Development of Novel Diastereoselective Alkenylation of Enolates Using Alkenylselenonium Salts

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Supporting Information

General. Melting points were obtained with a Yanagimoto micro-melting-point apparatus and are uncorrected. IR spectra of solids (KBr) and liquids (NaCl) were recorded on a JASCO FT/IR-230 spectrophotometer. ¹H NMR spectra were recorded on a JEOL GX-270 (270 MHz) or a JEOL EX-400 (400 MHz) spectrometer with tetramethylsilane as an internal standard. ¹³C NMR spectra were obtained on a JEOL EX-400 (100 MHz) spectrometer with chloroform as an internal standard. The *J* values are given in Hz. Mass spectra (MS and HRMS) were recorded on a JEOL JMS-SX102A spectrometer with an electron impact (EI, 70 eV) or fast atom bombardment (FAB, glycerol or 3-nitrobenzylalcohol) techniques. Elemental analyses of new compounds were performed by a Yanaco CHN Corder MT-5. All chromatographic isolations were accomplished with BW-127ZH (Fuji Silysia) for column chromatography or with Kieselgel 60 PF₂₅₄ containing gypsum (Merck) for preparative TLC. Organic solvents used were dried by standard methods. The recycling preparative HPLC was performed by LC-918 liquid chromatography (Japan Analytical Industry Co., Ltd.) equipped with JAIGEL-1H and -2H columns (polystyrene gel). Compounds 5g,¹ 5h,² 5i³ and 5j⁴ were prepared according to a literature method.

General procedure for the alkenylation reaction of achiral enolates with alkenylselenonium salt 1a: In a typical experiment, LHMDs (1 M in THF, 0.27 mmol) was dissolved in anhydrous THF (2 mL) and the corresponding carbonyl compound (0.24 mmol) was added at room temperature. After stirring for 30 min at same temperature, the reaction mixture was cooled to -78°C followed by the addition of a THF solution (2 mL) of alkenylselenonium salt **1a** (0.20 mmol) and the solution was stirred at same temperature for 2 h. The mixture was worked with water and extracted with ethyl acetate. The organic layers were combined, washed with brine, dried over MgSO₄, filtered, and concentrated. The crude products were separated by preparative TLC (silica gel, hexane/ethyl acetate mixtures) to give the corresponding alkenylation product.

(Z)-4-Benzenesulfonyl-2-methyl-1,4-diphenyl-3-buten-1-one (3a):

colorless needles (AcOEt-hexane), mp 115-116°C; IR (NaCl)/cm⁻¹ 1684, 1446, 1306, 1151; ¹H NMR (CDCl₃) δ: 1.48 (3 H, d, *J* = 6.8 Hz, CHCH₃), 5.90 (1 H, dq, *J* = 10.0 and 6.8 Hz, CHCH₃), 6.49 (1 H, d, *J* = 10.0 Hz, CH=C), 7.16-7.29 (5 H, m, ArH), 7.33 (2 H, t, *J* = 7.3 Hz, ArH), 7.47 (1 H, t, *J* = 7.3 Hz, ArH), 7.53 (2 H, t, *J* = 7.3 Hz, ArH), 7.57 (2 H, d, *J* = 8.3 Hz, ArH), 7.62 (1 H, t, *J* = 7.3 Hz, ArH), 8.12 (2 H, d, *J* = 8.3 Hz, ArH); ¹³C NMR (CDCl₃) δ: 19.2, 40.0, 127.9, 128.0, 128.70, 128.74, 128.8, 130.1, 133.3, 133.5, 135.0, 135.8, 139.9, 141.9, 144.6, 200.8; MS (EI) *m/z* 376 (M⁺); Anal. Calcd for C₂₃H₂₀O₃S: C, 73.38; H, 5.35. Found: C, 73.34; H, 5.38.

(Z)-4-Benzenesulfonyl-2-benzyl-1,4-diphenyl-3-buten-1-one (3b):

colorless oil; IR (NaCl)/cm⁻¹ 3061, 3028, 1682, 1446, 1307, 1146, 1083; ¹H NMR (CDCl₃) δ: 3.04 (1 H, dd, *J* = 13.7 and 7.3 Hz, CHHPh), 3.31 (1 H, dd, *J* = 13.7 and 4.9 Hz, CHHPh), 6.30-6.40 (2 H, m, CHCH₂Ph and CH=C), 7.02 (2 H, d, *J* = 8.1 Hz, ArH), 7.13-7.34 (12 H, m, ArH), 7.40 (1 H, t, *J* = 6.8 Hz, ArH), 7.51 (2 H, t, *J* = 7.6 Hz, ArH), 7.60 (1 H, t, *J* = 7.6 Hz, ArH), 8.14 (2 H, d, *J* = 7.6 Hz, ArH); ¹³C NMR (CDCl₃) δ: 40.1, 46.9, 126.7, 127.9, 128.0, 128.5, 128.6, 128.7, 128.79, 128.83, 129.5, 130.0, 133.1, 133.6, 135.0, 136.3, 137.9, 139.3, 142.9, 143.0, 200.1; HRMS (EI) calcd for C₂₉H₂₄O₃S (M⁺) 452.1446, found 452.1442.

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(Z)-4-Benzenesulfonyl-1,4-diphenyl-2-propyl-3-buten-1-one (3c):

colorless oil; IR (NaCl)/cm⁻¹ 2959, 2931, 1682, 1446, 1306, 1150, 1085; ¹H NMR (CDCl₃) δ: 0.96 (3 H, t, *J* = 7.3 Hz, CH₂CH₃), 1.42-1.51 (2 H, m, CH₂CH₃), 1.62-1.70 (1 H, m, CHHCH₂CH₃), 1.92-1.98 (1 H, m, CHHCH₂CH₃), 5.95 (1 H, ddd, *J* = 10.3 and 7.8 and 5.9 Hz, CHCH₂), 6.41 (1 H, d, *J* = 10.3 Hz, CH=C), 7.15-7.36 (7 H, m, ArH), 7.44 (1 H, t, *J* = 7.3 Hz, ArH), 7.53 (2 H, d, *J* = 7.3 Hz, ArH), 7.54 (2 H, t, *J* = 7.3 Hz, ArH), 7.63 (1 H, t, *J* = 7.3 Hz, ArH), 8.15 (2 H, d, *J* = 7.3 Hz, ArH); ¹³C NMR (CDCl₃) δ: 14.0, 20.6, 36.3, 45.1, 127.9, 128.0, 128.6, 128.7, 128.8, 130.1, 133.2, 133.5, 135.1, 136.5, 139.8, 142.7, 144.4, 200.9; HRMS (EI) calcd for C₂₅H₂₄O₃S (M⁺) 404.1446, found 404.1435.

(Z)-2-(2-Benzenesulfonyl-2-phenylethenyl)cyclohexanone (3d):

colorless oil; IR (NaCl)/cm⁻¹ 2939, 1709, 1446, 1307, 1149, 1084, 768, 731, 689, 586; ¹H NMR (CDCl₃) δ: 1.60-1.80 (2 H, m, CHH), 1.84-2.02 (2 H, m, CHH), 2.15-2.23 (1 H, m, CHH), 2.38-2.46 (1 H, m, CHH), 2.46-2.53 (2 H, m, CHH), 4.78 (1 H, ddd, *J* = 12.3 and 9.3 and 5.4 Hz, C(O)CHCH₂), 6.38 (1 H, d, *J* = 9.3 Hz, CH=C), 7.16-7.27 (5H, m, ArH), 7.35 (2 H, t, *J* = 7.8 Hz, ArH), 7.48 (1 H, t, *J* = 7.8 Hz, ArH), 7.59 (2 H, d, *J* = 7.8 Hz, ArH); ¹³C NMR (CDCl₃) δ: 24.8, 27.8, 35.4, 42.1, 49.8, 127.9, 128.0, 128.6, 130.1, 133.2, 135.1, 139.9, 142.3, 142.6, 209.5; MS (FAB) *m/z* 341 (M+H)⁺; Anal. Calcd for C₂₀H₂₀O₃S: C, 70.56; H, 5.92. Found: C, 70.29; H, 6.09.

(Z)-4-(2-Benzenesulfonyl-2-phenylethenyl)isochroman-3-one (3e):

white crystal (AcOEt-hexane), mp 171°C; IR (NaCl)/cm⁻¹ 1730, 1308, 1147, 1084; ¹H NMR (CDCl₃) δ: 5.13 (2 H, s, CH₂O), 6.47 (1 H, d, *J* = 10.7 Hz, CHCH=C), 6.91 (1 H, d, *J* = 10.7 Hz, CHCH=C), 7.19 (1 H, d, *J* = 6.8 Hz, ArH), 7.26-7.50 (10 H, m, ArH), 7.59 (1 H, t, *J* = 7.3 Hz, ArH), 7.72 (2 H, d, *J* = 7.3 Hz, ArH); ¹³C NMR (CDCl₃) δ: 69.1, 69.3, 124.1, 124.3, 128.7, 128.9, 129.1, 129.21, 129.25, 129.9, 130.9, 131.0, 131.26, 131.33, 132.2, 133.8, 137.6, 164.9; MS (FAB) *m/z* 391 (M+H)⁺; Anal. Calcd for C₂₃H₁₈O₄S: C, 70.75; H, 4.65. Found: C, 70.50; H, 4.72.

(Z)-4-Benzenesulfonyl-2,2-dimethyl-1,4-diphenyl-3-buten-1-one (3f):

pale purple needles (AcOEt-hexane), mp 188-189°C; IR (NaCl)/cm⁻¹ 1683, 1446, 1306, 1148; ¹H NMR (CDCl₃) δ: 1.79 (6 H, s, CH₃), 6.59 (1 H, s, CH=C), 6.69 (2 H, d, *J* = 7.3 Hz, ArH), 7.01 (2 H, t, *J* = 7.8 Hz, ArH), 7.06 (2 H, d, *J* = 7.3 Hz, ArH), 7.15 (2 H, t, *J* = 7.3 Hz, ArH), 7.22 (1 H, t, *J* = 7.3 Hz, ArH), 7.28 (1 H, t, *J* = 7.3 Hz, ArH), 7.53 (2 H, t, *J* = 7.3 Hz, ArH), 7.61 (1 H, t, *J* = 7.3 Hz, ArH), 8.05 (2 H, d, *J* = 7.3 Hz, ArH); ¹³C NMR (CDCl₃) δ: 30.1, 48.4, 128.0, 128.1, 128.2, 128.6, 129.5, 129.8, 131.9, 132.9, 135.6, 138.6, 140.8, 149.9, 200.6; MS (EI) *m/z* 390 (M⁺); Anal. Calcd for C₂₄H₂₂O₃S: C, 73.82; H, 5.68. Found: C, 73.65; H, 5.80.

(Z)-2-Benzenesulfonyl-2-phenylethenyl 2,2-dimethyl-1-phenylethenyl ether (4):

yellow oil; IR (NaCl)/cm⁻¹ 3059, 2916, 1621, 1445, 1307, 1194, 1144, 1083, 1017, 766, 724, 699, 689, 600, 559; ¹H NMR (CDCl₃) δ: 1.75 (3 H, s, *E*-CH₃), 1.79 (3 H, s, *Z*-CH₃), 6.47 (1 H, s, CH=C), 7.08 (2 H, d, *J* = 7.6 Hz, ArH), 7.15-7.30 (8 H, m, ArH), 7.50 (2 H, t, *J* = 7.3 Hz, ArH), 7.59 (1 H, t, *J* = 7.3 Hz, ArH), 7.97 (2 H, d, *J* = 7.3 Hz, ArH); ¹³C NMR (CDCl₃) δ: 18.1, 19.9, 120.1, 122.6, 127.7, 128.1, 128.26, 128.32, 128.5, 129.0, 130.8, 131.5, 132.7, 133.9, 142.7, 146.5, 152.8; MS (EI) *m/z* 390 (M⁺); HRMS calcd for C₂₄H₂₂O₃S (M⁺) 390.1289, found 390.1281.

General procedure for the alkenylation reaction of chiral enolates with alkenylselenonium salts 1: LHMDs (1 M in THF, 0.23 mmol) was added to a THF solution (1.6 mL) of the corresponding oxazolidinone derivative (0.2 mmol) at -78°C. After stirring for 1 h at same temperature, the reaction mixture was added to a THF solution (2.4 mL) of alkenylselenonium salt **1** (0.20 mmol) and the solution was stirred at -78°C for 2 h. The mixture was worked with water and extracted with ethyl acetate. The organic layers were combined, washed with brine, dried over MgSO₄, filtered, and concentrated. The crude products were separated by preparative TLC (silica gel, hexane/ethyl acetate mixtures) or recycling preparative HPLC (CHCl₃) to give the corresponding alkenylation product. Diastereoselectivities were determined by ¹H-NMR measurement.

(4S)-3-[(Z)-(2R)-4-Benzenesulfonyl-2-methyl-1-oxo-4-phenyl]-4-phenylmethyl-2-oxazolidinone (3g) (major

product):

white powder, mp 51-52°C; IR (NaCl)/cm⁻¹ 3061, 3029, 1790, 1697, 1446, 1387, 1361, 1308, 1211, 1146, 975, 730, 699; ¹H NMR (CDCl₃) δ: 1.47 (3 H, d, *J* = 7.3 Hz, CHCH₃), 2.80 (1 H, dd, *J* = 13.7 and 10.3 Hz, CHHPh), 3.44 (1 H, dd, *J* = 13.7 and 3.4 Hz, CHHPh), 4.19-4.26 (2 H, m, NCHCH₂), 4.70 (1 H, ddd, *J* = 13.7 and 6.8 and 3.4 Hz, NCHCH₂), 5.72 (1 H, dq, *J* = 8.8 and 7.3 Hz, CHCH₃), 6.35 (1 H, d, *J* = 8.8 Hz, CH=C), 7.24-7.34 (10 H, m, ArH), 7.39 (2 H, t, *J* = 7.3 Hz, ArH), 7.51 (1 H, t, *J* = 7.3 Hz, ArH), 7.70 (2 H, d, *J* = 7.3 Hz, ArH); ¹³C NMR (CDCl₃) δ: 19.3, 37.6, 38.0, 55.6, 66.1, 127.2, 128.0, 128.1, 128.77, 128.81, 128.9, 129.5, 130.1, 133.3, 134.9, 135.6, 140.2, 143.2, 143.4, 152.7, 174.5; MS (EI) *m/z* 475 (M)⁺; Anal. Calcd for C₂₇H₂₅NO₅S: C, 68.19; H, 5.30; N, 2.95. Found: C, 68.05; H, 5.38; N, 2.90.

(4S)-3-[(Z)-(2S)-4-Benzenesulfonyl-2-methyl-1-oxo-4-phenyl]-4-phenylmethyl-2-oxazolidinone (3g) (minor product):

white powder, mp 53-55°C; IR (NaCl)/cm⁻¹ 3061, 3029, 2925, 1789, 1695, 1446, 1386, 1360, 1308, 1211, 1145, 976, 761, 731, 699; ¹H NMR (CDCl₃) δ: 1.49 (3 H, d, *J* = 7.3 Hz, CHCH₃), 2.86 (1 H, dd, *J* = 13.4 and 9.3 Hz, CHHPh), 3.26 (1 H, dd, *J* = 13.4 and 3.4 Hz, CHHPh), 4.22 (1 H, dd, *J* = 8.5 and 2.7 Hz, NCHCHH), 4.32 (1 H, t, *J* = 8.5 Hz, NCHCHH), 4.76 (1 H, dddd, *J* = 9.3 and 8.5 and 3.4 and 2.7 Hz, NCHCH₂), 5.57 (1 H, dq, *J* = 8.6 and 7.3 Hz, CHCH₃), 6.35 (1 H, d, *J* = 8.6 Hz, CH=C), 7.22-7.37 (10 H, m, ArH), 7.40 (2 H, t, *J* = 7.6 Hz, ArH), 7.52 (1 H, t, *J* = 7.6 Hz, ArH), 7.66 (2 H, d, *J* = 7.6 Hz, ArH); ¹³C NMR (CDCl₃) δ: 19.3, 37.8, 38.1, 55.1, 66.4, 127.4, 127.99, 128.02, 128.81, 128.85, 128.9, 129.5, 130.1, 133.3, 134.8, 135.1, 140.2, 143.2, 143.6, 153.0, 174.5; MS (EI) *m/z* 475 (M)⁺; Anal. Calcd for C₂₇H₂₅NO₅S: C, 68.19; H, 5.30; N, 2.95. Found: C, 67.95; H, 5.22; N, 2.79.

(4S)-3-[(Z)-(2R)-4-Benzenesulfonyl-2-ethyl-1-oxo-4-phenyl]-4-phenylmethyl-2-oxazolidinone (3h) (major product):

pale yellow viscous oil; IR (NaCl)/cm⁻¹ 2924, 1780, 1693, 1446, 1387, 1308, 1210, 1148, 918, 761, 730, 700; ¹H NMR (CDCl₃) δ: 0.97 (3 H, t, *J* = 7.3 Hz, CHCH₂CH₃), 1.73 (1 H, ddq, *J* = 13.2 and 8.8 and 7.3 Hz, CHCHHCH₃), 1.98 (1 H, ddq, *J* = 13.2 and 7.3 and 4.4 Hz, CHCHHCH₃), 2.80 (1 H, dd, *J* = 13.7 and 10.3 Hz, CHHPh), 3.45 (1 H, dd, *J* = 13.7 and 3.4 Hz, CHHPh), 4.19-4.24 (2 H, m, NCHCH₂), 4.67-4.72 (1 H, m, NCHCH₂), 5.63 (1 H, dt, *J* = 8.8 and 4.4 Hz, CHCH₂CH₃), 6.32 (1 H, d, *J* = 8.8 Hz, CH=C), 7.25-7.35 (10 H, m, ArH), 7.40 (2 H, t, *J* = 7.8 Hz, ArH), 7.51 (1 H, t, *J* = 7.8 Hz, ArH), 7.72 (2 H, d, *J* = 7.8 Hz, ArH); ¹³C NMR (CDCl₃) δ: 11.5, 27.3, 37.6, 44.3, 55.6, 66.0, 127.2, 128.0, 128.77, 128.85, 128.9, 129.5, 130.1, 133.3, 135.0, 135.6, 140.4, 143.0, 144.7, 152.9, 173.7; HRMS calcd for C₂₈H₂₇NO₅S (M⁺) 489.1609, found 489.1607.

(4S)-3-[(Z)-(2R)-4-Benzenesulfonyl-2-ethyl-1-oxo-4-phenyl]-4-phenylmethyl-2-oxazolidinone (3h) (minor product):

white powder, mp 44-47°C; IR (NaCl)/cm⁻¹ 2925, 1780, 1694, 1446, 1387, 1308, 1211, 1146, 918, 761, 730, 699; ¹H NMR (CDCl₃) δ: 0.99 (3 H, t, *J* = 7.3 Hz, CHCH₂CH₃), 1.75 (1 H, ddq, *J* = 13.2 and 8.8 and 7.3 Hz, CHCHHCH₃), 2.04 (1 H, ddq, *J* = 13.2 and 7.3 and 4.4 Hz, CHCHHCH₃), 2.81 (1 H, dd, *J* = 13.7 and 9.8 Hz, CHHPh), 3.29 (1 H, dd, *J* = 13.7 and 3.4 Hz, CHHPh), 4.21 (1 H, dd, *J* = 8.8 and 2.4 Hz, NCHCHH), 4.31 (1 H, t, *J* = 8.8 Hz, NCHCHH), 4.75 (1 H, dddd, *J* = 9.8 and 8.8 and 3.4 and 2.4 Hz, NCHCH₂), 5.46 (1 H, dt, *J* = 8.8 and 4.4 Hz, CHCH₂CH₃), 6.32 (1 H, d, *J* = 8.8 Hz, CH=C), 7.23-7.37 (10 H, m, ArH), 7.41 (2 H, t, *J* = 7.8 Hz, ArH), 7.52 (1 H, t, *J* = 7.8 Hz, ArH), 7.67 (2 H, d, *J* = 7.8 Hz, ArH); ¹³C NMR (CDCl₃) δ: 11.4, 27.2, 38.2, 43.9, 55.3, 66.3, 127.4, 127.99, 128.04, 128.8, 128.90, 128.94, 129.4, 130.1, 133.3, 135.0, 135.2, 140.4, 143.1, 144.7, 153.1, 173.6; HRMS calcd for C₂₈H₂₇NO₅S (M⁺) 489.1609, found 489.1608.

(4S)-3-[(Z)-(2R)-4-Benzenesulfonyl-2-isopropyl-1-oxo-4-phenyl]-4-phenylmethyl-2-oxazolidinone (3i) (major product):

colorless crystal (CHCl₃-ether), mp 126-127°C; IR (NaCl)/cm⁻¹ 2964, 2929, 1780, 1692, 1446, 1386, 1349, 1307, 1209, 1148, 761, 731, 700, 608, 578; ¹H NMR (CDCl₃) δ: 0.96 (3 H, d, *J* = 6.8 Hz, CH(CH₃)(CH₃)), 1.00 (3 H, d, *J* = 6.8 Hz, CH(CH₃)(CH₃)), 2.24-2.32 (1 H, m, CH(CH₃)₂), 2.79 (1 H, dd, *J* = 13.7 and 10.3 Hz, CHHPh), 3.47 (1 H, dd, *J* = 13.7 and 3.4 Hz, CHHPh), 4.20 (2 H, d, *J* = 4.9 Hz, NCHCH₂), 4.67-4.73 (1 H, m, NCHCH₂), 5.71 (1 H, dd, *J* = 9.3 and 5.4 Hz, CHCH(CH₃)₂), 6.37 (1 H, d, *J* = 9.3 Hz, CH=C), 7.26-7.35 (10 H, m, ArH), 7.41 (2 H, t, *J* = 7.8 Hz, ArH), 7.52 (1 H, t, *J* = 7.8 Hz, ArH), 7.73 (2 H, d, *J* = 7.8 Hz, ArH); ¹³C NMR (CDCl₃)

δ : 17.9, 20.5, 31.6, 37.5, 47.9, 55.7, 66.0, 127.2, 128.0, 128.8, 128.87, 128.92, 129.5, 130.2, 133.3, 135.3, 135.7, 140.6, 141.1, 145.4, 152.9, 173.2; MS (EI) m/z 503 (M^+); Anal. Calcd for $C_{29}H_{29}NO_5S$: C, 69.16; H, 5.80; N, 2.78. Found: C, 68.98; H, 5.82; N, 2.58.

(4S)-3-[(Z)-(2R)-4-Benzenesulfonyl-2-isopropyl-1-oxo-4-phenyl]-4-phenylmethyl-2-oxazolidinone (3i) (minor product):

white powder, mp 46-49°C; IR (NaCl)/ cm^{-1} 2961, 2925, 1781, 1692, 1446, 1387, 1349, 1307, 1210, 1148, 761, 731, 700, 608, 575; ^1H NMR ($CDCl_3$) δ : 0.94 (3 H, d, $J = 6.8$ Hz, $CH(CH_3)(CH_3)$), 1.04 (3 H, d, $J = 6.8$ Hz, $CH(CH_3)(CH_3)$), 2.30-2.39 (1 H, m, $CH(CH_3)_2$), 2.75 (1 H, dd, $J = 13.2$ and 10.3 Hz, $CHHPh$), 3.36 (1 H, dd, $J = 13.2$ and 2.9 Hz, $CHHPh$), 4.19 (1 H, dd, $J = 8.8$ and 2.4 Hz, $NCHCHH$), 4.30 (1 H, t, $J = 8.8$ Hz, $NCHCHH$), 4.74-4.79 (1 H, m, $NCHCH_2$), 5.50 (1 H, dd, $J = 9.3$ and 5.9 Hz, $CHCH(CH_3)_2$), 6.36 (1 H, d, $J = 9.3$ Hz, $CH=C$), 7.25-7.37 (10 H, m, ArH), 7.42 (2 H, t, $J = 7.3$ Hz, ArH), 7.53 (1 H, t, $J = 7.3$ Hz, ArH), 7.69 (2 H, d, $J = 7.3$ Hz, ArH); ^{13}C NMR ($CDCl_3$) δ : 18.0, 20.4, 31.8, 38.4, 47.5, 55.5, 66.3, 127.3, 128.0, 128.1, 128.8, 128.9, 129.0, 129.4, 130.2, 133.3, 135.2, 135.4, 140.5, 141.5, 145.2, 153.2, 173.1; HRMS calcd for $C_{29}H_{29}NO_5S$ (M^+) 503.1766, found 503.1773.

(4S)-3-[(Z)-(2R)-4-Benzenesulfonyl-2-benzyl-1-oxo-4-phenyl]-4-phenylmethyl-2-oxazolidinone (3j) (major product):

pale yellow viscous oil; IR (NaCl)/ cm^{-1} 2921, 1779, 1694, 1446, 1387, 1307, 1212, 1148, 922, 732, 699; ^1H NMR ($CDCl_3$) δ : 2.79 (1 H, dd, $J = 13.2$ and 9.8 Hz, $NCHCHHPh$), 3.04 (1 H, dd, $J = 12.7$ and 8.8 Hz, $C(O)CHCHHPh$), 3.25 (1 H, dd, $J = 12.7$ and 6.4 Hz, $C(O)CHCHHPh$), 3.41 (1 H, dd, $J = 13.2$ and 2.4 Hz, $NCHCHHPh$), 3.94 (1 H, t, $J = 8.8$ Hz, $NCHCHHO$), 4.12 (1 H, dd, $J = 8.8$ and 2.4 Hz, $NCHCHHO$), 4.53 (1 H, ddt, $J = 9.8$ and 8.8 and 2.4 Hz, $NCHCH_2$), 6.15 (1 H, dt, $J = 8.8$ and 6.4 Hz, $C(O)CHCH_2Ph$), 6.41 (1 H, d, $J = 8.8$ Hz, $CH=C$), 7.09 (2 H, d, $J = 7.8$ Hz, ArH), 7.20-7.36 (15 H, m, ArH), 7.49 (1 H, t, $J = 7.3$ Hz, ArH), 7.53 (2 H, d, $J = 7.3$ Hz, ArH); ^{13}C NMR ($CDCl_3$) δ : 37.6, 40.6, 44.8, 55.7, 66.1, 126.9, 127.2, 127.9, 128.0, 128.4, 128.7, 128.8, 129.0, 129.3, 129.5, 130.2, 133.2, 134.9, 135.5, 137.4, 139.9, 142.2, 144.1, 152.8, 173.3; HRMS calcd for $C_{33}H_{29}NO_5S$ (M^+) 551.1766, found 551.1774.

(4S)-3-[(Z)-(2R)-4-Benzenesulfonyl-2-benzyl-1-oxo-4-phenyl]-4-phenylmethyl-2-oxazolidinone (3j) (minor product):

pale yellow viscous oil; IR (NaCl)/ cm^{-1} 2923, 1779, 1694, 1446, 1387, 1307, 1212, 1147, 923, 760, 731, 700; ^1H NMR ($CDCl_3$) δ : 2.75 (1 H, dd, $J = 13.2$ and 9.8 Hz, $C(O)CHCHHPh$), 2.89 (1 H, dd, $J = 13.2$ and 10.3 Hz, $NCHCHHPh$), 3.24 (1 H, dd, $J = 13.2$ and 3.4 Hz, $NCHCHHPh$), 3.44 (1 H, dd, $J = 13.2$ and 4.4 Hz, $C(O)CHCHHPh$), 4.21 (1 H, dd, $J = 8.8$ and 2.4 Hz, $NCHCHHO$), 4.34 (1 H, t, $J = 8.8$ Hz, $NCHCHHO$), 4.77 (1 H, dddd, $J = 10.3$ and 8.8 and 3.4 and 2.4 Hz, $NCHCH_2$), 5.98 (1 H, dt, $J = 9.8$ and 4.4 Hz, $C(O)CHCH_2Ph$), 6.33 (1 H, d, $J = 9.8$ Hz, $CH=C$), 7.01 (2 H, d, $J = 7.6$ Hz, ArH), 7.18-7.38 (17 H, m, ArH), 7.47 (1 H, t, $J = 7.3$ Hz, ArH); ^{13}C NMR ($CDCl_3$) δ : 38.1, 39.7, 44.5, 55.3, 66.4, 126.9, 127.4, 127.8, 127.9, 128.5, 128.7, 128.8, 129.0, 129.4, 129.5, 130.2, 133.1, 134.8, 135.2, 137.5, 139.7, 142.5, 144.1, 153.2, 173.1; HRMS calcd for $C_{33}H_{29}NO_5S$ (M^+) 551.1766, found 551.1760.

3i (syn)