Acta Crystallographica Section E
Structure Reports Online
ISSN 1600-5368

The absolute configuration of a new amino-alkylphenol derived from (*R*)-(–)-2-phenylglycine

Guang-You Zhang, Xiang-Bo Wang,* Jin-Yan Zhao, Wan-Hui Wang and Xiao-Feng Yang

School of Chemistry, Jinan University, Jinan 250022, People's Republic of China

Correspondence e-mail: wangxiangbo2000@hotmail.com

Key indicators

Single-crystal X-ray study
T = 298 K
Mean σ(C–C) = 0.005 Å
R factor = 0.052
wR factor = 0.144
Data-to-parameter ratio = 14.7

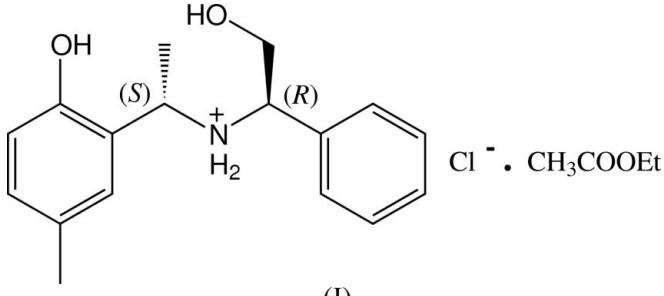
For details of how these key indicators were automatically derived from the article, see http://journals.iucr.org/e.

Received 28 March 2006
Accepted 15 June 2006

The chiral aminoalkylphenol *N*-[(*S*)-1-(5-methyl-2-hydroxyphenyl)ethyl]-*N*–[(*R*)-2-hydroxy-1-phenylethyl]amine, $C_{17}H_{21}NO_2$, was synthesized starting from *R*-(-)-2-phenylglycine. The corresponding hydrochloride salt was prepared and crystallized as an ethyl acetate solvate, affording *N*-[(*R*)-2-hydroxy-1-phenylethyl]-*N*-[(*S*)-1-(5-methyl-2-hydroxyphenyl)ethyl]-aminium chloride ethyl acetate solvate, $C_{17}H_{22}NO_2^+\cdot Cl^-\cdot C_4H_8O_2$, and the absolute configuration of the new stereogenic centre determined, from which that of the chiral aminoalkylphenol was inferred. The dihedral angle between the two aromatic rings is 40.74 (11)°.

Comment

The synthesis of new chiral ligands is widespread in asymmetric synthesis (Cimarelli & Palmieri, 1998, 2000; Tseng & Yang, 2004; Tümerdem *et al.*, 2005). Among them, enantiopure aminoalkylphenols have attracted wide attention for the reason that they can be used in catalytic asymmetric reactions (Puigjaner *et al.*, 1999; Guangyou *et al.*, 2003; Li *et al.*, 2004; Watts *et al.*, 2005), which is one of the most active areas of research in organic chemistry (Joshi & Malhotra, 2003). However, the chiral ligand is not always readily or economically available. Most of these aminoalkylphenols are derived from readily available natural products (Soai & Niwa, 1992). Amino acids can be converted into the corresponding aminoalcohols by reduction with $NaBH_4$ in THF. As the reduction method gave a single enantiomer in high yield (McKennon *et al.*, 1993), in our preliminary work we chose *R*-(−)-2-phenylglycine as starting material.



(I)

The aminoalkylphenol was prepared by conventional condensation of 2-hydroxy-5-methylacetophenone with *R*-(−)-phenylglycinol, followed by reduction with sodium borohydride (see *Experimental*). The *R*,*S* diastereoisomer is the main product, in agreement with the fact that attack of the hydride occurs on the less-hindered face. In order to confirm the structure of this aminoalkylphenol, the corresponding

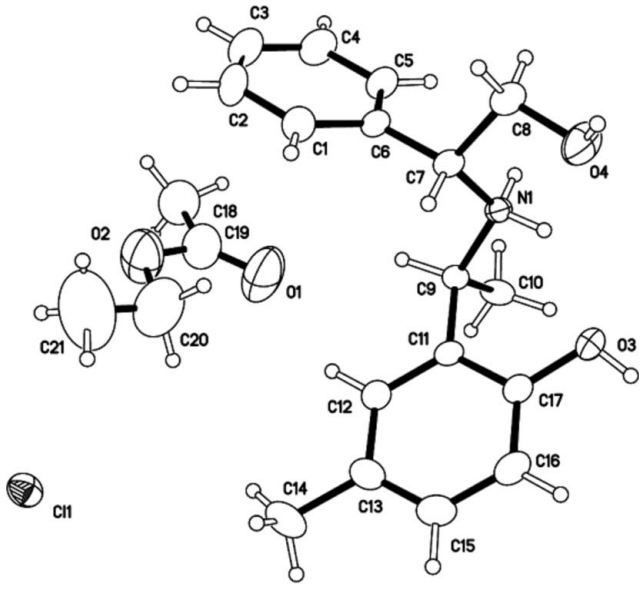


Figure 1
The asymmetric unit of (I), with displacement ellipsoids drawn at the 30% probability level for non-H atoms.

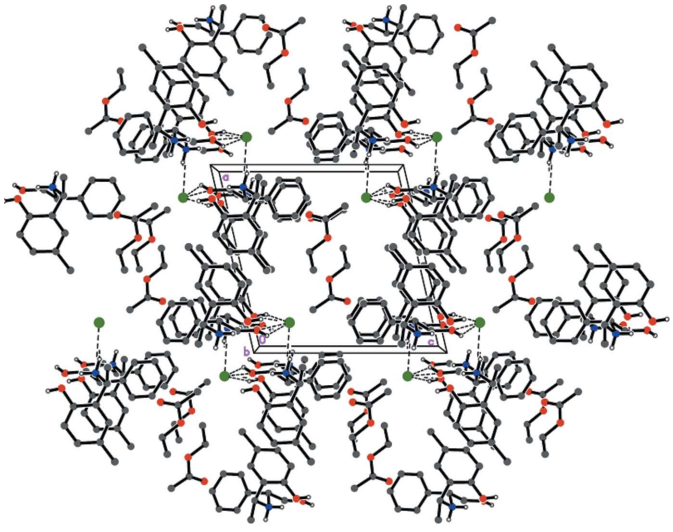


Figure 2
A packing diagram for (I), viewed down the *b* axis. Hydrogen bonds are shown as dashed lines. H atoms not involved in hydrogen bonding have been omitted.

hydrochloride ethyl acetate solvate, (I), was prepared and an X-ray crystallographic study carried out (Fig. 1). Geometric parameters (Table 1) are similar to those found in a closely related aminoalkylphenol (Yang *et al.*, 2005; Zhang *et al.*, 2006).

The absolute configuration of (I) is found to be *R*,*S*, from which that of its neutral aminoalkylphenol precursor is inferred to be the same. The dihedral angle between the planes of the C1–C6 and C11–C17 aromatic rings is 40.74 (11)°. Ethyl acetate is included as a solvent molecule. Intermolecular O—H···Cl and N—H···Cl (Fig. 2), as as well as intramolecular N—H···O hydrogen bonds are formed, tthereby stabilizing the crystal structure (Table 2).

Experimental

R-(−)-2-Phenylglycinol was prepared by the reduction of *R*-(−)-2-phenylglycine with $NaBH_4$ in THF [80.2% yield, $[\alpha]_D^{24} = -25.5$ (*c* 6, MeOH)] (Abiko & Masamune, 1992; McKennon *et al.*, 1993; Demir *et al.*, 1999). *R*-(−)-2-Phenylglycinol (2 mmol) and 1-(2-hydroxy-4-methylphenyl)-ethanone (2 mmol) were dissolved in methanol (15 ml) and reacted at 298 K for 12 h. The solvent was then removed by evaporation and THF/ethanol (15 ml, 1:1 *v*/*v*) and $NaBH_4$ (8 mmol) were added at 273 K. The reaction was quenched with 5 *M* HCl and then neutralized with NaOH. The organic layer was dried with anhydrous Na_2SO_4, filtered, and the solvent was removed under reduced pressure. Further purification was carried out by thin-layer silica-gel chromatography [chloroform/methanol 40:1; 70.1% yield; $[\alpha]_D^{27} = -77.4$ (*c* 1/2, $CHCl_3$)]. The hydrochloride was finally obtained by reaction of the amine (0.1 mmol) dissolved in methanol (10 ml) with concentrated HCl (0.1 ml) at 298 K, affording a white solid. Compound (I) was crystallized from a 2-propanol/ethyl acetate (1:20 *v*/*v* mixture (83% yield).

Crystal data

$C_{17}H_{22}NO_2^+\cdot Cl^-\cdot C_4H_8O_2$
$M_r = 395.91$
Monoclinic, $P2_1$
$a = 12.043$ (2) Å
$b = 7.7441$ (16) Å
$c = 12.043$ (2) Å
$\beta = 103.07$ (2)°
$V = 1094.2$ (4) Å^3
$Z = 2$
$D_x = 1.202$ Mg m^{-3}
Mo $K\alpha$ radiation
$\mu = 0.20$ mm^{-1}
$T = 298$ (2) K
Plate, colourless
0.50 × 0.40 × 0.12 mm

Data collection

Bruker SMART diffractometer
φ and ω scans
Absorption correction: multi-scan (*SADABS*; Sheldrick, 1996)
$T_{min} = 0.907$, $T_{max} = 0.977$
5629 measured reflections
3672 independent reflections
3546 reflections with $I > 2\sigma(I)$
$R_{int} = 0.025$
$\theta_{max} = 25.2°$

Refinement

Refinement on F^2
$R[F^2 > 2\sigma(F^2)] = 0.052$
$wR(F^2) = 0.144$
$S = 1.05$
3672 reflections
250 parameters
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.0958P)^2 + 0.1694P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max} = 0.001$
$\Delta\rho_{max} = 0.23$ e Å^{-3}
$\Delta\rho_{min} = -0.23$ e Å^{-3}
Absolute structure: Flack (1983), 1550 Friedel pairs
Flack parameter: 0.00 (8)

Table 1
Selected geometric parameters (Å, °).

C6—C7	1.503 (4)	C9—N1	1.510 (3)
C7—N1	1.499 (4)	C9—C10	1.527 (4)
C7—C8	1.521 (4)	C13—C14	1.521 (5)
C9—C11	1.508 (4)	C17—O3	1.370 (4)
N1—C7—C6	112.4 (2)	N1—C9—C10	108.8 (2)
N1—C7—C8	107.5 (2)	O3—C17—C16	123.2 (3)
C6—C7—C8	112.2 (2)	O3—C17—C11	117.0 (2)
O4—C8—C7	107.9 (3)		

Table 2
Hydrogen-bond geometry (Å, °).

D—H···A	D—H	H···A	D···A	D—H···A
N1—H1A···O3	0.90	2.00	2.719 (3)	136
N1—H1A···O3	0.90	2.00	2.719 (3)	136
N1—H1B···Cl1^{i}	0.90	2.31	3.181 (2)	163
O3—H3···Cl1^{ii}	0.82	2.21	3.022 (2)	172
O4—H4···Cl1^{iii}	0.82	2.35	3.149 (3)	164

Symmetry codes: (i) $x-1, y, z$; (ii) $-x+1, y+\frac{1}{2}, -z+2$; (iii) $-x+1, y-\frac{1}{2}, -z+2$.

The cell obtained for (I) has $a = c$, although actually belonging to Laue class 2/m. Such a case had been observed in previous reports (*e.g.* Sani *et al.*, 2005). In order to converge to a sensible geometry for the solvent molecule, the C20—C21 bond length was restrained to 1.50 (1) Å and atoms within this group were subjected to a rigid-bond restraint: the U^{ij} parameters in the direction of the bonds were restrained to be equal within an s.u. of 0.01 Å^2. Finally, for the complete asymmetric unit, atoms closer than 1.7 Å were restrained to have the same U^{ij} components, within an s.u. of 0.02 Å^2. All H atoms were placed in idealized positions and constrained to ride on their parent atom; constrained distances: O—H = 0.82 Å, N—H = 0.90 Å, and C—H = 0.93, 0.96, 0.97 and 0.98 Å for aromatic, methyl, methylene and methine groups, respectively. Isotropic displacement parameters were fixed at U_{iso}(H) = 1.5U_{iso}(carrier atom) for OH and methyl groups and at U_{iso}(H)=1.2U_{iso}(carrier atom) for other groups.

Data collection: *SMART* (Bruker, 1997); cell refinement: *SAINT* (Bruker, 1997); 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, 2001); software used to prepare material for publication: *SHELXTL*.

The authors are grateful to the Natural Science Foundation of Shandong Province China (grant No. G0231) and the Foundation of the Education Ministry of China for Returned Students (grant No. G0220) for financial support. X-ray data were collected at Shandong Normal University of China.

References

Abiko, A. & Masamune, S. (1992). *Tetrahedron Lett.* **33**, 5517–5518.
Bruker (1997). *SMART* (Version 5.6) and *SAINT* (Version 5.06a). Bruker AXS Inc., Madison, Wisconsin, USA.
Bruker (2001). *SHELXTL*. Version 6.12. Bruker AXS Inc., Madison, Wisconsin, USA.
Cimarelli, C. & Palmieri, G. (1998). *Tetrahedron*, **54**, 15711–15720.
Cimarelli, C. & Palmieri, G. (2000). *Tetrahedron Asymmetry*, **11**, 2555–2563.
Demir, A. S., Akhmedov, I. M. & Sesenoglu, O. (1999). *Turk. J. Chem.* **23**, 123–126.
Flack, H. D. (1983). *Acta Cryst.* A**39**, 876–881.
Guangyou, Z., Yuquing, L., Zhaohui, W., Nohira, H. & Hirose, T. (2003). *Tetrahedron Asymmetry*, **14**, 3297–3300.
Joshi, S. N. & Malhotra, S. V. (2003). *Tetrahedron Asymmetry*, **14**, 1763–1766.
Li, Y., He, B., Qin, B., Feng, X. & Zhang, G. (2004). *J. Org. Chem.* **69**, 7910–7913.
McKennon, M. J., Meyers, A. I., Drauz, K. & Schwarm, M. (1993). *J. Org. Chem.* **58**, 3568–3571.
Puigjaner, C., Vidal-Ferran, A., Moyano, A., Pericas, M. A. & Riera, A. (1999). *J. Org. Chem.* **64**, 7902–7911.
Sani, M., Candiani, G., Pecker, F., Malpezzi, L. & Zanda, M. (2005). *Tetrahedron Lett.* **46**, 2393–2396.
Sheldrick, G. M. (1996). *SADABS*. University of Göttingen, Germany.
Sheldrick, G. M. (1997). *SHELXS97* and *SHELXL97*. University of Göttingen, Germany.
Soai, K. & Niwa, S. (1992). *Chem. Rev.* **92**, 833–856.
Tseng, S.-L. & Yang, T.-K. (2004). *Tetrahedron Asymmetry*, **15**, 3375–3380.
Tümerdem, R., Topal, G. & Turgut, Y. (2005). *Tetrahedron Asymmetry*, **16**, 865–868.
Watts, C. C., Thoniyot, P., Hirayama, L. C., Romano, T. & Singaram, B. (2005). *Tetrahedron Asymmetry*, **16**, 1829–1835.
Yang, X.-F., Zhang, G.-Y., Zhang, Y., Zhao, J.-Y. & Wang, X.-B. (2005). *Acta Cryst.* C**61**, o262–o264.
Zhang, G.-Y., Wang, X.-B., Zhao J-Y., Wang, W-H. & Yang, X-F. (2006). *Acta Cryst.* E**62**, o2239–o2241.