Supporting Information

Pictet-Spengler Reactions in Multiphasic Supercritical Carbon Dioxide / CO_2-Expanded Liquid Media. In Situ Generation of Carbamates as a Strategy for Reactions of Amines in Supercritical Carbon Dioxide

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Contents

Part I. Experimental Procedures and Description of Experimental Apparatus

General Procedures. All reactions were performed in the 25-mL Thar stainless steel view cell reactor (model 05422-2) shown in Figure 1. A schematic flow diagram of the experimental apparatus is in Figure 2. This reactor allows visual inspection via two 1-inch coaxial sapphire windows. Cell pressures and temperatures were monitored with a Swagelok industrial pressure gauge (0 – 350 bar range, accuracy of ±5 bar) and Omega K-type low-noise thermocouple probe (accuracy of ±1 °C). Temperature set-points were attained using an Omega miniature autotune temperature controller in PID mode (series CN9000A) in conjunction with a Powerstat variable autotransformer (type 3PN116B) and Omega insulated heating tape (model# STH051-060) wrapped tightly about the exterior cell wall. The reactor was purged with argon before pressurizing with CO_2 and the reactor contents were mixed using a magnetic stir bar. Reaction product solutions and chromatography fractions were concentrated by rotary evaporation at ca. 20 mmHg and then at ca. 0.1 mmHg (vacuum pump) unless otherwise indicated. Thin layer chromatography was performed on Merck precoated glass-backed silica gel 60 F-254 0.25 mm plates. Column chromatography was performed on EM Science silica gel 60 or Silicycle silica gel 60 (230-400 mesh).

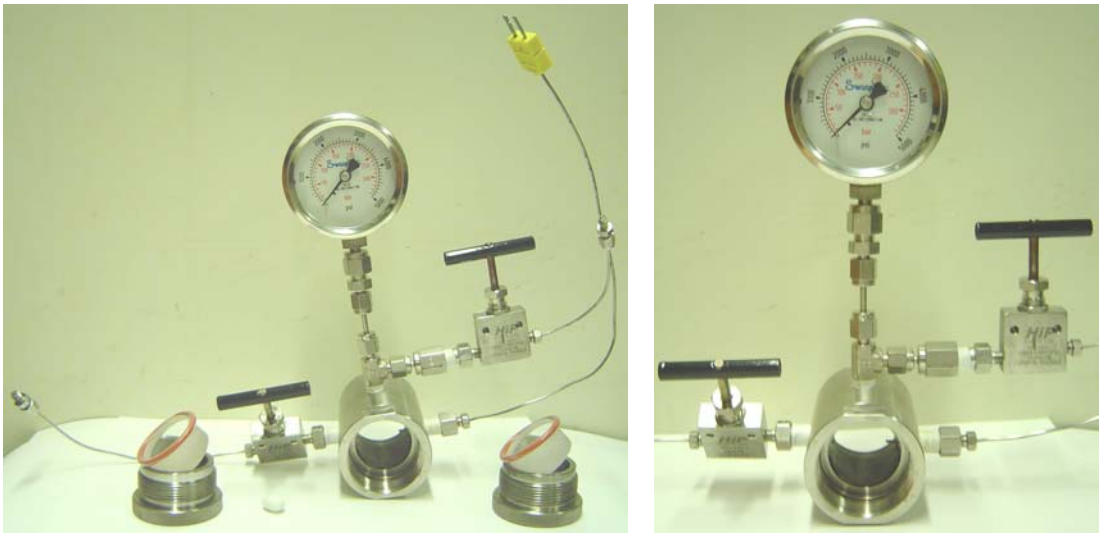


Fig. 1 Thar stainless steel view cell reactor (model 05422-2).

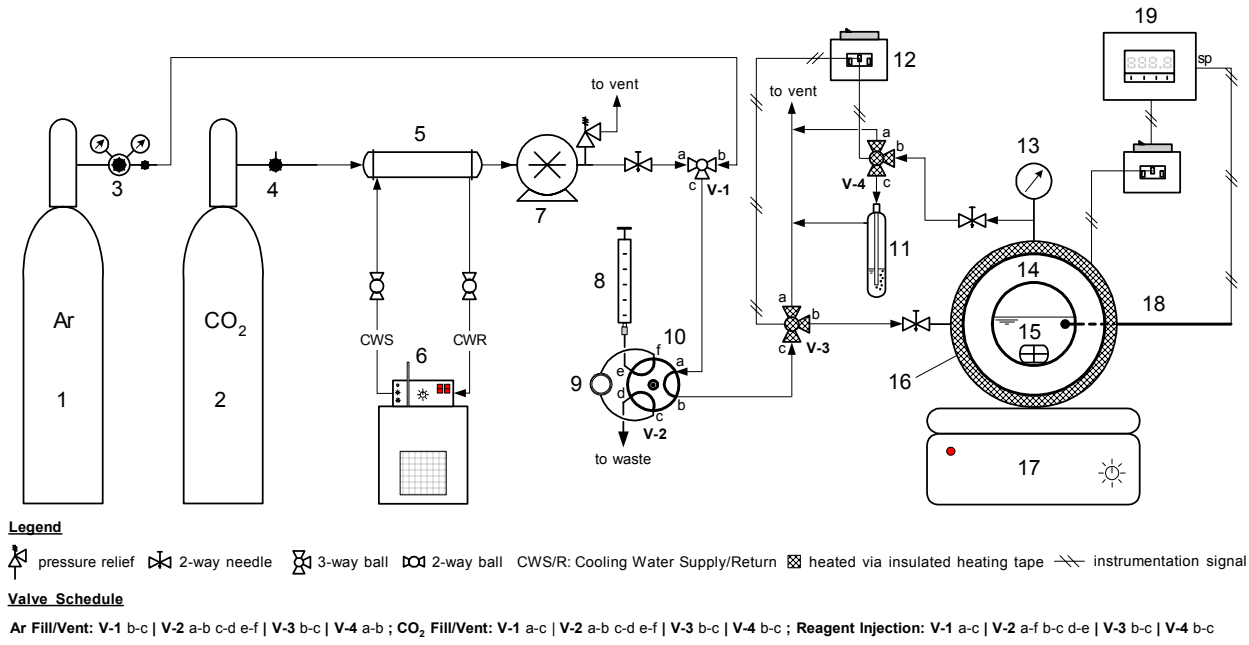


Fig. 2 Schematic flow diagram of the experimental apparatus. (1) argon gas cylinder; (2) carbon dioxide liquid cylinder; (3) gas regulator; (4) SFC/SFE transfer kit; (5) shell-and-tube heat exchanger; (6) cooled circulating bath; (7) metering pump; (8) syringe; (9) sample loop; (10) 6-way valve; (11) sparge chamber; (12) variable autotransformer; (13) pressure gauge; (14) view cell; (15) stir bar; (16) insulated heating tape; (17) stir plate; (18) thermocouple; (19) temperature controller.

Materials. Commercial grade reagents were used without further purification except as indicated below. Isobutyraldehyde and propionaldehyde were distilled under argon. Carbon dioxide (99.9995%) was purchased from Airgas. Aqueous solutions of H_2SO_4 and TFA were prepared by adding the acid to deionized water.

Instrumentation. The melting points of crystalline products were determined with a Fisher-Johns melting point apparatus and are uncorrected. Infrared spectra were obtained using a Perkin Elmer 2000 FT-IR spectrophotometer. ^{1}H NMR and ^{13}C NMR spectra were measured with an Inova 500 spectrometer. ^{1}H NMR chemical shifts are expressed in parts per million (δ) downfield from tetramethylsilane (with the $CHCl_3$ peak at 7.27 ppm used as a standard). ^{13}C NMR chemical shifts are expressed in parts per million (δ) downfield from tetramethylsilane (with the central peak of $CHCl_3$ at 77.23 ppm used as a standard). Low resolution mass spectra (GC-MS) were measured on a Agilent 6890N series gas chromatograph with Agilent 5973 series mass selective detection. High resolution mass spectra (HRMS) were measured on a Bruker Daltonics APEXII 3 telsa Fourier transform mass spectrometer.

General Procedure A for the Two-Stage Reaction Using Sulfuric Acid to Promote Pictet-Spengler Cyclization. *N*-(Methoxycarbonyl)-1,2,3,4-Tetrahydroisoquinoline (14). A 25-mL, stainless steel Thar view cell reactor was charged with phenethylamine (**13**) (1.6 mL, 1.5 g, 13 mmol) and dimethyl carbonate (2.2 mL, 2.4 g, 26 mmol), pressurized to 50 bar with CO_2, heated to 130 °C, and then pressurized with additional CO_2 to 120 bar. The biphasic reaction mixture was stirred at 130 °C (120 – 130 bar) for 24 h. The reactor was allowed to cool to 80 °C and formaldehyde (1.5 mL, 13 M in H_2O, 20 mmol) and H_2SO_4 (2.0 mL, 9.0 M in H_2O, 18 mmol) were added sequentially via the 2-mL sample loop (depicted in Figure 2 as #9). The resulting triphasic reaction mixture was stirred at 80 °C (140 – 160 bar) for 24 h. The reactor was cooled to rt, the CO_2-phase was sparged into a biphasic mixture containing 15 mL of CH_2Cl_2 and 15 mL of water, and the remaining reactor contents were dissolved in 100 mL of CH_2Cl_2 and 100 mL of water. The aqueous layer was separated from the combined organic layers and extracted with three 75-mL portions of CH_2Cl_2. The combined organic layers were washed with 150 mL of satd NaCl solution, dried over $MgSO_4$, filtered, and concentrated to afford 1.925 g of a dark yellow oil. Column chromatography on 90 g of silica gel (gradient elution with 10-15% EtOAc-hexanes) provided 1.271 g (52%) of tetrahydroisoquinoline **14** as a colorless oil: IR (neat) 2953, 1709, 1605, and 1449 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 7.10-7.32 (m, 4H), 4.63 (br s, 2H), 3.76 (s, 3H), 3.70 (m, 2H), and 2.86 (br s, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 156.2, 134.6 (and rotamer 134.8), 133.3 (and rotamer 133.6), 128.8 (and rotamer 129.0), 128.7, 126.5, 126.4 (and rotamer 126.7), 52.9, 45.9, 41.5 (and rotamer 41.7), and 28.9 (and rotamer 29.2); GC-MS *m/z*: 191 (M^+).

***N*-(Methoxycarbonyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline (15).** Reaction of amine **1** (2.1 mL, 2.3 g, 13 mmol), DMC (2.1 mL, 2.2 g, 25 mmol), formaldehyde (1.5 mL, 13 M in H_2O, 20 mmol) and H_2SO_4 (2.0 mL, 9.0 M in H_2O, 18 mmol) according to General Procedure A afforded 3.291 g of a dark brown oil. Column chromatography on 120 g of silica gel (gradient elution with 5-50% EtOAc-hexanes) provided 1.710 g (54%) of tetrahydroisoquinoline **15** as a colorless oil: IR (neat) 2953, 1710, 1691, 1612, and 1513 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 6.61 (s, 1H), 6.58 (m, 1H), 4.54 (br s, 2H), 3.85 (s, 3H), 3.84 (s, 3H), 3.74 (s, 3H), 3.65-3.70 (m, 2H), and 2.76 (br s, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 155.9, 147.53, 147.49, 126.0 (and rotamer 126.3), 124.7 (and rotamer 125.1), 111.3 (and rotamer

111.4), 108.8 (and rotamer 109.0), 55.82, 55.79, 52.5, 45.3, 41.3 (and rotamer 41.5), and 28.1 (and rotamer 28.3); GC-MS *m/z*: 251 (M^+).

***N*-(Methoxycarbonyl)-6,7-dimethoxy-1-phenyl-1,2,3,4-tetrahydroisoquinoline (16).** Reaction of amine **1** (2.1 mL, 2.3 g, 13 mmol), DMC (2.1 mL, 2.2 g, 25 mmol), benzaldehyde (2.0 mL, 2.1 g, 20 mmol) and H_2SO_4 (2.0 mL, 9.0 M in H_2O, 18 mmol) according to General Procedure A afforded 4.150 g of a brown oil. Column chromatography on 140 g of silica gel (elution with 30% EtOAc-hexanes) provided 2.300 g (56%) of tetrahydroisoquinoline **16** as a white solid: mp 98-100 °C; IR (film) 2952, 1703, 1692, 1611, 1515, and 1444 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 7.24-7.31 (m, 5H), 6.67 (s, 1H), 6.50 (s, 1H), 6.41 (rotamer, br s, 0.5H), 6.24 (rotamer, br s, 0.5H), 4.15 (rotamer, br s, 0.5H), 4.00 (rotamer, br s, 0.5H), 3.89 (s, 3H), 3.76 (s, 6H), 3.15 (br s, 1H), 2.94 (br s, 1H), 2.69 (rotamer, br s, 0.5H), and 2.66 (rotamer, br s, 0.5H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 156.0, 148.2, 147.6, 142.7, 128.8, 128.7, 128.4, 127.6, 127.1, 111.3, 111.2, 57.3 (and rotamer 57.4), 56.12, 56.06, 52.9, 37.7 (and rotamer 37.9), and 28.0 (and rotamer 28.2); GC-MS *m/z*: 327 (M^+).

***N*-(Methoxycarbonyl)-1-isopropyl-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline (17).** Reaction of amine **1** (2.1 mL, 2.3 g, 13 mmol), DMC (2.1 mL, 2.2 g, 25 mmol), isobutyraldehyde (1.7 mL, 1.3 g, 19 mmol) and H_2SO_4 (2.0 mL, 9.0 M in H_2O, 18 mmol) according to General Procedure A afforded 2.882 g of a dark orange oil. Column chromatography on 160 g of silica gel (gradient elution with 20-30% EtOAc-hexanes) provided 1.975 g (53%) of tetrahydroisoquinoline **17** as a colorless oil: IR (neat) 2958, 1698, 1611, 1518, and 1446 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 6.52-6.56 (m, 2H), 4.70 (rotamer, d, J = 8.5 Hz, 0.5H), 4.57 (rotamer, d, J = 8.5 Hz, 0.5H), 4.02 (rotamer, app quint, J = 6.1 Hz, 0.5H), 3.76 (s, 6H), 3.61 (s, 3H), 3.38 (rotamer, dt, J = 13.0, 6.9 Hz, 0.5H), 3.29 (rotamer, ddd, J = 5.8, 8.9, 13.1 Hz, 0.5H), 2.78 (m, 0.5H), 2.66-2.71 (m, 2H), 1.92 (m, 1H), and 0.84-0.91 (m, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 156.3 (and rotamer 156.6), 147.5 (and rotamer 147.6), 146.49 (and rotamer 146.53), 128.5 (and rotamer 129.0), 126.1 (and rotamer 126.3), 111.3 (and rotamer 111.4), 111.0 (and rotamer 111.1), 60.1 (and rotamer 60.2), 55.79 (and rotamer 55.83), 55.7, 52.3 (and rotamer 52.4), 39.0 (and rotamer 39.5), 33.77 (and rotamer 33.81), 27.1 (and rotamer 27.4), 20.1 (and rotamer 20.2), and 19.5 (and rotamer 19.6); GC-MS *m/z*: 293 (M^+).

***N*-(Methoxycarbonyl)-6,7-dimethoxy-1-methoxycarbonyl-1,2,3,4-tetrahydroisoquinoline (18).** Reaction of amine **1** (2.1 mL, 2.3 g, 13 mmol), DMC (2.1 mL, 2.2

g, 25 mmol), methyl dimethoxyacetate (2.3 mL, 2.5 g, 19 mmol) and H_2SO_4 (2.0 mL, 9.0 M in H_2O, 18 mmol) according to General Procedure A afforded 2.910 g of a dark red oil. Column chromatography on 140 g of silica gel (gradient elution with 30-35% EtOAc-hexanes) provided 1.901 g (49%) of tetrahydroisoquinoline **18** as a colorless oil: IR (neat) 2954, 1744, 1699, 1611, 1520, and 1447 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 6.98 (rotamer, s, 0.5H), 6.96 (rotamer, s, 0.5H), 6.62 (s, 1H), 5.54 (rotamer, s, 0.5H), 5.47 (rotamer, s, 0.5H), 4.00 (rotamer, dt, J = 12.5, 5.5 Hz, 0.5H), 3.87 (s, 3H), 3.85 (s, 3H), 3.80 (rotamer, m, 0.5H), 3.76 (rotamer, s, 1.5H), 3.75 (rotamer, m, 0.5H), 3.74 (rotamer, s, 1.5H), 3.72 (rotamer, s, 1.5H), 3.71 (rotamer, s, 1.5H), 3.67 (rotamer, m, 0.5H), and 2.76-2.86 (m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 171.8, 156.0 (and rotamer 156.6), 148.66 (and rotamer 148.70), 147.66 (and rotamer 147.69), 127.3 (and rotamer 127.5), 121.6 (and rotamer 122.1), 111.0 (and rotamer 111.2), 110.6 (and rotamer 110.8), 57.5 (and rotamer 57.6), 56.1, 55.9, 53.0 (and rotamer 53.1), 52.56 (and rotamer 52.59), 40.2 (and rotamer 40.5), and 28.0 (and 28.2); GC-MS *m/z*: 309 (M^+).

General Procedure B for the Two-Stage Reaction Using Trifluoroacetic Acid to Promote Pictet-Spengler Cyclization. *N*-(Carbobenzyloxy)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline (19). A 25-mL, stainless steel Thar view cell reactor was charged with amine **1** (2.1 mL, 2.3 g, 13 mmol) and dibenzyl carbonate (5.3 mL, 6.2 g, 26 mmol), pressurized to 50 bar with CO_2, heated to 130 °C, and then pressurized with additional CO_2 to 120 bar. The biphasic reaction mixture was stirred at 130 °C (120 – 130 bar) for 24 h. The reactor was allowed to cool to 80 °C and formaldehyde (1.5 mL, 13 M in H_2O, 20 mmol) and trifluoroacetic acid (3.0 mL, 50% v/v in H_2O, 19 mmol) were added sequentially via the 3-mL sample loop (depicted in Figure 2 as #9). The resulting triphasic reaction mixture was stirred at 80 °C (140 – 160 bar) for 24 h. The reactor was cooled to rt, the CO_2-phase was sparged into a biphasic mixture containing 15 mL of CH_2Cl_2 and 15 mL of water, and the remaining reactor contents were dissolved in 100 mL of CH_2Cl_2 and 100 mL of water. The combined organic and aqueous layers were washed with 100 mL of 1 M NaOH solution, and the aqueous layer was separated and extracted with four 75-mL portions of CH_2Cl_2. The combined organic layers were washed with 200 mL of satd NaCl solution, dried over $MgSO_4$, filtered, and concentrated to afford 8.528 g of a dark yellow oil. Column chromatography on 160 g of silica gel (gradient elution with 20-30% EtOAc-hexanes) provided 2.755 g (67%) of tetrahydroisoquinoline **19** as a colorless oil: IR (neat) 2935, 1703, 1692, 1611, 1517, and 1427 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 7.25-7.36

(m, 5H), 6.58 (s, 1H), 6.56 (rotamer, br s, 0.5H), 6.51 (rotamer, br s, 0.5H), 5.15 (s, 2H), 4.54 (s, 2H), 3.79 (s, 3H), 3.78 (s, 3H), 3.67 (m, 2H), and 2.72 (m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 155.1 (and rotamer 155.2), 147.42, 147.37, 136.5, 128.3, 127.8, 127.6, 125.9 (and rotamer 126.1), 124.4 (and rotamer 125.0), 111.2 (and rotamer 111.3), 108.7 (and rotamer 108.9), 66.8 (and rotamer 66.9), 55.64, 55.63, 45.1 (and rotamer 45.3), 41.2 (and rotamer 41.5), and 28.0 (and rotamer 28.2); HRMS-ESI *m/z*: $[M+Na]^+$ calcd for $C_{19}H_{21}NO_4$, 350.1363; found, 350.1360.

***N*-(Carbobenzyloxy)-1-ethyl-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline (20).** Reaction of amine **1** (2.1 mL, 2.3 g, 13 mmol), DBC (5.3 mL, 6.2 g, 26 mmol), propionaldehyde (1.4 mL, 1.1 g, 19 mmol) and TFA (3.0 mL, 50% v/v in H_2O, 19 mmol) according to General Procedure B afforded 8.890 g of an orange oil. Column chromatography on 140 g of silica gel (gradient elution with 10-30% EtOAc-hexanes) provided 3.173 g (71%) of tetrahydroisoquinoline **20** as a colorless oil: IR (neat) 2963, 1693, 1611, 1519, and 1427 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.33-7.38 (m, 5H), 6.62 (rotamer, s, 0.5H), 6.60 (rotamer, s, 0.5H), 6.58 (rotamer, s, 0.5H), 6.56 (rotamer, s, 0.5H), 5.23 (rotamer, d, J = 12.5 Hz, 0.5H), 5.18 (rotamer, s, 1H), 5.09 (rotamer, d, J = 12.5 Hz, 0.5H), 5.07 (rotamer, t, J = 7.3 Hz, 0.5H), 4.97 (rotamer, t, J = 7.3 Hz, 0.5H), 4.28 (rotamer, m, 0.5H), 4.09 (rotamer, m, 0.5H), 3.86 (s, 6H), 3.33 (rotamer, m, 0.5H), 3.22 (rotamer, m, 0.5H), 2.93 (rotamer, m, 0.5H), 2.85 (rotamer, m, 0.5H), 2.67 (rotamer, m, 0.5H), 2.64 (rotamer, m, 0.5H), 1.80 (m, 2H), 1.00 (rotamer, t, J = 7.3 Hz, 1.5H), and 0.96 (rotamer, t, J = 7.3 Hz, 1.5H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 155.2, 147.2 (and rotamer 147.3), 147.0, 136.4 (and rotamer 136.6), 129.2 (and rotamer 129.5), 128.0, 127.48 (and rotamer 127.6), 127.3 (and rotamer 127.55), 125.3 (and rotamer 125.5), 111.0 (and rotamer 111.2), 109.5 (and rotamer 109.8), 66.5 (and rotamer 66.8), 55.5, 55.4, 55.3, 37.0 (and rotamer 37.7), 29.2 (and rotamer 29.4), 27.4 (and rotamer 27.8), and 10.68 (and rotamer 10.72); HRMS-ESI *m/z*: $[M+Na]^+$ calcd for $C_{21}H_{25}NO_4$, 378.1676; found, 378.1666.

***N*-(Carbobenzyloxy)-6,7-dimethoxy-1-phenyl-1,2,3,4-tetrahydroisoquinoline (21).** Reaction of amine **1** (2.1 mL, 2.3 g, 13 mmol), DBC (5.3 mL, 6.2 g, 26 mmol), benzaldehyde (2.0 mL, 2.1 g, 18 mmol) and H_2SO_4 (2.0 mL, 9.0 M in H_2O, 18 mmol) according to General Procedure A afforded 8.960 g of an orange oil. Column chromatography on 100 g of silica gel (gradient elution with 5-30% EtOAc-hexanes) provided 2.882 g (57%) of tetrahydroisoquinoline **21** as a very pale yellow oil: IR (neat) 2935, 1693, 1611, 1517, and 1425 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.17-7.40 (m, 10H), 6.68 (s. 1H), 6.53 (s, 1H), 6.45 (rotamer, br s, 0.5H), 6.26

(rotamer, br s, 0.5H), 5.22-5.30 (m, 1H), 5.18 (rotamer, s, 0.5H), 5.16 (rotamer, s, 0.5H), 4.20 (rotamer, br s, 0.5H), 4.07 (rotamer, br s, 0.5H), 3.90 (s, 3H), 3.76 (s, 3H), 3.19 (br s, 1H), 2.96 (br s, 1H), and 2.69 (br s, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 154.9 (and rotamer 155.3), 147.9, 147.4, 142.4, 136.6, 128.5, 128.4, 128.3, 128.2, 127.7 (and rotamer 127.9), 127.4, 127.0, 126.7 (and rotamer 126.8), 126.6, 110.9 (and rotamer 111.2), 67.1 (and rotamer 67.4), 57.1 (and rotamer 57.3), 55.8, 55.7, 37.6 (and rotamer 37.8), and 27.8 (and rotamer 28.0); HRMS-ESI *m/z*: $[M+Na]^+$ calcd for $C_{25}H_{25}NO_4$, 426.1676; found, 426.1683.

2-(Carbobenzyloxy)-9-(*p*-toluenesulfonyl)-1,2,3,4-tetrahydro-β-carboline (24). A 25-mL, stainless steel Thar view cell reactor was charged with tryptamine **22** (0.798 g, 2.54 mmol) and DBC (2.7 mL, 3.2 g, 13 mmol), pressurized to 50 bar with CO_2, heated to 130 °C, and then pressurized with additional CO_2 to 130 bar. The biphasic reaction mixture was stirred at 130 °C (130 bar) for 24 h. The reactor was allowed to cool to 80 °C and formaldehyde (0.50 mL, 6.8 M in H_2O, 3.4 mmol) and TFA (0.50 mL, 50% v/v in H_2O, 3.2 mmol) were added sequentially via the 0.50-mL sample loop (depicted in Figure 2 as #9). The resulting triphasic reaction mixture was stirred at 80 °C (160 bar) for 24 h. The reactor was cooled to rt, the CO_2-phase was sparged into a biphasic mixture containing 15 mL of CH_2Cl_2 and 15 mL of water, and the remaining reactor contents were dissolved in 100 mL of CH_2Cl_2 and 50 mL of water. The combined organic and aqueous layers were washed with 50 mL of satd $NaHCO_3$ solution, and the aqueous layer was separated and extracted with three 50-mL portions of CH_2Cl_2. The combined organic layers were dried over $MgSO_4$, filtered, and concentrated to afford 4.116 g of a yellow oil. Two successive purifications by column chromatography on 120 g of silica gel (5-20% EtOAc-hexanes) provided 0.715 g (61%) of tetrahydro-β-carboline **24** as a white solid: mp 52-55 °C; IR (film) 2922, 1704, 1597, 1426, 1366, and 1232 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.16 (d, J = 8.2 Hz, 1H), 7.79 (m, 1H), 7.64 (m, 1H), 7.32-7.44 (m, 7H), 7.21-7.28 (m, 2H), 7.02 (m, 1H), 5.23 (s, 2H), 5.02 (br s, 2H), 3.81 (br s, 2H), 2.73 (br s, 2H), 2.33 (rotamer, s, 1H), and 2.30 (rotamer, s, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 155.6 (and rotamer 155.7), 145.1, 136.7, 135.5 (and rotamer 136.2), 131.0 (and rotamer 131.6), 130.1, 129.6, 128.7, 128.3, 128.1, 126.5 (and rotamer 126.7), 124.7 (and rotamer 124.8), 123.6 (and rotamer 123.7), 118.4 (and rotamer 118.5), 117.1 (and rotamer 117.8), 114.4, 67.6, 43.5 (and rotamer 43.8), 41.2 (and rotamer 41.4), 21.7, and 21.2; HRMS-ESI *m/z*: $[M+Na]^+$ calcd for $C_{26}H_{24}N_2O_4S$, 483.1349; found, 483.1355.

Part II. Reaction Phase Behavior Observed During Carbamate Formation and Pictet-Spengler Reaction

Fig. 3a Phase behavior during carbamate formation (130 °C, 120 – 130 bar): biphasic mixture with supercritical-like CO_2 phase (top) and CO_2-rich liquid phase (bottom).

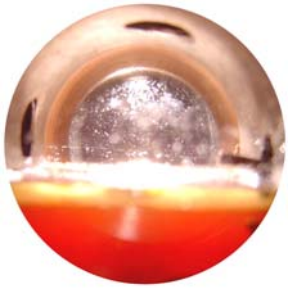
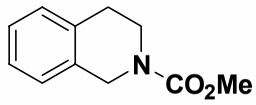


Fig. 3b Phase behavior during Pictet-Spengler reaction (80 °C, 140 – 160 bar): triphasic mixture with supercritical-like CO_2 phase (top), H_2O-rich liquid phase (middle), and CO_2-rich liquid phase (bottom).



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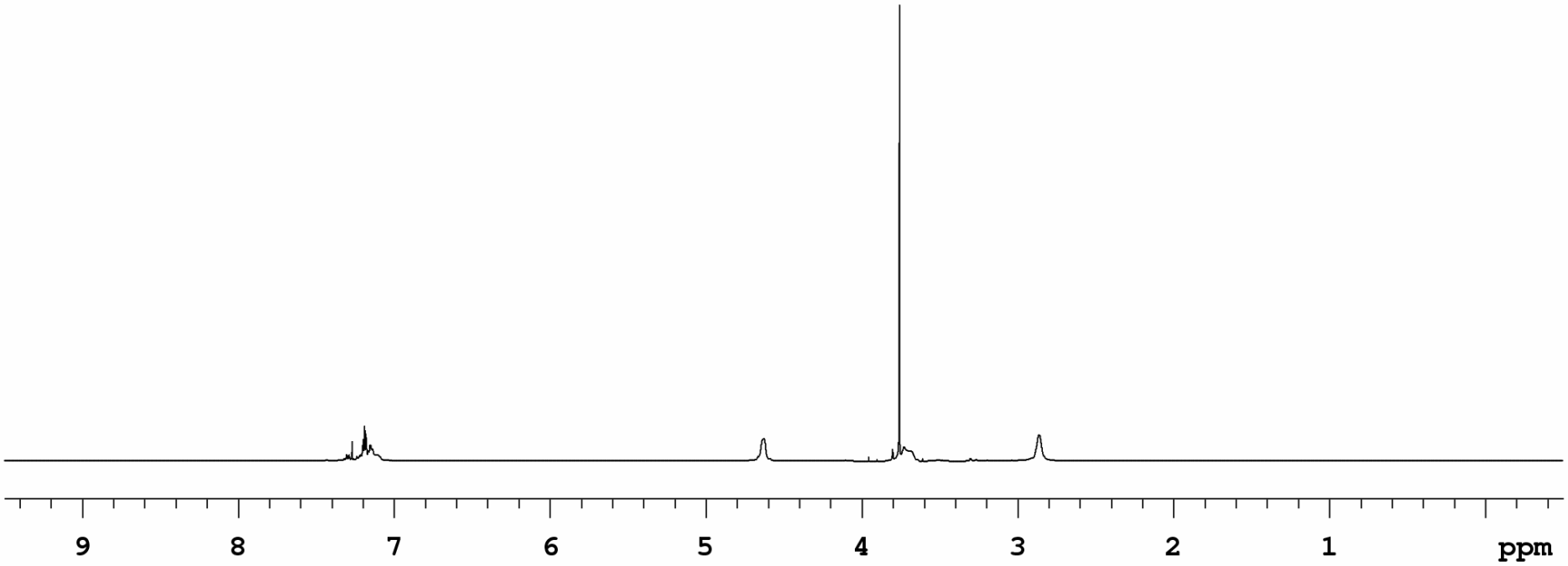

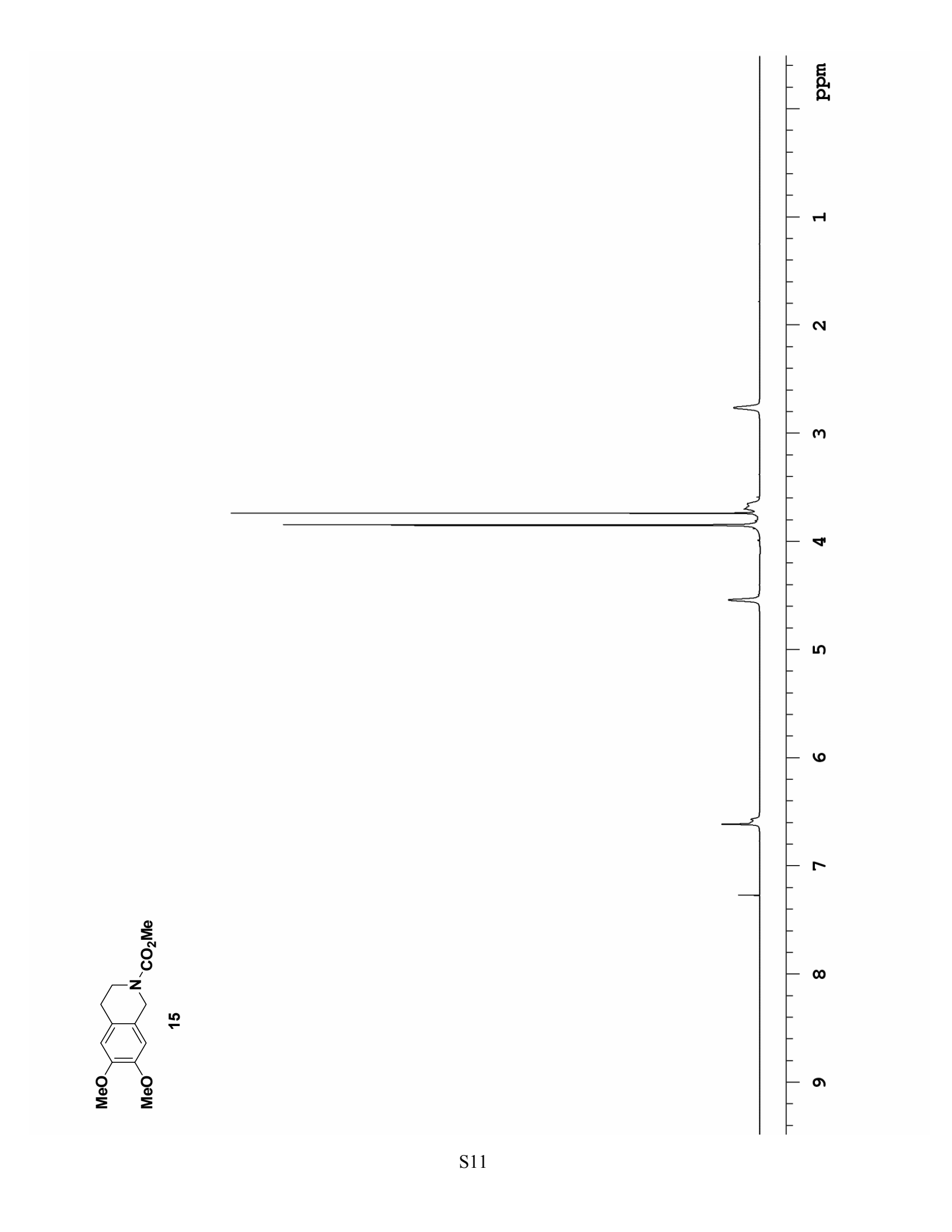
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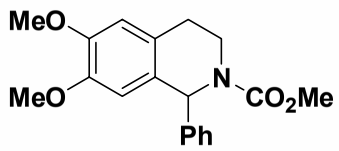

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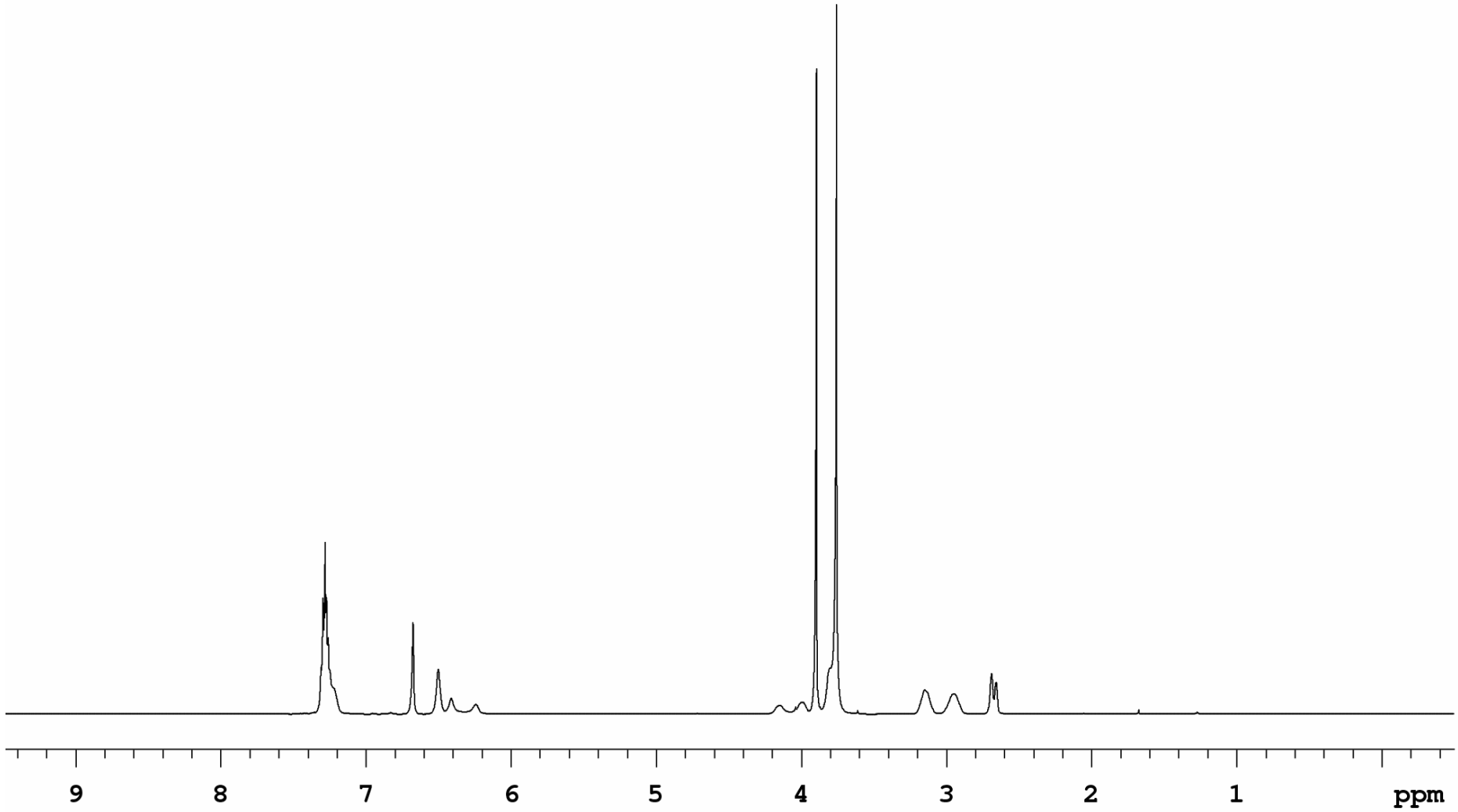

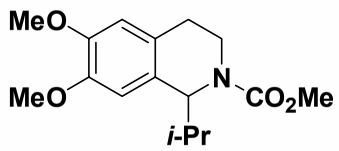

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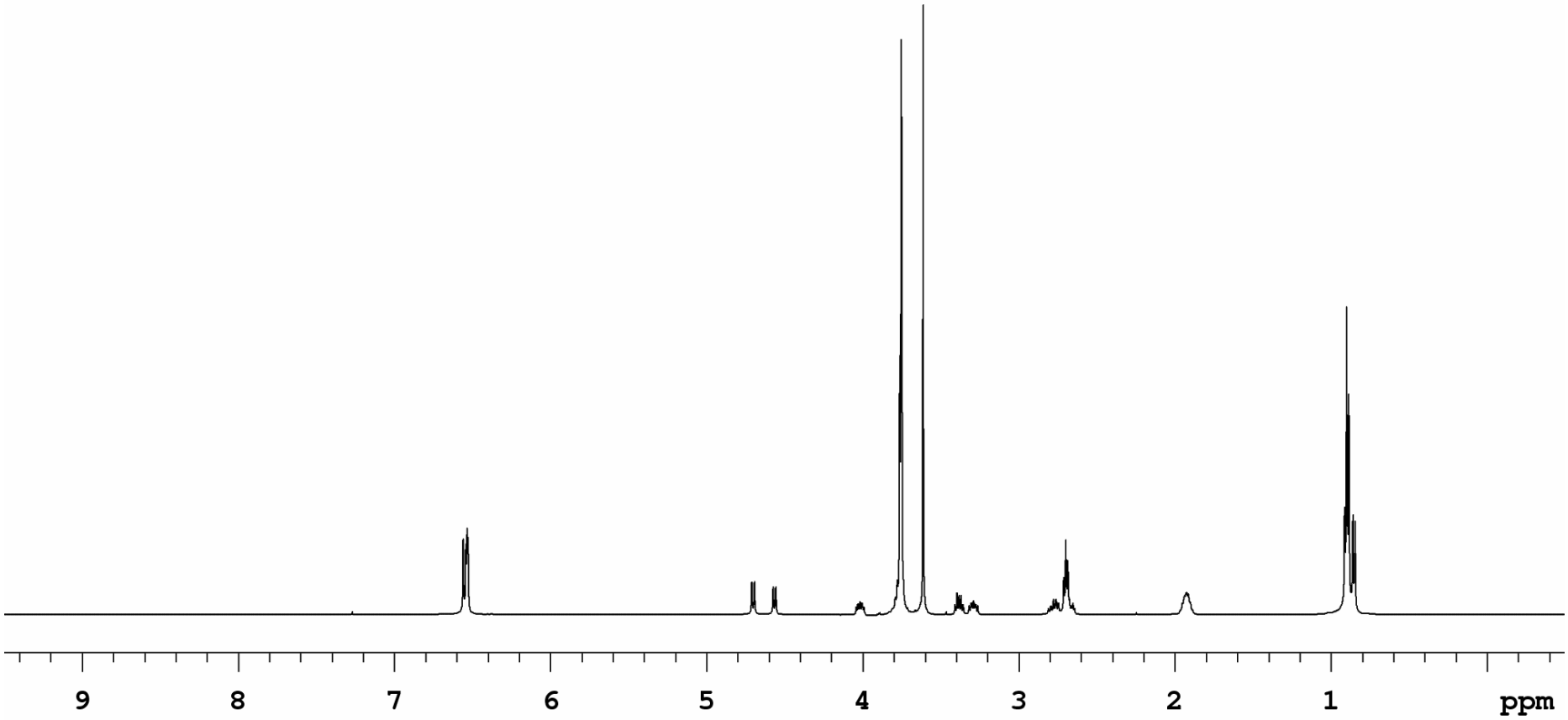

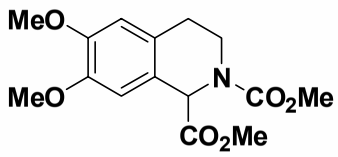

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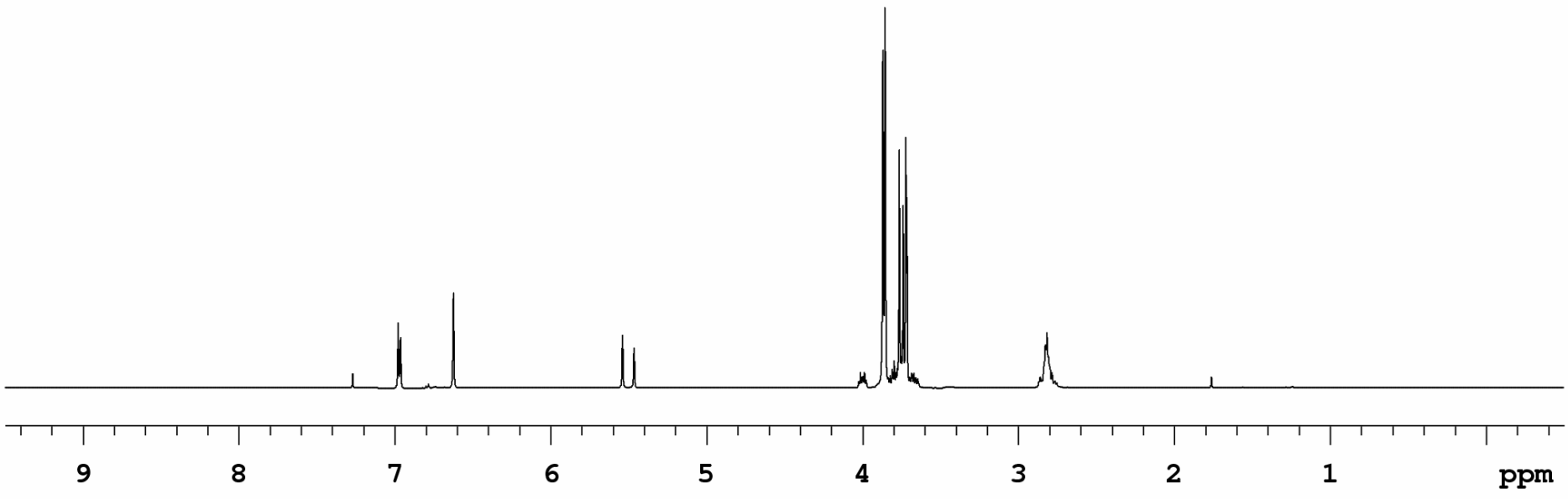

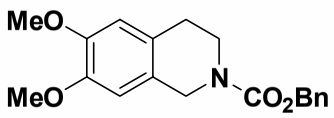

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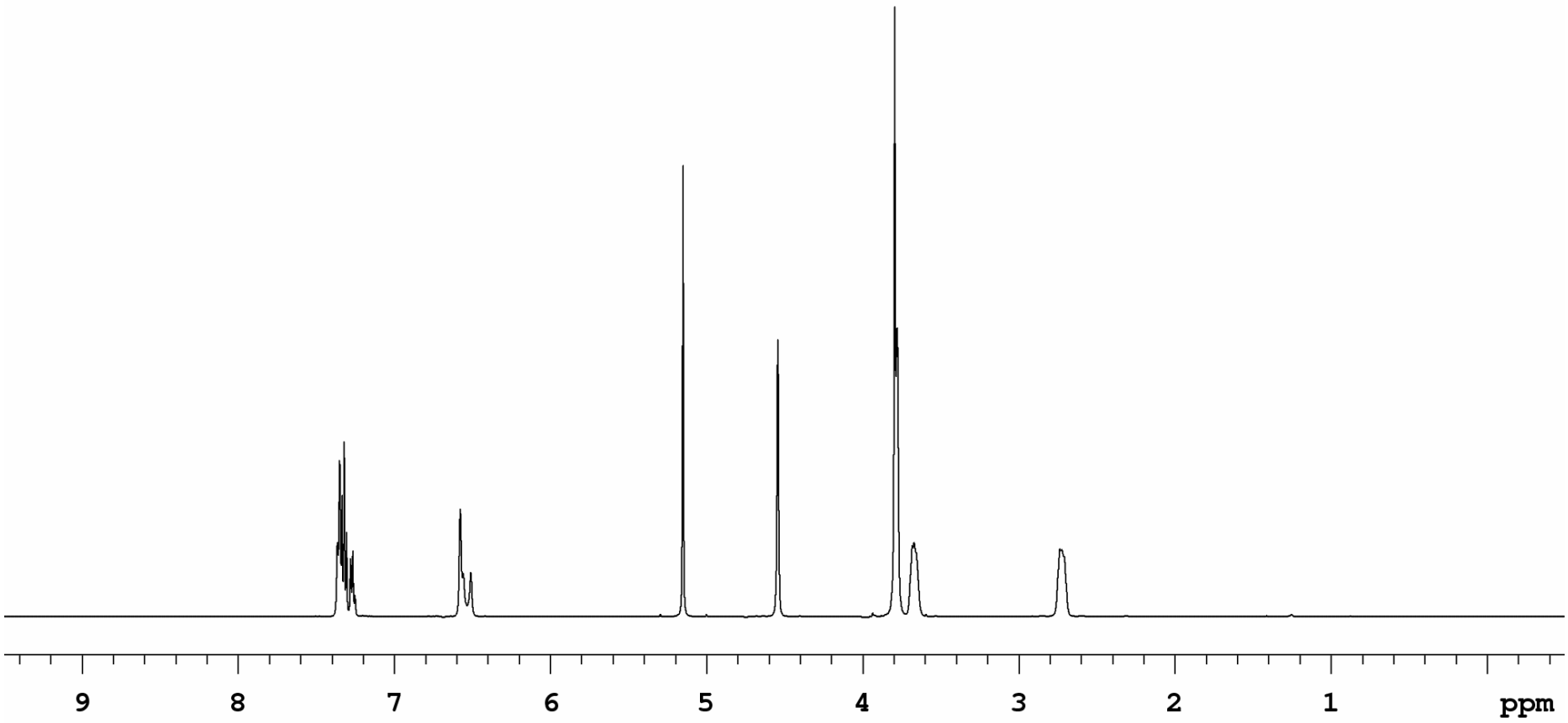

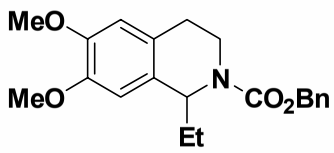

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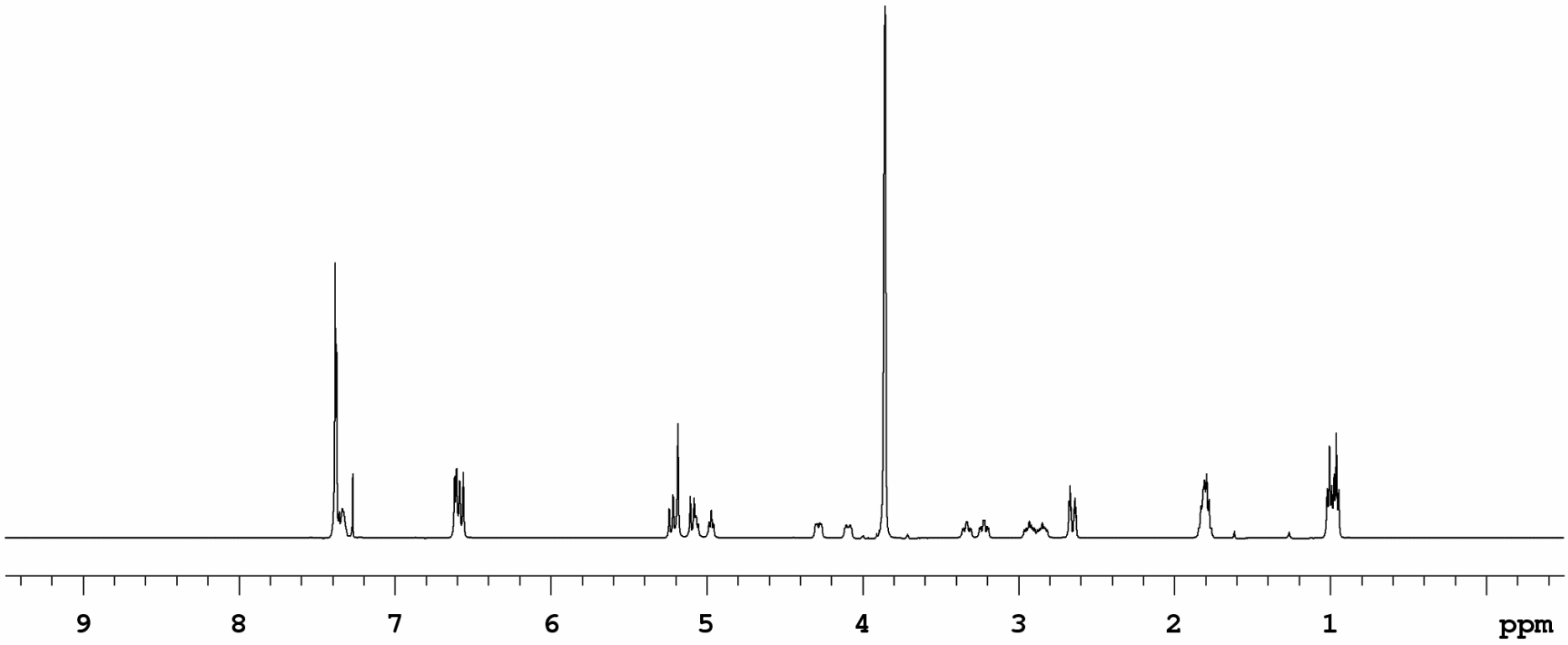

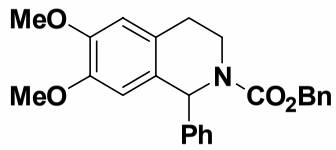

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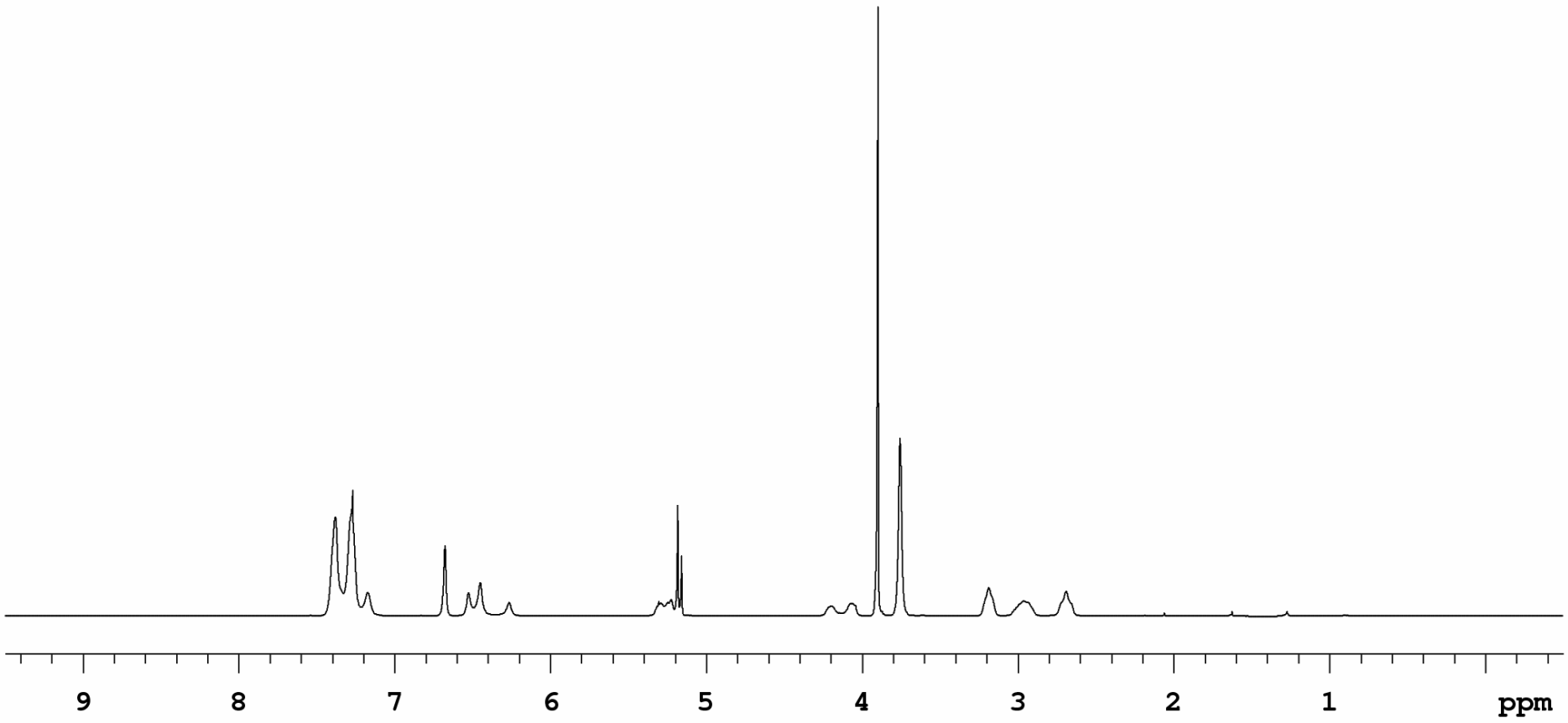

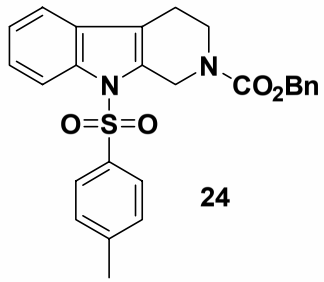

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