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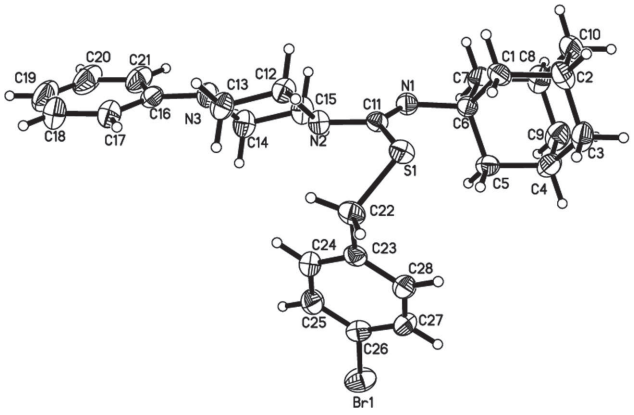
Crystal structure of 4-bromobenzyl (*Z*)-*N'*-(adamantan-1-yl)-4-phenylpiperazine-1-carbothioimidate, $C_{28}H_{34}BrN_3S$



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Abstract

$C_{28}H_{34}BrN_3S$, monoclinic, $P2_1/c$ (no. 14), $a = 10.4529(8)$ Å, $b = 11.8724(10)$ Å, $c = 21.3800(19)$ Å, $\beta = 101.864(3)°$, $V = 2596.6(4)$ Å^3, $Z = 4$, $R_{gt}(F) = 0.060$, $wR_{ref}(F^2) = 0.148$, $T = 296(2)$.

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The crystal structure is shown in the figure. Tables 1 and 2 contain details on crystal structure and measurement conditions and a list of the atoms including atomic coordinates and displacement parameters.

Table 1: Data collection and handling.

Crystal:	Colourless block
Size:	0.60 × 0.27 × 0.24 mm
Wavelength:	Mo *Kα* radiation (0.71073 Å)
μ:	16.8 cm^{-1}
Diffractometer, scan mode:	Bruker APEX-II, φ and ω
$2\theta_{max}$, completeness:	67.8°, >99%
$N(hkl)_{measured}$, $N(hkl)_{unique}$, R_{int}:	85675, 10433, 0.071
Criterion for I_{obs}, $N(hkl)_{gt}$:	$I_{obs} > 2\ \sigma(I_{obs})$, 5674
$N(param)_{refined}$:	298
Programs:	Bruker programs [25], SHELXL [26]

Source of material

Anhydrous potassium carbonate (276 mg, 2 mmol) and 4-bromobenzyl bromide (500 mg, 2 mmol) were added to a solution of *N*-(adamantan-1-yl)-4-phenylpiperazine-1-carbothioamide (711 mg, 2 mmol) in anhydrous acetone (15 mL). The mixture was heated under reflux for 4 h, and the solvent was then distilled off. The resulting residue was washed with water (20 mL), dried and crystallized from ethanol to yield 808 mg (77%) of the title compound as colourless needle-shaped crystals. M.P.: 403–405 K. Single crystals suitable for X-ray analysis were obtained by slow evaporation of $CHCl_3$:EtOH (1:1; 5 mL) solution at room temperature. **^{1}H-NMR** ($CDCl_3$, 700.17 MHz): δ 1.66 (s, 6H, adamantane-H), 1.68 (s, 6H, adamantane-H), 2.02–2.03 (m, 3H, adamantane-H), 3.26–3.27 (m, 4H, piperazine-H), 3.43–3.44 (m, 4H, piperazine-H), 3.95 (s, 2H, benzylic CH_2), 6.92–7.93 (m, 1H, Ar—H), 7.0–7.01 (m, 2H, Ar—H), 7.18 (d, 2H, Ar—H, $J = 7.0$ Hz), 7.29–7.33 (m, 2H, Ar—H), 7.44 (d, 2H, Ar—H, $J = 7.0$ Hz). **^{13}C—NMR** ($CDCl_3$, 176.08 MHz): δ 29.95, 36.58, 37.77, 42.98 (adamantane-C), 48.96, 49.17 (piperazine-C), 54.70 (benzylic CH_2), 116.20, 119.97, 120.94, 129.22, 130.59, 131.54,

Table 2: Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (Å^2).

Atom	*x*	*y*	*z*	U_{iso}*/U_{eq}
Br1	0.84202(3)	0.81330(3)	0.472660(16)	0.06371(12)
S1	0.15012(5)	0.78802(4)	0.45003(3)	0.03792(13)
N1	0.18870(18)	0.57214(15)	0.41215(9)	0.0378(4)
N2	0.24159(17)	0.60603(14)	0.52058(8)	0.0353(4)
N3	0.28939(19)	0.49161(16)	0.64046(9)	0.0413(4)
C1	0.0201(2)	0.6483(2)	0.32144(11)	0.0419(5)
H1A	−0.0456	0.5974	0.3337	0.050*
H1B	0.0152	0.7218	0.3428	0.050*
C2	−0.0098(3)	0.6646(2)	0.24901(12)	0.0517(6)
H2A	−0.0985	0.6988	0.2353	0.062*
C3	0.0927(3)	0.7431(2)	0.23081(12)	0.0536(6)
H3A	0.0723	0.7564	0.1841	0.064*
H3B	0.0912	0.8165	0.2526	0.064*
C4	0.2273(3)	0.6903(2)	0.25031(12)	0.0490(6)
H4A	0.2935	0.7414	0.2376	0.059*
C5	0.2600(2)	0.67440(19)	0.32300(11)	0.0403(5)
H5A	0.2612	0.7485	0.3444	0.048*
H5B	0.3476	0.6400	0.3361	0.048*
C6	0.1570(2)	0.59800(17)	0.34313(10)	0.0339(4)
C7	0.1604(3)	0.48390(19)	0.30938(11)	0.0468(5)
H7A	0.2482	0.4498	0.3227	0.056*
H7B	0.0959	0.4322	0.3221	0.056*
C8	0.1287(3)	0.4991(2)	0.23652(12)	0.0544(6)
H8A	0.1304	0.4241	0.2154	0.065*
C9	0.2309(3)	0.5762(2)	0.21750(13)	0.0577(7)
H9A	0.2123	0.5863	0.1705	0.069*
H9B	0.3188	0.5422	0.2306	0.069*
C10	−0.0060(3)	0.5514(2)	0.21582(13)	0.0593(7)
H10A	−0.0728	0.5005	0.2271	0.071*
H10B	−0.0259	0.5621	0.1689	0.071*
C11	0.19440(19)	0.64072(16)	0.45736(10)	0.0324(4)
C12	0.1538(2)	0.6184(2)	0.56522(11)	0.0414(5)
H12A	0.0827	0.5621	0.5553	0.050*
H12B	0.1138	0.6944	0.5606	0.050*
C13	0.2282(2)	0.6021(2)	0.63298(11)	0.0444(5)
H13A	0.2961	0.6611	0.6437	0.053*
H13B	0.1677	0.6096	0.6628	0.053*
C14	0.3747(2)	0.4759(2)	0.59465(11)	0.0472(6)
H14A	0.4112	0.3987	0.5990	0.057*
H14B	0.4486	0.5297	0.6045	0.057*
C15	0.3019(2)	0.49402(19)	0.52697(11)	0.0450(5)
H15A	0.3630	0.4872	0.4974	0.054*
H15B	0.2334	0.4357	0.5154	0.054*
C16	0.3413(2)	0.4548(2)	0.70369(11)	0.0441(5)
C17	0.3479(3)	0.5232(3)	0.75644(13)	0.0591(7)
H17A	0.3192	0.5992	0.7511	0.071*
C18	0.3971(4)	0.4807(4)	0.81787(15)	0.0792(10)
H18A	0.4015	0.5284	0.8540	0.095*
C19	0.4385(3)	0.3720(4)	0.82642(17)	0.0842(11)
H19A	0.4717	0.3439	0.8682	0.101*
C20	0.4320(3)	0.3032(3)	0.77418(18)	0.0756(10)
H20A	0.4613	0.2275	0.7800	0.091*
C21	0.3831(3)	0.3433(2)	0.71315(15)	0.0596(7)
H21A	0.3780	0.2946	0.6775	0.072*
C22	0.2751(2)	0.85457(19)	0.51026(11)	0.0422(5)
H22A	0.2555	0.9360	0.5115	0.051*
H22B	0.2713	0.8224	0.5526	0.051*
C23	0.4109(2)	0.84063(17)	0.49910(10)	0.0363(4)
C24	0.5038(2)	0.7830(2)	0.54283(11)	0.0472(5)
H24A	0.4794	0.7491	0.5789	0.057*
C25	0.6315(2)	0.7739(2)	0.53516(12)	0.0495(6)
H25A	0.6946	0.7348	0.5659	0.059*
C26	0.6662(2)	0.82187(19)	0.48282(12)	0.0431(5)
C27	0.5751(2)	0.8770(2)	0.43725(12)	0.0459(5)
H27A	0.5994	0.9079	0.4004	0.055*
C28	0.4480(2)	0.88679(19)	0.44584(11)	0.0435(5)
H28A	0.3852	0.9256	0.4149	0.052*

137.33, 149.26 (Ar—C), 151.29 (C = N). **EI-MS** *m/z* (Rel.Int.): 524.4 (M + H, 98)$^+$, 526.4 (M + 2+H, 100)$^+$.

Experimental details

All H atoms were placed in calculated positions and were included in the refinement in the riding model approximation, with U_{iso}(H) set to 1.2U_{eq}(C).

Discussion

The incorporation of an adamantyl group positively modulates the therapeutic index of several compounds through various mechanisms [1, 2]. Several adamantane derivatives have long been known for their antiviral activity against the influenza A [3–6], human immunodeficiency (HIV) [7–9] and herpes simplex [10] viruses. Several adamantane-based drugs are currently used as useful medications for the control of central nervous disorders [10–13]. In addition, potent antimicrobial [14–16], anticancer [17, 18], anti-inflammatory [19–21] and hypoglycemic [22] activities were reported for numerous adamantane-based derivatives. Isothiourea derivatives were also recognized as a structural motif of particular value in medicinal chemistry possessing diverse biological activities [23, 24]. In the present study, we report the synthesis and the X-ray structure analysis of the title adamantane-isothiourea hybrid molecule as potential bioactive agent.

The asymmetric unit of the title compound contains one independent molecule. The bond length of N1—C11 is 1.2640(19) Å, which is typical for a N = C double bond and the configuration around this double bond is *cis*. The piperazine ring of the phenylpiperazine adopts a chair conformation and the phenyl ring occupies an equatorial orientation. The molecules pack in the crystal structure without any significant intermolecular hydrogen bonds.

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