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6a-Methyl-7-phenylsulfonyl-6-phenylsulfonylmethyl-7,7a-dihydro-6a*H*-cyclopropa[*d*][1,2,3]triazolo[4,3-*b*]pyridazine acetone hemisolvate

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Key indicators

Single-crystal X-ray study
T = 293 K
Mean σ(C–C) = 0.011 Å
R factor = 0.058
wR factor = 0.121
Data-to-parameter ratio = 13.3

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

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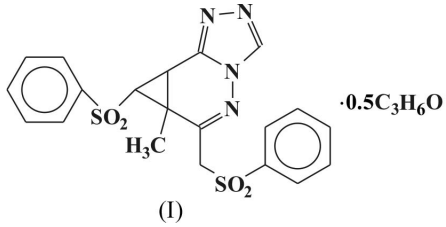
In the title inclusion structure, $C_{20}H_{18}N_4O_4S_2\cdot0.5C_3H_6O$, the phenyl groups form hydrophobic channels along [001], hosting acetone molecules. The phenylsulfonyl substituent group and the methyl group on the cyclopropane ring are *syn* with respect to each other, and the two phenylsulfonyl groups are positioned on the same side of the triazolopyridazine ring.

Comment

Azolopyridazine derivatives are applied as pharmaceutical agents and they are known for their hypotensive (Katrusiak *et al.*, 2001), anticonvulsant (Moreau *et al.*, 1998) and sedative (Rubat *et al.*, 1990) activities. In our search for new compounds with pharmaceutical activity, the title compound, (I), was synthesized in our laboratory from 7-methyltriazolopyridazine and bromomethyl phenyl sulfone as a precursor carbanion (Katrusiak, 2005) under vicarious hydrogen nucleophilic substitution (VNS) conditions (Golinski & Makosza, 1978; Makosza *et al.*, 1984; Chupakhin *et al.*, 1988; Makosza, 1991) and was characterized by ^{1}H and ^{13}C NMR spectroscopy and MS. The main aim of this X-ray diffraction study was to confirm the molecular structure of (I) and, in particular, the configuration of the phenylsulfonyl substituent at the cyclopropane ring. It was also intended to clarify the conformation of the phenylsulfonyl substituents, which are flexible about the C—S bonds and can assume various orientations in the molecule.



(I)

The structure of (I) and its atom labelling are shown in Fig. 1. It can be clearly seen that the phenylsulfonyl substituent group and the methyl group at C3 on the cyclopropane ring are *syn* to each other, whereas the pyridazine and this phenylsulfonyl group are *anti*. The two phenylsulfonyl substituents are located on the same side of the azolopyridazine ring. The cyclopropane ring is inclined to the mean plane of the pyridazine ring by 107.2 (3)°. The dihedral angle between the planes of the pyridazine and azole rings is 2.0 (4)°. The bond angles of the cyclopropane ring are essentially the same, *viz*. 59.0 (3), 60.1 (3) and 60.9 (3)° at C7, C8 and C21, respectively. The phenylsulfonyl substituents are in very similar conformations; the corresponding torsion angles

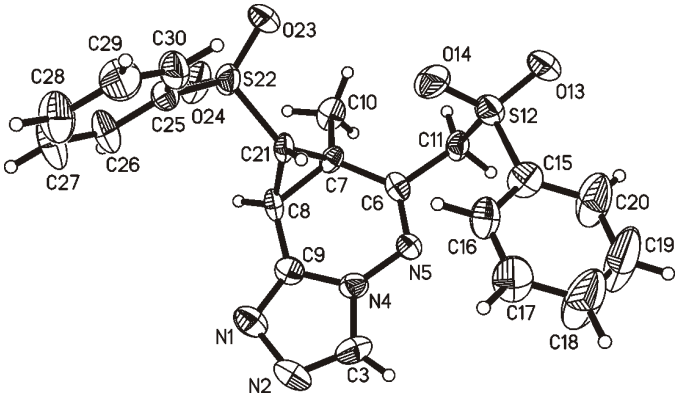


Figure 1
View of (I), with displacement ellipsoids drawn at the 50% probability level. The solvent molecule has been omitted.

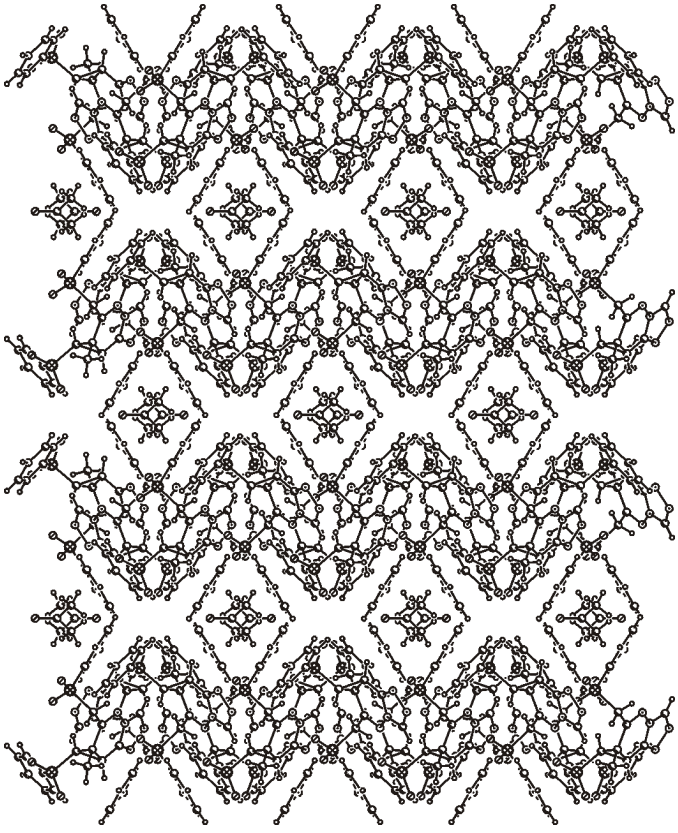


Figure 2
Crystal structure of (I), projected along the direction [001]. The *a* and *b* axes are directed down and across the page, respectively.

C11—S12—C15—C20 and C21—S22—C25—C30 are 86.1 (6) and 89.0 (5)°, respectively.

It appears that the molecular packing in (I) is dominated by van der Waals interactions, and that the molecules are arranged into hydrophilic and hydrophobic regions perpendicular to the direction [100]. As can be seen in Fig. 2, the $C_{20}H_{18}N_4O_4S_2$ molecules form channels parallel to [001]. The walls of these channels are lined with phenyl groups, and the channels host acetone molecules. However, only one of the phenyl rings, C15–C20, is involved in the formation of the channels. The role of the C15–C20 phenyl ring in channel formation may be a result of its junction with the bulk of the molecule incorporating a methylene group, and thus its greater flexibility than that of the other phenyl ring. The larger anisotropic displacement parameters of atoms C15–C20 may be attributed to the larger space available within the channels.

The $C_{20}H_{18}N_4O_4S_2$ molecule is located at a general position, while the acetone molecule lies on a twofold axis. Solubility is one of the central issues concerning the absorption of drugs, and this property of a given substance can be altered, as can the pharmaceutical activity. For example, the required lipophilic properties can be enhanced by adding methyl and phenyl substituents, and the crystal structure of (I) illustrates how the property of solubility can be restricted to specific molecular regions.

Experimental

The title compound was synthesized from methyltriazolopyridazine by a nucleophilic substitution (S_N) reaction. It was found that the methyllation of azolopyridazines can considerably change the course of S_N reactions, leading to cyclopropane annulation, and $C_{20}H_{18}N_4O_4S_2$ was obtained as the product of this newly observed reaction (Katrusiak, 2005). It was also observed that the S_N reactions of unmethyllated triazolopyridazines, apart from the expected VNS products, yield traces of the cyclopropane annulation. The single-crystal samples of (I) for X-ray analysis were recrystallized from acetone [the melting point of pure $C_{20}H_{18}N_4O_4S_2$ recrystallized from dry ethanol is 521–522 K (uncorrected)].

Crystal data

$C_{20}H_{18}N_4O_4S_2\cdot0.5C_3H_6O$
M_r = 471.54
Monoclinic, $C2/c$
a = 28.242 (6) Å
b = 9.5962 (19) Å
c = 21.108 (4) Å
β = 127.74 (3)°
V = 4524 (2) Å^3
Z = 8
D_x = 1.385 Mg m^{-3}
Mo $K\alpha$ radiation
Cell parameters from 1368 reflections
θ = 2.4–28.1°
μ = 0.27 mm^{-1}
T = 293 (2) K
Plate, colourless
0.22 × 0.13 × 0.05 mm

Data collection

Kuma KM-4 CCD diffractometer
ω scans
Absorption correction: none
16780 measured reflections
3985 independent reflections
1569 reflections with $I > 2\sigma(I)$
R_{int} = 0.158
θ_{max} = 25.0°
$h = -33 \rightarrow 32$
$k = -8 \rightarrow 11$
$l = -24 \rightarrow 25$

Refinement

Refinement on F^2
$R[F^2 > 2\sigma(F^2)]$ = 0.058
$wR(F^2)$ = 0.121
S = 0.90
3985 reflections
300 parameters
H atoms treated by a mixture of independent and constrained refinement
$w = 1/[\sigma^2(F_o^2)]$
$(\Delta/\sigma)_{max} < 0.001$
$\Delta\rho_{max}$ = 0.20 e Å^{-3}
$\Delta\rho_{min}$ = −0.23 e Å^{-3}

All H atoms were found in electron-density difference maps, but only atom H3 of the triazole ring was allowed to refine independently. All other H atoms were included in calculated positions (with C—H = 0.93 Å for phenyl, 0.96 Å for methyl, 0.97 Å for methylene and 0.98 Å for methine C atoms). The methyl group was allowed to refine its orientation about its pivotal C—C bond. U_{iso}(H) values were set to $1.2U_{eq}$(C) or $1.5U_{eq}$(methyl C). The increased R_{int} value resulted from the conjuncture of the broadened reflections, caused by the high

mosaicity of the sample crystal, and relatively long unit-cell dimensions leading to a partial overlap of neighbouring reflections.

Data collection: *CrysAlisCCD* (Oxford Diffraction, 2004); cell refinement: *CrysAlisRED* (Oxford Diffraction, 2004); data reduction: *CrysAlisRED*; program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: *Stereochemical Workstation* (Siemens, 1989) and *Mercury* (Version 1.3; Bruno *et al.*, 2002); software used to prepare material for publication: *SHELXL97*.

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