Supporting Information

Effective Asymmetric Synthesis of CBI

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^{1}H NMR's

4-Acetoxy-1-(acetylamino)naphthalene (S2). A solution of 4-aminonaphthol hydrochloride (**S1**, 10.0 g, 52 mmol) in anhydrous CH_2Cl_2 (600 mL) was cooled to 0 ºC and treated with Et_3N (22 mL, 158 mmol). The dark brown solution was stirred for 30 min, treated dropwise with Ac_2O (10.0 mL, 108 mmol), and stirred for 3 h at 0 ºC. The mixture was quenched by addition of MeOH (40 mL) and concentrated in vacuo. The resulting dark brown product was suspended in cold H_2O (300 mL), filtered, and dried in vacuo. The product could be recrystallized from EtOAc–hexanes, or simply suspended in 10% EtOAc–hexanes (300 mL) and washed with 10% EtOAc–hexanes to afford **S2** (9.24 g, 74%, typically 70–84%) as an off white powder: mp 152–154 °C (beige needles, EtOAc–hexanes); lit.[37] mp 158 °C (prisms, H_2O); ^{1}H NMR (acetone-d_6, 400 MHz) δ 9.19 (1H, br s), 8.13 (1H, dd, J = 6.3, 2.8 Hz), 7.94 (1H, dd, J = 6.2, 2.9 Hz), 7.85 (1H, d, J = 8.2 Hz), 7.54 (2H, m), 7.25 (1H, d, J = 8.2 Hz), 2.43 (3H, s), 2.23 (3H, s); ^{13}C NMR (acetone-d_6, 100 MHz) δ 169.9, 169.4, 144.8, 132.7, 129.5, 128.2, 127.1, 127.0, 123.4, 122.5, 121.6, 118.8, 23.8, 20.7; IR (film) ν_{max} 3262, 1762, 1654, 1540, 1506, 1203 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 244.0971 ($M+H^+$, $C_{14}H_{13}NO_3$ requires 244.0968).

4-Acetoxy-1-acetylamino-2-nitronaphthalene (5). Compound **S2** (8.78 g, 36.1 mmol) was added in several portions to 90% HNO_3 (6.0 mL, 144 mmol, 4 equiv) at 0 ºC. Upon complete addition of **S2**, the mixture was stirred at 18 ºC for 1 h. The dark red mixture was poured into ice (200 mL), filtered, and washed with several portions of cold H_2O. The orange solid was then dissolved in a minimal amount of EtOH and precipitated by the slow addition of H_2O to afford **5** (7.18 g, 69%, typically 59–78%) as an orange solid: mp 212–213 °C (yellow needles, EtOH); lit.[37] mp 216–217 °C (crystals, EtOH); ^{1}H NMR (DMSO-d_6, 400 MHz) δ 10.45 (1H, s), 8.31 (1H, m), 8.08 (1H, m), 7.91(1H, s), 7.82 (2H, m), 2.49 (3H, s) 2.19 (3H, s); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 169.3, 169.3, 144.6, 141.9, 129.9, 129.8, 128.7, 127.6, 125.8, 125.4, 121.9,

113.7, 22.9, 20.8; IR (film) ν_{max} 2986, 1762, 1654, 1506, 1191 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 311.0640 ($M+Na^+$, $C_{14}H_{12}N_2O_5$ requires 311.0644).

1-Acetylamino-4-hydroxy-2-nitronaphthalene (6). A solution of **5**[37] (7.18 g, 24.9 mmol) in MeOH (200 mL, dried over 4 Å molecular sieves) was treated with K_2CO_3 (3.79 g, 27.4 mmol) in portions at 0 ºC. The solution turned deep red and was stirred at 0 ºC for 30 min. A solution of 1 M aqueous HCl was added until the pH was less than 6 and the solvent was removed in vacuo. The solid was suspended in cold H_2O (100 mL), filtered, and washed several times with cold H_2O to afford **6** (6.17 g, 99%) as a dark red solid which was used in the next reaction without further purification. Flash chromatography (SiO_2, 66% EtOAc–hexanes) provided **6** as a light orange solid: mp 221–222 °C; ^1H NMR (acetone-d_6, 600 MHz) δ 9.90 (1H, s), 9.34 (1H, s), 8.22 (1H, d, *J* = 7.3 Hz), 8.17 (1H, d. *J* = 7.3 Hz), 7.67 (1H, t, *J* = 6.4 Hz), 7.66 (1H, t, *J* = 6.4 Hz), 7.28 (1H, s), 2.24 (3H, s); ^{13}C NMR (acetone-d_6, 150 MHz) δ 170.7, 153.5, 144.8, 132.1, 129.2, 128.8, 127.9, 125.9, 123.5, 120.8, 103.2, 23.3; IR (film) ν_{max} 3231, 1665, 1513, 1357 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 269.0537 ($M+Na^+$, $C_{12}H_{10}N_2O_4$ requires 269.0533).

1-Acetylamino-4-benzyloxy-2-nitronaphthalene (7). A solution of **6** (2.67 g, 10.8 mmol) in DMF (50 mL) at 25 °C was treated with Bu_4NI (80 mg, 0.22 mmol), and K_2CO_3 (2.09 g, 15.2 mmol) and the solution was stirred for 15 min. Benzyl bromide (1.36 mL, 11.4 mmol) was added dropwise, and the resulting solution was stirred for 1 h. The reaction mixture was poured into H_2O (500 mL) and the yellow solid was collected by filtration. The solid was suspended in a small amount of cold acetone, filtered, and washed with cold acetone to afford **7** (2.23 g, 71%, typically 71–92%) as a bright yellow solid: mp 199–200 °C (yellow needles, acetone); ^1H NMR (DMSO-d_6, 400 MHz) δ 10.26 (1H, s), 8.30 (1H, d, *J* = 9.1 Hz), 8.18 (1H, d, *J* = 9.1 Hz), 7.77 (2H, m), 7.58 (2H, d, *J* = 7.0 Hz), 7.52 (1H, s), 7.46 (2H, t, *J* = 7.3 Hz) 7.38 (1H, t, *J* = 7.2 Hz),

5.42 (2H, s), 2.16 (3H, s); ^{13}C NMR (DMSO-d_6, 100 MHz) δ 169.3, 152.5, 143.3, 136.3, 130.0, 128.8, 128.6 (2C), 128.2, 127.7 (2C), 127.6, 126.8, 125.1, 122.1, 120.7, 100.5, 70.3, 22.8; IR (film) ν_{max} 3264, 1662 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 359.1005 (M+Na$^+$, $C_{19}H_{16}N_2O_4$ requires 359.1002).

1-Amino-4-hydroxy-2-nitronaphthalene (8). A sample of **7** (4.62 g, 13.7 mmol) was added as a solid to 2 N NaOH in MeOH (100 mL). A deep red color developed, and the solution was stirred for 3 h at 70 ºC. The solution was cooled to 25 ºC and poured into saturated aqueous NH_4Cl (100 mL), followed by H_2O (100 mL). The orange–red solid was collected by filtration, washed with cold H_2O, and dried in vacuo. The solid was dissolved in a minimal amount of EtOAc and precipitated with hexanes to afford **8** (3.14 g, 78%, typically 74–78%) as a bright red solid: mp 150–151 °C (red needles, EtOAc–hexanes); ^{1}H NMR ($CDCl_3$, 400 MHz) δ 8.31 (1H, d, *J* = 8.2 Hz), 7.97 (1H, d, *J* = 8.2 Hz), 7.69 (1H, t, *J* = 7.9 Hz), 7.61 (1H, t, *J* = 8.2 Hz), 7.52 (2H, d, *J* = 7.4 Hz), 7.49 (1H, s) 7.44 (2H, t, *J* = 7.2 Hz), 7.38 (1H, t, *J* = 7.2 Hz), 7.26 (2H, br s), 5.19 (2H, s); ^{13}C NMR ($CDCl_3$, 100 MHz) δ 145.7, 140.5, 136.7, 130.5, 130.4, 128.8 (2C), 128.3, 127.8 (2C), 127.6, 126.2, 124.3, 123.6, 122.6, 99.3, 70.6; IR (film) ν_{max} 3563, 3339, 1597 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 295.1080 (M+H$^+$, $C_{17}H_{14}N_2O_3$ requires 295.1077).

4-Benzyloxy-1-chloro-2-nitronaphthalene (10). A solution of **8** (5.55 g, 18.9 mmol) in DME (5 mL) was added slowly to a solution of BF_3–OEt_2 (3.6 mL, 28.4 mmol) in DME (40 mL) at –15 °C, and the mixture was stirred for 30 min at –15 °C. *t*-BuONO (3.4 mL, 28.4 mmol) in DME (5 mL) was added dropwise, and the mixture was warmed to 0 ºC and stirred for 1.5 h. Pentane (50 mL) was added to completely precipitate the diazonium salt. The solution was filtered and washed with cold Et_2O to afford **9** (5.64 g, 76%) as a yellow solid: mp 126–128 °C; ^{1}H NMR (CD_3CN, 400 MHz) δ 8.65 (1H, d, *J* = 8.5 Hz), 8.26–8.29 (2H, m), 8.24 (1H, s), 8.04 (1H, m),

7.63 (2H, dd, J = 6.3, 1.8 Hz), 7.51 (3H, m), 5.76 (2H, s); ^{13}C NMR (CD_3CN, 100 MHz) δ 169.8, 136.8, 134.7, 132.9, 130.8, 130.4, 130.3, 130.0 (2C), 129.5 (2C), 129.4, 127.2, 126.6, 123.7, 106.8, 75.6; ^{19}F NMR (CD_3CN, 376 MHz) δ –151.21; IR (film) ν_{max} 1037, 743 cm^{-1}.

A solution of CuCl (17.8 g, 180 mmol) and $CuCl_2$ (28.9 g, 215 mmol) in H_2O (130 mL) cooled to 0 ºC was treated slowly with **9** (5.64 g, 14.4 mmol) in CH_3CN (80 mL). The mixture was warmed to 25 °C and stirred for 45 min. A saturated aqueous $NaHCO_3$ solution was added to adjust the pH to 7, H_2O (200 mL) was added to dissolve the copper salts, and the mixture was extracted with EtOAc (3 × 200 mL). The organic layer was dried (Na_2SO_4) and concentrated in vacuo. The crude product was filtered through a SiO_2 plug with EtOAc to afford **10** (3.40 g, 75%) as a tan solid: mp 139–140 °C (tan prisms, EtOAc–hexanes); ^{1}H NMR ($CDCl_3$, 400 MHz) δ 8.43 (1H, d, J = 8.5 Hz), 8.40 (1H, d, J = 8.5 Hz), 7.76 (1H, t, J = 8.2 Hz), 7.69 (1H, t, J = 8.4 Hz), 7.52 (2H, d, J = 8.5 Hz), 7.44 (3H, m), 5.29 (2H, s); ^{13}C NMR ($CDCl_3$, 125 MHz) δ 154.1, 145.8, 135.6, 131.2, 129.6, 129.0 (2C), 128.9, 128.7, 127.8 (2C), 127.8, 126.3, 123.0, 117.4, 100.8, 71.1; IR (film) ν_{max} 1507, 1348 cm^{-1}. Anal. Calcd for $C_{17}H_{12}ClNO_3$: C, 65.08; H, 3.86; N, 4.46. Found: C, 65.46; H, 3.78; N, 4.16.

Dimethyl 2-(4-Benzyloxy-2-nitronaphthalen-1-yl)malonate (11). A solution of dimethyl malonate sodium salt was prepared by suspending NaH (60% mineral oil dispersion, 0.592 g, 24.7 mmol) in DMF (40 mL). The solution was cooled to 0 °C and dimethyl malonate (2.83 mL, 24.7 mmol) was added slowly. Stirring was continued for 30 min at 0 °C before the solution was combined with a solution of **10** (1.55 g, 4.94 mmol) in DMF (10 mL). This mixture was warmed to 80 ºC for 12 h. After cooling to 25 °C, saturated aqueous $NaHCO_3$ (50 mL) was added. The product was extracted into Et_2O (3 × 50 mL). The combined organic extracts were washed with H_2O (3 × 20 mL), dried (Na_2SO_4), and concentrated in vacuo. The crude residue was dissolved in

a minimal amount of EtOAc and precipitated by the slow addition of hexanes to afford **11** (1.60 g, 79%, typically 75–86%) as a yellow solid: mp 121–122 °C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ 8.44 (1H, d, *J* = 7.6 Hz), 8.10 (1H, d, *J* = 8.8 Hz), 7.68 (1H, td, *J* = 6.7, 1.5 Hz), 7.64 (1H, td, *J* = 7.0, 1.2 Hz), 7.53 (2H, d, *J* = 6.8 Hz), 7.44 (3H, m), 7.41 (1H, s), 5.65 (1H, s), 5.32 (2H, s), 3.76 (6H, s); ^{13}C NMR ($CDCl_3$, 100 MHz) δ 167.9 (2C), 155.6, 148.7, 135.8, 132.8, 129.1, 129.0 (2C), 128.7, 128.4, 128.0, 127.9 (2C), 126.1, 123.4, 117.9, 100.4, 71.1, 53.3 (2C), 51.0; IR (film) ν_{max} 1749, 1513, 1236 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 432.1069 (M+Na$^+$, $C_{22}H_{19}O_7N$ requires 432.1054).

2-(4-Benzyloxy-2-nitronaphthalen-1-yl)propane-1,3-diol (12). A solution of **11** (0.504 g, 1.23 mmol) in anhydrous dioxane (10 mL) was treated with BH_3–SMe_2 (0.37 mL, 3.66 mmol). The mixture was stirred at 70 °C in a closed vessel for 16 h. The mixture was cooled to 25 °C and most of the solvent was removed by a stream of N_2. The residue was cooled to 0 °C and treated dropwise with saturated aqueous $NaHCO_3$ (5 mL). The mixture was extracted into Et_2O (3 × 30 mL), dried (Na_2SO_4), and concentrated in vacuo. Flash chromatography (SiO_2, 50% EtOAc–hexanes) afforded **12** (0.316 g, 73%; typically 70–76%) as a yellow oil which solidified slowly: mp 120–121 °C (yellow prisms, THF–Et_2O); ^{1}H NMR ($CDCl_3$, 600 MHz) δ 8.43 (1H, dd, *J* = 9.2, 1.5 Hz), 8.24 (1H, br s), 7.66 (1H, t, *J* = 7.5 Hz), 7.61 (1H, t, *J* = 7.0 Hz), 7.52 (2H, d, *J* = 7.5 Hz), 7.45 (2H, t, *J* = 7.5 Hz), 7.40 (1H, t, *J* = 7.5 Hz), 7.03 (1H, s), 5.25 (2H, s), 4.43 (2H, br s), 4.13 (2H, t, *J* = 7.0 Hz), 3.87 (1H, br s), 2.44 (2H, br s); ^{13}C NMR ($CDCl_3$, 100 MHz) δ 154.4, 149.7, 135.7, 132.4, 128.8 (2C), 128.6, 128.5, 127.60 (2C), 127.56, 127.4, 126.0, 123.4, 121.7, 99.8, 70.7, 64.9 (2C), 46.3; IR (film) ν_{max} 3378, 1527, 1362 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 376.1162 (M+Na$^+$, $C_{20}H_{19}NO_5$ requires 376.1661).

Alternative Synthesis of (*S*)-**17**

(*S*)-1-(Acetoxymethyl)-5-benzyloxy-3-(*tert*-butyloxycarbonyl)-1,2-dihydro-3*H*-benz[*e*]indole ((*S*)-18). A solution of (*R*)-**14** (102 mg, 0.215 mmol) in THF (1.0 mL) was treated with PtO_2 (5 mg), Et_3N (60.0 μL, 0.430 mmol), and Boc_2O (189 mg, 0.861 mmol) and the mixture was stirred at 25 °C for 3 h under 1 atm of H_2. The reaction mixture was filtered through Celite and stirred for an additional 6 h. The reaction mixture was then concentrated in vacuo. Flash chromatography (SiO_2, 1–10% EtOAc–hexanes) provided (*S*)-**18** (40.0 mg, 42%) as a white solid: mp 105–106 °C (white needles, 10% EtOAc–hexanes) $[\alpha]^{23}_D$ +6 (*c* 1.0, $CHCl_3$); ^{1}H NMR ($CDCl_3$, 600 MHz) δ 8.29 (1H, d, *J* = 8.3 Hz), 7.89 (1H, br s), 7.79 (1H, d, *J* = 8.3 Hz), 7.56 (2H, br s), 7.52 (1H, t, *J* = 7.0 Hz), 7.44 (1H, d, *J* = 6.5 Hz), 7.43 (1H, s), 7.38 (1H, t, *J* = 7.5 Hz), 7.34 (1H, t, *J* = 7.5 Hz), 5.28 (2H, s), 4.58 (1H, d, *J* = 7.8 Hz), 4.09 (2H, m), 3.96 (1H, td, *J* = 7.0, 3.5 Hz), 3.89 (1H, t, *J* = 10.0 Hz) 2.12 (3H, s), 1.62 (9H, s); ^{13}C NMR ($CDCl_3$, 100 MHz) δ 171.3, 156.0, 152.8, 141.8, 137.1, 130.8, 128.9, 128.8 (2C), 128.3, 128.2, 127.7 (2C), 123.5, 123.3, 122.6, 114.2, 96.6, 81.1, 70.4, 66.1, 52.8, 38.5, 28.7 (3C), 21.2; IR (film) ν_{max} 2979, 1741, 1701, 1582, 1332 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 470.1994 ($M+Na^+$, $C_{27}H_{29}NO_5$ requires 470.1938).

The recrystallization of (*S*)-**18** (EtOAc–hexanes) may be used to further enrich the optical purity of this and the following synthetic intermediates.

(*S*)-5-(Benzyloxy)-3-(*tert*-butyloxycarbonyl)-1-(hydroxymethyl)-1,2-dihydro-3*H*-benz[*e*]indole ((*S*)-19). A solution of (*S*)-**18** (40.0 mg, 0.089 mmol) in MeOH (0.5 mL) was treated with K_2CO_3 (13.6 mg, 0.0983 mmol) and stirred at 25 °C for 30 min. A solution of 1 M aqueous HCl was added to adjust the pH to 6, and the mixture was extracted with EtOAc (3 × 20 mL). The combined organic layers were dried (Na_2SO_4), and concentrated in vacuo providing

(*S*)-**19** (33.6 mg, 93%) as a clear film which did not require further purification. The *ee* of (*S*)-**19** was determined by HPLC (Chiralcel OD column, 0.46 × 25 cm, 19:1 hexanes–*i*-PrOH, 1 mL/min, retention times: 15.4 min (*S*)-**19**), 18.7 min (*S*)-**19**): before recrystallization of (*S*)-**18** (96% *ee*)**,** after recrystallization of (*S*)-**18** (99.9% *ee*). (*S*)-**19** correlates with the literature compound which can be converted to *seco*-*N*-Boc-CBI. For (*S*)-**19**: $[\alpha]^{23}_{D}$ +5 (*c* 0.19, $CHCl_3$); lit.[11] $[\alpha]^{23}_{D}$ +5.1 (*c* 1.78, CH_2Cl_2); ^{1}H NMR ($CDCl_3$, 600 MHz) δ 8.29 (1H, d, *J* = 8.8 Hz), 7.92 (1H, br s), 7.72 (1H, d, *J* = 7.5 Hz), 7.56 (2H, br s), 7.49 (1H, t, *J* = 7.5 Hz), 7.44 (2H, t, *J* = 7.9 Hz), 7.37 (1H, t, *J* = 7.5 Hz), 7.33 (1H, t, *J* = 7.0 Hz), 5.28 (2H, s), 4.21 (1H, m), 4.15 (1H, t, *J* = 9.2 Hz), 3.96 (1H, dd, *J* = 7.0, 3.5 Hz), 3.87 (1H, m), 3.80 (1H, m), 1.61 (9H, s).

Synthesis of *ent*-**17**

(*R*)-1-Acetoxy-2-(4-benzyloxy-2-nitronaphthalen-1-yl)-3-(*tert*-butyldimethylsilyloxy)propane ((*R*)-21). A solution of (*S*)-**13** (63.9 mg, 0.162 mmol) in DMF (1.6 mL) was treated with TBSCl (36.6 mg, 0.243 mmol) and imidazole (22.1 mg, 0.324 mmol) and the mixture was stirred for 2 h at 25 °C. H_2O (5 mL) was added, and the solution was extracted with Et_2O (3 × 20 mL). The combined organic extracts were washed with H_2O (3 × 20 mL), dried (Na_2SO_4), and concentrated in vacuo. Flash chromatography (SiO_2, 10% EtOAc–hexanes) afforded (*R*)-**21** (57.4 mg, 70%) as a yellow film: $[\alpha]^{23}_{D}$ –19 (*c* 1.0, $CHCl_3$); ^{1}H NMR ($CDCl_3$, 600 MHz) δ 8.44 (1H, d, *J* = 6.3 Hz), 8.24 (1H, br s), 7.64 (1H, br s), 7.61 (1H, t, *J* = 7.5 Hz), 7.53 (2H, d, *J* = 7.5 Hz), 7.46 (2H, t, *J* = 7.0 Hz), 7.40 (1H, t, *J* = 7.0 Hz), 7.06 (1H, s), 5.27 (2H, s), 4.90 (1H, br s), 4.57 (1H, br s), 4.24 (1H, br s), 4.14 (1H, br s), 3.83 (1H, br s), 2.00 (3H, s), 0.83 (9H, s), –0.01 (3H, s), –0.05 (3H, s); ^{13}C NMR ($CDCl_3$, 125 MHz) δ 171.1, 154.5, 150.7, 136.0, 132.3, 129.0 (2C), 128.6, 128.2, 127.8 (2C), 127.6, 127.5, 127.2, 123.5, 122.3, 100.3, 70.9, 64.9, 63.9, 43.7, 25.9 (3C), 21.1, 18.3, –5.36, –5.41; IR (film) ν_{max} 1742, 1531,

1362, 1101 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 532.2142 ($M+Na^+$, $C_{28}H_{35}NO_6Si$ requires 532.2126).

(*R*)-2-(4-Benzyloxy-2-nitronaphthalen-1-yl)-3-(*tert*-butyldimethylsilyloxy)propan-1-ol ((*R*)-22). A solution of (*R*)-**21** (57.4 mg, 0.113 mmol) in MeOH (1.0 mL) was treated with K_2CO_3 (62.3 mg, 0.450 mmol) at 25 °C. The mixture was stirred for 30 min before being diluted with CH_2Cl_2 (10 mL). The solution was washed with H_2O (10 mL), dried (Na_2SO_4), and concentrated in vacuo. Flash chromatography (SiO_2, 20% EtOAc~hexanes) afforded (*R*)-**22** (44.4 mg, 83%) as a yellow film: $[\alpha]^{23}_D$ +16 (*c* 1.2, $CHCl_3$); ^1H NMR ($CDCl_3$, 500 MHz) δ 8.43 (1H, d, *J* = 8.0 Hz), 8.29 (1H, br s), 7.67 (1H, br s), 7.62 (1H, t, *J* = 7.7 Hz), 7.52 (2H, d, *J* = 7.0 Hz), 7.47 (2H, t, *J* = 7.0 Hz), 7.40 (1H, t, *J* = 7.3 Hz), 7.03 (1H, br s), 5.26 (2H, s), 4.52 (1H, br s), 4.38 (1H, br s), 4.13 (1H, br s), 4.03 (1H, br s), 3.81 (1H, br s), 2.49 (1H, br s), 0.90 (9H, s), 0.08 (3H, s), 0.05 (3H, s); ^{13}C NMR ($CDCl_3$, 100 MHz) δ 154.5, 150.3, 136.0, 132.7, 129.0 (2C), 128.6, 128.4, 127.82, 127.78 (2C), 127.6, 127.5, 127.2, 123.5, 100.1, 70.9, 65.7, 65.2, 46.5, 26.0 (3C), 18.3, 5.31, 5.34; IR (film) ν_{max} 3425, 1531, 1360, 1101 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 490.2015 ($M+Na^+$, $C_{26}H_{33}NO_5Si$ requires 490.2020).

(*S*)-2-(4-Benzyloxy-2-nitronaphthalen-1-yl)-3-(*tert*-butyldimethylsilyloxy)-1-(methanesulfonyloxy)propane ((*S*)-23). A solution of (*R*)-**22** (34.5 mg, 0.074 mmol) in pyridine (0.5 mL) cooled to 0 °C was treated dropwise with MsCl (11 μL, 0.15 mmol) and the mixture was stirred for 1 h at 0 °C and at 25 °C for 1 h. Ice H_2O (5 mL) was added and the mixture was extracted with EtOAc (3 × 10 mL), washed with aqueous 1 N HCl (3 × 10 mL), dried (Na_2SO_4), and concentrated in vacuo to afford (*S*)-**23** (37.2 mg, 93%) as a tan film which was used in the next reaction without further purification: $[\alpha]^{23}_D$ –19 (*c* 1.6, $CHCl_3$); ^1H NMR ($CDCl_3$, 600 MHz) δ 8.45 (1H, d, *J* = 8.3 Hz), 8.18 (1H, br s), 7.67 (1H, br s), 7.65 (1H, t, *J* =

7.4 Hz), 7.52 (2H, d, *J* = 7.5 Hz), 7.46 (2H, t, *J* = 7.5 Hz), 7.41 (1H, t, *J* = 7.5 Hz), 7.10 (1H, s), 5.28 (2H, s), 4.99 (1H, br s), 4.76 (1H, br s), 4.29 (1H, br s), 4.19 (1H, br s), 3.92 (1H, br s), 2.89 (3H, s), 0.83 (9H, s), 0.01 (3H, s), –0.02 (3H, s); ^{13}C NMR ($CDCl_3$, 125 MHz) δ 154.9, 150.7, 135.9, 132.2, 129.02, 129.01 (2C), 128.74, 128.69, 127.8 (2C), 127.6, 127.2, 123.6, 121.0, 100.2, 71.0, 69.7, 63.3, 43.9, 37.5, 25.9 (3C), 18.3, –5.3, –5.4; IR (film) ν_{max} 1531, 1389, 1177, 1101, 956 cm^{-1}. Anal. Calcd for $C_{27}H_{35}NO_7SiS$: C, 59.42; H, 6.46; N, 2.57. Found: C, 59.64; H, 6.08; N, 2.61.

(*R*)-1-(*tert*-Butyldimethylsilyloxymethyl)-3-(*tert*-butyloxycarbonyl)-5-hydroxy-1,2-dihydro-3*H*-benz[*e*]indole ((*R*)-24). A solution of (*S*)-**23** (67.5 mg, 0.084 mmol) in THF (3.0 mL) was treated with 10% Pd/C (10 mg), Et_3N (32.0 μL, 0.247 mmol), and Boc_2O (80.0 mg, 0.371 mmol) and the mixture was stirred at 25 °C for 24 h under 1 atm of H_2. The reaction mixture was filtered through Celite and concentrated in vacuo. Flash chromatography (SiO_2, 1–5% EtOAc–hexanes) provided (*R*)-**24** (50.0 mg, 95%; typically 66̃95%) as a clear film: $[\alpha]^{23}_D$ +17 (*c* 1.0, $CHCl_3$); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 8.21 (1H, d, *J* = 8.2 Hz), 7.87 (1H, s), 7.69 (1H, d, *J* = 8.5 Hz), 7.47 (1H, t, *J* = 7.0 Hz), 7.31 (1H, t, *J* = 7.3 Hz), 4.26 (1H, d, *J* = 11.5 Hz), 4.00 (2H, m), 3.77 (1H, m), 3.49 (1H, t, *J* = 9.9 Hz), 1.62 (9H, s), 0.91 (9H, s), 0.06 (3H, s), 0.00 (3H, s); ^{13}C NMR ($CDCl_3$, 100 MHz) δ 153.6, 153.5, 141.1, 131.0, 127.2, 123.6, 122.8, 121.7, 121.4, 115.7, 99.5, 81.4, 64.9, 52.6, 41.9, 28.7 (3C), 26.1 (3C), 18.6, –5.2, –5.3; IR (film) ν_{max} 3344, 2929, 1666, 1258, 1142 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 429.2351 (M^+, $C_{24}H_{35}NO_4Si$ requires 429.2335).

(*R*)-3-(*tert*-Butyloxycarbonyl)-5-hydroxy-1-hydroxymethyl-1,2-dihydro-3*H*-benz[*e*]indole ((*R*)-16). A solution of (*R*)-**24** (125 mg, 0.290 mmol) in THF (4.0 mL) was treated with Bu_4NF (1.0 M in THF, 0.35 mL, 0.348 mmol) and the mixture was stirred for 1 h. Aqueous saturated

NaCl (5.0 mL) was added and the mixture was extracted with EtOAc (3 × 5 mL). The combined organic layers were washed with aqueous saturated NaCl (5 mL), dried (Na_2SO_4), and concentrated in vacuo. Flash chromatography (SiO_2, 33% EtOAc–hexanes) provided (*R*)-**16** (82.5 mg, 90%; typically 90–98%) as a beige film: $[\alpha]^{23}_D$ +1.6 (*c* 1.0, $CHCl_3$), identical in all other respects with its enantiomer and authentic material.

(*R*)-3-(*tert*-Butyloxycarbonyl)-1-(chloromethyl)-5-hydroxy-1,2-dihydro-3*H*-benz[*e*]indole ((*R*)-17). A solution of (*R*)-**16** (19.3 mg, 0.0612 mmol) in CH_2Cl_2 (0.5 mL) at 25 °C was treated with Ph_3P (48.3 mg, 0.184 mmol), and CCl_4 (53 μL, 0.551 mmol) and the mixture was stirred for 3 h. The reaction mixture was concentrated in vacuo. Flash chromatography (SiO_2, 10–20% EtOAc–hexanes) provided (*R*)-**17** (15.3 mg, 75%) as a white solid. (*R*)-**17** was identical to authentic compound. The recrystallization of (*R*)-**17** (EtOAc–hexanes) may be used to further enrich (≥99.9% *ee*) the optical purity of this and the following synthetic intermediates.

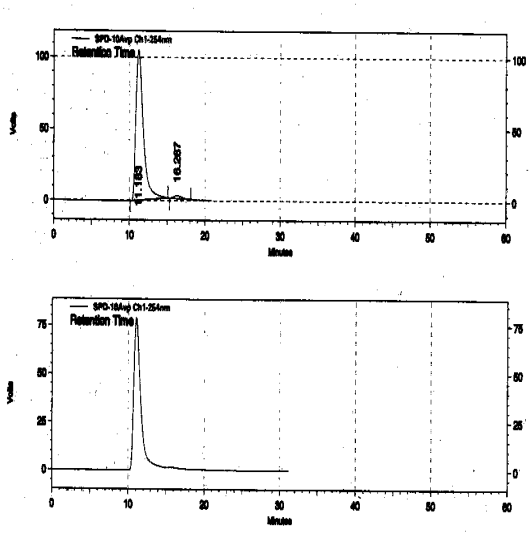
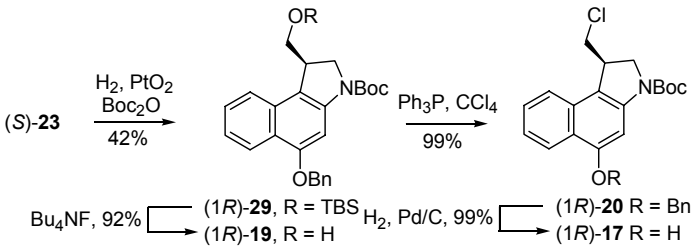


Figure S1. HPLC trace of (*R*)-**17** before (97% *ee*) and after recrystallization (≥99.9% *ee*) from EtOAc–hexanes (CHIRALCEL® OD 0.46 × 25 cm, 49:1 hexanes–*i*-PrOH, 1 mL/min, retention times: 11.2 min (*R*)-**17**, 16.3 min (*S*)-**17**).

Alternative Synthesis of (*R*)-**17.**

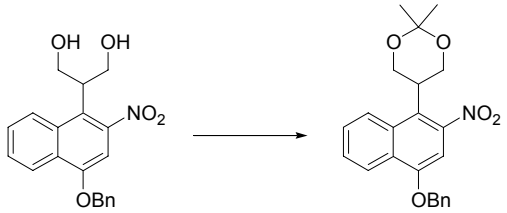


SCHEME S1

(*R*)-5-Benzyloxy-1-(*tert*-butyldimethylsilyloxymethyl)-3-(*tert*-butyloxycarbonyl)-1,2-dihydro-3*H*-benz[*e*]indole ((*R*)-29). A solution of (*S*)-**23** (67.5 mg, 0.123 mmol) in THF (3.0 mL) was treated with PtO_2 (5 mg), Et_3N (32 μL, 0.247 mmol), and Boc_2O (80.8 mg, 0.371 mmol). The mixture was stirred at 25 °C for 3 h under 1 atm of H_2. The reaction mixture was filtered through Celite and stirred for an additional 6 h. The mixture was then concentrated in vacuo. Flash chromatography (SiO_2, 1–5% EtOAc–hexanes) provided (*R*)-**29** (26.2 mg, 41%) as a beige film: $[\alpha]^{23}_D$ +5 (*c* 0.7, $CHCl_3$); ^{1}H NMR ($CDCl_3$, 600 MHz) δ 8.28 (1H, d, *J* = 8.3 Hz), 7.89 (1H, br s), 7.70 (1H, d, *J* = 7.9 Hz), 7.56 (2H, br s), 7.49 (1H, t, *J* = 7.0 Hz), 7.44 (2H, t, *J* = 7.9 Hz), 7.37 (1H, t, *J* = 7.5 Hz), 7.32 (1H, t, *J* = 7.9 Hz), 5.28 (2H, s), 4.25 (1H, d, *J* = 10.1 Hz), 4.03 (1H, br s), 3.97 (1H, dd, *J* = 5.7, 4.0 Hz), 3.78 (1H, br s), 3.49 (1H, br s), 1.60 (9H, s), 0.90 (9H, s), 0.04 (3H, s), –0.02 (3H, s); ^{13}C NMR ($CDCl_3$, 125 MHz) δ 155.6, 153.0, 141.7, 137.3, 130.9, 128.8 (2C), 128.1, 127.8 (2C), 127.3, 123.5, 123.0, 122.8, 122.5, 115.9, 96.8, 80.7, 70.5, 65.0, 52.5, 41.9, 28.7 (3C), 26.1 (3C), 18.5, –5.0, –5.3; IR (film) ν_{max} 1703, 1144 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 542.2697 (M+Na$^+$, $C_{31}H_{41}NO_4Si$ requires 542.2697).

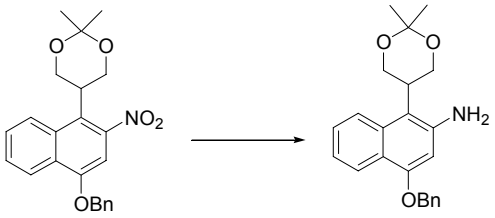
(*R*)-5-Benzyloxy-3-(*tert*-butyloxycarbonyl)-1-(hydroxymethyl)-1,2-dihydro-3*H*-benz[*e*]indole ((*R*)-19). A solution of (*R*)-**29** (26.2 mg, 0.0504 mmol) in THF (0.5 mL) was treated with Bu_4NF (1.0 M in THF, 60 μL, 0.061 mmol) and stirred for 1 h. H_2O (1 mL) was added, and the mixture was extracted into EtOAc (3 × 5 mL), dried (Na_2SO_4), and concentrated

in vacuo. Flash chromatography (SiO_2, 10% EtOAc–hexanes) provided (*R*)-**19** (18.7 mg, 92%) as a clear film: $[\alpha]^{23}_D$ –4.3 (*c* 1.9, CH_2Cl_2); lit.[11] $[\alpha]^{23}_D$ –5.2 (*c* 1.7, CH_2Cl_2) identical in all respects with authentic material.



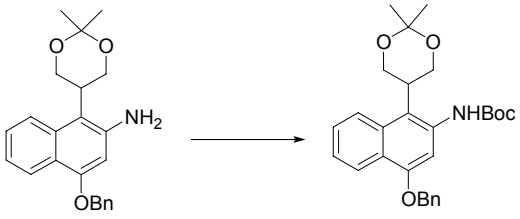
12 **S3**

5-(4-Benzyloxy-2-nitronaphthalen-1-yl)-2,2-dimethyl-[1,3]dioxane (S3). A sample of **12** (0.583 g, 1.65 mmol) in DMF (8.0 mL) was treated with 2,2-dimethoxypropane (0.28 mL, 2.31 mmol) and *p*-TsOH (44 mg, 0.231 mmol) and the mixture was stirred at 25 °C for 16 h. The mixture was diluted with Et_2O (50 mL) and washed with saturated aqueous Na_2CO_3 (10 mL). The organic phase was dried (Na_2SO_4) and concentrated in vacuo. Flash chromatography (SiO_2, 25% EtOAc–hexanes) afforded **S3** (0.402 g, 62%) as a yellow solid: mp 94–95 °C (yellow needles, Et_2O); ^{1}H NMR ($CDCl_3$, 400 MHz) δ 8.66 (1H, d, *J* = 7.9 Hz), 8.44 (1H, d, *J* = 8.5 Hz), 7.73 (1H, t, *J* = 7.0 Hz), 7.64 (1H, t, *J* = 7.1 Hz), 7.51 (2H, d, *J* = 7.6 Hz), 7.45 (2H, t, *J* = 7.6 Hz), 7.41 (1H, t, *J* = 7.0 Hz), 6.98 (1H, s), 5.26 (2H, s), 4.41 (2H, t, *J* = 9.7 Hz), 4.07 (1H, m), 4.00 (2H, m), 1.63 (3H, s), 1.51 (3H, s); ^{13}C NMR ($CDCl_3$, 100 MHz) δ 154.7, 149.8, 135.9, 132.7, 129.0 (2C), 128.9, 128.7, 127.8 (2C), 127.4, 126.0, 123.5, 120.85, 120.80, 99.9, 99.4, 70.9, 62.1 (2C), 38.1, 27.2, 22.0; IR (film) ν_{max} 2990, 1593, 1101 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 416.1455 ($M+Na^+$, $C_{23}H_{23}NO_5$ requires 416.1468).



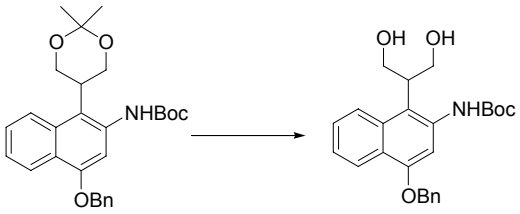
S3 **S4**

4-Benzyloxy-1-(2,2-dimethyl-[1,3]dioxan-5-yl)naphthalen-2-ylamine (S4). A sample of **S3** (0.206 g, 0.525 mmol) in EtOAc (10.0 mL) was treated with 5% $Pd/CaCO_3$ poisoned with Lead (20 mg) and quinoline (0.062 mL, 0.525 mmol) and stirred for 8 h at 25 °C. The mixture was filtered through Celite and concentrated in vacuo. Flash chromatography (SiO_2, 25% EtOAc–hexanes) afforded **S4** (0.130 g, 68%) as a yellow oil which solidified slowly: mp 153–154 °C (beige needles, EtOAc–hexanes); ^{1}H NMR ($CDCl_3$, 400 MHz) δ 8.28 (1H, dd, *J* = 8.2, 0.9 Hz), 7.88 (1H, d, *J* = 7.9 Hz), 7.54 (2H, d, *J* = 7.3 Hz), 7.48 (1H, t, *J* = 7.6 Hz), 7.44 (2H, t, *J* = 7.4 Hz), 7.39 (1H, t, *J* = 7.3 Hz), 7.24 (1H, t, *J* = 7.3 Hz), 6.40 (1H, s), 5.21 (2H, s), 4.96 (2H, br s), 4.25 (1H, br s), 4.11 (2H, t, *J* = 7.9 Hz), 4.03, (2H, br s), 1.56 (3H, s), 1.54 (3H, s); ^{13}C NMR ($CDCl_3$, 100 MHz) δ 154.5, 143.4, 137.2, 134.9, 128.8 (2C), 128.1, 127.6, 127.5 (2C), 122.3, 121.1, 121.0, 120.8, 106.2, 100.4, 99.8, 70.1, 60.4 (2C), 35.1, 24.4, 23.8; IR (film) ν_{max} 3461, 3360, 2986, 1223 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 363.1837 (M^+, $C_{23}H_{25}NO_3$ requires 363.1829).



S4 **S5**

[4-Benzyloxy-1-(2,2-dimethyl-[1,3]dioxan-5-yl)naphthalen-2-yl]carbamic Acid *tert*-Butyl Ester (S5). A sample of **S4** (31.5 mg, 0.086 mmol) in THF (1.0 mL) was treated with Boc_2O (37.8 mg, 0.173 mmol) and the mixture was warmed at 70 °C for 24 h. The solution was concentrated in vacuo and flash chromatography (SiO_2, 25% EtOAc–hexanes) afforded **S5** (32.3 mg, 80%) as a white solid: mp 138–139 °C (clear prisms, Et_2O–hexanes); ^{1}H NMR ($CDCl_3$, 500 MHz) δ 9.16 (1H, br s), 8.34 (1H, dd, *J* = 8.4, 1.1 Hz), 8.17 (1H, br s), 7.96 (1H, d, *J* = 6.6 Hz), 7.58 (2H, d, *J* = 8.0 Hz), 7.50 (1H, t, *J* = 8.8 Hz), 7.44 (2H, d, *J* = 7.3 Hz), 7.37 (2H, td, *J* = 7.4, 2.2), 5.30 (2H, s), 4.34 (1H, quintet, *J* = 6.6 Hz), 4.16 (2H, dd, *J* = 8.1, 4.0 Hz), 3.95 (2H, br s), 1.60 (3H, s), 1.59 (9H, s), 1.55 (3H, s); ^{13}C NMR ($CDCl_3$, 100 MHz) δ 154.1, 154.0, 137.3, 136.4, 133.5, 128.7 (2C), 128.1, 128.0 (2C), 127.5, 123.5, 123.1, 123.0, 122.1, 114.2, 101.0, 100.7, 80.3, 70.3, 61.4 (2C), 34.9, 28.7 (3C), 24.5, 23.5; IR (film) ν_{max} 3418, 1699, 1506, 1250, 1157 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 463.2358 (M^+, $C_{28}H_{33}NO_5$ requires 463.2353).



S5 **25**

2-(4-Benzyloxy-2-(*tert*-butyloxycarbonylamino)naphthalen-1-yl)-1,3-propanediol (25). A sample of **S5** (32.3 mg, 0.0697 mmol) in MeOH (1.0 mL) was treated with *p*-TsOH (1 mg) and the mixture was stirred for 1 h at 25 °C. The solution was concentrated in vacuo and purified by flash chromatography (SiO_2, 50% EtOAc–hexanes). The compound was then dissolved in a minimal amount of EtOAc and precipitated by the slow addition of hexanes to afford **25** (26.0 mg, 88%) as a snow white solid: mp 155–156 °C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ 9.05 (1H, br s), 8.35 (1H, d, *J* = 8.2 Hz), 7.92 (1H, d, *J* = 7.3 Hz), 7.54 (2H, d, *J* = 7.3 Hz), 7.50 (1H, t, *J* = 7.0

Hz), 7.35–7.45 (4H, m), 7.12 (1H, br s), 5.24 (2H, s), 4.19 (4H, br s), 3.91 (1H, br s), 2.53 (2H, br s), 1.53 (9H, s); ^{13}C NMR ($CDCl_3$, 100 MHz) δ 154.5, 154.0, 137.2, 135.8, 135.3, 133.7, 128.8 (2C), 128.2, 127.8 (2C), 127.4, 124.2, 123.2, 122.6, 104.2, 103.9, 80.5, 70.4, 62.9 (2C), 42.9, 28.7 (3C); IR (film) ν_{max} 3390, 2976, 1682 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 423.2042 (M^+, $C_{25}H_{29}NO_5$ requires 423.2046).

(1*S*)-1-Acetoxy-2-(4-benzyloxy-2-(*tert*-butyloxycarbonylamino)naphthalen-1-yl)-3-hydroxypropane ((1*S*)-26). A sample of **25** (50.0 mg, 0.118 mmol), 4 Å molecular sieves (50 mg), and *Pseudomonas sp*. Lipase (4 mg) from Sigma were dissolved in vinyl acetate (0.75 mL, distilled from $CaCl_2$). The reaction mixture was stirred at 35 ºC for 43 h and filtered through a Celite plug. The Celite was washed with CH_2Cl_2 and the combined organic solutions were concentrated in vacuo. Flash chromatography (SiO_2, 20–50% EtOAc–hexanes) afforded (*S*)-**26** (46.5 mg, 85%) and diacetate (6.9 mg, 12%). The sample of (*S*)-**26** was determined to be 93% *ee* by HPLC (CHIRALCEL® OD column, 0.46 × 25 cm, 19:1 hexanes–*i*-PrOH, 1 mL/min, retention times: 15.7 min (*S*)-**26**, 27.0 min (*R*)-**26**). For (*S*)-**26**: mp 147–148 °C (white needles, EtOAc–hexanes); $[\alpha]^{23}_D$ –40 (*c* 1.0 and 0.5, CH_2Cl_2), ^{1}H NMR ($CDCl_3$, 500 MHz, 50 °C) δ 8.73 (1H, br s), 8.37 (1H, d, *J* = 7.3 Hz), 7.89 (1H, d, *J* = 7.7 Hz), 7.55 (2H, d, *J* = 7.3 Hz), 7.51 (1H, t, *J* = 7.3 Hz), 7.40–7.45 (4H, m), 7.37 (1H, t, *J* = 7.0 Hz), 5.27 (2H, dd, *J* = 11.4, 6.2 Hz), 4.99 (1H, br s), 4.39 (1H, dd, *J* = 6.6, 4.4 Hz), 4.20 (1H, q, *J* = 5.1 Hz), 4.04 (2H, br s), 2.73 (1H, br s), 2.03 (3H, s), 1.57 (9H, s); ^{13}C NMR ($CDCl_3$, 100 MHz, 21 °C) δ 171.8, 154.2, 137.1, 135.9, 133.4, 128.7 (2C), 128.2, 127.9 (2C), 127.5, 125.2, 124.1, 123.2, 122.3, 119.9, 117.7, 103.8, 80.4, 70.4, 63.9, 63.5, 40.1, 28.6 (3C), 21.2; IR (film) ν_{max} 3418, 2929, 1716, 1251, 1159 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 465.2139 (M^+, $C_{27}H_{31}NO_6$ requires 465.2146).

(*S*)-1-Acetoxy-5-benzyloxy-3-(*tert*-butyloxycarbonyl)-1,2-dihydro-3*H*-benz[*e*]indole ((*S*)-18). A solution of (*S*)-**26** (25.2 mg, 0.0542 mmol) in pyridine (0.5 mL) cooled to 0 °C was treated dropwise with MsCl (8.0 μL, 0.108 mmol) and the mixture was stirred at 0 °C for 1 h and at 25 °C for 12 h. Ice (5 mL) was added and the mixture was extracted with EtOAc (3 × 10 mL). The combined organic layers were washed with 1 M aqueous HCl (3 × 5 mL), dried (Na_2SO_4), and concentrated in vacuo. Flash chromatography (SiO_2, 20% EtOAc–hexanes) provided (*S*)-**18** (21.8 mg, 90%) as a white solid which was identical in all respects to authentic compound.

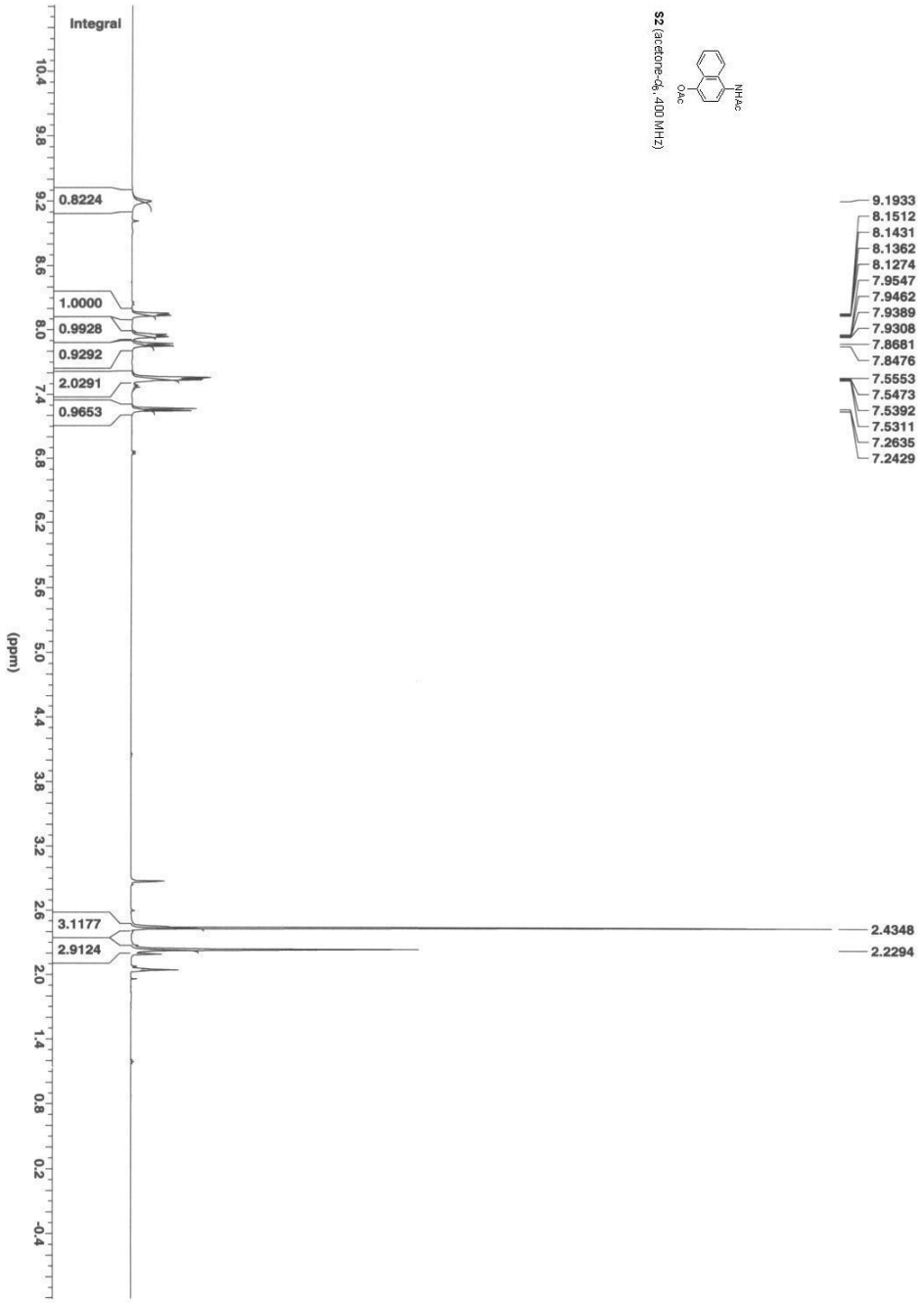
(*R*)-1-Acetoxy-2-(4-benzyloxy-2-(*tert*-butyloxycarbonylamino)naphthalen-1-yl)-3-(*tert*-butyldimethylsilyloxy)propane ((*R*)-27). A solution of (*S*)-**26** (33.4 mg, 0.0717 mmol) in DMF (0.8 mL) was treated with TBSCl (19.1 mg, 0.127 mmol) and imidazole (11.5 mg, 0.169 mmol) and the mixture was stirred for 2 h at 25 °C. H_2O (5 mL) was added, and the solution was extracted with Et_2O (3 × 10 mL). The combined organic extracts were washed with H_2O, dried (Na_2SO_4), and concentrated in vacuo. Flash chromatography (SiO_2, 20% EtOAc–hexanes) afforded (*R*)-**27** (30.9 mg, 74%) as a clear oil: $[\alpha]^{23}_D$ –42 (*c* 1.0 and 0.5, CH_2Cl_2); ^{1}H NMR ($CDCl_3$, 400 MHz) δ 8.83 (1H, br s), 8.36 (1H, d, *J* = 8.2 Hz), 7.87 (1H, d, *J* = 8.8 Hz), 7.57 (2H, d, *J* = 7.3), 7.52 (1H, t, *J* = 7.0 Hz), 7.36–7.46 (5H, m), 5.27 (2H, dd, *J* = 9.4, 5.6), 5.03 (1H, t, *J* = 10.6 Hz), 4.38 (1H, dd, *J* = 7.0, 5.1 Hz), 4.27 (1H, dd, *J* = 7.0, 3.2 Hz), 4.01 (2H, d, *J* = 7.9 Hz), 2.07 (3H, s), 1.58 (9H, s), 0.92 (9H, s), 0.12 (3H, s), 0.07 (3H, s); ^{13}C NMR ($CDCl_3$, 100 MHz) δ 171.0, 154.0, 153.9, 137.2, 136.2, 133.4, 128.7 (2C), 128.1, 128.0 (2C), 127.3, 124.2, 124.0, 123.3, 122.3, 117.9, 103.9, 80.4, 70.4, 65.4, 63.9, 40.0, 28.7 (3C), 26.2 (3C), 21.2, 18.8, –5.37, –5.40; IR (film) ν_{max} 3318, 1742, 1727, 1249, 1153, 837 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 602.2887 (M+Na$^+$, $C_{33}H_{45}NO_6Si$ requires 602.2908).

(*R*)-2-(4-Benzyloxy-2-(*tert*-butyloxycarbonylamino)naphthalen-1-yl)-3-(*tert*-butyldimethylsilyloxy)-1-propanol ((*R*)-28). A solution of (*R*)-**27** (25.0 mg, 0.0431 mmol) in MeOH (0.4 mL) was treated with K_2CO_3 (7.2 mg, 0.0518 mmol) at 25 °C. The mixture was stirred for 30 min then diluted with CH_2Cl_2 (5.0 mL). The solution was washed with H_2O (5 mL), dried (Na_2SO_4), and concentrated in vacuo. The crude residue was dissolved in Et_2O and filtered through a plug of SiO_2. Most of the solvent was removed by a stream of N_2 and the compound was precipitated by the slow addition of petroleum ether. The solid was collected by filtration and washed with petroleum ether, affording (*R*)-**28** (21.2 mg, 92%) as a white solid: mp 150–151 °C; $[\alpha]^{23}_D$ –15 (*c* 1.0 and 0.5, CH_2Cl_2); ^{1}H NMR ($CDCl_3$, 400 MHz) δ 8.94 (1H, br s), 8.35 (1H, d, *J* = 8.2 Hz), 7.92, (1H, d, *J* = 8.8 Hz), 7.56 (2H, d, *J* = 7.4 Hz), 7.52 (1H, t, *J* = 7.0 Hz), 7.36–7.46 (5H, m), 5.26 (2H, d, *J* = 2.1 Hz), 4.34 (1H, dt, *J* = 6.8, 2.7 Hz), 4.20 (2H, sextet, *J* = 3.2 Hz), 4.13 (1H, m), 3.88 (1H, br s), 1.56 (9H, s), 0.93 (9H, s), 0.11 (3H, s), 0.08 (3H, s); ^{13}C NMR ($CDCl_3$, 100 MHz) δ 154.1, 154.0, 137.3, 136.0, 133.7, 128.7 (2C), 128.1, 128.0 (2C), 127.3, 124.2, 124.0, 123.2, 122.5, 118.1, 103.7, 80.2, 70.4, 64.6, 62.7, 43.6, 28.8 (3C), 26.3 (3C), 18.8, –5.3 (2C); IR (film) ν_{max} 3391, 3236, 2928, 1688, 1163, 838 cm^{-1}; MALDIFT–HRMS (DHB) *m/z* 560.2809 (M+Na$^+$, $C_{31}H_{43}NO_5Si$ requires 560.2803).

(*R*)-5-Benzyloxy-1-(*tert*-butyldimethylsilyloxymethyl)-3-(*tert*-butyloxycarbonyl)-1,2-dihydro-3*H*-benz[*e*]indole ((*R*)-29). A solution of (*R*)-**28** (12.5 mg, 0.0233 mmol) in pyridine (0.2 mL) cooled to 0 °C was treated dropwise with MsCl (3.6 μL, 0.0465 mmol) and the mixture was stirred at 0 °C for 1 h and at 25 °C for 12 h. Ice (5 mL) was added and the mixture was extracted with EtOAc (3 × 10 mL). The combined organic layers were washed with 1 M aqueous HCl (3 × 5 mL), dried (Na_2SO_4), and concentrated in vacuo. Flash chromatography (SiO_2, 10%

EtOAc–hexanes) provided (*R*)-**29** (10.0 mg, 83%) as a clear oil which was identical in all respects to authentic compound.

Enzymatic resolution of 19. A solution of (±)-**19** (50.0 mg, 0.123 mmol) in vinyl acetate (1.0 mL, distilled from $CaCl_2$) was treated with *Pseudomonas sp*. Lipase (2 mg) from Sigma and 4Å molecular sieves. The reaction mixture was stirred at 35 °C for 24 h. The mixture was filtered through Celite and concentrated in vacuo. Flash chromatography (SiO_2, 20–33% EtOAc–hexanes) provided (*S*)-**18** (30.0 mg, 54%, 56% *ee*) as a white solid and (*R*)-**19** (17.0 mg, 34%, 99% *ee*) as a clear film. The *ee* of (*R*)-**19** was determined by HPLC (CHIRALCEL® OD column, 0.46 cm × 25 cm, 19:1 hexanes–*i*-PrOH, 1 mL/min, retention times: 15.4 min (*S*)-**19**, 18.7 min (*R*)-**19**). The *ee* of (*S*)-**18** was determined upon conversion to (*S*)-**19**. Successive recrystallization of (*S*)-**18** (54% *ee*) from EtOAc–hexanes afforded enantiomerically pure material (1×, 91% *ee*; 2×, 99.9% *ee*).


S2 (acetone-d_6, 400 MHz)
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OAc
Integral
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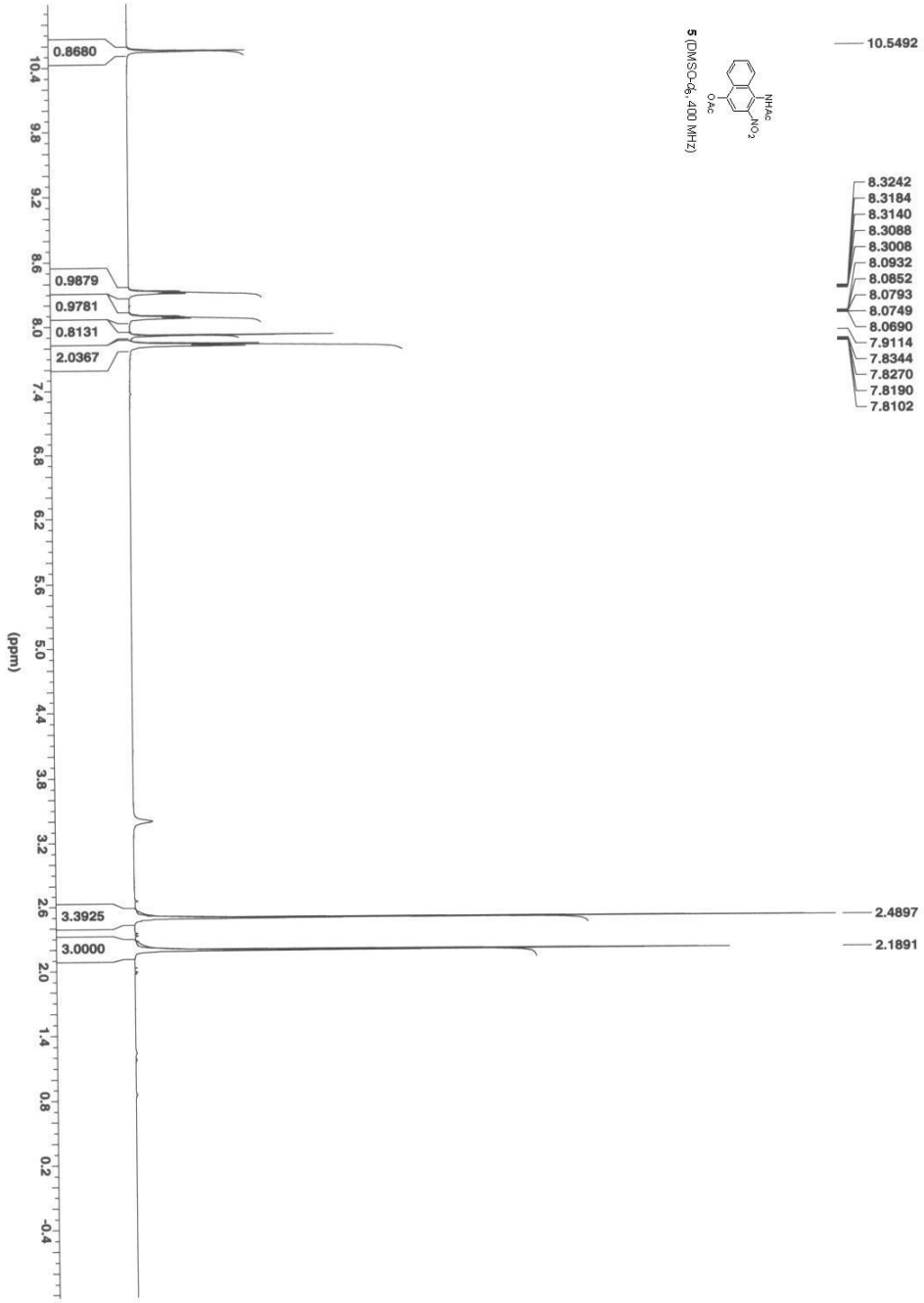
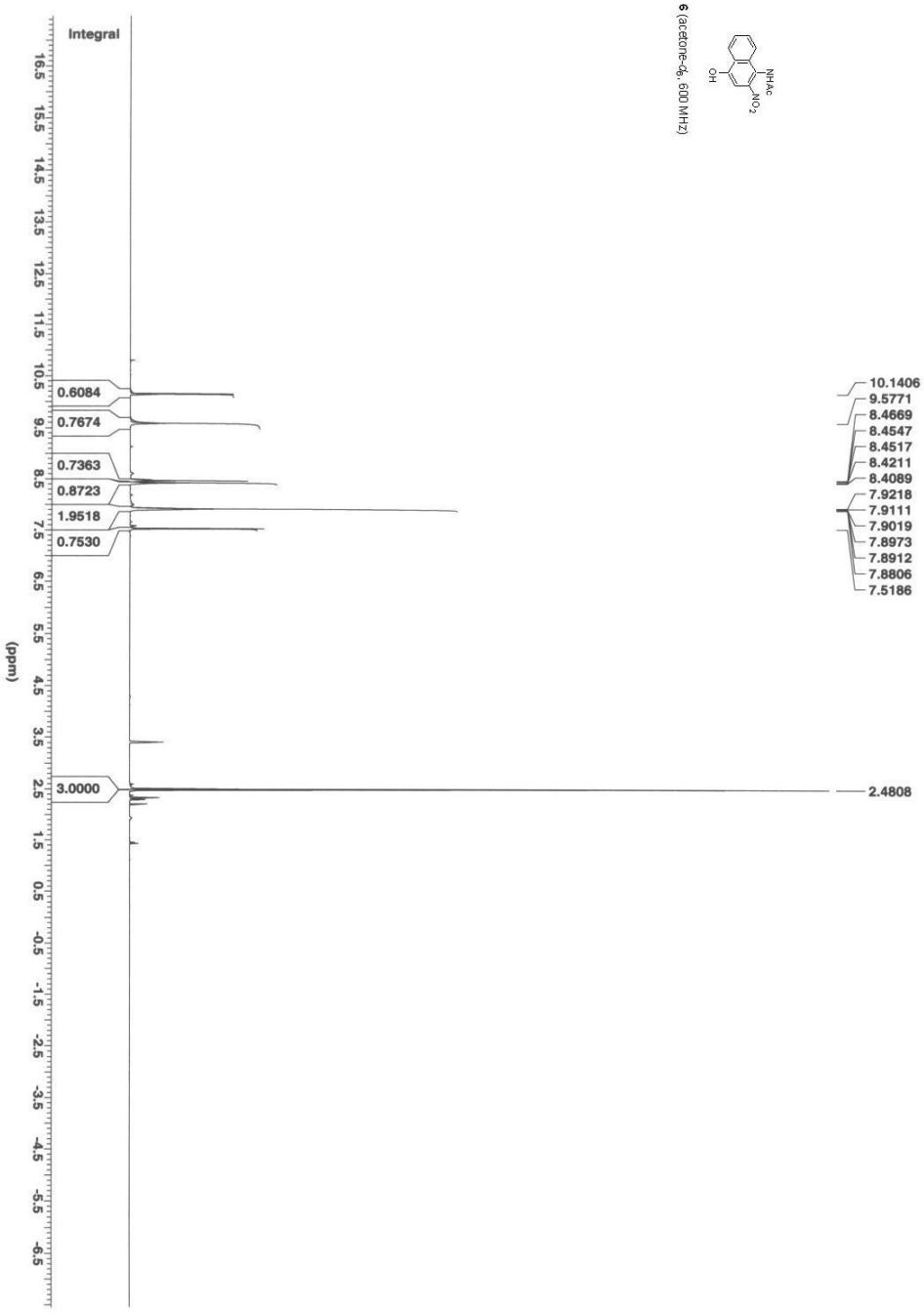
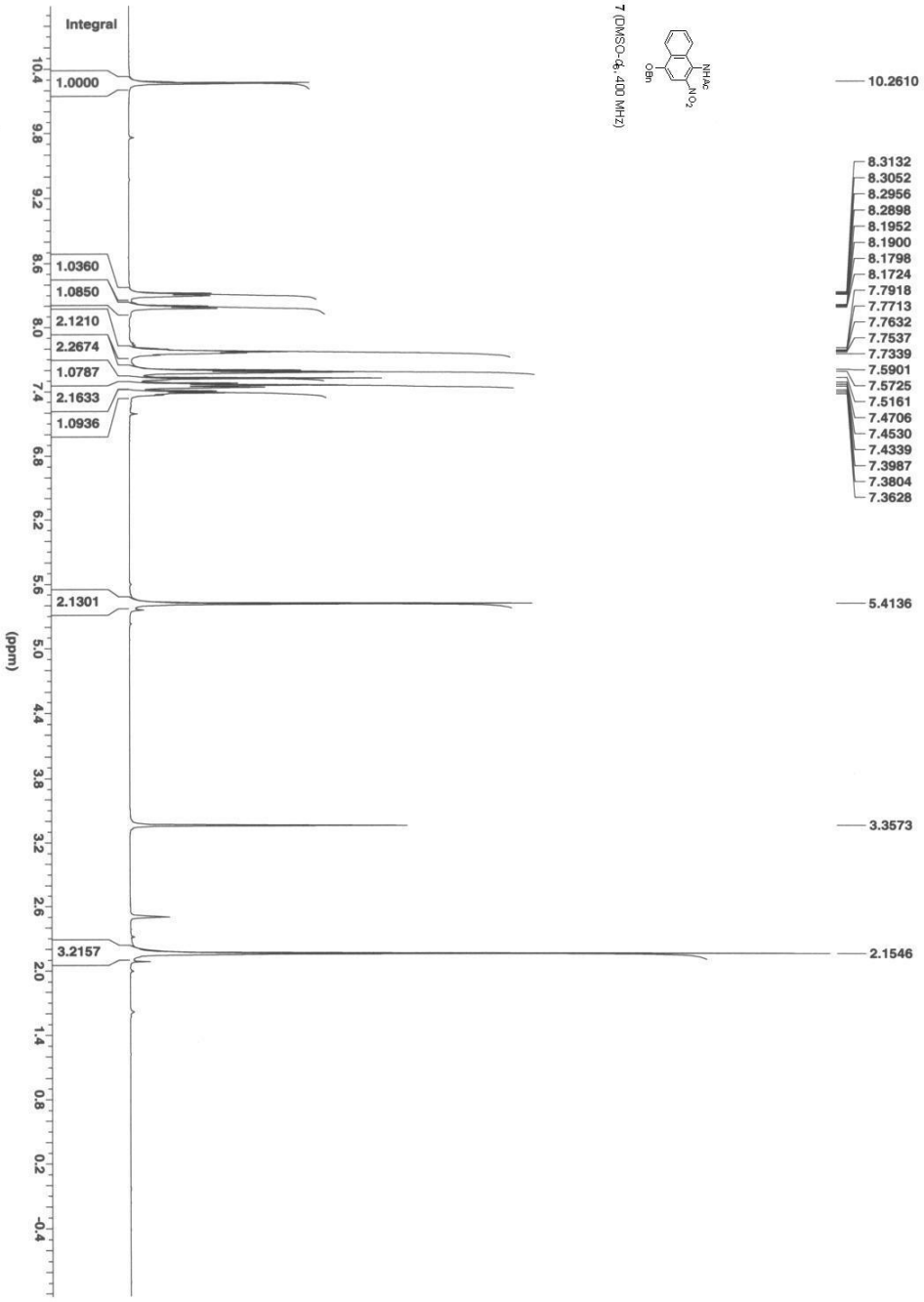
0.9292
2.0291
0.9653
3.1177
2.9124
9.1933
8.1512
8.1431
8.1362
8.1274
7.9547
7.9462
7.9389
7.9308
7.8681
7.8476
7.5553
7.5473
7.5392
7.5311
7.2635
7.2429
2.4348
2.2294
(ppm)


5 (DMSO-d6, 400 MHz)
OAc
NHAc
NO2
10.5492
8.3242
8.3184
8.3140
8.3088
8.3008
8.0932
8.0852
8.0793
8.0749
8.0690
7.9114
7.8344
7.8270
7.8190
7.8102
0.8680
0.9879
0.9781
0.8131
2.0367
3.3925
3.0000
2.4897
2.1891
(ppm)


6 (acetone-d_6, 600 MHz)
NHAc
NO_2
OH
Integral
0.6084
0.7674
0.7363
0.8723
1.9518
0.7530
3.0000
10.1406
9.5771
8.4669
8.4547
8.4517
8.4211
8.4089
7.9218
7.9111
7.9019
7.8973
7.8912
7.8806
7.5186
2.4808
(ppm)


7 (DMSO-d6, 400 MHz)
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NHAc
NO2
Integral
1.0000
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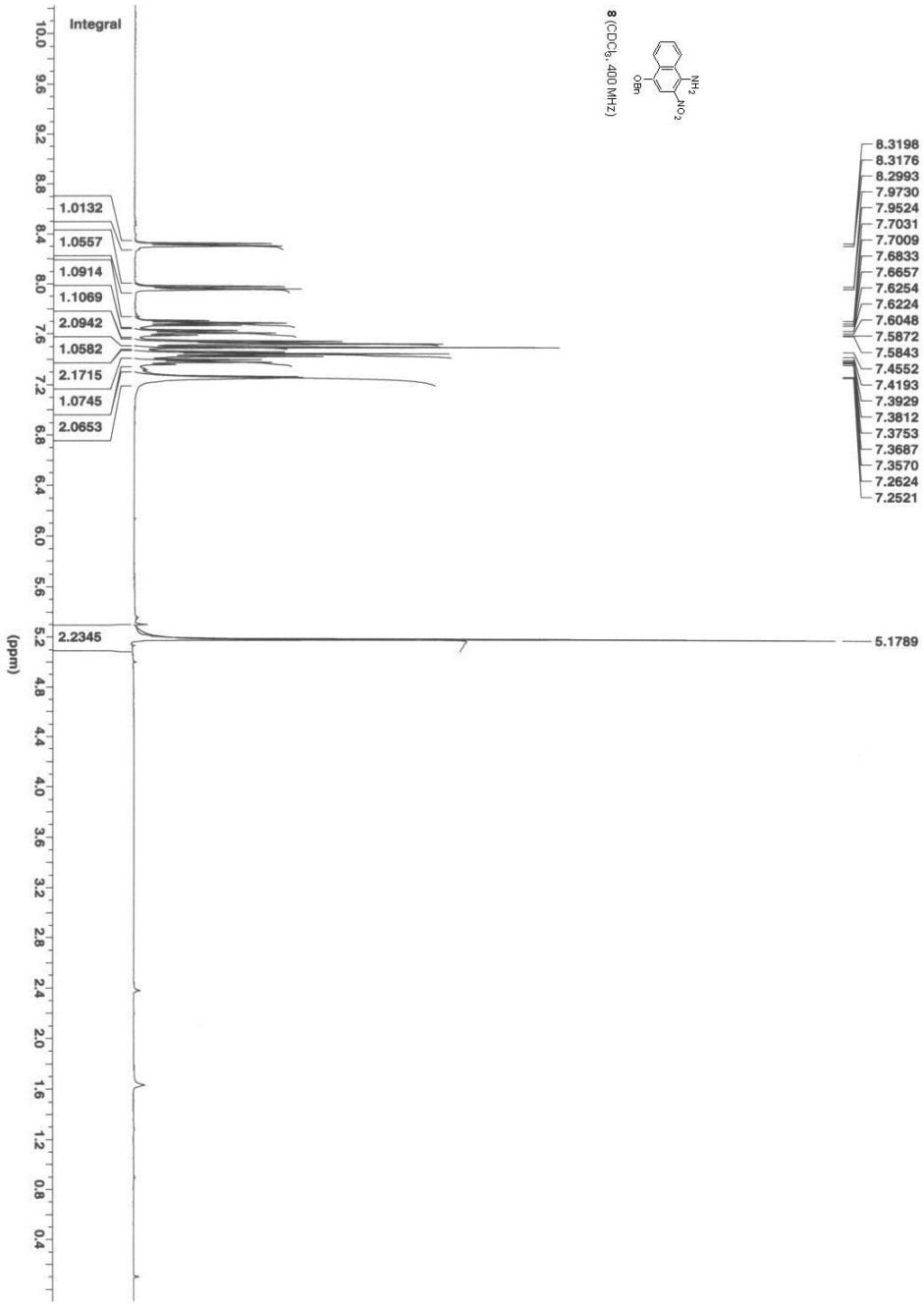
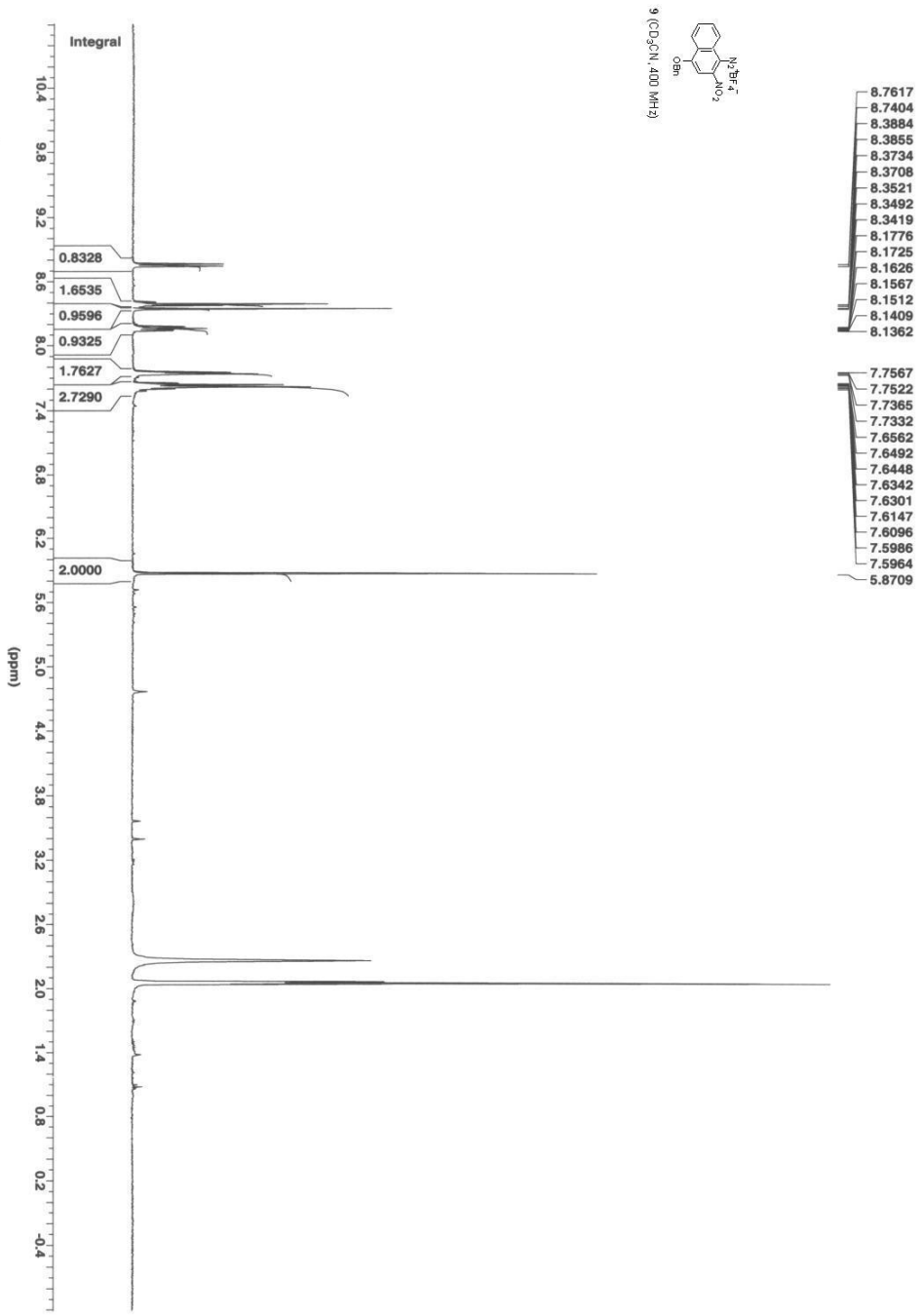
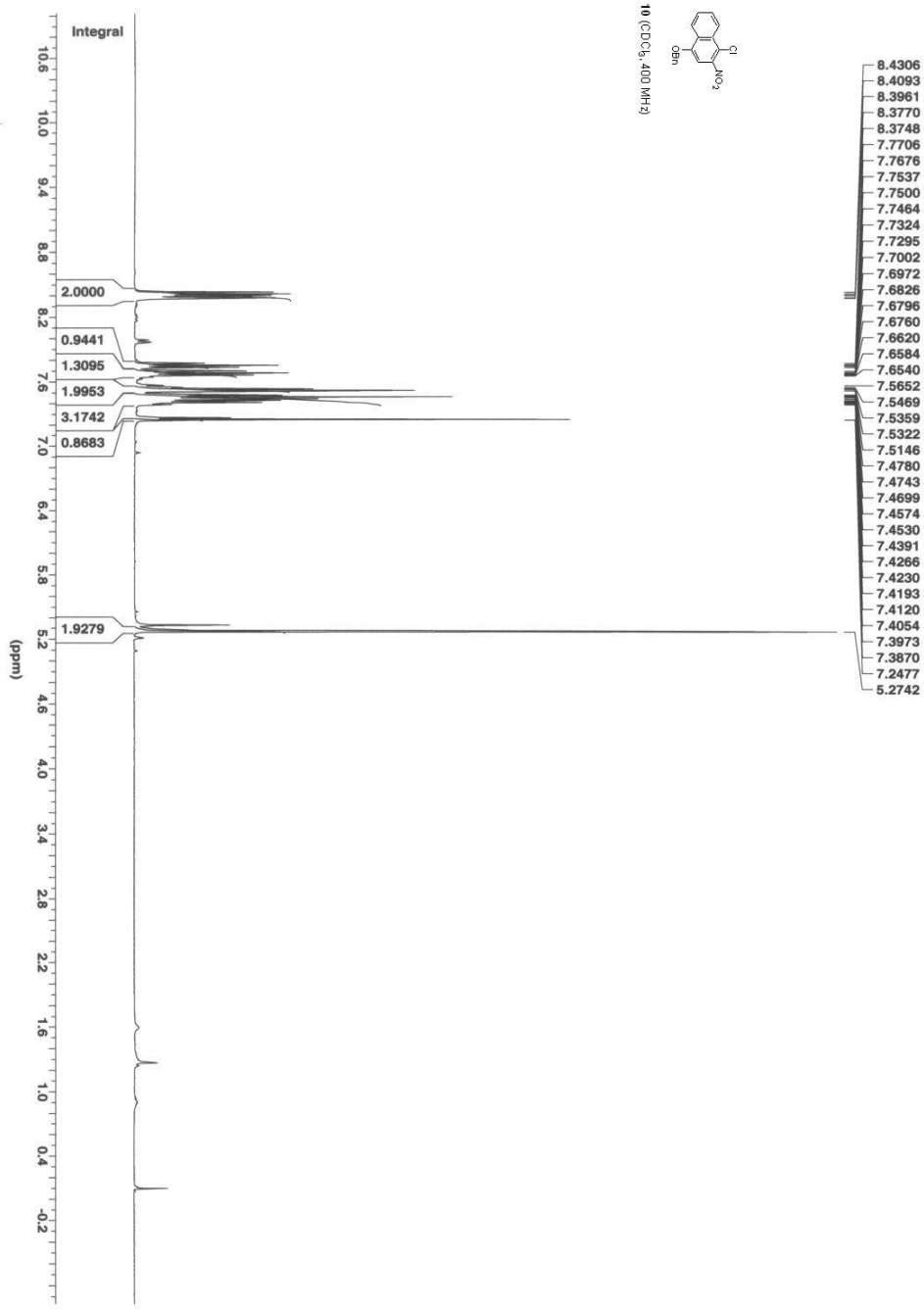
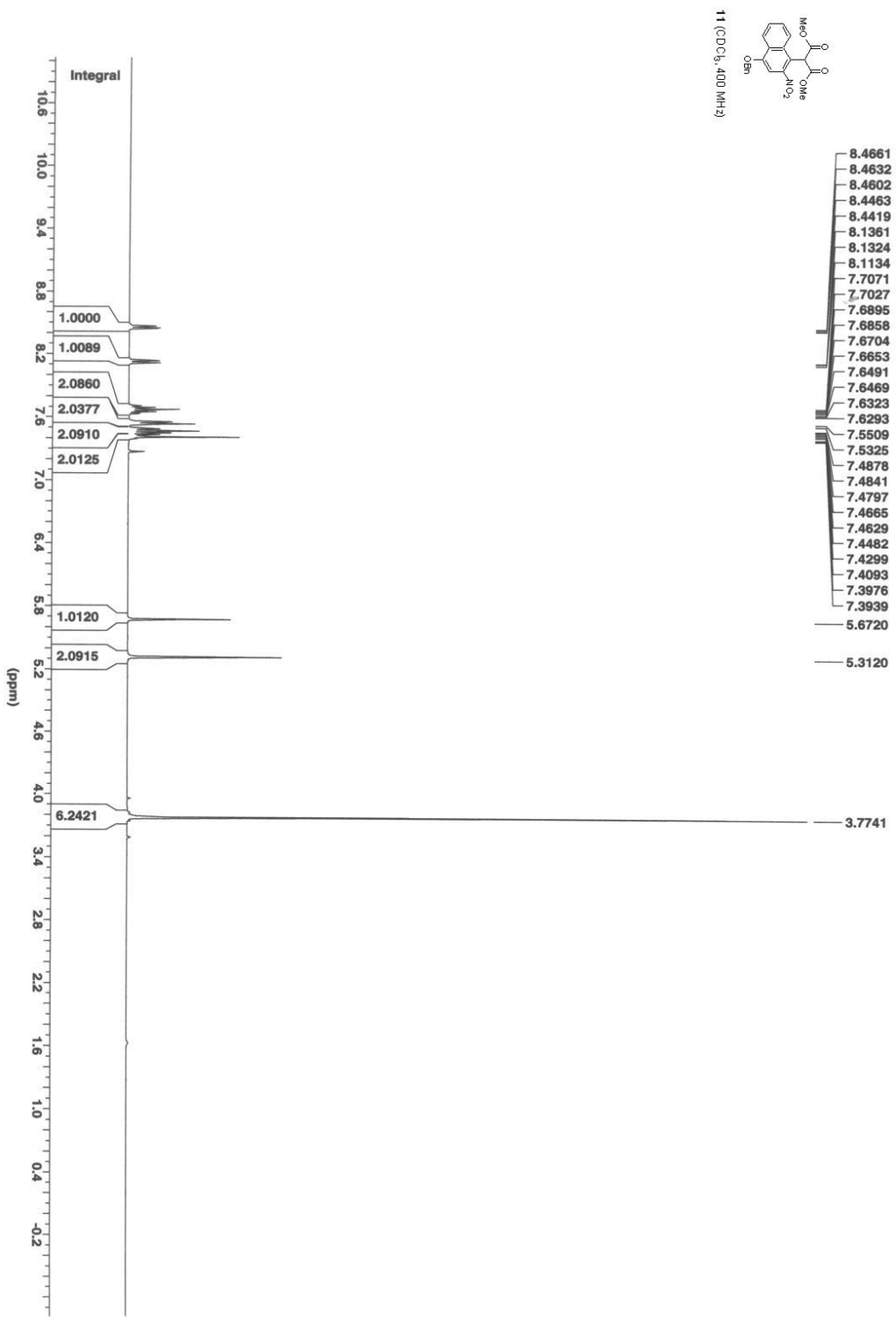
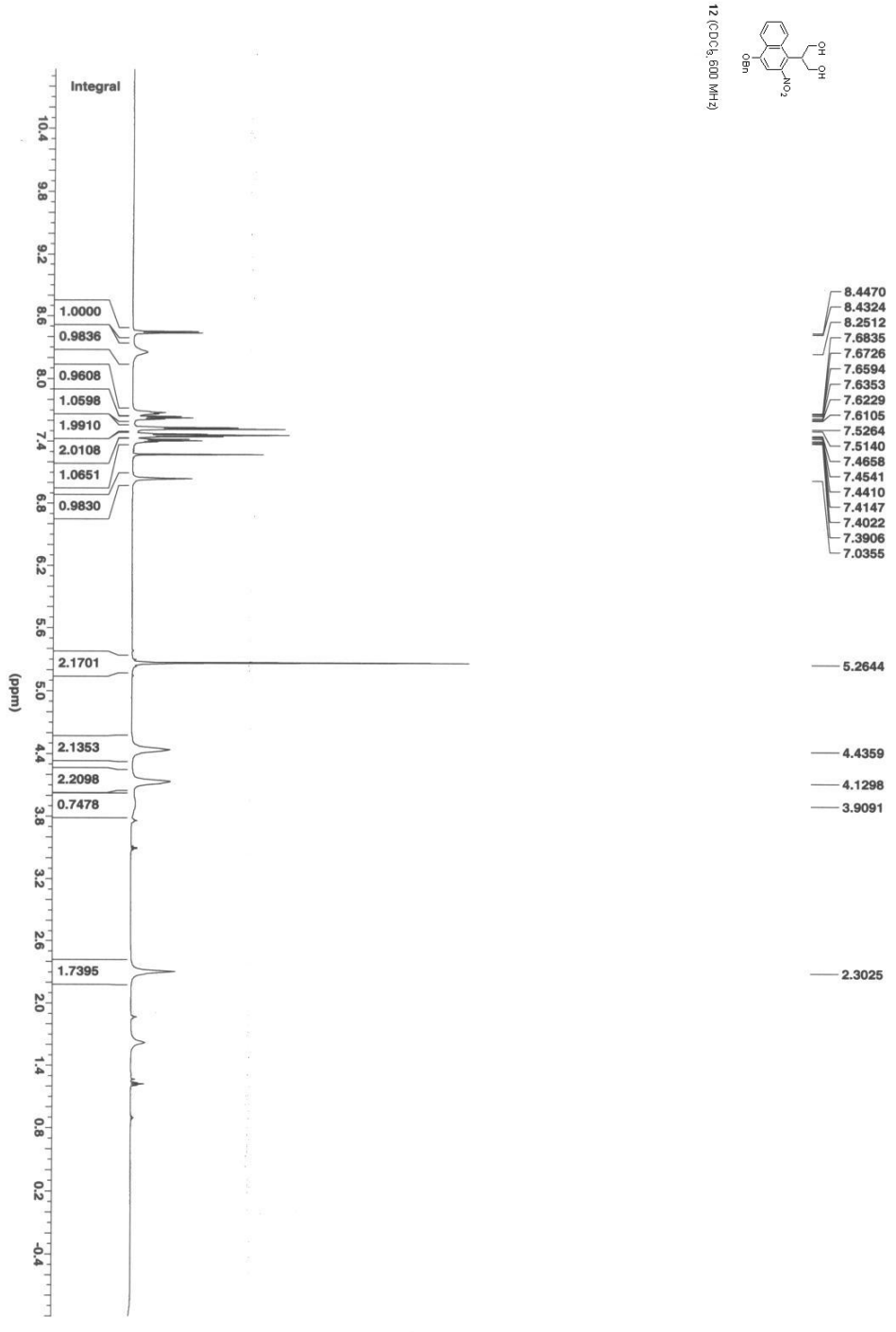
1.0850
2.1210
2.2674
1.0787
2.1633
1.0936
2.1301
3.2157
10.2610
8.3132
8.3052
8.2956
8.2898
8.1952
8.1900
8.1798
8.1724
7.7918
7.7713
7.7632
7.7537
7.7339
7.5901
7.5725
7.5161
7.4706
7.4530
7.4339
7.3987
7.3804
7.3628
5.4136
3.3573
2.1546
(ppm)


8 (CDCl3, 400 MHz)
OBn
NH2
NO2
Integral
1.0132
1.0557
1.0914
1.1069
2.0942
1.0582
2.1715
1.0745
2.0653
2.2345
5.1789
8.3198
8.3176
8.2993
7.9730
7.9524
7.7031
7.7009
7.6833
7.6657
7.6254
7.6224
7.6048
7.5872
7.5843
7.4552
7.4193
7.3929
7.3812
7.3753
7.3687
7.3570
7.2624
7.2521
(ppm)


Integral
0.8328
1.6535
0.9596
0.9325
1.7627
2.7290
2.0000
(ppm)
9 (CD3CN, 400 MHz)
OBn
N2+BF4−
NO2
8.7617
8.7404
8.3884
8.3855
8.3734
8.3708
8.3521
8.3492
8.3419
8.1776
8.1725
8.1626
8.1567
8.1512
8.1409
8.1362
7.7567
7.7522
7.7365
7.7332
7.6562
7.6492
7.6448
7.6342
7.6301
7.6147
7.6096
7.5986
7.5964
5.8709


10 (CDCl3, 400 MHz)
OBn
Cl
NO2
Integral
2.0000
0.9441
1.3095
1.9953
3.1742
0.8683
1.9279
(ppm)
8.4306
8.4093
8.3961
8.3770
8.3748
7.7706
7.7676
7.7537
7.7500
7.7464
7.7324
7.7295
7.7002
7.6972
7.6826
7.6796
7.6760
7.6620
7.6584
7.6540
7.5652
7.5469
7.5359
7.5322
7.5146
7.4780
7.4743
7.4699
7.4574
7.4530
7.4391
7.4266
7.4230
7.4193
7.4120
7.4054
7.3973
7.3870
7.2477
5.2742


11 (CDCl3, 400 MHz)
MeO
OMe
NO2
OBn
Integral
1.0000
1.0089
2.0860
2.0377
2.0910
2.0125
1.0120
2.0915
6.2421
(ppm)
8.4661
8.4632
8.4602
8.4463
8.4419
8.1361
8.1324
8.1134
7.7071
7.7027
7.6895
7.6858
7.6704
7.6653
7.6491
7.6469
7.6323
7.6293
7.5509
7.5325
7.4878
7.4841
7.4797
7.4665
7.4629
7.4482
7.4299
7.4093
7.3976
7.3939
5.6720
5.3120
3.7741


12 (CDCl3, 600 MHz)
OBn
NO2
OH
OH
Integral
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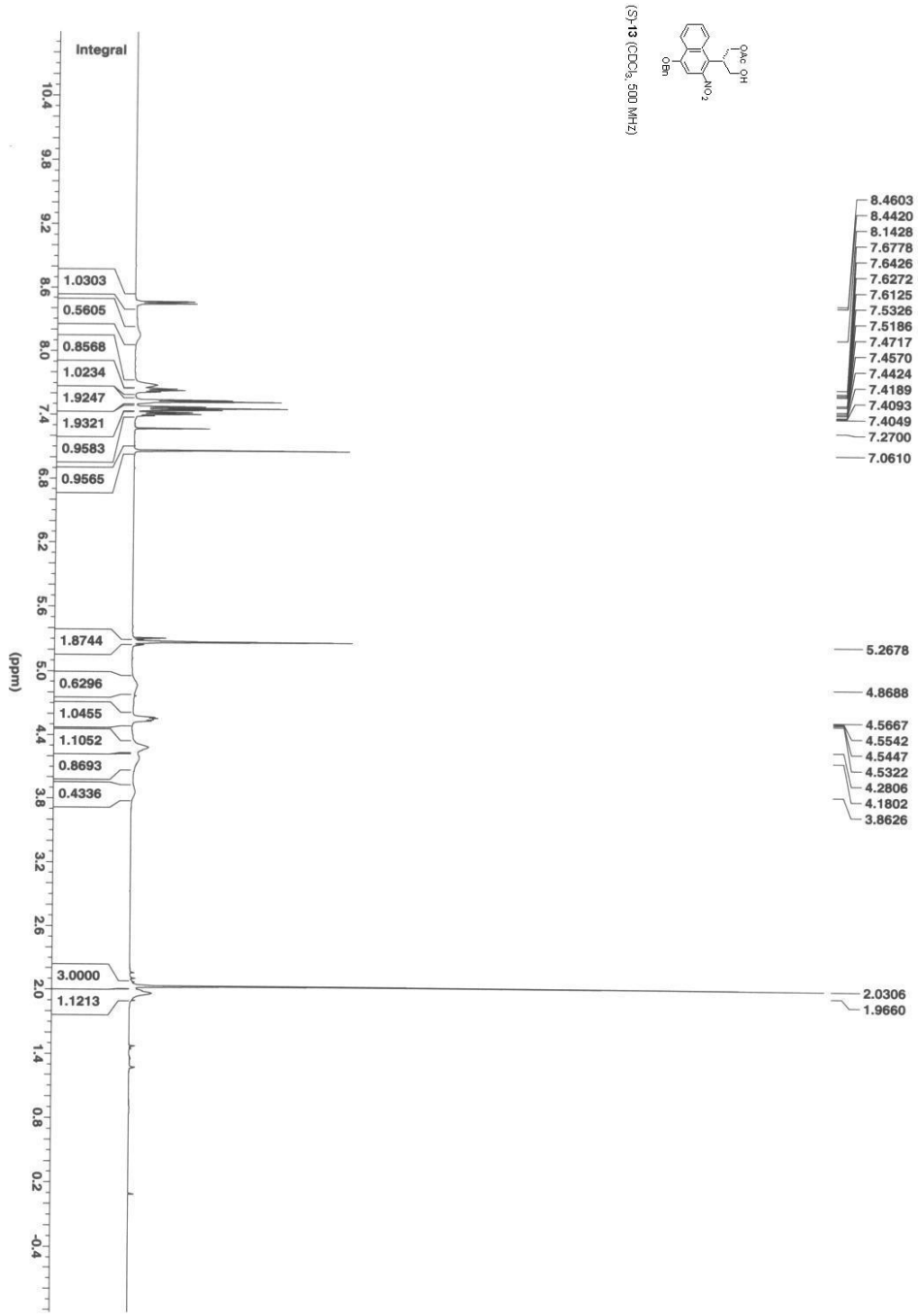
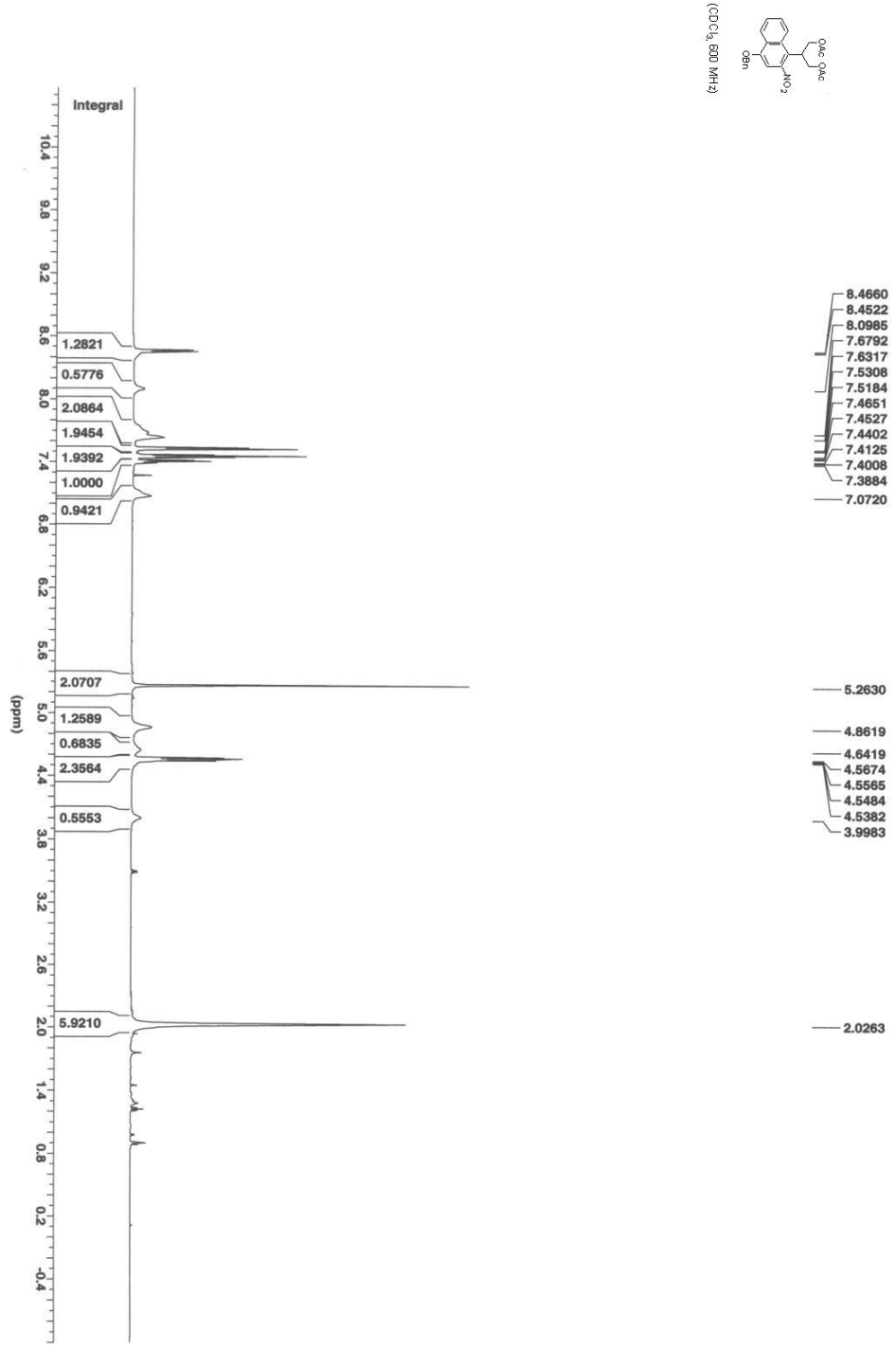
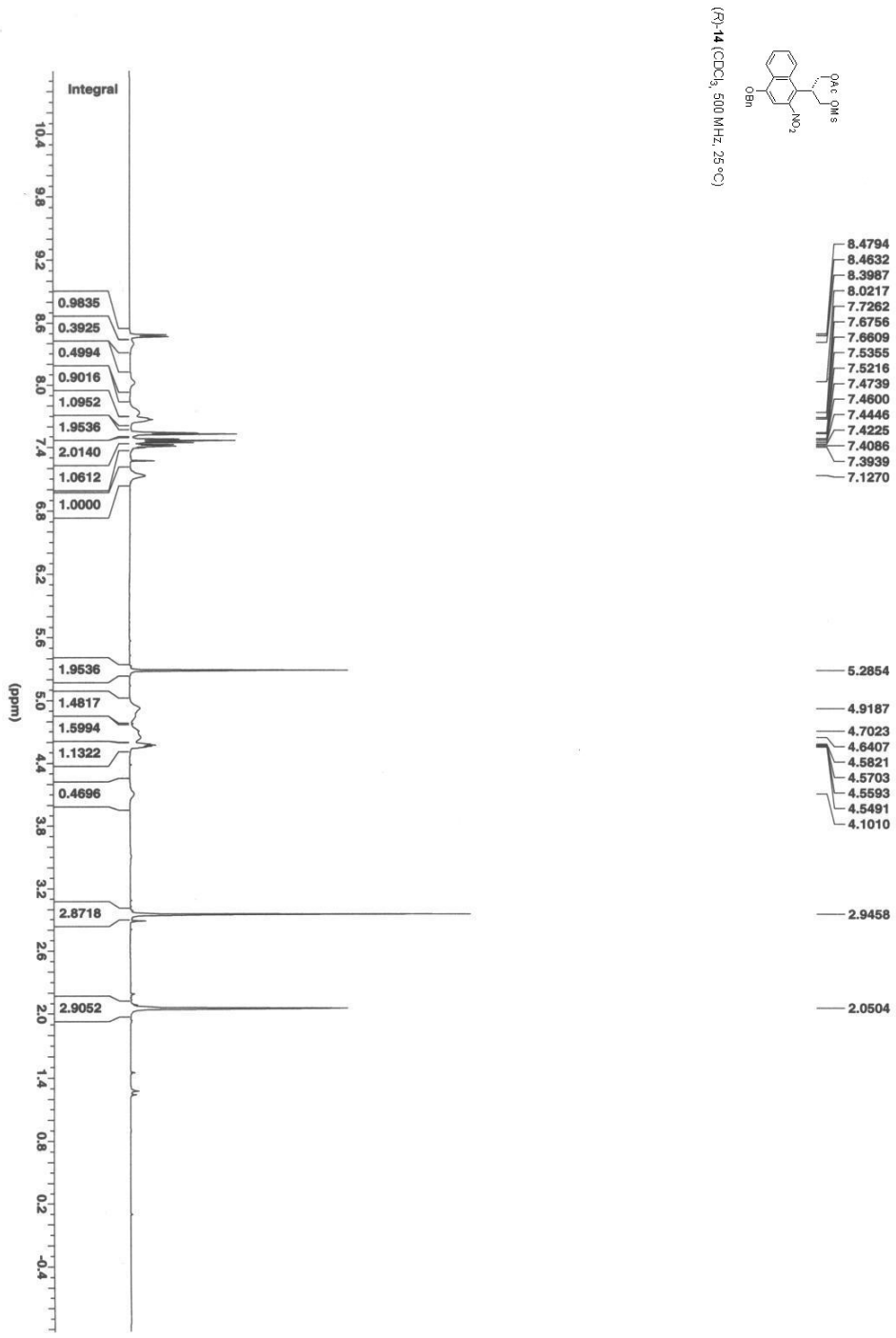
0.9608
1.0598
1.9910
2.0108
1.0651
0.9830
2.1701
2.1353
2.2098
0.7478
1.7395
(ppm)
8.4470
8.4324
8.2512
7.6835
7.6726
7.6594
7.6353
7.6229
7.6105
7.5264
7.5140
7.4658
7.4541
7.4410
7.4147
7.4022
7.3906
7.0355
5.2644
4.4359
4.1298
3.9091
2.3025


(S)-13 (CDCl3, 500 MHz)
OBn
NO2
OAc
OH
Integral
(ppm)
10.4
9.8
9.2
8.6
8.0
7.4
6.8
6.2
5.6
5.0
4.4
3.8
3.2
2.6
2.0
1.4
0.8
0.2
-0.4
1.0303
0.5605
0.8568
1.0234
1.9247
1.9321
0.9583
0.9565
1.8744
0.6296
1.0455
1.1052
0.8693
0.4336
3.0000
1.1213
8.4603
8.4420
8.1428
7.6778
7.6426
7.6272
7.6125
7.5326
7.5186
7.4717
7.4570
7.4424
7.4189
7.4093
7.4049
7.2700
7.0610
5.2678
4.8688
4.5667
4.5542
4.5447
4.5322
4.2806
4.1802
3.8626
2.0306
1.9660


(CDCl3, 600 MHz)
OBn
NO2
OAc
OAc
Integral
1.2821
0.5776
2.0864
1.9454
1.9392
1.0000
0.9421
2.0707
1.2589
0.6835
2.3564
0.5553
5.9210
(ppm)
8.4660
8.4522
8.0985
7.6792
7.6317
7.5308
7.5184
7.4651
7.4527
7.4402
7.4125
7.4008
7.3884
7.0720
5.2630
4.8619
4.6419
4.5674
4.5565
4.5484
4.5382
3.9983
2.0263


(R)-14 (CDCl3, 500 MHz, 25 °C)
OAc OMs
OBn
NO2
Integral
0.9835
0.3925
0.4994
0.9016
1.0952
1.9536
2.0140
1.0612
1.0000
1.9536
1.4817
1.5994
1.1322
0.4696
2.8718
2.9052
(ppm)
8.4794
8.4632
8.3987
8.0217
7.7262
7.6756
7.6609
7.5355
7.5216
7.4739
7.4600
7.4446
7.4225
7.4086
7.3939
7.1270
5.2854
4.9187
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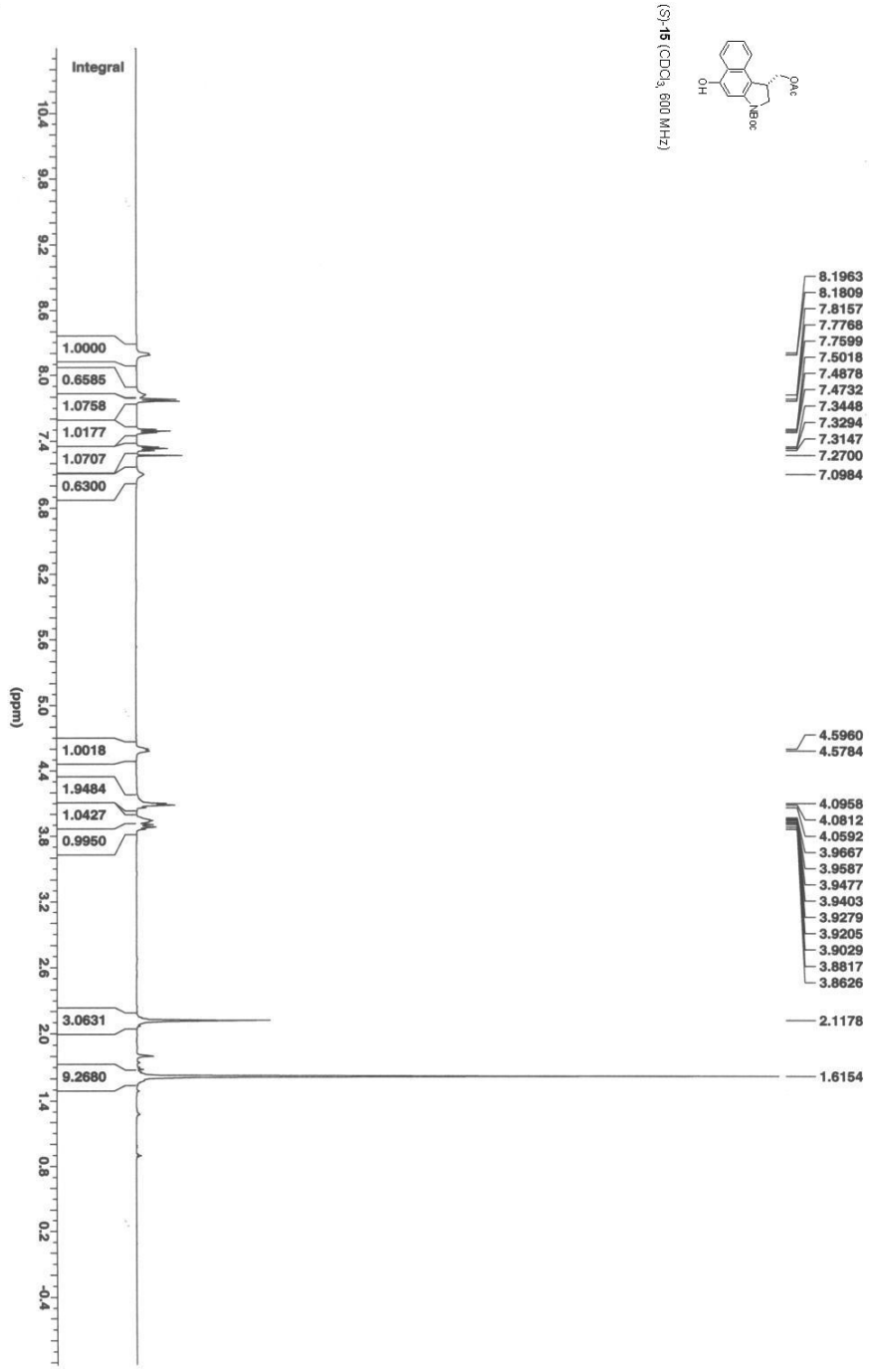
4.5821
4.5703
4.5593
4.5491
4.1010
2.9458
2.0504


(S)-15 (CDCl3, 600 MHz)
OAc
NBoc
OH
Integral
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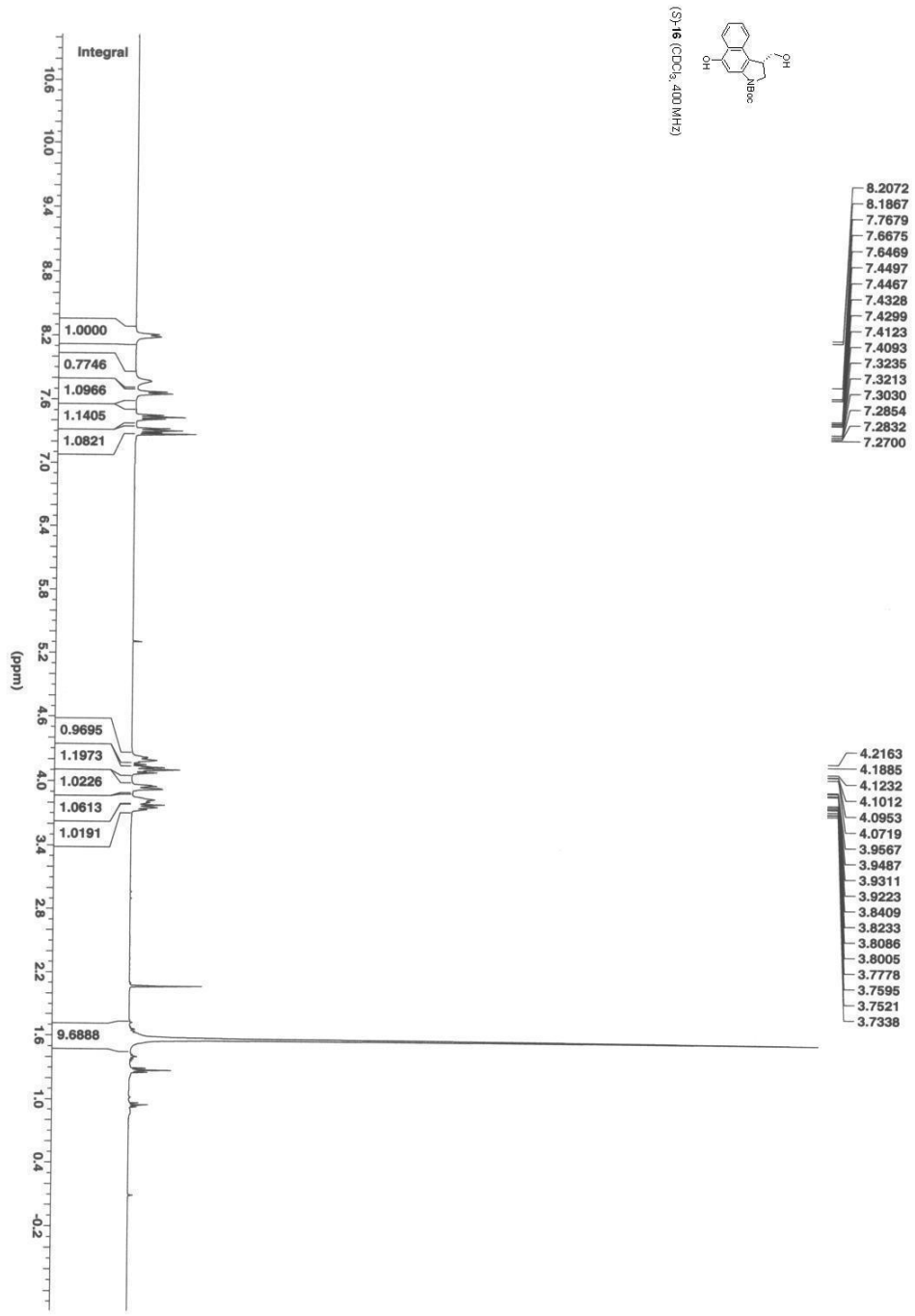
1.0177
1.0707
0.6300
1.0018
1.9484
1.0427
0.9950
3.0631
9.2680
(ppm)
8.1963
8.1809
7.8157
7.7768
7.7599
7.5018
7.4878
7.4732
7.3448
7.3294
7.3147
7.2700
7.0984
4.5960
4.5784
4.0958
4.0812
4.0592
3.9667
3.9587
3.9477
3.9403
3.9279
3.9205
3.9029
3.8817
3.8626
2.1178
1.6154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OH
OH
NBoc
Integral
1.0000
0.7746
1.0966
1.1405
1.0821
0.9695
1.1973
1.0226
1.0613
1.0191
9.6888
(ppm)
8.2072
8.1867
7.7679
7.6675
7.6469
7.4497
7.4467
7.4328
7.4299
7.4123
7.4093
7.3235
7.3213
7.3030
7.2854
7.2832
7.2700
4.2163
4.1885
4.1232
4.1012
4.0953
4.0719
3.9567
3.9487
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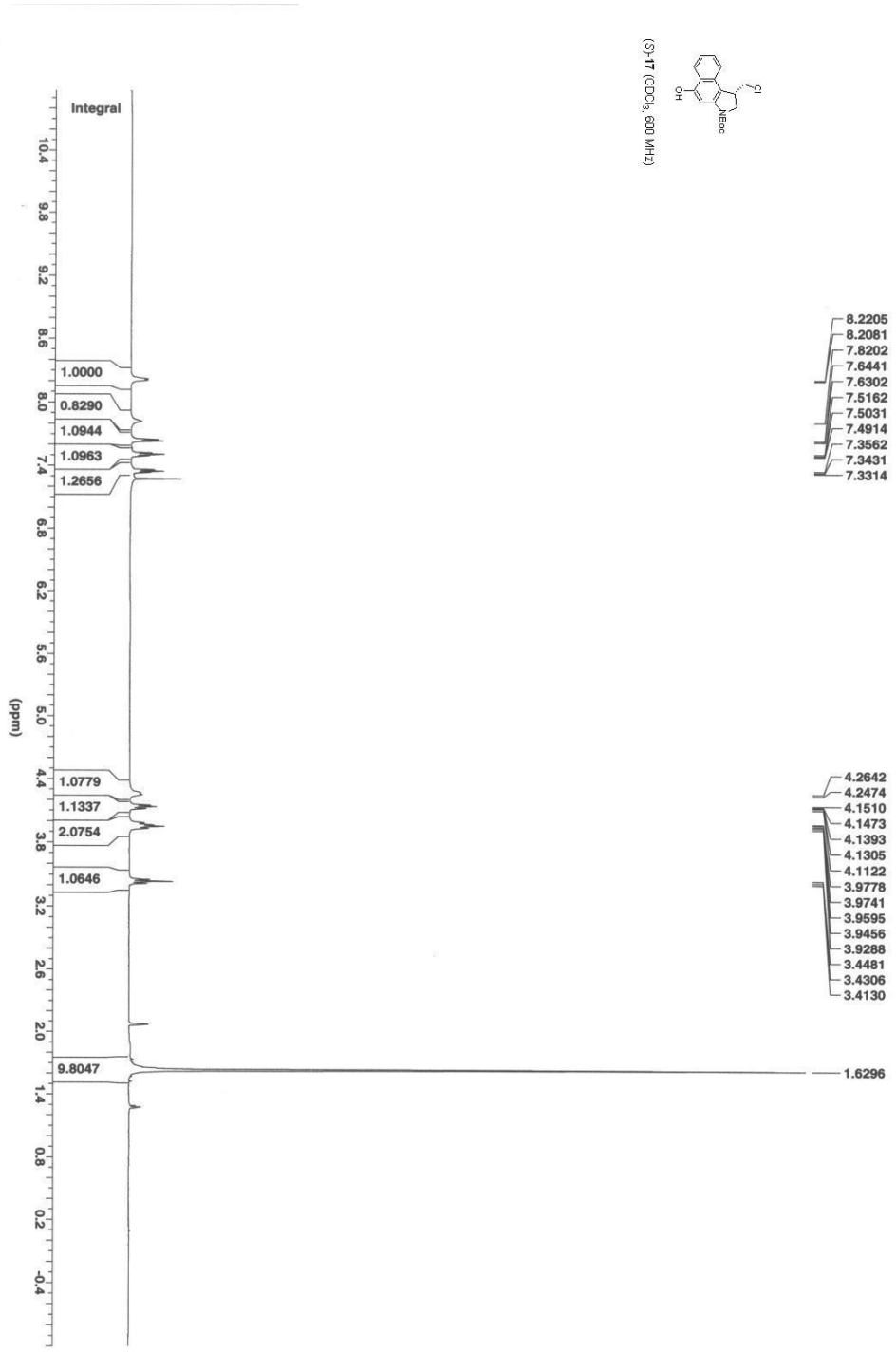
3.8005
3.7778
3.7595
3.7521
3.7338


(S)-17 (CDCl3, 600 MHz)
Integral
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1.0963
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1.0779
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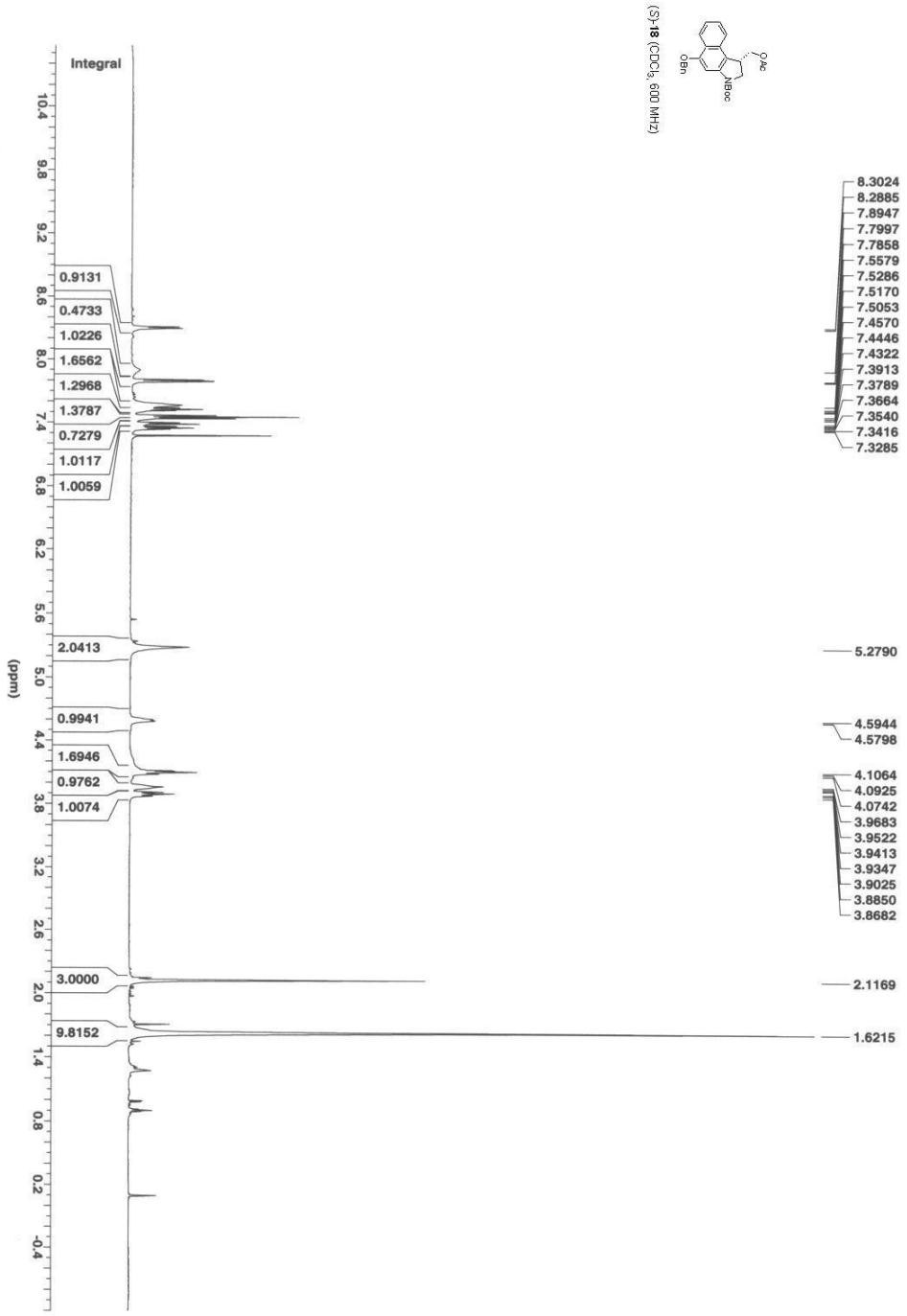
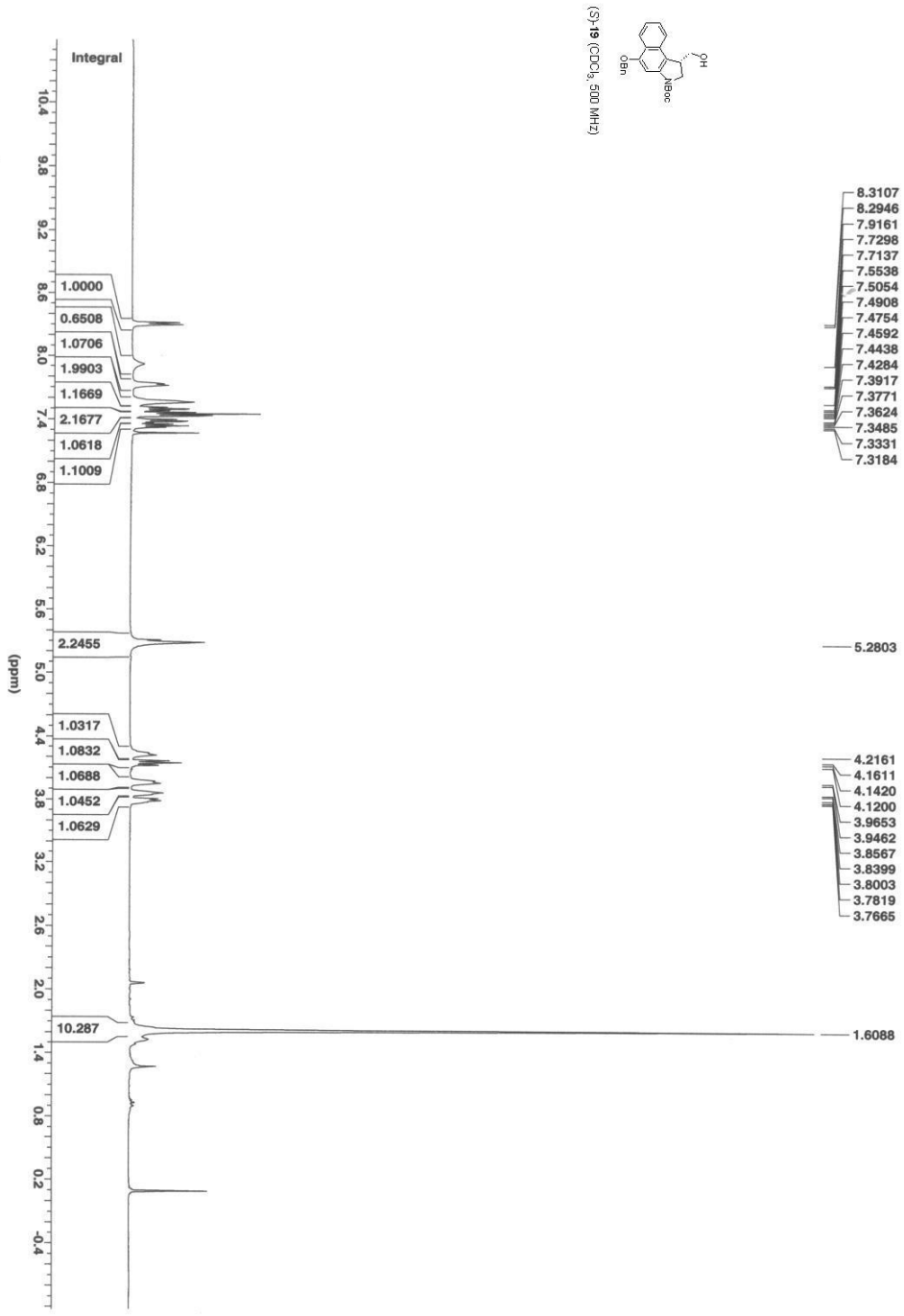
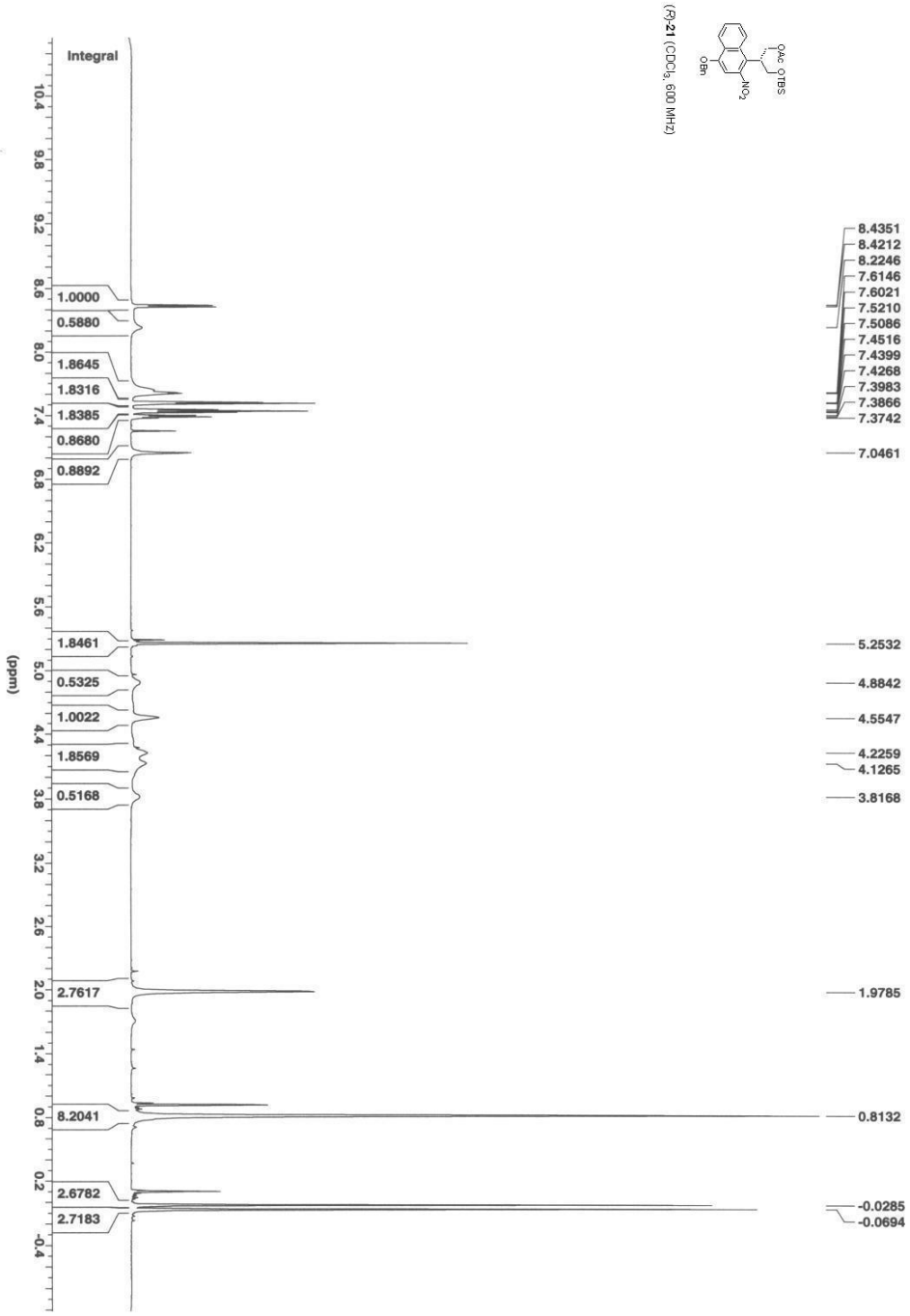
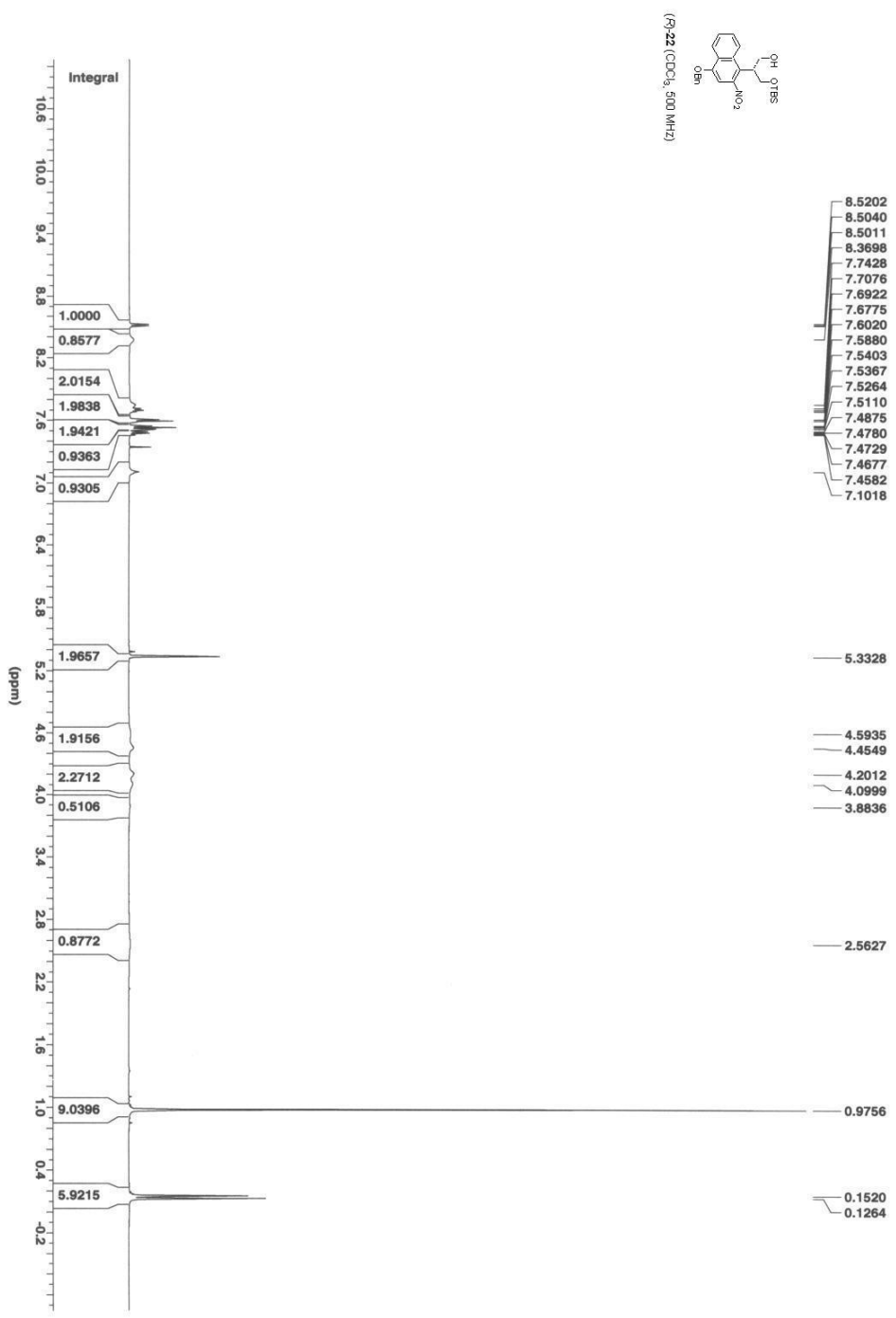
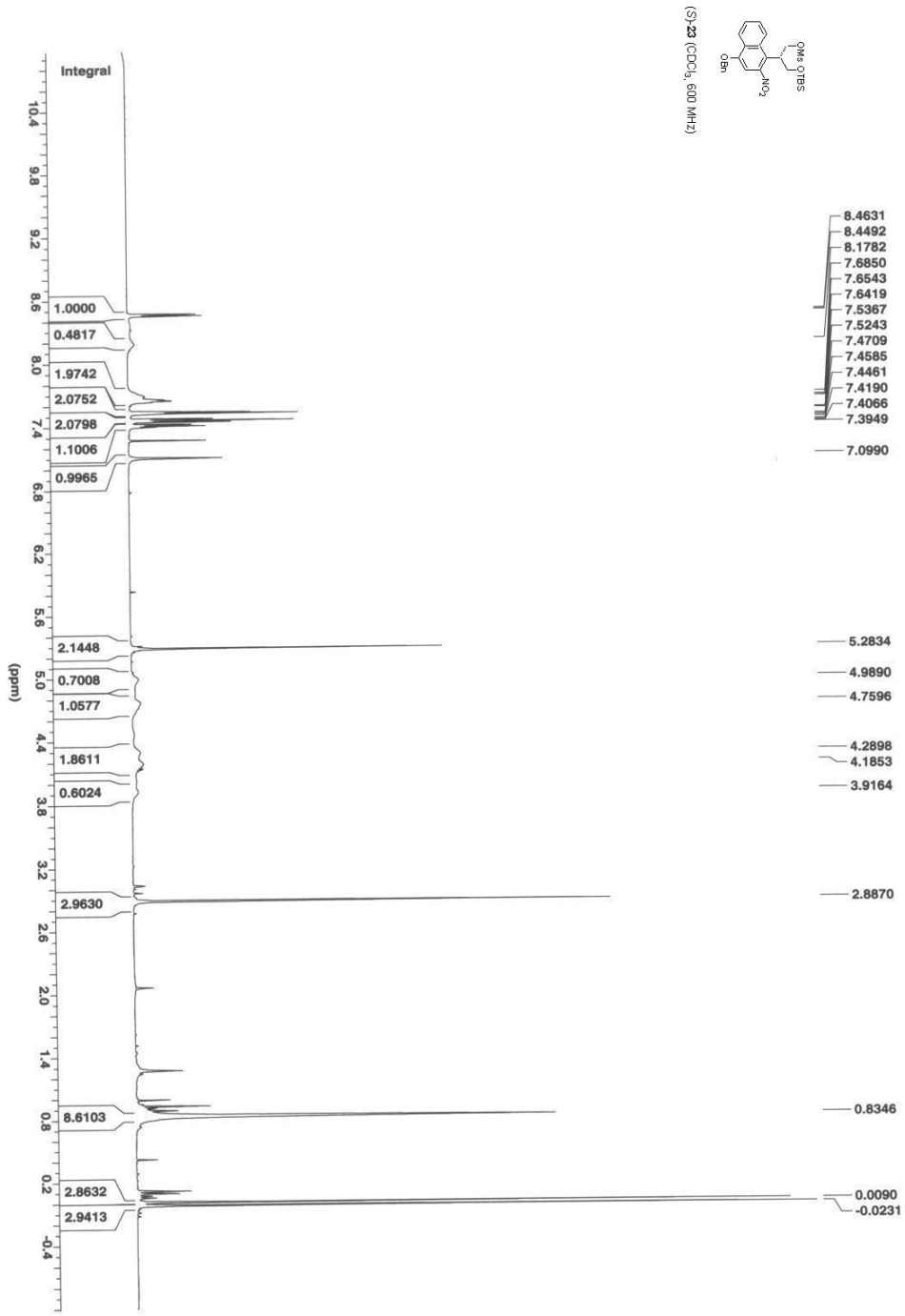
2.0754
1.0646
9.8047
(ppm)
8.2205
8.2081
7.8202
7.6441
7.6302
7.5162
7.5031
7.4914
7.3562
7.3431
7.3314
4.2642
4.2474
4.1510
4.1473
4.1393
4.1305
4.1122
3.9778
3.9741
3.9595
3.9456
3.9288
3.4481
3.4306
3.4130
1.6296

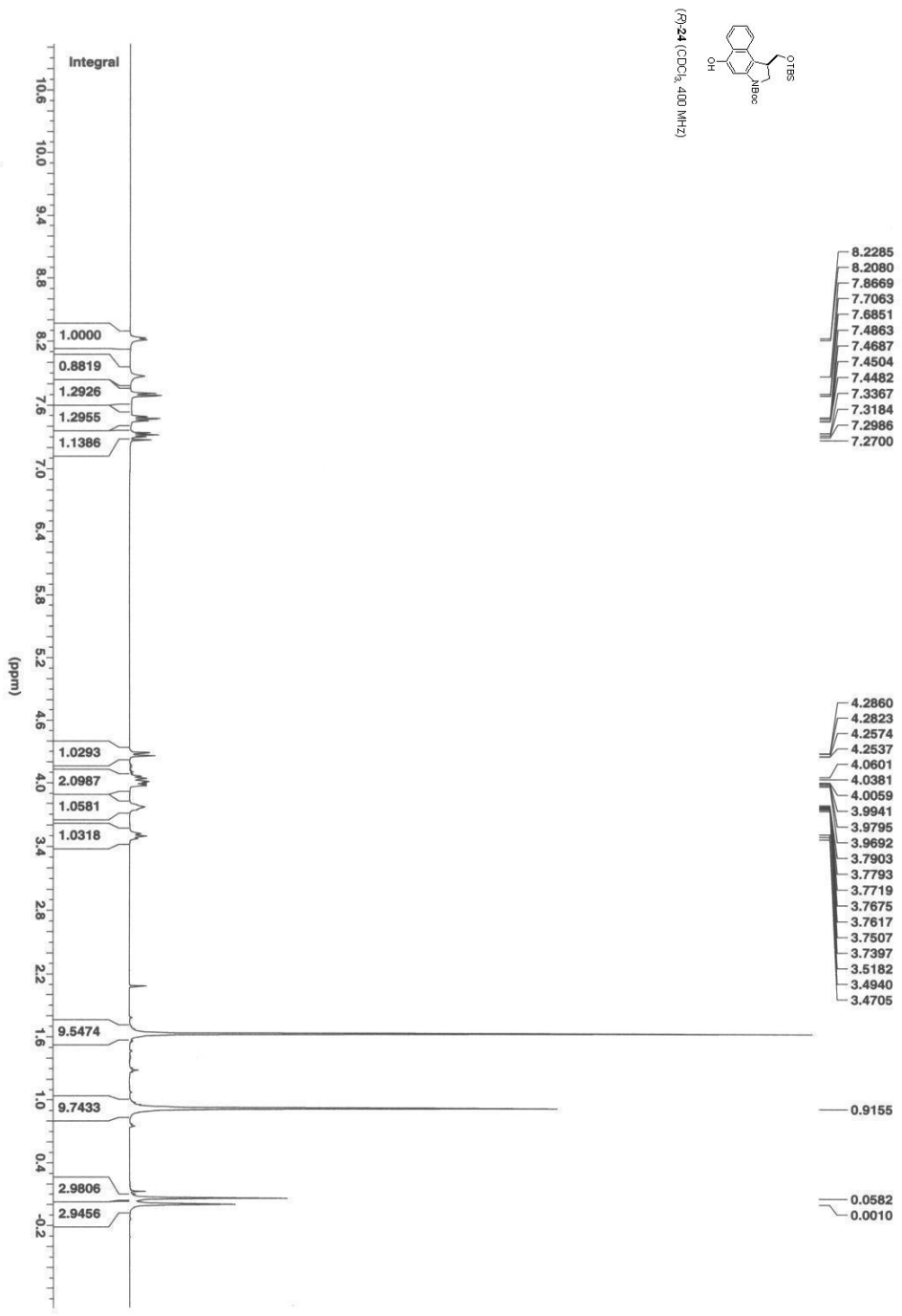

(S)-18 (CDCl3, 600 MHz)
OAc
OBn
NBoc
Integral
0.9131
0.4733
1.0226
1.6562
1.2968
1.3787
0.7279
1.0117
1.0059
2.0413
0.9941
1.6946
0.9762
1.0074
3.0000
9.8152
(ppm)
8.3024
8.2885
7.8947
7.7997
7.7858
7.5579
7.5286
7.5170
7.5053
7.4570
7.4446
7.4322
7.3913
7.3789
7.3664
7.3540
7.3416
7.3285
5.2790
4.5944
4.5798
4.1064
4.0925
4.0742
3.9683
3.9522
3.9413
3.9347
3.9025
3.8850
3.8682
2.1169
1.6215

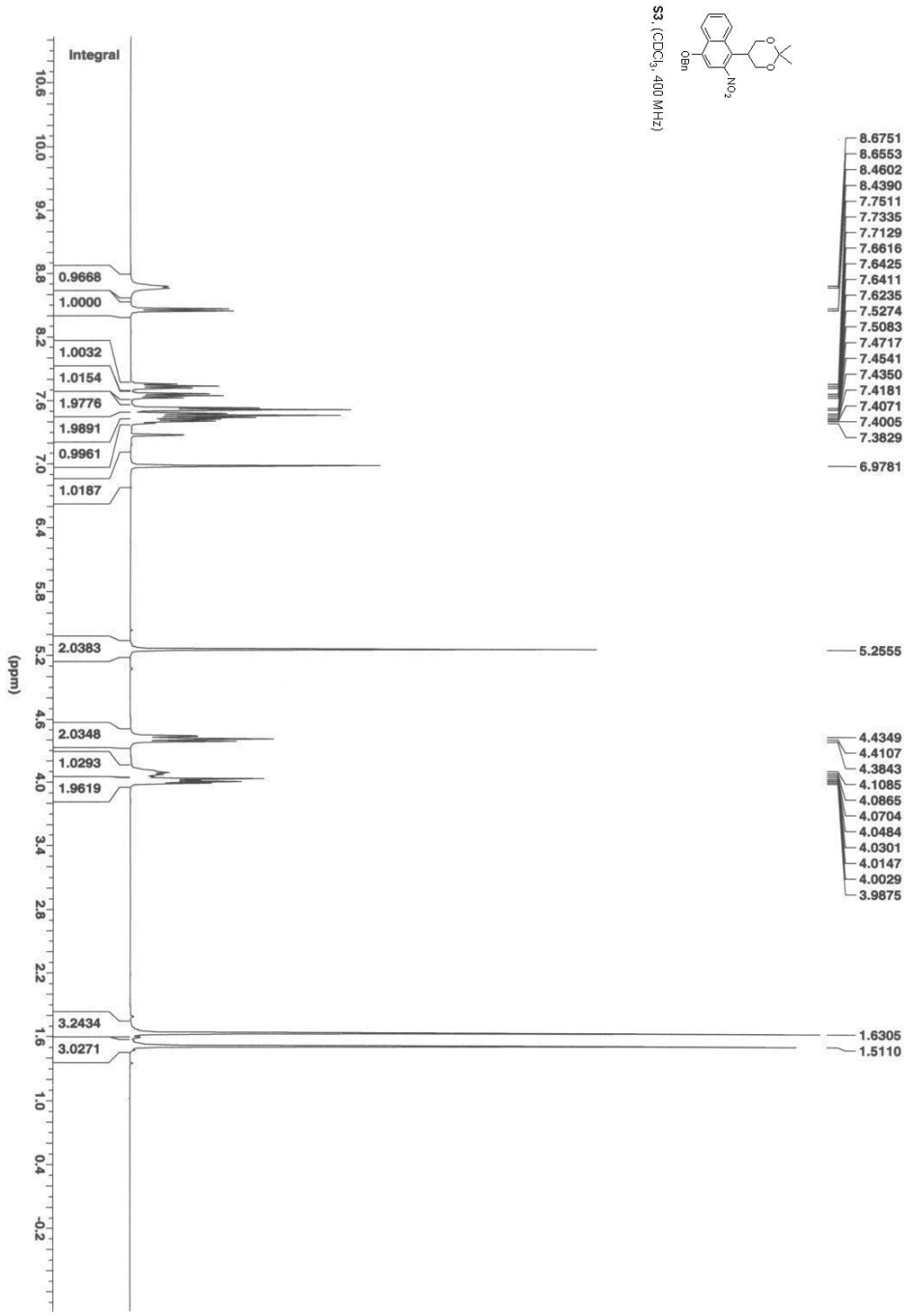

(S)-61 (CDCl3, 500 MHz)
OBn
NBoc
OH
Integral
(ppm)
1.0000
0.6508
1.0706
1.9903
1.1669
2.1677
1.0618
1.1009
2.2455
1.0317
1.0832
1.0688
1.0452
1.0629
10.287
8.3107
8.2946
7.9161
7.7298
7.7137
7.5538
7.5054
7.4908
7.4754
7.4592
7.4438
7.4284
7.3917
7.3771
7.3624
7.3485
7.3331
7.3184
5.2803
4.2161
4.1611
4.1420
4.1200
3.9653
3.9462
3.8567
3.8399
3.8003
3.7819
3.7665
1.6088

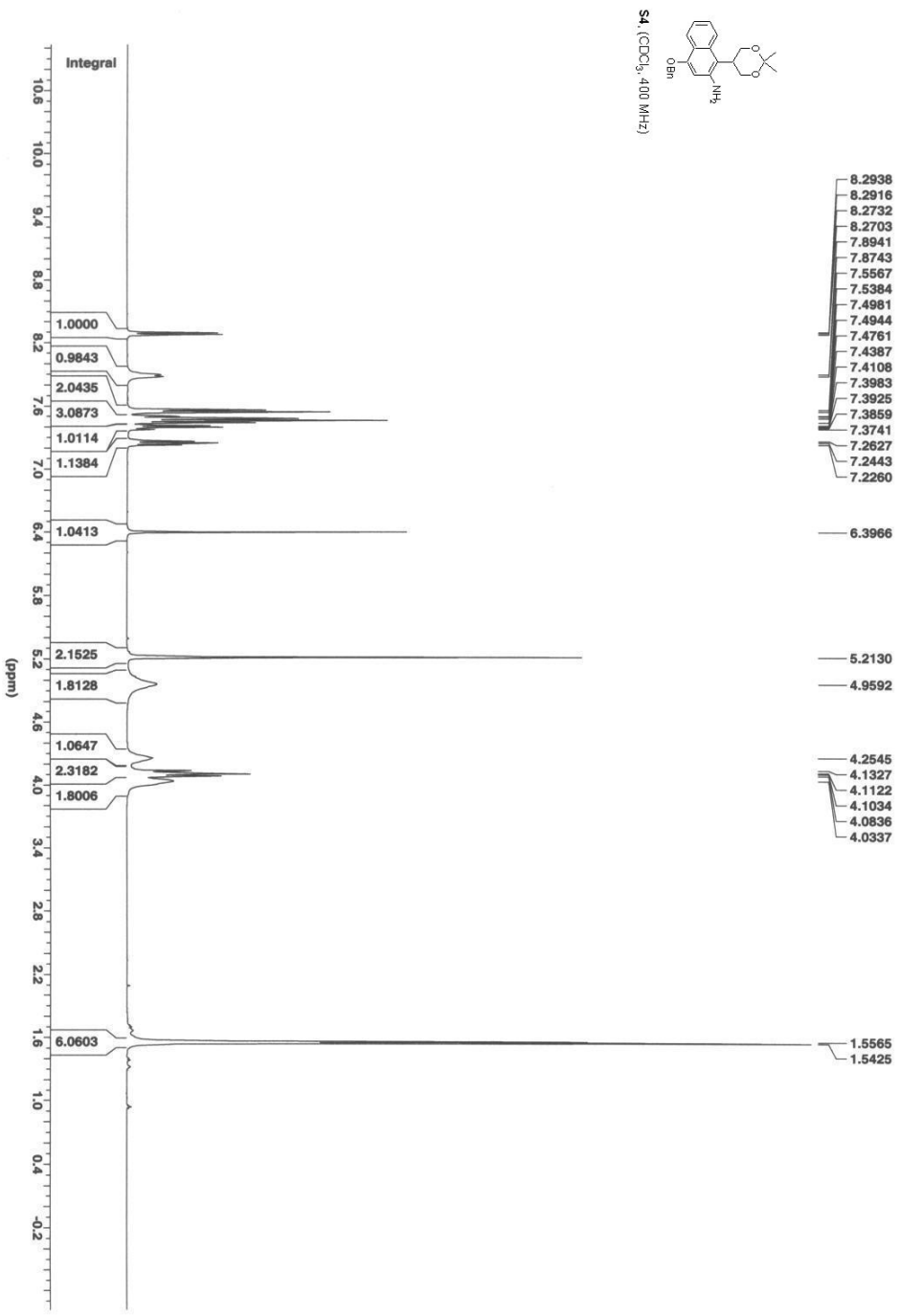

(R)-21 (CDCl3, 600 MHz)
OAc OTBS
OBn
NO2
Integral
(ppm)
1.0000
0.5880
1.8645
1.8316
1.8385
0.8680
0.8892
1.8461
0.5325
1.0022
1.8569
0.5168
2.7617
8.2041
2.6782
2.7183
8.4351
8.4212
8.2246
7.6146
7.6021
7.5210
7.5086
7.4516
7.4399
7.4268
7.3983
7.3866
7.3742
7.0461
5.2532
4.8842
4.5547
4.2259
4.1265
3.8168
1.9785
0.8132
-0.0285
-0.0694

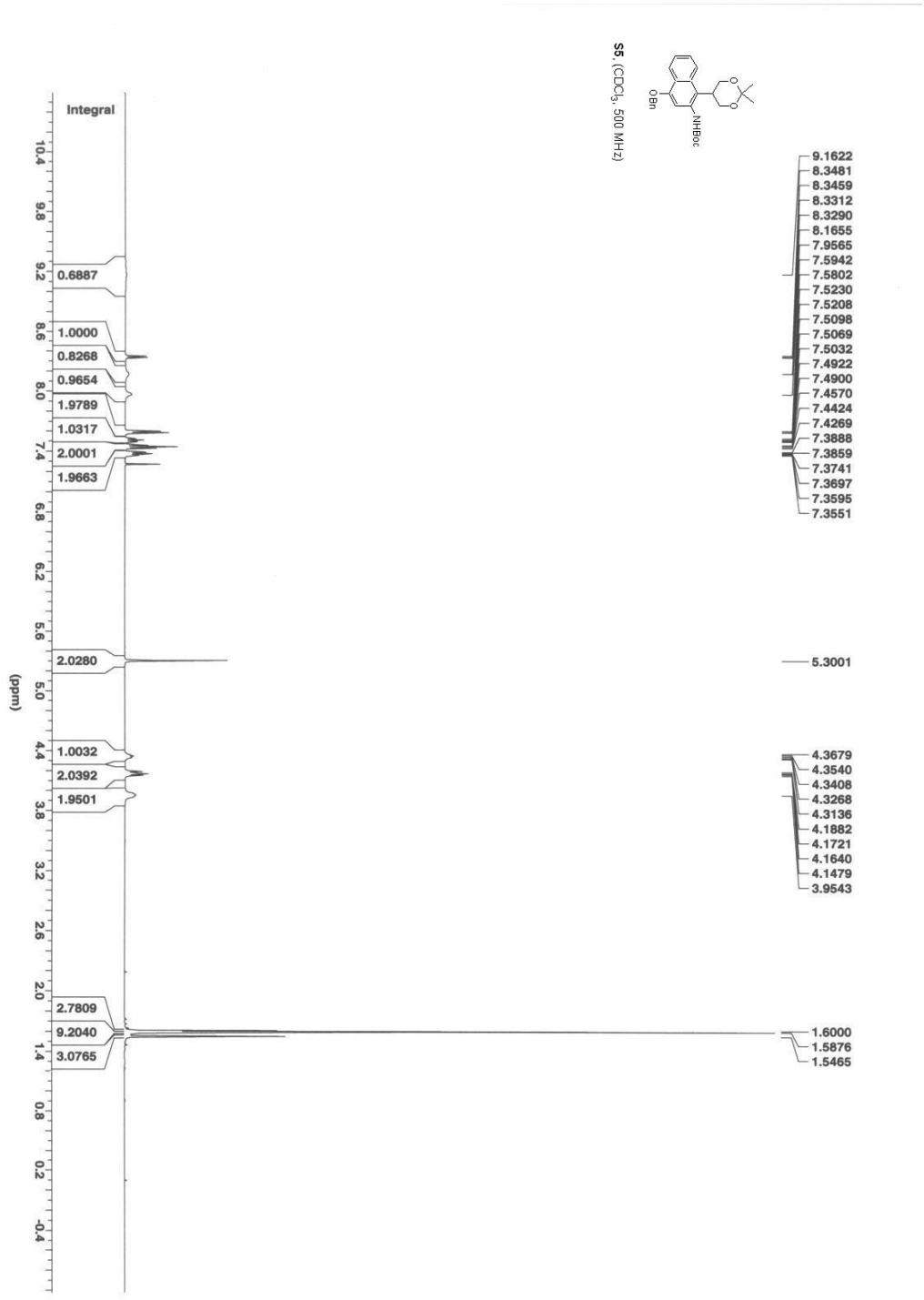

(R)-22 (CDCl3, 500 MHz)
OBn
NO2
OH
OTBS
Integral
(ppm)
1.0000
0.8577
2.0154
1.9838
1.9421
0.9363
0.9305
1.9657
1.9156
2.2712
0.5106
0.8772
9.0396
5.9215
8.5202
8.5040
8.5011
8.3698
7.7428
7.7076
7.6922
7.6775
7.6020
7.5880
7.5403
7.5367
7.5264
7.5110
7.4875
7.4780
7.4729
7.4677
7.4582
7.1018
5.3328
4.5935
4.4549
4.2012
4.0999
3.8836
2.5627
0.9756
0.1520
0.1264

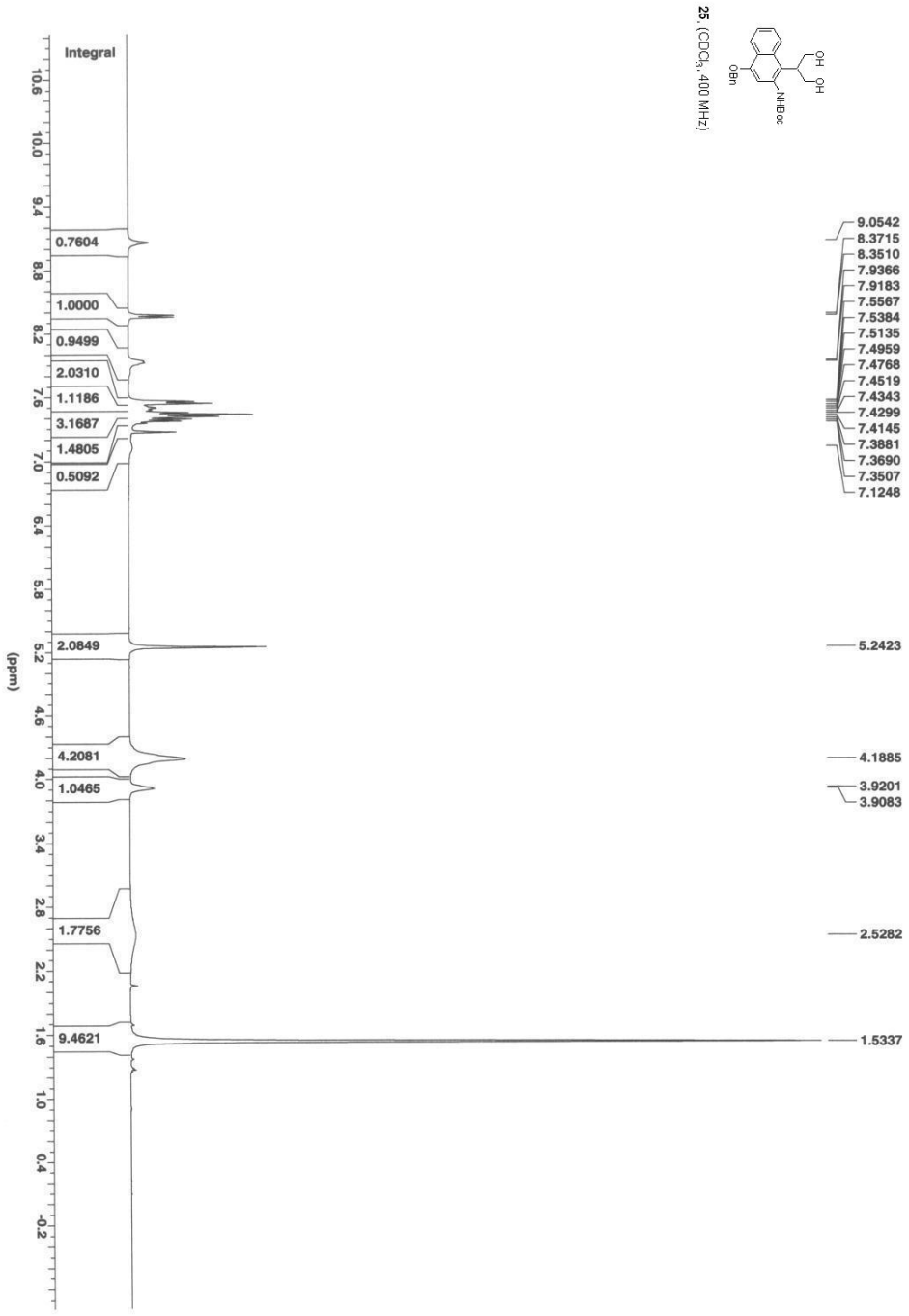

(S)-23 (CDCl3, 600 MHz)
OMs OTBS
OBn
NO2
Integral
(ppm)
1.0000
0.4817
1.9742
2.0752
2.0798
1.1006
0.9965
2.1448
0.7008
1.0577
1.8611
0.6024
2.9630
8.6103
2.8632
2.9413
8.4631
8.4492
8.1782
7.6850
7.6543
7.6419
7.5367
7.5243
7.4709
7.4585
7.4461
7.4190
7.4066
7.3949
7.0990
5.2834
4.9890
4.7596
4.2898
4.1853
3.9164
2.8870
0.8346
0.0090
-0.0231

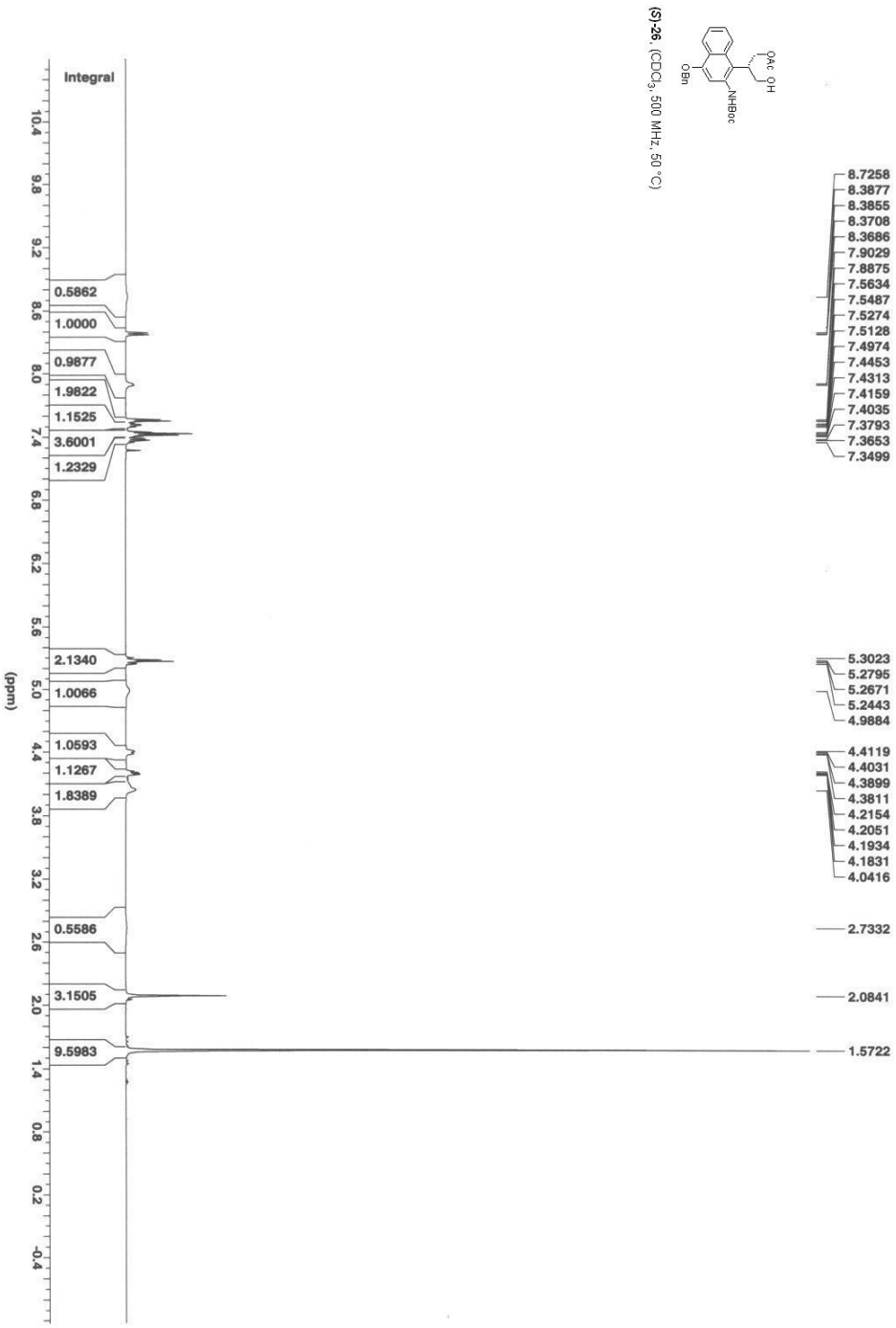

(R)-24 (CDCl3, 400 MHz)
OTBS
NBoc
OH
Integral
(ppm)
1.0000
0.8819
1.2926
1.2955
1.1386
1.0293
2.0987
1.0581
1.0318
9.5474
9.7433
2.9806
2.9456
8.2285
8.2080
7.8669
7.7063
7.6851
7.4863
7.4687
7.4504
7.4482
7.3367
7.3184
7.2986
7.2700
4.2860
4.2823
4.2574
4.2537
4.0601
4.0381
4.0059
3.9941
3.9795
3.9692
3.7903
3.7793
3.7719
3.7675
3.7617
3.7507
3.7397
3.5182
3.4940
3.4705
0.9155
0.0582
0.0010

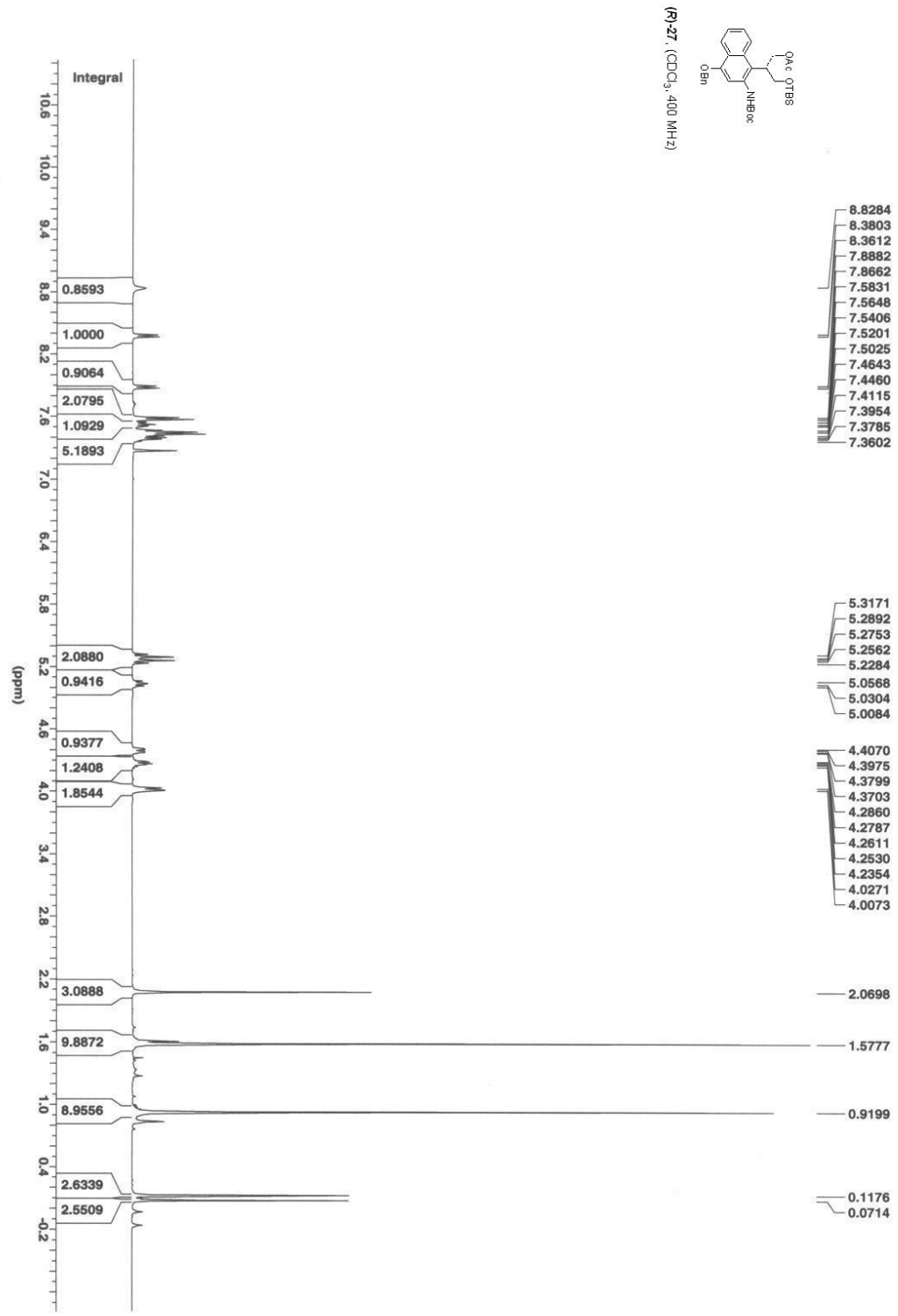

S3, ($CDCl_3$, 400 MHz)
OBn
NO_2
Integral
(ppm)
0.9668
1.0000
1.0032
1.0154
1.9776
1.9891
0.9961
1.0187
2.0383
2.0348
1.0293
1.9619
3.2434
3.0271
8.6751
8.6553
8.4602
8.4390
7.7511
7.7335
7.7129
7.6616
7.6425
7.6411
7.6235
7.5274
7.5083
7.4717
7.4541
7.4350
7.4181
7.4071
7.4005
7.3829
6.9781
5.2555
4.4349
4.4107
4.3843
4.1085
4.0865
4.0704
4.0484
4.0301
4.0147
4.0029
3.9875
1.6305
1.5110

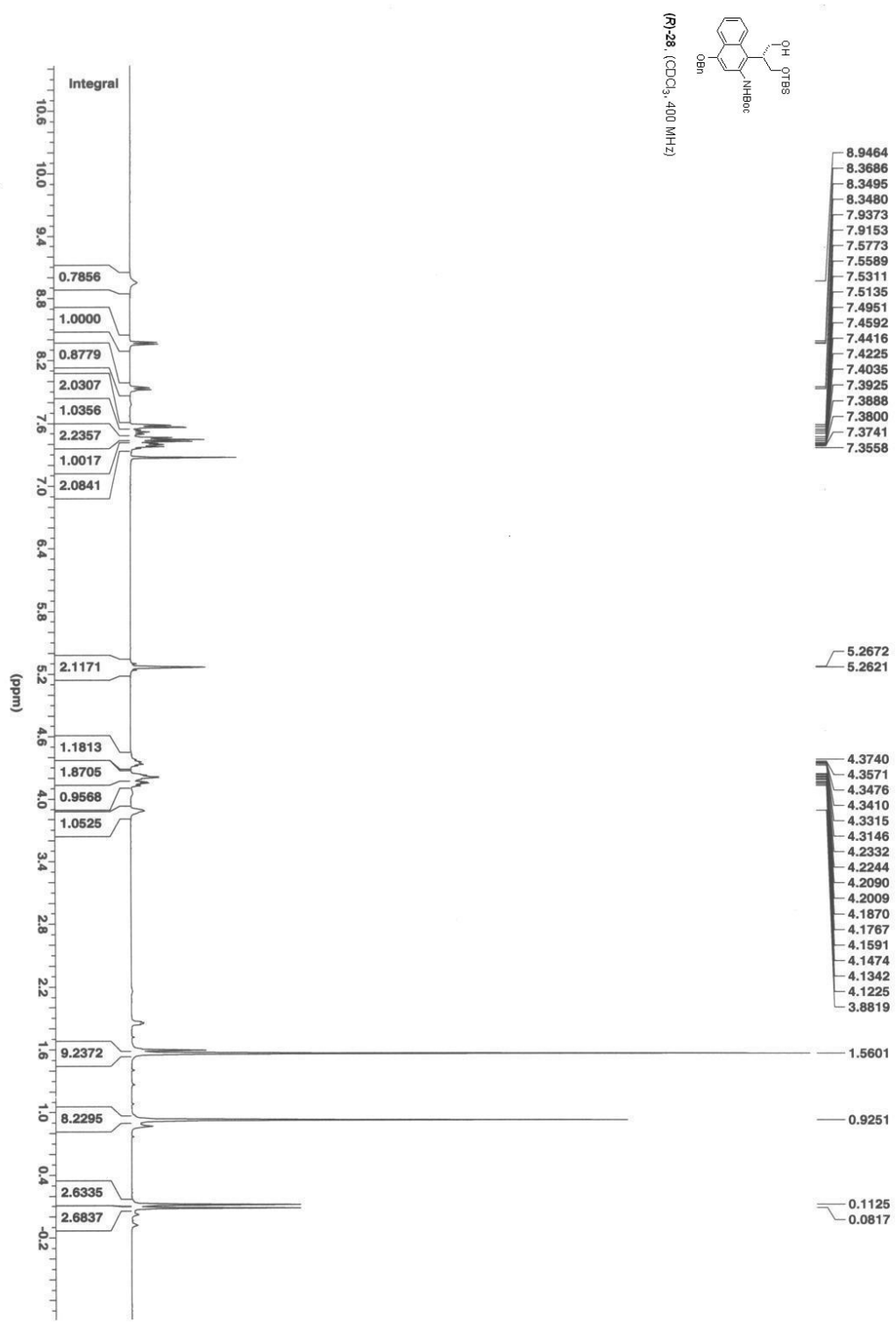

S4, ($CDCl_3$, 400 MHz)
OBn
NH_2
Integral
1.0000
0.9843
2.0435
3.0873
1.0114
1.1384
1.0413
2.1525
1.8128
1.0647
2.3182
1.8006
6.0603
(ppm)
8.2938
8.2916
8.2732
8.2703
7.8941
7.8743
7.5567
7.5384
7.4981
7.4944
7.4761
7.4387
7.4108
7.3983
7.3925
7.3859
7.3741
7.2627
7.2443
7.2260
6.3966
5.2130
4.9592
4.2545
4.1327
4.1122
4.1034
4.0836
4.0337
1.5565
1.5425

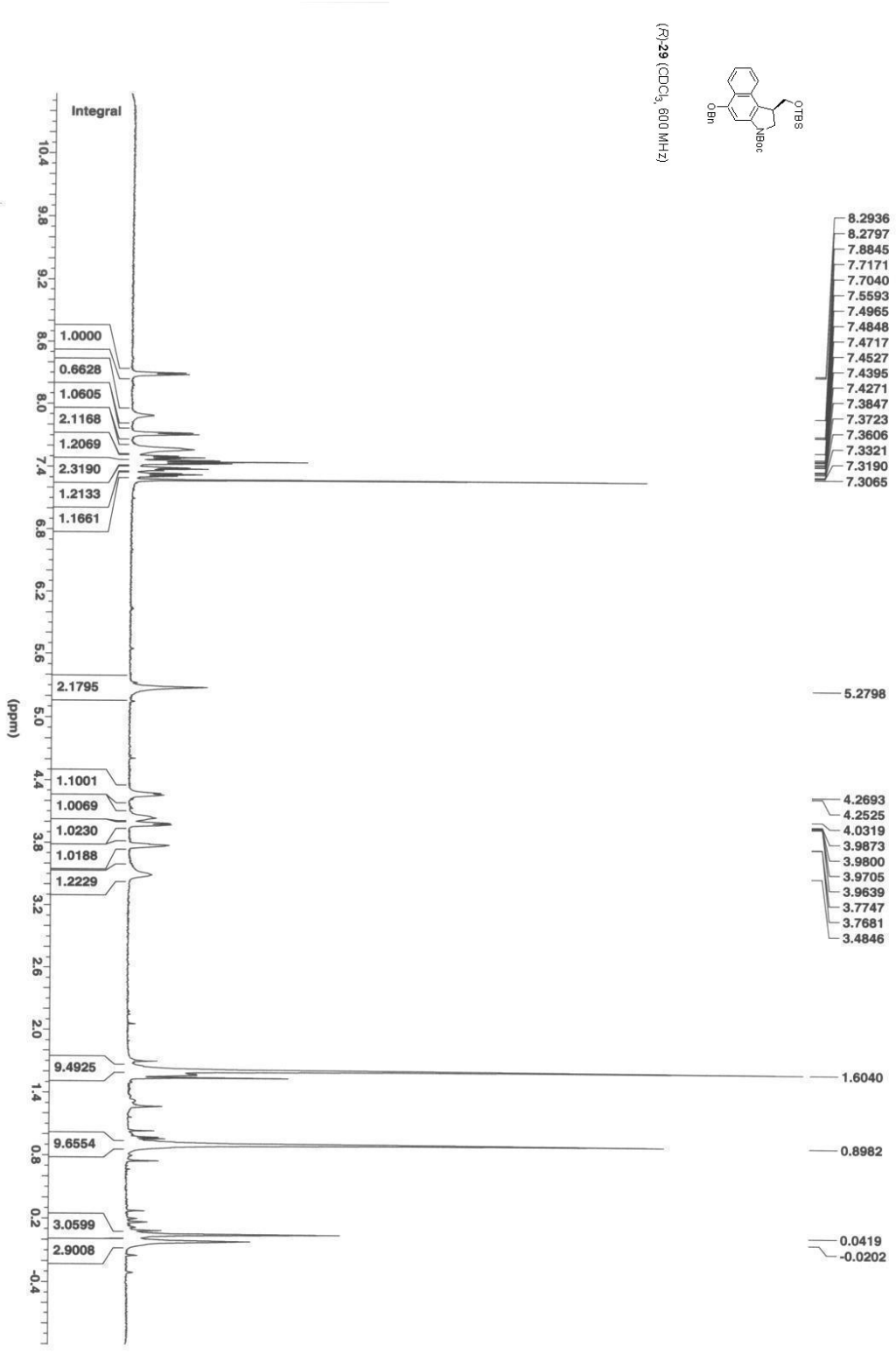

S5 (CDCl3, 500 MHz)
OBn
NHBoc
Integral
0.6887
1.0000
0.8268
0.9654
1.9789
1.0317
2.0001
1.9663
2.0280
1.0032
2.0392
1.9501
2.7809
9.2040
3.0765
(ppm)
9.1622
8.3481
8.3459
8.3312
8.3290
8.1655
7.9565
7.5942
7.5802
7.5230
7.5208
7.5098
7.5069
7.5032
7.4922
7.4900
7.4570
7.4424
7.4269
7.3888
7.3859
7.3741
7.3697
7.3595
7.3551
5.3001
4.3679
4.3540
4.3408
4.3268
4.3136
4.1882
4.1721
4.1640
4.1479
3.9543
1.6000
1.5876
1.5465


25 (CDCl3, 400 MHz)
OBn
NHBoc
OH
OH
Integral
0.7604
1.0000
0.9499
2.0310
1.1186
3.1687
1.4805
0.5092
2.0849
4.2081
1.0465
1.7756
9.4621
(ppm)
9.0542
8.3715
8.3510
7.9366
7.9183
7.5567
7.5384
7.5135
7.4959
7.4768
7.4519
7.4343
7.4299
7.4145
7.3881
7.3690
7.3507
7.1248
5.2423
4.1885
3.9201
3.9083
2.5282
1.5337


(S)-26, ($CDCl_3$, 500 MHz, 60 °C)
OBn
NHBoc
OAc
OH
Integral
(ppm)
0.5862
1.0000
0.9877
1.9822
1.1525
3.6001
1.2329
2.1340
1.0066
1.0593
1.1267
1.8389
0.5586
3.1505
9.5983
8.7258
8.3877
8.3855
8.3708
8.3686
7.9029
7.8875
7.5634
7.5487
7.5274
7.5128
7.4974
7.4453
7.4313
7.4159
7.4035
7.3793
7.3653
7.3499
5.3023
5.2795
5.2671
5.2443
4.9884
4.4119
4.4031
4.3899
4.3811
4.2154
4.2051
4.1934
4.1831
4.0416
2.7332
2.0841
1.5722


(R)-27, (CDCl3, 400 MHz)
OBn
NHBoc
OAc OTBS
Integral
(ppm)
0.8593
1.0000
0.9064
2.0795
1.0929
5.1893
2.0880
0.9416
0.9377
1.2408
1.8544
3.0888
9.8872
8.9556
2.6339
2.5509
8.8284
8.3803
8.3612
7.8882
7.8662
7.5831
7.5648
7.5406
7.5201
7.5025
7.4643
7.4460
7.4115
7.3954
7.3785
7.3602
5.3171
5.2892
5.2753
5.2562
5.2284
5.0568
5.0304
5.0084
4.4070
4.3975
4.3799
4.3703
4.2860
4.2787
4.2611
4.2530
4.2354
4.0271
4.0073
2.0698
1.5777
0.9199
0.1176
0.0714


(R)-28, (CDCl3, 400 MHz)
OBn
NHBoc
OH
OTBS
Integral
(ppm)
0.7856
1.0000
0.8779
2.0307
1.0356
2.2357
1.0017
2.0841
2.1171
1.1813
1.8705
0.9568
1.0525
9.2372
8.2295
2.6335
2.6837
8.9464
8.3686
8.3495
8.3480
7.9373
7.9153
7.5773
7.5589
7.5311
7.5135
7.4951
7.4592
7.4416
7.4225
7.4035
7.3925
7.3888
7.3800
7.3741
7.3558
5.2672
5.2621
4.3740
4.3571
4.3476
4.3410
4.3315
4.3146
4.2332
4.2244
4.2090
4.2009
4.1870
4.1767
4.1591
4.1474
4.1342
4.1225
3.8819
1.5601
0.9251
0.1125
0.0817


(R)-29 (CDCl3, 600 MHz)
OTBS
NBoc
OBn
Integral
(ppm)
1.0000
0.6628
1.0605
2.1168
1.2069
2.3190
1.2133
1.1661
2.1795
1.1001
1.0069
1.0230
1.0188
1.2229
9.4925
9.6554
3.0599
2.9008
8.2936
8.2797
7.8845
7.7171
7.7040
7.5593
7.4965
7.4848
7.4717
7.4527
7.4395
7.4271
7.3847
7.3723
7.3606
7.3321
7.3190
7.3065
5.2798
4.2693
4.2525
4.0319
3.9873
3.9800
3.9705
3.9639
3.7747
3.7681
3.4846
1.6040
0.8982
0.0419
-0.0202