organic papers

## (3′R,4S)-3-(3′-Cyclohexyl-3′-phenylpropionyl)-5,5-dimethyl-4-phenyloxazolidin-2-one

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The title compound, $C_{26}H_{31}NO_3$, was prepared with high stereoselectivity *via* asymmetric Michael addition, and characterized by NMR, HRMS and FT–IR spectroscopic analysis, and by single-crystal X-ray diffraction. All bond lengths and angles are within expected ranges and the absolute configuration is as expected.

Comment

Chirality is widely expressed in organic materials, perhaps most notably in biological molecules such as DNA, and in proteins, owing to the homochirality of their components (D-sugars and L-amino acids). Hruby and co-workers have prepared a series of the corresponding four diastereoisomers of β-methyl/isohexyl α-amino acid (Lin *et al.*, 2005; Liao *et al.*, 1996, 1997; Shenderovich *et al.*, 1995) *via* asymmetric Michael addition and other reactions. When we attempted to synthesize this kind of α-amino acid, crystals of the title compound, (2), were accidentally obtained as the intermediate of the target molecule. Using optically pure (4S)-5,5-dimethyl-4-phenyloxazolidinone as an auxiliary, the asymmetric Michael addition of non-hindered Grignard reagents in the presence of $CuBr\cdot SMe_2$ could be carried out with high stereoselectivity and in high optical purity (de > 90%).
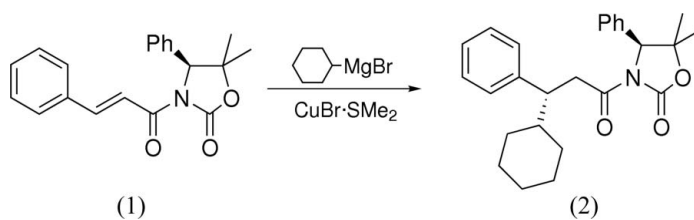
Compound (2) is an enantiomeric product obtained from the asymmetric Michael addition (see scheme).

An X-ray crystal structure of (2) has been determined and the molecular structure is shown in Fig. 1. These results suggested that in the asymmetric synthesis the β-carbon configuration was induced from the Si-face, presumably because the Re-face was shielded by the phenyl ring of the oxazolidinone in the Michael reaction transition state (Low *et al.*, 1995), and when the 4-carbon configuration of the auxiliary is S, the β-carbon configuration is R. Selected bond lengths and angles are given in Table 1. The bond lengths around the chiral atom C20 range from 1.473 (2) to 1.548 (3) Å, and the C—C bond lengths at chiral atom C7 range from 1.520 (3) to 1.542 (3) Å. The dihedral angle between the C20/N1/C16/O3/C17 mean plane and the substituted phenyl ring C21–C26 is 80.26 (7)°. There are no significant intermolecular interactions such as hydrogen bonding or π–π stacking.

Experimental

To a solution of (4S,2E)-5,5-dimethyl-4-phenyl-3-(3-phenylacryl-oyl)oxazolidin-2-one, (1) (1 mmol, 1.0 equivalent), in freshly distilled tetrahydrofuran (THF, 5 ml) was added dropwise a mixture of $C_6H_{11}MgBr$ (2 mmol, 2 equivalents) and $CuBr·SMe_2$ (128 mg, 0.6 equivalents) in THF (25 ml) at 195 K. The resulting mixture was stirred vigorously at 195 K for 15 min and at 273 K for 2 h, then slowly warmed to room temperature over a period of 1 h. The reaction was then quenched with saturated aqueous ammonium chloride (20 ml), and the product was extracted with diethyl ether (3 × 20 ml). The combined organic extracts were washed with brine (2 × 20 ml) and water (20 ml), and dried over anhydrous magnesium sulfate. After removal of ether by rotary evaporation, the crude product was purified by silica gel chromatography to give the pure compound (2). High resolution MS for $C_{26}H_{31}NO_3$: $[M + Na]^+$ calculated 428.2201; found: 428.2239; m.p. 403–404 K; $[\alpha]_D^{20}$ = 94.439 (c = 1.025, $CHCl_3$).

Crystal data

$C_{26}H_{31}NO_3$
$M_r = 405.52$
Orthorhombic, $P2_12_12_1$
$a = 10.1004 (2)$ Å
$b = 14.8636 (3)$ Å
$c = 15.5876 (3)$ Å
$V = 2340.14 (8)$ Å^3

$Z = 4$
$D_x = 1.151$ Mg m^{-3}
Mo $K\alpha$ radiation
$\mu = 0.07$ mm^{-1}
$T = 273 (2)$ K
Block, colourless
$0.30 \times 0.28 \times 0.26$ mm

Data collection

Bruker APEXII CCD area-detector diffractometer
φ and ω scans
Absorption correction: multi-scan (SADABS; Bruker, 1998)
$T_{min} = 0.977$, $T_{max} = 0.977$

20759 measured reflections
3028 independent reflections
2408 reflections with $I > 2\sigma(I)$
$R_{int} = 0.028$
$\theta_{max} = 27.5°$

Refinement

Refinement on F^2
$R[F^2 > 2\sigma(F^2)] = 0.036$
$wR(F^2) = 0.101$
$S = 1.03$
3028 reflections
271 parameters
H-atom parameters constrained

$w = 1/[\sigma^2(F_o^2) + (0.0522P)^2 + 0.179P]$
where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max} < 0.001$
$\Delta\rho_{max} = 0.10$ e Å^{-3}
$\Delta\rho_{min} = -0.11$ e Å^{-3}

Table 1
Selected geometric parameters (Å, °).

N1—C20	1.473 (2)	C7—C8	1.542 (3)
C1—C7	1.520 (3)	C20—C21	1.517 (3)
C7—C14	1.540 (3)		
C15—N1—C20	120.88 (16)	C9—C8—C7	111.06 (17)
C16—N1—C20	110.29 (16)	C13—C8—C7	113.24 (16)
C2—C1—C7	120.88 (18)	C15—C14—C7	110.69 (17)
C6—C1—C7	121.29 (18)	N1—C20—C21	112.43 (16)
C1—C7—C14	110.41 (15)	N1—C20—C17	99.74 (15)
C1—C7—C8	111.80 (15)	C21—C20—C17	115.83 (15)
C14—C7—C8	112.03 (16)		
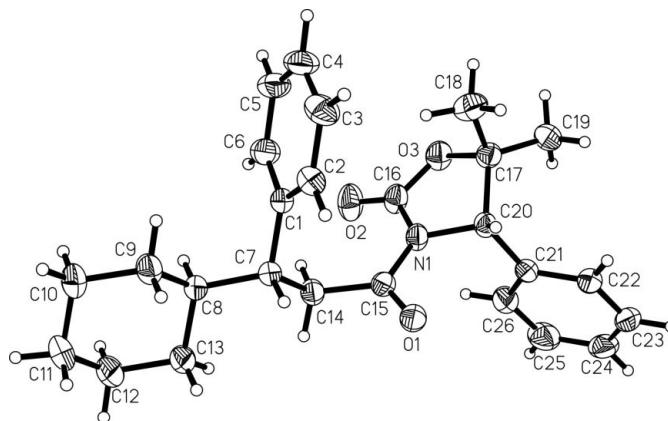
Figure 1
A view of (2), showing the molecular structure and crystallographic numbering scheme.

In the absence of significant anomalous dispersion effects, Freidel pairs were merged; the absolute configuration was assigned on the basis of the known configuration of the starting material. All H atoms were placed in idealized positions and refined as riding, with C—H distances in the range 0.93–0.98 Å and with $U_{iso}(H) = 1.2$ or 1.5 times $U_{eq}(C)$.

Data collection: SMART (Bruker, 1998); cell refinement: SAINT (Bruker, 1998); data reduction: SAINT; program(s) used to solve structure: SHELXS97 (Sheldrick, 1997); program(s) used to refine structure: SHELXL97 (Sheldrick, 1997); molecular graphics: SHELXTL (Bruker, 1998); software used to prepare material for publication: SHELXTL.

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