Acta Crystallographica Section E
Structure Reports Online
ISSN 1600-5368

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

D. Gayathri,[a] D. Velmurugan,[a]* K. Ravikumar,[b] M. Poornachandran[c] and R. Raghunathan[c]

[a]Department of Crystallography and Biophysics, University of Madras, Guindy Campus, Chennai 600 025, India, [b]Laboratory of X-ray Crystallography, Indian Institute of Chemical Technology, Hyderabad 500 007, India, and [c]Department of Organic Chemistry, University of Madras, Guindy Campus, Chennai 600 025, India

Correspondence e-mail: d_velu@yahoo.com

Key indicators

Single-crystal X-ray study
T = 293 K
Mean σ(C–C) = 0.002 Å
R factor = 0.042
wR factor = 0.123
Data-to-parameter ratio = 17.9

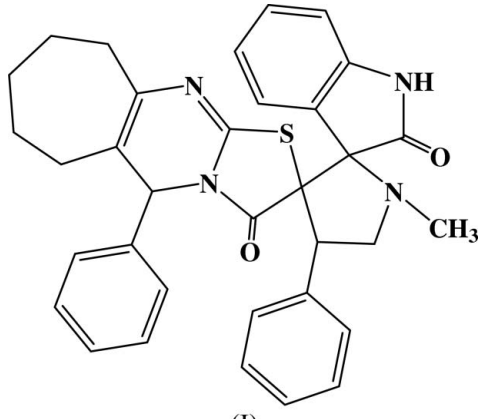
For details of how these key indicators were automatically derived from the article, see http://journals.iucr.org/e.

Received 27 September 2005
Accepted 30 September 2005
Online 8 October 2005

The pyrrolidine ring of the title compound, $C_{34}H_{32}N_4O_2S$, adopts an envelope conformation. The packing is stabilized by intermolecular C—H···O and N—H···N interactions.

Comment

Pyrrolidine derivaties are widely studied for their pharmacological properties. The pyrrolidine motif occurs in many families of biologically important compounds. Pyrrolidine derivatives possess anti-influenza virus (Galeazzi *et al.*, 1999) and anti-convulsant activities (Obniska *et al.*, 2002). They also show inhibitory activity towards post-proline cleaving enzymes and show strong anti-amnesic activities (Saito *et al.*, 1991). Oxindole derivatives help to treat and prevent diabetic complications arising from elevated levels of sorbitol and act as aldose reductase inhibitor (Rajeswaran *et al.*, 1999). Thiazole derivatives possess anti-inflammatory properties (Köysal *et al.*, 2004) and thiazole naphthyridine derivatives exhibit good antibacterial activity (Kondo *et al.*, 1990). A series of thiazolo[3,4-*a*]benzimidazole derivatives have been evaluated *in vitro* as antitumor agents against 60 human tumor cell-lines (Chimirri *et al.*, 1994).



(I)

The two spiro junctions in the title molecule, (I), are formed by a pyrrolidine ring, an oxindole ring and a hexahydro-1,3-cycloheptapyrimidino[2,3-*b*]thiazol-3-one ring. The sum of the bond angles at atom N1 of the pyrrolidine ring (337°) indicates sp^3 hybridization. The bond lengths and angles of the pyrrolidine ring are somewhat distorted, which may be due to the spiro fusion. Selected geometric parameters are given in Table 1. The pyrrolidine ring adopts an envelope conformation, with atom N1 deviating by −0.587 (1) Å from the plane composed of atoms C1, C2, C3 and C4.

Intermolecular C—H···O and N—H···N interactions stabilize the crystal packing. Atom C1 acts as a donor to O2 at

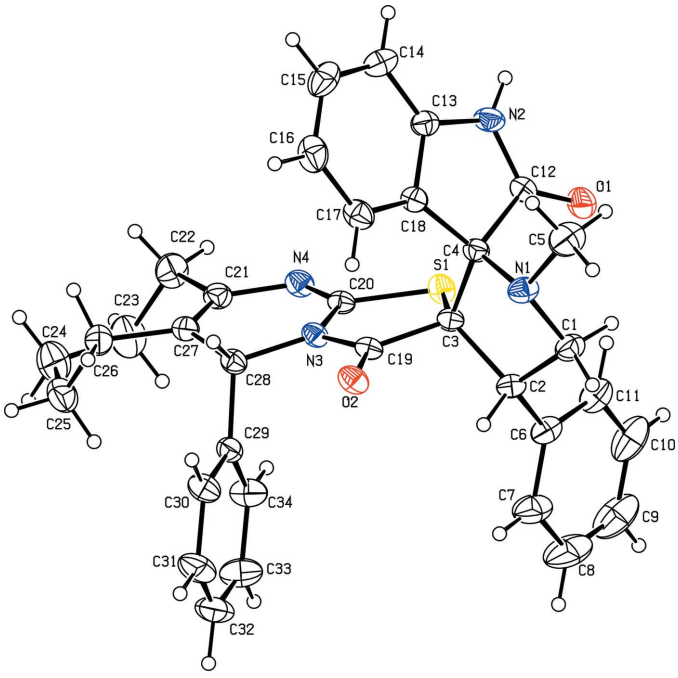


Figure 1
The molecular structure of the title compound, showing 30% probability displacement ellipsoids.

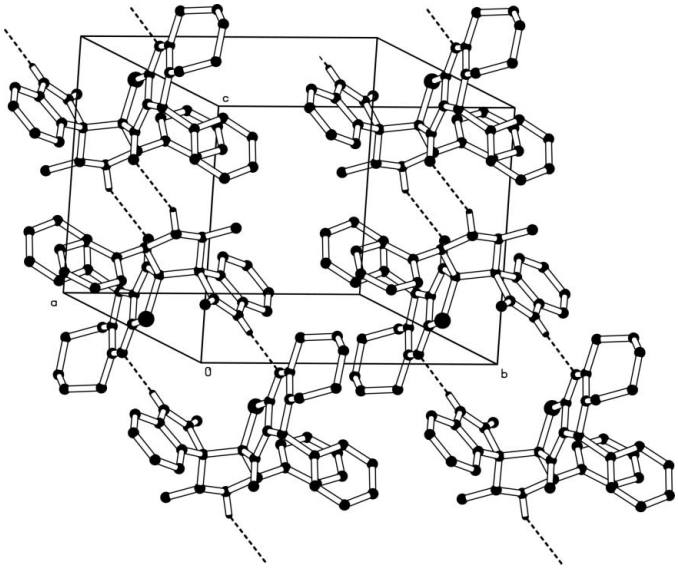


Figure 2
The molecular packing of (I). For the sake of clarity, H atoms not involved in the hydrogen bonds (dashed lines) have been omitted.

$(1-x, 2-y, 1-z)$, generating a centrosymmetric $R_2^2(12)$ ring centred at $(\frac{1}{2}, 1, \frac{1}{2})$ and amine atom N2 acts as a donor to N4 at $(-x, 2-y, -z)$, generating a centrosymmetric $R_2^2(16)$ ring centered at (0, 1, 0). The propagation of these two hydrogen bonds generates a chain running along [001].

Experimental

A mixture of 2-(phenylmethylene)-5-phenyl-5,6,7,8,9,10-hexahydro-1,3-cycloheptapyrimidino[2,3-*b*]thiazol-3-one (1 mmol), isatin (1 mmol) and sarcosine (1 mmol) was refluxed in 20 ml of methanol–dioxane solvent (1:1) for 5 h. After completion of the reaction, as evidenced by thin-layer chromatography, the residue was chromatographed with a hexane–ethyl acetate mixture (4:1) to getobtain the product. Diffraction quality crystals were obtained from a methanol solution.

Crystal data

$C_{34}H_{32}N_4O_2S$
$M_r = 560.70$
Triclinic, $P\overline{1}$
$a = 10.483$ (1) Å
$b = 12.133$ (1) Å
$c = 12.870$ (1) Å
$\alpha = 96.24$ (1)°
$\beta = 108.27$ (1)°
$\gamma = 107.14$ (1)°
$V = 1448.5$ (3) Å^3
$Z = 2$
$D_x = 1.286$ Mg m^{-3}
Mo $K\alpha$ radiation
Cell parameters from 5673 reflections
$\theta = 1.7$–25.0°
$\mu = 0.15$ mm^{-1}
$T = 293$ (2) K
Block, colourless
0.24 × 0.21 × 0.20 mm

Data collection

Bruker SMART CCD area-detector diffractometer
ω scans
Absorption correction: none
16755 measured reflections
6629 independent reflections
5676 reflections with $I > 2\sigma(I)$
$R_{int} = 0.018$
$\theta_{max} = 28.0°$
$h = -13 \rightarrow 13$
$k = -16 \rightarrow 15$
$l = -16 \rightarrow 16$

Refinement

Refinement on F^2
$R[F^2 > 2\sigma(F^2)] = 0.042$
$wR(F^2) = 0.123$
$S = 1.02$
6629 reflections
370 parameters
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.0697P)^2 + 0.4648P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max} < 0.001$
$\Delta\rho_{max} = 0.33$ e Å^{-3}
$\Delta\rho_{min} = -0.16$ e Å^{-3}

Table 1
Selected geometric parameters (Å, °).

S1—C20	1.743 (1)	N3—C20	1.377 (2)
S1—C3	1.831 (1)	N3—C28	1.477 (2)
N1—C5	1.455 (2)	N4—C20	1.277 (2)
N1—C1	1.455 (2)	N4—C21	1.429 (2)
N1—C4	1.460 (2)	C2—C3	1.582 (2)
N2—C12	1.351 (2)	C3—C4	1.581 (2)
N2—C13	1.401 (2)	C4—C12	1.570 (2)
N3—C19	1.373 (2)		
C20—S1—C3	93.4 (1)	C19—N3—C28	121.1 (1)
C1—N1—C4	107.2 (1)	C20—N3—C28	121.6 (1)
C12—N2—C13	112.2 (1)	C20—N4—C21	116.5 (1)
C19—N3—C20	117.1 (1)		

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

D—H···A	D—H	H···A	D···A	D—H···A
N2—H2···N4^{i}	0.86	2.11	2.964 (2)	175
C1—H1A···O2^{ii}	0.97	2.55	3.415 (2)	148

Symmetry codes: (i) $-x, -y+2, -z$; (ii) $-x+1, -y+2, -z+1$.

All H atoms were positioned geometrically and allowed to ride on their parent atoms, with N—H = 0.86 Å and C—H distances in the range 0.93–0.97 Å and with U_{iso}(H) = 1.2 U_{eq}(C,N).

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).

Financial support from the University Grants Commission (UGC–SAP) and the Department of Science & Technology (DST–FIST), Government of India, is acknowledged for providing facilities to the department. DG and DV thank the University Grants Commission and the Council of Scientific Industrial Research (CSIR), India, for funding.

References

Bruker (2001). *SMART* (Version 5.625/NT/2000) and *SAINT* (Version 6.28a). Bruker AXS Inc., Madison, Wisconsin, USA.

Chimirri, A., Grasso, S., Montforte, A. M., Montforte, P., Zappala, M. & Carotti A. (1994). *Il Farmaco*, **49**, 337–344.

Galeazzi, R., Geremia, S., Mobbili, G. & Orena, M. (1999). *Tetrahedron Asymmetry*, **10**, 587–605.

Kondo, H., Taguchi, M., Inoue, Y., Sakamoto, F. & Tsukamoto, G. (1990). *J. Med. Chem.* **33**, 2012–2015.

Köysal, Y., Isik, S., Dogdas, E., Tozkoparan, B. & Ertan, M. (2004). *Acta Cryst.* C**60**, o356–o357.

Nardelli, M. (1995). *J. Appl. Cryst.* **28**, 659.

Obniska, J., Zeic, A. & Zagorska, A. (2002). *Acta Pol. Pharm.* **59**, 209–213.

Rajeswaran, W. G., Labroo, R. B. & Cohen, L. A. (1999). *J. Org. Chem.* **64**, 1369–1371.

Saito, M., Hashimoto, M., Kawaguchi, N., Shibata, H., Fukami, H., Tanaka, T. & Higuchi, N. (1991). *J Enzyme Inhib.* **5**, 51–75.

Sheldrick, G. M. (1997). *SHELXS97* and *SHELXL97*. University of Göttingen, Germany.

Spek, A. L. (2003). *J. Appl. Cryst.* **36**, 7–13.