Acta Crystallographica Section E
Structure Reports Online
ISSN 1600-5368

4′-(4-Methoxyphenyl)-1′-methyl-5-diphenyl-5,6,7,8,9,10-hexahydro-1,3-cyclooctapyrimidino-[2,3-*b*]thiazole-2-spiro-3′-pyrrolidine-2′-spiro-3″-1*H*-indole-2″,3(2*H*,3″*H*)-dione

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Key indicators

Single-crystal X-ray study
T = 293 K
Mean σ(C–C) = 0.003 Å
R factor = 0.053
wR factor = 0.136
Data-to-parameter ratio = 17.9

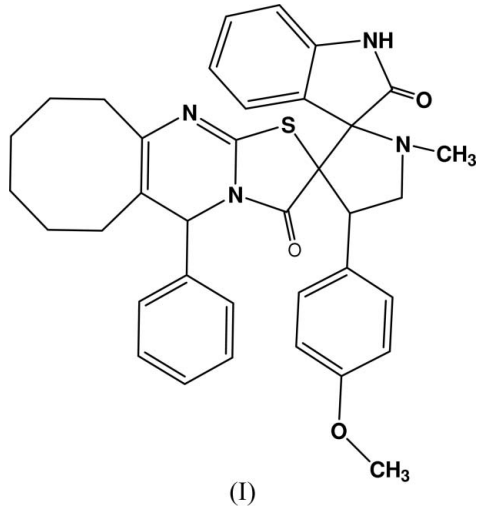
For details of how these key indicators were automatically derived from the article, see http://journals.iucr.org/e.

Received 22 November 2006
Accepted 24 November 2006

In the title compound, $C_{36}H_{36}N_4O_3S$, the pyrrolidine ring adopts an envelope conformation and the thiazolidine ring is planar. The molecule is stabilized by weak C—H···O interactions and the crystal packing is stabilized by N—H···N intermolecular interactions, generating a centrosymmetric dimer with an $R_2^2(16)$ motif.

Comment

Substituted pyrrolidine compounds have gained importance as they are the basic structural elements of many alkaloids and pharmacologically active compounds. Pyrrolidine alkaloids have been found to be DNA polymerase inhibitors and also exhibit characteristic inhibition to DNA metabolic enzymes (Mizushina *et al.*, 2003). Oxindole derivatives act as orally active potent growth hormone secretagogues (Tokunaga *et al.*, 2005) and also possess antifungal activity (Strigacova *et al.*, 2001). As the title compound, (I), is of great medicinal importance, we have undertaken its three-dimensional structure determination by X-ray diffraction.



(I)

The molecular geometry of (I) (Fig. 1) is comparable to those of related structures reported earlier (Gayathri *et al.*, 2005, 2006*a*,*b*). The sums of the bond angles around N1 (336.7°) and N3 (359.5°) indicate sp^3- and sp^2-hybridization, respectively.

The pyrrolidine ring adopts an envelope conformation, with atom N1 deviating by 0.593 (2) Å from the plane of the other atoms. The puckering parameters (Cremer & Pople, 1975) and the smallest displacement asymmetry parameters (Nardelli, 1983) for the pyrrolidine ring are q_2 = 0.408 (2) Å, φ = 354.7 (3)° and Δ_s(N1) = 5.5 (2)°.

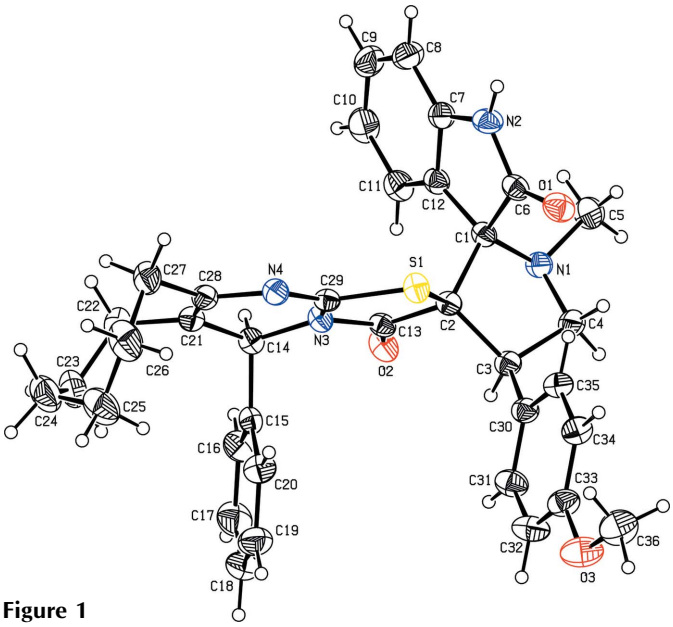


Figure 1
The molecular structure of (I), showing 30% probability displacement ellipsoids.

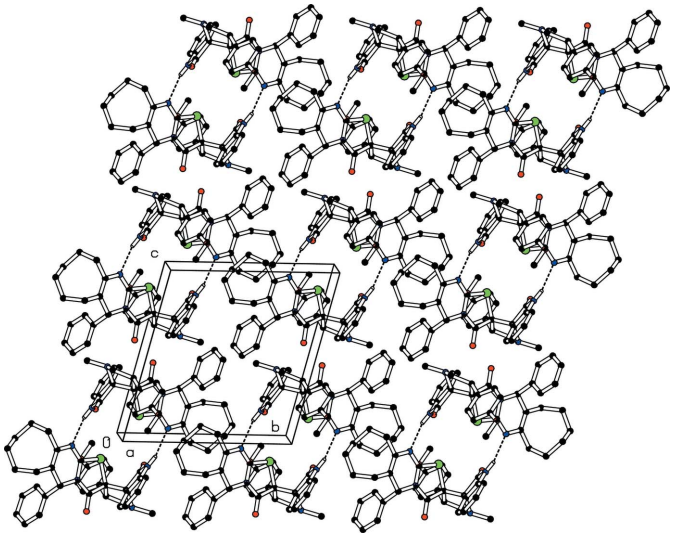


Figure 2
The crystal structure of (I), viewed down the *a* axis. Hydrogen bonds are shown as dashed lines. H atoms not involved in hydrogen bonding have been omitted.

The methyl atom C5 lies 0.545 (4) Å below the plane of atoms C1–C4. Atoms O1, O2 and O3 deviate by 0.041 (2), 0.146 (2) and 0.035 (2) Å, respectively, from the C1/C6/N2/C7/C12, thiazolidine and C30–C35 benzene ring planes. The dihedral angle between the five- (C1/C6/N2/C7/C12) and six-membered (C7–C12) rings in the indane system is 4.8 (2)°. The six-membered ring N3/C14/C21/C28/N4/C29 is an envelope, with atom C14 deviating by 0.210 (3) Å from the plane of the other atoms in the ring, which may be due to the phenyl (C15–C20) substituent at atom C14. The dihedral angle between the two benzene rings (C15–C20 and C30–C35) is 16.8 (1)°. The eight-membered ring has a boat–chair conformation.

The molecule is stabilized by weak C—H···O intramolecular interactions. The crystal packing is stabilized by N2—H2···N4($1-x, -y, -z$) intermolecular interactions (Table 1), generating a centrosymmetric dimer of $R_2^2(16)$ motif (Fig. 2).

Experimental

A mixture of isatin (1.2 mmol), sarcosine (1.2 mmol) and 5-phenyl-2-*p*-methoxy)phenylmethylene)-5,6,7,8,9,10,11-heptahydrocycloocta[*d*] thiazolo[3,2-*a*] pyrimidin-3(2*H*)-one (1 mmol) in methanol–dioxane (1:1, 20 ml) was refluxed until the disappearance of the starting materials (4.5 h) as shown by thin-layer chromatography analysis. The reaction mixture was then concentrated *in vacuo* and extracted with water (50 ml) and dichloromethane (50 ml). The organic layer was washed with brine, dried with anhydrous sodium sulfate and concentrated *in vacuo*. The residue was purified by column chromatography (silica gel, 100–200 mesh), eluting with a hexane–ethyl acetate (8:2) mixture, to give the title compound, which was recrystallized from methanol by slow evaporation.

Crystal data

$C_{36}H_{36}N_4O_3S$
M_r = 604.75
Triclinic, $P\overline{1}$
a = 11.4459 (19) Å
b = 12.085 (2) Å
c = 13.612 (2) Å
α = 69.568 (3)°
β = 65.586 (3)°
γ = 71.038 (3)°
V = 1570.2 (4) Å^3
Z = 2
D_x = 1.279 Mg m^{-3}
Mo $K\alpha$ radiation
μ = 0.15 mm^{-1}
T = 293 (2) K
Block, colourless
0.26 × 0.24 × 0.21 mm

Data collection

Bruker SMART APEX CCD area-detector diffractometer
ω scans
Absorption correction: none
17617 measured reflections
7101 independent reflections
4615 reflections with $I > 2\sigma(I)$
R_{int} = 0.039
θ_{max} = 28.0°

Refinement

Refinement on F^2
$R[F^2 > 2\sigma(F^2)]$ = 0.053
$wR(F^2)$ = 0.136
S = 0.93
7101 reflections
397 parameters
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.073P)^2]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max}$ = 0.001
$\Delta\rho_{max}$ = 0.34 e Å^{-3}
$\Delta\rho_{min}$ = −0.17 e Å^{-3}

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

D—H···A	D—H	H···A	D···A	D—H···A
N2—H2···N4^{i}	0.86	2.15	2.971 (2)	161
C3—H3···O2	0.98	2.45	2.940 (3)	111
C4—H4*A*···O1	0.97	2.47	3.041 (3)	118
C11—H11···O2	0.93	2.44	3.066 (3)	125

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

All H atoms were treated using a riding model, with C—H distances of 0.93 Å for aromatic H, 0.98 Å for methine H, 0.97 Å for methylene H and 0.96 Å for methyl H, and N—H = 0.86 Å, and with U_{iso}(H) = 1.2U_{eq}(C,N), or 1.5U_{eq}(C) for methyl groups.

Data collection: *SMART* (Bruker, 2001); cell refinement: *SAINT* (Bruker, 2001); data reduction: *SAINT*; program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics:

PLATON (Spek, 2003); software used to prepare material for publication: *SHELXL97* and *PARST* (Nardelli, 1995).

The Department of Science and Technology (DST–FIST), Government of India, is acknowledged by DG and DV for providing facilities to the department. DV thanks DST, India, for a major research project and DG thanks CSIR, India, for the award of a Senior Research Fellowship.

References

Bruker (2001). *SMART* (Version 5.625/NT/2000) and *SAINT* (Version 6.28a). Bruker AXS Inc., Madison, Wisconsin, USA.
Cremer, D. & Pople, J. A. (1975). *J. Am. Chem. Soc.* **97**, 1354–1358.
Gayathri, D., Velmurugan, D., Ravikumar, K., Poornachandran, M. & Raghunathan, R. (2005). *Acta Cryst.* E**61**, o3556–o3558.
Gayathri, D., Velmurugan, D., Ravikumar, K., Poornachandran, M. & Raghunathan, R. (2006*a*). *Acta Cryst.* E**62**, o5658–o5660.
Gayathri, D., Velmurugan, D., Ravikumar, K., Poornachandran, M. & Raghunathan, R. (2006*b*). *Acta Cryst.* E**62**, o5661–o5663.
Mizushina, Y., Xu, X., Asano, N., Kasai, N., Kato, A., Takemura, M., Asahara, H., Linn, S., Sugawara, F., Yoshida, H. & Sakaguchid, K. (2003). *Biochem. Biophys. Res. Commun.* **304**, 78–85.
Nardelli, M. (1983). *Acta Cryst.* C**39**, 1141–1142.
Nardelli, M. (1995). *J. Appl. Cryst.* **28**, 659.
Sheldrick, G. M. (1997). *SHELXS97* and *SHELXL97*. University of Göttingen, Germany.
Spek, A. L. (2003). *J. Appl. Cryst.* **36**, 7–13.
Strigacova, J., Hudecova, D., Mikulasova, M., Varecka, L., Lasikova, A. & Vegh, D. (2001). *Folia Microbiol. (Praha)*, **46**, 187–192. (In Czech.)
Tokunaga, T., Hume, W. E., Nagamine, J., Kawamura, T., Taiji, M. & Nagata, R. (2005). *Bioorg. Med. Chem. Lett.* **15**, 1789–1792.