A Facile and Efficient Direct Aldol Addition of Simple Thioesters

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Supporting Information

General Considerations: Unless stated to the contrary, where applicable, the following conditions apply: Reactions were carried out using dried solvents (see below) and under a slight static pressure of Ar (pre-purified quality) that had been passed through a column (5 x 20 cm) of Drierite. Glassware was dried in an oven at 120 °C for at least 12 h prior to use and then either cooled in a dessicator cabinet over Drierite or assembled quickly while hot, sealed with rubber septa, and allowed to cool under a stream of Ar. Reactions were stirred magnetically using Teflon-coated magnetic stirring bars. Teflon-coated magnetic stirring bars and syringe needles were dried in an oven at 120 °C for at least 12 h prior to use and then cooled in a dessicator cabinet over Drierite. Hamilton microsyringes were dried in an oven at 60 °C for at least 24 h prior to use and cooled in the same manner. Commercially available Norm-Ject disposable syringes were used. Dry benzene, toluene, Et₂O, CH₂Cl₂, THF, MeCN and DME were obtained using an Innovative Technologies solvent purification system. All other dry solvents were of anhydrous quality purchased from Aldrich. Commercial grade solvents were used for routine purposes without further purification. Et₃N, pyridine, *i*-Pr₂NEt, 2,6-lutidine, *i*-Pr₂NH and TMEDA were distilled from CaH₂ under a N₂ atmosphere prior to use. Flash column chromatography was performed on silica gel 60 (230–400 mesh). ¹H and ¹³C NMR were recorded on a 300 MHz spectrometer at ambient temperature. All ¹H chemical shifts are reported in ppm (δ) relative to TMS; ¹³C shifts are reported relative to the corresponding NMR solvent.

The following reaction is representative of those depicted in Table 1:

β-Hydroxy thioester (10). MgI₂ (0.167 g, 0.6 mmol) was added to a stirred solution of thioester **5** (0.076 g, 0.5 mmol) and benzaldehyde (61 μL, 0.6 mmol) in CH₂Cl₂ (2.5 mL), followed by the addition of *i*-Pr₂NEt (0.11 mL, 0.65 mmol). Stirring was continued for 30 min and EtOAc (2.5 mL) and 10% (v/v) aqueous HCl (2.5 mL) were added. Stirring was continued for 15 min and the mixture was partitioned between EtOAc (15 mL) and H₂O (2 mL). The aqueous phase was extracted with EtOAc (3 x 5 mL) and the combined organic extracts were washed with saturated aqueous NaCl, dried (MgSO₄), and evaporated to give a light-yellow solid. Flash chromatography over silica gel, using 10:90 EtOAc-hexanes gave **10** (0.121 g; 94%) as a pure, colorless solid: ¹H NMR

(CDCl₃, 300 MHz): δ 7.50-7.26 (m, 10H), 5.21 (X of an ABX system, apparent td, J = 3.4, 8.7 Hz, 1H), 3.12 (A of an ABX system, apparent dd, J = 8.8, 16.0 Hz, 1H), 3.03 (B of an ABX system, apparent dd, J = 3.8, 16.0 Hz, 1H), 2.97 (d, J = 3.3 Hz, 1H); ¹³C NMR (CDCl₃, 300 MHz): δ 197.4, 142.3, 134.6, 129.8, 129.4, 128.8, 128.1, 127.2, 125.8, 70.9, 52.2; ESI-MS m/z calcd for C₁₅H₁₄NaO₂S: 281.1, found: 280.8.

β -Hydroxy thioester (2). Flash chromatography over silica gel, using 10:90 EtOAc-hexanes gave **2** (0.1294 g; 95%) as a pure, colorless solid: ¹H NMR (CDCl₃, 300 MHz): δ 7.42-7.18 (m, 10H), 5.20 (X of an ABX system, apparent td, J = 3.6, 8.7 Hz, 1H), 4.17 and 4.15 (AB q, $\Delta\nu_{AB}$ = 6.6 Hz, J = 13.8 Hz, 2H), 3.08-2.88 [m, 3H, including A of an ABX system, apparent dd, at δ 3.02 (J = 9.0, 15.9 Hz, 1H) and B of an ABX system, apparent dd, at δ 2.93 (J = 3.9, 15.9 Hz, 1H)]; ¹³C NMR (CDCl₃, 300 MHz): δ 198.2, 142.4, 137.2, 129.0, 128.82, 128.75, 128.1, 127.5, 125.8, 71.0, 52.4, 33.4; ESI-MS m/z calcd for C₁₆H₁₆NaO₂S: 295.1, found: 294.9.

β -Hydroxy thioester (11). Flash chromatography over silica gel, using 15:85 EtOAc-hexanes gave **11** (0.1413 g; 98%) as a pure, colorless solid: ¹H NMR (CDCl₃, 300 MHz): δ 7.39-7.20 (m, 7H), 7.00-6.90 (m, 2H), 5.20 (X of an ABX system, apparent td, J = 3.3, 8.7 Hz, 1H), 3.83 (s, 3H), 3.14-2.97 [m, 3H, including A of an ABX system, apparent dd, at δ 3.09 (J = 8.7, 15.9 Hz, 1H), a d at δ 3.04 (J = 4.2 Hz), and B of an ABX system, apparent dd, at δ 2.99 (J = 3.3, 15.9 Hz, 1H)]; ¹³C NMR (CDCl₃, 300 MHz): δ 198.7, 161.0, 142.3, 136.2, 128.8, 128.1, 125.8, 117.8, 115.1, 70.9, 55.5, 51.9; ESI-MS m/z calcd for C₁₆H₁₆NaO₃S: 311.1, found: 310.9.

β -Hydroxy thioester (12). Flash chromatography over silica gel, using 15:85 EtOAc-hexanes gave **12** (0.1384 g; 96%) as a pure, light-yellow solid: ¹H NMR (CDCl₃, 300 MHz): δ 7.45-7.20 (m, 7H), 7.06-6.97 (m, 2H), 5.20 (X of an ABX system, apparent dd, J = 8.1, 4.5 Hz, 1H), 3.85 (s, 3H), 3.24-2.96 [m, 3H, including A of an ABX system, apparent dd, at δ 3.15 (J = 5.4, 15.9 Hz, 1H), and B of an ABX system, apparent dd, at δ 3.05 (J = 4.2, 15.9 Hz, 1H)]; ¹³C NMR (CDCl₃, 300 MHz): δ 197.0, 159.2, 142.3, 136.8, 132.1, 128.7, 128.0, 125.8, 121.3, 115.4, 111.8, 71.0, 56.1, 52.1; ESI-MS m/z calcd for C₁₆H₁₆NaO₃S: 311.1, found: 310.9.

β -Hydroxy thioester (13). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes gave **13** (0.1395 g; 92%) as a pure, light-yellow solid: ^1H NMR (CDCl_3 , 300 MHz): δ 8.30-8.20 (m, 2H), 7.70-7.55 (m, 2H), 7.50-7.22 (m, 5H), 5.26 (X of an ABX system, apparent td, $J = 3.6, 9.0$ Hz, 1H), 3.25-3.00 [m, 2H, including A of an ABX system, apparent dd, at δ 3.19 ($J = 9.0, 15.9$ Hz, 1H), and B of an ABX system, apparent dd, at δ 3.06 ($J = 3.6, 15.9$ Hz, 1H)], 2.64 (d, $J = 3.6$ Hz, 1H); ^{13}C NMR (CDCl_3 , 300 MHz): δ 194.5, 148.4, 142.1, 135.7, 134.9, 128.9, 128.4, 125.8, 124.2, 70.9, 52.8; **ESI-MS** m/z calcd for $\text{C}_{15}\text{H}_{13}\text{NNaO}_4\text{S}$: 326.0, found: 325.9.

β -Hydroxy thioester (14). Flash chromatography over silica gel, using 10:90 EtOAc-hexanes gave **14** (0.1259 g; 96%) as a pure, light-yellow oil: ^1H NMR (CDCl_3 , 300 MHz): δ 7.41-7.23 (m, 6H), 6.33-6.18 (m, 2H), 5.20 (X of an ABX system, broad apparent td, ($J = 2.7, 8.7$ Hz, 1 H) 4.20 and 4.17 (AB q, $\Delta\nu_{\text{AB}} = 10.4$ Hz, $J = 15.3$ Hz, 2H), 3.09-2.88 [m, 3H, including A of an ABX system, apparent dd, at δ 3.03 ($J = 8.8, 15.8$ Hz), B of an ABX system, apparent dd, at δ 2.93 ($J = 3.9, 15.8$ Hz), overlapping a broad d at δ 2.92 ($J = 2.4$ Hz)]; ^{13}C NMR (CDCl_3 , 300 MHz): δ 197.5, 150.1, 142.4, 142.3, 128.7, 128.0, 125.7, 110.7, 108.2, 70.8, 52.4, 25.8; **ESI-MS** m/z calcd for $\text{C}_{14}\text{H}_{14}\text{NaO}_3\text{S}$: 285.1, found: 284.8.

The following reaction is representative of those depicted in Table 2 and Scheme 2:

The following reactions were conducted using untreated CH_2Cl_2 , open to the atmosphere. Glassware and stirring bars were dried as described above, but allowed to cool open to the atmosphere.

β -Hydroxy thioester (10). $\text{MgBr}_2\cdot\text{OEt}_2$ (0.181 g, 0.7 mmol) was added to a stirred solution of thioester **5** (0.076 g, 0.5 mmol) and benzaldehyde (61 μL , 0.6 mmol) in CH_2Cl_2 (2.5 mL), followed by the addition of $i\text{-Pr}_2\text{NEt}$ (0.17 mL, 1.0 mmol). The reaction flask was capped to prevent evaporation. Stirring was continued for 30 min and then EtOAc (2.5 mL) and 10% (v/v) aqueous HCl (2.5 mL) were added. Stirring was continued for 20 min and the mixture was partitioned between EtOAc (30 mL) and H_2O (2 mL). The aqueous phase was extracted with EtOAc (3 x 5 mL) and the combined organic extracts were washed with saturated aqueous NaCl, dried (MgSO_4), and

evaporated to give a light-yellow solid. Flash chromatography over silica gel, using 10:90 EtOAc-hexanes gave **10** (0.1240 g; 96%) as a pure, colorless solid. Spectroscopic data was identical to that reported above.

β -Hydroxy thioester (22). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes gave **22** (0.1399 g; 97%) as a pure, colorless solid. **^1H NMR** (CDCl_3 , 300 MHz): δ 7.44-6.84 [m, 9H, including apparent d at δ 7.30 ($J = 8.8$ Hz), and apparent d at δ 6.89 ($J = 8.8$ Hz)], 5.16 (X of an ABX system, broad apparent d ($J = 8.7$ Hz, 1H), 3.80 (s, 3H), 3.11 (A of an ABX system, apparent dd, $J = 8.7$, 15.9 Hz, 1H), 3.00 (B of an ABX system, apparent dd, $J = 3.6$, 15.9 Hz, 1H), 2.90 (broad apparent s, 1H); **^{13}C NMR** (CDCl_3 , 300 MHz): δ 197.1, 159.3, 134.53, 134.50, 129.7, 129.3, 127.2, 127.0, 114.0, 70.4, 55.3, 52.2; **ESI-MS** m/z calcd for $\text{C}_{16}\text{H}_{16}\text{NaO}_3\text{S}$: 311.1, found: 310.8.

β -Hydroxy thioester (23). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes gave **23** (0.1384 g; 96%) as a pure, colorless solid. **^1H NMR** (CDCl_3 , 300 MHz): δ 7.50-7.22 (m, 6H), 6.98-6.78 (m, 3H), 5.19 (X of an ABX system, apparent overlapping td, $J = 3.6$, 8.5 Hz, 1H), 3.81 (s, 3H), 3.17-2.92 [m, 3H, including A of an ABX system, apparent dd, at δ 3.10 ($J = 8.5$, 16.0 Hz), B of an ABX system, apparent dd, at δ 3.02 ($J = 3.6$, 16.0 Hz), and a d at δ 2.97 ($J = 3.6$ Hz)]; **^{13}C NMR** (CDCl_3 , 300 MHz): δ 197.0, 159.8, 144.0, 134.5, 129.7, 129.3, 127.2, 118.0, 113.6, 111.1, 70.6, 55.3, 52.2 (2 peaks overlapping); **ESI-MS** m/z calcd for $\text{C}_{16}\text{H}_{16}\text{NaO}_3\text{S}$: 311.1, found: 310.8.

β -Hydroxy thioester (24). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes gave **24** (0.1355 g; 94%) as a pure, colorless solid. **^1H NMR** (CDCl_3 , 300 MHz): δ 8.22 (apparent d, $J = 8.7$ Hz, 2H), 7.56 (apparent d, $J = 8.7$ Hz, 2H), 7.48-7.34 (m, 5H), 5.32 (dt, $J = 3.6$, 6.3 Hz, 1H), 3.30 (d, $J = 3.6$ Hz, 1H), 3.08 (d, $J = 6.3$ Hz, 2H); **^{13}C NMR** (CDCl_3 , 300 MHz): δ 197.3, 149.4, 147.7, 134.6, 130.1, 129.6, 126.7, 124.0, 69.9, 51.6 (2 peaks overlapping); **ESI-MS** m/z calcd for $\text{C}_{15}\text{H}_{13}\text{NNaO}_4\text{S}$: 326.0, found: 325.8.

β -Hydroxy thioester (25). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes gave **25** (0.1420 g; 95%) as a pure, colorless solid. **^1H NMR** (CDCl_3 , 300 MHz): δ 7.46-7.36 (m, 6H), 7.34-7.20 (m, 3H), 5.18 (X of ABX system, apparent overlapping td, $J = 3.9, 7.8$ Hz, 1H), 3.14-2.96 [m, 3H, including A of an ABX system, apparent dd, at δ 3.08 ($J = 7.8, 15.9$ Hz), overlapping a d at δ 3.08 ($J = 3.3$ Hz), and B of an ABX system, apparent dd, at δ 3.01 ($J = 4.4, 15.9$ Hz)]; **^{13}C NMR** (CDCl_3 , 300 MHz): δ 197.2, 144.3, 134.6, 130.0, 129.8, 129.4, 128.1, 126.9, 126.0, 123.9, 70.1, 51.9 (2 peaks overlapping); **ESI-MS** m/z calcd for $\text{C}_{15}\text{H}_{13}\text{ClNaO}_2\text{S}$: 315.0, found: 314.8.

β -Hydroxy thioester (26). Flash chromatography over silica gel, using 10:90 EtOAc-hexanes gave **26** (0.1307 g; 92% with trace impurities) as a colorless solid. **^1H NMR** (CDCl_3 , 300 MHz): δ 7.46-7.20 (m, 10H), 6.68 (d, $J = 15.8$ Hz, 1H), 6.23 (dd, $J = 6.0, 15.8$ Hz, 1H), 4.87-4.76 (m, 1H), 3.00 (apparent d, $J = 6.6$ Hz, 2H), 2.74 (d, $J = 4.2$ Hz, 1H); **^{13}C NMR** (CDCl_3 , 300 MHz): δ 197.1, 136.4, 134.6, 131.2, 129.8, 129.6, 129.4, 128.7, 128.0, 127.2, 126.7, 69.5, 50.3; **ESI-MS** m/z calcd for $\text{C}_{17}\text{H}_{16}\text{NaO}_2\text{S}$: 307.1, found: 306.9.

β -Hydroxy thioester (27). Flash chromatography over silica gel, using 10:90 EtOAc-hexanes gave **27** (0.1120 g; 94%) as a pure, light-yellow oil. **^1H NMR** (CDCl_3 , 300 MHz): δ 7.44-7.40 (m, 5H), 3.78 (X of an ABX system, apparent d, $J = 10.2$ Hz, 1H), 2.94-2.58 [m, 3H, including A of an ABX system, apparent dd, at δ 2.88 ($J = 2.0, 15.8$ Hz), B of an ABX system, apparent dd, at δ 2.71 ($J = 10.2, 15.8$ Hz), and a d at δ 2.62 ($J = 3.3$ Hz)], 0.93 (s, 9H); **^{13}C NMR** (CDCl_3 , 300 MHz): δ 198.8, 134.6, 129.7, 129.4, 127.4, 76.0, 45.9, 34.8, 25.7; **ESI-MS** m/z calcd for $\text{C}_{13}\text{H}_{18}\text{NaO}_2\text{S}$: 261.1, found: 260.9.

β -Hydroxy thioester (28). Flash chromatography over silica gel, using 10:90 EtOAc-hexanes gave **28** (0.1084 g; 82%) as a pure, colorless solid. **^1H NMR** (CDCl_3 , 300 MHz): δ 7.43-7.37 (m, 5H), 3.92-3.78 (X of an ABX system, m, 1H), 2.90-2.64 [m, 3H, including A of an ABX system, apparent dd, at δ 2.86 ($J = 3.3, 15.9$ Hz), B of an ABX system, apparent dd, at δ 2.77 ($J = 8.7, 15.9$ Hz), and a d at δ 2.68 ($J = 3.9$ Hz)], 1.94-

0.88 (m, 11H); ^{13}C NMR (CDCl_3 , 300 MHz): δ 198.3, 134.5, 129.6, 129.3, 127.4, 72.7, 47.8, 43.2, 28.9, 28.1, 26.4, 26.2, 26.1; **ESI-MS** m/z calcd for $\text{C}_{15}\text{H}_{20}\text{NaO}_2\text{S}$: 287.1, found: 286.9.

α -Methyl- β -Hydroxy thioester (31). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes gave **31** (0.1226 g; 90%) as a pure, colorless oil comprised of a 2:1 (*syn:anti*) mixture of diastereomers. ^1H NMR (CDCl_3 , 300 MHz): δ 7.52-7.22 (m, 10H), 5.20-4.78 [m, 1H, including a dd at δ 5.13 ($J = 2.7, 4.2$ Hz) and a dd at δ 4.84 ($J = 4.4, 8.2$ Hz)], 3.20-2.98 (m, 1H), 2.82-2.67 (m, 1H, including a m from δ 2.82-2.75 and a m from δ 2.73-2.67), 1.32-1.06 [m, 3H, including a d at δ 1.30 ($J = 7.2$ Hz) and a d at δ 1.10 ($J = 7.2$ Hz)]; ^{13}C NMR (CDCl_3 , 300 MHz): δ 201.8, 201.6, 141.6, 141.2, 134.52, 134.50, 129.6, 129.5, 129.25, 129.23, 128.6, 128.3, 128.2, 127.7, 127.5, 127.2, 126.7, 126.2, 76.6, 74.0, 55.3, 55.1, 15.4, 11.9; **ESI-MS** m/z calcd for $\text{C}_{16}\text{H}_{16}\text{NaO}_2\text{S}$: 295.1, found: 294.8.

α -Benzyloxy- β -hydroxy thioester (32). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes gave **32** (0.1768 g; 97%) as a pure, colorless solid comprised of a 1:1 (*syn:anti*) mixture of diastereomers. ^1H NMR (CDCl_3 , 300 MHz): δ 7.48-7.16 (m, 15H), 5.13-4.92 [m, 1H, including a dd at δ 5.07 ($J = 4.2, 6.6$ Hz), and a dd at δ 4.95 ($J = 3.9, 6.6$ Hz)], 4.80-4.25 [m, 2H, including an AB q at δ 4.75 and 4.70 ($\Delta\nu_{\text{AB}} = 16.0$ Hz, $J = 11.1$ Hz) and an AB q at δ 4.43 and 4.26 ($\Delta\nu_{\text{AB}} = 24.6$ Hz, $J = 11.1$ Hz)], 4.22-4.12 [m, 1H, including a d at δ 4.19 ($J = 4.2$ Hz) and a d at δ 4.17 ($J = 6.6$ Hz)], 3.30-2.90 [m, 1H, including a dd at δ 3.10 ($J = 1.2, 3.9$ Hz) and a dd at δ 2.94 ($J = 1.5, 6.6$ Hz)]; ^{13}C NMR (CDCl_3 , 300 MHz): δ 201.0, 199.5, 139.4, 139.1, 136.5, 136.2, 134.62, 134.56, 129.43, 129.40, 129.2, 128.45, 128.42, 128.3, 128.23, 128.16, 128.1, 128.0, 127.4, 127.09, 127.06, 126.4, 88.3, 87.4, 74.9, 74.6, 74.5 (some peaks overlapping); **ESI-MS** m/z calcd for $\text{C}_{22}\text{H}_{20}\text{NaO}_3\text{S}$: 387.1, found: 386.8.

The following is representative of the synthesis of thioesters 1, 6 and 7.

S-(2-Methoxy)phenyl thioacetate (7). Ac_2O (1.86 mL, 19.68 mmol) was added via syringe to a stirred solution of the thiol (2.00 mL, 16.43 mmol), DMAP (0.0464 g, 0.38

mmol), pyridine (1 mL) and CH₂Cl₂ (19 mL). The mixture was allowed to stir for 12 h and then partitioned between EtOAc and saturated aqueous NaHCO₃. The organic phase was washed with water, saturated aqueous NaCl, dried (MgSO₄), and evaporated to give a light-yellow oil. Flash chromatography over silica gel, using 6:94 EtOAc-hexanes gave **7** (2.7551 g; 92%) as a pure, colorless liquid. ¹H NMR (CDCl₃, 300 MHz): δ 7.48-7.34 (m, 2H), 7.04-6.92 (m, 2H), 3.86 (s, 3H), 2.41 (s, 3H); ¹³C NMR (CDCl₃, 300 MHz): δ 193.5, 159.2, 136.8, 131.8, 121.2, 116.2, 111.6, 56.0, 30.1; **ESI-MS** *m/z* calcd for C₉H₁₀NaO₂S: 205.0, found: 204.8.

S-Benzyl thioacetate (1). Flash chromatography over silica gel, using 8:92 EtOAc-hexanes gave **1** (1.6637 g; 87%) as a pure, colorless liquid. Spectroscopic data was identical to that reported previously.¹

S-(4-Methoxy)phenyl thioacetate (6). Flash chromatography over silica gel, using 10:90 EtOAc-hexanes gave **6** (2.1141 g; 93%) as a pure, yellow oil. Spectroscopic data was identical to that reported previously.¹

S-Phenyl benzyloxythioacetate (30). EDCI (1.3073 g, 6.82 mmol) and DMAP (0.0731 g; 0.60 mmol) were added to a stirred solution of benzyloxyacetic acid (1.0323g, 6.21 mmol) and PhSH (0.95 mL; 9.29 mmol). The mixture was allowed to stir for 3 h and was partitioned between EtOAc and water. The organic phase was washed with saturated aqueous NaHCO₃, saturated aqueous NaCl, dried (MgSO₄) and evaporated to give a colorless oil. Flash chromatography over silica gel, using 5:95 EtOAc-hexanes gave **30** (1.5081 g; 94%) as a pure, colorless liquid. ¹H NMR (CDCl₃, 300 MHz): δ 7.48-7.29 (m, 10H), 4.73 (s, 2H), 4.27 (s, 2H); ¹³C NMR (CDCl₃, 300 MHz): δ 198.2, 136.9, 134.9, 129.6, 129.3, 128.7, 128.3, 128.1, 75.0, 74.3; **ESI-MS** *m/z* calcd for C₁₅H₁₄NaO₂S: 281.1, found: 280.8.

¹ Gulhane, R.; Chakraborti, A. K. *Chem. Commun.* **2003**, 1896-1897.

β-Hydroxy oxoester (4). MgI_2 (0.167 g, 0.6 mmol) was added to a stirred solution of *O*-benzyl acetate (**3**) (0.075 g, 0.5 mmol) and benzaldehyde (61 μL , 0.6 mmol) in CH_2Cl_2 (2.5 mL), followed by the addition of $i\text{-Pr}_2\text{NEt}$ (0.11 mL, 0.65 mmol). Stirring was continued for 20 h and EtOAc (2.5 mL) and 10% (v/v) aqueous HCl (2.5 mL) were added. Stirring was continued for 15 min and the mixture was partitioned between EtOAc (15 mL) and H_2O (2 mL). The aqueous phase was extracted with EtOAc (3 x 5 mL) and the combined organic extracts were washed with saturated aqueous NaCl, dried (MgSO_4), and evaporated. Flash chromatography over silica gel, using 10:90 EtOAc-hexanes gave **4** (0.0593 g; 46%) as a pure, colorless oil. Spectroscopic data was identical to that reported previously.²

² Wang, Y. C.; Hwang, J. Y.; Chen, Y. C.; Chuang, S. C.; Yan, T. H. *Tetrahedron: Asymmetry* **2000**, *11*, 1797-1800.