

6-(2-Fluorobenzylidene)- 2-[1-(2-fluoro-4-biphenyl)ethyl]- thiazolo[3,2-*b*][1,2,4]triazol- 5(6*H*)-one

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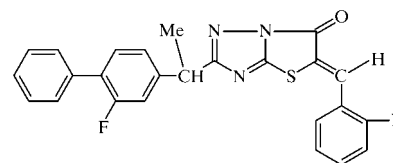
The title compound, C₂₅H₁₇F₂N₃OS, was synthesized from 6-(benzylidene)thiazolo[3,2-*b*][1,2,4]triazol-5(6*H*)-one. The fused thiazolo[3,2-*b*][1,2,4]triazole system is essentially planar, and bifurcated C—H···O, C—H···N and C—H···F interactions are present between molecules.

Comment

Since 6-(benzylidene)thiazolo[3,2-*b*][1,2,4]triazol-5(6*H*)-one is structurally related to 5-(3,5-di-*tert*-butyl-4-hydroxybenzylidene)thiazol-4-one, which forms the nucleus of a number of compounds with anti-inflammatory activity, our interest has focused recently on the synthesis and chemistry of this type of compound (Song *et al.*, 1999). In earlier studies, we synthesized new derivatives by combining condensed triazole with ibuprofen and *S*-naproxen, which belong to the class of 2-arylpropionic acid derivatives of non-steroidal anti-inflammatory drugs, to improve its effectiveness, and these derivatives were evaluated for their anti-inflammatory activity. In a continuation of our research programme on the synthesis of novel heterocyclic systems which have analgesic or anti-inflammatory activity, we have prepared some new 6-(benzylidene)thiazolo[3,2-*b*][1,2,4]triazol-5(6*H*)-ones starting from flurbiprofen and have determined their anti-inflammatory activities. In order to clarify the structure of this type of compound, an X-ray structure determination of the title compound, (I), has been carried out, and the results are presented here.

In compound (I), the fused thiazolo[3,2-*b*][1,2,4]triazole system is essentially planar. The maximum deviations from the plane of the eight-membered thiazole–triazole system are 0.030 (6) and −0.040 (4) Å for atoms C9 and N1, respectively. The puckering parameters (Cremer & Pople, 1975) of this

system are $q_2 = 0.045$ (5)° and $\varphi = 269$ (7)°. Atoms C10 and N1 are on opposite sides of the plane passing through atoms S1, C8 and C9, at distances of 0.081 (5) and 0.106 (4) Å, respectively. The thiazole–triazole system makes a dihedral angle of 34.54 (18)° with the C1–C6 ring and 86.70 (13)° with the C14–C19 ring. Rings C1–C6 and C14–C19 are almost perpendicular to each other, with a dihedral angle of 85.42 (17)°.



(I)

The C7–C8 bond is a double bond, while C1–C7 and C11–C12 are single bonds. A similar lengthening of the S1–C8 bond relative to the S1–C10 bond has been observed in the structure of a similar compound (Özbey *et al.*, 1999).

Compound (I) is stabilized by C—H···O, C—H···N and C—H···F intermolecular contacts. The C4–H4 bond forms a bifurcated contact to two acceptors, namely atoms N3 and O1 [C4–H4···O1ⁱ and C4–H4···N3ⁱ; symmetry code: (i) $x + \frac{1}{4}$, $-y + \frac{1}{4}$, $z + \frac{3}{4}$] (Table 2). The bifurcated nature of the contact explains the relatively large H···A distances and the relatively small D–H···A angles. Other important intermolecular

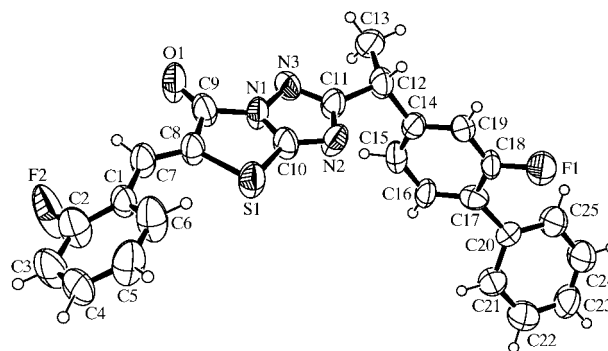


Figure 1

A view of the molecule of (I), showing the atom-numbering scheme. Displacement ellipsoids are drawn at the 40% probability level and H atoms are shown as small spheres of arbitrary radii.

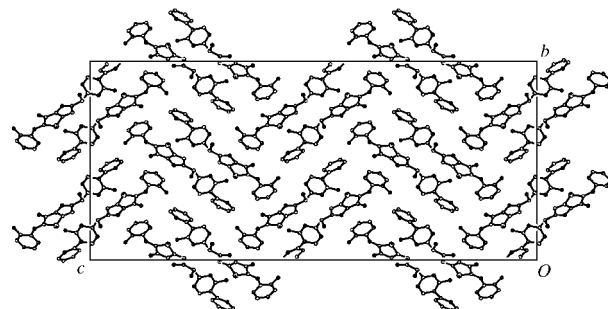


Figure 2

A crystal-packing diagram for (I), viewed along the *a* axis.

contacts are C15—H15···F2ⁱⁱ and C23—H23···F2ⁱⁱⁱ (Table 2), where atom F2 accepts hydrogen bonds from C—H donors [symmetry codes: (ii) $x - \frac{1}{4}, -y + \frac{1}{4}, z - \frac{1}{4}$; (iii) $x - \frac{1}{4}, y + \frac{1}{4}, z + \frac{3}{4}$].

Experimental

The synthesis of (I) was carried out simply by heating equimolar amounts of 3-[1-(2-fluoro-4-biphenyl)ethyl]-5-mercapto-1,2,4-triazole, chloroacetic acid and 2-fluorobenzaldehyde dissolved in acetic acid and acetic anhydride in the presence of anhydrous sodium acetate. The starting 1,2,4-triazole compound was prepared according to a previously reported procedure (Tozkoparan *et al.*, 2000; Berk *et al.*, 2001). Compound (I) was crystallized from acetone–water (yield 67.8%; m.p. 432–433 K). Spectroscopic analysis: IR (ν , cm⁻¹): 3087, 3032 (aromatic C—H), 2970, 2932 (aliphatic C—H), 1744 (lactam C=O), 1616 (C=N); ¹H NMR (CDCl₃, p.p.m.): 1.75 (*d*, 3H, CH₃), 4.30 (*q*, 1H, CH), 7.10–7.60 (*m*, 12H, aromatic H), 8.30 (*s*, 1H, CH).

Crystal data

C ₂₅ H ₁₇ F ₂ N ₃ OS	Mo <i>K</i> α radiation
<i>M_r</i> = 445.48	Cell parameters from 8331 reflections
Orthorhombic, <i>Fdd2</i>	$\theta = 1.5$ – 24.9°
<i>a</i> = 24.059 (3) Å	$\mu = 0.19$ mm ⁻¹
<i>b</i> = 54.213 (5) Å	<i>T</i> = 293 (2) K
<i>c</i> = 6.5223 (5) Å	Prism, yellow
<i>V</i> = 8507.3 (15) Å ³	0.40 × 0.23 × 0.13 mm
<i>Z</i> = 16	
<i>D_x</i> = 1.391 Mg m ⁻³	

Data collection

Stoe IPDS-2 diffractometer	<i>R</i> _{int} = 0.065
ω scans	$\theta_{\max} = 25.5^\circ$
10 401 measured reflections	<i>h</i> = -28 → 28
2135 independent reflections	<i>k</i> = -52 → 64
813 reflections with <i>I</i> > 2 σ (<i>I</i>)	<i>l</i> = -6 → 7

Table 1

Selected geometric parameters (Å, °).

S1—C10	1.747 (6)	C11—C12	1.511 (7)
S1—C8	1.763 (6)	F1—C18	1.391 (5)
N1—N3	1.386 (5)	O1—C9	1.193 (6)
N1—C9	1.394 (7)	C8—C7	1.331 (6)
C11—N3	1.314 (6)	C1—C7	1.435 (7)
C11—N2	1.376 (6)		
C10—S1—C8	88.3 (3)	N1—C10—S1	114.8 (4)
C10—N1—N3	110.0 (4)	N2—C10—S1	132.5 (5)
C10—N1—C9	117.9 (5)	C11—C12—C14	110.8 (5)
N3—C11—N2	115.5 (5)	C8—C7—C1	128.5 (5)
N1—C10—N2	112.7 (5)		
C12—C11—N3—N1	172.5 (5)	S1—C8—C7—C1	1.1 (9)
N3—C11—C12—C14	130.5 (6)	C2—C1—C7—C8	146.5 (6)
N2—C11—C12—C14	-58.2 (7)		

Refinement

Refinement on <i>F</i> ²	$w = 1/[\sigma^2(F_o^2) + (0.0269P)^2]$
$R[F^2 > 2\sigma(F^2)] = 0.037$	where $P = (F_o^2 + 2F_c^2)/3$
$wR(F^2) = 0.069$	$(\Delta/\sigma)_{\max} < 0.001$
<i>S</i> = 0.67	$\Delta\rho_{\max} = 0.24$ e Å ⁻³
2135 reflections	$\Delta\rho_{\min} = -0.12$ e Å ⁻³
291 parameters	Extinction correction: <i>SHELXL97</i>
H-atom parameters constrained	Extinction coefficient: 0.00023 (4)

Table 2

Hydrogen-bonding geometry (Å, °).

<i>D</i> —H··· <i>A</i>	<i>D</i> —H	H··· <i>A</i>	<i>D</i> ··· <i>A</i>	<i>D</i> —H··· <i>A</i>
C4—H4···O1 ⁱ	0.93	2.57	3.333 (8)	140
C4—H4···N3 ⁱ	0.93	2.71	3.551 (8)	150
C15—H15···F2 ⁱⁱ	0.93	2.54	3.448 (6)	165
C23—H23···F2 ⁱⁱⁱ	0.93	2.41	3.307 (8)	162

Symmetry codes: (i) $\frac{1}{4} + x, \frac{1}{4} - y, \frac{3}{4} + z$; (ii) $x - \frac{1}{4}, \frac{1}{4} - y, z - \frac{1}{4}$; (iii) $-\frac{1}{4} - x, \frac{1}{4} + y, \frac{3}{4} + z$.

H atoms were located geometrically and refined using a riding model, fixing the C—H distances at 0.93, 0.97 and 0.96 Å for aromatic, CH₂ and CH₃ H atoms, respectively. The N1—C10 bond length is a little short compared with the literature value. The intensity data collected for the title structure are generally weak. Friedel-related reflections were merged in the final refinement because of the meaningless value of the absolute structure parameter (Flack, 1983).

Data collection: *X-AREA* (Stoe & Cie, 2002); cell refinement: *X-AREA*; data reduction: *X-RED32* (Stoe & Cie, 2002); program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97*; molecular graphics: *ORTEPIII* (Burnett & Johnson, 1996); software used to prepare material for publication: *WinGX* (Farrugia, 1997) and *PARST* (Nardelli, 1995).

Supplementary data for this paper are available from the IUCr electronic archives (Reference: AV1166). Services for accessing these data are described at the back of the journal.

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