Acta Crystallographica Section E
Structure Reports Online
ISSN 1600-5368

(*E*)-*N*′-(2-Hydroxybenzylidene)-3,4,5-trimethoxybenzohydrazide

Yu-Min Wang, Zhen-Dong Zhao,* Yu-Xiang Chen and Liang-Wu Bi

Institute of Chemical Industry of Forest Products, Chinese Academy of Forestry, Nanjing 210042, People's Republic of China
Correspondence e-mail: minwangyu@126.com

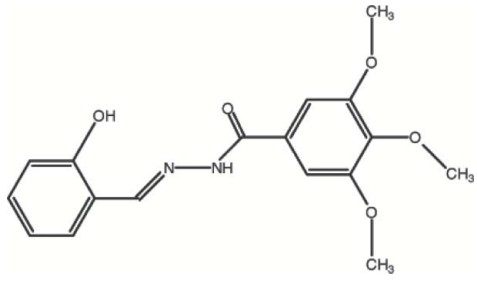
Received 30 January 2008; accepted 5 March 2008

Key indicators: single-crystal X-ray study; T = 273 K; mean σ(C–C) = 0.005 Å; R factor = 0.069; wR factor = 0.194; data-to-parameter ratio = 13.5.

The title compound, $C_{17}H_{18}N_2O_5$, was synthesized from 3,4,5-trimethoxybenzohydrazide and 2-hydroxybenzaldehyde. The dihedral angle between the planes of the two benzene rings is 29.9 (2)°. The crystal structure involves intramolecular O—H···N, and intermolecular N—H···O and C—H···O hydrogen bonds.

Related literature

For related literature, see: Yang *et al.* (1996); Nawar *et al.* (2000). Gardner *et al.* (1991); Labouta *et al.* (1989).



Experimental

Crystal data

$C_{17}H_{18}N_2O_5$
M_r = 330.33
Monoclinic, $P2_1/c$
a = 15.348 (12) Å
b = 13.330 (11) Å
c = 8.299 (7) Å
β = 99.854 (16)°
V = 1673 (2) Å^3
Z = 4
Mo $K\alpha$ radiation
μ = 0.10 mm^{-1}
T = 273 (2) K
0.10 × 0.06 × 0.04 mm

Data collection

Bruker APEX CCD area-detector diffractometer
Absorption correction: multi-scan (*SADABS*; Sheldrick, 1996)
T_{min} = 0.991, T_{max} = 0.995
8200 measured reflections
2952 independent reflections
1945 reflections with $I > 2\sigma(I)$
R_{int} = 0.048

Refinement

$R[F^2 > 2\sigma(F^2)]$ = 0.068
$wR(F^2)$ = 0.194
S = 1.00
2952 reflections
219 parameters
H-atom parameters constrained
$\Delta\rho_{max}$ = 0.59 e Å^{-3}
$\Delta\rho_{min}$ = −0.26 e Å^{-3}

Table 1
Hydrogen-bond geometry (Å, °).

D—H···A	D—H	H···A	D···A	D—H···A
O1—H1···N1	0.82	1.94	2.670 (4)	147
N2—H2···O2^{i}	0.86	2.00	2.826 (4)	161 (1)
C7—H7···O2^{i}	0.93	2.48	3.240 (5)	139

Symmetry code: (i) $x, -y+\frac{3}{2}, z-\frac{1}{2}$.

Data collection: *SMART* (Bruker, 1997); cell refinement: *SAINT* (Bruker, 1997); data reduction: *SAINT*; program(s) used to solve structure: *SHELXS97* (Sheldrick, 2008); program(s) used to refine structure: *SHELXL97* (Sheldrick, 2008); molecular graphics: *SHELXTL* (Sheldrick, 2008); software used to prepare material for publication: *SHELXTL*.

This work was supported by the Natural Science Fund of Jiangsu Province (No. BK2006012).

Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: AT2541).

References

Bruker (1997). *SAINT* and *SMART*. Bruker AXS, Inc., Madison, Wisconsin, USA.
Gardner, T. S., Weins, R. & Lee, J. (1991). *J Org Chem.* **26**, 1514–1530.
Labouta, I. M., Hassan, A. M., Aboulwafa, O. M. & Kader, O. (1989). *Monatsh. Chem.* **120**, 571–574.
Nawar, N. & Hosny, N. M. (2000). *Transition Met. Chem.* **25**, 1–8.
Sheldrick, G. M. (1996). *SADABS*. University of Göttingen, Germany.
Sheldrick, G. M. (2008). *Acta Cryst.* A**64**, 112–122.
Yang, Z. Y., Yang, R. D. & Yu, K. B. (1996). *Polyhedron*, **15**, 3749–3753.

supporting information

Acta Cryst. (2008). E**64**, o1009 [doi:10.1107/S1600536808006077]

(*E*)-*N*′-(2-Hydroxybenzylidene)-3,4,5-trimethoxybenzohydrazide

Yu-Min Wang, Zhen-Dong Zhao, Yu-Xiang Chen and Liang-Wu Bi

S1. Comment

3,4,5-Trimethoxybenzohydrazide and their deviatives show moderate fungicidal and anti-bacterial activities (Gardner *et al.*,1991). The antibacterial activity of formylhydrazines and formylhydrazones has been reported by Labouta *et al.* (1989). Many derivatives of formylhydrazines have interesting biological properties. So we synthesized the title compound (I) and report here its crystal structure.

The molecular structure of (I) is shown in Fig. 1, where the dash lines indicate N–H···O and O—H···N hydrogen bonds (Table 2). The atoms C7, N1, N2, C8 and O2 almost share a same plane for its delocalized structure. The dihedral angle between the planes of the two phenyl rings is 29.9 (217)°.

In the crystal structure, there is a intramolecular O—H···N hydrogen bond and two intermolecular N—H···O and C—H···O hydrogen bonds.

S2. Experimental

An ethanol solution (50 ml) of 3,4,5-trimethoxybenzohydrazide (0.01 mol) and 2-hydroxybenzaldehyde (0.01 mol) was refluxed and stirred for 4 h. The mixture was cooled and the resulting solid product, (I), was collected by filtration. Crystals suitable for single-crystal X-ray diffraction were grown by slow evaporation of a solution in THF.

S3. Refinement

All H atoms bonded to the C atoms were placed geometrically at the distances of 0.93–0.96 Å and included in the refinement in riding motion approximation with U_{iso}(H) = 1.2 or 1.5U_{eq} of the carrier atom.

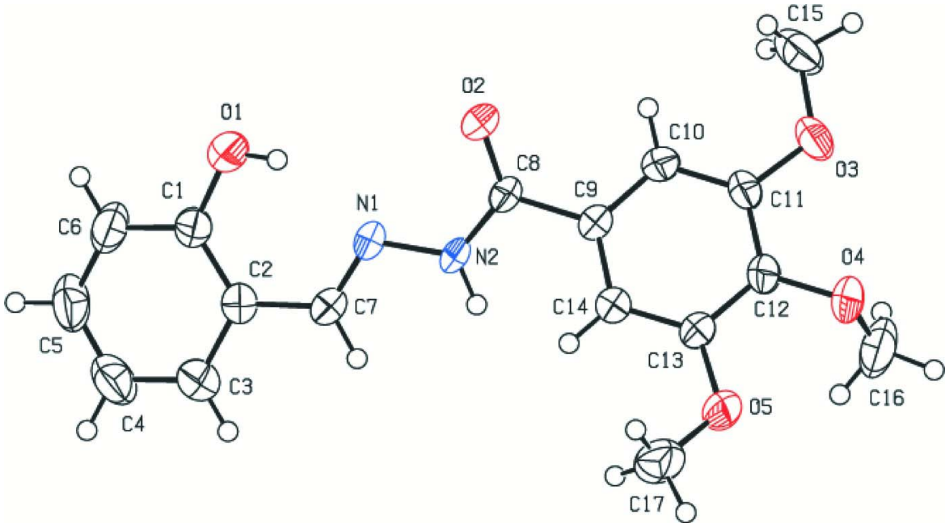


Figure 1

A view of the molecular structure of the title compound, showing displacement ellipsoids at the 50% probability level.

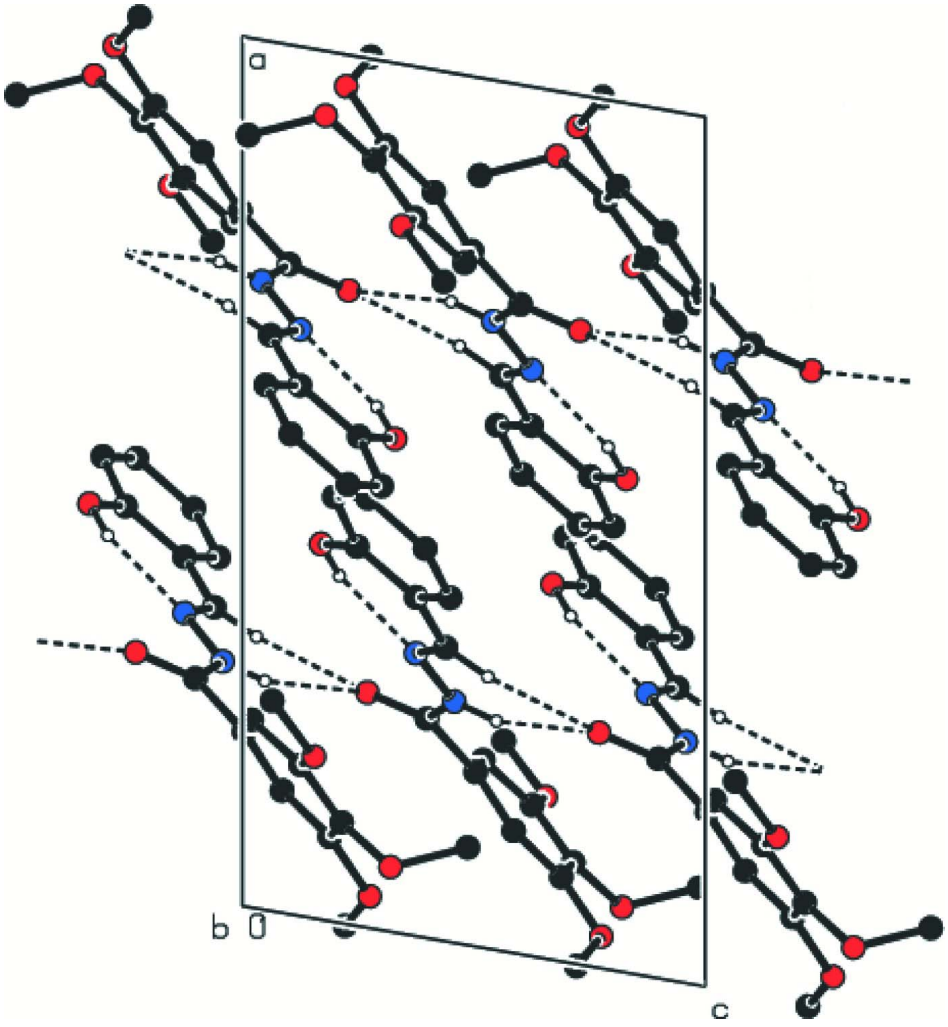


Figure 2

The packing diagram for (I) showing three dimensional network formed *via* hydrogen bonding.

(*E*)-*N*′-(2-Hydroxybenzylidene)-3,4,5-trimethoxybenzohydrazide

Crystal data

$C_{17}H_{18}N_2O_5$
M_r = 330.33
Monoclinic, $P2_1/c$
Hall symbol: -P 2ybc
a = 15.348 (12) Å
b = 13.330 (11) Å
c = 8.299 (7) Å
β = 99.854 (16)°
V = 1673 (2) Å^3
Z = 4
$F(000)$ = 696
D_x = 1.312 Mg m^{-3}
Mo $K\alpha$ radiation, λ = 0.71073 Å
Cell parameters from 2179 reflections
θ = 2.7–22.9°
μ = 0.10 mm^{-1}
T = 273 K
Needle, colourless
0.10 × 0.06 × 0.04 mm

Data collection

Bruker APEX CCD area-detector diffractometer
Radiation source: fine-focus sealed tube
Graphite monochromator
φ and ω scans
Absorption correction: multi-scan (*SADABS*; Sheldrick, 1996)
T_{min} = 0.991, T_{max} = 0.995
8200 measured reflections
2952 independent reflections
1945 reflections with $I > 2\sigma(I)$
R_{int} = 0.048
θ_{max} = 25.0°, θ_{min} = 1.4°
$h = -14 \rightarrow 18$
$k = -14 \rightarrow 15$
$l = -9 \rightarrow 9$

Refinement

Refinement on F^2
Least-squares matrix: full
$R[F^2 > 2\sigma(F^2)]$ = 0.068
$wR(F^2)$ = 0.194
S = 1.00
2952 reflections
219 parameters
0 restraints
Primary atom site location: structure-invariant direct methods
Secondary atom site location: difference Fourier map
Hydrogen site location: inferred from neighbouring sites
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.09P)^2 + 1.3P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max} < 0.001$
$\Delta\rho_{max}$ = 0.59 e Å^{-3}
$\Delta\rho_{min}$ = −0.26 e Å^{-3}
Extinction correction: *SHELXL97* (Sheldrick, 2008), $Fc^* = kFc[1+0.001xFc^2\lambda^3/\sin(2\theta)]^{-1/4}$
Extinction coefficient: 0.009 (2)

Special details

Geometry. All e.s.d.'s (except the e.s.d. in the dihedral angle between two l.s. planes) are estimated using the full covariance matrix. The cell e.s.d.'s are taken into account individually in the estimation of e.s.d.'s in distances, angles and torsion angles; correlations between e.s.d.'s in cell parameters are only used when they are defined by crystal symmetry. An approximate (isotropic) treatment of cell e.s.d.'s is used for estimating e.s.d.'s involving l.s. planes.

Refinement. Refinement of F^2 against ALL reflections. The weighted R-factor wR and goodness of fit S are based on F^2, conventional R-factors R are based on F, with F set to zero for negative F^2. The threshold expression of $F^2 > \sigma(F^2)$ is used only for calculating R-factors(gt) *etc*. and is not relevant to the choice of reflections for refinement. R-factors based on F^2 are statistically about twice as large as those based on F, and R- factors based on ALL data will be even larger.

Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (Å^2)

	x	*y*	*z*	U_{iso}*/U_{eq}
O1	0.56784 (18)	0.60473 (18)	0.8299 (3)	0.0620 (7)
H1	0.6008	0.6424	0.7904	0.093*
O2	0.72936 (16)	0.85318 (16)	0.7297 (3)	0.0523 (7)
O3	0.81393 (18)	1.13644 (15)	0.3448 (4)	0.0684 (8)
O4	0.92560 (17)	1.04300 (17)	0.1799 (3)	0.0613 (8)
O5	0.96337 (16)	0.84707 (17)	0.2246 (3)	0.0586 (7)
N1	0.67460 (17)	0.66256 (18)	0.6249 (3)	0.0390 (6)
N2	0.72254 (17)	0.72742 (18)	0.5423 (3)	0.0412 (7)
H2	0.7367	0.7084	0.4512	0.049*
C1	0.5635 (2)	0.5152 (2)	0.7521 (4)	0.0445 (8)
C2	0.6102 (2)	0.4977 (2)	0.6245 (4)	0.0423 (8)
C3	0.6039 (2)	0.4020 (2)	0.5511 (4)	0.0541 (9)
H3	0.6344	0.3888	0.4658	0.065*
C4	0.5525 (3)	0.3270 (3)	0.6047 (5)	0.0643 (11)
H4	0.5497	0.2636	0.5574	0.077*

C5	0.5060 (3)	0.3479 (3)	0.7282 (5)	0.0651 (11)
H5	0.4708	0.2983	0.7629	0.078*
C6	0.5108 (3)	0.4403 (3)	0.8012 (4)	0.0602 (10)
H6	0.4785	0.4530	0.8843	0.072*
C7	0.6621 (2)	0.5750 (2)	0.5607 (4)	0.0421 (8)
H7	0.6874	0.5602	0.4693	0.051*
C8	0.7475 (2)	0.8195 (2)	0.6011 (4)	0.0379 (7)
C9	0.7992 (2)	0.8781 (2)	0.4960 (4)	0.0368 (7)
C10	0.7841 (2)	0.9807 (2)	0.4799 (4)	0.0441 (8)
H10	0.7461	1.0123	0.5400	0.053*
C11	0.8259 (2)	1.0356 (2)	0.3738 (4)	0.0461 (8)
C12	0.8839 (2)	0.9881 (2)	0.2853 (4)	0.0460 (8)
C13	0.9029 (2)	0.8862 (2)	0.3110 (4)	0.0428 (8)
C14	0.8592 (2)	0.8308 (2)	0.4139 (4)	0.0415 (8)
H14	0.8701	0.7624	0.4279	0.050*
C15	0.7580 (3)	1.1888 (3)	0.4353 (6)	0.0807 (14)
H15A	0.6995	1.1610	0.4119	0.121*
H15B	0.7560	1.2584	0.4053	0.121*
H15C	0.7806	1.1824	0.5501	0.121*
C16	0.8877 (3)	1.0316 (3)	0.0131 (6)	0.0787 (14)
H16A	0.8832	0.9615	−0.0138	0.118*
H16B	0.9243	1.0644	−0.0538	0.118*
H16C	0.8298	1.0611	−0.0062	0.118*
C17	1.0023 (3)	0.7532 (3)	0.2783 (5)	0.0656 (11)
H17A	1.0269	0.7572	0.3925	0.098*
H17B	1.0483	0.7375	0.2171	0.098*
H17C	0.9580	0.7017	0.2613	0.098*

Atomic displacement parameters (Å²)

	U^{11}	U^{22}	U^{33}	U^{12}	U^{13}	U^{23}
O1	0.085 (2)	0.0474 (14)	0.0639 (17)	−0.0132 (13)	0.0429 (14)	−0.0088 (12)
O2	0.0821 (17)	0.0435 (13)	0.0395 (14)	0.0001 (11)	0.0339 (12)	−0.0002 (10)
O3	0.0843 (19)	0.0262 (12)	0.108 (2)	0.0009 (11)	0.0555 (17)	0.0053 (12)
O4	0.0757 (18)	0.0431 (13)	0.077 (2)	−0.0130 (12)	0.0470 (15)	0.0080 (12)
O5	0.0677 (16)	0.0472 (14)	0.0734 (18)	0.0114 (12)	0.0475 (14)	0.0096 (12)
N1	0.0488 (16)	0.0375 (14)	0.0352 (15)	−0.0023 (11)	0.0199 (12)	0.0062 (11)
N2	0.0614 (17)	0.0367 (14)	0.0326 (15)	−0.0051 (12)	0.0283 (13)	0.0024 (11)
C1	0.059 (2)	0.0382 (17)	0.0386 (19)	−0.0069 (15)	0.0148 (16)	−0.0011 (14)
C2	0.0508 (19)	0.0364 (16)	0.0417 (19)	−0.0023 (14)	0.0135 (15)	0.0034 (13)
C3	0.071 (2)	0.0403 (18)	0.054 (2)	−0.0005 (17)	0.0179 (18)	−0.0032 (16)
C4	0.087 (3)	0.0363 (18)	0.066 (3)	−0.0093 (19)	0.006 (2)	−0.0028 (17)
C5	0.086 (3)	0.051 (2)	0.056 (2)	−0.029 (2)	0.009 (2)	0.0073 (18)
C6	0.077 (3)	0.062 (2)	0.046 (2)	−0.0220 (19)	0.0245 (19)	0.0042 (17)
C7	0.053 (2)	0.0424 (18)	0.0355 (18)	0.0009 (14)	0.0201 (15)	0.0022 (14)
C8	0.0511 (19)	0.0370 (16)	0.0299 (17)	0.0027 (14)	0.0188 (14)	0.0058 (13)
C9	0.0451 (18)	0.0351 (16)	0.0339 (17)	−0.0007 (13)	0.0169 (14)	0.0011 (12)
C10	0.051 (2)	0.0367 (17)	0.051 (2)	−0.0017 (14)	0.0265 (16)	−0.0048 (14)

C11	0.057 (2)	0.0260 (15)	0.061 (2)	−0.0032 (14)	0.0271 (17)	0.0020 (14)
C12	0.053 (2)	0.0320 (16)	0.060 (2)	−0.0071 (14)	0.0305 (17)	0.0021 (14)
C13	0.0484 (19)	0.0369 (17)	0.050 (2)	0.0004 (14)	0.0271 (16)	0.0015 (14)
C14	0.053 (2)	0.0328 (16)	0.0429 (19)	0.0012 (14)	0.0213 (15)	0.0014 (13)
C15	0.093 (3)	0.0329 (19)	0.128 (4)	0.0065 (19)	0.053 (3)	−0.003 (2)
C16	0.090 (3)	0.079 (3)	0.077 (3)	−0.001 (2)	0.044 (3)	0.033 (2)
C17	0.065 (2)	0.069 (2)	0.070 (3)	0.024 (2)	0.031 (2)	0.009 (2)

Geometric parameters (Å, º)

O1—C1	1.353 (4)	C5—H5	0.9300
O1—H1	0.8200	C6—H6	0.9300
O2—C8	1.233 (3)	C7—H7	0.9300
O3—C11	1.373 (4)	C8—C9	1.496 (4)
O3—C15	1.417 (4)	C9—C14	1.387 (4)
O4—C12	1.379 (4)	C9—C10	1.390 (4)
O4—C16	1.415 (5)	C10—C11	1.384 (4)
O5—C13	1.369 (3)	C10—H10	0.9300
O5—C17	1.424 (4)	C11—C12	1.398 (4)
N1—C7	1.284 (4)	C12—C13	1.399 (4)
N1—N2	1.389 (3)	C13—C14	1.386 (4)
N2—C8	1.351 (4)	C14—H14	0.9300
N2—H2	0.8600	C15—H15A	0.9600
C1—C6	1.389 (5)	C15—H15B	0.9600
C1—C2	1.396 (4)	C15—H15C	0.9600
C2—C3	1.410 (5)	C16—H16A	0.9600
C2—C7	1.456 (4)	C16—H16B	0.9600
C3—C4	1.393 (5)	C16—H16C	0.9600
C3—H3	0.9300	C17—H17A	0.9600
C4—C5	1.373 (5)	C17—H17B	0.9600
C4—H4	0.9300	C17—H17C	0.9600
C5—C6	1.369 (5)		

C1—O1—H1	109.5	C10—C9—C8	118.3 (3)
C11—O3—C15	117.7 (3)	C11—C10—C9	119.6 (3)
C12—O4—C16	113.9 (3)	C11—C10—H10	120.2
C13—O5—C17	117.1 (3)	C9—C10—H10	120.2
C7—N1—N2	114.5 (2)	O3—C11—C10	124.5 (3)
C8—N2—N1	121.9 (2)	O3—C11—C12	115.4 (3)
C8—N2—H2	119.1	C10—C11—C12	120.1 (3)
N1—N2—H2	119.1	O4—C12—C11	120.0 (3)
O1—C1—C6	118.5 (3)	O4—C12—C13	120.3 (3)
O1—C1—C2	121.3 (3)	C11—C12—C13	119.6 (3)
C6—C1—C2	120.2 (3)	O5—C13—C14	124.3 (3)
C1—C2—C3	118.2 (3)	O5—C13—C12	115.6 (3)
C1—C2—C7	122.8 (3)	C14—C13—C12	120.1 (3)
C3—C2—C7	118.9 (3)	C13—C14—C9	119.5 (3)
C4—C3—C2	120.8 (3)	C13—C14—H14	120.2

C4—C3—H3	119.6	C9—C14—H14	120.2
C2—C3—H3	119.6	O3—C15—H15A	109.5
C5—C4—C3	119.2 (3)	O3—C15—H15B	109.5
C5—C4—H4	120.4	H15A—C15—H15B	109.5
C3—C4—H4	120.4	O3—C15—H15C	109.5
C6—C5—C4	121.2 (3)	H15A—C15—H15C	109.5
C6—C5—H5	119.4	H15B—C15—H15C	109.5
C4—C5—H5	119.4	O4—C16—H16A	109.5
C5—C6—C1	120.4 (3)	O4—C16—H16B	109.5
C5—C6—H6	119.8	H16A—C16—H16B	109.5
C1—C6—H6	119.8	O4—C16—H16C	109.5
N1—C7—C2	122.9 (3)	H16A—C16—H16C	109.5
N1—C7—H7	118.5	H16B—C16—H16C	109.5
C2—C7—H7	118.5	O5—C17—H17A	109.5
O2—C8—N2	123.5 (3)	O5—C17—H17B	109.5
O2—C8—C9	122.3 (3)	H17A—C17—H17B	109.5
N2—C8—C9	114.2 (2)	O5—C17—H17C	109.5
C14—C9—C10	120.9 (3)	H17A—C17—H17C	109.5
C14—C9—C8	120.8 (3)	H17B—C17—H17C	109.5

C7—N1—N2—C8	−174.6 (3)	C8—C9—C10—C11	−175.1 (3)
O1—C1—C2—C3	178.8 (3)	C15—O3—C11—C10	3.0 (6)
C6—C1—C2—C3	−1.5 (5)	C15—O3—C11—C12	−178.0 (3)
O1—C1—C2—C7	−3.6 (5)	C9—C10—C11—O3	178.1 (3)
C6—C1—C2—C7	176.1 (3)	C9—C10—C11—C12	−0.9 (5)
C1—C2—C3—C4	−0.1 (5)	C16—O4—C12—C11	−102.2 (4)
C7—C2—C3—C4	−177.8 (3)	C16—O4—C12—C13	81.3 (4)
C2—C3—C4—C5	1.5 (6)	O3—C11—C12—O4	1.1 (5)
C3—C4—C5—C6	−1.2 (6)	C10—C11—C12—O4	−179.9 (3)
C4—C5—C6—C1	−0.4 (6)	O3—C11—C12—C13	177.6 (3)
O1—C1—C6—C5	−178.5 (4)	C10—C11—C12—C13	−3.4 (5)
C2—C1—C6—C5	1.8 (6)	C17—O5—C13—C14	−18.9 (5)
N2—N1—C7—C2	−177.2 (3)	C17—O5—C13—C12	163.4 (3)
C1—C2—C7—N1	5.6 (5)	O4—C12—C13—O5	−0.7 (5)
C3—C2—C7—N1	−176.8 (3)	C11—C12—C13—O5	−177.1 (3)
N1—N2—C8—O2	−0.7 (5)	O4—C12—C13—C14	−178.4 (3)
N1—N2—C8—C9	179.5 (2)	C11—C12—C13—C14	5.1 (5)
O2—C8—C9—C14	143.6 (3)	O5—C13—C14—C9	179.9 (3)
N2—C8—C9—C14	−36.7 (4)	C12—C13—C14—C9	−2.5 (5)
O2—C8—C9—C10	−37.9 (4)	C10—C9—C14—C13	−1.8 (5)
N2—C8—C9—C10	141.9 (3)	C8—C9—C14—C13	176.8 (3)
C14—C9—C10—C11	3.5 (5)		

Hydrogen-bond geometry (Å, º)

D—H···*A*	*D*—H	H···*A*	*D*···*A*	*D*—H···*A*
O1—H1···N1	0.82	1.94	2.670 (4)	147

N2—H2···O2^{i}	0.86	2.00	2.826 (4)	161 (1)
C7—H7···O2^{i}	0.93	2.48	3.240 (5)	139

Symmetry code: (i) x, $-y+3/2$, $z-1/2$.