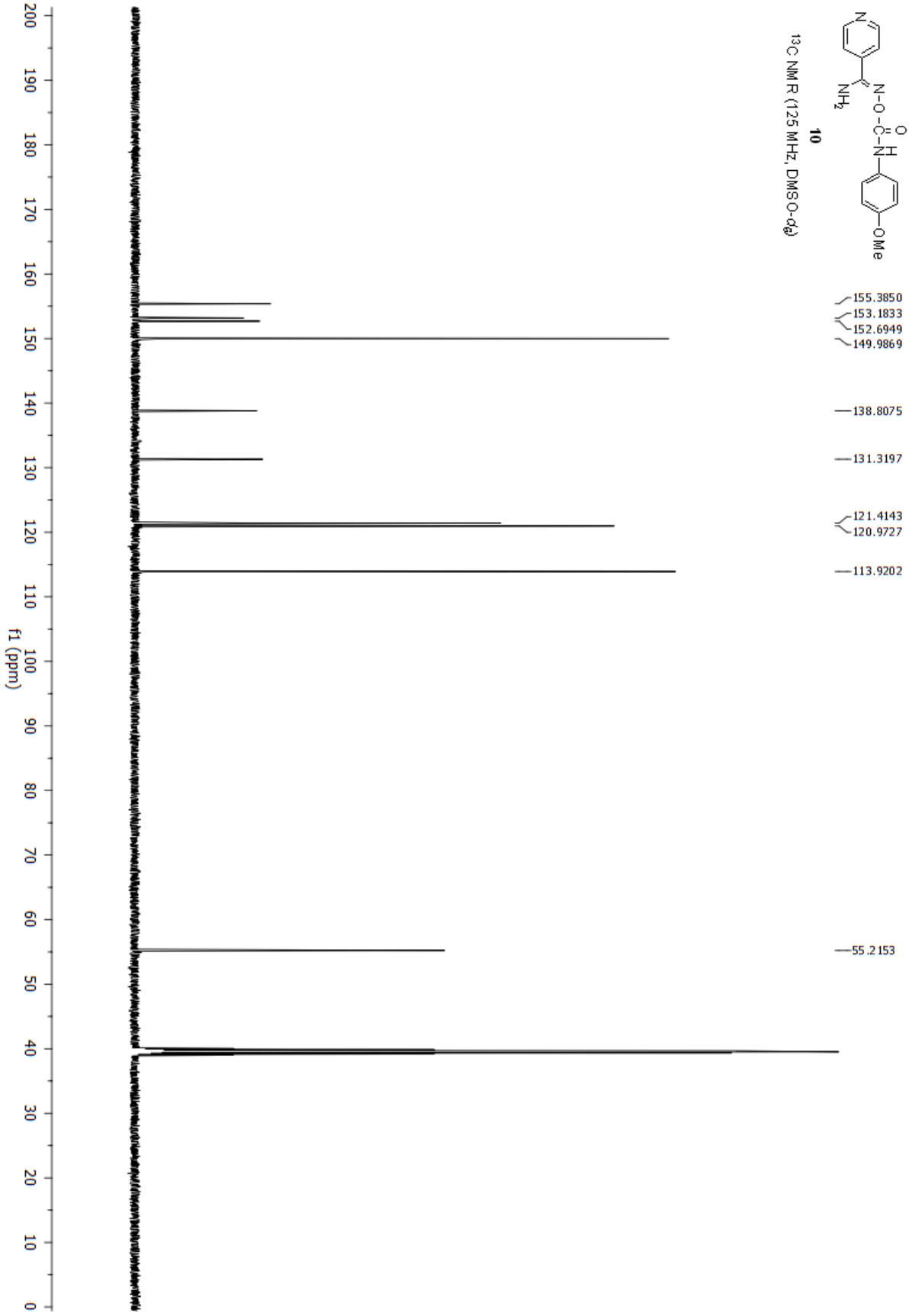
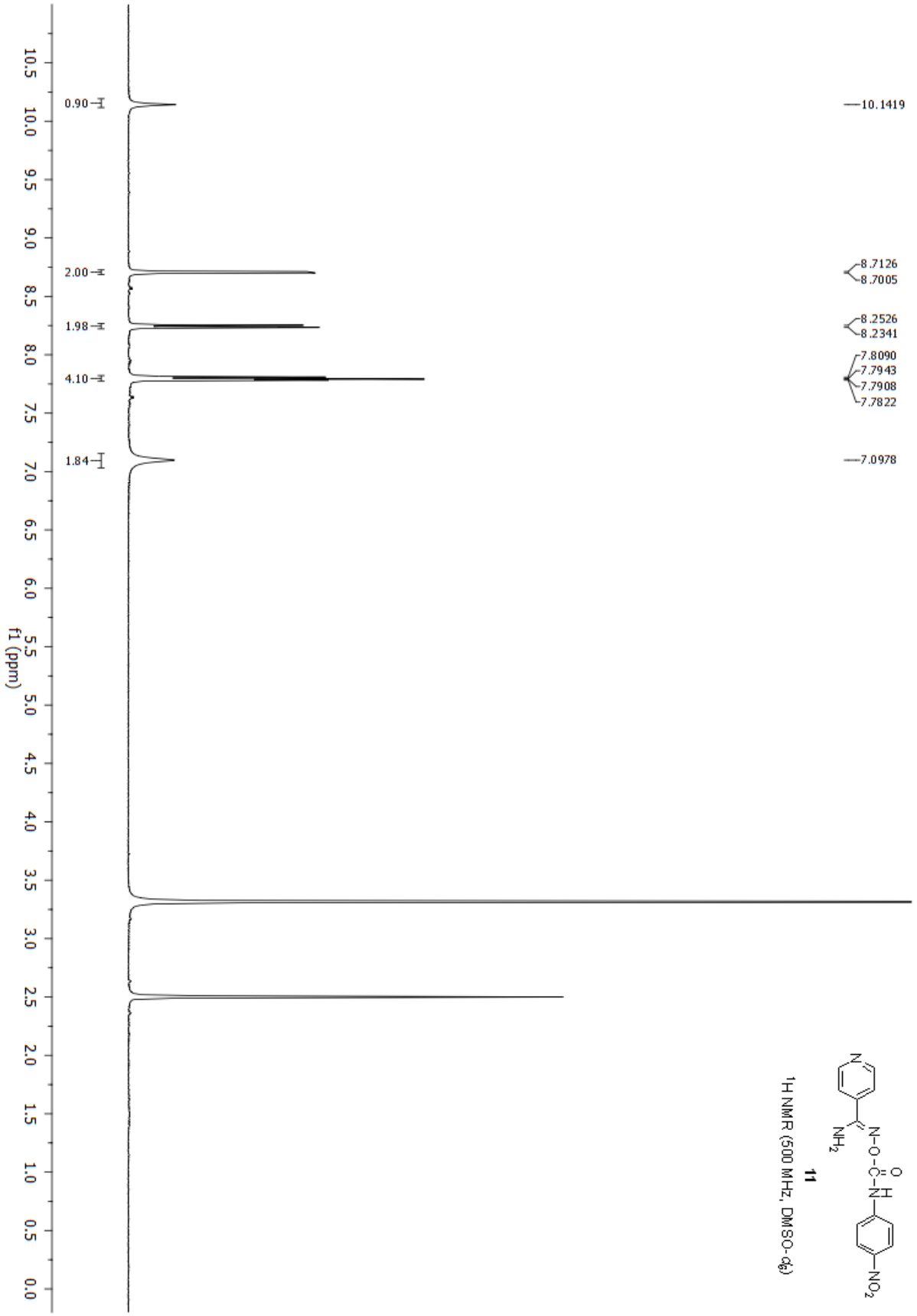
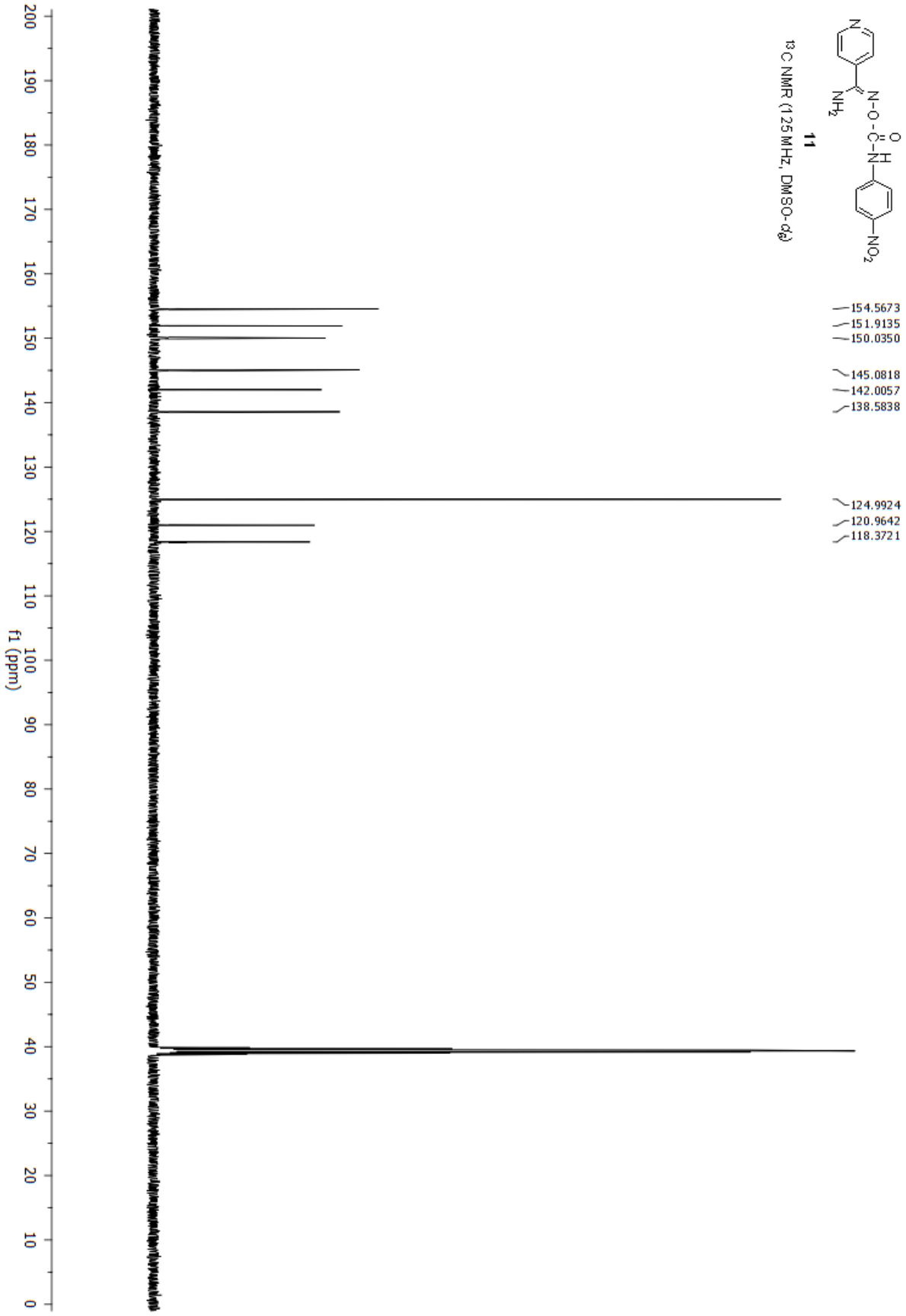


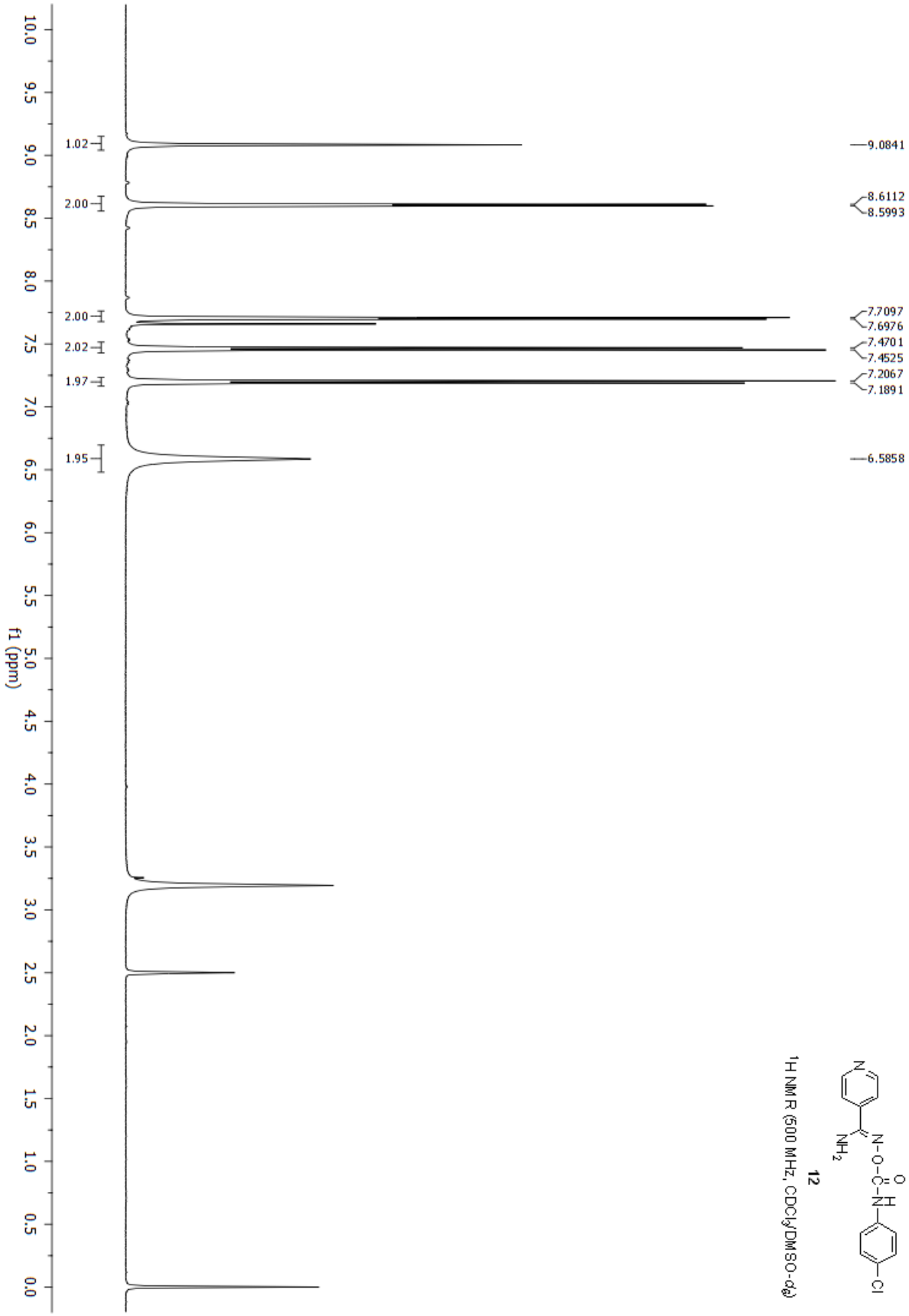
10

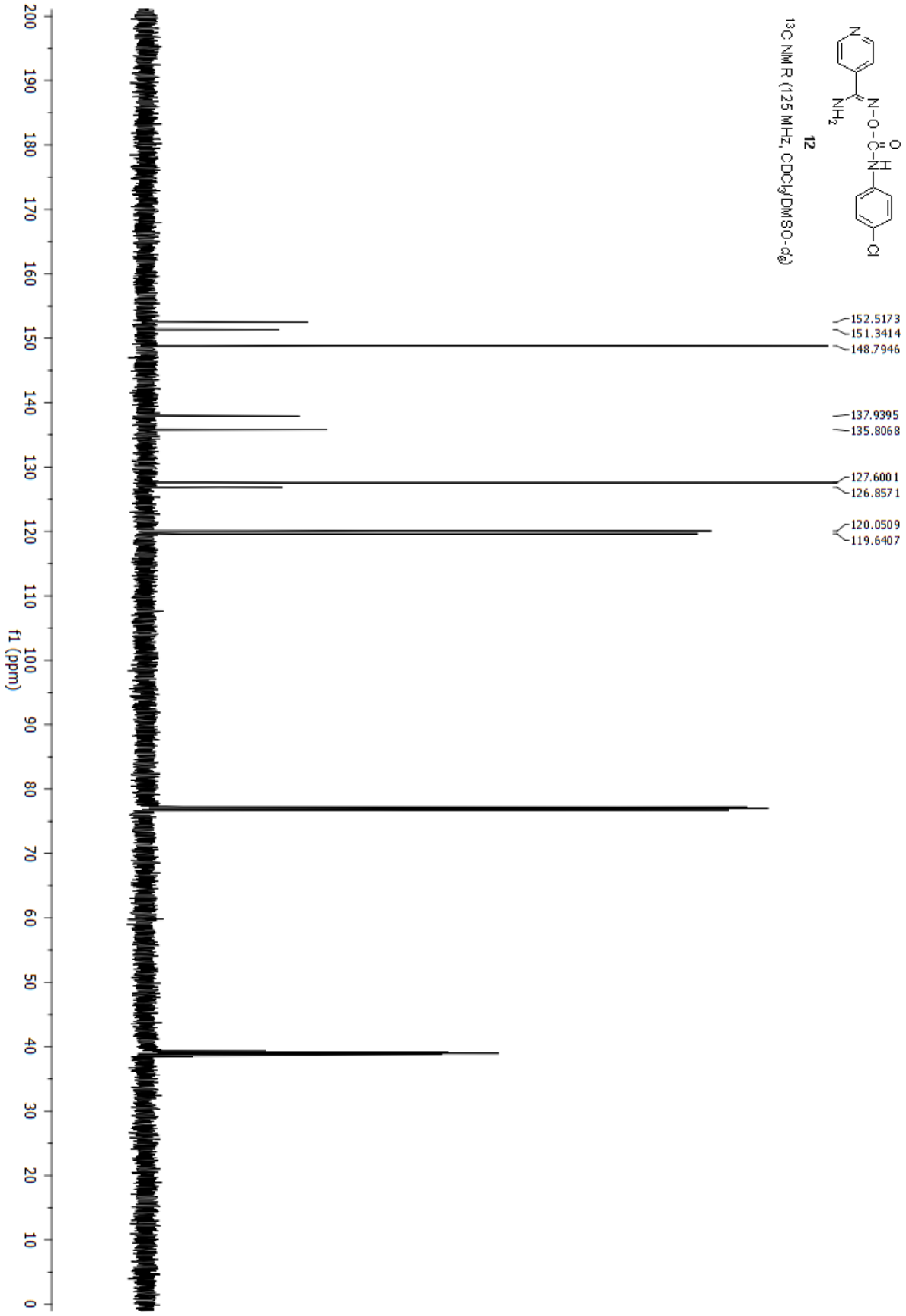
^{1}H NMR (500 MHz, DMSO-d_6)

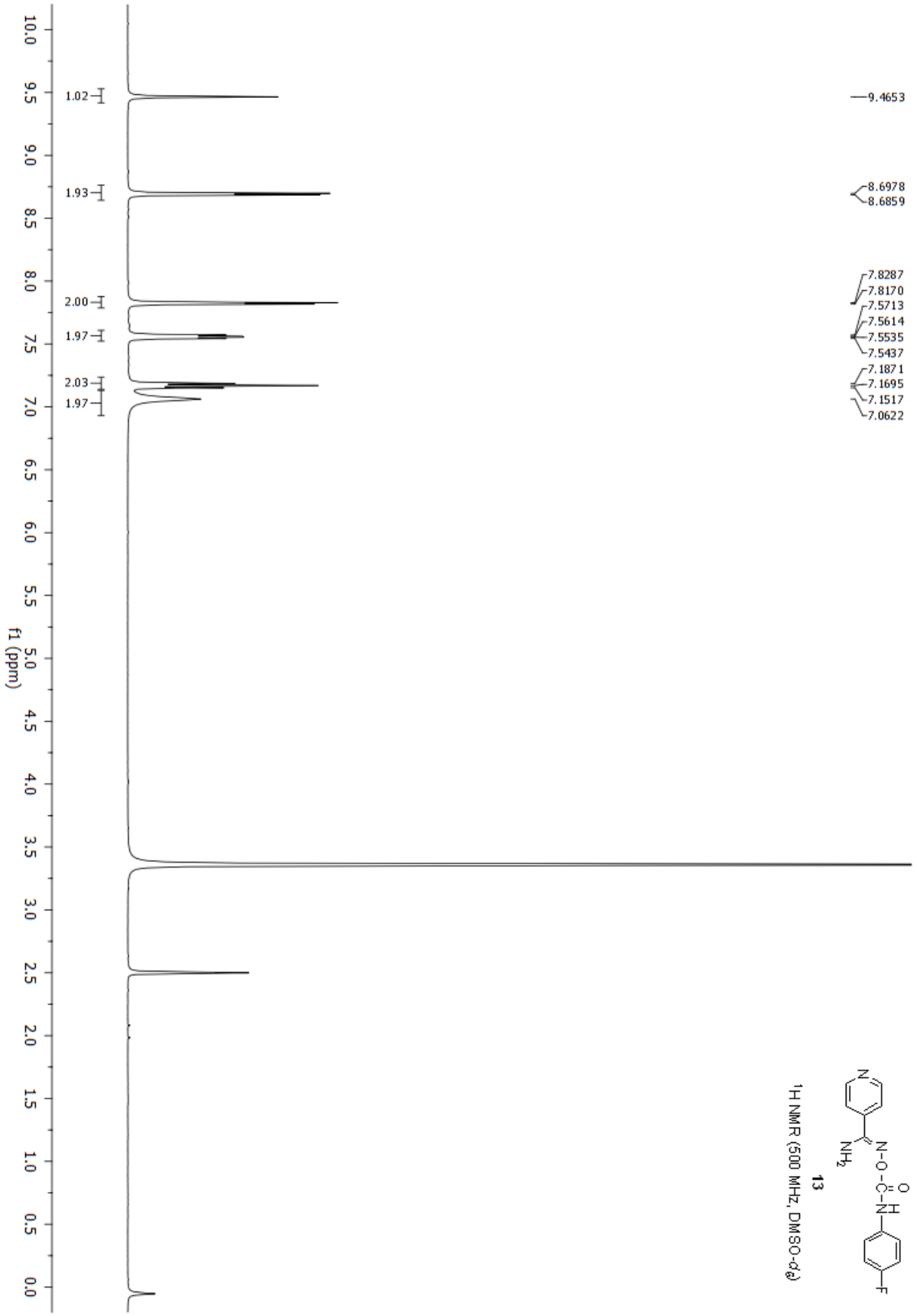

10
^{13}C NMR (125 MHz, DMSO-d_6)
155.3850
153.1833
152.6949
149.9869
138.8075
131.3197
121.4143
120.9727
113.9202
55.2153
f1 (ppm)

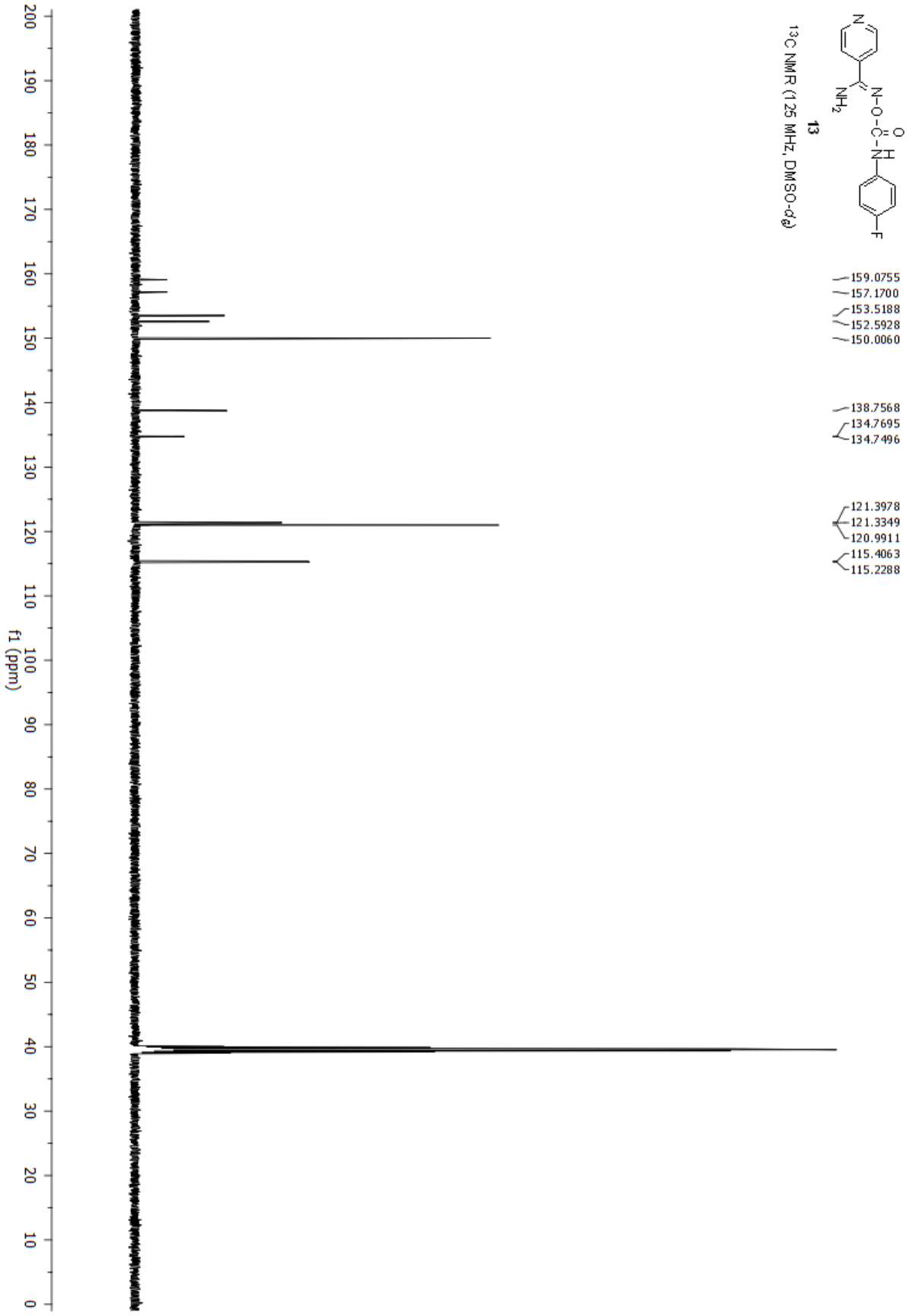

10.1419
8.7126
8.7005
8.2526
8.2341
7.8090
7.7943
7.7908
7.7822
7.0978
0.90
2.00
1.98
4.10
1.84
f1 (ppm)
11
1H NMR (500 MHz, DMSO-d6)

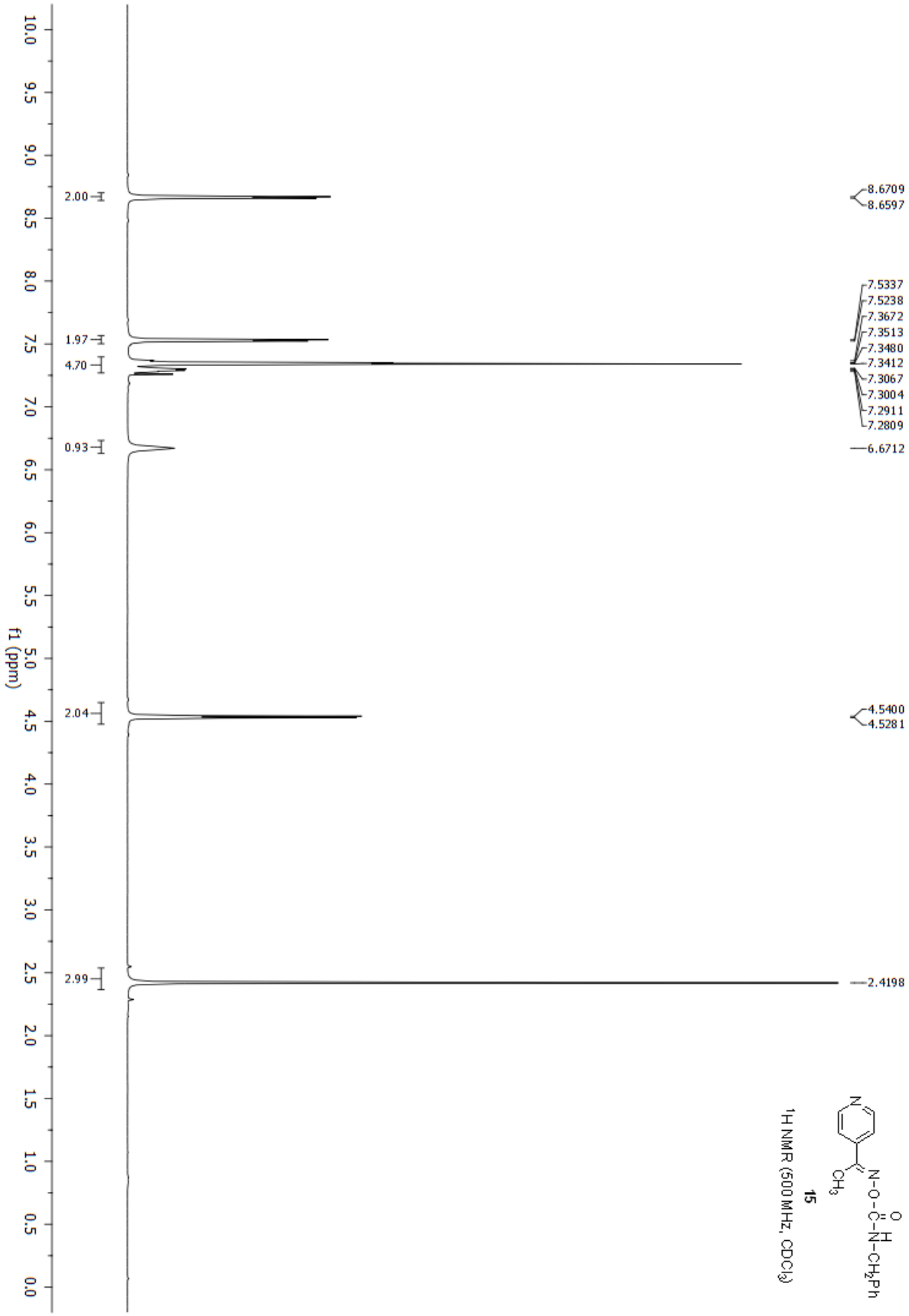

154.5673
151.9135
150.0350
145.0818
142.0057
138.5838
124.9924
120.9642
118.3721
11
13C NMR (125 MHz, DMSO-d6)
f1 (ppm)

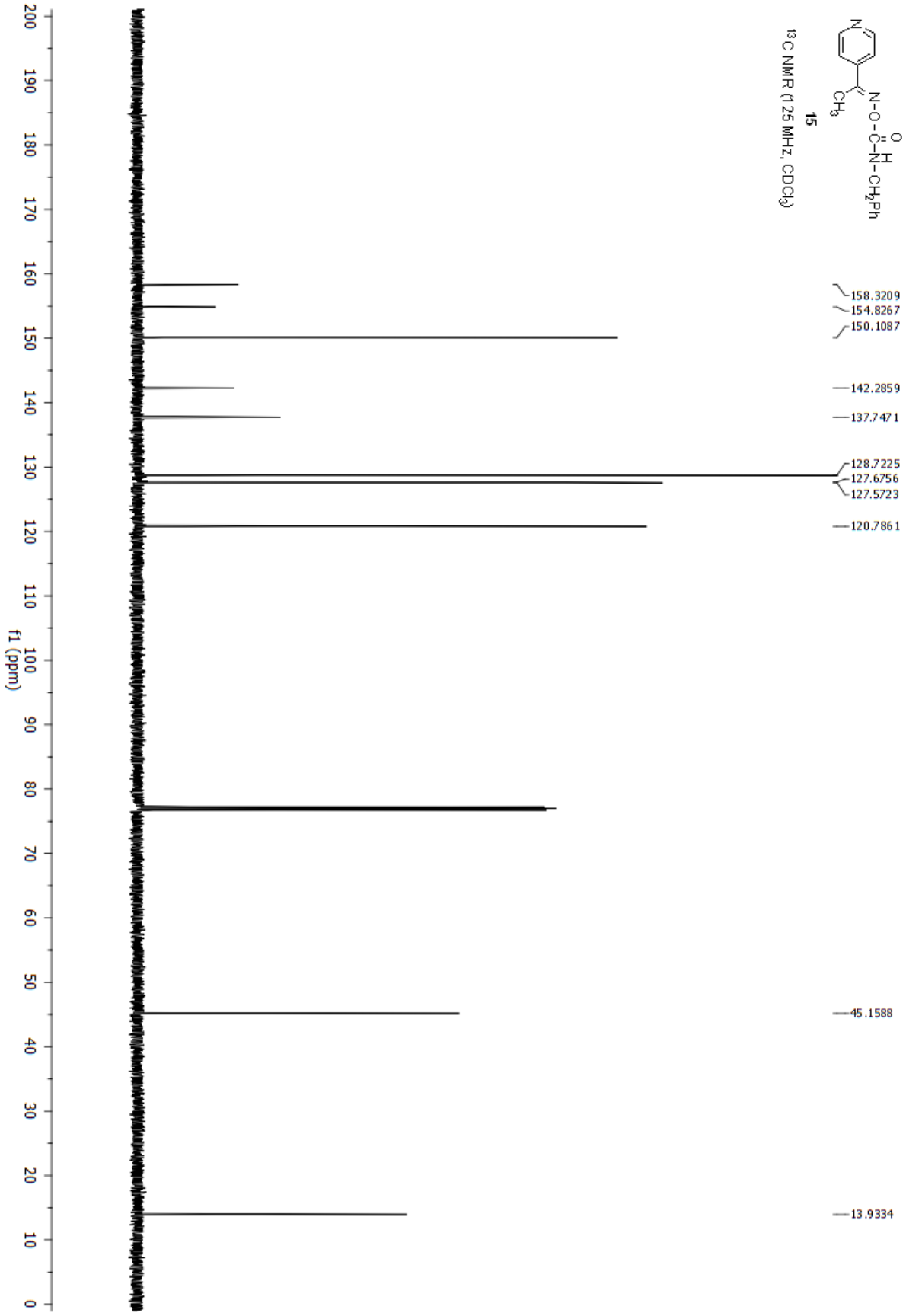

9.0841
8.6112
8.5993
7.7097
7.6976
7.4701
7.4525
7.2067
7.1891
6.5858
1.02
2.00
2.00
2.02
1.97
1.95
f1 (ppm)
12
^{1}H NMR (500 MHz, CDCl$_3$/DMSO-d_6)

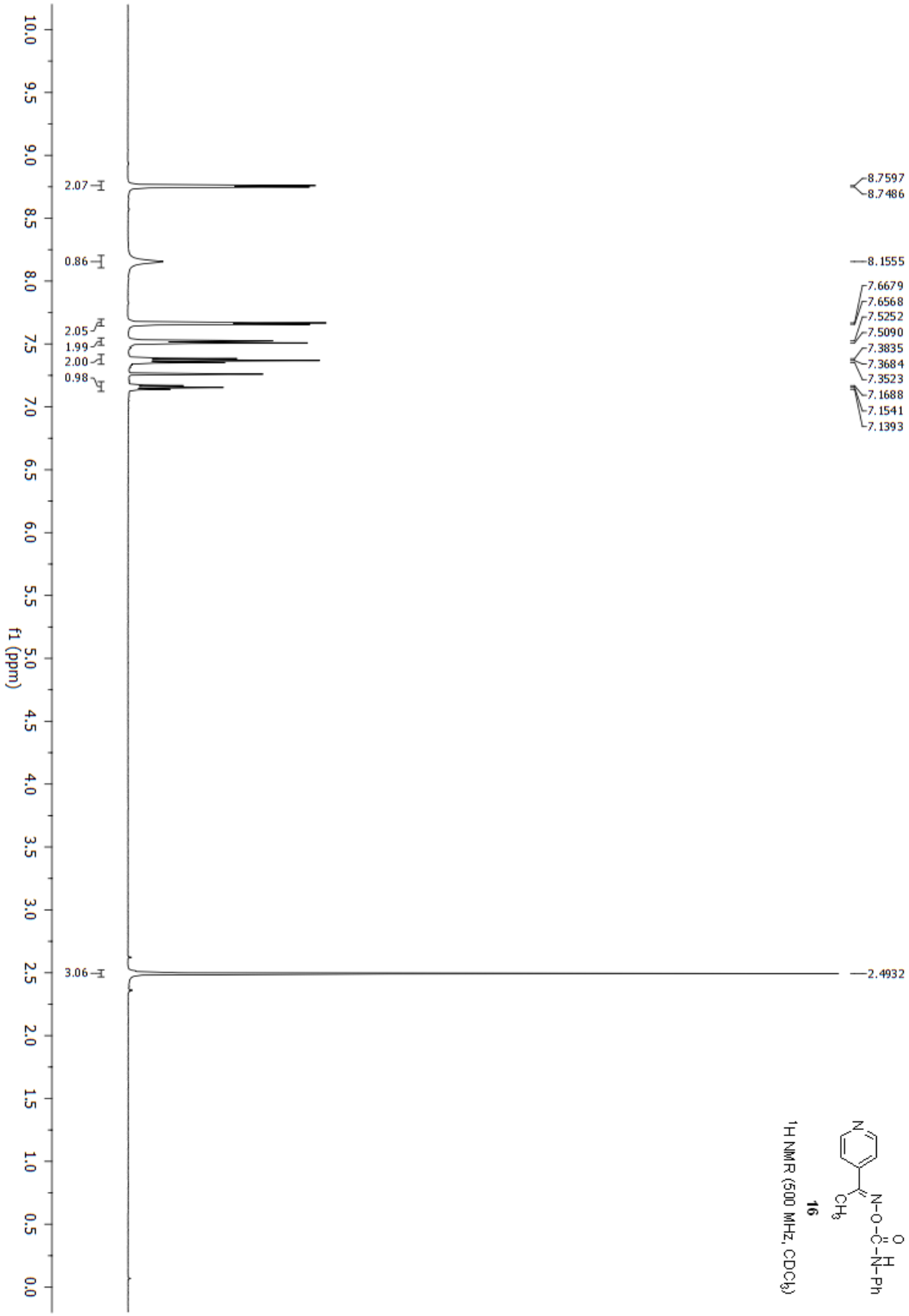

^{13}C NMR (125 MHz, CDCl$_3$/DMSO-d_6)
12
152.5173
151.3414
148.7946
137.9395
135.8068
127.6001
126.8571
120.0509
119.6407
f1 (ppm)

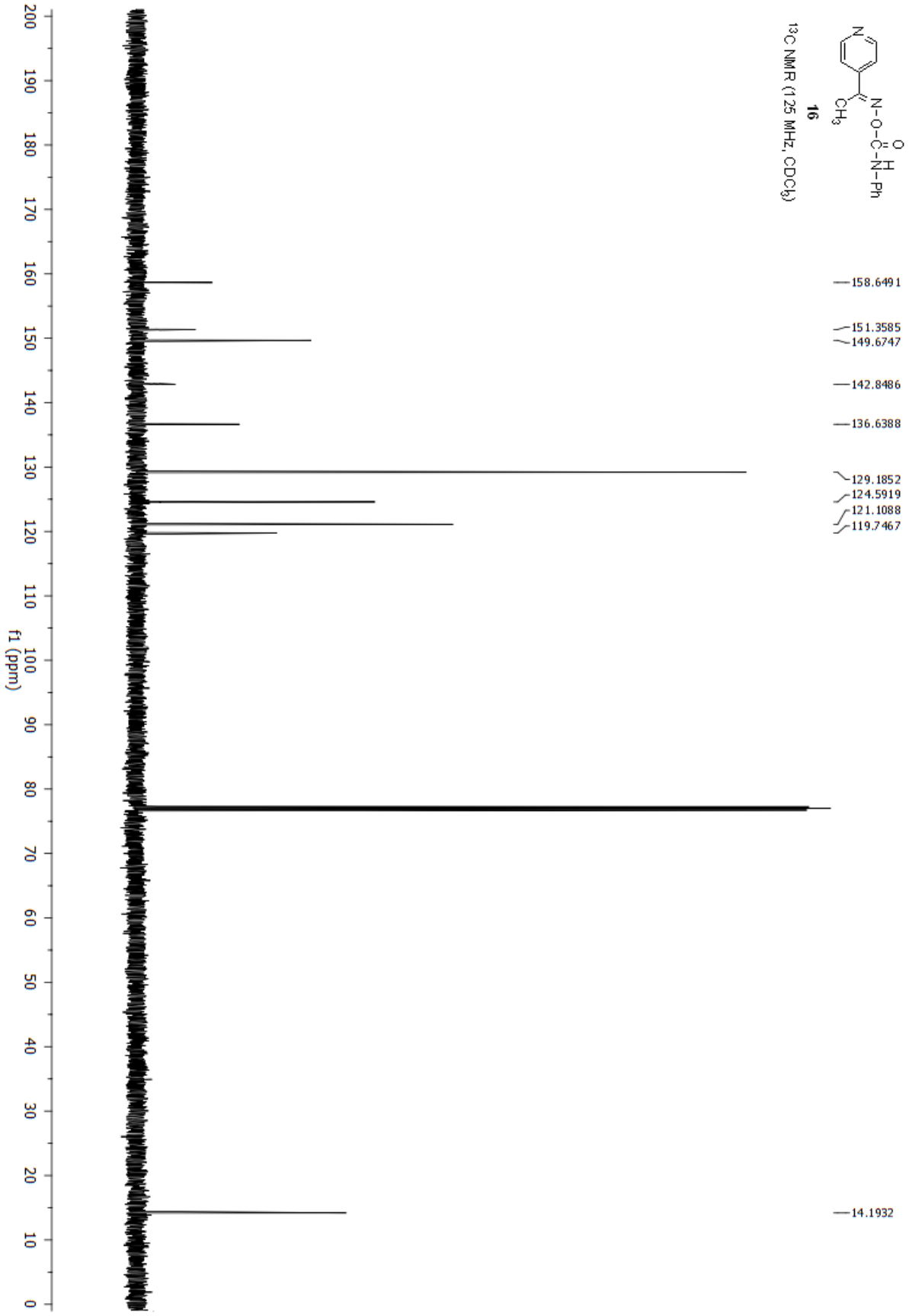

9.4653
8.6978
8.6859
7.8287
7.8170
7.5713
7.5614
7.5535
7.5437
7.1871
7.1695
7.1517
7.0622
1.02
1.93
2.00
1.97
2.03
1.97
f1 (ppm)
13
1H NMR (500 MHz, DMSO-d6)

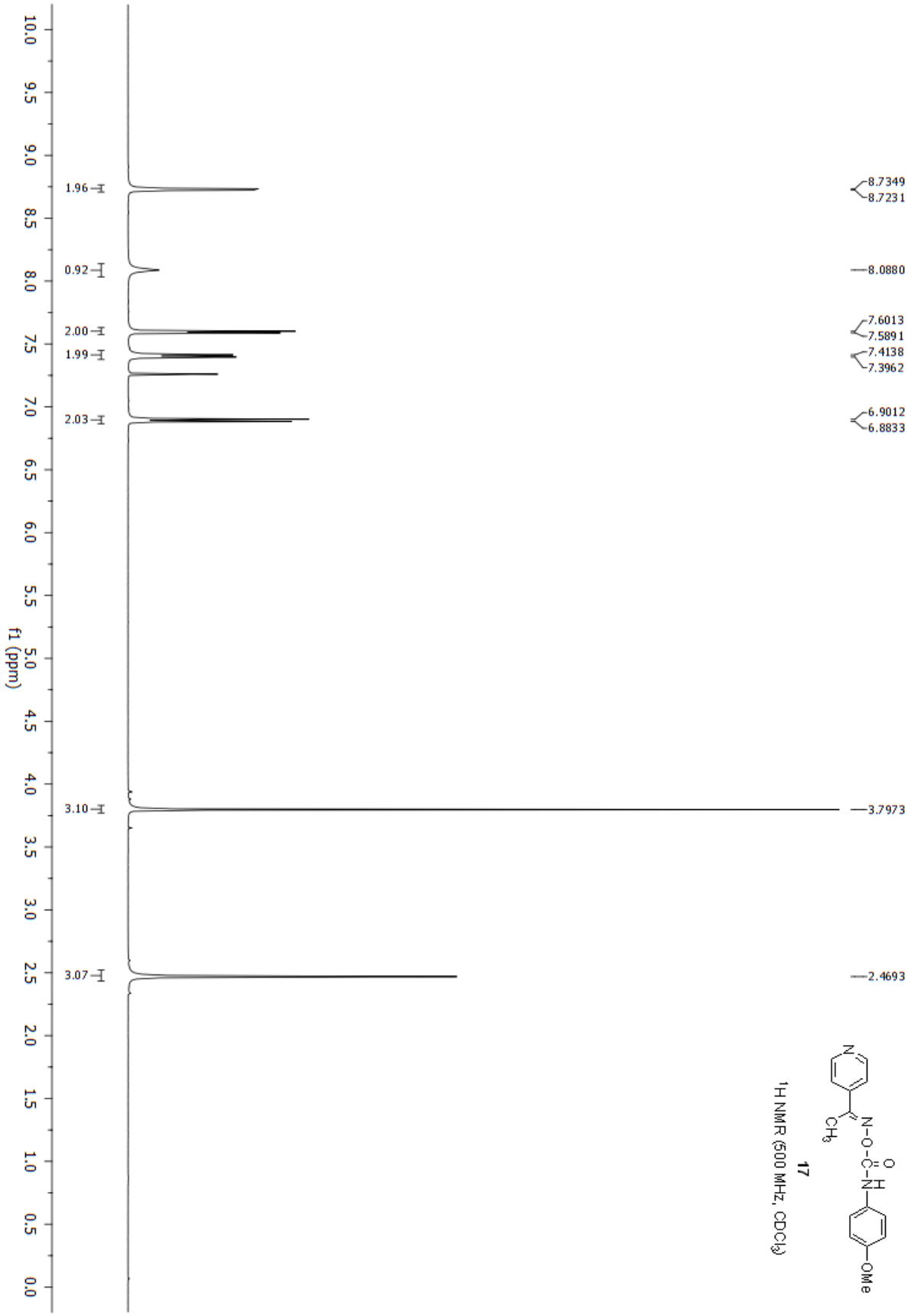

13
^{13}C NMR (125 MHz, DMSO-d_6)
159.0755
157.1700
153.5188
152.5928
150.0060
138.7568
134.7695
134.7496
121.3978
121.3349
120.9911
115.4063
115.2288
f1 (ppm)


8.6709
8.6597
7.5337
7.5238
7.3672
7.3513
7.3480
7.3412
7.3067
7.3004
7.2911
7.2809
6.6712
4.5400
4.5281
2.4198
2.00
1.97
4.70
0.93
2.04
2.99
f1 (ppm)
15
1H NMR (500 MHz, CDCl3)


15
^{13}C NMR (125 MHz, CDCl$_3$)
158.3209
154.8267
150.1087
142.2859
137.7471
128.7225
127.6756
127.5723
120.7861
45.1588
13.9334
f1 (ppm)

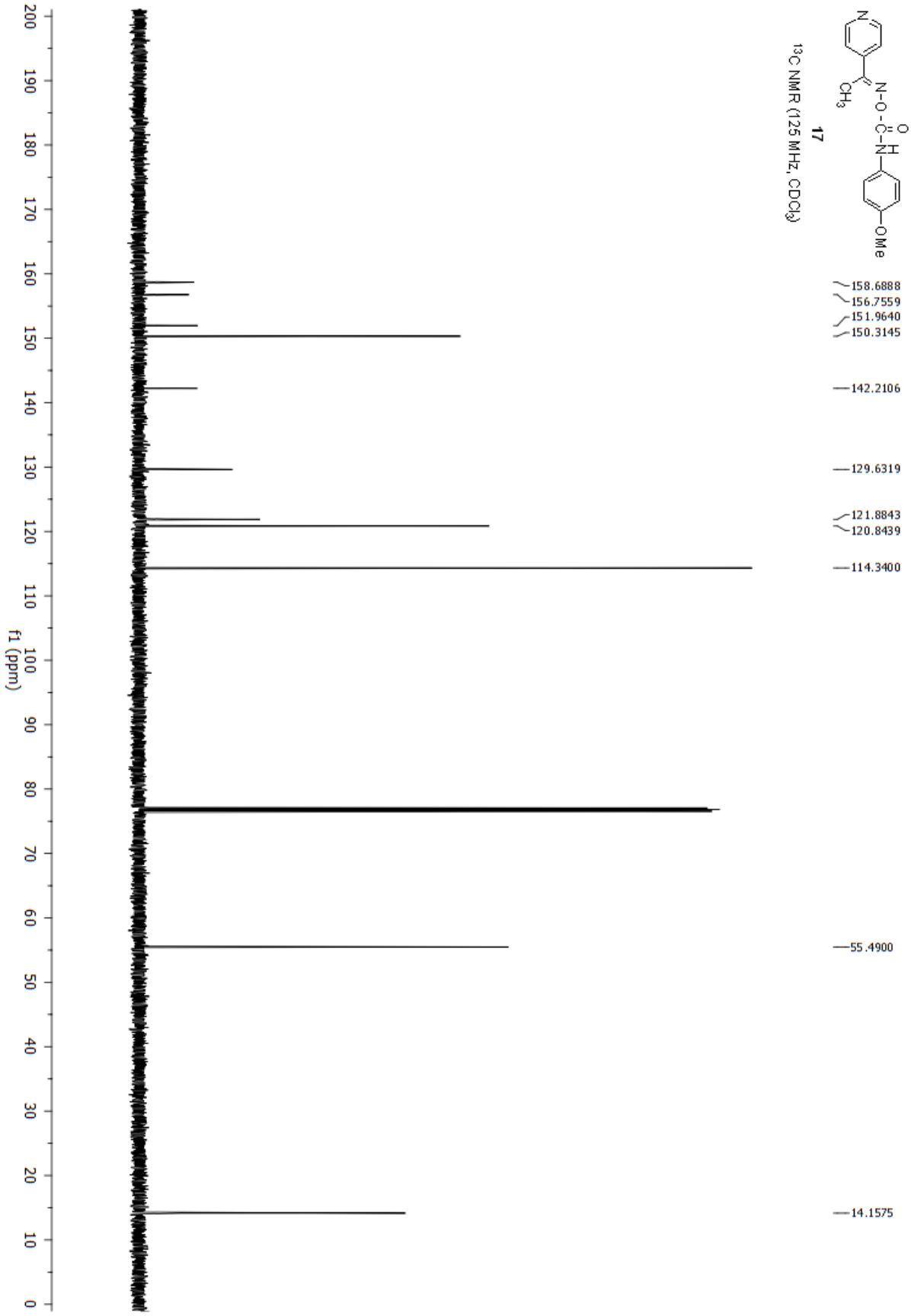

8.7597
8.7486
8.1555
7.6679
7.6568
7.5252
7.5090
7.3835
7.3684
7.3523
7.1688
7.1541
7.1393
2.4932
2.07
0.86
2.05
1.99
2.00
0.98
3.06
f1 (ppm)
16
^{1}H NMR (500 MHz, CDCl$_3$)

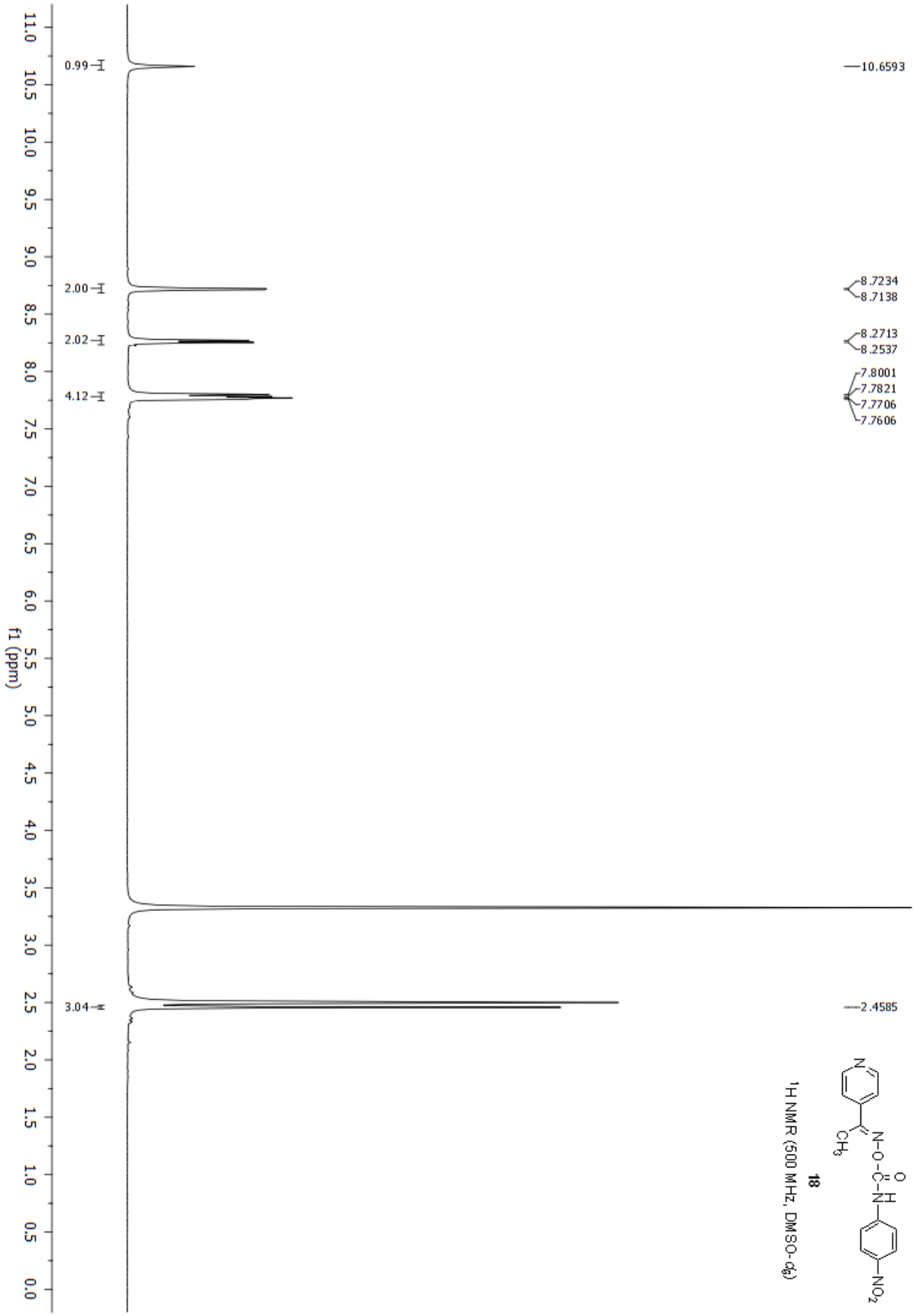

16
13C NMR (125 MHz, CDCl3)
158.6491
151.3585
149.6747
142.8486
136.6388
129.1852
124.5919
121.1088
119.7467
14.1932
f1 (ppm)

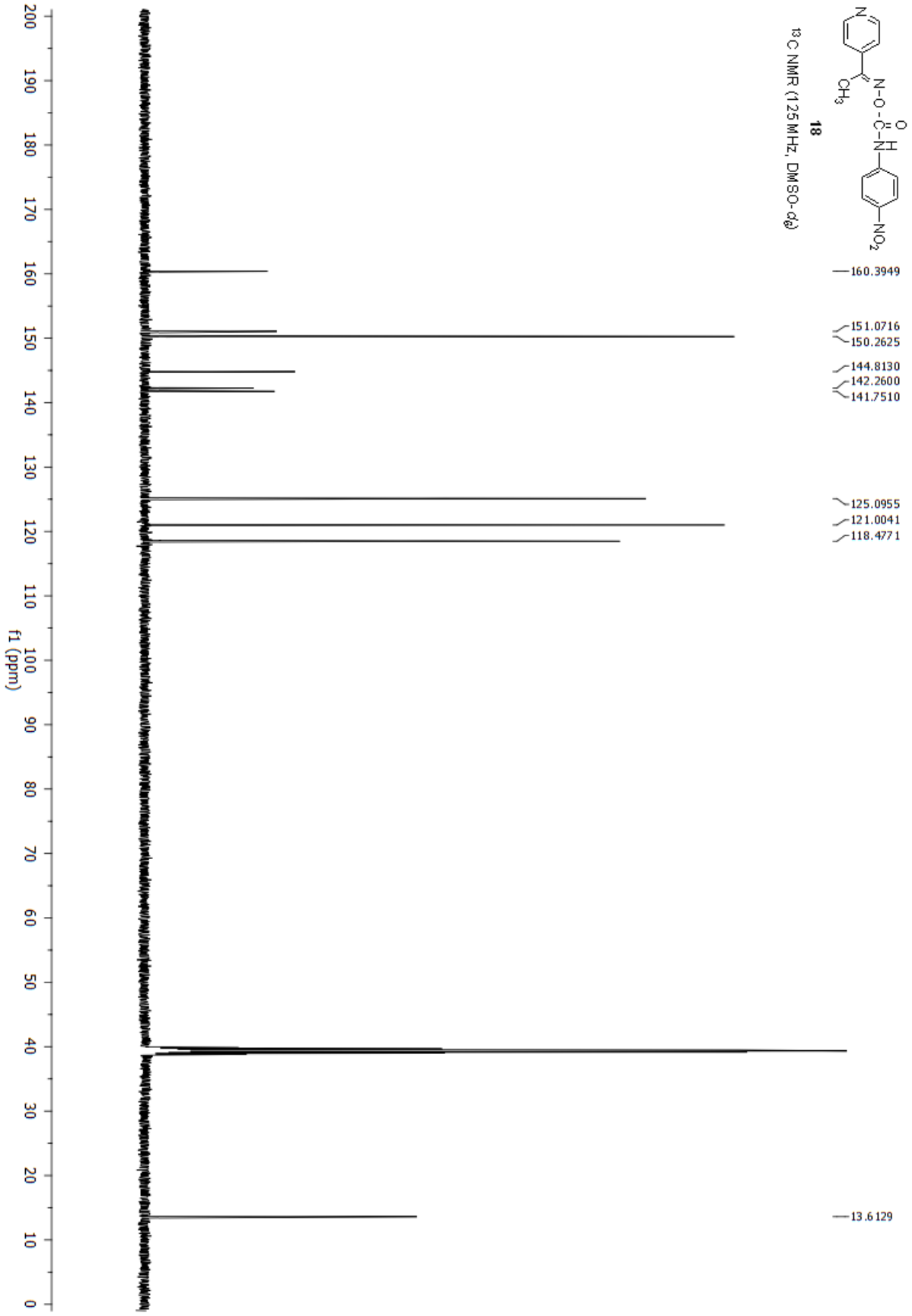


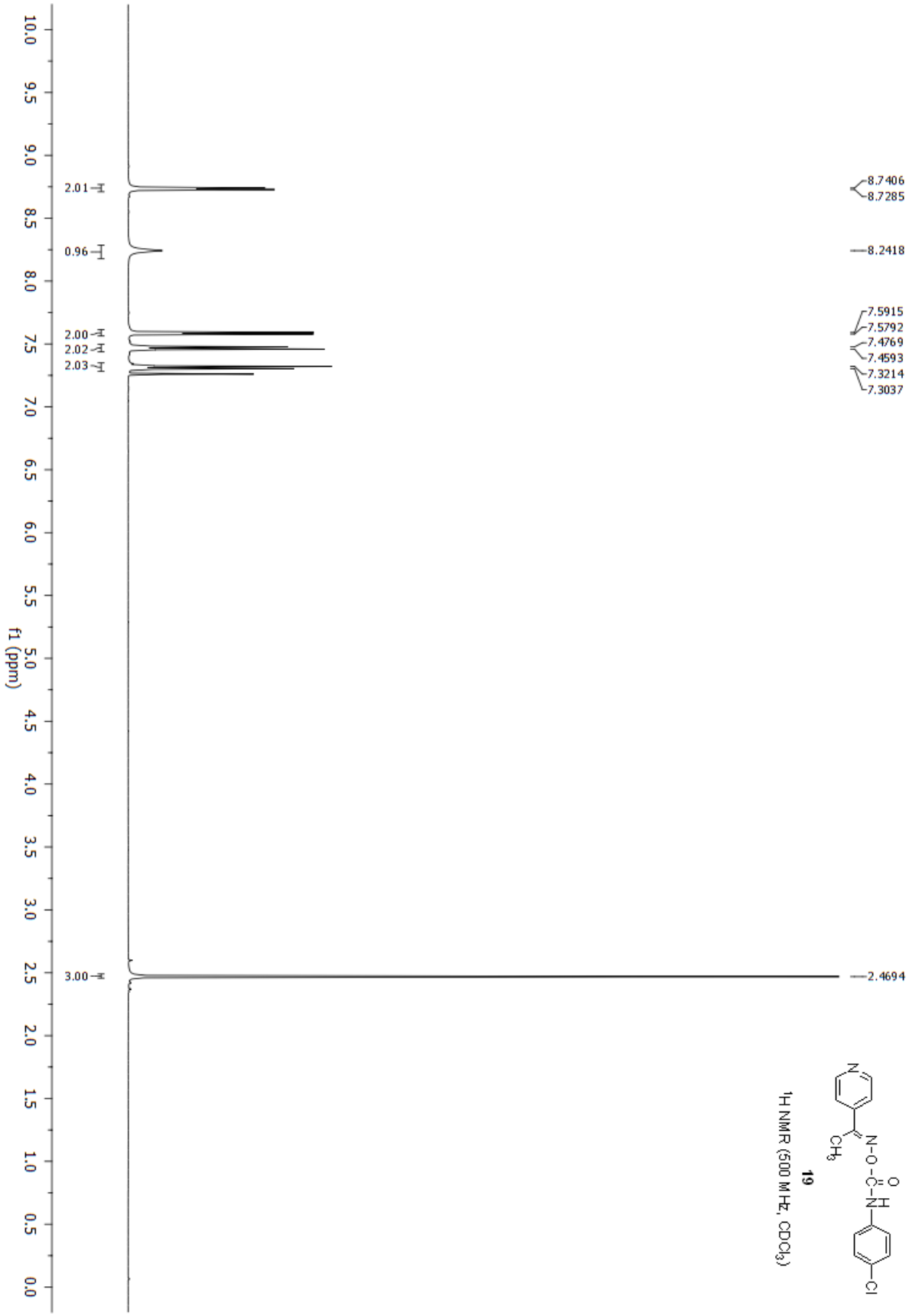
17

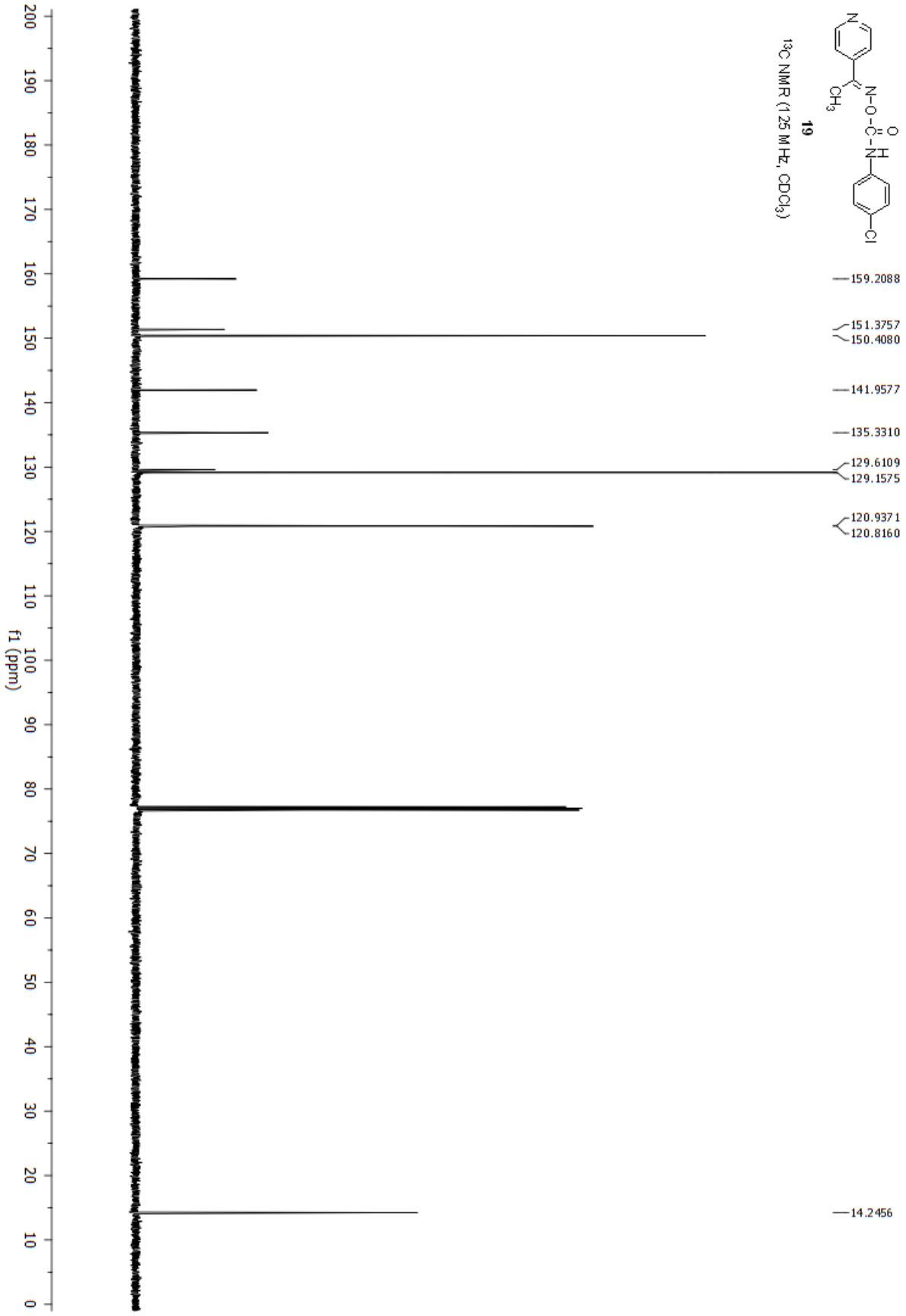
^{1}H NMR (500 MHz, $CDCl_3$)

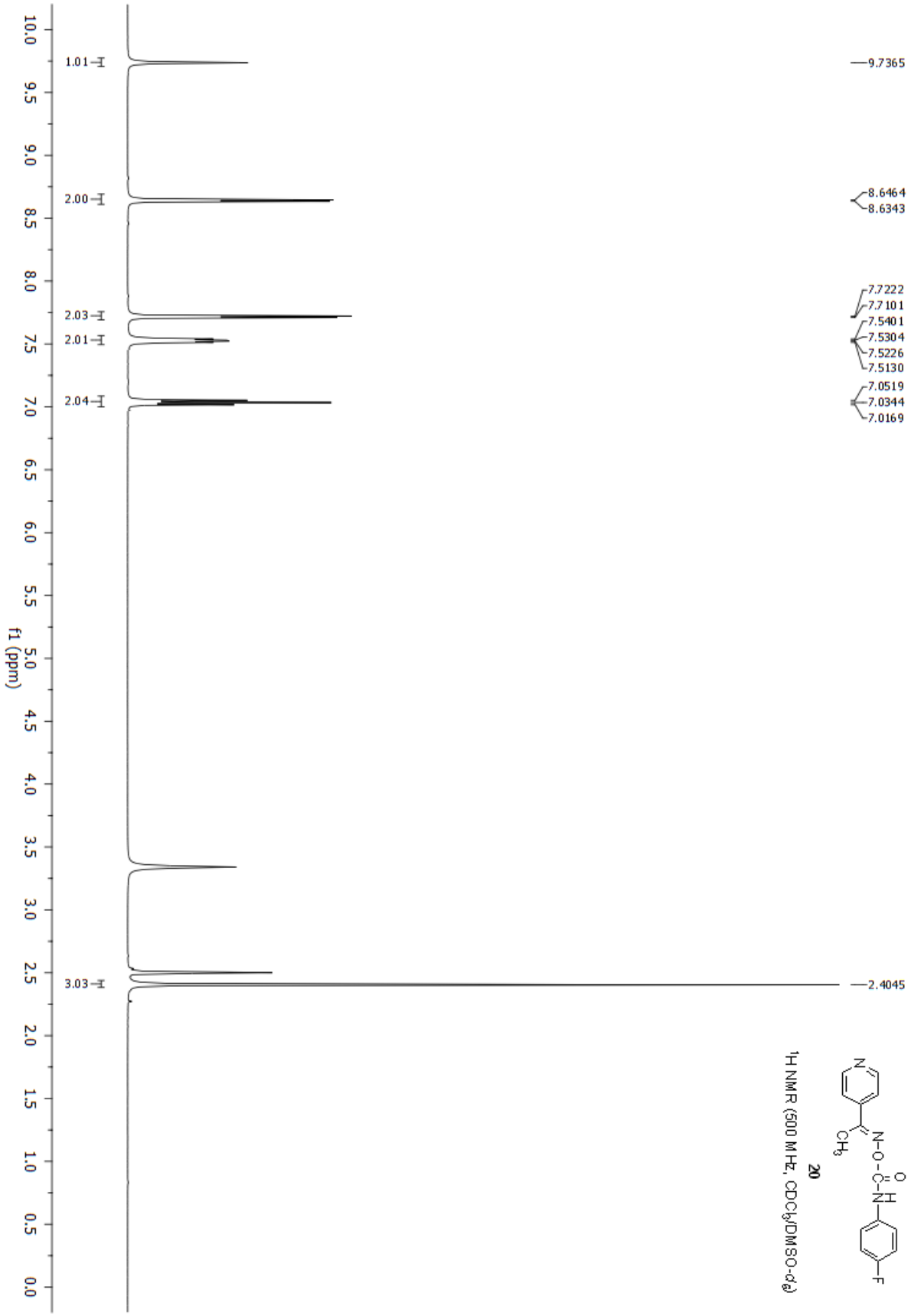

17
^{13}C NMR (125 MHz, CDCl$_3$)
158.6888
156.7559
151.9640
150.3145
142.2106
129.6319
121.8843
120.8439
114.3400
55.4900
14.1575
f1 (ppm)


0.99
2.00
2.02
4.12
3.04
10.6593
8.7234
8.7138
8.2713
8.2537
7.8001
7.7821
7.7706
7.7606
2.4585
f1 (ppm)
18
1H NMR (500 MHz, DMSO-d6)


18
13C NMR (125 MHz, DMSO-d6)
160.3949
151.0716
150.2625
144.8130
142.2600
141.7510
125.0955
121.0041
118.4771
13.6129
f1 (ppm)

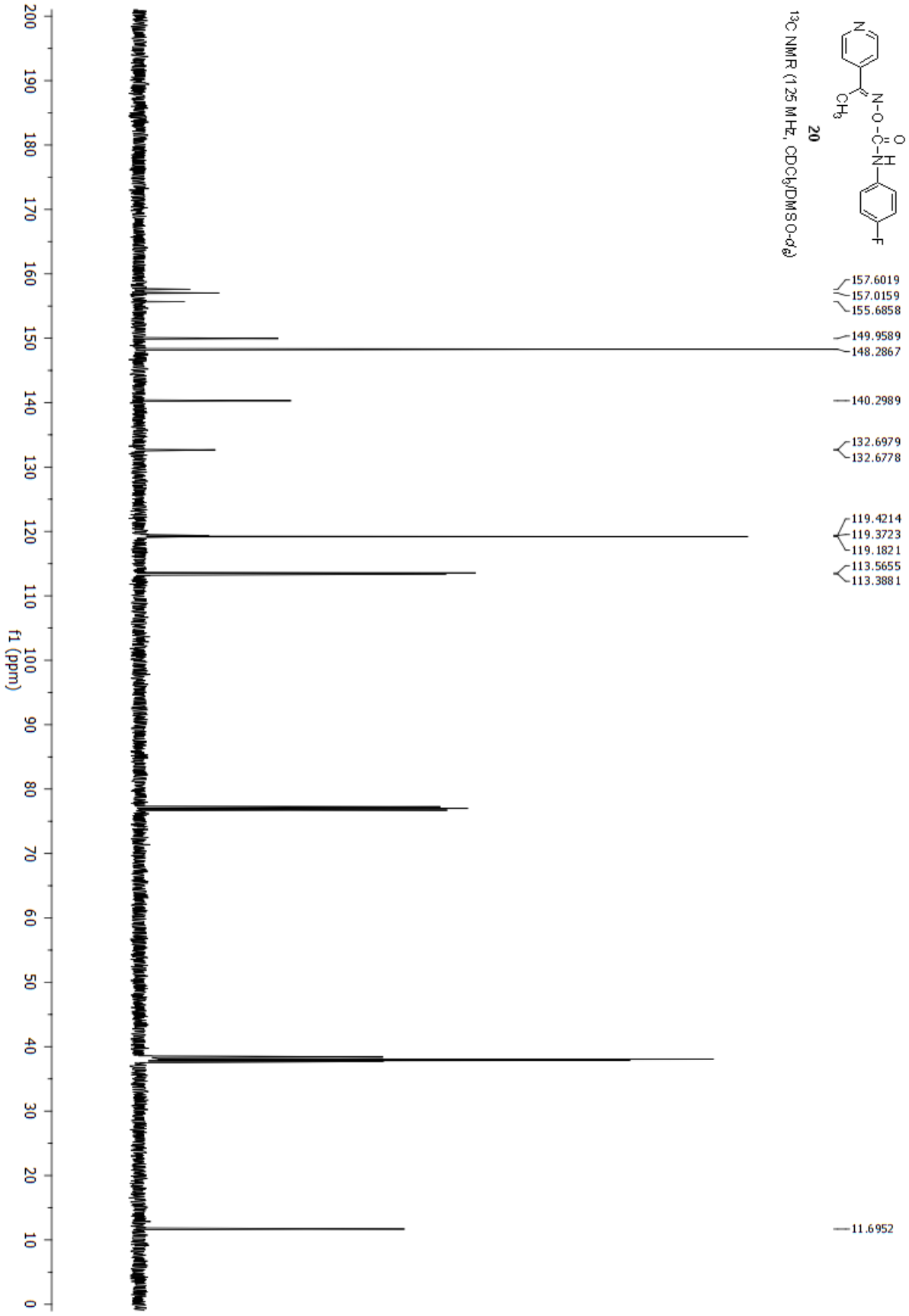

8.7406
8.7285
8.2418
7.5915
7.5792
7.4769
7.4593
7.3214
7.3037
2.4694
2.01
0.96
2.00
2.02
2.03
3.00
f1 (ppm)
19
^{1}H NMR (500 MHz, $CDCl_3$)

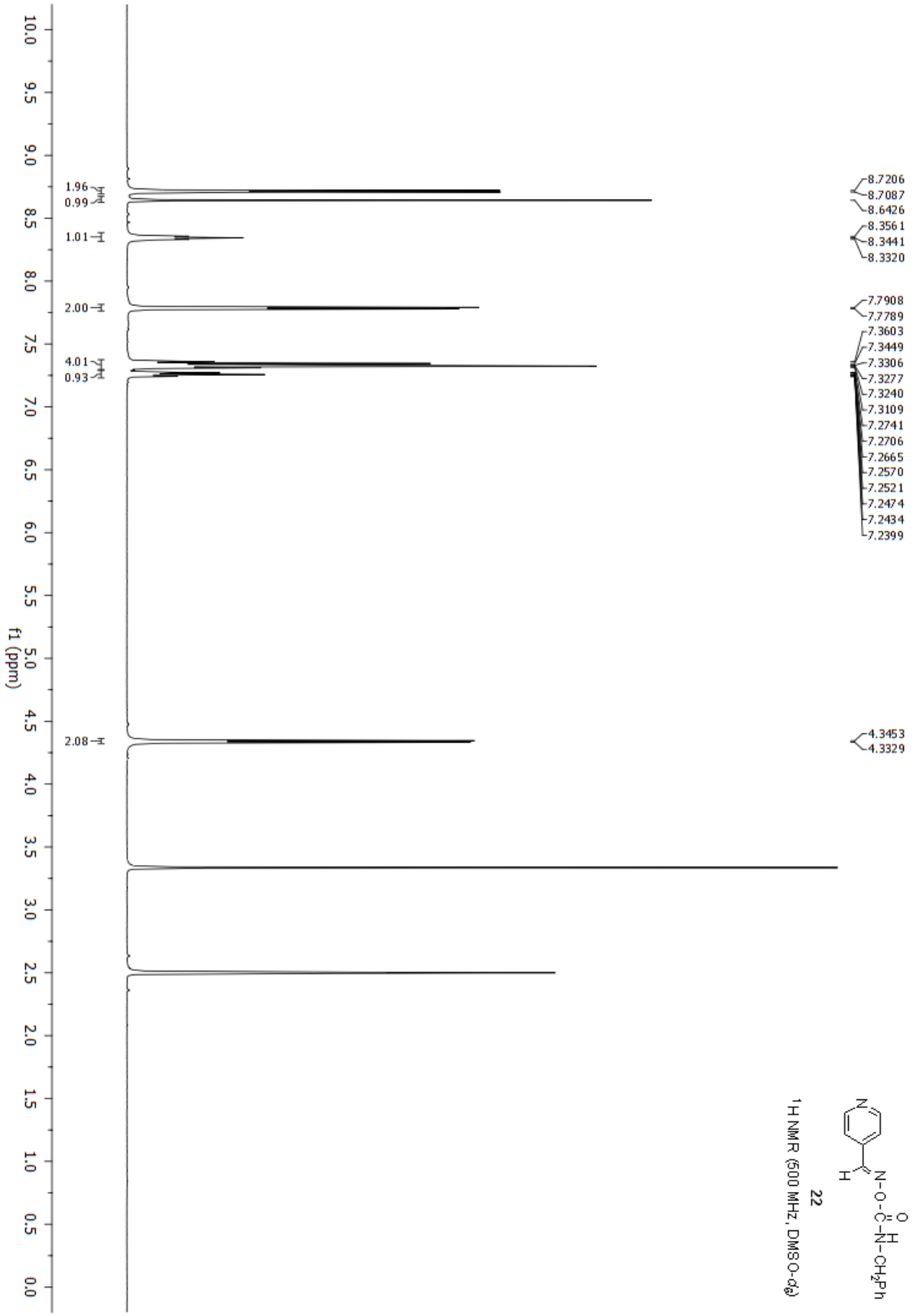

19
^{13}C NMR (125 MHz, $CDCl_3$)
159.2088
151.3757
150.4080
141.9577
135.3310
129.6109
129.1575
120.9371
120.8160
14.2456
f1 (ppm)

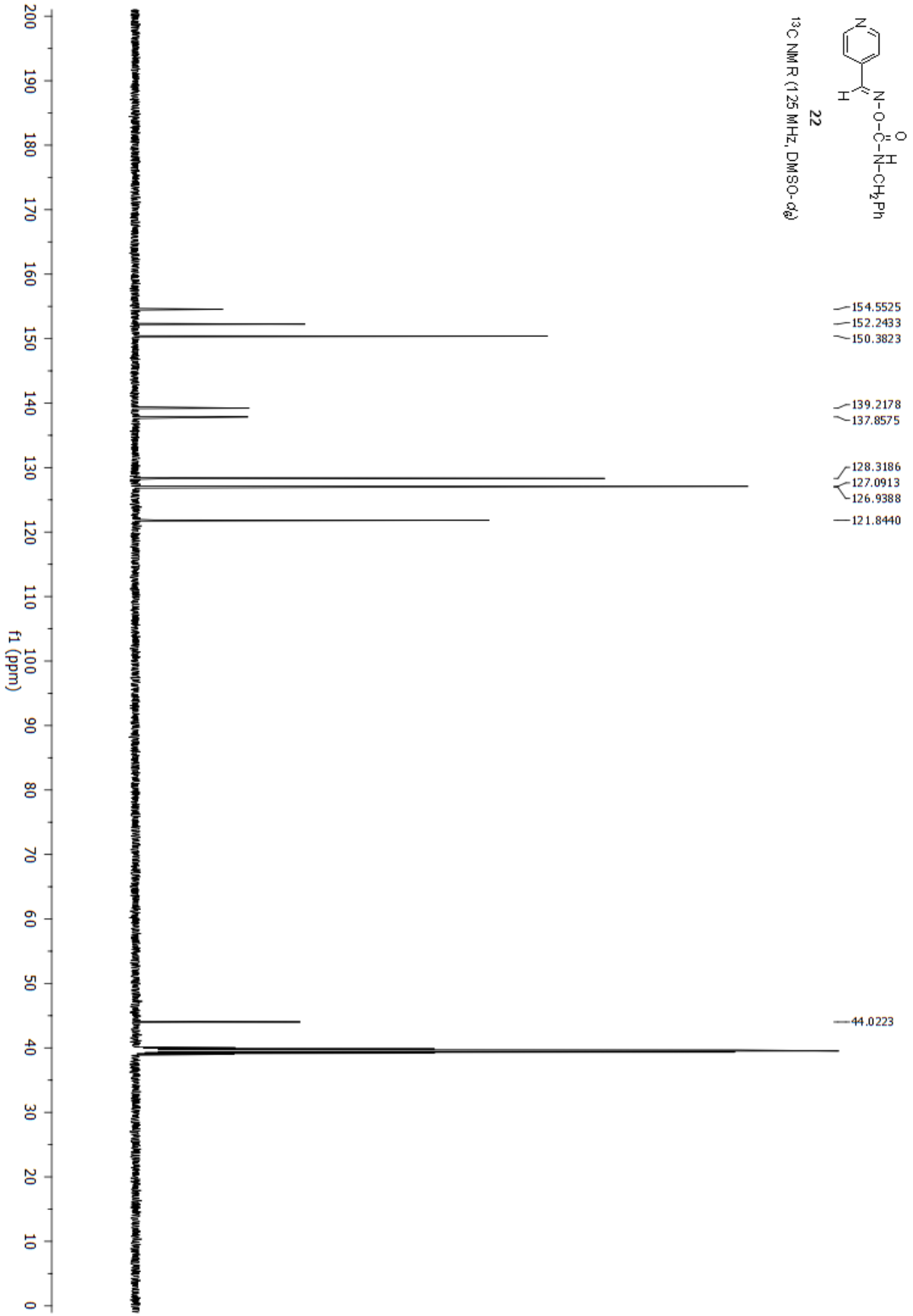


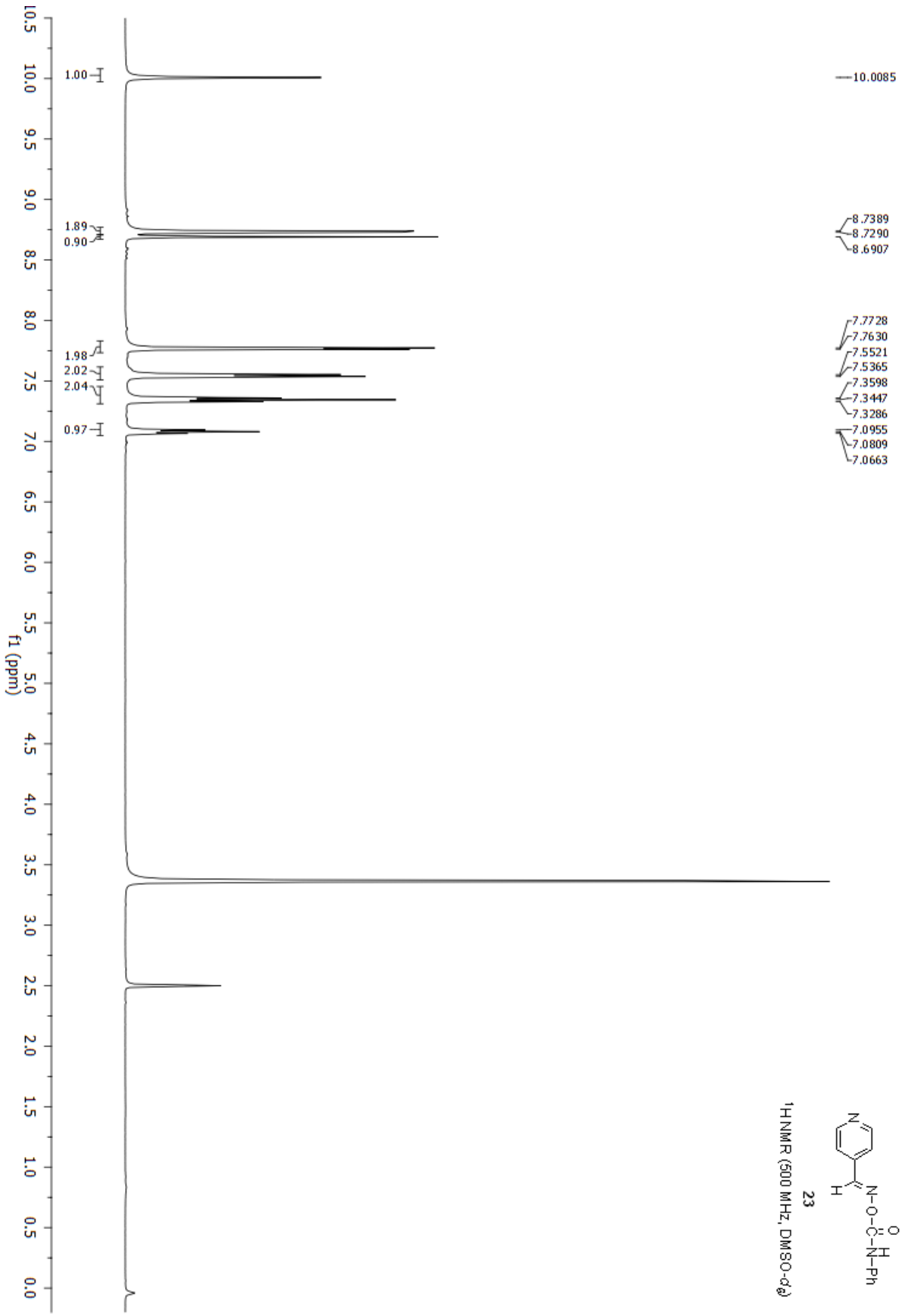
20

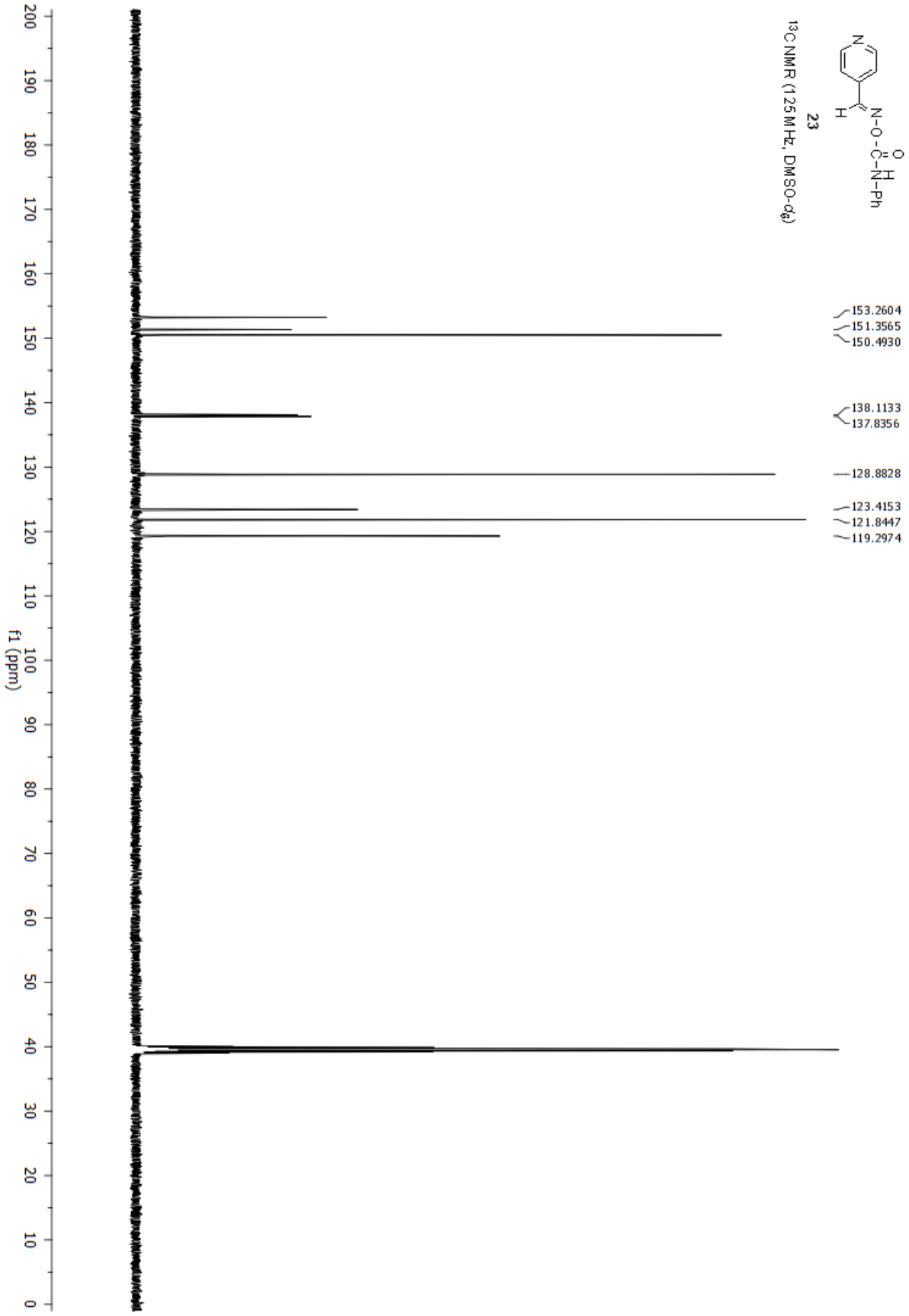
^{1}H NMR (500 MHz, CDCl$_3$/DMSO-d_6)

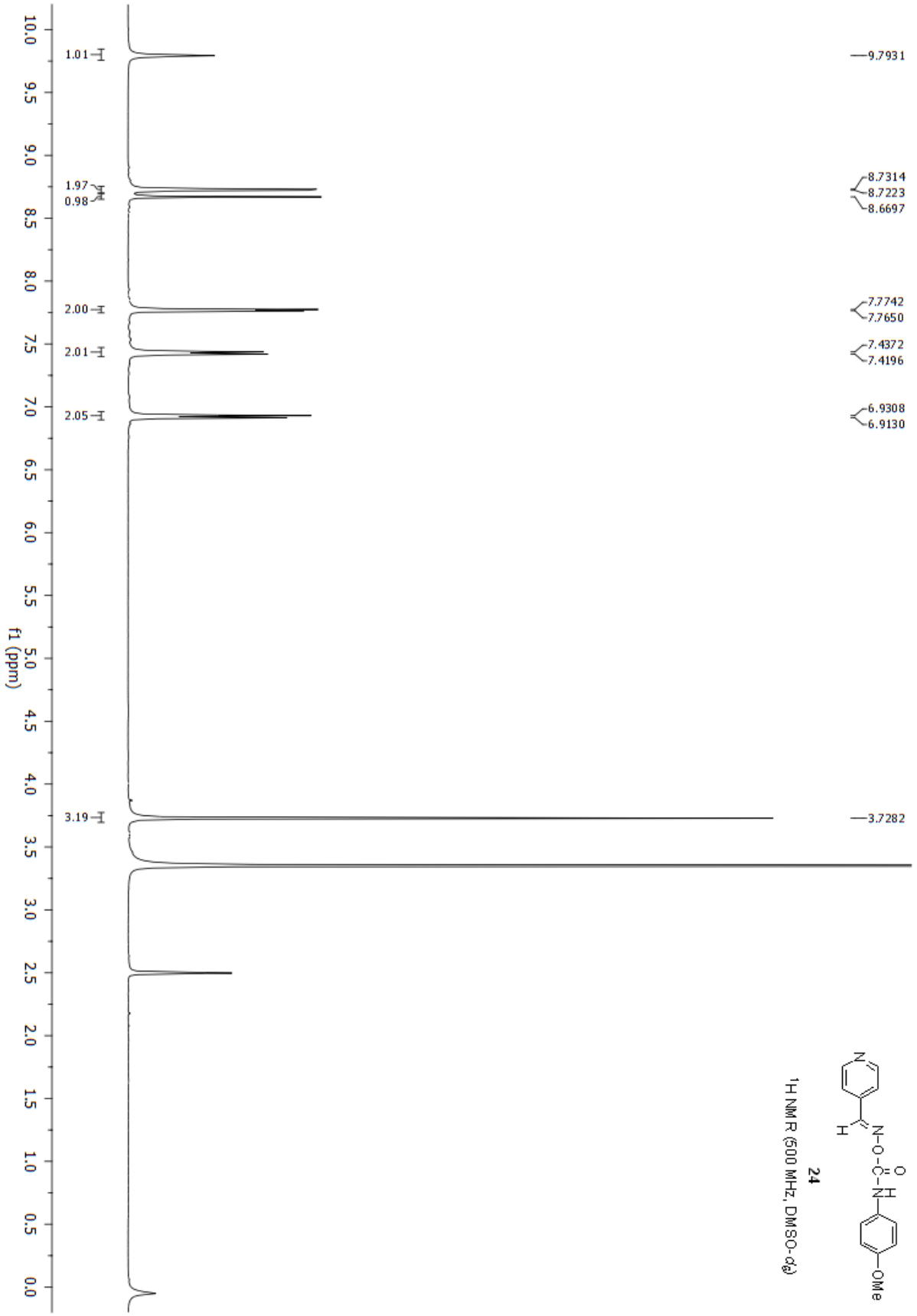

^{13}C NMR (125 MHz, CDCl$_3$/DMSO-d_6)
20
157.6019
157.0159
155.6858
149.9589
148.2867
140.2989
132.6979
132.6778
119.4214
119.3723
119.1821
113.5655
113.3881
11.6952
f1 (ppm)

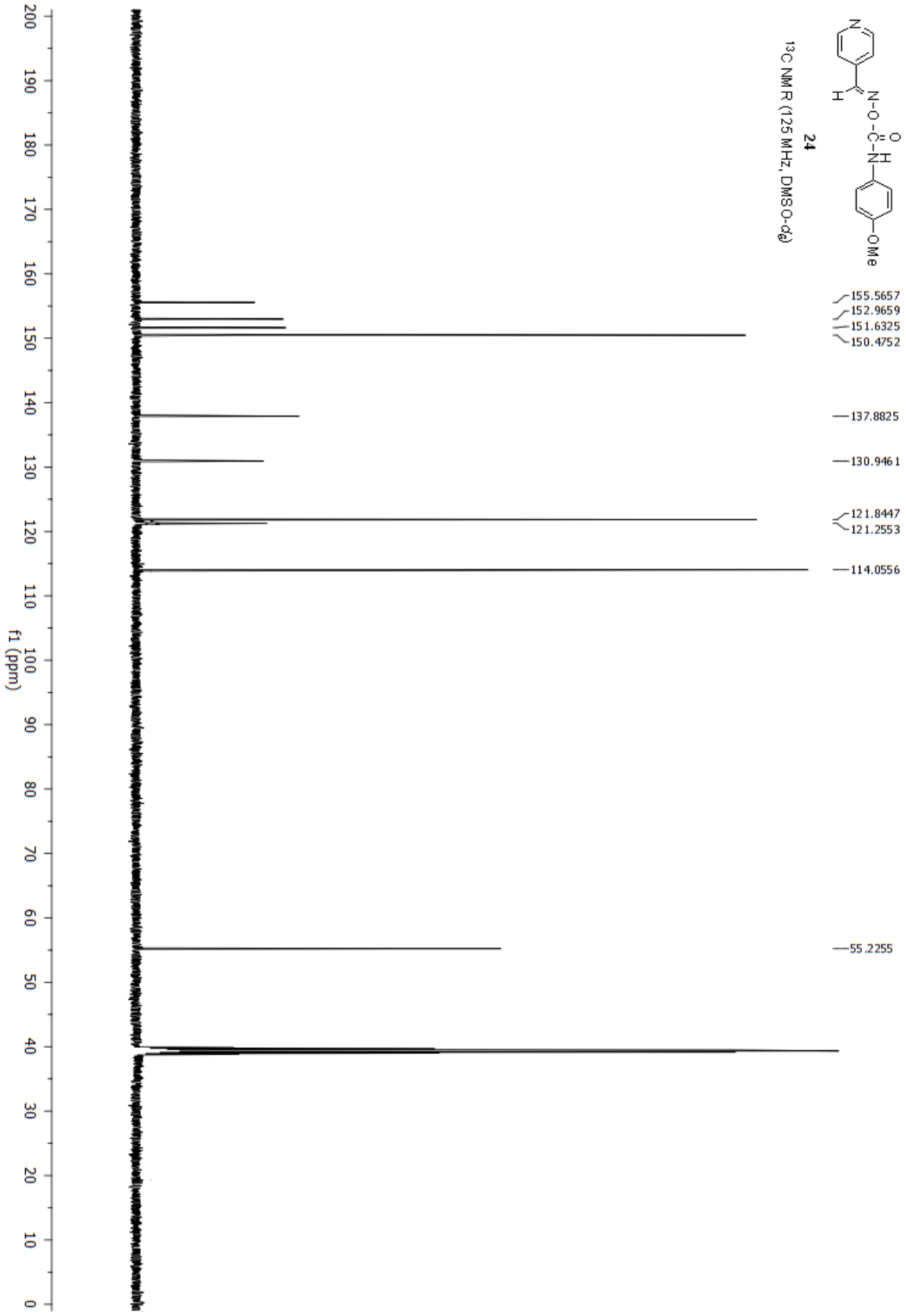

8.7206
8.7087
8.6426
8.3561
8.3441
8.3320
7.7908
7.7789
7.3603
7.3449
7.3306
7.3277
7.3240
7.3109
7.2741
7.2706
7.2665
7.2570
7.2521
7.2474
7.2434
7.2399
4.3453
4.3329
1.96
0.99
1.01
2.00
4.01
0.93
2.08
f1 (ppm)
22
1H NMR (600 MHz, DMSO-d6)

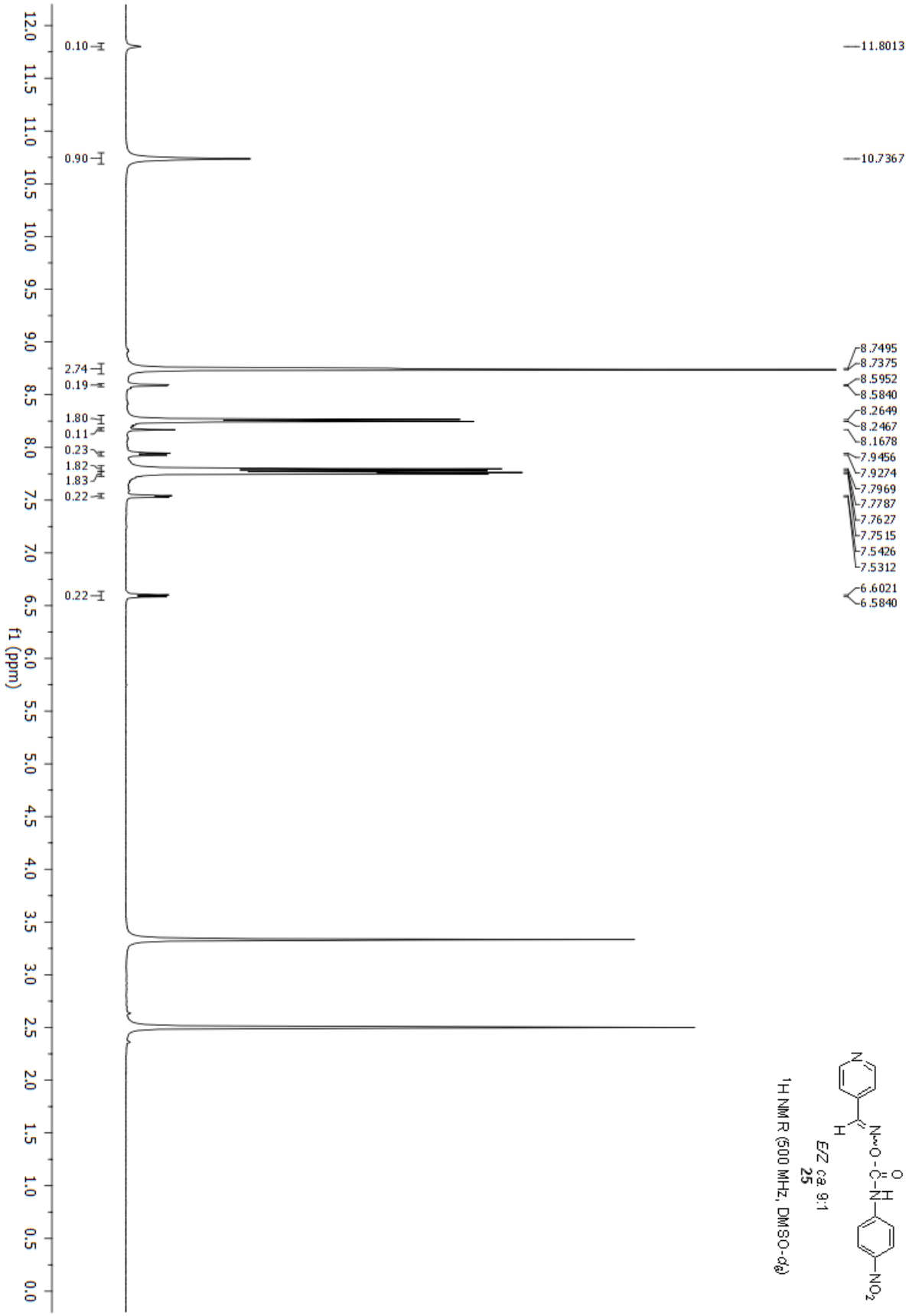

22
^{13}C NMR (125 MHz, DMSO-d_6)
154.5525
152.2433
150.3823
139.2178
137.8575
128.3186
127.0913
126.9388
121.8440
44.0223
f1 (ppm)

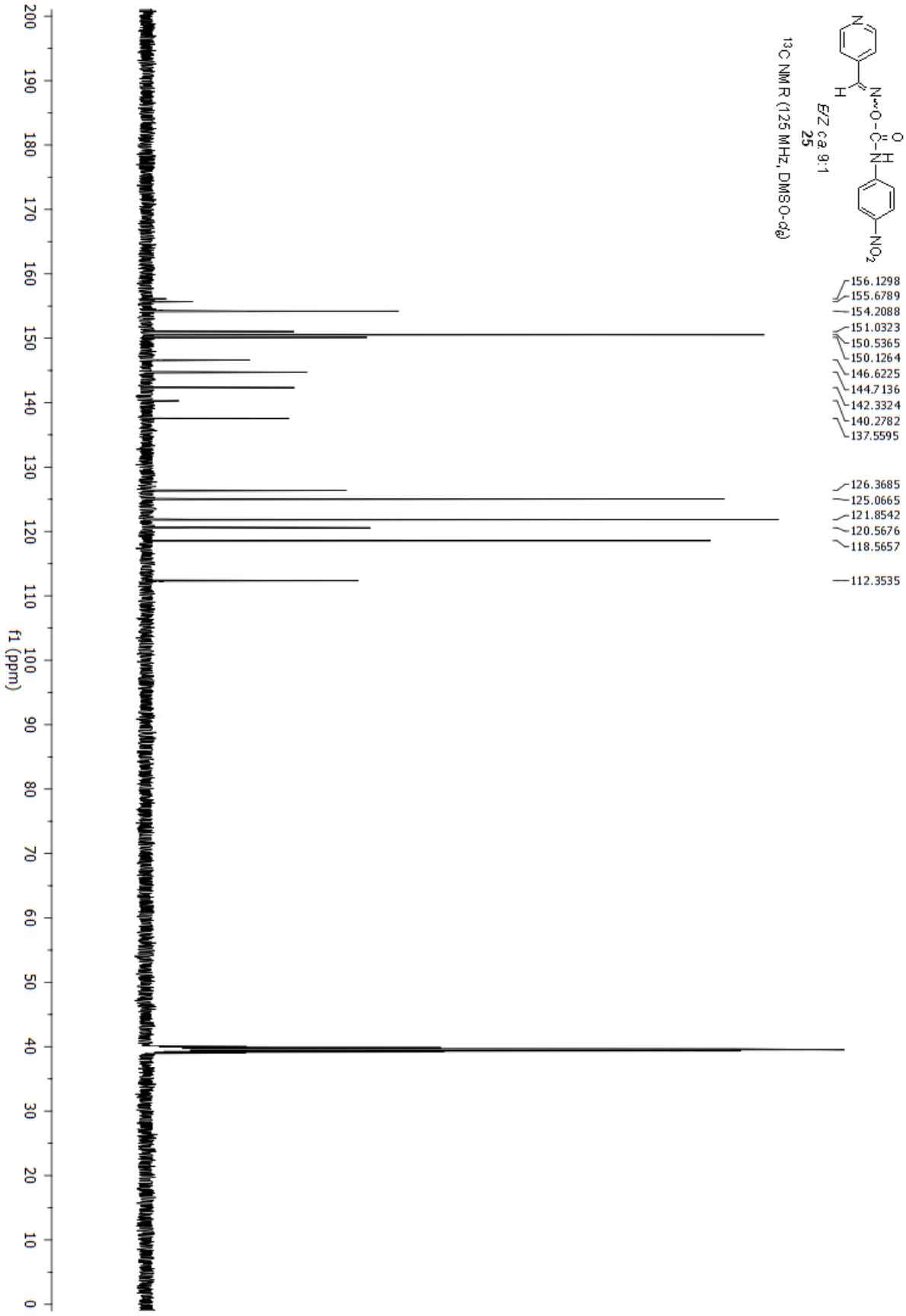

10.0085
8.7389
8.7290
8.6907
7.7728
7.7630
7.5521
7.5365
7.3598
7.3447
7.3286
7.0955
7.0809
7.0663
1.00
1.89
0.90
1.98
2.02
2.04
0.97
f1 (ppm)
23
1H NMR (500 MHz, DMSO-d6)

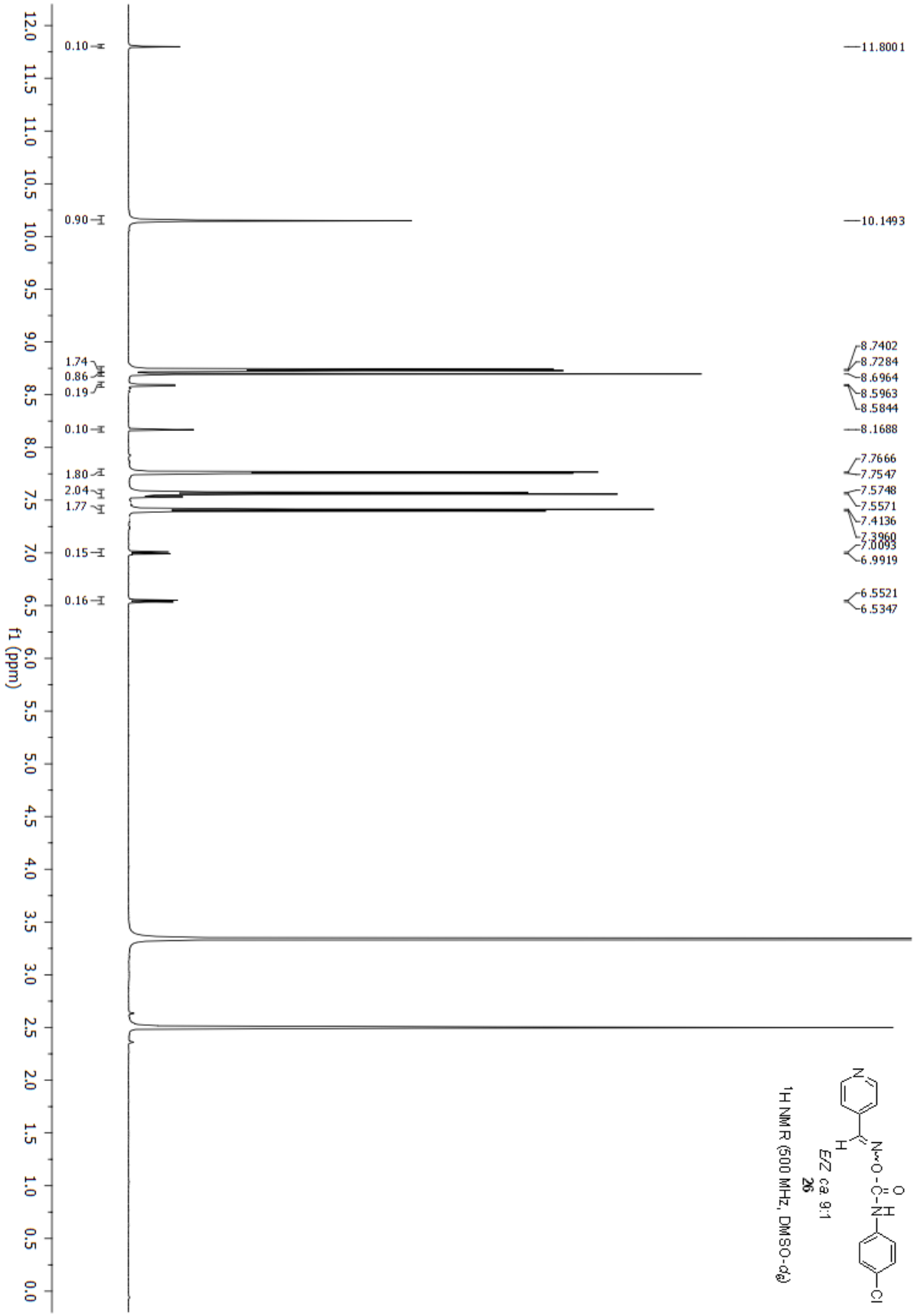

23
^{13}C NMR (125 MHz, DMSO-d_6)
153.2604
151.3565
150.4930
138.1133
137.8356
128.8828
123.4153
121.8447
119.2974
f1 (ppm)

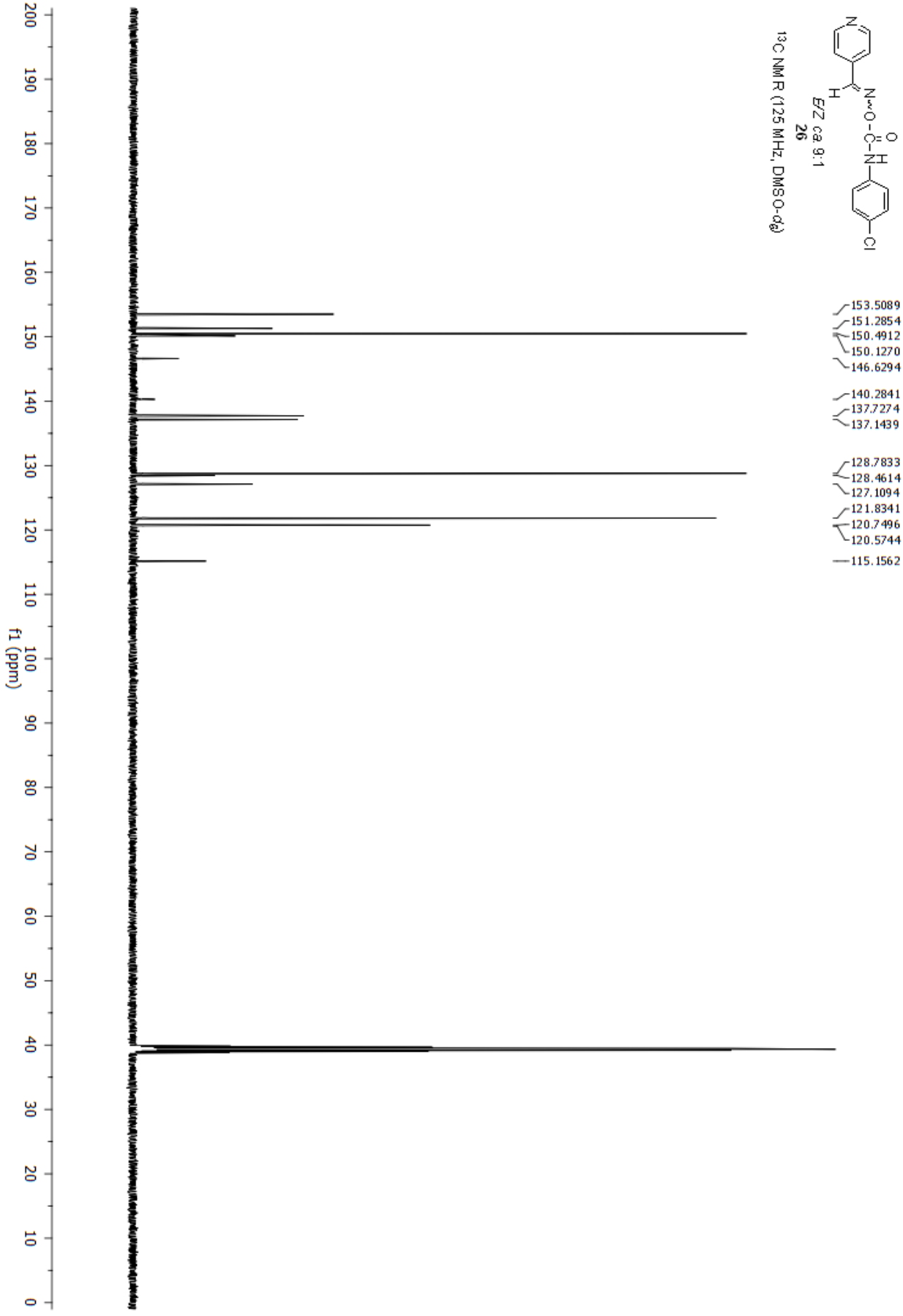

9.7931
8.7314
8.7223
8.6697
7.7742
7.7650
7.4372
7.4196
6.9308
6.9130
3.7282
1.01
1.97
0.98
2.00
2.01
2.05
3.19
f1 (ppm)
24
1H NMR (500 MHz, DMSO-d6)
OMe


24
^{13}C NMR (125 MHz, DMSO-d_6)
155.5657
152.9659
151.6325
150.4752
137.8825
130.9461
121.8447
121.2553
114.0556
55.2255
f1 (ppm)


11.8013
10.7367
8.7495
8.7375
8.5952
8.5840
8.2649
8.2467
8.1678
7.9456
7.9274
7.7969
7.7787
7.7627
7.7515
7.5426
7.5312
6.6021
6.5840
0.10
0.90
2.74
0.19
1.80
0.11
0.23
1.82
1.83
0.22
0.22
f1 (ppm)
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
1H NMR (500 MHz, DMSO-d6)
25
E/Z ca. 9:1
NO2


156.1298
155.6789
154.2088
151.0323
150.5365
150.1264
146.6225
144.7136
142.3324
140.2782
137.5595
126.3685
125.0665
121.8542
120.5676
118.5657
112.3535
13C NMR (125 MHz, DMSO-d6)
E/Z ca. 9:1
25
f1 (ppm)

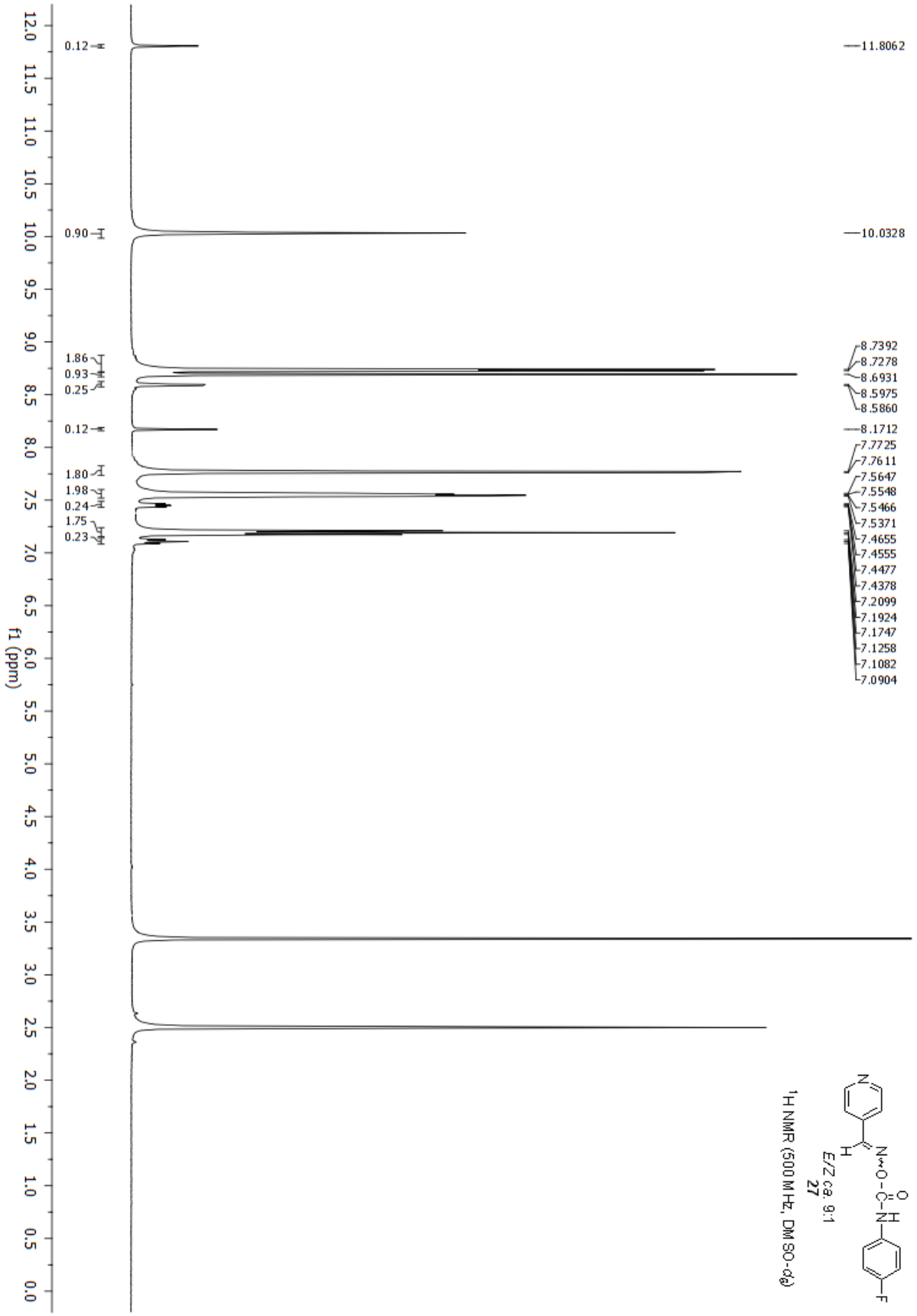

11.8001
10.1493
8.7402
8.7284
8.6964
8.5963
8.5844
8.1688
7.7666
7.7547
7.5748
7.5571
7.4136
7.3960
7.0093
6.9919
6.5521
6.5347
0.10
0.90
1.74
0.86
0.19
0.10
1.80
2.04
1.77
0.15
0.16
f1 (ppm)
EZ ca. 9:1
26
1H NMR (500 MHz, DMSO-d6)

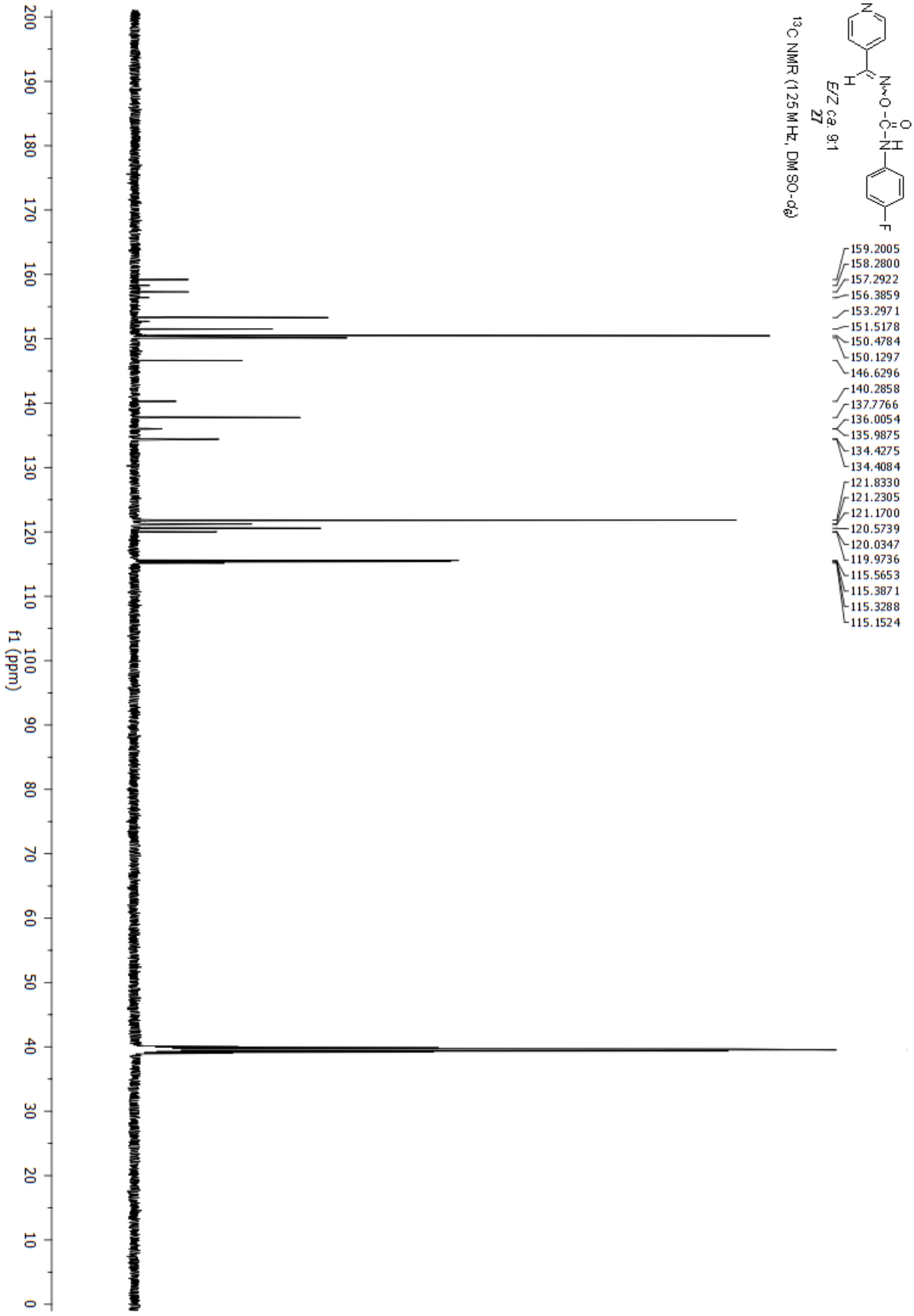


^{13}C NMR (125 MHz, DMSO-d_6)

26

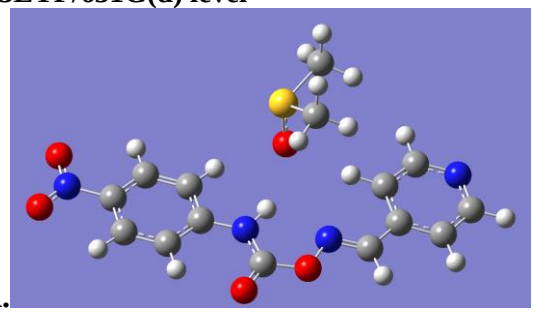
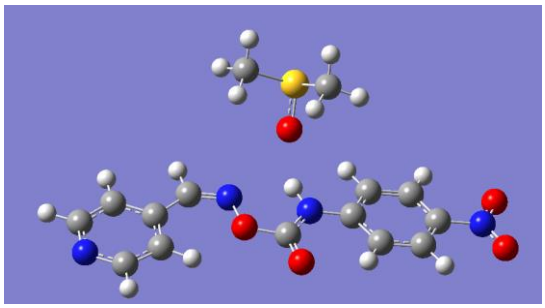
E/*Z* *ca.* 9:1


f1 (ppm)
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
0.12
0.90
1.86
0.93
0.25
0.12
1.80
1.98
0.24
1.75
0.23
11.8062
10.0328
8.7392
8.7278
8.6931
8.5975
8.5860
8.1712
7.7725
7.7611
7.5647
7.5548
7.5466
7.5371
7.4655
7.4555
7.4477
7.4378
7.2099
7.1924
7.1747
7.1258
7.1082
7.0904
^{1}H NMR (500 MHz, DMSO-d_6)
E/Z ca. 9:1
27

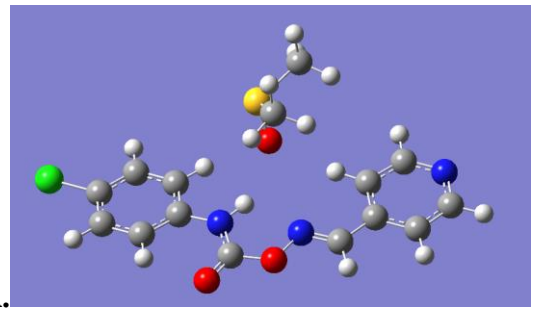
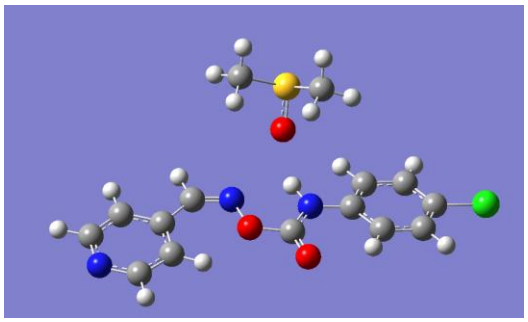

13C NMR (125 MHz, DMSO-d6)
E/Z ca. 9:1
27
159.2005
158.2800
157.2922
156.3859
153.2971
151.5178
150.4784
150.1297
146.6296
140.2858
137.7766
136.0054
135.9875
134.4275
134.4084
121.8330
121.2305
121.1700
120.5739
120.0347
119.9736
115.5653
115.3871
115.3288
115.1524
f1 (ppm)

3. *Optimized molecular geometries for NMR prediction*

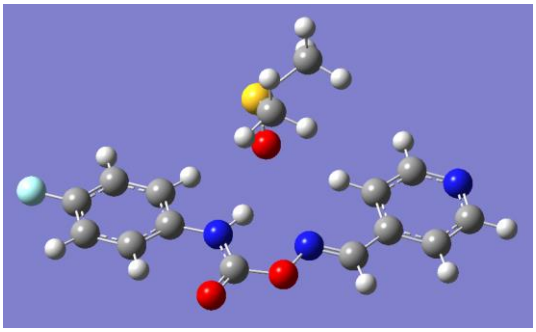
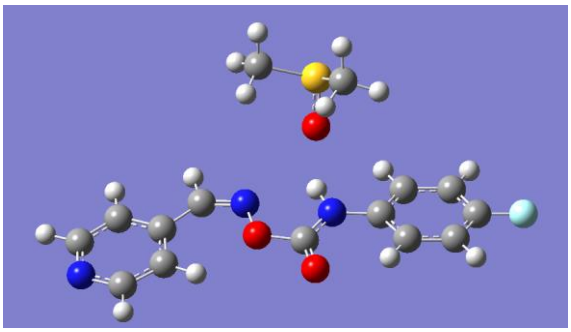
1. Optimized molecular geometries of *E*-25-DMSO (A) and *Z*-25-DMSO (B) complexes at B3LYP/631G(d) level

A.  **B.** 

2. Optimized molecular geometries of *E*-26-DMSO (A) and *Z*-26-DMSO (B) complexes at B3LYP/631G(d) level

A.  **B.** 

3. Optimized molecular geometries of *E*-27-DMSO (A) and *Z*-27-DMSO (B) complexes at B3LYP/631G(d) level

A.  **B.** 

4. *DNA binding studies*

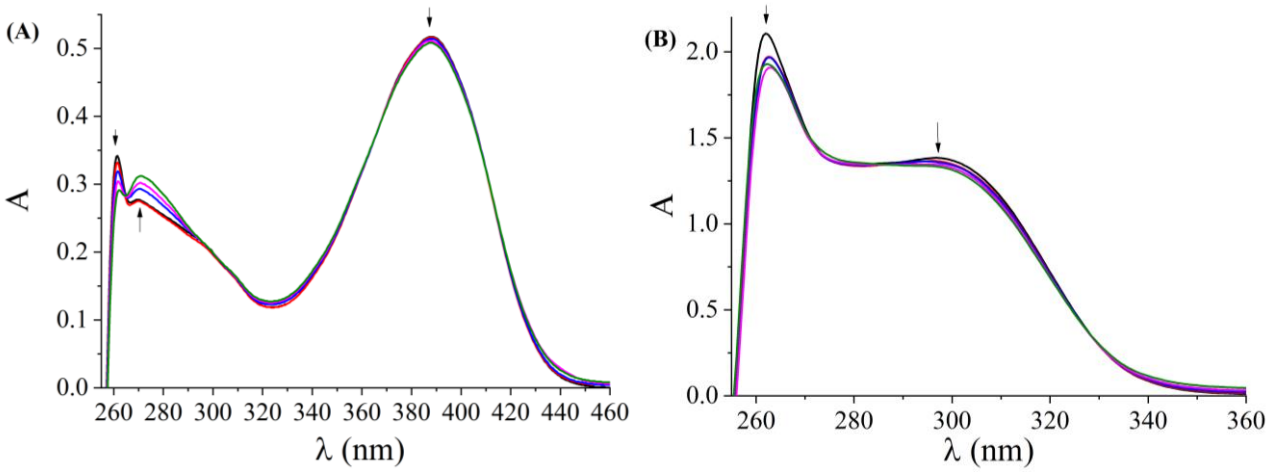


Figure S-4.1. UV−vis spectra of DMSO solution of compound (A) **11** (1 ×10^{-4} M) and (B) **12** (1 ×10^{-4} M) in the presence of increasing amounts of CT DNA (r' = [DNA]/[compound] = 0–0.8). The arrows show the changes upon increasing amounts of CT DNA.

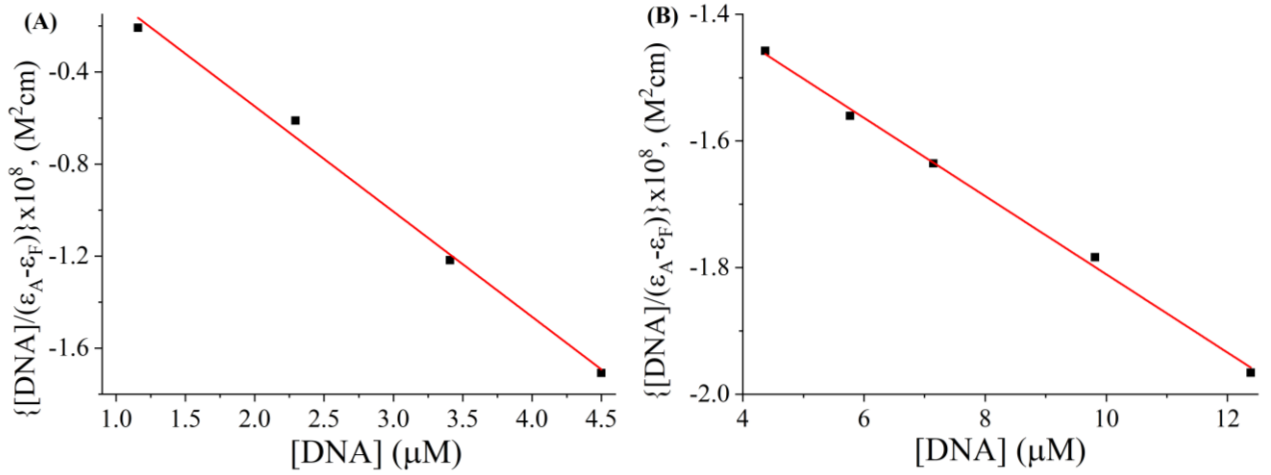


Figure S-4.2. Plot of [DNA]/(ε_A-ε_f) versus [DNA] for compound (A) **11** and (B) **12**.

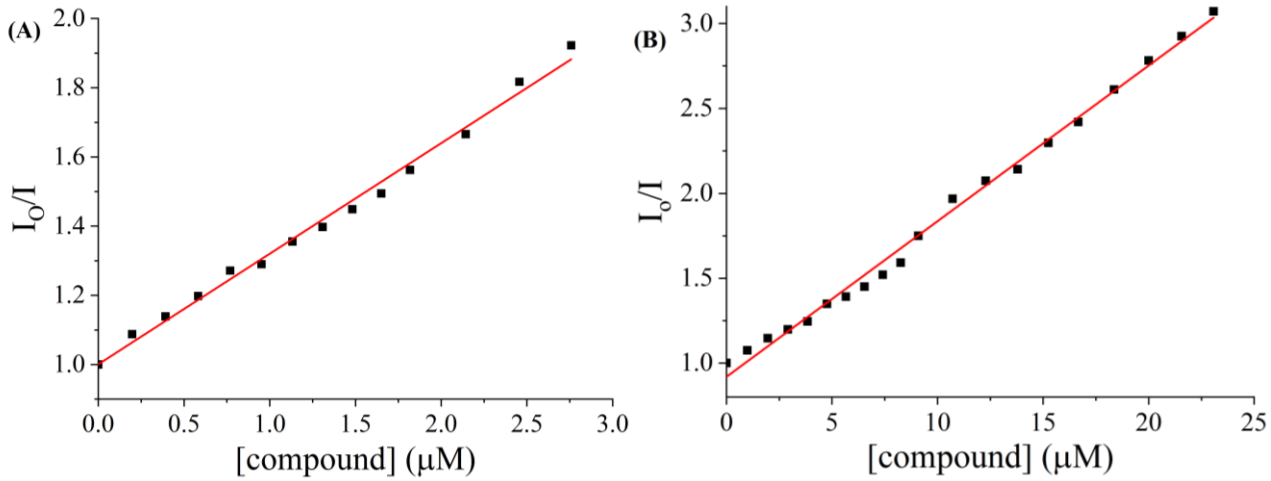
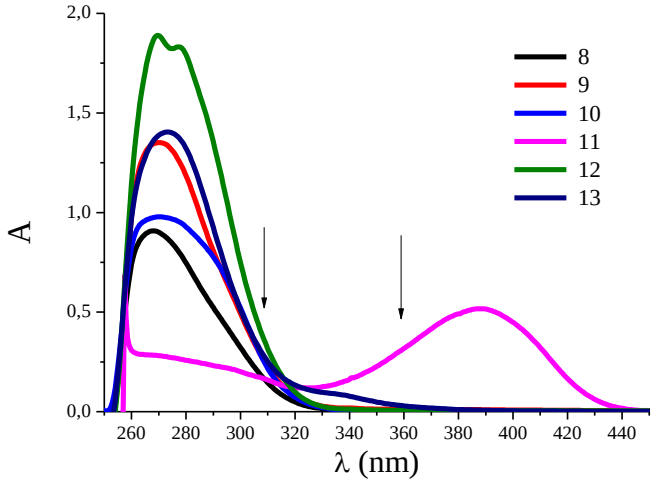


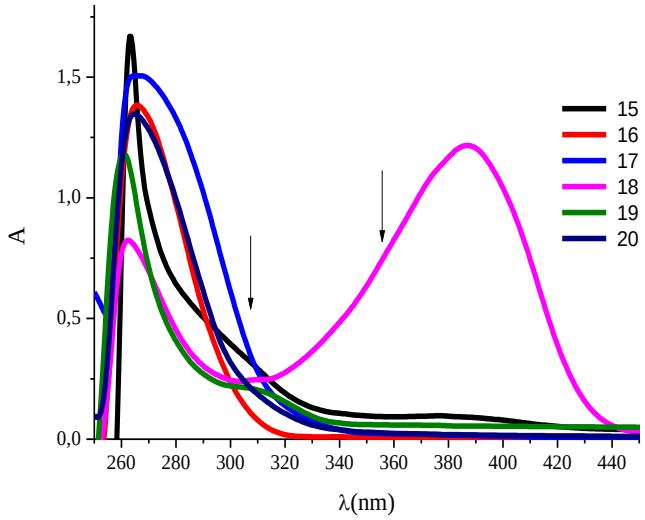
Figure S-4.3. Stern–Volmer quenching plot of EB bound to CT DNA for compound (A) **11** and (B) **12**.

5. *UV absorption spectra of amidoxime, ethanone oxime and aldoxime carbamates*



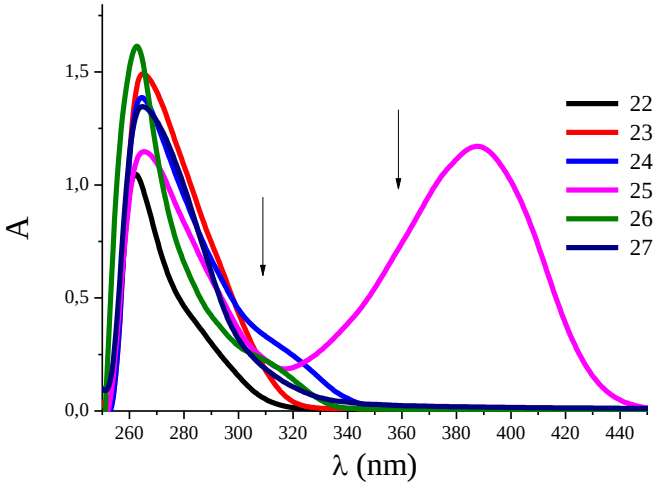
Concentration
8: 10^{-4} M
9: 10^{-4} M
10: 10^{-4} M
11: $2x10^{-5}$ M
12: 10^{-4} M
13: 10^{-4} M

Figure S-5.1. UV–vis spectra of amidoxime carbamates **8–13**.



Concentration
15: 10^{-4} M
16: 10^{-4} M
17: 10^{-4} M
18: 10^{-4} M
19: 10^{-4} M
20: 10^{-4} M

Figure S-5.2. UV–vis spectra of ethanone oxime carbamates **15–20**.



Concentration
22: 10^{-4} M
23: 10^{-4} M
24: 10^{-4} M
25: $5x10^{-5}$ M
26: 10^{-4} M
27: 10^{-4} M

Figure S-5.3. UV–vis spectra of aldoxime carbamates **22–27**.

6. *Gel electrophoresis pictures of amidoxime, ethanone oxime and aldoxime carbamates*

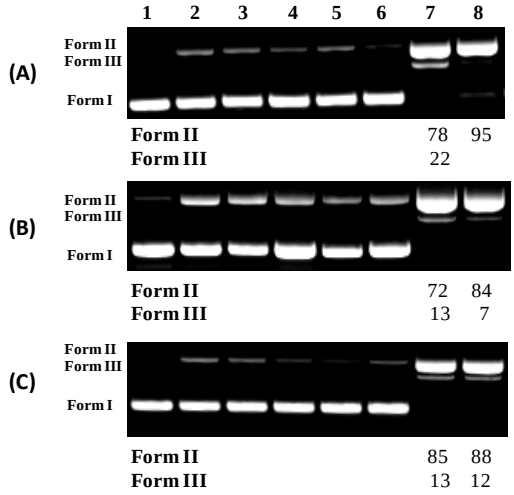


Figure S-6.1. DNA photo-cleavage at concentration of 500 μM. Gel electrophoreses pictures, Top: (**A**): Lane 1: DNA without UV irradiation; Lane 2: DNA with UV irradiation; Lanes 3–8: DNA + carbamoyl amidoximes (**8** or **9**, or **10**, or **11**, or **12**, or **13**, respectively) + UV irradiation; (**B**): Lane 1: DNA without UV irradiation; Lane 2: DNA with UV irradiation; Lanes 3–8: DNA + carbamoyl ethanone oximes (**15** or **16**, or **17**, or **18**, or **19**, or **20**, respectively) + UV irradiation; (**C**): Lane 1: DNA without UV irradiation; Lane 2: DNA with UV irradiation; Lanes 3–8: DNA + carbamoyl aldoximes (**22** or **23**, or **24**, or **25**, or **26**, or **27**, respectively) + UV irradiation; Bottom: Calculation of the % conversion to ss and ds damage.

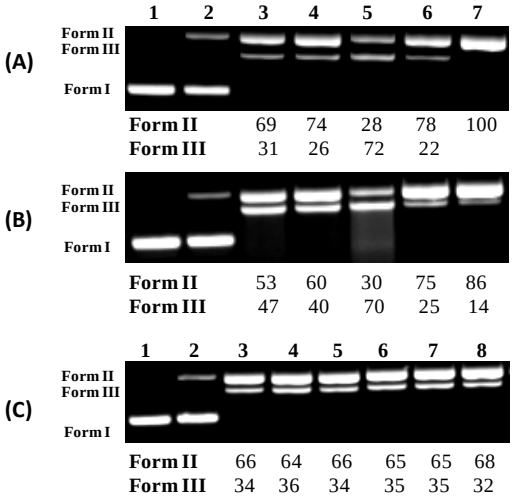


Figure S-6.2. DNA photo-cleavage at concentration of 500 μM. Gel electrophoreses pictures, Top: (**A**): Mechanistic studies involved by derivative **12**. Lane 1: DNA without UV irradiation; Lane 2: DNA with UV irradiation; Lane 3: DNA + **12**; Lane 4: DNA + **12** + argon; Lane 5: DNA + **12** + DMSO (20%); lane 6: DNA + **12** + NaN_3 (20 mM); lane 7: DNA + **12** + D_2O; (**B**): Mechanistic studies involved by derivative **26**. Lane 1: DNA without UV irradiation; Lane 2: DNA with UV irradiation; Lane 3: DNA + **26**; Lane 4: DNA + **26** + argon; Lane 5: DNA + **26** + DMSO (20%); lane 6: DNA + **26** + NaN_3 (20 mM); lane 7: DNA + **26** + D_2O; (**C**): Effect of pH on the cleavage of compound **12**. Lane 1: DNA without UV irradiation; Lane 2: DNA with UV irradiation; Lane 3−8: DNA + **12** + UV irradiation at pH 5, 6, 7, 8, 9, 10, respectively; Bottom: Calculation of the % conversion to ss and ds damage.

7. *UV absorption spectra of amidoxime carbamates 11 and 12 under irradiation*

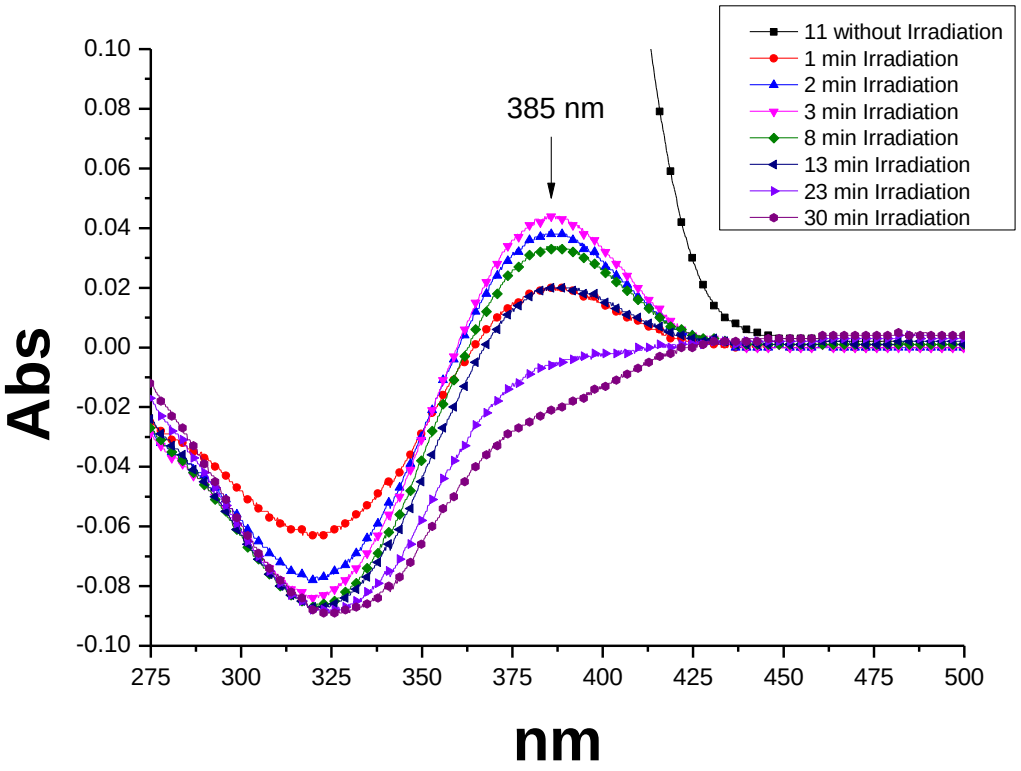


Figure S-7.1. UV absorption spectrum of amidoxime carbamate **11** under irradiation (312 nm).

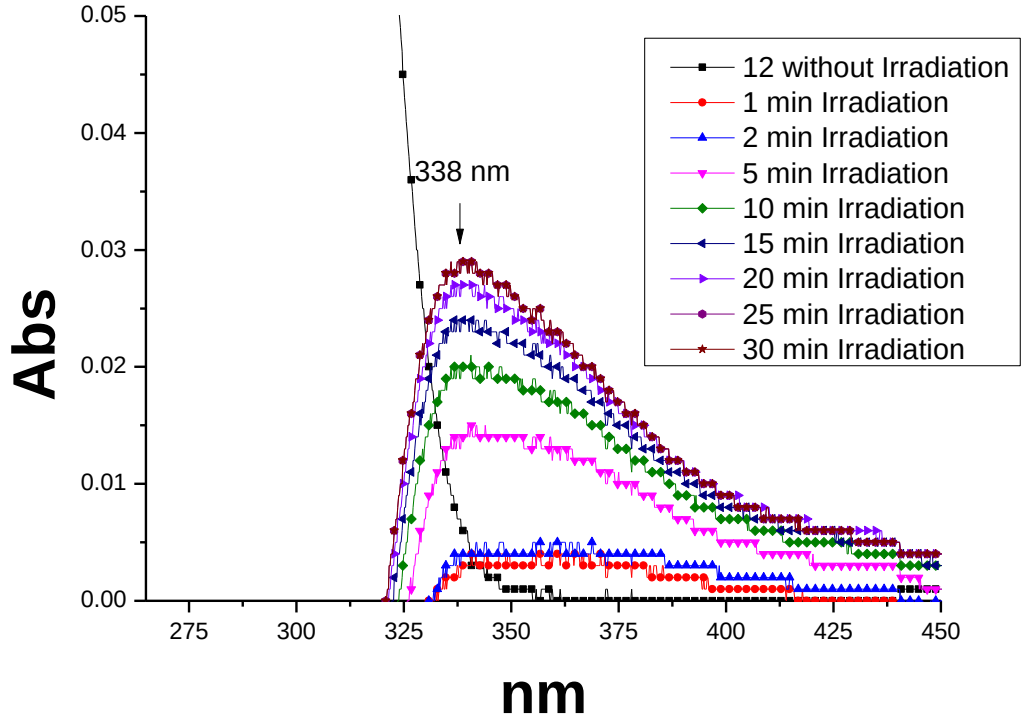
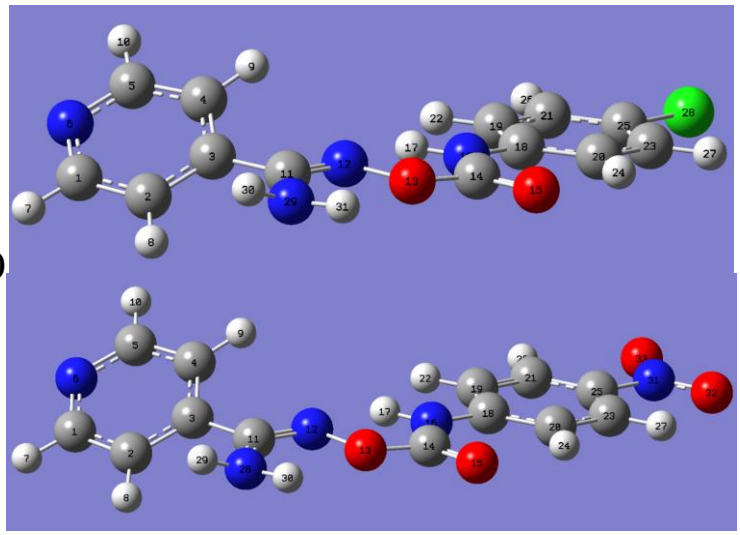


Figure S-7.2. UV absorption spectrum of amidoxime carbamate **12** under irradiation (312 nm).

8. *A computational study and photochemical aspects of compounds 11 and 12*

8.1. Ground state energies



(A)

(B)

Figure S-8.1. Ground state (S_0) structures of **12** (A) and **11** (B).

Table S-8.1. Molecular geometries of compounds 12 and 11. Selected B3PW91/6-31G(d) geometrical parameters for compounds **12** and **11** in the ground (S_0) and lowest triplet excited state (T_1)[a] in aqueous solution.

comp.	state	r_{C3C11}	r_{C11N12}	r_{N12O13}	r_{O13C14}	r_{C14N16}	φ_1	φ_2
12	S_0	1.483	1.299	1.423	1.370	1.357	162.61	164.02
	T_1	1.421	1.409	1.386	1.408	1.347	92.31	91.66
11	S_0	1.484	1.300	1.425	1.364	1.365	162.68	163.67
	T_1	1.484	1.300	1.424	1.367	1.360	162.41	163.84

[a]Bond lengths (r) in Angstroms (Å) and angles,φ (dihedral) in degrees. The values are given according to the suggestions of Hoffmann, Schleyer and Schaefer III [3], φ_1 = φ(C4C11C18C20), φ_2= φ(C4C11N12O13).

8.2. Franck–Condon excitation energies

Table S-8.2. Franck–Condon excitation energies. Franck–Condon (vertical) excitation energies (ΔE_{ex}/kcal·mol^{-1}) and their corresponding wave-lengths (λ/nm) for compounds **12** and **11** [PBE0/6-31G(d)//B3PW91/6-31G(d)]

comp./ state	T_1		T_2		T_3		S_1		S_2		S_3	
	ΔE_{ex}	λ	ΔE_{ex}	λ	ΔE_{ex}	λ	ΔE_{ex}	λ	ΔE_{ex}	λ	ΔE_{ex}	λ
12	74.38	384.36	78.45	364.44	87.87	325.37	91.75	311.61	95.60	299.05	99.17	288.29
11	66.18	432.05	67.18	425.58	75.30	379.32	77.33	369.72	88.00	324.90	90.79	314.92

8.3. Potential energy surface for the dissociation of 11 in T_1 excited state in aqueous solution

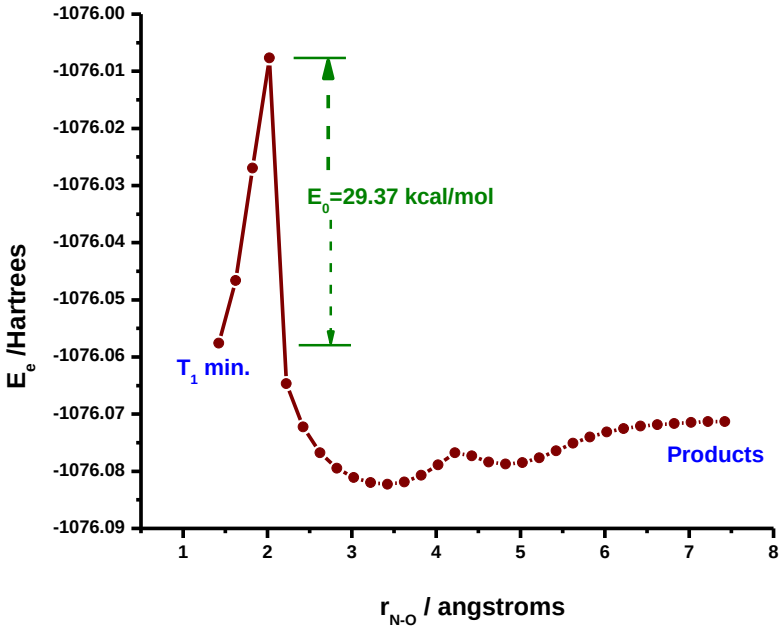


Figure S-8.3. PES for the dissociation of **11** in the first excited triplet state. The reaction coordinate is the N12–O13 bond. The products are ground state radicals.

8.4. Mathematical appendix

In this section we shall prove that the infinite series given in equation (8) of the paper,

$$\kappa(T) = \sum_{n=0}^{\infty} (-1)^n \beta \cdot \left[\frac{1 - e^{\{[\beta-(n+1)\alpha]\cdot \Delta E_0^{\neq}\}}}{(n+1)\alpha - \beta} + \frac{1}{n\alpha + \beta} \right] \qquad (1)$$

is convergent and we shall compute its sum. First we note that the above series can be written as a sum of three terms,

$$\kappa(T) = \sum_{n=0}^{\infty} \frac{(-1)^n \beta}{(n+1)\alpha - \beta} + \sum_{n=0}^{\infty} \frac{(-1)^n \beta}{n\alpha + \beta} - \sum_{n=0}^{\infty} \frac{(-1)^n \beta e^{[\beta-(n+1)\alpha]\Delta E_0^{\neq}}}{(n+1)\alpha - \beta} \qquad (2)$$

Consider first the third series. In order to test it for convergence we'll need the Ratio or D'Alembert's test [1-2]: if $\sum u_n$ is an infinite series and if $\lim_{n\to\infty} \left| u_{n+1} / u_n \right| = l$, then if (i) $l < 1$ the series is absolutely convergent and hence is convergent, (ii) $l > 1$ the series is divergent, while if $l = 1$ the test gives no information. For our case, $\alpha > \beta > 0$ and $\alpha \cdot \Delta E^{\neq}_0 = 12.54 >> 1$,

$$\lim_{n\to\infty} \left| \frac{u_{n+1}}{u_n} \right| = \lim_{n\to\infty} \left| \frac{(-1)^{n+1} \beta e^{[\beta-(n+2)\alpha]\Delta E_0^{\neq}} / [(n+2)\alpha - \beta]}{(-1)^n \beta e^{[\beta-(n+1)\alpha]\Delta E_0^{\neq}} / [(n+1)\alpha - \beta]} \right| = \lim_{n\to\infty} \left| \frac{(n+1)\alpha - \beta}{(n+2)\alpha - \beta} \cdot e^{-\alpha \Delta E_0^{\neq}} \right|$$

$$= \lim_{n\to\infty} \left| \frac{\left(1 + \frac{1}{n}\right)\alpha - \frac{\beta}{n}}{\left(1 + \frac{2}{n}\right)\alpha - \frac{\beta}{n}} \right| \cdot e^{-\alpha \Delta E_0^{\neq}} = e^{-\alpha \Delta E_0^{\neq}} << 1 \qquad (3)$$

Hence the series $\sum_{n=0}^{\infty} \frac{(-1)^n \beta e^{[\beta-(n+1)\alpha]\Delta E_0^{\neq}}}{(n+1)\alpha-\beta}$ converges.

For the other two series the ratio test cannot be applied since $\lim_{n\to\infty} \left| u_{n+1} / u_n \right| = 1$. In this case we shall use the alternating series test[1-2] : suppose that in the series $\sum u_n$ (i) the terms are alternately positive and negative, (ii) $|u_{n+1}| < |u_n|$ and (iii) $\lim_{n\to\infty} u_n = 0$. Then the series $\sum u_n$ converges. The first series of equation (2) gives,

$$|u_{n+1}| = \left| \frac{(-1)^{n+1}\beta}{(n+2)\alpha-\beta} \right| = \left| \frac{(-1)^{n}\beta}{(n+2)\alpha-\beta} \right|$$

Since $|(n+2)\alpha-\beta| > |(n+1)\alpha-\beta|$ it follows that $\left| \frac{1}{(n+2)\alpha-\beta} \right| < \left| \frac{1}{(n+1)\alpha-\beta} \right|$, and therefore $|u_{n+1}| < |u_n|$.

Taking the limit of the absolute value of the nth term gives,

$$\lim_{n\to\infty} |u_n| = \lim_{n\to\infty} \left| \frac{(-1)^n \beta}{(n+1)\alpha-\beta} \right| = \beta \cdot \lim_{n\to\infty} \left| \frac{1/n}{(1+\frac{1}{n})\alpha - \frac{\beta}{n}} \right| = 0$$

Consequently, the given series converges. By a similar argument it can be shown that the second series is also convergent. This completes the proof.

The sums of each series in equation (2) were computed at www.wolframalpha.com and are given below,

$$\sum_{n=0}^{\infty} \frac{(-1)^n \beta}{(n+1)\alpha-\beta} = 0.56123,$$

$$\sum_{n=0}^{\infty} \frac{(-1)^n \beta}{n\alpha+\beta} = 0.80692 \text{ and}$$

$$\sum_{n=0}^{\infty} \frac{(-1)^n \beta e^{[\beta-(n+1)\alpha]\Delta E_0^{\neq}}}{(n+1)\alpha-\beta} = 0.0005266$$

Finally, $\kappa(T)$ = 0.56123 + 0.80692 − 0.0005266 = 1.3676234 at T = 298.15 K.

References for session 8

1. J. A. Green, Sequences and Series, Routledge and Kegan Paul Ltd (1975)
2. M. H. Porter, C. B. Morrey, A first Course in Real Analysis, Springer-Verlag (1977)
3. Hoffmann, R.; Schleyer, P. von R.; Shaefer, H. F. III, Angew. Chem., Int. Ed. 2008, **47,** 7164