Acta Crystallographica Section E
Structure Reports
Online
ISSN 1600-5368

2-[(*E*)-(3,4-Dimethylisoxazol-5-yl)imino-methyl]phenol

Hoong-Kun Fun,[a]*‡ Madhukar Hemamalini,[a] Abdullah M. Asiri,[b]§ Salman A. Khan[b] and Khalid A. Khan[b]

[a]X-ray Crystallography Unit, School of Physics, Universiti Sains Malaysia, 11800 USM, Penang, Malaysia, and [b]Department of Chemistry, Faculty of Science, King Abdu Aziz University, Jeddah, Saudi Arabia
Correspondence e-mail: hkfun@usm.my

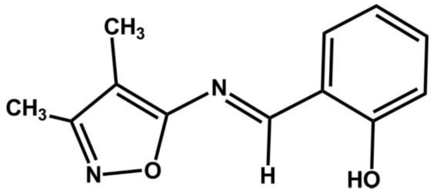
Received 24 February 2010; accepted 3 March 2010

Key indicators: single-crystal X-ray study; T = 100 K; mean σ(C–C) = 0.004 Å; R factor = 0.070; wR factor = 0.203; data-to-parameter ratio = 16.2.

The title compound, $C_{12}H_{12}N_2O_2$, has been synthesized by the reaction of 5-amino-3,4-dimethylisoxazole and salicyladehyde. The molecule adopts an E configuration about the central C=N double bond. The dihedral angle between the isoxazole and phenyl rings is 4.2 (2)° and an intramolecular O—H···N hydrogen bond generates an $S(6)$ ring motif. The crystal studied was a non-merohedral twin with a domain ratio of 0.834 (4):0.166 (4).

Related literature

For background to the biological and pharmacological properties of oxazole derivatives, see: Spinelli (1999); Conti *et al.* (1998); Mishra *et al.* (1998); Ko *et al.* (1998); Kang *et al.* (2000); Huang & Chen (2005). For details of hydrogen bonding and hydrogen-bond motifs, see: Jeffrey & Saenger (1991); Bernstein *et al.* (1995); Jeffrey (1997); Scheiner (1997). For the stability of the temperature controller used in the data collection, see: Cosier & Glazer (1986).



Experimental

Crystal data

$C_{12}H_{12}N_2O_2$
M_r = 216.24
Triclinic, $P\bar{1}$
a = 5.3475 (14) Å
b = 8.615 (2) Å
c = 12.321 (3) Å
α = 103.696 (5)°
β = 91.486 (5)°
γ = 94.059 (5)°
V = 549.6 (2) Å^3
Z = 2
Mo $K\alpha$ radiation
μ = 0.09 mm^{-1}
T = 100 K
0.56 × 0.14 × 0.08 mm

Data collection

Bruker APEX DUO CCD area-detector diffractometer
Absorption correction: multi-scan (*SADABS*; Bruker, 2009)
$T_{\min}$ = 0.951, $T_{\max}$ = 0.993
2467 measured reflections
2467 independent reflections
1946 reflections with $I > 2\sigma(I)$

Refinement

$R[F^2 > 2\sigma(F^2)]$ = 0.070
$wR(F^2)$ = 0.203
S = 1.06
2467 reflections
152 parameters
H atoms treated by a mixture of independent and constrained refinement
$\Delta\rho_{\max}$ = 0.40 e Å^{-3}
$\Delta\rho_{\min}$ = −0.34 e Å^{-3}

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

D—H···A	D—H	H···A	D···A	D—H···A
O2—H1*O2*···N1	1.00 (9)	1.71 (8)	2.648 (5)	154 (8)

Data collection: *APEX2* (Bruker, 2009); cell refinement: *SAINT* (Bruker, 2009); data reduction: *SAINT*; program(s) used to solve structure: *SHELXTL* (Sheldrick, 2008); program(s) used to refine structure: *SHELXTL*; molecular graphics: *SHELXTL*; software used to prepare material for publication: *SHELXTL* and *PLATON* (Spek, 2009).

HKF and MH thank the Malaysian Government and Universiti Sains Malaysia for the Research University Golden Goose grant No. 1001/PFIZIK/811012. MH thanks Universiti Sains Malaysia for a post-doctoral research fellowship. AMA, SAK and KAK thank the Chemistry Department, King Abdul Aziz University, Jeddah, Saudi Arabia, for providing research facilities. AMA would also like to thank the deanship of scientific research at KAU for grant No. 171/428.

Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: SJ2738).

References

Bernstein, J., Davis, R. E., Shimoni, L. & Chang, N.-L. (1995). *Angew. Chem. Int. Ed. Engl.* **34**, 1555–1573.
Bruker (2009). *APEX2*, *SAINT* and *SADABS*. Bruker AXS Inc., Madison, Wisconsin, USA.
Conti, P., Dallanoce, C., Amici, M. D., Micheli, C. D. & Klotz, K. N. (1998). *Bioorg. Med. Chem.* **6**, 401–409.
Cosier, J. & Glazer, A. M. (1986). *J. Appl. Cryst.* **19**, 105–107.
Huang, L. & Chen, D.-B. (2005). *Acta Cryst.* E**61**, o4169–o4170.
Jeffrey, G. A. (1997). *An Introduction to Hydrogen Bonding.* Oxford University Press.
Jeffrey, G. A. & Saenger, W. (1991). *Hydrogen Bonding in Biological Structures.* Berlin: Springer.
Kang, Y. Y., Shin, K. L., Yoo, K. H., Seo, K. J., Hong, C. Y., Lee, C. S., Park, S. Y., Kim, D. J. & Park, S. W. (2000). *Bioorg. Med. Chem. Lett.* **10**, 95–99.
Ko, D. H., Maponya, M. F., Khalil, M. A., Oriaku, E. T. & You, Z. (1998). *J. Med. Chem. Res.* **8**, 313–318.
Mishra, A., Jain, K. J. & Asthana, J. G. (1998). *Oriental J. Chem.* **14**, 151–152.

---

‡ Thomson Reuters ResearcherID: A-3561-2009.
§ On secondment to: The Center of Excellence for Advanced Materials Research, King Abdu Aziz University, Jeddah 21589, Saudi Arabia.

Scheiner, S. (1997). *Hydrogen Bonding, A Theoretical Perspective.* Oxford University Press.

Sheldrick, G. M. (2008). *Acta Cryst.* A**64**, 112–122.

Spek, A. L. (2009). *Acta Cryst.* D**65**, 148–155.

Spinelli, O. A. (1999). *Ital. Soc. Chem.* **3** 301–339.

o774 Fun *et al.* • $C_{12}H_{12}N_2O_2$ *Acta Cryst.* (2010). E**66**, o773–o774

supporting information

Acta Cryst. (2010). E**66**, o773–o774   [doi:10.1107/S1600536810008160]

2-[(*E*)-(3,4-Dimethylisoxazol-5-yl)iminomethyl]phenol

Hoong-Kun Fun, Madhukar Hemamalini, Abdullah M. Asiri, Salman A. Khan and Khalid A. Khan

S1. Comment

Heterocyclic compounds, especially isoxazoles, are one of the key building elements of natural products. Among the numerous heterocyclic systems of biological and pharmacological interest, the oxazole ring is endowed with various activities, including hypoglycemic (Spinelli, 1999), analgesic (Conti *et al.*, 1998), anti-inflammatory (Mishra *et al.*, 1998), anti-bacterial (Ko *et al.*, 1998) and anti-tumor (Kang *et al.*, 2000) properties. In view of the importance of the title compound as a pharmaceutical intermediate, the paper reports its synthesis and crystal structure.

In the title compound (Fig. 1), the isoxazole ring is essentially planar with a maximum deviation of 0.002 (2) Å for atom C8. The dihedral angle between the isoxazole ring (N2/O1/C8–C10) and the phenyl ring (C1–C6) is 4.30 (15)°. The methyl groups at C9 and C10 deviate from the isoxazole mean plane by 0.056 (3) Å and 0.013 (4) Å , respectively. The C5—O2 and C7═N1 bond lengths are 1.353 (4) Å and 1.293 (4) Å, respectively, and agree with the corresponding values in 4-{[(1E)-(3,5-dibromo-2-hydroxyphenyl) methylene]-amino}-1,5-dimethyl-2-phenyl-1,2-dihydro- 3H-pyrazol-3-one [1.344 (3) and 1.292 (4) Å; Huang & Chen, 2005].

In the crystal structure (Fig. 2), the imino N atoms are linked to the phenol O atoms and act as hydrogen-bond acceptors in intramolecular O2—H1O2···N1 interactions (Table 1) (Jeffrey & Saenger, 1991; Jeffrey, 1997; Scheiner, 1997), which generate S(6) ring motifs (Bernstein *et al.*, 1995).

S2. Experimental

A mixture of 5-amino-3,4-dimethylisoxazole (0.50g, 0.0044 mol) and salicyladehyde (0.54g, 0.0044 mol) in methanol (15 mL) was refluxed for 5 h with stirring to give a light yellow precipitate. It was then filtered and washed with methanol to gives the pure Schiff base. Yield: 68%; mp. 116°C. IR (KBr) v_{max} cm^{-1}: 2922(C—H), 1594 (C═O), 1562 (C═C), 1152 (C—N). ^{1}H NMR (CDCl$_3$) d: 8.89 (s, 1H, CH olefinic), 7.42 (d, H3, J=1.8Hz), 7.44 (dd, H4, J=7.8Hz), 7.02 (dd, H5, J=7.8Hz), 6.97 (d, H6, J=1.2 Hz), 2.25 (s, CH3), 2.05 (s, CH3).

S3. Refinement

Atom H1O2 was located from the difference Fourier map and refined freely. The remaining hydrogen atoms were positioned geometrically [C–H = 0.93 Å or 0.96 Å] and were refined using a riding model, with U_{iso}(H) = 1.2 or 1.5 U_{eq}(C). A rotating group model was applied to the methyl groups. The crystal is a non-merohedral twin with BASF = 0.166 (4).

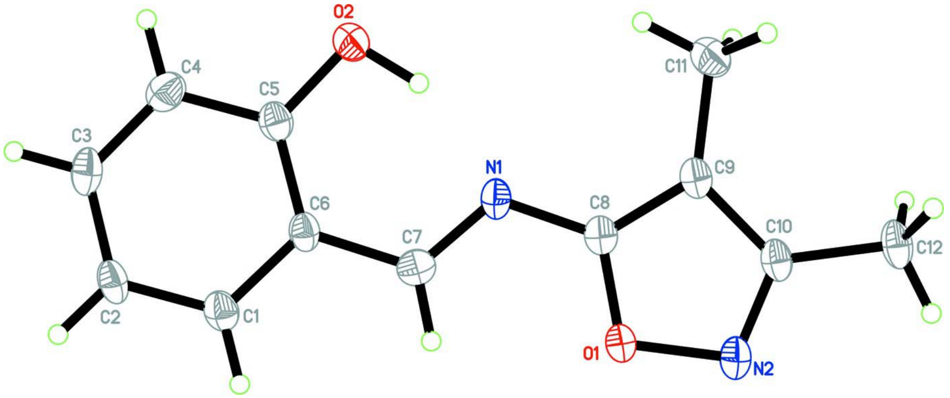


Figure 1

The asymmetric unit of the title compound, showing 50% probability displacement ellipsoids and the atom-numbering scheme.

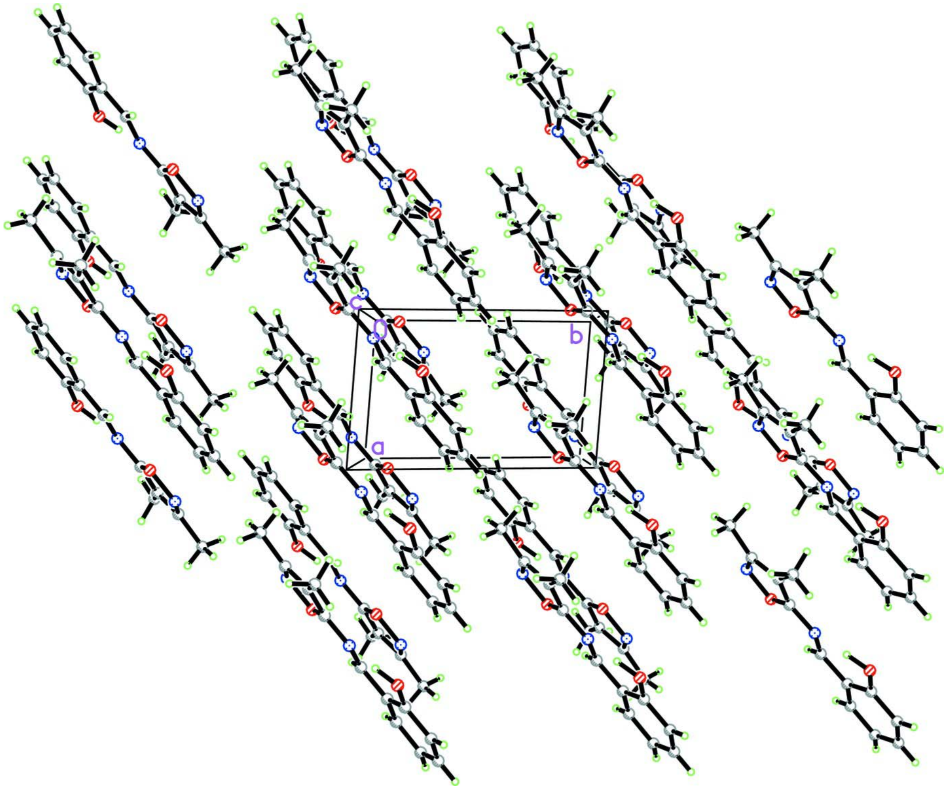


Figure 2

The crystal packing of the title compound (I).

2-[(*E*)-(3,4-Dimethylisoxazol-5-yl)iminomethyl]phenol

Crystal data

$C_{12}H_{12}N_2O_2$
$M_r = 216.24$
Triclinic, $P\overline{1}$
Hall symbol: -P 1
$a = 5.3475\ (14)$ Å
$b = 8.615\ (2)$ Å
$c = 12.321\ (3)$ Å
$\alpha = 103.696\ (5)°$
$\beta = 91.486\ (5)°$
$\gamma = 94.059\ (5)°$

V = 549.6 (2) Å^3
Z = 2
F(000) = 228
D_x = 1.307 Mg m^{-3}
Mo $K\alpha$ radiation, λ = 0.71073 Å
Cell parameters from 2862 reflections
θ = 2.4–29.7°
μ = 0.09 mm^{-1}
T = 100 K
Plate, yellow
0.56 × 0.14 × 0.08 mm

Data collection

Bruker APEX DUO CCD area-detector diffractometer
Radiation source: fine-focus sealed tube
Graphite monochromator
φ and ω scans
Absorption correction: multi-scan (*SADABS*; Bruker, 2009)
T_{min} = 0.951, T_{max} = 0.993
2467 measured reflections
2467 independent reflections
1946 reflections with $I > 2\sigma(I)$
R_{int} = 0.000
θ_{max} = 27.5°, θ_{min} = 1.7°
h = −6→6
k = −11→10
l = −6→15

Refinement

Refinement on F^2
Least-squares matrix: full
$R[F^2 > 2\sigma(F^2)]$ = 0.070
$wR(F^2)$ = 0.203
S = 1.06
2467 reflections
152 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 atoms treated by a mixture of independent and constrained refinement
$w = 1/[\sigma^2(F_o^2) + (0.0657P)^2 + 1.1217P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max}$ = 0.001
$\Delta\rho_{max}$ = 0.40 e Å^{-3}
$\Delta\rho_{min}$ = −0.34 e Å^{-3}

Special details

Experimental. The crystal was placed in the cold stream of an Oxford Cryosystems Cobra open-flow nitrogen cryostat (Cosier & Glazer, 1986) operating at 100.0 (1) K.

Geometry. All s.u.'s (except the s.u. in the dihedral angle between two l.s. planes) are estimated using the full covariance matrix. The cell s.u.'s are taken into account individually in the estimation of s.u.'s in distances, angles and torsion angles; correlations between s.u.'s in cell parameters are only used when they are defined by crystal symmetry. An approximate (isotropic) treatment of cell s.u.'s is used for estimating s.u.'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 > 2σ(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	1.0387 (4)	1.1305 (2)	0.41739 (17)	0.0228 (5)
O2	0.6135 (4)	0.7350 (3)	0.08828 (18)	0.0262 (5)
N1	0.8330 (5)	0.9521 (3)	0.2591 (2)	0.0194 (5)
N2	1.2481 (5)	1.2478 (3)	0.4414 (2)	0.0252 (6)
C1	0.2930 (5)	0.7387 (3)	0.3499 (3)	0.0201 (6)
H1A	0.3082	0.7892	0.4256	0.024*
C2	0.0960 (5)	0.6240 (3)	0.3108 (3)	0.0221 (6)
H2A	−0.0224	0.5990	0.3593	0.026*

C3	0.0782 (6)	0.5468 (4)	0.1976 (3)	0.0249 (7)
H3A	−0.0529	0.4691	0.1710	0.030*
C4	0.2512 (6)	0.5831 (4)	0.1235 (3)	0.0250 (7)
H4A	0.2362	0.5296	0.0484	0.030*
C5	0.4491 (5)	0.7008 (3)	0.1626 (2)	0.0199 (6)
C6	0.4711 (5)	0.7802 (3)	0.2771 (2)	0.0186 (6)
C7	0.6723 (5)	0.9024 (3)	0.3225 (2)	0.0191 (6)
H7A	0.6859	0.9462	0.3992	0.023*
C8	1.0225 (5)	1.0682 (3)	0.3052 (2)	0.0176 (6)
C9	1.2091 (5)	1.1366 (3)	0.2539 (2)	0.0192 (6)
C10	1.3428 (5)	1.2479 (3)	0.3446 (2)	0.0195 (6)
C11	1.2629 (6)	1.1010 (4)	0.1327 (3)	0.0276 (7)
H11A	1.1457	1.0163	0.0921	0.041*
H11C	1.4305	1.0685	0.1229	0.041*
H11D	1.2470	1.1953	0.1051	0.041*
C12	1.5687 (5)	1.3582 (4)	0.3386 (3)	0.0243 (7)
H12A	1.6191	1.4202	0.4124	0.036*
H12D	1.5285	1.4287	0.2920	0.036*
H12B	1.7034	1.2963	0.3075	0.036*
H1O2	0.722 (11)	0.820 (7)	0.132 (5)	0.080 (18)*

Atomic displacement parameters (Å^2)

	U^{11}	U^{22}	U^{33}	U^{12}	U^{13}	U^{23}
O1	0.0194 (11)	0.0238 (11)	0.0233 (11)	−0.0060 (8)	0.0019 (8)	0.0042 (8)
O2	0.0250 (12)	0.0281 (11)	0.0232 (11)	−0.0040 (9)	0.0061 (9)	0.0028 (9)
N1	0.0170 (12)	0.0148 (11)	0.0261 (13)	0.0009 (9)	0.0020 (9)	0.0041 (9)
N2	0.0207 (13)	0.0246 (13)	0.0290 (14)	−0.0061 (10)	−0.0003 (10)	0.0062 (10)
C1	0.0155 (14)	0.0176 (13)	0.0270 (15)	0.0054 (10)	0.0036 (11)	0.0036 (11)
C2	0.0152 (14)	0.0204 (14)	0.0318 (16)	0.0021 (11)	0.0054 (11)	0.0078 (12)
C3	0.0159 (14)	0.0225 (14)	0.0353 (17)	−0.0013 (11)	−0.0012 (12)	0.0063 (12)
C4	0.0247 (16)	0.0227 (15)	0.0246 (15)	−0.0006 (12)	−0.0007 (12)	0.0004 (12)
C5	0.0164 (14)	0.0194 (14)	0.0242 (14)	0.0026 (11)	0.0021 (11)	0.0052 (11)
C6	0.0154 (13)	0.0155 (13)	0.0256 (14)	0.0033 (10)	0.0019 (11)	0.0054 (11)
C7	0.0199 (14)	0.0158 (13)	0.0216 (14)	0.0058 (11)	0.0019 (11)	0.0034 (10)
C8	0.0140 (13)	0.0163 (13)	0.0237 (14)	0.0051 (10)	0.0029 (10)	0.0056 (10)
C9	0.0159 (13)	0.0169 (13)	0.0262 (15)	0.0037 (10)	0.0033 (11)	0.0074 (11)
C10	0.0136 (13)	0.0169 (13)	0.0296 (15)	0.0038 (10)	0.0020 (11)	0.0079 (11)
C11	0.0272 (16)	0.0291 (16)	0.0260 (16)	0.0009 (13)	0.0080 (12)	0.0055 (12)
C12	0.0137 (13)	0.0215 (14)	0.0392 (17)	0.0005 (11)	0.0038 (12)	0.0100 (12)

Geometric parameters (Å, º)

O1—C8	1.357 (3)	C4—H4A	0.9300
O1—N2	1.429 (3)	C5—C6	1.412 (4)
O2—C5	1.353 (4)	C6—C7	1.452 (4)
O2—H1O2	0.95 (6)	C7—H7A	0.9300
N1—C7	1.293 (4)	C8—C9	1.367 (4)

N1—C8	1.381 (4)	C9—C10	1.426 (4)
N2—C10	1.308 (4)	C9—C11	1.491 (4)
C1—C2	1.385 (4)	C10—C12	1.498 (4)
C1—C6	1.410 (4)	C11—H11A	0.9600
C1—H1A	0.9300	C11—H11C	0.9600
C2—C3	1.394 (4)	C11—H11D	0.9600
C2—H2A	0.9300	C12—H12A	0.9600
C3—C4	1.387 (4)	C12—H12D	0.9600
C3—H3A	0.9300	C12—H12B	0.9600
C4—C5	1.404 (4)		

C8—O1—N2	107.7 (2)	N1—C7—H7A	119.1
C5—O2—H1O2	103 (3)	C6—C7—H7A	119.1
C7—N1—C8	120.3 (2)	O1—C8—C9	110.8 (2)
C10—N2—O1	105.3 (2)	O1—C8—N1	119.7 (2)
C2—C1—C6	121.2 (3)	C9—C8—N1	129.5 (3)
C2—C1—H1A	119.4	C8—C9—C10	103.2 (3)
C6—C1—H1A	119.4	C8—C9—C11	128.4 (3)
C1—C2—C3	118.9 (3)	C10—C9—C11	128.4 (3)
C1—C2—H2A	120.6	N2—C10—C9	112.9 (3)
C3—C2—H2A	120.6	N2—C10—C12	119.8 (3)
C4—C3—C2	121.6 (3)	C9—C10—C12	127.3 (3)
C4—C3—H3A	119.2	C9—C11—H11A	109.5
C2—C3—H3A	119.2	C9—C11—H11C	109.5
C3—C4—C5	119.7 (3)	H11A—C11—H11C	109.5
C3—C4—H4A	120.2	C9—C11—H11D	109.5
C5—C4—H4A	120.2	H11A—C11—H11D	109.5
O2—C5—C4	118.4 (3)	H11C—C11—H11D	109.5
O2—C5—C6	121.9 (3)	C10—C12—H12A	109.5
C4—C5—C6	119.6 (3)	C10—C12—H12D	109.5
C1—C6—C5	119.0 (3)	H12A—C12—H12D	109.5
C1—C6—C7	118.8 (3)	C10—C12—H12B	109.5
C5—C6—C7	122.2 (3)	H12A—C12—H12B	109.5
N1—C7—C6	121.8 (3)	H12D—C12—H12B	109.5

C8—O1—N2—C10	−0.3 (3)	N2—O1—C8—C9	0.3 (3)
C6—C1—C2—C3	1.3 (4)	N2—O1—C8—N1	−179.4 (2)
C1—C2—C3—C4	−0.6 (5)	C7—N1—C8—O1	−0.3 (4)
C2—C3—C4—C5	−0.3 (5)	C7—N1—C8—C9	−179.9 (3)
C3—C4—C5—O2	−179.3 (3)	O1—C8—C9—C10	−0.2 (3)
C3—C4—C5—C6	0.5 (4)	N1—C8—C9—C10	179.4 (3)
C2—C1—C6—C5	−1.1 (4)	O1—C8—C9—C11	178.7 (3)
C2—C1—C6—C7	179.4 (3)	N1—C8—C9—C11	−1.7 (5)
O2—C5—C6—C1	180.0 (3)	O1—N2—C10—C9	0.1 (3)
C4—C5—C6—C1	0.2 (4)	O1—N2—C10—C12	−179.8 (2)
O2—C5—C6—C7	−0.5 (4)	C8—C9—C10—N2	0.0 (3)
C4—C5—C6—C7	179.7 (3)	C11—C9—C10—N2	−178.9 (3)
C8—N1—C7—C6	−179.7 (2)	C8—C9—C10—C12	180.0 (3)

C1—C6—C7—N1	−176.1 (3)	C11—C9—C10—C12	1.1 (5)
C5—C6—C7—N1	4.4 (4)		

Hydrogen-bond geometry (Å, º)

D—H···*A*	*D*—H	H···*A*	*D*···*A*	*D*—H···*A*
O2—H1*O*2···N1	1.00 (9)	1.71 (8)	2.648 (5)	154 (8)